

User Manual



MM650 CAT IV True RMS Digital Multimeter with LoZ



Introduction





The Triplett MM650 features True RMS measurements for more accurate AC readings and a Low Z setting for eliminating false readings caused by "ghost" voltages. Functions include AC/DC voltage and current, resistance, continuity, capacitance, frequency, duty cycle, temperature, and diode test. The MM650 also offers the added convenience of a built-in LED flashlight. This meter is fully

tested and calibrated and, with proper use, will provide many years of reliable service.

WARNINGS

- Read, understand and follow Safety Rules and Operating Instructions in this manual before using this meter.
- The meter's safety features may not protect the user if not used in accordance with the manufacturer's instructions.
- Ensure that the test leads are fully seated in the input jacks and keep fingers away from the metal probe tips when taking measurements.
- Before changing functions using the selector switch, always disconnect the test leads from the circuit under test.
- Use only UL listed test leads with the proper safety category rating.
- Comply with all applicable safety codes. Use approved personal protective equipment when working near live electrical circuits - particularly with regard to arc-flash potential.
- Use caution on live circuits. Voltages above 30 V AC rms, 42 V AC peak, or 60 V DC pose a shock hazard.
- Do not use if the meter or test leads if appear to be damaged.
- Verify operation before using meter by measuring a known live voltage.
- Do not use the meter in wet or damp environments or during electrical storms.
- Do not use the meter near explosive vapors, dust or gasses.
- Do not use the meter if it operates incorrectly. Protection may be compromised.
- Do not operate meter while Low Battery warning is on. Replace batteries immediately.
- Do not apply voltage or current that exceeds the meter's maximum rated input limits.
- When replacing the battery or fuses, be sure to secure the battery compartment door firmly to maintain the waterproof and dust proof integrity of the meter. Loose or overtightened screws, or an improperly seated O-ring may compromise the meter's water and dust ingress protection.

International Safety Symbols

	Potential danger. Indicates the user must refer to the manual for important safety information
	Indicates hazardous voltages may be present
	Equipment is protected by double or reinforced insulation
	Indicates the terminal(s) so marked must not be connected to a circuit where the voltage with respect to earth ground exceeds the maximum safety rating of the meter

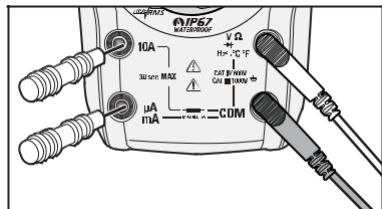
Safety Category Ratings

Category Rating	Brief Description	Typical Applications
CAT II	Single phase receptacles and connected loads	<ul style="list-style-type: none"> - Household appliances, power tools - Outlets more than 30ft (10m) from a CAT III source - Outlets more than 60ft (20m) from a CAT IV source
CAT III	Three phase circuits and single phase lighting circuits in commercial buildings	<ul style="list-style-type: none"> - Equipment in fixed installations such as 3-phase motors, switchgear and distribution panels - Lighting circuits in commercial buildings - Feeder lines in industrial plants - Any device or branch circuit that is close to a CAT III source
CAT IV	Connection point to utility power and outdoor conductors	<ul style="list-style-type: none"> - Primary distribution panels - Overhead or underground lines to detached buildings - Incoming service entrance from utility - Outdoor pumps

The measurement category (CAT) rating and voltage rating is determined by a combination of the meter, test probes and any accessories connected to the meter and test probes. The combination rating is the LOWEST of any individual component.

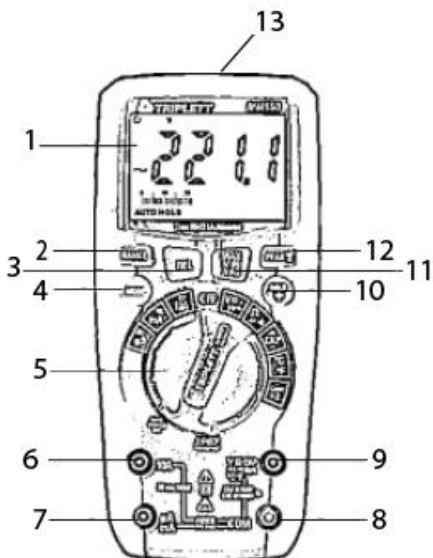
IP67 Rating

NOTE: Meter is waterproof and dust tight with supplied plugs or test leads inserted into input jacks.



Meter Description

- 1.LCD display
- 2.RANGE button
- 3.REL button
- 4.MODE button
- 5.Rotary function switch
- 6.10A input jack
7. μ A, mA input jack
- 8.COM input jack
9. V/ Ω , Hz/ %, Diode, Continuity, Cap, $^{\circ}$ C/F Input Jack
- 10.HOLD/Backlight button
- 11.MAX/MIN/Average button
- 12.Flashlight/PEAK button
- 13.Flashlight



Display Description



V	Volts	n	nano(10^{-9})
A	Amperes	μ	micro(10^{-6})
~	Alternating current	m	milli(10^{-3})
---	Direct current	k	kilo(10^3)
-	Minus sign	M	mega(10^6)
Ω	Ohms	OL	Overload
\rightarrow	Continuity	\odot	Auto Power Off
\rightarrow	Diode test	batt	Low battery
F	Farads (capacitance)	AUTO	Autoranging
Hz	Hertz (frequency)	HOLD	Display hold
%	Percent (duty ratio)	MAX/MIN/AVG	Maximum/Minimum/Average
$^{\circ}$ F	Degrees Fahrenheit	Peak	Peak hold
$^{\circ}$ C	Degrees Celsius	REL	Relative

Operating Instructions

RANGE Button

The Auto Range mode automatically selects the proper range for the measurement being made and is generally the best mode for most applications. For measurement situations requiring that a range be manually selected, perform the following:

1. Momentarily press the **RANGE** button. The “**AUTO**” indicator will no longer be shown on the LCD display.
2. Momentarily press the **RANGE** button to step through the available ranges until the desired range is selected.
3. To exit the Manual Ranging mode, press and hold the **RANGE** button until the “**AUTO**” indicator reappears.

NOTE: The range button does not work on Frequency, Duty Cycle, Capacitance or Temperature.

MODE Button

Used to select AC or DC, Frequency or Duty Cycle, Resistance, Continuity or Diode Test, and °C or °F.

REL button

The RELATIVE function zeros out the reading on the display and stores it as a reference. Subsequent readings will be displayed as the relative difference between the actual measurement and the stored reference value. To activate, press the REL button. The “REL” indicator will appear on the LCD display along with the relative reading. Press the REL button again to return to normal operation.


NOTE: The meter does not Auto Range when the Relative mode is active. The display will read OL if the difference exceeds the range. When this occurs, exit REL and use the **RANGE** button to select a higher range. REL does not work on Frequency, Duty Cycle, Temperature, Continuity or Diode Test.

MAX/MIN/AVG Button





1. Momentarily press the MAX/MIN/AVG button to activate the MAX/MIN/Average mode. "MAX" will appear on the LCD display and the meter will display and hold the highest reading. The meter will update the reading when a higher "max" occurs.
2. Momentarily press the MAX/MIN/AVG button again to view the lowest reading. "MIN" will appear on the LCD display and the meter will display and hold the lowest reading. The meter will update the reading when a lower "min" occurs.
3. Momentarily press the MAX/MIN/AVG button once more to view the average reading. The "AVG" symbol will appear on the LCD display and the meter will display the running average. The meter will update the reading when the average value changes.
4. Press and hold the MAX/MIN/AVG button to end MAX/MIN/Average and return to normal operation.

NOTE: The meter does not Auto Range when MAX/MIN/AVG is active. The meter will display OL if the reading exceeds the range. When this occurs, exit MAX/MIN/AVG and use the RANGE button to select a higher range. MAX/MIN/ AVG does not work on Frequency, Duty Cycle or Capacitance.

Flashlight/PEAK Button



Momentarily press the  **PEAK** button to turn the flashlight on and off.


The PEAK function is accessible when measuring AC Voltage or Current. It captures and displays the highest positive peak and the highest negative peak of the AC waveform.


1. Press and hold the  **PEAK** button until “**Peak MAX**” appears on the LCD display. The meter will display the highest reading and will update the reading when a higher positive peak occurs.
2. To view highest negative peak, press the  **PEAK** button for approximately one second. “Peak MIN” will appear on the LCD display and the meter will display and hold the highest reading. The meter will update the reading when a higher negative peak occurs.
3. Press the  **PEAK** button for approximately one second to switch between Peak MAX and Peak MIN readings.
4. Press and hold the  **PEAK** button to exit PEAK and return to normal operation.

NOTE: The meter does not Auto Range in the PEAK Mode. The meter will display OL if the reading exceeds the range. When this occurs, exit PEAK and use the range button to select a higher range.

HOLD/Backlight Button

To freeze the reading on the LCD display, momentarily press the HOLD  button. The “HOLD” indicator will be displayed while the reading is being held. Momentarily press the HOLD  button again to exit HOLD and return to normal operation.

To turn the backlight on, press and hold the HOLD  button until the backlight turns on.

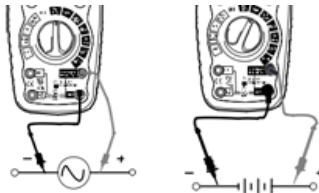
To turn the backlight off, press and hold the HOLD  button until the backlight turns off.

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

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

AC/DC Voltage Measurements

1. Set the Rotary Switch to the $V \sim$ HZ% position.
2. Press the **MODE** button to select AC or DC Voltage. The AC or DC Symbol will appear on the LCD display.
3. Insert the black test lead into the **COM** jack and the red test lead into the **V** input jack.
4. Touch the test leads to the circuit under test. If measuring DC voltage, touch the red test lead to the positive side of the circuit and the black test lead to the negative side of the circuit.



5. Read the voltage on the LCD display.

Frequency and % Duty Cycle Measurements

WARNING: Observe all safety precautions when working on live voltages. Do not measure frequency or % duty cycle on circuits that exceed 600V.

1. Set the rotary function switch to the **V ~ HZ %** position.
2. To select Frequency or % Duty Cycle, press the **MODE** button until the “**Hz**” or “**%**” symbol appears on the LCD display.
3. Insert the black test lead into the **COM** input jack and the red test lead into the **V** input jack.
4. Touch the test lead probes to the circuit under test.
5. Read the frequency or % duty cycle on the LCD display.

Low Z AC/DC Voltage

WARNING: Observe all safety precautions when working on live voltages. Do not connect to circuits that exceed 600V when the meter is set to Low Z. Do not use low Z when testing circuits that could be harmed by this function's low input impedance

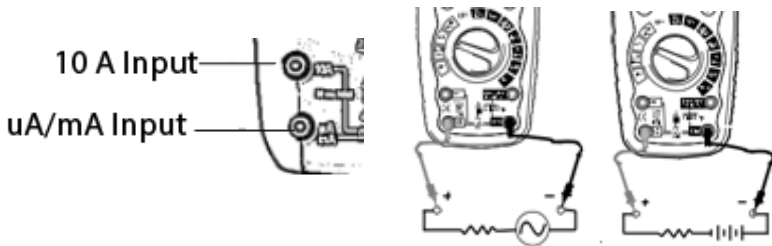
1. Set the rotary function switch to the Low Z position.
2. Press the MODE button to select AC or DC voltage. The AC “~” or DC “ \equiv ” symbol will appear on the LCD display.
3. Insert the black test lead into the COM input jack and the red test lead into the V input jack.
4. Touch the test leads to the circuit under test. If measuring DC voltage, touch the red test lead to the positive side of the circuit and the black test lead to the negative side of the circuit.
5. Read the voltage on the LCD display.

AC/DC Current Measurements

WARNING: Observe all safety precautions when working on live circuits. Do not measure current on circuits that exceed 1000V. Measurements in the 10A range should be limited to 30 seconds maximum every 15 minutes


1. Insert the black test lead into the negative COM input jack.
2. For current measurements up to 10A, set the rotary function switch to the **10A** position and insert the red test lead into the **10A** input jack
3. For current measurements up to 600mA, set the rotary function switch to the **mA** position and insert the red test lead into the **μ A/mA** input jack.

4. For current measurements up to 6000 μA set the rotary function switch to the **μA** position and insert the red test lead into the **$\mu\text{A}/\text{mA}$** input jack.
5. Press the MODE button to select AC or DC current. The AC “~” or DC “—” symbol will appear on the LCD display.
6. Remove power from the circuit under test, then open up the circuit at the point where you wish to measure current.
7. 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.
8. Apply power to the circuit.
9. Read the current on the LCD display.





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.

1. Set the function switch to the Ω  position.
2. Insert the black test lead banana plug into the negative COM jack.
Insert the red test lead banana plug into the positive jack.
3. Press the MODE button to indicate “ ” on the display.
4. 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.
5. Read the resistance in the display.

CONTINUITY CHECK

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

1. Set the function switch to the Ω  position.
2. Insert the black lead banana plug into the negative COM jack.
Insert the red test lead banana plug into the positive jack.
3. Press the MODE button to indicate “  ” and “ Ω ” on the display

4. Touch the test probe tips to the circuit or wire you wish to check.
5. If the resistance is less than approximately 35 Ω , the audible signal will sound. If the circuit is open, the display will indicate "OL".

DIODE TEST

1. Set the function switch to the $\Omega \rightarrow \rightarrow \rightarrow$ position.
2. Insert the black test lead banana plug into the negative COM jack and the red test lead banana plug into the positive V jack.
3. Press the MODE button to indicate " \rightarrow " and "V" on the display. \rightarrow
4. 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.

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.

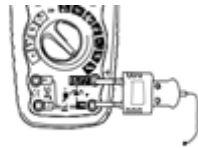
1. Set the rotary function switch to the CAP position.
2. Insert the black test lead banana plug into the

negative COM jack. Insert the red test lead banana plug into the positive V jack.

3. Touch the test leads to the capacitor to be tested.
4. Read the capacitance value in the display

TEMPERATURE MEASUREMENTS

1. Set the function switch to the green Temp position.
2. Insert the Temperature Probe into the input jacks, making sure to observe the correct polarity.
3. Press the MODE button to indicate "°F" or "°C"
4. 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).
5. Read the temperature in the display.



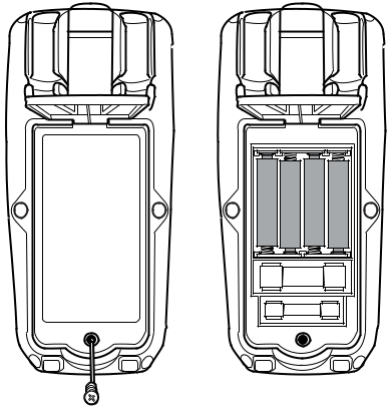
Note: The temperature probe is fitted with a type K mini connector. A mini connector to banana connector adaptor is supplied for connection to the input banana jacks.

Note: The temperature range of the supplied thermocouple probe is -20 to 250°C (-4 to 482°F)

Battery Replacement

⚠️ WARNINGS: To avoid electric shock, remove the test leads from the meter before removing the battery/fuse cover.

1. Lift up the tilt stand.
2. Loosen the Phillips screw(s) on the battery/fuse cover.
3. Remove the battery/fuse cover.
4. Replace the batteries with four AAA batteries.
5. Observe polarity as shown inside battery compartment.
6. Install the battery/fuse cover and tighten the screw(s).



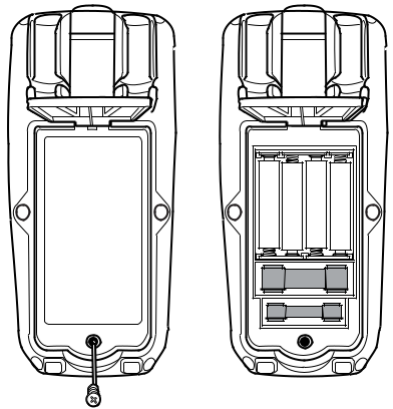
⚠️ WARNING: To avoid electric shock, do not operate the meter until the battery/fuse cover is securely fastened to the meter.

⚠️ WARNING: When replacing the battery or fuses, be sure to secure the battery compartment door firmly to maintain the waterproof and dust proof integrity of the meter. Loose or overtightened screws, or an improperly seated o-ring may compromise the meter's water and dust ingress protection.

Fuse Replacement

⚠️ WARNINGS: To avoid electric shock, remove the test leads from the meter before removing the battery/fuse cover.

1. Lift up the tilt stand.
2. Loosen the Phillips screw(s) on the battery/fuse cover.
3. Remove the battery/fuse cover.
4. Gently remove fuse and install new fuse into the holder.
5. Always use a UL recognized fuse of the proper size and value: 800mA/1000V (6.3 x 32mm) fast blow for the μ A/mA ranges and 10A/1000V (10 x 38mm) fast blow for the 10A range.
6. Install the battery/fuse cover and tighten the screw(s).



⚠️ WARNING: To avoid electric shock, do not operate meter until the battery/fuse cover is securely fastened to the meter.

⚠️ WARNING: When replacing the battery or fuses, be sure to secure the battery compartment door firmly to maintain the waterproof and dust proof integrity of the meter. Loose or overtightened screws, or an improperly seated O-ring may compromise the meter's water and dust ingress protection.

Specifications

Accuracy is stated at 65°F to 83°F (18°C to 28°C), less than 70% relative humidity

Function	Range	Resolution	Accuracy \pm (% of reading + digits)
AC Voltage	6.000V	1mV	$\pm(1.0\% + 5 \text{ digits})$
	60.00V	10mV	
	600.0V	0.1V	
	1000V	1V	$\pm(1.5\% + 5 \text{ digits})$

All AC voltage ranges are specified from 5% of range to 100% of range

Input Protection: 1000V AC RMS or 1000V DC

Input Impedance: 10M Ω

AC voltage bandwidth: 50 to 60Hz

Function	Range	Resolution	Accuracy \pm (% of reading + digits)
Low Z AC Voltage	6.000V	1mV	$\pm(3.0\% + 40 \text{ digits})$
	60.00V	10mV	
	600.0V	0.1V	

All AC voltage ranges are specified from 5% of range to 100% of range

Input Protection: 600V AC RMS or 600V DC

Input Impedance: approx. 3k Ω

AC Response: 50 to 60Hz

Function	Range	Resolution	Accuracy \pm (% of reading + digits)
DC Voltage	600.0mV	0.1mV	$\pm(1.0\% + 8 \text{ digits})$
	6.000V	1mV	$\pm(1.0\% + 3 \text{ digits})$
	60.00V	10mV	
	600.0V	0.1V	
	1000V	1V	$\pm(1.2\% + 3 \text{ digits})$

Input Protection: 1000V AC RMS or 1000V DC

Input Impedance: 10M Ω

Function	Range	Resolution	Accuracy \pm (% of reading + digits)
Low Z DC Voltage	600.0mV	0.1mV	$\pm(3.0\% + 40 \text{ digits})$
	6.000V	1mV	
	60.00V	10mV	
	600.0V	0.1V	

Input Protection: 600V AC RMS or 600V DC

Function	Range	Resolution	Accuracy \pm (% of reading + digits)
Frequency	9.999Hz	0.001Hz	$\pm(1.0\% +5 \text{ digits})$
	99.99Hz	0.01Hz	
	999.9Hz	0.1Hz	
	9.999kHz	1Hz	

Input Protection: 600V AC RMS or 600V DC
Sensitivity: >8V RMS

Function	Range	Resolution	Accuracy \pm (% of reading + digits)
Duty Cycle	20.0% to 80.0%	0.1%	$\pm(1.2\% +2 \text{ digits})$

Input Protection: 600V AC RMS or 600V DC
Pulse Width: 0.1 to 100mS
Frequency Range: 5Hz to 10kHz
Sensitivity: >8V RMS

Function	Range	Resolution	Accuracy \pm (% of reading + digits)
AC Current	600.0 μ A	0.1 μ A	$\pm(1.5\% +3 \text{ digits})$
	6000 μ A	1 μ A	
	60.00mA	10 μ A	
	600.0mA	0.1mA	
	10.00A	10mA	$\pm(2.0\% +8 \text{ digits})$

All AC current ranges are specified from 5% of range to 100% of range
Overload Protection: μ A, mA ranges: 800mA/1000V Fuse
10A range: 10A/1000V Fuse
AC current bandwidth: 50 to 60Hz

Function	Range	Resolution	Accuracy \pm (% of reading + digits)
DC Current	600.0 μ A	0.1 μ A	$\pm(1.0\% +3 \text{ digits})$
	6000 μ A	1 μ A	
	60.00mA	10 μ A	
	600.0mA	0.1mA	
	10.00A	10mA	$\pm(1.5\% +8 \text{ digits})$

Overload Protection: μ A, mA ranges: 800mA/1000V Fuse
10A range: 10A/1000V Fuse

Function	Range	Resolution	Accuracy \pm (% of reading + digits)
Resistance	600.0 Ω	0.1 Ω	\pm (1.5% +5 digits)
	6.000k Ω	1 Ω	
	60.00k Ω	10 Ω	
	600.0k Ω	100 Ω	\pm (2.0% +10 digits)
	6.000M Ω	1k Ω	
	60.00M Ω	10k Ω	

Input Protection: 600V AC RMS or 600V DC

Function	Range	Resolution	Accuracy \pm (% of reading + digits)
Capacitance	60.00nF	10pF	\pm (5.0% +35 digits)*
	600.0nF	100pF	\pm (3.0% +5 digits)
	6.000 μ F	0.001 μ F	
	60.00 μ F	0.01 μ F	
	600.0 μ F	0.1 μ F	
		6000 μ F	1 μ F

Input Protection: 600V AC RMS or 600V DC

*Accuracy is not stated below 6nF

Function	Range	Resolution	Accuracy \pm (% of reading + digits)
Temperature	-4°F to 1400°F	0.1°F	\pm (2.0% +9°F)
	-20°C to 760°C	0.1°C	\pm (2.0% +5°C)

Input Protection: 600V AC RMS or 600V DC

Maintenance

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

- KEEP THE METER DRY. If it gets wet, wipe it off.
- USE AND STORE THE METER IN NORMAL TEMPERATURES. Temperature extremes can shorten the life of the electronic parts and distort or melt plastic parts.
- HANDLE THE METER GENTLY AND CAREFULLY. Dropping it can damage the electronic parts or the case.
- KEEP THE METER CLEAN. Wipe the case occasionally with a damp cloth. DO NOT use chemicals, cleaning solvents, or detergents.
- USE ONLY FRESH BATTERIES OF THE RECOMMENDED SIZE AND TYPE. Remove old or weak batteries so they do not leak and damage the unit.
- IF THE METER IS TO BE STORED FOR A LONG PERIOD OF TIME, the batteries should be removed to prevent damage to the unit.

Warranty Information

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 (3) three 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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