

Megger®



AVO® 215

CAT III TRMS multimeter

User Guide

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Introduction

1. Introduction

Thank you for purchasing an AVO® digital multi-meter from Megger®. This user guide details the specifications, functional aspects and how to use the Megger digital multi-meter model No. AVO®215.

For your own safety and to get the maximum benefit from this Megger instrument, read and understand the safety warnings and instructions before the instrument is used.

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1.1 Company web site

Occasionally an information bulletin may be issued via the Megger web site. This may concern new accessories, new usage instructions or a software update. Please occasionally check on the Megger web site for anything applicable to your Megger instruments.

www.megger.com

2. Safety Warnings and Standards

These safety warnings must be read and understood before the instrument is used. Retain for future reference.

2.1 Warnings, Cautions and Notes

This user guide follows the internationally recognised definition. These instructions must be adhered to at all times.

Description

WARNING : Indicates a potentially dangerous situation which, if ignored, could lead to death, serious injury or health problems.

CAUTION : Indicates a situation which could lead to damage of the equipment or environment

NOTE : Indicates important instructions to be followed to perform the relevant process safely and efficiently.

2.2 Safety warnings

- Users of this instrument and their employers must do a valid risk assessment of all electrical work to identify potential sources of electrical danger and risk of electrical injury and must conform to national safety legislation.
- Where assessment shows significant risk from high energy systems, the use of fused leads must be considered.
- If the instrument is used in a manner not specified by the manufacturer, the protection provided by the instrument may be impaired.
- The instrument must not be used if any part of it is damaged.
- Use only Megger approved test leads and accessories with this instrument.
- Test leads and probes must be in good order, clean and have no broken or cracked insulation.
- Hold the test probes behind the finger-guards when they are in contact.
- Always check that the correct instrument connections and range selection have been made before connection to the test subject.
- Voltage or current that exceeds the instrument ratings can damage the instrument and present a shock or fire hazard.
- Use caution when working with voltages above 30 V AC rms, 42 V AC peak or 60 V DC. These voltages present a shock hazard.
- To avoid the risk of electric shock do not connect the thermocouple to circuits greater than 10 V.
- Before any resistance, continuity, diode, or capacitance measurements are started, circuits must be de-energised and isolated from the mains power.
- Before and after use always test a known voltage to check for correct instrument operation. Do not use the instrument if incorrect results are obtained.
- Make sure that the test probes are disconnected before the case or battery cover is opened.
- Replacement fuses must be of the correct type and rating.
- The instrument must not be used in wet conditions. If it should become wet, it must be dried thoroughly before use.

Safety Warnings and Standards

- Test leads, which are used for mains measurements, must be rated as appropriate for measurement Category III. They must also have a voltage rating of at least the voltage of the circuit to be measured.

2.2.1 Installation category definitions:

CAT IV - Measurement category IV: Equipment connected between the origin of the low-voltage mains supply and distribution panel.










CAT III - Measurement category III: Equipment connected between the distribution panel and electrical outlets.

CAT II - Measurement category II: Equipment connected between the electrical outlets and user's equipment.

Measurement equipment may be safely connected to circuits at the marked rating or lower. The connection rating is that of the lowest rated component in the measurement circuit.

2.3 Safety, Hazard and Warning symbols on the instrument

This paragraph details the various safety and hazard icons on the instrument's outer case.

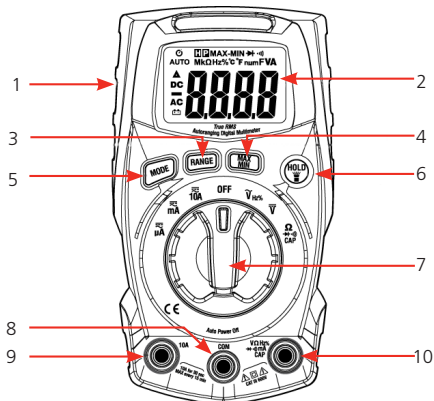
Icon	Description
	Risk of electric shock
	See instruction manual
	Both direct and alternating current
	AC volts
	DC volts
Hz%	Frequency and Percentage of duty cycle
	Resistance, Diode, Continuity, Capacitance selection
	Flashlight
	Equipment protected by double or reinforced insulation
UK CA	UK conformity. This equipment complies with current UK legislation
CE	EU conformity. Equipment complies with current EU directives
	Do not discard this product or throw away

3. Instrument Overview

3.1 Features

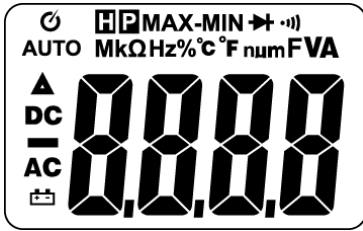
- 4000 count display
- AC / DC voltage 600 V max
- True RMS
- Capacitance 4000 μF max
- Duty cycle 99.9 %
- Auto power off
- Back light display
- Max/Min
- CAT III 600 V
- AC / DC current 10 A max
- Resistance 40 $\text{M}\Omega$
- Frequency 10 kHz max
- Data hold
- Auto ranging
- Built in flashlight
- Rear tilt stand

3.2 Instrument layout



Item	Description	Item	Description
1.	Battery cover (rear)	6.	HOLD and flashlight button
2.	4000 count LCD display	7.	Function switch
3.	RANGE button	8.	COM 4 mm socket
4.	MAX/MIN button	9.	10 A input 4 mm socket
5.	MODE button (VAC / Hz / Duty cycle)	10.	V, Ω , Hz%, Diode, mA, μF input 4 mm socket

3.3 Display symbols



Item	Description	Item	Description
	Auto power off	M	Mega (ohms)
	Continuity	Ω	Ohms
	Diode test	Hz	Hertz (frequency)
	Battery status	V	Volts
n	nano (capacitance)	%	Percent (duty cycle)
μ	micro (amps, capacitance)	AC	AC current
m	milli (volts, amps)	AUTO	Autoranging
A	Amps	DC	DC current
k	kilo (ohms)	HOLD	Display hold
F	Farads (capacitance)	MAX	Maximum
		MIN	Minimum

4. Operation

NOTE : Turn the function switch to **OFF** position when the meter is not in use.

If 'OL' appears on display during a measurement, the value exceeds the range you have selected. Change to a higher range.

4.1 DC Voltage measurements



Avoid measuring DC voltages if a motor on the circuit is being energised /de-energised. Large voltage surges may occur that can damage the meter.

1. Set the function switch to **VDC** position.
2. Insert the black test lead plug into the **COM** socket.
Insert the red test lead plug into the **V** socket.
3. Apply the black test probe to the negative side of circuit being tested.
Apply the red test probe to the positive side of circuit being tested.
4. Read the displayed voltage.
5. If necessary, adjust range.

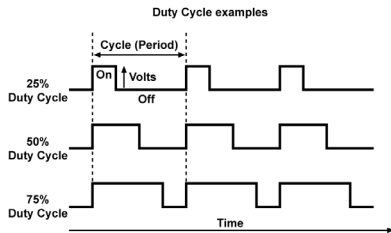
4.2 AC Voltage (Frequency, Duty Cycle) measurements



Avoid measuring AC voltages if a motor on the circuit is being energised/de-energised. Large voltage surges may occur that can damage the meter.

1. Set the function switch to **VAC / Hz / %** position.
2. Insert the black test lead plug into the **COM** socket.
Insert the red test lead plug into the **V** socket.
3. Apply the black test probe to the Neutral side of circuit being tested.
Apply the red test probe to the Live side of circuit being tested.
4. Read the displayed voltage.
5. If necessary, adjust range if required.
6. For frequency measurements press the **MODE** button to indicate Hz on display.
7. Read the displayed frequency.
8. For Duty Cycle press the **MODE** button to indicate % on display.
Read the displayed % of duty cycle.

Operation



NOTE : Duty Cycle is a ratio of time that a circuit is energised compared to the time the circuit is de-energised. Typical circuit would be a heater element controlled by a thermostat.

Duty cycle is measured in percentage of ON time.

Example: A 75% duty cycle is a signal that is on 75% of the time and off 25% of the time.

A complete ON / OFF cycle is generally called a period.

4.3 DC Current measurements



Do not make 20 A current measurements for longer than 30 seconds.

Exceeding 30 seconds may cause damage to the meter and /or test leads.

1. Insert the black test lead plug into the negative **COM** socket.
2. For current measurements up to 6000 μA DC, set the function switch to the μA position and insert the red test lead plug into the μA / mA socket.
For current measurements up to 600 mA DC, set the function switch to the mA position and insert the red test lead plug into the μA / mA socket.
For current measurements up to 20 A DC set the function switch to the 10 A position and insert the red test plug into the 10 A socket.
3. Press the MODE button to indicate DC on the display.
4. Remove power from the circuit under test, then open up the circuit at the point where the measurement is to be made.
5. Apply the black test probe to the negative side of circuit.
6. Apply the red test probe to the positive side of circuit.
7. Apply power to circuit.
8. Read the displayed current.

4.4 AC Current measurements



Do not make 20 A current measurements for longer than 30 seconds.

Exceeding 30 seconds may cause damage to the meter and /or test leads.

1. Insert the black test lead plug into the negative **COM** socket.
2. For current measurements up to 6000 μA AC, set the function switch to the μA position and insert the red test lead plug into the μA / mA socket.
For current measurements up to 600 mA AC, set the function switch to the mA position and insert the red test lead plug into the μA / mA socket.
For current measurements up to 20 A AC set the function switch to the 10 A position and insert the red test plug into the 10 A socket.
3. Press the MODE button to indicate AC on the display.
4. Remove power from the circuit under test, then open up the circuit at the point where the measurement is to be made.
5. Apply the black test probe and red test probe to either side of where the circuit has been opened.
6. Apply power to circuit.
7. Read the displayed current.

4.5 Resistance measurements



To avoid electric shock, disconnect power to circuit under test and discharge all capacitors before taking any resistance measurements.

1. Set the function switch to the $\rightarrow + \text{CAP}$ Ω **CAP** position.
2. Insert the black test lead plug into the negative **COM** socket.
3. Insert the red test lead plug into the positive Ω socket.
4. Repeatedly press the MODE button until Ω is indicated on the display.
5. Connect the test lead probes across circuit or part under test. (It is recommended to disconnect one side of the part under test, so the rest of the circuit does not interfere with the resistance measurement).
6. Read the displayed resistance.

4.6 Continuity check



To avoid electric shock, never measure continuity on circuits that have voltage on them.

1. Set the function switch to the Ω CAP position.
2. Insert the black test lead plug into the negative **COM** socket.
3. Insert the red test lead plug into the positive Ω socket.
4. Repeatedly press the MODE button until and Ω are indicated on the display.
5. Connect the test lead probes to the circuit under test.
6. If the resistance is less than 50 Ω , the audible signal will sound.
7. If the circuit is open, OL will be displayed.

4.7 Diode test

1. Set the function switch to the Ω CAP position.
2. Insert the black test lead plug into the negative **COM** socket.
3. Insert the red test lead plug into the positive **V** socket.
4. Repeatedly press the MODE button until and **V** are indicated on the display.
5. Connect the test lead probes to the diode under test.
6. Forward voltage will typically indicate 0.400 to 0.700 V. Reverse voltage will indicate OL.
7. Shorted diodes will indicate nearly 0 V while an open circuit diode will indicate OL with both polarities.

4.8 Capacitance measurements



To avoid electric shock, disconnect power to circuit under test and discharge all capacitors before taking any capacitance measurements.

1. Set the function switch to the Ω CAP position.
2. Insert the black test lead plug into the negative **COM** socket.
3. Insert the red test lead plug into the positive **V** socket.
4. Repeatedly press the MODE button until nF is indicated on the display.

5. Connect the test lead probes to the capacitor under test.
6. The test may take up to 3 minutes or more for large value capacitors to charge. Wait until the readings to settle.
7. Read the displayed capacitance.

4.9 Auto ranging / Manual range selection

The AVO®215 automatically enters auto ranging mode when first switched on. This automatically selects the best range for measurements. For measurements that require the range to be manually selected, the following procedure should be followed:

1. Press the RANGE button. The AUTO display indicator will turn off.
2. Repeatedly press the RANGE button to step through the available ranges until the required range is reached.
3. To exit manual ranging and return to auto ranging, press and hold the RANGE button for 2 seconds.

NOTE : Manual ranging does not apply for capacitance and frequency measurements.

4.10 MAX/MIN

NOTE : When using the MAX/MIN function in Auto ranging mode, the meter will lock into the range that is displayed on the LCD when MAX/MIN is activated. If a MAX/MIN reading exceeds that range, OL will be displayed. Select the desired range BEFORE entering MAX/MIN mode.




1. Press the MAX/MIN button to activate the MAX/MIN recoding mode. The display will show MAX. The meter will display and hold the maximum reading, updating only when a new maximum occurs.
2. Press the MAX/MIN button again. The display will show MIN. The meter will display and hold the minimum reading, updating only when a new minimum occurs.
3. To exit MAX/MIN mode press and hold the MAX/MIN button for 2 seconds.

4.11 Display back light

Positive display and back light activate when the meter is turned on.

Operation

4.12 MODE

The MODE button is active only in the selection switch    CAP position to allow selection of the diode, continuity, resistance and capacitance tests, and in the μA , mA and 10 A positions to select between AC or DC measurements.

4.13 HOLD / flashlight


The hold function freezes the reading on the display. Press the HOLD button momentarily to activate or deactivate the hold function.

To activate or de-activate the flashlight select any function switch position and press the HOLD button for >1 second.

4.14 Auto Power Off

The auto power off feature will turn the meter off after 15 minutes. To disable the auto power off, hold down the MODE button and switch meter on.

4.15 Low Battery Indication

The  symbol will appear in the lower left corner of the display when the battery voltage becomes low. The battery must be replaced as soon as this symbol appears to avoid incorrect/inaccurate readings.

5. Maintenance.

NOTE : There are no user replaceable parts within this product, other than the battery cells and the fuses.

5.1 General maintenance

Do not attempt to repair this multimeter. It contains no user-serviceable parts. Repair or servicing should only be performed by qualified personnel.

5.2 Cleaning

Periodically wipe the case with a dry cloth and detergent, do not use abrasives or solvents.

6. Specifications

DC Voltage

Range	Resolution	Accuracy
400 mV	0.1 mV	+/- (1.0 % reading + 5 digits)
4 V	0.001 V	+/- (1.0 % reading + 3 digits)
40 V	0.01 V	
400 V	0.1 V	
600 V	1 V	

AC Voltage

Range	Resolution	Accuracy
4 V	0.001 V	50 Hz to 60 Hz +/- (1.2 % reading + 3 digits)
40 V	0.01 V	
400 V	0.1 V	
600 V	1 V	

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

DC Current

Range	Resolution	Accuracy
400 μ A	0.1 μ A	+/- (1.0 % reading + 3 digits)
4000 μ A	1 μ A	+/- (1.2 % reading + 3 digits)
40 mA	0.01 mA	
400 mA	0.1 mA	
4 A	0.001 A	
10 A	0.01 A	

(20 A: 30 seconds maximum with reduced accuracy)

AC Current

Range	Resolution	Accuracy
400 μ A	0.1 μ A	+/- (1.2 % reading + 3 digits)
4000 μ A	1 μ A	
40 mA	0.01 mA	
400 mA	0.1 mA	
4 A	0.001 mA	+/- (1.8 % reading + 5 digits)
10 A	0.01 A	

(20 A: 30 seconds maximum with reduced accuracy)

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

Resistance

Range	Resolution	Accuracy
400 Ω	0.1 k Ω	+/- (1.5 % reading + 5 digits)
4 k Ω	0.001 k Ω	
40 k Ω	0.01 k Ω	
400 k Ω	0.1 k Ω	
4 M Ω	0.001 M Ω	
40 M Ω	0.01 M Ω	+/- (2.5 % reading + 20 digits)

Capacitance

Range	Resolution	Accuracy
40 nF	0.01 nF	+/- (4.5 % reading + 10 digits)
400 nF	0.1 nF	
4 μ F	0,001 μ F	+/- (3.0 % reading + 5 digits)
40 μ F	0.01 μ F	
400 μ F	0.1 μ F	
4000 μ F	1 μ F	+/- (5 % reading + 5 digits)

Frequency

Range	Resolution	Accuracy
10 Hz – 10 kHz	0.01 Hz	+/- (1.2 % reading)

Sensitivity: 15 V rms

Duty Cycle

Range	Resolution	Accuracy
0.1 to 99.9 %	0.1 %	+/- (1.2 % reading + 2 digits)

Pulse width: 100 μ s – 100 ms, Frequency: 5 Hz to 150 kHz

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

NOTE : Accuracy specifications consist of two elements.

(% reading) = accuracy of the measurement circuit.

(+ digits) = accuracy of analog to digital converter.

Drop test: 6.5 feet (2 metres)

Diode test: Test current of 1.5 mA maximum, open circuit voltage
3 V DC typical

Continuity check: Audible signal will sound if the resistance is less than
50 Ω (approx.), test current <0.35 mA

Specifications

Input impedance:	>10 M Ω VDC / VAC
AC response:	TRMS
ACV bandwidth:	50/60 Hz (All waveforms) 45 Hz to 1000 Hz (Sine wave)
Crest factor:	Less than or equal to 3 at full scale up to 300 V, decreasing linearly to less than or equal to 1.5 at 600 V
Auto power off:	15 minutes - can be disabled
Display:	4000 counts / positive display
Overrange indication:	'OL' is displayed
Polarity:	Automatic (No indication for positive) Minus symbol for negative
Measurement rate:	3 times per second
Battery:	1.5 V AAA x 2 batteries
Fuses:	mA / μ A ranges: 0.5 A 600 V ceramic quick blow fuse A range: 10 A 600 V ceramic quick blow fuse
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 31 °C (87 °F) decreasing linearly to 50 % at 40 °C (104 °F)
Storage humidity:	<80 %
Operating altitude:	2000 metres (7000 feet) maximum
Weight:	342 g (0.753 lb)
Size:	182 x 82 x 59 mm
IEC	IEC61010
Safety rating:	CAT III 600 V

7. Decommissioning

7.1 WEEE Directive

The crossed out wheeled bin symbol on the instrument and on the batteries is a reminder not to dispose of them with general waste at the end of their life.

Megger is registered in the UK as a Producer of Electrical and Electronic equipment. The registration No is; WEE/DJ2235XR. Users of Megger products in the UK may dispose of them at the end of their useful life by contacting B2B Compliance at www.b2bcompliance.org.uk or by telephone on 01691 676124.

Users of Megger products in other regions should contact their local Megger office or distributor.

7.2 Battery disposal

The batteries in this product are classified as Portable Batteries under the Batteries Directive. Please contact either Megger Ltd, your local Megger office or distributor for instructions on the safe disposal of these batteries.

Megger is registered in the UK as a producer of batteries. The registration number is BPRN01235.

For further information see www.megger.com

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