

Megger[®]

AVO410

Digital multimeter

Digitale Multimeter

Multimètre numérique

Multímetro digitales

Digitale multimeter

User manual

Bedienungsanleitung

Manuel utilisateur

Guía del usuario

Gebruikershandleiding



SAFETY WARNINGS

Safety warnings must be read and understood before instrument is used.

The following safety information must be observed to insure maximum personal safety during the operation of this meter:

- Do not use in wet environments.
- Measurements beyond the maximum selected range must not be attempted.
- Extreme care must be taken when measuring above 50 V, especially on live bus-bars.
- To measure voltage, the instrument must not be switched to a current or resistance range, or to the diode check or buzzer position.
- Circuits must be de-energised and isolated before carrying out resistance tests.
- The rotary selector switch must only be turned after removing test connections.
- All external voltages must be disconnected from the instrument before removing the battery.
- Test leads and prods must be in good order, clean, and with no broken or cracked insulation.
- UK Safety Authorities recommend the use of fused test leads when measuring voltage on high energy systems.
- Replacement fuses must be of the correct type and rating.
- The instrument must not be used if any part of it is damaged.
- Check for correct instrument operation by testing a known voltage before and after use. Do not use if misleading results are obtained.
- Warnings and precautions must be read and understood before an instrument is used. They must be observed during the operation of this instrument.

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

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

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

Note

This instrument must only be used by suitably trained and competent persons

Contents

Safety warnings	2
Symbols used on instrument	3
Introduction	4
Operation	5
Specifications	10
Manual de l'utilisateur	16
Bedienungsanleitung	30
Manual del usuario	44
Gebruikershandleiding	56

Symbols used on the instrument are:

-  Caution: risk of electric shock
-  Caution: refer to accompanying notes
-  Equipment protected throughout by Double Insulation (Class II)
-  Equipment complies with current EU directives.

END OF LIFE DISPOSAL



The crossed out wheeled bin placed on the Megger products is a reminder not to dispose of the product at the end of its product life with general waste.

Megger is registered in the UK as a Producer of Electrical and Electronic Equipment. The Registration number is WEE/HE0146QT.

BATTERIES

Should the display fail to illuminate then change the battery. For the purpose of end of life disposal and battery replacement, removing the two screws on the base of the unit accesses the battery.

The crossed out wheeled bin placed on the battery is a reminder not to dispose of it with general waste at the end of its life.

This product contains 1 x PP3 / 6F22 alkaline battery.

Do not use rechargeable batteries.

The battery fitted in this instrument is classified as a Portable Battery and should be disposed of in the UK in accordance with Local Authority requirements.

For disposal of batteries in other parts of the EU contact your local distributor. Megger is registered in the UK as a Producer of Batteries. The registration number is BPRN00142.

Introduction

Thank you for purchasing the Megger AVO410 Digital Multimeter. For your own safety and to get the maximum benefit from your instrument, please ensure that you read and understand the safety warnings and instructions before attempting to use the instrument.

The AVO410 is aimed at providing electricians with a rugged, easy to use multimeter for field use. Functions include voltage, current and resistance; in addition, there are extra functions that may also appeal to electrical and electronic engineers. The instrument features automatic or manual selection of ranges, True RMS readings and a CATIV 600 V safety rating.

Unpacking and inspection

Upon removing your new digital multimeter from its packing, you should have the following items.

1. Digital multimeter.
2. Test lead set (one black, one red)
3. User manual.
4. Protective holster.

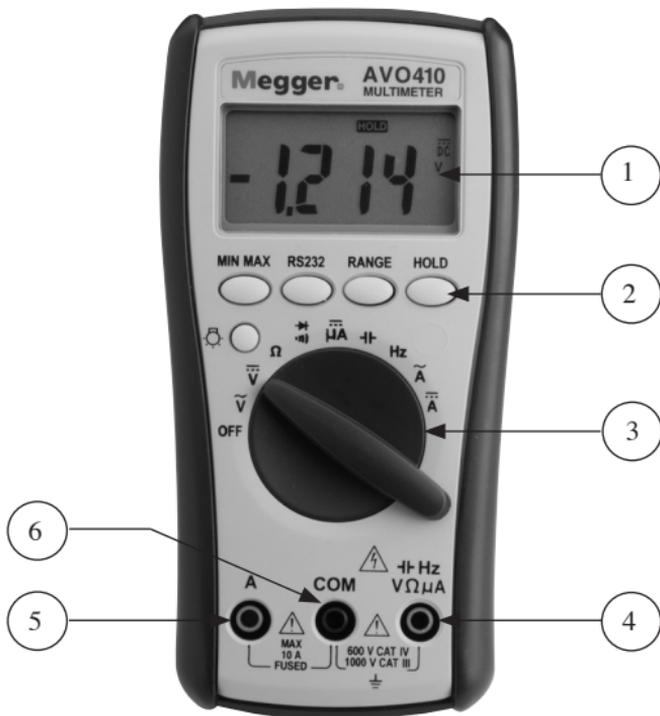
Symbols and annunciators

	Continuity
BAT	Low battery
	Diode test
HOLD	Data hold
AUTO	Auto-ranging
AC	Alternating current or voltage
DC	Direct current or voltage
MAX/MIN	Stores the highest or lowest measurement
	Backlight
V	Volts
A, mA, uA	Current range

Meter description

1. 6000 counts LCD display.
2. Push buttons for features
3. Selection switch
4. Input terminal for all other functions (Red)
5. Input terminal for A current selection (Red)
6. COM (Black) common or ground reference input terminal for all functions.

Features



Operation

AC VOLTAGE MEASUREMENTS

1. Set the function switch to the V AC position (AUTO, TRMS and AC volts will appear on the display).
2. Insert the black test lead in the COM jack and the red test lead into the V jack.
3. Connect the test probe tips to the circuit under test.
4. Read the voltage on the display.

DC VOLTAGE MEASUREMENTS

1. Set the function switch to the V DC position (AUTO and DC volts will be appear on the display).
2. Insert the black test lead into the COM jack and the red test lead into the V jack.
3. Connect the test probe tips to the circuit under test. Be sure to observe the correct polarity (red lead to positive, black lead to negative)
4. Read the voltage on the display. If the polarity is reversed, the display will show (-) minus before the reading.

RESISTANCE (Ω) MEASUREMENTS

1. Set the function switch to the Ω position (AUTO and M Ω will appear on the display).
2. In addition, O.L will be displayed indicating an open circuit.
3. Insert the black test lead into the COM jack and the red test lead into the Ω jack.
4. Connect the test probe tips to the circuit under test.
5. According to measured value the reading will be in Ω , k Ω or M Ω .

Note: The AVO410 provides an open circuit voltage <1.5 V to the circuit under test which will cause transistor junctions to conduct so it is advisable to disconnect the item to be tested from the circuit to obtain an accurate reading.

DIODE / CONTINUITY TESTS

WARNING: To avoid electric shock never test a diode or conduct a continuity test on an energized circuit.

1. Set the function switch to the diode/continuity position. (The diode and V symbols will appear).
2. In addition, .OL will be displayed indicating an open circuit.
3. Insert the black test lead into the COM jack and the red test lead into the Ω jack.

4. For continuity connect the test probes to the cable or circuit to be tested. (Polarity is not important).
5. The AVO410 will emit a tone if continuity is below $500\ \Omega$ / .OL with no tone will indicate either open circuit or continuity above $500\ \Omega$.
6. For diode testing connect the test probe tips to the diode or semiconductor junction and note the reading.
7. Reverse the probe polarity by switching probe position and note this reading.
8. The diode or junction can be evaluated as follows:
 - a. If one reading shows a value and the other reading shows .OL, the diode is good.
 - b. If both readings show .OL, the device is open circuit.
 - c. If both readings are very small or zero, the device is shorted.

DC μ A MEASUREMENTS (6000 μ A max.)

1. Set the function switch to the DC μ A position. (AUTO and DC μ A will be displayed).
2. Insert the black test lead into the COM jack and the red test lead into the μ A jack.
3. Remove power from circuit under test, then open circuit at a convenient point where current is to be measured.
4. Connect the black test probe to the negative side of the circuit. Connect the red test probe to the positive side of the circuit.
5. Carefully apply the power
6. Read the measured on the display.
7. Remove supply before removing test leads and reconnecting circuit.

CAPACITANCE MEASUREMENTS

WARNING: To avoid damage to the instrument. Before testing, discharge the capacitor/s to be tested.

1. Set the function switch to the capacitor position (AUTO and nF will be appear on the display).
2. Insert the black test lead into the COM jack and the red test lead into the capacitance jack.
3. Connect the test probe tips to the capacitor under test. Be sure to observe the correct polarity if the capacitor is an electrolytic / polarised type. Red to positive and black to negative.
4. Read the value on the display.

FREQUENCY MEASUREMENTS

1. Set the function switch to the Hz position (AUTO and Hz will appear on the display).
2. Insert the black test lead in the COM jack and the red test lead into the Hz jack.
3. Connect the test probe tips to the circuit under test.
4. Read the frequency on the display.

AC CURRENT MEASUREMENTS

1. Set the function switch to the ACA position. (AUTO, TRMS and ACA will appear on the display).
2. Insert the black test lead into the COM jack and the red test lead into the A jack.
3. Remove power from circuit under test, then open circuit at a convenient point where current is to be measured.
4. Connect the black test probe to the negative side of the circuit. Connect the red test probe to the positive side of the circuit.
5. Carefully apply the power
6. Read the measured on the display.
7. Remove supply before removing test leads and reconnecting circuit.

DC CURRENT MEASUREMENTS

1. Set the function switch to the DC A position. (AUTO and DC A will appear on the display).
2. Insert the black test lead into the COM jack and the red test lead into the A jack.
3. Remove power from circuit under test, then open circuit at a convenient point where current is to be measured.
4. Connect the black test probe to the negative side of the circuit. Connect the red test probe to the positive side of the circuit.
5. Carefully apply the power
6. Read the measured on the display.
7. Remove supply before removing test leads and reconnecting circuit.

FEATURE BUTTONS

BACKLIGHT

The AVO410 has a backlit display for all the different functions which has an auto off in 60 seconds.

MIN MAX

The MIN MAX function enables the user to display both a minimum and a maximum measured reading. To activate, first select a function and make a measurement. Press the MIN MAX button to store the maximum reading. Should the value increase then the new value will be stored. Pressing the MIN MAX button once more will switch the instrument display to minimum reading.

Pressing the HOLD button while in MIN MAX mode will stop the AVO410 updating the maximum and minimum displayed reading. Holding down the MIN MAX button for >1 sec. will switch the function off.

HOLD

Press the HOLD button to freeze the reading on the display. The MIN MAX function is unavailable when the Hold is active.

RS-232

With an optional USB adapter and software the AVO410 can be utilised with a computer to provide a virtual multimeter mode.

RANGE

When any of the individual functions are first selected the unit will be in the auto ranging mode.

Each successive press of the range button will enable the operator to manually choose a required range.

AUTO POWER OFF / DISABLE

If the meter is idle for more than 10 minutes, the meter automatically turns the display off. During this off time the last reading on the meter is stored. The AVO410 can be restored by pressing any button.

To disable the power off function simultaneously hold down the MIN MAX, RS232 and Range buttons and switch instrument to required function.

MAINTENANCE

To clean the instrument, do not immerse in water, periodically wipe the case with a damp cloth and mild detergent. Dirt in the terminals may affect readings. Remove the battery if the AVO410 is not to be used for a long period of time.

When the low battery symbol  appears on the display, replace the battery. To replace battery remove instrument from black boot and unscrew two screws on battery cover to reveal battery.

An internal user replaceable fuse can be accessed for replacement by unscrewing the four deep recess screws. Carefully separate the two halves of the tester taking care of battery lead. Use only the recommended replacement fuse (10 A 500 V 32 mm).

SPECIFICATIONS

General Specifications

Display:	6000 counts updates 1.5/sec.
Polarity indication:	Automatic, positive implied, negative indicated
Overrange indication:	"OL" or "-OL"
Low battery indication:	Displayed when the battery voltage drops below operating voltage
Auto power off:	Approx 10 minutes
Operating ambient:	
Non-condensing	$\leq 10\text{ }^{\circ}\text{C}$, $11\text{ }^{\circ}\text{C} \sim 30\text{ }^{\circ}\text{C}$ ($\leq 80\%$ R.H) $31\text{ }^{\circ}\text{C} \sim 40\text{ }^{\circ}\text{C}$ ($\leq 75\%$ R.H), $41\text{ }^{\circ}\text{C} \sim 50\text{ }^{\circ}\text{C}$ ($\leq 45\%$ R.H)
Storage temperature:	$-20\text{ }^{\circ}\text{C}$ to $60\text{ }^{\circ}\text{C}$, 0 to 80% R.H. when battery removed from meter
Temperature coefficient:	$0.15 \times (\text{Spec.Acc'y}) / ^{\circ}\text{C}$, $< 18\text{ }^{\circ}\text{C}$ or $> 28\text{ }^{\circ}\text{C}$
Power requirements:	Standard 9V battery NEDA 1604, IEC6F22, JIS006P
Battery life:	Alkaline 300 hours
Dimensions (W x H x D):	76 mm x 158 mm x 38 mm without holster 82 mm x 164 mm x 44 mm with holster
Weight:	522 g

ELECTRICAL SPECIFICATIONS

Accuracy is \pm (% reading + number of digits) at 23 °C \pm 5 °C, less than 80% R.H

DC/AC volts

Range	DC accuracy	AC accuracy
600.0 mV	\pm (0.5% + 2 digits)	50 Hz/60 Hz sine wave only for 600.0 mV range, \pm (0.9% + 5 digits) 50 Hz ~ 500 Hz *1
6.000		
60.00 V		
600.0 V		
DC 1000 V/AC 750 V		

Over voltage protection: DC 1000 V or AC

Input impedance: 10 M Ω // less than 100 pF

CMRR/NMRR

(Common mode rejection ration/normal mode rejection ratio)

V_{AC} : CMRR >60 dB at DC, 50 Hz/60 Hz

V_{DC} : CMRR >100 dB at DC, 50 Hz/60 Hz

NMRR >50 dB at DC, 50 Hz/60 Hz

AC conversion type:

AC conversions are AC coupled True RMS responding, calibrated to the sine wave input.

*1

The basic accuracy is specified for a sine wave below 4000 counts. Over 4000 counts, add 0.6% to the accuracy. For non-sine waves below 2000 counts, refer to the following for accuracy:

\pm 1.5% addition error for C.F from 1.4 to 3

Crest factor: C.F = Peak/rms

DC/AC current

Range	DC accuracy	AC accuracy	Voltage burden	
600.0 μ A	\pm (1.0% + 2 digits)	N/A	<4 mV/ μ A	
6000 μ A				
6.000 A		\pm (1.5% +6 dgt)	50 Hz ~ 500 Hz *1	2 V max
10.00 A				

Overload protection

A input: 10 A (500 V) fast blow fuse

μA input: 600 V rms

*1

AC conversion type:

Conversion type and additional specification are the same as DC/AC voltage

Resistance

Range	Accuracy	Overload protection
600.0 Ω *2	± (0.7% + 2 digits)	600 V rms
6.000 KΩ		
60.00 KΩ		
600.0 KΩ		
6.000 MΩ	± (1.0% + 2 digits)	
60.00 MΩ *1	± (1.5% + 2 digits)	

Open circuit voltage: -1.3 V approx.

*1 <100 digit rolling

*2 <10 digit rolling

Diode check and continuity

Range	Resolution	Accuracy
▶	10 mV	± (1.5% + digits*)

* For 0.4 V ~ 0.8 V

Max. test current: 1.5 mA

Max. open circuit voltage: 3 V

Overload protection: 600 V rms

Continuity: Built-in buzzer will sound when the resistance is less than 500 Ω approx.
Response time is 100 ms approx.

Frequency

Range	**Sensitivity	Overload protection
6000 Hz	100 mV rms *	Frequency: 0.1% \pm 1 digit
60.00 KHz		
600.0 KHz		
6.000 MHz	250 mV rms	
60.00 MHz	1 V rms	

Overload protection: 600 V rms

* Less than 20 Hz, the sensitivity is 1.5 V rms

** Max. sensitivity: <5 V ac rms

Capacitance

Range	Accuracy
6.000 nF	\pm (1.9%) +8 digits)
60.00 nF	
600.0 nF	
6.000 μ F	
60.00 μ F	
600.0 μ F	
6.00 mF*	

Overload protection: 600 V rms

* <100 digit of reading rolling

Auto power off (APO): If idle for more than 10 minutes

ACCESSORIES

Battery (installed)

Test leads

User manual

REPAIR AND WARRANTY

The instrument contains static sensitive devices, and care must be taken in handling the printed circuit board. If an instrument's protection has been impaired it should not be used, but sent for repair by suitably trained and qualified personnel. The protection is likely to be impaired if for example; it shows visible damage; fails to perform the intended measurements; has been subjected to prolonged storage under unfavourable conditions, or has been subjected to severe transport stresses.

Note: Any unauthorised prior repair or adjustment will automatically invalidate the warranty.

INSTRUMENT REPAIR AND SPARE PARTS

For service requirements for Megger instruments contact:

Megger Limited	or	Megger
Archcliffe Road		Valley Forge Corporate Centre
Dover		2621 Van Buren Avenue
Kent CT17 9EN		Norristown PA 19403 England, U.S.A.
Tel: +44 (0) 1304 502 243		Tel: +1 610 676 8579
Fax: +44 (0) 1304 207 342		Fax: +1 610 676 8625

or an approved repair company.

Returning and Instrument for Repair

If it is necessary to return an instrument for repair, a Returns Authorisation number must first be obtained by contacting one of the addresses shown. You will be asked to provide key information, such as the instrument serial number and fault reported when the number is issued. This will enable the Service Department to prepare in advance for the receipt of your instrument, and to provide the best possible service to you.

The Returns Authorisation number should be clearly marked on the outside of the product packaging, and on any related correspondence. The instrument should be sent, freight paid to the appropriate address. If appropriate a copies of the original purchase invoice and of the packing note, should be sent simultaneously by airmail to expedite clearance through customs.

For instruments requiring repair outside the warranty period a repair estimate will be submitted to the sender, if required, before work on the instrument commences.

Approved Repair Companies

A number of independent instrument repair companies have been authorised for repair work on most Megger instruments, using genuine Megger spare parts. A list of approved companies is available from the UK address shown.

AVO410

Digital Multimeter



- **6000 count backlit digital display**
- **True RMS reading on AC mode**
- **1000 V DC / 750 V AC ranges**
- **10 A AC / DC ranges**
- **Resistance, frequency and capacitance ranges**
- **CAT IV 600 V**

DESCRIPTION

The Megger AVO410 digital multimeter has been designed for the contracting electrician and has the additional features that also make the instrument suitable for wide range of applications and users.

The instrument offers AC and DC voltage and current measurements as well as resistance, frequency and capacitance ranges. True RMS readings on the AC functions are standard on the AVO410 and the instrument features a CATIV 600 V safety rating meaning the instrument is suitable for industrial applications.

The slim, compact case has a tough rubberised holster that provides that extra degree of protection from the extreme conditions found in industrial environments. The style of the case and positioning of the function switch and buttons means the unit sits comfortably in the palm for single handed use.

Continuous references to the user guide have been avoided by the AVO410 utilising simplified functions.

The display features a back light that allows measurements to be made in poorly lit areas.

The AVO410 test leads are supplied with silicon cable and have GS38 compliant shrouded tips on the prods.

Auto-ranging

When first selected, all functions are auto-ranging. A range button on the AVO410 allows multiple manual range selection on each function; a feature that is generally welcomed by many users.

Minimum / Maximum measurements

The instrument has a MIN MAX function that allows the user to switch between minimum and maximum measurements. The

display does not have to be continually monitored to capture a momentary increase or fall in readings.

Data hold

This function allows a displayed result to be frozen on the display which avoids having to remember a measurement value. The hold function can be nested within the MIN MAX feature which stops the AVO410 continuously updating the minimum and maximum measurement values.

Voltage measurements

Both AC and DC voltage measurements up to 750 V and 1000 V respectively are possible with the AVO410, the AC reading being a true RMS value.

Current measurements

For current measurements up to 10 A, a separate fused terminal is provided to protect both user and instrument from excess current.

RS232

The AVO410 has optically isolated RS232 interface that allows the user to connect to a PC via a USB port for data acquisition and analysis. (Optional software is required for this function).

Continuity / diode testing

The continuity function features a buzzer and provides the user both optical and audio indication of identifying and confirming continuity between two points. This function also allows forward and reverse bias testing of diode and semiconductor junctions.

Resistance, capacitance and frequency

Resistance can be measured directly on the ohms range from 0 to 60 MΩ with capacitance measurements from 0 to 6.000 mF. In addition, frequency measurements from 0 to 60 MHz are possible.

SPECIFICATIONS

Display	6000 counts updates 1.5/sec.
Polarity indication	Automatic, positive implied, negative indicated
Over-range indication	"OL" or "-OL"
Low battery indication	Displayed when the battery voltage drops below operating voltage
Auto power off	Approx 10 minutes
Operating ambient	Non-condensing ≤10 °C, 11 °C ~ 30 °C (≤80% R.H) 31 °C ~ 40 °C (≤75% R.H), 41 °C ~ 50 °C (≤45% R.H)
Storage temperature	-20 °C to 60 °C, 0 to 80% R.H. when battery removed from meter
Temperature coefficient	0.15 x (Spec.Acc'y) / °C, <18 °C or >28 °C

Safety

The instrument complies with IEC61010 CATIV 600 V

Power requirements

Standard 9 V battery PP3, NEDA 1604, IEC6F22, JIS006P

Battery life Alkaline 300 hours

Dimensions (W x H x D)

76 mm x 158 mm x 38 mm without holster
82 mm x 164 mm x 44 mm with holster

Weight

522 g

ELECTRICAL SPECIFICATIONS

Accuracy is ± (% reading + number of digits) at 23 °C ±5 °C, less than 80% R.H.

DC / AC Volts

Range	DC accuracy	AC accuracy
600.0 mV	± (0.5% + 2 digits)	50 Hz/60 Hz sine wave only for 600.0 mV range, ± (0.9% +5 digits) 50 Hz ~ 500 Hz *1
6.000		
60.00 V		
600 V		
DC 1000 V/AC 750 V		

Over voltage protection DC 1000 V or AC

Input impedance 10 MΩ // less than 100 pF

CMRR/NMRR

(Common mode rejection ration/normal mode rejection ratio)

VAC: CMRR >60 dB at DC, 50 Hz/60 Hz

VDC: CMRR >100 dB at DC, 50 Hz/60 Hz

NMRR: >50 dB at DC, 50 Hz/60 Hz

AC conversion type

AC conversions are AC coupled True RMS responding, calibrated to the sine wave input.

*1) The basic accuracy is specified for a sine wave below 4000 counts. Over 4000 counts, add 0.6% to the accuracy. For non-sine waves below 2000 counts, refer to the following for accuracy:

±1.5% addition error for C.F from 1.4 to 3

Crest factor

C.F. = Peak/rms

DC/AC current

Range	DC accuracy	AC accuracy	Voltage burden
600.0 μA	± (1.0% + 2 digits)	N/A	<4 mV/μA
6000 μA			
6.000 A		±(1.5% +6 dgt)	2 V max
10.00 A		50 Hz ~ 500 Hz *1	

Overload protection

A input 10 A (500 V) fast blow fuse

μA input 600 V rms

*1) AC conversion type

Conversion type and additional specification are the same as DC/AC voltage.

Resistance Range	Accuracy	Overload protection
600.0 Ω *2	± (0.7% + 2 digits)	600 V rms
6.000 KΩ		
60.00 KΩ		
600.0 KΩ		
6.000 MΩ ±(1.0% + 2 digits)	± (1.0% + 2 digits)	
60.00 MΩ *1	± (1.5% + 2 digits)	

Open circuit voltage -1.3 V approx.

*1 <100 digit rolling

*2 <10 digit rolling

Diode check and continuity

Range	Resolution	Accuracy
Diode	10 mV	± (1.5% + digits*)

* For 0.4 V ~ 0.8 V

Max. test current 1.5 mA

Max. open circuit voltage 3 V

Overload protection 600 V rms

Continuity

Built-in buzzer will sound when the resistance is less than 500 Ω approx. Response time is 100 ms approx.

Frequency Range	**Sensitivity	Overload protection
6000 Hz	100 mV rms *	Frequency: 0.1% ±1 digit
60.00 KHz		
600.0 KHz	250 mV rms	
6.000 MHz		
60.0 MHz	1 V rms	

Overload protection 600 V rms

* Less than 20 Hz, the sensitivity is 1.5 V rms

** Max. sensitivity <5 V ac rms

Capacitance

Range	Accuracy
6.000 nF	± (1.9%) + 8 digits)
60.00 nF	
600.0 nF	
6.000 µF	
60.00 µF	
600.0 µF	
6.00 mF*	

Overload protection 600 V rms

* <100 digit of reading rolling

Auto power OFF (APO)

If idle for more than 10 minutes

ORDERING INFORMATION

Item (Qty)	Cat. No.
AVO410 digital multimeter CAT IV 600 V	1001-613
Included accessories	
Test leads and probes	

UK
Archcliffe Road Dover
CT17 9EN England
T +44 (0) 1304 502101
F +44 (0) 1304 207342
UKsales@megger.com

UNITED STATES
4271 Bronze Way
Dallas TX 75237-1019 USA
T 800 723 2861 (USA only)
T +1 214 333 3201
F +1 214 331 7399
USsales@megger.com

OTHER TECHNICAL SALES OFFICES
Valley Forge USA, College Station USA, Sydney
AUSTRALIA, Täby SWEDEN, Ontario CANADA,
Trappes FRANCE, Oberursel GERMANY, Aargau
SWITZERLAND, Kingdom of SAUDI ARABIA, Mumbai
INDIA, Johannesburg SOUTH AFRICA, Chonburi
THAILAND, Malaga SPAIN

CERTIFICATION ISO
Registered to ISO 9001:2008 Cert. no. Q 09250
Registered to ISO 14001:2004 Cert. no. EMS 61597

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