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A THORN EMI company
This instrument is manufactured in the United Kingdom

This data uses the comma as the decimal marker to align with general European usage

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AVOMETER 2003

Operating Instructions

SAFETY IN THE USE OF ELECTRICAL EQUIPMENT

It should be understood than any use of electricity inherently involves some degree of safety hazard.

Whilst every effort is made by responsible manufacturers to reduce the hazard, it still rests with the user to play his part in ensuring his own safety.

The best way to achieve this is:-

Understand the equipment you are proposing to use and its ratings.

Understand the application to which the equipment is to be put.

Ensure that all reasonable safety procedures are followed.

Take no chances, nor short cuts, in safety procedures.

See also the notes on safety for this particular instrument in the papagraph headed 'WARNING' on page 11.

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Illustrations

GENERAL DESCRIPTION

The AVOMETER 2003 is a pocket sized battery powered, digital, hand-held multimeter in a robust plastic case.

The instrument is light in weight and, in addition to being operated while held in the hand, it is fitted with a two-position support stand that folds away into the back of the case. This support stand, when opened to its first position, enables the instrument to be propped on a bench at an angle of about 30°. When opened fully the stand forms a loop so that the instrument may be hung from a convenient hook. Non-slip rubber feet are fitted to "grip" the bench when the instrument is used laying horizontally.

Three terminal sockets are fitted at the top of the case for connecting the test leads. They are marked '(—)', '(V/Ω)' and '(A)'. For voltage and resistance measurements and for the audible continuity and diode testing facilities the sockets marked '(—)' and '(V/Ω)' are used. For all current measurements connections must be made to the '(—)' and '(A)' sockets. The terminal sockets are designed such that they will accept either the standard safety test lead terminal plugs, or a test prod direct or the optional heavy duty leads or prods. At the opposite end of the test leads, either prods or crocodile clips may be fitted.

The various positions of use together with the choice of prods, leads or clips, and their various combinations, meets most measuring requirements and gives the operator a wide scope in using the instrument e.g. in one hand or using both hands to manipulate the test leads.

The two thumb operated slider switches, mounted on the front of the instrument select the function and ranges available. The right hand four position switch selects 'OFF' or sets the instrument for a.c., d.c. or resistance measurements. The latter position also selecting the audible continuity facility. The left hand, seven position switch selects the required current, voltage or resistance measuring range or switches in the audible continuity facility and diode testing circuit.

Note:- On the range marked 10 A, current measurements are limited to 10 amperes even though the display will indicate up to 1999.

The measurements are shown on the 3½ digit liquid crystal display situated towards the bottom of the case. The display is easily visible in most lighting conditions and indicates, in addition to the reading, the units of measurement, a decimal point, a minus sign, an over-range symbol, an a.c. symbol and a low battery voltage symbol, when needed.

The power for the multimeter is supplied from a self-contained single 9 V battery (IEC 6-F22 type). The battery and the fuses have their own compartment in the case beneath the rear cover.

The audible continuity and diode testing is indicated by an internal buzzer which also warns when an invalid switch setting is made. It also indicates when the instrument has ruptured if a current measurement is attempted in a 12 V or 24 V system.

The basic d.c. voltage accuracy is ± 0,25% ± 1 digit.

APPLICATIONS

The primary application for the AVOMETER 2003 is concerned with the testing of vehicle electrical circuits. It has functions and ranges which are suited to that field of work and a separate shunt may be fitted to extend the d.c. current measuring facility. The multimeter may be used independently or in conjunction with dedicated pieces of test apparatus, for example, equipment built to simulate and test various circuits in a motor vehicle.

However the AVOMETER 2003 multimeter is also useful for making measurements in all kinds of electrical circuits. Its versatility makes it an ideal instrument for the service engineer or technician.

SPECIFICATION

Ranges

d.c. voltage	2 V 20 V 200 V
a.c. voltage	2 V 20 V 200 V
d.c. current	2000 mA 10 A plus 30 A with an external shunt
a.c. current	2000 mA 10 A
resistance	200 Ω 2 kΩ 20 kΩ 200 kΩ 2000 kΩ
diode test	2000 mV (test current 0,3 mA typical)
continuity buzzer	audible indication for resistances typically < 1 kΩ and junction voltages typically < 800 mV

Accuracy (for ambient temperatures 20 °C to 25 °C)

d.c. voltage ranges	± 0,25% of reading ± 1 digit
a.c. voltage ranges	± 1% of reading ± 3 digits (frequency range 40 Hz to 1 kHz)
d.c. current ranges	± 0,75% of reading ± 1 digit, 2000 mA range; ± 1% of reading ± 1 digit, 10 A range; (shunt range –when used with 2003S plug-in shunt accuracy is ± 2% of reading ± 1 digit)
a.c. current ranges	± 1,5% of reading ± 3 digits (frequency range 40 Hz to 450 Hz)
resistance ranges	± 0,25% of reading ± 2 digits, 200 Ω range ± 0,25% of reading ± 1 digit, 2 kΩ to 2000 kΩ ranges
diode test range	± 1% of reading ± 1 digit
continuity buzzer	± 0,25% of reading ± 1 digit

Temperature Coefficient

d.c. voltage ranges	± 0,03% / °C ± 1 digit/10 °C
a.c. voltage ranges	± 0,05% / °C
d.c. current ranges	± 0,03% / °C, 2000 mA range ± 0,1% / °C, 10 A range (shunt range – when used with 2003S plug-in shunt, temp. coeff. is ± 0,2% / °C ± 1 digit/10 °C
a.c. current ranges	± 0,05% / °C, 2000 mA range ± 0,15% / °C, 10 A range
resistance ranges	± 0,03% / °C ± 1 digit/10 ° C, 200 Ω to 200 kΩ ranges ± 0,05% / °C ± 1 digit/10 °C, 2000 kΩ range
diode test range and continuity buzzer	± 0,03% / °C ± 1 digit/10 °C

Input Characteristics

a.c. and d.c. voltage ranges	10 MΩ//⩽ 100 pF
a.c. and d.c. current ranges	voltage burden typically less than 500 mV at full scale
resistance ranges and continuity	300 mV max. at full scale
diode test range	source current 0,3 mA (nominal), o/c voltage typically 3,3 V

Overload Ratings

a.c. and d.c. voltage ranges	1000 V d.c. or a.c. r.m.s. (sine wave)
a.c. and d.c. current ranges	2 A/250 V fuse 2 A range, 10 A/250 V fuse 10 A range
remaining ranges	250 V a.c. r.m.s. (sine wave)

SPECIFICATION

Temperature Range	operation	— 5 °C to + 50 °C
	storage	— 20 °C to + 70 °C
Humidity Range	operation	80% R.H. max. up to 35 °C
	storage	95% R.H. max. up to 35 °C
Fuses		2 A/250 V 20 x 5 mm ceramic and 10 A/250 V 20 x 5mm ceramic (H.B.C. - 1500 A)
Safety		the instrument will in general meet the requirements of the IEC 348 safety specification.
Power Supply		single 9 V battery IEC 6-F22 type (e.g. Ever-Ready PP3B) battery life 350 hours approx.
Dimensions		193 x 90 x 40 mm (7,5 x 3,5 x 1,58 in)
Weight		350 g (12 oz approx.)

ACCESSORIES

SUPPLIED WITH THE INSTRUMENT*

Safety test lead set including prods and clips	part no. 6131-340
Carrying case (simulated leather, ever-ready type)	part no. 6420-025
Operating instruction book	

AVAILABLE AS AN OPTIONAL EXTRA

Carrying harness	part no. 6420-026
Heavy duty test lead set including prods and clips	part no. 6131-378
20 A test lead set including prods and clips (used with 2003S shunt)	part no. 6320-151
Multimeter temperature probe, MTP4, (—60 °C to + 700 °C), surface type	part no. 6110-247
Multimeter current clamp, MCC1, (0-100 A and 0-1000 A)	part no. 6110-246
30 A / 32 V current shunt, 2003S, (has a replaceable 30 A autofuse and is for use primarily on vehicles with 12 V or 24 V supplies — continuously rated up to 18 A, greater than 18 A duty cycle is 1 min on, 2 min off -accuracy when used with 2003 is 2%)	part no. 6310-766

*(The instruments supplied to Germany include a test lead set without prods and clips, part no. 6420-041 but no carrying case).

ACCESSORIES

Temperature Probe Specification

Range	—60 °C to + 700 °C
Accuracy	± 1.5 °C (for ambient temperature range + 15 °C to + 25 °C)
Sensitivity	1 mV/°C
Ambient range of operation	+ 5 °C to + 45 °C
Sensor type	Thermocouple type K (NiCr/NiAl)
Power supply	Single replaceable 12 V battery VR22 type
Dimensions	240 x 20 x 30 mm (9,4 x 0,8 x 1,2 in)
Weight	93 g (3,3 oz) approx.

Current Clamp Specification

Ranges	0 to ± 100 A d.c.; 0 to ± 1000 A d.c.
Accuracy	± 3% of rated output
Sensitivity	± 1 V at 100 A or ± 1 V at 1000 A according to switch selection (10 mV/A or 1mV/A)
Over-range capability	100 A range ± 4% of reading 100 A up to 200 A 1000 A range — 15% of reading 1000 A up to 1500 A — 25% of reading 1500 A up to 2000 A
Aperture size	19 mm dia.
Power supply	Four 1,5 V cells IEC R6 type (e.g. Ever-Ready R6B). Battery life: 30 hours with alkaline cells 60 hours with mercury cells.
Dimensions	230 x 115 x 37 mm (9,1 x 4,5 x 1,5 in).
Weight	400 g (0,88 lb)

OPERATION

WARNING

a) When measuring voltage ensure that the meter is not connected or switched for measuring current or resistance.
   Note: The units of measurement are shown at the right hand side of the digital display as a visual indication of the correct function and range selection. Also the buzzer will sound as a warning if an invalid switch setting is made.
b) Before removing the battery and fuse compartment cover, ensure that the meter is disconnected from any external circuit.
c) Use extreme care when measuring voltages above 50 V.
d) Avoid making connections to a live circuit whenever possible. Ensure that the circuit is not live before making resistance/diode measurements, (or using the buzzer facility), by making a check with the instrument switched to a voltage range).
e) Take care not to exceed the over-load limits especially on the 10 A range and when using the shunt, i.e. where the over-range symbol does not appear.

DISPLAY SYMBOLS

The 3½ digit liquid crystal display indicates the value of all measurements taken.

Normally the red terminal sockets are positive (+) and the black terminal socket is negative (—). If the reading shown on the display is preceded by a negative sign (e.g. '—' appears at the extreme left of the display), this indicates that, the reading is negative, i.e. the potential at the red socket is negative with respect to the black socket. When the instrument is switched for a.c. measurements the symbol '∿' appears in the bottom left hand corner of the display. The over-range symbol appears if the meter is asked to indicate a reading outside the range selected. The over-range symbol is a '1' as the left hand digit of the display with the remaining digits blank. (A decimal point may or may not appear depending on the switch position).

The symbol ▭ appears in the top left hand corner of the display when the battery voltage is becoming low. The battery should be changed at the earliest opportunity, however, there remains about 10 hours working life left in the battery when the symbol first appears. After use the instrument should be switched off to conserve battery power.

OPERATION

The units of measurement are always shown at the right hand side of the display.

CONNECTING THE TEST LEADS (see fig.1)

For all measurements the black terminal socket marked '⊖' should be used; connect the black test lead to this socket.

For voltage, resistance, continuity and diode measurements the centre, red terminal socket, marked '$V\Omega$' should be used. Connect the red test lead to this socket.

For current measurements only the right hand, red terminal socket marked 'A', should be used.

Connect the red test lead to this socket when current measurements are to be made.

Before measurements are taken the test leads may be checked to see if they are intact. Connect the test leads as for a resistance measurement, set the left hand slider switch (range selector) to the '200 Ω Shunt' position and the right hand slider switch (function selector) to the '•))/Ω' position. Connect the test lead prods or clips together, the display should then indicate between '00,0' and '00,5'

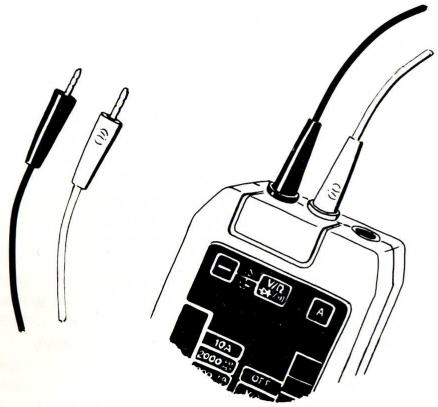

Fig. 1 Test lead connections

VOLTAGE MEASUREMENT A.C. AND D.C.
(see fig. 2).

1) Connect the test leads to the meter as described above, for voltage measurements.
2) Set the right hand slider switch to 'V/A∿' or 'V/A ⊣⊢ ⎓' as appropriate for a.c. or d.c. measurements.
3) Select the required range with the left hand slider switch.
4) Connect the test leads across the source of voltage to be measured.
5) The measured value is indicated directly on the display together with the units of measurement. If the over-range symbol appears, select a higher range.

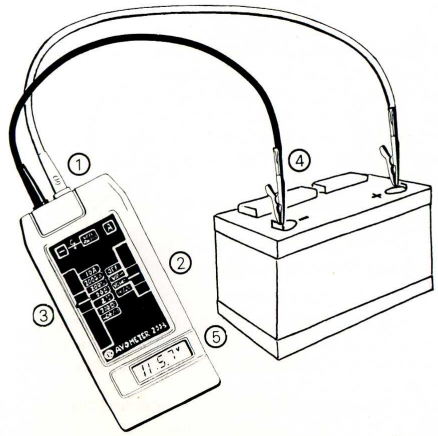

Fig. 2 Connection for voltage measurements

OPERATION

CURRENT MEASUREMENT A.C. AND D.C.

(see fig. 3)

1) Ensure that the circuit in which the current is to be measured is switched off before breaking that circuit in order to connect the meter.
2) Connect the test leads to the meter as described above, for current measurements.
3) Set the right hand slider switch to 'V/A∿' or 'V/A ⊣▶⊢ ⎓' as appropriate for a.c. or d.c. measurements.
4) Select the required range with the left hand slider switch.
5) Connect the test leads into the circuit to be measured. (Connect the black '⊖' lead to the lower potential point) and switch the circuit on.
6) The measured value is indicated directly on the display together with the units of measurement. If the over-range symbol appears select a higher range.
7) Switch the circuit off before disconnecting the test leads.

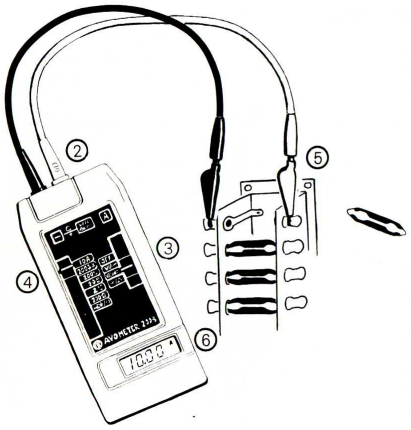

Fig. 3 Connection for current measurements

With the 30 A Shunt (see fig. 4)

1) Ensure that the circuit in which the current is to be measured is switched off before breaking that circuit in order to connect the meter.
2) Plug the shunt into the instrument terminals and connect the test leads to it.
3) Set the right hand slider switch to 'V/A ⊣▶⊢ ⎓'.
4) Set the left hand slider switch to '200 Ω Shunt'.
5) Connect the test leads into the circuit to be measured. (Connect the black '⊖' lead to the lower potential point) and switch the circuit on.
6) The measured value is indicated directly on the display together with the units of measurement.
7) Switch the circuit off before disconnecting the test leads.

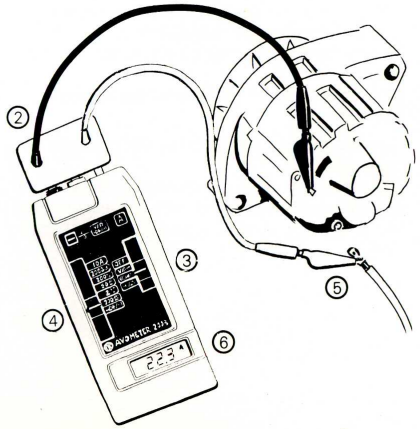

Fig. 4 Connection for current measurements with the 30 A shunt

OPERATION

RESISTANCE MEASUREMENT (see fig. 5)

1) Connect the test leads to the meter as described above, for resistance measurements.
2) Set the right hand slider switch to the '•))/Ω' position.
3) Select the required range with the left hand slider switch.
4) Connect the test leads across the points to be measured.
5) The measured value is indicated directly on the display together with the units of measurement. If the over-range symbol appears select a higher range.

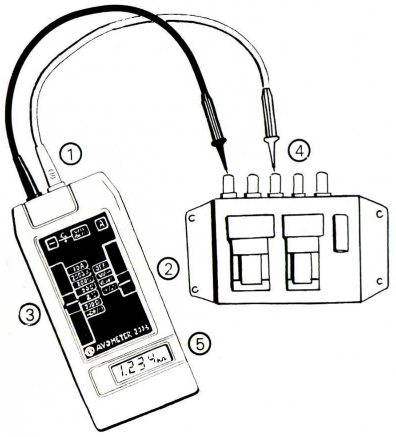

Fig. 5 Connection for resistance measurements

DIODE TESTING (see fig. 6)

1) Connect the test leads to the meter as described above, for diode measurements.
2) Set the right hand slider switch to the 'V/A ⊣◀ ⎓' position.
3) Select the '⊣◀/•))' position with the left hand slider switch.
4) Connect the test leads across the diode or transistor junction to be measured as follows:-
5) The red '(V/Ω / ⊣◀)' terminal is a source of nominally 0,3 mA. Therefore, for a forward bias test, connect the red lead to the junction anode and the back lead to the junction cathode.

   The display indication represents approximately the junction voltage (in volts). Also the internal buzzer will sound to identify a good junction. (This audible indication will be given for junction voltages less than approximately 800 mV). For a reverse bias test, reverse the connections to the diode or transistor junction. The display will indicate the over-range symbol '1' for a high impedance junction and the buzzer will remain silent.

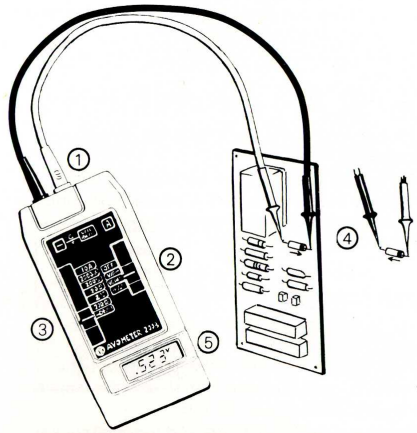

Fig. 6 Connection for diode testing

OPERATION

AUDIBLE CONTINUITY TESTING (see fig. 7)

1) Connect the test leads to the meter as described above for resistance measurements.
2) Set the right hand slider switch to the '•))/Ω' position.
3) Select the '⊣⊢/•))' position with the left hand slider switch.
4) Connect the test leads across the points to be measured.
5) The buzzer will sound for resistance less than typically 1kΩ. However, the display will continue to indicate the reading up to a maximum 1,999 kΩ.

BUZZER SIGNALS

1) A defective 2 A or 10 A fuse is indicated by the buzzer sounding.
   WARNING! When using the 30 A shunt, this indication is inoperative. If in doubt (the display showing 00,0) check the fuse.
2) Any invalid switch settings and terminal socket selection will be indicated by the buzzer sounding.

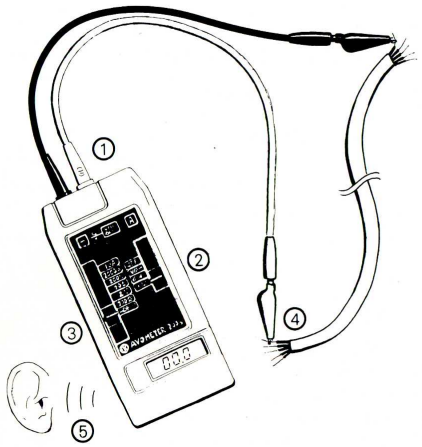

Fig. 7 Connection for audible continuity testing

REPLACING THE BATTERY OR THE FUSES (see fig. 8)

1) Switch off the external circuit under test and disconnect the multimeter. Set the right hand slider switch to 'OFF' and lay the multimeter face downwards on the bench.
2) Release the screw in the centre of the battery and fuse compartment cover on the rear of the case.
3) Remove the cover to expose the battery and fuses.

   Fuse ratings:- 2 A/250 V 20 x 5 mm ceramic.
   10 A/250 V 20 x 5 mm ceramic.

   Battery:- Single 9 V battery IEC 6-F22.
4) To replace an old battery, lift if from its slot in the bottom of the case, and transfer the terminal connector to the new battery observing the correct polarity.
5) Push the new battery back into its slot in the case.
6) To replace a fuse, remove it from its spring clips in the right hand recess by pulling on the extraction tape provided. Surround the new fuse with the tape and push it back into the fuse clips. The one situated toward the outside of the case is the 10 A fuse, the inner one is the 2 A fuse.
7) Replace the cover and secure it with the fixing screw.

WARNING:-The instrument is fitted with a 2 A and a 10 A HIGH RUPTURING CAPACITY CERAMIC IEC 127 FUSE. It is essential that any replacement fuse fitted to the instrument conforms to this specification. GLASS FUSES MUST NOT BE USED due to their low rupturing capacity. Failure to observe this may result in injury to the operator, damage to the instrument, or both.

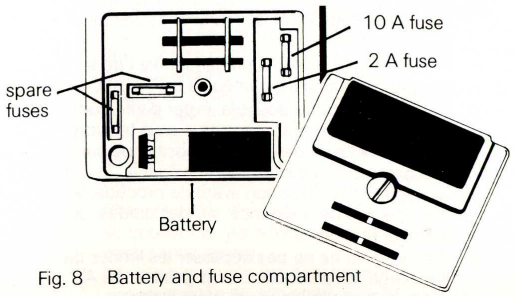

Fig. 8 Battery and fuse compartment