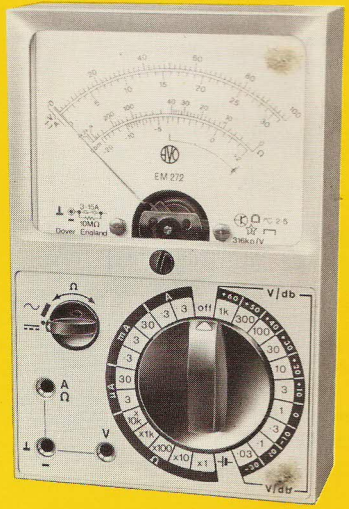
AVOMETER Model EM 272

Operating Instructions



SPECIFICATION

Ranges

A.C./D.C. Voltage	30mV, 100mV, 300mV, 1V, 3V, 10V, 30V, 100V, 300V and 1 000V f.s.d.
A.C./D.C. Current	3μA, 30μA, 300μA, 3mA, 30mA, 300mA, and 3A f.s.d.
Resistance	1Ω—4kΩ, 0—40kΩ, 0—400kΩ, 0—4MΩ and 0—40MΩ. Mid-scale values 40Ω, 400Ω, 4kΩ, 40kΩ, and 400kΩ.
Decibels	—50dB to +60dB in 10dB steps (0 dB level at 0·778V on the 1V range corresponding to 1 mW into 600Ω.)

Accuracy
(20°C and 50Hz a.c.)

A.C./D.C. Voltage ranges	± 2·5% of f.s.d. (all ranges above 30mV). ± 5% of f.s.d. (30mV range only). all up to approx. 1kHz on a.c.
A.C./D.C. Current Ranges	± 2·5% of f.s.d. (all ranges).
Resistance	± 5% at centre scale.

Bandwidth
(relative to 50Hz)

A.C. Voltage Ranges	± 5% up to 20kHz (all ranges up to 100V f.s.d.). ± 5% up to 5kHz (300 and 1 000V ranges).

SPECIFICATION

A.C. Current Ranges	± 5% to 20kHz (all ranges). Measurement at low frequencies is only limited by the effect of needle flicker.
AC/DC Input Characteristics	
Voltage Ranges	Impedance 316kΩ/V up to a maximum of 10MΩ.
Current Ranges	Maximum voltage drop between 120mV and 600mV at instrument terminals (see page 7).
Overload Protection	
	Prolonged overload could cause slight deterioration of accuracy.
A.C. and D.C. Voltage Ranges	260V r.m.s. on all ranges up to 10V f.s.d. 1,000V r.m.s. on 30V range and above.
A.C. and D.C. Current Ranges	Typically 10 times full scale deflection but not exceeding 10A. The possibility of accidental damage on these ranges is reduced by the provision of a separate socket for current measurements. All ranges fused at 3·15A.
Temperature Effect	
Operating Range	0 to 40°C.
Storage Range	—40°C to +70°C.
Temperature Co-efficient	Less than ±0·1%/°C on all ranges over 30mV.
Mechanical Shock	Will withstand a shock up to 40g.

SPECIFICATION

Batteries	One 15V battery type B154 (IEC 10F15). Typical life 1 000 hours. One 1·5V cell type HP7 (IEC R6) for resistance measurements only. Battery check facility provided.
Dimensions	146 × 95 × 57mm (5·75 × 3·75 × 2·25 in.) approx.
Weight	450 g (15½ oz) approx. with batteries.
Fuse Link	3·15A (ceramic) 20 × 5 mm. 25413–280 (IEC 127 Sh 1)

WARNING

When measuring voltage on live circuits, make sure that the meter is **NOT** switched to a current (Amps) or resistance (Ohms) range. This mistake can cause injury to the operator.

GENERAL DESCRIPTION

The *AVO* EM272 Electronic Multimeter is an inexpensive, pocket sized, multirange instrument, using a conventional meter movement with a solid state current amplifier to give a high input impedance, wide frequency response and low battery consumption.

The multimeter is extremely simple to use, with only two controls. A single range switch selects all the ranges and also provides a Battery Check position. The AC/DC Function switch is combined with the Ohms Set Zero control. No electrical Set Zero is required, but mechanical zero adjustment is provided.

Three sockets are provided for input connections. One is common, one is used for voltage inputs and the other for current or resistance measurements.

The instrument is housed in a rugged, shockproof moulded case.

WARNING

THE INSTRUMENT WILL CONTINUE TO INDICATE AFTER THE FUSE HAS FAILED, BECAUSE A HIGH VALUE RESISTOR IS CONNECTED ACROSS THE FUSEHOLDER.

This is intentional and acts as a safeguard, preventing operators from wrongly assuming a circuit to be 'dead' when in fact it is 'live'.

The reading is not accurate. When the meter is connected to voltages between 30V and 1000V only half the true voltage will be indicated. Below 30 volts the indication will be rather less than half. Care should be exercised therefore, particularly when checking mains circuits above 200V a.c.

OPERATION

Preliminary

(a) *Battery Check*
Before use, the Range Selector should be set to the Battery Check position (⊣/⊢) to ensure that the 15V amplifier battery is serviceable. If the meter indication is below the minimum battery limit marked on the scaleplate, the battery (15V) should be replaced. (See Page 6).

(b) *AC Measurements with DC Component*
If measuring a.c. voltage or current in a circuit also carrying d.c., a capacitor should be connected in series with the instrument to block the d.c. The value of blocking capacitor chosen will depend upon the frequency of a.c. to be measured, e.g. if plotting an audio frequency response curve, a 0·5μF capacitor will limit errors to 5% on the one volt range at 20Hz. A larger capacity will improve accuracy in proportion.

AC/DC Voltage Measurement

(a) Set the Function switch to AC (~) or DC (⎓) as required.

(b) Set the Range Selector to the appropriate range. If the value to be measured is unknown, set to the highest voltage range. (When the circuit to be measured is connected the range settings can be decreased until an adequate pointer deflection is obtained).

(c) Connect the circuit to be measured across the input terminals, one lead to Common (—) and the other to V. The measured value will be obtained from the combination of the indicated value and the range in use.

AC/DC Current Measurement

(a) Set the Function switch to AC (~) or DC (⎓) as required.

(b) Set the Range Selector to the appropriate range. If the value is unknown, set to the highest range and then decrease the Range settings until an adequate pointer deflection is obtained when the circuit to be measured is connected.

(c) Connect the circuit to be measured in series with the input terminals, one connection to Common (—) and other to A/ Ω. Care should be taken to ensure that the circuit under test is not live when making connections.
The measured value will be obtained from the combination of the indicated value and the range in use.

NOTE: When the instrument is set for Current measurement great care should be taken to ensure that it is not connected across a voltage source.

Decibel Measurements

(a) Set the controls and make connections as for AC Voltage measurement.

(b) Decibel values may then be read directly on the dB scale provided. (0 dB level is at 0·778V on the 1V range corresponding to 1mW into 600Ω). The voltage ranging is such that the dB ranges are in steps of 10 dB.

Resistance Measurement

(a) Set the Function switch to AC (~)

(b) Set the Range Selector switch to an appropriate resistance range.

(c) Connect the test leads to the Common (—) and A/ Ω input terminals.

(d) Short together the test leads and adjust the Ohms potentiometer for meter full scale deflection (zero ohms). If it is impossible to obtain zero ohms setting, the 1·5V cell should be replaced. (See Page 6).

(e) Connect the test leads across the unknown resistor.

(f) The resistance value will then be indicated on the meter and the measured value will be obtained from a combination of the indicated value and the range in use.

Battery Replacement

Replacement of the battery is easily effected. Remove the two screws from the back cover and open the instrument to reveal the batteries. Ensure that new batteries are inserted in the correct polarity.

Fuse Link

The 3,15 A ceramic fuse is contained in the fuse-holder on the lower half of the printed circuit board. Access to this and to the two spare fuses carried in a clip at the top of the instrument, is by removing the two securing screws and lifting off the back cover.

Mechanical Zero Setting

Although seldom necessary, if the pointer is not on the zero position, it may be set to zero using the slotted screw adjuster. The 15V battery should be removed while this adjustment is carried out. When the instrument is switched on again with the battery replaced, it may be found that the zero is slightly off-set either in the positive or negative direction. This is quite normal and may be ignored as the up-scale reading accuracy will not be affected. Any deterioration in the 1·5V battery used for resistance measurements will be apparent when setting the Ohms zero during resistance measurements.

Instrument Design Features

The construction is similar to that of a conventional multimeter except that a current amplifier is connected between the input ranging resistors and the movement. This achieves a full scale reading for an input current of 3·162μA as opposed to the conventional requirement of about 40μA for f.s.d.

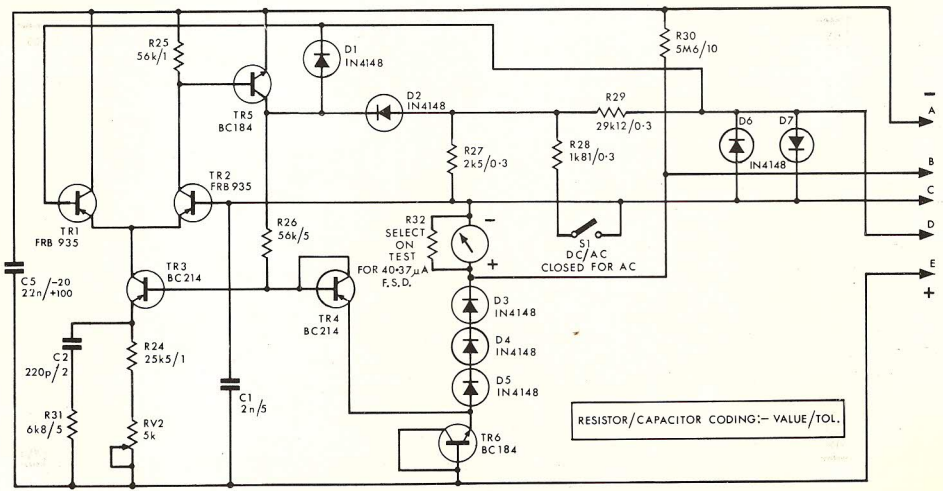
The amplifier also serves as a half wave rectifying circuit to provide measurements for both a.c. and d.c. inputs. The AC/DC switch which is integral with the Ohms Set Zero control, simply changes the gain of the amplifier to provide a waveform correction for sine wave a.c. operation.

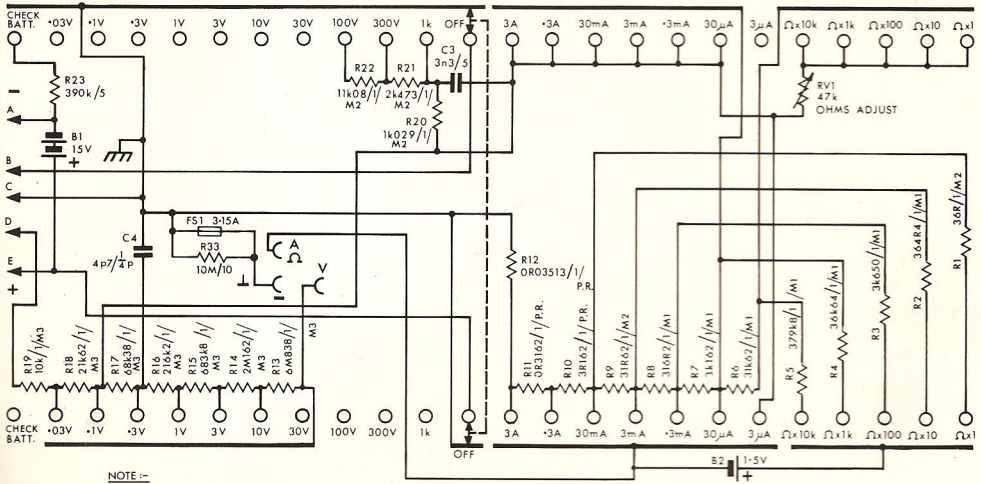
No built-in capacitor is provided to block d.c. voltages when the instrument is set for a.c. measurement. This allows the user to select the value of capacitor most suited to his requirements. This flexibility is particularly valuable at low frequencies where a very large capacitor could be used to exploit the excellent low frequency performance of the instrument.

The input impedance of the instrument is 316kΩ/V up to the 30V range; above this, the input impedance remains at a constant 10MΩ. By-pass resistors switched into the 0·1V attenuator tapping are used for range switching on the voltage ranges above 30V.

For current measurements low resistance shunts provide a nominal 100mV drop to match the 100mV range of the instrument. Due to the finite resistance of the inter-connections within the instrument (typically 0·16Ω) the terminal voltage when measuring high currents will be in excess of the basic 100mV required for measurement. In the worst case, the terminal voltage for current measurements may be taken as 0·120V+ (0·16 × Current in Amps) for full scale deflection. The multimeter is well protected against overloads, but prolonged overloads could slightly affect the accuracy.

CIRCUIT DIAGRAM




CHECK BATT.
•03V
•1V
•3V
1V
3V
10V
30V
100V
300V
1k
OFF
3A
•3A
30mA
3mA
•3mA
30µA
3µA
Ωx10k
Ωx1k
Ωx100
Ωx10
Ωx1
R23 390k/5
B1 15V
C3 3n3/5
R22 11k08/1/ M2
R21 2k473/1/ M2
R20 1k029/1/ M2
RV1 47k OHMS ADJUST
C4 4p7/ 1/4p
FS1 3·15A
R33 10M/10
R12 OR03513/1/ P.R.
R11 OR3162/1/P.R.
R10 3R162/1/P.R.
R9 31R62/1/M2
R8 316R2/1/M1
R7 1k162/1/M1
R6 3lk62/1/M1
R5 379kΩ/1/M1
R4 366k4/1/M1
R3 3k650/1/M1
R2 364R4/1/M1
R1 36R/1/M2
R19 10k/1/M3
R18 21k62/1/ M3
R17 68k38/1/ M3
R16 216k2/1/ M3
R15 683k8 /1/ M3
R14 2M162/1/ M3
R13 6M838/1/ M3
B2 1·5V
NOTE :-
M1, IS ON MODULE 1 etc.
P.R. IS ON PRINTED RESISTOR.

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