



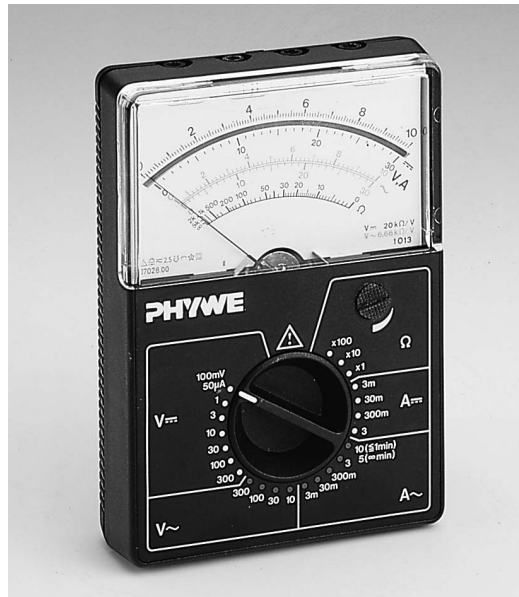
Multimeter A

07028.01

PHYWE SYSTEME GMBH
Robert-Bosch-Breite 10
D-37079 Göttingen

Telefon (0551) 604-0
Telefax (0551) 604-107

CE The unit complies
with the corresponding
EC guidelines.



Operating instructions

1. APPLICATION

Multimeter A is suitable for the measurement of DC and AC voltages, DC and AC currents and resistances. The internal resistances and the measurement ranges have been selected such that the instrument can be used in many fields of electrical engineering and electronics. Due to its clear-cut design and extensive electrical fuse protection, the instrument, which is equipped with a moving-coil movement, is particularly suitable for use in lessons and laboratory practicals.

2. TECHNICAL DATA

2.1 General

- 24 measurement ranges
- main scale: 100°, approx. 87mm
- accuracy class: 2.5
- internal resistance: 20kΩ/Vdc, 6.66kΩ/Vac
- type of protection: protective insulation, class II
- test voltage: 4kV
- dimensions: 100mm x 140mm x 35mm
- weight: approx. 0.3kg

2.2 Voltage ranges

U _{dc}	R _i	U _{ac}	R _i
100 mV	2 kΩ	10 V	66,7 kΩ
1 V	20 kΩ	30 V	200 kΩ
3 V	60 kΩ	100 V	667 kΩ
10 V	200 kΩ	300 V	2000 kΩ
30 V	600 kΩ		
100 V	2000 kΩ		
300 V	6000 kΩ		

2.3 Current ranges

I _{dc}	approx. ΔU	I _{ac}	approx. ΔU
50 μA	0.1 V	3 mA	0.05 V
3 mA	0.35 V	30 mA	0.35 V
30 mA	0.35 V	300 mA	0.35 V
300 mA	0.35 V	3 A	0.50 V
3 A	0.5 V	*10 A	0.40 V

* Can only be loaded to ≤ 5Aac in continuous operation.

2.4 Resistance ranges

Measurement range and centre of scale	Max. current measurement	Power- source
Ωx1 1Ω...35 Ω...5 kΩ	45 mA	battery
Ωx10 10Ω...350 Ω...50 kΩ	4.5 mA	1.5 V
Ωx100 100Ω...3500 Ω...500 kΩ	0.45 mA	IEC R 6

3. ACCURACY

3.1 Error

The following quoted error limits apply to use in the horizontal position at a temperature of 20°C and for a sinusoidal AC current of 50...60Hz.

Current and voltage ranges:

DC and AC current: ±2.5% of full-scale deflection.

Resistance ranges: ±2.5% of the scale length.

3.2 Performance parameters

3.2.1 Frequency

±2.5% in the range 30Hz...1kHz (Voltage)

45Hz...65Hz (Current)

3.2.2 Temperature

With a temperature change of 10K in the range 0...+40°C:

- DC current and voltage: 1% of full-scale deflection.
- 100mV/50μA: 2.5% of full-scale deflection.
- AC current and voltage: 1.5% of full-scale deflection.

3.2.3 Standards

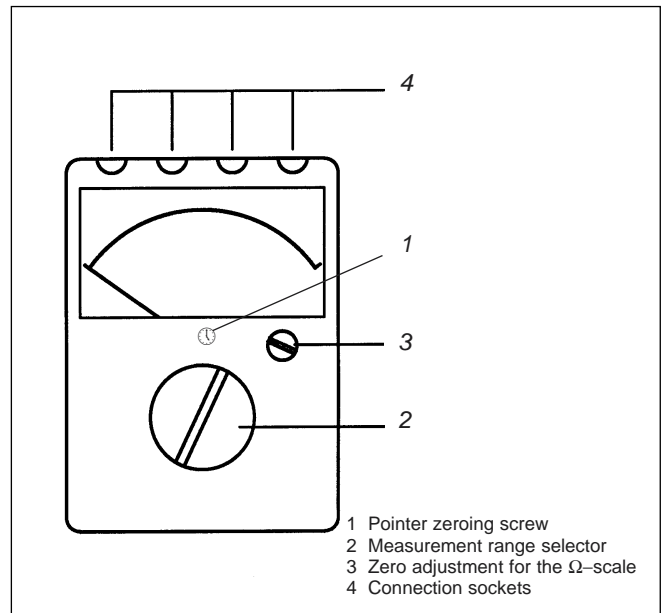
- IEC 51 (DIN 43 780) Directly operating indicating instruments and their accessories.
- IEC 414 (DIN 57 410) Safety regulations for display and recording instruments and their accessories.

3.2.4 Overload protection

The movement is protected using two silicon diodes and the measurement range selector and the circuit network are protected with a fusible-link fuse.

Fuse	M 2.5 A, IEC 127/-2/1, DIN 41 660
Switching capacity	250Vac, 1500Aac
Dimensions	20x5mm dia.

The resistors in the voltage measurement circuit are selected such that they can withstand an unintended connection to 230Vac.



4. OPERATION

4.1 General

For safe and proper handling of the instrument, it is necessary to observe the following points: The instrument should be in a horizontal position during measurement. A battery must be inserted into the instrument to take resistance readings. To insert a battery, remove the base and place a battery, 1.5V, type IEC R 6 (Mignon), in the battery holder. **Important: The instrument should be completely isolated from the measurement circuit before the base is removed.** Make sure that the contacts, i.e. sockets and plugs, are always clean and in good condition. Check the state of the battery as follows: Set the measurement range selector to $\Omega \times 1$, short circuit the connection sockets and adjust the pointer to 0Ω with the knob (3). If this adjustment is not possible or the pointer position is not stable, then the battery must be changed.

1. Check the mechanical zero setting by correcting, if necessary, the pointer position by turning the adjustment screw (1) with a screwdriver. (After cleaning the transparent cover, eliminate any static electricity by touching it or wiping with a cloth.)
2. In order to avoid damage or blown fuses, it is usual to begin with the highest measurement range and then switch down to the appropriate range. The circuit is not interrupted using this method. Ensure correct polarity. Always switch back to the highest range after the measurement.

Tapping the instrument lightly once and reading the display from directly above increases the measurement accuracy. After use, the measurement range selector should always be set to 300Vac to prevent unintentional overload of the low voltage or low current ranges.

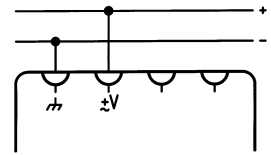
3. Note the preceding zero setting (0Ω) during resistance measurement.
4. Please observe the instructions in the following sections regarding the connection sockets, the measurement range selector and the scales.

5. TAKING MEASUREMENTS

5.1 DC voltage measurement

Measurement range selector: 300V..1Vdc
Reading: black scale V, Adc

For measurements in the range 100mV, the positive pole of the power source must be connected to the socket (A,Ω) instead of as shown in the following illustration. This measurement range is identical to the 50μAdc range.

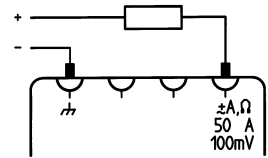


5.2 DC current measurement

For voltages > 50V, always connect the instrument in the line, the voltage of which is closest to earth. The voltage with respect to earth must not exceed 650V for safety reasons.

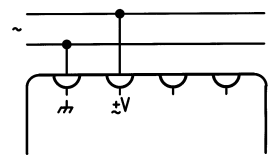
Measurement range selector: 3A...50μAdc (100mVdc)
Reading: black scale V, Adc

For measurements in the range 50μAdc, the positive pole of the power source is connected to the socket (A,Ω). The indicated figure must be divided by two to obtain the correct measurement in μA.



5.3 AC voltage measurements

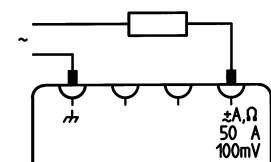
Measurement range selector: 300V...10Vac (red reference point)
Reading: red scale V, Aac



5.4 AC current measurement up to 3Aac

For voltages > 50V, always connect the instrument in the line, the voltage of which is closest to earth. The voltage with respect to earth must not exceed 650V for safety reasons.

Measurement range selector: 3A...3mAac (red reference point)
Reading: red scale V, Aac



5.5 AC current measurement up to 10Aac (using the special socket)

For voltages > 50V, always connect the instrument in the line, the voltage of which is closest to earth. The voltage with respect to earth must not exceed 650V for safety reasons.

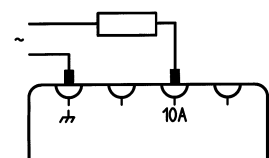
Measurement range selector: 10Aac (red reference point)
Reading: red scale V, Aac

This measurement range may only be loaded to a maximum of 5Aac in continuous operation (∞ min) and it is not protected against overload. For current levels > 5Aac the measurement period must be reduced due to the voltage drop across the integral shunt resistor as stated below:

6Aac: 5 min

10Aac: 1 min

An interval of 10 min should be allowed between measurements at 10Aac. This can be reduced to 5 min for measurements at 6Aac.

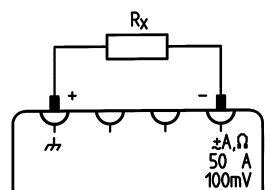


5.6 Resistance measurement

The condition of the battery should be checked from time to time. A discharged or decomposing battery should not be left in the battery compartment. Before starting a resistance measurement ensure that a voltage is not present on the resistance to be measured. Capacitors must be discharged. Before taking measurements and on changing the range, short circuit the measuring leads and adjust the pointer to the end-scale deflection (0 on the Ω scale) using the zero adjustment (3). It should be taken into account when testing semiconductors that the positive battery contact is connected to the (⊥) socket. In the Ω x 1 range the battery is relatively heavily loaded due to the measuring current and therefore measurements in this range should be taken as quickly as possible.

Measurement range selector: Ω x 1...Ω x 100

Reading: Ω scale



6. MAINTENANCE

The instrument does not require any special care or maintenance. However, it is recommended that the battery is checked periodically.

6.1 Replacing the battery or fuse

Press on the rectangular nipple in the centre between the connection sockets using a screwdriver or similar tool and remove the base of the case. **It is essential that the instrument is disconnected from the power source before removing the base.** Replace the used battery or the blown fuse with a new one.

6.2 Cleaning

A soft cloth and brush are required for cleaning the instrument. Any static electricity which has built up on the transparent cover during cleaning and which may affect the reading can be conducted away by touch or with a damp cloth.

7 GUARANTEE

We give a guarantee of 24 months on equipment that we have supplied; it does not include natural wear and tear and faults which are the result of improper handling.

The manufacturer can only be regarded as being responsible for the proper function and safety characteristics of the equipment if maintenance, repair and modifications have been carried out by the manufacturer or by agents expressly authorised by the manufacturer.