

User's guide for Demonstration multimeter



Description:

This demonstration multimeter has been developed especially for teaching, and it can display the following quantities: Voltage, Current, Resistance, Frequency, Temperature, Pressure and Acidity (pH).

The demonstration multimeter is supplied with a large 4-digit display with 45 mm high illuminated digits on the front panel. On the rear a smaller display with 14 mm high digits is provided for the teacher.

The connections for measuring Voltage, Current, Resistance and Frequency are made with standard 4 mm safety jacks on the front panel. The temperature measurement is made using a type K thermocouple probe via the special connector designed for

this purpose. The Acidity (pH) measurement is performed using a standard pH-electrode with a BNC connector. Pressure measurements are made using pressure sensor accessories. For thermocouple probes, pH-electrodes and pressure sensors, please see the section on accessories.

The quantity to be measured is selected using the rotary switch in the center of the front panel below the display.

The instrument is supplied with an RS232 computer interface for transferring data to a PC. This data transfer can be performed using general communication software like hyperterminal – or the free program Datalyse (datalyse.dk).



Operation:

- 1: 4 digit display for readout.
- 2: Dot matrix display for displaying units.
- 3: Select button for confirmation of quantity chosen.
4. Adjustment buttons for calibration of pH electrode using buffer solutions, selection of measuring units for pressure, temperature and electrode measurements.
- 5: Connection jack for pressure sensors.
- 6: BNC connector for pH electrodes (or Redox electrodes)
- 7: Connection jack for K-type thermocouples.
- 8: Rotary switch for selection of physical quantity to be measured.
- 9: 4 mm safety jacks for measuring voltage, current, resistance and frequency.
- 10: Fuse holder for current measurements in mA region.

The instrument is separated into 4 galvanically isolated components:

Temperature

pH and pressure

Voltage, current, resistance and frequency

Serial port

This means that the demonstration multimeter can measure several parameters at once without changing connections. This can be useful in a setup where the instrument is used to measure current and temperature in turn (Joule's Law experiment). This also means that several measurements can be recorded on a computer at the same time if required.

The use of the instrument is very straightforward: just turn the rotary switch to the desired parameter, and the display will show it. The "Adjust" buttons can then be used to switch among various units of measurement (Celcius, Fahrenheit, Kelvin), pH (pH/mV).

The apparatus is connected to AC power using the power cable supplied.

Required accessories:

For measurements of voltage, current, resistance and frequency standard laboratory leads can be used.

- Temperature sensors:

Any K-type thermocouple sensor can be used.

We recommend:

No	Type	Size (mm)	Range	Time constant*
3868.01	Liquid	150 x dia. 3	to 1200°C	1,3 s
3868.02	Liquid	150 x dia. 1,5	to 1200°C	1,5 s
3868.03	Liquid	197 x dia. 3	to 1200°C	1,5 s
3868.04	Surface	150 x dia. 5	to 500°C	0,95 s
3868.05	Air	185 x dia. 6	to 250°C	0,5 s
2606.53	Wire	120 cm long	to 400°C	
2606.52	Air	200 x dia. 8	to 250°C	
2606.51	Liquid	200 x dia. 3	to 1200°C	
2606.50	Liquid	105 x dia. 3	to 1200°C	

* The time constant is the time required for the sensor to reach 63.2% of the measured value.

- pH-electrode:

Any standard pH-electrode with a BNC-connector can be used.

We recommend:

5415.20 pH-electrode

- Pressure sensors:

Only the following pressure sensors can be used:

IM-131410 pressure 0-1300 hPa

IM-131510 pressure 500-7000 hPa

Connection to a PC

The Demonstration Multimeter can be connected to a PC using a standard RS232 serial port.

Data transfer is readily managed using the program "Datalyse".

Accessories for connecting to a PC:

1123.05: Serial cable 25/9 pin for PC with 9-pin serial port.

1123.30: USB-serial adapter for connection of the above serial cable to a PC with a USB port

Comments on certain measurement ranges:

- Resistance:

Under no circumstances may a voltage be applied to the V/ohm/Hz input terminal and Ground terminal when the instrument is set for resistance measurements.

- Frequency:

Frequency measurements up to 10 kHz require an input signal of at least 1 volt. For measurements from 10 kHz to 100 kHz a signal of at least 10 volts is required. If no reading is observed during a frequency measurement, try increasing the amplitude of the signal.

- pH:

If the pH measurement is selected using the rotary switch, the instrument can also serve as a high impedance millivolt-meter, e.g. for measurements with redox electrodes or a gas chromatograph. These options can be selected cyclically by pressing the Adjust buttons.

- Calibration of pH electrode

The principle used is that for a given buffer solution the pH value is selected using the Adjust buttons and confirmed using Select. You can choose between a single or dual point calibration.

Place the pH electrode in the desired buffer solution. Press the Select button twice. In the display you will see: *buF1*. This is the single point calibration option. If you want the two point calibration, just press one of the Adjust buttons. The display will now show: *buF2*. Confirm the calibration method you desire by pressing Select.

The display now shows various number values followed by the text *Buf*, e.g. *7.00Buf*. These values are the most commonly used standard buffer solutions (4.00, 4.62, 7.00, 9.00 and 10.00). Use the Adjust buttons to select the appropriate value. Execute the calibration by pressing the Select button. A voltage value is now shown in the display. When the value shown is stable, press Select. This completes the single point calibration procedure, and the display will now show the pH value.

When the dual point calibration has been selected, a second buffer value will be displayed. Use the Adjust buttons as before to select the appropriate value and confirm it by pressing Select. Rinse the electrode in distilled water, and place it in the second buffer solution. The display will show a new voltage value in millivolts. When the value has stabilized after a few seconds, press Select to confirm. The display will then show pH values. The dual point calibration procedure is now completed.

If the calibration values are unusable, e.g. if the same buffer was used twice during the dual point calibration, then the display will briefly show the message: *CalErr*, and the previous calibration values will be used.

Please note that the calibration is retained when the instrument has been turned off. The same values will be used whenever a pH electrode is selected.

- *Pressure*

The Multimeter can only be used with the specified pressure sensor accessories (see Table above).

- *Calibration of pressure sensor:*

The pressure sensor must be connected to the instrument during the calibration procedure. Press the Select button once, and the message: *ProbCal* will be shown in the display. Press Select again, and the message: *1.000 cF* will be shown. The scale factor for the pressure sensor can now be selected using the Adjust buttons. The new selection is confirmed by pressing the Select button, and the display shows the message: *0.0 OfS*. It is now possible to adjust the zero offset for the pressure sensor by means of the Adjust buttons. Confirm the selection by pressing Select. The instrument will then change to the measurement mode and show the current pressure reading. Note that the calibration factors are stated on a label on each pressure sensor.

- *Menu:*

This option is intended for use with special facilities, e.g. for connection to a PC. In the current version of the Multimeter this option has not been implemented.

Technical data

Supply voltage:	230VAC +/-10%
Power consumption:	20 W
Front panel display:	4-digit 7-segment LED, 45 mm hih
Units display:	7x15 LED matrix
Bagdisplay:	4-digit 7-segment LED, 13 mm high
Fuse for current	mA-range: 2A (slow) (4090.21)
Current limiter:	A-range - electronic limit with warning display
Fuse for grid:	315mA (slow) (4090.36)

(Located in fuse holder on back panel)

Measurement	Range	Accuracy	Input impedance
DC Voltage	0 – 500V	0.5% + 1 digit	10MΩ
AC Voltage	20mV – 500V	10Hz – 1kHz: 1% + 1 digit	10MΩ
		1kHz – 2kHz: 2% + 2 digit	
		2kHz – 5kHz: 5% + 2 digit	
		5Hz – 10kHz: 10% + 2 digit	
DC Current	0 – 10A	0.5% + 1 digit	10Ω 0.1Ω 0.01Ω
AC Current	20μA – 10A	10Hz – 10kHz 1% + 2 digit	
Resistance	0 – 10MΩ	1% + 1 digit	
Frequency *	0 – 100 kHz	0.5% + 1 digit	10MΩ
Temperature	-200°C – 1370°C	0.1% + 1 digit	
Pressure	0 – 7000 hPa	0.1% + 1 digit	
pH	0-14	0.1% + 1 digit	>10GΩ

* Frequency measurements up to 10 kHz require at least 1 volt; from 10 kHz to 100 kHz require at least 10 volts.