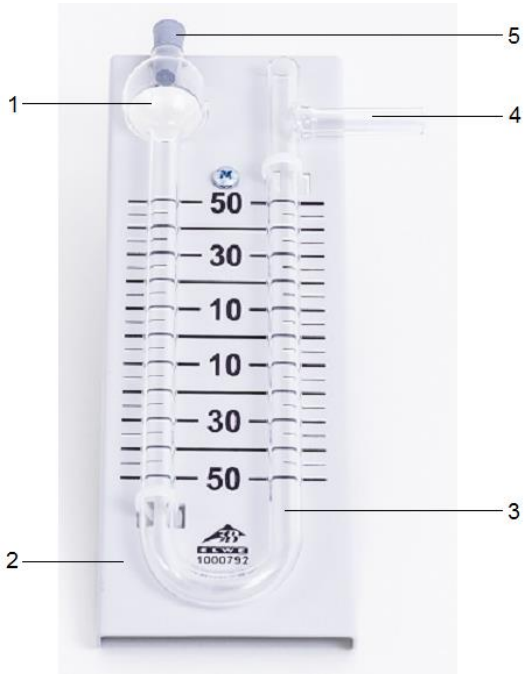
U-Tube Manometer S 1000792

Instruction Sheet

07/15 ALF



1 Overflow reservoir
2 Supporting plate
3 Glass tube
4 Tubing connection
5 Rubber bung

1. Safety instructions

There is a risk of injury if the U-tube manometer gets broken.

- Do not put any mechanical stress on glass body.

2. Description

The U-tube manometer is a simple form of pressure-measuring instrument, and is used for measuring small pressures or pressure-differences in the region of 0 to 10 hPa (0 to 10 cm water column).

It consists of a U-tube open at both ends with an overflow reservoir at one end, mounted on an aluminium supporting plate marked with a scale. On the back of the supporting plate there is a fixing rod for clamping the instrument to a stand.

To connect up the manometer in an experiment set-up it is recommended that 6 mm silicone tubing be used (1002622). The Indigo solution (1000793) makes a suitable dye for colouring the water.

3. Technical Data

Length of arms:	200 mm
Stand rod:	33 mm x 10 mm diam.
Base plate:	210x70 mm² approx.
Hose nipple:	9 mm diam. approx.
Weight:	80 g approx.

4. Operating principle

Pressure p is defined as the quotient of the force F acting at right angles to a plane and the area A of that plane.

$$p = \frac{F}{A} \qquad 1$$

The units for this are N/m², also named pascals (Pa). Pressure is also measured in bars (bar), torrs (Torr), physical atmospheres (atm), technical atmospheres (at) and millimetres of mercury (mmHg).

The absolute pressure p_{abs} is the pressure measured with respect to the zero pressure in a vacuum. Atmospheric pressure p_{amb} is the pressure of air over and above the absolute pressure. The difference between the atmospheric pressure and absolute pressure is called pressure over atmospheric p_e.

Pressure over atmospheric is positive when the air pressure is less than the absolute pressure and negative otherwise. If it is negative then it can be called underpressure or partial vacuum.

This manometer is a U-tube open at both ends and partially filled with a liquid impervious to air. It is mainly used for measure small pressures and pressure differences. The pressure in a closed container to be measured acts on the fluid in one arm of the tube. The other open arm is subject only to atmospheric pressure. The fluid then rises on one side so that there is a difference in height Δh between the two sides. From Δh and the density ρ of the fluid in the tube, it is possible to calculate pressure over atmospheric p_e in the closed container:

p_e (mbar) = $g \cdot \rho$ (g/cm³)$\cdot \Delta h$ (mm) 2

5. Operation

For the liquid in the manometer it is possible to use distilled water with coloured dye, ethanol and special oils, or even mixtures of silicone and anti-freeze fluid.

- Remove the rubber bung.
- Slowly pour the liquid into the overflow reservoir until the columns of liquid in both limbs of the manometer are on the zero mark.
- Attach the tubing and connect it to the vessel for which the pressure is to be measured.
- Read the height difference Δh, estimating tenths of the scale divisions.
- Calculate the pressure using equation 2.

6. Conversion table

	Pa	bar	mbar	Torr	atm	at
1 Pa	1	10^{-5}	10^{-2}	$7.5*10^{-3}$	$9.87*10^{-6}$	$1.02*10^{-5}$
1 bar	10^{5}	1	10^{3}	750	0.987	1.02
1 mbar	10^{2}	10^{-3}	1	0.75	$0.987*10^{-3}$	$1.02*10^{-3}$
1 Torr	133	$1.33*10^{-3}$	1.33	1	$1.32*10^{-3}$	$1.36*10^{-3}$
1 atm	101325	1.01325	1013.25	760	1	1.033
1 at	98100	0.981	981	736	0.968	1