C6 9 Physical principles

9.1 Definition of pressure

Pressure P is the quotient of a force F acting on an area A.

The derived unit for pressure in the SI system is Pascal: 1 Pa = 1 N/m², whereas 1 bar = 100.000 Pa.

$$Pressure(P) = \frac{Force(F)}{Area(A)}$$

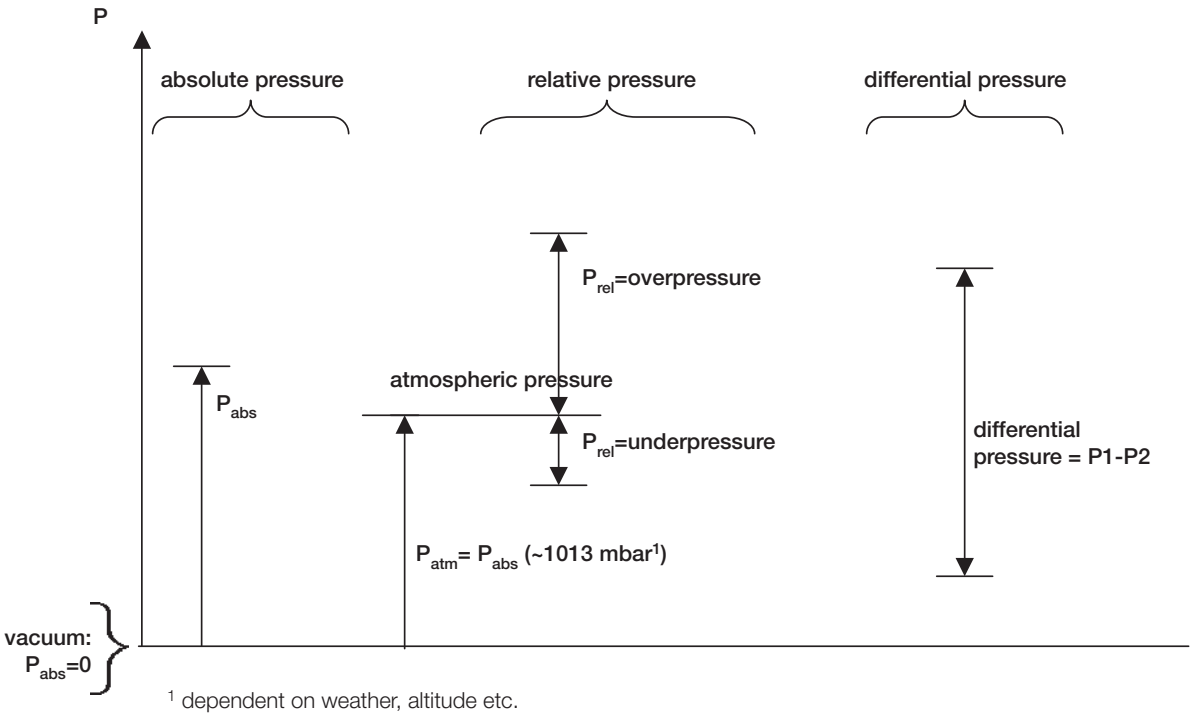
P = pressure [Pa]
F = vertical force on area [N]
A = area [m²], on which the force acts vertically

Example: 1000 Pa correspond to 10 mbar

Pressure unit	Values						Symbol
Pascal	1	10	50	1,000	10,000	100,000	Pa
Hectopascal	0.01	0.1	0.5	10	100	1,000	hPa
Millibar	0.01	0.1	0.5	10	100	1,000	mbar
Bar	0.00001	0.0001	0.0005	0.01	0.1	1	bar
Inch of water	0.004	0.04	0.2	4	40	400	in H2O
kg/cm²	0.00001	0.0001	0.0005	0.01	0.1	1	kg/cm²

9.2 Overview of pressures

With the help of testo 6340
1. **differential pressure**
2. **relative pressure** (one pressure connection remains open)
can be measured.



[1] dependent on weather, altitude etc.

9.3 Atmospheric air pressure (P_{atm})

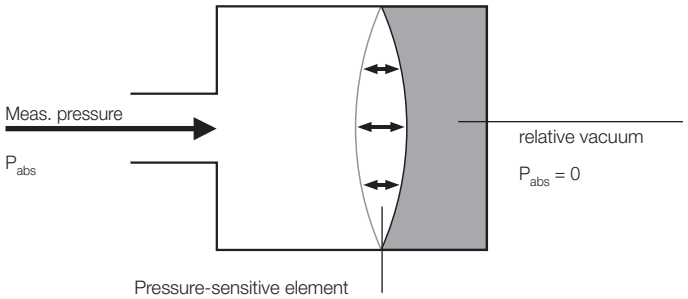
Atmospheric pressure (=ambient pressure) is the most important pressure for life on earth. It is created by the weight of the air surrounding the earth. The air cover reaches to an altitude of approx. 500 km. The air pressure constantly decreases up to this height (absolute pressure in space P_{abs} = zero). The atmospheric air pressure is additionally influenced by climatic fluctuations. The mean P_{atm} at sea level is 1013.25 hectopascal (hPa) or millibar (mbar). It can vary up to +/- 5% in high or low pressure weather zones.

9.4 Absolute pressure (P_{abs})

The pressure relating to the air-free space of the universe (pressure zero) or to an (artificially) created vacuum, is described as absolute pressure.

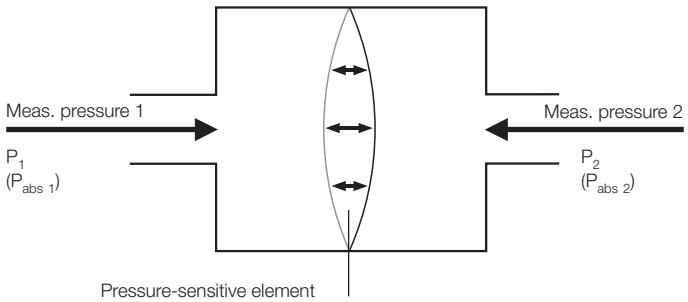
Absolute pressure is denoted with the index “abs”.

This measurement cannot be made with the testo 6340.



9.5 Differential pressure (ΔP)

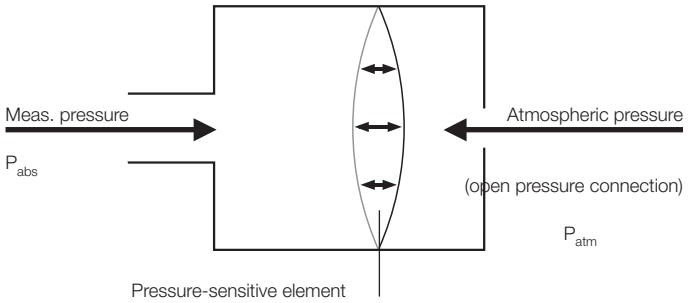
The difference between two pressures p1 and p2 is referred to as differential pressure (Δp= p1-p2).



9.6 Relative pressure (P_{rel})

The relative pressure describes by which amount an absolute pressure (P_{abs}) is higher or lower than the atmospheric pressure (P_{atm}); $P_{rel} = P_{abs} - P_{atm}$. A positive relative pressure is an overpressure and a negative relative pressure is an underpressure.

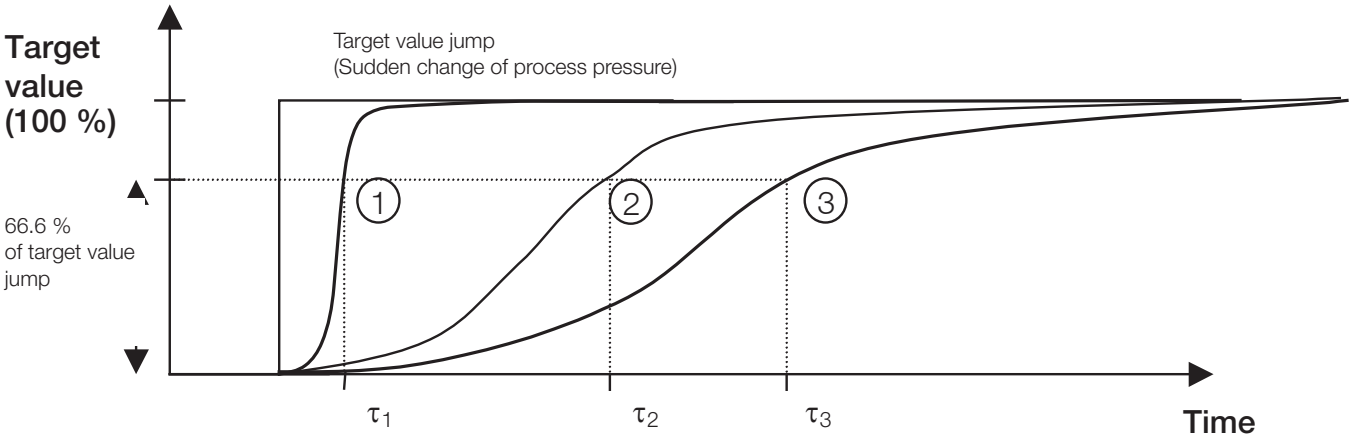
Relative pressure can be measured with the testo 6340 by connecting the positive pressure connection to the process and leaving the negative pressure connection open (i.e. opened to atmospheric pressure).



C6 9 Physical principles

9.7 Signal delay/damping

The testo 6340 has a reaction time in the millisecond range. This enables an optimum reaction/control in many applications. Some applications, however, require a slower signal reaction (e.g. individual pressure peaks should not trigger an alarm in a cleanroom). For this reason, the reaction time is increased (damped) by increasing the time constant "τ ".



① Jump reaction of testo 6340 without damping

② Jump reaction of testo 6340 with weak damping

③ Jump reaction of testo 6340 with strong damping

testo 6341/43: The damping value (time constant) can be set in the instrument (twist potentiometer (S1)).
The standard time constant is 2.5 sec. This can be altered to 1/5/10/20/30 or 40 seconds by the user if required.

testo 6342/44: A specified damping value (time constant) can be set. The standard time consant is 2 sec.. On request, this can be increased to 1/2/5 or 10 seconds in the factory - alteration on site not possible !

Note: To enhance stability in small measurement values, small measurement ranges are given a higher damping (minimal fluctuations are blanked out).