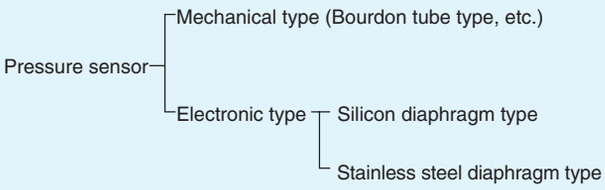
1. Overview

Pressure sensors use an internal pressure sensitive element to convert a change in air pressure into an electrical signal. When the pressure exceeds a preset value, the pressure sensor outputs a signal which can be used for various applications using air pressure such as suction confirmation, seating confirmation, leakage test, base pressure control, etc.

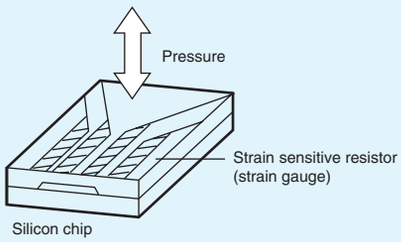
2. Classification



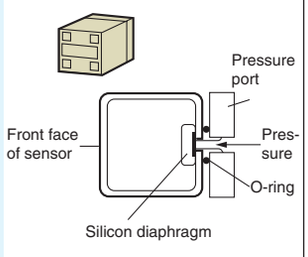
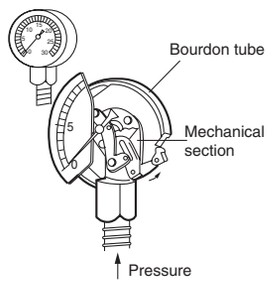
3. Silicon Diaphragm Type (only for gases)

Principle

A strain sensitive resistor (strain gauge) layer is formed on a silicon chip. When pressure is applied in the direction of the arrow, the silicon chip deforms and the resistance value of the strain sensitive resistor (strain gauge) changes. A change in pressure is thereby converted into an electrical signal.



Structure

Silicon diaphragm type AP-30 Series	Mechanical type (Bourdon tube type, etc.)
	
Pressure is applied directly to the silicon diaphragm through the pressure port, and is detected.	Pressure applied to the inside of the Bourdon tube expands or contracts the entire tube, and moves the pointer.

Features

Pressure sensors fit into two basic categories, electronic and mechanical. Previously, mechanical sensors like the Bourdon tube type, etc., were used. However, since they have a short service life, electronic pressure sensors that feature long service life, high accuracy, and high-speed response have become popular.

	Electronic type AP-30 Series	Mechanical type
Display	7-segment LED display (3 digits)	Pointer
Output	Open-collector output	Contact output
Service life	100 million operations or more	10 million operations or more
Responsibility	5 ms	150 ms (typical)

4. Pressure Conversion Table

	mmHg	mmH_2O	kgf/cm^2	atm
1mmHg	1	13.60	$1.360x10^{-3}$	$1.316x10^{-3}$
1mmH_2O	$7.356x10^{-2}$	1	$1x10^{-4}$	$0.968x10^{-4}$
kgf/cm^2	735.6	10000	1	0.968
1 atm	760	10332	1.033	1
1 bar	750.1	10197	1.020	0.987
1 Psi	51.72	703.1	0.070	0.068
1 Pa	$7.501x10^{-3}$	0.102	$1.020x10^{-5}$	$9.869x10^{-6}$

	bar	Psi	Pa
1mmHg	$1.333x10^{-3}$	$1.933x10^{-2}$	133.3
1mmH_2O	$0.981x10^{-4}$	$1.422x10^{-3}$	9.8067
kgf/cm^2	0.981	14.22	98067
1 atm	1.013	14.71	101325
1 bar	1	14.50	100000
1 Psi	0.069	1	6895
1 Pa	$1x10^{-5}$	$1.45x10^{-4}$	1

Reference information

Torr: Unit used to represent absolute pressure close to absolute vacuum

Example: 1 Torr = 1 mmHg abs

10^{-3} Torr = 0.001 mmHg abs

For “mmHg abs”, refer to “5. Gauge pressure and absolute pressure”.

Technical Guide

5. Gauge Pressure and Absolute Pressure

Gauge pressure basics

Pressure is represented by defining atmospheric pressure as zero. Pressure higher than atmospheric pressure is positive pressure, while pressure lower than atmospheric pressure is negative pressure.

Absolute pressure

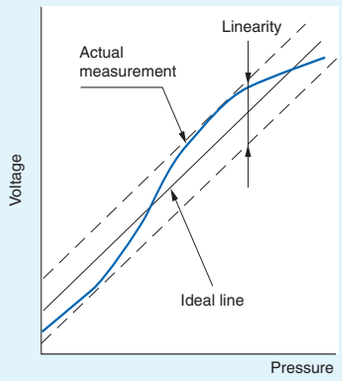
Pressure is represented by defining absolute vacuum as zero.
Gauge pressure is generally used. Absolute pressure is used for scientific calculations, etc., and is distinguished from gauge pressure by putting “abs” after the unit (for example, mmHg abs).

[Note] Atmospheric pressure varies depending on the weather, the altitude, etc. Therefore, a gauge pressure measuring instrument in which atmospheric pressure is defined as zero may not display the pressure value under absolute vacuum as “-760 mmHg”.

6. Analog Monitor Output

Linearity

Analog output voltage from a pressure sensor increases in proportion to pressure. Ideally, the relationship between analog output voltage and pressure would be represented by a straight line. However, actual measurement deviates from this ideal line. Linearity refers to the tolerance range in relation to the ideal line, and is indicated as a percentage of F.S. That is, linearity is the ratio of the deviation from the ideal line to the measuring range.



7. Glossary

Withstanding pressure

The maximum pressure that can be applied to the pressure sensor. Applying pressure exceeding this value will cause the pressure sensitive element to lose its repeatability or to be damaged.

Display resolution

The minimum unit that can be displayed. With the AP-31, for example, the display resolution is 1 mmHg. Displayed values change sequentially as follows; 99, 100, 101 ....

Repeatability

Represents the detecting point tolerance range when pressure is repeatedly applied under set conditions.

Responsibility

Represents the delay time, that is, the time required from pressure application to signal output.

Temperature characteristics

Represents the fluctuation of the detecting point within the ambient temperature range.

Noncorrosive gases

Noncorrosive gases include gases in the air (nitrogen gas, carbon dioxide gas, etc.) and inert gases (argon gas, neon gas, etc.). The AP Series cannot be used with oxygen gas and hydrogen gas because they are highly combustible. The AP Series also cannot be used for helium gas because the molecular structure is extremely small.

8. General Specifications

Vibration:

10 to 55 Hz, 1.5 mm 0.06" double amplitude in X, Y, and Z directions, 2 hours respectively.

Shock:

1,000 m/s² 3280.8' (approx. 100 G) in X, Y, and Z directions, 10 times respectively (Total: 60 times)

AP-40 Series