

Pressure Sensor Solution Guide

KEYENCE

D *Two Color* *Digital Display* *Pressure Sensor* *AP Series*

*High-speed response &
NEW Centralized management ...
... Separate amplifier type
is also available.*



Green & Red two-color LED display clearly shows abnormal pressure

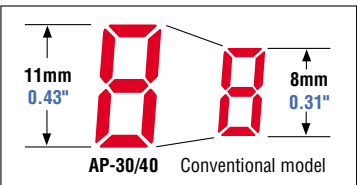


The **red** display warns of abnormal pressure to attract immediate attention.

AP-30



AP-40



First-in-industry, two-color LED display

High-accuracy and High-speed response

The tallest character height in its class

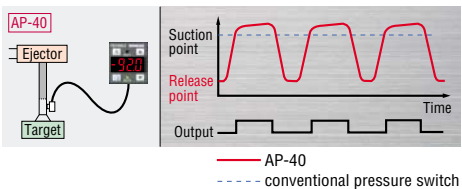
AP-40 NEW PRODUCTS FEATURES

Industry's smallest & lightest, weighing only 7 g

The super small and light sensor head measures 20(L) x 13(W) x 10(H) (mm), weighing only 7 g. It can be mounted in a tight space or onto a moving section, such as a suction nozzle.

High-speed response of 2.5 ms

The super-small sensor head can be mounted close to the detection point. As a result, loss of response time due to air tube length can be eliminated.



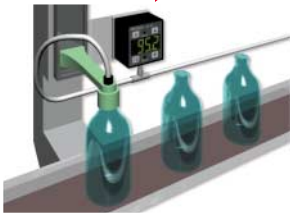
even from a distance.

APPLICATION SOLUTION

Suction See to P.4



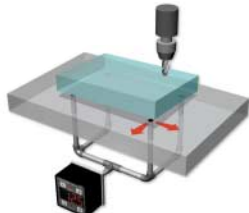
Leakage test See to P.8



Base Pressure See to P.6



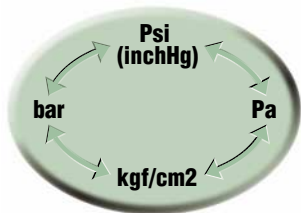
Seating Confirmation See to P.8



AP-SERIES COMMON FEATURES

Unit conversion function

The AP-30's pressure can be displayed in any of 4 pressure units enabling it to be used worldwide.



Psi: North America
Pa: International System of Units (SI)
kgf/cm2, mmHg: Japan
bar: Europe

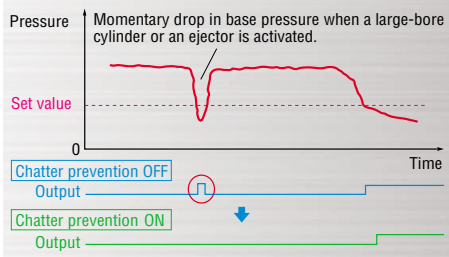
Analog output function (1 to 5 V)

The analog output can be used to record pressure data.

Prevents erroneous output due to momentary pressure changes

Chatter prevention function

When a large-bore cylinder or an ejector is activated, the base pressure drops momentarily. The chatter prevention function ignores this abnormal pressure change for a specified period. This eliminates the need for external sequence programs.



Simple automatic tuning

(AP-30 offers 4 convenient tuning modes.)

The auto-tuning mode enables you to set the detection level automatically with two presses of the key when a target is picked up and released. One of the two outputs can be used to alert operators when the vacuum pad is damaged or clogged.



Peak-hold/bottom-hold display

The pressure value changes quickly during the suction condition check. The peak-hold/bottom-hold function holds the pressure value for a certain period to ensure reliable checking of the pressure condition.

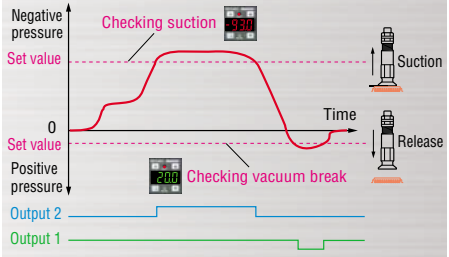
N.O./N.C. output selectable

The peak-hold/bottom-hold value can be checked on the display.

Measures both negative/positive pressure

Compound pressure type

A single sensor head can check not only the suction condition of a workpiece but also the vacuum break for releasing the workpiece.



Suction

Base pressure

Leakage test

Dimensions

Specifications

Suction check



■ Applications (Suction check)

Checking suction condition of ICs (AP-44 + AP-40)

Detection/ control



Description

In the inspection process of the integrated circuits, the AP-40 Series Digital Display Pressure Sensor checks the suction transfer condition of the IC transferred onto the inspection table.

Checking suction condition of stickers (AP-44 + AP-40)

Detection/ control



Description

The AP-40 Series Digital Display Pressure Sensor checks the suction transfer condition of thin stickers. Although the sizes of the stickers vary, the automatic tuning features a quick changeover setting, ensuring reliable checking.

Checking suction condition of wafers (AP-41 + AP-40)

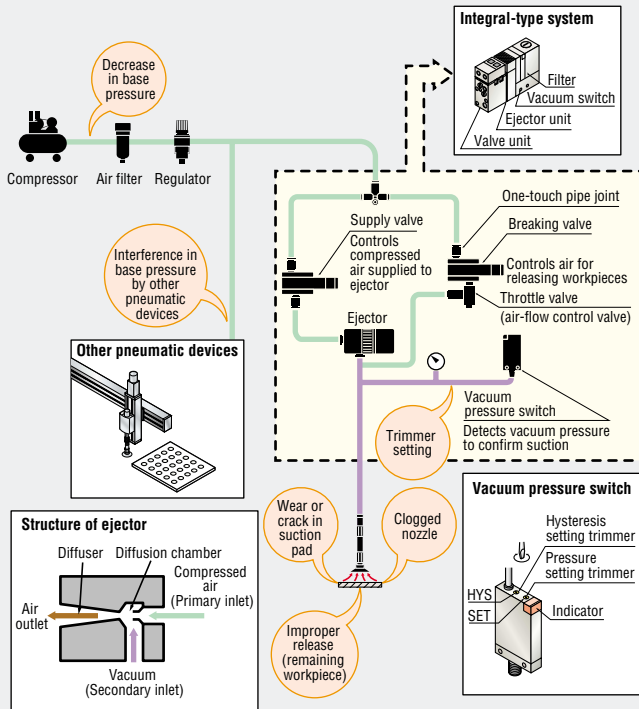
Detection/ control



Description

The AP-40 Series Digital Display Pressure Sensor checks the suction transfer condition of wafers. A compound pressure type is used to check both the suction condition and vacuum break. This enables checking the pressure when the target is released, eliminating wafer breakage.

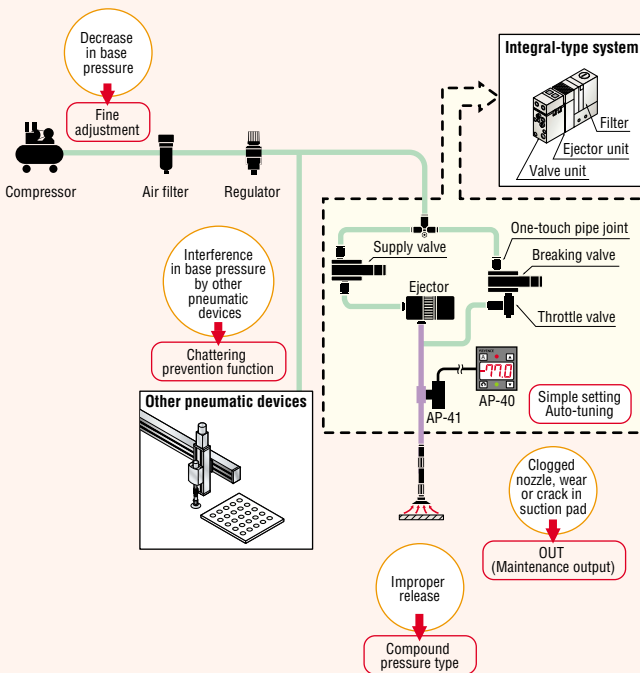
Conventional Method

Air suction control system
(with conventional pressure switch)

Disadvantages of conventional air suction control system

- The vacuum pressure switch for suction confirmation is set using a trimmer, making adjustment difficult. It is time-consuming, especially during product changeovers.
- When the base pressure changes, the suction pressure also changes. In this case, even proper suction is regarded as improper.
- A temporary drop in pressure due to the actuation of another pneumatic device is detected as improper suction.
- A wear or crack in the suction pad or a clogged nozzle is not detected.
- The vacuum break is not reliably controlled. As a result, workpieces are sometimes not released properly.

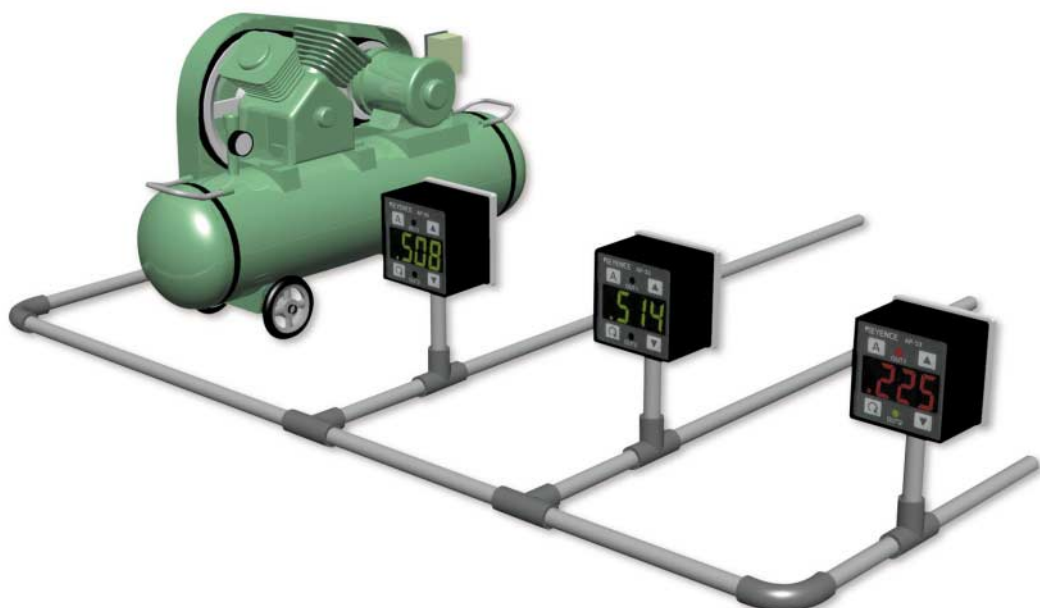
AP-40

Air suction control system
(with AP-40 series digital display pressure sensor)

Advantages of air suction control system with the AP-40 series

- Auto-tuning mode enables simple setting changes. Just press the SET key twice when the workpiece is released and lifted. The setting for product changeovers is quite easy. Fine adjustment is also available.
- The chattering prevention function cancels the interference caused by the actuation of other pneumatic devices. The response time can be selected from 4 settings. Creating a timer program for the PLC is unnecessary.
- In addition to the alarm output, the AP series produces a maintenance output to indicate a wear or crack in the suction pad or a clogged nozzle before malfunctions occur.
- The compound pressure type sensor has twice the performance, checking both the suction and release. It ensures reliable control of vacuum breaks.

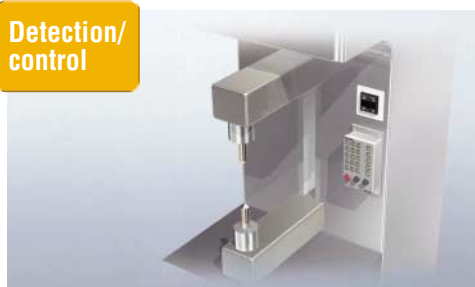
Confirm base pressure at a glance



Applications

Control of applied pressure in spot welding machine (AP-33K)

Detection/
control

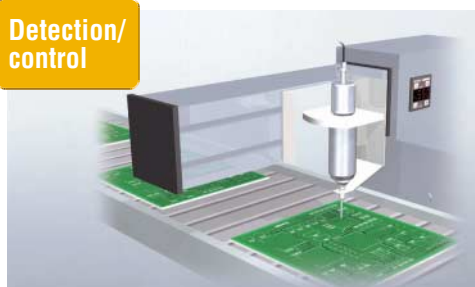


Description

To prevent improper welding, the AP-33K digital pressure sensor controls the applied weld pressure. The AP-33K outputs according to the specified upper and lower limits, and the operator can check the pressure status with the 2-color LED display. The AP-33K reliably outputs when the pressure goes out of the specified range. The LED indication is easily noticed by the operator.

Control of application pressure of dispenser (AP-32K)

Detection/
control



Description

A single sensor can detect improper dispenser discharge caused by insufficient pressurization (lower limit) as well as insufficient discharge pressure caused by a clogged nozzle (upper limit).

Control of filling pressure (AP-34K)

Detection/
control

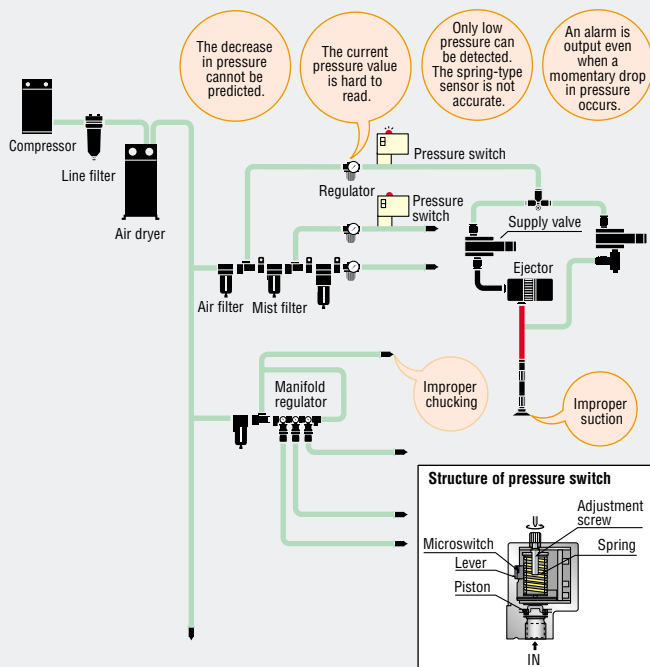


Description

The AP-34K digital pressure sensor controls the pressure to fill argon gas on the packaging line. For sterilization, the negative pressure is used first to evacuate air from the package, then the positive pressure is used to fill the argon gas. One AP-34K can check both the positive and negative pressure. A single AP-34K not only checks both positive and negative pressures but also provides an analogue output. The status of the pressure can be recorded as data using the analogue output.

Conventional Method

Base pressure control system (with conventional Bourdon tube and pressure switch)

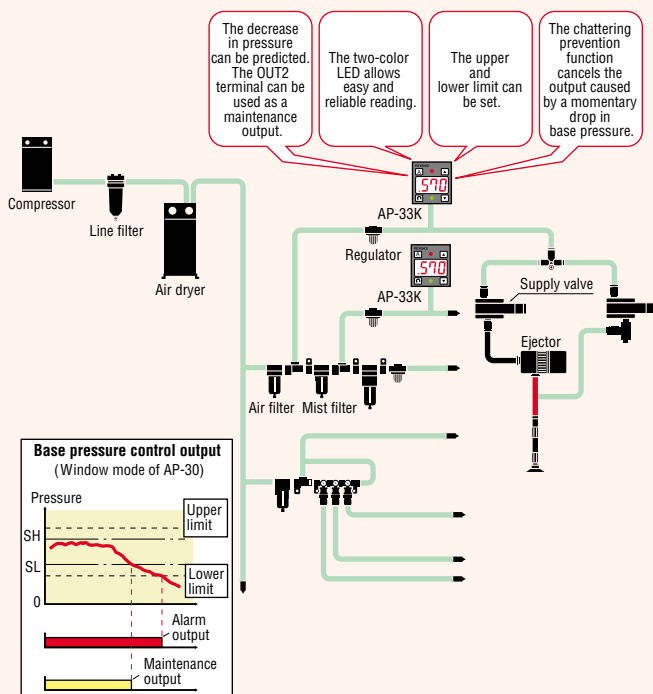


Disadvantages of conventional base pressure control system

- The system is turned off for inspection after the alarm output indicates low base pressure. An advance alarm output is desirable.
- The current value of the Bourdon tube pressure gauge is hard to read accurately, especially when the gauge is located on the lower part of the device.
- It is difficult to precisely set the pressure switch, which consists of just a spring and a micro-switch. In addition, only the lower limit of the pressure can be set.
- An alarm is output even when a momentary drop in base pressure occurs.

AP-30

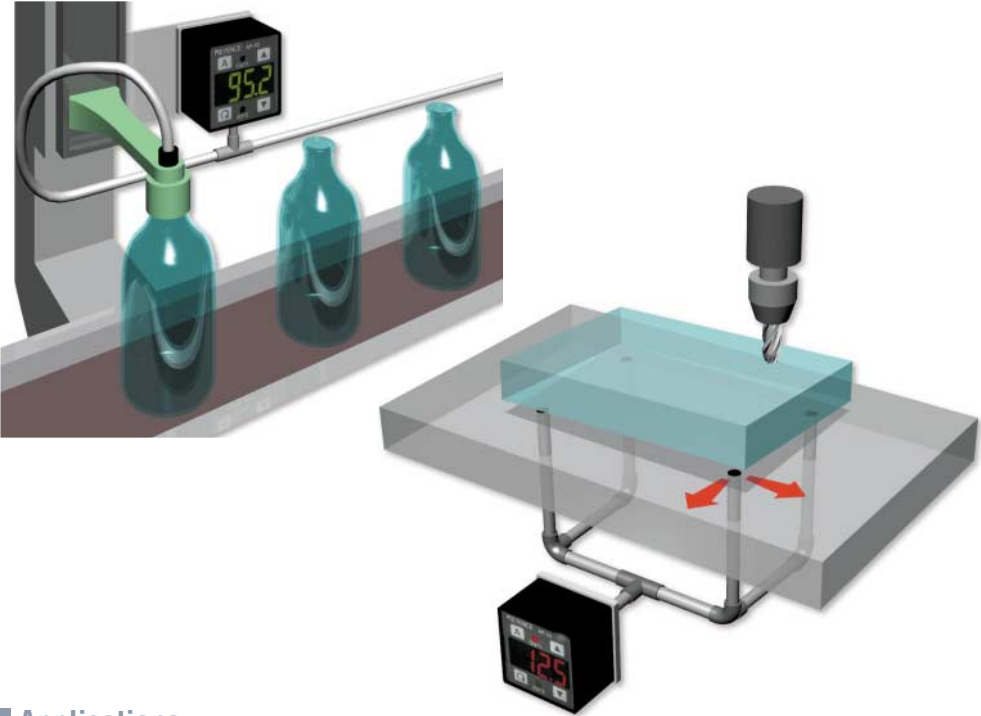
Base pressure control system (with AP-30 series digital display pressure sensor)



Advantages of base pressure control system with the AP-30 series

- When the upper and lower limit pressure values are set in Window mode, the stability level is automatically set to produce an alarm output before the pressure reaches the upper or lower limit. This ensures timely maintenance without stopping the system.
- The large, two-color LED digital display allows quick direct reading and shows **OK** or **NG** status at a glance. The display is visible even when the sensor is located on the lower part of the device.
- The semiconductor-type pressure sensor has a significantly longer life than mechanical sensors. Measurement is accurate and the setting can be entered using numerical values.
- The chattering prevention function easily solves the problem of a momentary drop in base pressure. Creating a timer program for the PLC is unnecessary.

Leakage test



Applications

Leakage testing of PET bottles (AP-44 + AP-40)

Detection/
control

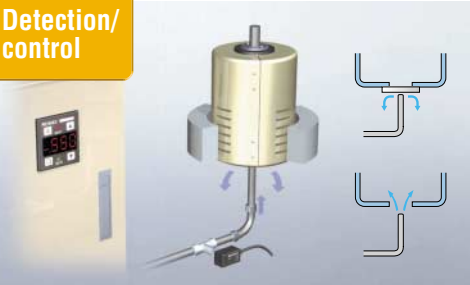


Description

The AP-40 Series Digital Display Pressure Sensor is used in the leakage testing of PET bottles.

Detecting presence/absence of motor parts (AP-43 + AP-40)

Detection/
control

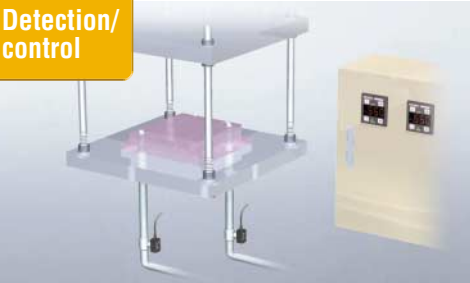


Description

In the motor assembly process, the AP-40 Series Digital Display Pressure Sensor detects the presence or absence of the lid on the rear of a motor. When a motor housing is fastened with the jig, pressure is applied to the lid. The presence or absence of the lid can be determined according to the resulting pressure value.

Confirmation of workpiece seating (AP-43 + AP-40)

Detection/
control

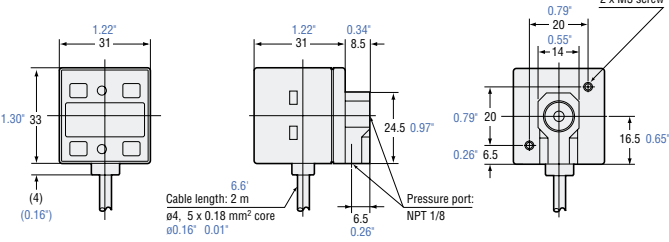


Description

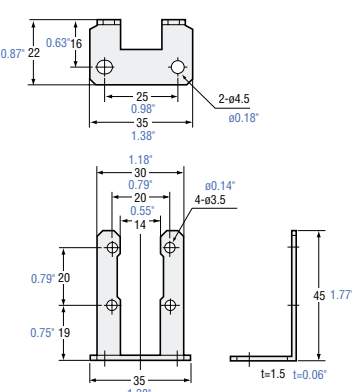
The AP-40 Series Digital Display Pressure Sensor checks if a casting part is properly seated on a die.

Dimensions

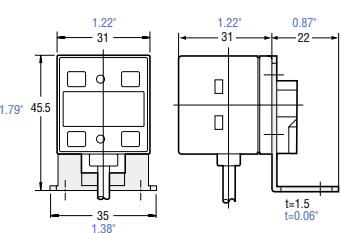
Sensor unit AP-31K(P)/32K(P)/33K(P)/34K(P)



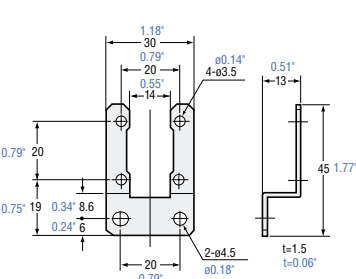
Mounting bracket A (Accessory)



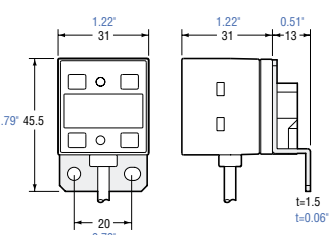
When mounting bracket A is attached



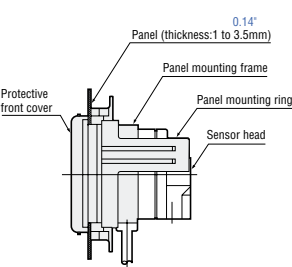
Mounting bracket B (Accessory)



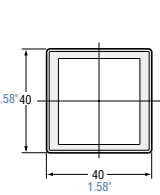
When mounting bracket B is attached



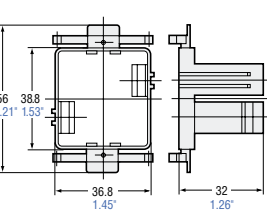
When flush-mounted in control panel with OP-31357



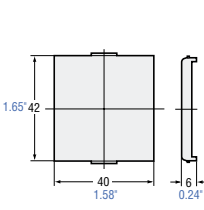
Panel mounting frame



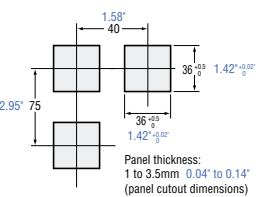
Panel mounting ring



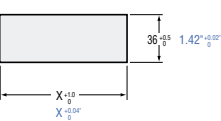
Protective front panel



Panel cutout



Panel cutout:side-by-side mounting



A is the number of sensor head:
X = 36 + (A - 1) x 40
1.42" + (A - 0.04") x 1.57"

Accessory

Mounting bracket A	X1
Mounting bracket B	X1
Quick Reference Sticker	X1
Hexagonal-socket port stopper	X1

Suction

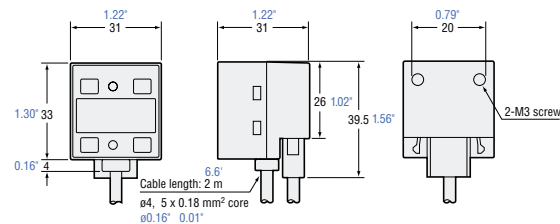
Base pressure

Leakage test

Dimensions

Specifications

Sensor head AP-41/43/44 NEW

[illegible]

Technical drawing of a mechanical part, showing a front view and a side view. The front view is a rectangular block with a central vertical slot and four circular holes. The side view shows the profile of the block with a flange. Dimensions are given in inches and millimeters.

Front View Dimensions:

- Overall width: 1.19" (30 mm)
- Slot width: 0.79" (20 mm)
- Slot depth: 0.55" (14 mm)
- Overall height: 0.79" (20 mm)
- Height from base to center of holes: 0.75" (19 mm)
- Distance from center of holes to slot edge: 0.34" (8.6 mm)
- Distance from base to center of holes: 0.24" (6 mm)
- Distance from center of holes to slot edge: 0.24" (6 mm)
- Distance from center of holes to slot edge: 0.24" (6 mm)
- Distance from center of holes to slot edge: 0.24" (6 mm)

Side View Dimensions:

- Overall width: 0.51" (13 mm)
- Overall height: 1.77" (45 mm)
- Flange thickness: 1.5" (38 mm)
- Flange width: 0.06" (1.5 mm)

Other Dimensions:

- Top hole diameter: $\varnothing 0.14"$ (3.5 mm)
- Bottom hole diameter: $2-\varnothing 0.5$ (12.7 mm)
- Bottom hole diameter: $\varnothing 0.18"$ (4.5 mm)

[illegible]

Technical drawing of the sensor head assembly. The drawing shows a cross-section of the assembly with the following components labeled:

- Panel (thickness: 1 to 3.5mm)
- Panel mounting frame
- Sensor head
- Panel mounting ring
- Protective front cover

A dimension line indicates a height of 0.14' for the sensor head assembly.

Technical drawing of the 1000 Series 1/2" (25.4 mm) connector. The drawing shows a top view and a side view. Dimensions are provided in both inches and millimeters:

- Overall height: 56 mm (2.21")
- Height to top of mounting flange: 38.8 mm (1.53")
- Overall width: 36.8 mm (1.45")
- Width of mounting flange: 32 mm (1.26")

Technical drawing of a rectangular block. The top view shows a rectangle with dimensions 1.65' (width) and 42' (length). The side view shows a rectangle with dimensions 6' (height) and 0.24' (depth). The block is shaded gray.

Technical drawing of a panel layout showing dimensions and tolerances. The drawing includes a central panel with a width of 40 inches and a height of 75 inches. The panel is divided into four quadrants by a vertical and a horizontal line. The top-left quadrant is labeled with a width of 1.58 inches and a height of 1.42 inches. The top-right quadrant is labeled with a width of 1.58 inches and a height of 1.42 inches. The bottom-left quadrant is labeled with a width of 1.58 inches and a height of 1.42 inches. The bottom-right quadrant is labeled with a width of 1.58 inches and a height of 1.42 inches. The panel thickness is specified as 1 to 3.5 mm (0.04 to 0.14 inches). The panel cutout dimensions are also indicated.

Panel thickness:
1 to 3.5 mm (0.04 to 0.14")
(panel cutout dimensions)

Diagram of a rectangular sensor head. The height is labeled as 36 with a tolerance of ± 0.5 . The width is labeled as X with a tolerance of ± 0.04 . A calculation for the width is shown: $1.42'' \pm 0.05$.

A is the number of sensor head:
 $X = 36 + (A - 1) \times 40$
 $1.42'' + (A - 0.04)'' \times 1.57''$

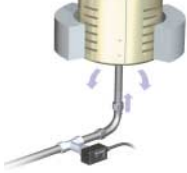
Mounting bracket A	X1
Mounting bracket B	X1
Quick Reference Sticker	X1
Hexagonal-socket port stopper	X1

Replacement connector X1

Specifications

AP-40^{NEW} (Separate Sensor head model)

Sensor head

Model	AP-41 ^{NEW}	AP-43 ^{NEW}	AP-44 ^{NEW}
Applications			
Type	Negative pressure	Positive pressure	Compound pressure
Rated pressure	0 to -29.9 inchHg (0 to -101.3 kPa)	0 to 145 Psi (0 to -1.000 MPa)	29.9 to -29.9 inchHg (101.3 to -101.3 kPa)
Proof pressure	72.5 Psi (490 kPa)	217.5 Psi (1.47 MPa)	72.5 Psi (490 kPa)
Fluid types	Air or noncorrosive gases		
Pressure type	Gauge pressure		
Repeatability	±0.2% of F.S. max. (including amplifier)		
Temperature fluctuation	±2% of F.S. max.		
Connection port diameter	M5 male screw		
Material	Housing: PBT, Screw: SUS303		
Weight	7 g (without cable), 70 g (including 3 m cable)		

Amplifier

Model	AP-40		
Power supply	12 to 24 VDC±10%, Ripple (p-p): 10% max.		
Current consumption	105 mA (12 V), 55 mA (24 V) (including sensor head)		
Display	3 1/2-digit, 2-color, 7-segment LED (Character height: 11 mm), Display cycle: 5 times/sec.		
Pressure range for detection/setting	-15% to +110% of F.S.		
Display resolution	0.1 inchHg, 0.1 kPa, 1 mmHg, 0.001 bar	0.2 Psi, 0.001 MPa, 0.01 kgf/cm ² , 0.01 bar	0.1 inchHg, 0.2 kPa, 2 mmHg, 0.002 bar
Response time (chattering prevention function)	2.5/5/100/500 ms		
Control output	NPN open-collector: 100 mA max. (40 V max.), Residual voltage: 1 V max. 2-output (N.O./N.C. selectable)		
Analog voltage output	1 to 5 V		
Temperature fluctuation for display	±1.0% of F.S.		
Temperature fluctuation for analog output ¹	±2.0% of F.S.		
Material	Front housing: Polyamide, Rear housing: Polysulfone		
Mounting	With supplied mounting bracket (2 types) or optional panel mounting bracket		
Weight	80 g (including 2 m cable) (28 g without cable)		

AP-30 (Self-contained model)

Type	Negative pressure	Positive pressure		Compound pressure
Model	AP-31K(P)	AP-32K(P)	AP-33K(P)	AP-34K(P)
Rated pressure	0 to -29.9 inchHg (0 to -101.3 kPa)	0 to 14.50 Psi (0 to 100.0 kPa)	0 to 145 Psi (0 to -1.000 MPa)	29.9 to -29.9 inchHg (101.3 to -101.3 kPa)
Proof pressure	72.5 Psi (490 kPa)	72.5 Psi (490 kPa)	217.5 Psi (1.47 MPa)	72.5 Psi (490 kPa)
Pressure type	Gauge pressure			
Fluid types	Air or noncorrosive gases			
Display	3 1/2-digit, 2-color, 7-segment LED (Character height: 11 mm) Display cycle: 5 times/sec.			
Display resolution	0.1 inchHg, 0.1 kPa, 1 mmHg, 0.001 bar	0.02 Psi, 0.1 kPa, 0.001 kgf/cm ² , 0.001 bar	0.2 Psi, 0.001 MPa, 0.01 kgf/cm ² , 0.01 bar	0.1 inchHg, 0.2 kPa, 2 mmHg, 0.002 bar
Display range/ detectable pressure range	-15% to +110% of F.S.			
Repeatability	±0.2% of F.S.			
Temperature fluctuation for display	±1% max. (of F.S.) of detecting pressure at 25 °C (0 to 50 °C)			
Response time (chattering prevention function)	2.5/5/100/500 ms (selectable)			
Analog output	1 to 5 V (Load impedance: 47 kΩ min.)			
Control output	NPN open-collector: 100 mA max. (40 V max.), Residual voltage: 1 V max. 2-output (N.O./N.C. selectable)			
Analog output	1 to 5 V (Reflects zero point adjustment.)			
Power supply	12 to 24 VDC±10%, Ripple (p-p): 10% max.			
Current consumption	90 mA (at 12 V) max. 50 mA (at 24 V) max.			
Material	Front housing: Polyamide, Rear housing: Polysulfone, Front panel sheet: PET, Pressure port: Die-cast zinc			
Weight (including 2 m cable)	Approx. 120 g			

1. Response speed: 5 ms or more

Suction

Base pressure

Leakage test

Dimensions

Specifications

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AP-31K (P)	Fixed		Suction confirmation	P.4
AP-32K (P)			Seating confirmation leakage test	P.8
AP-33K (P)			Base pressure control	P.6
AP-34K (P)			Suction confirmation	P.4

Pressure Conversion Table

Pressure					
	Psi	inchHg	Pa	kPa	MPa
1Psi=	1	2.036	6.895X10 ³	6.895	6.895X10 ⁻³
1inchHg=	4.912X10 ⁻¹	1	3.386X10 ³	3.386	3.386X10 ⁻³
1Pa=	1.450X10 ⁻⁴	2.953X10 ⁻⁴	1	1X10 ⁻³	1X10 ⁻⁶
1kPa=	1.450X10 ⁻¹	2.953X10 ⁻¹	1X10 ³	1	1X10 ⁻³
1MPa=	1.450X10 ²	2.953X10 ²	1X10 ⁶	1X10 ³	1
1bar=	1.450X10	2.953X10	1X10 ⁵	1X10 ²	1X10 ⁻¹
1kgf/cm ² =	1.422X10	2.896X10	9.806 65X10 ⁴	9.806 65X10	9.806 65X10 ⁻²
1atm=	1.469X10	2.992X10	1.013 25X10 ⁵	1.013 25X10 ²	1.013 25X10 ⁻¹
1mmH2O=	1.422X10 ⁻³	2.896X10 ⁻³	9.806 65	9.806 65X10 ⁻³	9.806 65X10 ⁻⁶
1mmHg or 1Torr=	1.934X10 ⁻²	3.937X10 ⁻²	1.333 22X10 ²	1.333 22X10 ⁻¹	1.333 22X10 ⁻⁴
	bar	kgf/cm ²	atm	mmH2O	mmHg or Torr
1Psi=	6.895X10 ⁻²	7.031X10 ⁻²	6.805X10 ⁻²	7.031X10 ²	5.171X10
1inchHg=	3.386X10 ⁻²	3.454X10 ⁻²	3.454X10 ⁻²	3.454X10 ²	2.540X10
1Pa=	1X10 ⁻⁵	1.019 72X10 ⁻⁵	9.869 23X10 ⁻⁶	1.019 72X10 ⁻¹	7.500 62X10 ⁻³
1kPa=	1X10 ⁻²	1.019 72X10 ⁻²	9.869 23X10 ⁻³	1.019 72X10 ²	7.500 62
1MPa=	1X10	1.019 72X10	9.869 23	1.019 72X10 ⁵	7.500 62X10 ³
1bar=	1	1.019 72	9.869 23X10 ⁻¹	1.019 72X10 ⁴	7.500 62X10 ²
1kgf/cm ² =	9.806 65X10 ⁻¹	1	9.678 41X10 ⁻¹	1X10 ⁴	7.355 59X10 ²
1atm=	1.013 25	1.033 23	1	1.033 23X10 ⁴	7.600 00X10 ²
1mmH2O=	9.806 65X10 ⁻⁵	1X10 ⁻⁴	9.678 41X10 ⁻⁵	1	7.355 59X10 ⁻²
1mmHg or 1Torr=	1.333 22X10 ⁻³	1.359 51X10 ⁻³	1.315 79X10 ⁻³	1.359 51X10	1

1Pa=1N/m²

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Specifications are subject to change without notice



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