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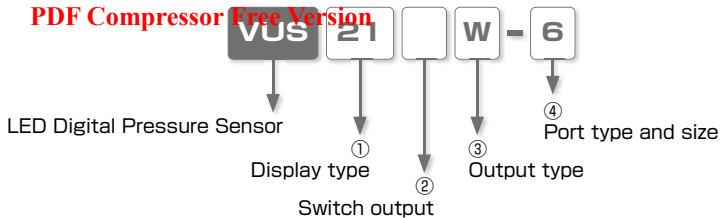
Vacuum Switch with LED display LED Digital Pressure Sensor 21-series

- *To improve visibility, an LED display is adopted for the vacuum switch.*
- *LED displays indicates set-up pressure and working pressure.*
- *Two types of vacuum switch selection: Two switch output type, and one switch output and an analog output. A connector wiring realize easy layout.*
- *Three pipe connection methods are available: Push-in Fitting, M5 metric female thread, and direct mount.*
- *Output detection accuracy is enhanced by the use of semiconductor switch.*

LED Digital Pressure Sensor 21-series

Model Designation (Example)

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① Display type

Code	21
Display	LED display

② Switch output

Code	No code	P
Output	NPN open collector	PNP open collector

③ Output type

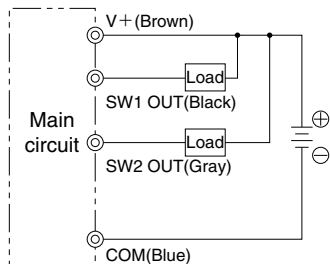
Code	W	A
Sensor	2 switch outputs	1 switch output and 1 analog output

④ Port type and size

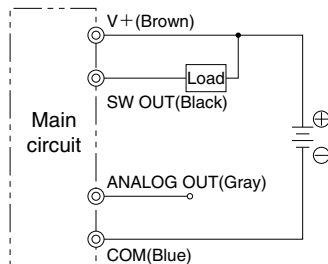
	Metric Thread (mm)	Push-In Fitting (mm)			Direct Mount
Code	M5	4	6	8	F
Size	M5×0.8	ø4	ø6	ø8	—

Internal Circuit diagram and Connection Method

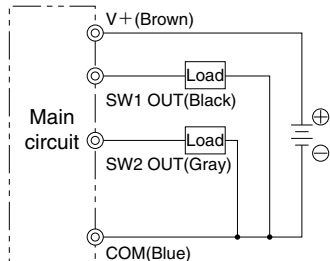
NPN / 2 switch outputs



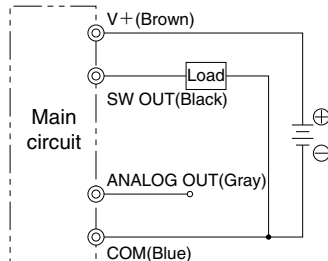
NPN / 1 switch output and 1 analog output



PNP / 2 switch outputs



PNP / 1 switch output and 1 analog output



Specifications

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Output	2 switch outputs (PW)		1 switch output and 1 analog output (A)	2 switch outputs (PW)		1 switch output and 1 analog output (PA)		
Factory setting pressure	-50kPa(SW1), -10kPa(SW2)		-50kPa	-50kPa(SW1), -10kPa(SW2)		-50kPa		
Current consumption	40mA or less							
Pressure detection	Diffusion type semiconductor pressure switch							
Operating pressure range	-100 ~ 0kPa							
Pressure setting range	-99 ~ 0kPa							
Proof pressure	0.2MPa							
Storage temperature range	-20 ~ 70°C (Atmospheric pressure / Humidity: 60% RH or less)							
Operating temp. range	0 ~ 50°C (No freezing)							
Operating humidity range	35 ~ 85%RH (No dew condensation)							
Rated voltage	DC12-24V ± 10%, Ripple (P-P) 10% or less							
Protective structure	Equivalent to IEC / IP40							
No. of pressure setting	2		1	2		1		
Operating accuracy	±3%F.S. max. (at Ta=25°C)							
Hysteresis	Fixed (2% F.S. or less)		Variable (About 0-15% of setting value)	Fixed (2% F.S. or less)		Variable (About 0-15% of setting value)		
Switch output	NPN open collector / 30V 80mA or less / Residual voltage: 0.8V or less			PNP open collector / 30V 80mA or less / Residual voltage: 0.8V or less				
Analog output		Output voltage	1 ~ 5V			Output voltage	1 ~ 5V	
		Zero-point voltage	1±0.1V			Zero-point voltage	1±0.1V	
		Span voltage	4±0.1V			Span voltage	4±0.1V	
		Output current	1mA or less (Load resistance: 5kΩ or less)			Output current	1mA or less (Load resistance: 5kΩ or less)	
		LIN / HYS	±0.5%F.S. max.			LIN / HYS	±0.5%F.S. max.	
Response time	About max. 2m・sec.							
Display	0 ~ -99kPa (2-digit red LED display)							
Display frequency	About 4 times / sec.							
Indication accuracy	±3%F.S. ±2digit							
Sensor resolution	1digit							
Operation indication	SW1: Red LED turns ON, when pressure is above the setting.	Red LED turns ON, when pressure is above the setting.	SW1: Red LED turns ON, when pressure is above the setting.	Red LED turns ON, when pressure is above the setting.				
	SW2: Green LED turns ON, when pressure is above the setting.		SW2: Green LED turns ON, when pressure is above the setting.					
Function	1. MODE switch (ME / S1 / S2)	1. MODE switch (ME / SW)	1. MODE switch (ME / S1 / S2)	1. MODE switch (ME / SW)				
	2. S1 setting trimmer (2/3-rotation trimmer)	2. SW setting trimmer (2/3-rotation trimmer)	2. S1 setting trimmer (2/3-rotation trimmer)	2. SW setting trimmer (2/3-rotation trimmer)				
	3. S2 setting trimmer (2/3-rotation trimmer)	3. HYS setting trimmer (About 0-15% of setting value)	3. S2 setting trimmer (2/3-rotation trimmer)	3. HYS setting trimmer (About 0-15% of setting value)				

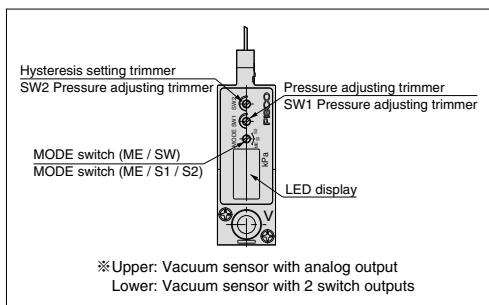
Using Method

1. Pressure Setting method

- ① Turn on the power (Make sure the correct wiring and apply DC power to the vacuum pressure sensor).
- ②-1 Set the indicator switch at Pressure Setting Mode (ME → S1 / S2 and SW)
- ②-2 (Vacuum switch with analog output)
Fully turn the hysteresis setting trimmer (HYS) in the counterclockwise direction in order to minimize the hysteresis adjustment in advance.
- ③ Adjust the pressure adjusting trimmer (S1 / S2 and SW) with a flathead screwdriver to set at the desired value.
- ④ Set the indicator switch at ME and apply pressure and check the actual operation.
(Vacuum switch with 2 switch output)
Switch output 1 (S1): Red LED turns ON at the pressure with more than the setting.
Switch output 2 (S2): Green LED turns ON at the pressure with more than the setting.
(Vacuum switch with analog output)
Switch output (SW): Red LED turns ON at the pressure with more than the setting.

2. Hysteresis Setting

- ① Hysteresis can be adjusted by the hysteresis setting trimmer (HYS).
- ② Hysteresis setting range is regulated within about 0-15% of the set value. Hysteresis setting becomes larger when the trimmer is turned in the clockwise direction.
- ③ Hysteresis adjustment
Set the indicator at ME and gradually increase and decrease the pressure supply around the setting pressure level and read ON and OFF of the switch LED. This ON range is the hysteresis.
- ④ Hysteresis adjustment is useful for the following cases:
 - Increase differential response when pressure pulsates with output repeatedly showing small on/off movements.
 - When an allowable range is to be set for the lowering of pressure.



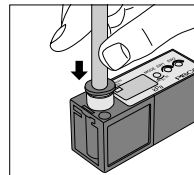
■ How to insert and disconnect

1. How to insert and disconnect tubes

① Tube insertion

Insert a tube into Push-In Fitting up to the tube end. Lock-claws bite the tube and fix it automatically, then the elastic sleeve seals around the tube.

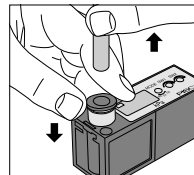
Refer to "2. Instructions for Tube Insertion" under "Common Safety Instructions for Fittings" .



② Tube disconnection

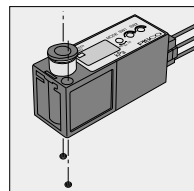
The tube is disconnected by pushing release-ring to release Lock-claws.

Make sure to stop air supply before the tube disconnection.



2. How to fix body

Use fixing holes on the sensor to fix the body with M2.5 screws. Refer to the dimensional drawings of the hole pitch. Tighten screws, referring to "Table: Recommended tightening torque" in "Common Safety Instructions for Pressure Sensors".



△ Detailed Safety Instructions

Before using PISCO products, be sure to read "Safety Instructions" and "Safety Instruction Manual" on page 35-39, "Common Safety Instructions for Pressure Sensors" on page 794.

■ Applicable Tube and Related Products

Polyurethane Tube

(1. Piping products catalog P.596)

- Polyurethane Tube is for general pneumatic piping and suitable for piping compactly.

Nylon Tube

(1. Piping products catalog P.608)

- Nylon Tube is for general pneumatic piping and suitable for a high-pressure fluid medium up to 1.5MPa (NB tube: 1.0MPa).

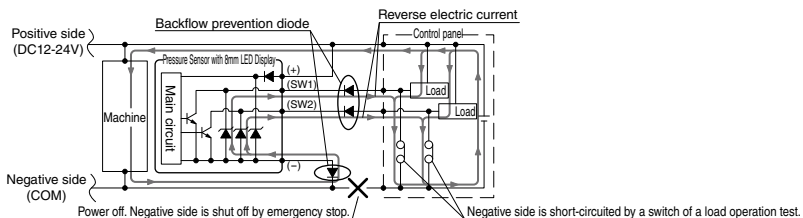
Vacuum Generators P.52

- Vacuum Generator changes over from compressed air to vacuum air

LED Digital Pressure Sensor 21-series

△ Safety Instructions

- Avoid using this product in the flammable explosive gas and corrosive gas. Otherwise, it may cause a sensor trouble.
- Wrong wire arrangement generating noise (or surge) can cause malfunctions of the sensor.
- Avoid using this product in the flammable explosive gas, liquid or ambience. This product is not designed to be explosive-proof and may cause fire or explosion under these conditions.
- Keep the product away from water / oil drops or dusts, since it is not the drip / dust proof structure. Otherwise, there is a possibility of the sensor malfunction.
- Use the product within the described temperature range. Otherwise, there is a possibility of the sensor malfunction by the heat.
- The power shall be turned off before electric wiring. Make sure to confirm the wire colors and terminal numbers, and avoid short-circuiting output terminals, power supply terminals and COM terminals. Short-circuits may cause a sensor trouble.
- Avoid an excessive tensile force and bending force on a lead wire. Otherwise, there is a possibility of wire breaking or damaging connector joint.
- Do not keep applying 0.2MPa or more of positive pressure to the sensor continuously during a vacuum release. Otherwise, there is a possibility of damaging to the sensor.
- When adjusting pressure and the hysteresis setting, use a flathead screwdriver (accessory). Do not apply an excessive force on the trimmer and slowly turn it within its rotation limits. Otherwise, there is a possibility of damaging the trimmer and the circuit board.
- Supply a stable DC power to the product.
- Add a surge absorption circuit when connecting the sensor to output terminals or power terminals (e.g. relay or solenoid valve). Do not apply a current exceeding 80mA.
- Set a frame ground terminal, when a power supply unit such as a switching power supply is used.
- Output terminals (lead wire color: black and gray) and other terminals shall not be short-circuited.
- Avoid any external impact on the sensor.
- Use fixing holes on the sensor to fix the body with M2.5 screws, referring to the recommended torque force.
- Keep a fluid air clean as much as possible.
- When a machine is connected with the power supply which also applies the power to the sensor and switch output terminals are short-circuited with the negative side by a switch of load operation test while the negative side (COM) is shut off, a reverse electric current flows in to the switch output circuit and damages the sensor. In order to prevent this problem, place backflow prevention diode on the power supply wire of the negative side or on the switch output wire toward the direction which is indicated on the drawing below.



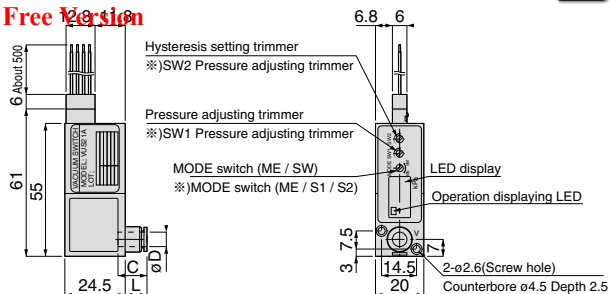
VUS Vacuum Sensor / Push-In Fitting

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RoHS compliant

¥
P.929

CAD
-2D-



Unit : mm

Model code	Tube O.D. øD	L	C	Weight (g)	CAD file name
VUS21□□-4	4	5.8	10.9	28	CRLS-001
VUS21□□-6	6	8.7	11.7	28	
VUS21□□-8	8	14.5	21.7	34.5	

※ . Left □ in model code: Replaced with "P" for PNP open collector

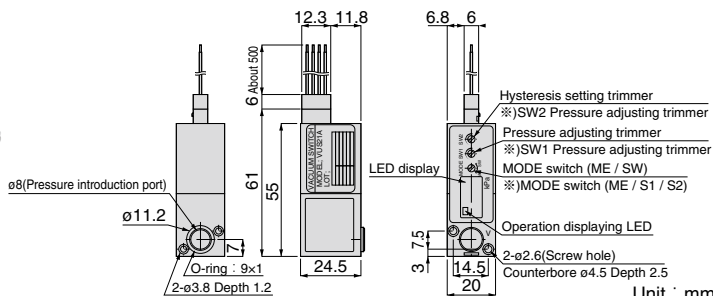
※ . Right □ in model code: Replaced with "W" for 2 switch outputs or "A" for 1 switch output and 1 analog output

VUS Vacuum Sensor / Direct Mount

RoHS compliant

¥
P.929

CAD
-2D-



Unit : mm

Model code	Weight (g)	CAD file name
VUS21□□-F	19	CRLS-001

※ . Left □ in model code: Replaced with "P" for PNP open collector

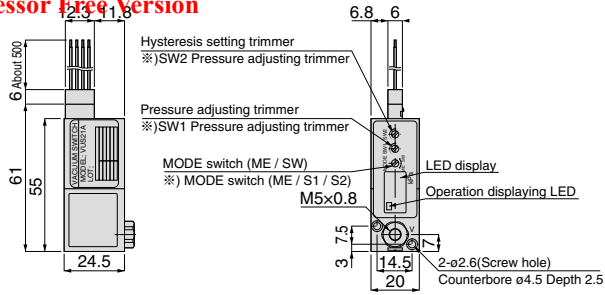
※ . Right □ in model code: Replaced with "W" for 2 switch outputs or "A" for 1 switch output and 1 analog output

LED Digital Pressure Sensor 21-series

VUS Vacuum Sensor / Metric Thread



RoHS compliant



Unit : mm

Model code	Weight (g)	CAD file name
VUS21□□-M5	28.5	CRLS-001

※ . Left □ in model code: Replaced with "P" for PNP open collector

※ . Right □ in model code: Replaced with "W" for 2 switch outputs or "A" for 1 switch output and 1 analog output



SAFETY Instructions

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This safety instructions aim to prevent personal injury and damage to properties by requiring proper use of PISCO products.

Be certain to follow ISO 4414 and JIS B 8370

ISO 4414 : Pneumatic fluid power...Recommendations for the application of equipment to transmission and control systems.

JIS B 8370 : General rules and safety requirements for systems and their components.

This safety instructions is classified into "Danger", "Warning" and "Caution" depending on the degree of danger or damages caused by improper use of PISCO products.



Danger

Hazardous conditions. It can cause death or serious personal injury.



Warning

Hazardous conditions depending on usages. Improper use of PISCO products can cause death or serious personal injury.



Caution

Hazardous conditions depending on usages. Improper use of PISCO products can cause personal injury or damages to properties.



Warning

1. Selection of pneumatic products

- ① A user who is a pneumatic system designer or has sufficient experience and technical expertise should select PISCO products.
- ② Due to wide variety of operating conditions and applications for PISCO products, carry out the analysis and evaluation on PISCO products. The pneumatic system designer is solely responsible for assuring that the user's requirements are met and that the application presents no health or safety hazards. All designers are required to fully understand the specifications of PISCO products and constitute all systems based on the latest catalog or information, considering any malfunctions.

2. Handle the pneumatic equipment with enough knowledge and experience

- ① Improper use of compressed air is dangerous. Assembly, operation and maintenance of machines using pneumatic equipment should be conducted by a person with enough knowledge and experience.

3. Do not operate machine / equipment or remove pneumatic equipment until safety is confirmed.

- ① Make sure that preventive measures against falling work-pieces or sudden movements of machine are completed before inspection or maintenance of these machine.
- ② Make sure the above preventive measures are completed. A compressed air supply and the power supply to the machine must be off, and also the compressed air in the systems must be exhausted.
- ③ Restart the machines with care after ensuring to take all preventive measures against sudden movements.

Disclaimer

1. PISCO does not take any responsibility for any incidental or indirect loss, such as production line stop, interruption of business, loss of benefits, personal injury, etc., caused by any failure on use or application of PISCO products.
2. PISCO does not take any responsibility for any loss caused by natural disasters, fires not related to PISCO products, acts by third parties, and intentional or accidental damages of PISCO products due to incorrect usage.
3. PISCO does not take any responsibility for any loss caused by improper usage of PISCO products such as exceeding the specification limit or not following the usage the published instructions and catalog allow.
4. PISCO does not take any responsibility for any loss caused by remodeling of PISCO products, or by combinational use with non-PISCO products and other software systems.
5. The damages caused by the defect of Pisco products shall be covered but limited to the full amount of the PISCO products paid by the customer.



SAFETY INSTRUCTION MANUAL

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PISCO products are designed and manufactured for use in general industrial machines. Be sure to read and follow the instructions below.

Danger

1. Do not use PISCO products for the following applications.
 - ① Equipment used for maintaining / handling human life and body.
 - ② Equipment used for moving / transporting human.
 - ③ Equipment specifically used for safety purposes.

Warning

1. Do not use PISCO products under the following conditions.
 - ① Beyond the specifications or conditions stated in the catalog, or the instructions.
 - ② Under the direct sunlight or outdoors.
 - ③ Excessive vibrations and impacts.
 - ④ Exposure / adhere to corrosive gas, inflammable gas, chemicals, seawater, water and vapor. *
 * Some products can be used under the condition above(④), refer to the details of specification and condition of each product.
2. Do not disassemble or modify PISCO products, which affect the performance, function, and basic structure of the product.
3. Turn off the power supply, stop the air supply to PISCO products, and make sure there is no residual air pressure in the pipes before maintenance and inspection.
4. Do not touch the release-ring of push-in fitting when there is a working pressure. The lock may be released by the physical contact, and tube may fly out or slip out.
5. Frequent switchover of compressed air may generate heat, and there is a risk of causing burn injury.
6. Avoid any load on PISCO products, such as a tensile strength, twisting and bending. Otherwise, there is a risk of causing damage to the products.
7. As for applications where threads or tubes swing / rotate, use Rotary Joints, High Rotary Joints or Multi-Circuit Rotary Block only. The other PISCO products can be damaged in these applications.
8. Use only Die Temperature Control Fitting Series, Tube Fitting Stainless SUS316 Series, Tube Fitting Stainless SUS316 Compression Fitting Series or Tube Fitting Brass Series under the condition of over 60°C (140° F) water or thermal oil. Other PISCO products can be damaged by heat and hydrolysis under the condition above.
9. As for the condition required to dissipate static electricity or provide an antistatic performance, use EG series fitting and antistatic products only, and do not use other PISCO products. There is a risk that static electricity can cause system defects or failures.
10. Use only Fittings with a characteristic of spatter-proof such as Anti-spatter or Brass series in a place where flame and weld spatter is produced. There is a risk of causing fire by sparks.
11. Turn off the power supply to PISCO products, and make sure there is no residual air pressure in the pipes and equipment before maintenance. Follow the instructions below in order to ensure safety.
 - ① Make sure the safety of all systems related to PISCO products before maintenance.
 - ② Restart of operation after maintenance shall be proceeded with care after ensuring safety of the system by preventive measures against unexpected movements of machines and devices where pneumatic equipment is used.
 - ③ Keep enough space for maintenance when designing a circuit.
12. Take safety measures such as providing a protection cover if there is a risk of causing damages or fires on machine / facilities by a fluid leakage.

⚠ Caution

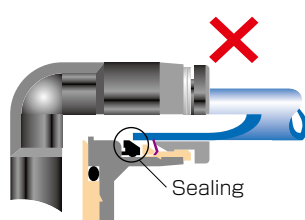
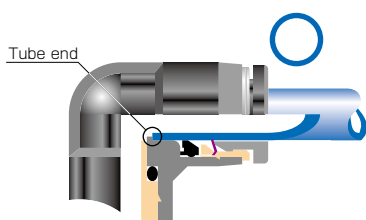
1. Remove dusts or drain before piping. They may get into the peripheral PISCO components and cause malfunction.
2. When inserting an ultra-soft tube into push-in fitting, make sure to place an Insert Ring into the tube edge. There is a risk of causing the escape of tube and a fluid leakage without using an Insert Ring.
3. The product incorporating NBR as seal rubber material has a risk of malfunction caused by ozone crack. Ozone exists in high concentrations in static elimination air, clean-room, and near the high-voltage motors, etc. As a countermeasure, material change from NBR to HNBR or FKM is necessary. Consult with PISCO for more information.
4. Special option "Oil-free" products may cause a very small amount of a fluid leakage. When a fluid medium is liquid or the products are required to be used in harsh environments, contact us for further information.
5. In case of using non-PISCO brand tubes, make sure the tolerance of the outer tube diameter is within the limits of Table 1.

● Table 1. Tube O.D. Tolerance

mm size	Nylon tube	Polyurethane tube	inch size	Nylon tube	Polyurethane tube
ø1.8mm	—	± 0.05mm	ø1/8	± 0.1mm	± 0.15mm
ø3mm	—	± 0.15mm	ø5/32	± 0.1mm	± 0.15mm
ø4mm	± 0.1mm	± 0.15mm	ø3/16	± 0.1mm	± 0.15mm
ø6mm	± 0.1mm	± 0.15mm	ø1/4	± 0.1mm	± 0.15mm
ø8mm	± 0.1mm	± 0.15mm	ø5/16	± 0.1mm	± 0.15mm
ø10mm	± 0.1mm	± 0.15mm	ø3/8	± 0.1mm	± 0.15mm
ø12mm	± 0.1mm	± 0.15mm	ø1/2	± 0.1mm	± 0.15mm
ø16mm	± 0.1mm	± 0.15mm	ø5/8	± 0.1mm	± 0.15mm

6. Instructions for Tube Insertion

- ① Make sure that the cut end surface of the tube is at right angle without a scratch on the surface and deformations.
- ② When inserting a tube, the tube needs to be inserted fully into the push-in fitting until the tubing edge touches the tube end of the fitting as shown in the figure below. Otherwise, there is a risk of leakage.



- ③ After inserting the tube, make sure it is inserted properly and not to be disconnected by pulling it moderately.
- ※ When inserting tubes, Lock-claws may be hardly visible in the hole, observed from the front face of the release-ring. But it does not mean the tube will surely escape. Major causes of the tube escape are the followings;
- ① Shear drop of the lock-claws edge
 - ② The problem of tube diameter (usually small)
- Therefore, follow the above instructions from ① to ③, even lock-claws is hardly visible.

7. Instructions for Tube Disconnection

- ① Make sure there is no air pressure inside of the tube, before disconnecting it.
- ② Push the release-ring of the push-in fitting evenly and deeply enough to pull out the tube toward oneself. By insufficient pushing of the release-ring, the tube may not be pulled out or damaged by scratch, and tube shavings may remain inside of the fitting, which may cause the leakage later.

8. Instructions for Installing a fitting

- ① When installing a fitting, use proper tools to tighten a hexagonal-column or an inner hexagonal socket. When inserting a hex key into the inner hexagonal socket of the fitting, be careful so that the tool does not touch lock-claws. The deformation of lock-claws may result in a poor performance of systems or an escape of the tube.
- ② Refer to Table 2 which shows the recommended tightening torque. Do not exceed these limits to tighten a thread. Excessive tightening may break the thread part or deform the gasket and cause a fluid leakage. Tightening thread with tightening torque lower than these limits may cause a loosened thread or a fluid leakage.
- ③ Adjust the tube direction while tightening thread within these limits, since some PISCO products are not rotatable after the installation.

●Table 2: Recommended tightening torque / Sealock color / Gasket materials

Thread type	Thread size	Tightening torque	Sealock color	Gasket materials
Metric thread	M3 × 0.5	0.7N·m	—	SUS304 NBR
	M5 × 0.8	1.0 ~ 1.5N·m		
	M6 × 1	2 ~ 2.7N·m		POM
	M3 × 0.5	0.5 ~ 0.6N·m		
	M5 × 0.8	1 ~ 1.5N·m		
	M6 × 0.75	0.8 ~ 1N·m		
Taper pipe thread	M8 × 0.75	1 ~ 2N·m	White	—
	R1/8	7 ~ 9N·m		
	R1/4	12 ~ 14N·m		
	R3/8	22 ~ 24N·m		
Unified thread	R1/2	28 ~ 30N·m	—	SUS304, NBR
	No.10-32UNF	1.0 ~ 1.5N·m		
National pipe thread taper	1/16-27NPT	7 ~ 9N·m	White	—
	1/8-27NPT	7 ~ 9N·m		
	1/4-18NPT	12 ~ 14N·m		
	3/8-18NPT	22 ~ 24N·m		
	1/2-14NPT	28 ~ 30N·m		

※ These values may differ for some products. Refer to each specification as well.

9. Instructions for removing a fitting

- ① When removing a fitting, use proper tools to loosen a hexagonal-column or an inner hex bolt.
- ② Remove the sealant stuck on the mating equipment. The remained sealant may get into the peripheral equipment and cause malfunctions.

10. Arrange piping avoiding any load on fittings and tubes such as twist, tensile, moment load, shaking and physical impact. These may cause damages to fittings, tube deformations, bursting and the escape of tubes.

Common Safety Instructions for Pressure Sensors

Before selecting or using PISCO products, read the following information. Regarding the instructions of each series, please follow each Detailed Safety Instructions.

Warning

1. Avoid an excessive tensile strength, twisting force, bending, dropping and strong impact on pressure sensors. Otherwise, there is a possibility of damaging the products.
2. Supply clean air to the operating pressure source. There is a possibility of malfunction of sensors by sludge or dusts.

Caution

1. Refer to "Common Safety Instructions for Fittings" for handling Fittings.
2. Instructions for Installation
 - ①. Use a proper tool to tighten hexagonal-columns of body.
 - ②. Refer to the following recommended tightening torque to tighten thread. Do not exceed these limits to tighten a thread. Excessive tightening may break the thread part or deform the gasket to cause a fluid leakage. Tightening thread with tightening torque less than these limits may cause a loosened thread or fluid leakage.

● Table: Recommended tightening torque (Hexagonal-column)

Thread type	Thread size	Tightening torque
Metric thread	M5×0.8	1.5 ~ 1.9N·m
Taper pipe thread	R1/8	7 ~ 9N·m

3. Instructions for Removal

- ①. Use a proper tool to tighten hexagonal-columns of body.
- ②. Remove the sealant stuck on the mating equipment. The remained sealant may get into the peripheral equipment and cause malfunctions.