



Operation Manual

PRODUCT NAME

*Metal Speed Controller
Low Profile Type*

MODEL/ Series/ Product Number

*ASBL * * * * - * **

SMC Corporation

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Metal Speed Controller Low Profile Type ASBL Series Safety Instructions

These safety instructions are intended to prevent hazardous situations and/or equipment damage. These instructions indicate the level of potential hazard with the labels of “**Caution**,” “**Warning**” or “**Danger**.” They are all important notes for safety and must be followed in addition to International Standards (ISO/IEC)^{*1)}, and other safety regulations.

*1) ISO 4414: Pneumatic fluid power - General rules and safety requirements for systems and their components
ISO 4413: Hydraulic fluid power - General rules and safety requirements for systems and their components
IEC 60204-1: Safety of machinery - Electrical equipment of machines - Part 1: General requirements
ISO 10218-1: Robots and robotic devices - Safety requirements for industrial robots - Part 1: Robots
etc.



Danger

Danger indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.



Warning

Warning indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.



Caution

Caution indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.



Warning

1. The compatibility of the product is the responsibility of the person who designs the equipment or decides its specifications.

Since the product specified here is used under various operating conditions, its compatibility with specific equipment must be decided by the person who designs the equipment or decides its specifications based on necessary analysis and test results. The expected performance and safety assurance of the equipment will be the responsibility of the person who has determined its compatibility with the product. This person should also continuously review all specifications of the product referring to its latest catalog information, with a view to giving due consideration to any possibility of equipment failure when configuring the equipment.

2. Only personnel with appropriate training should operate machinery and equipment.

The product specified here may become unsafe if handled incorrectly. The assembly, operation and maintenance of machines or equipment including our products must be performed by an operator who is appropriately trained and experienced.

3. Do not service or attempt to remove product and machinery/equipment until safety is confirmed.

1. The inspection and maintenance of machinery/equipment should only be performed after measures to prevent falling or runaway of the driven objects have been confirmed.
2. When the product is to be removed, confirm that the safety measures as mentioned above are implemented and the power from any appropriate source is cut, and read and understand the specific product precautions of all relevant products carefully.
3. Before machinery/equipment is restarted, take measures to prevent unexpected operation and malfunction.

4. Our products cannot be used beyond their specifications. Our products are not developed, designed, and manufactured to be used under the following conditions or environments. Use under such conditions or environments is not covered.

1. Conditions and environments outside of the given specifications, or use outdoors or in a place exposed to direct sunlight.
2. Use for nuclear power, railways, aviation, space equipment, ships, vehicles, military application, equipment affecting human life, body, and property, fuel equipment, entertainment equipment, emergency shut-off circuits, press clutches, brake circuits, safety equipment, etc., and use for applications that do not conform to standard specifications such as catalogs and operation manuals.
3. Use for interlock circuits, except for use with double interlock such as installing a mechanical protection function in case of failure. Please periodically inspect the product to confirm that the product is operating properly.



Metal Speed Controller Low Profile Type ASBL Series Safety Instructions

Caution

We develop, design, and manufacture our products to be used for automatic control equipment, and provide them for peaceful use in manufacturing business.

Use in non-manufacturing business is not covered.

Products we manufacture and sell cannot be used for the purpose of transactions or certification specified in the Measurement Act.

The new Measurement Act prohibits use of any unit other than SI units in Japan.

Limited warranty and Disclaimer/Compliance Requirements

The product used is subject to the following “Limited warranty and Disclaimer” and “Compliance Requirements”. Read and accept them before using the product.

Limited warranty and Disclaimer

1. The warranty period of the product is 1 year in service or 1.5 years after the product is delivered, whichever is first.*2)

Also, the product may have specified durability, running distance or replacement parts. Please consult your nearest sales branch.

2. For any failure or damage reported within the warranty period which is clearly our responsibility, a replacement product or necessary parts will be provided.

This limited warranty applies only to our product independently, and not to any other damage incurred due to the failure of the product.

3. Prior to using SMC products, please read and understand the warranty terms and disclaimers noted in the specified catalog for the particular products.

***2) Vacuum pads are excluded from this 1 year warranty.**

A vacuum pad is a consumable part, so it is warranted for a year after it is delivered.

Also, even within the warranty period, the wear of a product due to the use of the vacuum pad or failure due to the deterioration of rubber material are not covered by the limited warranty

Compliance Requirements

1. The use of SMC products with production equipment for the manufacture of weapons of mass destruction (WMD) or any other weapon is strictly prohibited.

2. The exports of SMC products or technology from one country to another are governed by the relevant security laws and regulations of the countries involved in the transaction. Prior to the shipment of a SMC product to another country, assure that all local rules governing that export are known and followed.

2. Specific Product Precautions

Design/ Selection

Warning

(1) Confirm the specifications.

The products are designed to be used in compressed air systems (including vacuum) only. Do not operate at pressures, temperatures, etc., beyond the range of specifications, as this can cause damage or malfunction. (Refer to the specifications.)

Please contact SMC when using a fluid other than compressed air (including vacuum). We do not guarantee against any damage if the product is used outside of the specifications range.

(2) Products mentioned in this catalog are not designed for use as stop valves with zero air leakage.

A certain amount of leakage is allowed in the products specifications. Tightening the needle forcibly to achieve zero air leakage through main valve may result in damage of internal parts and the product may stop functioning properly. Please do not tighten the needle forcibly.

(3) Do not disassemble the product or make any modifications, including additional machining.

Doing so may cause human injury and/or an accident.

(4) Sonic conductance (C) and critical pressure ratio (b) values for products are representative values.

The speed controller's controlled flow values are with the needle fully open and free flow with the needle fully closed.

(5) The flow rate characteristics for each product are representative values.

The flow rate characteristics are characteristics of each individual product. Actual values may differ depending on the piping, circuitry, pressure conditions, etc. The flow rate may not be recognized from the fully closed position until around the first turn. This is due to the product design and not a malfunction.

Also, depending on product specifications, there may be variations in the zero needle rotations position.

(6) Check if PTFE can be used in application.

PTFE powder (Polytetrafluoroethylene resin) is included in the seal material of the male thread type piping taper thread. Confirm that the use of it will not cause any adverse effect on the system. Please contact SMC if the Safety Data Sheet (SDS) is required.

Design/ Selection

Warning

(7) Speed controllers are designed to control the speed of the actuator.

(8) The surface of brass may turn black depending on the storage and operating environment.

Use of brass with electroless nickel plating is recommended when discoloration of brass needs to be avoided.

Mounting

Warning

(1) Operation Manual

Install the products and operate it only after reading the operation Manual carefully and understanding its contents. Also, keep the Manual where it can be referred to as necessary.

(2) Ensure sufficient space for maintenance activities.

When installing the products, allow access for maintenance.

(3) Tighten threads with the proper tightening torque.

When installing the products, follow the listed proper torque.

(4) Confirm that the lock nut is securely tightened.

Confirm that the lock nut is securely tightened and the needle is locked after adjusting the cylinder speed.

When the product is used with a loose lock nut, the set flow rate may change unknowingly and the actuator speed may change, which leads to dangerous situations.

Forcibly tightening the lock nut exceeding the locked state may result in breakage. Follow the proper tightening torque when tightening.

(5) Check the degree of rotation of the needle valve.

As the needle valve has a stopper mechanism for maximum opening, it is not possible to rotate beyond the given limit.

Excessive rotation will cause damage to the product. Please check the specified number of rotations before using the product.

(6) Do not use tools such as pliers to rotate the knob.

It can cause idle rotation of the knob or damage.

Mounting

Warning

(7) Verify the air flow direction.

Mounting backward is dangerous, because the speed adjustment needle will not work and the actuator may lurch suddenly.

(8) Adjust the speed by opening the needle slowly from the fully closed state.

Loose needle valves may cause unexpected sudden actuator lurching.

When a needle valve is turned clockwise, it is closed and cylinder speed decreases. When a needle valve is turned counterclockwise, it is open and cylinder speed increases.

Note that the application of excessive torque may break the needle valve.

Flow Direction Symbols on Body

	Meter-out	Meter-in
Indication symbol		

(9) Do not apply excessive force or shock to the body or fittings with an impact tool.

It can cause damage or air leakage.

(10) For handling One-touch fittings, refer to the Fittings and Tubing Precautions.

(11) Use R external threads with Rc internal threads and NPT external threads with NPT internal threads and G external threads with G internal threads.

(12) The handle of this product is attached only by press fitting. Excess torque may break the product. The table below shows the maximum allowable torque of the handle.

Body size	Maximum allowable torque N·m
M5, 10-32UNF	0.03~0.05
1/8	0.15~0.17
1/4	0.21~0.23
3/8	0.23~0.25
1/2	0.38~0.40

(13) To install and remove the product with hexagonal hole, use an appropriate hex key and push it into the hexagon hole of the stud.

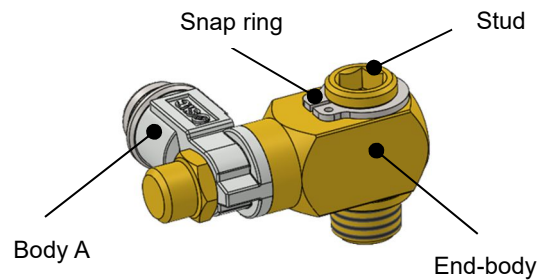
Do not apply torque at other points as the product may be damaged.

Rotate End-body manually for positioning after installation. Refer to the applicable dimension of the hexagon wrench.

Mounting

Warning

Connection Thread	Hex Key (Nominal)	
	Metric [mm]	Imperial [Inch]
M5, 10-32UNF	2.5	-
R1/8, G1/8	6	-
NPT1/8	-	7/32"
R1/4, G1/4	8	-
NPT1/4	-	5/16"
R3/8, G3/8	10	-
NPT3/8	-	3/8"
R1/2, G1/2	10	-
NPT1/2	-	3/8"



*Photos of products

(14) After tightening, Body-A and End-body can be rotated slightly for positioning purposes with no air supply. However, do not use the product in an application where it rotates constantly or a moment load is applied.

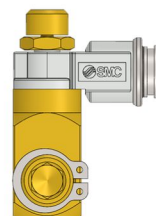
Failure to follow these instructions may result in wear causing metal powder to enter the operating fluid, air leakage, or damage to the fitting.

(15) Do not use the product in a way that the connection tube oscillates or turns.

It may cause damage to the product body or to the fitting which may pose a risk to the user. If Body-A and End-body are likely to oscillate or rotate, use the product with the tube secured.

(16) After installation, the opening of the snap ring may protrude from End-body.

Adjust the direction of the snap ring so that it does not protrude. Using the product with the snap ring opening protruding may cause injury to the user or product damage.



Before adjustment



After adjustment

Mounting

Caution

(1) For M5, 10-32UNF

① Tightening method

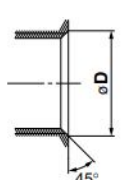
First, tighten it by hand, then give it an additional 1/6 turn to 1/4 turn with a wrench. A reference value for the tightening torque is 1 to 1.5 N·m.

Note) Excessive tightening may damage the thread portion or deform the gasket and cause air leakage.

If the screw is too shallowly screwed in, it may come loose or air may leak.

② Chamfered area for female thread

Conforming to ISO 16030 (air pressure fluid dynamics – connection – ports and stud ends), the chamfered dimensions shown in the table below are recommended.

	Female thread size	Chamfered port size φD (Recommended value)
	M5	5.1 to 5.4
	10-32UNF	5.0 to 5.3

(2) For R, NPT, G thread

① Tightening method

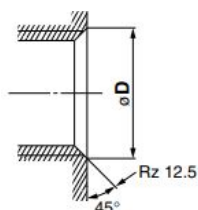
To tighten a screw, tighten it by hand and then insert an appropriate hexagon wrench to the hexagonal socket of the stud and turn it.

Refer to the reference values in the table below for the tightening torque.

Connection thread size	Tightening Torque (N·m)
1/8	3 to 5
1/4	8 to 12
3/8	15 to 20
1/2	20 to 25

② Chamfered area for female thread

By chamfering as shown in the following table, machining of threads is easier and effective for burr prevention.



Connection Thread size	Chamfered port size φD (Recommended value)		
	Rc	NPT	G Face seal
1/8	10.2 to 10.4	10.5 to 10.7	9.8 to 10.2
1/4	13.6 to 13.8	14.1 to 14.3	13.3 to 13.7
3/8	17.1~17.3	17.4~17.6	16.8~17.2
1/2	21.4~21.6	21.7~21.9	21.0~21.4

*G thread (face seal) complies with ISO16030-2001.

Mounting

Caution

(3) The proper tightening torques for hexagon lock nuts are shown in the table below.

For standard installation, turn 15 to 30° using a tool, after fastening by hand. Pay attention not to over tighten the product. Check the dimensions for each product for the width across flats.

Body size	Proper tightening torque [N·m]	Lock nut width across flats
M5	0.17	7
1/8	0.3	9
1/4	1	12
3/8	1.5	14
1/2	2	17

Piping Threads with Sealant

Caution

(1) If the fitting is tightened with excessive torque, a large amount of sealant will seep out. Remove the excess sealant.

(2) Insufficient tightening may loosen the threads, or cause air leakage.

(3) Reuse

- ① Normally, fittings with a sealant can be reused 2 to 3 times.
- ② To prevent air leakage through the sealant, remove any loose sealant stuck to the fitting by blowing air over the threaded portion.
- ③ If the sealant no longer provides effective sealing, wrap sealing tape over the sealant before reusing. Do not use the sealant in any form other than a tape type.

(4) Once the fitting has been tightened, backing it out to its original position often causes the sealant to become defective. Air leakage will occur.

Piping

Caution

(1) Refer to the Fittings & Tubing Precautions for handling One-touch fittings.

Piping

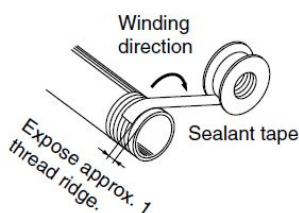
Caution

(2) Preparation before piping

Before piping is connected, it should be thoroughly blown out with air (flushing) or washed to remove chips, cutting oil and other debris from inside the pipe.

(3) Winding of sealant tape

When screwing together pipes and fittings, etc., be certain that chips from the pipe threads and sealing material do not get inside the pipe. Also, when the sealant tape is used, leave approx. 1 thread ridges exposed at the end of the threads.



Precautions for One-Touch Tube Fittings

Piping

Caution

(1) Connection and disconnection of tube from one-touch fitting

① Installation of tube

1) Cut the tube perpendicularly, being careful not to damage the external surface. Use an SMC tube cutter TK-1, 2, 3 or 6. Do not cut the tubing with pliers, nippers, scissors, etc., otherwise the tubing will be deformed and problems may result.

2) The outside diameter of the polyurethane tubing swells when internal pressure is applied to it. Therefore, it may be impossible to re-insert the tubing into One-touch fittings. Check the tubing outside diameter, and when the accuracy of the outside diameter is +0.07mm or larger for $\phi 2$, and +0.15mm or larger for other sizes, re-insert it into the One-touch fitting without cutting the tube. When the tubing is re-inserted into the One-touch fitting, confirm that the tubing goes through the release button smoothly.

3) Grasp the tubing, and slowly push it straight (0 to 5°) into the One-touch fitting until it comes to a stop.

4) Pull the tubing back gently to make sure it has a positive seal. Insufficient installation may cause air to leak or the tubing to release.

As a guide for checking if the tubing is pulled out or not, refer to the following table.

Precautions for One-Touch Tube Fittings

Piping

Caution

② Removal of the tube

1) Push the release button flange evenly and sufficiently to release the tube. Do not push in the tubing before pressing the release button.

2) Pull out the tubing while keeping the release button depressed. If the release button is not held down sufficiently, the tubing cannot be withdrawn.

3) To reuse the tubing, remove the previously lodged portion of the tubing. If the lodged portion is left on without being removed, it may result in air leakage and make the removal of the tubing difficult.

(2) Connection of a part with a metal rod

Do not connect a part with a metal rod (such as KC series) to the one-touch fitting. If connected, the one-touch fitting's chuck cannot retain the metal rod, and the metal rod part may release during pressurization, causing injury to the user or an accident.

If a metal rod part is connected, it must not be used with a tube, resin plug, or resin reducer; such use may cause the tube, plug, or reducer to release.

(3) When mounting the tube, resin plug or metal rod, do not press the release button.

Do not press the release button unnecessarily before mounting tubing, resin plugs and metal rods. This can cause the disconnection of tube.

(4) When using a tubing other than from SMC, confirm that the tube material and the O.D. accuracy satisfy the following specifications.

- 1) Nylon tube ± 0.1 mm max.
- 2) Soft nylon tube ± 0.1 mm max.
- 3) Polyurethane tube +0.15 mm at max.
Within -0.2 mm

Do not use the tubing which does not satisfy the specified tubing O.D. accuracy, or if the tubing has a different I.D., material, hardness, or surface roughness from those of SMC's tubing. If you have any questions, please consult SMC. Failure to satisfy the specifications may lead to difficulty in connecting the tubing, leakage, disconnection of the tubing, or fitting damage.

Recommended Piping Conditions

Caution

(1) When connecting piping to the One-touch fitting, use a pipe length with sufficient margin, in accordance with the piping conditions shown in Figure 1.

Also, when using a tying band, etc., to bind the piping together, make sure that external force does not come to bear on the fitting. (see Figure 2)

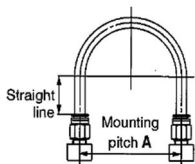


Figure 1 Recommended piping

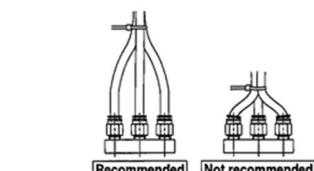


Fig. 2 When using a tying band to bind the piping together

Unit:mm

Tubing size	Mounting pitch A			Straight-line length
	Nylon tube	Soft nylon tube	Polyurethane tube	
φ4, φ5/32"	56 or more	44 or more	26 or more	20 or more
φ6	84 or more	66 or more	39 or more	30 or more
φ1/4"	89 or more	70 or more	57 or more	32 or more
φ8, φ5/16"	112 or more	88 or more	52 or more	40 or more
Ø10	140 or more	110 or more	69 or more	50 or more
φ12	168 or more	132 or more	88 or more	60 or more

Air Supply

Warning

(1) Type of fluids

Please consult with SMC when using the product in applications other than compressed air.

(2) When there is a large amount of drainage

Compressed air containing a large amount of drainage can cause the malfunction of pneumatic equipment. An air dryer or water separator should be installed upstream from filters.

(3) Drain flushing

If condensation in the drain bowl is not emptied on a regular basis, the bowl will overflow and allow the condensation to enter the compressed air lines. This causes the malfunction of pneumatic equipment.

If the drain bowl is difficult to check and remove, the installation of a drain bowl with an auto drain option is recommended.

For compressed air quality, refer to SMC catalog "Compressed Air Purification System".

(4) Use clean air

Do not use compressed air that contains chemicals, synthetic oils that include organic solvents, salt, corrosive gases, etc., as it can cause damage or malfunction.

Air Supply

Caution

(1) Install an air filter.

Install an air filter upstream near the valve. For the filtration rating, select 5 μm or below, or select a rating equivalent to or lower than ISO 8573-1:2010 [6:4:4]*.

*This is equivalent to the filtration performance achieved when an air filter is attached for inlet side compressed air with purity class of [7:4:4].

(2) Ensure that the fluid and ambient temperatures are within the specified range.

If the fluid temperature is 5°C or less, the moisture in the circuit could freeze, causing damage to the seals or leading to equipment malfunction.

Therefore, take appropriate measures to prevent freezing.

For compressed air quality, refer to SMC catalog "Compressed Air Purification System".

Operating environment

Warning

(1) Do not use in an atmosphere containing corrosive gases, chemicals, sea water, water, water steam, or where there is direct contact with any of these.

(2) Do not expose the product to direct sunlight for an extended period of time.

(3) Do not mount the product in locations where it is exposed to radiant heat.

Maintenance

Warning

(1) Perform maintenance and inspection according to the procedures indicated in the operation manual.

If handled improperly, malfunction or damage of machinery and equipment may occur.

(2) Maintenance work

If handled improperly, compressed air can be dangerous. Assembly, handling, repair and element replacement of pneumatic systems should be performed by a knowledgeable and experienced person.

(3) Drain flushing

Remove drainage from air filters regularly.



Caution

(4) Removal of equipment, and supply/exhaust of compressed air

Before components are removed, first confirm that measures are in place to prevent workpieces from dropping, run-away equipment, etc.

Then, Cut the supply pressure and electric power, and exhaust all compressed air from the system using the residual pressure release function.

When machinery is restarted, proceed with caution after confirming that appropriate measures are in place to prevent sudden movement.

3. Application

This product is designed to provide a temporary intermediate stop of a pneumatic actuator.

4. Specifications

Fluid	Air
Proof pressure	1.5MPa
Maximum operating pressure	1.0MPa
Minimum operating pressure	0.1MPa
Ambient and fluid temperature	-5 to 60°C (No freezing)
Applicable tube materials ^(note 1)	FEP, PFA, Nylon, Soft nylon, Polyurethane, Polyolefin

Note1: Check the maximum operation pressure of the tubing.

Tubing with inner layer of materials is applicable.

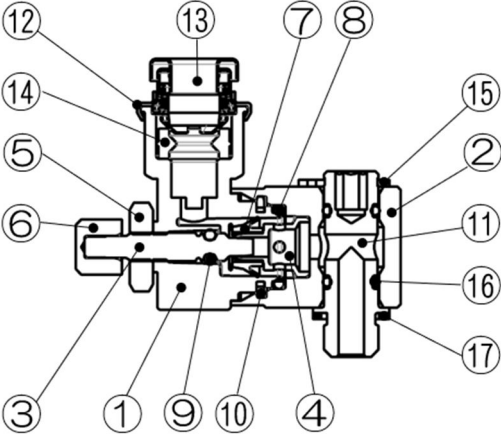
SMC tubing : TRBU(FR double layer), TRTU(FR three-layer), TRS(FR soft nylon), etc.

5. Troubleshooting

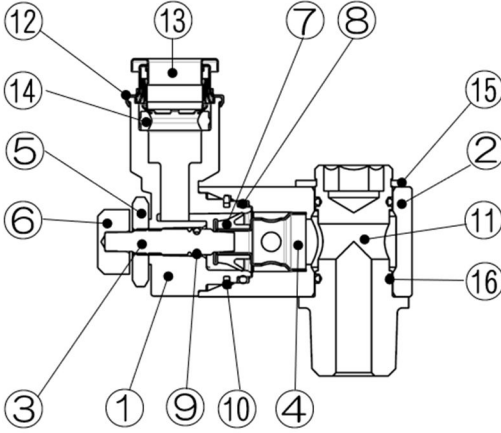
Trouble	Possible causes	Countermeasure
Speed cannot be adjusted.	Check valve is the wrong way round.	Check the control method is suitable for operating conditions, meter-out or meter-in.
	Dust inside.	Fully open the needle and apply air blow inside. If the problem is not solved even after air blow, install an air filter to the upstream piping, and replace the product with a new one.
Air leaks from the One-touch fitting. Or the tubing disconnects.	Tubing has been cut using pliers or nipper.	Use tube cutters.
	The tolerance of the outside diameter of the tubing in use is beyond the specification.	When using a tubing other than from SMC, confirm that the tube material and the O.D. accuracy satisfy the following specifications. 1) Nylon tube ±0.1 mm max. 2) Soft nylon tube ±0.1 mm max. 3) Polyurethane tube +0.15 mm at max. Within -0.2 mm

6. Construction

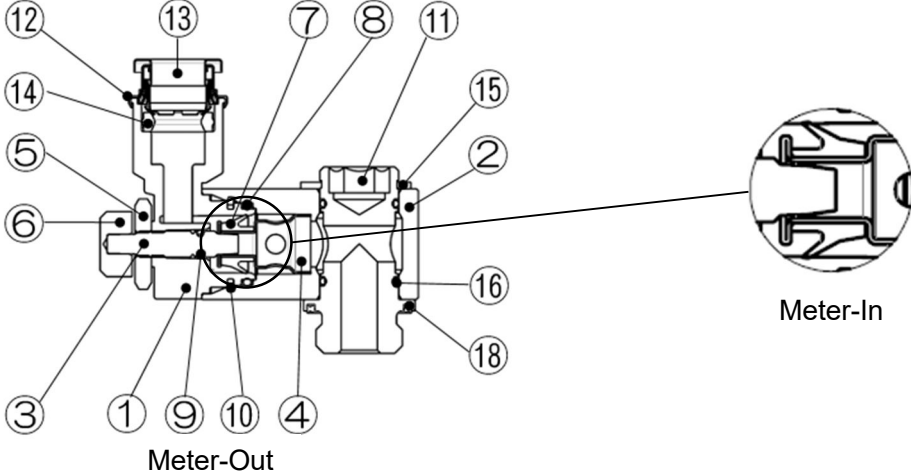
Seal method : Gasket seal
For M5,10-32UNF



Seal method : Sealant
For R,NPT thread



Seal method : Face seal
For G thread



Revision history

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Note: Specifications are subject to change without prior notice and any obligation on the part of the manufacturer.
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