

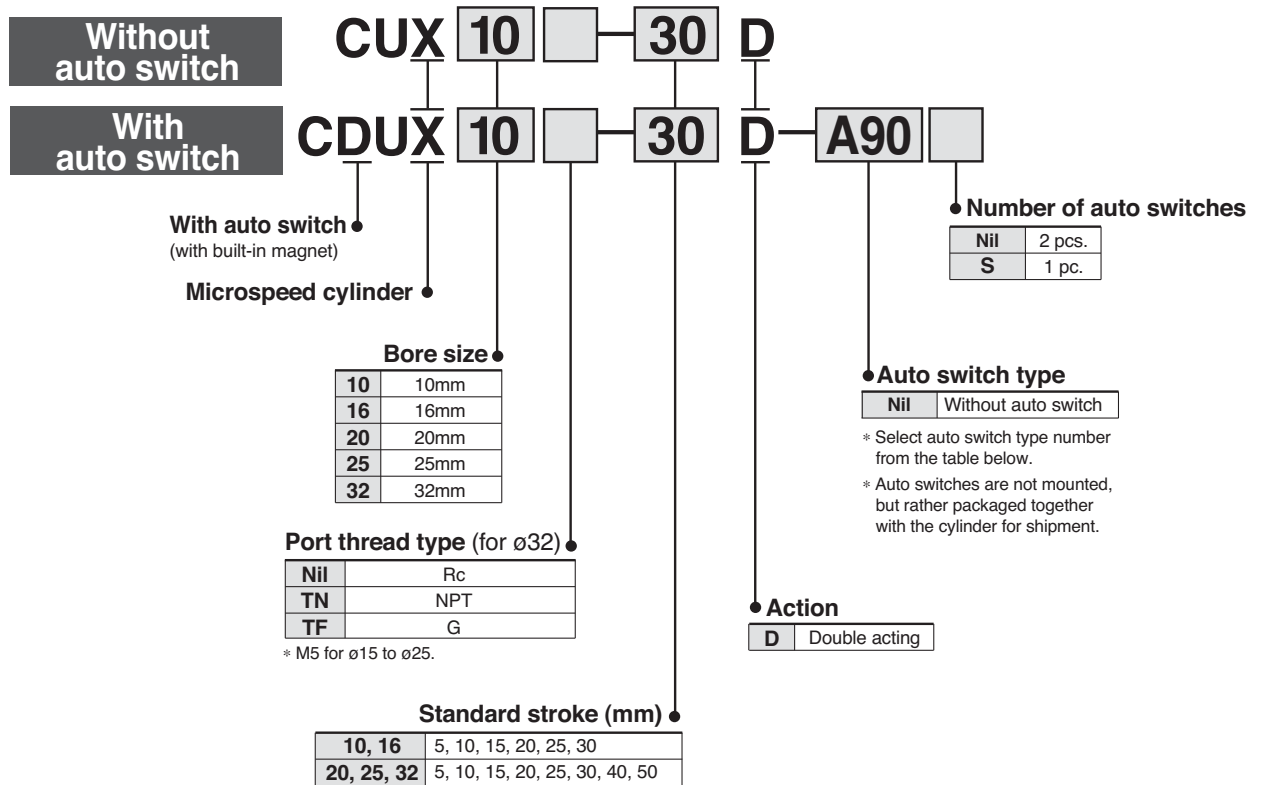
Microspeed Cylinder: Double Acting/Single Rod

Series CUX

∅10, ∅16, ∅20, ∅25, ∅32

Dimensions and auto switch details are equivalent to those of the standard double acting single rod cylinder. Refer to the Series CU, CDU sections in "Best Pneumatics No. 2".

How to Order



Auto switch specifications

| Type | Special function | Electrical entry | Indicator light | Wiring (output) | Load voltage | | Auto switch type | | Lead wire length (m)* | | | Applicable load | |
|--------------------|--|------------------|-----------------|---------------------|--------------|-----------|------------------|---------|-----------------------|-------|-------|-----------------|------------|
| | | | | | DC | AC | Perpendicular | In-line | 0.5 (Nil) | 3 (L) | 5 (Z) | | |
| Reed switch | — | Grommet | No | 2-wire | 24V | 5V 12V | 100V or less | A90V | A90 | ● | ● | — | IC circuit |
| | | | Yes | | | 12V | | 100V | A93V | A93 | ● | ● | — |
| | | | Yes | 3-wire (NPN equiv.) | — | 5V | — | A96V | A96 | ● | ● | — | IC circuit |
| Solid state switch | — | Grommet | Yes | 3-wire (NPN) | 24V | 5V 12V | — | M9NV | M9N | ● | ● | ○ | IC circuit |
| | | | | 3-wire (PNP) | | | | M9PV | M9P | ● | ● | ○ | IC circuit |
| | | | | 2-wire | | | | M9BV | M9B | ● | ● | ○ | — |
| | | | | 3-wire (NPN) | | | | M9NVV | M9NV | ● | ● | ○ | IC circuit |
| | | | | 3-wire (PNP) | | | | M9PWW | M9PW | ● | ● | ○ | IC circuit |
| | 2-wire | M9BWW | M9BW | ● | ● | ○ | — | | | | | | |
| | Diagnostic indication (2-colour display) | | | | | | | | | | | | Relay PLC |

* Lead wire length symbols: 0.5m Nil (Example) A93

3m L (Example) A93L

5m Z (Example) M9NWZ

* Solid state auto switches marked "○" are produced upon receipt of order.
D-9□ type auto switches can also be mounted.

Specifications



| | |
|-------------------------------|--|
| Fluid | Air |
| Proof pressure | 1.05MPa |
| Maximum operating pressure | 0.7MPa |
| Ambient and fluid temperature | Without auto switch: -10 to 70°C With auto switch: -10 to 60°C (with no freezing) |
| Lubrication | Non-lube |
| Piston speed | ø10, ø16: 1 to 300mm/s ø20 to ø32: 0.5 to 300mm/s |
| Cushion | Double side rubber bumper |
| Rod end threads | Male threads |
| Thread tolerance | JIS class 2 |
| Stroke length tolerance | $\begin{matrix} +1.0 \\ 0 \end{matrix}$ |
| Mounting type | Basic type |

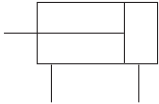
Minimum Operating Pressure

Unit: MPa

| Bore size (mm) | ø10 | ø16 | ø20 | ø25 | ø32 |
|-------------------------------|------|------|------|------|------|
| Min. operating pressure (MPa) | 0.06 | 0.06 | 0.05 | 0.05 | 0.05 |

JIS symbol

Double acting/Single rod



Standard Strokes

| Bore sizes (mm) | Standard strokes (mm) |
|-----------------|-------------------------------|
| 10, 16 | 5, 10, 15, 20, 25, 30 |
| 20, 25, 32 | 5, 10, 15, 20, 25, 30, 40, 50 |

⚠ Specific Product Precautions

- Be sure to read before handling.
- Refer to pages 3 to 12 for safety instructions and precautions.

Mounting

⚠ Caution

- Tightening the cylinder beyond the range of the indicated torque (shown in the table below) may affect operation. Apply Loctite® (No. 242, Blue) to the mounting threads.

| Bore sizes (mm) | Hexagon socket head cap screw size (mm) | Proper tightening torque (N·m) (cylinder body) |
|-----------------|---|--|
| 10 | M3 | 0.54 ±10% |
| 16 | M4 | 1.23 ±10% |
| 20, 25 | M5 | 2.55 ±10% |
| 32 | M6 | 4.02 ±10% |

Operation

⚠ Warning

- The speed may not be controllable during low speed operation with the meter-out controller.

⚠ Caution

- For Series CUX10, up to 0.1Nℓ/min (ANR) of internal leakage is anticipated due to cylinder structure.

Maintenance

⚠ Caution

- Replacement parts/Seal kits
Replacement parts and seal kits can be ordered using the seal kit number for each bore size.

| Bore size (mm) | Seal kit no. | Kit components |
|----------------|--------------|--------------------------|
| 16 | CUX16-PS | Piston seal: 1 pc. |
| 20 | CUX20-PS | Rod seal: 1 pc. |
| 25 | CUX25-PS | Gasket: 1 pc. |
| 32 | CUX32-PS | Grease pack (10g): 1 pc. |

* Due to cylinder structure, 10mm bore size seals cannot be replaced.


- Grease pack
When maintenance requires only grease, use the following part numbers to order.
Grease pack
GR-L-005 (5g)
GR-L-010 (10g)
GR-L-150 (150g)





Microspeed Cylinders

Safety Instructions

These safety instructions are intended to prevent a hazardous situation and/or equipment damage. These instructions indicate the level of potential hazard by a label of "**Caution**", "**Warning**", or "**Danger**". To ensure safety, be sure to observe ISO 4414 Note 1), JIS B 8370 Note 2) and other safety practices.

 **Caution** : Operator error could result in injury or equipment damage.

 **Warning** : Operator error could result in serious injury or loss of life.

 **Danger** : In extreme conditions, there is a possible result of serious injury or loss of life.

Note 1) ISO 4414: Pneumatic fluid power – Recommendations for the application of equipment to transmission and control systems

Note 2) JIS B 8370: General Rules for Pneumatic Equipment

Warning

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

Since the products specified here are used in various operating conditions, their compatibility with the specific pneumatic system must be based on specifications or after analysis and/or tests to meet your specific requirements.

2. Only trained personnel should operate pneumatically operated machinery and equipment.

Compressed air can be dangerous if handled incorrectly. Assembly, handling or maintenance of pneumatic systems should be performed by trained and experienced operators.

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

1. Inspection and maintenance of machinery/equipment should only be performed after confirmation of safe locked-out control positions.

2. When equipment is to be removed, confirm the safety process as mentioned above. Cut the supply pressure for this equipment and exhaust all residual compressed air in the system.

3. Before machinery/equipment is restarted, take measures to prevent shooting-out of cylinder piston rod, etc. (Bleed air into the system gradually to create back pressure.)

4. Contact SMC if the product is to be used in any of the following conditions:

1. Conditions and environments beyond the given specifications, or if product is used outdoors.

2. Installation on equipment in conjunction with atomic energy, railway, air navigation, vehicles, medical equipment, food and beverages, recreation equipment, emergency stop circuits, press applications, or safety equipment.

3. An application which has the possibility of having negative effects on people, property, or animals, and therefore requires special safety analysis.



Microspeed Cylinders

Actuator Precautions 1

Be sure to read before handling.

Design

Warning

1. **There is a danger of sudden erratic action by air cylinders if sliding parts of machinery are twisted, causing changes in forces to occur.**

In such cases, bodily injury may occur, e.g., by having hands or feet get caught in the machinery, or damage to the machinery itself may occur. Therefore, the machine should be adjusted to operate smoothly and designed to prevent such dangers.

2. **A protective cover is recommended to minimize the risk of personal injury.**

If driven objects and moving parts of a cylinder pose a likely threat of personal injury, design the structure to avoid direct human contact with that area.

3. **Securely tighten all of the cylinder's stationary parts and connected parts so that they will not become loose.**

Refer to the "Specific Product Precautions" section for each model.

4. **Cases when a deceleration circuit or shock absorber may be required**

When a driven object is operated at high speed or the load is heavy, a cylinder's cushion will most likely not be sufficient to absorb the impact. Install a deceleration circuit to reduce the speed before cushioning, or install an external shock absorber to relieve the impact. In this case, the rigidity of the machinery should also be examined.

5. **Take into account a possible drop in circuit pressure due to a power outage.**

When the cylinder is used as a clamping mechanism, there is a danger of work pieces dropping out of it if there is a decrease in clamping force due to a drop in circuit pressure caused by a power outage. Therefore, safety equipment should be installed to prevent damage to machinery and human injury. Also apply drop prevention measures to suspension mechanisms and lifting devices.

6. **Take into account a possible loss of power supply.**

Measures should be taken to protect against bodily injury and equipment damage in the event that there is a loss of power to equipment controlled by air pressure, electricity, or hydraulics.

7. **Design circuitry to prevent sudden lurching of driven objects.**

When a cylinder is driven by an exhaust center type directional control valve or when starting up after residual pressure is exhausted from the circuit, the piston and its driven object will lurch at high speed if pressure is applied to one side of the cylinder because of the absence of air pressure inside the cylinder. Therefore, equipment should be selected and circuits designed to prevent sudden lurching because there is a danger of bodily injury and/or damage to equipment when this occurs.

8. **Take into account emergency stops.**

Design the system so that bodily injury and/or damage to machinery and equipment will not occur when machinery is stopped by a manual emergency stop or a safety device triggered by abnormal conditions such as a power outage.

9. **Consider the action of the system when operation is restarted after an emergency stop or an abnormal stop.**

Design machinery so that bodily injury or equipment damage will not occur upon restart of operation. In the case that the cylinder needs to be reset at the starting position, install safe manual control equipment.

Warning

10. **When transferring work pieces that may fall and be damaged due to vibration, install a device such as a guide that prevents this from happening.**

Caution

1. **Design the system to prevent the application of lateral loads to the cylinder.**

A malfunction may occur when a lateral load is applied to the cylinder.

2. **Design the system to prevent vibration from being applied to the cylinder.**

A malfunction may occur due to the vibration.

3. **Avoid using a guide with obvious variations in operating resistance.**

Operation may become unstable when using a guide that manifests variations in operating resistance, or when the external load changes.

4. **Avoid a system structure in which the mounting orientation changes.**

Operation may become unstable if the mounting orientation changes.

5. **Avoid operation where the temperature fluctuates greatly. Also, when using at low temperatures, make sure that frost does not form inside the cylinder and on the piston rod.**

Operation may become unstable.

6. **Do not operate at a high frequency.**

As a guide, operate at a rate of 30 c.p.m. or less.

7. **Adjust the speed in accordance with the operating environment.**

When the operating environment changes, the speed adjustment will be off unless it is reset to reflect operation in the new environment.

Selection

Warning

1. **Confirm the specifications.**

The products featured in this catalog are designed exclusively for use with industrial compressed air systems. If the products are used in conditions where pressure and/or temperature are outside the range of specifications, damage and/or malfunction may occur. Do not use in aberrant conditions. (Refer to specifications.)

Consult with SMC if fluid other than compressed air is required.

2. **Intermediate stops**

When intermediate stopping of a cylinder piston is performed with a 3-position closed center type directional control valve, it is difficult to achieve stopping positions as accurate and precise as with hydraulic pressure due to the compressibility of air.

Furthermore, since valves and cylinders are not guaranteed for zero air leakage, it may not be possible to hold a stopped position for an extended period of time. Contact SMC in case it is necessary to hold a stopped position for an extended period.



Microspeed Cylinders

Actuator Precautions 2

Be sure to read before handling.

Selection

⚠ Caution

1. Operate within the limits of the maximum usable stroke.

The piston rod will be damaged if operated beyond the maximum stroke. Refer to the cylinder model selection procedure for the maximum usable stroke.

2. Operate the piston in such a way that collision damage will not occur at the stroke end.

The operation range should prevent damage from occurring when a piston, having inertial force, stops by striking the cover at the stroke end.

3. Use a speed controller to adjust the cylinder drive speed, gradually increasing from a low speed to the desired speed setting.

4. Provide intermediate supports for long stroke cylinders.

Provide intermediate supports for cylinders with long strokes to prevent rod damage due to sagging of the rod, deflection of the tube, vibration, and external loads.

Pneumatic Circuits

⚠ Caution

1. Keep the piping that connects the speed controller and cylinder port as short as possible.

Speed adjustment may be unstable if the speed controller and cylinder are far apart from each other.

2. Use a low speed controller, which facilitates speed adjustment for low speed operation, or a dual speed controller (Series ASD), which prevents a cylinder from lurching.

(Using a low speed controller may restrict the maximum speed.) Refer to the recommended circuits on page 6.

3. Allow an extra margin when you set the supply pressure for the cylinder to ensure sufficient pressure always.

If the operating pressure is too low, low speed operation may not be stable depending on the condition of the load. Furthermore, the maximum speed may be restricted depending on the pneumatic circuit or operating pressure.

Mounting

⚠ Caution

1. Do not apply a lateral load to the piston rod.

A malfunction may occur when a lateral load is applied to the piston rod.

2. Make sure to align the rod axis with the load and direction of movement when connecting.

When not properly aligned, twisting of the rod and tubing may occur, and damage may be caused due to wear on areas such as the tube's inner working surface, bushings, rod surface and seals.

3. When an external guide is used, connect the rod end and the load in such a way that there is no interference at any point within the stroke.

4. Do not scratch or gouge the sliding parts of the cylinder tube or piston rod by striking or grasping them with other objects.

Cylinder bores are manufactured to precise tolerances, so that even a slight deformation may cause faulty operation.

Also, scratches or gouges in the piston rod may lead to damaged seals and cause air leakage.

5. Prevent the sticking (through friction) of rotating parts.

Prevent the sticking of rotating parts (pins, etc.) by applying grease.

6. Do not use until you can verify that equipment can operate properly.

Following mounting, repairs, or conversions, verify that all equipment is mounted correctly by conducting suitable function and leakage tests after piping and power connections have been made.

5. Instruction manual

The product should be mounted and operated only after thoroughly reading the manual and understanding its contents.

Keep the instruction manual readily available for easy reference as needed.

Piping

⚠ Caution

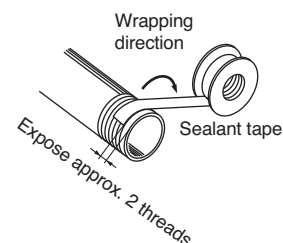
1. Preparation before piping

Before piping is connected, it should be thoroughly flushed out with air or water to remove chips, cutting oil and other debris.

2. Wrapping of sealant tape

When screwing together pipes and fittings, be certain that chips from the pipe threads and sealing material do not get inside the piping.

Also, when sealant tape is used, leave 1.5 to 2 thread ridges exposed at the end of the threads.





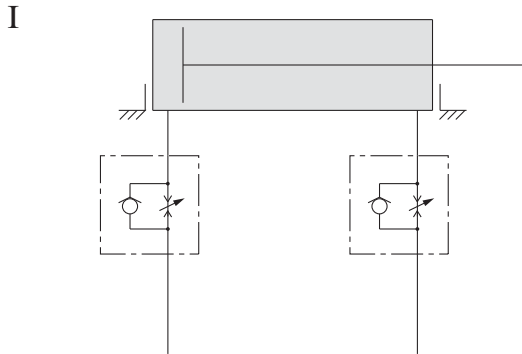
Microspeed Cylinders Actuator Precautions 3

Be sure to read before handling.

Recommended Pneumatic Circuits

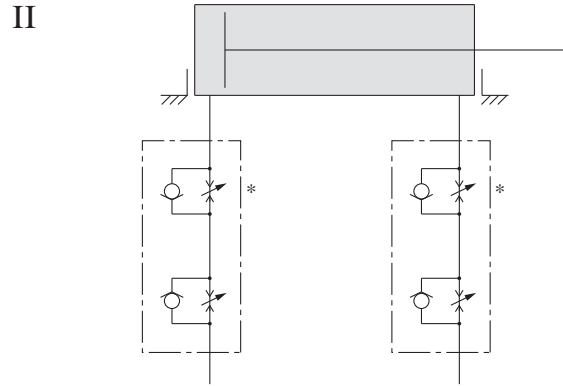
Warning

Horizontal operation



Meter-in speed controllers

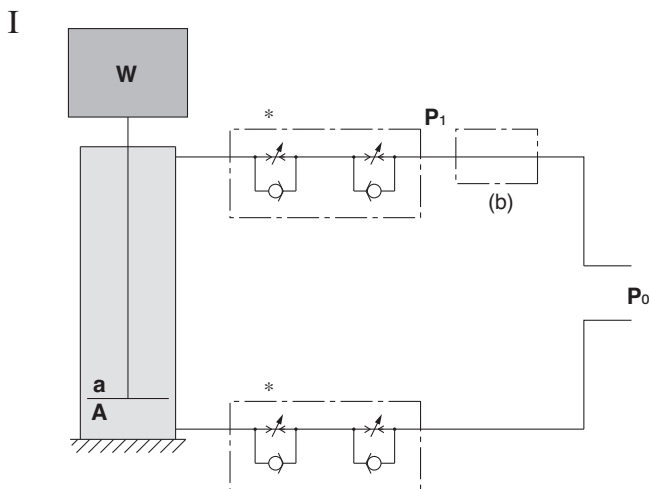
Meter-in speed controllers can reduce lurching while controlling the speed. The two knobs facilitate adjustment.



Dual speed controllers

The meter-out function controls the speed. When the meter-in controller is used in conjunction with the meter-out controller, lurching is reduced. Compared to a circuit with only meter-in control, more stable low-speed operation is possible.

Vertical operation

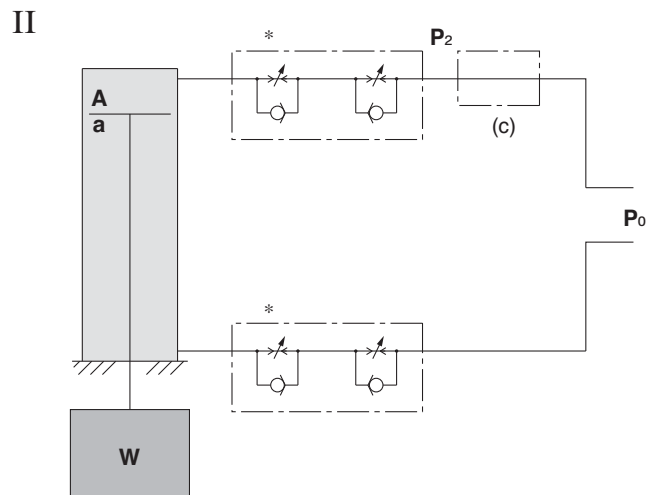


- (1) The speed is controlled with meter-out control. When the meter-in controller is used in conjunction with the meter-out controller, lurching is reduced.*
- (2) Depending on the size of the load, installing a regulator with check valve at position (b) can decrease lurching during descent, and operation delay during ascent.

As a guide:

$$\text{When } W + P_0 a > P_0 A$$

adjust P_1 to satisfy the equation, $W + P_1 a = P_0 A$.



- (1) The speed is controlled with meter-out control. When the meter-in controller is used in conjunction with the meter-out controller, lurching is reduced.*
- (2) Installing a regulator with check valve at position (c) can decrease lurching during descent and actuation delay during ascent.

As a guide:

$$\text{Adjust } P_2 \text{ to satisfy the equation, } W + P_2 a = P_0 A.$$

W: Load (N) P_0 : Operating pressure (MPa) a: Rod side piston area (mm²) A: Head side piston area (mm²)

Warning

Since C□J2X and C□UX10 are subject to internal leakage due to their construction, the speed may not be fully controlled with the meter-out controller (*) during low speed operation.



Microspeed Cylinders

Actuator Precautions 4

Be sure to read before handling.

Cushion

⚠ Caution

1. Readjust cushion using the cushion needle.

Cushions are adjusted at the time of shipment. However, the cushion needle on the cover should be readjusted when the product is put into service, based on factors such as the size of the load and the operating speed. When the cushion needle is turned clockwise, the restriction port passage becomes smaller and the cushion's effectiveness is increased. Tighten the lock nut securely after adjustment is performed.

2. Do not operate with the cushion needle fully closed.

This will cause damage to the seals.

Lubrication

⚠ Caution

1. Operate without lubrication from a pneumatic system lubricator.

Malfunction may occur when lubricated in this fashion.

2. Only use the grease recommended by SMC.

The microspeed cylinder and the microspeed cylinder with clean room specifications use different types of grease. The use of grease other than the specified type can cause malfunctions and particulate generation.

Air Supply

⚠ Warning

1. Use clean air.

Do not use compressed air that is tainted with chemicals, synthetic oils containing organic solvents, salt or corrosive gases, as it can cause damage or malfunctions.

⚠ Caution

1. Install air filters.

Install air filters at the upstream side of valves. The filtration degree should be 5μm or finer.

2. Install an after-cooler, air dryer, or water separator (Drain Catch).

Air that includes excessive condensate may cause malfunction of valves and other pneumatic equipment. Install an air dryer, after-cooler or water separator to prevent this from happening.

3. Use within the specified range of fluid and ambient temperature.

Take measures to prevent freezing when below 5°C, since moisture in circuits can freeze, possibly causing damage to seals and leading to a malfunction.

Refer to the "Air Preparation System" on page 8 for further details on compressed air quality.

4. Take measures to prevent pressure fluctuation.

Malfunctions may occur with the fluctuation of pressure.

Operating Environment

⚠ Warning

1. Do not use in environments where there is a danger of corrosion.
2. Do not use in dusty environments or where exposure to water and oil spray or splash are expected.

Maintenance

⚠ Warning

1. Perform maintenance inspection according to the procedures indicated in the instruction manual.

Improper handling and maintenance may cause malfunctioning and damage of machinery or equipment to occur.

2. Removal of equipment and supply/exhaust of compressed air.

Before any equipment is removed or dismantled, first ensure that the appropriate measures are in place to prevent the fall or erratic movement of driven objects and equipment. Then cut off the supply pressure and electric power and exhaust all compressed air from the system.

When machinery is restarted, proceed with caution after confirming any necessary measures to prevent cylinder lurching.

⚠ Caution

1. Filter drainage

Drain out condensate from air filters regularly.



Microspeed Cylinders

Clean Room Series Precautions 1

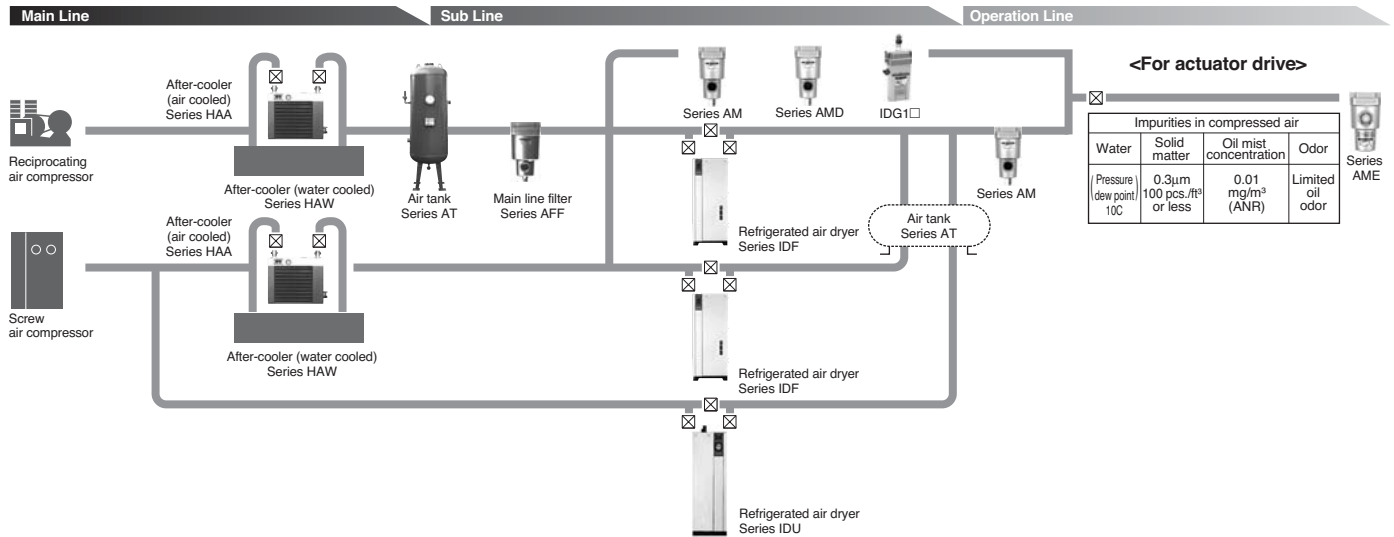
Be sure to read before handling.

Air Supply

Caution

1. System configuration

To properly design and configure a clean room system, refer to the "Air Preparation System" diagram below for the components and quality of compressed air to be used.

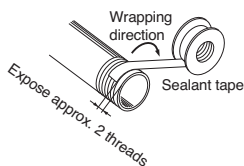


2. Piping

1. Apply a downward incline of 1cm for every 1m in the direction of air flow for the main piping.
2. When branching from the main piping, provide the outlet for compressed air on the upper part of the piping using a tee to prevent the outflow of condensate that accumulates inside the piping.
3. Set up a drainage outlet at every low point, corner, and dead end to prevent the accumulation of condensate.
4. For the future extension of piping, install a tee at the end of the piping and close it with a plug.
5. Preparation before piping
Before piping is connected, it should be thoroughly flushed out with air or water to remove chips, cutting oil and other debris.
6. Wrapping of sealant tape

When screwing together pipes and fittings, be certain that chips from the pipe threads and sealing material do not get inside the valve.

Also, when sealant tape is used, leave 1.5 to 2 thread ridges exposed at the end of the threads.



3. Maintenance

When the heatless air dryer series ID is not used for an extended time, the absorbent may become damp. In such a case, close the valve on the downstream side of the dryer, performing regeneration to dry the absorbent before operating.

4. Design precautions

To prevent the unpredictable situations described on the right, design the system with consideration for safety.

Warning

1. Design the system to prevent compressed air at high temperatures from flowing downstream.

When the cooling water of a water-cooled after-cooler or the fan motor of an air-cooled after-cooler stops, high temperature compressed air flows downstream and can cause damage or malfunction of downstream equipment such as the mainline filter (AFF), mist separator (AM), micro mist separator (AMD), or refrigerated air dryer (IDF).

2. Design the system considering a possible interruption of the compressed air supply.

Freezing of a refrigerated air dryer or malfunction of a switching valve (heatless dryer) may cause the interruption of compressed air flow.

Caution

1. Design a system in consideration of cooling water leakage and condensation.

With a water-cooled after-cooler, water leakage may occur due to freezing, or a refrigerated air dryer and its downstream piping may drip water due to condensation forming from over refrigeration depending on the operating conditions.

2. Design the system to prevent back pressure and back flow.

The generation of back pressure or back flow can cause damage and malfunctioning of equipment. Apply safety measures that includes handling safety.



Microspeed Cylinders

Clean Room Series Precautions 2

Be sure to read before handling.

Piping in a Clean Room

⚠ Caution

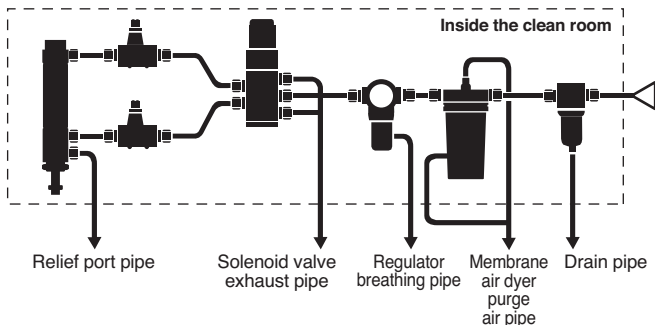
1. Do not use common piping for the relief port of the air cylinder and the breathing piping of the regulator with the exhaust piping of the solenoid valves.

Common piping can cause malfunctioning of the air cylinder and regulator pressure fluctuation.

2. Set up the exhaust piping of the solenoid valves to release exhaust outside the clean room.

3. Air filter drain piping

Set up the piping for drainage from the drain guide section of the air filter to the outside of the clean room.



4. Make sure there is no looseness between piping connection threads and tubing connections.

When piping shakes due to equipment vibration, retighten connections to prevent dust from being generated.

5. Use a polyurethane tube without plasticizer for the tubing.

Handling

⚠ Caution

1. Open the inner wrapping of any double-packaged clean room series products in the clean room or in a clean environment.
2. When bringing standard pneumatic equipment into a clean room, be sure to remove dirt by blowing with ultraclean air, and then wiping the cylinder tube surface and the exterior surfaces of solenoid valves and auxiliary devices with alcohol.
3. Before replacing parts or disassembling in the clean room, be sure to release the compressed air inside the piping to the outside of the clean room.
4. Do not use rotating type mounting brackets such as clevis and trunnion types because the amount of particle generation due to the sliding/rotation of metal parts in their bearings is unacceptably large.

Lubrication of Actuators

⚠ Warning

Be sure to wash your hands after handling fluorine grease.

The grease itself is not dangerous, but toxic gas may be released at high temperatures of 260°C or more.

⚠ Caution

1. Do not use grease other than that specified by SMC. Using a grease other than the specified type can cause malfunctions and particulate generation.

2. Do not lubricate using a pneumatic system lubricator, as the actuators featured here are non-lube type.

Since clean room series actuators are already lubricated with fluorine type grease at the factory, lubrication with turbine oil will result in failure to meet product specifications.

3. The microspeed cylinder and the microspeed cylinder with clean room specifications use different types of grease. For the microspeed cylinder with clean room specifications, use GR-X-005 (5g pack).

4. Refer to "Microspeed Cylinder Actuator Precautions" on pages 4 to 7 for additional information.

Piston Speed

⚠ Caution

To maintain the grade of particulate generation and low speed operation, limit the air cylinder's maximum drive speed to no more than 200mm/s.

Suction Flow Created by Vacuum Ejection

⚠ Caution

Optimum suction flow varies depending on the series and size. Use the following table as a guide.

(Vacuum pressure is -13kPa to -27kPa near the relief port.)

| Series | Model | Bore sizes | Optimum suction flow |
|------------------|---------------|------------|----------------------|
| Compact cylinder | Series 11-CQS | Ø12 to Ø25 | 5ℓ/min (ANR) |
| | Series 11-CQ2 | Ø32, Ø40 | 5ℓ/min (ANR) |



Microspeed Cylinders

Auto Switch Precautions 1

Be sure to read before handling.

Design and Selection

Warning

1. Confirm the specifications.

Read the specifications carefully and use this product appropriately. The product may be damaged or malfunction if it is used outside the range of specifications for current load, voltage, temperature, or impact.

2. Take precautions when cylinders are used close together.

When two or more cylinders with auto switches are lined up in close proximity to each other, magnetic field interference may cause the switches to malfunction. Maintain a minimum cylinder separation of 40mm. (When the allowable separation is indicated for each cylinder series, use the specified value.)

3. Monitor the length of time that a switch is on at an intermediate stroke position.

When an auto switch is placed at an intermediate position of the stroke and a load is driven at the time the piston passes, the auto switch will operate, but if the speed is too great the operating time will be shortened and the load may not operate properly. The maximum detectable piston speed is:

$$V \text{ (mm/s)} = \frac{\text{Auto switch operating range (mm)}}{\text{Load operating time (ms)}} \times 1000$$

In case of a high piston speed, it is possible to extend the operating time of the load by using an auto switch (D-F7NT, D-G5NT) with a built-in off-delay timer (approximately 200ms).

4. Keep wiring as short as possible.

<Reed switches>

As the length of the wiring to a load gets longer, the rush current at switching on becomes greater, and this may shorten the product's life. (The switch will stay on all the time.)

- 1) For an auto switch without a contact protection circuit, use a contact protection box when the wire length is 5m or longer.
- 2) Even when an auto switch has a built-in contact protection circuit, if the lead wire length is 30m or more, the rush current cannot be adequately absorbed and the life of the switch may be shortened. Contact SMC, as it may be necessary in this case to connect a contact protection box to extend the switch life.

<Solid state switches>

- 3) Although wire length should not affect switch function, use a wire that is 100m or shorter.

5. Monitor the internal voltage drop of the switch.

<Reed switches>

- 1) Switches with an indicator light (except D-A76H, D-A96, D-A96V, and D-C76)
 - If auto switches are connected in series as shown below, take note that there will be a large voltage drop because of internal resistance in the light emitting diodes. (Refer to internal voltage drop in the auto switch specifications.)
[The voltage drop will be "n" times larger when "n" auto switches are connected.]
- Even though an auto switch operates normally, the load may not move.



Warning

- Similarly, when operating below a specified voltage, although an auto switch may operate normally, the load may not operate. Therefore, the formula below should be satisfied after confirming the minimum operating voltage of the load.

$$\text{Supply voltage} - \text{Internal voltage drop of switch} > \text{Minimum operating voltage of load}$$

- 2) If the internal resistance of a light emitting diode causes a problem, select a switch without an indicator light (D-A80, D-A80H, D-A90, D-A90V, D-C80, or D-90).

<Solid state switches>

- 3) Generally, the internal voltage drop will be greater with a 2-wire solid state auto switch than with a reed switch. Take the same precautions as in 1).
Also, note that a 12VDC relay is not applicable.

6. Monitor leakage current.

<Solid state switches>

With a 2-wire solid state auto switch, current (leakage current) flows to the load to operate the internal circuit even when in the off state.

$$\text{Current to operate load (off condition)} > \text{Leakage current}$$

If the condition given in the above formula is not met, it will not reset correctly (stays on). Use a 3-wire switch if this specification cannot be satisfied.

Moreover, leakage current flow to the load will be "n" times larger when "n" auto switches are connected in parallel.

7. Do not use a load that generates surge voltage.

<Reed switches>

If driving a load such as a relay that generates surge voltage, use a switch with a built-in contact protection circuit or a contact protection box.

<Solid state switches>

Although a zener diode for surge protection is connected at the output side of a solid state auto switch, damage may still occur if the surge is applied repeatedly. When a load—such as a relay or solenoid—that generates surge is directly driven, use a type of switch with a built-in surge absorbing element.

8. Cautions for use in an interlock circuit

When an auto switch is used for an interlock signal requiring high reliability, devise a double interlock system to avoid trouble by providing a mechanical protection function, or by also using another switch (sensor) together with the auto switch.

Also perform periodic maintenance inspections and confirm proper operation.

9. Ensure sufficient clearance for maintenance activities.

When designing an application, be sure to allow sufficient clearance for maintenance inspections.



Microspeed Cylinders

Auto Switch Precautions 2

Be sure to read before handling.

Mounting and Adjustment

Warning

1. Do not drop or bump.

Do not drop, bump, or apply excessive impacts (300m/s² or more for reed switches and 1000m/s² or more for solid state switches) while handling. Although the external body of the switch (switch case) may not be damaged, the inside of the switch could be damaged and cause a malfunction.

2. Do not carry a cylinder by the auto switch lead wires.

Never carry a cylinder by its lead wires, as this may not only result in broken lead wires, but may also cause the internal elements of the switch to be damaged by the stress.

3. Mount switches using the proper tightening torque.

When a switch is tightened beyond the range of tightening torque, the mounting screws, mounting bracket, or switch may be damaged. On the other hand, tightening below the range of tightening torque may cause the switch to slip out of position. (Refer to the switch mounting procedure for each series regarding switch mounting, movement and tightening torque.)

4. Mount a switch at the center of the operating range.

Adjust the mounting position of an auto switch so that the piston stops at the center of the operating range (the range in which a switch is on). (The mounting positions shown in the catalog indicate the optimum positions at stroke end.) If mounted at the end of the operating range (around the borderline of on and off), operation may be unstable.

Wiring

Warning

1. Avoid repeatedly bending or stretching lead wires.

Broken lead wires will result from installation or applications that repeatedly apply bending stress or stretching force to the lead wires.

2. Be sure to connect the load before power is applied.

<2-wire type>

If the power is turned ON when an auto switch is not connected to a load, the switch will be instantly damaged because of excess current.

3. Confirm proper insulation of wiring.

Be certain that there is no faulty wiring insulation (such as contact with other circuits, ground fault, or improper insulation between terminals). Damage may occur due to excess current flow into a switch.

4. Do not wire in conjunction with power lines or high voltage lines.

Wire separately from power lines or high voltage lines, avoiding parallel wiring or wiring in the same conduit with these lines. Control circuits containing auto switches may malfunction due to noise from these other lines.

Wiring

Warning

5. Do not allow the short circuiting of loads.

<Reed switches>

If the power is turned on with a load in a short circuit condition, the switch will be instantly damaged because of excess current flow into the switch.

<Solid state switches>

None of the PNP output type switches have built-in short circuit protection circuits. If loads are short circuited, the switches will be instantly damaged, as in the case of reed switches.

Take special care to avoid reverse wiring with the brown power supply line and the black output line on 3-wire type switches.

6. Avoid incorrect wiring.

<Reed switches>

A 24VDC switch with indicator light has polarity. The brown lead wire or terminal No.1 is (+), and the blue lead wire or terminal No. 2 is (-).

For D-97, the side without incication is (+) and the blue wire is (-).

1) If connections are reversed, the switch will still operate, but the light emitting diode will not light up.

Also note that a current greater than specified will damage a light emitting diode and make it inoperable.

Applicable types: D-A73, D-A73H, D-A73C, D-C73, D-C73C, D-97, D-93A, D-A93, D-A93V, D-A33A, D-A34A, D-A44A, D-B53, D-B54

2) Note however, in the case of 2-color display type auto switches (D-A79W, D-B59W), if the wiring is reversed, the switch will be in a normally ON condition.

<Solid state switches>

1) Even if connections are reversed on a 2-wire type switch, the switch will not be damaged because it is protected by a protection circuit, but it will remain in a normally on state. But reverse wiring in a short circuited load condition should be avoided to protect the switch from being damaged.

2) Even if (+) and (-) power supply line connections are reversed on a 3-wire type switch, the switch will be protected by a protection circuit. However, if the (+) power supply line is connected to the blue wire and the (-) power supply line is connected to the black wire, the switch will be damaged.

* Lead wire colour changes

Lead wire colours of SMC switches have been changed in order to meet NECA Standard 0402 for production beginning September, 1996 and thereafter. Please refer to the tables provided. Special care should be taken regarding wire polarity during the time that the old colours still coexist with the new colors.

2-wire

| | Old | New |
|------------|-------|-------|
| Output (+) | Red | Brown |
| Output (-) | Black | Blue |

3-wire

| | Old | New |
|------------------|-------|-------|
| Power supply (+) | Red | Brown |
| Power supply GND | Black | Blue |
| Output | White | Black |

Solid state with diagnostic output

| | Old | New |
|-------------------|--------|--------|
| Power supply (+) | Red | Brown |
| Power supply GND | Black | Blue |
| Output | White | Black |
| Diagnostic output | Yellow | Orange |

Solid state with latch type diagnostic output

| | Old | New |
|------------------------------|--------|--------|
| Power supply (+) | Red | Brown |
| Power supply GND | Black | Blue |
| Output | White | Black |
| Latch type diagnostic output | Yellow | Orange |



Microspeed Cylinders

Auto Switch Precautions 3

Be sure to read before handling.

Operating Environment

Warning

1. Never use in the presence of explosive gases.

The construction of auto switches is not intended to prevent an explosion. Never use in the presence of an explosive gas since this may cause a serious explosion.

2. Do not use in an area where a magnetic field is generated.

Auto switches will malfunction or magnets inside cylinders will become demagnetized. (Consult with SMC regarding the availability of magnetic field resistant auto switches.)

3. Do not use in an environment where the auto switch will be continually exposed to water.

4. Do not use in an environment laden with oil or chemicals.

Consult with SMC if auto switches will be used in an environment laden with coolants, cleaning solvents, various oils, or chemicals. If auto switches are used under these conditions for even a short time, they may be adversely affected by a deterioration of the insulation, a malfunction due to swelling of the potting resin, or hardening of the lead wires.

5. Do not use in an environment with extreme or unusual temperature cycles.

Consult with SMC if switches are to be used where there are temperature cycles other than normal temperature changes, as they may be adversely affected internally.

6. Do not use in an environment where excessive impact or shock are common.

<Reed switches>

When excessive impact (300m/s² or more) is applied to a reed switch during operation, the contact point may malfunction and generate or cut off a signal momentarily (1ms or less). Consult with SMC regarding the need to use a solid state switch depending on the environment.

7. Do not use in an area where surges are generated.

<Solid state switches>

When there are units (such as solenoid type lifters, high frequency induction furnaces, motors) that generate a large amount of surge in the area around cylinders with solid state auto switches, their proximity or presence may cause deterioration or damage to the internal circuit elements of the switches. Avoid sources of surge generation and crossed lines.

8. Avoid accumulation of iron waste or close contact with magnetic substances.

When a large accumulated amount of ferrous waste such as machining chips or welding spatter, or a magnetic substance (something attracted by a magnet) is brought into close proximity of a cylinder with auto switches, this may cause the auto switches to malfunction due to a loss of the magnetic force inside the cylinder.

Maintenance

Warning

1. Perform the following maintenance inspection and services periodically in order to prevent possible danger due to unexpected auto switch malfunctions.

- 1) Securely tighten switch mounting screws.

If screws become loose or the mounting position is dislocated, retighten them after readjusting the mounting position.

- 2) Confirm that there is no damage to lead wires.

To prevent faulty insulation, replace switches or repair lead wires if damage is discovered.

- 3) Confirm that the green light on the 2-color display type switch lights up.

Confirm that the green LED is on when stopped at the set position. If the red LED is on, the mounting position is not appropriate. Readjust the mounting position until the green LED lights up.

Other

Warning

1. Consult with SMC concerning water resistance, elasticity of lead wires and usage at welding sites.