Photovoltaic Cell Manufacturing Process Equipment

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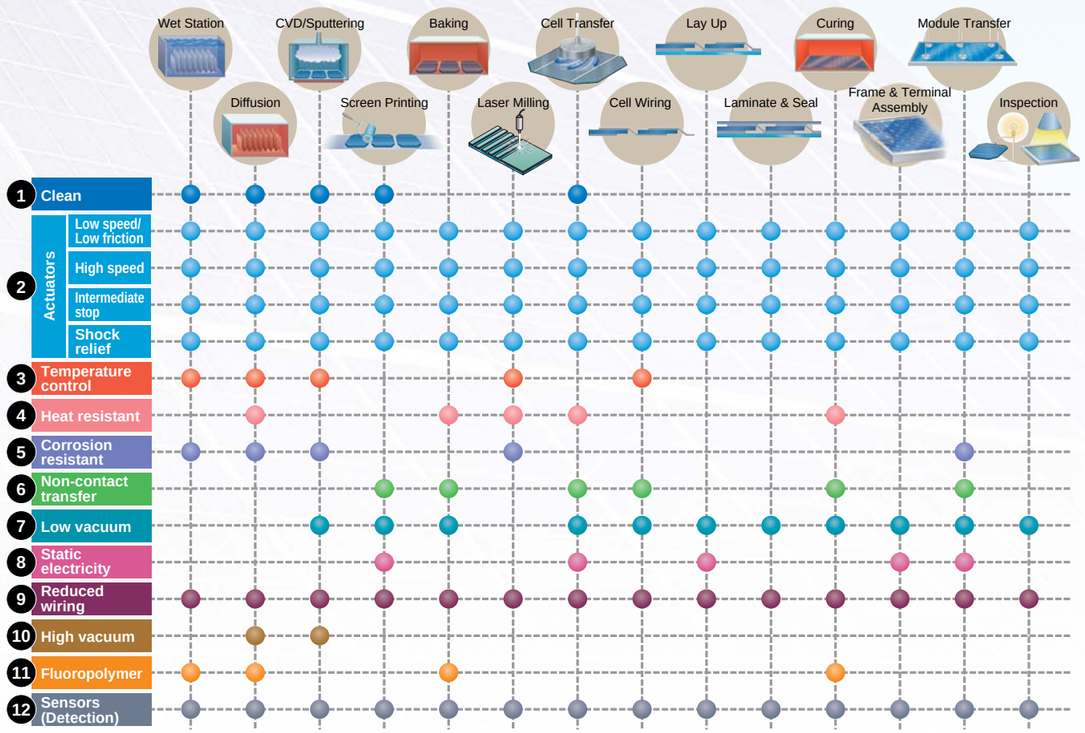

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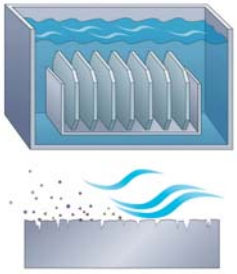
P-E07-11A

Crystalline Si
Manufacturing Process

Cell Process

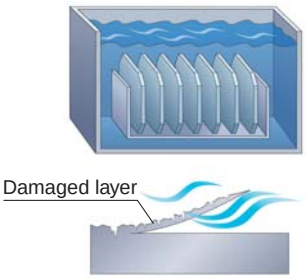
Wet Station

1 Washing



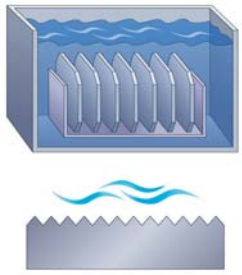
Removes contaminants and stains from the surface of the Si substrate.

2 Bulk Bonding



Removes scratches (or damaged layers) from the surface of the Si substrate to form a smooth surface.

3 Texture Formation

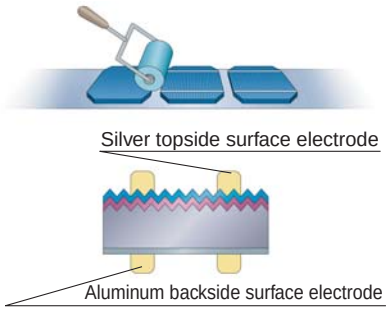


Forms a micro rough surface to increase the light-receptive area, compared to flat surfaces.

1 Clean ▸P.2 | 2 Actuators ▸P.4 | 3 Temperature control ▸P.5
5 Corrosion resistant ▸P.7 | 9 Reduced wiring ▸P.10 | 11 Fluoropolymer ▸P.12
12 Sensors (Detection) ▸P.13

Screen Printing

7 Electrode Formation

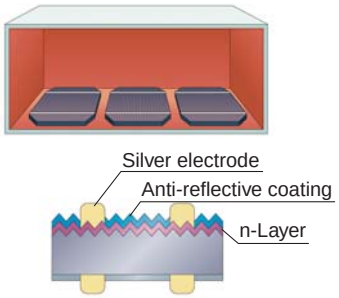


Screen printing forms the electrodes on the surface of the top and backside.

1 Clean ▸P.2 | 2 Actuators ▸P.4
6 Non-contact transfer ▸P.9 | 7 Low vacuum ▸P.9
8 Static electricity ▸P.10 | 9 Reduced wiring ▸P.10
12 Sensors (Detection) ▸P.13

Baking

8 Hardening

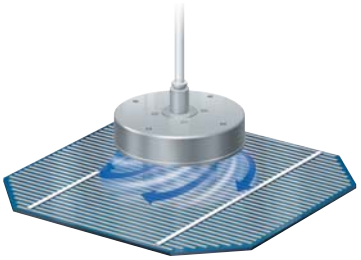


The silver electrode penetrates the anti-reflective coating and connects to the n-Layer.

2 Actuators ▸P.4 | 4 Heat resistant ▸P.6
6 Non-contact transfer ▸P.9 | 7 Low vacuum ▸P.9
9 Reduced wiring ▸P.10 | 11 Fluoropolymer ▸P.12
12 Sensors (Detection) ▸P.13

Cell Transfer

9 Cell Transfer



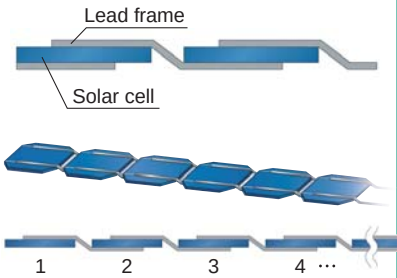
Cyclone pads vacuum-lift and transfer the cells.

1 Clean ▸P.2 | 2 Actuators ▸P.4
4 Heat resistant ▸P.6 | 6 Non-contact transfer ▸P.9
7 Low vacuum ▸P.9 | 8 Static electricity ▸P.10
9 Reduced wiring ▸P.10 | 12 Sensors (Detection) ▸P.13

Module Process

Cell Wiring (String)

11 Electrical Wiring

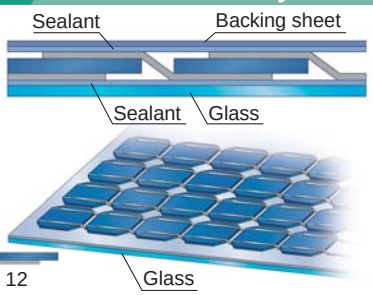


Aligns the cells and joins them in series with a lead frame. (String)

2 Actuators ▸P.4 | 3 Temperature control ▸P.5
6 Non-contact transfer ▸P.9 | 7 Low vacuum ▸P.9
9 Reduced wiring ▸P.10 | 12 Sensors (Detection) ▸P.13

Lay Up

12 Module Assembly

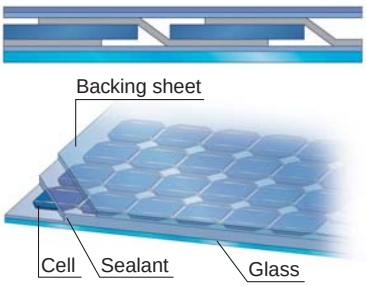


Places sealant on a glass panel and aligns the stringed cells in parallel on top which are covered with sealent and a backing sheet.

2 Actuators ▸P.4 | 7 Low vacuum ▸P.9
8 Static electricity ▸P.10 | 9 Reduced wiring ▸P.10
12 Sensors (Detection) ▸P.13

Laminate & Seal

13

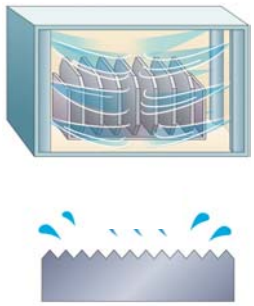


Applies heat and pressure under vacuum to create the semi-finished product.

2 Actuators ▸P.4 | 7 Low vacuum ▸P.9
9 Reduced wiring ▸P.10 | 12 Sensors (Detection) ▸P.13

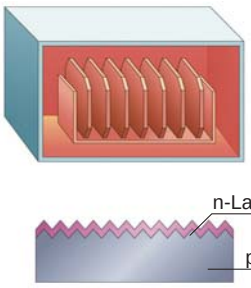
Diffusion

4 Drying



Blow dries the cells.

5 p-n Layer Formation

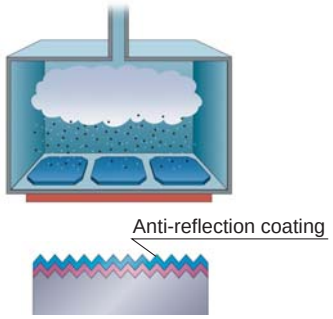


Forms the n-Layer.

1 Clean ▶P.2
2 Actuators ▶P.4
3 Temperature control ▶P.5
4 Heat resistant ▶P.6
5 Corrosion resistant ▶P.7
9 Reduced wiring ▶P.10
10 High vacuum ▶P.11
11 Fluoropolymer ▶P.12
12 Sensors (Detection) ▶P.13

CVD/Sputtering

6 Anti-Reflection Coating

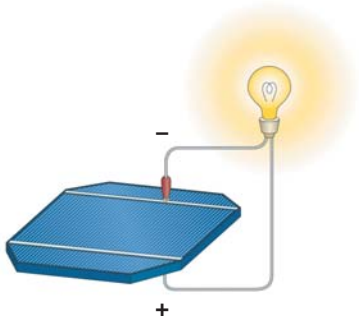


Forms the anti-reflection coating on the surface of the silicon.

1 Clean ▶P.2
2 Actuators ▶P.4
3 Temperature control ▶P.5
5 Corrosion resistant ▶P.7
7 Low vacuum ▶P.9
9 Reduced wiring ▶P.10
10 High vacuum ▶P.11
12 Sensors (Detection) ▶P.13

Inspection

10 Performance Test



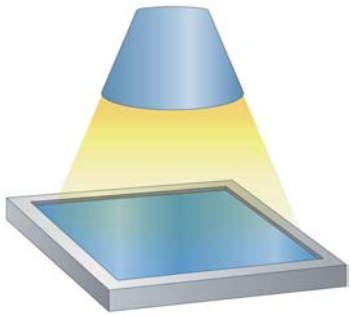
Tests conductivity performance, etc.

2 Actuators ▶P.4
7 Low vacuum ▶P.9
9 Reduced wiring ▶P.10
12 Sensors (Detection) ▶P.13

Inspection

Inspection

17 Performance Test

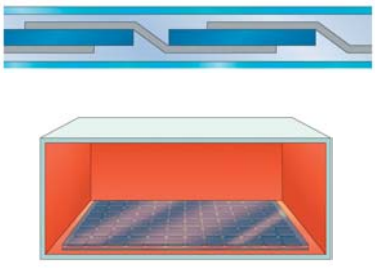


Tests output performance under artficial sunlight and checks pressure resistance and insulation.

2 Actuators ▶P.4
7 Low vacuum ▶P.9
9 Reduced wiring ▶P.10
12 Sensors (Detection) ▶P.13

Curing

14

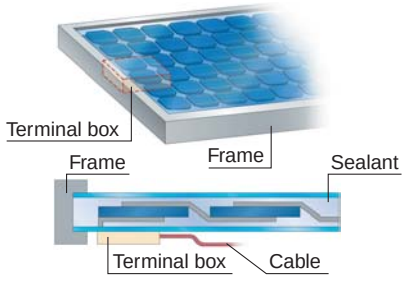


Curing hardens the sealant.

2 Actuators ▶P.4
4 Heat resistant ▶P.6
6 Non-contact transfer ▶P.9
7 Low vacuum ▶P.9
9 Reduced wiring ▶P.10
11 Fluoropolymer ▶P.12
12 Sensors (Detection) ▶P.13

Frame & Terminal Assembly

15

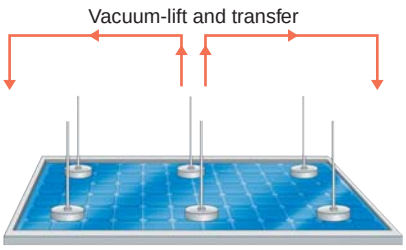


Fits an aluminum frame around the module edged by a cutting machine and installs a terminal box.

2 Actuators ▶P.4
7 Low vacuum ▶P.9
8 Static electricity ▶P.10
9 Reduced wiring ▶P.10
12 Sensors (Detection) ▶P.13

Module Transfer

16 Module Transfer



Transfers the modules.

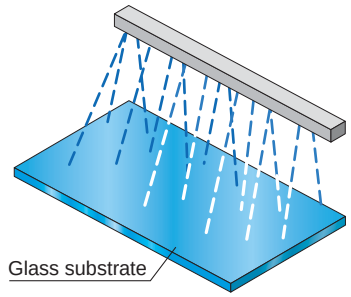
2 Actuators ▶P.4
5 Corrosion resistant ▶P.7
6 Non-contact transfer ▶P.9
7 Low vacuum ▶P.9
8 Static electricity ▶P.10
9 Reduced wiring ▶P.10
12 Sensors (Detection) ▶P.13

Thin Film Si
Manufacturing Process

Cell Process

Washing

1

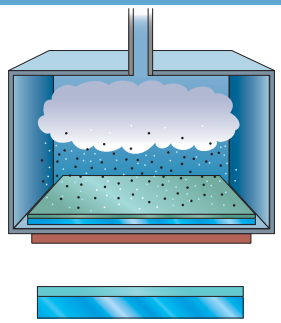


Washes a glass substrate with pure water.

1 Clean P.2 | 2 Actuators P.4
3 Temperature control P.5 | 5 Corrosion resistant P.7
9 Reduced wiring P.10 | 11 Fluoropolymer P.12
12 Sensors (Detection) P.13

CVD/Sputtering

2

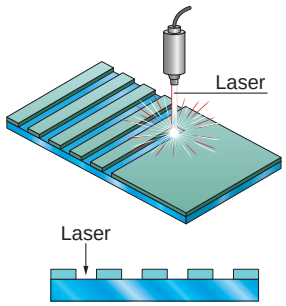


Forms a transparent electrode film on the glass substrate.

1 Clean P.2 | 2 Actuators P.4
3 Temperature control P.5 | 5 Corrosion resistant P.7
7 Low vacuum P.9 | 9 Reduced wiring P.10
10 High vacuum P.11 | 12 Sensors (Detection) P.13

Laser Milling

3 Transparent Electrode Patterning

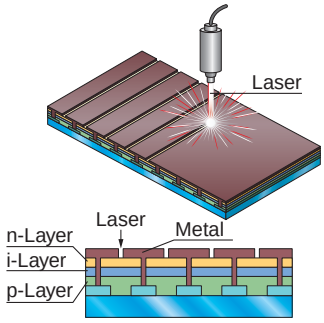


A laser is used to cut the transparent electrode film to form circuits.

2 Actuators P.4 | 3 Temperature control P.5
4 Heat resistant P.6 | 5 Corrosion resistant P.7
9 Reduced wiring P.10 | 12 Sensors (Detection) P.13

Laser Milling

7 Backside Electrode Patterning

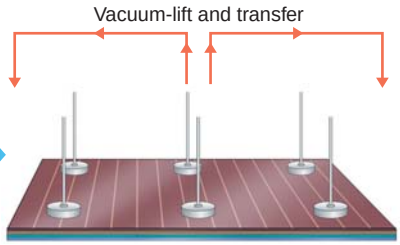


A laser is used to cut the metallic backside electrode to form circuits.

2 Actuators P.4 | 3 Temperature control P.5
4 Heat resistant P.6 | 5 Corrosion resistant P.7
9 Reduced wiring P.10 | 12 Sensors (Detection) P.13

Cell Transfer

8 Cell Transfer



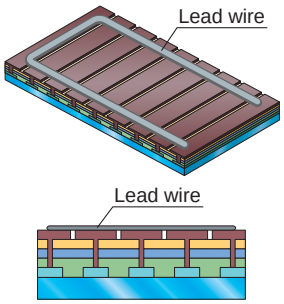
Cyclone pads vacuum-lift and transfer the cells.

1 Clean P.2 | 2 Actuators P.4
4 Heat resistant P.6 | 6 Non-contact transfer P.9
7 Low vacuum P.9 | 8 Static electricity P.10
9 Reduced wiring P.10 | 12 Sensors (Detection) P.13

Module Process

Lead Wire Assembly

9

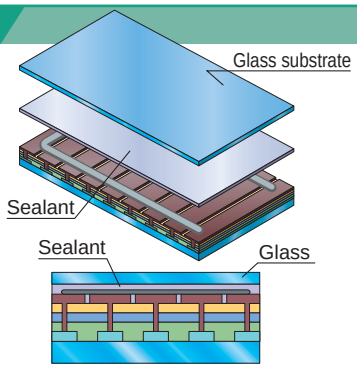


Assembles the lead wire.

2 Actuators P.4 | 3 Temperature control P.5
6 Non-contact transfer P.9 | 7 Low vacuum P.9
9 Reduced wiring P.10 | 12 Sensors (Detection) P.13

Laminate & Seal

10

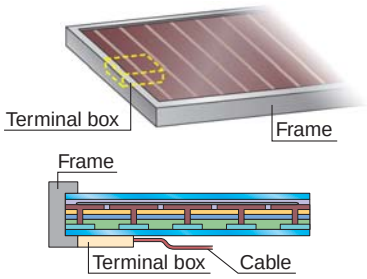


Places a glass substrate with sealant on top and hardens the sealant through curing.

2 Actuators P.4 | 7 Low vacuum P.9
9 Reduced wiring P.10 | 12 Sensors (Detection) P.13

Frame & Terminal Assembly

11

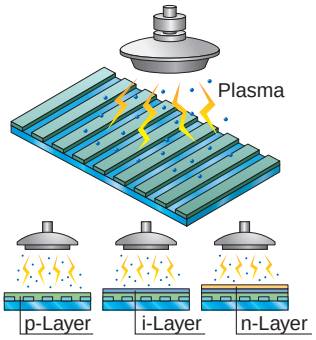


Fits an aluminum frame around the laminated and sealed module and installs a terminal box.

2 Actuators P.4 | 7 Low vacuum P.9
8 Static electricity P.10 | 9 Reduced wiring P.10
12 Sensors (Detection) P.13

CVD

4 p-i-n Layer Formation

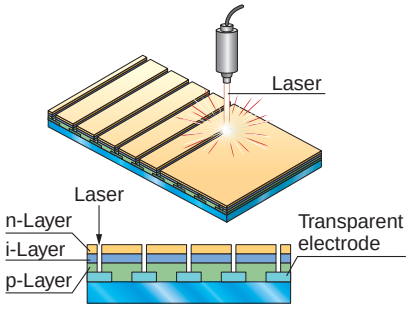


Plasma is applied to form each layer.

1 Clean ▶P.2
2 Actuators ▶P.4
3 Temperature control ▶P.5
5 Corrosion resistant ▶P.7
7 Low vacuum ▶P.9
9 Reduced wiring ▶P.10
10 High vacuum ▶P.11
12 Sensors (Detection) ▶P.13

Laser Milling

5 p-i-n Layer Patterning

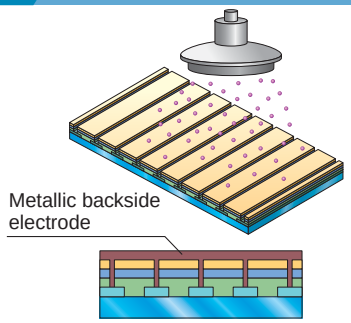


A laser is used to cut p-i-n layers to form circuits.

2 Actuators ▶P.4
3 Temperature control ▶P.5
4 Heat resistant ▶P.6
5 Corrosion resistant ▶P.7
9 Reduced wiring ▶P.10
12 Sensors (Detection) ▶P.13

Sputtering

6 Backside Electrode Formation

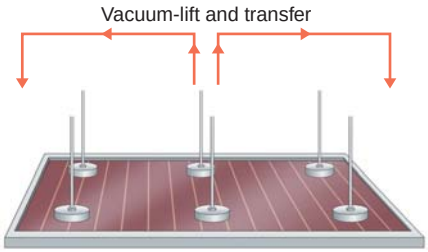


Forms the metallic backside electrode.

1 Clean ▶P.2
2 Actuators ▶P.4
3 Temperature control ▶P.5
5 Corrosion resistant ▶P.7
7 Low vacuum ▶P.9
9 Reduced wiring ▶P.10
10 High vacuum ▶P.11
12 Sensors (Detection) ▶P.13

Module Transfer

12 Module Transfer



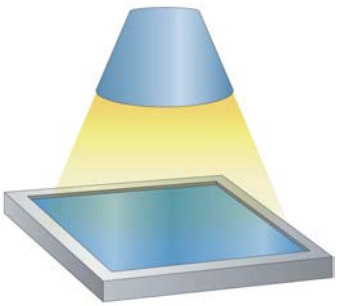
Transfers the modules.

2 Actuators ▶P.4
5 Corrosion resistant ▶P.7
6 Non-contact transfer ▶P.9
7 Low vacuum ▶P.9
8 Static electricity ▶P.10
9 Reduced wiring ▶P.10
12 Sensors (Detection) ▶P.13

Inspection

Inspection

13 Performance Test



Tests output performance under artificial sunlight and checks pressure resistance and insulation.

2 Actuators ▶P.4
7 Low vacuum ▶P.9
9 Reduced wiring ▶P.10
12 Sensors (Detection) ▶P.13

CONTENTS

1 Clean

■ Clean Room Products

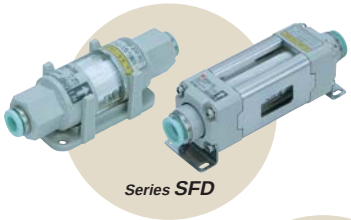
Products for use in clean rooms. Particle reducing products.
Assembled inside a clean room and shipped in double packaging.

Series CYP

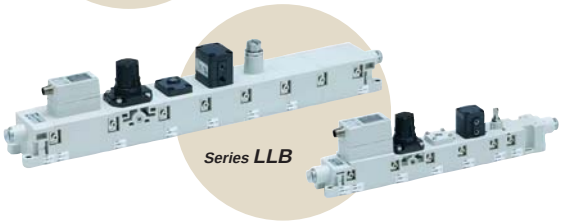
Series KPQ

■ Clean Blow Products

Products for clean air lines.
Assembled inside a clean room and double packaging.



Series SFD

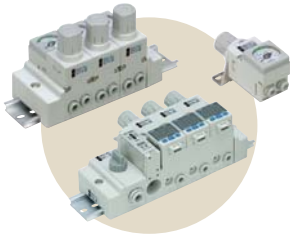


Series LLB

Series SRH

■ Grease-free Products

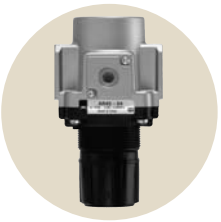
Assembled under normal conditions. Grease-free products.



Series ARM10/11

Pressure Control Equipment

- Grease-free Regulator (Made to Order) ····· *AR-X2400* P.40
- Compact Manifold Regulator ····· Series *ARM* P.41
- Grease-free Precision Regulator (Made to Order) ····· *IR-X1* P.41



Series AR

Fittings and Tubings

- Grease-free Miniature One-touch Fittings (Made to Order) ····· *KJ-X17, X39, X94* P.43
- Grease-free Miniature One-touch Fittings (Made to Order) ····· *KQ2-X17, X29, X39, X94* P.44
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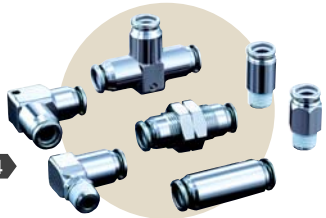
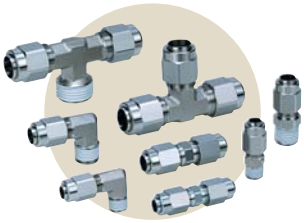
- Stainless Steel 316 One-touch Fittings ····· Series *KQG* P.45
- Stainless Steel 316 Insert Fittings ····· Series *KFG* P.45
- S Coupler/Stainless Steel Type ····· Series *KKA* P.46



Series KQG



Series KFG

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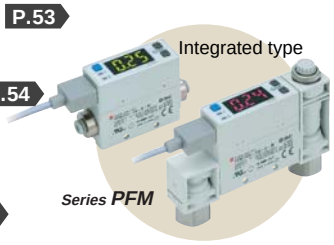
- Pressure Sensor for General Fluids ····· Series *PSE56□* P.54
- 2-Color Display Digital Flow Switch ····· Series *PFM* P.55
- Flow Sensor ····· Series *PFMV* P.55
- Digital Flow Switch for Water ····· Series *PF2A* P.55

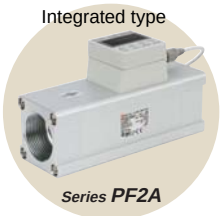
Series ISE80

Series PSE56□



Integrated type

Series PFM

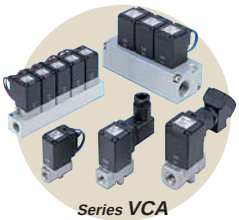


Integrated type

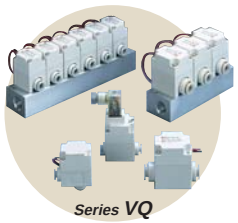
Series PF2A

Fluid Control Equipment

- Oil-free Direct Operated 2 Port Solenoid Valve for Air (Made to Order) ····· *VCA-X15* P.58
- Oil-free Pilot Operated/ 2 Port Solenoid Valve for Dry Air (Made to Order) ····· *VQ-X2* P.58
- Compact Direct Operated 2/3 Port Solenoid Valve for Chemicals ····· Series *LVM* P.58



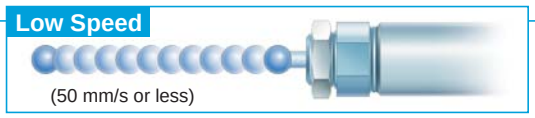
Series VCA



Series VQ

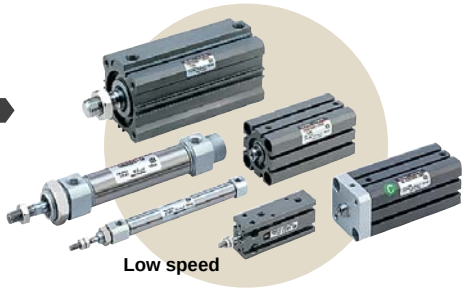
2 Actuators

■ Low Speed/Low Friction

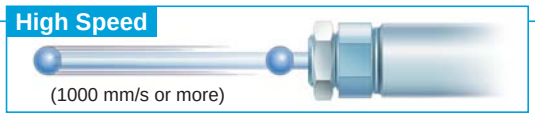


These products meet the demand for low-speed drive (50 mm/s or less), low pressure, low sliding resistance, reduced sticking, and lurch prevention when starting.

- Smooth Cylinder P.25
- Low Speed Cylinder P.25
- Low Friction Cylinder/ Metal Seal ..... *Series MQQ/MQM/MQP* P.26
- Low Speed Rotary Actuator ..... *Series CRQ2X/MSQX* P.26
- Low Speed Cylinder (Made to Order) ..... *-XB9/-XB13* P.26, 27
- e-Rodless Cylinder ..... *Series E-MY2* P.30
- Speed Controller for Low Speed Control ..... *Series AS-FM/AS-M* P.49



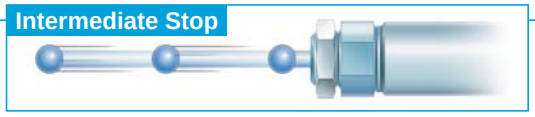
■ High Speed



High speed drive (1000 mm/s or greater) and improved takt time.

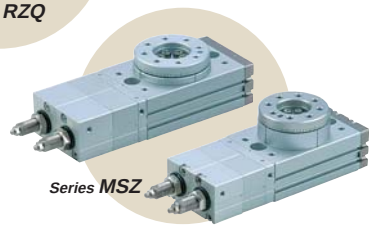
- High Speed Rodless Cylinder (Made to Order) *CY3-X160* P.24
- High Speed Dual Rod Cylinder (Made to Order) *CXS-XB19* P.24
- Low Friction Cylinder/ Metal Seal ..... *Series MQQ/MQM/MQP* P.26
- High Power Cylinder ..... *Series RHC* P.28
- e-Rodless Cylinder ..... *Series E-MY2* P.30

■ Intermediate Stop



Actuators with intermediate stop function.

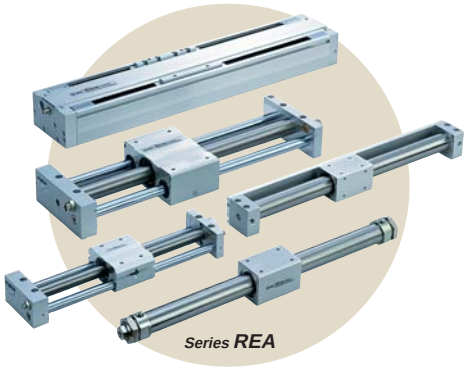
- 3 Position Cylinder ..... *Series RZQ* P.29
- 3 Position Rotary Table ..... *Series MSZ* P.29
- 3 Position Cylinder/Compact Type (Made to Order) *CJ2-X1302* P.30
- 4 Position Cylinder/Dual Rod Type (Made to Order) *CXSJ20-X1323* P.30
- e-Rodless Cylinder ..... *Series E-MY2* P.30
- Electro-Pneumatic Hybrid Actuator (Made to Order) P.31



■ Shock Relief

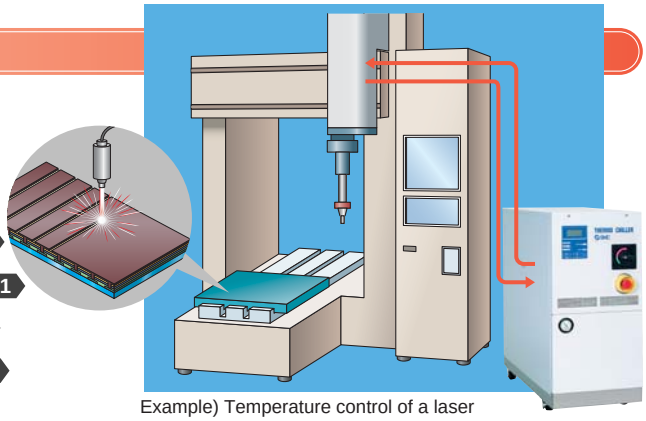
Applicable to transfer a workpiece which hates shocks at high speed. Shock absorbing at the stroke end.

- Clean Rodless Cylinder ..... *Series CYP* P.25
- Sine Rodless Cylinder ..... *Series REA/REB* P.28
- Sine Cylinder ..... *Series REC* P.28
- Electro-Pneumatic Hybrid Actuator (Made to Order) P.31
- Shock Absorber/Soft Type ..... *Series RJ* P.29
- Shock Absorber ..... *Series RB* P.29



3 Temperature Control

Heat sources set at a constant temperature.



Example) Temperature control of a laser oscillating tube

Chiller

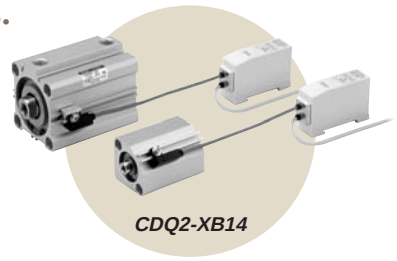
- Thermo-cooler ..... *Series HRG* P.61
- Thermo-cooler ..... *Series HRGC* P.61
- Thermo-chiller ..... *Series HRZ* P.61
- Thermo-chiller ..... *Series HRW* P.62

Thermo-con

- Thermo-con ..... *Series HEC* P.62
- Thermoelectric Bath ..... *Series HEB* P.62
- Chemical Thermo-con ..... *Series HED* P.62

4 Heat Resistant

Suitable for use in high temperature environments.

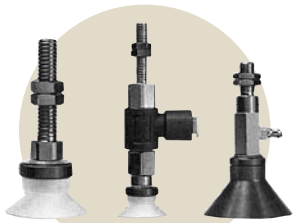

CDQ2-XB14

Actuators

- Heat Resistant Cylinder (–10 to 150°C/–10 to 110°C) (Made to Order) ····· *-XB6/-XC5* P.32, 33
- Cylinder with Heat Resistant Auto Switch (Made to Order) ····· *CDQ2-XB14* P.33
- Heat Resistant Air Gripper (–10 to 100°C) (Made to Order) ····· *-X4* P.34

Vacuum Pad

- Vacuum Pad ····· *Series ZP* P.37


Vacuum pad *Series ZP*

Air Preparation Equipment

- Clean Gas Filter ····· *Series SF* P.39

Air Line Equipment

- Regulator for High Temperature Environments (Made to Order) ····· *AR/AW-X440* P.40, 41
- Precision Regulator for High Temperature Environments (Made to Order) ····· *IR-T* P.41


Series KQG

Fittings and Tubings

- Brass One-touch Fittings ····· *Series KQB* P.44
- Stainless Steel 316 One-touch Fittings ····· *Series KQG* P.45
- Stainless Steel 316 Insert Fittings ····· *Series KFG* P.45
- S Coupler/Stainless Steel Type ····· *Series KKA* P.46
- Fluoropolymer Fittings Hyper Fitting ····· *Series LQ1/LQ3* P.46, 47
- Fluoropolymer Tubing ····· *Series TL/TIL* P.47
- FEP Tubing (Fluoropolymer) ····· *Series TH/TIH* P.47
- Soft Fluoropolymer Tubing ····· *Series TD/TID* P.48

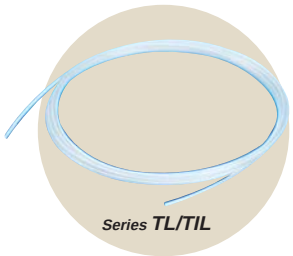

Series KKA


Series LQ1


Series LQ3

Flow Control Equipment

- Speed Controller for High Temperature ····· *Series AS-H* P.49


Series TL/TIL

Sensors

- Digital Flow Switch for Water (for High Temperature Fluids) ····· *Series PF2W□T* P.56
- Digital Flow Switch for Deionized Water and Chemicals ····· *Series PF2D* P.56

Fluid Control Equipment

- Air Operated Chemical Valve ····· *Series LV* P.58 to 60

Pump

- Non-Metallic Pump/Double Acting Pump ····· *Series PAF* P.60


Series XL

Vacuum Equipment

- High Vacuum Valve ····· *Series XL/XM/XY* P.63, 64

5 Corrosion Resistant

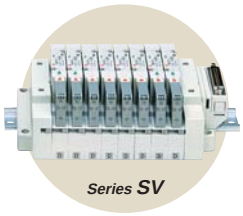

Water resistant

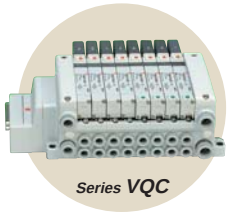
■ Water Resistant

Applicable for use in environments with exposure to water.

Directional Control Valves (IP65/IP67 compliant)

- 5 Port Solenoid Valve ..... Series ***SV/VQC*** P.16, 18
- 4/5 Port Solenoid Valve ..... Series ***SY/SYJ*** P.16, 17
- 7 mm Width Compact 5 Port Solenoid Valve ..... Series ***S0700*** P.17
- 5 Port Solenoid Valve ..... Series ***VQ*** P.17
- 5 Port Solenoid Valve ..... Series ***VQZ*** P.18

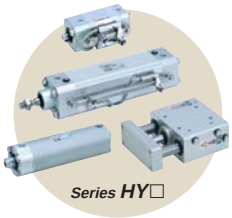

Series SV


Series VQC

Actuators

- Stainless Steel Cylinder ..... Series ***CJ5·S/CG5·S*** P.21
- Hygienic Design Cylinder ..... Series ***HY□*** P.21
- Water Resistant Cylinder P.21
- Water Resistant 2-Color Indication Solid State Switch ..... Series ***D-□*** P.22
- External Parts Stainless Steel Cylinder (Made to Order) ***CM2-XB12*** P.22
- Made of Stainless Steel (Made to Order) ..... ***-XC6/-XC7*** P.23, 24

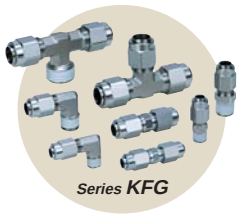

Series CJ5·S/CG5·S


Series HY□

Fittings and Tubings (Stainless steel products)

- Stainless Steel 316 One-touch Fittings ..... Series ***KQG*** P.45
- Stainless Steel 316 Insert Fittings ..... Series ***KFG*** P.45
- Miniature Fittings/Stainless Steel 316 ..... Series ***MS*** P.45


Series KQG


Series KFG

Sensors (IP65/IP67 compliant)

- High-Precision Digital Pressure Switch ..... Series ***ZSE/ISE40*** P.52
- 2-Color Display Digital Pressure Switch ..... Series ***ISE70/75(H)*** P.52
- 2-Color Display Digital Pressure Switch ..... Series ***ZSE/ISE80*** P.53
- High-Precision Digital Pressure Switch for General Fluids ..... Series ***ZSE/ISE50/60*** P.53
- Pressure Sensor for General Fluids ..... Series ***PSE56□*** P.54
- Digital Flow Switch for Air/Water ..... Series ***PF2A/2W*** P.55, 56


Series ISE80


Series PSE56□

■ High Purity (Fluoropolymer)

Suitable for fluids including chemicals and pure water, this product is made with fluoropolymer.


Series SRF

Pressure Control Equipment

- Clean Regulator/ Fluoropolymer Type ..... Series *SRF* P.42


Series LQ3

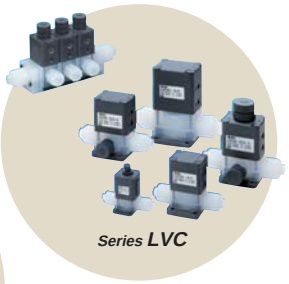
Fittings and Tubings

- Fluoropolymer Fittings Hyper Fitting ..... Series *LQ1/LQ3* P.46, 47
- Fluoropolymer Tubing ..... Series *TL/TIL* P.47
- FEP Tubing (Fluoropolymer) ..... Series *TH/TIH* P.47
- Soft Fluoropolymer Tubing ..... Series *TD/TID* P.48

Series PF2D

Flow Sensor

- Digital Flow Switch for Deionized Water and Chemicals ..... Series *PF2D* P.56


Series LVC

Fluid Control Equipment

- Air Operated Chemical Valve ..... Series *LV* P.58 to 60


Series PAF

Pump

- Non-Metallic Pump/ Double Acting Pump ..... Series *PAF* P.60

■ Gas Resistant

Improved resistance to corrosion by chlorine gas due to oxalic acid anodized treatment.


Series XL

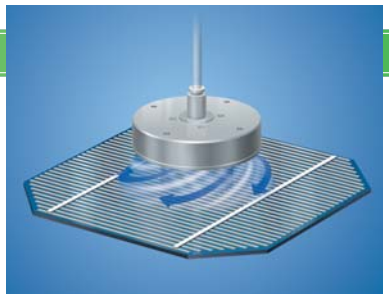
High Vacuum Equipment

- Aluminum High Vacuum Angle Valve ..... Series *XL* P.63
- Aluminum One-touch Connection and Release High Vacuum Angle Valve ..... Series *XLAQ/XLDQ* P.63
- Stainless Steel High Vacuum Angle/In-line Valve ..... Series *XM/XY* P.64
- Slit Valve ..... Series *XGT* P.64


Series XM


Series XGT

6 Non-Contact Transfer



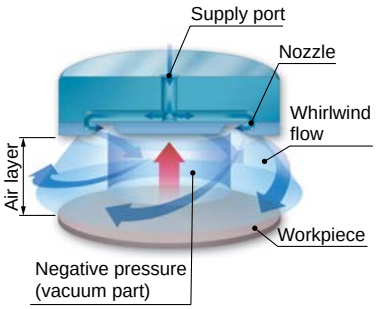
Cyclone Pad

The vacuum-lift and transfer of a workpiece with uneven and/or viscous surface (solar battery cell) is possible.

- **Cyclone Pad (Made to Order)** P.66

Working Principle

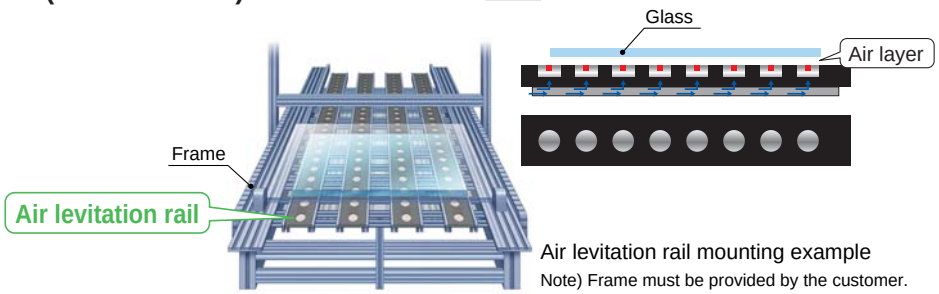
Air from the supply port is ejected from a nozzle on the cylindrical side to generate a whirlwind flow inside the cylinder and leading to the vacuum. (Cyclone effect) Supply air is discharged to the atmosphere from between the suction surface and the workpiece. As a result, an air layer is generated between the cyclone pad and the workpiece, resulting in the workpiece being lifted without contact.



Series XT661

Prevents vibration and deflection of plates for thin film.

- **Air Levitation Rail (Made to Order)** P.67



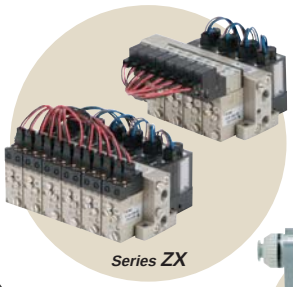
Air levitation rail mounting example

Note) Frame must be provided by the customer.

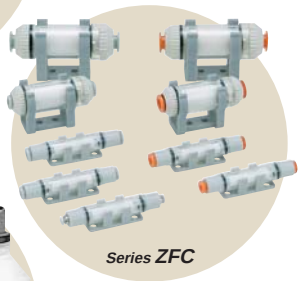
7 Low Vacuum

Equipment for vacuum-lift and transfer systems for workpieces.

- **Vacuum Ejector** ..... *Series Z*□ P.35, 36
- **Air Suction Filter** ..... *Series ZF*□ P.37
- **Vacuum Pad** ..... *Series ZP* P.37
- **Sponge Pad** ..... *Series ZP2* P.38
- **Vacuum/Release Unit** ..... *Series VQD1000-V* P.36



Series ZX



Series ZFC

Series ZP

8 Static Electricity

Ionizer *Series IZS*

■ Antistatic Equipment

Antistatic performance achieved through conductive measures for a reduction in static-related trouble.

Actuators

- Antistatic Air Cylinder (Made to Order) *CM2-X1051* P.34

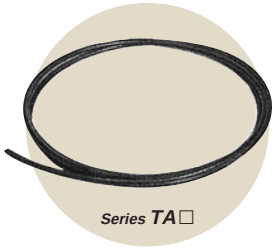
Vacuum Equipment

- Vacuum Pad ..... *Series ZP* P.37

Fittings and Tubings

- Antistatic One-touch Fittings ..... *Series KA* P.45
- Miniature Fittings/Stainless Steel 316 ..... *Series MS* P.45
- Miniature Fittings ..... *Series M* P.45
- Antistatic Tubing ..... *Series TA□* P.47

Series KA



Series TA□

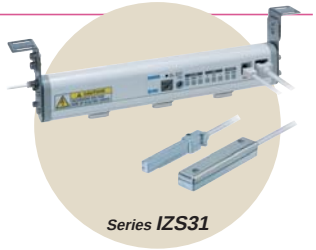
Flow Control Equipment

- Antistatic Speed Controller (Made to Order) *AS-X260* P.50

■ Static Electricity Elimination Equipment

Ions generated by corona discharge eliminate (neutralize) static electricity.

- Ionizer ..... *Series IZS31* P.57
- Ionizer/Nozzle Type ..... *Series IZN10* P.57

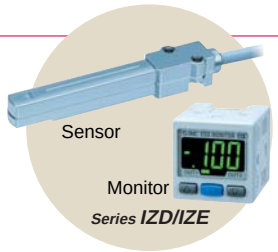


Series IZS31

■ Measurement Equipment

Measures the electrostatic potential.

- Electrostatic Sensor ..... *Series IZD10/IZE11* P.57
- Handheld Electrostatic Meter ..... *Series IZH10* P.57



Series IZD/IZE

9 Reduced Wiring

Reduces wiring labor and material.

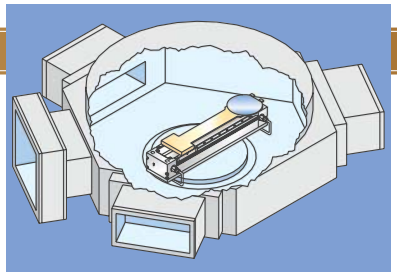
- Serial Transmission System ..... *Series EX* P.20

Series EX180

Series EX250

Series EX510

10 High Vacuum



Can be used at high vacuum of 10^{-6} Pa.
This valve can be used for the exhaust systems, supply systems and block systems of vacuum chambers.

■ Exhaust System

- **Aluminum High Vacuum Angle Valve** ..... *Series XL* P.63
- **Aluminum One-touch Connection and Release High Vacuum Angle Valve** ..... *Series XLAQ/XLDQ* P.63
- **Stainless Steel High Vacuum Angle/In-line Valve** ..... *Series XM/XY* P.64

■ Supply System

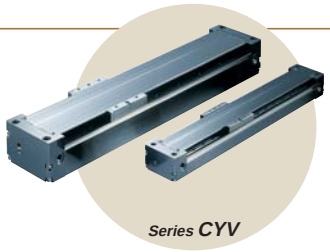
- **High Vacuum Straight Solenoid Valve** ..... *Series XSA* P.64
- **Smooth Vent Valve** ..... *Series XVD* P.64

■ Block System

- **Slit Valve** ..... *Series XGT* P.64
- **Door Valve (Made to Order)** ..... *Series XGD* P.65

■ Transfer System

- **Rodless Cylinder for Vacuum** ..... *Series CYV* P.65



11 Fluoropolymer

Equipment made with fluoropolymer excels in corrosion resistance and heat resistance.


Series SRF

Pressure Control Equipment

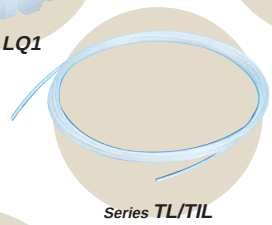
- Clean Regulator/ Fluoropolymer Type ..... Series *SRF* P.42

Fittings and Tubings

- Fluoropolymer Fittings Hyper Fitting ..... Series *LQ1/LQ3* P.46, 47
- Fluoropolymer Tubing ..... Series *TL/TIL* P.47
  FEP Tubing (Fluoropolymer) ..... Series *TH/TIH* P.47
- Soft Fluoropolymer Tubing ..... Series *TD/TID* P.48


Series LQ1

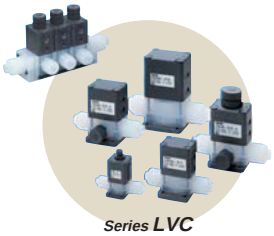

Series LQ3


Series TL/TIL

Flow Sensor

- Digital Flow Switch for Deionized Water and Chemicals ..... Series *PF2D* P.56

Series PF2D


Series LVC

Fluid Control Equipment

- Air Operated Chemical Valve ..... Series *LV* P.58 to 60

Pump

- Non-Metallic Pump/ Double Acting Pump ..... Series *PAF* P.60


Series LVP


Series PAF

12 Sensors (Detection)

Detects the pressure and flow rate of a wide variety of materials: air, water, oil, pure water, chemicals, etc. Suitable for detection of vacuum pressure on a vacuum-lift and transfer line.

■ Digital Pressure Switches

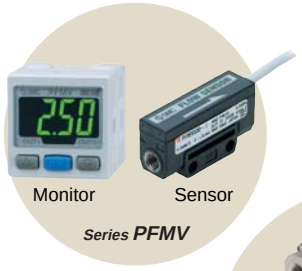
- Self-Contained Type Digital Pressure Switch ..... *Series ZSE/ISE* P.52, 53
- Remote Type Pressure Sensor ..... *Series PSE* P.53, 54
- Multi-Channel Digital Pressure Sensor Controller ..... *Series PSE200* P.54
- 2-Color Display Digital Pressure Sensor Controller ..... *Series PSE300* P.54

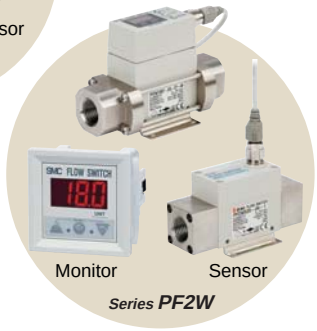

Series ZSE/ISE80


Series PSE

■ Digital Flow Switches

- 2-Color Display Digital Flow Switch ..... *Series PFM* P.55
- Flow Sensor ..... *Series PFMV* P.55
- Digital Flow Switch for Air/Water ..... *Series PF2A/2W* P.55, 56
- Digital Flow Switch for Deionized Water and Chemicals ..... *Series PF2D* P.56
- 4-Channel Flow Monitor ..... *Series PF2□200* P.56


Monitor Sensor
Series PFMV


Monitor Sensor
Series PF2W

CONTENTS

Photovoltaic Cell Manufacturing Process Equipment

4 Port Solenoid Valve/Cassette Type Manifold *Series* SJ

Rubber seal

Series	Flow characteristics 4/2 → 3/5 (A/B → E)			Applicable cylinder size	Power consumption (W)
	C[dm³/(s·bar)]	b	Cv		
SJ2000	0.36	0.13	0.08	ø20	0.55 (Standard) 0.23 (With power saving circuit)
SJ3000	0.56	0.11	0.12	ø25	0.4 (Standard) 0.15 (With power saving circuit)
Features	● Low-profile cassette type with baseless structure ● Takes up minimal space with a body width of 7.5 mm (SJ2000) or 10 mm (SJ3000). ● Combination of the SJ2000 and the SJ3000 is possible. ● A multi-pin connector makes it easy to add or subtract stations or to exchange valves. ● One side solenoid ● 4 position, dual 3 port specifications available				

5 Port Solenoid Valve *Series* SY

Water resistant (IP65)

Rubber seal

Series	Flow characteristics 4/2 → 5/3 (A/B → EA/EB)			Applicable cylinder size	Power consumption (W)
	C[dm³/(s·bar)]	b	Cv		
SY3000	1.1	0.30	0.26	ø40	0.35 (Standard) 0.1 (With power saving circuit)
SY5000	2.8	0.29	0.66	ø63	
SY7000	4.5	0.27	1.1	ø80	
SY9000	10	0.29	2.5	ø100	
Features	● Combined mounting of 3 port valve and 5 port valve is possible. ● Electricity consumption: 0.1 W (with power saving circuit) ● A wide variety of manifold options such as Aluminum body manifold, DIN rail, Stacking type manifold ● IP65 compliant Note)				

Note) Degrees of protection may differ depending on the manifold type and electrical entry.

5 Port Solenoid Valve *Series* SV

Water resistant (IP67)

Rubber seal

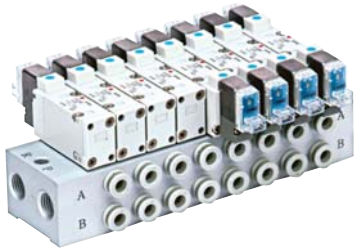
Series	Flow characteristics 4/2 → 5/3 (A/B → E)			Applicable cylinder size	Power consumption (W)
	C[dm³/(s·bar)]	b	Cv		
SV1000	1.1	0.35	0.28	ø40	0.6
SV2000	2.4	0.18	0.48	ø63	
SV3000	4.3	0.21	0.93	ø80	
SV4000	7.0	0.18	1.6	ø100	
Features	● It is easily possible to add stations of the manifold valve or change specifications. ● One side solenoid ● 4 position, dual 3 port specifications available ● IP67 compliant Note)				

Note) Degrees of protection may differ depending on the manifold type and electrical entry.

4/5 Port Solenoid Valve *Series* SYJ

Water resistant (IP65)

Rubber seal



Series	Flow characteristics 4/2 → 5/3 (A/B → EA/EB)			Applicable cylinder size	Power consumption (W)
	C[dm³/(s·bar)]	b	Cv		
SYJ3000	0.46	0.35	0.12	ø25	0.35 (Standard) 0.1 (With power saving circuit)
SYJ5000	0.83	0.32	0.21	ø40	
SYJ7000	2.9	0.35	0.74	ø50	
Features	● Combined mounting of 3 port valve and 5 port valve is possible. ● Electricity consumption: 0.1 W (with power saving circuit) ● IP65 compliant Note)				

Note) Degrees of protection may differ depending on the manifold type and electrical entry.

5 Port Solenoid Valve/Cassette Type Manifold *Series* SZ

Rubber seal

Series	Flow characteristics 4/2 → 3 (A/B → R)			Applicable cylinder size	Power consumption (W)
	C[dm³/(s·bar)]	b	Cv		
SZ3000	0.77	0.19	0.19	ø32	0.6
Features	● Cassette type allows easy valve exchange. ● Valve has switch attached for safe maintenance. ● Low-profile cassette type with baseless structure takes up less space.				

7 mm Width Compact 5 Port Solenoid Valve *Series* S0700

Rubber seal

Series	Flow characteristics 4/2 → 5/3 (A/B → R1/R2)			Applicable cylinder size	Power consumption (W)
	C[dm³/(s·bar)]	b	Cv		
S0700	0.39	0.39	0.11	ø20	0.35
Features	● 7 mm width compact solenoid valve manifold ● 4 position, dual 3 port valve ● A variety of common wiring methods				

5 Port Solenoid Valve *Series* VQ

Water resistant (IP65)

Metal seal, Rubber seal

Series	Flow characteristics 2/4 → 3/5 (A/B → R1/R2)			Applicable cylinder size	Power consumption (W)
	C[dm³/(s·bar)]	b	Cv		
VQ1000	1.0	0.30	0.25	ø40	1.0 0.5 (Low wattage type)
VQ2000	3.2	0.30	0.80	ø63	
Features	● Space-saving design with one side solenoid and fittings all positioned one side, allowing free three-directional mounting ● No screws, one clamp structure for reduced recombination labor ● A variety of option parts (Back pressure check valve, Dual flow fitting, etc) ● A variety of common wiring methods ● 4 position, dual 3 port valve ● IP65 compliant Note)				

Note) Degrees of protection may differ depending on the manifold type and electrical entry.

5 Port Solenoid Valve *Series* VQC

Metal seal, Rubber seal

Water resistant (IP67)

Series	Flow characteristics 4/2 → 5/3 (A/B → R1/R2)			Applicable cylinder size	Power consumption (W)
	C[dm³/(s·bar)]	b	Cv		
VQC1000	1.0	0.30	0.25	ø40	1.0 0.5 (Low wattage type)
VQC2000	3.2	0.30	0.80	ø63	
VQC4000	7.3	0.38	2.0	ø100	
Features	● Enclosure IP67 compliant Note) ● Flexible adaptation such as added stations and changed specifications is made possible with the use of a multi-pin connector manifold. ● Space-saving design with one side solenoid and fittings all positioned one side, allowing free mounting ● No screws, one clamp structure for reduced recombination labor (VQC1000/2000) ● A variety of common wiring methods ● 4 position, dual 3 port valve				

Note) Degrees of protection may differ depending on the manifold type and electrical entry.

5 Port Solenoid Valve *Series* VQZ

Metal seal, Rubber seal

Water resistant (IP65)

Series	Flow characteristics 4/2 → 5/3 (A/B → EA/EB)			Applicable cylinder size	Power consumption (W)
	C[dm³/(s·bar)]	b	Cv		
VQZ1000	1.3	0.24	0.32	ø63	0.35 (Standard) 0.9 (High pressure type, High speed response type)
VQZ2000	2.3	0.29	0.53	ø80	
VQZ3000	4.6	0.26	1.2	ø100	
Features	● Combined mounting of 3 port valve and 5 port valve on manifold valve is possible. ● Allows mounting on aluminum body manifold or DIN rail ● IP65 compliant Note)				

Note) Degrees of protection may differ depending on the manifold type and electrical entry.

5 Port Solenoid Valve *Series* SQ

Metal seal, Rubber seal

Water resistant (IP65)

Series	Flow characteristics 4/2 → 5/3 (A/B → R1/R2)			Applicable cylinder size	Power consumption (W)
	C[dm³/(s·bar)]	b	Cv		
SQ1000	0.80	0.20	0.19	ø32	1.0 0.5 (Low wattage type)
SQ2000	3.1	0.18	0.71	ø63	
Features	● The use of cassette type valves and manifolds makes it easy to increase or decrease the number of stations on a DIN rail. ● With built-in manifold, it is easy to recombine valves with one screw action without opening the manifold. ● Easy replacement of one-touch fittings ● 4 position, dual 3 port valve specifications available ● Allows mounting of back pressure check valve without opening manifold, a variety of option parts				

3 Port Solenoid Valve/Unit Manifold Valve *Series* VV061

Rubber seal

Series		Flow characteristics 2 → 3 (A → R)	Power consumption (W)	Available in vacuum applications
VV061	Standard	Effective area: 0.11 mm²	0.55 (Standard) 0.23 (With power saving circuit)	–100 kPa
	High flow	Effective area: 0.21 mm²		
Features		● Valve, Base plate, Base, and Fitting in one compact unit ● Innovative unit manifold ● Equipped with 6 mm width valve, V060 series		

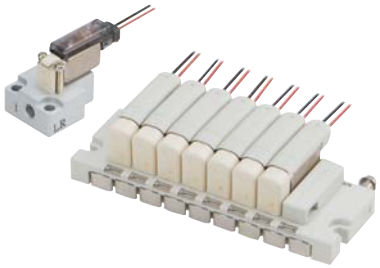
3 Port Solenoid Valve/Highly Integrated Unit Manifold *Series* VV100

Rubber seal

Series	Flow characteristics 2a/2b → 3 (E)		Power consumption (W)	Available in vacuum applications
	C[dm³/(s·bar)]	b		
VV100	0.05	0.29	0.4 (Standard) 0.15 (With power saving circuit)	–100 kPa
Features	● Compact manifold with one station equipped with two 3 port valves ● A multi-pin connector (in the case of plug-in connector) ● Can be combined with separate wirings.			

3 Port Solenoid Valve *Series* S070

Rubber seal



Series	Flow characteristics			Power consumption (W)	Max. operating pressure: MPa
	C[dm³/(s·bar)]	b	Cv		
S070	0.042	0.27	0.011	0.5	0.5
	0.083	0.28	0.021		0.3
	0.042	0.27	0.011	0.35	0.3
	0.083	0.28	0.021		0.1
	0.021	0.27	0.006	0.1 (With power saving circuit)	0.3
	0.042	0.28	0.011		0.1
Features	● 7 mm width compact solenoid valve manifold ● Mass of valve alone: 5 g ● Stand-alone specifications, Base mounted manifold, Body ported manifold can be selected.				

Serial Transmission System *Series EX*

Reduced wiring

Integrated type: Output

Series	Enclosure	Communication protocol	Applicable valve
EX120	IP20	DeviceNet™ CC-Link OMRON Corp. (CompoBus/S) SUNX Ltd (S-LINK) NKE (Wiring saving system)	SV1000, 2000, 3000, 4000 VQ1000, 2000
EX121	IP20		SY3000, 5000
EX122	IP20		SY3000, 5000
EX123	IP65		VQ2000, 4000, 5000
EX124	IP65		VQ2000, 4000, 5000
EX126	IP67∗1		SV1000, 2000, 3000 VQC1000, 2000, 4000
EX140	IP20		SZ3000 SQ1000, 2000
EX180	IP20∗2		SJ2000, 3000

∗1 Compatible with CC-Link only
∗2 Compatible with CC-Link and DeviceNet™

Serial Transmission System *Series EX*

Reduced wiring

Integrated type: Input/Output

Series	Enclosure	Communication protocol	Applicable valve
EX240	IP65	DeviceNet™ PROFIBUS DP CC-Link∗	VQC4000 VQ2000, 4000
EX250	IP67	AS-Interface∗ CANopen∗ ControlNet∗ EtherNet/IP™∗	SV1000, 2000, 3000 VQC1000, 2000, 4000 S0700 (IP40)

∗ Compatible with the EX250 only

Serial Transmission System *Series EX*

Reduced wiring

Decentralized type

Series	Enclosure	Communication protocol	Applicable valve
EX500	IP65	DeviceNet™	SV1000, 2000, 3000, 4000 VQC1000, 2000, 4000 S0700 (IP40)
EX510	IP20	PROFIBUS DP CC-Link EtherNet/IP™∗	SJ2000, 3000 SY3000, 5000, 7000, 9000 SYJ3000, 5000, 7000 SQ1000, 2000 VQ1000, 2000 VQZ1000, 2000, 3000 S0700

∗ Compatible with the EX500 only

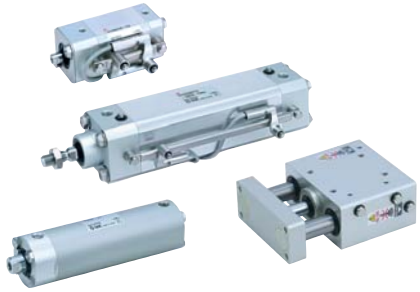
Stainless Steel Cylinder *Series CJ5·S/CG5·S*

Water resistant

Type	Series	Action	Bore size (mm)
Standard	CJ5·S	Double acting	10, 16
	CG5·S		20, 25, 32, 40, 50, 63, 80, 100
Features	• Applicable for use in an environment with water splashing		

Hygienic Design Cylinder *Series HY□*

Water resistant



Type	Series	Action	Bore size (mm)
Basic	HYQ	Double acting	20, 25, 32, 40, 50, 63
ISO standard	HYC		32, 40, 50, 63
With guide	HYG		20, 25, 32, 40, 50, 63
Basic	HYB		20, 25, 32, 40, 50, 63, 80, 100
Features	• Easily washable configuration, improved water-resistant air cylinder • Five times the lifespan of improved water-resistant cylinder (SMC comparison)		

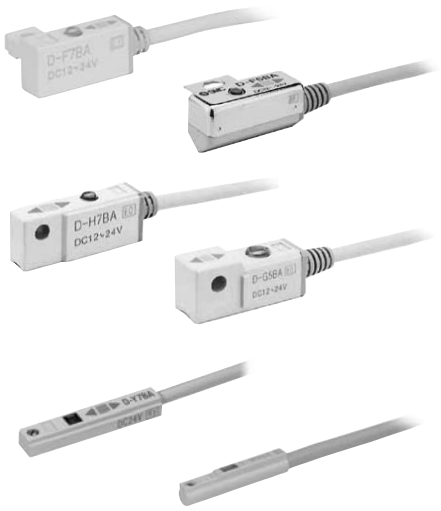
Water Resistant Cylinder

Water resistant

Type	Series	Action	Bore size (mm)
Air cylinder	CM2	Double acting	20, 25, 32, 40
	CG1		32, 40, 50, 63, 80, 100
Compact cylinder	CQ2		20, 25, 32, 40, 50, 63, 80, 100
Air cylinder	CA2		40, 50, 63, 80, 100
Compact guide cylinder	MGP		20, 25, 32, 40, 50, 63, 80, 100
Guide cylinder	MGG		32, 40, 50, 63, 80, 100
Compact hydraulic cylinder conforming to JIS/10 MPa	CHKDB		20, 25, 32, 40, 50, 63, 80, 100
Hydraulic cylinder comforming to JIS/7 MPa	CH2F		32, 40, 50, 63, 80, 100
Features	• Can be used in environments where contact with water or coolant occurs. • With water-resistant 2-color indication auto switch • Suitable for factory machinery, food manufacturing machinery, car washes, etc.		

Water-Resistant 2-Color Indication Solid State Switch *Series D-□*

Water resistant



Type	Applicable cylinder
D-F7BA(V)L/Rail mounting	CQ2 (ø20 to ø100)
D-F5BAL/Tie-rod mounting	CH2F (ø32 to ø100) CA2 (ø40 to ø100) MB (ø32 to ø100)
D-H7BAL/Band mounting	CM2, CG1 (ø32 to ø63) MGG (ø32 to ø63)
D-G5BAL/Band mounting	CG1 (ø80, ø100) MGG (ø80, ø100)
D-Y7BAL/Direct mounting	CA2 (ø40 to ø100) MB (ø32 to ø100) MB1 (ø32 to ø100) MGP (ø20 to ø100) CHKDB (ø32 to ø100)
D-M9□A(V)L/Direct mounting	CQ2 (ø20 to ø100) CHKDB (ø20 to ø100) CA2 (ø40 to ø100) MB (ø32 to ø100) MB1 (ø32 to ø100) MGP (ø20 to ø100)
Features	● Changed internal structure with better water repellent properties of the switch base plate for improved water resistance (SMC comparison)

External Parts Stainless Steel Cylinder *CM2-XB12*

Made to Order

Water resistant

A cylinder that uses stainless steel (stainless steel 304) that excels in corrosion resistance for all external parts that are exposed to the surrounding environment. Its external dimensions and installation dimensions are identical to those of the standard CM2 series.

Applicable Series

Series	Description	Model	Action
CM2	Air cylinder	CM2	Double acting single rod
			Single acting (Spring return/extend)
		CM2W	Double acting double rod
	Non-rotating rod	CM2K	Double acting single rod
			Single acting (Spring return/extend)

Piston Rod and Rod End Nut Made of Stainless Steel -XC6 Made to Order Water resistant

● Suitable for the cases it is likely to generate rust by being immersed in the water and corrosion.

Applicable Series

Series	Description	Model	Action
CM2	Air cylinder	CM2	Double acting single rod
			Single acting (spring return/extend)
		CM2W	Double acting double rod
	Non-rotating rod	CM2K	Double acting single rod
			Single acting (spring return/extend)
		CM2KW	Double acting double rod
	Direct mount	CM2R	Double acting single rod
	Non-rotating rod/Direct mount	CM2RK	Double acting single rod
	Centralized piping	CM2□□P	Double acting single rod
	Low friction	CM2Y	Double acting single rod
	Air-hydro	CM2H	Double acting single rod
	Direct mount/Air-hydro	CM2RH	Double acting single rod
	End lock cylinder	CBM2	Double acting single rod
CG1	Air cylinder	CG1	Double acting single rod
			Single acting (spring return)
	Double rod	CG1W	Double acting double rod
	Direct mount	CG1R	Double acting single rod
	Low friction	CG1□Y	Double acting single rod
MB Note 2)	Air cylinder	MB	Double acting single rod
		MBW	Double acting double rod
	Non-rotating rod	MBK	Double acting single rod
	Low friction	MB□Q	Double acting single rod
MB1 Note 2)	Air cylinder	MB1	Double acting single rod
		MB1W	Double acting double rod
	Non-rotating rod	MB1K	Double acting single rod
CA2 Note 2)	Air cylinder	CA2	Double acting single rod
		CA2W	Double acting double rod
	Low friction	CA2□Q	Double acting single rod
		CA2□Y	Double acting single rod
	End lock cylinder	CBA2 Note 1)	Double acting single rod
	Air-hydro	CA2H	Double acting single rod
CS1 Note 2)	Air cylinder	CS1	Double acting single rod
		CS1W	Double acting double rod
	Air-hydro	CS1H	Double acting single rod

Series	Description	Model	Action
CQS	Compact cylinder	CQS	Double acting single rod
			Single acting (spring return/extend)
		CQSW	Double acting double rod
	Non-rotating rod	CQSK	Double acting single rod
	Anti-lateral load	CQS□S	Double acting single rod
CQ2	Compact cylinder	CQ2	Double acting single rod
			Single acting (spring return/extend)
		CQ2W	Double acting double rod
	Axial piping (Centralized piping)	CQP2	Double acting single rod
			Single acting (spring return/extend)
	Long stroke	CQ2	Double acting single rod
	Anti-lateral load	CQ2□S	Double acting single rod
CV	Valve mounted cylinder	CVM5	Double acting single rod
		CVM5K	Double acting single rod
		CV3	Double acting single rod
		CVS1	Double acting single rod
MGP	Compact guide cylinder	MGP	Double acting
MGG	Guide cylinder	MGG	Double acting
MGC	Guide cylinder	MGC	Double acting
CXS	Dual rod cylinder	CXSM	Double acting
CXSJ	Dual rod cylinder/Compact	CXSJM	Double acting
RHC	High power cylinder	RHC	Double acting

Note 1) Head end locking only
Note 2) There are limitations to the maximum stroke of CA2, MB, MB1 (ø100), CS1 cylinders.

Maximum Stroke

(mm)

Series	Double acting single rod	Double acting single rod with rod boot
CA2, MB, MB1 (Bore size 100) Otherwise same as standard	1500 (Same as standard)	1000
CS1	1200	1200

Tie-rod, Cushion Valve, Tie-rod Nut, etc. Made of Stainless Steel Made to Order Water resistant
-XC7

- When using in locations where the rust generation or corrosion likelihood exists, the standard parts material have been partly changed to the stainless steel.

Applicable Series

Series	Description	Model	Action
MB	Standard	MB	Double acting single rod
		MBW	Double acting double rod
	Non-rotating rod	MBK	Double acting single rod
	Low friction	MB□Q	Double acting single rod
	End lock	MBB	Double acting single rod
MB1	Standard	MB1	Double acting single rod
		MB1W	Double acting double rod
	Non-rotating rod	MB1K	Double acting single rod
CA2	Standard	CA2	Double acting single rod
		CA2W	Double acting double rod
	Non-rotating rod	CA2K	Double acting single rod
		CA2KW	Double acting double rod
	End lock cylinder	CBA2	Double acting single rod
CV	Valve mounted cylinder	CV3	Double acting single rod
		CVS1	Double acting single rod
		CV3K	Double acting single rod
		CVS1K	Double acting single rod

High Speed Rodless Cylinder CY3-X160 Made to Order High speed

Type	Series	Action	Bore size (mm)
Basic	CY3B	Double acting	20, 25, 32, 40, 50, 63
Direct mount	CY3R		
Features	● Mounting dimensions are same as those of the CY1 series. ● NPT thread, G thread are standardized.		

Specifications

Applicable series	CY3B/CY3R
Bore size	ø20 to ø63
Piston speed (with no load)	1500 mm/s (Max.)

Note 1) When using this cylinder with high speed specifications, be sure to use an impact attenuator.
Note 2) The piping for the CY3R is bilateral piping only.
Note 3) Piston speed generated may depend on the conditions of usage. Please consult SMC.
Note 4) Depending on conditions of usage, there is a tendency for speed to decrease gradually over time. You may wish to consider greasing up on a regular basis.

High Speed Dual Rod Cylinder CXS-XB19 Made to Order High speed

- A version of dual rod cylinder CXS series with high-speed specifications
- Wider cylinder port orifice brings cylinder speed to max. 1500 mm/s (ø25, ø32 are max. 1000 mm/s).
- Four times the allowable kinetic energy of the standard models

Applicable Series

Series	Description	Model	Action
CXS	Dual rod cylinder	CXS	Double acting single rod

Clean Rodless Cylinder *Series CYP*

Clean room | Shock relief

Type	Series	Action	Bore size (mm)
Standard	CYP	Double acting	15, 32
Features	● Low particle generation transfer in a clean environment		

Smooth Cylinder *Series CQSY/CQ2Y/CM2Y/CG1Y/CA2Y*

Low speed/Low friction

Type	Series	Action	Bore size (mm)	Min. operating pressure (MPa)
Compact cylinder	CQSY	Double acting	12, 16	0.03
			20, 25	0.02
Compact cylinder	CQ2Y		32, 40	0.02
			50, 63, 80, 100	0.01
Air cylinder	CM2Y		20, 25, 32, 40	0.02
Air cylinder	CG1Y		20, 25, 32, 40	0.02
			50, 63, 80, 100	0.01
Air cylinder	CA2Y		40	0.02
			50, 63, 80, 100	0.01
Features	● Bi-directional low-friction operation possible regardless of the direction of pressure			

Low Speed Cylinder *Series CJ2X/CUX/CQSX/CQ2X/CM2X*

Low speed/Low friction

Type	Series	Bore size (mm)	Min. operating pressure (MPa)	Min. piston speed (mm/s)
Air cylinder	CJ2X	10, 16	0.06	1
Free mount cylinder	CUX	10, 16	0.06	1
		20, 25, 32	0.05	0.5
Compact cylinder	CQSX	12, 16	0.03	1
		20, 25	0.025	0.5
Compact cylinder	CQ2X	32, 40	0.025	0.5
		50, 63, 80, 100	0.01	0.5
Air cylinder	CM2X	20, 25, 32, 40	0.025	0.5
Features	● Stable low-speed operation even at 0.5 mm/s (1 mm/s in the case of ø16 and under)			

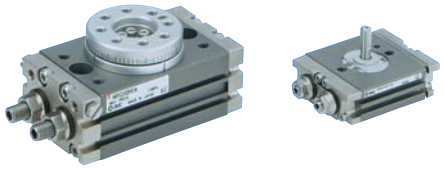
Low Friction Cylinder/Metal Seal *Series MQQ/MQM/MQP*

Low speed/Low friction | High speed

Type	Series	Bore size (mm)	Pressure range (MPa)	Driving speed (mm/s)
Standard	MQQT	10, 16, 20, 25, 30, 40	0.005 to 0.5	0.3 to 300
Anti-lateral load	MQQL	10, 16, 20, 25, 30, 40	0.005 to 0.7	0.5 to 500
	MQML	6	0.02 to 0.7	0.5 to 1000
		10, 16, 20, 25	0.005 to 0.7	
High speed/ High frequency	MQML□□H	10, 16, 20, 25	0.01 to 0.7	5 to 3000
Single acting	MQP	4, 6, 10, 16, 20	0.001 to 0.7	—
Features	● Covers a range of driving speeds and output controls not possible with standard cylinders thanks to the metal seal structure with minimal sliding resistance.			

Low Speed Rotary Actuator *Series CRQ2X/MSQX*

Low speed/Low friction



Series	Rack type	Size	Rotating angle
CRQ2X	Double	10, 15, 20, 30, 40	80° to 100°, 170° to 190°
MSQX		10, 20, 30, 50	0 to 190°
Features	● Possible to transfer a workpiece at lower speeds. (5 s/90°)		

Low Speed Cylinder (10 to 50 mm/s) *-XB9*

Made to Order | Low speed/Low friction

● Even if driving at lower speeds 10 to 50 mm/s, there would be no stick-slip phenomenon and it can run smoothly.

Applicable Series

Series	Description	Model	Action	Note
CJ2	Air cylinder	CJ2	Double acting single rod	Except with air cushion
CM2	Air cylinder	CM2	Double acting single rod	Except with air-hydro, with air cushion, with rod boot
	Direct mount	CM2R	Double acting single rod	Except with air cushion
	End lock cylinder	CBM2	Double acting single rod	Except with air cushion
CG1	Air cylinder	CG1	Double acting single rod	Except with air cushion
	Direct mount	CG1R	Double acting single rod	Except with air cushion
CU	Free mount cylinder	CU	Double acting single rod	
	Non-rotating rod	CUK	Double acting single rod	
	Long stroke/Standard	CU	Double acting single rod	
	Long stroke/Non-rotating rod	CUK	Double acting single rod	
CQS	Compact cylinder	CQS	Double acting single rod	
		CQSW	Double acting double rod	
CQ2	Compact cylinder	CQ2	Double acting single rod	
		CQ2W	Double acting double rod	
	Axial piping (Centralized piping)	CQP2	Double acting single rod	
CY Note 2)	Magnetically coupled rodless cylinder	CY3B	Double acting	
		CY1S	Double acting	
		CY1L	Double acting	
MGQ	Compact guide cylinder	MGQ	Double acting	

Note 1) Operate without lubrication from a pneumatic system lubricator.
Note 2) Operating speed of the CY series is 15 to 50 mm/s.

Low Speed Cylinder (5 to 50 mm/s) *-XB13* Made to Order Low speed/Low friction

- Even if driving at lower speeds 5 to 50 mm/s (CY: 7 to 50 mm/s), there would be no stick-slip phenomenon and it can run smoothly.

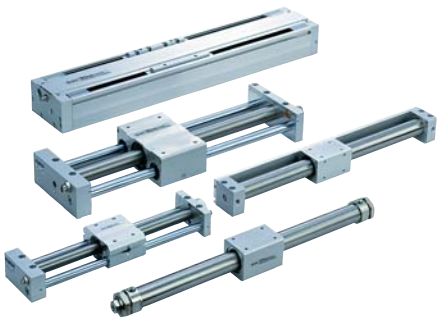
Applicable Series

Series	Description	Model	Action	Note
CJ2	Air cylinder	CJ2	Double acting single rod	Except with air cushion
CM2	Air cylinder	CM2	Double acting single rod	Except with air cushion
	Direct mount	CM2R	Double acting single rod	Except with air cushion
CG1	Air cylinder	CG1	Double acting single rod	Except with air cushion
	Direct mount	CG1R	Double acting single rod	Except with air cushion
MB	Air cylinder	MB	Double acting single rod	
CU	Free mount cylinder	CU	Double acting single rod	
	Non-rotating rod	CUK	Double acting single rod	
	Long stroke/Standard	CU	Double acting single rod	
	Long stroke/Non-rotating rod	CUK	Double acting single rod	
CQS	Compact cylinder	CQS	Double acting single rod	Except long stroke, non-rotating, anti-lateral load
		CQSW	Double acting double rod	Except non-rotating
CQ2	Compact cylinder	CQ2	Double acting single rod	Except long stroke, non-rotating, large bore size, anti-lateral load
		CQ2W	Double acting double rod	Except non-rotating, large bore size
	Axial piping (Centralized piping)	CQP2	Double acting single rod	
CX2	Slide unit	CX2	Slide bearing	
CXW	Slide unit	CXWM	Slide bearing	
		CXWL	Ball bushing bearing	
MXU	Compact slide	MXU	Double acting single rod	
MXH		MXH	Double acting single rod	
CXSJ	Dual rod cylinder	CXSJ	Standard	
CXS		CXS	Standard	
MGP	Compact guide cylinder	MGP$^{M}_{L}$	Standard	Except with air cushion, with end lock
MGG	Guide cylinder	MGGM	Double acting	Shock absorber cannot be mounted.
MGC		MGCM	Double acting	With rubber bumper
CY	Magnetically coupled rodless cylinder	CY3B	Basic	
		CY1S	Slide bearing	
		CY1L	Ball bushing bearing	
CXT	Platform cylinder	CXT	Standard	Except long stroke

Note 1) Operate without lubrication from a pneumatic system lubricator.
Note 2) For the speed adjustment, use speed controllers for low speed operation. (AS-FM/AS-M series)

Sine Rodless Cylinder *Series* REA

Shock relief



Type	Series	Action	Bore size (mm)
Basic	REA	Double acting	25, 32, 40, 50, 63
Direct mount	REAR		10, 15, 20, 25, 32, 40
Slider (Slide bearing)	REAS		
Slider (Ball bushing bearing)	REAL		
Linear guide (Single axis)	REAH		10, 15, 20, 25
Linear guide (Double axes)	REATH		25, 32
Features	• Allows high-speed transfer of a workpiece which must avoid shock/impact. • Maximum speed: 300 mm/s		

Sine Rodless Cylinder *Series* REB

Shock relief

Type	Series	Action	Bore size (mm)
Direct mount	REBR	Double acting	15, 25, 32
Linear guide (Single axis)	REBH		15, 25
Linear guide (Double axes)	REBHT		25, 32
Features	• Allows high-speed transfer of a workpiece which must avoid shock/impact. • Maximum speed: 600 mm/s		

Sine Cylinder *Series* REC

Shock relief

Type	Series	Action	Bore size (mm)
Standard	REC	Double acting	20, 25, 32, 40
Features	• Allows high-speed transfer of a workpiece which must avoid shock/impact.		

High Power Cylinder *Series* RHC

High speed Shock relief

Type	Series	Action	Bore size (mm)
Standard	RHC	Double acting	20, 25, 32, 40, 50, 63, 80, 100
Features	• Provides 10 to 20 times the energy absorption capacity of general purpose cylinder (SMC CG1 series). • Smooth cushioning from high speed operation (3000 mm/s) with light loads and low/medium operation with heavy loads.		

Shock Absorber/Soft Type *Series RJ*

Shock relief

Series	Max. absorbed energy (J)	Absorption stroke (mm)	O.D. thread
RJ0806	1	6	M8
RJ1007	3	7	M10
RJ1412	10	12	M14

Shock Absorber *Series RB*

Shock relief

Type	Series	Absorbed energy (J)	Absorption stroke (mm)	O.D. thread
Standard	RB	0.5 to 147	4 to 25	M6 to M27
Coolant resistant	RBL	3.92 to 147	6 to 25	M10 to M27
Short	RBQ	1.96 to 49	4 to 13	M16 to M32
Features	● Automatic adjustment to the most appropriate absorption performance			

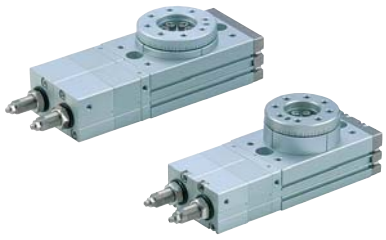
3 Position Cylinder *Series RZQ*

Intermediate stop

Type	Series	Action	Bore size (mm)
Standard	RZQ	Double acting	32, 40, 50, 63
Features	● Equipped with intermediate stop mechanism ● Two-stage stroke possible with just a minute extension		

3 Position Rotary Table *Series MSZ*

Intermediate stop



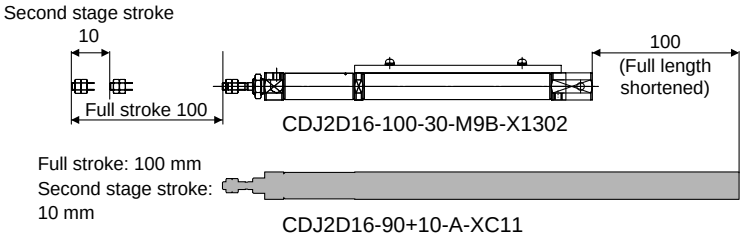
Type	Series	Rack type	Size	Stop position adjustment range
High-precision	MSZA	Double	10, 20, 30, 50	Intermediate position: ±10° Rotating end: Left/right, both 0 to 95° using intermediate position as a basis
Basic	MSZB			
Features	● Three-point-stop possible ● Suitable for applications such as positioning a workpiece at left, right, or center ● Can be operated with one valve.			

3 Position Cylinder/Compact Type *CJ2-X1302* Made to Order

Intermediate stop

- Intermediate stop is possible with one valve.

Space saved when second stage stroke is short

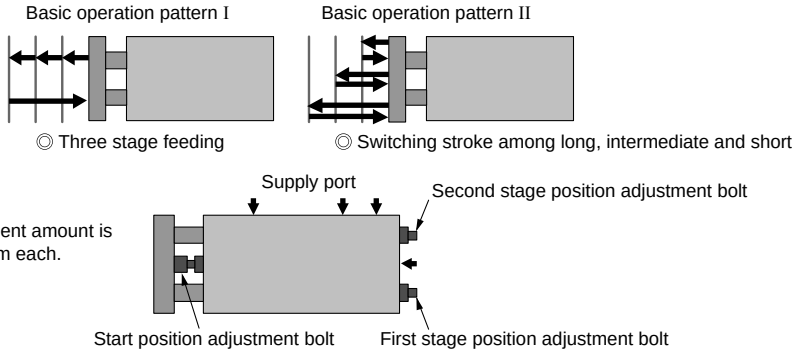


Full stroke	Second stage stroke	Full length		Amount shortened
		CJ2D-XC11	CDJ2D16-X1302	
100 mm	10 mm	322 mm	222 mm	100 mm
100 mm	30 mm	302 mm	242 mm	60 mm

4 Position Cylinder/Dual Rod Type *CXSJ20-X1323* Made to Order

Intermediate stop

- Intermediate stop at two points in the extending direction is possible.
- Forward and backward adjustment at the intermediate position or start position is possible.



e-Rodless Cylinder *Series E-MY2*

Low speed | High speed | Intermediate stop | Shock relief

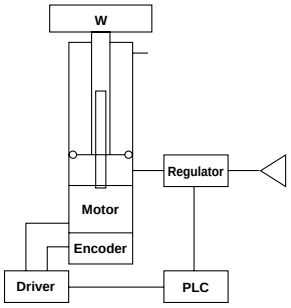
Guide type	Series	Driving speed (mm/s)	Nominal size	Maximum work load (kg)	Stroke (mm)
Basic	E-MY2B	10 to 1000	16, 25	Nominal size 16: 6 kg Nominal size 25: 11 kg	100 to 1000 (1 mm increments)
Cam follower guide	E-MY2C	10 to 1000		Nominal size 16: 10 kg Nominal size 25: 20 kg	50 to 1000 (1 mm increments)
Linear guide (Single axis)	E-MY2H	10 to 2000			
Linear guide (Double axis)	E-MY2HT	10 to 2000			100 to 1000 (1 mm increments)
Features	● No programming. • Air cylinder-like electric controllability is achieved with 1, 2, 3 operation.				

Electro-Pneumatic Hybrid Actuator Made to Order

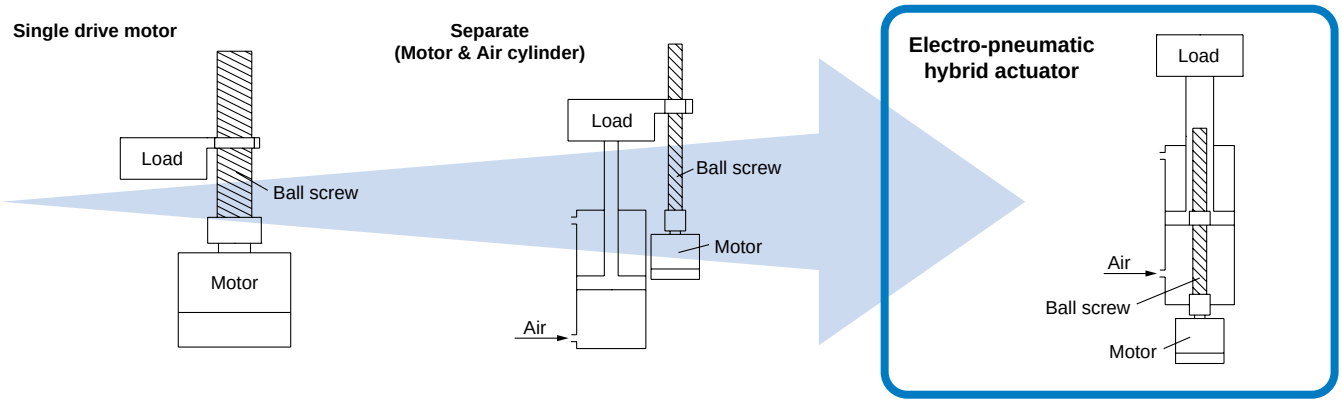
Intermediate stop Shock relief

- Space-saving
- High stopping accuracy

System



Stopping accuracy (mm)	Stroke (mm)	Speed (mm/sec) Workpiece: 40 kg	Thrust (N)	Footprint area (mm^2)
±0.05	200	250 Stepping motor	710 (Reference value)	2500 Cross sectional area of bore size 40 mm cylinder tube



Electro-Pneumatic Hybrid Actuator/ Guide Table Made to Order

Intermediate stop Shock relief

- **Z-axis heavy duty transfer (80 kg) with increased speed, and intermediate stop (stopping accuracy: ± 0.05 mm)**
- **Pressure control makes it possible to respond to load fluctuations.**
- **Smaller motor size**

Heat Resistant Cylinder (–10 to 150°C) -XB6 Made to Order Heat resistant

- Air cylinder which changed the seal material and grease so that it could be used even at higher temperature up to 150 from –10°C.

Applicable Series

Series	Description	Model	Action	Note
CJP2	Pin cylinder	CJP2	Double acting single rod	Except clevis and trunnion style
CJ2	Air cylinder	CJ2	Double acting single rod	Except with air cushion
		CJ2W	Double acting double rod	Except with air cushion
CM2	Air cylinder	CM2	Double acting single rod	
		CM2W	Double acting double rod	
	Non-rotating rod	CM2K	Double acting single rod	
		CM2KW	Double acting double rod	
	Direct mount	CM2R	Double acting single rod	
	Non-rotating rod/Direct mount	CM2RK	Double acting single rod	
	End lock cylinder	CBM2	Double acting single rod	
CG1	Air cylinder	CG1	Double acting single rod	Type with rubber bumper comes without a damper.
		CG1W	Double acting double rod	Type with rubber bumper comes without a damper.
	Direct mount	CG1R	Double acting single rod	Type with rubber bumper comes without a damper.
MB	Air cylinder	MB	Double acting single rod	Except without air cushion
		MBW	Double acting double rod	Except without air cushion
MB1	Air cylinder	MB1	Double acting single rod	Except without air cushion
		MB1W	Double acting double rod	Except without air cushion
CA2	Air cylinder	CA2	Double acting single rod	
		CA2W	Double acting double rod	
	End lock cylinder	CBA2	Double acting single rod	
CS1	Air cylinder	CS1□N	Double acting single rod	Applicable bore size (ø125 to ø200)
		CS1W□N	Double acting double rod	
CUJ	Mini free mount cylinder	CUJ	Double acting single rod	Except ø4
CU	Free mount cylinder	CU	Double acting single rod	
	Non-rotating rod	CUK	Double acting single rod	
	Long stroke	CU	Double acting single rod	
	Long stroke/Non-rotating rod	CUK	Double acting single rod	
CQS	Compact cylinder	CQS	Double acting single rod	Except with rubber bumper
		CQSW	Double acting double rod	Except with rubber bumper
CQ2	Compact cylinder	CQ2	Double acting single rod	Except with rubber bumper
		CQ2W	Double acting double rod	Except with rubber bumper
	Axial piping (Centralized piping)	CQP2	Double acting single rod	Except with rubber bumper
CG5	Stainless steel cylinder	CG5	Double acting single rod	Type with rubber bumper comes without a damper. (Grease is not intended for food products)
CY3	Magnetically coupled rodless cylinder	CY3B	Basic	
MK	Rotary clamp	MK	Double acting	
MGP	Compact guide cylinder	MGPM	Double acting	Except with air cushion, with end lock
MGQ		MGQ	Double acting	Except ø12 to ø25 MGQL (Ball bushing type)
MGG	Guide cylinder	MGG	Double acting	No shock absorber and rubber bumper are equipped.
MGC		MGC	Double acting	
CXSJ	Dual rod cylinder	CXSJ	Compact type	
CXS		CXS	Basic	

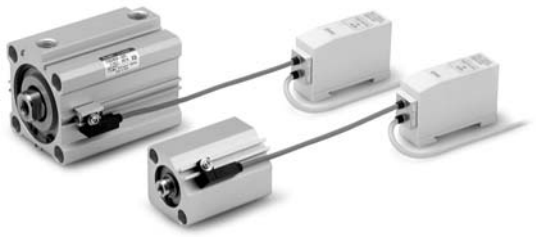
Note 1) Operate without lubrication from a pneumatic system lubricator.
Note 2) Please contact SMC for details on the maintenance intervals for this cylinder, which differ from those of the standard cylinder.
Note 3) In principle, it is impossible to make built-in magnet type and the one with auto switch. But, as for the one with auto switch, and the heat resistant cylinder with heat resistant auto switch, since it will be differed depending on the series, please contact SMC.
Note 4) Piston speed is ranged from 50 to 500 mm/s.
But, for the MGQ□80, 100 and MGP□80, 100, it will be 50 to 400 mm/s, 50 to 200 mm/s for the MK series. The CY3B series piston speed is 50 to 400 mm/s.
Note 5) Please contact SMC for the CQ2, CQS and MGQ series with rubber bumper.
Note 6) CY3B: Product specifications may differ depending on the temperature conditions, so refer to the catalog.

Cylinder with Heat Resistant Auto Switch *CDQ2-XB14* Made to Order Heat resistant

- Heat resistant compact cylinder CDQ2 series (ø16 to ø63) which can mount heat resistant solid state switch. (D-F7NJ½, Max. 150°C)

Applicable Series

Series	Description	Model	Action	Note
CQ2	Compact cylinder	CQ2	Double acting single rod	Applicable to ø16 to ø63 Except with rubber bumper



Heat Resistant Cylinder (–10 to 110°C) *-XC5* Made to Order Heat resistant

- Cylinder which changed the seal material for heat resistance (up to 110°C) in order to use under the severe ambient temperature condition which exceeds the standard specifications of –10 to 70°C (0 to 70°C for CS1 series).

Applicable Series

Series	Description	Model	Action
CM2	Air cylinder	CM2	Double acting single rod
		CM2W	Double acting double rod
	Direct mount	CM2R	Double acting single rod
MB	Air cylinder	MB	Double acting single rod
		MBW	Double acting double rod
MB1	Air cylinder	MB1	Double acting single rod
		MB1W	Double acting double rod
CA2	Air cylinder	CA2	Double acting single rod
		CA2W	Double acting double rod
CS1＊	Air cylinder	CS1	Double acting single rod
		CS1W	Double acting double rod

＊ CS1 series applicable bore size
Lube type: ø125 to ø300
Non-lube type: ø125 to ø200

Note 1) Please contact SMC for details on the maintenance intervals for this cylinder, which differ from those of the standard cylinder.
Note 2) Manufacturing built-in magnet type and the one with auto switch is impossible.
Note 3) Material of rod boot is heat resistant tarpaulin.

Heat Resistant Air Gripper (–10 to 100°C) -X4 Made to Order Heat resistant

- Seal material and grease have been changed, so that it could be used even at higher temperature up to 100 from –10°C.

Applicable Series

Series	Description	Model	Action	Note
MHC	Angular type	MHC2	Double acting, Single acting (Normally open)	
		MHCA2	Double acting, Single acting (Normally open)	Magnet is not built in.
		MHCM2	Single acting (Normally open)	Magnet is not built in.
MHF	Low profile	MHF2	Double acting	
MHK	Wedge cam operation glide guide	MHK2	Double acting, Single acting (Normally open, Normally closed)	
		MHKL2	Double acting, Single acting (Normally open, Normally closed)	
MHL	Wide opening	MHL2	Double acting	
MHS	2 finger	MHS2	Double acting	
	3 finger	MHS3	Double acting	
	3 finger with dust cover	MHSJ3	Double acting	
	With through hole	MHSH3	Double acting	
	With through hole and dust cover	MHSHJ3	Double acting	
	Long stroke 3 finger	MHSL3	Double acting	
	4 finger	MHS4	Double acting	
MHT	Toggle type	MHT2	Double acting	
MHW	180° angular type	MHW2	Double acting	
MHY	180° angular type cam style	MHY2	Double acting	
MHZ	Parallel type (Compact)	MHZA2	Double acting, Single acting (Normally open, Normally closed)	Magnet is not built in.
	Parallel type with dust cover (Compact)	MHZAJ2	Double acting, Single acting (Normally open, Normally closed)	Magnet is not built in.
	Parallel type	MHZ2	Double acting, Single acting (Normally open, Normally closed)	
	Parallel type (Long stroke)	MHZL2	Double acting, Single acting (Normally open, Normally closed)	
	Parallel type with dust cover	MHZJ2	Double acting, Single acting (Normally open, Normally closed)	

Note 1) Magnet is built in, but when using an auto switch, the acceptable temperature range becomes –10 to 60°C.
Note 2) With the product number for the dust cover option, only fluoropolymer (F) or silicon rubber (S) options may be selected.
Note 3) With the product number compatible with body options, only E-type or M-type are compatible.
Note 4) For lubrication, specialized grease GR-F is recommended.

Antistatic Air Cylinder CM2-X1051 Made to Order Static electricity

- Removing the film covering the contacting foot brackets (anodization) causes the cylinder to become conductive from the piston rod end to the foot brackets.

How to Order

CM2 L 40 – 150 – X1051

Mounting

I	Axial foot
F	Rod end flange
G	Head end flange
C	Single clevis
D	Double clevis
T	Head end trunnion

Bore size

20	20 mm
25	25 mm
32	32 mm
40	40 mm

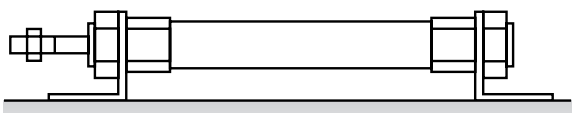
Cylinder stroke (mm)

Bore size	Stroke
20	25, 50, 75, 100, 125, 150
25	25, 50, 75, 100, 125, 150
32	25, 50, 75, 100, 125 150, 200
40	25, 50, 75, 100, 125 150, 200, 250

Conductive cylinder

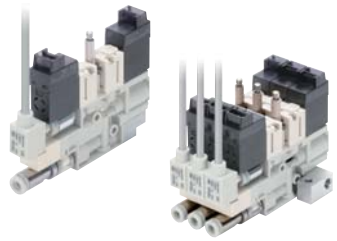
It is possible to eliminate static electricity from the mounting brackets without moving the ground wire attached to the flexible part.

Surface resistance value: 10^{-1} Ω or less



Compact Vacuum Ejector *Series ZA*

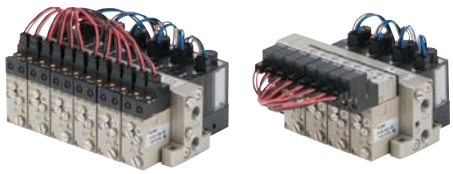
Low vacuum



Series	Features
ZA	● Total width: 9.9 mm, Total length: 72.9 mm, Total height: 52.5 mm, Mass: 50 g ● Can be installed on moving parts ● Improved response through shortening of the length of the tube to the pad ● Adaptable for manifold application

Vacuum Unit *Series ZX*

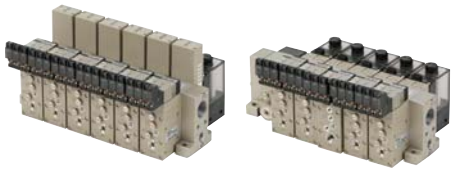
Low vacuum



Series	Features
ZX	● Necessary functions can be combined through a modular design. ● Ideal for electronic parts or small precision parts weighing up to 100 g ● Compatible with ejector systems and the vacuum pump systems ● Adaptable for manifold application

Large Vacuum Unit *Series ZR*

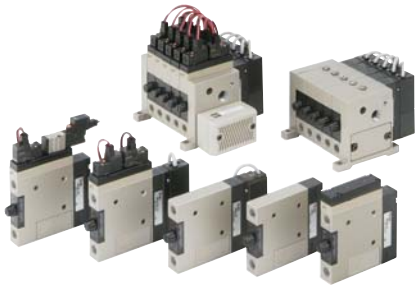
Low vacuum



Series	Features
ZR	● Necessary functions can be combined through a modular design. ● Double solenoids provide a selfholding function ● Adaptable for manifold application ● Functions such as a digital vacuum switch or a solenoid valve can be selected. ● Compatible with ejector systems and the vacuum pump systems

Vacuum Ejector *Series ZM*

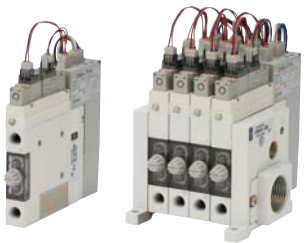
Low vacuum



Series	Features
ZM	● Valves and switches are unitized. ● Adaptable for manifold application ● Maximum absorption flow rate is increased by 40%. ● Maximum vacuum pressure –84 kPa

Vacuum Ejector with Solid State Timer *Series ZMA*

Low vacuum



Series	Features
ZMA	● Electronic timer is implemented to control vacuum release valve. ● Enables common power supply for switch and valve as well as serial transmission of vacuum signals. ● Integrated easy to set time ● Adaptable for manifold application

Vacuum/Release Unit *Series* VQD1000-V

Low vacuum

Direct operated poppet seal

Model	Features
VQD1000-V	● Applicable to 0603 chip ● Response speed: 13 msec (at time of 500 mm*)/18.5 msec (at time of 1000 mm*) ● Smooth workpiece removal, with no overshoot ● No need for timing adjustment of switchback between vacuum and positive pressure ● No need for throttle circuit of release air

Compact Vacuum Ejector/Pump System *Series* ZQ

Low vacuum

Series	Features
ZQ	● Width: 10 mm, Mass: 109 g (single unit, with vacuum pressure switch and suction filter) ● Digital vacuum pressure switch ● With LED display function ● Adaptable for a manifold application

Vacuum Ejector *Series* ZH

Low vacuum

Series	Features
ZH	● Nozzle diameters: ø0.5, ø0.7, ø1.0, ø1.3, ø1.5, ø1.8, ø2.0 ● Composite formed resin nozzle and body ● Available in series of 2 types: Box type (built-in silencer), and Body ported type

Vacuum Ejector/In-line Type *Series* ZU

Low vacuum

Series	Features
ZU	● Vacuum port and supply port are located collinearly to facilitate piping. ● A lightweight construction is achieved through the use of the resin body. ● Nozzle diameter ø0.5: 6.5 g ø0.7: 7.0 g ● Built-in one-touch fittings (copper-free countermeasures taken)

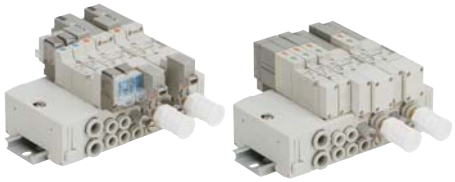
Multi-stage Ejector *Series* ZL

Low vacuum

Series	Features
ZL	● Suction flow rate increased by a 3 stage diffuser construction ● Functions such as a digital vacuum switch or a vacuum pressure gauge can be selected.

Ejector Valve Unit *Series ZYY/ZYX*

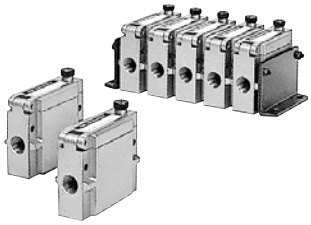
Low vacuum



Series	Features
ZYY ZYX	● Ejector valve unit suitable for vacuum adsorption system ● Can be combined with valve for cylinder drive.

Air Suction Filter *Series ZFA*

Low vacuum



Series	Features
ZFA	● Prevents problems related to vacuum circuits or airborne contaminants. ● Provides a large filter element surface.

Air Suction Filter with One-touch Fittings *Series ZFB*

Low vacuum

Series	Features
ZFB	● Prevents problems related to vacuum circuits or airborne contaminants. ● Vacuum tubes can be connected and removed by a one-touch operation.

Air Suction Filter with One-touch Fittings/In-line Type *Series ZFC*

Low vacuum

Series	Features
ZFC	● IN/OUT straight piping ● One-touch fittings for easy installation and remove ● Lightweight molded resin parts ● Cartridge type allows element replacement.

Vacuum Pad *Series ZP*

Heat resistant | Low vacuum | Static electricity

Series	Features
ZP	● A variety of models accommodate a wide range of applications. ● Pad shapes: Flat, Flat with ribs, Thin flat, Thin flat with ribs, Deep, and Bellows shape ● Pad diameters: ø2 to ø50

Vacuum Pad/Large/Heavy Duty Type *Series ZPT/ZPX*

Low vacuum

Series	Features
ZPT ZPX	● Ideal for heavy or large workpieces such as CRT tubes and automobile bodies ● Pad diameter: ø40 to ø125

Vacuum Pad/Large Bellows Pad *Series ZPT/ZPX*

Low vacuum

Series	Features
ZPT ZPX	● Ideal for workpieces with a curved picking surface, heavy mass, or large size ● Pad diameter: ø40 to ø125

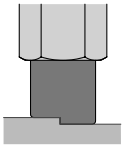
Vacuum Pad/Ball Joint Type *Series ZPT/ZPR*

Low vacuum

Series	Features
ZPT ZPR	● Ball joint type ideal for adsorption on slanted work surfaces ● Pad diameter: ø10 to ø50

Sponge Pad *Series ZP2*

Low vacuum Static electricity

Series	Features
ZP2	● Conductive silicon and conductive CR sponge are adopted. ● Applicable to uneven work surface such as electric substrate ● Rubber is used for the adapter end surface to reduce impact when contacting the workpiece.  (Image)

Clean Gas Filter *Series SF*

Clean blow | Heat resistant


SFA


SFB


SFB300


SFC

Type	Series	Operating pressure	Filtration	Temperature (°C)
Cartridge type disc	SFA100/200/300	Max. 0.99 MPa (Vacuum: 1.3 x 10^{-6} kPa)	0.01 µm (Filtration efficiency 99.99%)	5 to 80
Cartridge type straight	SFB100	Max. 0.99 MPa (Vacuum: 1.3 x 10^{-6} kPa)		
Features	● Cartridge type allows element replacement.			

Type	Series	Operating pressure	Filtration	Temperature (°C)
Disposable type straight	SFB300	Max. 0.99 MPa (Vacuum: 1.3 x 10^{-6} kPa)	0.01 µm (Filtration efficiency 99.99%)	5 to 120
Disposable type multiple disc	SFC100	Max. 0.99 MPa (Vacuum: 1.3 x 10^{-6} kPa)		
Features	● Compact disposable type for semiconductor industry			

Clean Air Filter/Hollow Fiber Element *Series SFD*

Clean blow


SFD100


SFD200

Series	Type	Operating pressure	Filtration
SFD100	Disposable type (Irreplaceable element)	Max. 1.0 MPa	0.01 µm (Filtration efficiency 99.99%)
SFD200	Cartridge type (Replaceable element)		
Features	● Built-in hollow fiber element ● Pressure drop: 0.03 MPa (Inlet pressure 0.7 MPa, Max. flow rate) ● Conforms to RoHS reduction of environmentally detrimental chemicals.		

∗ High flow (4000 ℓ) type can also be made to order.

Clean Air Module *Series LLB*

Clean blow


LLB4


LLB3

Series	Fluid	Set pressure	Flow range (ℓ/min (ANR))
LLB3	Clean air N_2 gas Note)	0.05 to 0.4 MPa	5 to 100
LLB4			50 to 500
Features	● Clean equipment modularized (Reduction of piping labor/Space-saving) Clean air is easily available. ● Nominal filtration rating: 0.01 µm (Filtration efficiency 99.99%) ● Wetted parts: Grease-free, Silicon-free ● Assembled in a clean room, shipped and packed in a duplicate package ● 24 combinations available		

Note) Inlet air conditions ISO 8573-1 Quality grade: Equivalent to 1.4.1 to 1.6.1

∗ High flow (3000 ℓ, 8000 ℓ) type can also be made to order. Filter is not adaptable to module.

Grease-free Regulator *AR-X2400* Made to Order

Grease-free

Series	Port size	Set pressure (MPa)
AR20 to 60	1/8, 1/4, 3/8, 1/2, 3/4, 1	0.05 to 0.85
Features	● Grease-free	

Note) Refer to page 43 for pressure gauge.

Regulator for High Temperature Environments *AR-X440* Made to Order

Heat resistant

Series	Port size	Set pressure (MPa)	Ambient temperature (°C)
AR25 to 60	1/4, 3/8, 1/2, 3/4, 1	0.05 to 0.85	–5 to 80

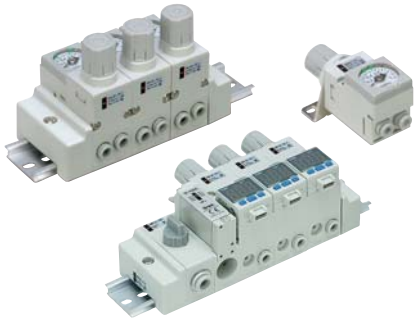
Filter Regulator for High Temperature Environments *AW-X440* Made to Order

Heat resistant

Series	Port size	Set pressure (MPa)	Ambient temperature (°C)
AW30 to 60	1/4, 3/8, 1/2, 3/4, 1	0.05 to 0.85	–5 to 80

Compact Manifold Regulator *Series ARM10/11 (-3, -5, -6, -7 type)*

Grease-free



Series		Type	Applicable tubing bore size		Set pressure (MPa)
			Metric size	Inch size	
ARM11A	Manifold specifications	Common air supply	ø4 to ø10	ø5/32 to ø3/8	0.05 to 0.7
ARM11B		Individual air supply	ø4, ø6	ø5/32, ø1/4	
ARM10	Single unit specifications	Standard	ø4, ø6	ø5/32, ø1/4	
ARM10F		Knob front face	ø4, ø6	ø5/32, ø1/4	
Features	● Free selection in response to positioning conditions ● Knob positions: Top/Front/Bottom ● Piping directions: Up/Down ● One-touch fitting varieties: Straight/Elbow ● Varieties and sizes of one-touch fittings can be changed. ● Standard model equipped with back flow function ● Compatible with digital pressure switch				

Grease-free Precision Regulator *IR-X1* Made to Order

Grease-free

Series	Port size	Set pressure (MPa)
IR1000	1/8	0.005 to 0.2 0.01 to 0.4 0.01 to 0.8
IR2000	1/4	
IR3000	1/4, 3/8, 1/2	0.01 to 0.2 0.01 to 0.4 0.01 to 0.8
Features	● Grease-free ● Tension control ● Contact pressure control ● Sensitivity setting: within 0.2% F.S. ● Repeatability ±: within 0.5% F.S.	

Precision Regulator for High Temperature Environments *IR-T* Made to Order

Heat resistant

Series	Port size	Set pressure (MPa)	Ambient temperature (°C)
IR1000	1/8	0.005 to 0.2 0.01 to 0.4 0.01 to 0.8	–5 to 100 Maximum 80°C when equipped with pressure gauge
IR2000	1/4		
IR3000	1/4, 3/8, 1/2	0.01 to 0.2 0.01 to 0.4 0.01 to 0.8	
Features	● Tension control ● Contact pressure control ● Setting sensitivity: within 0.2% F.S. ● Repeatability ±: within 0.5% F.S.		

Clean Regulator *Series* SRH

Clean room | Clean blow

Series	Relief mechanism	Port size	Set pressure (MPa)
SRH	Non-relief	Rc1/8, 1/4, 3/8, 1/2 9/16-18UNF, 7/8-14UNF	Low pressure type: 0.02 to 0.2 High pressure type: 0.05 to 0.7
	Relief	Rc1/8, 1/4, 3/8, 1/2	
Features	● Contamination controlled stainless steel regulator ● Oil-free ● Two types of diaphragm materials: PTFE, Fluoropolymer		

Note) Refer to page 43 for pressure gauge.

Precision Clean Regulator *Series* SRP

Clean room | Clean blow

Series	Port size	Set pressure (MPa)
SRP	M5, 1/8	Low pressure type: 0.005 to 0.2 High pressure type: 0.01 to 0.4
Features	● High precision low flow consumption stainless steel regulator ● Bleed air flow 0.5 ℓ/min (ANR) or less (0.2 MPa at outlet pressure) ● Setting sensitivity: 0.3% F.S. ● Repeatability: 1% F.S.	

Note) Refer to page 43 for pressure gauge.

Clean Regulator/Fluoropolymer Type *Series* SRF

Clean room | Clean blow | High purity | Fluoropolymer

Series		Applicable tubing O.D.		Set pressure (MPa)
		Metric size	Inch size	
SRF	Integrated with fitting	ø4 to ø19	ø1/8 to ø3/4	0.02 to 0.4
	With nut	Fitting size: 2 to 6		
	Tube extension	—	Tubing O.D. ø1/4 to ø3/4	
Features	● Wetted parts Body: New PFA Diaphragm: PTFE ● Recommended maximum flow rate: 20 ℓ/min (SRF50) (0.3 MPa at inlet pressure, fluidization)			

Oil-free/External Parts Copper-free Pressure Gauge *Series G46E*

Series	Size (O.D.)	Connecting thread
G46E	ø42.5	R1/8, 1/4
Features	● Oil-free, external parts copper-free ● With limit indicator	

Pressure Gauge for Clean Regulator *Series G46-□-□-SR A, B*

Series	Size (O.D.)	Connecting thread
G46-□-□-SR A, B	ø42.5	R1/8, 1/4
Features	● For clean regulators ● With limit indicator	

Grease-free Miniature One-touch Fittings *KJ-X17, X39, X94* Made to Order Grease-free

For ø2 tubing

Series	Applicable tubing O.D.	Connecting thread
KJ	ø2, ø3.2, ø4, ø6	M3, M5, 1/8
Features	● One-touch connection ● Vacuum from –100 kPa applicable ● Compact (20% miniaturization compared to the KQ series) ● With sealant as standard ● Copper-free (Electroless nickel plated)	

Symbol	Specifications/Contents
X17	Grease-free Rubber material: NBR (With fluoro coated) Color of release button: Light blue
X39	Grease-free Rubber material: NBR (With fluoro coated) Color of release button: Light blue Clean specifications (Copper-free, Air blowing, Duplicate package)
X94	Grease-free Rubber material: FKM (With fluoro coated) Color of release button: Light blue

Grease-free One-touch Fittings *KQ2-X17, X29, X39, X94* Made to Order Grease-free

Series	Applicable tubing O.D.	Connecting thread
KQ2	ø3.2, ø4, ø6, ø8, ø10, ø12, ø16	M5 x 0.8, M6 x 1.0 1/8, 1/4, 3/8, 1/2
Features	● One-touch connection ● Vacuum from –100 kPa applicable	

Symbol	Specifications/Contents
X17	Grease-free Rubber material: NBR (With fluoro coated) Color of release button: Light blue
X29	Grease-free Rubber material: NBR (With fluoro coated) Color of release button: Light blue Copper-free (Electroless nickel plated)
X39	Grease-free Rubber material: NBR (With fluoro coated) Color of release button: Light blue Clean specifications (Copper-free, Air blowing, Duplicate Package, Resin body: White)
X94	Grease-free Rubber material: FKM (With fluoro coated) Color of release button: Light blue

Brass One-touch Fittings *Series KQB* Grease-free Heat resistant

Series	Applicable tubing O.D.	Connecting thread
KQB	ø4, ø6, ø8, ø10, ø12	M5, 1/8, 1/4, 3/8, 1/2
Features	● Material Body: Brass (C3604, C3771), Release button: Stainless steel 304 Seal: Special FKM ● Fluid temperature: –5 to 150°C ● Grease-free	

Insert Fittings *Series KF* Grease-free

Resin sleeve

Brass sleeve

Series	Applicable tubing O.D.	Connecting thread
KF	ø4, ø6, ø8, ø10, ø12	1/8, 1/4, 3/8, 1/2
Features	● Vacuum 1.3 x 10^{-2} kPa applicable ● Piping can be done without removing nut. ● Fluid temperature: –5 to 150°C (Brass sleeve) –5 to 60°C (Resin sleeve) ● Steam can be used. (Brass sleeve) ● Grease-free	

Miniature Fittings *Series M*

Static electricity

For ø2 tubing

Series	Applicable tubing O.D.	Connecting thread
M-□□-2	ø2	M3, M5
M	ø3.2, ø4, ø6	M3, M5, 1/8
Features	● Compact and non-tool connection ● Compact piping space ● Hose nipple, Hose elbow, Barb	

Antistatic One-touch Fittings *Series KA*

Static electricity

Series	Applicable tubing O.D.	Connecting thread
KA	ø3.2, ø4, ø6, ø8, ø10, ø12	M5 M6, standard UNI thread 1/8, 1/4, 3/8, 1/2
Features	● Surface resistance: 10^4 Ω to 10^7 Ω ● For preventing static electricity ● Body: Conductive resin used for seal parts ● Copper-free (Electroless nickel plated) ● UNI thread	

Stainless Steel 316 One-touch Fittings *Series KQG*

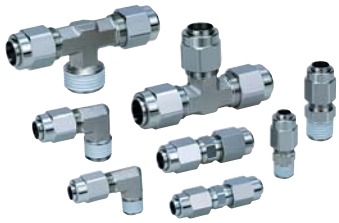
Grease-free Heat resistant Water resistant

Applicable tubing: Metric size

Series	Applicable tubing O.D.	Connecting thread
KQG	ø4, ø6, ø8, ø10, ø12	M5, 1/8, 1/4, 3/8, 1/2
Features	● Material • Metal parts: Stainless steel 316 Seal parts: Special FKM ● Fluid temperature: –5 to 150°C ● Steam can be used. ● Grease-free	

Stainless Steel 316 Insert Fittings *Series KFG*

Grease-free Heat resistant Water resistant



Series	Applicable tubing O.D.	Connecting thread
KFG	ø4, ø6, ø8, ø10, ø12	1/8, 1/4, 3/8, 1/2
Features	● Material: Stainless steel 316 ● Fluid temperature: –5 to 150°C ● Steam can be used. ● Grease-free	

Miniature Fittings/Stainless Steel 316 *Series MS*

Water resistant Static electricity

Series	Applicable tubing O.D.	Connecting thread
MS	ø3.2, ø4, ø6	M5
Features	● Possible to use in corrosive conditions ● Compact piping space ● Hose nipple, Hose elbow, Barb	

S Coupler/Stainless Steel Type *Series* KKA

Grease-free | Heat resistant

Series	Connecting thread
KKA	1/8, 1/4, 3/8, 1/2, 3/4, 1, 1¼, 1½
Features	● Body material: Stainless steel 304 ● Seal material: Fluoropolymer (Special FKM) is employed. ● Grease-free ● Check valve built in to both plug and socket ● Operating temperature: –5 to 150°C

Clean One-touch Fittings (for Blowing) *Series* KP

Clean blow

Series	Applicable tubing O.D.	Connecting thread
KP	ø4, ø6, ø8, ø10, ø12	1/8, 1/4, 3/8, 1/2
Features	● One-touch fittings for clean room blowing systems ● Seal material: EPDM ● Completely oil-free (Fluoro coated rubber portions) ● Wetted parts are non-metallic. ● Parts washed and assembled in a clean room, packed in a duplicate package. ● Can be used in a vacuum (–100 kPa).	

Clean One-touch Fittings for Driving Air Piping *Series* KPQ/KPG

Clean room

KPQ

KPG

Series	Applicable tubing O.D.	Connecting thread
KPQ KPG	ø4, ø6, ø8, ø10, ø12	M5, 1/8, 1/4, 3/8, 1/2
Features	● One-touch fittings suitable for drive air systems in clean room environments ● Resin parts: Polypropylene ● All metal portions: Brass (Electroless nickel plated) KPQ Stainless steel (Stainless steel 304) KPG	

Fluoropolymer Fittings Hyper Fitting *Series* LQ1

Clean room | Heat resistant | High purity | Fluoropolymer

Insert bushing type

Series	Maximum operating pressure	Operating temperature
LQ1	1.0 MPa	0 to 200°C

Fluoropolymer Fittings Hyper Fitting Series LQ3

Clean room | Heat resistant | High purity | Fluoropolymer

Flare type

Series	Maximum operating pressure	Operating temperature
LQ3	1.0 MPa	Nut material PVDF: 0 to 150°C Nut material PFA: 0 to 200°C

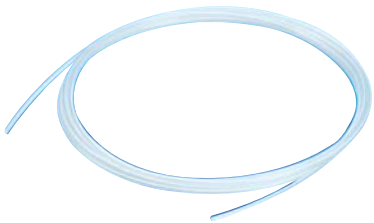
Antistatic Tubing Series TA□

Static electricity

Series	Tubing O.D.	Colors
	Metric size	
TA□	ø3.2, ø4, ø6, ø8, ø10, ø12	Black
Features	● Antistatic ● For the TAU series, colored tubes can also be made to order (White, Blue, Black, Green, Transparent). (-X100 series)	

Fluoropolymer Tubing Series TL/TIL

Clean room | Heat resistant | High purity | Fluoropolymer



Series	Tubing O.D.		Colors
	Metric size	Inch size	
TL/TIL	ø4,ø6,ø8,ø10 ø12,ø19	ø1/8",ø3/16",ø1/4" ø3/8",ø1/2",ø3/4",ø1"	Translucent
Features	● Maximum operating temperature: 260°C (This can vary according to operating pressure.)		

FEP Tubing (Fluoropolymer) Series TH/TIH

Clean room | Heat resistant | High purity | Fluoropolymer

Series	Tubing O.D.		Colors
	Metric size	Inch size	
TH/TIH	ø4, ø6, ø8, ø10, ø12	ø1/8", ø3/16", ø1/4" ø3/8", ø1/2", ø3/4"	Translucent, Black, Red, Blue
Features	● Food Sanitation Law compliant ● FDA (United States Food & Drug Administration) *177-1550 dissolution testing compliant ● Maximum operating temperature: 200°C (This can vary according to operating pressure.)		

Soft Fluoropolymer Tubing *Series TD/TID*

Clean room | Heat resistant | High purity | Fluoropolymer

Series	Tubing O.D.		Colors
	Metric size	Inch size	
TD/TID	ø4, ø6, ø8, ø10, ø12	ø1/8", ø3/16", ø1/4" ø3/8", ø1/2"	Translucent
Features	● Food Sanitation Law compliant ● FDA (United States Food & Drug Administration) *177-1550 dissolution testing compliant ● Maximum operating temperature: 260°C (This can vary according to operating pressure.)		

Polyolefin Tubing *Series TPH*

Clean room | Clean blow

Series	Applicable tubing O.D.	Colors
TPH	ø4, ø6, ø8, ø10, ø12	Black, White, Red, Blue, Yellow, Green
Features	● ø4, ø6: 1.0 MPa ø8, ø10, ø12: 0.7 MPa (at 20°C)	

Soft Polyolefin Tubing *Series TPS*

Clean room | Clean blow

Series	Applicable tubing O.D.	Colors
TPS	ø4, ø6, ø8, ø10, ø12	Black, White, Red, Blue, Yellow, Green
Features	● ø4 to ø12: 0.7 MPa (at 20°C)	

Grease-free + Restrictor *AS-X21*

Made to Order | Grease-free

Elbow type

Universal type

Type	Series	Port size in the cylinder side	Applicable tubing O.D.		Applicable cylinder bore size
			Metric size	Inch size	
Elbow	AS12□1F-X21 to 42□1F-X21	M3 to 1/2	ø2* to ø12	ø1/8 to ø1/2	ø2.5 to ø100
Universal	AS13□1F-X21 to 43□1F-X21				

* Applicable tubing O.D. ø2 is for elbow type only.

Grease-free + Restrictor *AS-X21*

Made to Order | Grease-free

Type	Series	Port size in the cylinder side	Applicable tubing O.D.	
			Metric size	Inch size
In-line	AS1001F-X21 to 4001F-X21	—	ø2 to ø12	ø1/8 to ø1/2

Grease-free + Restrictor *AS-X21*

Made to Order

Grease-free

Type	Series	Applicable tubing O.D.		Applicable cylinder bore size
		Metric size	Inch size	
Panel mount	AS□□□1F-3-X21	ø3.2 to ø12	ø1/8 to ø1/2	ø6 to ø100
Features	● Panel mounting plate thickness: Maximum 35 mm			

Speed Controller for High Temperature *Series AS-H*

Heat resistant

Type	Series	Port size in the cylinder size	Applicable cylinder bore size
In-line	AS2000-H to AS5000-H	1/8 to 1/2	ø20 to ø100
Features	● Operating temperature: –5 to 80°C		

Clean Speed Controller with One-touch Fitting *Series AS-FPQ/FPG*

Clean room

AS-FPQ

AS-FPG

Series	Port size	Applicable tubing O.D.	Applicable cylinder bore size
AS-FPQ AS-FPG	M5 x 0.8, R1/8, 1/4, 3/8, 1/2	ø4 to ø12	ø6 to ø100
Features	● Low particle generation type speed controller suitable for use in clean rooms. AS-FPQ: Brass (Electroless nickel plated) AS-FPG: Stainless steel 304 ● Resin parts: Polypropylene		

Speed Controller for Low Speed Control *Series AS-FM/AS-M*

Low speed/Low friction

Type		Series	Port size in the cylinder size	Applicable tubing O.D.		Applicable cylinder bore size
				Metric size	Inch size	
With one-touch fitting	Elbow/Universal	AS1□□1FM to AS2□□1FM	M5 to 1/4	ø3.2 to ø10	ø1/8 to ø3/8	ø6 to ø40
	In-line					
	Dual speed controller	ASD230FM to ASD430FM				
Standard (Metal body)		AS12□0M to AS22□0M				
Features	● Ideal for low-speed control (from 10 to 50 mm/sec) ● Number of needle rotations: 10 turns (20 in the case of M5 type)					

Antistatic Speed Controller *AS-X260* (In-line/Elbow)

Made to Order

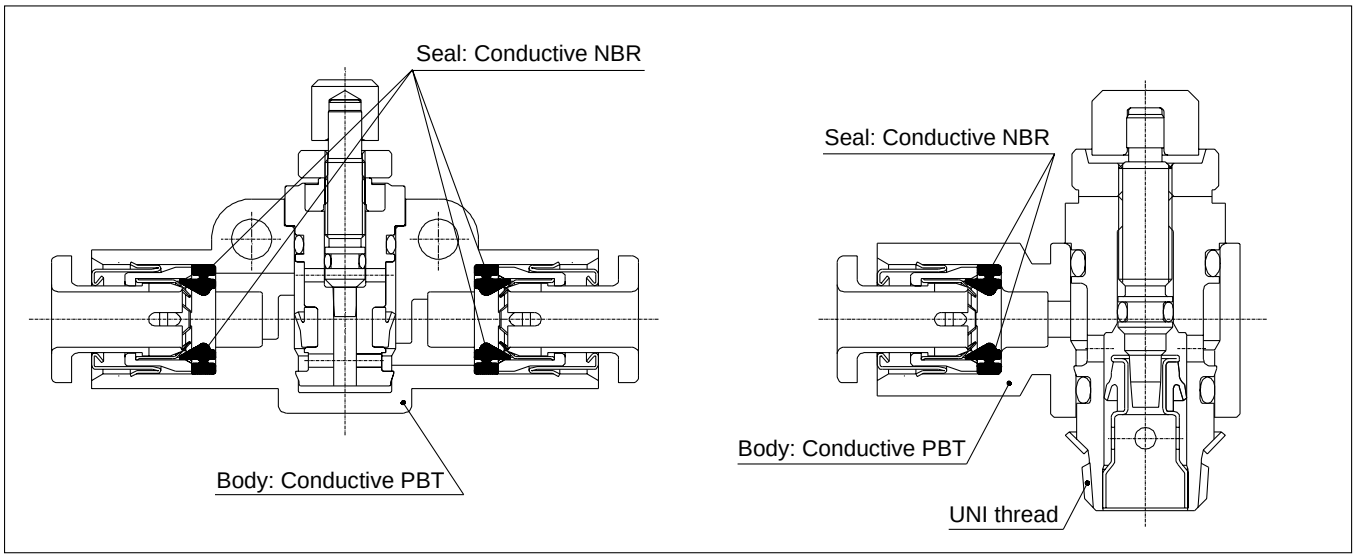
Static electricity

Electrostatic prevention measures for semiconductor manufacturing devices, etc.

It is possible to prevent products from being electro-statically charged by applying conductive materials (using conductive NBR seal) and grounding UNI thread structure*1) (Gasket seal method).

⚠ *1 Ensure that the female thread connected to the speed controller is grounded.
If not grounded, there is a possibility that the controller and tube may remain charged.
Antistatic tubes should also be used.

Feature 1: Surface Resistance 10^4 to 10^7 Ω (Conductive material is applied to the body seal of the controller.)



Feature 2: Antistatic UNI Thread Structure (Gasket seal method)

(AS22□1F-□-□-X260 type)

Grounding Method

When UNI thread screws are used metal contact occurs between female and male threads and the controller does not become electrostatically charged. (With taper threaded screws it is necessary to apply a sealant to the thread, which electrically insulates the controller causing it to become charged.)

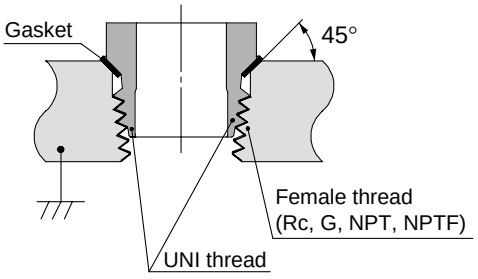


Figure: UNI thread ridge profile

⚠ **Caution** (Chamfer the female thread.)

Specifications

Common Specifications

Type	Elbow	In-line
Model	AS□2□1F-□-□-X260	AS□000F-□-X260
Fluid	Air	
Proof pressure	1.5 MPa	1 MPa
Max. operating pressure	1 MPa	0.7 MPa
Min. operating pressure	0.1 MPa	
Ambient and fluid temperature	–5 to 60°C (No freezing)	
Number of needle rotations	10 rotations*2	8 rotations
Applicable tubing material	Antistatic soft nylon tubing (Series TAS) Antistatic polyurethane tubing (Series TAU)	
Surface resistance	10^4 to 10^7 Ω	

*2 8 rotations for AS12□1F-M5-04-X260 and AS12□1F-M5-06-X260

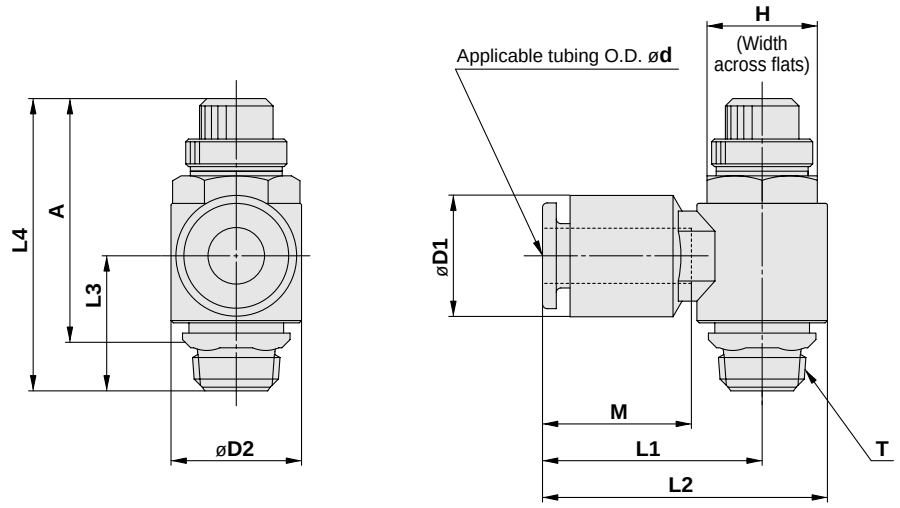
Series Variation

Type	Model		Port size	Applicable tubing O.D.				Applicable cylinder bore size (mm)
	Meter-out	Meter-in		4	6	8	10	
Elbow	AS1201F-M5	AS1211F-M5	M5 x 0.8	●	●			6, 10, 16, 20
	AS2201F-U01	AS2211F-U01	Uni1/8	●	●	●	●	20, 25, 32
	AS2201F-U02	AS2211F-U02	Uni1/4	●	●	●	●	20, 25, 32, 40
In-line	AS1000F		—	●	●			6, 10, 16, 20

*3 Contact SMC for models other than the above.
*4 Manufactured upon receipt of order.

Dimensions

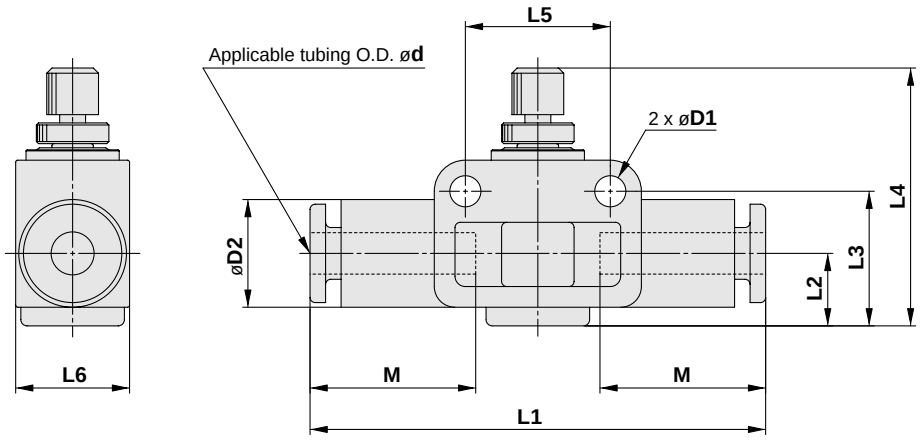
Elbow type



Model		Applicable tubing O.D. ød	T	H	D1	D2	L1	L2	L3	L4		A*		M
Meter-out	Meter-in									Max.	Min.	Max.	Min.	
AS1201F-M5-04-X260	**AS1211F-M5-04-X260**	**4**	M5	8	10.4	9.6	20.6	25.4	12.2	28.8	26	25.2	22.4	15.8
AS1201F-M5-06-X260	**AS1211F-M5-06-X260**	**6**			12.8		21.6	26.4						16.8
AS2201F-U01-04-X260	**AS2211F-U01-04-X260**	**4**	Uni1/8	12	11.4	14.2	23.1	30.2	14.3	36.4	31.4	31	26	15.8
AS2201F-U01-06-X260	**AS2211F-U01-06-X260**	**6**			13.2		23.9	31						16.8
AS2201F-U01-08-X260	**AS2211F-U01-08-X260**	**8**			15.2		25.3	32.4						18.7
AS2201F-U01-10-X260	**AS2211F-U01-10-X260**	**10**			18.5		32.1	39.2	16.1					20.8
AS2201F-U02-04-X260	**AS2211F-U02-04-X260**	**4**	Uni1/4	17	10.4	18.5	25.2	34.4	17.2	39.6	34.6	33	28	15.8
AS2201F-U02-06-X260	**AS2211F-U02-06-X260**	**6**			12.8									16.8
AS2201F-U02-08-X260	**AS2211F-U02-08-X260**	**8**			15.2		27.2	36.4						18.7
AS2201F-U02-10-X260	**AS2211F-U02-10-X260**	**10**			18.5		35.3	44.5	17.8					20.8

* Reference thread dimensions after installation

In-line type



Model	Applicable tubing O.D. ød	D1	D2	L1	L2	L3	L4		L5	L6	M
							Max.	Min.			
AS1000F-04-X260	**4**	3.2	10.4	44	7	13	25	28	14	11	15.8
AS1000F-06-X260	**6**		12.8	46		13.5					16.8

For the safe use of the controller, be sure to read “Safety Precautions” in our company’s Best Pneumatics General Catalog before handling.

Exhaust Cleaner for Clean Room *Series* AMP

Clean room

Series	Maximum flow capacity (ℓ/min (ANR))	Port size
AMP	200 to 1000	1/4, 3/8, 1/2, 3/4
Features	● An exhaust cleaner that can be used inside a clean room	

2-Color Display High-Precision Digital Pressure Switch *Series* ZSE/ISE30A

Grease-free | Water resistant (IP65) | Sensors

Series	Type	Rated pressure range
ZSE30AF	Compound pressure	–100.0 to 100.0 kPa
ZSE30A	Low pressure/Vacuum	0.0 to –101.0 kPa
ISE30A	Positive pressure	0.100 to 1.000 MPa
Features	● With one-touch fitting (Straight, Elbow) ● Space-saving, capable of vertical and horizontal contact mounting ● With display calibration function ● Up to 10 units can copy at once.	

High-Precision Digital Pressure Switch *Series* ZSE/ISE40

Water resistant (IP65) | Sensors

Series	Type	Rated pressure range
ZSE40F	Compound pressure	–100.0 to 100.0 kPa
ZSE40	Low pressure/Vacuum	–101.3 to 0.0 kPa
ISE40	Positive pressure	0.000 to 1.000 MPa
Features	● IP65 ● With one-touch fitting ● With auto-shift function	

2-Color Display Digital Pressure Switch *Series* ISE70/75(H)

Water resistant (IP67) | Sensors

Series	Type	Rated pressure range
ISE70	Positive pressure (For air)	0 to 1 MPa
ISE75	Positive pressure (For general purpose fluids)	0 to 10 MPa
ISE75H	Positive pressure (For general purpose fluids)	0 to 15 MPa
Features	● Metal body type (Aluminum die-casted) ● IP67 ● With M12 connector	

2-Color Display Digital Pressure Switch
Series ZSE/ISE80

Grease-free | Water resistant (IP65) | Sensors

Series	Type	Rated pressure range
ZSE80F	Compound pressure	–100.0 to 100.0 kPa
ZSE80	Vacuum pressure	–101.0 to 0.0 kPa
ISE80	Positive pressure	–0.100 to 1.000 MPa
ISE80H	Positive pressure	–0.100 to 2.000 MPa
Features	● Suitable for a wide variety of fluids with stainless diaphragm ● IP65 ● RoHS compatible ● Low leakage. VCR®, Swagelok® compatible fittings can be selected. ● With one-touch fitting (Straight, Elbow) ● Back piping, underside piping	

High-Precision Digital Pressure Switch for General Fluids
Series ZSE/ISE50/60

Grease-free | Water resistant (IP65) | Sensors

Series	Type	Rated pressure range
ZSE50F/60F	Compound pressure	–100.0 to 100.0 kPa
ISE50/60	Positive pressure	0.000 to 1.000 MPa
Features	● Suitable for a wide variety of fluids with stainless diaphragm ● IP65 ● Low leakage. VCR®, Swagelok® compatible fittings can be selected.	

Compact Pneumatic Pressure Sensor *Series* PSE53□

Sensors

Series	Type	Rated pressure range
PSE531	Vacuum pressure	–101 to 0 kPa
PSE533	Compound pressure	–101 to 101 kPa
PSE532	Positive pressure	0 to 101 kPa
PSE530	Positive pressure	0 to 1 MPa
Features	● Connector ● Analog output (voltage)	

Compact Pneumatic Pressure Sensor *Series* PSE54□

Sensors

Series	Type	Rated pressure range
PSE541	Vacuum pressure	–101 to 0 kPa
PSE543	Compound pressure	–100 to 100 kPa
PSE540	Positive pressure	0 to 1 MPa
Features	● Analog output (voltage)	

Low Differential Pressure Sensor *Series* PSE55□

Sensors

Series	Type	Rated differential pressure range
PSE550	Vacuum pressure	0 to 2 kPa
Features	● Suitable for applications such as air current volume maintenance, filter blockage, and liquid surface detection ● Analog output (voltage/current)	

Pressure Sensor for General Fluids *Series* PSE56□

Grease-free | Water resistant (IP65) | Sensors

Series	Type	Rated pressure range
PSE561	Vacuum pressure	–101 to 0 kPa
PSE563	Compound pressure	–100 to 100 kPa
PSE564	Positive pressure	0 to 500 kPa
PSE560	Positive pressure	0 to 1 MPa
Features	● Wetted parts: Stainless steel 316L ● IP65 ● Suitable for a wide variety of fluids ● Analog output (voltage/current) ● Low leakage. VCR®, Swagelok® compatible fittings can be selected.	

Multi-Channel Digital Pressure Sensor Controller *Series* PSE200

Sensors

Series	Set pressure range
PSE200	–101 to 101 kPa
	–101 to 10 kPa
	–10 to 101 kPa
	–0.1 to 1 MPa
Features	● Four sensors can be connected. ● Applicable sensors: PSE53□, 54□, 56□ ● Capable of controlling various different applications from one controller ● 4 inputs, 5 outputs

2-Color Display Digital Pressure Sensor Controller *Series* PSE300

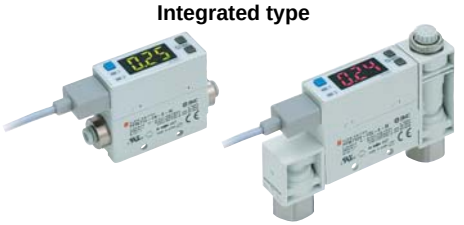
Sensors

Series	Set pressure range
PSE300	–101 to 101 kPa
	–101 to 10 kPa
	–10 to 100 kPa
	–0.1 to 1 MPa
	–50 to 500 kPa
	–0.2 to 2 kPa
Features	● Applicable sensors: PSE53□, 54□, 56□ ● Compatible with voltage input and current input ● Response time: 1 ms ● Space-saving, capable of vertical and horizontal contact mounting ● Panel mounting, Bracket mounting, DIN rail mounting

2-Color Display Digital Flow Switch *Series PFM*

Grease-free | Sensors

Integrated type



Monitor

Sensor

Separate type

Series	Set flow range (ℓ/min)
PFM	0.2 to 10 (0.2 to 5)
	0.5 to 25 (0.5 to 12.5)
	1 to 50 (1 to 25)
	2 to 100 (2 to 50) ( ): For CO_2
Features	● Air, N_2, Ar, CO_2 ● Grease-free ● Integrated flow adjustment valve ● Compact, Lightweight, Space-saving

Flow Sensor *Series PFMV*

Grease-free | Sensors

Monitor

Sensor

Separate type

Series	Set flow range (ℓ/min)
PFMV	0 to 0.5
	0 to 1
	0 to 3
	–0.5 to 0.5
	–1 to 1
	–3 to 3
Features	● Adsorption confirmation of minute workpieces ● Repeatability: ± 2% F.S. or less ● Response speed: 5 ms or less, withstand pressure: 500 kPa ● Grease-free, RoHS compatible ● Covers total range with one voltage monitor

Digital Flow Switch for Air *Series PF2A*

Grease-free | Water resistant (IP65) | Sensors

Integrated type

Monitor

Sensor

Separate type

Series	Set flow range (ℓ/min)
PF2A	1 to 10
	5 to 50
	10 to 100
	20 to 200
	50 to 500
	150 to 3000
	300 to 6000
	600 to 12000
Features	● Integrated type and separate monitor type are available. ● Switch output, accumulated pulse output, analog output ● Capable of switching back and forth between cumulative and instantaneous flow ● IP65 ● Grease-free (except 3000, 6000, 12000 ℓ types)

Digital Flow Switch for Water
Series PF2W

Grease-free | Heat resistant | Water resistant (IP65) | Sensors

Integrated type

Monitor Sensor

Separate type

Series	Set flow range (ℓ/min)
PF2W	0.5 to 4
	2 to 16
	5 to 40
	10 to 100
Features	● Integrated type and Separate monitor type are available. ● Switch output, Accumulated pulse output, Analog output ● Capable of switching back and forth between cumulative and instantaneous flow ● Capable of operating at temperatures as high as 90°C (PF2W□T) ● IP65

Digital Flow Switch for Deionized Water and Chemicals *Series* PF2D

Clean room | Grease-free | Water resistant (IP65) | Fluoropolymer | Sensors

Monitor Sensor

Separate type

Series	Set flow range (ℓ/min)
PF2D	0.4 to 4
	1.8 to 20
	4.0 to 40
Features	● Body sensor: New PFA, Tube: Super PFA ● Low-particle generation, Excellent flow-through characteristics ● IP65

4-Channel Flow Monitor *Series* PF2□200

Sensors

For air

For water

For pure water/chemicals

Series	Applicable sensor		Set flow range (ℓ/min)
PF2A200/201	For air	PF2A5	0.5 to 10.5
			2.5 to 52.5
			5 to 105
			10 to 210
			25 to 525
PF2W200/201	For water	PF2W5	0.35 to 4.50
			1.7 to 17.0
			3.5 to 45.0
			7 to 110
PF2D200/201	For pure water/ chemicals	PF2D5	0.25 to 4.50
			1.3 to 21.0
			2.5 to 45.0
Features	● One controller can handle four units' worth of flow volume maintenance. ● Four different flow ranges can be connected to one controller.		

Ionizer *Series IZS31*

Static electricity

Series	Ion generation method	Ion balance
IZS31	Corona discharge type	±30 V or less (±100 V in the case of stainless steel electrode needle)
Features	● Discharge time: 0.3 sec. ● The choice of 3 types of the sensors are available. • High-speed discharge (0.3 seconds) using feedback sensor • Ion balance control by an autobalance sensor High-precision type: Accurately controls the ion balance at the workpiece position. Main body mounted type: Can function mounted directly on the ionizer by detecting current returning to ground ● A suitable electrode cartridge can be selected depending on the application. • Rapid elimination of static electricity type places emphasis on discharging speed • Low maintenance type for improvement of the maintenance cycle	

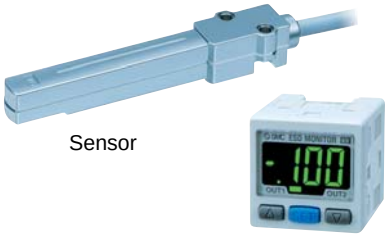
Ionizer/Nozzle Type *Series IZN10*

Static electricity

Series	Nozzle configuration	Ion generation method	Ion balance
IZN10	Energy saving discharging nozzle	Corona discharge type	±10 V or less
	High flow nozzle		±15 V or less
Features	● Compact 16 mm thickness ● Stain-detection on an electrode needle ● No need for connection to high-voltage power cables or external high-voltage power supply with built-in power supply base plate		

Electrostatic Sensor *Series IZD10/IZE11*

Static electricity



Sensor

Monitor

Series	Measurement potential	Output voltage	Effective detection distance
IZD10-110	±0.4 kV (At detection distance 25 mm)	1 to 5 V (Output impedance: Approx. 100 Ω)	10 to 50 mm
IZD10-510	±20 kV (At detection distance 50 mm)		25 to 75 mm

Series	Rated measurement range	Minimum unit setting	Output
IZE11	–0.4 kV to +0.4 kV –20 kV to +20 kV	0.001 kV (at ±0.4 kV) 0.1 kV (at ±20 kV)	Switch output x 2 + Analog output (1 to 5 V, 4 to 20 mA)
Features	● Detects electrostatic potential of the workpiece, and is capable of switch output, analog output or output of current.		

Handheld Electrostatic Meter *Series IZH10*

Static electricity

Series	Rated charge amount range	Minimum display unit
IZH10	±20.0 kV	0.1 kV (±1.0 to ±20.0 kV) 0.01 kV (0 to ±0.99 kV)
Features	● Easy-to-use handheld electrostatic meter	

Oil-free Direct Operated 2 Port Solenoid Valve for Air *VCA-X15* Made to Order Grease-free

Series	Actuation	Port size	Orifice dia. (mmø)
VCA20/30/40	N.C.	1/4 (8A) to 3/4 (20A)	3 to 10

Oil-free Pilot Operated 2 Port Solenoid Valve for Dry Air *VQ-X2* Made to Order Grease-free

Series	Actuation	Port size	Orifice dia. (mmø)
VQ20	N.C.	ø6 to ø12	3.4
VQ30			4.8

Compact Direct Operated 2/3 Port Solenoid Valve for Chemicals *Series LVM* Grease-free

Series	Valve structure	Actuation	Orifice dia. (mmø)
LVM09/090	Diaphragm type Directly operated poppet (Locker type)	N.C. N.O. Universal	1.1
LVM11	Diaphragm type Directly operated poppet	N.C.	1.5
LVM10/100	Diaphragm type Directly operated poppet (Locker type)	N.C. N.O. Universal	1.4
LVM15/150			1.6
LVM20/200			2
Features	● Wetted parts: Body/plate: PEEK Diaphragm: EPDM, FKM, Kalrez® can be selected. ● Life expectancy: 10 million times or more (under test conditions used by SMC) ● Can be used with: Air, Water, Pure water, Diluted fluids, Cleaning fluids		

Air Operated Chemical Valve/Integral Fitting *Series LVC* Clean room Heat resistant High purity Fluoropolymer

Series		Actuation	Applicable tubing O.D.	Orifice dia. (mmø)
Integral fitting	LVC	N.C./N.O./ Double acting	Metric: 3 to 25 Inch: 1/8 to 1	4 to 22
Features	● Body material: New PFA ● Same configuration N.C./N.O./double-acting ● Able to handle fluid temperatures up to 100°C ● Fluid temperature range: 0 to 100°C			

Air Operated Chemical Valve/Threaded Type
Series LVA

Clean room | Clean blow | Heat resistant | High purity | Fluoropolymer

Series		Actuation	Port size	Orifice dia. (mmø)
Threaded type	LVA	N.C./N.O./ Double acting	1/8 to 1	2 to 22
Features	● Body material: New PFA/Stainless steel/PPS ● Diaphragm material: PTFE, EPR, NBR can be selected. ● Fluid temperature range: 0 to 100°C			

Chemical Valve/Manual Type (Integral Fitting/ Threaded Type) Series LVH

Clean room | High purity | Fluoropolymer

Series		Actuation	Port size (Applicable tubing O.D.)	Orifice dia. (mmø)
Manual type (Integral fitting/ Threaded type)	LVH	N.C.	1/8 to 1/2 (Metric size: ø3 to ø12 Inch size: 1/8 to 1/2)	4 to 12
Features	● Body material: New PFA/Stainless steel/PPS ● Compatible with locking and non-locking types			

Air Operated Chemical Valve/Compact Type
Series LVD

Clean room | Heat resistant | High purity | Fluoropolymer

Series		Actuation	Applicable tubing O.D. Note)		Orifice dia. (mmø)
			Metric size	Inch size	
Integral fitting	LVD	N.C./N.O./ Double acting	3 to 19	1/8 to 3/4	2 to 16
Tube extension			6 to 19	1/4 to 3/4	
Features	● Lineup of compact and space-saving types Up to 29% reduction in dimensions on piping side ● Body material: New PFA ● Diaphragm material: PTFE ● Actuator material: PPS ● Fluid temperature range: 0 to 100°C				

Note) Tubing O.D. for tube extension type.

Air Operated Chemical Valve/Non-Metallic Exterior
Series LVQ

Clean room | Heat resistant | High purity | Fluoropolymer

Series		Actuation	Applicable tubing O.D.		Orifice dia. (mmø)
			Metric size	Inch size	
Integral fitting	LVQ	N.C./N.O./ Double acting	3 to 25	1/8 to 1	4 to 22
Space-saving type			Fitting size: 2 to 6		
Tube extension			6 to 25 Note)	1/4 to 1 Note)	
Features	● No screws, all-in-one integrated design ● Non-metallic structure with no metal screws used to fasten the actuator portion and body portion ● Body material: New PFA ● Diaphragm material: PTFE ● Actuator material: PVDF ● Fluid temperature range: 0 to 100°C				

Note) Tubing size

Air Operated Valve for Vinyl Chloride Piping
Series LVP

Clean room | High purity | Fluoropolymer

Model	Applicable vinyl chloride piping size	Orifice dia. (mmø)	Actuation	Option
LVP5□	O.D.: ø22 (Nominal size 16A)	16	N.C./N.O./ Double acting	With flow adjustment
LVP6□	O.D.: ø26 (Nominal size 20A)	22		
	O.D.: ø32 (Nominal size 25A)			
Features	● Compatible with vinyl chloride piping: Union type ● Body material: CPVC, Diaphragm material: PTFE			

Fluoropolymer Needle Valve Series LVN

Clean room | Heat resistant | High purity | Fluoropolymer

Series	Applicable tubing O.D.		Flow adjustment range (ℓ/min)	Orifice dia. (mmø)
	Metric size	Inch size		
LVN	4 to 12	1/8 to 1/2	0 to 12	4.4 to 10
Features	● Material: New PFA ● Fitting integrated, all-in-one structure • Hyper fitting/LQ2 series used ● Triple seal structure ● Fluid temperature range: 5 to 90°C			

Non-Metallic Pump/Double Acting Pump
Series PAF

Clean room | Heat resistant | High purity | Fluoropolymer

PAF5000

PAF3000

Series	Model	Driving mechanism	Discharge rate (ℓ/min)	Wetted material
PAF3000	PAF3410	Automatically operated type	1 to 20	New PFA (Fluoropolymer)
	PAF3413	Air operated type	1 to 15	
PAF5000	PAF5410	Automatically operated type	5 to 45	
	PAF5413	Air operated type	5 to 38	
Features	● Fluid temperature range: 0 to 90°C			

Refrigerated Thermo-cooler *Series* HRG

Temperature control

Economy type chiler (Three-phase power supply)

Series	Set temperature range	Cooling capacity	Temperature stability	Cooling method	Circulating liquid
HRG	5 to 35°C	1 to 15 kW	±1.0°C/ ±0.5°C	Air-cooled refrigeration/ Water-cooled refrigeration	Clean water, Pure water, Ethylene glycol aqueous solution
Features	● Air-cooled models provide cooling water wherever needed thanks to easy mounting and easy operation. ● Proven performance with a wide range of applications such as lasers/ analysis equipment/LCD manufacturing equipment/mold temperature regulators, etc.				

Refrigerated Thermo-cooler *Series* HRGC

Temperature control

Economy type chiler (Single phase power supply)

Series	Set temperature range	Cooling capacity	Temperature stability	Cooling method	Circulating liquid
HRGC	5 to 35°C	1 to 5 kW	±1.0°C/ ±0.5°C	Air-cooled refrigeration Water-cooled refrigeration	Clean water, Pure water, Ethylene glycol aqueous solution
Features	● Air-cooled models provide cooling water wherever needed thanks to easy mounting and easy operation. ● Proven performance with a wide range of applications such as mold temperature regulators/lasers/analysis equipment/LCD manufacturing equipment, etc. ● Ideal for overseas models (single-phase 200 to 230 V) ● Conforms to UL specifications, CE marking.				

Refrigerated Thermo-chiller *Series* HRZ

Temperature control

High-performance chiller

Series	Set temperature range	Cooling capacity	Temperature stability	Cooling method	Circulating liquid
HRZ	–20 to 40°C 20 to 90°C –20 to 90°C	1 to 15 kW	±0.1°C	Water-cooled refrigeration	Fluorinated liquid, Clean water, Pure water, Ethylene glycol aqueous solution
Features	● Proven performance with semiconductor process equipment, with a wide range of features such as high temperature stability, wide temperature range, failure testing, external signal. ● All models conform to safety standards. ● Conforms to UL and SEMI specifications, CE marking.				

Refrigerated Thermo-chiller *Series* HRZ

Temperature control

High-performance chiller (Built-in inverter)

Series	Set temperature range	Cooling capacity	Temperature stability	Cooling method	Circulating liquid
HRZ	–20 to 90°C	1.8 to 10 kW	±0.1°C	Water-cooled refrigeration	Fluorinated liquid, Clean water, Pure water, Ethylene glycol aqueous solution
Features	● In addition to the state-of-the-art functions of the HRZ series, these models employ a DC inverter compressor to achieve better energy efficiency. ● Wide temperature range and cooling capacity range covered by one unit ● Suited to the short innovation cycle of semiconductor equipment, and capable of responding flexibly to changes in the process conditions. ● Conforms to UL and SEMI specifications, CE marking.				

Water-cooled Thermo-chiller *Series* HRW

Temperature control

High-performance chiller (Water-cooled type)

Series	Set temperature range	Cooling capacity	Temperature stability	Cooling method	Circulating liquid
HRW	20 to 90°C	2 to 30 kW	±0.3°C	Water-cooled refrigeration	Fluorinated liquid, Clean water, Pure water, Ethylene glycol aqueous solution

Features

- Direct heat exchanger for water circulated within a plant
- For temperature regulation within the temperature range where no freezer is needed
- Proven performance with semiconductor process equipment, with a wide range of features such as high temperature stability, wide temperature range, failure testing, external signal.
- Conforms to UL and SEMI specifications, CE marking.
- Inverter type as standard

Peltier-Type Thermo-con *Series* HEC

Temperature control

High-performance chiller

Series	Set temperature range	Cooling capacity	Temperature stability	Cooling method	Circulating liquid
HEC	10 to 60°C	230 W	±0.03°C	Peltier-type air cooled	Clean water
		600 to 1200 W	±0.03°C	Peltier-type water cooled	Clean water, Fluorinated aqueous liquid

Features

- For applications requiring high-precision temperature control
- High-precision, refrigerant-free temperature control equipment employing Peltier elements
- Simple structure and high reliability
- Can easily be built into equipments with compact and low-vibration design
- Compatible with wide range of power supply voltages
- Conforms to UL specifications, CE marking.

Peltier-Type Thermoelectric Bath *Series* HEB

Temperature control

High-precision constant-temperature bath

Series	Set temperature range	Cooling capacity	Temperature stability	Cooling method	Circulating liquid
HEB	–15 to 60°C	140 W	±0.1°C	Peltier-type water cooled	Clean water, Fluorinated aqueous liquid

Features

- High-precision temperature-regulation thermostatic chamber that employs Peltier elements
- Compact and low vibration
- Unique agitation method keeps up-down temperature distribution to a minimum.

Peltier-Type Chemical Thermo-con *Series* HED

Temperature control

Fluoropolymer temperature control equipment for chemicals

Series	Set temperature range	Cooling capacity	Temperature stability	Cooling method	Circulating liquid
HED	10 to 60°C	300 to 750 W	±0.1°C	Peltier-type water cooled	Pure water, Chemicals

Features

- Heat exchanger employs Peltier elements for direct temperature control of chemicals
- Fluoropolymer heat exchanger is suitable for a wide range of chemicals.
- Conforms to UL specifications, CE marking.

Aluminum High Vacuum Angle Valve
Series XL

Clean room | Heat resistant | Gas resistant | High vacuum

Series	Actuation	Shaft seal system	Valve type	Material	Flange size
XLA	Air operated	Bellows seal	Single acting (N.C.)	Body: Aluminum alloy Bellows: Stainless steel 316L	16 to 80
XLAV (With solenoid valve)					
XLC			Double acting		
XLCV (With solenoid valve)					
XLF		O-ring seal	Single acting (N.C.)	Body: Aluminum alloy	16 to 160
XLFV (With solenoid valve)					
XLG			Double acting		16 to 80
XLGV (With solenoid valve)					
XLD		Bellows/ O-ring seal	Single acting (N.C.)	Body: Aluminum alloy Bellows: Stainless steel 316L	25 to 80
XLDV (With solenoid valve)					
XLH	Manual	Bellows seal	Manual	Body: Aluminum alloy Bellows: Stainless steel 316L	16 to 50
XLS	Electro-magnetic	Pressure balanced bellow seal	Single acting (N.C.)		16, 25
Features	● Strong against fluorine ● Minimal gas emissions ● Minimal heavy metal contamination ● Suitable for high temperatures: 5 to 150°C ● Improved resistance to corrosion by chlorine gas due to oxalic acid anodized treatment				

Aluminum One-touch Connection and Release High Vacuum Angle Valve *Series XLAQ/XLDQ*

Clean room | Heat resistant | Gas resistant | High vacuum

Series	Actuation	Shaft seal system	Valve type	Material	Flange size
XLAQ	Air operated	Bellows seal	Single acting (N.C.)	Body: Aluminum Bellows: Stainless steel 316L	16 to 50
XLDQ		Bellows seal O-ring seal			40, 50
Features	● One-touch connection and release (no tool) ● Suitable for high temperatures: 5 to 150°C ● Improved resistance to corrosion by chlorine gas due to oxalic acid anodized treatment				

Stainless Steel High Vacuum Angle/In-line Valve *Series XM/XY*

Clean room | Heat resistant | High vacuum

Series		Actuation	Shaft seal system	Valve type	Material	Flange size
Angle	In-line					
XMA	XYA	Air operated	Bellows seal	Single acting (N.C.)	Body: SCS13 (equivalent to stainless steel 304) Bellows: Stainless steel 316L	Note) 16 to 80
XMC	XYC			Double acting		
XMD	XYD		Bellows/ O-ring seal	Single acting (N.C.)	Body: SCS13 (equivalent to stainless steel 304) Bellows: Stainless steel 316L	25 to 80
XMH	XYH	Manual	Bellows seal	Manual	Body: SCS13 (equivalent to stainless steel 304) Bellows: Stainless steel 316L	Note) 16 to 50
Features		● All-in-one integrated structure with high-precision casting, no gas buildup ● Mounting interchangeable with Aluminum High Vacuum Angle Valve XL series (XM series) ● High temperature type: 5 to 150°C				

Note) Size 16 is not available for In-line type.

High Vacuum Straight Solenoid Valve *Series XSA*

Clean room | Clean blow | High vacuum

Series	Valve type	Fluid	Piping	Port size
XSA	Normally closed direct operated 2 port solenoid valve	Gas that will not corrode stainless steel (equivalent to Stainless steel 405)	VCR®/SWJ (Swagelok)®	1/4B, 3/8B
Features	● Reduced dust generation due to no metallic sliding parts			

Smooth Vent Valve *Series XVD*

Clean room | High vacuum

Series	Valve type	Fluid	Piping	Port size
XVD	Normally closed (Open when pressured, Spring seal)	Nitrogen, Air, Inert gas, etc.	VCR® Swagelok®	1/4B
Features	● With the valve and needle valve all in one unit, takes up 1/4 the space of conventional models ● Major reduction in particles through the use of a metal diaphragm in the sheet portion ● The flow rate of both initial air supply and main air supply can be adjusted.			

Slit Valve *Series XGT*

Clean room | Gas resistant | High vacuum

Series	Operating pressure range (Pa)	Fluid	Gate size (Height x Width) (mm)	Operating pressure (MPa)
XGT	Atmospheric pressure to 1 x 10^{-6}	Inert gas type vacuum	32 x 222 46 x 236 50 x 336	0.45 to 0.6
Features	● Suitable for use as a block disk between the load lock chamber and transfer chamber, or the transfer chamber and process chamber, of semi-conductor equipment			

Door Valve *Series XGD*

Made to Order

Clean room High vacuum

Operating pressure range (Pa)	Fluid	Gate size (Height x Width) (mm)	Operating pressure (MPa)
Atmospheric pressure to 1 x 10^{-6}	Inert gas type vacuum	46 x 236 50 x 336	0.4 to 0.6

Rodless Cylinder for Vacuum *Series CYV*

Clean room High vacuum

Series	Operating environment pressure [Pa (ABS)]	Bore size (mm)
CYV	Atmosphere to 1.3 x 10^{-4}	15, 32
Features	● Air cylinder for vacuum transfer (1.3 x 10^{-4} Pa)	

Cyclone Pad

Made to Order

Grease-free | Non-contact transfer

● Prevents suction traces, scars or dirt on the workpiece surface

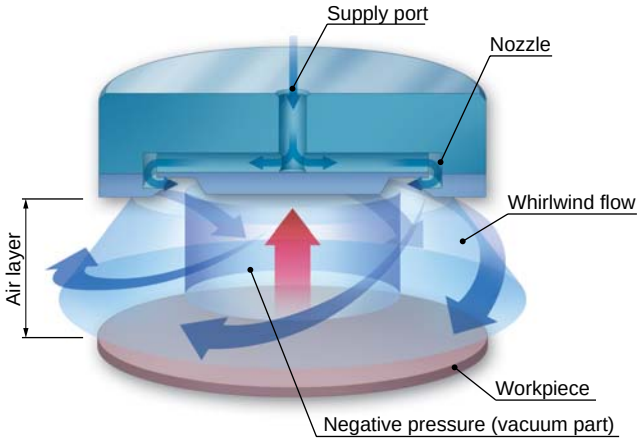
Workpiece with uneven and/or viscous surface

Solar battery cell

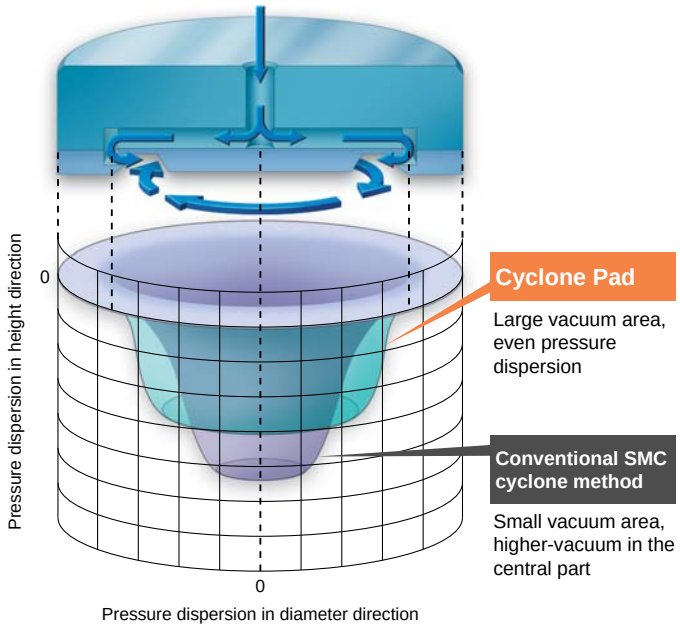
Non-contact transfer is possible.

Initial cost/running cost ▲34% down*

* Compared with other makers, with a workpiece mass of 12 kg (LCD mother glass G10) (Typ.)



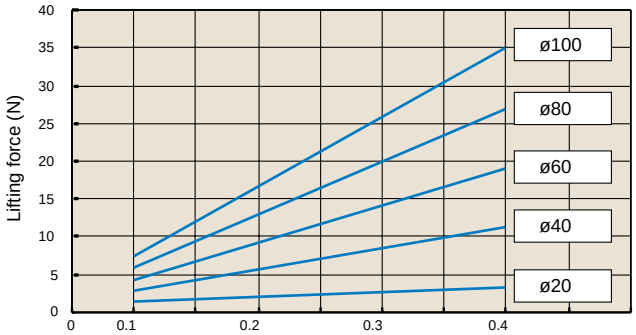
Provides larger suction area and more even pressure dispersion!



Working Principle

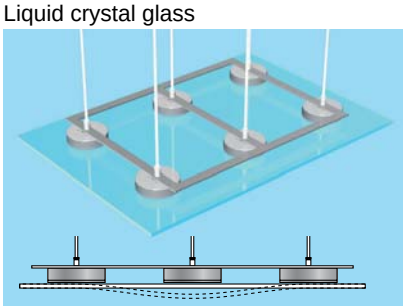
Air from the supply port is ejected from a nozzle on the cylindrical side to generate a whirlwind flow inside the cylinder and leading to the vacuum. (Cyclone effect.) Supply air is discharged to the atmosphere from between the suction surface and the workpiece. As a result, an air layer is generated between the cyclone pad and the workpiece, resulting in the workpiece being lifted without contact.

Lifting force — Supply pressure characteristic



Workpiece sensitive to scars or suction trace

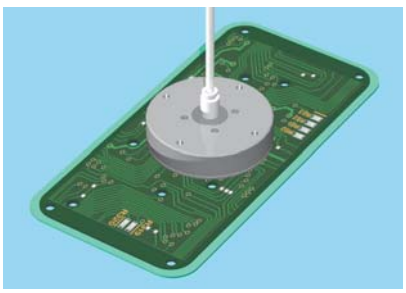
Liquid crystal glass



Prevents deflection

Thin workpiece

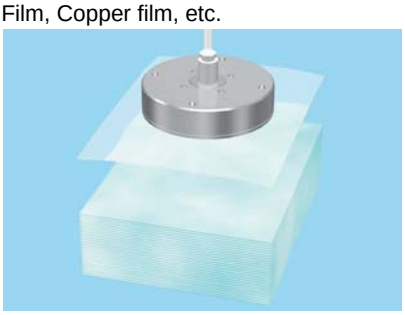
Substrate



Note) Open hole ratio within 1%

Thin workpiece

Film, Copper film, etc.



SMC

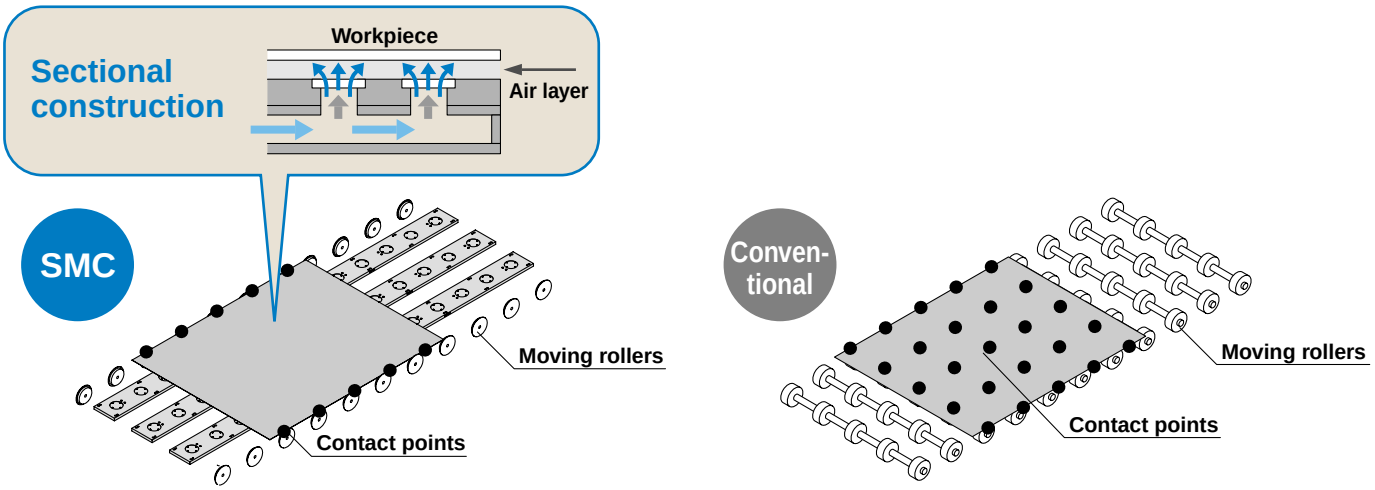
Air Levitation Rail Made to Order

Non-contact transfer

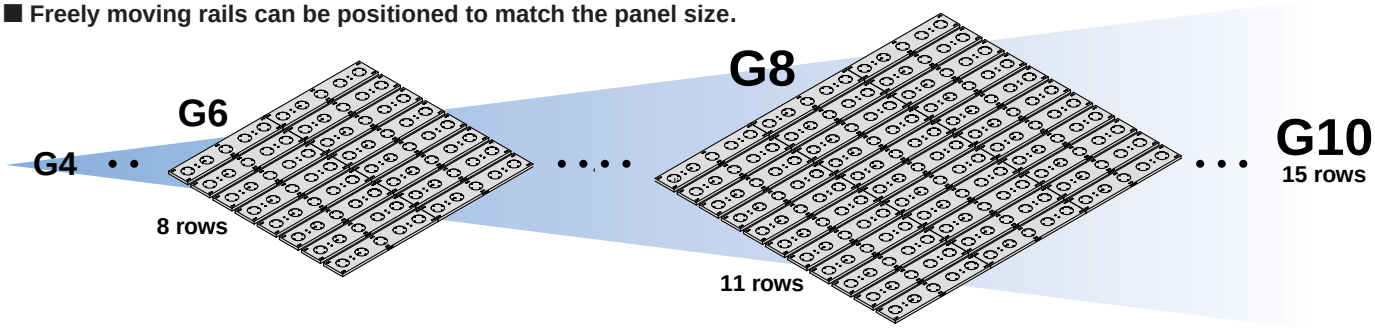
- Conforms to clean series **Class100**
- Elements changed to black color
- Free layout to match glass size
- Even air flow by a built-in air tank

For conveyance and alignment Made to Order

- Porous element (Stainless steel 316L) unitized
- Reduction in reflections through blackening treatment
- Levitation accuracy: ±50 μm or less



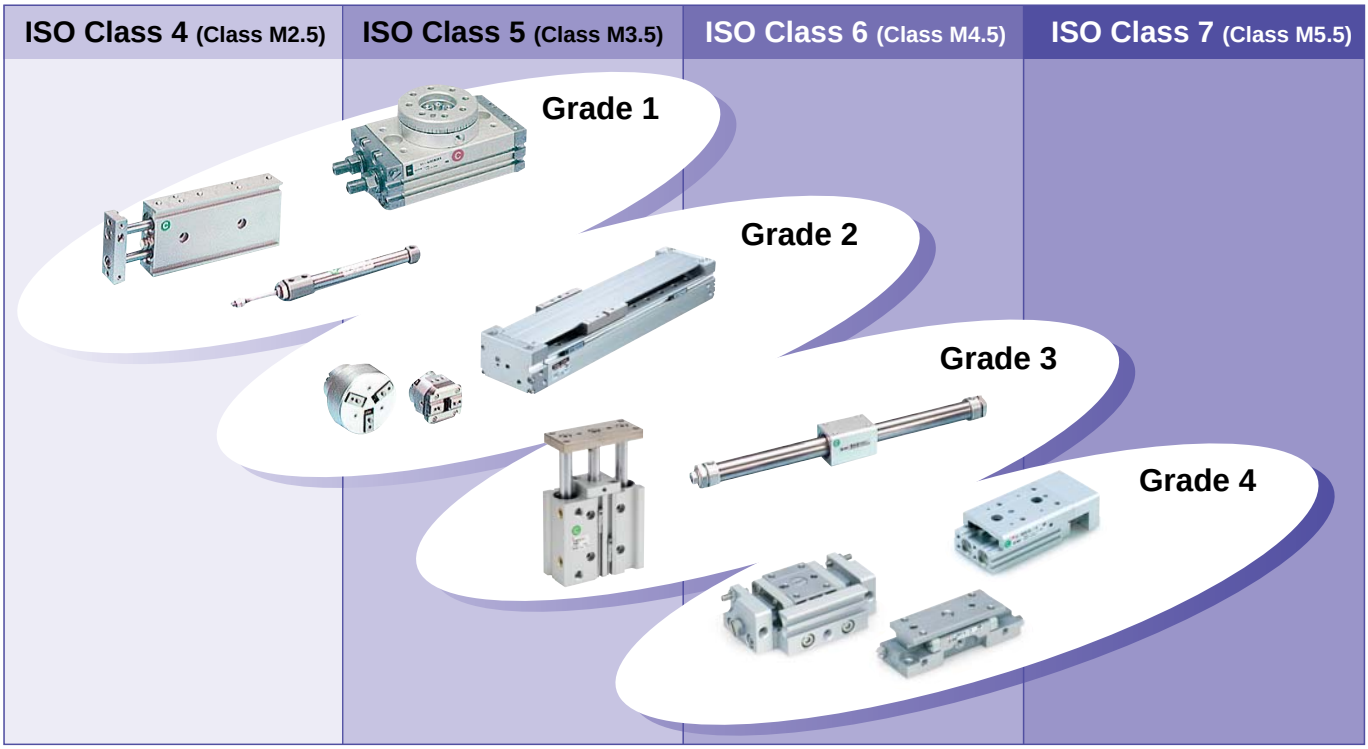
- Freely moving rails can be positioned to match the panel size.



Clean Series *10-/11-/12-/13- series*

Clean room Clean blow

SMC pneumatic equipment for clean room undergoes particle generation testing, and is divided into particle generation levels (Grade 1 to 4). Equipment can be selected based on the cleanliness class of the clean room.



The above table is a simulated image only. For details on the particle generation grade of each equipment, refer to pages 75 through to 84. Figures in parentheses indicate for reference the cleanliness grade according to Fed.Std.209E (abolished in Nov. 2001).

Clean Series *10-/11-/12-/13- series*

Suitable for a clean environment.
Prevents particle generation in a clean room.

Applicable equipment

Actuators (Cylinders, Rotary actuators, Air grippers), Directional control equipment, Flow control equipment, Filters, Pressure control equipment, Fittings/Tubings, Air preparation equipment, Pressure switches

Note) The 11-, 12-, and 13-series are only applicable to actuators.

Special Clean Series

Adheres to an even higher standard of cleanliness than the Clean Series.
The development of this line of products, from structure and materials to assembly environment, are all determined for clean environment use.

Applicable equipment

Clean rodless cylinders, Clean regulators, Clean one-touch fittings, Clean tubings, Clean gas filters, Clean air filters

Copper, Fluorine, Silicon-free, Low-particle Generation *21-/22- series*

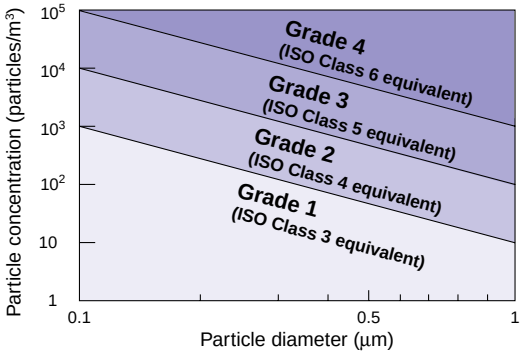
Suitable for environments where the presence of copper, fluorine or silicon materials is restricted.
Structures are identical to the Clean Series (Grease and packaging are different from the Clean Series.)

Applicable equipment

Actuators (Cylinders, Rotary actuators, Air grippers), Directional control valves, Flow control equipment, Pressure control equipment, Fittings

Note) The 22- series is only applicable to actuators.

Particle Generation Grade Classification



Cleanliness Grade (Reference)

SMC	Fed.Std.209E Note) SI unit	ISO 14644-1
Grade 1	M1.5	ISO Class 3
Grade 2	M2.5	ISO Class 4
Grade 3	M3.5	ISO Class 5
Grade 4	M4.5	ISO Class 6
—	M5.5	ISO Class 7
—	M6.5	ISO Class 8

Note) Fed.Std.209E was abolished in Nov. 2001, so these figures are for reference only.

Grading is based on SMC's original system of designation, with a lower grade number indicating a smaller volume of particle generation.
The information in parentheses indicates the upper limit of concentration for the cleanliness classes based on ISO 14644-1.

(Refer to page 85 "Particle Generation Measuring Method" and page 86 "Comparison of Cleanliness Standards".)

Note) In case of the one-touch fitting 10-KQ (that includes built-in one-touch fitting solenoid valve manifolds, and speed controllers with one-touch fittings), changes in internal pressure may cause the collet chuck to slide very slightly. This may result in particle generation, so please avoid using this item in Grade 1 or Grade 2 areas. However, there is no need for similar caution in the case of insert fittings (KF), miniature fittings (M/MS), clean one-touch fittings (KP/KPQ/KPG), or speed controllers with clean one-touch fittings (AS-FPQ/FPG).

Dust is kept from the clean room.

- **After inspection, the product is blown with high purity air (of ISO Class 5 equivalent clean bench) in a clean environment.**
- **Products are sealed and shipped in anti-static double bags.**

10-/11-/12-/13- (Clean Series)

Assembly and inspection in a standard workshop
↓
Clean room ISO Class 8 equivalent
Surface wiped with alcohol (to remove oil)
↓
Clean room ISO Class 8 equivalent
Clean booth ISO Class 5 equivalent
Interior packed after blowing surface with clean air (anti-static electricity measures)
↓
Clean room ISO Class 8 equivalent
Exterior packed (Double packing)
↓
Shipping

Assembled item in clean room (Special Clean Series)

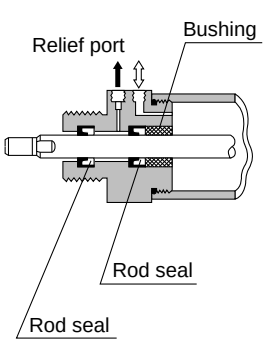
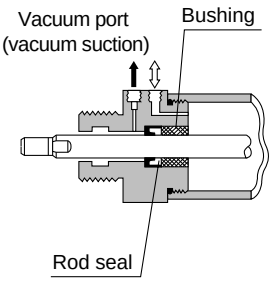
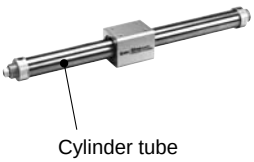
Clean booth ISO Class 5 equivalent

Clean bench ISO Class 5 equivalent in Clean room ISO Class 7 equivalent

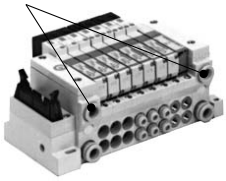
Parts washed
↓
Assembly/Inspection
↓
Double packing
↓
Shipping

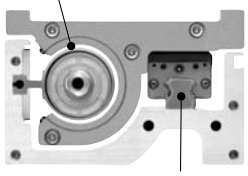
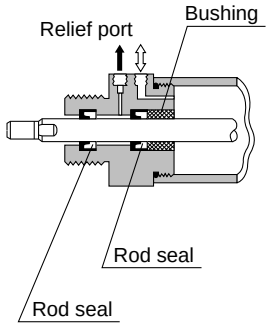
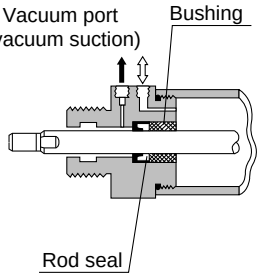
The **21- and 22-series** are given standard packaging (assembly, inspection, packing, and shipping carried out in a standard workshop.)
Contact SMC for clean packaging.

Basic Specifications of Actuators

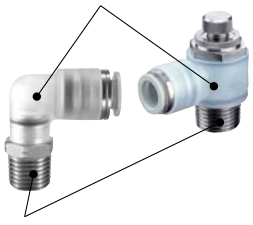
	10-series	11-series	12-series	
Construction	· Double seal type / release to atmosphere 	· Single seal type / vacuum suction 	· Guide cylinder · Dual rod cylinder Double seal type / release to atmosphere (10-series equivalent) and specially treated guide  Ball bushing guide Linear guide	· Rodless cylinder Specially treated cylinder tube exterior 
Restricted material	None			
Grease	Fluorine grease			
Assembly environment	General environment (assembly and inspection in a workshop)			
Packaging	Clean packaging: Products are sealed in antistatic double bags after giving			

Basic Specifications of Other Equipment

	10-series		Special		
Construction	· Directional control valve Main valve and pilot valve common exhaust  · Pressure control equipment 	· Air filter  Fitting, speed controller, pressure switch, etc. have the same structure as those of standard.	· Clean regulator All wetted parts are made of stainless steel, FPM and PTFE, and exterior metal parts are made of anodized aluminum, which provides high corrosion resistance. 	· Clean one-touch fittings (for blow)  · Clean tubing Polyolefin-based resin	
Restricted material	None				
Grease	Fluorine grease		—	—	
Assembly environment	General environment (assembly and inspection in a workshop)		Parts are washed and		
Packaging	Clean packaging: Products are sealed in antistatic double bags after				

	13-series	Special clean series	21-series	22-series
	· **Guide cylinder** · **Air slide table** Single seal type / vacuum suction (11-series equivalent) and specially treated guide  Ball bushing guide Linear guide	· **Clean rodless cylinder** No contact between the cylinder tube exterior and the slider interior  Linear guide Special treatment	· **Double seal type / release to atmosphere** 	· **Single seal type / vacuum suction** 
		None	Copper, fluorine and silicon-free	
		Fluorine grease	Lithium soap base grease	
		Parts are washed and assembled in a clean room.	General environment (assembly and inspection in a workshop)	
	blow to the surface with clean air.		Standard packaging Note)	

Note) Contact SMC for clean packaging.

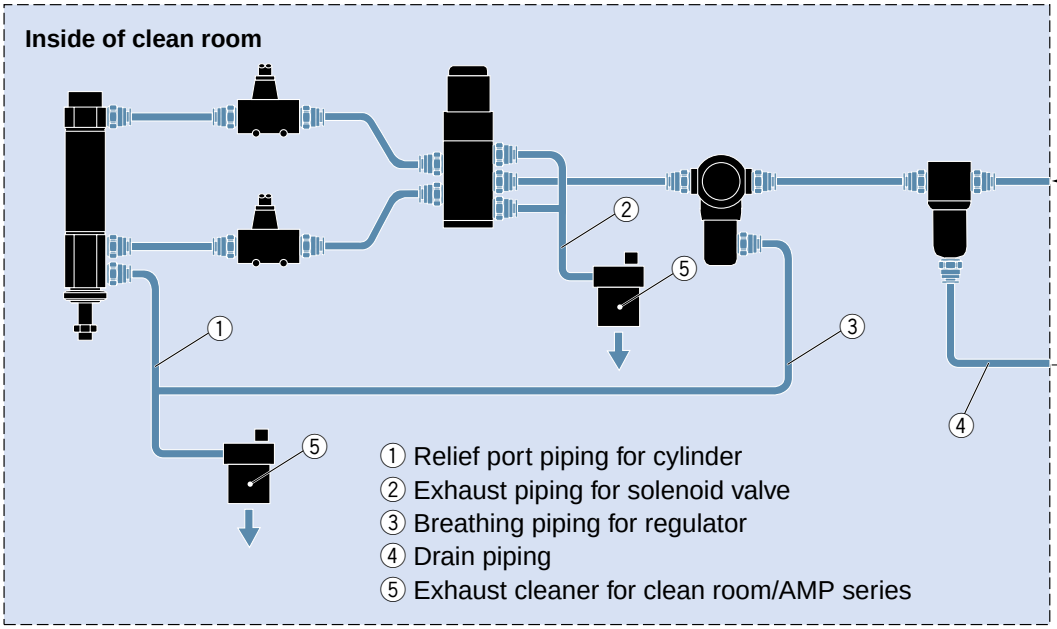
	clean series		21-series	
	· **Clean one-touch fittings** (for driving system air piping) · **Clean speed controller** Polypropylene resin  Metal parts Brass (Electroless nickel plated) or Stainless steel 304	· **Exhaust cleaner for clean room**  · **Clean gas filter** **PTFE membrane element**  · **Clean air filter** **Polyolefin hollow fiber membrane element** 	· **Directional control valve** · **Pressure control equipment** The same construction as the 10- series	· **Clean one-touch fittings** (for driving system air piping) · **Clean speed controller** No sealant on thread parts ∗ UNI thread is also applicable. (Made to Order)
	None		Copper, fluorine and silicon-free	
	Fluorine grease	——	Lithium soap base grease	
	assembled in a clean room.		General environment (assembly and inspection in a workshop)	Parts are washed and assembled in a clean room.
	giving blow to the surface with clean air.		Standard packaging Note)	

Note) Contact SMC for clean packaging.

System Circuit in Clean Room

Following are the actuator driving system and circuit configuration of blow system employed to reduce particle generation when using pneumatic equipment in a clean room.

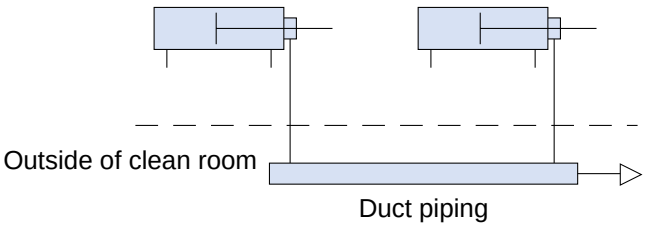
Actuator Driving System



Cylinder Relief Port Piping

10-/12-/21-series (Atmospheric release type)

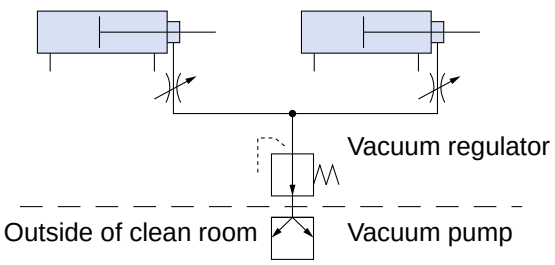
Connect the relief port piping with the dedicated duct piping installed outside the clean room or with the exhaust cleaner for clean room/AMP series.



11-/13-/22-series (Vacuum suction type)

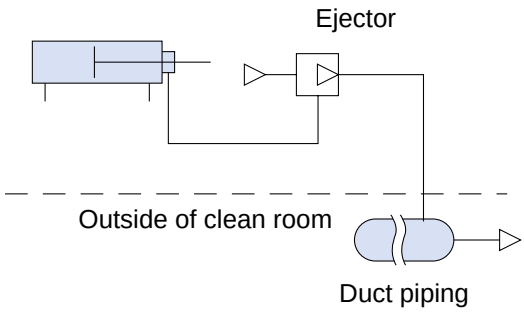
With a vacuum pump

When several air cylinders are used together or a model with high vacuum suction flow is used.



With an ejector

When a few air cylinders are locally used.



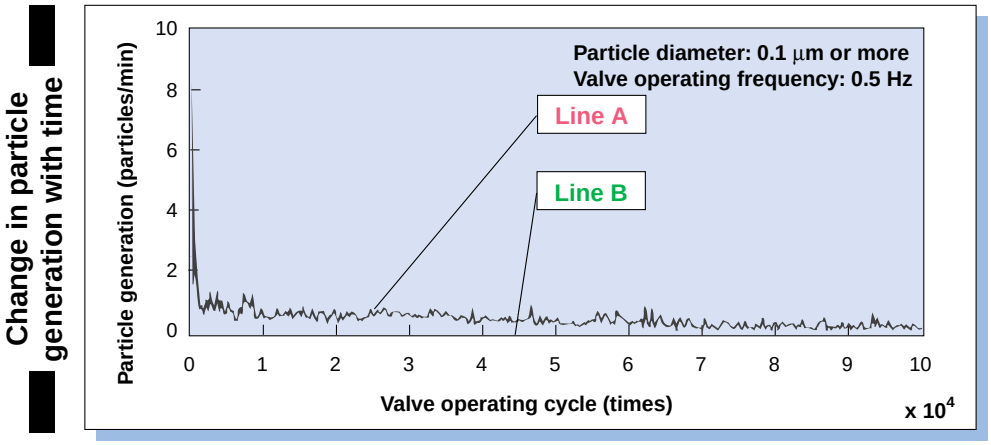
Clean Blow System

Example of equipment to suit each clean blow grade

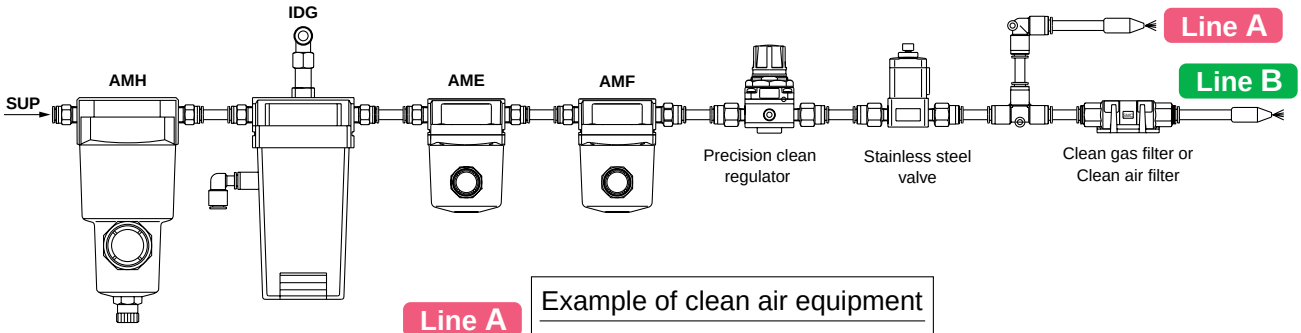
Line A : For clean blow

Line B : For clean blow (with clean gas filter, or with clean air filter)

Line C : For N_2 blow



Example of Air Line Equipment

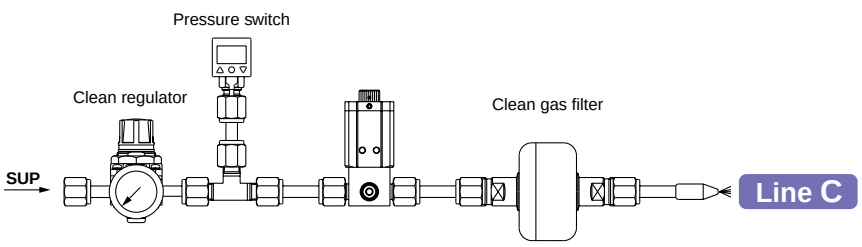


Line A
Line B

Example of clean air equipment

Fittings: Clean one-touch fittings
Piping : Polyolefine tubing
Clean: Oil-free, Assembled in clean room

Example of N_2 Equipment



Feature (Line C)

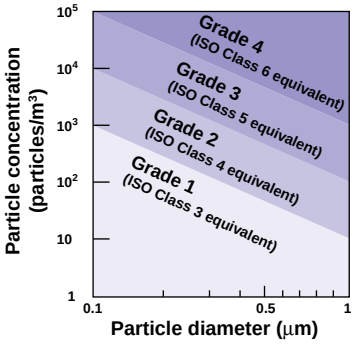
Excellent corrosion resistance
(Body: Stainless steel 316L)
Integral fitting type
Seal material : Fluoropolymer or Stainless steel
Precision cleaning, Assembly in clean room

How to Use Clean Series

The position of the pneumatic equipment to the workpiece is determined by the particle generation degree.

Particle generation grade no. of the pneumatic equipment ≦ Particle concentration grade no. around the workpiece

Particle Generation Grade Classification



Grading is based on SMC's original system of designation, with a lower grade number indicating a smaller volume of particle generation. The information in parentheses indicates the upper limit of concentration for the cleanliness classes based on ISO 14644-1.

(For further details, refer to page 85 "Particle Generation Measuring Method" and page 86 "Comparison of Cleanliness Standards".)

Note) In case of the one-touch fitting 10-KQ (that includes built-in one-touch fitting solenoid valve manifolds, and speed controllers with one-touch fittings), changes in internal pressure may cause the collet chuck to slide very slightly. This may result in particle generation, so please avoid using this item in Grade 1 or Grade 2 areas. However, there is no need for similar caution in the case of insert fittings (KF), miniature fittings (M/MS), clean one-touch fittings (KP/KPQ/KPG), or speed controllers with clean one-touch fittings (AS-FPQ/FPG).

Cleanliness Grade (Reference)

SMC	Fed.Std.209E Note) SI unit	ISO 14644-1
Grade 1	M1.5	ISO Class 3
Grade 2	M2.5	ISO Class 4
Grade 3	M3.5	ISO Class 5
Grade 4	M4.5	ISO Class 6
—	M5.5	ISO Class 7
—	M6.5	ISO Class 8

Note) Fed.Std.209E was abolished in Nov. 2001, so these figures are for reference only.

Selection Procedure

① Required clean room cleanliness? ····· ISO Class 4 or ISO Class 5 or ISO Class 6?

↓

② Air flow to the workpiece? (Refer to Diagram 1.) ····· Diagram 1: Air flow

↓

③ Where is the pneumatic equipment located? (Refer to Diagram 2.) ····· Diagram 2: Installation location of equipment

↓

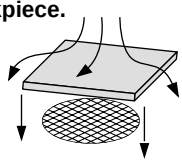
④ Determine the particle concentration grade no. around the workpiece based on above ① to ③. (Refer to Table 1.)

↓

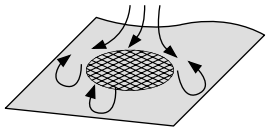
⑤ Select the equipment to be used. (Refer to pages 75 through to 84.)

Diagram 1: Air flow

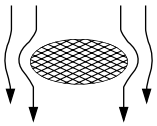
Workpiece A
The air flow is blocked before it reaches the workpiece.



Workpiece B
Convection currents are frequently generated around the workpiece.



Workpiece C
The air flows freely.



Workpiece D
The air is sucked under the workpiece.

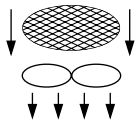


Diagram 2: Installation location of equipment

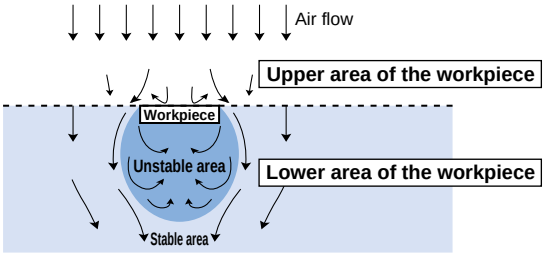


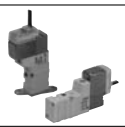
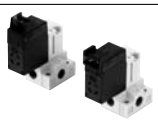
Table 1: Particle Concentration Grade around the Workpiece

② Workpiece		A, B			C			D		
③ Position of the equipment to be used		Upper area of the workpiece	Lower area of the workpiece		Upper area of the workpiece	Lower area of the workpiece		Upper area of the workpiece	Lower area of the workpiece	
			Unstable area	Stable area		Unstable area	Stable area		Unstable area	Stable area
① Cleanliness	ISO Class 4	▨	▨	▨	Grade 1		Grade 2	Grade 1	Grade 2	
	ISO Class 5	▨	▨	▨		Grade 2	Grade 3			Grade 3
	ISO Class 6	Grade 1	Grade 2	Grade 3	Grade 2	Grade 3	Grade 4	Grade 2	Grade 3	Grade 4

▨: ISO Class 4 and 5 levels of cleanliness cannot be achieved in area due to dust accumulation or flotation.

Particle Generation Grade

Directional Control Valves

Description		Series	Particle generation grade by series		
			Standard	10-	21-
	5 port solenoid valve	10-SY3000/5000/7000/9000	3	1	
		10-SV1000/2000/3000/4000	3	1	
		10-SYJ3000/5000/7000	3	1	
		10-SZ3000	3	1	
		10-S0700	3	1	1
		10-/21- VQ1000/2000	3	1	1
		10-/21- SQ1000/2000	3	1	1
		10-VQD1000	3	1	
	3 port solenoid valve	10-SYJ300/500/700	3	1	
		10-V100	3	1	
		10-S070	3	1	1
		10-SY100	3	1	
		10-/21- VQ100	3	1	1

Note) Particle generation grades apply to threaded port connection type.
Different grades apply to the one-touch fittings. For details, refer to page 74.

Values in ▭ show grades.
▭ No grade applies to blanks.

Particle Generation Grade

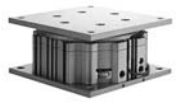
Cylinders

Description			Series	Particle generation grade by series						
				Standard	10-	11-	12-	13-	21-	22-
	Air cylinder	Standard	10-/11-/21-/22- CJ2	3	2	1			2	1
		Double rod	10-/11-/21-/22- CJ2W							
		Direct mount type	10-/11-/21-/22- CJ2RA							
	Air cylinder	Standard	10-/11-/21-/22- CM2	3	2	1			3	1
		Double rod	10-/11-/21-/22- CM2W							
		Direct mount type	10-/11-/21-/22- CM2R							
		End lock (Except rod-side lock)	10-/11-/21-/22- CBM2							
	Air cylinder	Standard	10-/11-/21-/22- CG1	3	2	1			3	1
		Double rod	10-/11-/21-/22- CG1W							
		Direct mount type	10-/11-/21-/22- CG1R							
	Air cylinder Standard		10-/11-/21-/22- CA2	3	2	1			3	1
	Mini free mount cylinder		10-/11- CUJ	3	2	1				
	Free mount cylinder		10-/11-/21-/22- CDU	3	2	1			3	1
	Compact cylinder		10-/11-/21-/22- CQS	3	2	1			2	1
			10-/11-/21-/22- CQ2	3	2	1			2	1
	Low speed cylinder		10-/11- CQSX	3	2	1				
			10-/11- CQ2X	3	2	1				
			10-/11- CM2X	3	2	1				
	Rodless cylinder Basic type		12-CY3B	4			3			

Values in ▭ show grades.
▭ No grade applies to blanks.

Particle Generation Grade

Cylinders

Description		Series	Particle generation grade by series						
			Standard	10-	11-	12-	13-	21-	22-
	Rodless cylinder Direct mount type	12-CY3R	4			3			
	Clean rodless cylinder	CYP	2						
	Air slide table	13-/22- MXS	—				Note 1) 3, 4		Note 1) 3, 4
		13-/22- MXQ							
	Air slide table	11-/22- MXJ	—		Note 1) 3, 4				Note 1) 3, 4
	Air slide table	11-/22- MXP	—		Note 1) 1, 2, 4				Note 1) 1, 2, 4
		11-/22- MXPJ6	—		1				1
	Compact guide cylinder	12-/13-/21-/22- MGPL	4			3	2	4	3
	Guide table	10-MGF	4	2					
	Dual rod cylinder	11-/12-/21-/22- CXSJ	3, 4		1	Note 2) 2		Note 2) 3	Note 2) 1
		10-/11-/12-/21-/22- CXS	3, 4	2	1	Note 2) 2		Note 2) 3	Note 2) 1
	Sine rodless cylinder	12-REA	4			3			
	Sine cylinder	10-/11- REC	3	2	1				

Note 1) The grade is different depending on the type of the adjuster option.
Note 2) The 12-, 21-, 22-series are only available for ball bushing bearing (CXSL/CXSJL).

Values in ▭ show grades.
▭ No grade applies to blanks.

MXQ

Option	13-	22-
Without adjuster	3	
Rubber stopper		
Metal stopper	4	

MXP

Option	11-	22-
Without adjuster	1	
Rubber stopper	2	
Metal stopper	4	

The MXP6 without adjuster is not available.

MXJ

Option	11-	22-
Without adjuster	3	
Metal stopper	4	

CXSJ

Model	Bearing type	Standard
CXSJL	Ball bushing bearing	3
CXSJM	Slide bearing	4

CXS

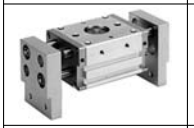
Model	Bearing type	Standard
CXSL	Ball bushing bearing	3
CXSM	Slide bearing	4

Particle Generation Grade

Rotary Actuators

Description			Series	Particle generation grade by series						
				Standard	10-	11-	12-	13-	21-	22-
	Rotary actuator	Vane	10-21- CRB1	4	2				2	
		Rack & pinion	11-CRA1	3		2				
	Rotary table		11-22- MSQ	3		1				1

Air Grippers

Description			Series	Particle generation grade by series						
				Standard	10-	11-	12-	13-	21-	22-
	Air gripper 2 fingers		11-22- MHZ2	—		2				2
	Wide opening parallel type air gripper 2 fingers		11-22- MHL2	—		2				2
	Rotary actuated air gripper	2 fingers	11-22- MHR2	—		1				1
		3 fingers	11-22- MHR3	—		1				1

Values in ▭ show grades.
▭ No grade applies to blanks.

Particle Generation Grade

Air Preparation Equipment

Description		Series	Particle generation grade	
			Standard	10-
	Membrane air dryer	10-IDG1	3	1
		10-IDG3 to 100	3	1
		10-IDG3H to 100H	3	1
		10-IDG30L to 100L	3	1
		10-IDG60S to 100S	3	1
	Main line filter	10-AFF2C to 22C 10-AFF37B, 75B	3	1
	Mist separator	10-AM150C to 550C 10-AM650, 850	3	1
	Micro mist separator	10-AMD150C to 550C 10-AMD650, 850	3	1
	Micro mist separator with pre-filter	10-AMH150C to 550C 10-AMH650, 850	3	1
	Super mist separator	10-AME150C to 550C 10-AME650, 850	3	1
	Odor removal filter	10-AMF150C to 550C 10-AMF650, 850	3	1
	Exhaust cleaner for clean room	AMP220 to 420	1	—

Values in ▭ show grades.
▭ No grade applies to blanks.

Particle Generation Grade

Clean Gas Filters

Description		Series	Particle generation grade
			Standard
	Clean gas filter Cartridge type	**SFA100/200/300**	**1**
	Clean gas filter Cartridge type	**SFB100**	**1**
	Clean gas filter Disposable type	**SFB300**	**1**
	Clean gas filter Disposable type	**SFC100**	**1**

Clean Air Filters

Description		Series	Particle generation grade
			Standard
	Clean air filter Disposable type	**SFD100**	**1**
	Clean air filter Cartridge type	**SFD101/102**	**1**
	Clean air filter Cartridge type	**SFD200**	**1**

Values in ▭ show grades.

Particle Generation Grade

Filters and Pressure Control Equipment

Description		Series	Particle generation grade by series		
			Standard	10-	21-
	Air filter	10-/21- AF20 to 60	3	1	1
	Mist separator	10-/21- AFM20 to 40	3	1	1
	Micro mist separator	10-/21- AFD20 to 40	3	1	1
	Regulator	10-/21- AR20 to 60	3	1	1
	Regulator with back flow mechanism	10-/21- AR20K to 60K	3	1	1
	Filter regulator	10-/21- AW20 to 60	3	1	1
	Filter regulator with back flow mechanism	10-/21- AW20K to 60K	3	1	1
	Mist separator regulator	10-/21- AWM20 to 40	3	1	1
	Micro mist separator regulator	10-/21- AWD20 to 40	3	1	1
	Direct operated precision regulator	10-/21- ARP20 to 40	3	1	1
	Direct operated precision regulator with back flow mechanism	10-/21- ARP20K to 40K	3	1	1
	Precision regulator	10-IR1000 to 3000	—	—	
	Vacuum regulator	10-IRV1000 to 3000	—	1	
	Clean regulator	SRH3000/4000	1		
	Precision clean regulator	SRP1000	3		

Values in ▭ show grades.
▭ No grade applies to blanks.

Particle Generation Grade

Fittings & Tubings

Description			Series	Particle generation grade by series		
				Standard	10-	21-
	One-touch mini		10-KJ	4	3	
	One-touch fittings		10-KQ	4	3	
	Insert fittings		10-KF	3	1	
	Miniature fittings		10-M	3	1	
	Rectangular multi-connector		10-KDM	4	3	
	Stainless steel one-touch fittings		10-KG	4	3	
	Stainless steel miniature fittings		10-MS	3	1	
	Clean one-touch fittings	For blow	KP	1		
		For driving system air piping	(21-)KPQ	1		1
			(21-)KPG	1		1
	Polyurethane tubings		10-TU	3	1	
	Polyurethane coil tubing		10-TCU	3	1	
	Polyurethane flat tubing		10-TFU	3	1	
	Clean tubing	Polyolefin	TPH	1		
		Soft polyolefin	TPS	1		

Values in ▭ show grades.
▭ No grade applies to blanks.

Particle Generation Grade

Flow Control Equipment

Description		Series	Particle generation grade by series		
			Standard	10-	21-
	Speed controller Elbow type/Universal type	**10-AS-F**	**4**	**3**	
	Speed controller In-line type	**10-AS-F**	**4**	**3**	
	Dual speed controller	**10-ASD**	**4**	**3**	
	Stainless steel speed controller Elbow type/Universal type	**10-AS-FG**	**4**	**3**	
	Stainless steel speed controller In-line type	**10-AS-FG**	**4**	**3**	
	Stainless steel dual speed controller	**10-ASD-FG**	**4**	**3**	
	Clean speed controller	**(21-)AS-FPQ**	**1**		**1**
		(21-)AS-FPG	**1**		**1**
	Speed controller for low speed operation Elbow type/Universal type	**10-AS-FM**	**4**	**3**	
	Speed controller for low speed operation In-line type	**10-AS-FM**	**4**	**3**	
	Dual speed controller for low speed operation	**10-ASD-FM**	**4**	**3**	
	Metal body speed controller Elbow type	**10-AS12□□ to 42□□**	**3**	**1**	
	Metal body speed controller In-line type	**10-AS1000 to 5000**	**3**	**1**	

Values in ▭ show grades.
▭ No grade applies to blanks.

Particle Generation Grade

Pressure Switches

Description			Series	Particle generation grade	
				Standard	10-
	2-color display high-precision digital pressure switch		**10-ZSE/ISE30**	**3**	**2**
	High-precision digital pressure switch		**10-ZSE/ISE40**	**3**	**2**
	High-precision digital pressure switch for general fluids		**10-ZSE/ISE50**	**3**	**2**
			10-ZSE/ISE60	**3**	**2**
	Remote type pressure sensor	For compact pneumatics	**10-PSE530**	**3**	**2**
		For compact pneumatics	**10-PSE540**	**3**	**2**
		For low differential pressure	**10-PSE550**	**3**	**2**
		For general fluids	**10-PSE560**	**3**	**2**
	Remote type digital pressure sensor controller/ Multi-channel		**10-PSE200**	**1**	**1**
	Remote type 2-color display digital pressure sensor controller		**10-PSE300**	**1**	**1**

Values in ▭ show grades.
▭ No grade applies to blanks.

Particle Generation Measuring Method

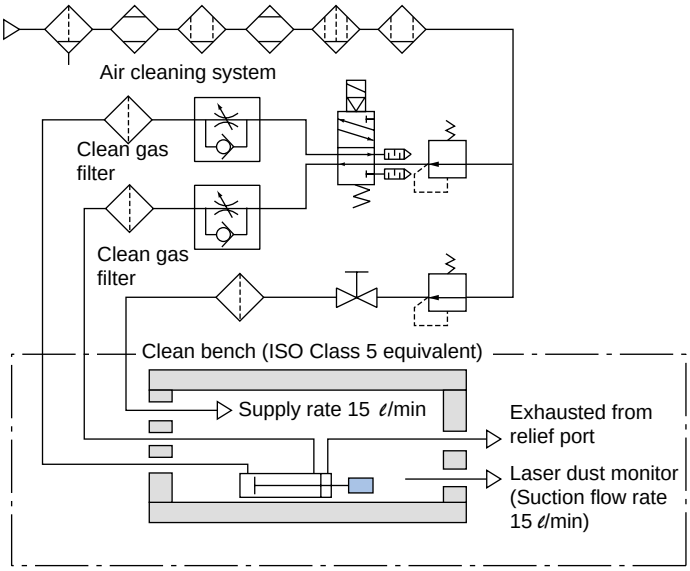
The particle generation data for SMC Clean Series are measured in the following test method.

Test Method (Example)

Place the specimen in the acrylic resin chamber and operate it while supplying the same flow rate of clean air as the suction flow rate of the measuring instrument (15 ℓ/min). Measure the changes of the particle concentration over time until the number of cycles reaches the specified point. The chamber is placed in an ISO Class 5 equivalent clean bench.

Measuring Conditions

Chamber	Internal volume	15 ℓ
	Supply air quality	Same quality as the supply air for driving
Measuring instrument	Description	Laser dust monitor (Automatic particle counter by light-scattering method)
	Model no.	TS-1500
	Minimum measurable particle diameter	0.17 μm
	Suction flow rate	15 ℓ/min
	Manufacturer	Hitachi Electronics Engineering Co. Ltd.
Setting conditions	Sampling time	5 min
	Interval time	55 min
	Sampling air flow	75 ℓ



Particle generation measuring circuit

Evaluation Method

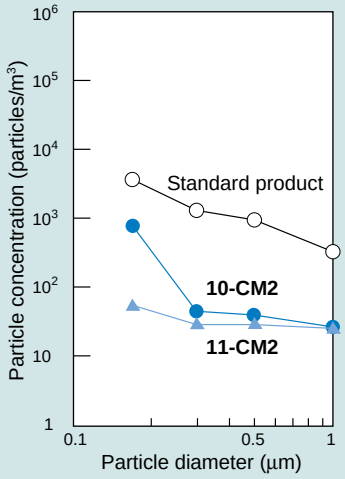
To obtain the measured values of particle concentration, the accumulated value Note 1) of particles captured every 5 minutes, by the laser dust monitor, is converted into the particle concentration in every 1 m³.

When determining particle generation grades, the 95% upper confidence limit of the average particle concentration (average value), when each specimen is operated at a specified number of cycles Note 2) is considered.

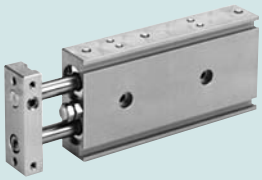
The plots in the graphs indicate the 95% upper confidence limit of the average particle concentration of particles with a diameter within the horizontal axis range.

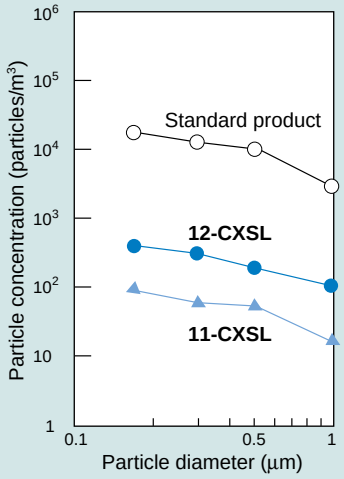
Note 1) Sampling air flow rate: Number of particles contained in 75 ℓ of air
Note 2) Actuator: 1 million cycles
Solenoid valve: 2 million cycles

Particle generation characteristics of CM2

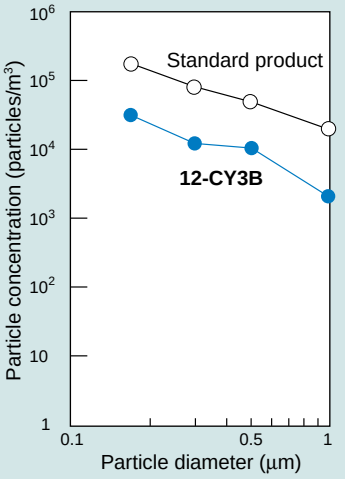


Particle generation characteristics of CXSL





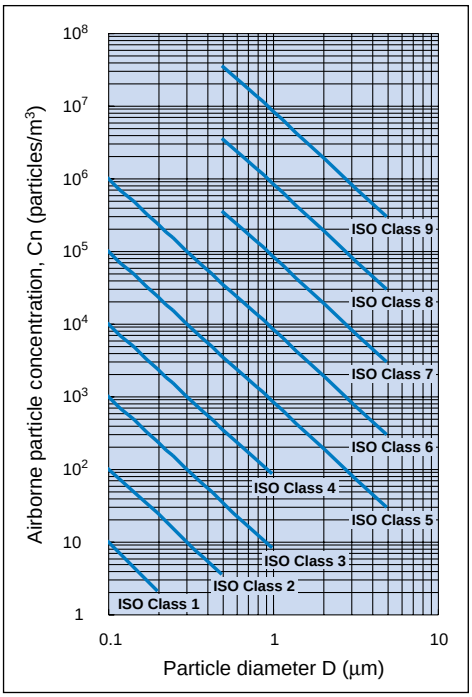
Particle generation characteristics of CY3B



Comparison of Cleanliness Standards (Reference)

Standard		Fed.Std.209E Note)		ISO 14644-1
Cleanliness class		British unit: Class 1 to 100.000 SI unit: Class M1 to M7 U descriptor: Particle diameter less than 0.1 μm		ISO Class 1 to 9 Intermediate class available U descriptor: Particle diameter less than 0.1 μm M descriptor: Particle diameter exceeding 5.0 μm
	Corresponding class indication	(British unit)	(SI unit)	
				ISO Class 1
				ISO Class 2
		1	M1.5	ISO Class 3
		10	M2.5	ISO Class 4
		100	M3.5	ISO Class 5
		1000	M4.5	ISO Class 6
		10000	M5.5	ISO Class 7
		100000	M6.5	ISO Class 8
				ISO Class 9
Cleanliness class indication		The number of particles with diameter 0.5 μm or larger in an air volume of 1 m^3 is expressed in 10 M or coefficient Nc. Cleanliness class: Nc or M		The number of particles with diameter 0.1 μm or larger in an air volume of 1 m^3 is expressed in 10^N. ISO Class N: Occupancy state: Sampling particle diameter
Calculation of the maximum permitted concentration of particulate cleanliness classes		British unit: Number of particles/ft^3 = N_c x $(0.5/D)^{2.2}$ SI unit: Number of particles/m^3 = 10 M x $(0.5/D)^{2.2}$		$C_n = 10^N \times (0.1/D)^{2.08}$
Evaluation method using a simple sampling		① Number of sampling locations: 2 to 9 95% UCL of the mean and the mean of the averages ② Number of sampling locations: 10 or more The mean		① Number of sampling locations: 2 to 9 95% UCL of the mean and the mean of the averages ② Number of sampling locations: 1, or 10 or more The mean
Number of sampling locations		① Non-unidirectional airflow: at least two locations $N_L = A \times 64/(10\ M)^{0.5}$ ② Unidirectional airflow: at least two locations Smaller value between $N_L = A/2.32$, $N_L = A \times 64/(10\ M)^{0.5}$		Derive it from the area of the clean room or clean air controlled space. Number of sampling locations $N_L = (A)^{0.5}$ At least one location
Min. sampling air flow volume		2 litters or a sufficient volume of air that a minimum of 20 particles could be counted if the particle concentration were at the class limit.		2 litters or a sufficient volume of air that a minimum of 20 particles could be counted if the particle concentration were at the class limit. Min. sampling time: 1 minute
Number of samplings		Total number of samplings in each clean zone: 5 times or more		Where only one sampling location is required, take a minimum of three single sample volumes at that location.
Sampling method		5.0 μm or larger: Constant velocity and suction in the same direction of the air flow 0.5 to 5 μm: Correction possible when it is sucked at a nonconstant velocity		Suction in the same direction as the airflow If the direction of the airflow is not predictable, the inlet of the sampling probe shall be directed vertically upward.

Note) Fed.Std.209E was abolished in Nov. 2001, so these figures are for reference only.



Cleanliness class (N)		Maximum concentration limit (particles/m^3) Sampling particle diameter (μm)					
		0.1	0.2	0.3	0.5	1	5
ISO Class	1	10	2				
	2	100	24	10	4		
	3	1000	237	102	35	8	
	4	10000	2370	1020	352	83	
	5	100000	23700	10200	3520	832	29
	6	1000000	237000	102000	35200	8320	293
	7				352000	83200	2930
	8				3520000	832000	29300
	9				35200000	8320000	293000

Note) Concentration data with no more than three significant figures be used in determining the classification level.

$C_n = 10^N \times (0.1/D)^{2.08}$

C_n: The maximum permitted concentration of airborne particles that are equal to or larger than the sampling particle diameter (D). C_n is rounded down to the nearest whole number, using no more than three significant figures.

N: Class No. (1 to 9), Intermediate class (1.1 to 8.9)

D: Sampling particle diameter (μm)

0.1: Constant number (μm)