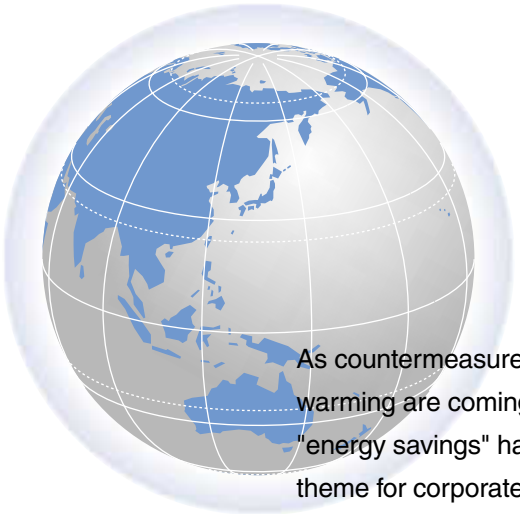
SMC

Proposals for Energy Saving Pneumatic Systems

SMC supports innovations in energy saving production systems.

SMC ECOLOGICALLY MINDED PNEUMATICS SYSTEMS



As countermeasures for global warming are coming into effect, "energy savings" has become a key theme for corporate reforms.
At the Kyoto Conference on Climate Change (December 1997), a 6% reduction of CO_2 emissions from the 1990 emission rate was set as a target to be achieved by 2010. Also, as amendment of the energy saving law in Japan suggests, it is predicted that the trend for energy savings involving corporations will become increasingly demanding.
In this climate, SMC will strive for innovations of production systems with energy savings in mind. With cooperation from customers, we will promote energy saving programs for pneumatic systems.

Table of Contents

Energy Saving Proposals

Japan's Approach to Global Warming Prevention

Energy saving law
(The law concerning the rationalization of energy usage)

- Effective as of June 1979 (amended in 1993 and 1997)
- Amended in February 1997
  Reduction of energy units by an annual average of 1% or more
- Future
  Due to the responsibility placed on Japan at the Kyoto Conference on Climate Change, it is predicted that corporations will be expected to implement active and deliberate reduction measures (energy savings).

Series ISO14000
(Environment management system)

- Corporate approach
  Global warming prevention → Reduction of electrical energy
  Ozone layer protection measures → Promote replacement of refrigerants
  Reducing industrial wastes → Increase recycling rate
  Producing products with reduced environmental burden
- Future
  Reduction of environmental burden and active implementation of energy saving measures with consideration to limited natural resources based on management and control in accordance with ISO14000 will be demanded.

Global warming prevention bill
A 6% reduction of industrial CO_2 emissions from 1990 levels is targeted for 2010. However, presentation of a plan for 10% or more reduction will be demanded.

Energy Saving Equipment

Actuators

Directional Control Equipment

Auxiliary Pneumatic Equipment/Air Preparation Equipment

Sensors/Measuring Instruments

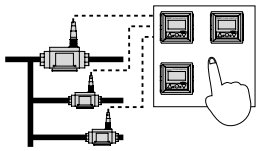
Vacuum Equipment

Industrial Filters

Other (CD-ROM)

Proposal 1 Pressure/Flow Control

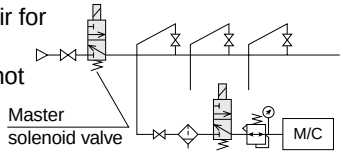
Flow rate and pressure controls



Digital flow switch	**Series PFA/PFW**	**Page 84**
Air leakage tester	**(Made to order)**	**133**
Compact manometer	**Series PPA**	**127**
Nozzles for blowing/Sensing heads	**Series KN**	**56**
Differential pressure gauge	**GD40-2-01**	**81**
Filter with element service indicator		**82**
High precision digital pressure switch	**Series ISE40**	**111**
Digital pressure switch	**Series ISE3**	**117**
Digital pressure switch for general purpose fluid	**Series ISE5B**	**119**
Industrial filter (Regenerative element specification)	**(Made to order)**	**154**
Air filter element part number list		**80**

Proposal 2 Idling

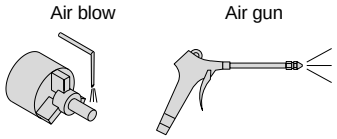
Reduction of air leakage and air for purging when equipment is not operated.



Pilot operated 2 port solenoid valve	**Series VXD21/22/23**	**30**
Pilot operated 3 port solenoid valve	**Series VG342**	**42**
Large 3 port solenoid valve	**Series VP3145/3165/3185**	**44**

Proposal 3 Air Blow

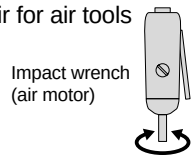
Reduction of air for blowing



Pilot operated 2 port solenoid valve	**Series VXD21/22/23**	**Page 30**
Direct operated 2 port solenoid valve	**Series VCA**	**33**
Pilot operated 2 port solenoid valve	**Series VQ20/30**	**35**
Nozzles for blowing/Sensing heads	**Series KN**	**56**
S couplers	**Series KK**	**59**
Polyurethane coil tubing	**Series TCU**	**72**
Modular type regulator	**Series AR1000 to 6000**	**73**
Regulator with integrated pressure gauge	**Series AR2001 to 4001**	**74**
Pilot operated regulator	**Series AR425 to 935**	**75**
Filter regulator	**Series AW1000 to 4000**	**77**
Filter regulator with integrated pressure gauge	**Series AW2001 to 4001**	**79**
Digital flow switch for air	**Series PFA**	**85**
High precision digital pressure switch	**Series ISE40**	**111**
Compact manometer	**Series PPA**	**127**
Air leakage tester	**(Made to order)**	**133**
Energy Saving Program		**159**
Hollow rod cylinder	**(Made to order)**	**17**
Free mount cylinder for vacuum	**Series ZCUK**	**18**

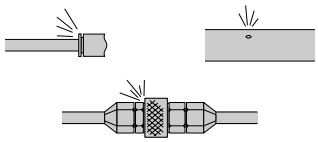
Proposal 4 Air Tools

Reduction of air for air tools



Proposal 5 Air Leakage

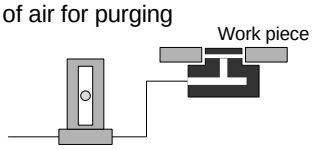
Stop air leakage from piping equipment



S couplers	**Series KK**	**Page 59**
FR double layer tubing	**Series TRB/TRBU**	**69**
Double layer tubing stripper	**Series TKS**	**71**
Tube cutter	**Series TK**	**72**
Air leakage tester	**(Made to order)**	**133**
Digital flow switch for air	**Series PFA Series**	**85**
Water resistant air cylinder		**19**
Air cylinder with heavy duty scraper	**(Made to order)**	**22**
Air cylinder with coil scraper	**(Made to order)**	**23**

Proposal 6 Air Purging (Air Micro)

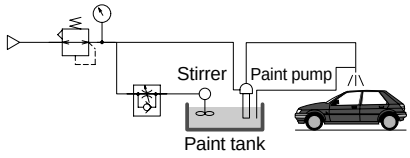
Reduction of air for purging



Direct air operated 2 port valve	**Series VXA 21/22**	**Page 39**
3 port mechanical valve	**Series VM1000 VM100/200/400**	**46**
Air catch sensor	**Series ISA 21/22**	**135**

Proposal 7 Paint Stirring

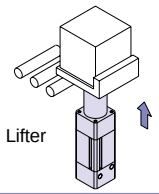
Reduction of air consumption for paint stirrer



Pilot operated 3 port solenoid valve	**Series VP300/500/700**	**Page 40**
Flow switching 2 port air operated valve	**(Special order product)**	**52**

Proposal 8 Actuators

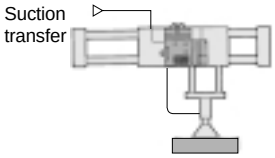
Air reduction for actuators



Non-rotating double power cylinder	**Series MGZ**	**Page 2**
Guide table	**Series MGF**	**13**
PFC/QFC valves		**15**
Modular type regulator with check valve	**Series AR1000 to 6060**	**76**
Model Selection Program		**158**
SMC Pneumatics CAD System Ver. 2.1E		**161**

Proposal 9 Vacuum

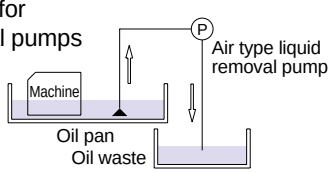
Air reduction for vacuum ejectors



High precision digital pressure switch	**Series ZSE40**	**Page 111**
Vacuum ejector with check valve	**(Special order product)**	**148**
Pad with check valve	**(Special order product)**	**149**
Multistage ejector	**Series ZL112, 212**	**143**

Proposal 10 Liquid Removal

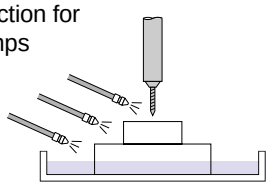
Air reduction for liquid removal pumps



Vacuum ejector for water soluble coolant removal	**(Special order product)**	**Page 150**
Vacuum ejector	**Series ZH**	**140**
Linear vacuum ejector	**Series ZU**	**142**
Negative pressure detection valve	**(Special order product)**	**137**
Digital pressure switch for general purpose fluid	**Series ZSE5B/ISE5B**	**120**

Proposal 11 Coolant (Cleaning) Blow

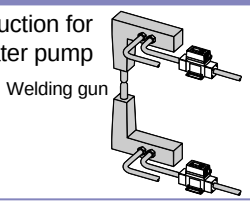
Power reduction for coolant pumps



Coolant valve	**Series VNC**	**Page 50**
Nozzles for blowing/Sensing heads	**Series KN**	**56**
Digital pressure switch for general purpose fluid	**Series ISE5B**	**120**
Energy Saving Program		**159**
Industrial filter	**Series FG**	**152**
Industrial filter (Regenerative element specification)	**(Made to order)**	**154**

Proposal 12 Cooling Water

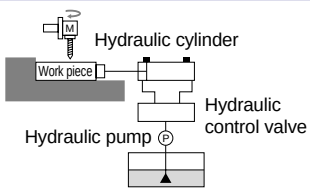
Power reduction for cooling water pump



Zero differential pressure operated 2 port solenoid valve	**Series VXZ**	**Page 37**
Digital flow switch for water	**Series PFW**	**104**

Proposal 13 Hydraulic Clamp

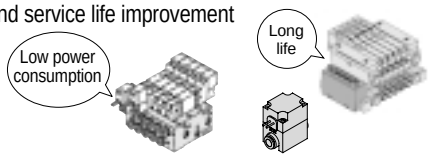
Power reduction for hydraulic pump



Air-hydro booster	**(Made to order)**	**Page 24**
Air-hydro converter	**Series CCT**	**27**

Proposal 14 Low Power Consumption/Long Life

Reduction of power used for solenoid valve energization and service life improvement



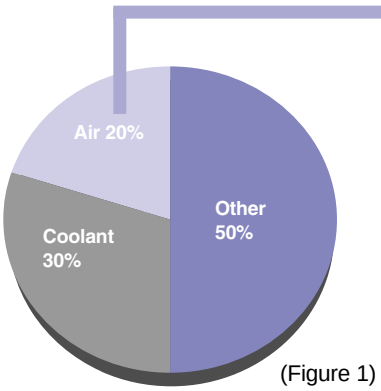
5 port solenoid valve	**Series SY**	**Features 24**
5 port solenoid valve	**Series VQ**	**24**
2 port solenoid valve	**Series VQ20/30**	**Page 35**

Recognizing the current state... First step toward energy savings and improving awareness

To promote energy savings in pneumatic systems, it is necessary to recognize and control the existing system's air consumption and to improve the awareness of energy saving (cost awareness) in the work place.

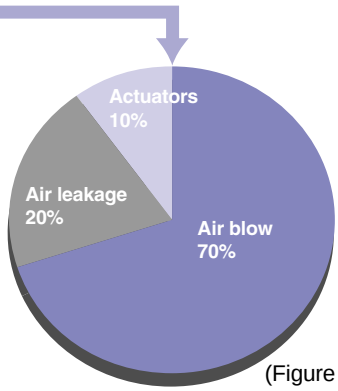
Based on usage, electric power consumption for air (compressor) is thought to be 20% of the entire consumption (Figure 1).

Furthermore, air consumption based on usage is as shown in Figure 2. It is necessary to understand and control the air consumption for these usages.



(Figure 1)

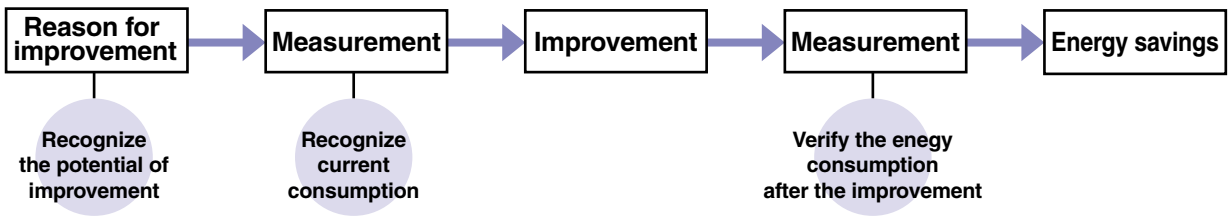
Electric power consumption



(Figure 2)

Air consumption

It is said that energy saving measures begin with measurement and end with measurement.
Find out where, how much, and for what purpose the energy is being used.
Then, find out how much can be reduced as a result of improvements.
Effective energy saving improvements can be implemented by recognizing and controlling the current state of energy consumption and the result of the improvements, entirely with numerical values.



Air line maintenance equipment to recognize the current state

Digital flow switch Series PFA

Separately measures air consumption by facility and by line.
• Measured flow rate: 12000/ (max.)

Air leakage tester (Made to order)

Measures leakage flow rate.
• Measured flow rate: 9999/ (max.)

Compact manometer Series PPA

Measures the work piece collision pressure. Calculates air blow rate with flow rate formula.

Refer to Proposal 1 "Air Line Maintenance" on Features 3 for details.

Educational panels to improve energy saving awareness

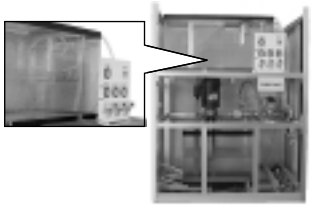
Air blow demonstration panel

Guides the approach to and improvement methods for air blow.

Air leakage demonstration panel

Air leakage can be heard and felt.

Coolant blow demonstration panel



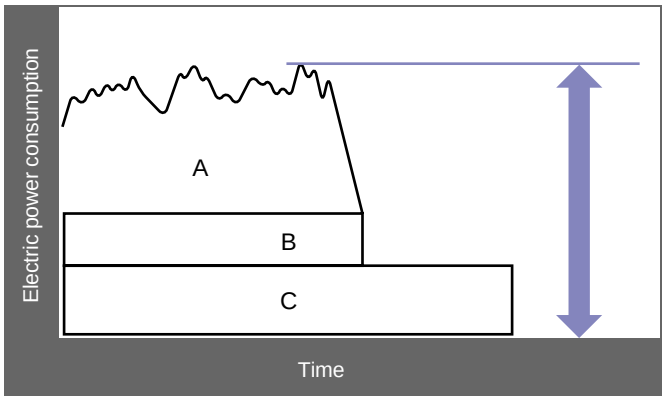
Large fluctuations of energy in the discharge, caused by the relationship between the nozzle and upstream piping system, can actually be confirmed.
The point where the difference occurs between a good system and a bad system can actually be measured.

Vacuum ejector demonstration panel

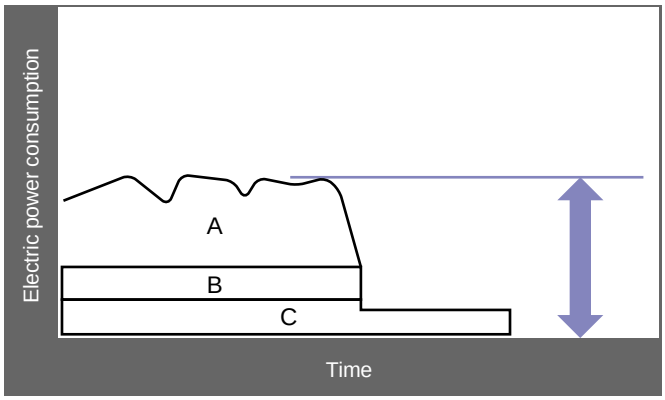
Demonstrates how suction is maintained by using an ejector with check valve.
Air consumption can be compared with a general vacuum suction system.

What are energy saving measures?

Before improvement

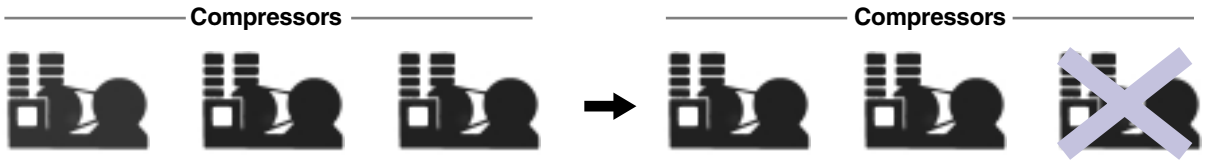


After improvement



Compressor operation capacity

Peak consumption of A
Consumption of B
+ Consumption of C
Continuous operation of compressor



Consumption of A: Consumption from equipment operation

1) Cylinder operation
2) Air blow
3) Suction by ejector, etc.

→ Reduction of consumption by optimizing.
Reduce the peak flow rate for more even consumption by considering the cycle time and operating time.

Consumption of B: Consumption from line operation

1) Purge air to prevent intrusion of coolant, etc.
2) Air blow to prevent foreign matter adhesion
3) Down blow inside the painting booth

→ Reduction of consumption by optimizing.
Reduce consumption in connection with equipment operation.
Or, hold consumption to the minimum required.

Consumption of C

1) Air leakage
2) Air curtain, etc.
3) Liquid stirring system operation, etc.

→ Reduction of consumption by optimizing.
Fix air leakage.
Fix the cause of air leakage.
Consider other methods for consumption such as air curtains that has purpose.

Proposal 1

Air Line Maintenance

Purpose

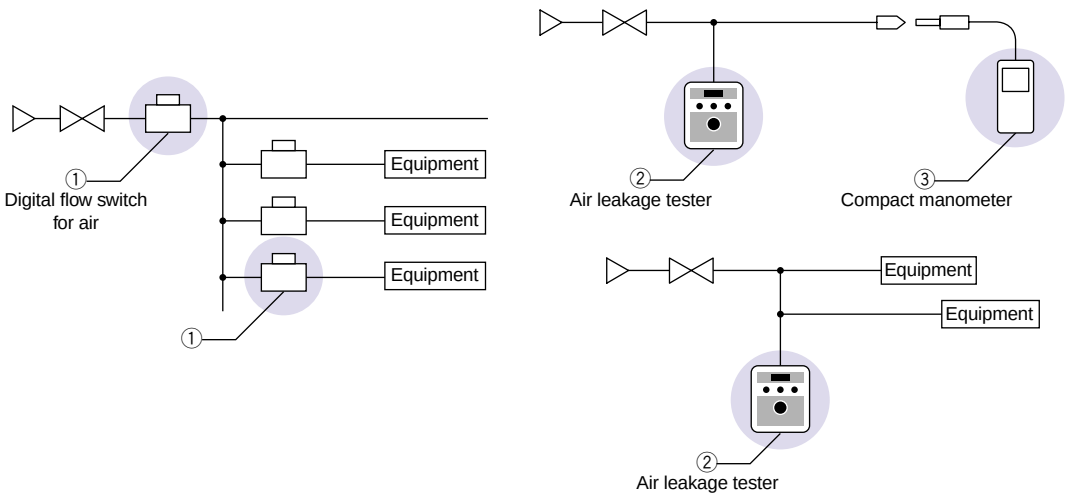
Flow maintenance

Before Improvement

Since the current flow rate based on the usage is not recognized, the target for improvement and its effect are not expressed in numerical values and remain unclear.

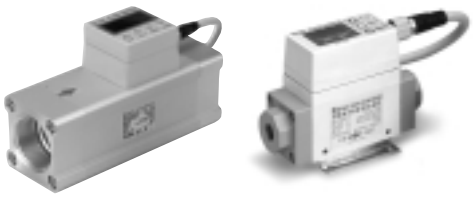
After Improvement

Effective use of measuring instruments.
Flow rate is maintained with numerical values, and the target for improvement and its effect are clarified.



Main Points

① Measure main line and branch line flow rates.
Digital flow switch for air
Series PFA Page 84



② Measure air leakage rate and air blow rate
Air leakage tester.
(Made to order) Page 133

③ Measure air blow rate.
Compact manometer
Series PPA Page 127

Measures work piece collision pressure to calculate flow rate by using flow formula.

Related Equipment

Nozzles for blowing/Sensing heads Series KN Page 56

Purpose

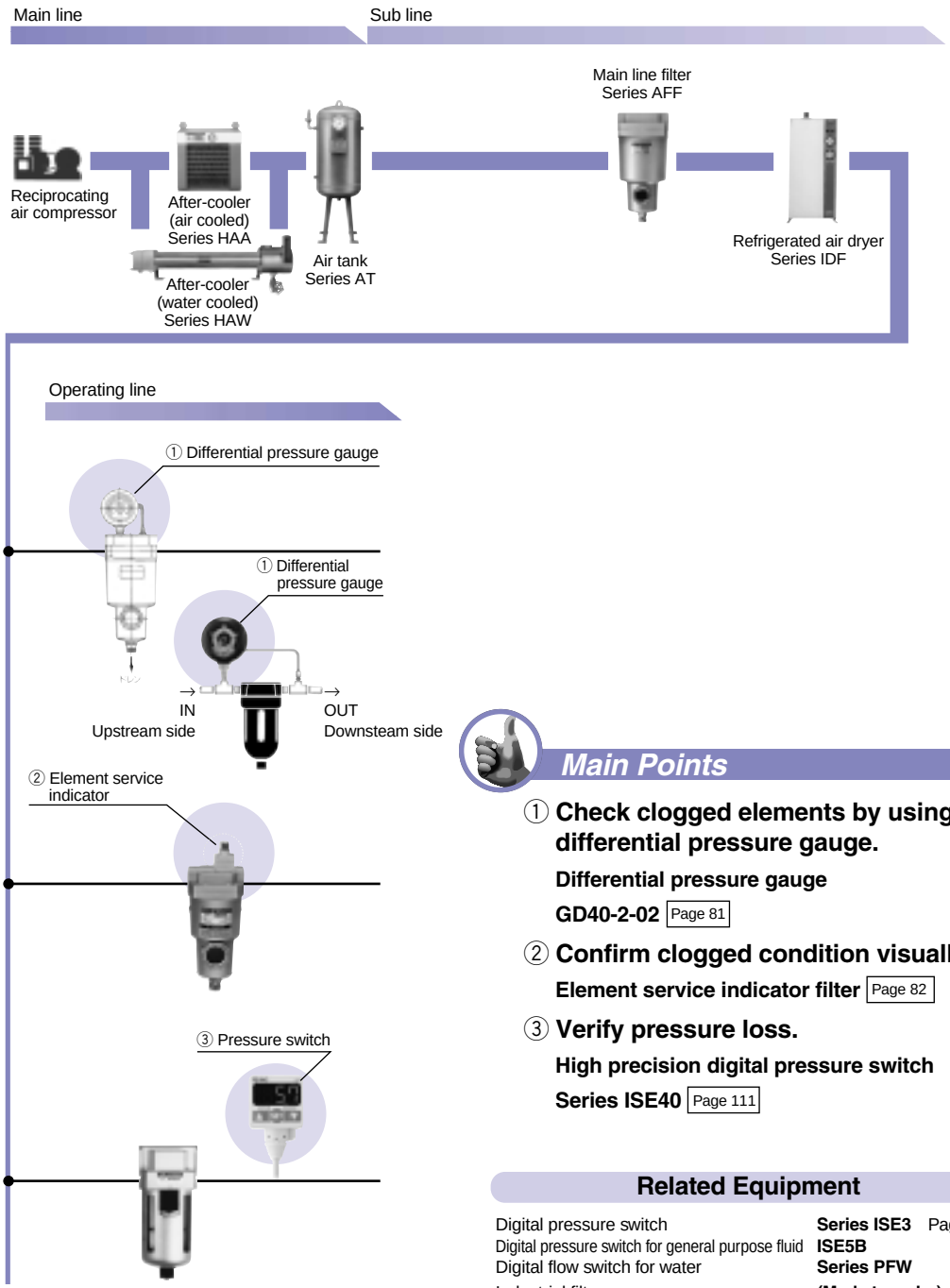
Pressure maintenance

Before Improvement

The importance of regular maintenance for the pressure loss caused by clogged elements is not recognized. Therefore, a large burden is placed on the compressor and pump, etc.

After Improvement

Regular maintenance of clogged elements is implemented by mounting pressure and flow monitoring equipment on each type of filter used on each line.



Main Points

① **Check clogged elements by using a differential pressure gauge.**

Differential pressure gauge

GD40-2-02 Page 81

② **Confirm clogged condition visually.**

Element service indicator filter Page 82

③ **Verify pressure loss.**

High precision digital pressure switch

Series ISE40 Page 111

Related Equipment

Digital pressure switch	**Series ISE3**	Page 117
Digital pressure switch for general purpose fluid	**ISE5B**	119
Digital flow switch for water	**Series PFW**	104
Industrial filter (Regenerative element specification)	**(Made to order)**	154
Industrial filter	**Series FG**	152
Air filter element list		80

Proposal 2

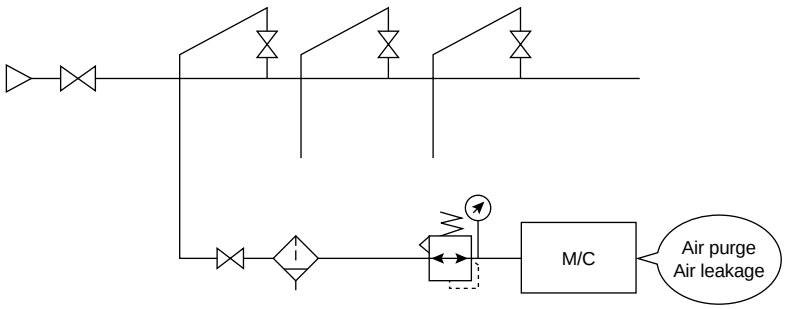
Non-operation

Purpose

Reduction of air for purging and air leakage when equipment is non-operation.

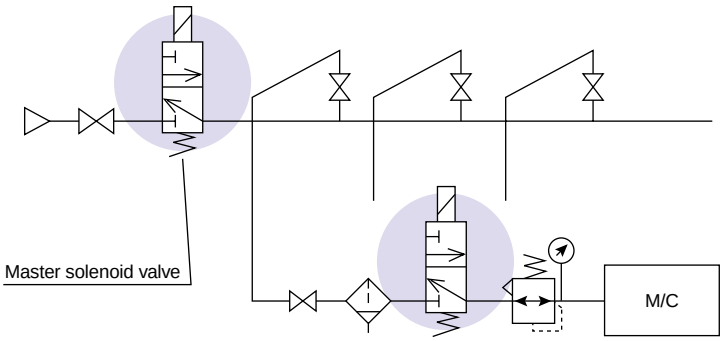
Before Improvement

Since the compressor is in continuous operation even when the equipment is non-operation, air is constantly consumed due to air leakage and purging, etc.



After Improvement

Air supply to the equipment is stopped when it is non-operation.



Main Points

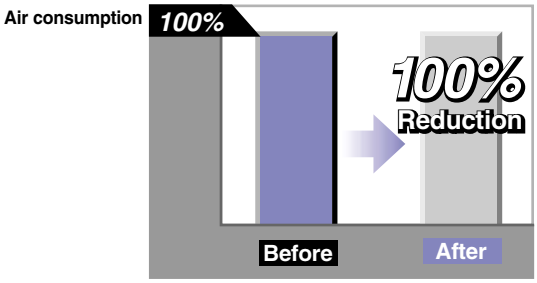
Mount a master solenoid valve to each line and component.

Pilot operated 2 port solenoid valve Series VXD21/22/23
Page 30

Pilot operated 3 port solenoid valve Series VG342
Page 42

Pilot operated 3 port solenoid valve Series VP3145/3165/3185
Page 44

Effect of Energy Saving Improvement



Proposal 3

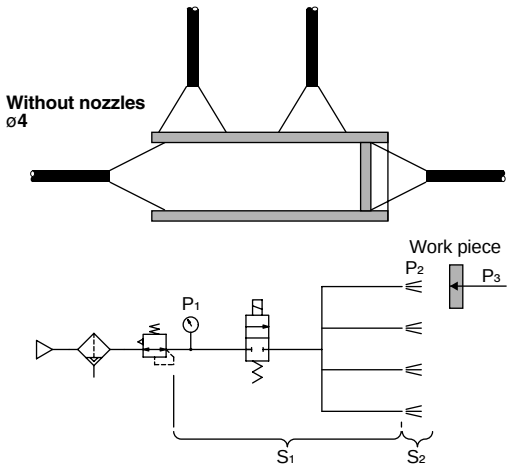
Air Blow

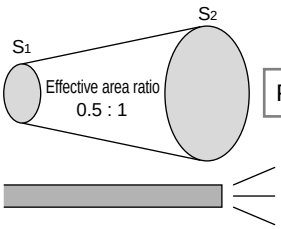
Purpose

Reduction of air consumption for air blow

Before Improvement

Air blow is performed without any attachment at the air outlet.





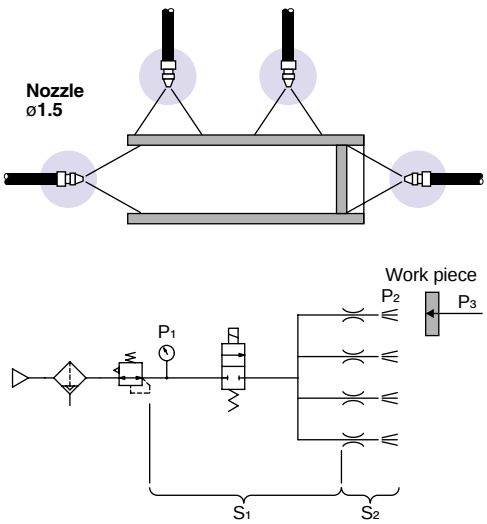
Pressure loss: **Large**

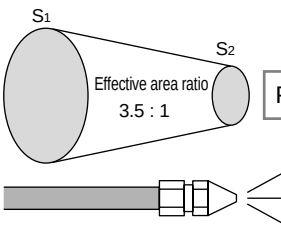
Effective area (mm²)	Upstream side S1: 22.6 Nozzle side S2: 45.2
Effective area ratio	S1 : S2 = 0.5 : 1
Nozzle size (mm)	ø4
Number of nozzles	4
Regulator pressure (P1)	0.4MPa
Outlet pressure (P2)	0.08MPa
Collision pressure (P3)*	0.002MPa

* The pressure that the work piece receives is called collision pressure.

After Improvement

Nozzles are attached



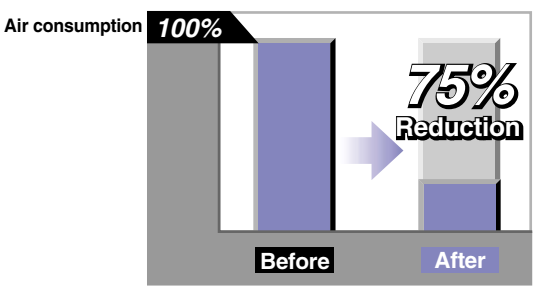


Pressure loss: **Small**

Effective area (mm²)	Upstream side S1: 22.6 Nozzle side S2: 6.4
Effective area ratio	S1 : S2 = 3.5 : 1
Nozzle size (mm)	ø1.5
Number of nozzles	4
Regulator pressure (P1)	0.25MPa
Outlet pressure (P2)	0.225MPa
Collision pressure (P3)*	0.002MPa

* The pressure that the work piece receives is called collision pressure.

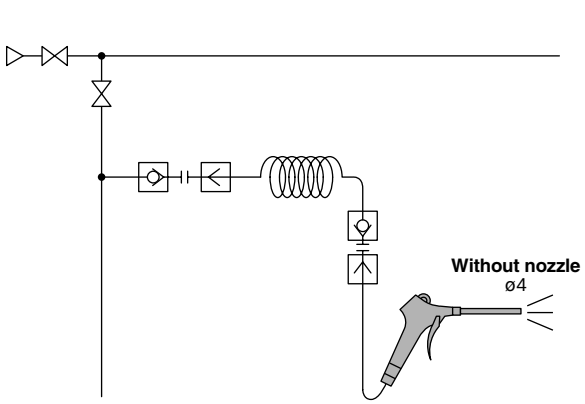
Effect of Energy Saving Improvement

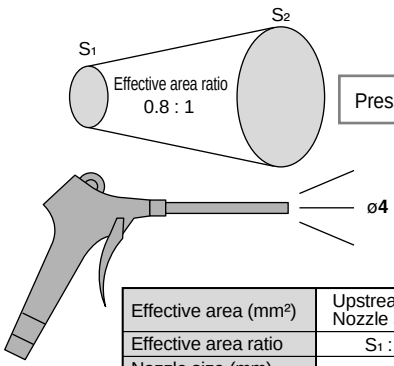


Blowing with Air Gun

Before Improvement

In the case of air guns, energy saving measures are not considered and the factory line pressure is used directly in most cases.



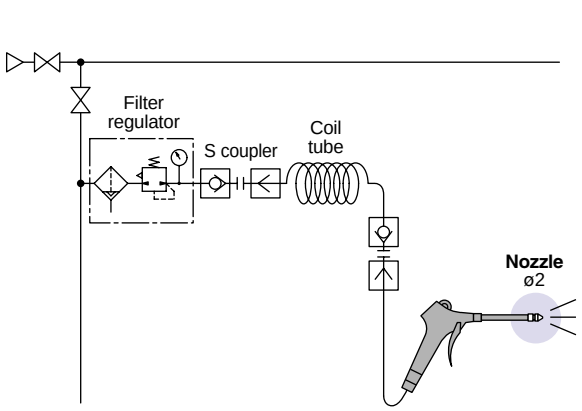


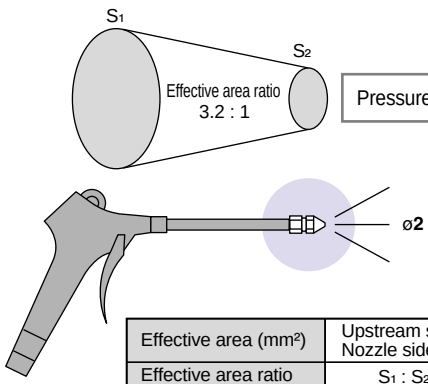
Pressure loss: **Large**

Effective area (mm²)	Upstream side S1: 9 Nozzle side S2: 11.3
Effective area ratio	S1 : S2 = 0.8 : 1
Nozzle size (mm)	ø4
Number of nozzles	1
Supply pressure	0.5MPa
Regulator pressure	—
Outlet pressure	0.2MPa

After Improvement

A nozzle is attached to the tip of the air gun.
A regulator is added and pressure control is improved.
Fittings and tubing are changed to those with large effective areas.

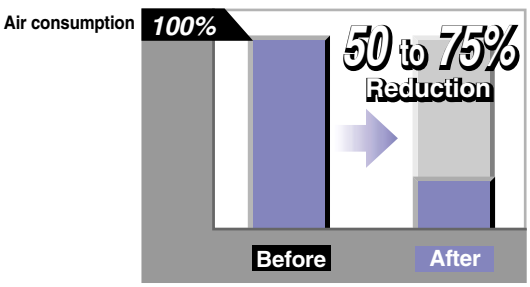




Pressure loss: **Small**

Effective area (mm²)	Upstream side S1: 9 Nozzle side S2: 2.8
Effective area ratio	S1 : S2 = 3.2 : 1
Nozzle size (mm)	ø2
Number of nozzles	1
Supply pressure	0.5MPa
Regulator pressure	0.35MPa
Outlet pressure	0.33MPa

Effect of Energy Saving Improvement



Main Points

Pressure loss improvement

① **Use small size nozzles to improve the effective area ratio with the upstream side.**

Nozzles for blowing

Series KN Page 56

② **Reduce pressure for optional usage.**

Regulator

Series AR Page 73

Filter regulator

Series AW Page 77

③ **Improve effective area by changing fittings.**

S couplers

Series KK Page 59

Large effective area

Related Equipment

Pilot type 2 port solenoid valve	**Series VXD21/22/23**	Page 30
Regulator with integrated pressure gauge	**Series AR2001 to 4001**	74
Pilot type regulator	**Series AR425 to 935**	75
Filter regulator with integrated pressure gauge	**Series AW2001 to 4001**	79
Digital flow switch for air	**Series PFA**	85
High precision digital pressure switch	**Series ISE40**	111
Compact manometer	**Series PPA**	127
Polyurethane coil tubing	**Series TCU**	72
Energy Saving Program		159
Hollow rod cylinder	**(Made to order)**	17
Free mount cylinder for vacuum	**Series ZCUK**	18
Air leakage tester	**(Made to order)**	133

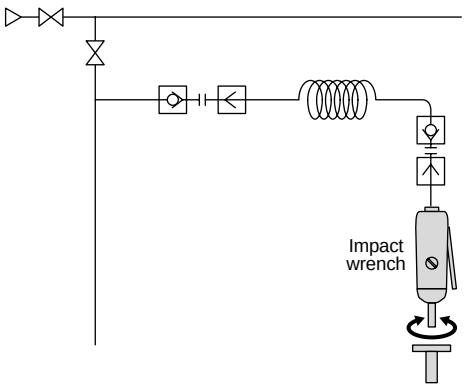
Air Tools

Purpose

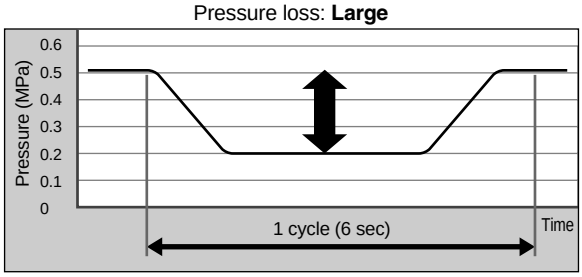
Reduction of air consumption for air tools

Before Improvement

As in the case of air guns, energy saving measures are not considered and the factory line pressure is used directly.



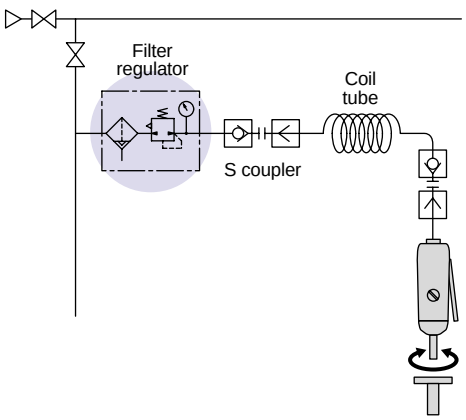
Change in immediate pressure



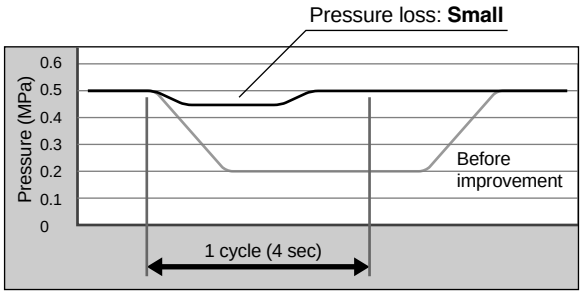
Since the torque for impact wrenches, etc., is determined by the immediate pressure, a large pressure loss will cause problems such as torque instability and long cycle time.

After Improvement

Fittings and tubing are changed to those with large effective areas. A regulator is added and pressure control is improved.

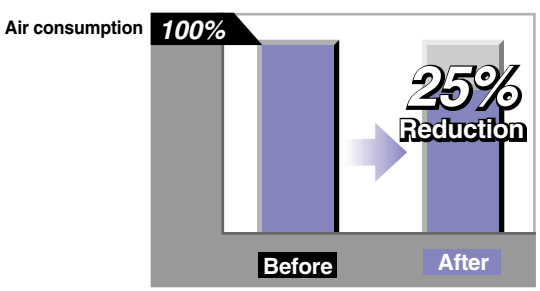


Change in immediate pressure



Torque stability
Shortened cycle time

Effect of Energy Saving Improvement



Main Points

Pressure loss improvement

Methods and related equipment are the same as Proposal 2 "Air Blow" on Features 6.

Proposal 5

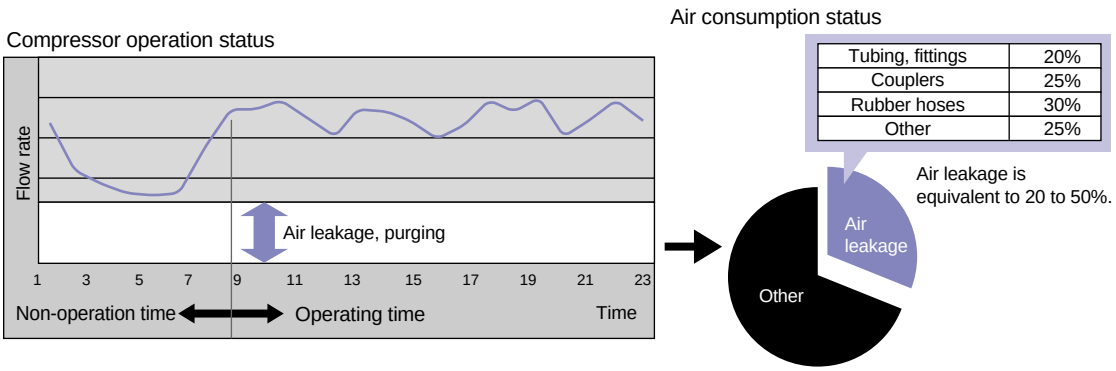
Air Leakage

Purpose

Stop air leakage from piping components

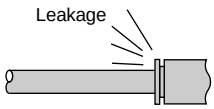
Before Improvement

20 to 50% of air consumption is accounted to air leakage.
Since the compressor is in continuous operation regardless of whether equipment is in operation or at rest, a fixed amount of air is constantly consumed due to leakage from piping.

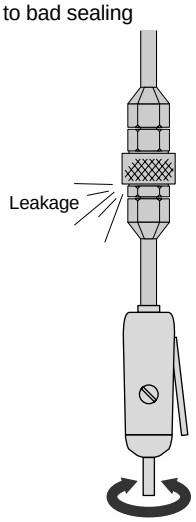


Air leakage examples

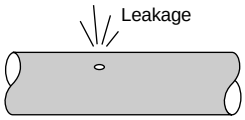
- Air leakage from One-touch fittings due to bad cutting surface of tubing



- Air leakage from couplers due to bad sealing



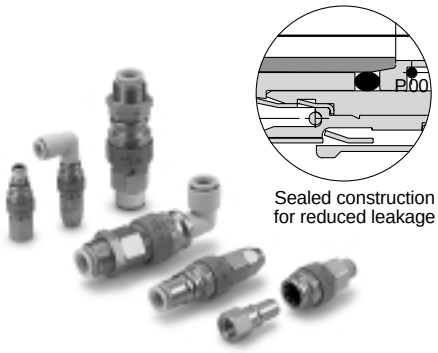
- Air leakage from tubing due to chips, wear-out and spatter, etc.



Main Points

① Select leakage resistant equipment.

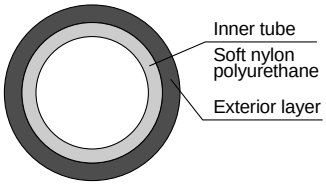
S couplers
Series KK Page 59



Sealed construction for reduced leakage

② Use double layer tubing to prevent damage to tubing by chips, spatter and wear-out.

Double layer tubing
Series TRB/TRBU Page 69

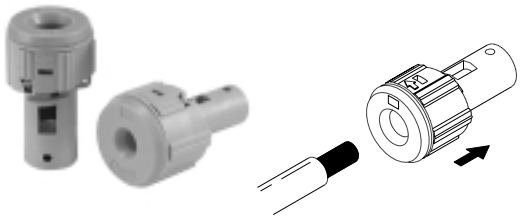


FR double layer tubing cross section

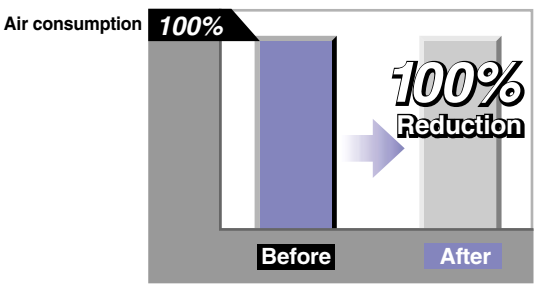
③ Correct tube cutting surface by using special tools.

Tube cutter
Series TK Page 72

Double layer tube stripper
Series TKS Page 71



Effect of Energy Saving Improvement



Related Equipment

Air leakage tester	**(Made to order)**	Page 133
Digital flow switch for air	**Series PFA**	84
Water resistant air cylinder		19
Air cylinder with heavy duty scraper	**(Made to order)**	22
Air cylinder with coil scraper	**(Made to order)**	23

Proposal 6

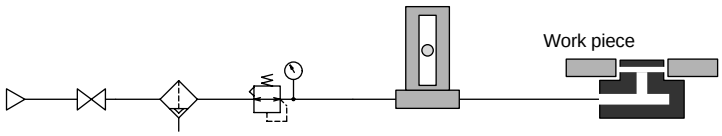
Air Purge (Air Micro)

Purpose

Reduction of air consumption for air micro

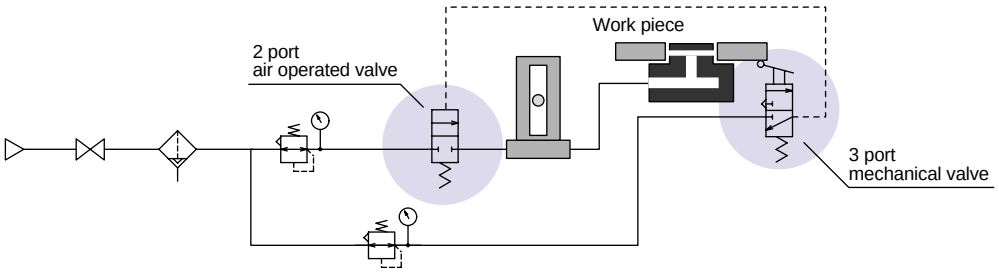
Before Improvement

An air micro is used on machining equipment to confirm precision after machining.
Air is constantly released regardless of the presence of a work piece.



After Improvement

The circuit is changed to supply air only when measuring work pieces.

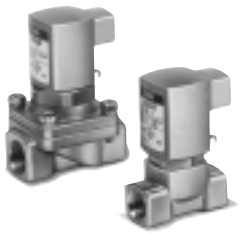


Main Points

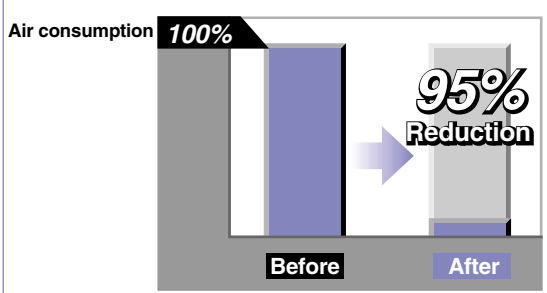
Stop the air supply depending on the presence of work pieces.

3 port mechanical valve
Series VM Page 46

Direct air operated 2 port valve
Series VXA21/22 Page 39



Effect of Energy Saving Improvement



Related Equipment

Air catch sensor **Series ISA** Page 135

Proposal 7

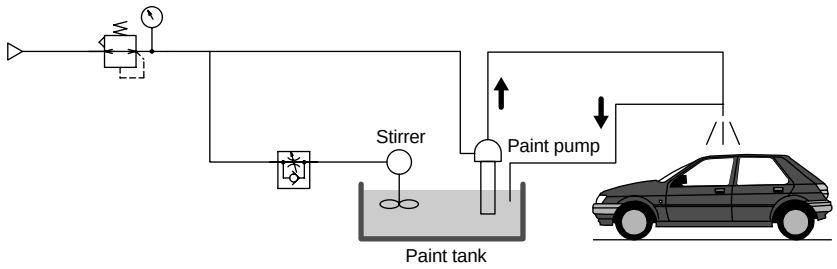
Paint Stirring

Purpose

Reduction of air consumption for paint stirrer

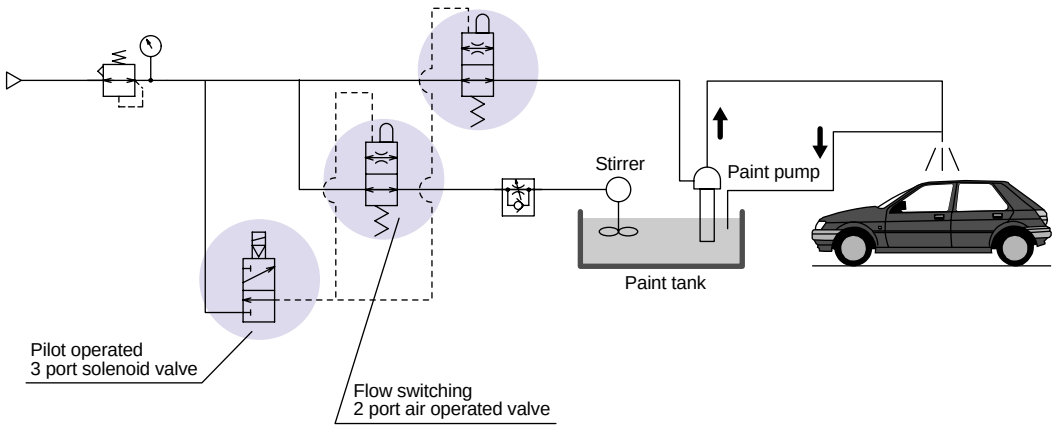
Before Improvement

In a painting booth, it is necessary to have the stirrer in operation at all times to prevent paint from coagulating. Even when the line is not in operation, air is supplied in the same manner as when it is in operation.



After Improvement

The circuit is changed to operate the stirrer with a minimal air supply when the line is not in operation.



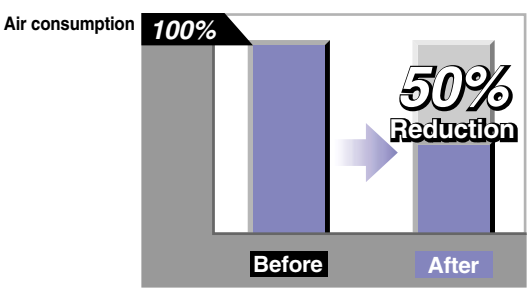
Main Points

Switch the line flow rate depending on the operating time and non-operating time.

Flow switching 2 port air operated valve (Special order product)
Series VKFA332-X1 Page 52

Pilot operated 3 port solenoid valve
Series VP300/500/700 Page 40

Effect of Energy Saving Improvement



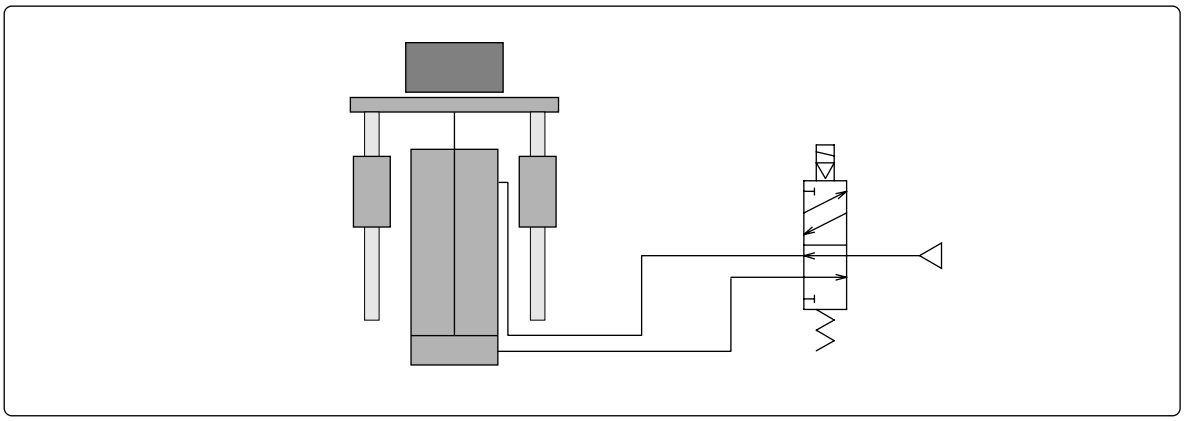
Actuators

Purpose

Reduction of air consumption by actuators

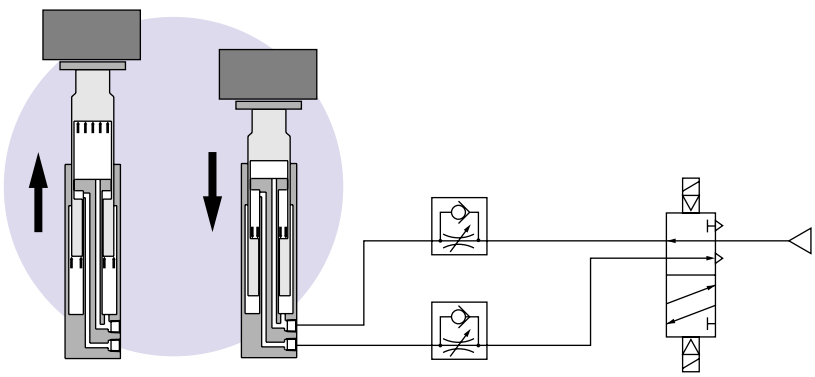
Before Improvement

Cylinder output uses the same pressure for lifting or lowering.
Use of an exterior guide adds extra weight.

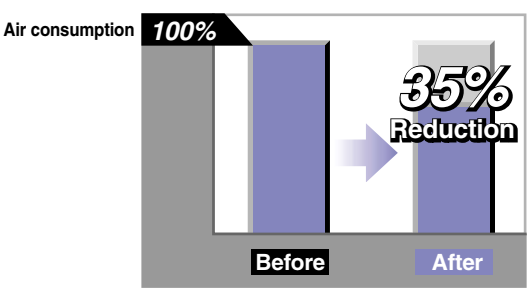


After Improvement

By using a double power extension cylinder, a reduction in operating pressure or use of a smaller size cylinder is made possible.
Use of a large bore tube rod and non-rotating mechanism makes the guide unnecessary.



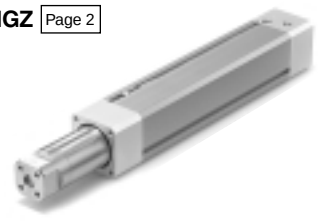
Effect of Energy Saving Improvement



Main Points

Change to a non-rotating double power cylinder.

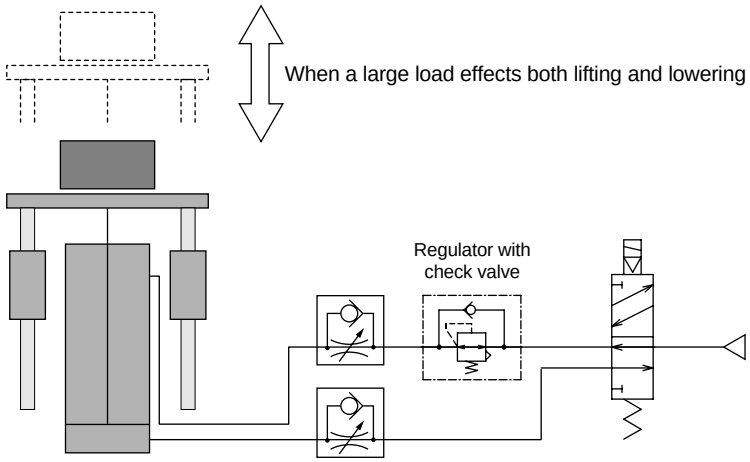
Non-rotating double power cylinder
Series MGZ Page 2



After Improvement

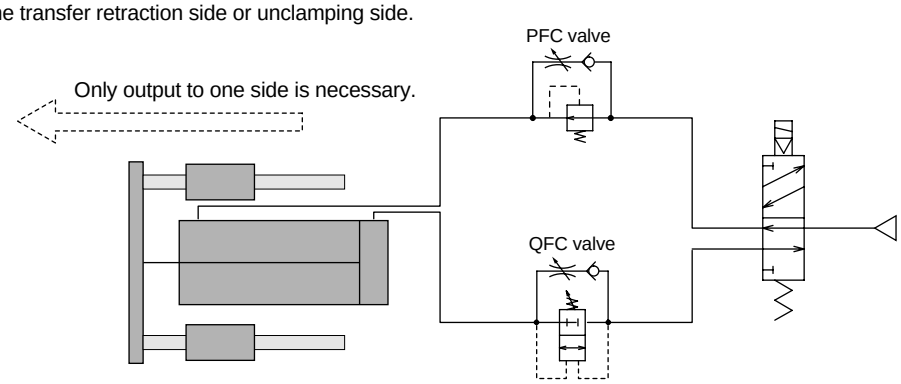
① To reduce the non-working side output for a lifter when the jig weight is heavy and the work piece is light

Pressure is reduced in the direction that is influenced by the jig and work piece load.



② To reduce the non-workting side output for horizontal transfer or a clamp

A PFC valve is used to reduce pressure in the direction that is not affected by a smaller cylinder output, such as the transfer retraction side or unclamping side.



Main Points

Reduce pressure on the non-working side.

(Change to a one side regulated circuit.)

Regulator with check valve
Series AR Page 73

PFC/QFC valves Page 15

Related Equipment

Guide table	**Series MGF**	Page	13
Model Selection Program			158
SMC Pneumatics CAD System Ver.2.1E			161

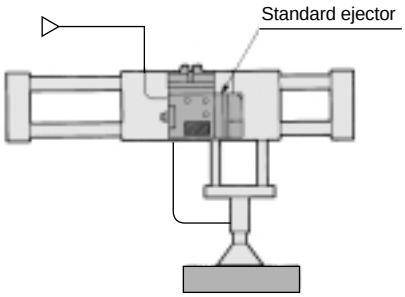
Vacuum Ejectors

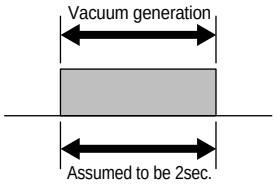
Purpose

Reduction of air consumption for vacuum ejectors

Before Improvement

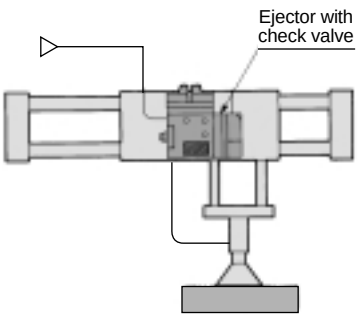
Normally, in the case of vacuum ejector suction, air needs to be constantly supplied to maintain the suction of a work piece.

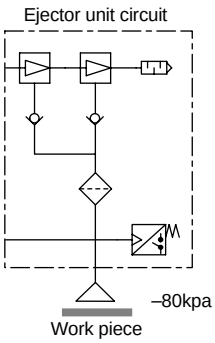


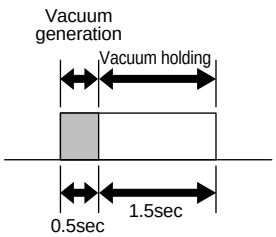


After Improvement

Use of an ejector with vacuum holding specification enables stopping air supply to maintain the suction at a work piece. Air consumption is reduced by shortening the vacuum generation time.

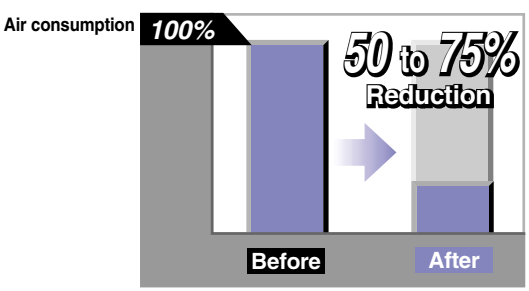






Note) Since vacuum pressure may drop due to leakage, etc., use a pressure switch to maintain the vacuum pressure necessary for the suction of a work piece.

Effect of Energy Saving Improvement



Main Points

Change to an ejector with built-in check valve.

Vacuum ejector with check valve (Special order product) Page 148

Related Equipment

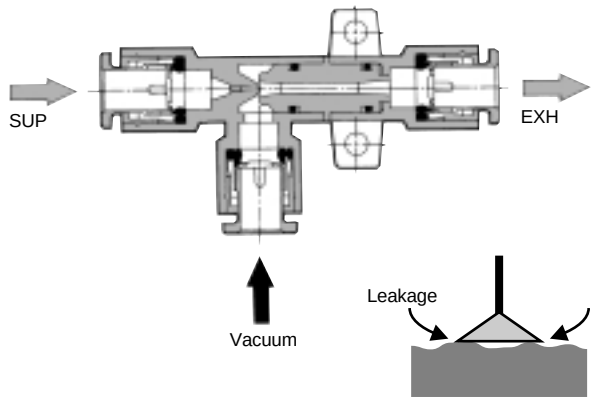
High precision digital pressure switch **Series ZSE40/ISE40** Page 111

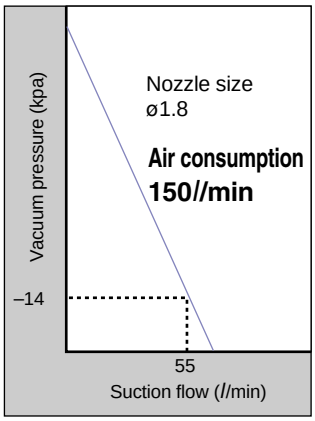
Pad with check valve **INO-3769 (Special order product)** 149

Before Improvement

For suction of a work piece with leakage, a large suction flow is necessary, which in turn necessitates the use of a larger nozzle size and increased air consumption.

Single stage ejector ZH18

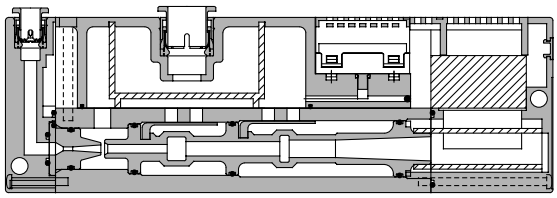


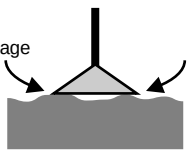


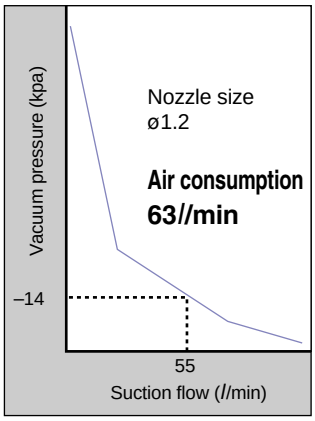
After Improvement

Use of an ejector with 3-stage diffuser construction enables a reduction of the air consumption even with the same suction flow and vacuum pressure.

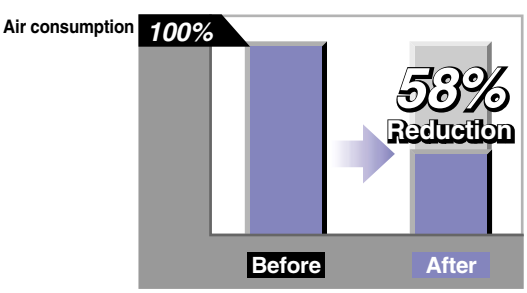
Multistage ejector ZL112







Effect of Energy Saving Improvement



Main Points

Change to an ejector with 3-stage diffuser construction.

Multistage ejector

Series ZL112, 212 Page 143

Proposal 10

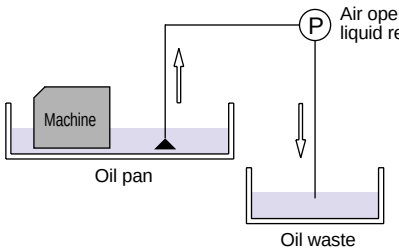
Liquid Removal

Purpose

Reduction of air for a liquid removal pump

Before Improvement

Removal of oil waste accumulated in the oil pan under a machine or conveyor.
The pump is in operation regardless of the amount of liquid and this causes a great energy loss.

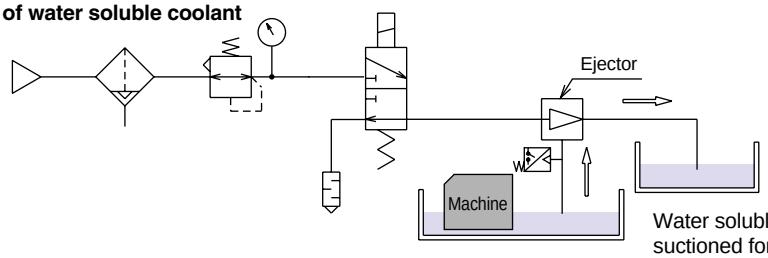


- Damage to the diaphragm due to operating without accumulated liquid
- Clogged check valve due to foreign matter (chips, etc.)

After Improvement

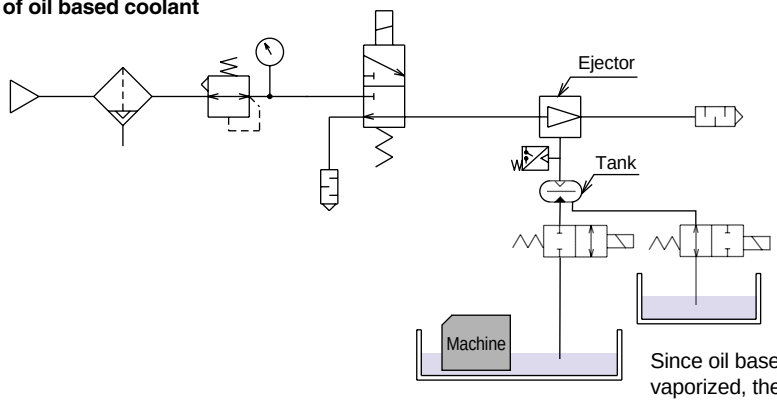
Suction method is changed to an ejector operated type and an automatic stop circuit is installed to stop operation when there is no liquid.

Removal of water soluble coolant



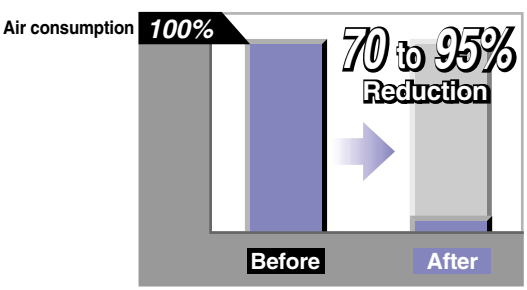
Water soluble coolants are directly suctioned for removal by the ejector.

Removal of oil based coolant



Since oil based coolants are easily vaporized, they are temporarily stored in a tank.

Effect of Energy Saving Improvement



Main Points

Start or stop the pump depending on the presence of liquid (waste).

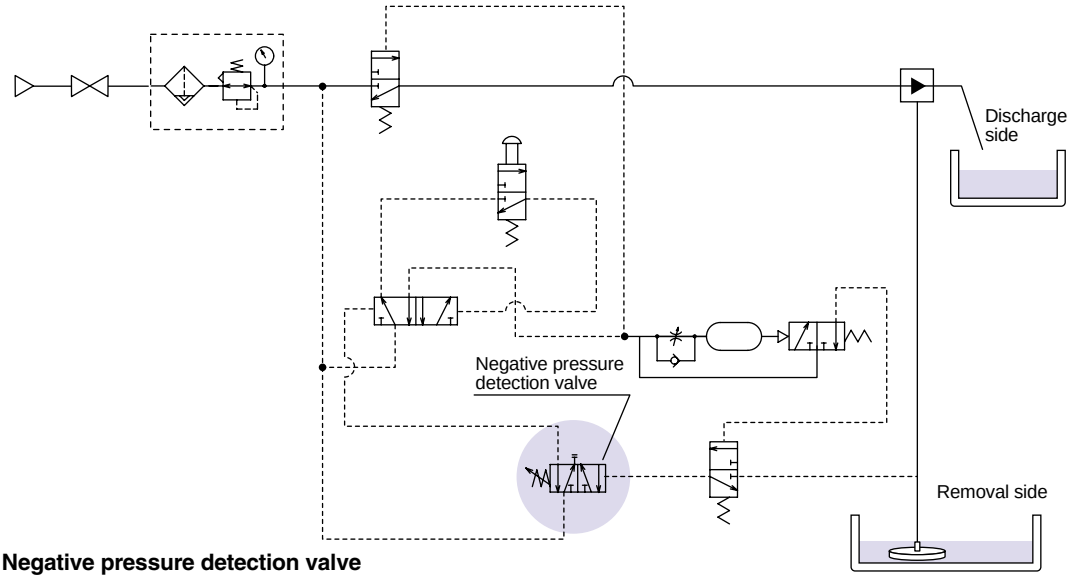
① Suction by an ejector prevents clogging (without check valve mechanism)

Vacuum ejector for water soluble coolant removal
(Special order product) Page 150

Vacuum ejector (for oil based coolant removal)
ZH Page 140

② An automatic shut off circuit prevents operation when there is no liquid.

Circuit example



Negative pressure detection valve
(Special order product) Page 137

Related Equipment

Linear vacuum ejector	**Series ZU**	Page 142
Digital pressure switch for general purpose fluid	**Series ZSE5B/ISE5B**	119

Proposal 11

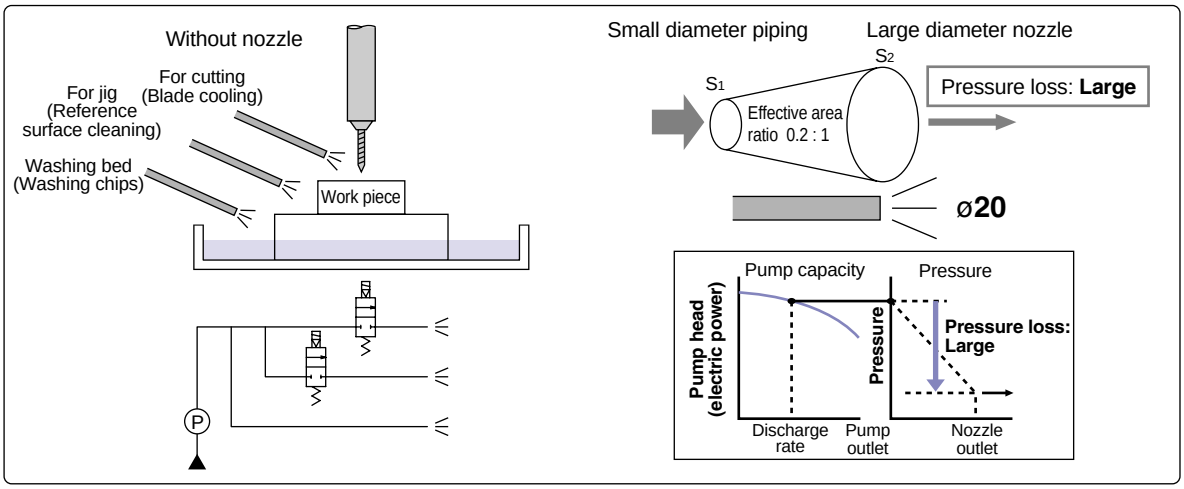
Coolant (Cleaning) Pump

Purpose

Reduction of electric power consumption for coolant pump

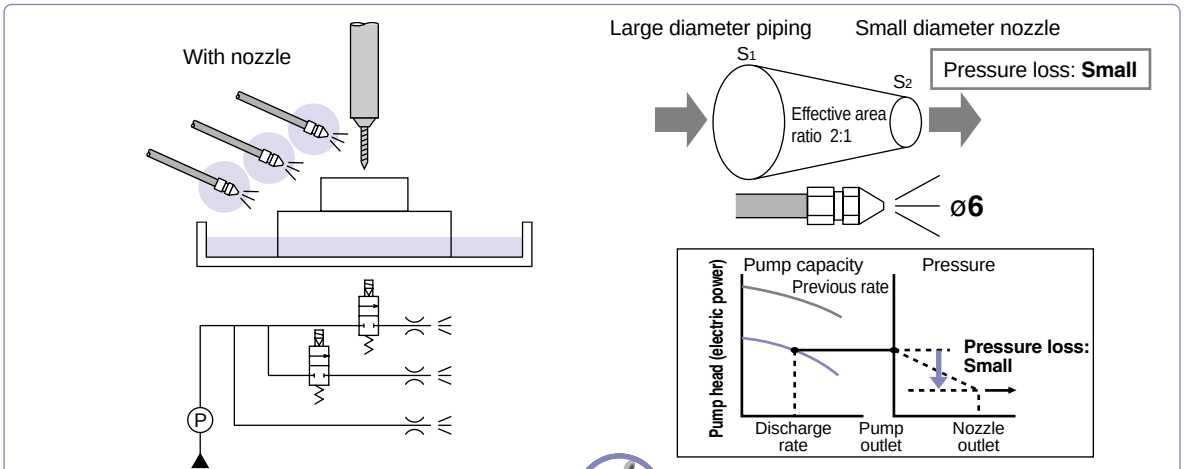
Before Improvement

Coolant is blown without any attachment at the coolant outlet.

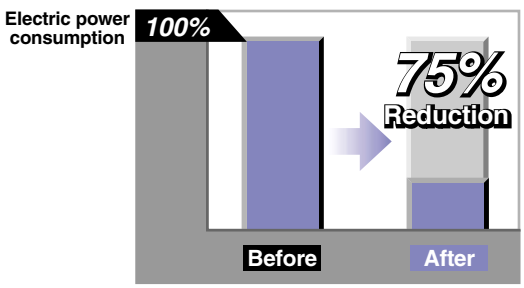


After Improvement

Pressure loss is reduced by attaching nozzles.



Effect of Energy Saving Improvement



Main Points

Improve pressure loss.

Improve the effective area ratio with the upstream side by using a small diameter nozzle.

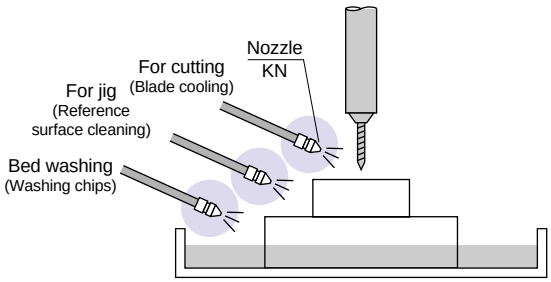
Nozzles for blowing **Series KN** Page 56

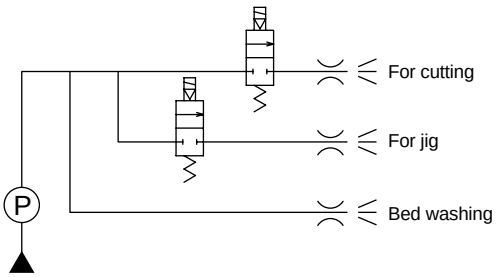
Related Equipment

Digital pressure switch for general purpose fluid	**Series ZSE5B/ISE5B**	Page 119
Energy Saving Program		159
Industrial filter	**Series FG**	152
Industrial filter (Regenerative element specification)	**(Made to order)**	154

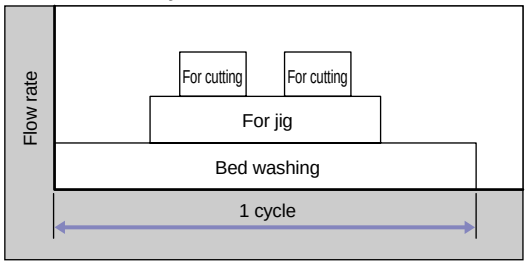
Before Improvement

For bed washing (chip washing), coolant is discharged constantly without any restraint.



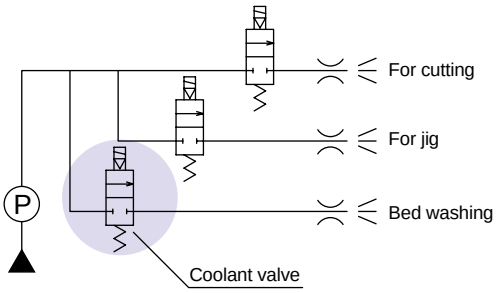


Coolant flow/cycle

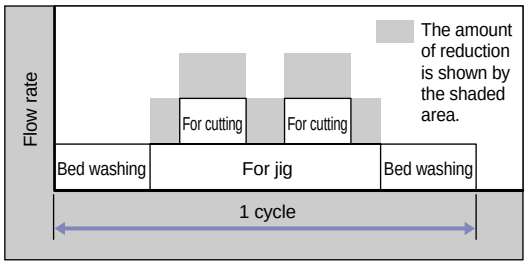


After Improvement

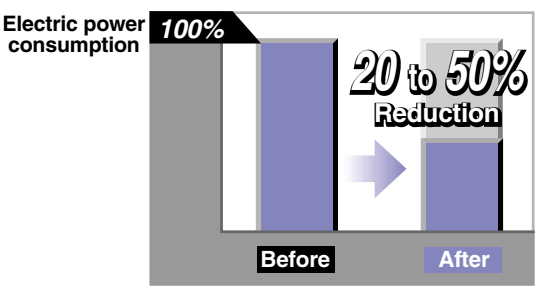
Bed washing is stopped when blowing for cutting or jig.



Coolant flow/cycle



Effect of Energy Saving Improvement

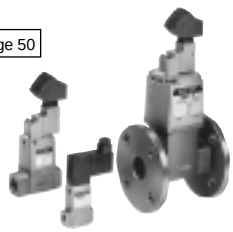


Main Points

Improve pressure loss.

Supply and stop coolant for bed washing.

Coolant valve
Series VNC Page 50



Related Equipment

Digital pressure switch for general purpose fluid	**Series ZSE5B/ISE5B**	Page 119
Energy Saving Program		159
Industrial filter	**Series FG**	152
Industrial filter (Regenerative element specification)	**(Made to order)**	154

Proposal 12

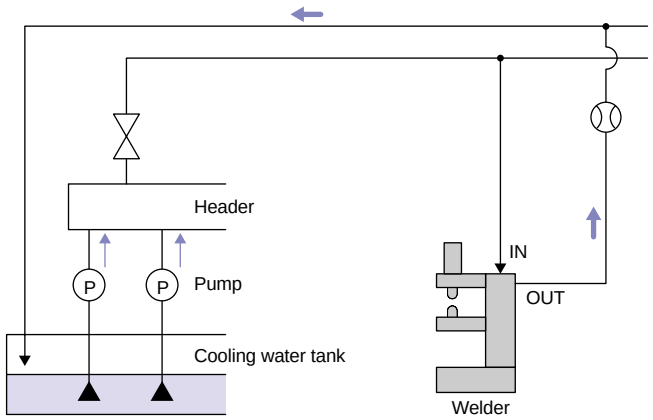
Cooling Water

Purpose

Reduction of electric power consumption for cooling water pump

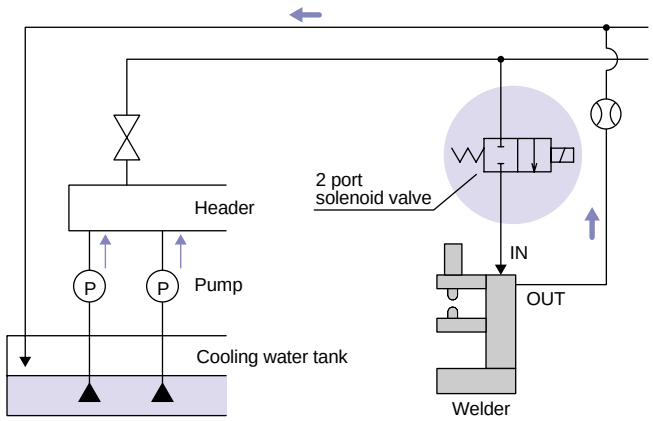
Before Improvement

Regardless of operating or non-operating state of a welding gun, cooling water is constantly discharged.



After Improvement

Stop cooling water supply when not welding.

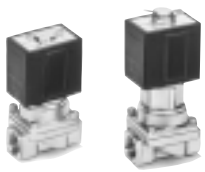


Main Points

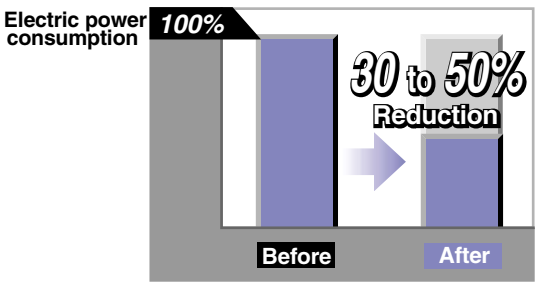
Stop the supply of cooling water when not welding.

Zero differential pressure operated 2 port solenoid valve

Series VXZ Page 37



Effect of Energy Saving Improvement



Related Equipment

Digital flow switch for water **Series PFW** Page 104

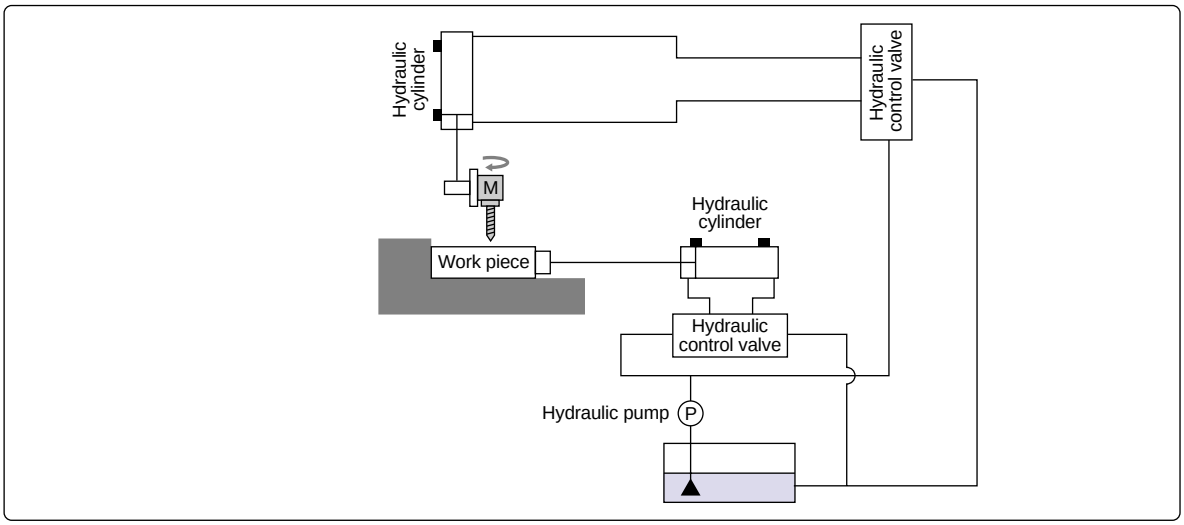
Hydraulic Clamp

Purpose

Reduction of electric power consumption for hydraulic clamp

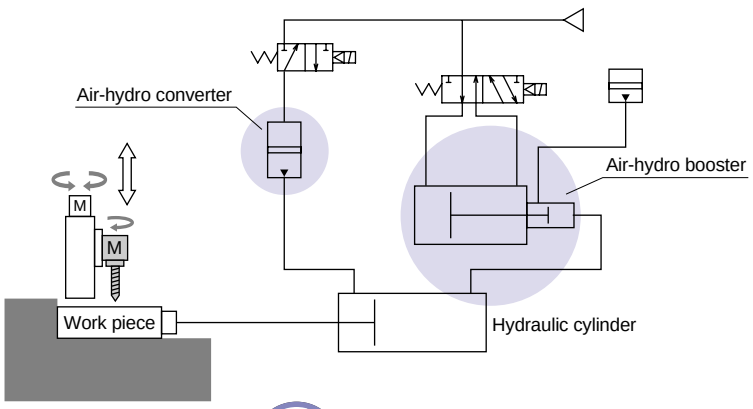
Before Improvement

A hydraulic unit is used for work piece clamping when cutting is performed.

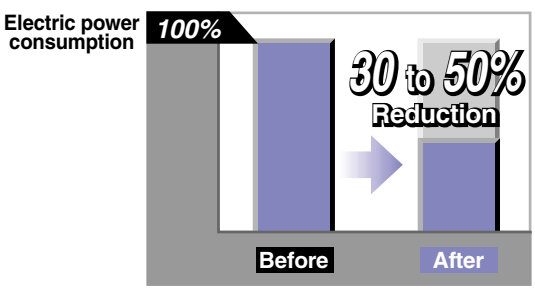


After Improvement

By performing air-hydro conversion for the clamping process, the use of the hydraulic unit is eliminated. Cutting feed is electrically driven.



Effect of Energy Saving Improvement

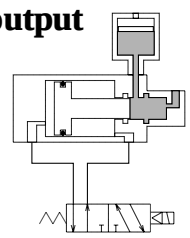


Main Points

Convert to high output hydraulic drive.

Air-hydro booster
(Made to order)

Page 24



Air-hydro converter
Series CCT

Page 27

Proposal 14

Low Power Consumption/Long Life

Purpose

Reduction of power used for solenoid valve energization, and service life improvement

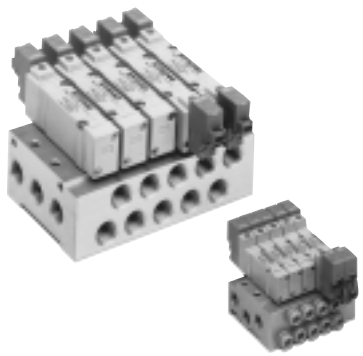
After Improvement

Electric power used for solenoid valve energization is reduced by using low power consumption solenoid valves.
Also, the use of a metal seal construction improves the service life.

Main Points

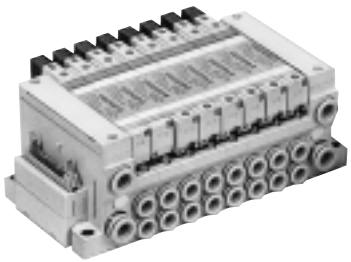
5 port solenoid valve
Series SY

0.5W (21mA, 24VDC)
50 million cycles*



5 port solenoid valve
Series VQ/Metal seal

0.5W (21mA, 24VDC)
200 million cycles*



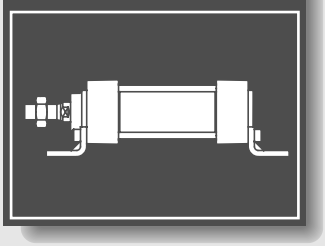
2 port solenoid valve
Series VQ20/30

2.5W (104mA, 24VDC)
20 million cycles*

* **These values are based on SMC life test conditions.**

For more details refer to Best Pneumatics No. 1.

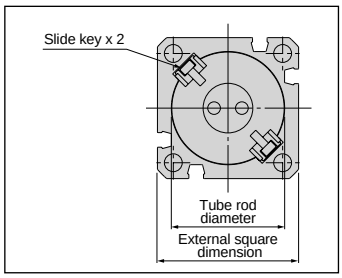
Actuators



Series MGZ ø40, ø50, ø63

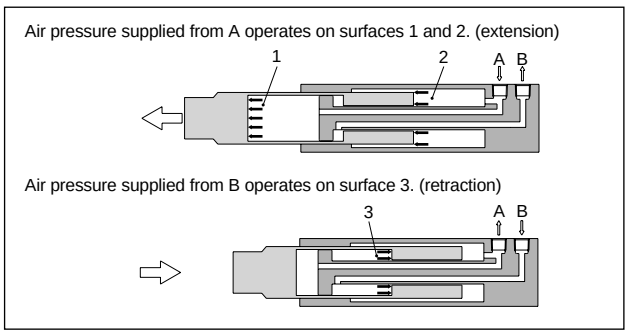
Non-rotation guide is unnecessary !

Employs a large bore tube rod up to 80% of the cylinder's external square dimension plus slide bearings. In addition, a built-in non-rotation mechanism using slide keys allows direct mounting of loads.



Double output power for extension!

A unique construction doubles the pressurized area for extension. An ideal air cylinder for lifting and pressing operations.

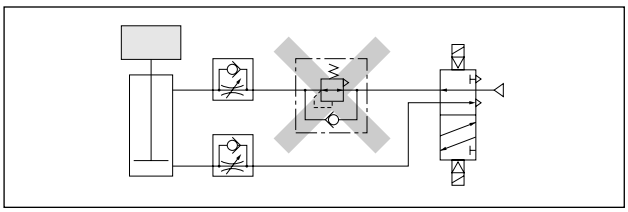


Mounting accuracy improved

Positioning holes are provided on the work piece mounting surface for easy alignment.

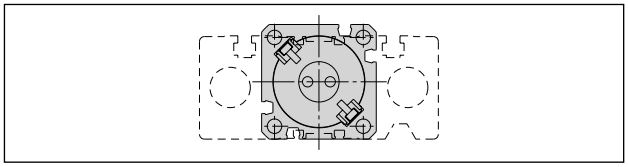
Regulator with check valve is unnecessary

A regulator with check valve normally required for a lifting circuit becomes unnecessary.



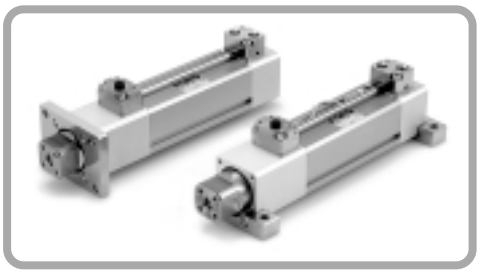
High strength with space savings

Moment resistance is equal to that of a guide cylinder (cylinder + two guide shafts). Furthermore, the mounting cross section is reduced by approximately 40%.



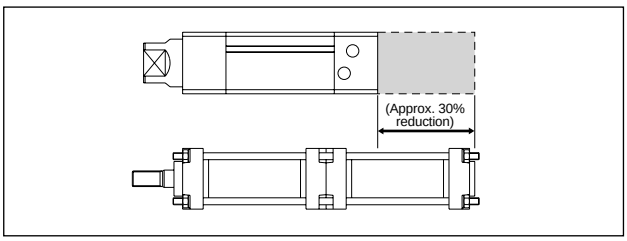
Front end lock type and mounting brackets now available

- End lock holds the rod when extended
- Transaxial foot type, front flange type and rear flange type



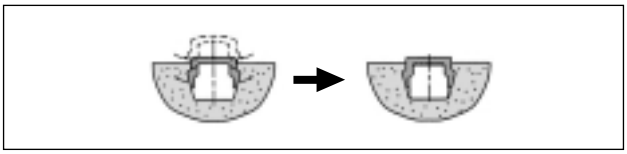
Long stroke capability with space savings

Strokes up to 1000mm are possible.
The overall cylinder length is not two or more times the stroke length, as is the case with conventional double output cylinders (tandem type).

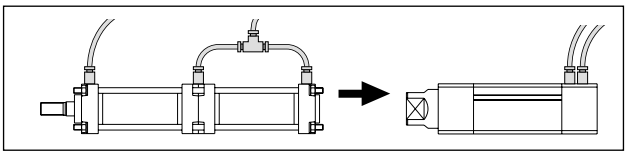


Clean external appearance

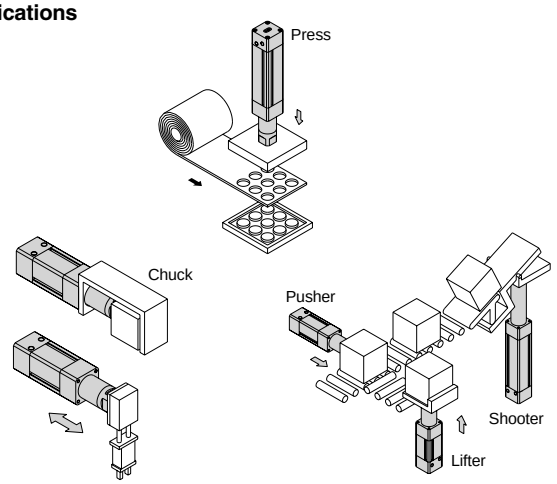
Auto switches are contained in grooves on four sides



Piping is centralized on the head cover.



Applications



How to Order

Standard Type **MGZ** [ ] **40** — **100** — **Z73** [ ]

Mounting

Nil	Basic type
L	Transaxial foot type
F	Front flange type
G	Rear flange type

Bore size

40	40mm
50	50mm
63	63mm

Stroke (mm)
Refer to the standard stroke table.

Auto switch type

Nil	Without auto switch (built-in magnet cylinder)

∗ Select applicable auto switch models from the table below.

Number of auto switches

Nil	2 pcs.
S	1 pc.

Actuators

Applicable auto switches: Direct mount type

Type	Special function	Electrical entry	Indicator light	Wiring (output)	Load voltage			Auto switch model		Lead wire length (m)∗			Applicable load	
					DC		AC	Electrical entry direction		0.5 (Nil)	3 (L)	5 (Z)		
								Perpendicular	In-line					
Reed switch	—	Grommet	Yes	3 wire	—	5V	—	—	**Z76**	●	●	—	IC circuit	—
				2 wire	24V	—	100V	—	**Z73**	●	●	●	—	Relay, PLC
			No			5V, 12V	100V or less	—	**Z80**	●	●	—	IC circuit	
Solid state switch	—	Grommet	Yes	3 wire (NPN)	24V	5V, 12V	—	**Y69A**	**Y59A**	●	●	○	IC circuit	Relay, PLC
				3 wire (PNP)				**Y7PV**	**Y7P**	●	●	○		
				2 wire		12V		**Y69B**	**Y59B**	●	●	○	—	
	Diagnostic indication (2 color indicator)			3 wire (NPN)		5V, 12V		**Y7NWV**	**Y7NW**	●	●	○	IC circuit	
				3 wire (PNP)				**Y7PWV**	**Y7PW**	●	●	○		
				2 wire		12V		**Y7BWV**	**Y7BW**	●	●	○	—	
	Water resistant (2 color indicator)							—	**Y7BA**	—	●	○		

Note 1) Lead wire length symbols: 0.5m ..... Nil (Example) Y69B
3m ..... L Y69BL
5m ..... Z Y69BZ

Note 2) Solid state switches marked with a "○" symbol are produced upon receipt of order.

Note 3) When later installing auto switches on a cylinder ordered without auto switches, the switch spacers in the table below are necessary.

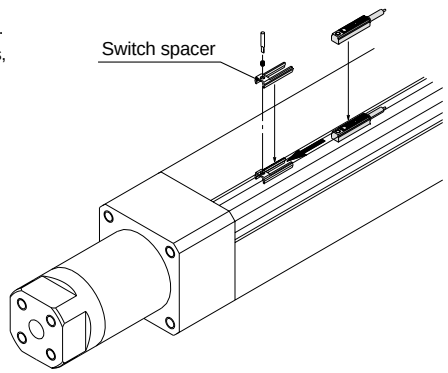
Switch spacers

Applicable bore size (mm)	**40, 50, 63**
Switch spacer	BMP1-032

Mounting bracket part nos.

Bore size (mm)	**40**	**50**	**63**
Foot Note1)	MGZ-L04	MGZ-L05	MGZ-L06
Flange	MGZ-F04	MGZ-F05	MGZ-F06

Note 1) When ordering foot brackets, order two pieces per cylinder.



Specifications

Bore size (mm)	40	50	63
Action	Double acting single rod		
Fluid	Air		
Proof pressure	1.5MPa		
Maximum operating pressure	1.0MPa		
Minimum operating pressure	Standard stroke: 0.08MPa		
	Long stroke: 0.12MPa		
Ambient and fluid temperature	Without auto switch: –10 to 70°C (with no freezing)		
	With auto switch: –10 to 60°C (with no freezing)		
Lubrication	Non-lube		
Piston speed	Extending: 50 to 700mm/s		
	Retracting: 50 to 450mm/s		
Stroke length tolerance	to 250 $^{+1.0}_{0}$, 251 to 1000 $^{+1.4}_{0}$		
Cushion	Rubber bumper		
Thread tolerance	JIS class 2		
Port size	Rc 1/4		
Mounting	Basic type, Transaxial foot type, Front flange type, Rear flange type		

Standard strokes

Bore size (mm)	Standard stroke (mm)	Long stroke (mm)
40, 50, 63	75, 100, 125, 150, 175 200, 250, 300	350, 400, 450, 500, 600 700, 800, 900,1000

Intermediate strokes and strokes of less than 75mm can also be manufactured.

Weights

(kg)

Bore size (mm)		40	50	63
Standard weight	Basic type	1.90	3.03	4.83
	Foot type	2.39	3.92	6.08
	Flange type	2.34	3.79	5.83
Additional weight per 50mm of stroke	All brackets	0.39	0.59	0.78

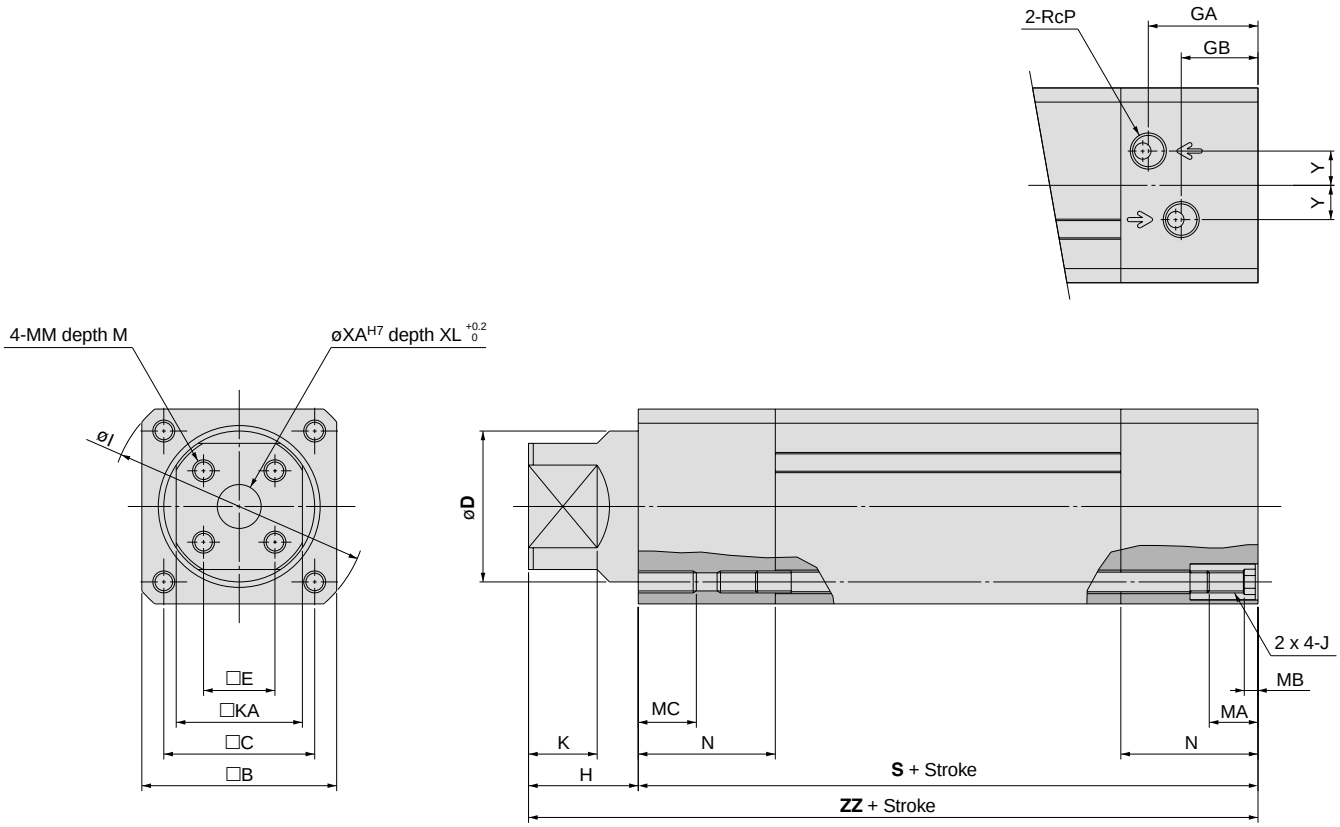
Theoretical output

(N)

Model	Bore size (mm)	Rod size (mm)	Operating direction	Piston area (mm²)	Operating pressure (MPa)								
					0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
MGZ40	45 x 40	20	OUT	2533	507	760	1013	1267	1520	1773	2026	2280	2533
	40		IN	942	188	283	377	471	565	659	754	848	942
MGZ50	55 x 50	25	OUT	3848	770	1154	1539	1924	2309	2694	3078	3463	3848
	50		IN	1473	295	442	589	737	884	1031	1178	1326	1473
MGZ63	68 x 63	32	OUT	5945	1189	1784	2378	2973	3567	4162	4756	5351	5945
	63		IN	2313	463	694	925	1157	1388	1619	1850	2082	2313

Dimensions

Basic type



Allowable angle displacement of □E to □B is ±1.5°.

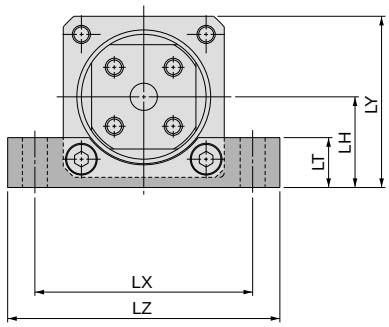
(mm)

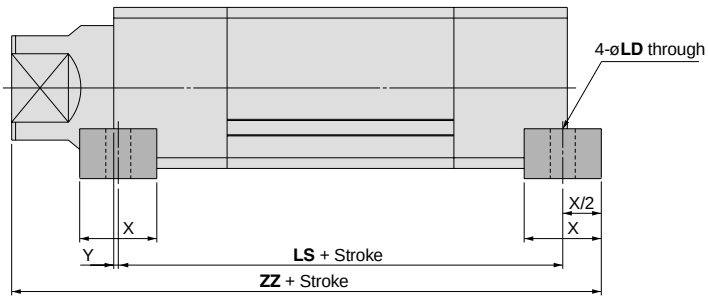
Bore size (mm)	Stroke range	B	C	D	E	KA	GA	GB	H	I	J	K	M
40	to 1000	59	46	45	21	36	34.5	23.5	40	78	M6 x 1.0	25	10
50	to 1000	71	55	55	26	46	40	28	45	92	M8 x 1.25	25	14
63	to 1000	82	66	68	32	53	46.5	34.5	50	110	M8 x 1.25	25	14

Bore size (mm)	Stroke range	MA	MB	MC	MM	N	P	S	XA	XL	Y	ZZ
40	to 1000	16	4	12	M6 x 1.0	44	1/4	138	12	6	9.5	178
50	to 1000	16	5	15	M8 x 1.25	50	1/4	150	16	6	12.5	195
63	to 1000	16	5	15	M8 x 1.25	56	1/4	171	16	6	15	221

Dimensions with Mounting Brackets

Transaxial foot type (L)

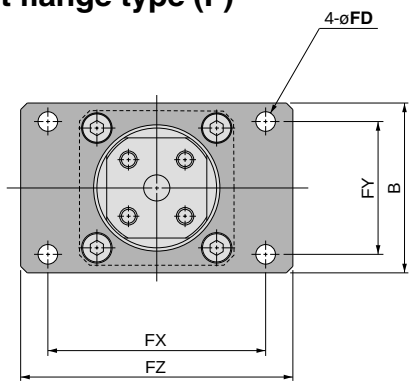


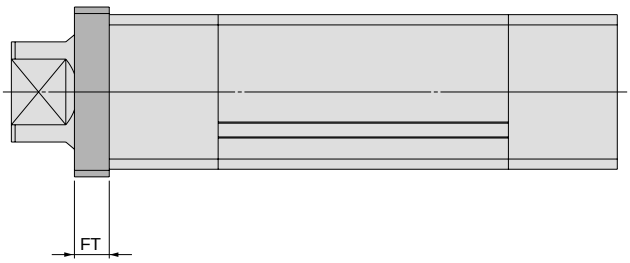


(mm)

Bore size (mm)	Stroke range	X	Y	LD	LH	LT	LX	LY	LZ	LS	ZZ
40	to 1000	24	0	9	34	19	80	63.5	100	138	190
50	to 1000	32	1	11	40	22	96	75.5	120	148	210
63	to 1000	36	3	13	47	24	110	88	140	165	236

Front flange type (F)

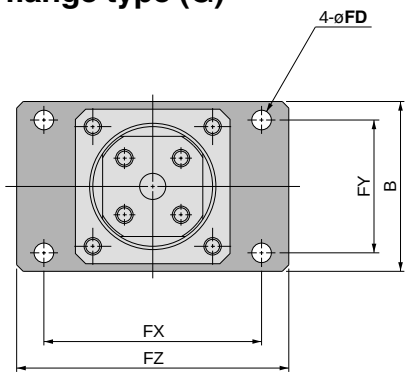


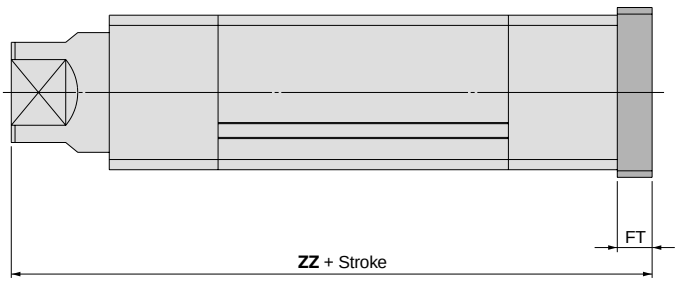


(mm)

Bore size (mm)	Stroke range	B	FD	FT	FX	FY	FZ
40	to 1000	74	9	12	80	58	100
50	to 1000	78	9	16	100	61	125
63	to 1000	100	12	16	112	75	138

Rear flange type (G)

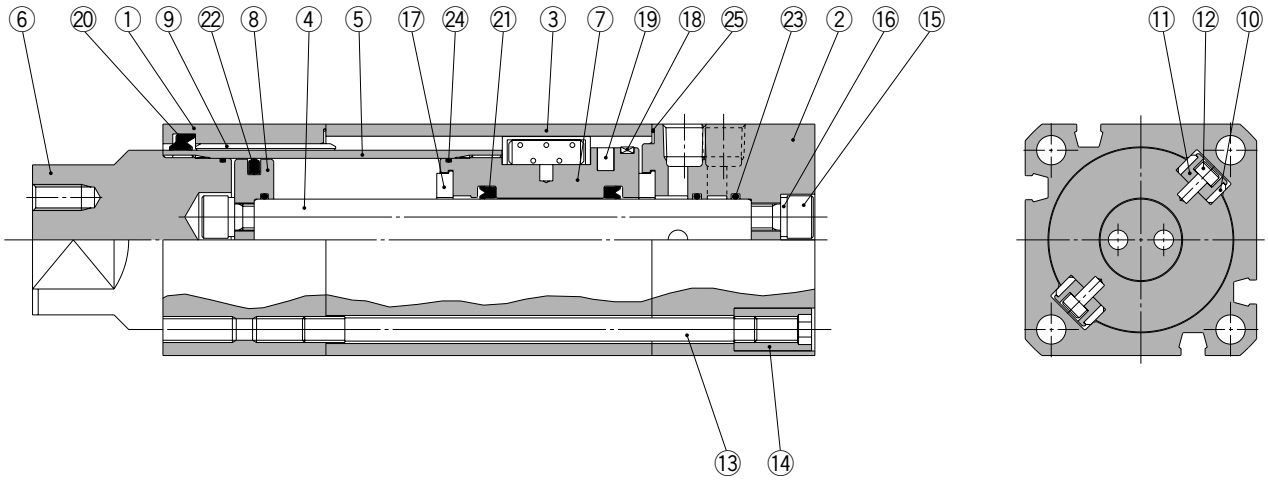




(mm)

Bore size (mm)	Stroke range	B	FD	FT	FX	FY	FZ	ZZ
40	to 1000	74	9	12	80	58	100	190
50	to 1000	78	9	16	100	61	125	211
63	to 1000	100	12	16	112	75	138	237

Construction



Parts list

No.	Description	Material	Note
1	**Rod cover**	Aluminum alloy	Clear anodized
2	**Head cover**	Aluminum alloy	Clear anodized
3	**Cylinder tube**	Aluminum alloy	Hard anodized
4	**Piston rod**	Aluminum alloy	Hard anodized
5	**Tube rod**	Carbon steel pipe	Hard chrome plated
6	**Tube rod cover**	Carbon steel	Electroless nickel plated
7	**Piston**	Aluminum alloy	Chromated
8	**Stationary piston**	Aluminum alloy	Chromated
9	**Bushing**	Lead bronze casting	
10	**Thrust plate**	Lead bronze casting	
11	**Holder**	Aluminum alloy	Chromated
12	**Pin**	Carbon steel	Zinc chromated
13	**Tie-rod**	Carbon steel	Corrosion resistant chromated

No.	Description	Material	Note
14	**Tie-rod nut**	Carbon steel	Nickel plated
15	**Hexagon socket head cap screw**	Chrome molybdenum steel	Nickel plated
16	**Spring washer**	Steel wire	Nickel plated
17	**Bumper**	Urethane	
18	**Wear ring**	Resin	
19	**Magnet**	Magnetic material	
20*	**Rod seal A**	NBR	
21	**Rod seal B**	NBR	
22	**Piston seal**	NBR	
23	**Piston gasket**	NBR	
24	**Tube rod gasket**	NBR	
25*	**Cylinder tube gasket**	NBR	

Replacement parts: Seal kits

Bore size (mm)	Seal kit no.	Content
40	MGZ40-PS	A set of above nos. 20 and 25.
50	MGZ50-PS	
63	MGZ63-PS	

* Seal kits consist of a set of items 20 and 25, which can be ordered using the seal kit number for each bore size.

How to Order

With End Lock **MGZ** [ ] **40** — **100** **R** — **Z73** [ ]

Mounting

Nil	Basic type
L	Transaxial foot type
F	Front flange type
G	Rear flange type

Bore size

40	40mm
50	50mm
63	63mm

With front end lock

Stroke (mm)
Refer to the standard stroke table.

Auto switch type

Nil	Without auto switch (built-in magnet cylinder)

∗ Select applicable auto switch models from the table below.

Number of auto switches

Nil	2 pcs.
S	1 pc.

Applicable auto switches: Direct mount type

Type	Special function	Electrical entry	Indicator light	Wiring (output)	Load voltage			Auto switch model		Lead wire length (m)∗			Applicable load	
					DC		AC	Electrical entry direction		0.5 (Nil)	3 (L)	5 (Z)		
								Perpendicular	In-line					
Reed switch	—	Grommet	Yes	3 wire	—	5V	—	—	**Z76**	●	●	—	IC circuit	—
				2 wire	24V	—	100V	—	**Z73**	●	●	●	—	Relay, PLC
			No			5V, 12V	100V or less	—	**Z80**	●	●	—	IC circuit	
Solid state switch	—	Grommet	Yes	3 wire (NPN)	24V	5V, 12V	—	**Y69A**	**Y59A**	●	●	○	IC circuit	Relay, PLC
				3 wire (PNP)				**Y7PV**	**Y7P**	●	●	○		
				2 wire		12V		**Y69B**	**Y59B**	●	●	○	—	
	Diagnostic indication (2 color indicator)			3 wire (NPN)		5V, 12V		**Y7NWV**	**Y7NW**	●	●	○	IC circuit	
				3 wire (PNP)				**Y7PWV**	**Y7PW**	●	●	○		
	Water resistant (2 color indicator)			2 wire		12V		**Y7BWV**	**Y7BW**	●	●	○	—	
								—	**Y7BA**	—	●	○		

Note 1) Lead wire length symbols: 0.5m ..... Nil (Example) Y69B
3m ..... L Y69BL
5m ..... Z Y69BZ

Note 2) Solid state switches marked with a "○" symbol are produced upon receipt of order.

Note 3) When later installing auto switches on a cylinder ordered without auto switches, the switch spacers in the table below are necessary.

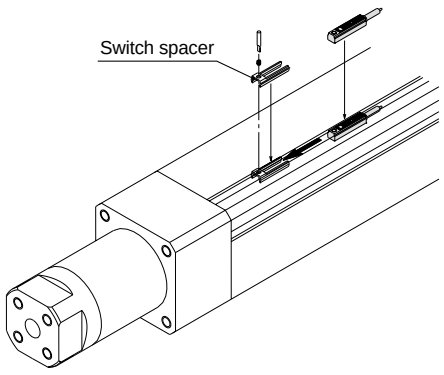
Switch spacers

Applicable bore size (mm)	**40, 50, 63**
Switch spacer	BMP1-032

Mounting bracket part nos.

Bore size (mm)	40	50	63
Foot Note1)	MGZ-L04	MGZ-L05	MGZ-L06
Flange	MGZ-F04	MGZ-F05	MGZ-F06

Note 1) When ordering foot brackets, order two pieces per cylinder.



Cylinder specifications

Bore size (mm)	40	50	63
Action	Double acting single rod		
Fluid	Air		
Proof pressure	1.5MPa		
Maximum operating pressure	1.0MPa		
Minimum operating pressure	0.2MPa*		
Ambient and fluid temperature	Without auto switch: −10 to 70°C (with no freezing)		
	With auto switch: −10 to 60°C (with no freezing)		
Lubrication	Non-lube		
Piston speed	Extending: 50 to 700mm/s		
	Retracting: 50 to 450mm/s		
Stroke length tolerance	to $250^{+1.0}_{0}$, 251 to $1000^{+1.4}_{0}$		
Cushion	Rubber bumper		
Thread tolerance	JIS class 2		
Port size	Rc 1/4		
Mounting	Basic type, Transaxial foot type, Front flange type, Rear flange type		

* Except for the lock section, the minimum operating pressure is 0.08MPa (0.12MPa for long strokes).

Lock specifications

End lock position	Front only		
Holding force (maximum) N	ø40	ø50	ø63
	1770	2690	4160
Backlash	2mm or less		
Manual release	Non-locking type		

Adjust an auto switch's position so that it operates for movement to both the stroke end and backlash (2mm) positions.

Standard strokes

Bore size (mm)	Standard stroke (mm)	Long stroke (mm)
40, 50, 63	75, 100, 125, 150, 175 200, 250, 300	350, 400, 450, 500, 600 700, 800, 900, 1000

Intermediate strokes and strokes of less than 75mm can also be manufactured.

Weights

(kg)

Bore size (mm)		40	50	63
Standard weight	Basic type	2.80	4.08	6.13
	Foot type	3.29	4.97	7.39
	Flange type	3.24	4.84	7.13
Additional weight per 50mm of stroke	All brackets	0.41	0.61	0.80

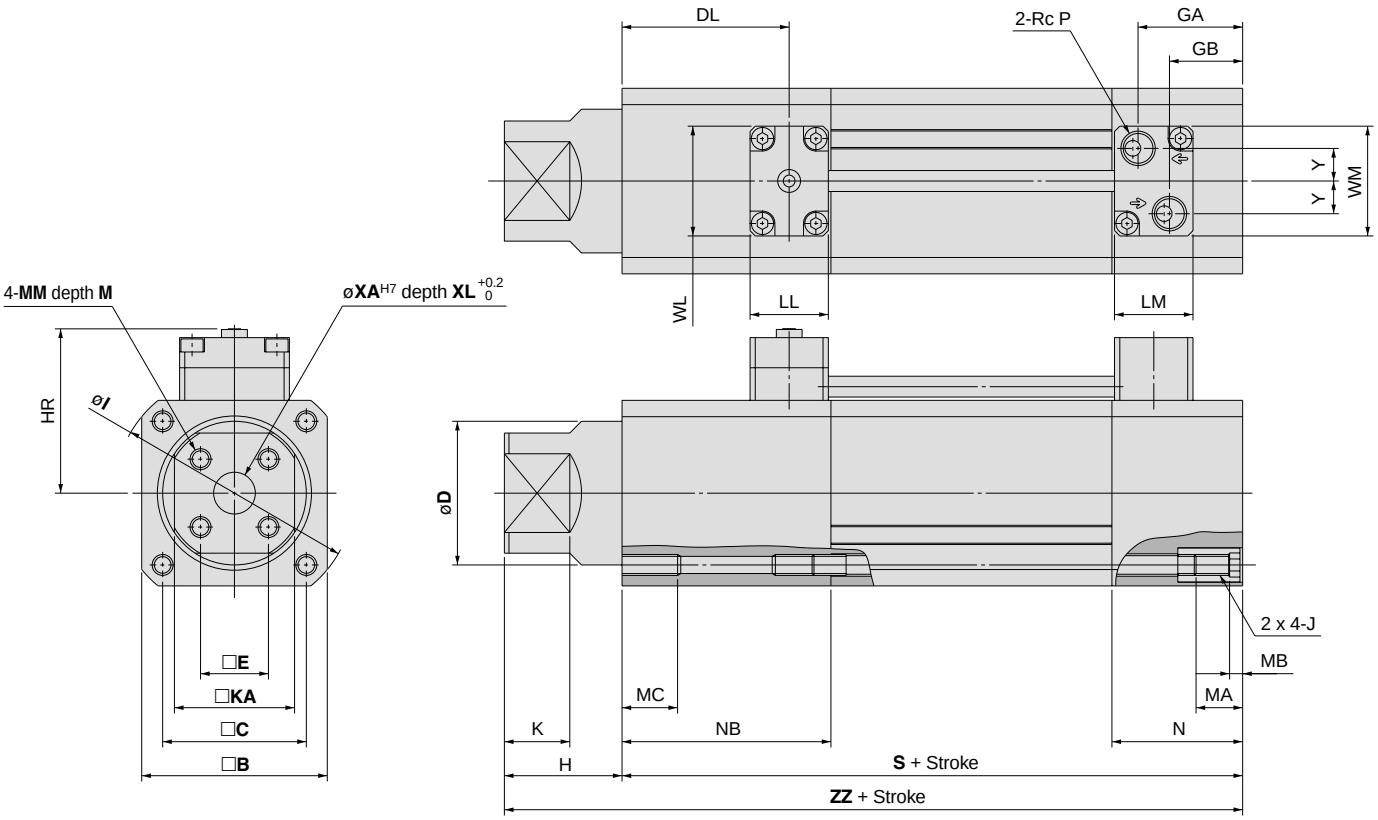
Theoretical output

(N)

Model	Bore size (mm)	Rod size (mm)	Operating direction	Piston area (mm^2)	Operating pressure (MPa)								
					0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
MGZ40	45 x 40	20	OUT	2533	507	760	1013	1267	1520	1773	2026	2280	2533
	40		IN	942	188	283	377	471	565	659	754	848	942
MGZ50	55 x 50	25	OUT	3848	770	1154	1539	1924	2309	2694	3078	3463	3848
	50		IN	1473	295	442	589	737	884	1031	1178	1326	1473
MGZ63	68 x 63	32	OUT	5945	1189	1784	2378	2973	3567	4162	4756	5351	5945
	63		IN	2313	463	694	925	1157	1388	1619	1850	2082	2313

Dimensions

Basic type



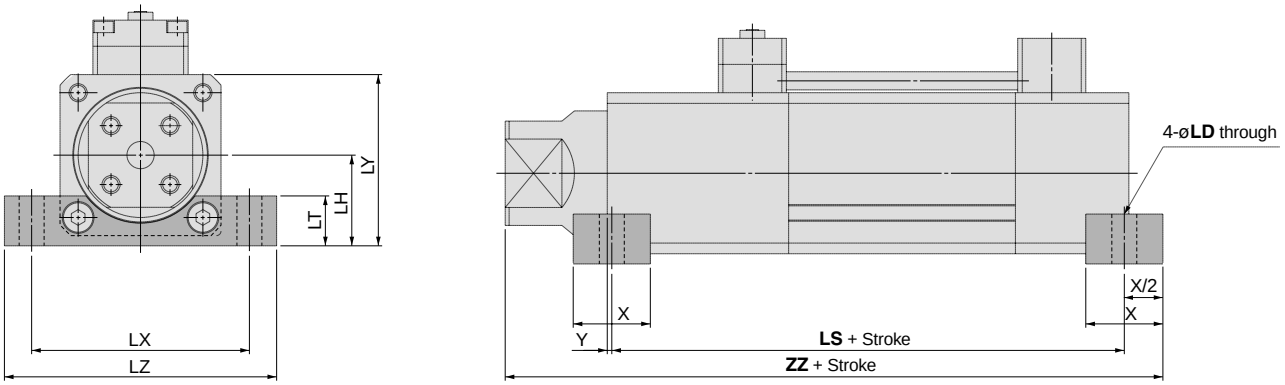
(mm)

Bore size (mm)	Stroke range	□B	□C	D	DL	□E	GA	GB	H	HR	I	J	K	KA	LL	LM
40	to 1000	59	46	45	58	21	34.5	23.5	40	57.5	78	M6 x 1.0	25	36	30	30
50	to 1000	71	55	55	67	26	40	28	45	63.5	92	M8 x 1.25	25	46	30	30
63	to 1000	82	66	68	73	32	46.5	34.5	50	69	110	M8 x 1.25	25	53	30	30

Bore size (mm)	Stroke range	M	MA	MB	MC	MM	N	NB	P	S	XA	XL	Y	WL	WM	ZZ
40	to 1000	10	18	4	12	M6 x 1.0	44	74	1/4	168	12	6	9.5	42	39	208
50	to 1000	14	18	5	15	M8 x 1.25	50	83	1/4	183	16	6	12.5	42	42	228
63	to 1000	14	18	5	15	M8 x 1.25	56	89	1/4	204	16	6	15	52	52	254

Dimensions with Mounting Brackets

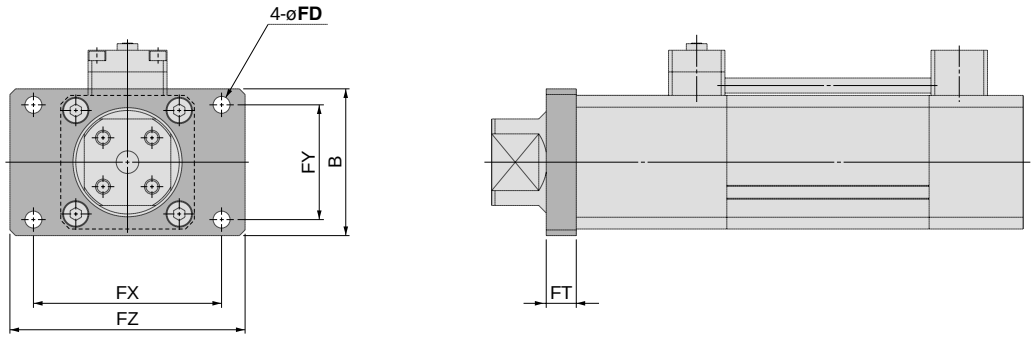
Transaxial foot type (L)



(mm)

Bore size (mm)	Stroke range	X	Y	LD	LH	LT	LX	LY	LZ	LS	ZZ
40	to 1000	24	0	9	34	19	80	63.5	100	168	220
50	to 1000	32	1	11	40	22	96	75.5	120	181	243
63	to 1000	36	3	13	47	24	110	88	140	198	269

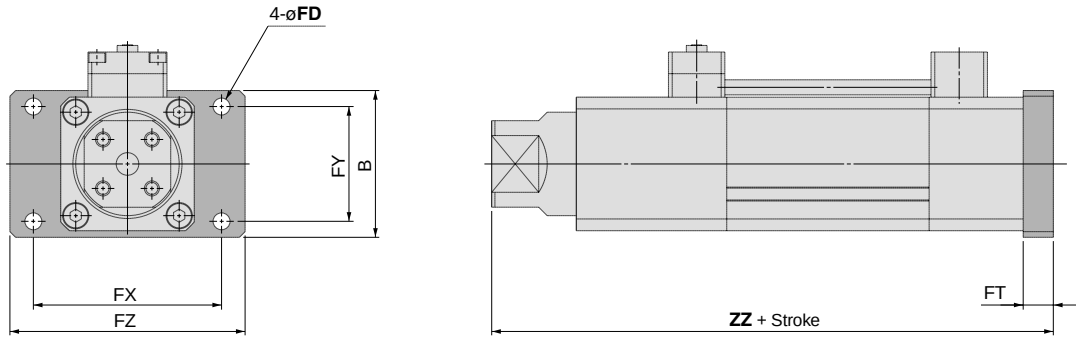
Front flange type (F)



(mm)

Bore size (mm)	Stroke range	B	FD	FT	FX	FY	FZ
40	to 1000	74	9	12	80	58	100
50	to 1000	78	9	16	100	61	125
63	to 1000	100	12	16	112	75	138

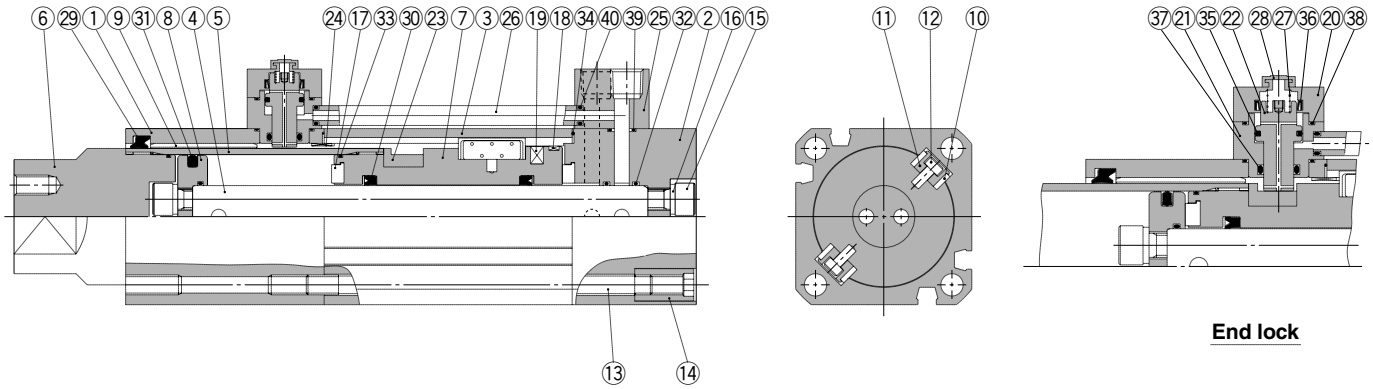
Rear flange type (G)



(mm)

Bore size (mm)	Stroke range	B	FD	FT	FX	FY	FZ	ZZ
40	to 1000	74	9	12	80	58	100	220
50	to 1000	78	9	16	100	61	125	244
63	to 1000	100	12	16	112	75	138	270

Construction



Parts list

No.	Description	Material	Note
1	**Rod cover**	Aluminum alloy	Clear anodized
2	**Head cover**	Aluminum alloy	Clear anodized
3	**Cylinder tube**	Aluminum alloy	Hard anodized
4	**Piston rod**	Aluminum alloy	Hard anodized
5	**Tube rod**	Carbon steel pipe	Hard chrome plated
6	**Tube rod cover**	Carbon steel	Electroless nickel plated
7	**Piston**	Aluminum alloy	Chromated
8	**Stationary piston**	Aluminum alloy	Chromated
9	**Bushing**	Lead-bronze casting	
10	**Thrust plate**	Lead-bronze casting	
11	**Holder**	Aluminum alloy	Chromated
12	**Pin**	Carbon steel	Zinc chromated
13	**Tie-rod**	Carbon steel	Corrosion resistant chromated
14	**Tie-rod nut**	Carbon steel	Nickel plated
15	**Hexagon socket head cap screw**	Chrome molybdenum steel	Nickel plated
16	**Spring washer**	Steel wire	Nickel plated
17	**Bumper**	Urethane	
18	**Wear ring**	Resin	
19	**Magnet**	Magnetic material	
20	**Cap**	Bronze alloy	Electroless nickel plated

No.	Description	Material	Note
21	**Lock holder**	Stainless steel	
22	**Lock piston**	Carbon steel	Quenched, Hard chrome plated
23	**Stopper**	Carbon steel	Quenched
24	**Collar**	Lead-bronze casting	
25	**Port block**	Bronze alloy	Electroless nickel plated
26	**Pipe**	Bronze alloy	
27	**Lock spring**	Steel wire	
28	**Rubber cap**	Synthetic rubber	
29*	**Rod seal A**	NBR	
30	**Rod seal B**	NBR	
31	**Piston seal**	NBR	
32	**Piston gasket**	NBR	
33	**Tube rod gasket**	NBR	
34*	**Cylinder tube gasket**	NBR	
35*	**Lock piston seal A**	NBR	
36*	**Lock piston seal B**	NBR	
37*	**Lock piston seal C**	NBR	
38*	**Lock holder gasket**	NBR	
39*	**Port block gasket**	NBR	
40*	**Pipe gasket**	NBR	

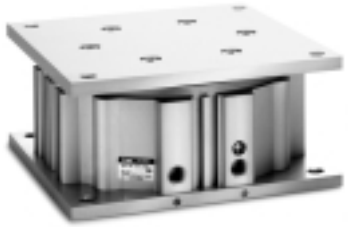
Replacement parts: Seal kits

Bore size (mm)	Seal kit no.	Content
40	**MGZ40R-PS**	A set of above nos. 29, 34, 35, 36, 37, 38, 39 and 40.
50	**MGZ50R-PS**	
63	**MGZ63R-PS**	

* Seal kits consist of a set of items 29 and 34 through 40, which can be ordered using the seal kit number for each bore size.

Series MGF ø40, ø63, ø100

Compact type with reduced height. A large bore guide cylinder with superior eccentric load resistance and low profile.



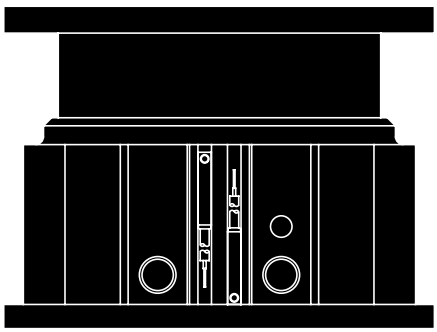
Dramatically reduced mounting height

The compact design of the cylinder makes it possile to reduce the overall size of equipment.

Mounting height

△15 to 20% reduction

(compared to SMC series MGQ)



Built-in non-rotating mechanism

Internal guide pin prevents the top plate from rotating.

Non-rotating accuracy

Bore size (mm)	Non-rotating accuracy θ
40	±0.08°
63	±0.06°
100	±0.05°

With T-slots

T-slots are provided on three sides (except the port side), allow mounting of various brackets, etc. (The slots cannot be used for securing the cylinder body.)

Series variations

Model	Bore size (mm)	Standard stroke (mm) 30	50	75	100	Auto switches
MGF 40	40	●	●	●	●	Reed switches: D-Z7/Z8
MGF 63	63	●	●	●	●	Solid state switches: D-Y5/Y6/Y7
MGF100	100	●	●	●	●	2 color indication solid state switch: D-Y7 Water resistant 2 color indication solid state switch: D-Y7BA

How to Order

MGF **63** — **30** — **Z73** ☐

Guide table

Cylinder bore size/Standard stroke (mm)

40	30, 50, 75, 100
63	30, 50, 75, 100
100	30, 50, 75, 100

Number of auto switches

Nil	2 pcs.
S	1 pc.

Auto switch type

Nil	Without auto switch

∗ Refer to the table below for auto switch models.

Applicable auto switches

/Refer to page 5.3-2 of "Best Pneumatics No. 2" for auto switch related information.

Type	Special function	Electrical entry	Indicator light	Wiring (output)	Load voltage			Auto switch model		Lead wire length (m)∗			Applicable load	
					DC		AC	Lead wire entry direction		0.5 (Nil)	3 (L)	5 (Z)		
								Perpendicular	In-line					
Reed switch	—	Grommet	Yes	3 wire	—	5V	—	—	**Z76**	●	●	—	IC circuit	Relay, PLC
				2 wire	24V	12V	100V	—	**Z73**	●	●	●	—	
			No			5V 12V	100V or less	—	**Z80**	●	●	—	IC circuit	
Solid state switch	—	Grommet	Yes	3 wire (NPN)	24V	5V 12V	—	**Y69A**	**Y59A**	●	●	●	IC circuit	Relay, PLC
				3 wire (PNP)				**Y7PV**	**Y7P**	●	●	●		
				2 wire		12V		**Y69B**	**Y59B**	●	●	●	—	
	Diagnostic indication (2 color indicator)			3 wire (NPN)		5V 12V		**Y7NWV**	**Y7NW**	●	●	●	IC circuit	
				3 wire (PNP)				**Y7PWV**	**Y7PW**	●	●	●		
				2 wire		12V		**Y7BWV**	**Y7BW**	●	●	●	—	
	Water resistant (2 color indicator)							—	**Y7BAL**	—	●	●		

∗ Lead wire length symbols 0.5m ..... Nil (Example) Y59A
3m ..... LY Y59AL
5m ..... ZY Y59AZ

Specifications

Action	Double acting
Fluid	Air
Proof pressure	1.5MPa
Maximum operating pressure	1.0MPa
Minimum operating pressure	0.1MPa
Ambient and fluid temperature	–10 to 60°C
Operating piston speed	20 to 200mm/s
Cushion	Rubber bumper at both ends
Lubrication	Non-lube
Stroke length tolerance	$^{+1.0}_{0}$ mm

Standard Strokes

Model	Standard stroke (mm)	Intermediate stroke
MGF 40	30, 50, 75, 100	A spacer with a width of 5, 10, 15, 20 or 25mm is installed to manufacture intermediate strokes (5mm increments) other than standard strokes. Example) For MGF63 with 15mm stroke A spacer of 15mm width is installed inside MGF63 with a 30mm stroke. Therefore, the overall length will be the same as the model with a 30mm stroke.
MGF 63		
MGF100		

Refer to page 3.21-1 of Best Pneumatics No. 2 for details.

PFC/QFC Valves

PFC valve: A control valve with pressure adjustment and cylinder speed control functions

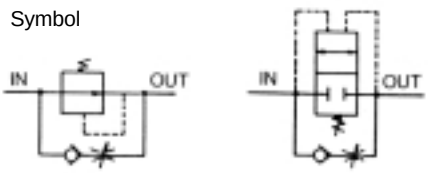
QFC valve: A control valve with quick exhaust and cylinder speed control functions

PFC valve

QFC valve

Patent pending

Symbol



PFC valve QFC valve

Models

Description	Model	Port size	Effective area mm²		Weight g
			Regulated flow	Free flow	
PFC valve	**ASR100**	1/8	2.4	—	97
	ASR300	1/4, 3/8	14.5	—	220
	ASR500	1/2, 3/4	52.0	—	580
	ASR600	3/4, 1	80.0	—	950
QFC valve	**ASQ100**	1/8	2.4	5.4	97
	ASQ300	1/4, 3/8	14.5	22.0	220
	ASQ500	1/2, 3/4	52.0	68.0	580
	ASQ600	3/4, 1	80.0	106.0	950

Specifications

Fluid		Air
Maximum operating pressure		0.7MPa
Ambient and fluid temperature		0 to 60°C
Set pressure	PFC valve	0.2 to 0.5MPa
	QFC valve	0.1 to 0.5MPa

How to Order

ASR **100** — **[ ]** **01** **B**

Product type

ASR	PFC valve
ASQ	QFC valve

Body size

100	1/8
300	3/8
500	3/4
600	1

Thread type

Nil	Rc
N	NPT
F	G

Accessory

Nil	Without bracket
B	With bracket

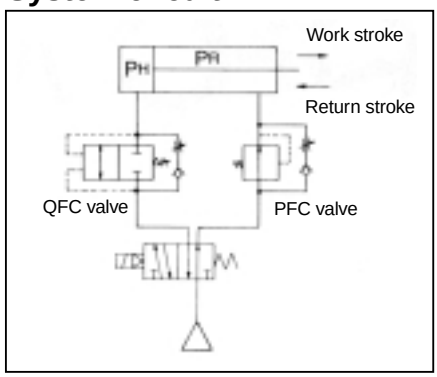
Port size

Port size		Applicable series
01	1/8	ASR100, ASQ100
02	1/4	ASR300, ASQ300
03	3/8	ASR300, ASQ300
04	1/2	ASR500, ASQ500
06	3/4	ASR500, 600, ASQ500, 600
10	1	ASR600, ASQ600

25% reduction of air consumption

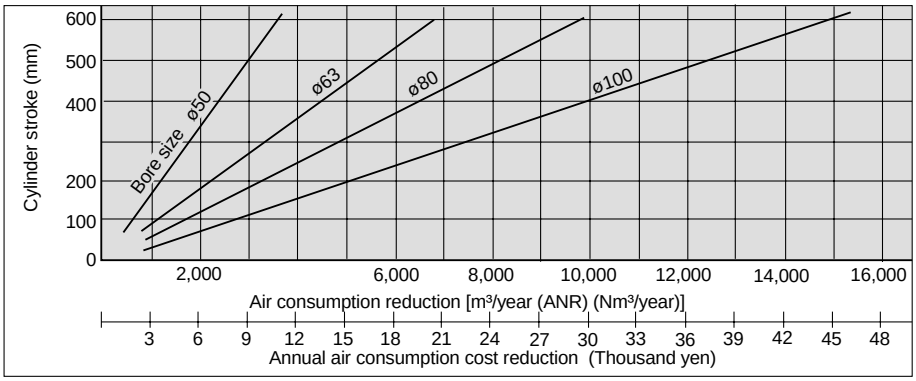
It is not necessary to supply high pressure to both the extension and retraction sides of a piston. On the non-working side, it is sufficient to supply just enough pressure (0.2MPa) for the piston to operate smoothly within the set time. A reduction system using PFC and QFC valves reduces air consumption by 25%, which translates into reduced running cost and dramatic reduction of equipment cost.

System circuit



Effect of Reduction

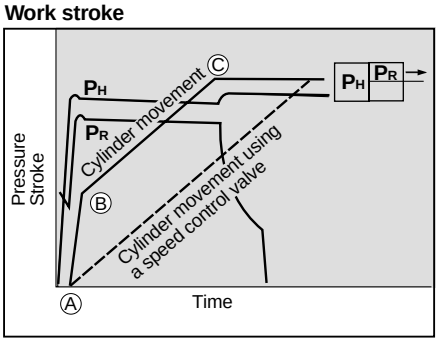
Rod side set pressure: 0.2MPa



Conditions — Cylinder operating frequency: 10 cycles/min
Operating time: 8hrs/day
Number of operating days: 250 days/year
Cylinder pressure: Head side pressure of 0.5MPa

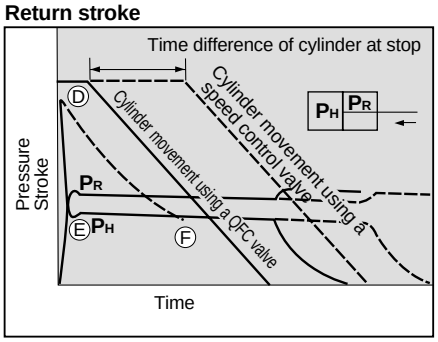
Pressure and Time Line Charts

Work stroke



During the work stroke, the cylinder moves quickly from A to B due to the difference between the head side pressure (P_H) and rod side pressure (P_R). Cylinder speed is then controlled by a PFC valve from B to C. Therefore, the cylinder speed remains the same for a shorter length of time than it did previously.

Return stroke



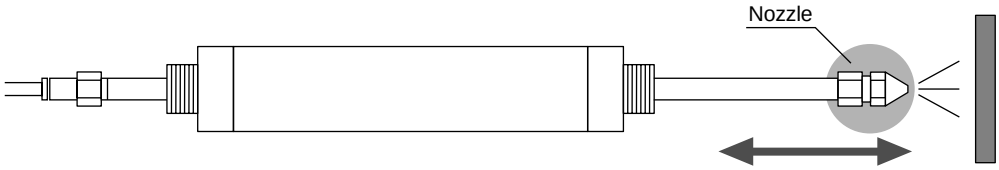
To prevent time lag, air is quickly exhausted from D to E, after which the piston moves at a constant speed. When a speed controller is used instead of a QFC valve, the time required for exhaust becomes longer as shown by the D to F line of the head side pressure (P_H). This causes a longer stopping time for the cylinder and time loss.

Hollow Rod Cylinder
(Rod Through Hole Type)

Made to Order

Air Blow

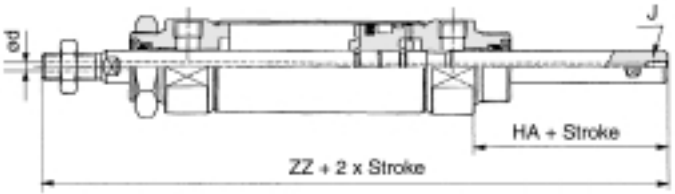
A hollow rod for vacuum piping is utilized for air flow. The nozzle position can be moved.



Air cylinder/CM2W-XC38

Specifications

Model	Pneumatic type
Cylinder bore size (mm)	ø20, ø25, ø32, ø40
Action	Double acting double rod
Maximum operating pressure	1.0MPa
Minimum operating pressure	0.08MPa
Cushion	Rubber bumper (standard)
Mounting	Basic type, Axial foot type, Flange type, Trunnion type
Auto switch	Capable
Specifications other than above	Specifications are the same as series CM2W. Refer to page 1.4-23 of "Best Pneumatics No.2".



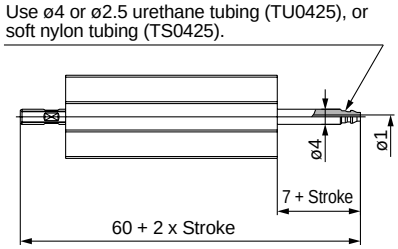
Bore size (mm)	d	J	HA	ZZ
20	3	M5 x 0.8	32	135
25	3	M5 x 0.8	32	139
32	3	M5 x 0.8	32	141
40	4	Rc 1/8	36	174

Precision cylinder/MTS8-XC38

Specifications

Bore size (mm)	**8**
Port direction	Standard type, Top ported type
Rod end configuration	Female thread

Dimensions



Refer to the catalog "Precision Cylinder Series MTS" CAT.ES20-127 C for details.

Free Mount Cylinder for Vacuum
Series ZCUK

Air Blow

How to Order

Basic type ZCUK C 16 20 D

With auto switch ZCDUK C 16 20 D A90 S

Built-in magnet

Type (Vacuum side piping)/(Rod end configuration)
C — Cap piping/Male thread
D — Cap piping/Direct pad mount
Q — Rod piping/Male thread
R — Rod piping/Direct pad mount

Bore size
10 — 10mm
16 — 16mm
20 — 20mm
25 — 25mm
32 — 32mm

Standard stroke (mm)
10, 16 ——— 5, 10, 15, 20, 25, 30
20, 25, 32 — 5, 10, 15, 20, 25, 30, 40, 50

Action
D — Double acting

Auto switch type

Nil	Without auto switch

Select an auto switch model from the table below.

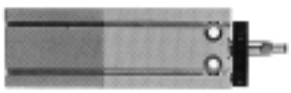
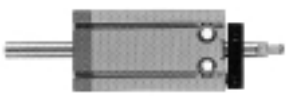
Number of auto switches
Nil — 2 pcs.
S —— 1 pc.

Auto switch specifications/ For detailed specifications of an auto switch unit, refer to page 3.9-5 of "Best Pneumatics No. 3."

Type	Special function	Electrical entry	Indicator light	Wiring (output)	Load voltage DC	Load voltage DC	Load voltage AC	Auto switch model Perpendicular	Auto switch model In-line	Lead wire length (m) Note 1) 0.5 (Nil)	3 (L)	5 (Z)	Applicable load	
Reed switch	——	Grommet	No	2 wire	24V	5V 12V	100V or less	**A90V**	**A90**	●	●	—	IC circuit	Relay, PLC
			Yes			12V	100V	**A93V**	**A93**	●	●	—	—	
				3 wire (NPN equiv.)	—	5V	—	**A96V**	**A96**	●	●	—	IC circuit	—
Solid state switch	——	Grommet	Yes	3 wire (NPN)	24V	12V	—	**F9NV**	**F9N**	●	●	—	—	Relay, PLC
				3 wire (PNP)				**F9PV**	**F9P**	●	●	—		
				2 wire				**F9BV**	**F9B**	●	●	—		
	Diagnostic indication (2 color indicator)			3 wire (NPN)				**F9NWV**	**F9NW**	●	●	○		
				3 wire (PNP)				**F9PWV**	**F9PW**	●	●	○		
				2 wire				**F9BWV**	**F9BW**	●	●	○		

Note 1) Lead wire length symbols
0.5m ..... Nil (Example) A93
3m ..... L (Example) A93L
5m ..... Z (Example) F9NWZ

Note 2) Solid state switches marked with a "○" symbol are produced upon receipt of order.
D-9□ auto switch can also be mounted.

Piping type	Free mount cylinder for vacuum		Hollow rod diameter	
			Bore size (mm)	Hollow diameter (mm)
Cap piping	Vacuum	**ZCUKC** 	10	ø1.5
Cap piping	Vacuum	**ZCUKD** 	16	ø2
Rod piping	Vacuum	**ZCUKQ** 	20	ø3
Rod piping	Vacuum	**ZCUKR** 	25	ø4
			32	ø5

Refer to page 3.9-1 of Best Pneumatics No. 3 for details.

Water Resistant Air Cylinder

Series CM2 ø20 to ø40

Specifications

Action	Double acting single rod
Cylinder bore size (mm)	ø20, ø25, ø32, ø40
Cushion	Rubber bumper
Auto switch mounting	Band mount type
Made to order	Stainless steel piston rod and rod end nut (-XC6)

Note) Specifications other than above are the same as the standard basic type.

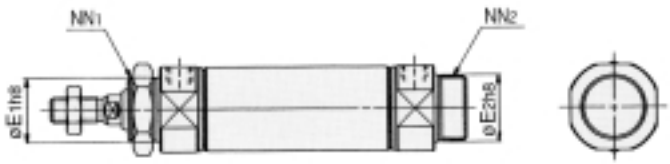
How to Order

CDM2 [Mounting] [Bore size] **R** — [Stroke] — **H7BAL** [-XC6]

- With auto switch (built-in magnet)
- Made to order specification
- **Water resistant 2 color indication solid state switch**
- **Water resistant cylinder**

R	Seal, NBR (nitrile rubber)
V	Seal, FKM (fluoro rubber)

Dimensions



Bore size (mm)	E1	E2*	NN1	NN2*
20	$22^{\ 0}_{-0.033}$	$20^{\ 0}_{-0.033}$	M22 x 1.5	M20 x 1.5

Note) Dimensions other than the above are the same as the standard double acting single rod type. [An asterisk (*) indicates those that are the same as standard.]

Series CG1 ø32 to ø100

Specifications

Action	Double acting single rod
Cylinder bore size (mm)	ø32, ø40, ø50, ø63, ø80, ø100
Cushion	Rubber bumper, Air cushion
Auto switch mounting	Band mount type
Made to order	Stainless steel piston rod and rod end nut (-XC6)

Note) Specifications other than above are the same as the standard basic type.

How to Order

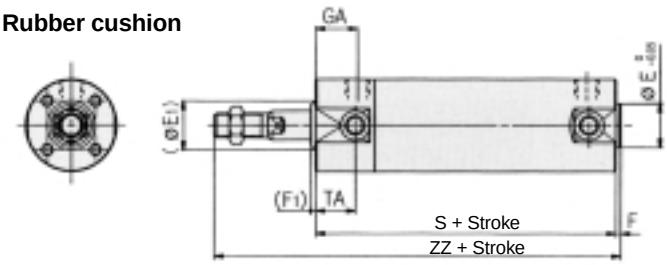
CDG1 [Mounting] [Type] [Bore size] **R** — [Stroke] — **G5BAL** [-XC6]

- With auto switch (built-in magnet)
- Made to order specification
- **Water resistant 2 color indication solid state switch**
- **Water resistant cylinder**

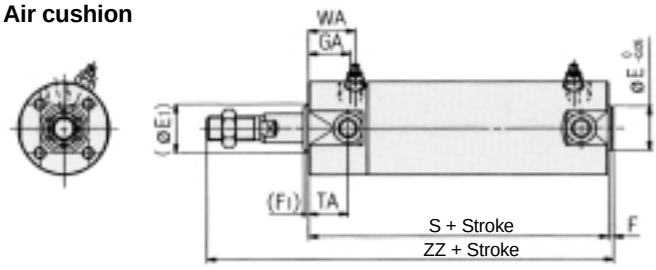
R	Seal, NBR (nitrile rubber)
V	Seal, FKM (fluoro rubber)

Dimensions

Rubber cushion



Air cushion



Bore size (mm)	(E1)	E*	(F1)	F*	GA	S	TA	WA	ZZ
32	17	18	2	2	18	77 (85)	17	20	119 (127)
40	21	25	2	2	19	84 (93)	18	21	136 (145)
50	26	30	2	2	21	97 (109)	20	23	157 (169)
63	26	32	2	2	21	97 (109)	20	23	157 (169)
80	32	40	3	3	28	116 (130)	—	30	190 (204)
100	37	50	3	3	29	117 (131)	—	31	191 (205)

Note 1) Dimensions other than the above are the same as the standard double acting single rod type. [An asterisk (*) indicates those that are the same as standard.]

Note 2) Dimensions inside ( ) are for long strokes.

Water Resistant Air Cylinder

Compact Cylinder
Series CQ2 ø20 to ø100

Specifications

Action	Double acting single rod
Cylinder bore size (mm)	ø20, ø25, ø32, ø40, ø50, ø60, ø80, ø100
Cushion	None
Auto switch mounting	Rail mount type
Made to order	Stainless steel piston rod and rod end nut (-XC6)

Note) Specifications other than the above are the same as the standard basic type.

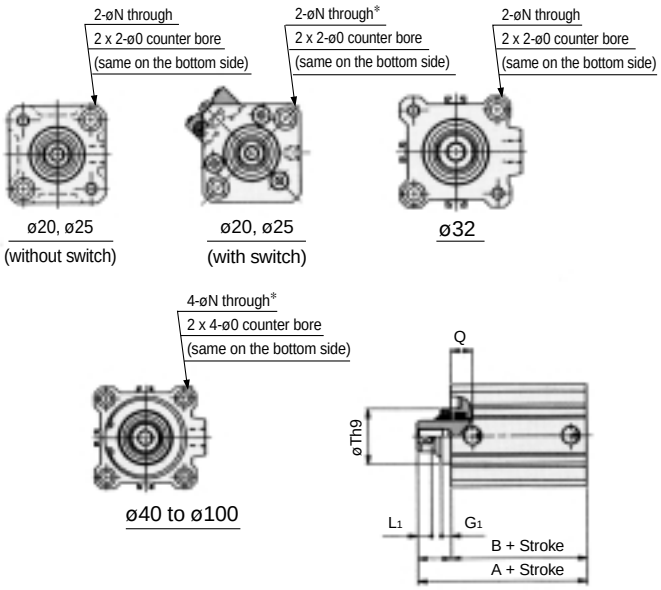
How to Order

CDQ2 | Mounting | Bore size | **R** | Stroke | D | Option | **F7BAL** | -XC6

- With auto switch (built-in magnet)
- Made to order specification
- **Water resistant 2 color indication solid state switch**
- **Water resistant cylinder**

R	Seal, NBR (nitrile rubber)
V	Seal, FKM (fluoro rubber)

Dimensions



Bore size (mm)	A		B	
	50 stroke or less	75, 100 stroke	50 stroke or less	75, 100 stroke
20	39 (51)	—	29.5 (41.5)	—
25	42.5 (52.5)	—	32.5 (42.5)	—
32	45 (55)	55	33 (43)	43
40	46.5 (56.5)	56.5	29.5 (39.5)*	39.5*
50	48.5 (58.5)	58.5	30.5 (40.5)*	40.5*
63	54 (64)	64	36 (46)*	46*
80	63.5 (73.5)	73.5	43.5 (53.5)*	53.5*
100	75 (85)	85	53 (63)*	63*

Bore size (mm)	G1	L	L1*	N*	O*	Q	Th9
20	—	9.5	4.5	5.5	9 depth 7	19 (20.5)	—
25	—	10	5	5.5	9 depth 7	21	—
32	—	12	6.5	5.5	9 depth 7	20.5 Note 3)	—
40	5	17	7	5.5	9 depth 7	11*	$28^{0}_{-0.052}$
50	5	18	8	6.6	11 depth 8	10.5*	$35^{0}_{-0.062}$
63	5	18	8	9	14 depth 10.5	15*	$35^{0}_{-0.062}$
80	5	20	10	11	17.5 depth 13.5	16*	$43^{0}_{-0.062}$
100	5	22	12	11	17.5 depth 13.5	23*	$59^{0}_{-0.074}$

Note 1) Dimensions other than above are the same as the standard double acting single rod type. [An asterisk (*) indicates those that are the same as standard.]

Note 2) Dimensions inside ( ) are for cylinders with auto switch.

Note 3) For a cylinder with ø32 bore size and 5mm stroke, without switch, dimension Q will be 21.5.

Series CA1 ø40 to ø100

Specifications

Action	Double acting single rod
Cylinder bore size (mm)	ø40, ø50, ø63, ø80, ø100
Cushion	Air cushion
Auto switch mounting	Tie-rod mount type
Made to order	Stainless steel piston rod and rod end nut (-XC6)

Note 1) Specifications other than the above are the same as the standard basic type.

Note 2) Except series CA1 air-hydro type and rod boot specification.

Note 3) The combination of auto switch and steel tube is not possible.

How to Order

CDA1 | Mounting | Type | Bore size | **R** | Stroke | Option | **F5BAL** | -XC6

- With auto switch (built-in magnet)
- Made to order specification
- **Water resistant 2 color indication solid state switch**
- **Water resistant cylinder**

R	Seal, NBR (nitrile rubber)
V	Seal, FKM (fluoro rubber)

Dimensions

Note) Dimensions are the same as the standard double acting single rod type.

Compact Guide Cylinder
Series MGP ø20 to ø100

Specifications

Action	Double acting
Cylinder bore size (mm)	ø20, ø25, ø32, ø40, ø50, ø63, ø80, ø100
Bearing type	Slide bearing
Cushion	Rubber bumper
Auto switch mounting	Direct mount type

Note) Specifications other than the above are the same as the standard basic type.

How to Order

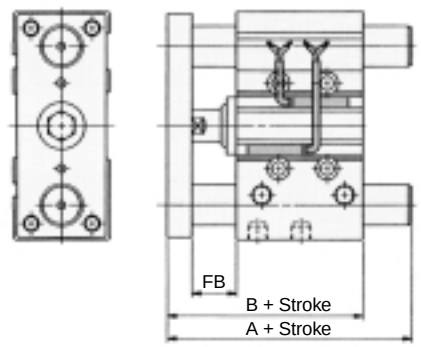
MGPM [Bore size] **R** — [Stroke] — **H7BAL**

- **H7BAL**: **Water resistant 2 color indication solid state switch**
- **R**: **Water resistant cylinder**

R	Seal, NBR (nitrile rubber)
V	Seal, FKM (fluoro rubber)

Note) Stainless steel piston rods are available as a special order.

Dimensions



Bore size (mm)	A		B	FB
	50 stroke or less	51 stroke or more		
20	66	97.5	66	19
25	67.5	99	67.5	20
32	109	114	71.5	22
40	109	114	78	22
50	117.5	129	83	23
63	117.5	129	88	23
80	121	148	102.5	24
100	141	166	120	29

Note) Dimensions other than above are the same as the standard double acting single rod type.

Guide Cylinder
Series MGG ø32 to ø50

Specifications

Action	Double acting
Cylinder bore size (mm)	ø32, ø40, ø50
Bearing type	Slide bearing
Cushion	Rubber bumper, Built-in shock absorber
Auto switch mounting	Band mount type

Note 1) Specifications other than the above are the same as the standard basic type.
Note 2) RBL (coolant resistant) shock absorbers are used.

How to Order

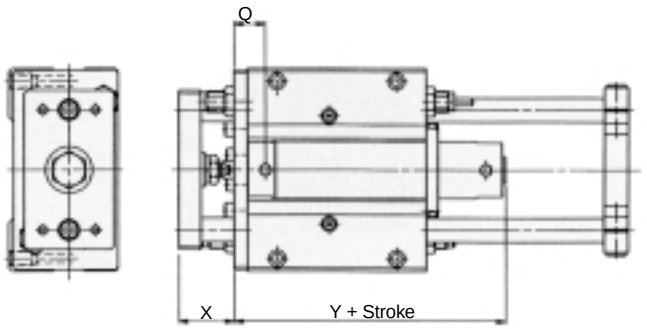
MGGM [Mounting] [Bore size] **R** — [Stroke] — **H7BAL**

- **H7BAL**: **Water resistant 2 color indication solid state switch**
- **R**: **Water resistant cylinder**

R	Seal, NBR (nitrile rubber)
V	Seal, FKM (fluoro rubber)

Note) Stainless steel piston rods are available as a special order.

Dimensions



Bore size (mm)	Q	X	Y
32	25	39	86 (94)
40	29	46	96 (105)
50	31	57	109 (121)

Note 1) Dimensions other than the above are the same as the standard basic type.
Note 2) Dimensions inside ( ) are for long strokes.

1. When mounting a cylinder, sufficiently flush the piping port to prevent the entry of foreign matter such as dust or chips. In case of hydraulic cylinders, remove the air inside the cylinder through an air release valve.
2. Since eccentric load applied to the piston rod will cause a dramatic decrease in service life, always operate the cylinder with the load applied in the axial directions.
3. Do not scrach or gouge the sliding parts of the cylinder, as this will damage the seals, and cause leakage.
4. When the cylinder is operated in an environment where the piston rod is exposed to dust and debris with little liquid splashing, use the heavy duty scraper (-XC4) type.

Air Cylinder with Heavy Duty Scraper

Made to Order

Air Leakage

Symbol

With heavy duty scraper -XC4

CM2 — Mounting — Bore size — Stroke — Cushion — XC4

CG1 — Follow the standard ordering procedures. — XC4

CA1 — Follow the standard ordering procedures. — XC4

CS1 — Follow the standard ordering procedures. — XC4

MB — Follow the standard ordering procedures. — XC4

With heavy duty scraper ●

CB — Follow the standard ordering procedures. — XC4
(With rear lock only)

CQ2 — Follow the standard ordering procedures. — XC4

CV — Follow the standard ordering procedures. — XC4

MGG — Follow the standard ordering procedures. — XC4

MGC — Follow the standard ordering procedures. — XC4

With heavy duty scraper ●

The heavy duty scraper feature is ideal for cylinders used in a dusty environment, or in environments where there is contact with earth and sand, such as molding machines, construction equipment, and industrial vehicles, etc.

Specifications

Applicable cylinder	Air cylinder/Standard type					End lock cylinder (with rear lock only)	Cylinder with valve	Compact cylinder	Guide cylinder	
Series	**CM2**	**CG1**	**MB**	**CA1**	**CS1**	**CB**	**CV**	**CQ2**	**MGG**	**MGC**
	CM2, CM2W	CG1	MB, MBW	CA1, CA1W	CS1, CS1W	CBM2, CBA1	CV3, CVM5, CVS1	CQ2	MGG	MGC
Action	Double acting single rod, double rod (not applicable for CG1)					Double acting single rod			Double acting	
Bore size (mm)	20, 25, 32, 40	32, 40, 50, 63	32, 40, 50, 63, 80, 100	40, 50, 63, 80, 100	125, 140, 160, 180, 200, 250, 300	20, 25, 32, 40, 50, 63, 80, 100	20, 25, 32, 40, 50, 63, 80, 100	20, 25, 32, 40, 50, 63, 80, 100	32, 40, 50	
Wiper ring	SCB scraper									
Cushion	Rubber bumper Air cushion	Rubber bumper Air cushion	Air cushion			CBM2: Rubber bumper CBA1: Air cushion	CVM5: Rubber bumper CV3, CVS1: Air cushion	None Rubber bumper	Rubber bumper (base cylinder unit)	Air cushion (base cylinder unit)
Auto switch	Mountable (bores sizes 200mm or less.)									
Specifications and dimensions other than above	Specifications are the same as those on pages 1.4-4 and 1.4-31.	Specifications are the same as those on pages 1.6-3 through 1.6-10.	Specifications are the same as those on pages 1.7-7 through 1.7-19.	Specifications are the same as those on pages 1.9-3 though 1.9-21.	Specifications are the same as those on pages 1.10-3 through 1.10-28, except dimension K has been changed.	Specifications are the same as those on pages 3.4-5 through 3.4-17.	Specifications are the same as those on pages 3.5-53 through 3.5-74.	Refer to pages 2.3-3 through 2.3-17.	Specifications are the same as those on pages 3.19-7 and 3.19-22.	Specifications are the same as those on pages 3.20-3 and 3.20-10.

Refer to Best Pneumatics No. 2 for the pages listed in the table above for details.

⚠Caution

Do not replace the heavy duty scraper.

- Since the heavy duty scraper is press fit, replace the rod cover assembly instead of the cover only.
  (In the case of CM2, it cannot be replaced.)
  (For series CS1, replace the retaining plate assembly.)

MGP M/L — Bore size — Stroke — XC4 — ☐

With heavy duty scraper ●

Scraper specification ●

Nil	Single side scraper
W	Double side scrapers

Specifications

Applicable series		**MGPM, MGPL**
Bearing type		Slide bearing, Ball bushing
Cylinder bore size (mm)		20, 25, 32, 40, 50, 63, 80, 100
Minimum operating pressure	Single side	0.12MPa
	Double side	0.14MPa

∗ Refer to the catalog "Compact Guide Cylinder Series MGP" CAT.ES20-117 C for details.

Air Cylinder with Coil Scraper

Made to Order

Air Leakage

Symbol

With coil scraper -XC35

CM2 | Mounting | Bore size | Stroke — XC35

CQ2 | Follow the standard ordering procedures. — XC35

CG1 | Follow the standard ordering procedures. — XC35

With coil scraper

Removes frost, welding spatter, and machining chips from the piston rod, and protects the seals.

MB | Follow the standard ordering procedures. — XC35

CA1 | Follow the standard ordering procedures. — XC35

CS1 | Follow the standard ordering procedures. — XC35

CBA1 | Follow the standard ordering procedures. — XC35

With coil scraper

Actuators

Specifications

Applicable series	Air cylinder/Series **CM2**	Air cylinder/Series **CG1**	Compact air cylinder/Series **CQ2**	Air cylinder/Series **CA1**
Action	Double acting single rod	Double acting single rod	Double acting single rod	Double acting single rod, double rod
Applicable bore size (mm)	20, 25, 32, 40	20, 25, 32, 40, 50, 63	32, 40, 50, 63, 80, 100	40, 50, 63, 80, 100
Maximum operating pressure	1.0MPa	1.0MPa	1.0MPa	1.0MPa
Minimum operating pressure	0.05MPa	0.05MPa	0.05MPa	Single rod: 0.05MPa, Double rod: 0.08MPa
Cushion	Rubber bumper	Rubber bumper, Air cushion	None, Rubber bumper	Air cushion
Scraper	Coil scraper (metal)			
Auto switch	Mountable			
Mounting	Basic, Axial foot, Front flange, Rear flange, Single clevis, Double clevis, Front trunnion, Rear trunnion, Integral clevis, Boss cut	Basic, Axial foot, Front flange, Rear flange, Front trunnion, Rear trunnion, Clevis (used when the port location is moved 90°)	Through holes, Double end tapped	Basic, Foot, Front flange, Rear flange, Single clevis, Double clevis, Center trunnion
Specifications other than above	Specifications are the same as those on page 1.4-1.	Specifications are the same as those on page 1.6-3.	Specifications are the same as those on page 2.3-3.	Specifications are the same as those on page 1.9-3.

For details, refer to Best Pneumatics No. 2 for the pages listed in the table

Specifications

Applicable series	Air cylinder/Series **MB**	Air cylinder/Series **CS1**	End lock cylinder/Series **CBA1**
Action	Double acting single rod	Double acting single rod, double rod	Double acting single rod
Applicable bore size (mm)	32, 40, 50, 63, 80, 100	125, 140, 160, 180, 200, 250, 300	40, 50, 63, 80, 100
Maximum operating pressure	1.0MPa	0.97MPa	1.0MPa
Minimum operating pressure	0.05MPa	0.05MPa	0.15MPa
Cushion	Air cushion, Rubber bumper	Air cushion	Air cushion
Scraper	Coil scraper (metal)		
Auto switch	Capable (bores sizes 200mm or less.)		
Mounting	Basic, Foot, Front flange, Rear flange, Single clevis, Double clevis, Shaft type trunnion	Basic, Foot, Front flange, Rear flange, Single clevis, Double clevis, Center trunnion (For double rod, only Basic, Foot, Front flange, Center trunnion are available.)	Basic, Foot, Front flange, Single clevis, Double clevis, Center trunnion
Specifications other than above	Specifications are the same as those on page 1.7-7.	Specifications are the same as those on pages 1.10-3 and 1.10-22.	Specifications are the same as those on page 3.4-13.

For details, refer to Best Pneumatics No. 2 for the pages listed in the table

MGPM | Bore size | Stroke — XC35 | ☐

With coil scraper

Scraper specification

Nil	Single side scraper
W	Double side scraper

Specifications

Applicable series		**MGPM**
Bearing type		Slide bearing
Cylinder bore size (mm)		20, 25, 32, 40, 50, 63, 80, 100
Minimum operating pressure	Single side	0.12MPa
	Double side	0.14MPa

∗ Refer to the catalog "Compact Guide Cylinder Series MGP" CAT.ES20-117(C) for details.

Air-hydro Booster

Converts air pressure to hydraulic pressure for high pressure hydraulic cylinder actuation.

CA1 B H63 — 50 — 1 — XB4

Mounting

B	Basic type
L	Axial foot type
G	Rear flange type

Oil discharge volume

25	25cm³
40	40cm³
50	50cm³
75	75cm³
100	100cm³

Oil pot specification

Nil	Without oil pot
P	With oil pot

Voltage

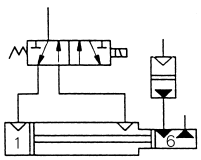
1	100VAC
2	200VAC
5	24VDC
9	Other

Electrical entry

Nil	Molded type
D	DIN terminal

Type of pressurization

Nil	Pressurized when energized
B	Not pressurized when energized



JIS symbol

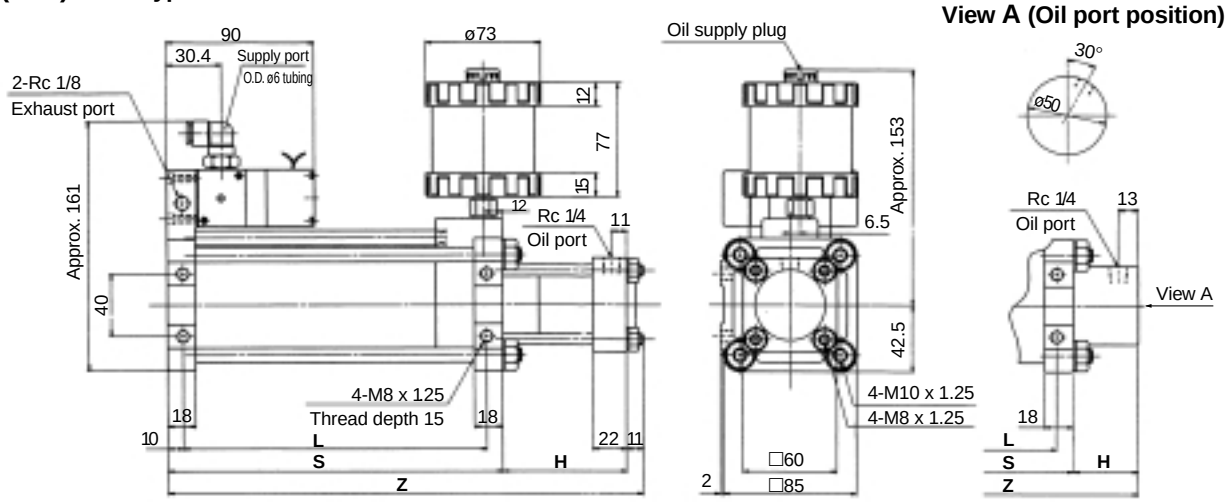
Specifications

Operating fluid	Compressed air
Driving fluid	ISO VG32
Operating pressure (air)	0.3 to 0.7MPa
Withstand pressure (air)	1.6MPa
Ambient and fluid temperature	5 to 60°C
Intensified pressure ratio	1 : 6
Reservoir capacity (oil pot capacity)	110cm³

Specifications other than -XB4 are available by special order. Select according to the usage. (Refer to the following two pages for the list of special order products.)

Dimensions

CA1BH63(XB4)/Basic type



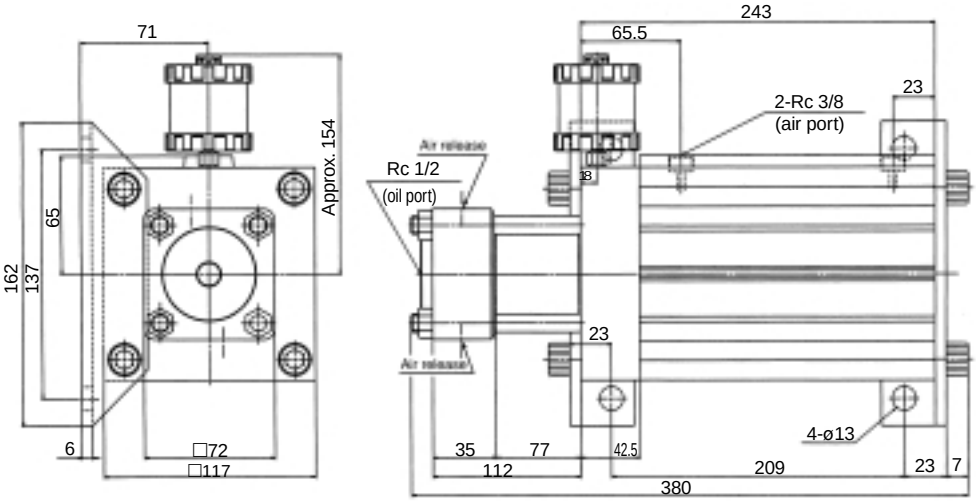
Amount of oil discharge	Stroke range (mm)	S	L	H	Z
25	64	163	143	37	200
40	98	197	177	62	270
50	115	214	194	80	305
75	170	269	249	135	415
100	220	319	299	185	515

For oil discharge volume of 25cm³

Special Order Products

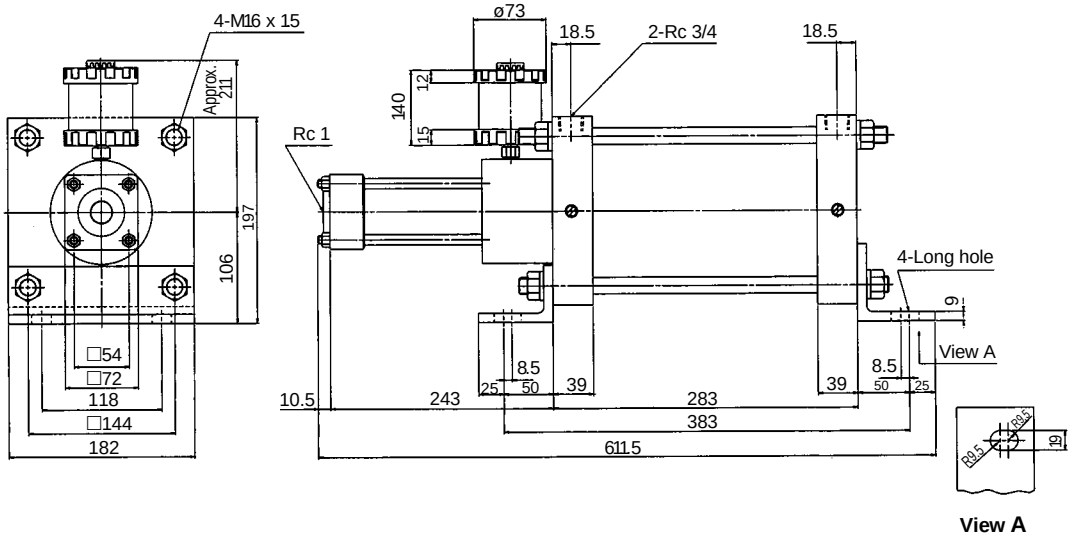
CQ2L100-P2866-60

Intensified pressure ratio 1 : 12.8
Oil discharge volume: 60cm³



CS1LH160-Q5731-160

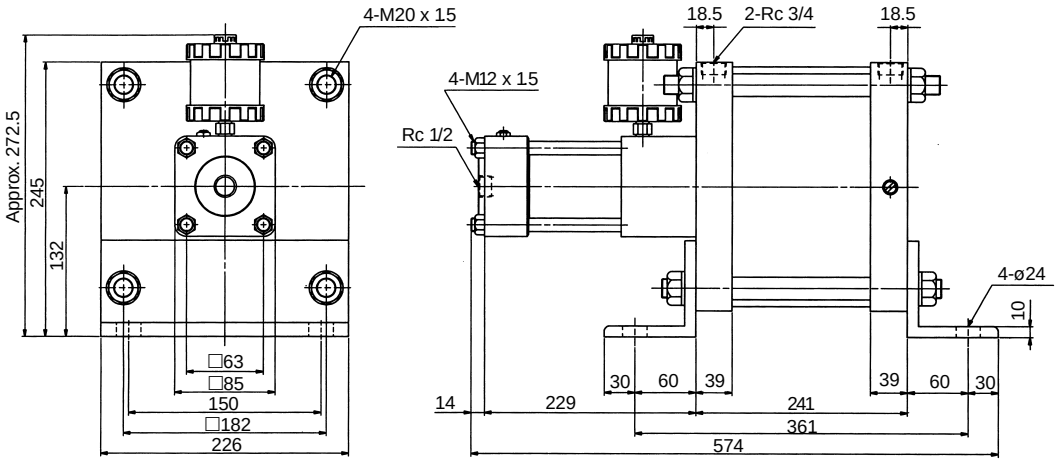
Intensified pressure ratio 1 : 16
Oil discharge volume: 160cm³



View A

CS1LH200-Q3496-130

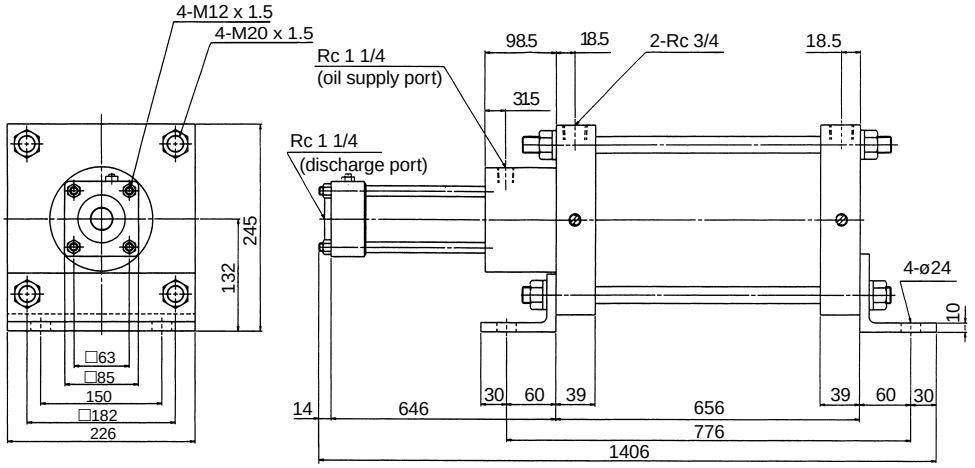
Intensified pressure ratio 1 : 25
Oil discharge volume: 131cm³



Special Order Products

CS1LH200-Q8405-350

Intensified pressure ratio 1 : 44
Oil discharge volume: 350cm³



For dimensions and other information etc., of special order products in the table on the right, contact SMC.

Intensified pressure range	Part no.	Intensified pressure ratio	Oil discharge volume (cm³)	Notes
1 to 9.9	CDS1BH140-Q5902	1 : 1.96	1000	Without tank
	CA1LH63-Q0717-25	1 : 6	25	With tank, Foot type
	CA1LH63-Q5857-40	1 : 6	40	With tank, Foot type
	CA1LH63-Q7045-100	1 : 6	100	With tank, Foot type
	CA1BH63-Q5856-125	1 : 6	125	Without tank, Basic type
	CA1BH140-Q7055-200	1 : 6	200	Without tank, Basic type
	CDS1LH160-K5457-100	1 : 6	315	Without tank, Foot type
	CQ2LH100-P6978-160	1 : 9.76	160	Without tank, Foot type
10 to 19.9	HC03-80-Q4602-25	1 : 10	25	With tank, Foot type
	CA1LH63-Q7886-50	1 : 10	50	With tank, Foot type
	TMS80-A2484-178	1 : 10	87	With tank, Foot type
	CA1LH63-Q8409-100	1 : 10	100	With tank, Foot type
	CS1LN160-Q3930-147	1 : 10	147	Without tank, Foot type
	CA1BH100-Q5896-60	1 : 11	60	Without tank, Basic type
	CDQ2LH140-P6024-90	1 : 12.25	90	Without tank, Foot type
	CDQ2LH140-P4578-180	1 : 12.25	180	Without tank, Foot type
	CS1LN160-Q3931-57	1 : 16	57	Without tank, Foot type
	CQ2LH100-P6517-64	1 : 16	64	Without tank, Foot type
	CQ2L100-P0987-238	1 : 16	100	With tank, Foot type
	CQ2L160-P3270-150	1 : 16	150	Without tank, Foot type
	CDS1L160-01-27928	1 : 16	160	Without tank, Foot type
20 to 29.9	CDQ2L140-P1009-116	1 : 21.7	116	Without tank, Foot type
	CS1LH200-Q3495-77	1 : 25	77	With tank, Foot type
	CS1L200-Q3932-151	1 : 25	151	Without tank, Foot type
	CS1LH200-Q64100-165	1 : 25	165	Without tank, Foot type
	CS1LH200-Q6411-325	1 : 25	325	Without tank, Foot type
	CS1LH300-L9421-180	1 : 25	420	Without tank, Foot type
	CS1FH160-K4133-175	1 : 28	99	With tank, Flange type
	CS1LH300-Q1382-250	1 : 29	250	With tank, Foot type
30 or more	CS1LH160-Q6528-80	1 : 32.7	80	With tank, Foot type

Air-hydro Converter

Series CCT

How to Order

CCT 63 — 100

- CCT: Air-hydro converter
- 63: Nominal converter size/Stroke (mm)
- 100: Effective oil level stroke (mm)

Nominal converter size/Stroke (mm)	
63	50, 100, 200, 300, 400, 500
100	100, 200, 300, 400, 500, 600
160	200, 300, 400, 500, 600, 700, 800

Specifications

Operating pressure	0 to 0.7MPa
Proof pressure	1.05MPa
Ambient and fluid temperature	5 to 50°C
Fluid	Turbine oil (40 to 100cSt)

Converter standard effective oil level stroke/Effective volume (cm^3)

Nominal size of converter (mm)	Standard effective oil level stroke (mm)									Maximum flow* (l/min)
	50	100	200	300	400	500	600	700	800	
63	150	300	600	890	1190	1480	—	—	—	36
100	—	750	1510	2260	3010	3770	4520	—	—	88
160	—	—	3660	5490	7320	9150	10980	12810	14640	217

* Maximum flow indicates the converter oil speed (0.2m/s) limit, which can maintain converter oil level stability, expressed as a flow rate.

CCT40 — Effective oil level stroke

CCT40 cannot be used as an air-hydro unit since it is a converter for small capacity actuators. Use an individual CC valve unit or a speed controller (AS2000, AS3000 or AS4000, etc.) through a piping connection instead.

Specifications

Operating pressure	0 to 0.7MPa
Proof pressure	1.05MPa
Ambient and fluid temperature	5 to 50°C
Fluid	Turbine oil (40 to 100cSt)
Nominal size of converter	40mm

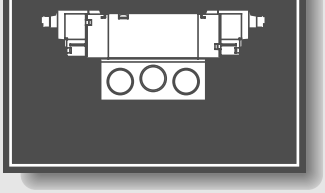
Converter standard effective oil level stroke/Effective volume

Standard effective oil level stroke (mm)	50	100	150	200	300
Effective volume (cm^3)	60	120	180	250	370
Maximum flow (l/min)	15				

* Maximum flow indicates the converter oil speed (0.2m/s) limit, which can maintain converter oil level stability, expressed as a flow rate.

Refer to page 4.12-8 of Best Pneumatics No. 2 for details.

Directional Control Equipment



	Series	Application	Page
Pilot operated 2 port solenoid valve	**VXD21/22/23**	**Air blow, Air tool, Non-operation**	**30**
Direct operated 2 port solenoid valve	**VCA**	**Air blow, Air tool**	**33**
Pilot operated 2 port solenoid valve	**VQ20/30**	**Air blow, Air tool**	**35**
Zero differential pressure operated 2 port solenoid valve	**VXZ**	**Cooling water**	**37**
Direct air operated 2 port valve	**VXA21/22**	**Air purge**	**39**
Pilot operated 3 port solenoid valve	**VP300/500/700**	**Air purge, Paint stirring**	**40**
Pilot operated 3 port solenoid valve	**VG342**	**Air purge, Non-operation**	**42**
Large 3 port solenoid valve	**VP3145/3165/3185**	**Air purge, Non-operation**	**44**
3 port mechanical valve	**VM1000, VM100/200/400**	**Air purge**	**46**
Coolant valve	**VNC**	**Coolant**	**50**
Flow switching 2 port air operated valve	**(Special order product)**	**Paint stirring**	**52**
Booster valve	**VBA1110 to 4200**	**Hydraulic clamp**	**53**

Pilot Operated 2 Port Solenoid Valve

For air, gas, water, oil

Series VXD21/22/23

Normally Closed Type (N.C.)

Models/Valve Specifications

Connection		Orifice ø mm	Flow coefficient		Model	Min. operating pressure differential MPa	Max. operating pressure differential MPa						Max. system pressure MPa	Weight* g
Thread	Flange		Cv	Effective area mm²			Water		Air		Oil			
							AC	DC	AC	DC	AC	DC		
1/4	—	10	1.9	34	**VXD2130-02**	0.02	0.7	0.5	0.9	0.7	0.5	0.4	1.5	420
3/8	—	10	2.4	43	**VXD2130-03**	0.02	0.7	0.5	0.9	0.7	0.5	0.4		420
	—	15	4.5	80	**VXD2140-03**	0.02	1.0	1.0	1.0	1.0	0.7	0.7		670
1/2	—	10	2.4	43	**VXD2130-04**	0.02	0.7	0.5	0.9	0.7	0.5	0.4		500
	—	15	5.5	100	**VXD2140-04**	0.02	1.0	1.0	1.0	1.0	0.7	0.7		670
3/4	—	20	9.5	170	**VXD2150-06**	0.02	1.0	1.0	1.0	1.0	0.7	0.7		1150
1	—	25	12.5	225	**VXD2260-10**	0.02	1.0	1.0	1.0	1.0	0.7	0.7		1650
—	32A	35	23	415	**VXD2270-32**	0.03	1.0	1.0	1.0	1.0	0.7	0.7		5400
—	40A	40	31	560	**VXD2380-40**	0.03	1.0	1.0	1.0	1.0	0.7	0.7		6800
—	50A	50	49	880	**VXD2390-50**	0.03	1.0	1.0	1.0	1.0	0.7	0.7		8400

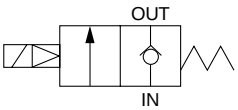
∗ Weight for grommet type. Add 10g for conduit type, 30g for DIN terminal type, and 60g for terminal type.

Solenoid specifications

Model	Power supply	Frequency Hz	Apparent power VA		Power consumption W (energized)	Temperature increase °C (rated voltage)
			Inrush	Energized		
VXD21	AC	50	20 (32)	11	4.5	45
		60	17 (28)	7	3.2	35
	DC	—	—	—	6	55
VXD22	AC	50	40	18	7.5	60
		60	35	12	6	50
	DC	—	—	—	8	60
VXD23	AC	50	50	21	11	65
		60	45	17	9.5	60
	DC	—	—	—	11.5	65

Note 1) Reset voltage is 20% or more of rated voltage for AC, and 2% or more of rated voltage for DC.
Note 2) Allowable voltage fluctuation is ±10% of rated value for both AC and DC.
Note 3) The values are for ambient temperature of 20°C ±5°C and rated voltage.
Note 4) For VXD2130, AC to DC or DC to AC coil exchange is not possible due to different armature configuration.
For VXD21$^{5}_{4}$0, 22$^{7}_{6}$0, 23$^{9}_{8}$0, AC to DC coil exchange is possible, but not DC to AC exchange. (DC will generate humming sound since it does not have a shading coil.)
Note 5) Values for apparent power inside ( ) are for VXD2130.

Symbol



Normally Open Type (N.O.)

Models/Valve Specifications

Connection		Orifice ø mm	Flow coefficient		Model	Min. operating pressure differential MPa	Max. operating pressure differential MPa		Max. system pressure MPa	Weight* g
Thread	Flange		Cv	Effective area mm²			Water, Air	Oil		
3/8	—	15	4.5	80	**VXD2142-03**	0.02	0.7	0.6	1.5	690
1/2	—	15	5.5	100	**VXD2142-04**	0.02	0.7	0.6		690
3/4	—	20	9.5	170	**VXD2152-06**	0.02	0.7	0.6		1170
1	—	25	12.5	225	**VXD2262-10**	0.02	0.7	0.6		1690
—	32A	35	23	415	**VXD2272-32**	0.03	0.7	0.6		5400
—	40A	40	31	560	**VXD2382-40**	0.03	0.7	0.6		6800
—	50A	50	49	880	**VXD2392-50**	0.03	0.7	0.6		8400

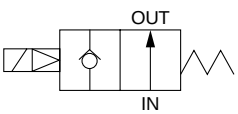
∗ Weight for grommet type. Add 10g for conduit type, 30g for DIN terminal type, and 60g for terminal type.

Solenoid Specifications

Model	Power supply	Frequency Hz	Apparent power VA		Power consumption W (energized)	Temperature increase °C (rated voltage)
			Inrush	Energized		
VXD21	AC	50	25	12	5	50
		60	20	8	3.5	35
	DC	—	—	—	6	50
VXD22	AC	50	45	20	8	55
		60	40	15	6.5	45
	DC	—	—	—	8	50
VXD23	AC	50	60	25	10.5	60
		60	50	20	9.5	50
	DC	—	—	—	11.5	55

Note 1) The values are for ambient temperature of 20°C ±5°C and rated voltage.
Note 2) When in operation, AC to DC or DC to AC exchange is not possible due to different armature configuration.
Note 3) Reset voltage is 20% or more of rated voltage for AC, and 5% or more of rated voltage for DC.
Note 4) Allowable voltage fluctuation is ±10% of rated value for both AC and DC.

Symbol



Refer to page 4.1-17 of Best Pneumatics No. 1 for details.

How to Order (Normally Closed Type)

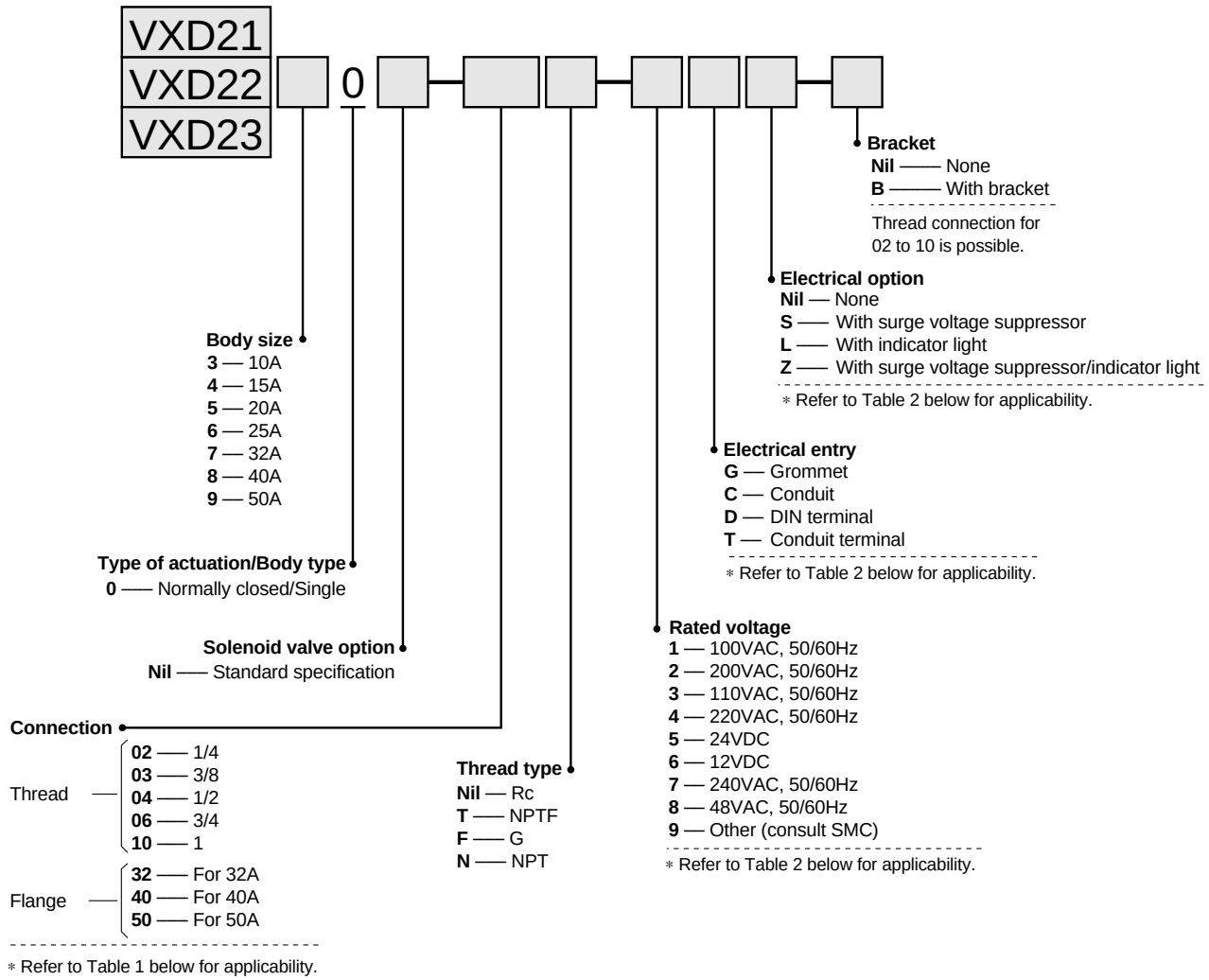


Table 1 Connection size/Applicable models

Connection	Size	Applicable model
Thread	1/4	VXD2130-02
	3/8	VXD2130-03, VXD2140-03
	1/2	VXD2130-04, VXD2140-04
	3/4	VXD2150-06
	1	VXD2260-10
Flange	32A	VXD2270-32
	40A	VXD2380-40
	50A	VXD2390-50

Table 2 Rated voltage/Electrical entry/Electrical options

Insulation classification		Class B				Class H		
Electrical entry		G	C	D, T		G, C	T	
Electrical option		S[Note]	—	S	L, Z	—	S	L, Z
AC	**1** (100V)	●	●	●	●	●	●	●
	2 (200V)	●	●	●	●	●	●	●
	3 (110V)	●	●	●	●	●	●	●
	4 (220V)	●	●	●	●	●	●	●
	7 (240V)	●	●	●	—	●	●	—
	8 (48V)	●	●	●	—	—	●	—
DC	**5** (24V)	●	●	●	●	—	—	—
	6 (12V)	●	●	●	—	—	—	—

Note) Surge voltage suppressor is attached to the lead wire.

How to order (example)

For series VXD21, Rc 3/4, 200VAC,
DIN terminal, with surge voltage suppressor
(Model number) **VXD2150-06-2DS**

Made to order specification

Splash Proof Specification (Conforming to JIS-C-0920 Conforming to IEC529IP-X4)

VXD | **Type** | **Bore size** | **Electrical specification** | **-X36**

DIN terminal and class H coil are not available.

How to Order (Normally Open Type)

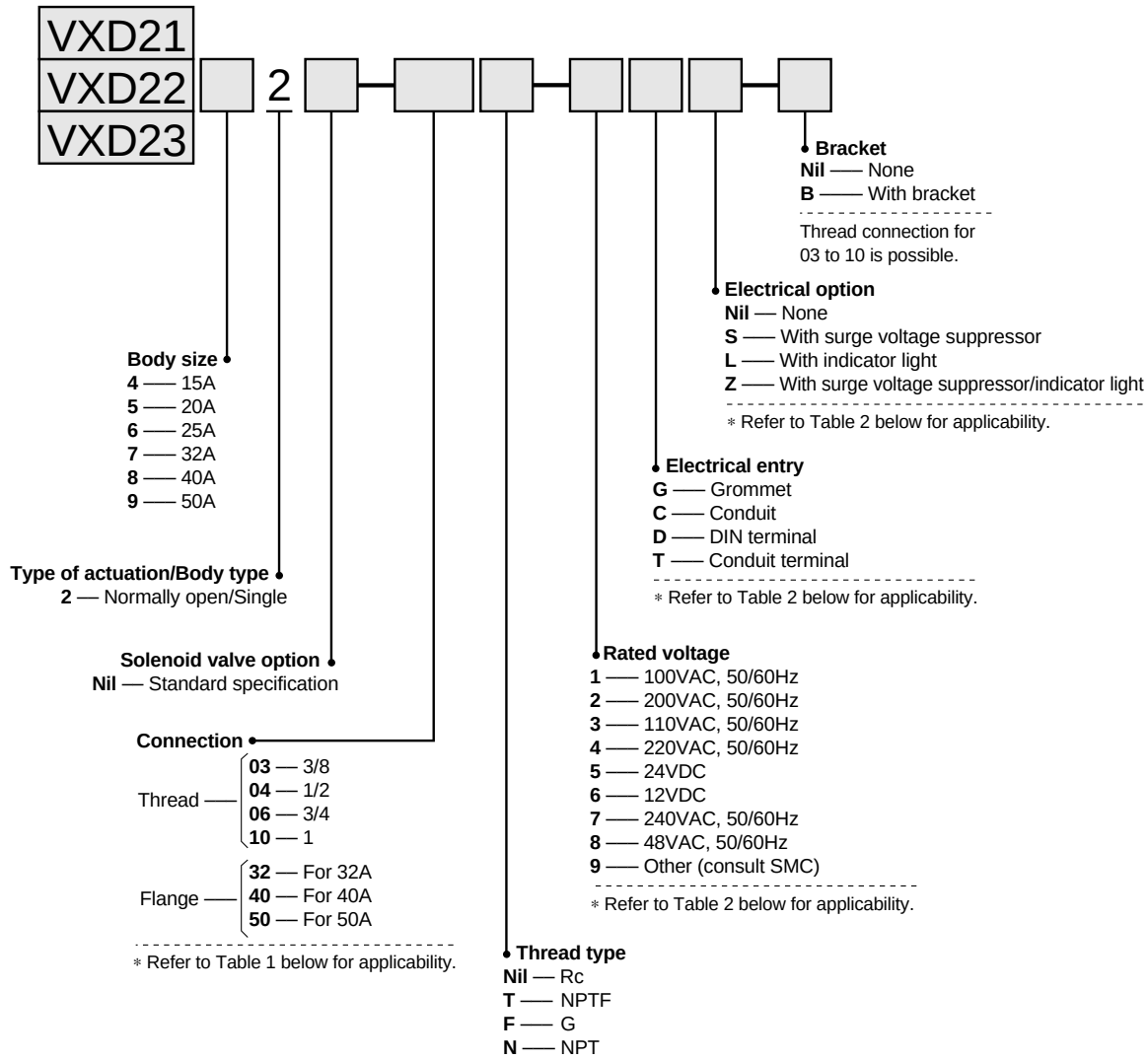


Table 1 Connection size/Applicable models

Connection	Size	Applicable model
Thread	3/8	VXD2142-03
	1/2	VXD2142-04
	3/4	VXD2152-06
	1	VXD2262-10
Flange	32A	VXD2272-32
	40A	VXD2382-40
	50A	VXD2392-50

How to order (example)
For series VXD21, Rc 1/2, 200VAC,
DIN terminal, with surge voltage suppressor
(Model number) **VXD2142-04-1TZ**

Table 2 Rated voltage/Electrical entry/Electrical options

Insulation classification		Class B				Class H		
Electrical entry		G	C	D, T		G, C	T	
Electrical option		S Note)	—	S	L, Z	—	S	L, Z
AC	**1** (100V)	●	●	●	●	●	●	●
	2 (200V)	●	●	●	●	●	●	●
	3 (110V)	●	●	●	●	●	●	●
	4 (220V)	●	●	●	●	●	●	●
	7 (240V)	●	●	●	—	●	●	—
	8 (48V)	●	●	●	—	—	●	—
DC	**5** (24V)	●	●	●	●	—	—	—
	6 (12V)	●	●	●	—	—	—	—

Note) Surge voltage suppressor is attached to the lead wire.

Made to order specification

Splash Proof Specification (Conforming to JIS-C-0920 Conforming to IEC529IP-X4)

VXD [Type] – [Bore size] – [Electrical specification] **-X36**

DIN terminal and class H coil are not available.

Direct Operated 2 Port Solenoid Valve for Air
Series VCA

How to Order Valves (Single Type)

VC A 2 1 □ – 1 G □ – 3 – 02 □ – □

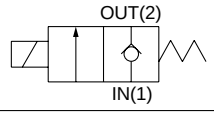
For air

Series

2	Class 2
3	Class 3
4	Class 4

Type of actuation

1	N.C.



Fluid

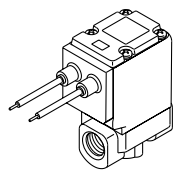
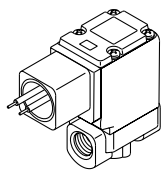
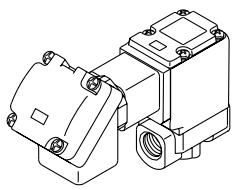
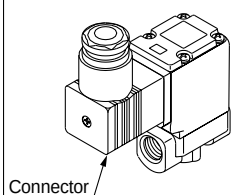
Nil	General air
A	Dry air

Voltage

1	100VAC
2	200VAC
3	110VAC
4	220VAC
5	24VDC
6	12VDC

∗ Consult SMC regarding other voltages.

Electrical entry

G – Grommet	C – Conduit
	
T – With conduit terminal **TL– With conduit terminal and light**	**D – DIN** **DL – DIN with light** **DO – DIN (without connector)**
	

∗ All types equipped with surge voltage suppressor.

Manual override

Nil	None
B	Slotted locking type

Orifice size

Symbol	Orifice size (mmø)	Class 2	Class 3	Class 4
3	3	○	—	—
4	4	—	○	—
5	5	○	—	○
7	7	—	○	○
10	10	—	—	○

∗ Refer to the table below for orifice and port size combinations.

Port size

Symbol	Port size	Class 2	Class 3	Class 4
02	1/4 (8A)	○	○	—
03	3/8 (10A)	—	○	○
04	1/2 (15A)	—	—	○
06	3/4 (20A)	—	—	○

Thread type (single type)

Nil	Rc
F	G
N	NPT
T	NPTF

Option

Nil	None
F	Foot type bracket

∗ When only brackets are required, refer to Table 2 below.

Table 1. Orifice and port size combinations

Class	Port size	Orifice size (mmø)				
		3	4	5	7	10
2	1/4 (8A)	●	—	●	—	—
3	1/4 (8A)	—	●	—	●	—
	3/8 (10A)	—	●	—	●	—
4	3/8 (10A)	—	—	●	●	●
	1/2 (15A)	—	—	●	●	●
	3/4 (20A)	—	—	—	—	●

Table 2. Bracket assembly part nos.

Valve model	Bracket assembly part no.
VCA21	VCA20-12-1A
VCA31	VCA30-12-1A
VCA41	VCA40-12-1A

Standard Specifications

Valve specifications	**Valve construction**			Direct operated poppet
	Fluid			Air/Inert gas
	Withstand pressure MPa			2.0
	Body material			Al
	Seal material			HNBR
	Ambient temperature °C			−20 to 60
	Fluid temperature °C			−10 to 60 (with no freezing)
	Enclosure			Dust proof, Splash proof (equivalent to IP65)
	Environment			Location without corrosive or explosive gases
	Valve leakage cm^3/ min (ANR)			0.2 or less
	Mounting orientation			Free
	Vibration/Impact resistance m/s^2 Note 2)			30/150 or less
Coil specifications	**Rated voltage**			24VDC, 12VDC, 100VAC, 110VAC, 200VAC, 220VAC (50/60Hz)
	Allowable voltage fluctuation			±10% of rated voltage
	Coil insulation type			Class B
	Power consumption	**DC**		VCA2: 6.5W, VCA3: 8W, VCA4: 11.5W
	Apparent power	**AC** Note 1)	**50Hz**	VCA2: 7.5VA, VCA3: 10VA, VCA4: 13VA
			60Hz	

Note 1) Since AC coil specifications include a rectifying device, there is no difference in apparent power for inrush and energized conditions.

Note 2) Vibration resistance … Conditions when tested with one sweep of 10 to 300Hz in the axial direction and at a right angle to the armature, in both energized and deenergized states

Impact resistance …… Conditions when tested with a drop tester in the axial direction and at a right angle to the armature, one time each in energized and deenergized states

Characteristic Specifications

Model	Class	Port size	Orifice size ø mm	Maximum operating pressure differential MPa	Effective area mm^2 (Cv factor)	Max. operating pressure MPa	Note) Weight kg
VCA (for air) 2 port solenoid valve	2	1/4 (8A)	3	1.0	6 (0.33)	1.0	0.21
			5	0.15	15 (0.83)		
	3	1/4 (8A) 3/8 (10A)	4	1.0	10 (0.55)	1.0	0.30
			7	0.15	27 (1.5)		
	4	3/8 (10A) 1/2 (15A) 3/4 (20A)	5	1.0	15 (0.83)	1.0	0.50
			7	0.3	27 (1.5)		
			10	0.15	38 (2.11)		

Note) Weight values are for the grommet type.

2 Port Solenoid Valve

For dry air, pilot operated

Series VQ20/30

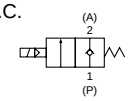
How to Order Valves

VQ | 2 | 1 | A | 1 | — | 1 | G | | | — | C6 | — | |

Series/Orifice size

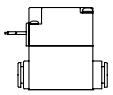
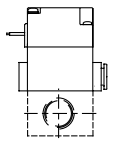
Symbol	Series	Effective orifice
2	**VQ20**	ø3.4mm
3	**VQ30**	ø4.8mm

Type of actuation

1	N.C. 

Note) Consult SMC for N.O. type.

Body type

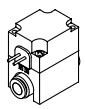
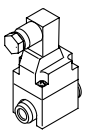
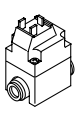
A: Single valve	
M: For manifold	

Coil voltage

1	100VAC (50/60Hz)
2	200VAC
3	110VAC
5	24VDC
6	12VDC
9 Note)	Other, Special voltage

Note) Consult SMC for a special voltage.

Electrical entry

G: Grommet	
Y: DIN terminal	
YO: DIN terminal without connector	

Indicator light/Surge voltage suppressor

Nil	None
S	With surge voltage suppressor
Z	With indicator light/surge voltage suppressor

Note 1) For a coil voltage of 100VAC, the unit will be with surge voltage suppressor.

Note 2) "YOZ" is not available.

Manual override

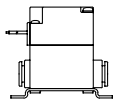
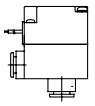
Nil	None
B Note)	Slotted locking type

Note) Available only for normally closed DIN terminal in-line type.

Port size

Symbol	Port size	VQ20	VQ30
C6	ø6 One-touch fitting	○	—
C8	ø8 One-touch fitting	○	—
C10	ø10 One-touch fitting	—	○
C12	ø12 One-touch fitting	—	○

Option

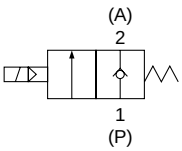
Nil: None	
F: With bracket	
L: L type (VQ20 only)	

Note) Specify "LF" for L type with bracket.

VQ20

VQ30

Symbol



N.C.

Standard Specifications

Valve specifications	**Series**		**VQ20**		**VQ30**	
	Valve construction		Pilot operated 2 port poppet type			
	Fluid		Air, Inert gas			
	Minimum operating pressure		0.01MPa			
	Maximum operating pressure		0.6MPa		0.5MPa	
	Effective area (Cv factor/Effective orifice)		C6	7.2mm² (Cv0.4/ø3)	C10	14.4mm² (Cv0.8/ø4.3)
			C8	9mm² (Cv0.5/ø3.4)	C12	17.5mm² (Cv1/ø4.8)
	Body orifice size		ø6		ø13.8	
	Response time Note 1)		5ms or less		20ms or less	
	Maximum operating frequency		100cps		30cps	
	Ambient and fluid temperature		−10 to 50°C Note 2)			
	Lubrication		Not required			
	Manual override		Slotted locking type Note 3)			
	Impact resistance/Vibration resistance		150/30m/s² Note 4)			
	Enclosure		Dust proof Note 5)			
	Mounting orientation		Free			
	Weight		46g		80g	
Electrical specifications	**Rated coil voltage**		12VDC, 24VDC, 100VAC, 110VAC, 200VAC			
	Allowable voltage fluctuation		±10% of rated voltage			
	Coil insulation		Equivalent to class B			
	Power consumption (current value)	**24VDC**	2.5W DC (104mA)			
		12VDC	2.5W DC (208mA)			
		100VAC	Inrush: 2VA (20mA), Energized: 2VA (20mA)			
	Electrical entry		Grommet, DIN terminal			

Note 1) Based on JISB8375-1981 (Values for supply pressure of 0.5MPa, without indicator light/surge voltage suppressor)

Note 2) Use dry air without condensation when operating at low temperatures.

Note 3) Manual override is available for DIN terminal type only.

Note 4) Vibration resistance: No malfunction resulted in a one sweep test between 8.3 and 2000Hz. Test was performed in the axial and right angle directions of the main valve and armature for both energized and de-energized states. (The value is for the initial stage.)

Impact resistance: No malfunction resulted from the impact test using a drop impact tester. The test was performed one time each in the axial and right angle directions of the main valve and armature for both energized and de-energized states. (The value is for the initial stage.)

Note 5) DIN terminal type is dust and splash proof (IP65) compatible.

Pilot Operated Zero Differential Pressure Operated 2 Port Solenoid Valve

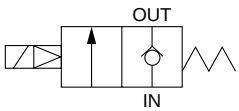
For air, gas, vacuum, water, oil

Series VXZ

Cooling Water

Normally Closed Type (N.C.)

Symbol



Models/Valve specifications

Port size	Orifice ø mm	Flow coefficient Cv	Flow coefficient Effective area mm²	Model	Min. operating pressure differential MPa	Max. operating pressure differential MPa Water AC	Water DC	Air AC	Air DC	Oil AC	Oil DC	Max. system pressure MPa	Weight* g
1/4	10	1.9	34	**VXZ2230-02**	0	1.0	0.7	1.0	0.7	0.7	0.7	1.5	550
3/8	10	2.4	43	**VXZ2230-03**		1.0	0.7	1.0	0.7	0.7	0.7		550
1/2	15	5.3	95	**VXZ2240-04**		1.0	0.7	1.0	0.7	0.7	0.7		760
3/4	20	9.2	165	**VXZ2350-06**		1.0	1.0	1.0	1.0	0.7	0.7		1,300
1	25	12	215	**VXZ2360-10**		1.0	1.0	1.0	1.0	0.7	0.7		1,480

∗ Weight for grommet type. Add 10g for conduit type, 30g for DIN terminal type, and 60g for terminal type.

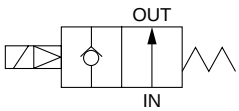
Solenoid specifications

Model	Power supply	Frequency Hz	Apparent power VA Inrush	Apparent power VA Energized	Power consumption W (energized)	Temperature increase °C (rated voltage)
VXZ22	AC	50	60 (53)	18	7.5	60
		60	51 (44)	12	6	50
	DC	—	—	—	8	60
VXZ23	AC	50	80	21	11	65
		60	67	17	9.5	60
	DC	—	—	—	11.5	65

Note 1) Reset voltage is 20% or more of rated voltage for AC, and 2% or more of rated voltage for DC.
Note 2) Allowable voltage fluctuation is ±10% of rated value for both AC and DC.
Note 3) The values are for ambient temperature of 20°C ±5°C and rated voltage.
Note 4) **AC to DC or DC to AC coil exchange is not possible due to different armature configuration.**
Note 5) Values for apparent power inside ( ) are for VXZ2230.

Normally Open Type (N.O.)

Symbol



Models/Valve specifications

Port size	Orifice ø mm	Flow coefficient Cv	Flow coefficient Effective area mm²	Model	Min. operating pressure differential MPa	Max. operating pressure differential MPa Water AC	Water DC	Air AC	Air DC	Oil AC	Oil DC	Max. system pressure MPa	Weight* g
1/4	10	1.9	34	**VXZ2232-02**	0	0.7	0.6	0.7	0.6	0.7	0.6	1.5	600
3/8	10	2.4	43	**VXZ2232-03**		0.7	0.6	0.7	0.6	0.7	0.6		600
1/2	15	5.3	95	**VXZ2242-04**		0.7	0.6	0.7	0.6	0.7	0.6		850
3/4	20	9.2	165	**VXZ2352-06**		0.7	0.6	0.7	0.6	0.7	0.6		1,370
1	25	12	215	**VXZ2362-10**		0.7	0.6	0.7	0.6	0.7	0.6		1,550

∗ Weight for grommet type. Add 10g for conduit type, 30g for DIN terminal type, and 60g for terminal type.

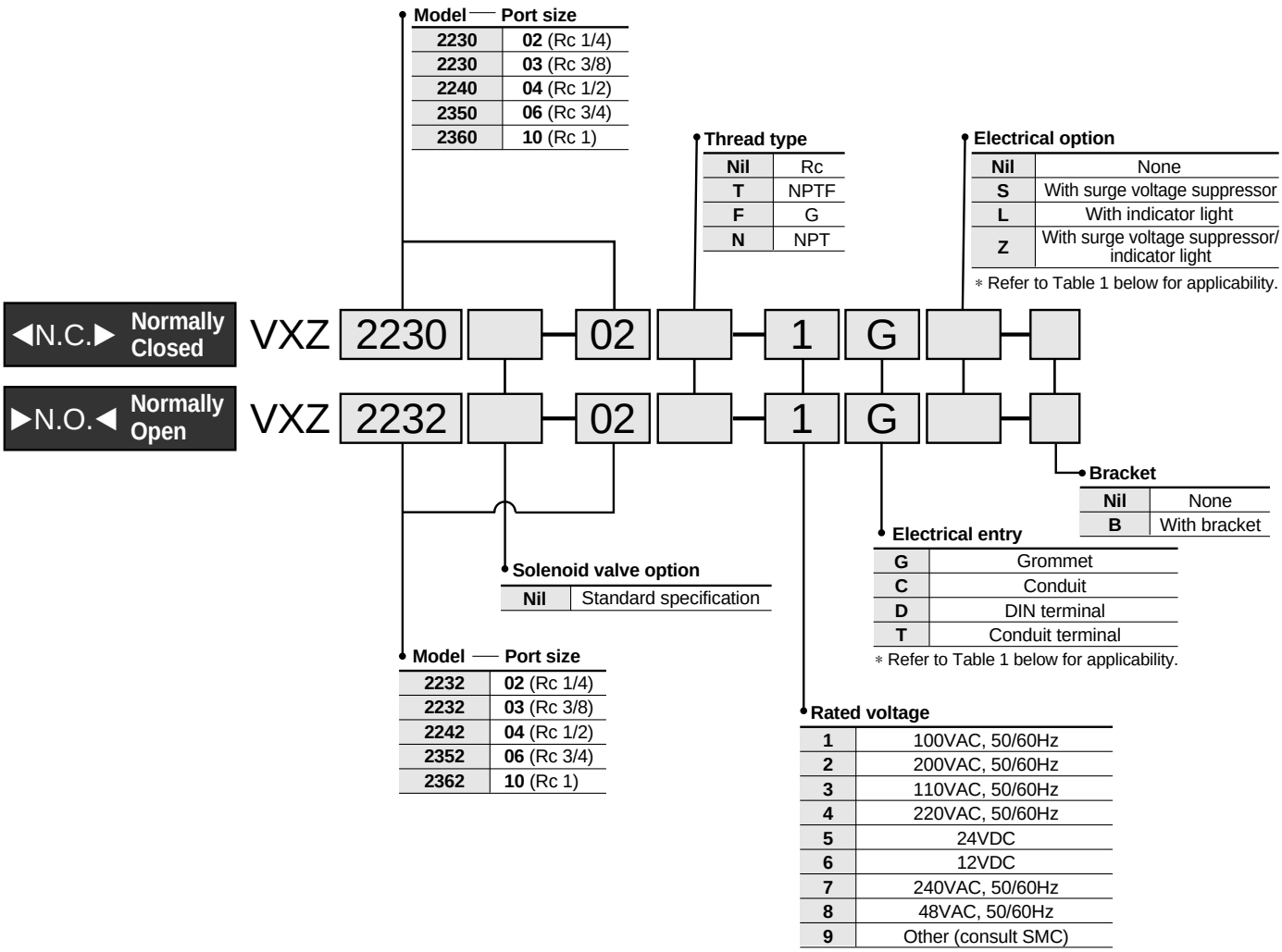
Solenoid specifications

Model	Power supply	Frequency Hz	Apparent power VA Inrush	Apparent power VA Energized	Power consumption W (energized)	Temperature increase °C (rated voltage)
VXZ22	AC	50	66 (60)	20	8	55
		60	57 (51)	15	6.5	45
	DC	—	—	—	8	50
VXZ23	AC	50	93	25	11	60
		60	79	20	9.5	50
	DC	—	—	—	11.5	55

Note 1) Reset voltage is 20% or more of rated voltage for AC, and 5% or more of rated voltage for DC.
Note 2) Allowable voltage fluctuation is ±10% of rated value for both AC and DC.
Note 3) The values are for ambient temperature of 20°C ±5°C and rated voltage.
Note 4) **AC to DC or DC to AC coil exchange is not possible due to different armature configuration.**
Note 5) Values for apparent power inside ( ) are for VXZ2232.

Refer to page 4.1-77 of Best Pneumatics No. 1 for details.

How to Order



Fluid

Standard specifications	Option
Air (general, dry) Vacuum (up to 1Torr) Turbine oil, Carbon dioxide (CO_2), Gaseous nitrogen (N_2) Freon 11, 113, 114	Air (dry)····· (T) High temperature water····· (D, E) Argon, Helium····· (F) ⋮ (Other)

Fluid and ambient temperature

Temperature condition	Power supply	Fluid temperature °C					Ambient temperature °C
		Water (standard)	Air (standard)	Oil (standard)	High temp. water (D.E.N.P.) Note 3)	High temp. oil (D.N.) Note 3)	
Maximum	AC	60	80	60	99	100	60
	DC	40	60	40	—	—	40
Minimum	AC, DC	1	−10 Note 2)	−5 Note 3)	—	—	−10

Note 1) D.E.N.P., etc., inside ( ) indicate option codes.
Note 2) Dew point is −10°C or below.
Note 3) 50cSt or less

Table 1
Rated voltage/Electrical entry/Electrical options

Insulation classification		Class B				Class H		
Electrical entry		G	C	D, T		G, C	T	
Electrical option		S Note)	–	S	L, Z	–	S	L, Z
AC	1 (100V)	●	●	●	●	●	●	●
	2 (200V)	●	●	●	●	●	●	●
	3 (110V)	●	●	●	●	●	●	●
	4 (220V)	●	●	●	●	●	●	●
	7 (240V)	●	●	●	–	●	●	–
	8 (48V)	●	●	●	–	–	●	–
DC	5 (24V)	●	●	●	●	–	–	–
	6 (12V)	●	●	●	–	–	–	–

Note) Surge voltage suppressor is attached to the lead wire.

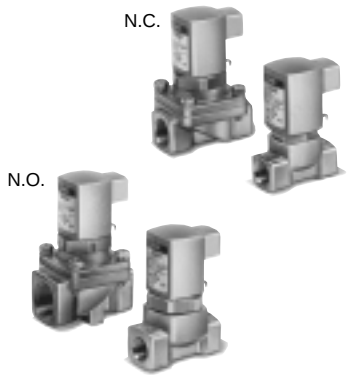
Direct Air Operated 2 Port Valve

For air, gas, vacuum, water, oil

Series VXA21/22

Air Purge

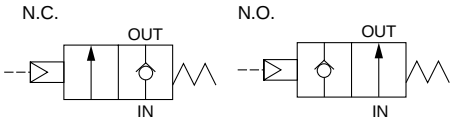
Normally Closed (N.C.)/Normally Open (N.O.)



Models/Valve specifications

Port size Rc	Orifice ø mm	Flow coefficient Cv	Flow coefficient Effective area mm²	Model	Max. operating pressure differential MPa	Max. system pressure MPa	Proof pressure MPa	Weight g
1/8 (6A)	3	0.33	6	**VXA212**$^{2}_{0}$	1.0	1.0	1.5	170
	4.5	0.61	11	**VXA213**$^{2}_{0}$	0.5			
1/4 (8A)	3	0.33	6	**VXA212**$^{2}_{0}$	1.0			
	4.5	0.61	11	**VXA213**$^{2}_{0}$	0.5			
				VXA223$^{2}_{0}$	1.0			250
	6	1.05	19	**VXA224**$^{2}_{0}$	0.6			
	8	1.7	31	**VXA225**$^{2}_{0}$	0.2	0.4		340
	10	1.9	34	**VXA226**$^{2}_{0}$	0.1			
3/8 (10A)	4.5	0.61	11	**VXA223**$^{2}_{0}$	1.0	1.0		250
	6	1.05	19	**VXA224**$^{2}_{0}$	0.6			
	8	1.7	31	**VXA225**$^{2}_{0}$	0.2	0.4		340
	10	2.4	43	**VXA226**$^{2}_{0}$	0.1			
1/2 (15A)	10	2.4	43	**VXA226**$^{2}_{0}$	0.1	0.4		420

Symbols



Pilot pressure

Model	Pressure MPa
VXA21□□ **VXA22□□**	0.25 to 0.7

How to Order

VXA21 / VXA22 □ □ □ — □ □ — □

Bracket
Nil — None
B — With bracket

∗ Refer to Table 2 below when only brackets are required.

Thread type
Nil — Rc
T — NPTF
F — G
N — NPT

Orifice size
2 — ø3mm
3 — ø4.5mm
4 — ø6mm
5 — ø8mm
6 — ø10mm

∗ Refer to Table 1 below for applicability.

Port size
01 — 1/8
02 — 1/4
03 — 3/8
04 — 1/2

∗ Refer to Table 1 below for applicability.

Type of actuation/Body type
0 — Normally closed (N.C.)/Single
2 — Normally open (N.O.)/Single

Valve option
Nil — Standard specification
V — Vacuum, non-leak

Table 1 Model/Port size/Orifice

Model		Orifice (symbol)				
VXA21	**VXA22**	2 (ø3mm)	3 (ø4.5mm)	4 (ø6mm)	5 (ø8mm)	6 (ø10mm)
01 (1/8)	—	●	●	—	—	—
02 (1/4)	—	●	●	—	—	—
—	02 (1/4)	—	●	●	●	●
—	03 (3/8)	—	●	●	●	●
—	04 (1/2)	—	—	—	—	●

Table 2 Bracket part numbers

Model	Part no.
VXA212□ VXA213□	VX070-020
VXA223□ VXA224□	VX070-022
VXA225□ VXA226□	VX070-029

Ordering example:
For series VXA21, orifice of ø4.5mm, normally open, Rc1/4
(Model number) **VXA2130-02**

Refer to page 4.1-57 of Best Pneumatics No. 1 for details.

Rubber Seal Pilot Operated Poppet Type 3 Port Solenoid Valve

Series VP300/500/700

Air Purge

Paint Stirring

High flow capacity:
Cv1.0 (VP300), Cv2.3 (VP500), Cv4.0 (VP700)

Low power consumption: 1.8W(DC)

Can be used as a selector valve or divider valve

Vacuum operation is possible.
Up to –101.2kPa (1Torr)

Models

Series		Series VP300		Series VP500		Series VP700	
Model	Body ported	VP342		VP542		VP742	
	Base mounted	VP344		VP544		VP744	
Port size Rc		1/8	1/4	1/4	3/8	3/8	1/2
Effective area mm² (Cv factor)		16.2 (0.9)	18 (1.0)	36 (2)	41.4 (2.3)	62 (3.4)	72 (4)
Weight kg (Body ported/Base mounted) Note)		0.19/0.25		0.33/0.43		0.64/0.75	

Note) Values for grommet type. Values for body ported type do not include brackets.

Specifications

Fluid	Air		
Type of actuation	N.C. or N.O. (changeable)		
Pilot type	Internal pilot type	External pilot type	
Operating pressure range MPa	0.2 to 0.8	Supply pressure	−101.2kPa to 0.8
		External pilot pressure	Equivalent to supply pressure, Minimum 0.2
Ambient and fluid temperature °C	Maximum 50		
Response time ms Note 1)	30 or less (at 0.5MPa)		
Maximum operating frequency Hz	5		
Lubrication	Not required (If lubricated, use turbine oil class 1, ISOVG32)		
Manual override	Non-locking push type		
	Slotted locking type*, Locking type*		
Mounting orientation	Free		
Impact resistance/Vibration resistance m/s² Note 2)	300/50		

Note 1) Based on dynamic performance test JIS B8374-1981 (at coil temperature of 20°C, rated voltage, without surge voltage suppressor)

Note 2) Impact resistance: No malfunction resulted from the impact test using a drop impact tester. The test was performed one time each in the axial and right angle directions of the main valve and armature for both energized and de-energized states. (The value is for the initial stage.)

Vibration resistance: No malfunction resulted in a one sweep test between 8.3 and 2000Hz. Test was performed in the axial and right angle directions of the main valve and armature for both energized and de-energized states. (The value is for the initial stage.)

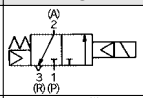
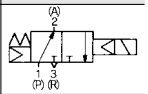
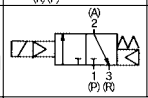
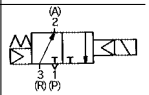
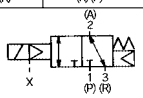
Electrical entry			Grommet (G), Grommet terminal (E), Conduit terminal (T), DIN terminal (D)
Rated coil voltage V	AC (50/60Hz)		100, 200, 12*, 24*, 48*, 110 to 120*, 220*, 240* Note 1)
	DC		24, 6*, 12*, 48*, 100*, 110* Note 1)
Allowable voltage fluctuation			–15% to +10% of rated voltage
Apparent power VA Note 2)	AC	Inrush	5.6 (50Hz), 5.0 (60Hz)
		Energized	3.4 (50Hz), 2.3 (60Hz)
Power consumption W Note 2)	DC		1.8 or 2 (with indicator light)

Note 1) Values indicated by an asterisk (*) are optional.
Note 2) At rated voltage

Options

Description	Series	Part no.
Bracket (screws included)	VP342	VP300-27-1A
	VP542	VP500-27-1A
	VP742	VP700-27-1A

JIS symbols

Type		N.C.	N.O.
Standard	Body ported		
	Base mounted		
External pilot	Universal		

External Pilot Type (Optional)

Use the external pilot type for the following cases.

- Vacuum or low pressure of 0.2MPa or less
- Consult SMC for holding vacuum.
- When P port is largely restricted
- When using A port for atmospheric release while blowing, etc.
- When using on a manifold, the external pilot piping can be centralized on the manifold

Refer to page 2.6-1 of Best Pneumatics No. 1 for details.

How to Order

VP 3 4 2 ☐ – 1 E ☐ B – 01 A – ☐

VP solenoid valve

Body size

3	1/4 standard
5	3/8 standard
7	1/2 standard

Type of actuation

4	N.C./N.O. common (pilot type)

Body type

2	Body ported
4	Base mounted

Valve option

Nil	Standard (Internal pilot type)
R*	External pilot type

* Optional

Rated voltage

1	100VAC, 50/60Hz
2	200VAC, 50/60Hz
3*	110 to 120VAC, 50/60Hz
4*	220VAC, 50/60Hz
5	24VDC
6*	12VDC
7*	240VAC, 50/60Hz
9*	Other

* Optional

Electrical entry

G	Grommet
E	Grommet terminal
T	Conduit terminal
D	DIN terminal

Indicator light/Surge voltage suppressor

Nil	None
Z*	With indicator light/surge voltage suppressor (for "E", "T", "D" only)
S*	With surge voltage suppressor (for "G" only)

* Optional

Manual override

Nil	Push type
B*	Slotted locking type
C*	Locking type

* Optional

Flow passage

A	Normally closed
B	Normally open

Port size

Symbol	Port size Rc	VP342 VP344	VP542 VP544	VP742 VP744
Nil*	Without sub-plate	●	●	●
01	1/8	●		
02	1/4	●	●	
03	3/8		●	●
04	1/2			●

* For VP344, VP544, VP744 only

Option

F	With bracket

(For VP342, 542, 742 only)

How to Order Pilot Valve Assemblies

SF4 – 1 E Z B – 50

Rated voltage

1	100VAC, 50/60Hz
2	200VAC, 50/60Hz
3*	110 to 120VAC, 50/60Hz
4*	220VAC, 50/60Hz
5	24VDC
6*	12VDC
7*	240VAC, 50/60Hz
9*	Other

* Optional

Electrical entry

G	Grommet
E	Grommet terminal
T	Conduit terminal
D	DIN terminal

Indicator light/Surge voltage suppressor

Nil	None
Z*	With indicator light/surge voltage suppressor (for "E", "T", "D" only)
S*	With surge voltage suppressor (for "G" only)

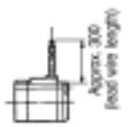
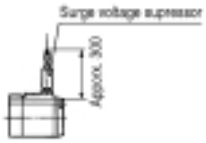
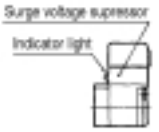
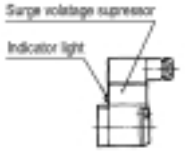
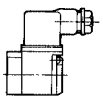
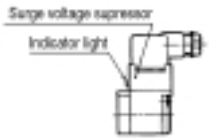
* Optional

Manual override

Nil	Push type
B*	Slotted locking type
C*	Locking type

* Optional

Pilot valve assemblies/Electrical entry

Symbol	Electrical entry	Symbol	Electrical entry
G		GS	
E		EZ	
T		TZ	
D		DZ	

Rubber Seal Pilot Operated Poppet Type 3 Port Solenoid Valve

Series VG342

Non-operation

Air Purge

Light weight: 1.1kg
Valve capacity: Rc 1/Cv13.1

Low power consumption:
4.8W DC (standard)
2W DC (low power consumption type)

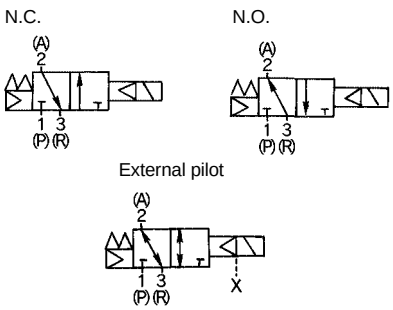
No lubrication required

Can be used in vacuum or with low pressure
External pilot type — Vacuum: up to 101.2kPa
Low pressure: 0 to 0.2MPa

Changeable actuation: N.C., N.O., external pilot

Can be used as a selector or divider valve (external pilot)

JIS symbols



Specifications

Type of actuation	N.C., N.O. common	
Operation	Internal pilot type	External pilot type
Operating pressure range	0.2 to 0.9MPa	–101.2kPa to 0.9MPa
External pilot pressure	—	Equivalent to operating pressure, Minimum 0.2MPa
Response time Note 1)	30ms or less (at 0.5MPa)	
Maximum operating frequency	5 cycles/sec (min. operating frequency of 1 cycle/30 days based on JIS B8374-1981)	
Ambient and fluid temperature	Maximum 50°C	
Lubrication	Not required (If lubricated, use turbine oil class 1, ISO VG32.)	
Manual override	Push type (non-locking type)	
Mounting orientation	Free	
Impact resistance/Vibration resistance m/s² Note 2)	150/50	
Weight	1.1kg Note 3)	

Note 1) Based on dynamic performance test JIS B8374-1981 (at coil temperature of 20°C, rated voltage, without surge voltage suppressor)

Note 2) Impact resistance: No malfunction resulted from the impact test using a drop impact tester. The test was performed one time each in the axial and right angle directions of the main valve and armature for both energized and de-energized states. (The value is for the initial stage.)

Vibration resistance: No malfunction resulted in a one sweep test between 45 and 1000Hz. Test was performed in the axial and right angle directions of the main valve and armature for both energized and de-energized states. (The value is for the initial stage.)

Note 3) For grommet type

Effective area/Cv factor

Port size		Rc 1/2	Rc 3/4	Rc 1
Effective area mm²	P → A	140	185	210
	A → R	145	195	235
Cv factor	P → A	7.8	10.3	11.7
	A → R	8.1	10.8	13.1

Pilot valve assembly specifications

Electrical entry			Grommet (G), Grommet terminal (E) Conduit terminal (T), DIN terminal (D)
Lead wire color			100VAC: Blue, 200VAC: Red, 24VDC: Red/Black
Enclosure			Dust proof
Rated coil voltage V	AC (50/60Hz)		100, 200, 24*, 48*, 110*, 220*, 240* Note 1)
	DC		24, 6*, 12*, 48*, 100* Note 1)
Allowable voltage fluctuation			–15% to +10% of rated voltage
Apparent power VA (Hz) Note 2)	AC	Inrush	12.7 (50), 10.7 (60)
		Energized	7.6 (50), 5.4 (60)
Power consumption Note 2)	DC		4.8W or 5W (with indicator light)

Note 1) Values indicated by an asterisk (*) are optional.
Note 2) At rated voltage

Option specification

Low power consumption type: VG342□–□□□–□□□–Y

Consider this specification when an electronic control, etc., requires low power consumption.

The following specification is different from the standard.

Power consumption	2W DC or 2.2W (with indicator light)*

* 100VDC is 2.4W, with indicator light 2.6W.

Continuous energization type: VG342□–□□□–□□□–E

Consider this specification when operating valves in a continuously energized state for a long period of time.

The following specification is different from the standard.

Apparent power VA (Hz) Note)	AC	Inrush	7.9 (50), 6.2 (60)
		Energized	5.8 (50), 3.5 (60)
Power consumption Note)	DC		2W or 2.2W (with indicator light)

Note) At rated voltage

Refer to page 2.7-1 of Best Pneumatics No. 1 for details.

How to Order

VG342 □ 1 G □ 04 □ A □

Valve type

Nil	Internal pilot
R	External pilot

Rated voltage

1	100VAC, 50/60Hz
2	200VAC, 50/60Hz
3*	110VAC, 50/60Hz
4*	220VAC, 50/60Hz
5	24VDC
6*	12VDC
7*	240VAC, 50/60Hz
9*	Other

* Optional

Electrical entry

G	Grommet
D	DIN terminal
E	Grommet terminal
T	Conduit terminal

Port size

04	Rc 1/2
06	Rc 3/4
10	Rc 1

Thread type

Nil	Rc
F*	G
N*	NPT
T*	NPTF

* Optional

Indicator light/Surge voltage suppressor

Nil	None
S	With surge voltage suppressor (for grommet type only)
Z	With indicator light/surge voltage suppressor (except grommet type)

Flow passage

Nil	External pilot
A	N.C. (Normally closed)
B	N.O. (Normally open)

Pilot valve option

Nil	Standard
Y*	Low power consumption
E*	Continuous energization

* Optional

How to Order Pilot Valve Assemblies

VO307 □ 1 G □ X84

Pilot valve assembly for VG342

Valve option

Nil	Standard
Y*	Low power consumption
E*	Continuous energization

* Optional

Rated voltage

1	100VAC, 50/60Hz
2	200VAC, 50/60Hz
3*	110VAC, 50/60Hz
4*	220VAC, 50/60Hz
5	24VDC
6*	12VDC
7*	240V, 50/60Hz
9*	Other

* Optional

Electrical entry

G	Grommet
D	DIN terminal
E	Grommet terminal
T	Conduit terminal

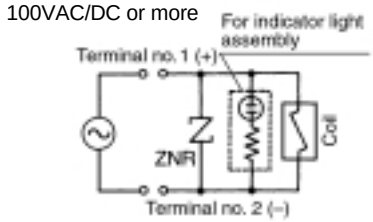
Indicator light/Surge voltage suppressor

Nil	None
S	With surge voltage suppressor (for grommet type only)
Z	With indicator light/surge voltage suppressor (except grommet type)

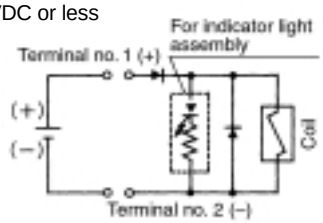
⚠Caution

Indicator Light/ Surge Voltage Suppressor

100VAC/DC or more



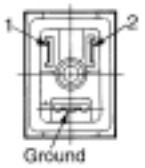
48VDC or less



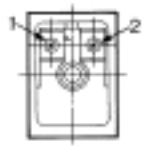
Electrical Connection

The internal connections for DIN terminal and terminal (with indicator light/surge voltage suppressor circuit) are as shown below. Connect each to the power supply side.

With DIN terminal block

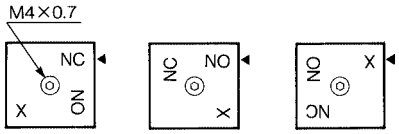


With terminal block



Terminal no.	1	2
DIN terminal	+	–
Terminal	+	–

Changing the Flow Passage



N.C. **N.O.** **External pilot**

When changing the flow passage, confirm that pressure has been removed from the valve.
Loosen the hexagon socket head cap screw M4 x 0.7 in the switching plate and match the mark on the adapter plate with a character symbol on the switching plate. Perform piping as shown in the table below.

Piping

Flow passage \ Port	P	A	R
N.C.	Primary	Secondary	Exhaust side (Plug for 2 port valve)
N.O.	Exhaust side (Plug for 2 port valve)	Secondary	Primary
External	Universal porting (Piping of primary side is possible anywhere.)		

Note 1) When operating with internal pilot, confirm that the X port is plugged. If it is not plugged, use an R 1/8 plug.

Note 2) When operating with external pilot, pressurize from the X port.

Directional Control Equipment

Rubber Seal Large 3 Port Solenoid Valve

Series VP3145/3165/3185

Non-operation

Air Purge

Large flow capacity, small exhaust resistance

(Refer to Cv factor values in "Models" table.)

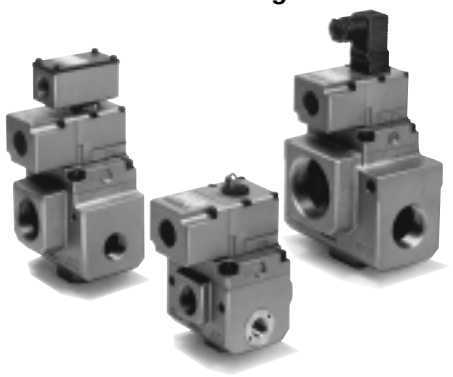
Easy conversion to N.C. or N.O.

The switching plate enables conversion to N.C. or N.O. without changing ports.

Can be used in vacuum or with low pressure

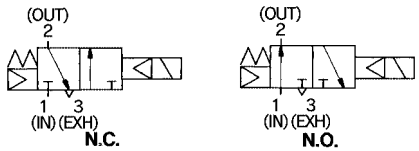
External pilot type — Vacuum: up to 101.2kPa
Low pressure: 0 to 0.2MPa

Unrestricted mounting orientation

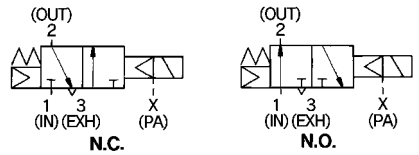


JIS symbols

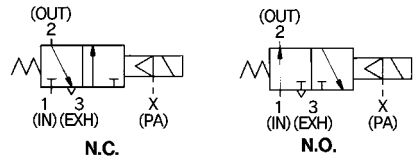
Internal pilot type
<Standard>



External pilot type
<For pressurizing>



<For vacuum>



Note) In the case of the N.O. specification, it operates as a normally open valve only when the proper pressure is applied to the pilot chamber.

Models

Model		VP3145 VPA3145			VP3165 VPA3165			VP3185 VPA3185		
Port size Rc	IN, OUT	3/8	1/2	3/4	3/4	1	1 1/4	1 1/4	1 1/2	2
	EXT	3/4			1 1/4			2		
Cv factor	IN → OUT	5.0	5.6	6.1	12.8	15.6	17.2	31.7	36.1	36.1
	OUT → EXT	7.2	8.9	11.7	15.6	17.2	18.3	36.1	37.2	37.2
Effective area mm²	IN → OUT	90	100	110	230	280	310	570	650	650
	OUT → EXT	130	160	210	280	310	330	650	670	670
Weight kg Note)		1.5			2.0			2.8		

Note) For grommet type.
Add 0.2kg for conduit terminal type.
Subtract 0.5kg for air operated type.

Specifications

Fluid		Air				
Type of actuation		N.C. or N.O. (changeable)				
Pilot type		Internal pilot type	External pilot type			
		General	Vacuum/ Low pressure	General		
Operating pressure range MPa	Main pressure	0.2 to 0.8	−101.2kPa to 0.2	0.2 to 0.8		
	Pilot pressure		0.2 to 0.3	See the graph on next page.		
Ambient and fluid temperature °C		0 (no freezing) to 60				
Response time ms (at 0.5MPa) Note 1)		ON	AC	30 or less	OFF	AC	30 or less
			DC	40 or less		DC	30 or less
Maximum operating frequency Hz		3				
Lubrication Note 2)		Required (equivalent to turbine oil class 1, ISO VG32)				
Manual override		Non-locking type				
Mounting orientation		Free				
Impact resistance/Vibration resistance m/s² Note 3)		150/50				

Note 1) Based on dynamic performance test JIS B8374-1981 (at coil temperature of 20°C, rated voltage, without surge voltage suppressor)

Note 2) Since this solenoid valve is a lubricating type, use a lubricant equivalent to turbine oil class 1 (ISO VG32).

Note 3) Impact resistance: No malfunction resulted from the impact test using a drop impact tester. The test was performed one time each in the axial and right angle directions of the main valve and armature for both energized and de-energized states. (The value is for the initial stage.)

Vibration resistance: No malfunction resulted in a one sweep test between 45 and 1000Hz. Test was performed in the axial and right angle directions of the main valve and armature for both energized and de-energized states. (The value is for the initial stage.)

Solenoid specifications

Electrical entry	Standard		Grommet (G), Conduit terminal (T), DIN terminal (D)
	Options		Conduit terminal with indicator light (TL), Conduit terminal with surge voltage suppressor (TS), Conduit terminal with indicator light/surge voltage suppressor (TZ), DIN terminal with indicator light (DL), DIN terminal with surge voltage suppressor (DS), DIN terminal with indicator light/surge voltage suppressor (DZ)
Rated coil voltage	AC (50/60 Hz)		100V, 200V, 110V*, 220V*, 240V* Note 1)
	DC		12V*, 24V, 48V*, 100V* Note 1)
Allowable voltage fluctuation			−15% to +10% of rated voltage
Apparent power Note 2)	AC	Inrush	73VA (50Hz), 58VA (60Hz)
		Energized	28VA (50Hz), 17VA (60Hz)
Power consumption Note 2)	DC		12W

Note 1) Values indicated by an asterisk (*) are optional.
Note 2) At rated voltage

Refer to page 2.8-1 of Best Pneumatics No. 1 for details.

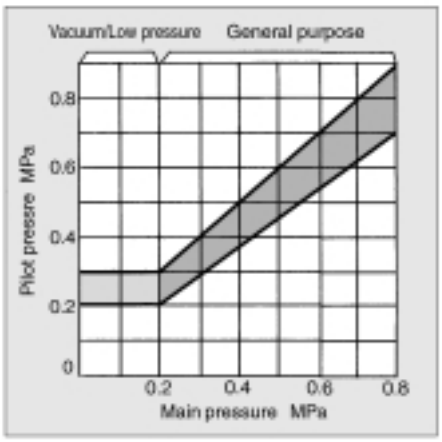
External Pilot Type

Use an external pilot model in the following cases:

- Vacuum or low pressure of 0.2MPa or less: External pilot for vacuum/low pressure
- Operation with restricted supply port: External pilot for general purpose
- Slow build up of supply port air pressure: External pilot for general purpose
- Low resistance in the secondary side as in the case of air blowing or filling an air tank, etc.: External pilot for general purpose

Note 1) Use external pilot pressure within the range shown in the graph below.

Note 2) Changing from an internal pilot to an external pilot or vice versa is not possible.



How to Order

VP3 1 4 5 ☐ – 04 1 G A ☐

VP 3 port solenoid valve

No. of solenoids

1	Single

Body size

4	1/2
6	1
8	1 1/2

Body type

5	Body ported

Valve option

Nil	General
V	Vacuum/Low pressure

Port size (IN/OUT port)

Symbol	Port size Rc (Nominal size)	VP3145	VP3165	VP3185
03	3/8 (10A)	●		
04	1/2 (15A)	●		
06	3/4 (20A)	●	●	
10	1 (25A)		●	
12	1 1/4(32A)		●	●
14	1 1/2(40A)			●
20	2 (50A)			●

Rated coil voltage

1	100VAC, 50/60Hz
2	200VAC, 50/60Hz
3*	110VAC, 50/60Hz
4*	220VAC, 50/60Hz
5	24VDC
6*	12VDC
7*	240VAC, 50/60Hz
9*	Other

* Optional

Electrical entry

G	Grommet
T	Conduit terminal
D	DIN terminal
TL*	Conduit terminal with indicator light
TS*	Conduit terminal with surge voltage suppressor
TZ*	Conduit terminal with indicator light/ surge voltage suppressor
DL*	DIN terminal with indicator light
DS*	DIN terminal with surge voltage suppressor
DZ*	DIN terminal with indicator light/ surge voltage suppressor

* Optional

Type of actuation

A	N.C. (Normally closed)
B	N.O. (Normally open)

Pilot option

Nil	Standard (Internal pilot)
1	External pilot

How to Order Pilot Valve Assemblies

VT3113 – 00 1 G

Rated coil voltage

1	100VAC, 50/60Hz
2	200VAC, 50/60Hz
3*	110VAC, 50/60Hz
4*	220VAC, 50/60Hz
5	24VDC
6*	12VDC
7*	240VAC, 50/60Hz
9*	Other

* Optional

Electrical entry

G	Grommet
T	Conduit terminal
D	DIN terminal
TL*	Conduit terminal with indicator light
TS*	Conduit terminal with surge voltage suppressor
TZ*	Conduit terminal with indicator light/ surge voltage suppressor
DL*	DIN terminal with indicator light
DS*	DIN terminal with surge voltage suppressor
DZ*	DIN terminal with indicator light/surge voltage suppressor

* Optional

3 Port Micro Mechanical Valve

Series VM1000

Air Purge

Miniature construction requires minimal mounting space.

Easy tubing connection with built-in hose nipple.

Port options: Side ported
Bottom ported

Large over travel after actuation (mechanically operated type)

Standard specifications

Valve type	N.C. poppet type
Number of ports	3 port
Total travel (T.T.)	4.8mm (Basic type)
Piping	Side ported or Bottom ported
Fluid	Air
Operating pressure	5 to 0.8MPa
Ambient and operating air temperature	–5 to 60°C (with no freezing)
Effective area (Cv factor)	1mm² (0.055)
Lubrication	Not required (If lubricated, use turbine oil class 1, ISO VG32.)
Fitting	With hose nipple
Weight (Basic type)	6g

Option specifications

Total travel (T.T.)	2.5mm (Basic type)

- A commercially available actuator for the V micro switch can be installed.
- However, be aware that there are different types of micro switch such as P.T., O.T. or F.O.F.
- Total travel of 2.5mm is only available for the basic type.

Note) T.T.: Total travel (From free position to total travel position)
P.T.: Pre-travel (From free position to initial valve operating position)
O.T.: Over travel (From initial valve operating position to total travel position)
F.O.F.: Full operating force (Required force to total travel position)

Models

	Actuator	Port type	No. of ports	Applicable tube		Note
				T0425	TU0425/T0403	
Mechanical operation	Basic type	Side ported	3 port	**VM1000-4N-00**	**VM1000-4NU-00**	
		Bottom ported	3 port	**VM1010-4N-00**	**VM1010-4NU-00**	
	Roller lever	Side ported	3 port	**VM1000-4N-01**	**VM1000-4NU-01**	
		Bottom ported	3 port	**VM1010-4N-01**	**VM1010-4NU-01**	
	One way roller lever	Side ported	3 port	**VM1000-4N-02**	**VM1000-4NU-02**	
		Bottom ported	3 port	**VM1010-4N-02**	**VM1010-4NU-02**	
Manual operation	Toggle lever	Side ported	3 port	**VM1000-4N-08**	**VM1000-4NU-08**	
		Bottom ported	3 port	**VM1010-4N-08**	**VM1010-4NU-08**	
	Push button	Side ported	3 port	**VM1000-4N-32R**	**VM1000-4NU-32R**	Red
		Bottom ported	3 port	**VM1010-4N-32R**	**VM1010-4NU-32R**	Red
		Side ported	3 port	**VM1000-4N-32B**	**VM1000-4NU-32B**	Black
		Bottom ported	3 port	**VM1010-4N-32B**	**VM1010-4NU-32B**	Black
		Side ported	3 port	**VM1000-4N-32G**	**VM1000-4NU-32G**	Green
		Bottom ported	3 port	**VM1010-4N-32G**	**VM1010-4NU-32G**	Green

Refer to page 3.5-7 of Best Pneumatics No. 1 for details.

3 Port Mechanical Valve

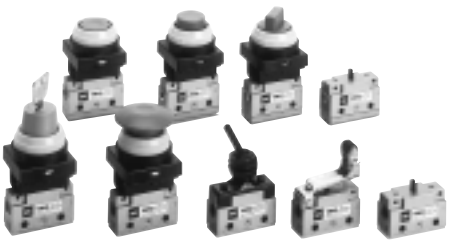
Series VM100

Air Purge

Compact size equivalent to micro switch

Port options: Side ported
Bottom ported

A variety of actuators available



Specifications

Piping	Side ported	Bottom ported
Fluid	Air	
Operating pressure	−100kPa to 1.0MPa	
Ambient and operating air temperature	−5 to 60°C (with no freezing)	
Effective area (Cv factor)	2.5mm² (0.14)	
Lubrication	Not required (If lubricated, use turbine oil class 1, ISO VG32.)	
Port size (Nominal size)	Rc 1/8 (6A)	M5 x 0.8
Weight (Basic type)	95g	110g

Models

	Actuator \ Piping / No. of ports	Side ported 3 port	Bottom ported 3 port	Actuator part no.	Application
Mechanical operation	Basic type	**VM130-01-00**	**VM132-M5-00**	—	
		VM131-01-00	**VM133-M5-00**		
	Roller lever	**VM130-01-01**	**VM133-M5-01**	—	Polyacetal roller
		VM131-01-01S	**VM133-M5-01S**	—	Hard steel roller
	One way roller lever	**VM131-01-02**	**VM133-M5-02**	—	Polyacetal roller
		VM131-01-02S	**VM133-M5-02S**	—	Hard steel roller
	Straight plunger	**VM130-01-05**	**VM132-M5-05**	VM-05B	—
	Roller plunger	**VM130-01-06**	**VM132-M5-06**	VM-06B	Polyacetal roller
		VM130-01-06S	**VM132-M5-06S**	VM-06BS	Hard steel roller
	Cross roller plunger	**VM130-01-07**	**VM132-M5-07**	VM-07B	Polyacetal roller
		VM130-01-07S	**VM132-M5-07S**	VM-07BS	Hard steel roller
Manual operation	Toggle lever	**VM130-01-08**	**VM132-M5-08**	VM-08B	
	Push button (Mushroom)	**VM130-01-30R**	**VM132-M5-30R**	VM-30AR	Red
		VM130-01-30B	**VM132-M5-30B**	VM-30AB	Black
		VM130-01-30G	**VM132-M5-30G**	VM-30AG	Green
		VM130-01-30Y	**VM132-M5-30Y**	VM-30AY	Yellow
	Push button (Extended)	**VM130-01-32R**	**VM132-M5-32R**	VM-32AR	Red
		VM130-01-32B	**VM132-M5-32B**	VM-32AB	Black
		VM130-01-32G	**VM132-M5-32G**	VM-32AG	Green
		VM130-01-32Y	**VM132-M5-32Y**	VM-32AY	Yellow
	Push button (Flush)	**VM130-01-33**	**VM132-M5-33**	VM-33A	A set of Red, Black, Green, and Yellow included.
	Selector (2 position)	**VM130-01-34R**	**VM132-M5-34R**	VM-34AR	Red
		VM130-01-34B	**VM132-M5-34B**	VM-34AB	Black
		VM130-01-34G	**VM132-M5-34G**	VM-34AG	Green
		VM130-01-34Y	**VM132-M5-34Y**	VM-34AY	Yellow
	Key selector (2 position)	**VM130-01-36**	**VM132-M5-36**	VM-36A	
	Selector (3 position)	**VM151-01-35R**	**VM153-M5-35R**	—	Red
		VM151-01-35B	**VM153-M5-35B**	—	Black
		VM151-01-35G	**VM153-M5-35G**	—	Green
		VM151-01-35Y	**VM153-M5-35Y**	—	Yellow
		(5 port)	**(5 port)**		

Note) Actuator replacement is available except for roller lever, one way roller lever, and 3 position selector types.

Refer to page 3.5-11 of Best Pneumatics No. 1 for details.

3 Port Mechanical Valve

Series VM200

Air Purge

Large flow capacity

A variety of actuators available

Specifications

Fluid	Air
Operating pressure	0 to 1.0MPa
Ambient and operating air temperature	–5 to 60°C (with no freezing)
Effective area (Cv factor)	19mm² (1.0)
Lubrication	Not required (If lubricated, use turbine oil class 1, ISO VG32.)
Port size (Nominal size)	Rc 1/4 (8A)
Weight (Basic type)	111g

Models

	Actuator \ No. of ports	3 port	Actuator part no.	Application
Mechanical operation	Basic type	**VM230-02-00**	—	—
	Roller lever	**VM230-02-01**	VM-01A	Polyacetal roller
		VM230-02-01S	VM-01AS	Hard steel roller
	One way roller lever	**VM230-02-02**	VM-02A	Polyacetal roller
		VM230-02-02S	VM-02AS	Hard steel roller
	Straight plunger	**VM230-02-05**	VM-05A	—
	Roller plunger	**VM230-02-06**	VM-06A	Polyacetal roller
		VM230-02-06S	VM-06AS	Hard steel roller
	Cross roller plunger	**VM230-02-07**	VM-07A	Polyacetal roller
		VM230-02-07S	VM-07AS	Hard steel roller
Manual operation	Toggle lever	**VM230-02-08**	VM-08A	—
	Push button (Mushroom)	**VM230-02-30R**	VM-30AR	Red
		VM230-02-30B	VM-30AB	Black
		VM230-02-30G	VM-30AG	Green
		VM230-02-30Y	VM-30AY	Yellow
	Push button (Extended)	**VM230-02-32R**	VM-32AR	Red
		VM230-02-32B	VM-32AB	Black
		VM230-02-32G	VM-32AG	Green
		VM230-02-32Y	VM-32AY	Yellow
	Push button (Flush)	**VM230-02-33**	VM-33A	A set of Red, Black, Green, and Yellow included.
	Selector (2 position)	**VM230-02-34R**	VM-34AR	Red
		VM230-02-34B	VM-34AB	Black
		VM230-02-34G	VM-34AG	Green
		VM230-02-34Y	VM-34AY	Yellow
	Key selector (2 position)	**VM230-02-36**	VM-36A	—
	Selector (3 position)	**VM230-02-35R**	—	Red
		VM230-02-35B	—	Black
		VM230-02-35G	—	Green
		VM230-02-35Y	—	Yellow
	Foot pedal	**VM230-02-40**	—	—

Note) Actuator replacement is available except for 3 position selector and foot pedal types.

Refer to page 3.5-19 of Best Pneumatics No. 1 for details.

3 Port Mechanical Valve

Series VM400

Air Purge

N.C. or N.O. models available

Piping connection to any port

(Proper countermeasures can be taken for applications in which noise or dirt from exhaust could cause a problem to the environment.)

Specifications

Fluid	Air
Operating pressure	−100kPa to 1.0MPa
Ambient and operating air temperature	−5 to 60°C (with no freezing)
Effective area (Cv factor)	7mm² (0.38)
Lubrication	Not required (If lubricated, use turbine oil class 1, ISO VG32.)
Port size (Nominal size)	Rc 1/8 (6A)
Weight (Basic type)	110g

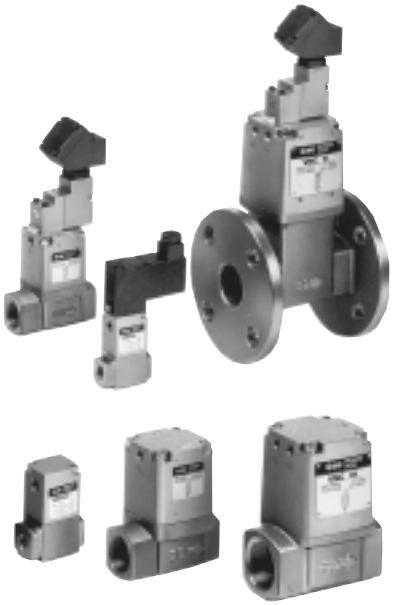
Models

	Actuator	Model	Actuator part no.	Application
Mechanical operation	Basic type	**VM430-01-00**	—	—
	Roller lever	**VM430-01-01**	VM-01A	Polyacetal roller
		VM430-01-01S	VM-01AS	Hard steel roller
	One way roller lever	**VM430-01-02**	VM-02A	Polyacetal roller
		VM430-01-02S	VM-02AS	Hard steel roller
	Straight plunger	**VM430-01-05**	VM-05A	—
	Roller plunger	**VM430-01-06**	VM-06A	Polyacetal roller
		VM430-01-06S	VM-06AS	Hard steel roller
	Cross roller plunger	**VM430-01-07**	VM-07A	Polyacetal roller
		VM430-01-07S	VM-07AS	Hard steel roller
Manual operation	Toggle lever	**VM430-01-08**	VM-08A	—
	Push button (Mushroom)	**VM430-01-30R**	VM-30AR	Red
		VM430-01-30B	VM-30AB	Black
		VM430-01-30G	VM-30AG	Green
		VM430-01-30Y	VM-30AY	Yellow
	Push button (Extended)	**VM430-01-32R**	VM-32AR	Red
		VM430-01-32B	VM-32AB	Black
		VM430-01-32G	VM-32AG	Green
		VM430-01-32Y	VM-32AY	Yellow
	Push button (Flush)	**VM430-01-33**	VM-33A	A set of Red, Black, Green, and Yellow included.
	Selector (2 position)	**VM430-01-34R**	VM-34AR	Red
		VM430-01-34B	VM-34AB	Black
		VM430-01-34G	VM-34AG	Green
		VM430-01-34Y	VM-34AY	Yellow
	Key selector (2 position)	**VM430-01-36**	VM-36A	—

Note) Actuator replacement is available.

Refer to page 3.5-25 of Best Pneumatics No. 1 for details.

Coolant Valve
Solenoid/Air Operated Type *Series VNC*

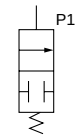
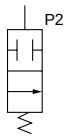
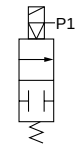
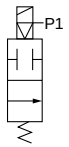


Models

Model	Piping port		Orifice ø mm	Flow coefficient		Weight kg	
	Rc	Flange Note)		Cv	Effective area mm²	Air operated type	Solenoid type
VNC1□□□-6A	1/8	—	7	0.7	13	0.2	0.3
VNC1□□□-8A	1/4	—		1	18		
VNC1□□□-10A	3/8	—		1.3	23		
VNC2□4□-10A			11	2.5	45	0.5	0.7
VNC2□□□-10A			15	3.8	70		
VNC2□4□-15A	1/2	—	11	3	55		
VNC2□□□-15A			15	5	90		
VNC3□4□-20A	3/4	—	14	5	90	0.8	1.0
VNC3□□□-20A			20	8	140		
VNC4□4□-25A	1	—	16	7	130	1.2	1.4
VNC4□□□-25A			25	12	220		
VNC5□4□-32A	1 1/4	—	22	11	210	2.2	2.4
VNC5□□□-32A			32	18	320		
VNC5□4□-32F	—	32	22	11	210	5.0	5.2
VNC5□□□-32F			32	18	320		
VNC6□4□-40A	1 1/2	—	28	19	330	3.6	3.8
VNC6□□□-40A			40	28	500		
VNC6□4□-40F	—	40	28	19	330	6.8	7.0
VNC6□□□-40F			40	28	500		
VNC7□4□-50A	2	—	33	29	520	5.5	5.7
VNC7□□□-50A			50	43	770		
VNC7□4□-50F	—	50	33	29	520	10.2	10.4
VNC7□□□-50F			50	43	770		
VNC814□-65F	—	65	45	49	880	—	15.7
VNC811□-65F			65	70	1260		
VNC914□-80F	—	80	56	73	1400	—	21.2
VNC911□-80F			80	100	1800		

Note) The flange is equivalent to JIS B 2210 10K (regular type).

Symbols

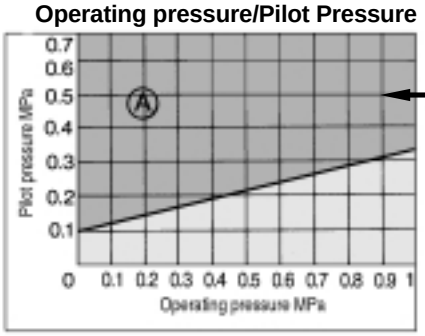
Operation \ Valve type	N.C.	N.O.
Air operated	**VNC□0$\frac{1}{4}$□**	**VNC□02□**
		
External pilot solenoid type	**VNC□0$\frac{1}{4}$□**	**VNC□12□**
		

Valve specifications

Fluid			Coolant
Fluid temperature	**VNC□□□A**		–5 to 60°C*
	VNC□□□B		–5 to 99°C* (air operated type only)
Ambient temperature			–5 to 50°C* (60°C for air operated type)
Proof pressure			1.5MPa
Operating pressure range	**VNC□□1□**		0 to 0.5MPa
	VNC□□$^{2}_{4}$□		0 to 1MPa
External pilot air	Pressure	**VNC□□$\frac{1}{4}$□**	0.25 to 0.7MPa
		VNC□□□2	0.1 to 0.7MPa (Refer to Table 1.)
	Lubrication		Not required (If lubricated, use turbine oil class 1, ISO VG32.)
	Temperature		–5 to 50°C* (60°C for air operated type)

* With no freezing

Table 1
Operating pressure/Pilot Pressure



Use pilot pressure that is within range Ⓐ with respect to the operating pressure.

Pilot solenoid valve specifications

Model			**VNC1□□□**	**VNC2□□□ to 9□□□**
Pilot solenoid valve			SF4-□□□-23	VO301-00□T□-X302
Electrical entry			Grommet Grommet terminal Conduit terminal DIN terminal	Conduit terminal
Rated coil voltage V	AC (50/60Hz)		100V, 200V, other (option)	
	DC		24V, other (option)	
Allowable pressure fluctuation			–15% to +10% of rated voltage	
Coil insulation type			Equivalent to class B (130°C)	
Temperature increase			35°C or less (at rated voltage)	70°C or less (at rated voltage)
Apparent power	AC	Inrush	5.6VA (50Hz) 5.0VA (60Hz)	12VA (50Hz) 10.5VA (60Hz)
		Energized	3.4VA (50Hz) 2.3VA (60Hz)	7.5VA (50Hz) 6VA (60Hz)
Power consumption	DC		1.8W	4.8W
Manual override			Push type, other (option)	Non-locking push type

Refer to page 4.2-19 of Best Pneumatics No. 1 for details.

How to Order

Seal material

A	NBR seal
B	FPM seal

Bracket

Nil	None
B	With bracket

For valve sizes 1, 2, 3, and 4 only

Air Operated Type VNC 2 0 1 A — 15A — □ **(Except valve sizes 8 and 9)**

External Pilot Solenoid Type VNC 2 1 1 A — 15A — 1 T □ —□

Valve size

Valve type

Port size

Symbol	Orifice size (mm)	Symbol 1 N.C. 0.5MPa	Symbol 2 N.O. 1MPa	Symbol 4 N.C. 1MPa	Symbol	Port size Rc
1	ø7	—	●	●	6A	1/8
		—	●	●	8A	1/4
		—	●	●	10A	3/8
2	ø15 (ø11)	●	●	●	10A	3/8
		●	●	●	15A	1/2
3	ø20 (ø14)	●	●	●	20A	3/4
4	ø25 (ø16)	●	●	●	25A	1
5	ø32 (ø22)	●	●	●	32A	1 1/4
		●	●	●	32F	1 1/4B Flange
6	ø40 (ø28)	●	●	●	40A	1 1/2
		●	●	●	40F	1 1/2B Flange
7	ø50 (ø33)	●	●	●	50A	2
		●	●	●	50F	2B Flange
8	ø65 (ø45)	●	—	●	65F	2 1/2B Flange
9	ø80 (ø56)	●	—	●	80F	2B Flange

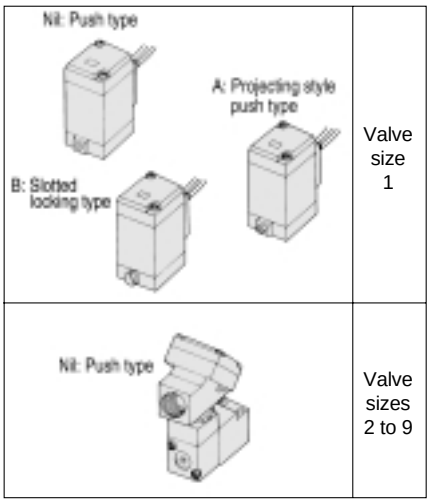
Values inside ( ) are for N.C. at 1MPa.

Rated voltage

Nil	Air operated type
1	100VAC, 50/60Hz
2	200VAC, 50/60Hz
3*	110VAC, 50/60Hz
4*	220VAC, 50/60Hz
5	24VDC
6*	12VDC
7*	240VAC, 50/60Hz
9*	Other

* Optional

Manual override



Nil: Push type; A: Projecting style push type; B: Slotted locking type	Valve size 1
Nil: Push type	Valve sizes 2 to 9

Electrical entry and indicator light/surge voltage suppressor

Nil	Air operated type	
G	Grommet	Valve size 1
GS	Grommet with surge voltage suppressor	
E	Grommet terminal	
EZ	Grommet terminal with indicator light/surge voltage suppressor	
T	Conduit terminal	
TZ	Conduit terminal with indicator light/surge voltage suppressor	
D	DIN terminal	
DZ	DIN terminal with indicator light/surge voltage suppressor	
T	Conduit terminal	Valve sizes 2 to 9
TS	Conduit terminal with surge voltage suppressor	
TZ*	Conduit terminal with indicator light/surge voltage suppressor	
TL*	Conduit terminal with indicator light	

* Except rated voltages 6, 7, and 9

Flow Switching 2 Port Air Operated Valve

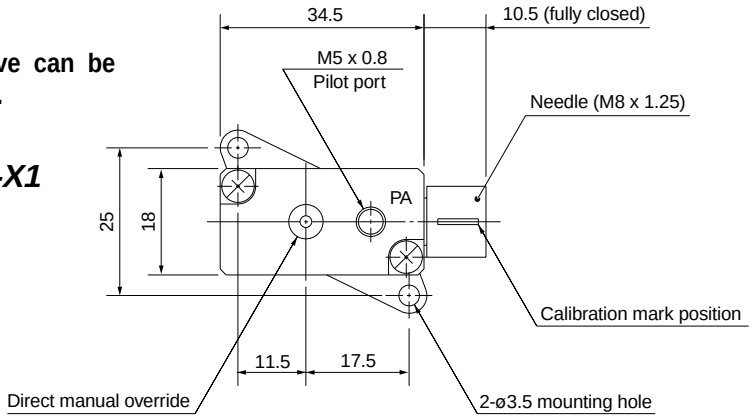
Special Order Product

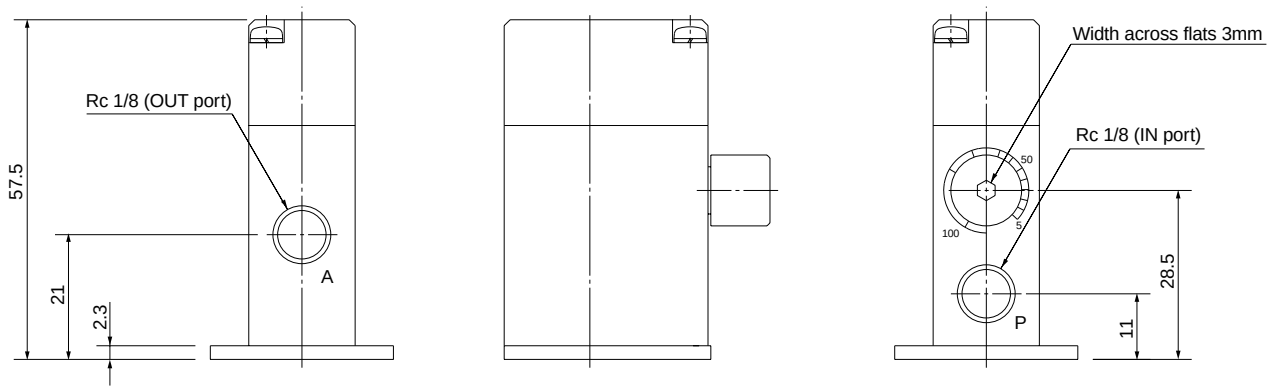
Air operated 2 port valve with compact metering valve

Metering valve construction with reproducibility (adjustable between 0 to 300°)

Effective area for single valve can be detected with calibration mark.

VKFA332-1-01-X1





Specifications

Valve type		Poppet
Fluid		Air, Inert gas
Operating pressure range		0 to 0.7MPa
Pilot pressure		0.15 to 0.7MPa
Effective area	OFF	4mm² (Cv factor: 0.22)
	ON	Adjustable type: 0 to 4mm² (at 5/6 rotation from fully closed state)

Booster Valve
Series VBA1110 to 4200

Hydraulic Clamp

Specifications

Intensified pressure ratio	**VBA1110** **VBA2□00** **VBA4□00**	Maximum 2
	VBA1111	Maximum 4
Fluid		Compressed air
Proof pressure	**VBA1110** **VBA1111**	3.0MPa
	VBA2□00 **VBA4□00**	1.5MPa
Maximum supply pressure		1.0MPa
Set pressure range	**VBA1110** **VBA1111**	0.2 to 2.0MPa
	VBA2□00 **VBA4□00**	0.2 to 1.0MPa
Ambient and fluid temperature		2 to 50°C (with no freezing)
Lubrication		None
Mounting orientation		Horizontal
Pressure adjustment mechanism		Relieving type

VBA1110-02

VBA1111-02

VBA4100-04

VBA2100-03

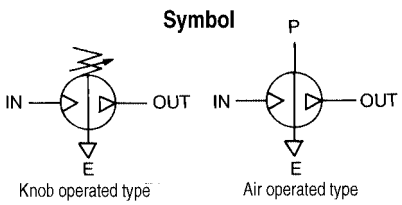
Knob operated type

VBA4200-04

VBA2200-03

Air operated type

Symbol



Knob operated type

Air operated type

Models

Model	Knob operated type				Air operated type	
	VBA1110-02	**VBA1111-02**	**VBA2100-03**	**VBA4100-04**	**VBA2200-03**	**VBA4200-04**
Max. flow rate l/min (ANR) Note)	400	60	1000	1900	1000	1900
Port size Rc	1/4 (IN, OUT)		3/8 (IN, OUT)	1/2 (IN, OUT)	3/8 (IN, OUT)	1/2 (IN, OUT)
Exhaust port size Rc	1/4		3/8	1/2	3/8	1/2
Pilot port size Rc	—				1/8	
Pilot pressure range	—				0.1 to 0.5MPa	
Weight kg	0.85	0.98	3.8	7.5	3.8	7.5

Note) Flow conditions — IN/OUT: 1.0MPa for VBA1110, IN/OUT: 0.5MPa for VBA1111, VBA2$^{2}_{1}$00, 4$^{2}_{1}$00
Refer to flow characteristics graphs on page 1.13-2 of "Best Pneumatics No. 4" when selecting a model.

Accessory (option) part nos.

Description \ Model	Part no.				
	VBA1110-1111	**VBA2100**	**VBA4100**	**VBA2200**	**VBA4200**
Pressure gauge	G27-20-R1 ... 2 pcs.	G27-10-R1-X209 ... 2 pcs.	G46-10-01 ... 2 pcs.	G27-10-R1-X209 ... 2 pcs.	G46-10-01 ... 2 pcs.
Silencer	AN200-02	AN300-03	AN400-04	AN300-03	AN400-04

How to Order

Pressure
1	2.0MPa

Intensified pressure ratio
0	Double
1	Quadruple

Pressure adjustment
1	Knob operated type

Port size
Symbol	Port size
02	Rc 1/4

Body size
1	1/4 standard

Series VBA1000: **VBA 1 1 1 0 – 02 GN**

Series VBA2000/4000: **VBA 2 1 0 0 – 03 GN**

Body size
2	3/8 standard
4	1/2 standard

Option
G	Pressure gauge
N	Silencer

Pressure adjustment
1	Knob operated type
2	Air operated type

Port size
Symbol	Port size	Applicable series
03	Rc 3/8	VBA2100/2200
04	Rc 1/2	VBA4100/4200

Pressure
0	1.0MPa

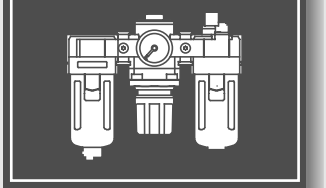
Related products

Description \ Model	**VBA1110/1111**	**VBA2100/2200**	**VBA4100/4200**	Note
Mist separator	AM250-02	AM450-04, 06	AM550-06, 10	Page 4.6-1 (Best Pneumatics No.4)
Exhaust cleaner	AMC310-03	AMC510-06	AMC610-10	35dB or more noise reduction
Air tank	VBAT05 (5*l*, Directly connected to booster valve)	VBAT20 (20*l*, Directly connected to booster valve) VBAT38 (38*l*, Directly connected to booster valve)	——	——
	VBAT10 (10*l*, Directly connected to booster valve)		——	

Refer to page 1.13-1 of Best Pneumatics No. 4 for details.

Auxiliary Pneumatic Equipment

Air Preparation Equipment

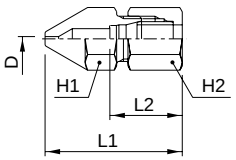


Nozzles for Blowing
Series KN

Nozzle with self-align fitting/KN

(mm)

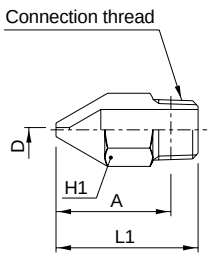
Model	Nozzle size D	Connection size	Width across flats H_1	Width across flats H_2	L_1	L_2
KN-04-100	ø1	ø4	10	10	27	15
KN-04-150	ø1.5	ø4	10	10	27.7	15
KN-06-100	ø1	ø6	12	12	30.1	16
KN-06-150	ø1.5	ø6	12	12	30.8	16
KN-06-200	ø2	ø6	12	12	31.5	16
KN-08-150	ø1.5	ø8	14	14	33.8	16
KN-08-200	ø2	ø8	14	14	34.6	16
KN-10-250	ø2.5	ø10	14	17	35.6	17
KN-10-300	ø3	ø10	14	17	36.3	17
KN-10-350	ø3.5	ø10	14	17	37.1	17
KN-10-400	ø4	ø10	14	17	29.5	17
KN-10-600	ø6	ø10	14	17	27.7	17
KN-12-350	ø3.5	ø12	17	19	40.4	17
KN-12-400	ø4	ø12	17	19	41.3	17
KN-12-600	ø6	ø12	17	19	31.2	17
KN-16-400	ø4	ø16	22	24	40.1	17
KN-16-600	ø6	ø16	22	24	38.4	17
KN-20-400	ø4	ø20	26	27	45.6	17
KN-20-600	ø6	ø20	26	27	43.9	17



Nozzle with male thread/KN

(mm)

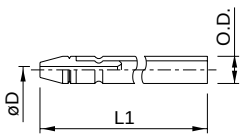
Model	Nozzle size D	Connection size	Width across flats H_1	L_1	A
KN-R01-100	ø1	R 1/8	10	21.4	17.4
KN-R01-150	ø1.5	R 1/8	10	21	17
KN-R02-100	ø1	R 1/4	14	31.4	25.4
KN-R02-150	ø1.5	R 1/4	14	31	25
KN-R02-200	ø2	R 1/4	14	30.5	24.5
KN-R02-250	ø2.5	R 1/4	14	30.1	24.1
KN-R02-600	ø6	R 1/4	14	27.1	21.1
KN-R03-400	ø4	R 3/8	17	31.8	25.4
KN-R03-600	ø6	R 3/8	17	30.1	23.7
KN-R04-400	ø4	R 1/2	22	41.8	33.6
KN-R04-600	ø6	R 1/2	22	40.1	31.8
KN-R06-600	ø6	R 3/4	27	49.6	40.1
KN-R06-800	ø8	R 3/4	27	47.8	38
KN-R10-800	ø8	R 1	36	62.8	52.4



Copper extension nozzle/KNL

(mm)

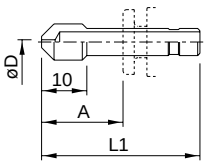
Model	Nozzle size D	Outside diameter	L_1
KNL3-06-150	ø1.5	ø6	300
KNL3-06-200	ø2	ø6	300
KNL3-08-200	ø2	ø8	300
KNL3-08-250	ø2.5	ø8	300
KNL3-10-250	ø2.5	ø10	300
KNL3-10-300	ø3	ø10	300
KNL6-06-150	ø1.5	ø6	600
KNL6-06-200	ø2	ø6	600
KNL6-08-200	ø2	ø8	600
KNL6-08-250	ø2.5	ø8	600
KNL6-10-250	ø2.5	ø10	600
KNL6-10-300	ø3	ø10	600



Nozzle for One-touch fitting/KN

(mm)

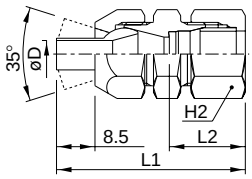
Model	Nozzle size D	Connection size	L_1	A
KN-Q06-100	ø1	ø6	35	18
KN-Q06-150	ø1.5	ø6	35	18
KN-Q06-200	ø2	ø6	35	18
KN-Q08-150	ø1.5	ø8	39	20.5
KN-Q08-200	ø2	ø8	39	20.5
KN-Q10-200	ø2	ø10	43	22
KN-Q10-250	ø2.5	ø10	43	22
KN-Q12-250	ø2.5	ø12	45.5	24
KN-Q12-300	ø3	ø12	45.5	24



Pivoting nozzle with self-align fitting/KNK

(mm)

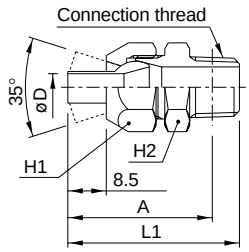
Model	Nozzle size D	Connection size	Width across flats H_1	Width across flats H_2	L_1	L_2
KNK-10-400	ø4	ø10	17	17	41.7	17
KNK-10-600	ø6	ø10	17	17	41.7	17
KNK-12-400	ø4	ø12	17	19	41.2	17
KNK-12-600	ø6	ø12	17	19	41.2	17
KNK-16-400	ø4	ø16	17	24	41.8	17
KNK-16-600	ø6	ø16	17	24	41.8	17
KNK-20-400	ø4	ø20	17	27	43.8	17
KNK-20-600	ø6	ø20	17	27	43.8	17



Pivoting nozzle with male thread/KNK

(mm)

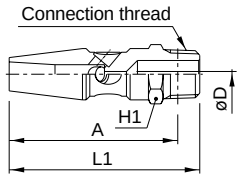
Model	Nozzle size D	Connection size	Width across flats H_1	Width across flats H_2	L_1	A
KNK-R02-400	ø4	R 1/4	17	17	38	31.9
KNK-R02-600	ø6	R 1/4	17	17	38	31.9
KNK-R03-400	ø4	R 3/8	17	17	39	32.4
KNK-R03-600	ø6	R 3/8	17	17	39	32.4
KNK-R04-400	ø4	R 1/2	17	22	42.2	34.1
KNK-R04-600	ø6	R 1/2	17	22	42.2	34.1



High efficiency nozzle/KNH

(mm)

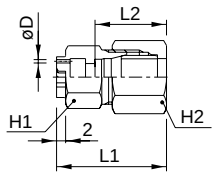
Model	Nozzle size D	Connection size	Width across flats H_1	L_1	A
KNH-R02-100	ø1	R 1/4	14	52	46
KNH-R02-150	ø1.5	R 1/4	14	52	46
KNH-R02-200	ø2	R 1/4	14	52	46



Low noise nozzle with self-align fitting/KNS

(mm)

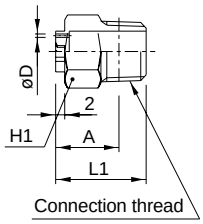
Model	Nozzle size D	Connection size	Width across flats H_1	Width across flats H_2	L_1	L_2
KNS-08-075-4	ø0.75 x 4	ø8	12	14	24.3	16
KNS-08-100-4	ø1 x 4	ø8	12	14	24.3	16
KNS-10-075-4	ø0.75 x 4	ø10	14	17	24	17
KNS-10-090-8	ø0.9 x 8	ø10	14	17	24	17
KNS-10-100-4	ø1 x 4	ø10	14	17	24	17



Low noise nozzle with male thread/KNS

(mm)

Model	Nozzle size D	Connection size	Width across flats H_1	L_1	A
KNS-R01-075-4	ø0.75 x 4	R 1/8	12	18	14
KNS-R01-100-4	ø1 x 4	R 1/8	12	18	14
KNS-R01-090-8	ø0.9 x 8	R 1/8	12	18	14
KNS-R02-075-4	ø0.75 x 4	R 1/4	14	20	14
KNS-R02-090-8	ø0.9 x 8	R 1/4	14	20	14
KNS-R02-100-4	ø1 x 4	R 1/4	14	20	14
KNS-R02-110-8	ø1.1 x 8	R 1/4	14	20	14



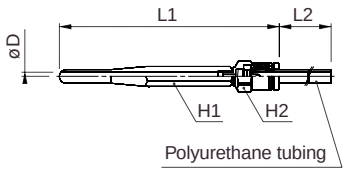
Sensing Heads

Standard sensing head

(mm)

Model	Nozzle size D	Connection size	Width across flats H_1	Width across flats H_2	L_1	L_2
KNP-1	ø2.5	ø4	5	8	63.7	1000

∗ A 1m polyurethane tube is included.

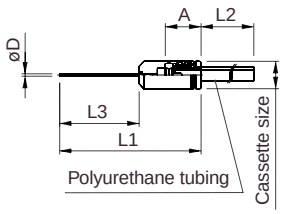


Needle sensing head

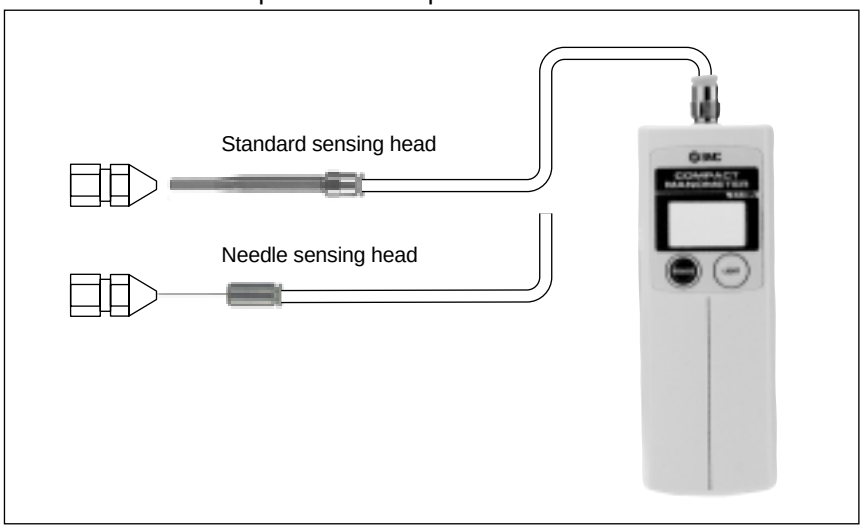
(mm)

Model	Nozzle size D	Connection size	Cassette size H_1	A	L_1	L_2	L_3
KNP-2	ø0.7	ø4	5	12.7	41	1000	23

∗ A 1m polyurethane tube is included.



Use to measure work piece collision pressure.



Specifications

Nozzle (KN, KNK, KNH, KNS, KNL)

Applicable tubing material		Nylon, Soft nylon, Flexible copper pipe (C1220T-O), OST pipe
Applicable piping O.D. mm		ø4, ø6, ø8, ø10, ø12, ø16, ø20
Fluid		Air, Coolant
Maximum operating pressure		1.0MPa (0.3MPa with SGP pipe)
Ambient and fluid temperature		–5 to 60°C (with no freezing)
Threads	**Mounting**	JISB0203 (taper threads for piping)
	Nut	JISB0211, class 2 (taper threads for piping)
Seal for R threads		None

Sensing head (KNP)

Applicable fitting size	ø4
Fluid	Air
Maximum operating pressure (at 20°C)	0.8MPa
Ambient and fluid temperature	–5 to 60°C (with no freezing)

Series KK

Male thread type

Series	Body size	Connection thread size R				
		1/8	1/4	3/8	1/2	3/4
KK3	1/8	●	●			
KK4	1/4	●	●	●	●	
KK6	1/2			●	●	●

Female thread type

Series	Body size	Connection thread size Rc			
		1/8	1/4	3/8	1/2
KK3	1/8	●			
KK4	1/4		●	●	
KK6	1/2			●	●

Nut fitting type

Series	Body size	Applicable hose I.D./O.D. mm					
		5/8	6/9	6.5/10	8/12	8.5/12.5	11/16
KK3	1/8	●	●	●			
KK4	1/4	●	●	●	●	●	
KK6	1/2				●	●	●

One-touch fitting type

Series	Body size	Applicable tubing O.D. mm					
		4	6	8	10	12	16
KK3	1/8	●	●	●	●		
KK4	1/4		●	●	●	●	●
KK6	1/2					●	●

Employs a unique connection method

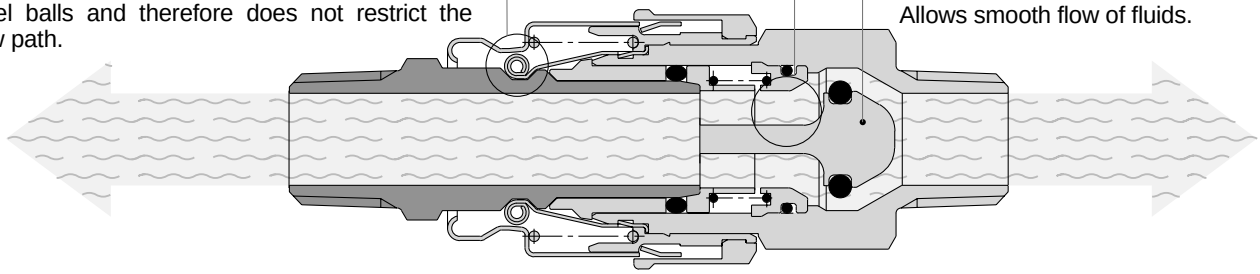
A slim body design and large effective area are achieved with a construction that does not use steel balls and therefore does not restrict the flow path.

No spring located in the flow path

Loss of effective area is minimized because there is no valve spring to block the flow path.

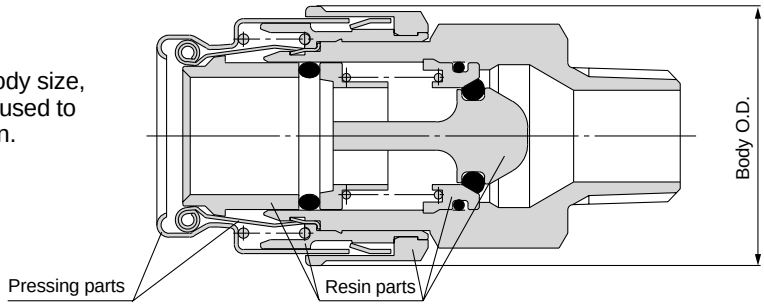
Check valve end configuration facilitates rectifying effect

Allows smooth flow of fluids.



Light weight

Together with a reduction of the body size, pressing parts and resin parts are used to achieve an overall weight reduction.

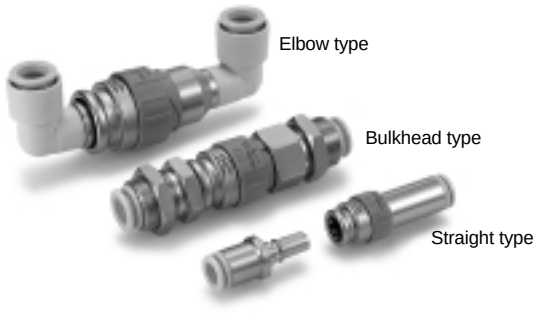


Series	Plug no.	Socket no.	Effective area mm² Note 1)	Body O.D. mm	Weight g Note 2)
Series **KK3**	KK3P-01MS	KK3S-01MS	20	ø18.2	18.9
Series **KK4**	KK4P-02MS	KK4S-02MS	39	ø25.4	41.3
Series **KK6**	KK6P-04MS	KK6S-04MS	82	ø31.2	87.7

Note 1) Values when plug and socket are connected.
Note 2) Values for socket only.

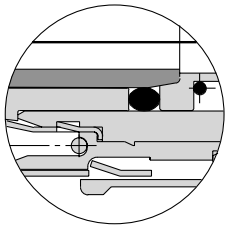
■ One-touch fitting type now standard

Three types from ø4 to ø16 added to series.



■ Low leakage seal construction

Reliable sealing is achieved by surface contact.

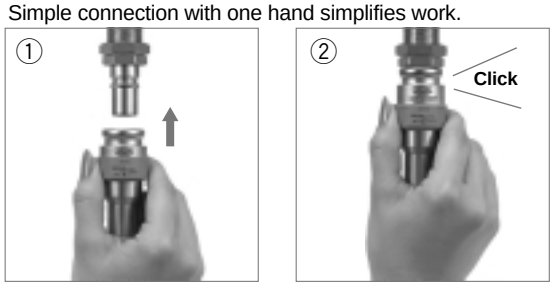


■ Flow is possible from the plug side or socket side.

■ Fluids: Air and Water

■ One-touch connection

Simple connection with one hand simplifies work.



■ Sleeve lock mechanism

Prevents accidents caused by unexpected separation.

Variations

Plug (P)

Male thread type

Body size	Port size	Part no.
1/8	R 1/8	**KK3P-01MS**
	R 1/4	**-02MS**
1/4	R 1/8	**KK4P-01MS**
	R 1/4	**-02MS**
	R 3/8	**-03MS**
	R 1/2	**-04MS**
1/2	R 3/8	**KK6P-03MS**
	R 1/2	**-04MS**
	R 3/4	**-06MS**

Female thread type

Body size	Port size	Part no.
1/8	Rc 1/8	**KK3P-01F**
1/4	Rc 1/4	**KK4P-02F**
	Rc 3/8	**-03F**
1/2	Rc 3/8	**KK6P-03F**
	Rc 1/2	**-04F**

Nut fitting type (for fiber reinforced urethane hose)

Body size	Applicable hose I.D./O.D. mm	Part no.
1/8	5/8	**KK3P-50N**
	6/9	**-60N**
	6.5/10	**-65N**
1/4	5/8	**KK4P-50N**
	6/9	**-60N**
	6.5/10	**-65N**
	8/12	**-80N**
	8.5/12.5	**-85N**
1/2	8/12	**KK6P-80N**
	8.5/12.5	**-85N**
	11/16	**-110N**

Straight type with One-touch fitting

Body size	Applicable tubing O.D. mm	Part no.
1/8	4	**KK3P-04H**
	6	**-06H**
	8	**-08H**
	10	**-10H**
1/4	6	**KK4P-06H**
	8	**-08H**
	10	**-10H**
	12	**-12H**
1/2	12	**KK6P-12H**
	16	**-16H**

Elbow type with One-touch fitting

Body size	Applicable tubing O.D. mm	Part no.
1/8	4	**KK3P-04L**
	6	**-06L**
	8	**-08L**
	10	**-10L**
1/4	6	**KK4P-06L**
	8	**-08L**
	10	**-10L**
	12	**-12L**
1/2	12	**KK6P-12L**
	16	**-16L**

Bulkhead type with One-touch fitting

Body size	Applicable tubing O.D. mm	Part no.
1/8	4	**KK3P-04E**
	6	**-06E**
	8	**-08E**
	10	**-10E**
1/4	6	**KK4P-06E**
	8	**-08E**
	10	**-10E**
	12	**-12E**
1/2	12	**KK6P-12E**
	16	**-16E**

Socket (S)

Male thread type

Body size	Port size	Part no.
1/8	R 1/8	**KK3S-01MS**
	R 1/4	**-02MS**
1/4	R 1/8	**KK4S-01MS**
	R 1/4	**-02MS**
	R 3/8	**-03MS**
	R 1/2	**-04MS**
1/2	R 3/8	**KK6S-03MS**
	R 1/2	**-04MS**
	R 3/4	**-06MS**

Female thread type

Body size	Port size	Part no.
1/8	Rc 1/8	**KK3S-01F**
1/4	Rc 1/4	**KK4S-02F**
	Rc 3/8	**-03F**
1/2	Rc 3/8	**KK6S-03F**
	Rc 1/2	**-04F**

Nut fitting type (for fiber reinforced urethane hose)

Body size	Applicable hose I.D./O.D. mm	Part no.
1/8	5/8	**KK3S-50N**
	6/9	**-60N**
	6.5/10	**-65N**
1/4	5/8	**KK4S-50N**
	6/9	**-60N**
	6.5/10	**-65N**
	8/12	**-80N**
	8.5/12.5	**-85N**
1/2	8/12	**KK6S-80N**
	8.5/12.5	**-85N**
	11/16	**-110N**

Straight type with One-touch fitting

Body size	Applicable tubing O.D. mm	Part no.
1/8	4	**KK3S-04H**
	6	**-06H**
	8	**-08H**
	10	**-10H**
1/4	6	**KK4S-06H**
	8	**-08H**
	10	**-10H**
	12	**-12H**
1/2	12	**KK6S-12H**
	16	**-16H**

Elbow type with One-touch fitting

Body size	Applicable tubing O.D. mm	Part no.
1/8	4	**KK3S-04L**
	6	**-06L**
	8	**-08L**
	10	**-10L**
1/4	6	**KK4S-06L**
	8	**-08L**
	10	**-10L**
	12	**-12L**
1/2	12	**KK6S-12L**
	16	**-16L**

Bulkhead type with One-touch fitting

Body size	Applicable tubing O.D. mm	Part no.
1/8	4	**KK3S-04E**
	6	**-06E**
	8	**-08E**
	10	**-10E**
1/4	6	**KK4S-06E**
	8	**-08E**
	10	**-10E**
	12	**-12E**
1/2	12	**KK6S-12E**
	16	**-16E**

Specifications

Fluid	Air, Water (standard industrial water)
Operating pressure range	0 to 1.0MPa
Proof pressure	1.5MPa
Ambient and fluid temperature	–5 to 60°C
Plating, Sealant	Electroless nickel plated (copper-free application), With male thread sealant

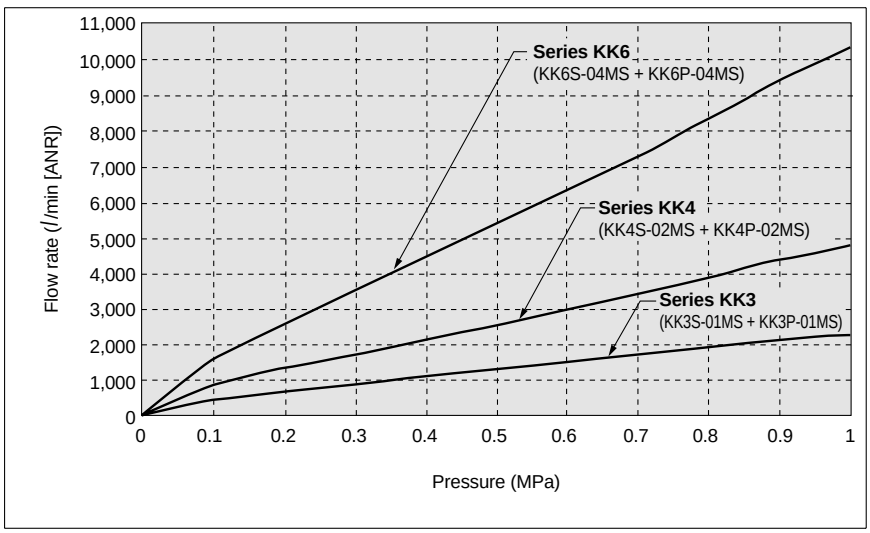
Performance

Plug and socket connection	One-touch connection and release
Check valve	Socket: Built-in check valve (standard)
Sleeve lock mechanism	Manual locking type (standard)

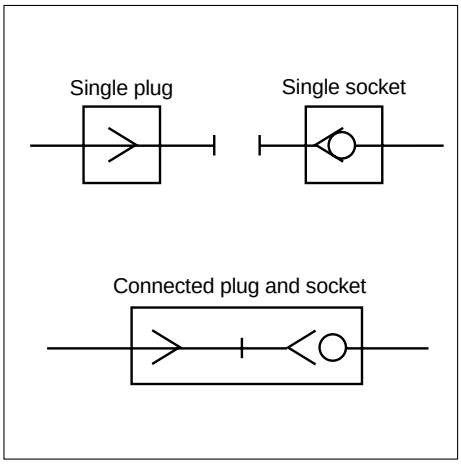
Effective Area

Body size	Plug	Socket	Effective area mm²
1/8	KK3P-01MS	KK3S-01MS	20
1/4	KK4P-02MS	KK4S-02MS	39
1/2	KK6P-04MS	KK6S-04MS	82

Flow Characteristics



JIS symbols



How to Order

KK 4 S – 02 M S

Body size

3	1/8
4	1/4
6	1/2

Socket/Plug designation

S	Socket
P	Plug

Connection type

Symbol	Type
M	Male thread
F	Female thread
N	With nut fitting
H	Straight with One-touch fitting
L	Elbow with One-touch fitting
E	Bulkhead with One-touch fitting

With sealant (male thread)

Piping port size variation

Male/Female thread type

Symbol	Thread size
01	R, Rc 1/8
02	R, Rc 1/4
03	R, Rc 3/8
04	R, Rc 1/2
06	R, Rc 3/4

One-touch fitting type

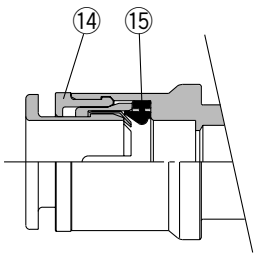
Symbol	Tubing O.D. mm
04	ø4
06	ø6
08	ø8
10	ø10
12	ø12
16	ø16

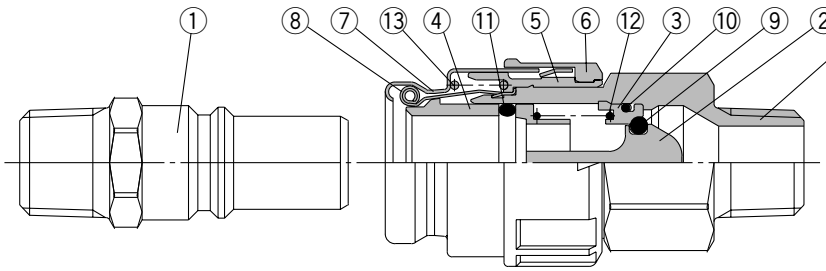
Nut fitting type

Symbol	Hose O.D./I.D. mm
50	8/5
60	9/6
65	10/6.5
80	12/8
85	12.5/8.5
110	16/11

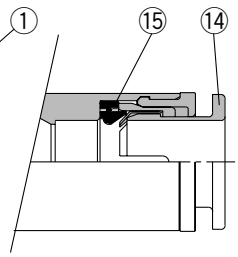
Construction

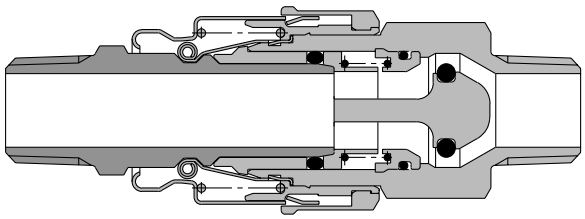
<With One-touch fitting>





<With One-touch fitting>





Plug

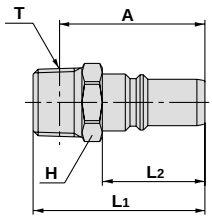
No.	Description	Material	Note
1	**Stem**	Brass	Electroless nickel plated
14	**Cassette**	—	
15	**Seal**	NBR	

Socket

No.	Description	Material	Note
1	**Body**	Brass	Electroless nickel plated
2	**Valve**	PBT	
3	**Valve seat**	PBT	
4	**Collar**	PBT	
5	**Spacer**	PBT	
6	**Lock ring**	PBT	
7	**Sleeve**	Cold rolled carbon steel sheet	Electroless nickel plated
8	**Chuck**	Stainless steel	
9	**Valve O-ring**	FPM	
10	**Valve seat O-ring**	NBR	
11	**Plug O-ring**	NBR	
12	**Valve spring**	Stainless steel	
13	**Sleeve spring**	Stainless steel	
14	**Cassette**	—	
15	**Seal**	NBR	

Dimensions/Plug (P)

Male thread type

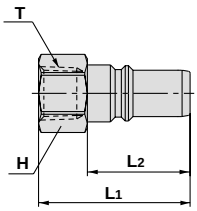


(mm)

Body size	Model	T Connection male thread	H Width across flats	L1	L2	A*	Minimum bore	Effective area mm²	Weight g
1/8	**KK3P-01MS**	R 1/8	10	30.4	18.4	26.4	6	22.6	8.4
	-02MS	R 1/4	14	33.4		27.4			14.2
1/4	**KK4P-01MS**	R 1/8		37	25.2	33	9	50.9	17
	-02MS	R 1/4		40.2		34.2			20.2
	-03MS	R 3/8	17	42.2		35.7			32.5
	-04MS	R 1/2	22	46.2		38.2			57.4
1/2	**KK6P-03MS**	R 3/8	19	48	31	41.5	11	76.0	44.7
	-04MS	R 1/2	22	52		44	13	106.2	53.7
	-06MS	R 3/4	27	55		45.5			94.4

∗ Reference dimension for R threads after installation.

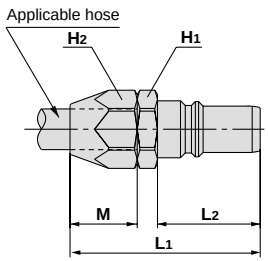
Female thread type



(mm)

Body size	Model	T Connection female thread	H Width across flats	L1	L2	Minimum bore	Effective area mm²	Weight g
1/8	**KK3P-01F**	Rc 1/8	14	28.3	18.4	6	22.6	10.4
1/4	**KK4P-02F**	Rc 1/4	17	37.2	25.2	9	50.9	23.9
	-03F	Rc 3/8	19	39.8				24.6
1/2	**KK6P-03F**			43.3	31	13	106.2	28.6
	-04F	Rc 1/2	24	50.2				43.9

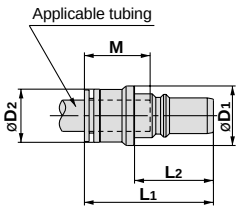
Nut fitting type
(for urethane hose with fiber reinforcement)



(mm)

Body size	Model	Applicable hose I.D./O.D. mm	H1 Width across flats	H2 Width across flats	L1	L2	M	Minimum bore	Effective area mm²	Weight g
1/8	**KK3P-50N**	5/8	14	14	36.1	18.4	13.7	4.5	12.7	21.4
	-60N	6/9	17	17	39.9		16.5	5.4	18.3	38.8
	-65N	6.5/10						5.9	21.9	35.9
1/4	**KK4P-50N**	5/8	17	14	43.9	25.2	13.7	4.5	12.7	34.7
	-60N	6/9		17	46.7		16.5	5.4	18.3	48.4
	-65N	6.5/10						5.9	21.9	45.1
	-80N	8/12	19	19	47.6		17.4	7.4	34.4	53.2
	-85N	8.5/12.5						7.8	38.2	55.6
1/2	**KK6P-80N**	8/12			53.4	31		7.4	34.4	60.5
	-85N	8.5/12.5						7.8	38.2	62.8
	-110N	11/16	24	24	57.2		20.1	10.2	65.4	96.5

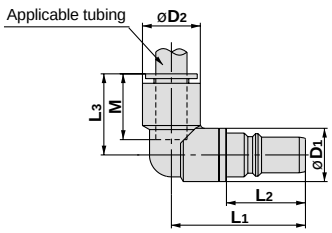
Straight type with One-touch fitting



(mm)

Body size	Model	Applicable tubing O.D. mm	øD1	øD2	L1	L2	M	Minimum bore	Effective area mm² Urethane tubing	Effective area mm² Nylon tubing	Weight g
1/8	KK3P-04H	ø4	12	10	35.4	18.4	16	3.2	3.9	5.6	7.9
	-06H	ø6	14	12			17	4.7	10.1	12.8	9.1
	-08H	ø8	16	14	38.6		18.5	6	15.7	22.6	13.2
	-10H	ø10	19	17	39.7		21		22.6		17.6
1/4	KK4P-06H	ø6	14	12	46.2	25.2	17	4.7	10.1	12.8	22.3
	-08H	ø8	16	14			18.5	6.2	19.8	22.6	23.0
	-10H	ø10	19	17			21	7.7	27.6	35.3	27.1
	-12H	ø12	21	19	47.5		22	9	40.2	50.9	30.0
1/2	KK6P-12H				56.1	31		9.2	41.2		44.4
	-16H	ø16	26	25.7			25	13	—	106.2	50.7

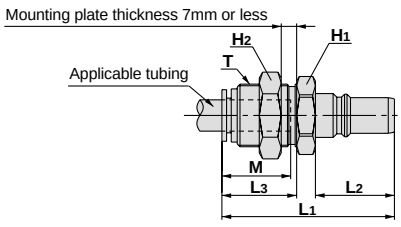
Elbow type with One-touch fitting



(mm)

Body size	Model	Applicable tubing O.D. mm	øD1	øD2	L1	L2	L3	M	Minimum bore	Effective area mm² Urethane tubing	Effective area mm² Nylon tubing	Weight g
1/8	KK3P-04L	ø4	10	10.4	31.6	18.4	18	16	3	3.7	5.3	7.2
	-06L	ø6		12.8	32.8		20	17	4.5	10.1	11.4	8.0
	-08L	ø8	12	15.2	34		23	18.5	6	15.0	16.8	9.7
	-10L	ø10	17	18.5	36		26.5	21		18.0	18.5	23.0
1/4	KK4P-06L	ø6	14	12.8	40.2	25.2	20	17	4.5	10.1	11.4	19.6
	-08L	ø8		15.2	41.4		23	18.5	6	17.5	19.8	21.3
	-10L	ø10	17	18.5	42.8		26.5	21	7.5	24.7	27.5	25.7
	-12L	ø12		20.9	44		28.5	22	9	29.0	29.6	28.0
1/2	KK6P-12L		19		49.9	31				38.1	39.7	40.3
	-16L	ø16	21	26.5	53.5		34	25	13	—	58.7	48.7

Bulkhead type with One-touch fitting

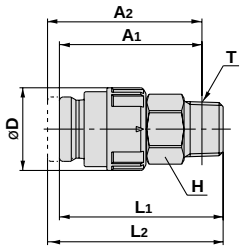


(mm)

Body size	Model	Applicable tubing O.D. mm	T Thread	H1 Width across flats	H2 Width across flats	L1	L2	L3	M	Minimum bore	Effective area mm² Urethane tubing	Effective area mm² Nylon tubing	Weight g
1/8	KK3P-04E	ø4	M12 x 1	14	14	39.3	18.4	16.9	16	3.2	3.9	5.6	16.6
	-06E	ø6	M14 x 1	17	17	40.2		16.8	17	4.7	10.1	12.8	22.3
	-08E	ø8	M16 x 1		19	43.4		20	18.5	6	15.7	22.6	30.2
	-10E	ø10	M20 x 1	22	24	46.4		22	21		22.6		54.7
1/4	KK4P-06E	ø6	M14 x 1	17	17	47	25.2	16.8	17	4.7	10.1	12.8	30.6
	-08E	ø8	M16 x 1		19	50.2		20	18.5	6.2	19.8	22.6	38.2
	-10E	ø10	M20 x 1	22	24	53.2		22	21	7.7	27.6	35.3	61.4
	-12E	ø12	M22 x 1	24	27	54.2		23	22	9	40.2	50.9	75.2
1/2	KK6P-12E					60.1	31			9.2	41.2		86.1
	-16E	ø16	M28 x 1.5	30	32	62.6		24.5	25	13	—	106.2	125.0

Dimensions/Socket (S)

Male thread type

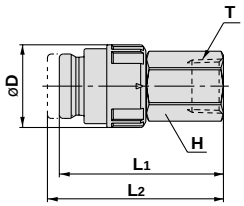


(mm)

Body size	Model	T Connection male thread	H Width across flats	øD	L1	L2 When connected	A1*	A2* When connected	Minimum bore	Effective area mm²	Weight g
1/8	**KK3S-01MS**	R 1/8	14	18.2	37.5	40	33.5	36	6	19.1	18.9
	-02MS	R 1/4					31.5	34	9	21.1	18.0
1/4	**KK4S-01MS**	R 1/8	19	25.4	50.4	54.1	46.4	50.1	6	22.9	44.7
	-02MS	R 1/4			51	54.7	45	48.7	9	35.9	41.3
	-03MS	R 3/8			50	53.7	43.5	47.2	11	40.4	48.1
	-04MS	R 1/2	22		49.7	53.4	41.7	45.4	13	42.7	58.4
1/2	**KK6S-03MS**	R 3/8	24	31.2	60.2	65.5	53.7	59	11	71.7	85.5
	-04MS	R 1/2					52.2	57.5	13	80.1	87.7
	-06MS	R 3/4	27				50.7	56	15	81.6	110.9

∗ Reference dimension for R threads after installation.

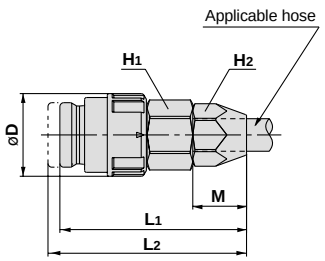
Female thread type



(mm)

Body size	Model	T Connection female thread	H Width across flats	øD	L1	L2 When connected	Minimum bore	Effective area mm²	Weight g
1/8	**KK3S-01F**	Rc 1/8	14	18.2	36	38.5	8.2	20.6	22.4
1/4	**KK4S-02F**	Rc 1/4	19	25.4	50.4	54.1	10.9	36.6	54.1
	-03F	Rc 3/8			51.1	54.8	14.4	42.7	43.4
1/2	**KK6S-03F**		24	31.2	58.6	63.9		80.9	91.2
	-04F	Rc 1/2			61	66.3	18	81.6	85.0

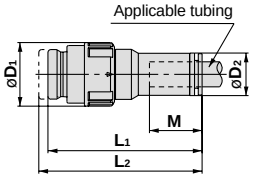
Nut fitting type
(for urethane hose with fiber reinforcement)



(mm)

Body size	Model	Applicable hose I.D./O.D. mm	H1 Width across flats	H2 Width across flats	øD	L1	L2 When connected	M	Minimum bore	Effective area mm²	Weight g
1/8	**KK3S-50N**	5/8	14	14	18.2	42.6	45.1	13.7	4.5	12.2	30.9
	-60N	6/9	17	17		44.4	46.9	16.5	5.4	18.3	47.5
	-65N	6.5/10							5.9	19.2	45.2
1/4	**KK4S-50N**	5/8	19	14	25.4	54.1	57.8	13.7	4.5	12.2	53.0
	-60N	6/9		17		56.8	60.5	16.5	5.4	20.4	66.5
	-65N	6.5/10							5.9	24.1	64.0
	-80N	8/12		19		55.4	59.1	17.4	7.4	35.1	65.7
	-85N	8.5/12.5							7.8	36.6	68.3
1/2	**KK6S-80N**	8/12	24		31.2	66	71.3		7.4		105.1
	-85N	8.5/12.5							7.8	41.2	107.8
	-110N	11/16		24		64.4	69.7	20.1	10.2	68.4	117.4

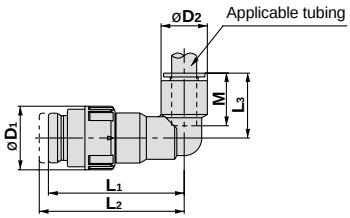
Straight type with One-touch fitting



(mm)

Body size	Model	Applicable tubing O.D. mm	øD1	øD2	L1	L2 When connected	M	Minimum bore	Effective area mm² Urethane tubing	Effective area mm² Nylon tubing	Weight g
1/8	KK3S-04H	ø4	18.2	10	46.6	49.1	16	3.2	3.8	5.8	21.3
	-06H	ø6		12	47.1	49.6	17	4.7	10.4	13.4	23.2
	-08H	ø8		14	48.9	51.4	18.5	6.2	16.8	18.9	26.1
	-10H	ø10		17	49.9	52.4	21	7.7	19.1	19.1	35.9
1/4	KK4S-06H	ø6	25.4	12	58.2	61.9	17	4.7	10.4	13.4	48.6
	-08H	ø8		14	60.1	63.8	18.5	6.2	18.3	21.8	48.5
	-10H	ø10		17	61.5	65.2	21	7.7	27.0	29.4	52.0
	-12H	ø12		19	62.5	66.2	22	9.2	30.5	32.0	56.6
1/2	KK6S-12H		31.2		70.1	75.4			42.7	48.8	81.7
	-16H	ø16		25.7	72.3	77.6	25	13.2	53.4	62.5	97.5

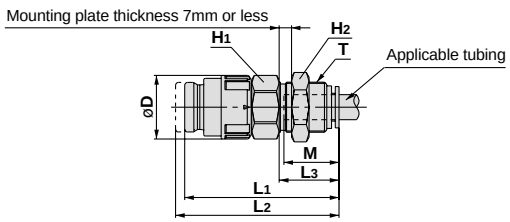
Elbow type with One-touch fitting



(mm)

Body size	Model	Applicable tubing O.D. mm	øD1	øD2	L1	L2 When connected	L3	M	Minimum bore	Effective area mm² Urethane tubing	Effective area mm² Nylon tubing	Weight g
1/8	KK3S-04L	ø4	18.2	10.4	41.7	44.2	18	16	3	3.7	5.3	22.0
	-06L	ø6		12.8	42.9	45.4	20	17	4.5	10.1	11.4	22.8
	-08L	ø8		15.2	43.1	45.6	23	18.5	6	15.0	16.8	23.8
	-10L	ø10		18.5	42.9	45.4	26.5	21	7.5	18.0	18.5	33.2
1/4	KK4S-06L	ø6	25.4	12.8	54.3	58	20	17	4.5	10.1	11.4	50.7
	-08L	ø8		15.2	55.5	59.2	23	18.5	6	17.5	19.8	50.3
	-10L	ø10		18.5	54.2	57.9	26.5	21	7.5	24.7	27.5	51.9
	-12L	ø12		20.9	55.4	59.1	28.5	22	9	29.0	29.6	54.2
1/2	KK6S-12L		31.2		66.3	71.6				38.1	39.7	89.0
	-16L	ø16		26.5	66.9	72.2	34	25	13	50.3	58.7	91.1

Bulkhead type with One-touch fitting



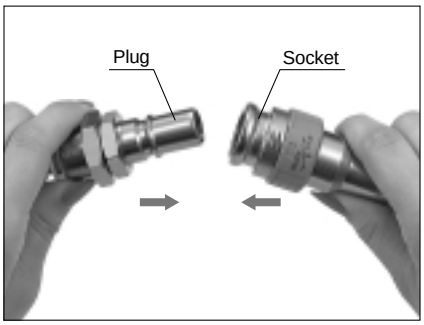
(mm)

Body size	Model	Applicable tubing O.D. mm	T Thread	H1 Width across flats	H2 Width across flats	øD	L1	L2 When connected	L3	M	Minimum bore	Effective area mm² Urethane tubing	Effective area mm² Nylon tubing	Weight g
1/8	KK3S-04E	ø4	M12 x 1	14	14	18.2	46.6	49.1	16.9	16	3.2	3.8	5.8	27.8
	-06E	ø6	M14 x 1	17	17		47.1	49.6	16.8	17	4.7	10.4	13.4	38.2
	-08E	ø8	M16 x 1		19		49	51.5	20	18.5	6.2	16.8	18.9	42.2
	-10E	ø10	M20 x 1	22	24		49.9	52.4	22	21	7.7	19.1	19.1	67.1
1/4	KK4S-06E	ø6	M14 x 1	19	17	25.4	58.2	61.9	16.8	17	4.7	10.4	13.4	54.4
	-08E	ø8	M16 x 1		19		60.1	63.8	20	18.5	6.2	18.3	21.8	57.8
	-10E	ø10	M20 x 1	22	24		61.7	65.4	22	21	7.7	27.0	29.4	84.0
	-12E	ø12	M22 x 1	24	27		62.7	66.4	23	22	9.2	30.5	32.0	102.9
1/2	KK6S-12E					31.2	70.1	75.4				42.7	48.8	113.6
	-16E	ø16	M28 x 1.5	30	32		72.5	77.8	24.5	25	13.2	53.4	62.5	180.8

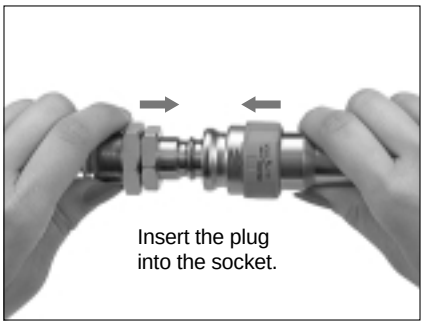
Operating Procedure

<Connection>

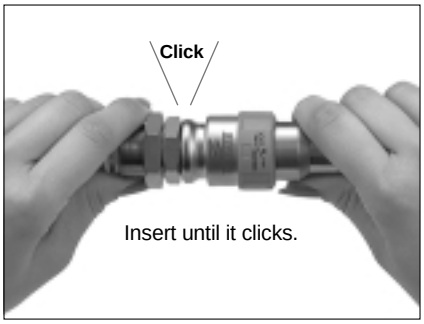
1



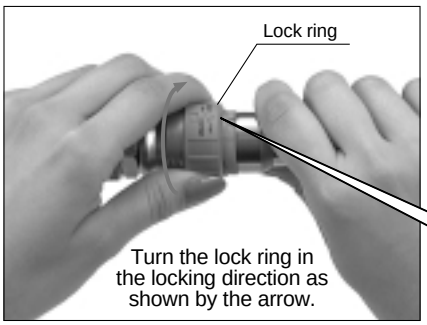
2



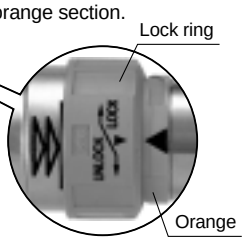
3



4

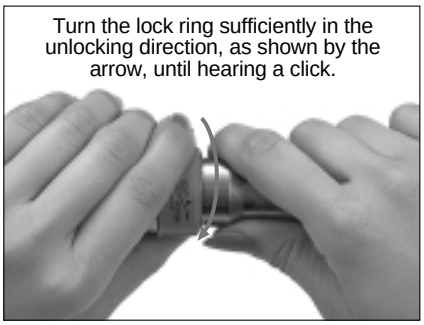


When the two ▶ marks face each other, the plug and the socket are locked. The locked condition can be confirmed with the visible orange section.

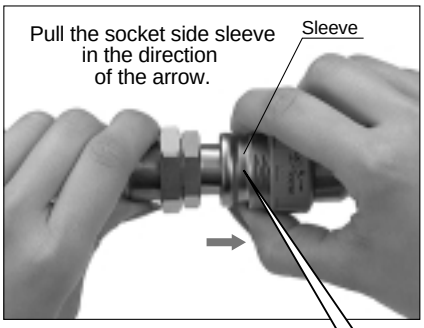


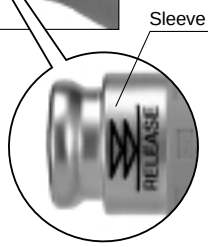
<Release>

1

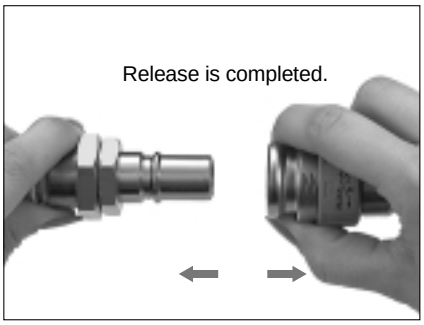


2



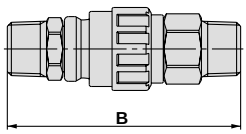


3



Calculation of Dimensions When Plug and Socket are Connected

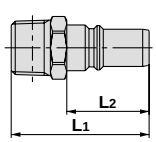
Overall length B when plug and socket connected = Plug (L_1 – L_2) + Socket (L_2) + 0.5



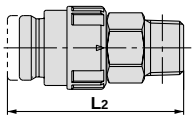
Example)
Overall length of KK3P-01MS (plug) and KK3S-01MS (socket) when they are connected.

Plug (30.4 –18.4) + Socket (39.4) + 0.5 = 51.9mm

Plug



Socket

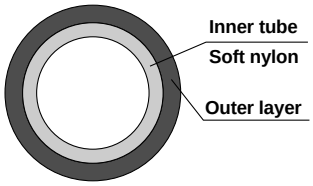


Flame Resistant (Equivalent to UL-94 Standard V-0) FR Double Layer Tubing

Series TRB

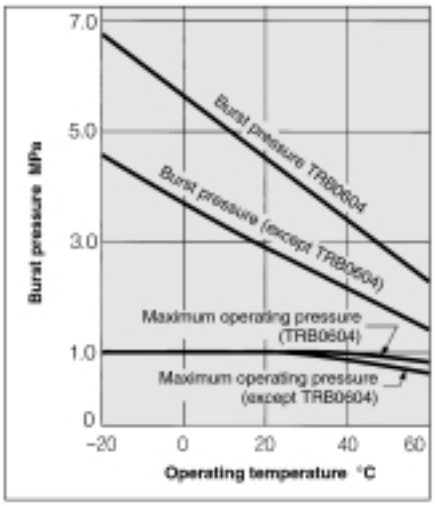
For general air pressure and water piping in environments with sparks from spot welding, etc.

Double layer construction using flame resistant resin for the outer layer.
(equivalent to UL-94 Standard V-0)



Sectional view of FR double layer tube

Burst Pressure Characteristics Curve and Operating Pressure



How to Order

TRB 10 75 B – 100

- **Inner tube O.D.**
- **Inner tube I.D.**
- **Color**

Symbol	Color
B	Black
W	White
R	Red
BU	Blue
Y	Yellow
G	Green

- **Roll length**

Symbol	Length
20	20m roll
100	100m reel

Series

● - 20m roll □ - 100m reel

	Tube size			
	Metric size			
Model	**TRB0604**	**TRB0806**	**TRB1075**	**TRB1209**
Inner tube O.D. mm	**6**	**8**	**10**	**12**
Inner tube I.D. mm	**4**	**6**	**7.5**	**9**
Outer layer thickness mm	**1**	**1**	**1**	**1**
Outer layer color Note 1) **Black (B)**	●	●	●	●
White (W)	●	●	●	●
Red (R)	●	●	●	●
Blue (BU)	●	●	●	●
Yellow (Y)	●	●	●	●
Green (G)	●	●	●	●

Specifications

Fluid		Air, Water Note 2)			
Maximum operating pressure (at 20°C) Note 3)		1.0MPa			
Burst pressure		Refer to burst pressure characteristics curve.			
Minimum bending radius mm Note 4)		**15**	**28**	**35**	**45**
Operating Temperature		–20 to 60°C, For water: 0 to 60°C (with no freezing)			
Materials	**Inner tube**	Nylon 12			
	Outer layer	PVC (equivalent to UL-94 standard V-0)			

Note 1) The color of all inner tubes is black.

Note 2) Can be used with general industrial water. Contact SMC if used with other fluids. Also keep surge pressure at or below the maximum operating pressure.

Note 3) In the case of other temperatures, refer to the burst pressure characteristics curve. In addition, operate so that abnormal temperature increase due to adiabatic compression does not occur.

Note 4) Indicates the bending value when the outside diameter rate of change is 10% or less at a temperature of 20°C.

Refer to page 2.4-8 of Best Pneumatics No. 4 for details.

Flame Resistant (Equivalent to UL-94 Standard V-0) FR Double Layer Polyurethane Tubing

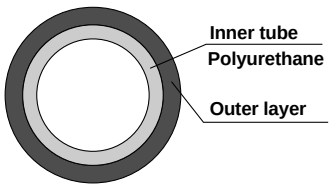
Series TRBU

For general air pressure and water piping in environments with sparks from spot welding, etc.

Double layer construction using flame resistant resin for the outer layer.

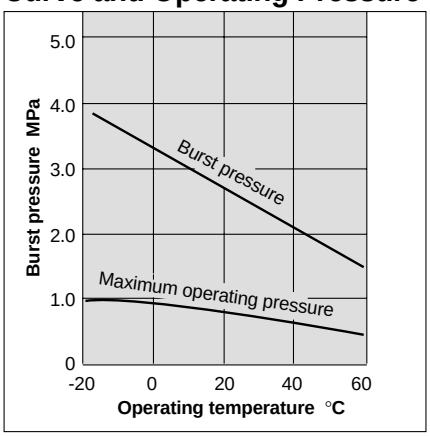
(equivalent to UL-94 Standard V-0)

Inner tube material: Polyurethane



Sectional view of FR double layer tube

Burst Pressure Characteristics Curve and Operating Pressure



How to Order

TRBU 10 75 B – 100

- **Inner tube O.D.**
- **Inner tube I.D.**
- **Color**

Symbol	Color
B	Black
W	White
R	Red
BU	Blue
Y	Yellow
G	Green

- **Roll length**

Symbol	Length
20	20m roll
100	100m reel

Series

● - 20m roll □ - 100m reel

Model	Tube size (Metric size) TRBU0604	TRBU0805	TRBU1065	TRBU1208
Inner tube O.D. mm	6	8	10	12
Inner tube I.D. mm	4	5	6.5	8
Outer layer thickness mm	1	1	1	1
Outer layer color Note 1) Black (B)	●	●	●	●
White (W)	●	●	●	●
Red (R)	●	●	●	●
Blue (BU)	●	●	●	●
Yellow (Y)	●	●	●	●
Green (G)	●	●	●	●

Specifications

Fluid		Air, Water Note 2)			
Maximum operating pressure (at 20°C) Note 3)		0.8MPa			
Burst pressure		Refer to burst pressure characteristics curve.			
Minimum bending radius mm Note 4)		**15**	**20**	**27**	**35**
Operating Temperature		–20 to 60°C, For water: 0 to 40°C (with no freezing)			
Materials	**Inner tube**	Polyurethane			
	Outer layer	PVC (equivalent to UL-94 standard V-0)			

Note 1) The color of all inner tubes is black.

Note 2) Can be used with general industrial water. Contact SMC if used with other fluids. Also keep surge pressure at or below the maximum operating pressure.

Note 3) In the case of other temperatures, refer to the burst pressure characteristics curve. In addition, operate so that abnormal temperature increase due to adiabatic compression does not occur.

Note 4) Indicates the bending value when the outside diameter rate of change is 10% or less at a temperature of 20°C.

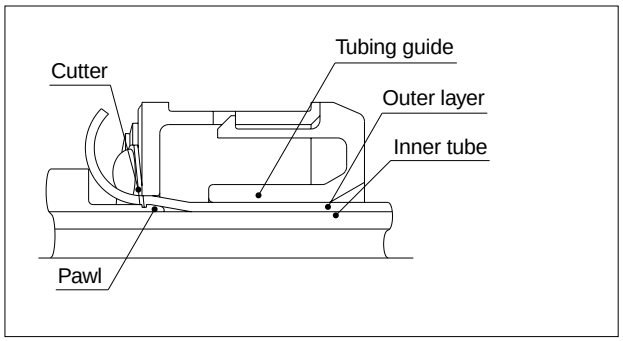
Refer to catalog CAT.E521 A "FR Double Layer Polyurethane Tubing Series TRBU" for details.

Double Layer Tubing Stripper
Series TKS

Allows easy stripping of the outer layer from double layer tubing.

Able to strip without damaging the inner tube

The outer layer can be stripped without damaging the inner tube because a pawl is inserted between the inner tube and outer layer.



⚠Caution

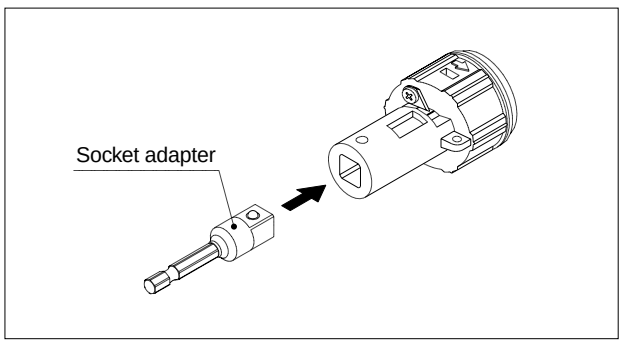
Do not use to strip covering materials from electrical wires, etc.

Adjustment of cutter and stripping length is unnecessary

A constant stripping length is always possible due to the fixed cutter with angle that cuts until the tubing reaches the end surface inside the stripper.

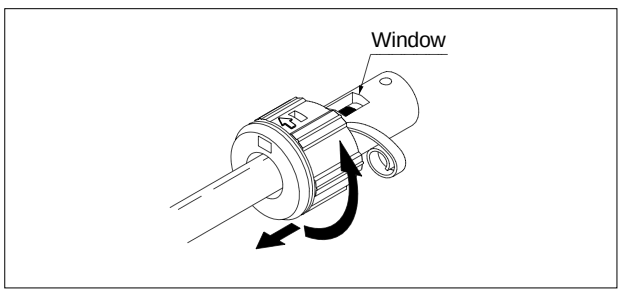
Can be attached to tools

Stripping work can be automated by attaching to an air driver, etc.



Removal of stripped tubing is unnecessary

Since the stripped tubing is discharged to the outside, no additional labor is required to remove it.

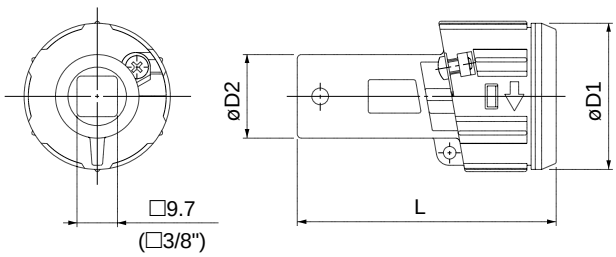


- **Even double layer polyurethane tubing (series TRBU) which is highly adhesive to the outer layer can be stripped easily.**

Variations

Model	Tip color	Applicable tubing*	Dimensions mm			Weight g
			D1	D2	L	
TKS-06	Orange	TRB0604, TRBU0604	35	16	58	45
TKS-08	Yellow	TRB0806, TRBU0805		18		
TKS-10	Blue	TRB1075, TRBU1065		20	62	50
TKS-12	Green	TRB1209, TRBU1208		22		

* Inner tube material: TRB for Nylon, TRBU for Polyurethane



Polyurethane Coil Tubing

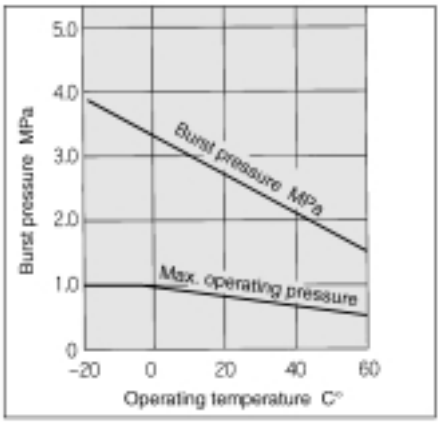
Series TCU

Air Blow

Air Tool

Compact piping possible

Burst pressure characteristics curve and operating pressure



Specifications

Model	TCU 0425B-1	TCU 0425B-2	TCU 0425B-3	TCU 0604B-1	TCU 0604B-2	TCU 0604B-3	TCU 0805B-1
Number of tubes	1 tube	2 tubes	3 tubes	1 tube	2 tubes	3 tubes	1 tube
Tube O.D. mm	4			6			8
Tube I.D. mm	2.5			4			5
Fluid	Air Note 1)						
Max. operating pressure (at 20°C) Note 2)	0.8MPa						
Burst pressure	Refer to the burst pressure characteristics curve.						
Operating temperature	−20 to 60°C						
Material	Polyurethane						
Color	Black						

Note 1) Consult SMC if used with other than air fluids.

Note 2) For other temperatures, refer to the burst pressure characteristics curve. In addition, operate so that abnormal temperature increase due to adiabatic compression does not occur.

Coil Tubing

O.D.	I.D.	Color	No. of tubes	Max. operating length m	Model
4	**2.5**	**Black (B)**	1	1.5	**TCU0425B-1**
		Black (B)	2		**TCU0425B-2**
		Black (B)	3	1	**TCU0425B-3**
6	**4**	**Black (B)**	1	2	**TCU0604B-1**
		Black (B)	2	1.5	**TCU0604B-2**
		Black (B)	3	1	**TCU0604B-3**
8	**5**	**Black (B)**	1	2	**TCU0805B-1**

Refer to page 2.5-3 of Best Pneumatics No. 4 for details.

Tube Cutter

Series TK

Air Leakage

TK-1 Applicable tube O.D.: 13mm or less

TK-2 Applicable tube O.D.: 18mm or less

TK-3 (Simplified type)

Applicable tube O.D.: 12mm or less

Note) Do not use the cutter to cut metal such as electrical wires.

Modular Type Regulator

Series AR1000 to 6000

Air Blow

Air Tool

Standard specifications

Model	AR1000	AR2000	AR2500	AR3000	AR4000	AR4000-06	AR5000	AR6000
Port size	M5 x 0.8	1/8 1/4	1/4 3/8	1/4 3/8	1/4 3/8 1/2	3/4	3/4 1	1
Operating fluid	Air							
Proof pressure	1.5MPa							
Maximum operating pressure	1.0MPa							
Set pressure range	0.05 to 0.7MPa	0.05 to 0.85MPa						
Pressure gauge port size	1/16	1/8	1/8	1/8	1/4	1/4	1/4	1/4
Ambient and fluid temperature	–5 to 60°C (with no freezing)							
Construction	Relieving type							
Weight kg	0.08	0.27	0.27	0.41	0.84	0.94	1.19	1.55

Accessory (option) part nos.

Description \ Model		Part no. AR1000	AR2000	AR2500	AR3000	AR4000	AR4000-06	AR5000	AR6000
Bracket		B120	B220	B220	B320	B420	B420	B640A Note 3)	B640A Note 3)
Pressure gauge Note 1)	1.0MPa	G27-10-R1	G36-10-□01	G36-10-□01	G36-10-□01	G46-10-□02	G46-10-□02	G46-10-□02	G46-10-□02
	0.2MPa	(G27-10-R1) Note 2)	G36-2-□01	G36-2-□01	G36-2-□01	G46-2-□02	G46-2-□02	G46-2-□02	G46-2-□02

Note 1) Indicate a symbol for the connection thread type in the square (□) of pressure gauge part numbers (example: G36-10-□01).
Indicate Nil for Rc and N for NPT. Consult SMC regarding NPT pressure gauge.

Note 2) For 1.0MPa

Note 3) With two mounting screws

AR4000

AR3000-□□BG

AR2500

AR2000-□□BG

How to Order

AR 30 00 - □ 03 BG - 1N

Regulator

Body size

10	M5
20	1/8
25	1/4
30	3/8
40	1/2
50	3/4
60	1

Thread type

Nil	Metric thread (M5)
	Rc
N	NPT
F	G

Port size

M5	M5 x 0.8
01	1/8
02	1/4
03	3/8
04	1/2
06	3/4
10	1

Accessory

Symbol		Description	Applicable model
Nil		—	—
B		With bracket	AR1000 to AR6000
G	Pressure gauge	Without limit indicator	AR1000
		With limit indicator	AR2000 to AR6000

Option specification

1 Note)	Set at 0.2MPa
N	Non-relieving
R	Flow direction: Right to left

If specifying more than one option, list symbols in alphabetical order.
(Example) 1NR

Note) Only the adjusting spring will be different from the standard specifications.

Option specification combinations

Option specification	Symbol	Option specification 1	N	R	Applicable regulator model AR1000	AR2000	AR2500	AR300 to AR6000
0.02 to 0.2MPa	-1		◎	◎	◎	◎	◎	◎
Non-relieving	-N	◎		◎	◎	◎	◎	◎
Flow direction: Right to left	-R	◎	◎		◎	◎	◎	◎

◎ Combination possible Combination not possible

Modular Type Regulator with Integrated Pressure Gauge

Series AR2001/2501/3001/4001

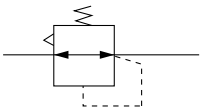
Standard specifications

Model	AR2001	AR2501	AR3001	AR4001
Port size	1/8, 1/4	1/4, 3/8	1/4, 3/8	1/4, 3/8, 1/2
Proof pressure	1.5MPa			
Maximum operating pressure	1.0MPa			
Set pressure range	0.05 to 0.85MPa			
Ambient and fluid temperature	–5 to 60°C (with no freezing)			
Construction	Relieving type			
Weight kg	0.28	0.26	0.40	0.88

Accessory (option) part nos.

Description \ Model		Part no. AR2001	AR2501	AR3001	AR4001
Bracket		B220	B220	B320	B420
Pressure gauge	1.0MPa	GC30-10			
	0.2MPa	GC30-2			

JIS symbol



How to Order

AR 30 01 – [ ] 03 B G – 1N

Regulator

Body size

20	1/8
25	1/4
30	3/8
40	1/2

Thread type

Nil	Rc
N	NPT
F	G

Port size

01	1/8
02	1/4
03	3/8
04	1/2

Accessory

Symbol	Description	Applicable model
Nil	—	—
B	With bracket	AR2001 to AR4001

Option specification

1	0.2MPa
N	Non-relieving
R	Flow direction: Right to left

If specifying more than one option, list symbols in alphabetical order.
(Example) 1NR

Option specification combinations

Option specification	Symbol	Option specification 1	N	R	Applicable regulator model AR2001	AR2501	AR3001 to AR4001
0.02 to 0.2MPa	–1		◎	◎	◎	◎	◎
Non-relieving	–N	◎		◎	◎	◎	◎
Flow direction: Right to left	–R	◎	◎		◎	◎	◎

◎ Combination possible Combination not possible

Refer to page 1.5-15 of Best Pneumatics No. 4 for details.

Pilot Operated Regulator

Series AR425 to 935

Standard specifications

Model	AR425	AR435	AR625	AR635	AR825	AR835	AR925	AR935
Port size	1/4, 3/8, 1/2		3/4, 1		1 1/4, 1 1/2		2	
Fluid	Air							
Proof pressure	1.5MPa							
Maximum operating pressure	1.0MPa							
Set pressure range MPa Note 1)	0.05 to 0.83	0.02 to 0.2	0.05 to 0.83	0.02 to 0.2	0.05 to 0.83	0.02 to 0.2	0.05 to 0.83	0.02 to 0.2
Air consumption Note 2)	5l/min (ANR) (at maximum set pressure)							
Pressure gauge port size	1/4							
Ambient and fluid temperature	–5 to 60°C (with no freezing)							
Construction	Internal pilot operated relieving type (constant pilot air bleeding)							
Weight kg	0.7		1.1		2.5		4.5	

Note 1) Downstream pressure adjustment range: $P_2 \leq P_1 \times 90\%$
Note 2) Air consumption rate differs depending on the set pressure.

Accessory (option) part nos.

Description \ Model	Part no. AR4□5	AR6□5	AR8□5	AR9□5
Bracket	B24P	B25P	—	—
Pressure gauge with limit indicator Note)	G46-10-□02 (Max. measurement 1.0MPa), G46-2-□02 (Max. measurement 0.2MPa)			

Note) Indicate a symbol for the connection thread type in the square (□) of pressure gauge part numbers (example: G46-10-□02).
Indicate Nil for Rc and N for NPT. Consult SMC regarding NPT pressure gauge.

How to Order

AR | 4 | 25 | – | □ | 02 | BG | – | R

Regulator

Body size

4	1/2
6	1
8	1 1/2
9	2

Set pressure range

25	0.05 to 0.83MPa
35 Note)	0.02 to 0.2MPa

Note) Only the adjusting spring will be different from AR□25 type.

Port size

02	1/4
03	3/8
04	1/2
06	3/4
10	1
12	1 1/4
14	1 1/2
20	2

Thread type

Nil	Rc
N	NPT
F	G

Accessory

Symbol		Description	Applicable model
Nil		—	—
B		With bracket	AR4□5 to 6□5
G	Pressure gauge	G46-10-02	AR□25
		G46-2-02	AR□35

Option specification

Nil	None
R	Flow direction: Right to left

Internal pilot operated relieving type regulator

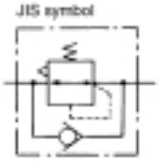

AR8□5


AR6□5


AR6□5-□□BG


AR425-□□BG

JIS symbol



Refer to page 1.5-18 of Best Pneumatics No. 4 for details.

AR1000 to 6060

Standard specifications

Model	AR1000	AR2060	AR2560	AR3060	AR4060	AR4060-06	AR5060	AR6060
Port size	M5 x 0.8	1/8 1/4	1/4 3/8	1/4 3/8	1/4 3/8 1/2	3/4	1/4 1	1
Fluid	Air							
Proof pressure	1.5MPa							
Maximum operating pressure	1.0MPa							
Set pressure range	0.05 to 0.7MPa	0.1 to 0.85MPa						
Maximum effective area mm² (OUT → IN)	2.8	1/8: 6 1/4: 6.5	1/4: 18 3/8: 20	1/4: 26 3/8: 31	1/4: 34 3/8: 56 1/2: 84	92	3/4: 127 1: 131	203
Pressure gauge port size	1/16	1/8	1/8	1/8	1/4	1/4	1/4	1/4
Ambient and fluid temperature	–5 to 60°C (with no freezing)							
Construction	Relieving type							
Weight kg	0.08	0.26	0.25	0.39	0.84	0.94	1.19	1.55

∗ The standard AR1000 functions as a regulator with check valve.

Accessory (option) part nos.

Description \ Model	Part no. AR1000	AR2060	AR2560	AR3060	AR4060	AR4060-06	AR5060	AR6060
Bracket	B120	B220	B220	B320	B420	B420	B640A Note 1)	B640A Note 1)
Pressure gauge Note 2) 1.0MPa	G27-10-R1 Note 3)	G36-10-□01			G46-10-□02			

Note 1) With two mounting screws

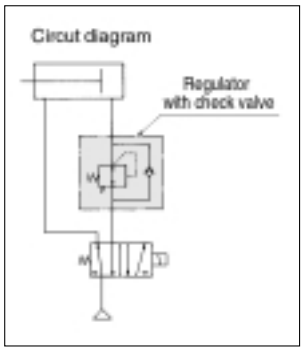
Note 2) Indicate a symbol for the connection thread type in the square (□) of pressure gauge part numbers (example: G36-10-□01). Indicate Nil for Rc and N for NPT. Consult SMC regarding NPT pressure gauge.

Note 3) Handling precautions: If drainage or oil, etc., enters the pressure gauge, an error may occur in the pressure gauge indication.

A regulator with mechanism for quick and reliable exhaust of downstream pressure (built-in check valve, with back flow mechanism)

AR4060 AR3060 AR2560

For different pressures at the front and rear sides of the cylinder



How to Order

AR | 30 | 60 | — | | 03 | BG | — | R

Regulator

Body size

10	M5
20	1/8
25	1/4
30	3/8
40	1/2
50	3/4
60	1

Symbol	Applicable model
00	AR1000
60	AR2060 AR2560 AR3060 AR4060 AR5060 AR6060

Thread type

Nil	Metric thread (M5)
	Rc
N	NPT
F	G

Port size

M5	M5 x 0.8
01	1/8
02	1/4
03	3/8
04	1/2
06	3/4
10	1

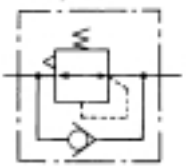
Accessory (option)

Nil	None
B	With bracket
G	With pressure gauge

Option specification

Nil	Flow direction: Left to right
R	Flow direction: Right to left

JIS symbol



Refer to page 1.5-30 of Best Pneumatics No. 4 for details.

Filter Regulator
Series AW1000 to 4000

Standard specifications

Model		AW1000	AW2000	AW3000	AW4000	AW4000-06
Port size		M5 x 0.8	1/8 1/4	1/4 3/8	1/4 3/8 1/2	3/4
Fluid		Air				
Proof pressure		1.5MPa				
Maximum operating pressure		1.0MPa				
Set pressure range		0.05 to 0.7MPa	0.05 to 0.85MPa			
Pressure gauge port size		1/16	1/8	1/8	1/4	1/4
Ambient and fluid temperature		–5 to 60°C (with no freezing)				
Nominal filtration rating		5μm				
Drain capacity cm³		2.5	8	23	45	45
Bowl material		Polycarbonate				
Construction		Relieving type				
Weight kg		0.09	0.36	0.53	1.09	1.15
Accessory (standard)	Bowl guard	—	—	●	●	●

Accessory (option) part nos.

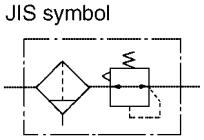
Description \ Model			Part no. AW1000	AW2000	AW3000	AW4000	AW4000-06
Accessory	Bracket		**B120**	**B220**	**B320**	**B420**	**B420**
	Pressure gauge Note 1)	1.0MPa	**G27-10-R1**	**G36-10-□01**	**G36-10-□01**	**G46-10-□02**	**G46-10-□02**
		0.2MPa	**(G27-10-R1)** Note 2)	**G36-2-□01**	**G36-2-□01**	**G46-2-□02**	**G46-2-□02**
	Float type auto drain Note 3)	N.O.	—	—	**AD43**	**AD44**	**AD44**
		N.C.	—	—	**AD53**	**AD54**	**AD54**
	Differential pressure type auto drain		**AD61**	**AD62**	—	—	—

Note 1) Indicate a symbol for the connection thread type in the square (□) of pressure gauge part numbers (example: G36-10-□01).
Indicate Nil for Rc and N for NPT. Consult SMC regarding NPT pressure gauge.
Note 2) For 1.0MPa
Note 3) Minimum operating pressure: 0.1MPa for N.O., 0.15MPa for N.C.
Note 4) -01, -02, -03,-06 at the end of the part number indicates the port size. (01: 1/8, 02: 1/4, 03: 3/8, 04: 1/2, 06: 3/4)
Note 5) The pressure gauge for AW1000-M5G-1 will be G27-10-R1 for 1.0MPa.

Integrated filter and regulator minimizes space and piping requirements

Direct operated, relieving type

JIS symbol



Refer to page 1.8-1 of Best Pneumatics No. 4 for details.

How to Order

AW **30** **00** – **[ ]** **03** **BG** – **2N**

Filter regulator

Body size

10	M5
20	1/8
30	3/8
40	1/2

Thread type

Nil	Metric thread (M5)
	Rc
N	NPT
F	G

Port size

M5	M5 x 0.8
01	1/8
02	1/4
03	3/8
04	1/2
06	3/4

Accessory

Symbol		Description	Applicable model
Nil		—	—
B		Bracket	AW1000 to AW4000-06
C	Auto drain	Float type auto drain (N.C.)	AW3000 to AW4000-06
D	Auto drain	Differential pressure auto drain	AW1000/2000
	Auto drain	Float type auto drain (N.O.)	AW3000 to AW4000-06
G	Pressure gauge	Without limit indicator	AW1000
	Pressure gauge	With limit indicator	AW2000 to AW4000-06

Option specification

1 Note 1)	Set pressure at 0.02 to 0.2MPa
2	Metal bowl
6	Nylon bowl
8	Metal bowl with level gauge (AW3000/4000 only)
C	Bowl guard (AW2000 only)
J Note 2)	Drain guide (AW3000/4000 only)
N	Non-relieving type
R	Flow direction: Right to left
W	Drain cock with barb fitting (AW3000/4000 only) (for ø6/ø4 nylon)

If specifying more than one option, list symbols in alphabetical order.
(Example) 2NR

Note 1) Only the adjusting spring will be different from the standard.

Note 2) Without valve mechanism

Option specification combinations

	Description	Symbol	Auto drain			Option specification									Applicable model for filter regulator			
			D	D	C	1	2	6	8	C	J	N	R	W	AW1000	AW2000	AW3000	AW4000
Accessory	Differential pressure type auto drain	D				◎	◎	◎		●		◎	◎		◎	◎		
	Float type auto drain (N.O.)	D				◎	◎	◎	◎			◎	◎				◎	◎
	Float type auto drain (N.C.)	C				◎	◎	◎	◎			◎	◎				◎	◎
Option specification	0.02 to 0.2MPa	-1	◎	◎	◎		◎	◎	●	●	●	◎	◎	●	◎	◎	◎	◎
	Metal bowl	-2	◎	◎	◎	◎					●	◎	◎		◎	◎	◎	◎
	Nylon bowl	-6	◎	◎	◎	◎				●	●	◎	◎	●	◎	◎	◎	◎
	Metal bowl with level gauge	-8		◎	◎	◎					◎	◎	◎				◎	◎
	With bowl guard	-C	◎			◎		◎				◎	◎			◎		
	With drain guide (Port size: 1/4)	-J				◎	◎	◎	◎			◎	◎				◎	◎
	Non-relieving type	-N	◎	◎	◎	◎	◎	◎	●	●	●		◎	●	◎	◎	◎	◎
	Flow direction: Right to left	-R	◎	◎	◎	◎	◎	◎	●	●	●	◎		●	◎	◎	◎	◎
	One-touch drain cock with barb fitting	-W				◎		◎				◎	◎				◎	◎

◎ Combination possible Combination not possible ● Depends on the model

Series AW2001/3001/4001

Standard specifications

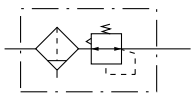
Model		AW2001	AW3001	AW4001
Port size		1/8, 1/4	1/4, 3/8	1/4, 3/8, 1/2
Fluid		Air		
Proof pressure		1.5MPa		
Maximum operating pressure		1.0MPa		
Set pressure range		0.05 to 0.85MPa		
Ambient and fluid temperature		–5 to 60°C (with no freezing)		
Nominal filtration rating		5μm		
Drain capacity cm³		8	23	45
Bowl material		Polycarbonate		
Construction		Relieving type		
Weight kg		0.37	0.54	1.16
Accessory (standard)	Bowl guard	—	●	●

Accessory (option) part nos.

Description \ Model			Part no. AW2001	AW3001	AW4001
Accessory	Bracket		B220	B320	B420
	Pressure gauge	1.0MPa	GC30-10		
		0.2MPa	GC30-2		
	Float type auto drain Note 1)	N.O.	—	AD43	AD44
		N.C.	—	AD53	AD54
	Differential pressure auto drain		AD62	—	—

Note 1) Minimum operating pressure: 0.1MPa for N.O., 0.15MPa for N.C.
Note 2) -01, -02, -03,-04 at the end of the part number indicates the port size.
(01: 1/8, 02: 1/4, 03: 3/8, 04: 1/2)

JIS symbol



How to Order

AW 30 0 1 — 03 B G — 2N

Filter regulator

Body size

20	1/8
30	3/8
40	1/2

Flow direction

1	Left to right
2	Right to left

Thread type

Nil	Rc
N	NPT
F	G

Port size

01	1/8
02	1/4
03	3/8
04	1/2

Accessory

Symbol		Description	Applicable model
Nil		—	—
B		Bracket	AW2001 to AW4001
C	Auto drain	Float type auto drain (N.C.)	AW3001 AW4001
D	Auto drain	Differential pressure type auto drain	AW2001
	Auto drain	Float type auto drain (N.O.)	AW3001 AW4001

Option specification

1 Note 1)	Set pressure at 0.02 to 0.2MPa
2	Metal bowl
6	Nylon bowl
8	Metal bowl with level gauge (AW3001/4001 only)
C	Bowl guard (AW2001 only)
J Note 2)	Drain guide (AW3001/4001 only)
N	Non-relieving type
W	Drain cock with barb fitting (AW3001/4001 only) (for ø6/ø4 nylon)

If specifying more than one option, list symbols in alphabetical order.
(Example) 2NW

Note 1) Only the adjusting spring will be different from the standard specifications.

Note 2) Without valve mechanism

Option specification combinations

	Description	Symbol	Auto drain D	D	C	Option specification 1	2	6	8	C	J	N	W	Applicable filter regulator model AW2001	AW3001	AW4001
Accessory	Differential pressure type auto drain	D				◎	◎	◎		◎		◎		◎		
	Float type auto drain (N.O.)	D				◎	◎	◎	◎			◎			◎	◎
	Float type auto drain (N.C.)	C				◎	◎	◎	◎			◎			◎	◎
Option specification	0.02 to 0.2MPa	-1	◎	◎	◎		◎	◎	●	●	●	◎	●	◎	◎	◎
	Metal bowl	-2	◎	◎	◎	◎					●	◎		◎	◎	◎
	Nylon bowl	-6	◎	◎	◎	◎				◎	●	◎	●	◎	◎	◎
	Metal bowl with level gauge	-8		◎	◎	◎					◎	◎			◎	◎
	With bowl guard	-C	◎			◎		◎				◎		◎		
	Drain guide (Port size: 1/4)	-J				◎	◎	◎	◎			◎			◎	◎
	Non-relieving	-N	◎	◎	◎	◎	◎	◎	●	●	●		●	◎	◎	◎
	One-touch drain cock with barb fitting	-W				◎		◎				◎			◎	◎

◎ Combination possible ▭ Combination not possible ● Depends on the model

Refer to page 1.8-7 of Best Pneumatics No. 4 for details.

Air Filter Element Part Number List

Air filter
Series AF

Filter regulator
Series AW

Filter model		Element part no.
AF1000	**AW1000**	111344
AF2000	**AW2000**	1129116
AF3000	**AW3000**	111585
AF4000	**AW4000**	1116103
AF4000-06	**AW4000-06**	1116103
AF5000	—	111724
AF6000	—	111825

Air filter (large capacity)
Series AF

Filter model	Element part no.
AF800	11345-5B
AF900	11352-5B

Mist separator
Series AFM

Mist separator regulator
Series AWM

Filter model		Element part no.
AFM2000	**AWM2000**	630611
AFM3000	**AWM3000**	630617
AFM4000	**AWM4000**	630623

Micro mist separator
Series AFD

Micro mist separator regulator
Series AWD

Filter model		Element part no.
AFD2000	**AWD2000**	63092
AFD3000	**AWD3000**	63093
AFD4000	**AWD4000**	63094

Main line filter
Series AFF

Filter model	Element part no.
AFF2B	AFF-EL2B
AFF4B	AFF-EL4B
AFF8B	AFF-EL8B
AFF11B	AFF-EL11B
AFF22B	AFF-EL22B
AFF37B	AFF-EL37B
AFF75B	AFF-EL75B

Free standing main line filter
Series AFF

Filter model	Element part no.
AFF75A	EC700-003N
AFF125A	EC700-003N
AFF150A	EC800-003N
AFF220A	EC900-003N

Mist separator
Series AM

Filter model	Element part no.
AM150	AM-EL150
AM250	AM-EL250
AM350	AM-EL350
AM450	AM-EL450
AM550	AM-EL550
AM650	AM-EL650
AM850	AM-EL850

Micro mist separator
Series AMD

Micro mist separator
(Free standing type, In-line type)
Series AMD

Filter model	Element part no.
AMD150	AMD-EL150
AMD250	AMD-EL250
AMD350	AMD-EL350
AMD450	AMD-EL450
AMD550	AMD-EL550
AMD650	AMD-EL650
AMD850	AMD-EL850

Filter model	Element part no.
AMD800	63174
AMD801	63174
AMD900	63174 (3 pcs.)
AMD901	63174 (3 pcs.)
AMD1000	63174 (5 pcs.)

Micro mist separator with prefilter
Series AMH

Filter model	Element part no.
AMH150	AMH-EL150
AMH250	AMH-EL250
AMH350	AMH-EL350
AMH450	AMH-EL450
AMH550	AMH-EL550
AMH650	AMH-EL650
AMH850	AMH-EL850

Super mist separator
Series AME

Filter model	Element part no.
AME150	AME-EL150
AME250	AME-EL250
AME350	AME-EL350
AME450	AME-EL450
AME550	AME-EL550
AME650	AME-EL650
AME850	AMH-EL850

Odor removal filter
Series AMF

Odor removal filter
(Free standing type, In-line type)
Series AMF

Filter model	Element part no.
AMF150	AMF-EL150
AMF250	AMF-EL250
AMF350	AMF-EL350
AMF450	AMF-EL450
AMF550	AMF-EL550
AMF650	AMF-EL650
AMF850	AMF-EL850

Filter model	Element part no.
AMF800	63271
AMF801	63271
AMF900	63271 (3 pcs.)
AMF901	63271 (3 pcs.)
AMF1000	63271 (5 pcs.)

GD40-2-01

Differential Pressure Gauge

The difference between the inlet and outlet pressures can be viewed at a glance on a differential pressure gauge. It is ideal for filter maintenance.

- **Compact and light weight**
- **Easily installed by merely providing a bypass circuit**
- **With protective cover for hazard prevention**

JIS symbol

Models/Specifications

Model	GD40-2-01
Fluid	Compressed air
Maximum operating pressure	1MPa
Proof pressure	1.5MPa
Ambient and fluid temperature	5 to 60°C
Port size Rc	1/8
Gauge range	0 to 0.2MPa
Accuracy	±0.006MPa
Dial size	ø40
Weight g	300

Main part materials

Case	Die-cast zinc
Internal parts	Brass, Phosphor bronze
Window	Chloroethylene
Gauge plate	Stainless steel

Standard accessories

Nylon tubing	T0425 (0.5m)
Male connector	H04-01 (1 pc.)
Male elbow	DL04-01 (1pc.)

Design Precautions

⚠Caution

A differential pressure gauge cannot be used in a location with frequent pulsation.

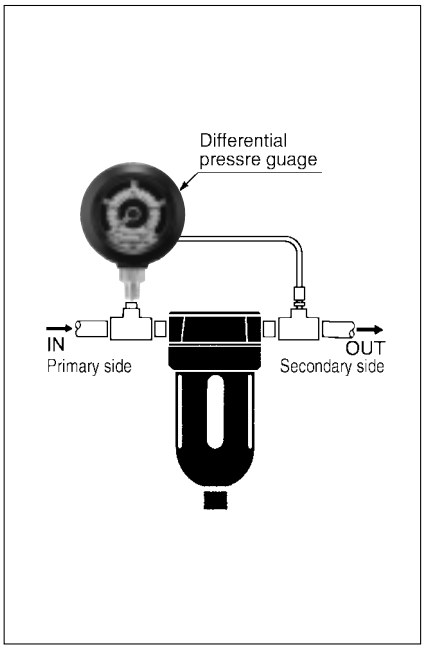
Mounting

⚠Caution

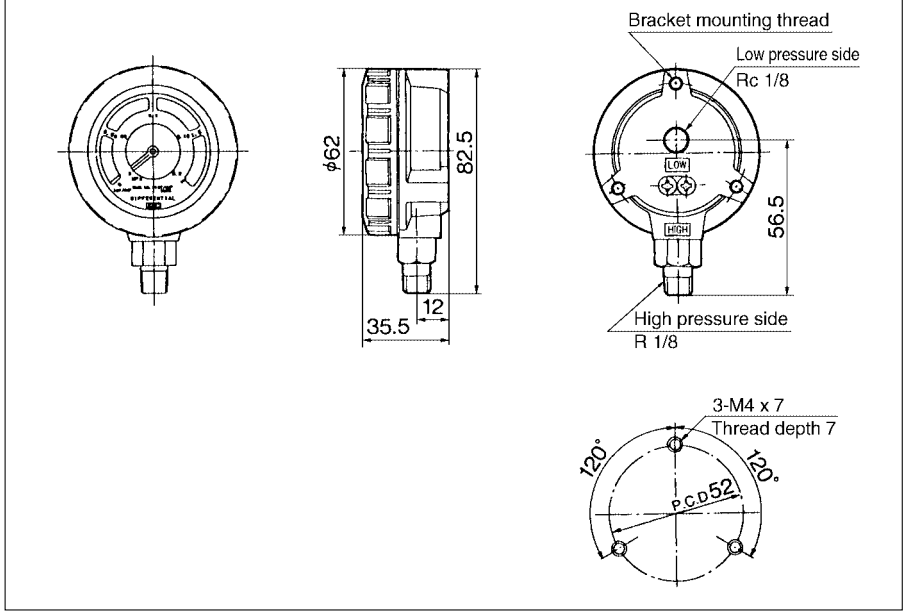
Mounting

1) The HIGH and LOW marks on the back of the differential pressure gauge indicate high pressure and low pressure sides, respectively. Connect the HIGH side to the primary side and the LOW side to the secondary side of filters and other equipment. Do not use a stop valve, as damage to the differential pressure gauge may occur if the valve is inadvertently left open or closed.
2) Install the differential pressure gauge vertically.
3) Securely connect the piping of the differential pressure gauge, because it will be damaged if the piping becomes detached.

Piping example



Dimensions



Filter with Element Service Indicator

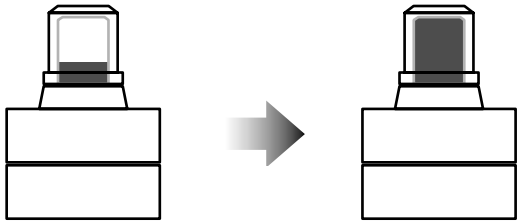
Air Line Maintenance

This unit indicates the clogging (service life) of elements.

The element service indicator indicates the clogging of elements in a mist separator, etc., which can be used as a guide for the time to replace the element.

Clogging Indication

Replace an element when the element service indicator's red indicator reaches to the top.
The top of the indicator window indicates differential pressure of approximately 0.1MPa.
Replace an element every 2 years even if the red indicator does not reach the top.



Differential pressure: 0.05MPa or less
(The indicator's tip is visible.)

Differential pressure: 0.1MPa or more
(The indicator reaches to the top.)

Applicable series
Main line filter: AFF2B to AFF75B
Mist separator: AM150 to AM850
Micro mist separator: AMD150 to AMD850
Micro mist separator with prefilter: AMH150 to AMH850

An element service indicator is already mounted on each series at the factory. It cannot be mounted at a later time or used as a separate unit.

How to Order

	Size
AFF	2B
	4B
	8B
	11B
	22B
	37B
	75B

	Size
AM	150
AMD	250
AMH	350
	450
	550
	650
	850

Thread type
Nil
N
F

Bore size
01
02
03
04
06
10
14
20

Accessory
Nil
B
C
D
BC
BD

Option
Nil
J
M
R
T
JR
MR
JT
MT
RT
JRT
MRT

Size	
1/8	2B, 150
1/4	4B, 250
3/8	8B, 350
1/2	11B, 450
3/4	22B, 550
1	37B, 650
1 1/2	75B, 850

Thread type	
Rc	Nil
NPT	N
G	F

Bore size	
1/8	01
1/4	02
3/8	03
1/2	04
3/4	06
1	10
1 1/2	14
2	20

Accessory	
Without accessory	Nil
With bracket	B
With N.C. auto drain	C
With N.O. auto drain	D

Option	
Without option	Nil
Drain guide with 1/4B female thread	J
Drain cock with M5 thread	M
Flow direction: Right to left	R
With element service indicator	T

Size \ Bore size	01	02	03	04	06	10	14	20
2B, 150	●	●	●					
4B, 250		●	●	●				
8B, 350			●	●	●			
11B, 450				●	●	●		
22B, 550					●	●		
37B, 650						●	●	
75B, 850							●	●

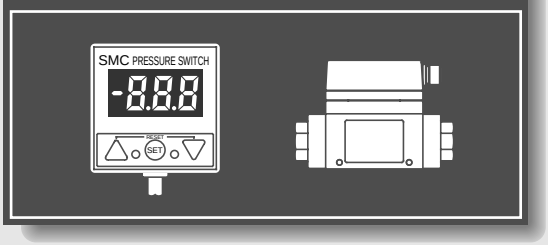
Size	Accessory \ Option	J	M	R	T	JR	MR	JT	MT	RT	JRT	MRT
2B, 150 to 22B, 550	Nil	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●
	C			●	●					●		
	D			●	●					●		
	BC			●	●					●		
	BD			●	●					●		
37B, 650	Nil	●	●	●	●	●	●	●	●	●	●	●
	B	●	●	●	●	●	●	●	●	●	●	●
	D			●	●					●		
	BD			●	●					●		
75B, 850	Nil			●	●					●		
	B			●	●					●		
	D			●	●					●		
	BD			●	●					●		

●: Applicable (Combinations other than those indicated are not possible.)

Refer to the "Air Preparation Equipment" portion of Best Pneumatics No. 3 for selecting the model number and size of a mist separator, etc.

SMC

Sensors/Measuring Instruments



	Series	Application	Page
Digital flow switch	**PFA/PFW**	**Air line maintenance, Air blow, Air tool, Air leakage, Cooling water**	**84**
High precision digital pressure switch	**ZSE40/ISE40**	**Air line maintenance, Air blow, Air tool, Vacuum**	**111**
Digital pressure switch	**ZSE3/ISE3**	**Air line maintenance**	**117**
Digital pressure switch for general purpose fluid	**ZSE5B/ISE5B**	**Air line maintenance, Liquid removal, Coolant**	**119**
Compact manometer	**PPA**	**Air blow, Air tool**	**127**
Air leakage tester	**(Made to order)**	**Air line maintenance, Air blow, Air leakage**	**133**
Air catcher sensor	**ISA**	**Air purge**	**135**
Negative pressure detection valve	**(Special order product)**	**Liquid removal**	**137**

Digital Flow Switch
Series PFA/PFW

Bright and easy to read LED display/digital setting

A new LCD display is used for the high flow rate types (PFA703H/706H/712H) in order to reduce the power consumption without losing visibility.

Two types for different applications
Integrated and remote type displays

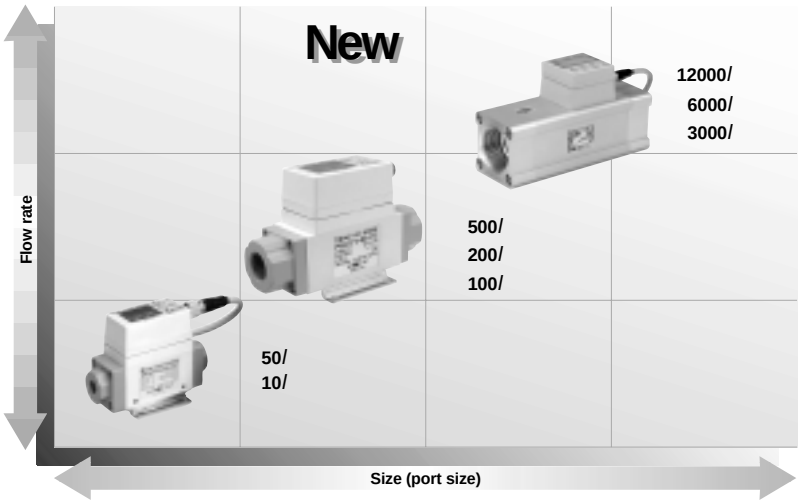
Water resistant construction equivalent to IP65

Two independent flow rate settings are possible.

Can be switched from real-time flow rate to accumulated flow.

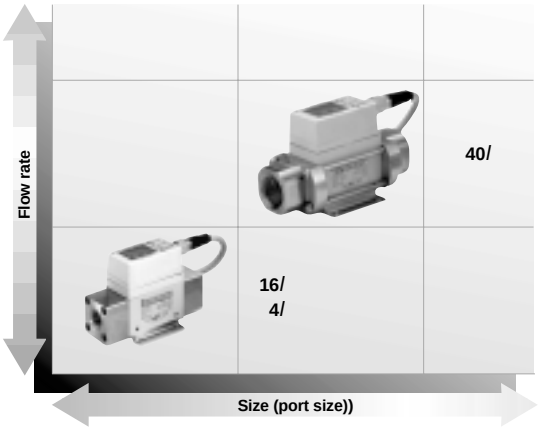
Digital Flow Switch **for Air**

Series PFA



Digital Flow Switch **for Water**

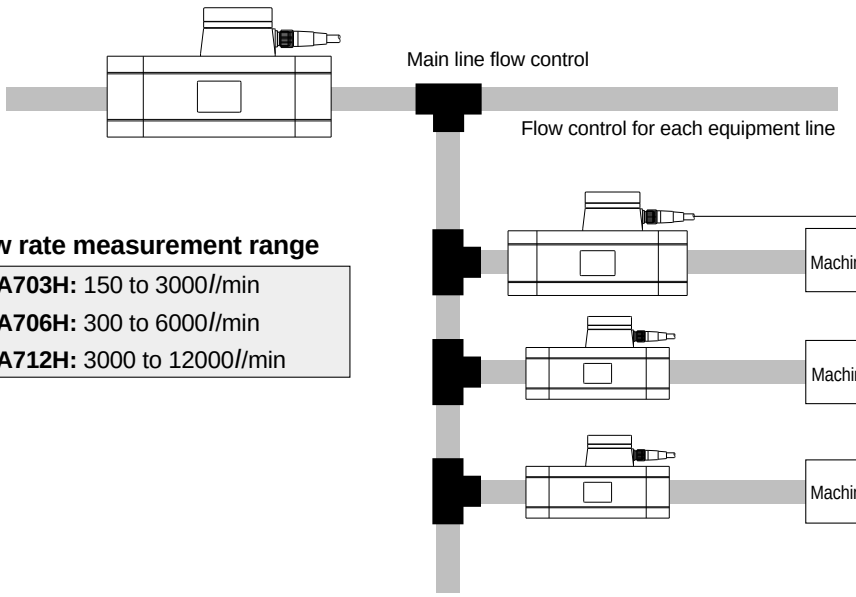
Series PFW



Maximum Flow Rate

3000, 6000, 12000//min

The addition of the high flow rate types supports energy saving measures.
Air flow rates can be controlled from the main line to each equipment line.



■ **The accumulated pulse output function (100//pulse) enables remote detection of accumulated flow.**

100//pulse

Pulse counter

Flow rate measurement range

PFA703H:	150 to 3000//min
PFA706H:	300 to 6000//min
PFA712H:	3000 to 12000//min

- **Analog output (1 to 5VDC, 4 to 20mA) and switch output can also be accommodated.**

For Air

Digital Flow Switch

Series PFA

How to order

Integrated display type **PFA7 10 — □ 01 — 27 □ — □**

Flow rate range

10	1 to 10ℓ/min
50	5 to 50ℓ/min
11	10 to 100ℓ/min
21	20 to 200ℓ/min
51	50 to 500ℓ/min

Thread type

Nil	Rc
N	NPT
F	G

Wiring specification

Nil	3m lead wire with connector
N	Without lead wire

Unit specification

Nil	With unit switching function
M	Fixed SI unit Note)

Note) Fixed units:
Real-time flow rate: ℓ/min
Accumulated flow: ℓ

Port size

Symbol	Size	Flow rate (ℓ/min)					Applicable model
		10	50	100	200	500	
01	1/8	●	●				PFA710, 750
02	1/4	●	●				
03	3/8			●	●		PFA711, 721
04	1/2					●	PFA751

Output specification

Nil	Output specification	Applicable model
27	NPN open collector 2 outputs	PFA710, 750 PFA711, 721, 751
28	NPN open collector 1 output + Analog output (1 to 5V)	PFA711, 721, 751
67	PNP open collector 2 outputs	PFA710, 750 PFA711, 721, 751
68	PNP open collector 1 output + Analog output (1 to 5V)	PFA711, 721, 751

Specifications

Model		PFA710	PFA750	PFA711	PFA721	PFA751
Measured fluid		Dry air, N_2				
Detection type		Heater type				
Flow rate measurement range		1 to 10ℓ/min	5 to 50ℓ/min	10 to 100ℓ/min	20 to 200ℓ/min	50 to 500ℓ/min
Minimum setting unit		1% of maximum flow rate				
Display units Note 1)	Real-time flow rate	ℓ/min, CFM x 10^{-2}		ℓ/min, CFM x 10^{-1}		
	Accumulated flow	ℓ, ft^3 x 10^{-1}				
Operating pressure range		0 to 0.5MPa				
Withstand pressure		1.0MPa				
Pressure loss		3kPa (at 50ℓ/min)		3kPa (at 100ℓ/min)	10kPa (at 200ℓ/min)	30kPa (at 500ℓ/min)
Accumulated flow range		0 to 999999ℓ				
Operating temperature range		0 to 50°C (with no condensation)				
Linearity		± 5% F.S. or less				
Repeatability		±1% F.S. or less		±2% F.S. or less		
Temperature characteristics		±3% F.S. or less (15 to 35°C), ±5% F.S. or less (0 to 50°C)				
Output specifications Note 2)	Switch output	NPN open collector	Maximum load current: 80mA, Internal voltage drop: 1V or less (with load current of 80mA) Maximum applied voltage: 30V			
		PNP open collector	Maximum load current: 80mA Internal voltage drop: 1.5V or less (with load current of 80mA)			
	Analog output	—		Output voltage: 1 to 5V Load impedance: 100kΩ or more		
Indicator lights		**27, 67**: Lights up when ON, OUT1: Green, OUT2: Red		**27, 67**: Lights up when ON, OUT1: Green, OUT2: Red **28, 68**: Lights up when ON, OUT1: Green, OUT2: None		
Response time		1s or less				
Hysteresis		Hysteresis mode: Variable (can be set from 0), Window comparator mode: Fixed (3 digits) Note 3)				
Power supply voltage		12 to 24VDC (ripple ±10% or less)				
Current consumption		150mA or less		160mA or less		170mA or less
Withstand voltage		1000VAC for 1 min. between external terminal block and case				
Insulation resistance		50MΩ (500VDC) between external terminal block and case				
Noise resistance		1000Vp-p, Pulse width 1μs, Rise time 1ns				
Vibration resistance		10 to 500Hz at whichever is smaller, amplitude 1.5mm or acceleration 98m/s², in X, Y, Z directions, 2 hours each				
Impact resistance		490m/s² in X, Y, Z directions, 3 times each				
Weight		250g (without lead wire)		290g (without lead wire)		
Enclosure		Equivalent to IP65				
Port size (Rc, NPT, G)		1/8, 1/4		3/8		1/2

Note 1) For the type with unit switching function [The type without the unit switching function will have a fixed SI unit (ℓ/min or ℓ).]
Note 2) The output functions operate only for the real-time flow rate display, and do not operate for the accumulated flow display.
Note 3) Window comparator mode — Since hysteresis is 3 digits, separate P1 and P2 by 7 digits or more. 1 digit is the minimum setting unit (refer to the table above).
Note 4) The flow rate unit is based on 0˚C and 101.3kPa.

How to Order

Remote Type Display Unit

PFA3 0 0 — A — □

Flow rate range

0	10, 50/min
1	100, 200, 500/min

Mounting

A	Panel mount
B	DIN rail, Wall mount

Unit specification

Nil	With unit switching function
M	Fixed SI unit Note)

Note) Fixed units:
Real-time flow rate: /min
Accumulated flow:

Output specification

Nil	Output specification	Applicable model
0	NPN open collector 2 outputs	PFA30□, 31□
1	PNP open collector 2 outputs	
2	NPN open collector 1 output + Analog output (1 to 5V)	PFA31□
3	PNP open collector 1 output + Analog output (1 to 5V)	

∗ PFA302 and 303 combinations are not available.

Specifications

Model		**PFA300**	**PFA301**	**PFA310**	**PFA311**	**PFA312**	**PFA313**
Flow rate measurement range Note 1)		1 to 10, 5 to 50/min		10 to 100/min, 20 to 200/min 50 to 500/min			
Minimum setting unit		1% of maximum flow rate					
Display units Note 2)	**Real-time flow rate**	/min, CFM x 10^{-2}		/min, CFM x 10^{-1}			
	Accumulated flow	, ft^3 x 10^{-1}					
Accumulated flow range		0 to 999999					
Operating temperature range		0 to 50°C (with no condensation)					
Linearity Note 3)		±5% F.S. or less					
Repeatability		±1% F.S. or less Note 3)		±1% F.S. or less			
Temperature characteristics		±1% F.S. or less (15 to 35°C) ±2% F.S. or less (0 to 50°C)					
Output Specifications Note 4)	**Switch output**	NPN open collector	Maximum load current: 80mA Maximum applied voltage: 30V Internal voltage drop: 1V or less (with load current of 80mA)				
		PNP open collector	Maximum load current: 80mA Internal voltage drop: 1.5V or less (with load current of 80mA)				
	Analog output	—		Output voltage: 1 to 5V Load impedance: 100kΩ or more			
Indicator lights		Lights up when On, OUT1: Green, OUT2: Red		Lights up when ON, OUT1: Green, OUT2: Red		Lights up when ON, OUT1: Green, OUT2: None	
Response time		1s or less					
Hysteresis		Hysteresis mode: Variable (can be set from 0), Window comparator mode: Fixed (3 digits) Note 4)					
Power supply voltage		12 to 24VDC (ripple ±10% or less)					
Current consumption		50mA or less		60mA or less			
Enclosure		Equivalent to IP40					
Weight		45g					

Note 1) The flow rate measurement range can change depending on the setting.
Note 2) For the type with unit switching function [The type without the unit switching function will have a fixed SI unit (/min or).]
Note 3) The system accuracy when combined with sensor unit.
Note 4) The output functions operate only for the real-time flow rate display, and do not operate for the accumulated flow display.
Note 5) Window comparator mode — Since hysteresis is 3 digits, separate P1 and P2 by 7 digits or more. 1 digit is the minimum setting unit (refer to the table above).
Note 6) The flow rate unit is based on 0°C and 101.3kPa.

How to Order

Remote Type Sensor Unit

PFA5 10 — □ 01 □

Flow rate range

10	1 to 10/min
50	5 to 50/min
11	10 to 100/min
21	20 to 200/min
51	50 to 500/min

Thread type

Nil	Rc
N	NPT
F	G

Wiring specification

Nil	3m lead wire with connector
N	Without lead wire

Port size

Symbol	Size	Flow rate (/min)					Applicable model
		10	50	100	200	500	
01	1/8	●	●				PFA510, 550
02	1/4	●	●				
03	3/8			●	●		PFA511, 521
04	1/2					●	PFA551

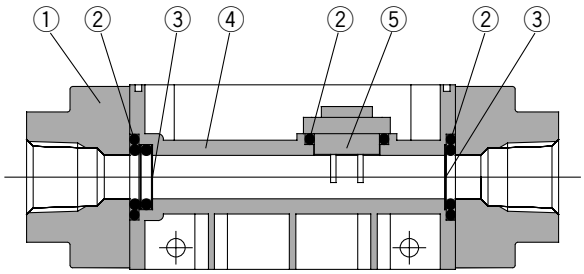
Specifications

Model	PFA510	PFA550	PFA511	PFA521	PFA551
Measured fluid	Dry air, N_2				
Detection type	Heater type				
Flow rate measurement range	1 to 10/min	5 to 50/min	10 to 100/min	20 to 200/min	50 to 500/min
Operating pressure range	0 to 0.5MPa				
Withstand pressure	1.0MPa				
Pressure loss	3kPa (at 50/min)		3kPa (at 100/min)	10kPa (at 200/min)	30kPa (at 500/min)
Operating temperature range	0 to 50°C (with no condensation)				
Linearity Note 1)	±25% F.S. or less		±20% F.S. or less		
Repeatability	±1% F.S. or less Note 2)		±1% F.S. or less		
Temperature characteristics	±2% F.S. or less (15 to 35°C) ±3% F.S. or less (0 to 50°C)				
Power supply voltage	12 to 24VDC (ripple ±10% or less)				
Current consumption	100mA or less				110mA or less
Weight	200g (without lead wire)		240g (without lead wire)		
Enclosure	Equivalent to IP65				
Port size (Rc, NPT, G)	1/8, 1/4		3/8		1/2

Note 1) The system accuracy will be adjusted to ±5% F.S. or less when combined with PFA3□□.
Note 2) The system accuracy will be adjusted to ±1% F.S. or less when combined with PFA30□.
Note 3) The flow rate unit is based on 0°C and 101.3kPa.

Sensor Unit Construction

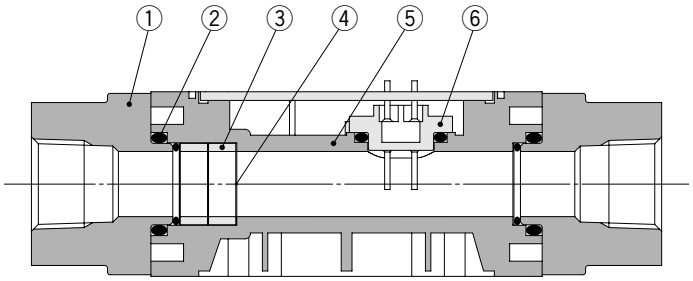
PFA710/750
PFA510/550



Parts list

No.	Description	Material
1	**Attachment**	ADC
2	**Seal**	NBR
3	**Mesh**	Stainless steel
4	**Body**	PBT
5	**Sensor**	PBT

PFA711/721/751
PFA511/521/551



Parts list

No.	Description	Material
1	**Attachment**	ADC
2	**Seal**	NBR
3	**Spacer**	PBT
4	**Mesh**	Stainless steel
5	**Body**	PBT
6	**Sensor**	PBT

Operating Unit Descriptions

RESET Buttons

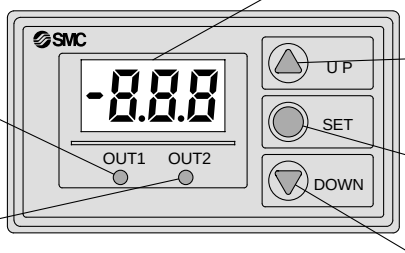
Pressing the UP and DOWN buttons simultaneously activates the RESET function.
This clears the unit when an abnormality occurs and clears the accumulated flow display to "0".

Output (OUT1) Indicator/Green

Lights up when OUT1 is ON.
It also blinks when an overcurrent error occurs on OUT1.

Output (OUT2) Indicator/Red

Lights up when OUT2 is ON.
It also blinks when an overcurrent error occurs on OUT2.



LED Display

Displays the real-time flow rate, accumulated flow, and setting value. The ➡ mark blinks when the accumulated flow is being measured.

UP Button (▲ Button)

Use when increasing a setting value.

SET Button (● Button)

Use when changing a setting value or any of the modes.

DOWN Button (▼ Button)

Use when decreasing a setting value.

Error Correction

Take the following corrective actions when errors occur.

LED display	Problem	Corrective action
Er 1	A current of more than 80mA is flowing to OUT1.	Check the load and wiring for OUT1.
Er 2	A current of more than 80mA is flowing to OUT2.	Check the load and wiring for OUT2.
Er 4	The setting data has changed due to some influence.	Perform the RESET operation, and set all data again.
- - -	The flow exceed the flow measuring range. (For air only)	Reduce the flow until it is within the flow measuring range, using an adjustment valve, etc.

Connectors

Since the connectors (female contacts) shown below can be used, please refer to the respective manufacturers.

Connector size	Number of pins	Manufacturer	Applicable series
M12	4	C. CORRENS & CO., LTD.	VA-4D
		OMRON Corporation	XS2
		Yamatake-Honeywell Co., Ltd.	PA5-4I
		Hirose Electric Company	HR24
		DDK Ltd.	CM01-8DP4S

Note) C. CORRENS & CO., LTD. is the general agent in Japan for Hirschmann.

Flow Rate Setting

Setting procedure

Initial setting
Initial setting: Sets the display mode (real-time flow rate/accumulated flow), unit mode, and output mode (non-inverted/inverted).

Manual flow setting
Sets the flow rate which generates switch output.

Auto preset
Sets the flow rate automatically.

Manual flow setting
Can make fine adjustment of data which is automatically set with the auto preset.

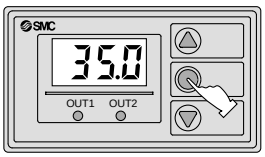
Key lock mode
Disable mode switching even if the button is pressed during operation.

Normal operation
Displays the flow rate and performs switch operations.

Initial setting

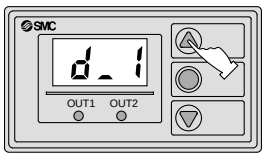
Note) Operation is the same for the integrated display type and the remote type (display unit).

1. Initial Setting Mode



Press the SET button for 1 second or more. Since the display will change from F_1 to d_1 or d_2, release the SET button after it has changed.

2. Select the Display Mode



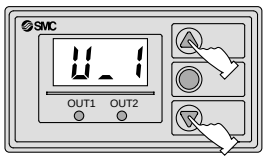
Sets the display mode.
Switches the mode with the ▲ button.
d_1: Real-time flow rate display
d_2: Accumulated flow display

Press the SET button.

SET

For -M (fixed SI unit)

3. Select Display Units

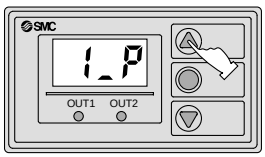


Sets display unit.Note)
Switches the unit with the ▲ button and ▼ button.
U_□ Unit number
(Refer to Table 1.)

Press the SET button.

SET

4. Select OUT1 Output Mode

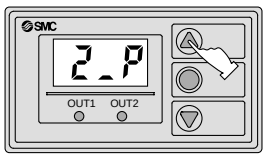


Sets the OUT1 output mode.
Switches the OUT1 output mode with the ▲ button.
1_P: Non-inverted output
1_n: Inverted output
(Refer to Table 2.)

SET

Press the SET button.

5. Select OUT2 Output Mode



Sets the OUT2 output mode.
Switches the OUT2 output mode with the ▲ button.
2_P: Non-inverted output
2_n: Inverted output

SET

Setting is completed when the SET button is pressed.

Table 1 Note)

For air

Display	Real-time flow rate	Accumulated flow
U_1	/min	/
U_2	CFM x 10^{-2}	ft^3 x 10^{-1}

CFM = ft^3/min

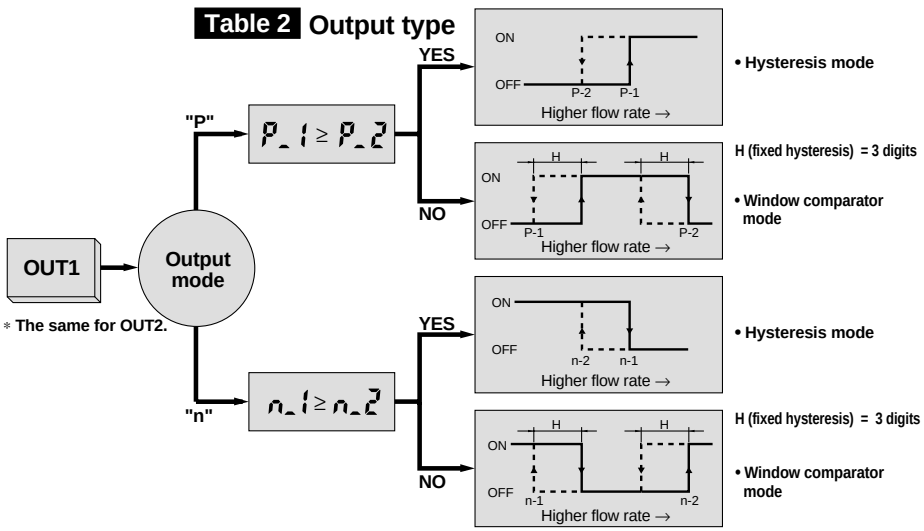
For water

Display	Real-time flow rate	Accumulated flow
U_1	/min	/
U_2	GPM	gal (US)

GPM = gal (US)/min

Note) For the type with unit switching function
[The type without the unit switching function will have a fixed SI unit (/min or /).]

Table 2 Output type



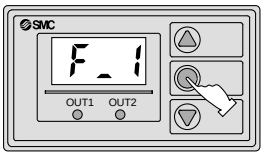
Flow Rate Setting

Flow rate setting mode (manual)

1. Set Value Input Mode (Manual)

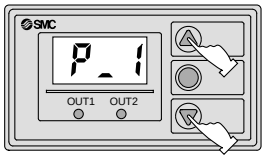
Press the SET button.
(Refer to Table 2 for the relationship of each value to the switch output.)

2. Setting in the Manual Mode



The display shows F_1.
Press the SET button.

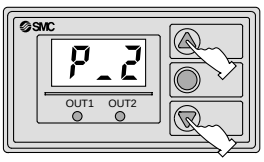
3. OUT1 Setting Value (1) Input



Press the SET button.

Display changes to input of OUT1 setting value (1).
The setting value and P_1 (or n_1) are displayed alternately.
▲ Button: Increases the setting value
▼ Button: Decreases the setting value

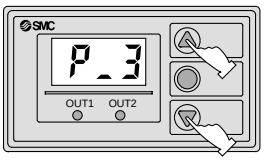
4. OUT1 Setting Value (2) Input



Press the SET button.

Display changes to input of OUT1 setting value (2).
The setting value and P_2 (or n_2) are displayed alternately.
▲ Button: Increases the setting value
▼ Button: Decreases the setting value

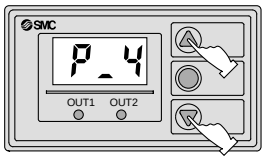
5. OUT2 Setting Value (1) Input



Press the SET button.

Display changes to input of OUT2 setting value (1).
The setting value and P_3 (or n_3) are displayed alternately.
▲ Button: Increases the setting value
▼ Button: Decreases the setting value

6. OUT2 Setting Value (2) Input

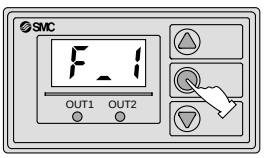


Setting is completed when the SET button is pressed.

Display changes to input of OUT2 setting value (2).
The setting value and P_4 (or n_4) are displayed alternately.
▲ Button: Increases the setting value
▼ Button: Decreases the setting value

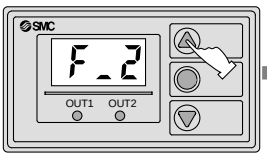
Flow rate setting mode (auto preset)

1. Set Value Input Mode



Press the SET button, and then release it when F_1 is displayed.

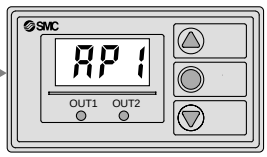
2. Setting in the Auto Preset Mode



Press the SET button.

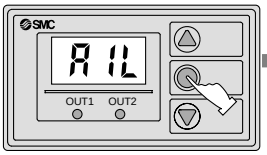
Press the ▲ button to switch the display to F_2.

3. Auto Preset Preparations



In this status, preparations are performed on equipment for the OUT1 setting, and flow is started.
(In the case where the OUT1 setting is not required, press the ▲ button and the ▼ button simultaneously while in this status.)

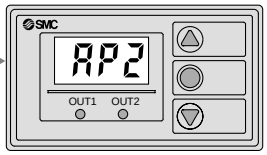
4. OUT1 Auto Preset



Press the SET button.

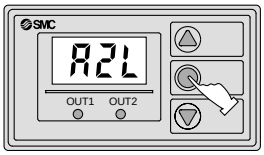
When the SET button is pressed at this point, the flow rate values are read automatically, and the optimum setting value is input.
A1L and the input value are displayed alternately.

5. Auto Preset Preparations



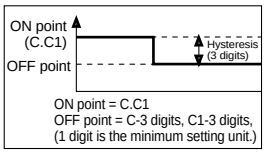
Preparations are performed on equipment for the OUT2 setting, and flow is started.
(In the case where the OUT2 setting is not required, press the ▲ button and the ▼ button simultaneously while in this condition.)

6. OUT2 Auto Preset



Setting is completed when the SET button is pressed.

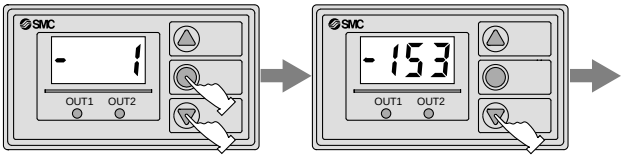
When the SET button is pressed at this point, the flow rate values are read automatically, and the optimum setting value is input.
A2L and the input value are displayed alternately.



Other functions

• Accumulated flow function

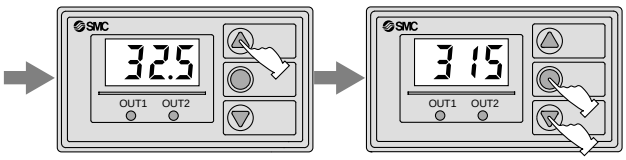
Start Accumulation



Accumulation start
Press the SET button while pressing the ▼ button.
The - mark blinks and accumulation begins.

The value can be accumulated to 999999, but normally only the lower 3 digits are displayed. Press the ▼ button to confirm the upper 3 digits.

Stop Accumulation

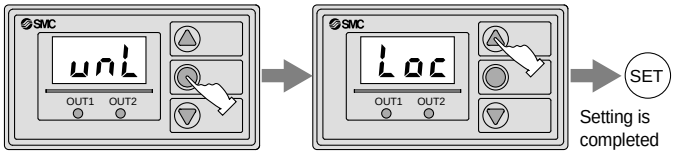


By pressing the ▲ button, the real-time flow rate can be confirmed during accumulation.

Press the SET button while pressing the ▼ button.
The display holds the value accumulated up to the present and stops. To start further accumulation from this point, press the SET button while pressing the ▼ button.
The display can be cleared by pressing the ▲ button and the ▼ button simultaneously for 2 seconds or more.

• Key lock mode ---------- Prevents misoperation of buttons.

Start Key Locking

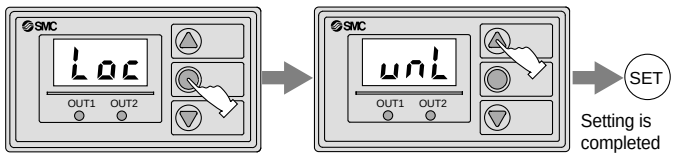


Press the SET button continuously for 3 seconds or more.
The display changes from F.t to d.t, and when unL is displayed, release the SET button.

Using the ▲ button, change the display to Loc.

Setting is completed when the SET button is pressed.

Release Key Locking



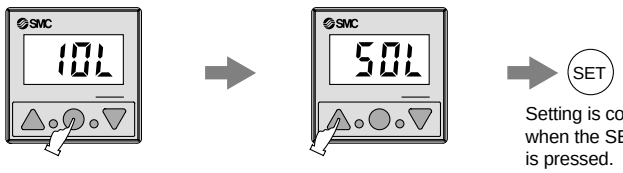
Press the SET button continuously for 3 seconds or more.
Release the SET button when Loc is displayed.

Using the ▲ button, change the display to unL.

Setting is completed when the SET button is pressed.

• Switching the flow rate range of the remote type (for air)

Flow Rate Range Switching



When the SET button is pressed continuously for 4 seconds or more, the display changes as shown in Table 3.

Setting is completed when the SET button is pressed.

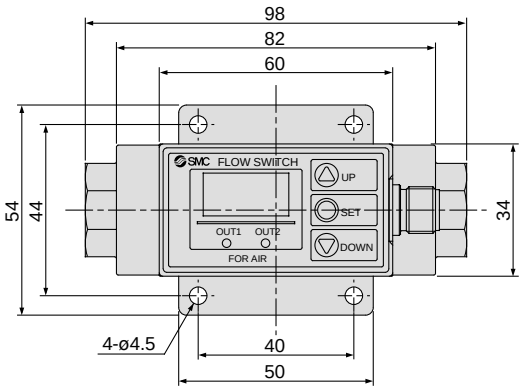
Press the ▲ button to set to the flow rate range being used.

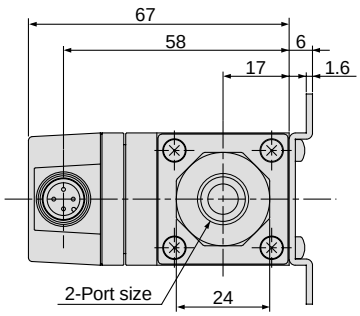
Table 3

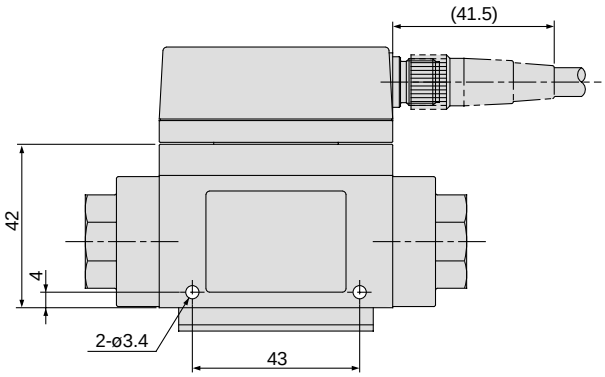
Display	Flow rate range	Applicable model
10L	1 to 10/min	For PFA30□
50L	5 to 50/min	
1 1L	10 to 100/min	For PFA31□
2 1L	20 to 200/min	
5 1L	50 to 500/min	

Dimensions/Integrated Display Type for Air

PFA710/750

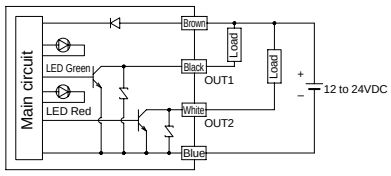




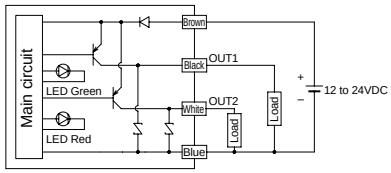


Flow direction

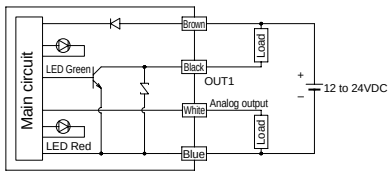
Internal circuit and wiring examples



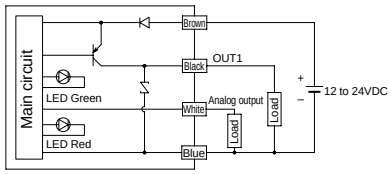
PFA7□□-□□-27□(-M)



PFA7□□-□□-67□(-M)

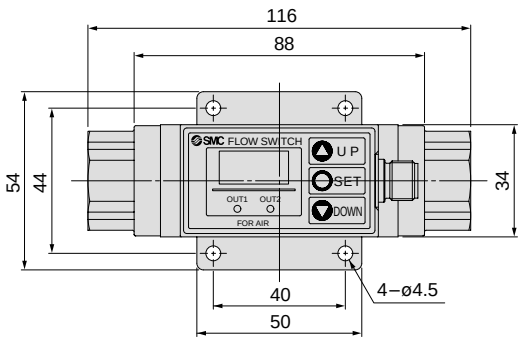


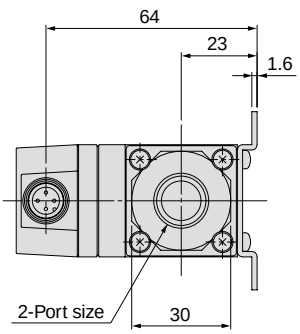
PFA7□1-□□-28□(-M)

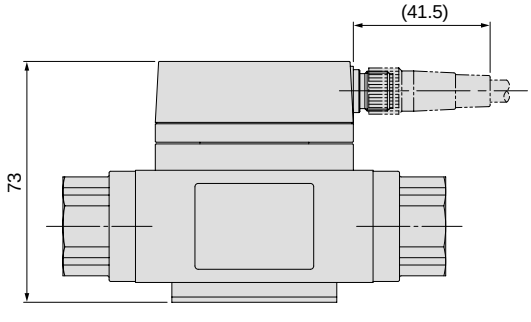


PFA7□1-□□-68□(-M)

PFA711/721/751

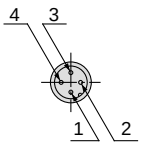






Flow direction

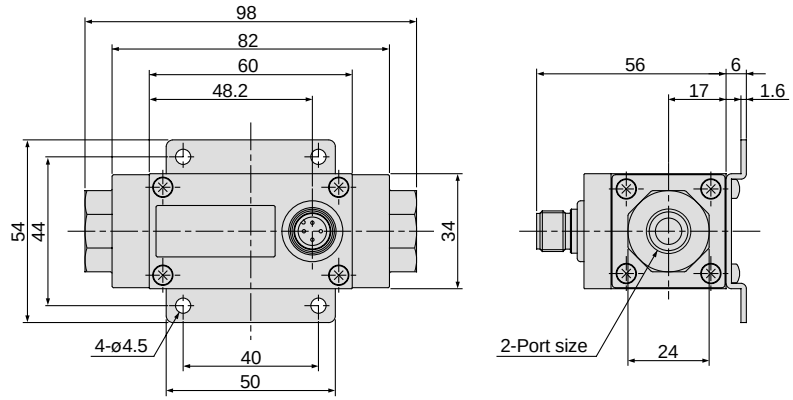
Connector pin numbers

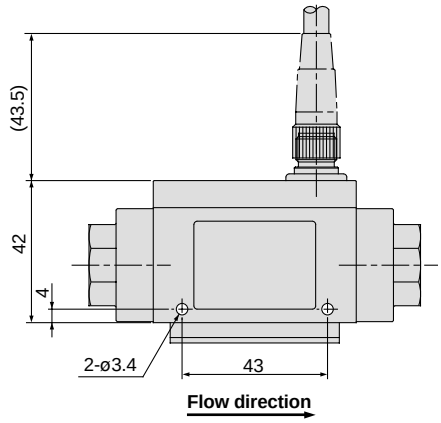


Pin no.	Pin description
1	DC (+)
2	OUT2/Analog output
3	DC (–)
4	OUT1

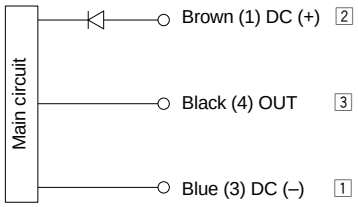
Dimensions/Remote Type Sensor Unit for Air

PFA510/550



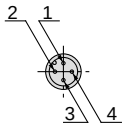


Wiring



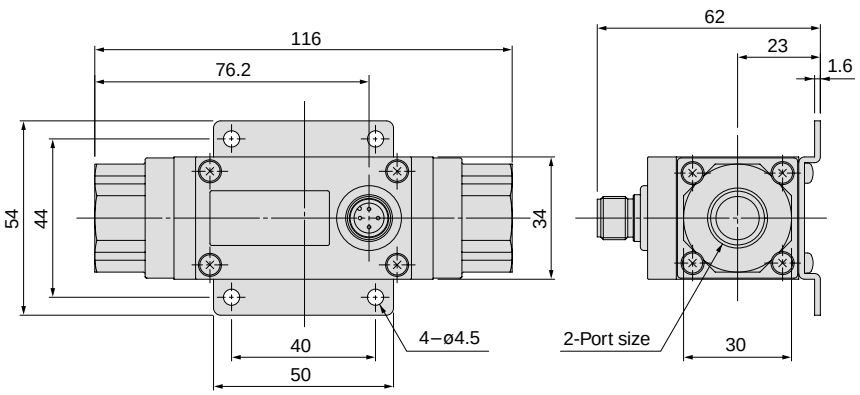
∗ Use this sensor by connecting it with the SMC remote type display unit series PFA3□□.
(1), (3), and (4) are connector pin numbers.
1, 2, and 3 are the series PFA3□□ terminal numbers.

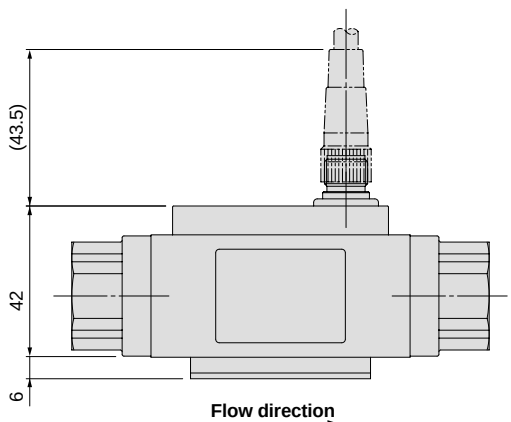
Connector pin numbers



Pin no.	Pin description
1	DC (+)
2	NC
3	DC (–)
4	OUT

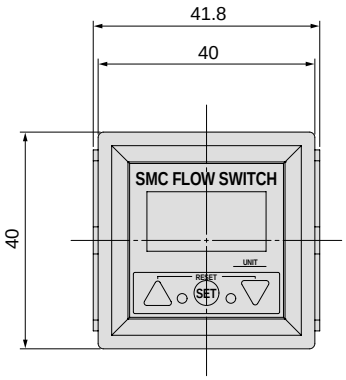
PFA511/521/551

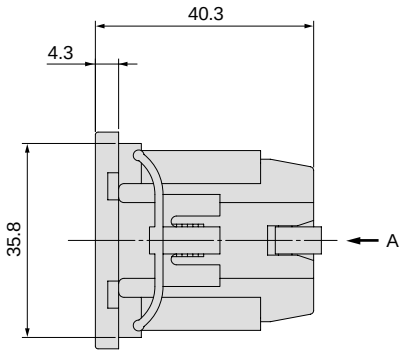


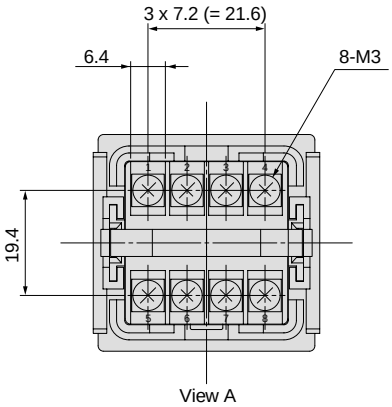


Dimensions/Remote Type Display Unit for Air

PFA3□□-A
Panel mounting type

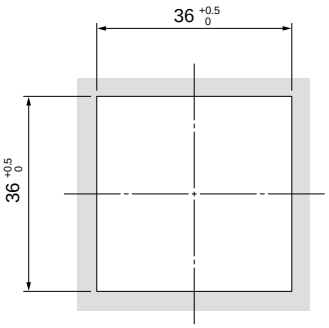






View A

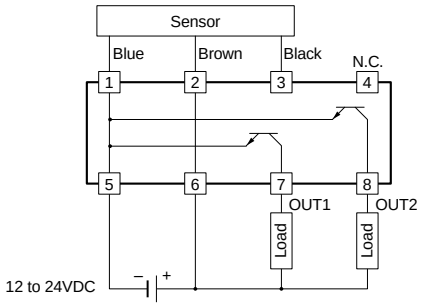
Panel fitting dimensions



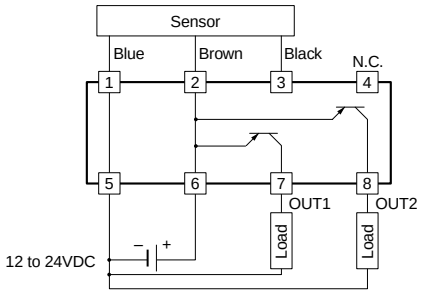
∗ The applicable panel thickness is 1 to 3.2mm.

Internal circuit and wiring examples

1 to 8 are terminal numbers.

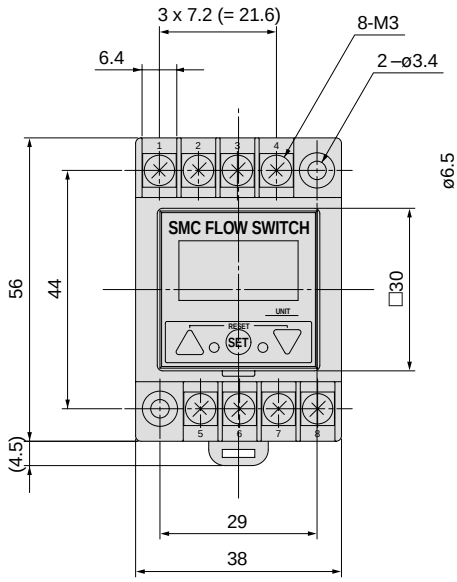


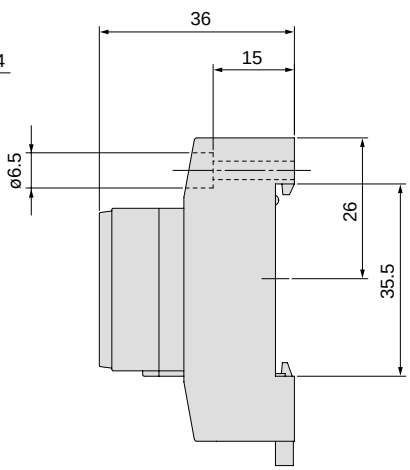
PFA3□0-□(-M)

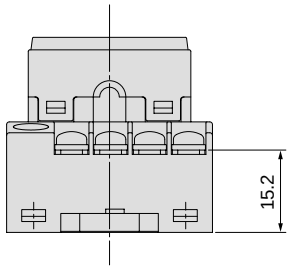


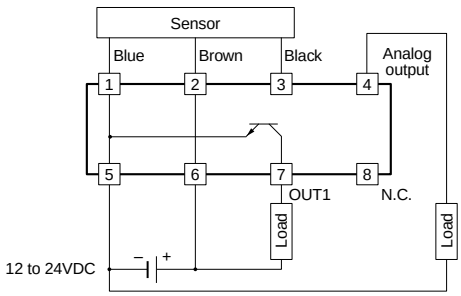
PFA3□1-□(-M)

PFA3□□-B
DIN rail type

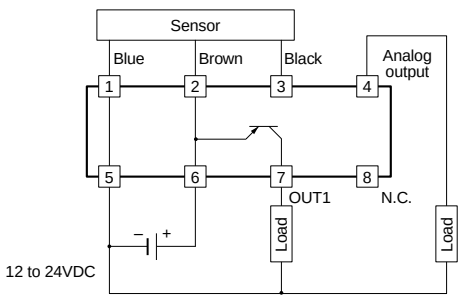








PFA312-□(-M)



PFA313-□(-M)

For Air

Digital Flow Switch/High Flow Rate Type

Series PFA

How to order

Integrated display type

PFA7 □ H — □ □ — □ □ — □

Flow rate range

03	150 to 3000/min
06	300 to 6000/min
12	600 to 12000/min

High flow rate type

Port specification

Nil	Rc
N	NPT
F	G

Port size

Symbol	Port size	Flow rate (/min) 3000	6000	12000	Applicable model
10	1	●			PFA703H
14	1 1/2		●		PFA706H
20	2			●	PFA712H

Wiring specification

Nil	3m lead wire with connector
N	Without lead wire

Output specification

28	NPN open collector 1 output + Analog output (1 to 5V)
29	NPN open collector 1 output + Analog output (4 to 20mA)
68	PNP open collector 1 output + Analog output (1 to 5V)
69	PNP open collector 1 output + Analog output (4 to 20mA)

Switching of switch output and cumulative pulse output is possible with NPN or PNP open collector outputs.

Unit specification

Nil	With unit switching function
M	Fixed SI unit Note)

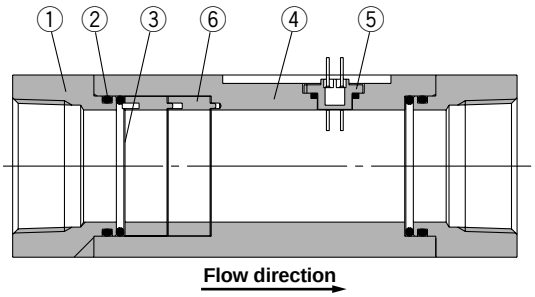
Note) Fixed units:
Real-time flow rate: /min
Accumulated flow: , m³, m³ x 10³

Specifications

Model		PFA703H	PFA706H	PFA712H
Measured fluid		Dry air		
Detection type		Heater type		
Flow rate measurement range Note 5)		150 to 3000/min	300 to 6000/min	600 to 12000/min
Minimum setting unit Note 5)		5/min	10/min	
Display units Note 1)	Real-time flow rate	/min, CFM		
	Accumulated flow	, m³, m³ x 10³, ft³, ft³ x 10³, ft³ x 10⁶		
Operating pressure range		0.1 to 1.5MPa		
Withstand pressure		2.25MPa		
Pressure loss		20kPa (at maximum flow rate)		
Accumulated flow range		0 to 9,999,999,999		
Operating temperature range		0 to 50°C (with no condensation)		
Linearity Note 2)		±1.5% F.S. or less (0.7MPa, at 20°C)		
Repeatability		±1.0% F.S. or less (0.7MPa, at 20°C)		
Pressure characteristics		±1.5% F.S. or less (0.1 to 1.5MPa, based on 0.7MPa)		
Temperature characteristics		±2.0% F.S. or less (0 to 50°C, based on 25°C)		
Output specifications	Switch output Note 3)	NPN open collector Max. load current: 80mA, Max. applied voltage: 30V, Internal voltage drop: 1V or less (with load current of 80mA)		
		PNP open collector Max. load current: 80mA, Internal voltage drop: 1.5V or less (with load current of 80mA)		
	Accumulated pulse output Note 3)	NPN or PNP open collector Flow rate per pulse: 100/pulse, 10.0ft³/pulse ON time per pulse: 50msec/pulse		
	Analog output Note 4)	Output voltage: 1 to 5V, Load impedance: 100kΩ or more		
		Output current: 4 to 20mA, Load impedance: 250kΩ or more		
Response time		1s or less		
Hysteresis		Hysteresis mode: Variable (can be set from 0), Window comparator mode: (can be set from 0 to 3% F.S.)		
Power supply voltage		24VDC (ripple ±10% or less)		
Current consumption		150mA or less		
Withstand voltage		1000VAC for 1 min. between external terminal block and case		
Insulation resistance		50MΩ (500VDC) between external terminal block and case		
Noise resistance		1000Vp-p, Pulse width 1μs, Rise time 1ns		
Vibration resistance		10 to 500Hz at whichever is smaller, amplitude 1.5mm or acceleration 98m/s², in X, Y, Z directions, 2 hours each		
Impact resistance		490m/s² in X, Y, Z directions, 3 times each		
Weight		1.1kg (without lead wire)	1.3kg (without lead wire)	2.0kg (without lead wire)
Enclosure		Equivalent to IP65		
Port size (Rc, NPT, G)		1	1 1/2	2

Note 1) For the type with unit switching function [The type without the unit switching function will have a fixed SI unit (/min, or , m³ or m³ x 10³).]
Note 2) The high flow rate type is with CE marking. However, the linearity with applied noise is ±5% F.S. or less.
Note 3) Switch output and accumulated pulse output selections are made by button operation.
Note 4) The analog output operates only for real-time flow rate, and does not operate for accumulated flow.
Note 5) Flow rate display can be switched between the basic condition of 0°C, 101.3kPa and the standard condition (ANR) of 20°C, 101.3kPa, 65% RH.

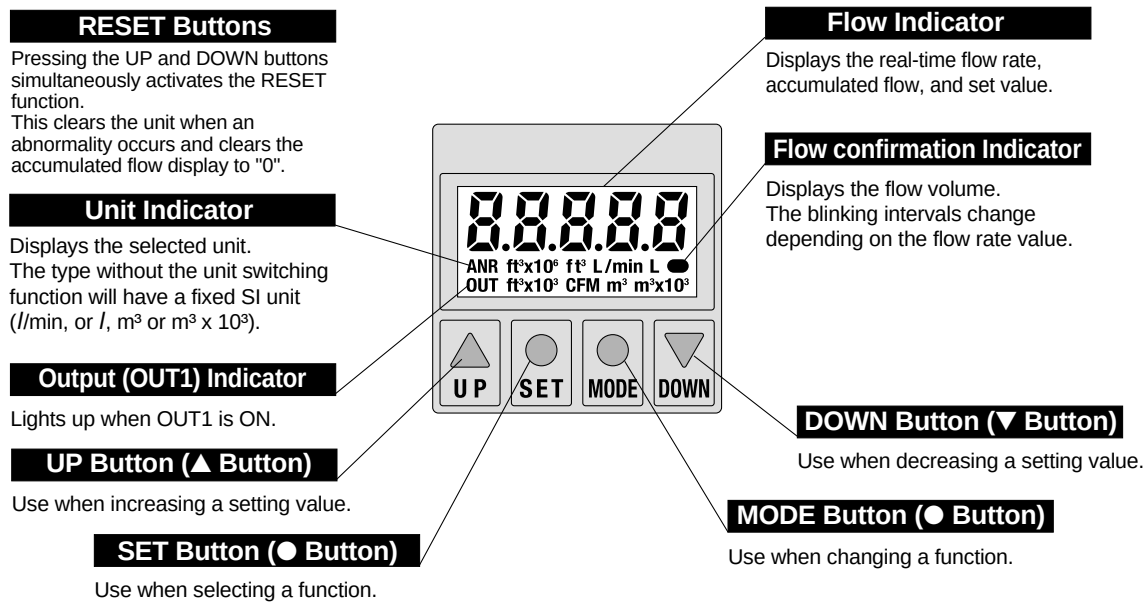
Construction



Parts list

No.	Description	Material	Note
1	**Attachment**	Aluminum alloy	Anodized
2	**Seal**	H, NBR	—
3	**Mesh**	Stainless steel	—
4	**Body**	Aluminum alloy	Anodized
5	**Sensor**	PPS	—
6	**Spacer**	PBT	—

Operating Unit Descriptions



Error Correction

Take the following corrective actions when errors occur.

LED display	Problem	Corrective action
Err-1	A current of more than 80mA is flowing to OUT1.	Check the load and wiring for OUT1.
Err-3	The setting data has changed due to some influence.	Perform the RESET operation, and set all data again.
-----	The flow rate exceeds over the flow measurement range.	Reduce the flow rate until it is within the flow rate measurement range, using an adjustment valve, etc.

Connectors

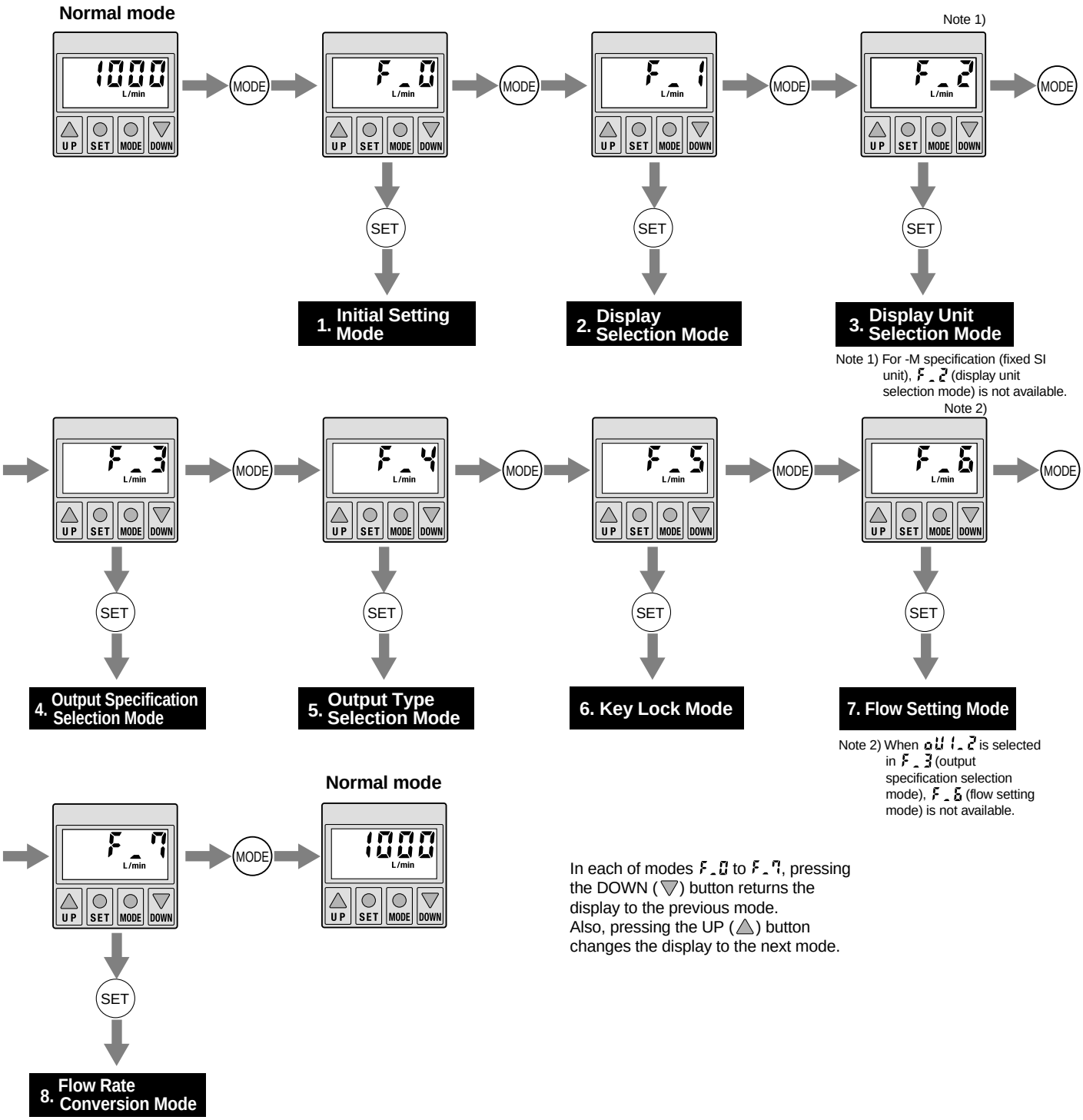
Since the connectors (female contacts) shown below can be used, please refer to the respective manufacturers.

Connector size	Number of pins	Manufacturers	Applicable series
M12	4	C. CORRENS & CO., LTD.	VA-4D
		OMRON Corporation	XS2
		Yamatake-Honeywell Co., Ltd.	PA5-4I
		Hirose Electric Company	HR24
		DDK Ltd.	CM01-8DP4S

Note) C. CORRENS & CO., LTD. is the general agent in Japan for Hirschmann.

Operation

Function configuration



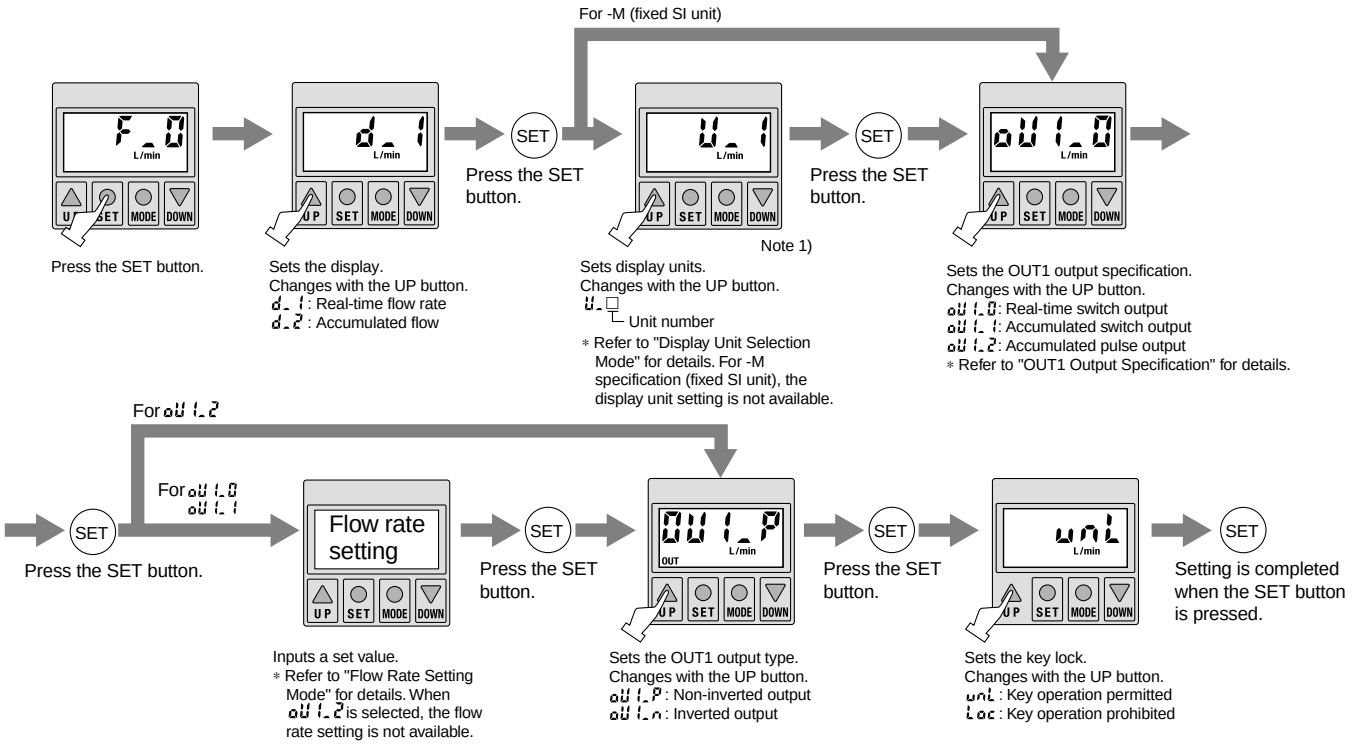
Note 1) For -M specification (fixed SI unit), F_2 (display unit selection mode) is not available.

Note 2) When oUt_2 is selected in F_3 (output specification selection mode), F_6 (flow setting mode) is not available.

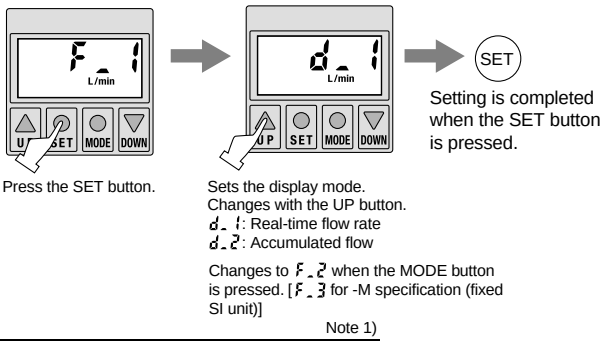
In each of modes F_0 to F_7, pressing the DOWN (▽) button returns the display to the previous mode.
Also, pressing the UP (△) button changes the display to the next mode.

Operation

1. Initial Setting Mode



2. Display Selection Mode



3. Display Unit Selection Mode

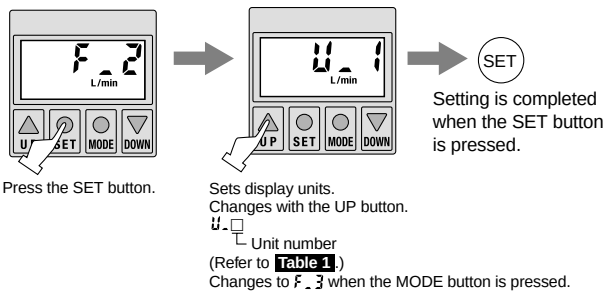
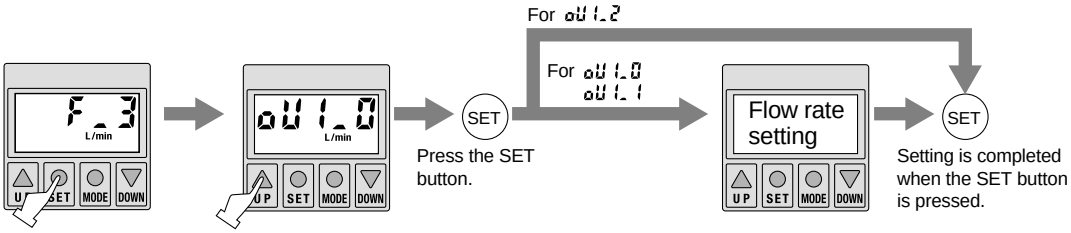


Table 1

Display	Real-time flow rate	Accumulated flow
U_1	l/min	*l*, m³, m³ x 10³
U_2	CFM	ft³, ft³ x 10³, ft³ x 10⁶

Note 1) For the type with unit switching function
[The type without the unit switching function will have a fixed SI unit (*l*/min, or *l*, m³ or m³ x 10³)].

4. Output Specification Selection Mode



Press the SET button.

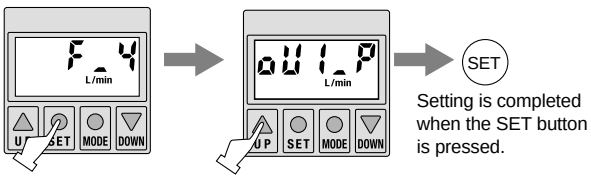
Sets the OUT1 output specification.
Changes with the UP button.
oU1_0 : Real-time switch output
oU1_1 : Accumulated switch output
oU1_2 : Accumulated pulse output
Refer to the OUT1 output specifications.
Changes to F_4 when the "MODE" button is pressed.

Press the SET button.

Input a set value.
∗ Refer to "Flow Rate Setting Mode" for details. When oU1_2 is selected, the flow rate setting is not available.

Setting is completed when the SET button is pressed.

5. Output Type Selection Mode



Press the SET button.

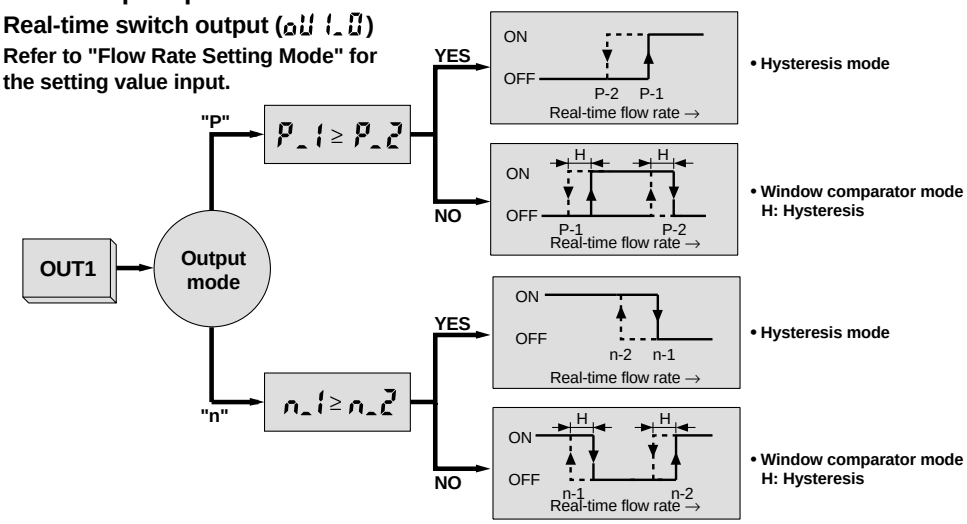
Sets the OUT1 output type.
Changes with the UP button.
oU1_P : Non-inverted output
oU1_n : Inverted output
Changes to F_5 when the MODE button is pressed.

Setting is completed when the SET button is pressed.

OUT1 output specifications

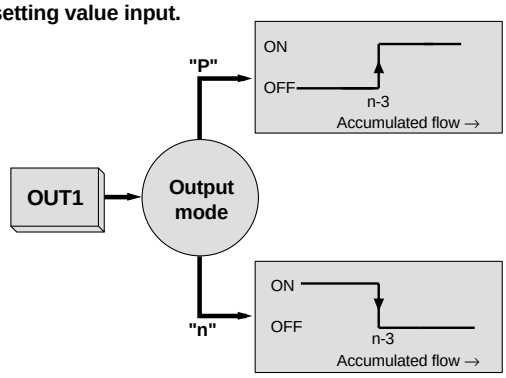
Real-time switch output (oU1_0)

Refer to "Flow Rate Setting Mode" for the setting value input.



Accumulated switch output (oU1_1)

Refer to "Flow Rate Setting Mode" for the setting value input.



Accumulated pulse output (oU1_2)

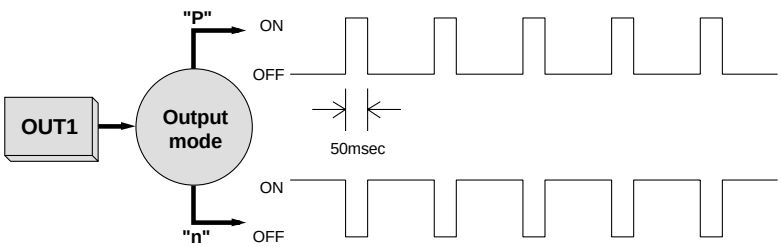


Table 2 Flow rate value per pulse Note 1)

Display	Accumulated flow
U_1	100ℓ/pulse
U_2	10.0ft³/pulse

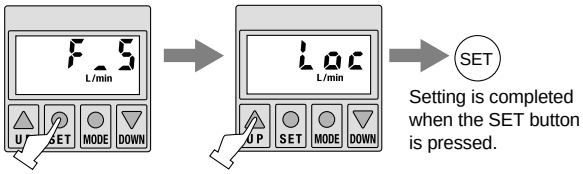
Note 1) For the type with unit switching function
[The type without the unit switching function will have a fixed SI unit (ℓ/min, or ℓ, m³ or m³ x 10³).]

Operation

6. Key Lock Mode

Prevents the misoperation of buttons.

Lock the key operation

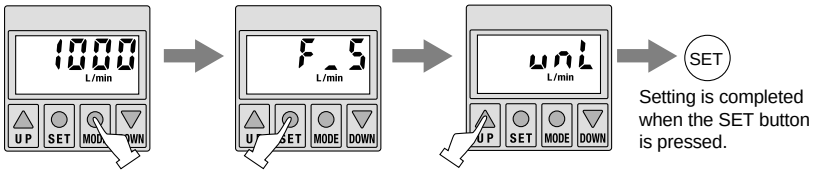


Press the SET button.

Changes with the UP button.
unL: Key operation permitted
Loc: Key operation prohibited
Changes to F_6 when the MODE button is pressed.
(Changes to F_7 when oUt_2 is selected in F_3.)

Setting is completed when the SET button is pressed.

Unlock the key operation



Press the MODE button continuously for 3 seconds or more.

Press the SET button.

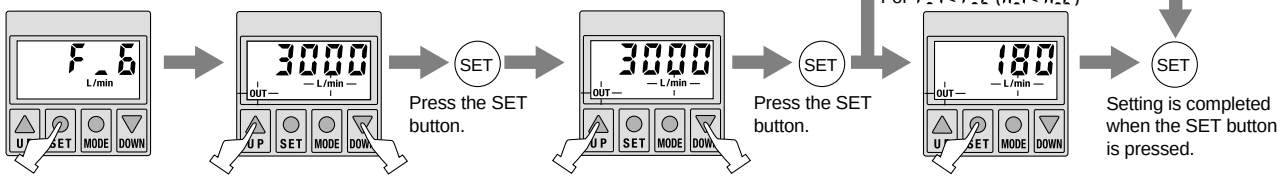
Using the UP button, set the display to unL.

Setting is completed when the SET button is pressed.

7. Flow Setting Mode

Input a set value.
The input method differs depending on the OUT1 output specification.

Real-time switch output (oUt_0)



Press the SET button.

Press the SET button.

Enter the setting value.
The setting value and P_1 (or n_1) are displayed alternately.
UP Button: Increases the setting value
DOWN Button: Decreases the setting value

Press the SET button.

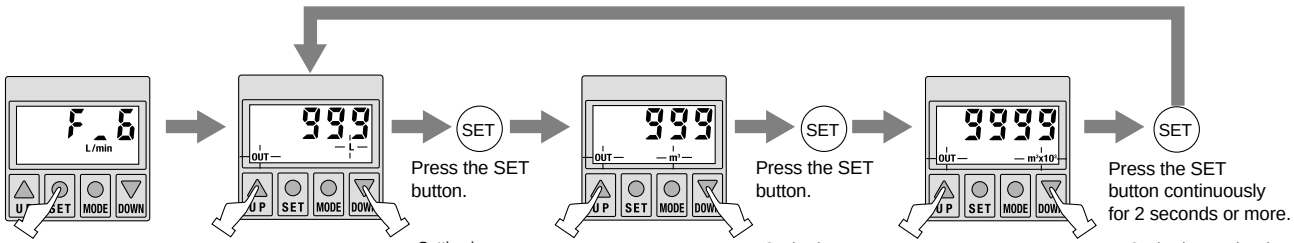
Enter the setting value.
The setting value and P_2 (or n_2) are displayed alternately.
UP Button: Increases the setting value
DOWN Button: Decreases the setting value

Setting is completed when the SET button is pressed.

P_1 < P_2 (n_1 < n_2): Window comparator mode
Sets the hysteresis value.
The hysteresis value and HIS are displayed alternately.
UP Button: Increases the setting value
DOWN Button: Decreases the setting value
The hysteresis value can be set between 0 to 3% of the rated flow rate value. However, if the difference between P_1 (n_1) and P_2 (n_2) is less than 6% of the rated flow rate value, the difference between P_1 (n_1) and P_2 (n_2) will be half for the maximum hysteresis setting value.

P_1 ≥ P_2 (n_1 ≥ n_2): Hysteresis mode
Hysteresis value setting is not available.

Accumulated switch output (oUt_1)



Press the SET button.
The setting value can be set up to 9,999 [m³ x 10³], 999 [m³] or 999 [/].

Enter the setting value.
The setting value and P_3 (or n_3) are displayed alternately.
UP Button: Increases the setting value
DOWN Button: Decreases the setting value

Setting is completed when the SET button is pressed continuously for 2 seconds or more.

Press the SET button.

Enter the setting value.
The setting value and P_3 (or n_3) are displayed alternately.
UP Button: Increases the setting value
DOWN Button: Decreases the setting value

Setting is completed when the SET button is pressed continuously for 2 seconds or more.

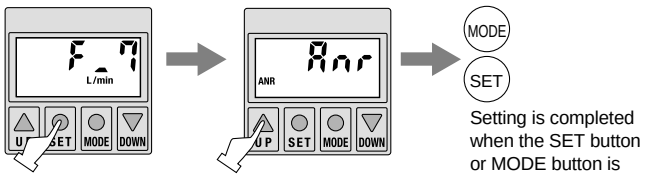
Press the SET button.

Enter the setting value.
The setting value and P_3 (or n_3) are displayed alternately.
UP Button: Increases the setting value
DOWN Button: Decreases the setting value

Press the SET button continuously for 2 seconds or more.

Setting is completed when the SET button is pressed continuously for 2 seconds or more.

8. Flow Conversion Mode



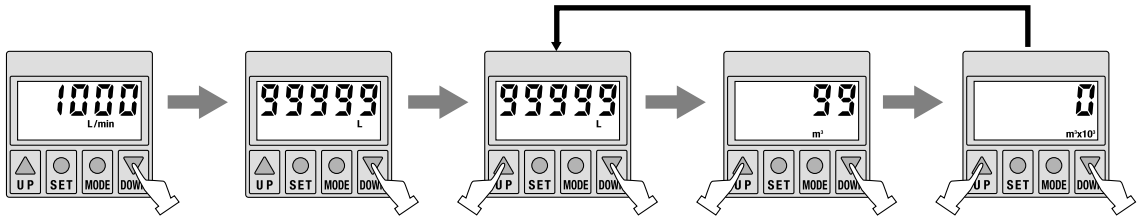
Press the SET button.

Sets flow conversion conditions.
Changes with the UP button.
ANR : 20°C, 101.3kPa, 65% RH (ANR)
NOR : 0°C, 101.3kPa

Setting is completed when the SET button or MODE button is pressed.

Flow display confirmation

Confirming the accumulated flow when real-time flow rate is selected

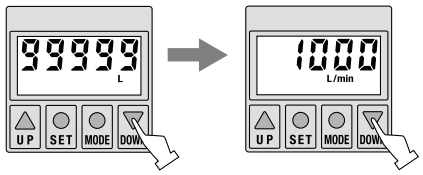


Press the DOWN button.

Displays the accumulated flow while the DOWN button is pressed.
(Returns to the real-time flow rate display when the DOWN button is released.)

Pressing the UP button while pressing the DOWN button changes the accumulated flow unit.

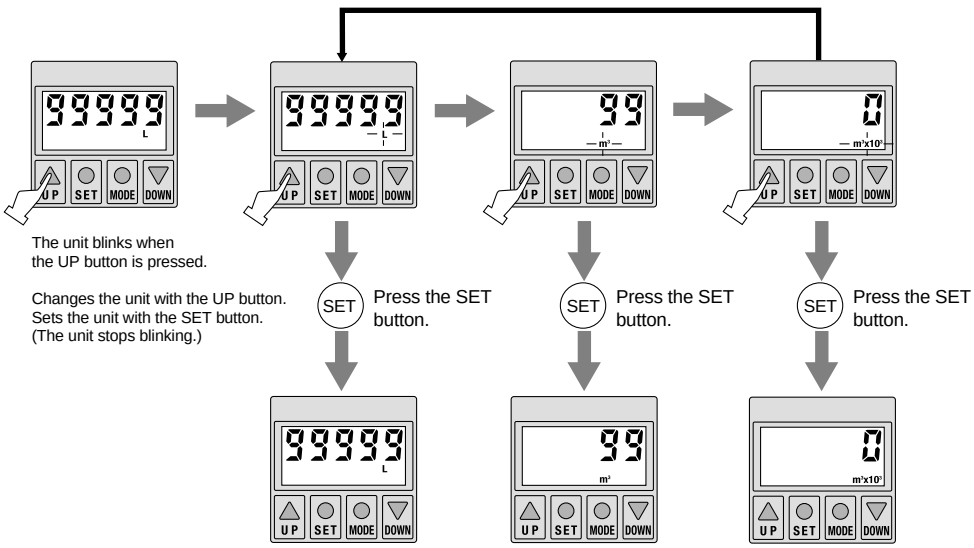
Confirming the real-time flow rate when accumulated flow is selected



Press the DOWN button.

Displays the real-time flow rate while the DOWN button is pressed.
(Returns to the accumulated flow display when the DOWN button is released.)

Changing the accumulated flow unit (Sets the accumulated flow display unit when accumulated flow is selected.)



The unit blinks when the UP button is pressed.

Changes the unit with the UP button.
Sets the unit with the SET button.
(The unit stops blinking.)

SET Press the SET button.

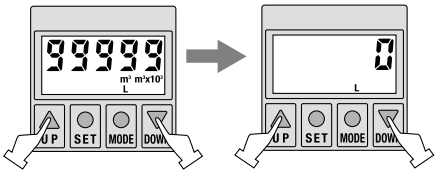
SET Press the SET button.

SET Press the SET button.

∗ When the buttons are not operated for 5 seconds, the unit stops blinking automatically and exits from changing of the accumulated flow display unit. The accumulated flow display unit does not change in this case.

Operation

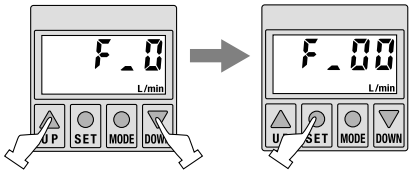
Clearing the accumulated value



Press the UP button while pressing the DOWN button.

The accumulated value is cleared when the buttons are pressed continuously for 5 seconds or more.

Initializing the setting



In the initial setting mode F_0, press the UP button and DOWN button for 2 seconds or more.

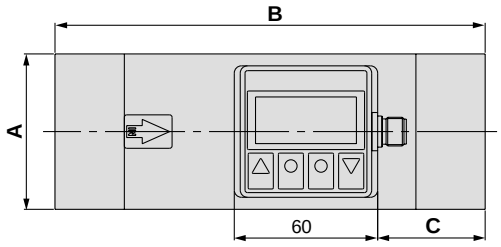
When the SET button is pressed, the setting returns to the factory setting.

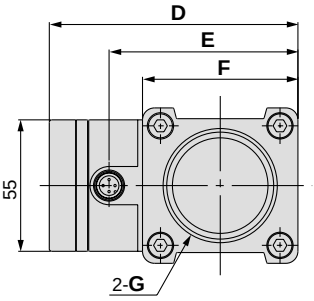
Factory setting
Display setting: Real-time flow rate (d_1)
Unit setting : l/min (U_1)
Switch specification: Real-time switch output (oU1_0)
Output mode: Inverted output (oU1_n)
Flow rate setting value: Real-time flow rate Full range median value
Accumulated flow 0
Key lock mode: Unlocked (unL)
Flow rate conversion conditions: 20°, 101.3kPa, 65% RH (ANR) (Rnr)

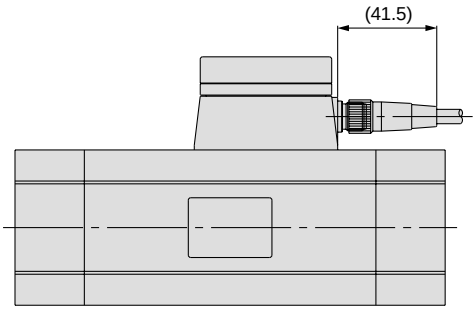
When the MODE button is pressed, the setting changes to F_0 without initializing the setting.

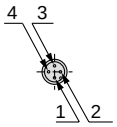
Dimensions

PFA703H/706H/712H



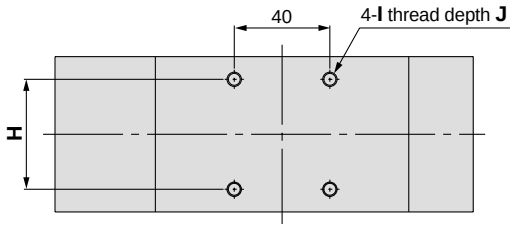




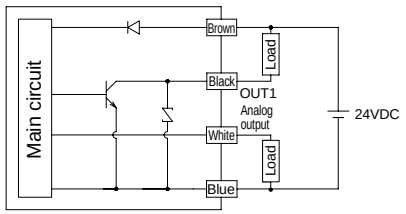


Connector pin numbers

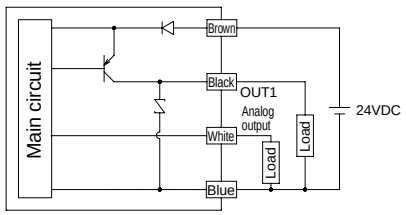
Pin no.	Pin description
1	DC (+)
2	Analog output
3	DC (–)
4	OUT1



Internal circuit and wiring examples

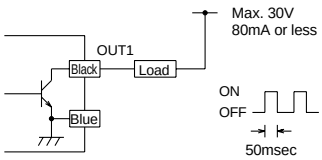


PFA7□□H-□□-$\frac{28}{29}$(-M)

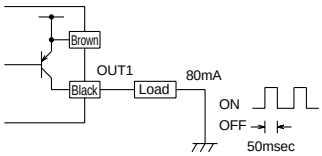


PFA7□□H-□□-$\frac{68}{69}$(-M)

Accumulated pulse output wiring examples



PFA7□□H-□□-$\frac{28}{29}$(-M)

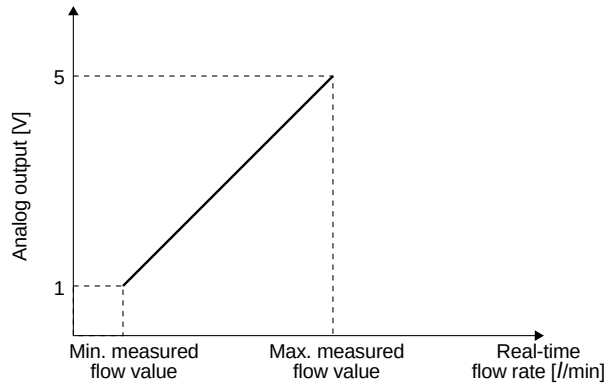


PFA7□□H-□□-$\frac{68}{69}$(-M)

Model	A	B	C	D	E	F	G	H	I	J
PFA703H	55	160	40	92	67	55	Rc 1, NPT 1, G 1	36	M5 x 0.8	8
PFA706H	65	180	45	104	79	65	Rc 1 1/2, NPT 1 1/2, G 1 1/2	46	M6 x 1	9
PFA712H	75	220	55	114	89	75	Rc 2, NPT 2, G 2	56	M6 x 1	9

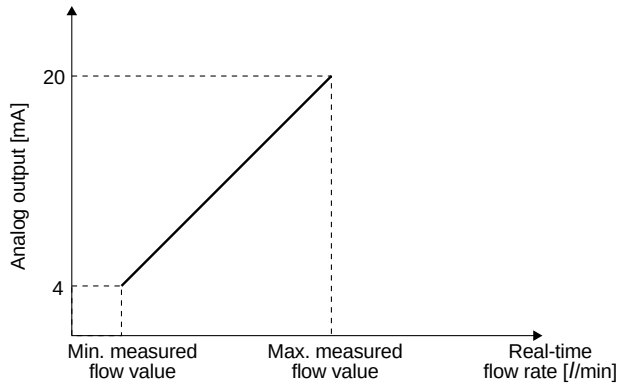
Analog output

1 to 5VDC



Part no.	Minimum measured flow value [l/min]	Maximum measured flow rate value [l/min]
PFA703H-□-28 **PFA703H-□-68**	150	3000
PFA706H-□-28 **PFA706H-□-68**	300	6000
PFA712H-□-28 **PFA712H-□-68**	600	12000

4 to 20mA DC



Part no.	Minimum measured flow value [l/min]	Maximum measured flow value [l/min]
PFA703H-□-29 **PFA703H-□-69**	150	3000
PFA706H-□-29 **PFA706H-□-69**	300	6000
PFA712H-□-29 **PFA712H-□-69**	600	12000

For Water

Digital Flow Switch

Series PFW

How to order

Integrated display type **PFW7 20 – □ 03 – 27 □ – □**

Flow rate range

04	0.5 to 4 l/min
20	2 to 16 l/min
40	5 to 40 l/min

Thread type

Nil	Rc
N	NPT
F	G

Port size

Symbol	Size	Flow rate (l/min) 4	16	40	Applicable model
03	3/8	●	●		PFW704, PFW720
04	1/2		●	●	PFW720, PFW740
06	3/4			●	PFW740

Output specification

27	NPN open collector 2 outputs
67	PNP open collector 2 outputs

Wiring specification

Nil	3m lead wire with connector
N	Without lead wire

Unit specification

Nil	With unit switching function
M	Fixed SI unit Note)

Note) Fixed units:
Real-time flow rate: l/min
Accumulated flow: l

Specifications

Model		PFW704	PFW720	PFW740
Measured fluid		Water		
Detection type		Karman vortex		
Flow rate measurement and setting range		0.5 to 4 (setting is 0.6 to 4) l/min	2 to16l/min	5 to 40l/min
Minimum setting unit		0.05l/min	0.1l/min	0.5l/min
Display units Note 1)	Real-time flow rate	l/min, gal (US)/min		
	Accumulated flow	l, gal (US)		
Operating pressure range		0 to 1MPa		
Withstand pressure		1.5MPa		
Accumulated flow range		0 to 999999l		
Operating temperature range		0 to 50°C (with no condensation)		
Linearity		±5% F.S. or less		
Repeatability		±3% F.S. or less		
Temperature characteristics		±5% F.S. or less (0 to 50°C)		
Output specifications Note 2)	Switch output	NPN open collector: Maximum load current: 80mA, Internal voltage drop: 1V or less (with load current of 80mA) Maximum applied voltage: 30V		
		PNP open collector: Maximum load current: 80mA Internal voltage drop: 1.5V or less (with load current of 80mA)		
Indicator lights		Lights up when ON, OUT1: Green, OUT2: Red		
Response time		1s or less		
Hysteresis		Hysteresis mode: Variable (can be set from 0), Window comparator mode: Fixed (3 digits) Note 3)		
Power supply voltage		12 to 24VDC (ripple ±10% or less)		
Current consumption		70mA or less		
Withstand voltage		1000VAC for 1 min. between external terminal block and case		
Insulation resistance		50MΩ (500VDC) between external terminal block and case		
Noise resistance		1000Vp-p, Pulse width 1µs, Rise time 1ns		
Vibration resistance		10 to 500Hz at whichever is smaller, amplitude 1.5mm or acceleration 98m/s², in X, Y, Z directions, 2 hours each		
Impact resistance		490m/s² in X, Y, Z directions, 3 times each		
Weight		460g (without lead wire)	520g (without lead wire)	700g (without lead wire)
Enclosure		Equivalent to IP65		
Port size (Rc, NPT, G)		3/8	3/8, 1/2	1/2, 3/4

Note 1) For the type with unit switching function [The type without the unit switching function will have a fixed SI unit (l/min or l).]
Note 2) The output functions operate only for the real-time flow rate display, and do not operate for the accumulated flow display.
Note 3) Window comparator mode — Since hysteresis is 3 digits, separate P1 and P2 by 7 digits or more. 1 digit is the minimum setting unit (refer to the table above).

How to order

Remote Type Display Unit **PFW3 0 0 — A — □**

Flow rate range

1	0.5 to 4 l/min
0	2 to 16 l/min
2	5 to 40 l/min

Output specification

0	NPN open collector 2 outputs
1	PNP open collector 2 outputs

Mounting

A	Panel mount
B	DIN rail, Wall mount

Panel mount adapter part no.

Description	Panel adapter B
Part No.	ZS-22-02

Unit specification

Nil	With unit switching function
M	Fixed SI unit Note)

Note) Fixed units:
Real-time flow rate: l/min
Accumulated flow: l

Specifications

Model		PFW310	PFW311	PFW300	PFW301	PFW320	PFW321
Flow measuring and setting range		0.5 to 4 (setting is 0.6 to 4) l/min		2 to 16 l/min		5 to 40 l/min	
Minimum setting unit		0.05 l/min		0.1 l/min		0.5 l/min	
Display units Note 1)	Real-time flow rate	l/min, gal (US)/min					
	Accumulated flow	l, gal (US)					
Accumulated flow range		0 to 999999 l					
Operating temperature range		0 to 50°C (with no condensation)					
Linearity Note 2)		±5% F.S. or less					
Repeatability Note 2)		±3% F.S. or less					
Temperature characteristics Note 2)		±5% F.S. or less (0 to 50°C)					
Output specifications Note 3)	Switch output	NPN open collector	Maximum load current: 80mA Maximum applied voltage: 30V Internal voltage drop: 1V or less (with load current of 80mA)				
		PNP open collector	Maximum load current: 80mA Internal voltage drop: 1.5V or less (with load current of 80mA)				
Indicator lights		Lights up when ON, OUT1: Green, OUT2: Red					
Response time		1s or less					
Hysteresis		Hysteresis mode: Variable (can be set from 0) Window comparator mode: Fixed (3 digits) Note 4)					
Power supply voltage		12 to 24VDC (ripple ±10% or less)					
Current consumption		50mA or less					
Weight		45g					
Enclosure		Equivalent to IP40					

Note 1) For the type with unit switching function [The type without the unit switching function will have a fixed SI unit (l/min or l).]
Note 2) The system accuracy when combined with PFW5□□.
Note 3) The output functions operate only for the real-time flow rate display, and do not operate for the accumulated flow display.
Note 4) Window comparator mode — Since hysteresis is 3 digits, separate P1 and P2 by 7 digits or more. 1 digit is the minimum setting unit (refer to the table above).

How to order

Remote Type Sensor Unit **PFW5 20 — □ 03 □**

Flow rate range

04	0.5 to 4ℓ/min
20	2 to 16ℓ/min
40	5 to 40ℓ/min

Wiring specification

Nil	3m lead wire with connector
N	Without lead wire

Thread type

Nil	Rc
N	NPT
F	G

Port size

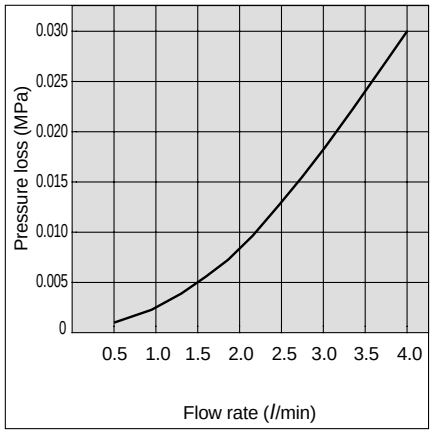
Symbol	Size	Flow rate (ℓ/min)			Applicable model
		4	16	40	
03	3/8	●	●		PFW504, 520
04	1/2		●	●	PFW520, 540
06	3/4			●	PFW540

Specifications

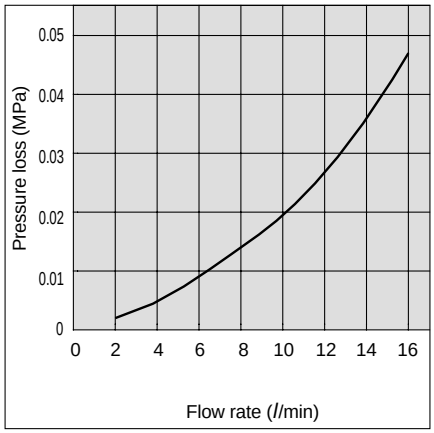
Model	PFW504	PFW520	PFW540
Measured fluid	Water		
Detection type	Karman vortex		
Flow measuring range	0.5 to 4ℓ/min	2 to 16ℓ/min	5 to 40ℓ/min
Operating pressure range	0 to 1MPa		
Withstand pressure	1.5MPa		
Operating temperature range	0 to 50°C (with no condensation)		
Power supply voltage	12 to 24VDC (ripple ±10% or less)		
Current consumption	20mA or less		
Weight	410g (without lead wire)	470g (without lead wire)	650g (without lead wire)
Enclosure	Equivalent to IP65		
Port size (Rc, NPT, G)	3/8	3/8, 1/2	1/2, 3/4

Flow Characteristics (Pressure Loss)

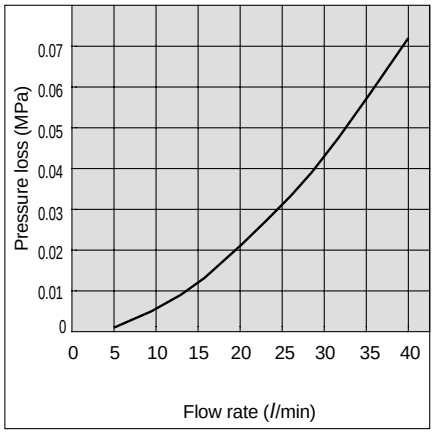
PFW704, 504



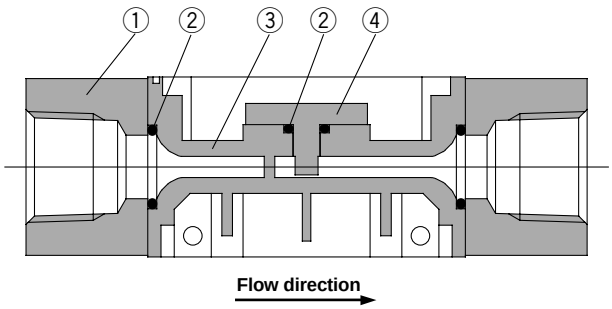
PFW720, 520



PFW740, 540



Sensor Unit Construction



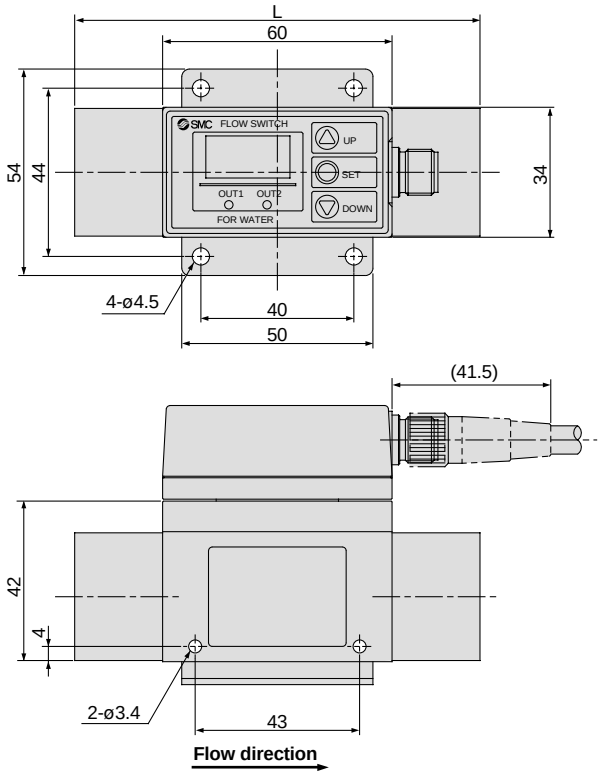
Parts list

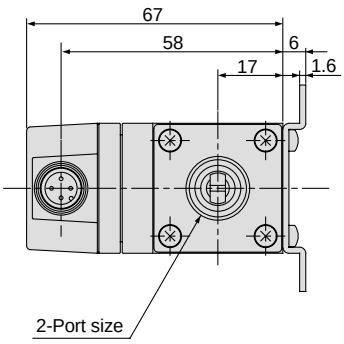
No.	Description	Material
1	**Attachment**	Stainless steel
2	**Seal**	NBR
3	**Body**	PPS
4	**Sensor**	PPS

Error correction, connectors, operating part descriptions, and flow rate setting are the same as series PFA for air. Refer to pages 88 through 91.

Dimensions/Integrated Display Type **for Water**

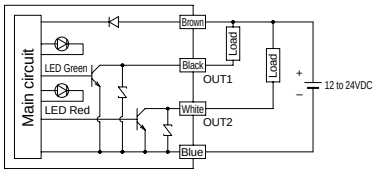
PFW704/720



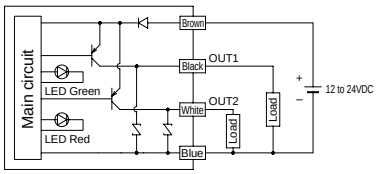


Model	Dimension L
PFW704	100
PFW720	106

Internal circuit and wiring examples

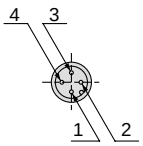


PFW7□□-□□-27□ (-M)



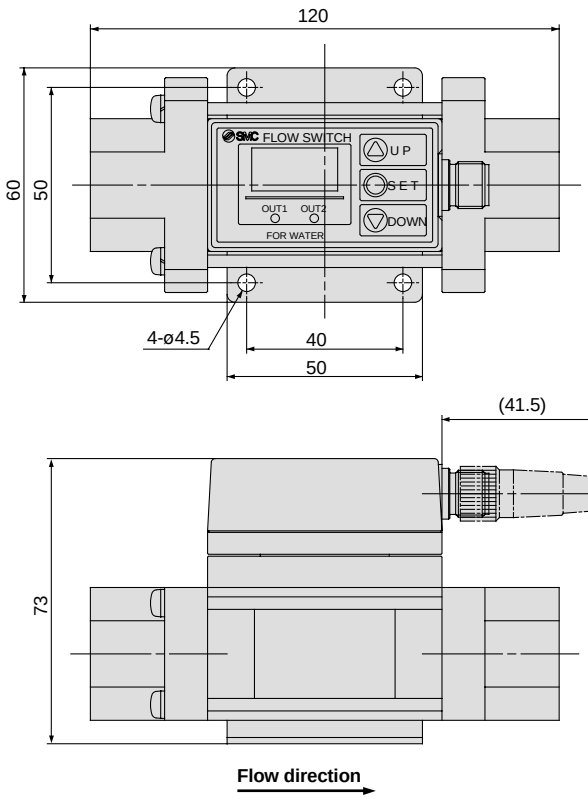
PFW7□□-□□-67□ (-M)

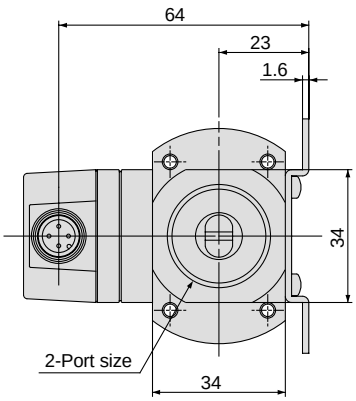
Connector pin numbers



Pin no.	Pin description
1	DC (+)
2	OUT2
3	DC (–)
4	OUT1

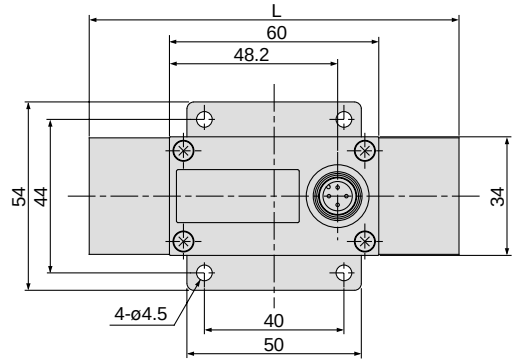
PFW740

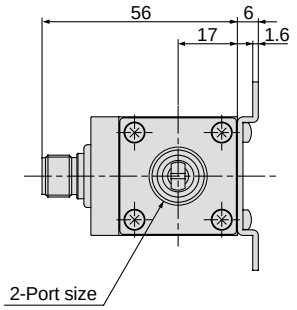


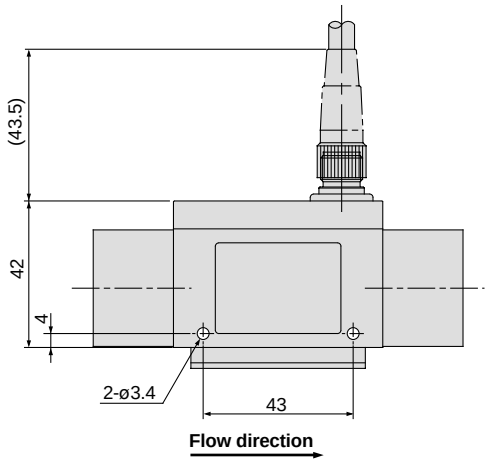


Dimensions/Remote Type Sensor Unit for Water

PFW504/520

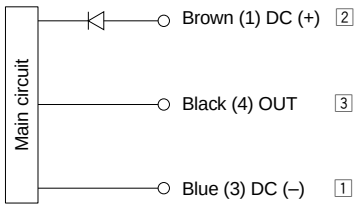






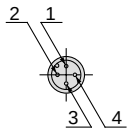
Model	Dimension L
PFW504	100
PFW520	106

Wiring



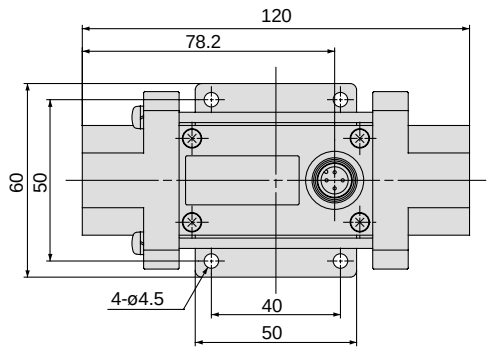
∗ Use this sensor by connecting it with the SMC remote type display unit series PFW3□□.
(1), (3), and (4) are connector pin numbers.
1, 2, and 3 are the series PFW3□□ terminal numbers.

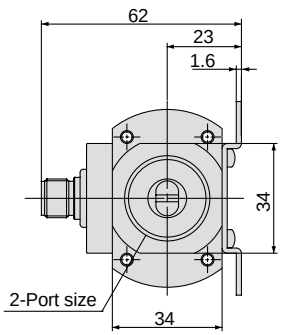
Connector pin numbers

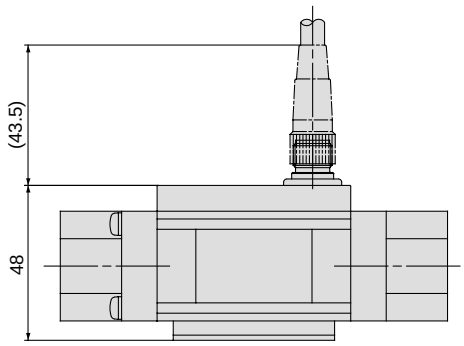


Pin no.	Pin description
1	DC (+)
2	N C
3	DC (–)
4	OUT

PFW540

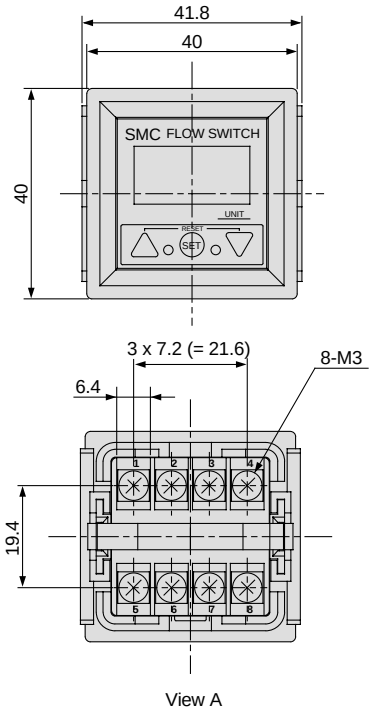


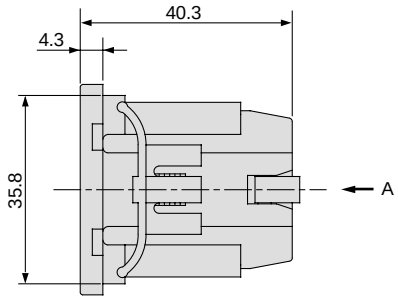




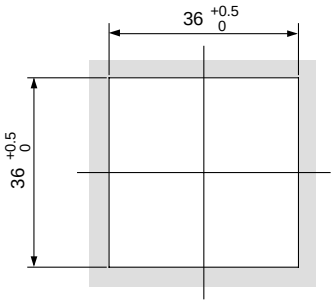
Dimensions/Remote Type Display Unit for Water

PFW3□□-A
Panel mount type



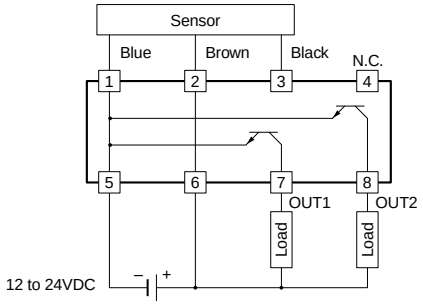


Panel fitting dimensions

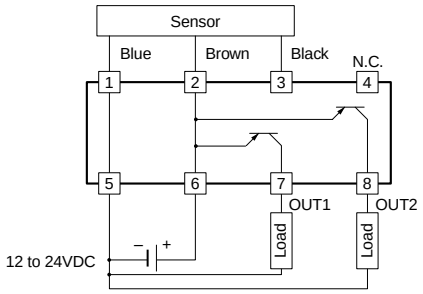


∗ The applicable panel thickness is 1 to 3.2mm.

Internal circuits and wiring

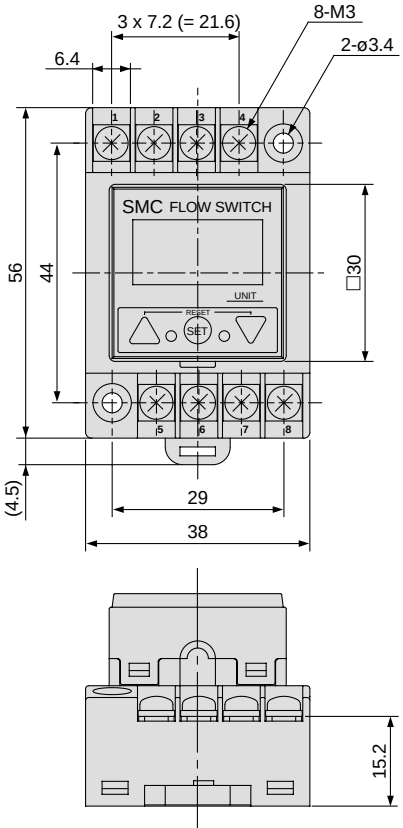


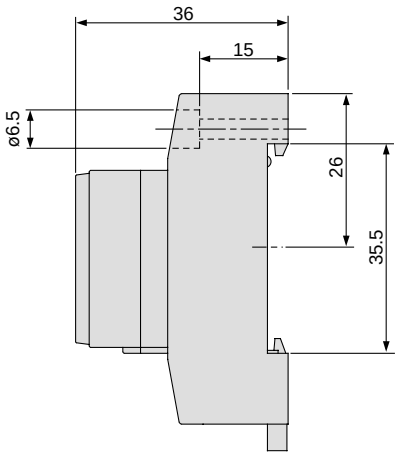
PFW3□0-□ (-M)



PFW3□1-□ (-M)

PFW3□□-B
DIN rail type





High precision/High resolution

Vacuum pressure: 1/1000 (0.1kPa)
Compound pressure: 1/2000 (0.1kPa)
Positive pressure: 1/1000 (0.001MPa)

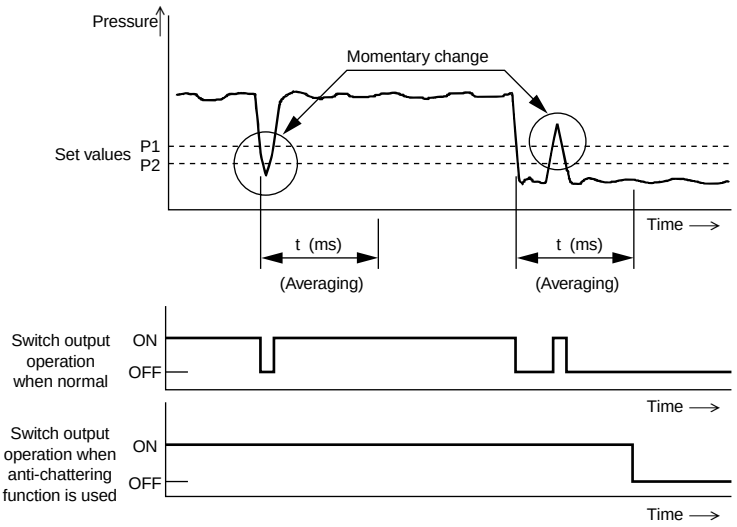
High speed response: 2.5ms or less with anti-chattering function

Stable switch output is possible even with sudden changes in the primary pressure (when operating large bore cylinders, etc.)

Anti-chattering function
Devices such as large bore cylinders and high-flow vacuum ejectors consume a large volume of air when they operate, and this may cause a momentary drop in the primary pressure. This function prevents such momentary pressure drops from being detected as abnormal pressures by allowing the response time selection to be changed.

[Selectable response times: t]
2.5ms (normal), 24ms, 192ms or 768ms
The normal setting is selected when shipped from the factory.

(Operating principle)
The pressure values measured within the user-selected response time are averaged, and switch output (ON/OFF) is determined by comparing this averaged pressure value with the set pressure.



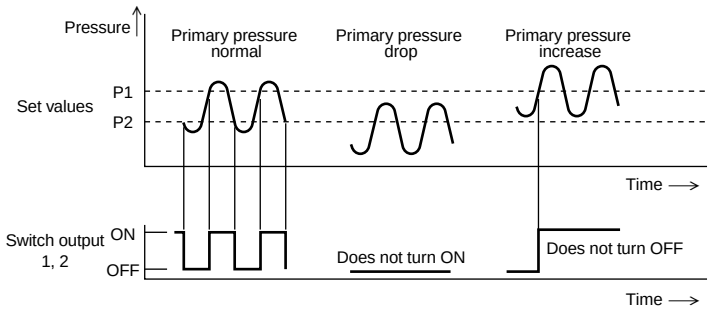
With auto shift function

Allows switch to compensate for variations in primary pressure.

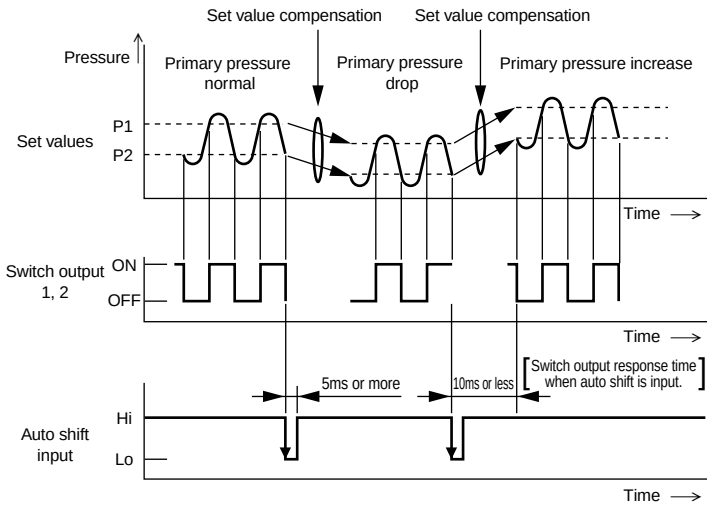
Auto shift function
Erroneous operation may occur if there is fluctuation in the primary pressure.
The auto shift function compensates for pressure changes to ensure proper ON/OFF switch response during such fluctuations.

(Operating principle)
At the point when the primary pressure fluctuates, the set pressure value is compensated by setting the auto shift input (external input) to Lo (no-voltage) input, using the pressure measured at that point as a standard.

Without using auto shift
When the primary pressure fluctuates, a correct determination becomes impossible.



When using auto shift



Compound pressure (ZSE40F)

Able to detect suction pressure (vacuum pressure) and release pressure (positive pressure) with a single pressure switch.

Three types of piping

Different piping methods are possible to accommodate the installation location.

Repeatability
±0.2% F.S. ±1digit or less

IP65 compatible
Dust-tight/Splash proof type

How to Order

Set pressure range

Nil	–0.100 to 1.000MPa	For positive pressure

For Positive Pressure **ISE40** — **01** — **22** — ☐ — ☐ — ☐

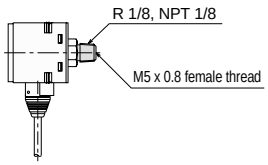
For Vacuum/Compound Pressure **ZSE40** — ☐ — **01** — **22** — ☐ — ☐ — ☐

Set pressure range

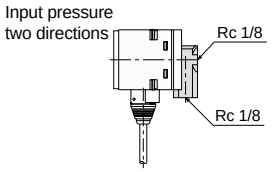
Nil	10.0 to –101.3kPa	**For vacuum pressure**
F	–100.0 to 100.0kPa	**For compound pressure**

Piping specification

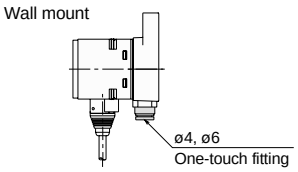
01: R 1/8 (with M5 female thread)
T1: NPT 1/8 (with M5 female thread)



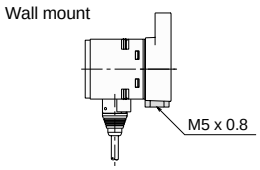
W1: Rc 1/8



C4: With ø4 One-touch fitting*
C6: With ø6 One-touch fitting*



M5: M5 x 0.8 (female thread)*



* Optional

Piping specifications/Option combinations

	Piping specification						
Description	Symbol	01	T1	W1	C4	C6	M5
Bracket A	A	○	○	○	x	x	x
Bracket B	B	x	x	○	x	x	x
Bracket D	D	○	○	○	x	x	x
Panel mount	E	○	○	○	○	○	○
Panel mount + Front protection	F	○	○	○	○	○	○

○: Combination available x: Combination not available

Input/Output specification

22	NPN open collector 2 outputs + Analog output
30	NPN open collector 2 outputs + Auto shift input
62*	PNP open collector 2 outputs + Analog output
70*	PNP open collector 2 outputs + Auto shift input

* Optional

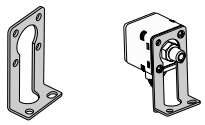
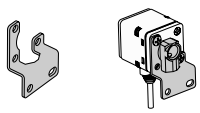
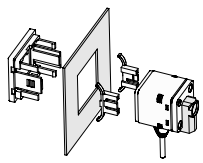
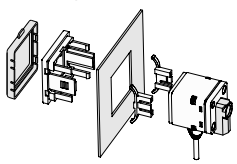
Note) When equipped with auto shift function, the following ranges can be set.

Set pressure range	Setting range
–100.0 to 100.0kPa	–100.0 to 100.0kPa
10.0 to –101.3kPa	–101.3 to 101.3kPa
–0.1 to 1.000MPa	–1.000 to 1.000MPa

Lead wire length

Nil	0.6m
L	3m

Option

Nil	None
A	Bracket A (ZS-24-A) 
B	Bracket B (ZS-24-B) 
D	Bracket D (ZS-24-D) Confirm on the dimensions page.
E	Panel mount (ZS-22-A) 
F	Panel mount + Front protective cover (ZS-24-C) 

* When only optional parts are required, order with the part numbers inside ( ).

Unit specifications

Nil	With unit switching function
M	Fixed SI units Note)

Note) Fixed units
For vacuum/compound pressure : kPa
For positive pressure : MPa

Specifications

		ZSE40F (Compound pressure)	ZSE40 (Vacuum pressure)	ISE40 (Positive pressure)
Rated pressure range		−100.0 to 100.0kPa	0.0 to −101.3kPa	0.000 to 1.000MPa
Operating pressure range/Set pressure range		−100.0 to 100.0kPa	10.0 to −101.3kPa	−0.100 to 1.000MPa
Withstand pressure		500kPa		1.5MPa
Set pressure resolution Note 1)	kPa	0.1		——
	MPa	——		0.001
	kgf/cm²	0.001		0.01
	bar	0.001		0.01
	psi	0.02	0.01	0.1
	mmHg	1		——
	InHg	0.1		——
Applicable fluid		Air, Non-corrosive/Non-flammable gas		
Power supply voltage		12 to 24VDC ±10%, Ripple (p–p) 10% or less		
Current consumption		55mA or less		
Switch output		NPN or PNP 2 outputs — Max. load current : 80mA; Max. applied voltage: 30VDC (with NPN output); Residual voltage : 1V or less (with 80mA load current)		
Repeatability		±0.2% F.S. ±1digit or less		
Hysteresis	Hysteresis mode	Variable		
	Window comparator mode	Fixed (3 digits) Note 4)		
Response time (with anti-chattering function)		2.5ms or less (With anti-chattering function: 24ms, 192ms and 768ms selections)		
Output short circuit protection		Yes		
Display		3 1/2 digit LED display (Sampling cycle: 5 times/sec.)		
Display accuracy		±2% F.S. ±1 digit or less (at ambient temperature of 25 ±3°C)		
Indicator lights		Green LED (OUT1: Lights when ON), Red LED (OUT2: Lights when ON)		
Analog output Note 2)		Output voltage: 1 to 5V ±5% F.S. or less (in rated pressure range) Linearity: ±1% F.S. or less Output impedance: Approx. 1kΩ	Output voltage: 1 to 5V ±2.5% F.S. or less (In rated pressure range) Linearity: ±1% F.S. or less Output impedance: Approx. 1kΩ	
Auto shift input Note 3)		No-voltage input (reed or solid state), Input 5ms or more		
Environmental resistance	Enclosure	IP65		
	Ambient temperature range	Operating: 0 to 50°C, Stored: –10 to 60°C (with no condensation or freezing)		
	Ambient humidity range	Operating/Stored: 35 to 85% RH (with no condensation)		
	Withstand voltage	1000VAC for 1min. between lead wires and case		
	Insulation resistance	50MΩ or more (at 500VDC) between lead wires and case		
	Vibration resistance	10 to 500Hz at whichever is smaller, amplitude 1.5mm or acceleration 98m/s² (10G), in X, Y, Z directions for 2hrs. each		
	Impact resistance	980m/s² (100G) in X, Y, Z directions 3 times each (deenergized)		
Temperature characteristics		In a temperature range of 0 to 50°C, ±2% F.S. or less of pressure measured at 25°C		
Port size		01: R1/8, M5 x 0.8, T1: NPT1/8, M5 x 0.8, W1: Rc1/8 C4: With ø4 One-touch fitting, C6: With ø6 One-touch fitting, M5: M5 female thread		
Lead wire		5 wire oil resistant heavy duty cord (0.15mm²)		
Weight		01/T1 types approx. 60g, W1 type approx. 80g, C4/C6/M5 types approx. 92g (each including 0.6m lead wires)		

Note 1) Equipped with unit switching function
[The type without the unit switching function will have a fixed SI unit (kPa or MPa).]

Note 2) For ZSE40 (F)/ISE40-□-$^{22}_{62}$

Note 3) For ZSE40 (F)/ISE40-□-$^{30}_{70}$

Note 4) For ZSE40F (compound pressure) with "psi" indication, this is 0.03 to 0.04 psi.

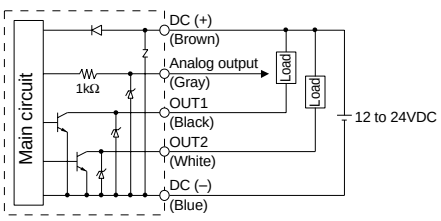
Note 5) For ZSE40F (compound pressure) with "psi" indication, zero clear is in the range of ±0.01 psi.

Note) When equipped with auto shift function, the following ranges can be set.

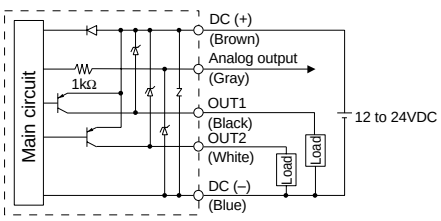
Set pressure range	Setting range
−100.0 to 100.0kPa	−100.0 to 100.0kPa
10.0 to −101.3kPa	−101.3 to 101.3kPa
−0.1 to 1.000MPa	−1.000 to 1.000MPa

Internal Circuits and Wiring Examples

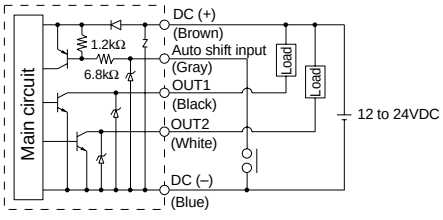
ZSE40(F)
ISE40-□-22(L)-(M)
With analog output



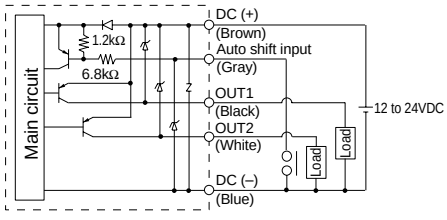
ZSE40(F)
ISE40-□-62(L)-(M)
With analog output



ZSE40(F)
ISE40-□-30(L)-(M)
With auto shift input

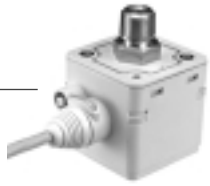


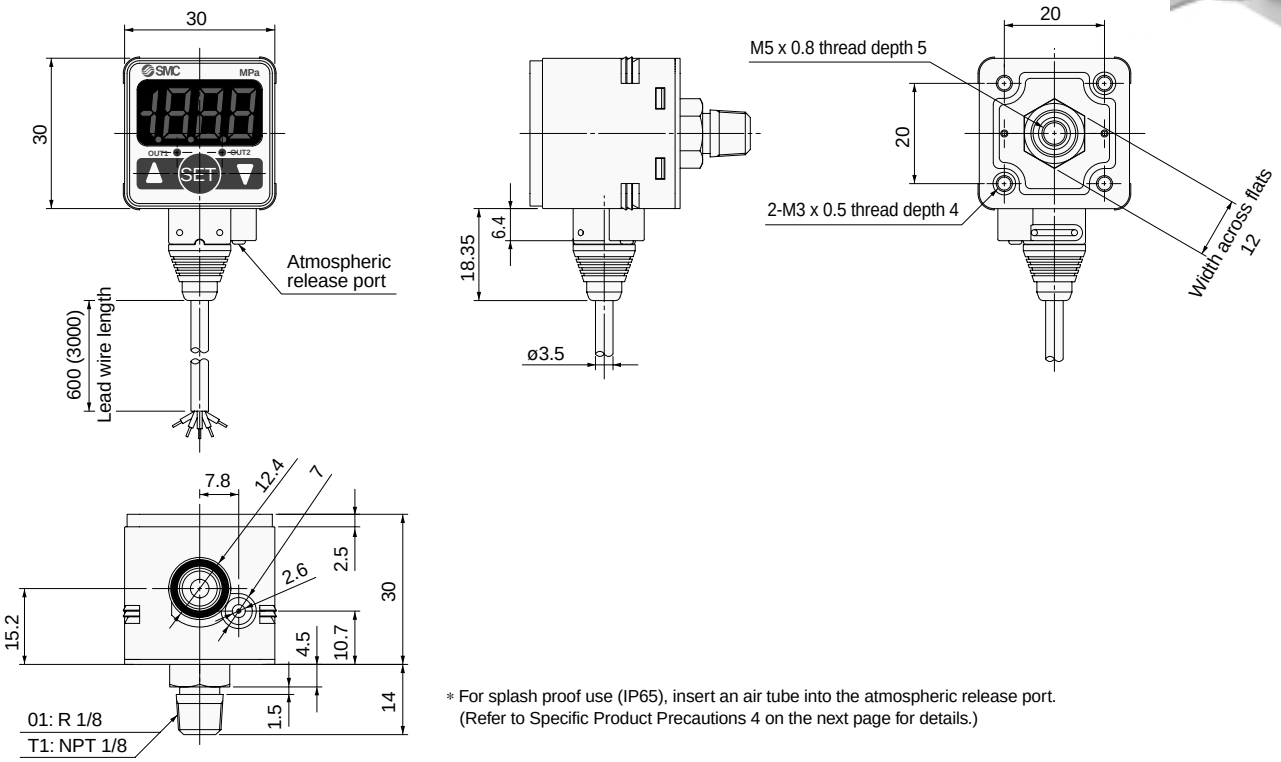
ZSE40(F)
ISE40-□-70(L)-(M)
With auto shift input



Dimensions

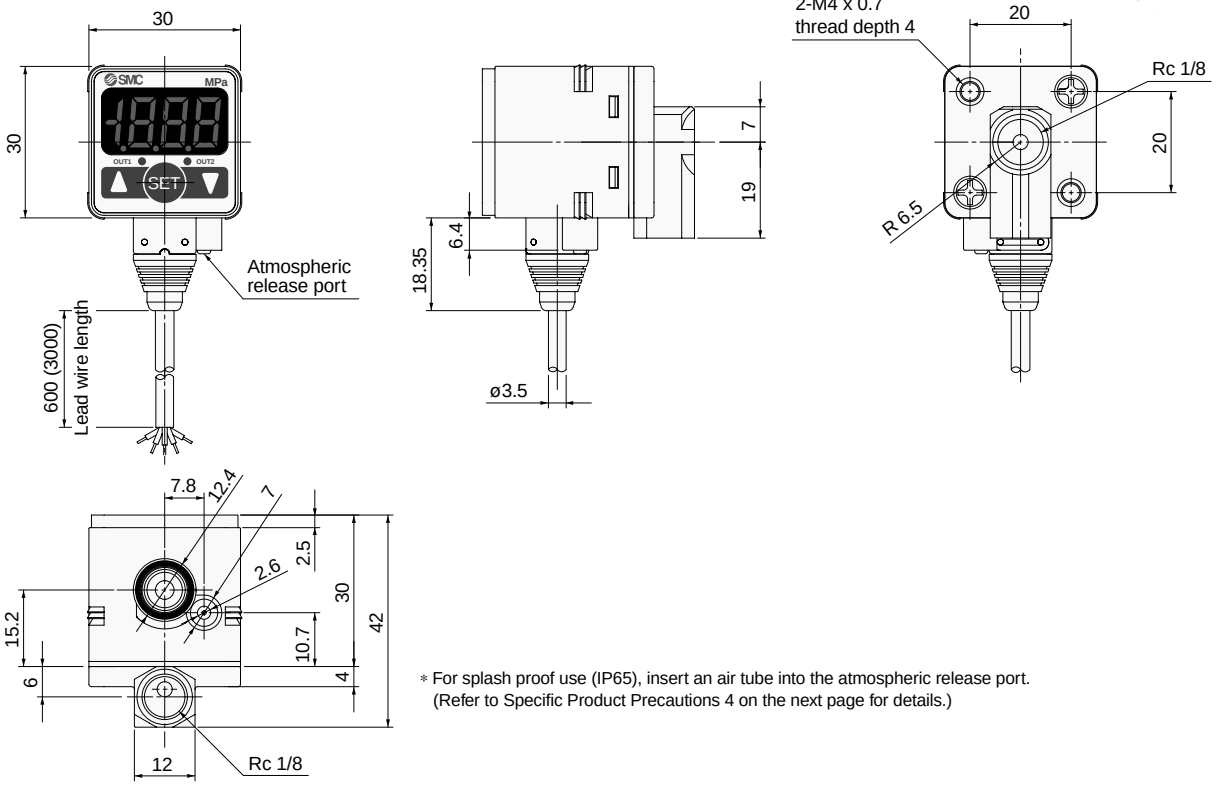
ZSE40(F)/ISE40– $\frac{01}{T1}$





∗ For splash proof use (IP65), insert an air tube into the atmospheric release port.
(Refer to Specific Product Precautions 4 on the next page for details.)

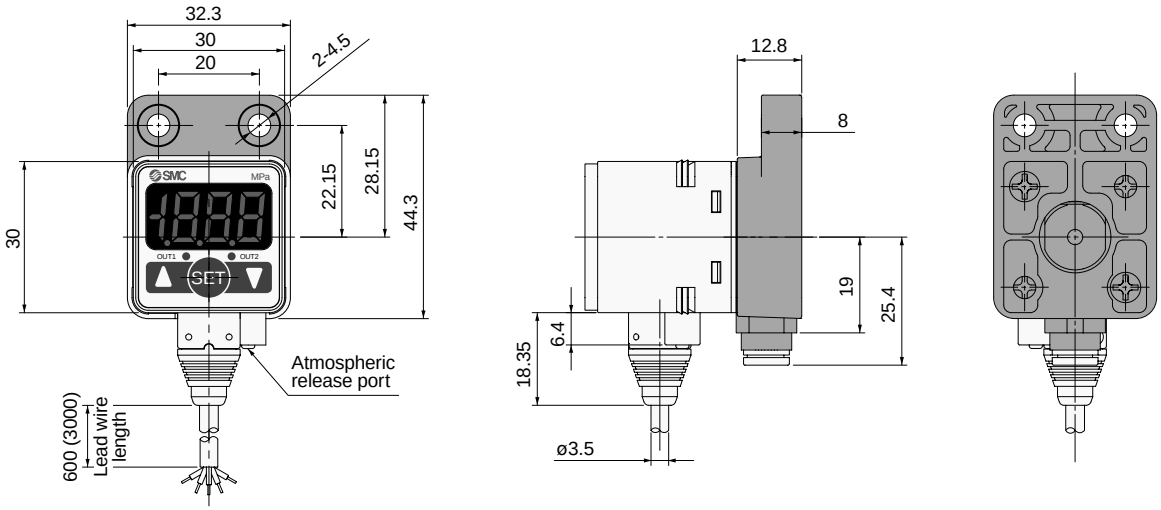
ZSE40(F)/ISE40–W1

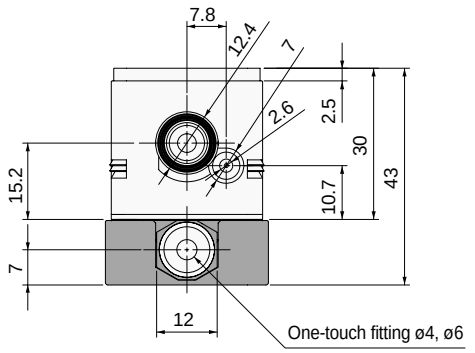


∗ For splash proof use (IP65), insert an air tube into the atmospheric release port.
(Refer to Specific Product Precautions 4 on the next page for details.)

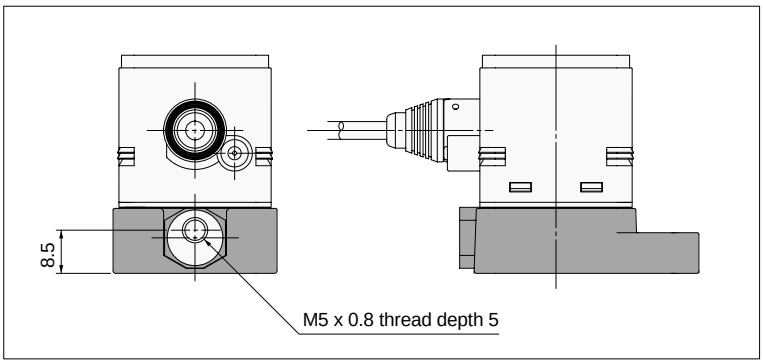
Dimensions

ZSE40(F)/ISE40– C4 C6 M5





For – **M5**

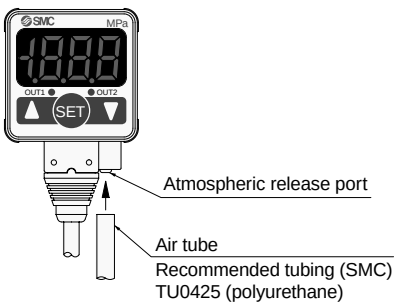


∗ For splash proof use (IP65), insert an air tube into the atmospheric release port.
(Refer to Specific Product Precautions 4 below for details.)

⚠ Specific Product Precautions

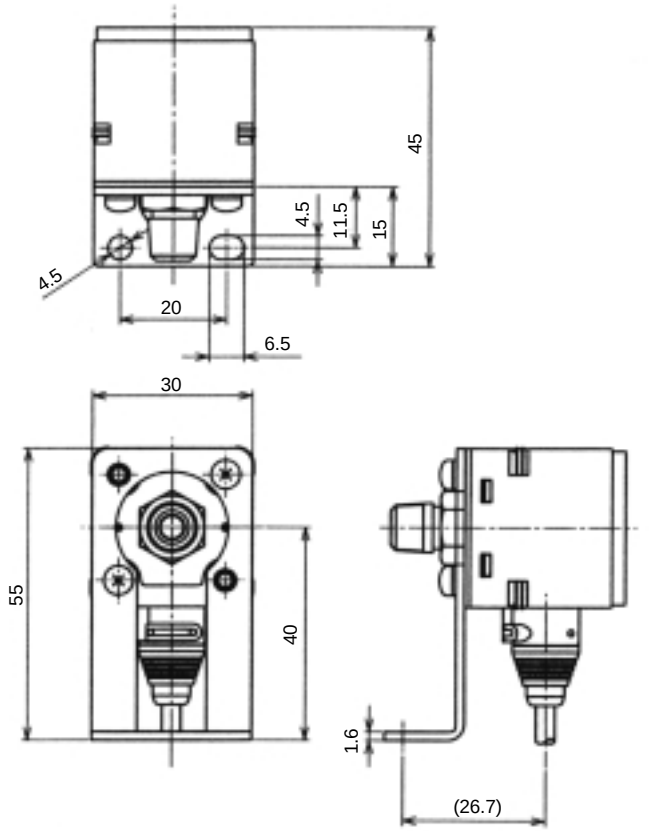
⚠ Caution

1. Immediately after supplying power, there is drift of about ±0.5% F.S. When used with very low pressure, allow the unit to warm up for about 20 to 30 minutes.
2. Do not use in locations where there is splashing or spraying of oils and solvents.
3. When using a commercially available switching regulator, be sure to ground the FG terminal.
4. In locations where the switch is exposed to water and dust, etc., these may enter the switch from the atmospheric release port. Insert ø4 tubing (inside diameter ø2.5) into the atmospheric release port, and extend the other end to a safe area where water, etc., is not splashed or sprayed. Be sure that tubing is not bent and holes are not blocked, etc., or it will become impossible to make correct pressure measurements.

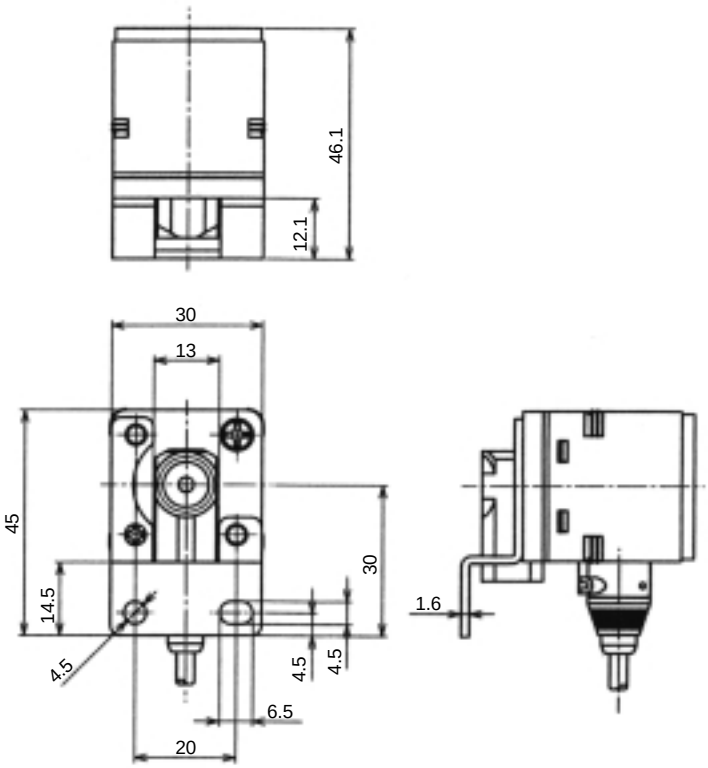


Dimensions with Bracket

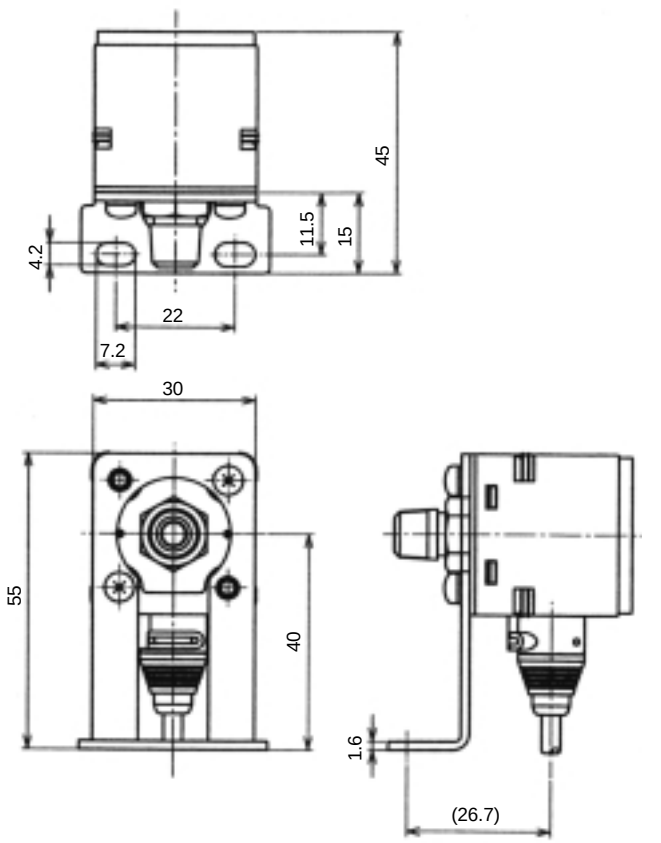
With bracket A (ZS-24-A)



With bracket B (ZS-24-B)



With bracket D (ZS-24-D)



LCD Display Type Digital Pressure Switch

Series ZSE3/ISE3

(For vacuum) (For positive pressure)

The digital display allows easy pressure setting.

For General Pneumatics

Data storage function

Since a dedicated IC (EEPROM) is used, set data will be stored for 100,000 hours (approximately 11 years) even without power.

Vacuum unit: Can be used as a modular unit with series ZX.

With suction filter

Built-in failure detection output function

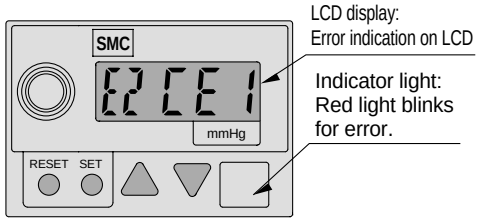
This feature senses an overall decrease in vacuum pressure due to clogged filter elements, worn vacuum pads or system leakage and and sends a warning output signal before a failure occurs.

Two independent pressure settings

This feature is ideal when a change of vacuum suction pad size requires two different set pressures, or switching of positive pressure lines requires confirmation of two pressures.

Self-diagnostic function

- **Overcurrent detection**
- **Excess pressure detection**
- **Data error**



Specifications

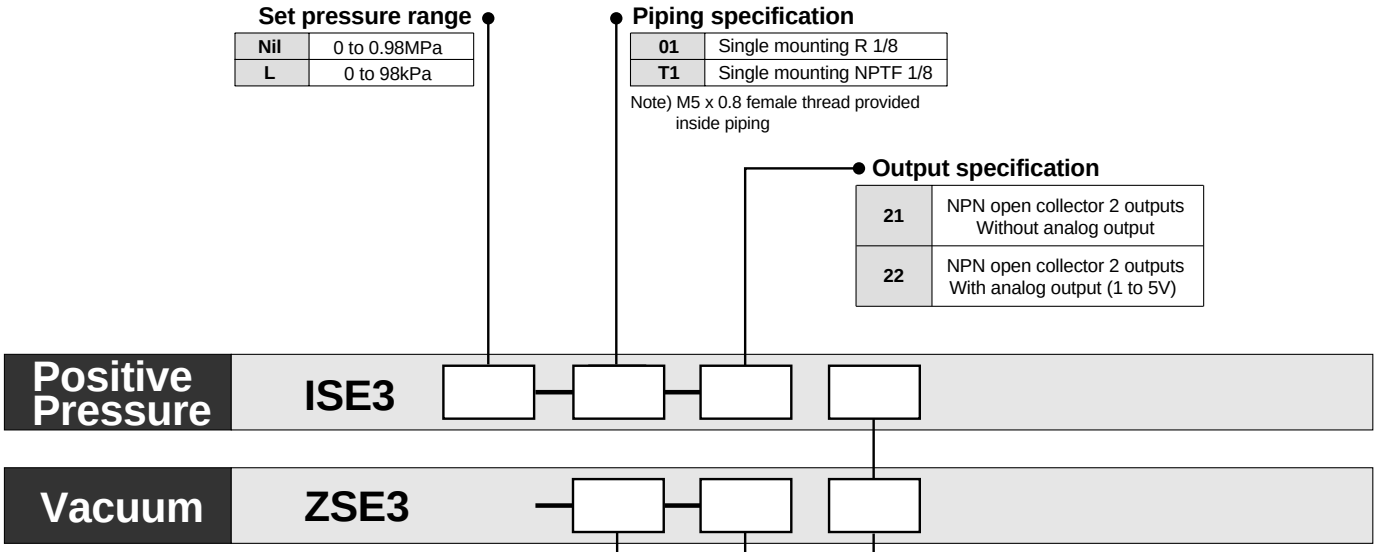
Model		Vacuum ZSE3	Positive pressure 100kPa ISE3L	Positive pressure 1MPa ISE3
Set pressure range		0 to −101kPa	0 to 98kPa	0 to 0.98MPa
Maximum pressure		200kPa Note 1)		1MPa
Minimum display unit	kPa	1	1	—
	MPa	—	—	0.01
Indicator light Note 2)		Lights up when ON (OUT1: Green, OUT2: Red)		
Response frequency		200Hz		
Hysteresis Note 3)	Hysteresis mode	Variable (3 digits or more)		
	Window comparator mode	Fixed (3 digits)		

Fluid		Air, Non-corrosive gas
Temperature characteristics		±3% F.S. or less
Repeatability		±1% F.S. or less
Operating voltage		12 to 24VDC (Ripple ±10% or less)
Output specification		NPN open collector 30V, 80mA or less
Current consumption		25mA or less
Error display		Indicator light: Red light blinks, Error code displayed on LCD
Pressure display		3 1/2 digit LCD (5mm-size numerals)
Self-diagnostic function		Overcurrent , Excess pressure, Data error, Pressure at zero clear
Operating temperature range		0 to 60°C (with no condensation)
Noise resistance		1000Vp-p, Pulse width 1μS, Rise time 1nS
Withstand voltage		1000VAC 50/60 Hz for 1 min between external terminals and case
Insulation resistance		2MΩ (500VDC) between external terminals and case
Vibration resistance		10 to 500Hz at whichever is smaller, amplitude 1.5mm or acceleration 98m/s² (10G), in X, Y, Z directions for 2hrs. each
Shock resistance		980m/s² in X,Y,Z directions 3 times each
Lead wire	Connector type	Heat resistant vinyl cord ø1.55, 0.31mm², 4 wire
	Grommet type	Oil resistant vinyl heavy duty cord -21, -23: ø3.5, 0.14mm², 4 cores -22, -24: ø3.5, 0.15mm², 5 cores
Weight		40g (with 0.6m lead wire)
Port size		R 1/8, M5 x 0.8, NPTF 1/8, M5 x 0.8 ZX ejector mounted type: M5 x 0.8 / R 1/8, M5 x 0.8, NPTF 1/8, M5 x 0.8
Enclosure		IP40

Note 1) For vacuum operation, a momentary pressure of 0.5MPa will not be a problem.
Note 2) For ZSE3-□-$^{23}_{24}$, the red light will be ON for failure detection output.
Note 3) Hysteresis mode:
When the value of P1 and P2 are the same, or when P1 > P2 is within 3 digits, the hysteresis will automatically be 3 digits for the set value of P1.
Window comparator mode:
Since the hysteresis is 3 digits, separate P1 and P2 by 7 digits or more when setting.
1 digit is the minimum pressure display unit. (See the table above.)

Refer to page 3.5-1 of Best Pneumatics No. 4 for details.

How to Order



Set pressure range

Nil	0 to 0.98MPa
L	0 to 98kPa

Piping specification

01	Single mounting R 1/8
T1	Single mounting NPTF 1/8

Note) M5 x 0.8 female thread provided inside piping

Output specification

21	NPN open collector 2 outputs Without analog output
22	NPN open collector 2 outputs With analog output (1 to 5V)

Wiring specification

Nil	Grommet type lead wire length 0.6m
L	Grommet type lead wire length 3m
C	Connector type lead wire length 0.6m
CL	Connector type lead wire length 3m
CN	Without connector

Only grommet type available for analog output.

Piping specification

01	Single mounting R 1/8
T1	Single mounting NPTF 1/8
0X	With suction filter M5 x 0.8
0XY	With suction filter M6 x 1 (optional)

Note) M5 x 0.8 female thread provided inside piping for single mounting type

Output specification

21	NPN open collector 2 outputs Without analog output
22	NPN open collector 2 outputs With analog output (1 to 5V)
23	NPN open collector 1 output Failure detection function, Without analog output
24	NPN open collector 1 output Failure detection function, With analog output (1 to 5V)

Digital Pressure Switch with Backlight

Series ZSE5B/ISE5B (For vacuum) (For positive pressure)

For use in various fluid applications

- Hydraulic fluid • Silicon oil • Lubricating oil
- Dry air • Carbon dioxide • Argon
- Drainage-containing air • Ammonia • Nitrogen gas
- Freon

For General Purpose Fluids

Stainless steel diaphragms

SUS630 is used for the sensor unit and SUS304 is used for the fitting.

Leakage rate: 1 x 10^{-4} atm cc/s

The use of an electron beam to weld the sensor unit and fitting enables pressure calibration of various fluids, which were not previously applicable, such as air containing moisture, and oil.

Two independent pressure settings

This feature is ideal when a change of vacuum suction pad size requires two different set pressures, or switching of positive pressure lines requires confirmation of two pressures.

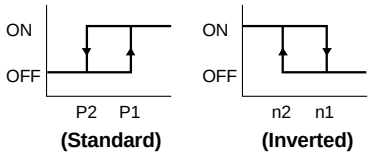
Multiple units available with unit switching function

Display units can be easily selected.

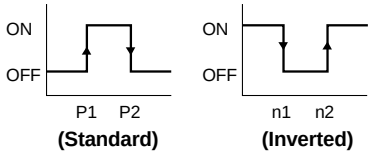
Vacuum	**mmHg ↔ kPa ↔ PSI ↔ kgf/cm² ↔ bar**
Positive Pressure	**MPa ↔ PSI ↔ kgf/cm² ↔ bar**

Variety of switch output modes

Hysteresis mode



Window comparator mode



Exact detection of atmospheric pressure (for vacuum)

Detects restored atmospheric pressure after vacuum release pressure is applied.

Data storage function

Since a dedicated IC (EEPROM) is used, set data will be stored for 100,000 hours (approximately 11 years) even without power.

Panel mounting available

A special adaptor permits panel mounting.

How to Order

Positive Pressure **ISE5B** — □ — □ **L** — □

Vacuum **ZSE5B** — □ — □ **L** — □

Piping specification

02	R 1/4
T2	NPTF 1/4

Note) M5 x 0.8 female thread provided inside piping

Unit specification

Nil	With unit switching function
M	Fixed SI units Note)

Note) Fixed units
ISE5B: MPa
ZSE5B: kPa

Lead wire length

L	3m

Output specification

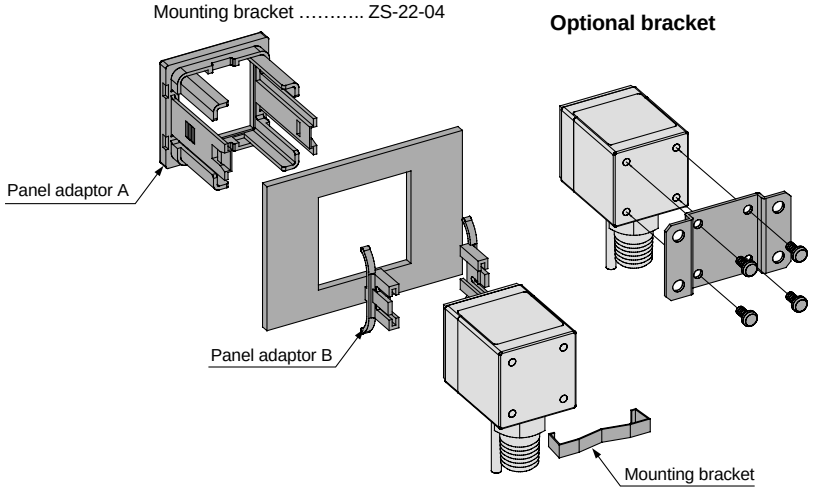
26	Analog output (1 to 5V)
27	NPN open collector 2 outputs
67	PNP open collector 2 outputs

Panel mount adaptor part no.
(Panel adaptor A + Panel adaptor B + Mounting bracket)

ZS-22-E
Panel adaptor A ZS-22-03
Panel adaptor B ZS-22-02
Mounting bracket ZS-22-04

ZS-22-D
(With 4 pcs. of M3 tapping screws)

Optional bracket



Specifications

Model		Vacuum ZSE5B	Positive pressure ISE5B
Set pressure range		–100 to 100kPa	–0.1 to 1MPa
Maximum operating pressure		200kPa	1.5MPa
Minimum display unit (Note 1)	kPa	2	—
	MPa	—	0.01
	mmHg	10	—
	kgf/cm²	0.02	0.1
	PSI	0.2	1
	bar	0.02	0.1
Indicator light		Lights up when ON (OUT1: Green, OUT2: Red)	
Response frequency		200Hz (5ms)	
Hysteresis (Note 2)	Hysteresis mode	Variable (2 digits or more)	Variable (3 digits or more))
	Window comparator mode	Fixed (2 digits)	Fixed (3 digits)

Fluid	Non-corrosive fluid for SUS304, SUS630
Temperature characteristics	±3% F.S. or less
Repeatability	±1% F.S. or less
Supply voltage	12 to 24VDC (Ripple ±10% or less)
Output specification	NPN open collector 30V, 80mA or less PNP open collector 80mA or less
Current consumption	45mA or less
Error display	Indicator light: Red light blinks, Error code displayed on LCD
Pressure display	3 1/2 digit LCD (character height 10mm)
Self diagnostic function	(Overcurrent Note 3)), Excess pressure, Data error, Pressure at zero clear
Operating temperature range	0 to 50°C (with no condensation)
Noise resistance	500Vp-p, Pulse width 1μS, Rise time 1nS
Withstand voltage	250VAC 50/60 Hz for 1 min. between external terminals and case
Insulation resistance	2MΩ (50VDC) between external terminals and case
Vibration resistance	10 to 500Hz at whichever is smaller, amplitude 1.5mm or acceleration 98m/s², in X, Y, Z directions for 2hrs. each
Impact resistance	980m/s² in X, Y, Z directions, 3 times each
Lead wire	Grommet oil resistant heavy duty cord -26: ø3.4, 0.2mm², 3 cores, 3m -27, -67: ø3.5, 0.14mm², 4 cores, 3m
Weight	126g (with 3m lead wire)
Port size	02: R 1/4, M5 x 0.8 T2: NPTF 1/4, M5 x 0.8
Enclosure	IP40

Note 1) Equipped with unit switching function [The type without the unit switching function will have a fixed SI unit (kPa or MPa).]

Note 2) **Hysteresis mode**

ZSE: When the value of P1 and P2 are the same, or when P1 > P2 is within 2 digits, the hysteresis will automatically be 2 digits for the set value of P1.

ISE: When the value of P1 and P2 are the same, or when P1 > P2 is within 3 digits, the hysteresis will automatically be 3 digits for the set value of P1.

Window comparator mode

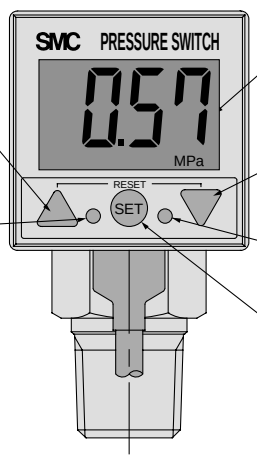
ZSE: Since the hysteresis is 2 digits, separate P1 and P2 by 5 digits or more when setting.

ISE: Since the hysteresis is 3 digits, separate P1 and P2 by 7 digits or more when setting.

∗ 1 digit is the minimum pressure display unit. (See the table above.)

Note 3) The analog output type has no overcurrent detection function.

Operating Unit Descriptions



UP Button

Increases ON/OFF setting value.
Changes to the peak display mode.

LED (Green)

Displays OUT1 operation status.

RESET Button

Reset the switch by pressing the UP and Down buttons simultaneously.
Clears when an abnormality occurs.
Clears the display to zero.

LCD

Displays present pressure.
Displays ON/OFF setting value.
Displays error code.
Displays unit.

DOWN Button

Decreases ON/OFF setting value.
Use for changing to the bottom display mode, unit switching or output mode.

LED (Red)

Displays OUT2 operation status.
Flashes when an error occurs.

SET Button

Changes to the setting mode.
Press and hold for one second or longer to change to the unit switching or output mode.

Pressure Setting

Setting procedure

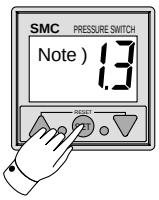
Initial setting
Select a display unit and output mode.

Pressure setting
Set the pressure for switch output.

Normal operation
Display the pressure operation and perform the switch operation.

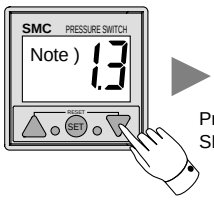
Initial setting

1. Set Mode



Press the SET button and hold for one second or longer. "1.3" is displayed as shown above and the unit flasher.
Note) "1.3" indicates the micro computer's program version.

2. Display Units

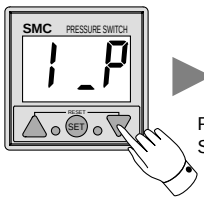


Press the SET button.

Select a display unit by pressing the ▼ button.
For high pressure:
MPa → PSI → kgf/cm² → bar
For low pressure:
mmHg → kPa → PSI → kgf/cm² → bar

Unit display changes for the type with the unit switching function only.
The type without the unit switching function will have a fixed SI unit (kPa or MPa).

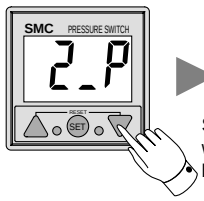
3. Select OUT1 Output Mode



Press the SET button.

Out1 changes between P and n by pressing the ▼ button.
P: Normal output
n: Inverted output
(Refer to Table 1.)

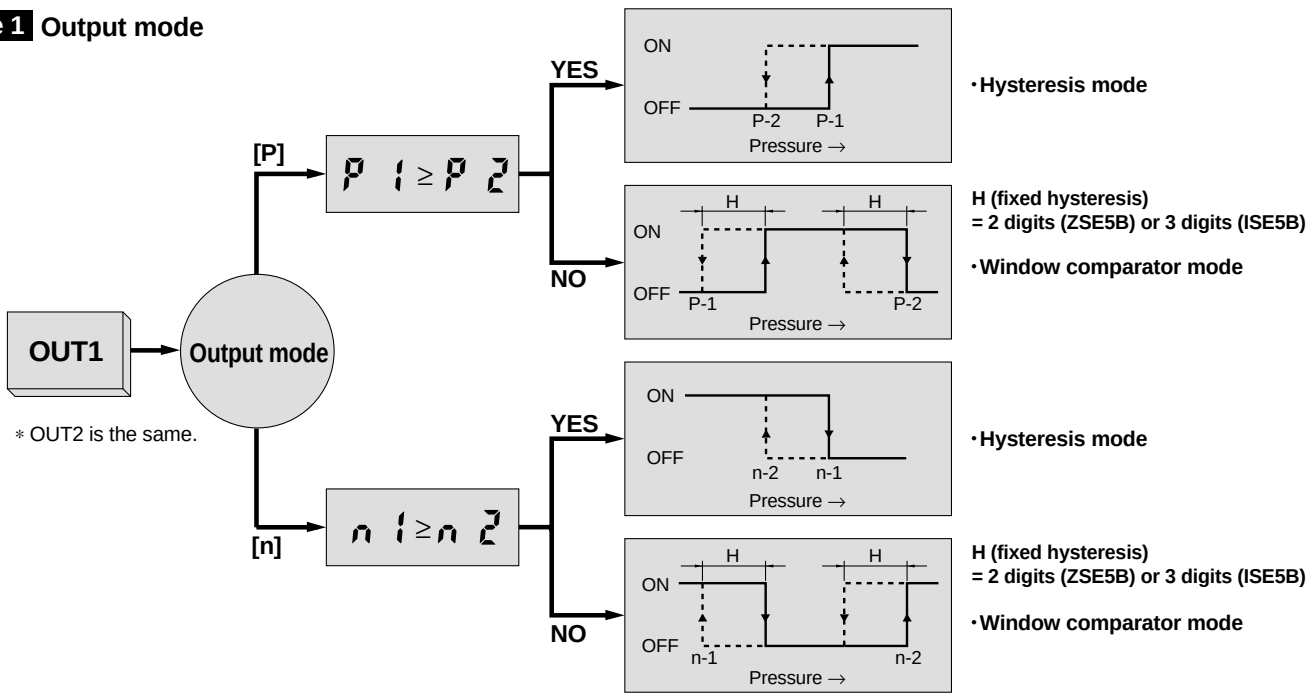
4. Select OUT2 Output Mode



Setting is completed when the SET button is pressed.

Out2 changes between P and n by pressing the ▼ button.
P: Normal output
n: Inverted output
(Refer to Table 1.)

Table 1 Output mode



・**Hysteresis mode**

H (fixed hysteresis)
= 2 digits (ZSE5B) or 3 digits (ISE5B)

・**Window comparator mode**

・**Hysteresis mode**

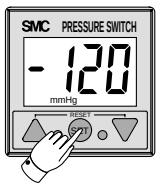
H (fixed hysteresis)
= 2 digits (ZSE5B) or 3 digits (ISE5B)

・**Window comparator mode**

Pressure Setting

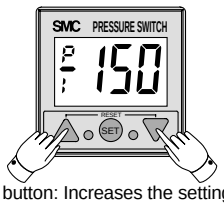
Setting procedure

1. Setting Value Input Mode



Press the SET button.

2. OUT1 Setting Value (1) Input



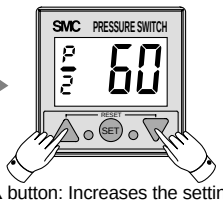
▲ button: Increases the setting value
▼ button: Decreases the setting value

(Refer to **Table 2** when using in vacuum.

SET

Press the SET button.

3. OUT1 Setting Value (2) Input

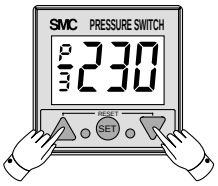


▲ button: Increases the setting value
▼ button: Decreases the setting value

4. OUT2 Setting Value (1) Input

SET

Press the SET button.



▲ button: Increases the setting value
▼ button: Decreases the setting value

SET

Press the SET button.

5. OUT2 Setting Value (2) Input

▲ button: Increases the setting value
▼ button: Decreases the setting value

SET

Setting is completed when the SET button is pressed.

Table 2 For use as a vacuum switch

The setting range for the ZSE5 pressure switch is –100kPa to 100kPa.
Note that the setting method is different from the conventional digital pressure switch.

1. Hysteresis mode

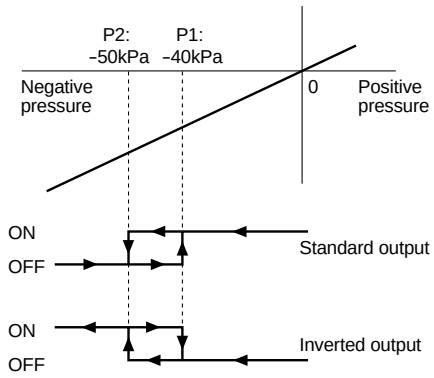
<Example> When switched at –50kPa or higher and the hysteresis is 10kPa

• Set P1 at –40kPa and P2 at –50kPa.

Note) Pressure must be P1 > P2, which is the opposite of conventional switches.

Note) Set the hysteresis at more than 2 digits.

∗ "Digit" is the minimum setting unit for pressure.
1 digit 2kPa



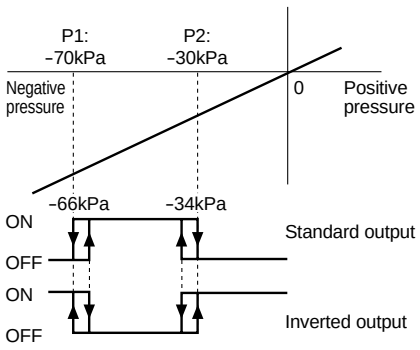
Relationship between pressure and switch output

2. Window comparator mode

<Example> When switched at –30kPa or higher and –70kPa or lower

• Set P1 at –70kPa and P2 at –30kPa.

Note) Hysteresis is automatically set at 2 digits in case of the window comparator mode.



Relationship between pressure and switch output

Other Functions

• Peak Display Mode

Displays the peak pressure value (highest degree of vacuum) when the UP button is pressed during pressure display. The LCD displays "H". Press the UP button again to return to the previous display.

• Bottom Display Mode

Displays the bottom pressure value (lowest degree of vacuum) when the DOWN button is pressed during pressure display. The LCD displays "L".
Press the DOWN button again to return to the previous display.

• Reset Function

Simultaneously pressing the UP and DOWN buttons will reset the switch.

1) Reset will cause the following during normal operation.
   - Clears peak or bottom pressure display, or resets to zero clear.

2) Reset will cause the following when an error has occurred.
   - Display changes to the condition at the time of power supply input while retaining the data set in the setting mode. (The system resets.)
   - In case of a data error, the setting mode is displayed. When the setting is completed, the display changes to the condition at the time of power supply input. (The system resets.)

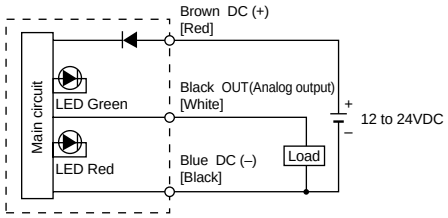
Note) The reset function does not work in the setting mode.

Internal Circuits and Wiring

Lead wire colors inside [ ] are those prior to conformity with IEC standards.

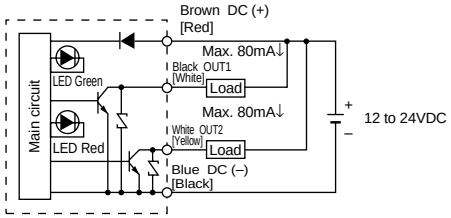
-26
Analog Output Type

1 to 5V (±5%F.S.)
Load impedance:
1kΩ or more



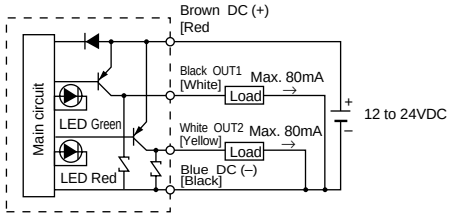
-27
NPN Open Collector

Max. 30V, 80mA
Residual voltage:
1V or less



-67
PNP Open Collector

Max. 80mA



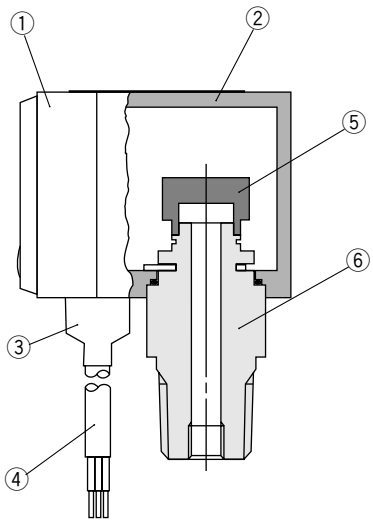
Error Corrections

Take the following corrective actions when errors occur.

Display	Problem	Solution
E1 dE	Set data was changed by accident for an unknown reason.	Push the UP and Down buttons to reset all data.
Note) E2CE1	Out1 load current is exceeding 80mA.	Turn off the power and replace the load connected to OUT1.
	During output ON, OUT1 without load may have shorted or is currently shorting the power supply, etc.	Confirm that OUT1 is not shorted, and then reset the switch.
Note) E2CE2	OUT2 load current is exceeding 80mA.	Turn off the power and replace the load connected to OUT2.
	During output ON, OUT2 without load may have shorted or is currently shorting the power supply, etc.	Confirm that OUT2 is not shorted, and then reset the switch.
E3 PE	Max. operating pressure has been exceeded for more than 2 seconds: 1.5 times the max. operating pressure for positive pressure, or 0.5MPa for vacuum.	Reduce the supply pressure to below the maximum pressure rating, and then reset the switch.
E4 HP	When compared with the atmospheric pressure, a pressure of ±0.07MPa for 1MPa type, or ±7kPa for vacuum and 100kPa types is applied at zero clear.	Apply atmospheric pressure, and then reset the switch.

Note) Not available for analog output type.

Construction



Parts list

No.	Description	Material
1	Indicator panel	Denatured PPO
2	Body	PBT
3	Seal	NBR
4	Lead wire	Vinyl chloride (Vinyl sheath)
5	Pressure sensor	SUS630
6	Fitting	SUS304

⚠ Specific Product Precautions

Be sure to read before handling.

Wiring

⚠Warning

1. Withstand voltage

Withstand voltage between the metal fitting and lead wire of the switch is 250V. Do not apply voltage in excess of 250V.

⚠Caution

1. When there is a danger of induction noise being generated in the piping, ground the piping.

Pressure Source

⚠Warning

1. Operating fluid

Sections in contact with fluid are made of SUS630 (pressure sensor) and SUS304 (fitting). Use a fluid that will not corrode these materials. The corrosion resistance of SUS630 and that of SUS304 are almost the same. For reference, non-corrosive fluids and gases for SUS304 are shown below.

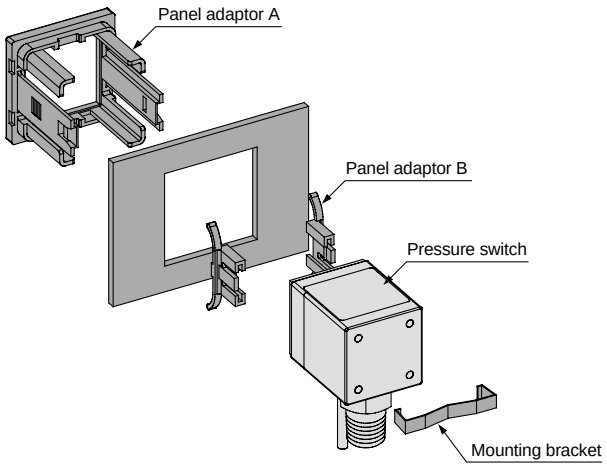
Dry air	○
Drainage-containing air	○
Hydraulic fluid (JIS-K2213)	○
Silicon oil (JIS-K2213)	○
Lubrication oil (JIS-K6301)	○
Fluoro carbon	○
Carbon dioxide	○
Ammonia	○
Argon	○
Gaseous nitrogen	○

Others

⚠Caution

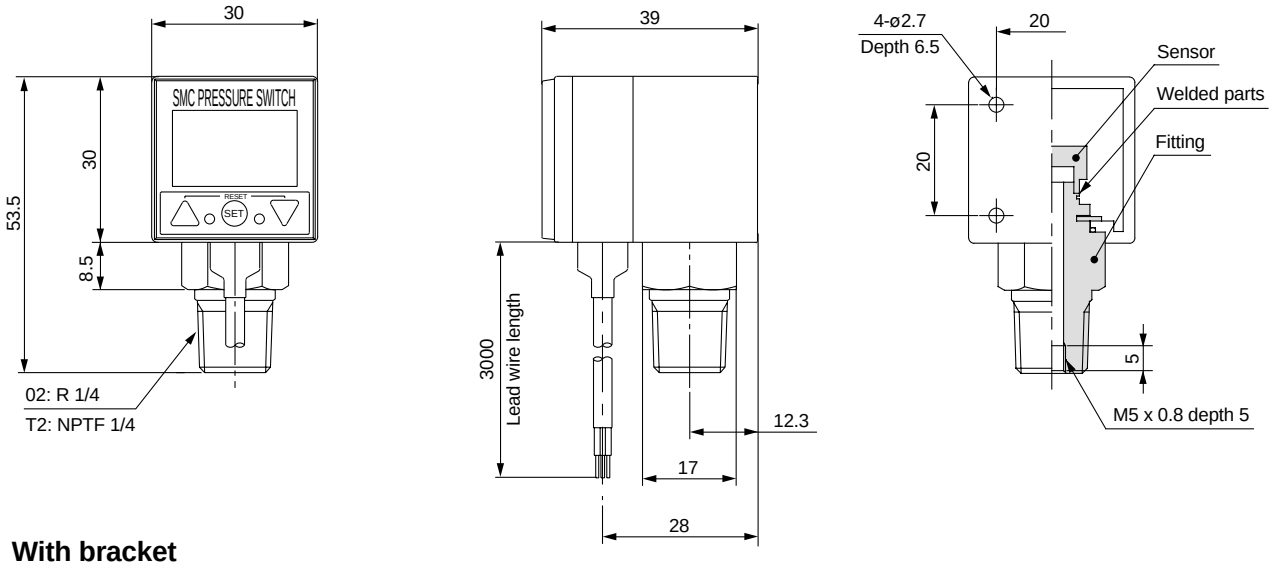
1. Panel mounting

① Insert the panel adaptor A from the front side of the panel.
↓
② Firmly secure the panel adaptor A with the panel adaptors B from the back side of the panel.
↓
③ Insert a pressure switch in to the panel adaptor A from the back side of the panel.
↓
④ Secure the switch with a mounting bracket.

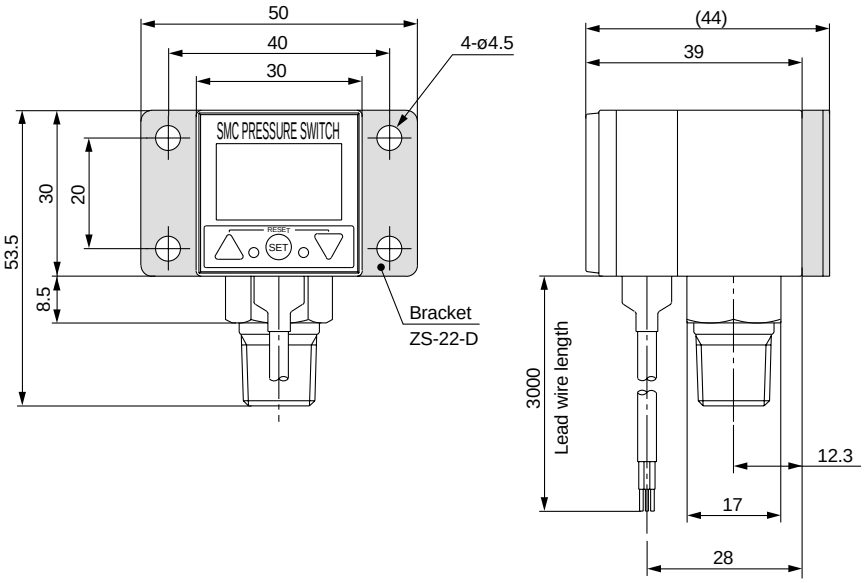


Dimensions

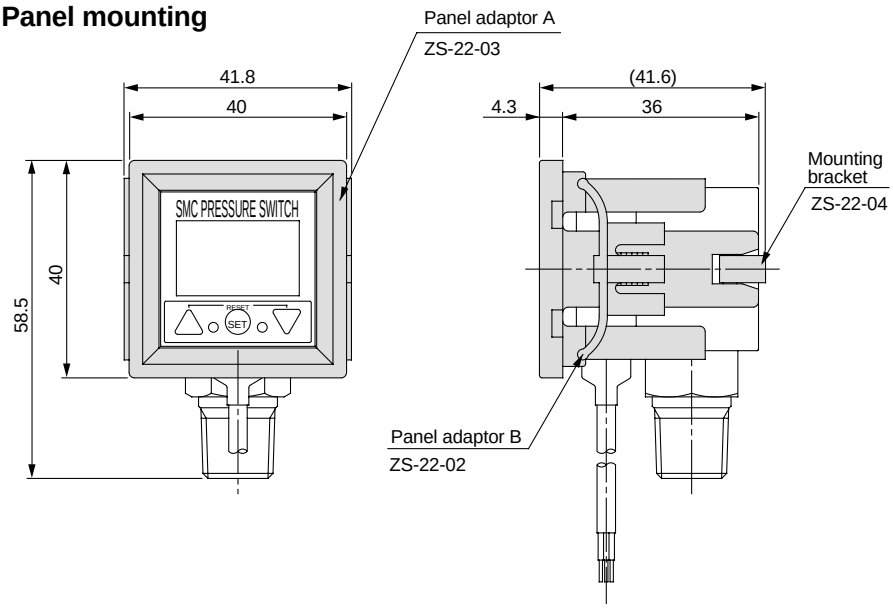
Standard type



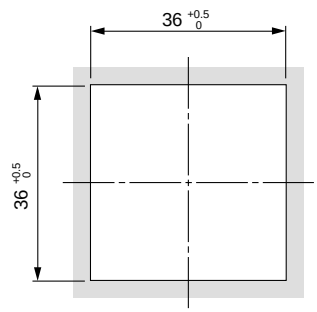
With bracket



Panel mounting



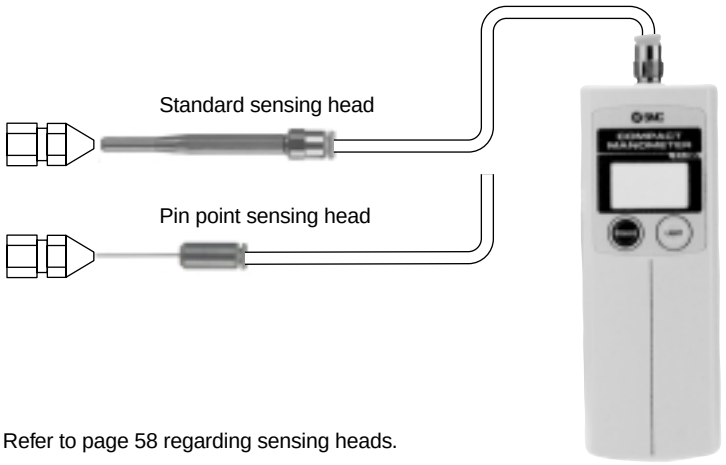
Panel fitting dimensions



Panel thickness: 1 to 3.2mm

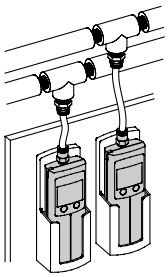
Series PPA

Measures the collision pressure received by an air blown work piece.



Refer to page 58 regarding sensing heads.

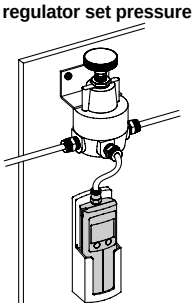
Confirmation of air line supply pressure



The digital display of line pressure eliminates human reading errors.

It is also possible to check pulsation in the supply pressure using the peak/bottom display function.

Confirmation of regulator set pressure

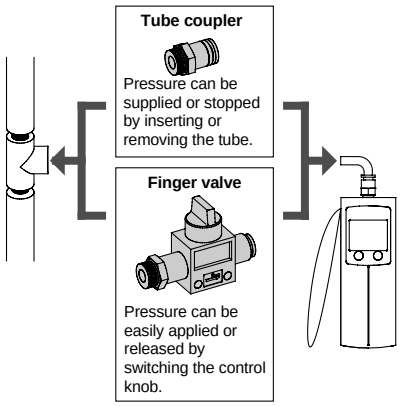


Regulator settings can be performed more precisely than with a dial gauge by viewing the digital display.

Furthermore, since the unit is battery operated, power lines are not necessary.

Related products for line pressure measurement

Convenient for easy line pressure measurement without removing piping or stopping supply pressure, etc.



Compact and lightweight

Portable type weighing only about 100g (unit 50g, battery 50g) can also be held in the palm of the hand.

Measurement unit switching for global use

Freely selectable display units and easy unit conversions also make it ideal for the SI unit transition period.

Back light for easy viewing in dark locations

Long life of 12 months continuous operation

Continuous one year operation is possible with two AA batteries (3V).

Convenient hand strap for carrying

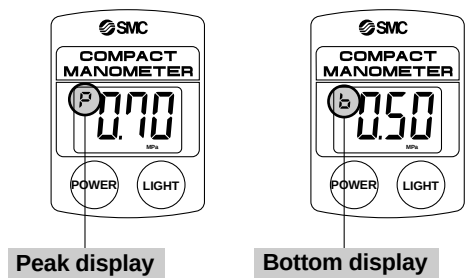
Keeping practical use in mind, the hand strap is a standard feature.

Zero/span calibration is possible

Offset adjustment with the zero clear function, and span calibration with the trimmer can be performed.

Peak/bottom hold function

With pressure being displayed, variations in supply pressure can be grasped instantly with one-touch switching of the display from peak value to bottom value.



Peak display

Bottom display

Auto power off function to save battery life

Power turns off automatically if not operated for more than 5 minutes.

Case holder is available

The case holder is provided as an option to allow for situations where portability is not required.

How to Order

PPA10 0 ☐ ☐ ☐

Pressure specification

0	–0.1 to 1MPa (for high pressure)
1	–101 to 10kPa (for vacuum)
2	–10 to 100kPa (for low pressure)

Option/Case holder

Nil	Without case
B	With PPA-B

Unit specification

Nil	With unit switching function
B	Fixed SI unit Note)

Note) Fixed units
For vacuum/low pressure: kPa
For high pressure: MPa

One-touch fitting type

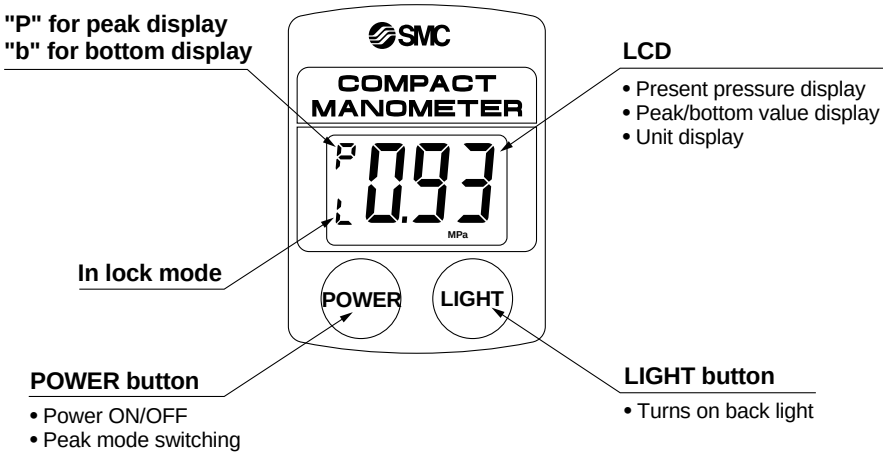
Symbol	Applicable tube size	One-touch fitting	Applicable tube material
Nil	N/A	N/A	N/A
04	ø4 (mm)	KJH04-M5	Nylon Soft nylon Polyurethane
06	ø6 (mm)	KJH06-M5	

Specifications

Model		PPA100 for high pressure	PPA101 for vacuum	PPA102 for low pressure
Rated pressure range		–0.1 to 1MPa	–101 to 10kPa	–10 to 100kPa
Pressure display		3 digit LCD with back light		
Pressure display resolution		1/100		
Minimum display units Note 1)	kPa	——	1	1
	MPa	0.01	——	——
	mmHg	——	5	——
	kgf/cm²	0.1	0.01	0.01
	inHg	——	0.2	——
	PSI	1	0.1	0.1
	bar	0.1	0.01	0.01
Error display		Excess pressure, Memory data error, Change battery signal		
Functions		Peak/Bottom display, Back light, Auto power OFF Zero clear, Unit display switching		
Withstand pressure		1.5MPa	200kPa	200kPa
Fluid		Air, Non-corrosive gas		
Power supply		3V(DC), Type AA dry cell battery x 2 pcs. Note 2)		
Battery life		12 months continuous operation (without back lighting)		
Response speed		250ms		
Display accuracy		±2% F.S. or less (Temperature conditions: at 25°C)		
Repeatability		±1% F.S. or less (Temperature conditions: at 25°C)		
Temperature characteristics		±3% F.S. or less (0 to 50°C, based on 25°C)		
Piping port		M5 x 0.8		
Ambient temperature		0 to 50°C (with no condensation)		
Ambient humidity		35 to 85% RH (with no condensation)		
Impact resistance		100G in X, Y, Z directions, 3 times each		
Enclosure		IP40 (IEC standard)		
Weight		Approx. 100g (Unit 50g, Batteries 50g)		

Note 1) Equipped with unit switching function [The type without the unit switching function will have a fixed SI unit (kPa or MPa).]
Note 2) Two pieces of type AA dry cell batteries (manganese R6 or alkaline LR6) are not included.

Operating Unit Descriptions



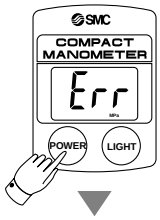
Operation and Functions

(PPA100 shown. Unit: MPa)

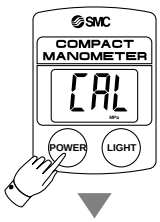
Initial Setting

Be sure to initialize the operating unit set when using for the first time and after changing batteries, as the unit will indicate memory data error.

1. Press and hold the POWER button for 3 seconds or more.



2. Press and hold the POWER button for 6 seconds or more.

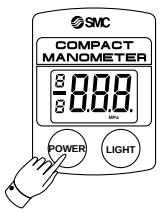


3. Release the POWER button.

1. The display will show "Err". Turn the power OFF.
2. Press and hold down for 6 seconds or longer. The unit will be zero cleared. When this happens, "CAL" will appear on the LCD.
3. When zero clear is completed, the unit is ready for operation.

Power ON

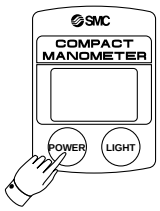
Press the POWER button.



- The power comes ON as it is pressed.
- When pressed and held for 6 seconds or more, the unit is zero cleared.

Power OFF

Press and hold the POWER button for 3 seconds or more.



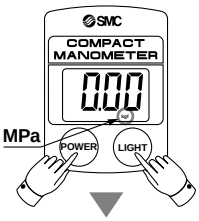
- When pressed and held for 3 seconds or more, the power turns OFF.
- When there is no button operation for more than 5 minutes, the power turns OFF. (automatic power OFF function)

Operation and Functions

(PPA100 shown. Unit: MPa)

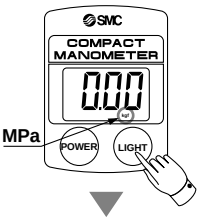
Unit Display Switching

1. Press and hold the POWER and LIGHT buttons for 3 seconds or more.



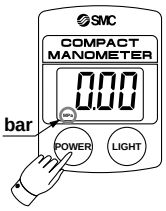
1. When pressed continuously for 3 seconds or more, the unit on the LCD will flash.
2. The unit will change. (See the table below.)
3. The unit is set, and switching is finished.

2. Press the LIGHT button.



Unit display changes for the type with the unit switching function only. The type without the unit switching function will have a fixed SI unit (kPa or MPa).

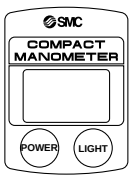
3. Press the POWER button.



High pressure (PPA100)	Vacuum (PPA101)	Low pressure (PPA102)
MPa → bar → PSI → kgf	kPa → bar → PSI → inHg → mmHg	kPa → bar → PSI → kgf

Note) The "inHg" unit cannot be displayed.

Auto Power OFF Function

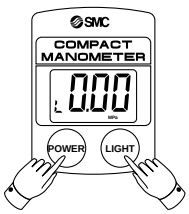


When the power is turned ON and there is no button operation for more than 5 minutes, the power will turn OFF.

Note) For canceling this function, refer to the functions and operation of the lock mode (below).

Lock Mode (Auto Power OFF Cancel)

Press and hold the POWER and LIGHT buttons for 6 seconds or more.



The auto power OFF function is canceled by activating the lock mode (auto power OFF cancel).

When continuously pressed for 6 seconds or more, "L" is displayed on the LCD.

Moreover, when the power is turned OFF, the lock mode is released.

Peak/Bottom Display

Note) Since this is combined with power OFF operation, the button should be released at the point when "P" or "b" is displayed.

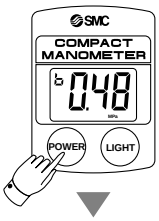
Press the POWER button.

Do this when pressure is being displayed.

Peak Display

Displays the maximum pressure value and "P" appears on the LCD. The display will change if pressure increases beyond the pressure value that is being held.

Press the POWER button.



Bottom Display

Displays the minimum pressure value and "b" appears on the LCD. The display will change if pressure falls below the pressure value that is being held.

(These modes are convenient for confirming pressure fluctuations.)

Press the POWER button.

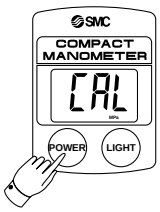
Turning On the Back Light

Press the LIGHT button.

It normally lights up while the button is being pressed. In the lock mode, it lights up when pressed and turns off when pressed again. However, the maximum lighting time is approximately one minute.

Zero Clear

Press and hold the POWER button for 6 seconds or more.

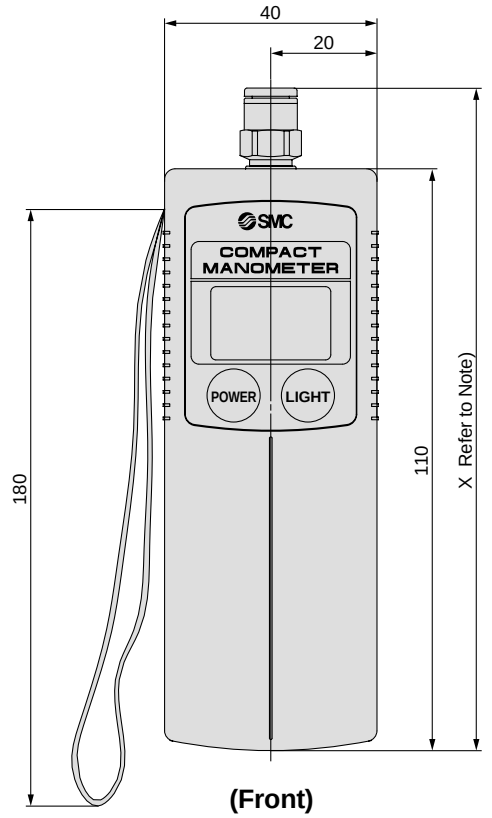


The zero point displayed at atmospheric pressure can be automatically adjusted. By this means it is possible to eliminate a display discrepancy at atmospheric pressure.

- Turn the power OFF.
- Release the supply pressure to the atmosphere.
- When continuously pressed for 6 seconds or longer, zero clear is performed and "CAL" is displayed on the LCD.

Dimensions

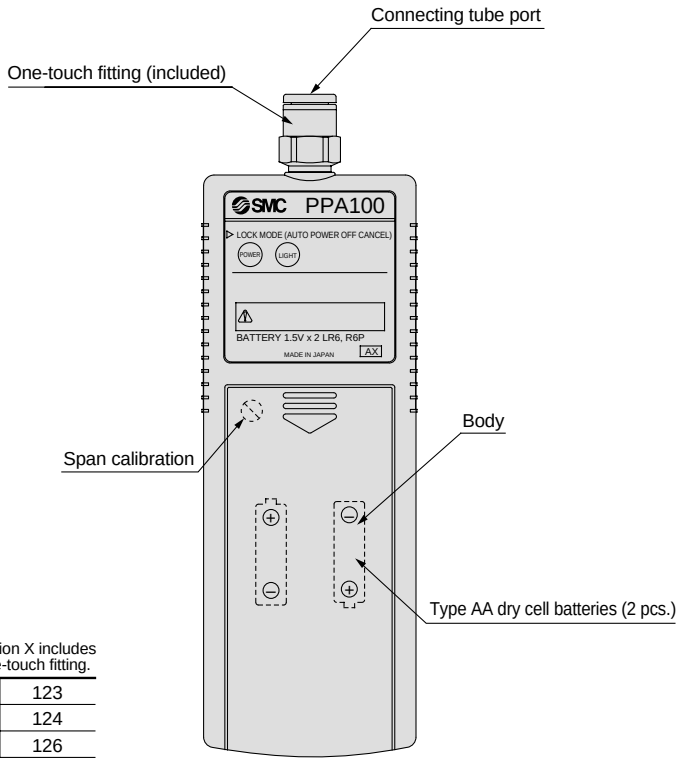
Scale: 70%



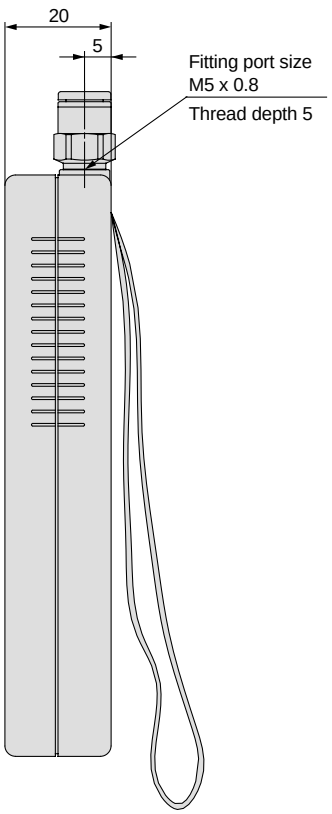
Note) Dimension X includes the One-touch fitting.

ø4	123
ø6	124
ø1/4"	126

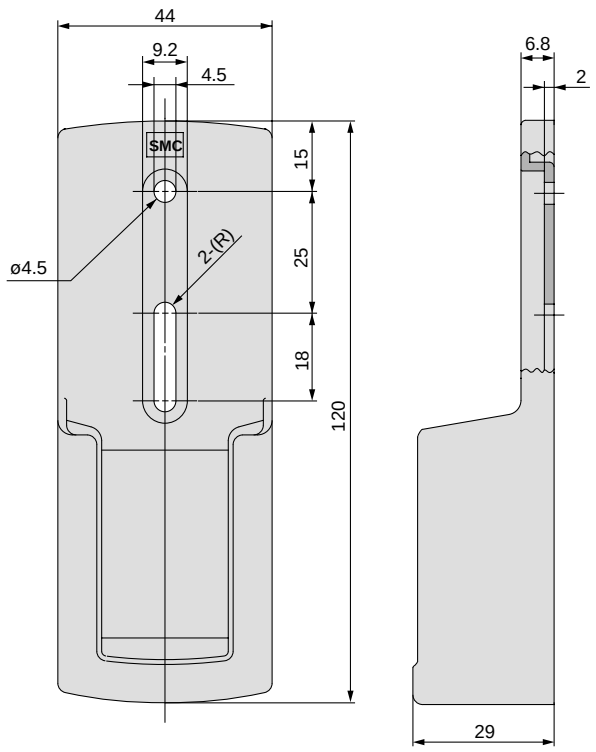
(Front)



(Back)



Option/Case holder



Error Corrections

Take the following corrective actions when errors occur.

Display	Problem	Solution
- - -	Pressure being applied is above the rating.	Operate within the rated pressure range.
Err	Memory data has probably been corrupted in some way.	Perform auto zero adjustment.
Entire display flashes	Battery voltage is low.	Replace the batteries.

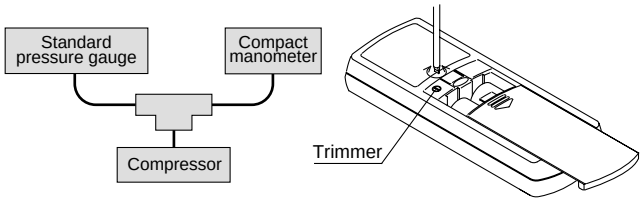
Maintenance

• Span calibration method

⚠ Caution

Do not touch the span calibration trimmer except when performing span calibration.

1. Perform zero clear at atmospheric pressure.
2. Apply the maximum rated pressure, and calibrate the span while comparing with a standard pressure gauge.
3. If the display value of the compact manometer is "0" after returning to atmospheric pressure, then calibration is complete. If the display value is not "0," calibrate again by repeating step 2.



• Replacing the batteries

When battery voltage becomes low the entire LCD will flash.
When the LCD flashes replace the batteries. Use two AA dry cell batteries.

⚠ Caution

To replace the batteries, turn the power OFF and replace them within approximately 30 seconds.
When not completed within 30 seconds, "Err" will be displayed. In that case, perform zero clear once again.

In the event that the display runs out of control, remove the batteries for one minute or longer, and then perform zero clear again after inserting the batteries and turning on the power.

Related products useful for line pressure measurement

These products are convenient for measuring line pressure easily without the need to remove piping or stop supply pressure, etc.

Switching between pressurization and atmospheric release can be easily performed by switching the control knob.

Finger Valve

Series VHK

Specifications

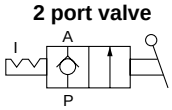
Valve type	2 port valve, 3 port valve
Fluid	Air
Proof pressure	1.5MPa
Maximum operating pressure	1.0MPa
Operating vacuum pressure Note 1)	-100kPa (10 Torr)
Ambient and fluid temperature	0 to 60°C
Applicable tubing material Note 2)	Nylon, Soft nylon, Polyurethane
Accessory (option)	Bracket

Note 1) For a vacuum application use a VHK2 (2 way valve).

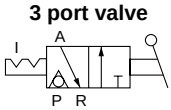
Note 2) Use caution with soft nylon and polyurethane at the maximum operating pressure. (For further details, refer to catalog CAT.E501-(B), "Fittings & Tubing for Pneumatic Piping.")

JIS symbols

2 port valve



3 port valve



Pressure can be supplied or stopped by inserting or removing a tube.

Tube Coupler

Series KC

Applicable tubing

Tubing material	Nylon, Soft nylon, Polyurethane
Tubing outside diameter	ø4, ø6, ø8, ø10, ø12

Specifications

Fluid		Air
Maximum operating pressure		1.0MPa
Proof pressure		3.0MPa
Ambient and fluid temperature		0 to 60°C
Thread	**Mounting**	JIS B0203 (taper threads for piping)
	Nut	JIS B0211 class 2 (metric fine screw thread)
Thread sealant		With sealant (standard)
Copper-free application		Part C3604BD (electroless nickel plated)

Main part materials

Body	C3604BD, PBT
Stud	C3604BD (thread)
Chuck spring	SUS304
Guide	C3604BD, POM
Collet release bushing	POM
Valve retainer	POM
Stopper	C3604BD, POM
Seal O-ring	NBR

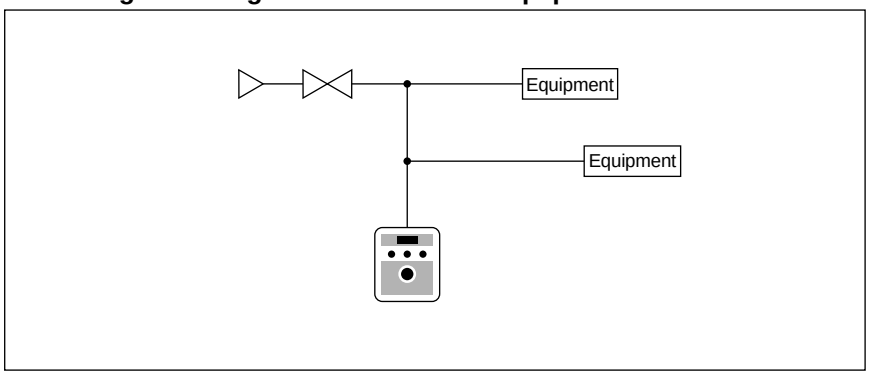
Air Leakage Tester

Made to order

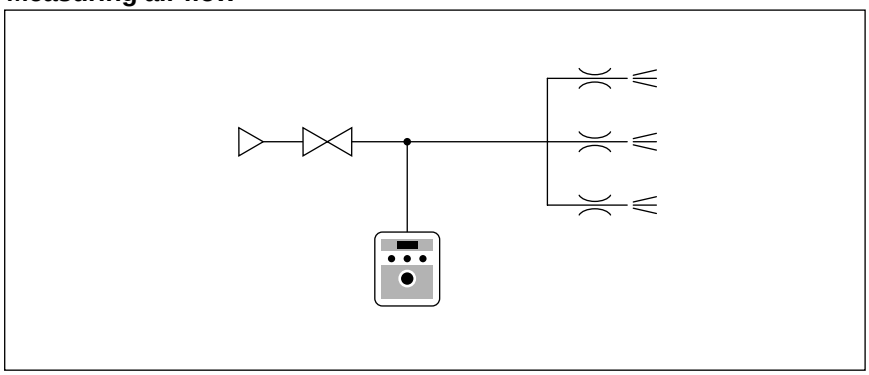
World's first external connection type measuring instrument for air flow rate

IN502-07-A

Measuring air leakage for each line and equipment



Measuring air flow



Easy piping installation at an extra port (3/8 B).
Measuring can be performed for each line or equipment.
Simple operation with measuring time of 5 to 10 minutes.
Wide measuring range from 300 to 3000 l/min (ANR).
Portable: Battery operated and does not require any other power supply preparation.
The energy saving automatic power shut off function turns power OFF when not operated for more than 10 minutes.

Other measuring items

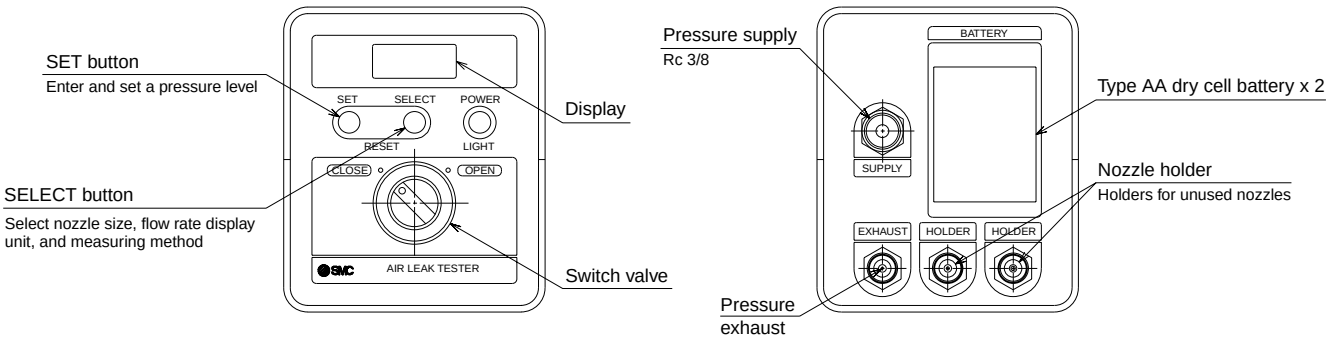
1. **Ejector**
2. **Purge air**
3. **Cooling blow of dies, etc.**
   Fixed discharge air flow rate measurement
   (Cannot be measured while in operation.)

Standard specifications

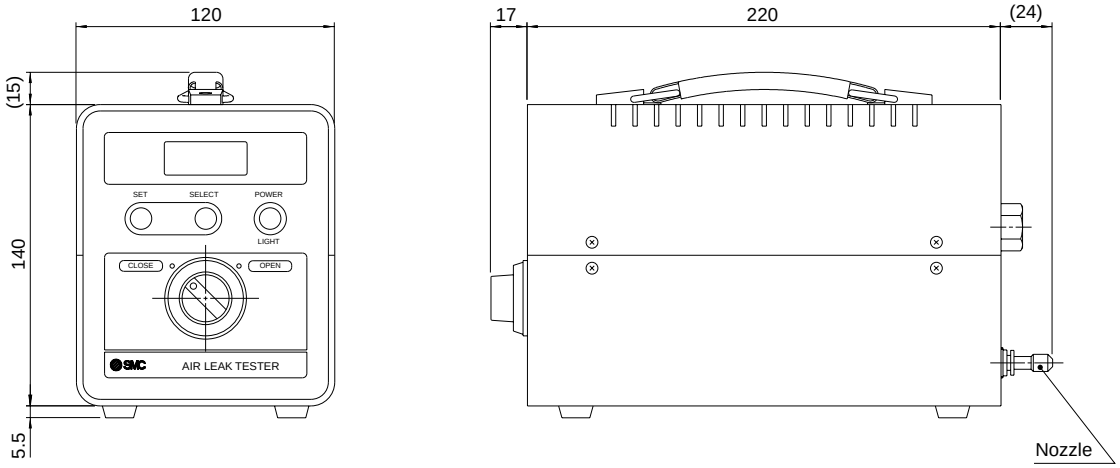
Model	IN502-07-A
Flow rate display range	0 to 9999l/min (ANR)
Flow rate display unit	l/min (ANR), CFM x 10^{-1}
Flow rate display resolution	l/min (ANR)
Operating pressure range	0.1 to 1.0MPa
Maximum operating pressure	1.0MPa
Pressure display unit	MPa
Flow measuring accuracy	±15% of reading [300 to 3000l/min (ANR) *]
Fluid	Air
Leakage	10cc/min or less (based on 0°C, 1atm)
Power supply voltage	3VDC, Type AA dry cell battery x 2
Battery life	Approx. 720 measurements
Port size	Rc 3/8
Weight	1.7kg (without batteries)

* The measuring error may be greater than ±15% outside the flow range.

Unit Descriptions



Dimensions



Operation

Connect the extra port downstream from the stop valve to the pressure supply port of the air leakage tester.

<Initial setting>

1. Select a nozzle size.

Press the SELECT button and hold for 2 seconds or longer. When the display indicates as shown below, select the size of the nozzle which is attached to the EXHAUST outlet on the back side, and press the SET button.

P1 ✻✻✻✻

↓ Press the SELECT button and hold for 2 seconds or longer.

SEL n_1.0 ⇄ SELECT ⇄ SEL n_1.5 ⇄ SELECT ⇄ SEL n_2.0

SELECT

↓ Press the SET button.

(Nozzle sizes)

ø1.0	300 to 1000//min
ø1.5	1000 to 2000//min
ø2.0	2000 to 3000//min

2. Select a flow rate display unit.

Select a flow rate display unit, and then press the SET button.

F_1 U_1 ⇄ SELECT ⇄ F_1 U_2

↓ Press the SET button.

Complete

(Flow rate display unit)

U_1	/min
U_2	CFM

<Measuring>

1. Enter the P1 pressure value.

Fully open the stop valve and press the SET button.

P1 ✻✻✻✻

↓ Press the SET button.

2. Enter the P2 pressure value.

Select a flow display unit, and then press the SET button.

1) Press the SELECT button to confirm the P2 set pressure range.
2) Gradually close the stop valve to reduce the pressure until it is below the confirmed set range.
3) Press the SET button when the pressure level is below the set range.

P2 ✻✻✻✻ ⇄ SELECT ⇄ P2 ✻✻✻✻

The set pressure is displayed while the SELECT button is pressed.

↓ Press the SET button.

3. Turn the knob to OPEN.

The P3 pressure will decrease. When the pressure is stabilized, press the SET button.

P3 ✻✻✻✻

↓ Press the SET button.

4. Calculate the flow.

Based on the entered pressure values, the flow rate is automatically calculated and displayed.

CAL → U1 ✻✻✻✻

Flow display

Air Catch Sensor

Series ISA

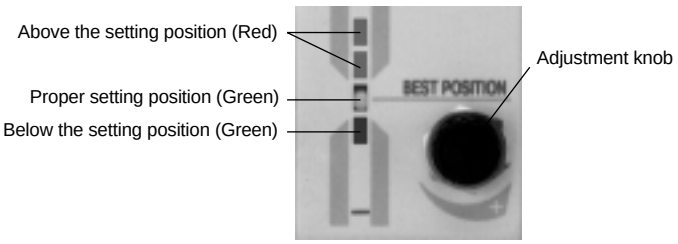
Air Purge

Due to the construction of the sensor, fluctuations in the supply pressure do not influence operation. This is a non-contact type sensor for applications requiring confirmation of work piece presence for machining operations.

For Detection of Work Piece Presence

LED level meter for easy calibration

The LED level meter in conjunction with the adjustment knob allows for easy and correct calibrations.



Reliable detection of a 10μm gap

Due to the internal air bridge circuit and solid state pressure sensor, the air catch sensor is not influenced by supply pressure fluctuations.

Can be mounted on manifolds with up to six stations

Centralized wiring and piping are possible.

Versatile mounting orientation

Due to the use of a pressure sensor, stable detection is guaranteed regardless of mounting orientation.

Wide detection range

Applicable range: 10 to 300μm

IP66 enclosure

Dust proof and splash proof

How to Order

Individual/Centralized Wiring **ISA** □ — □ □ — **01** □

Output specification

11	NPN open collector 1 output
15	PNP open collector 1 output

Station 1 to 6

Wiring specification

Nil	Individual wiring (without terminal block box)
L	Centralized wiring (with terminal block box on left side)
R	Centralized wiring (with terminal block box on right side)

Option

Nil *	For DIN rail
B	With bracket
G	With gauge

* Order DIN rail separately.

Example 1) NPN output, 4 stations, centralized wiring with terminal block box on left side, with bracket and gauge

ISA11-4L-01BG

Example 2) PNP output, single unit individual wiring, with gauge

ISA15-1-01G

Refer to page 3.8-1 of Best Pneumatics No. 4 for details.

Sensors Measuring Instruments

Specifications

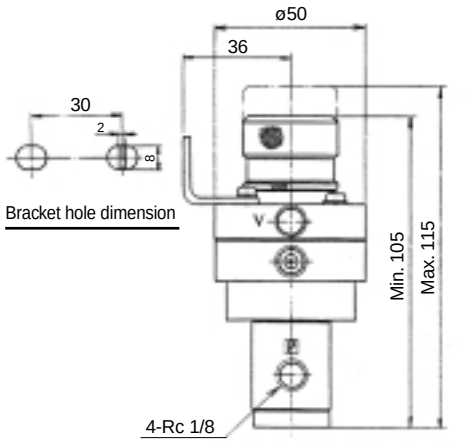
Fluid		Dry air (filtered through a 5μm filter)
Operating pressure range		0.05 to 0.2MPa
Recommended pressure range		0.1 to 0.2MPa
Detection distance range		10 to 300μm
Repeatability including temperature characteristics		±10μm (0 to 60°C, based on 25°C)
Hysteresis		10μm or less (detection distance 10 to 150 μm)
Detection nozzle size		ø1.0 standard
Indicator functions		Operation indicator light (lights up when ON), Deflection level indicator light
Power supply voltage		12 to 24VDC (Ripple ±10% or less)
Current consumption		30mA or less (Output ON, All LED's ON)
Output	**ISA11**	NPN open collector 30V, 80mA or less
	ISA15	PNP open collector 80mA or less
Operating temperature range		0 to 60°C (with no condensation)
Operating humidity range		35 to 85% RH
Noise resistance		1000Vp-p, Pulse width 1μS, Rize time 1ns pulse
Withstand voltage		1000VAC 50/60Hz for one minute between external terminals and case
Insulation resistance		2MΩ or more (at 500VDC) between external terminals and case
Vibration resistance		10 to 500Hz at whichever is smaller, amplitude 1.5mm or acceleration 98m/s², in X, Y, Z directions, for 2 hours each
Impact resistance		980m/s² X, Y, Z direction, 3 times for each direction
Lead wire		Oil resistant chloroethylene cable (ø3.4, 0.2 mm², 5m)
Weight		250g (with gauge, 5m lead wire)
Port size		Rc 1/8
Enclosure		IP66 (dust proof and splash proof)
Flow consumption	**Supply pressure**	16ℓ/min at 0.10 MPa
		21ℓ/min at 0.15 MPa
		25ℓ/min at 0.2 MPa

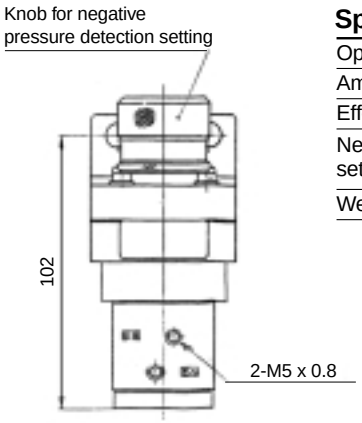
Negative Pressure Detection Valve

Special Order

Liquid Removal

XT-92-65



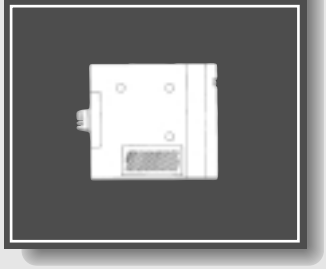


Specifications

Operating pressure range	0.15 to 0.8MPa
Ambient and fluid temperature	5 to 60°C
Effective area (Cv factor)	2.7mm² (0.15)
Negative pressure detection setting range	−400mmHg to −130mmHg (at 0.4MPa)
Weight	0.4kg

Sensors Measuring Instruments

Vacuum Equipment



	Series	Application	Page
Vacuum ejector	**ZH**	**Liquid removal**	**140**
In-line vacuum ejector	**ZU**	**Liquid removal**	**142**
Multistage ejector	**ZL112/212**	**Vacuum**	**143**
Vacuum ejector with check valve	**(Special order product)**	**Vacuum**	**148**
Pad with check valve	**(Special order product)**	**Vacuum**	**149**
Vacuum ejector for water soluble coolant removal	**(Special order product)**	**Liquid removal**	**150**

Vacuum Ejector

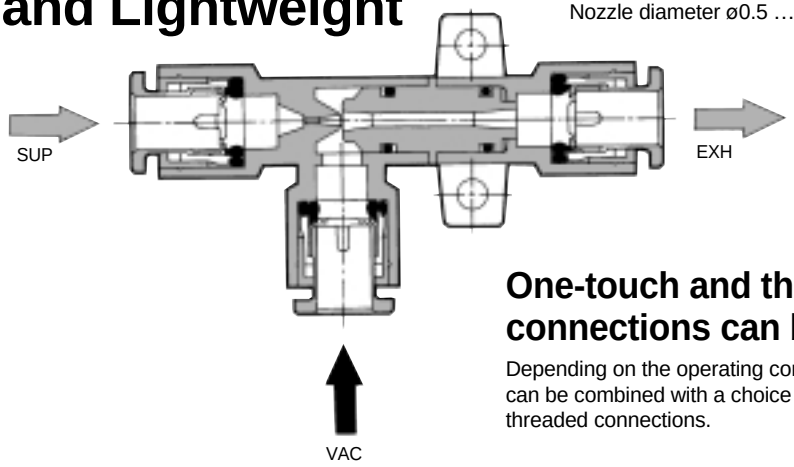
Box Type (with Built-in Silencer) Body Ported Type ***Series ZH***

Liquid Removal

Nozzle diameter —— ø0.5, ø0.7, ø1.0, ø1.3, ø1.5, ø1.8, ø2.0
Type ———————— S: Standard
L: High flow capacity

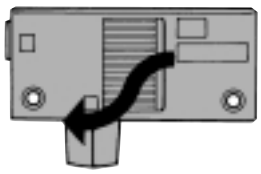
Compact and Lightweight

Composite resin nozzle and body for compact and lightweight construction
Nozzle diameter ø0.5 … 28g



Box type (with built-in silencer) and body ported type

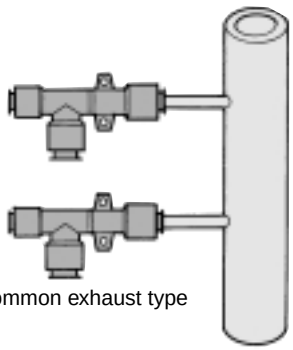
Two types are available in the series: Box type with silenced exhaust and body ported type with individual exhaust.



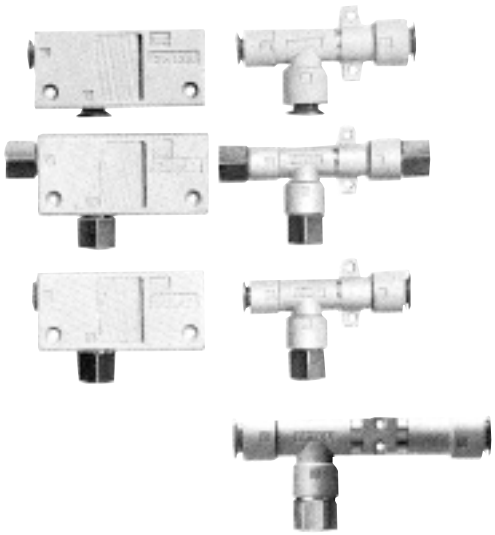
Silenced exhaust

One-touch and threaded connections can be combined

Depending on the operating conditions, port connections can be combined with a choice of One-touch and threaded connections.

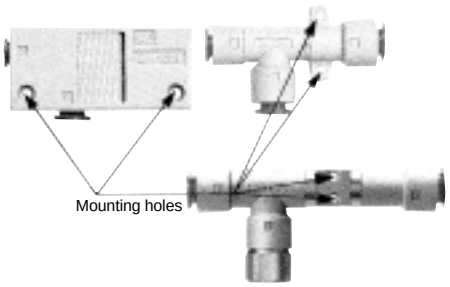


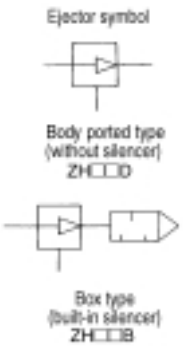
Common exhaust type



Body can be mounted and secured

Mounting holes for securing the body are provided for body ported type also.





Models and Specifications

Model	Nozzle diameter mm	Body type	Maximum vacuum pressure* (kPa)		Maximum suction flow l/min (ANR)		Air consumption l/min (ANR)	Connection (One-touch/Threaded)			Weight (g)
			S type	L type	S type	L type	S type/L type	SUP	VAC	EXH	
ZH05B□	0.5	Box type (with built-in silencer)	–88	–48	5	8	13	ø6/Rc 1/8	ø6/Rc 1/8	—	28
ZH07B□	0.7				12	20	23				28
ZH10B□	1.0				24	34	46				33
ZH13B□	1.3				40	70	78	ø8/Rc 1/8	ø10/Rc 1/4		66
ZH05D□	0.5	Body ported type (without silencer)	–88	–48	5	8	13	ø6/Rc 1/8	ø6/Rc 1/8	ø6/Rc 1/8	11
ZH07D□	0.7				12	20	23				12
ZH10D□	1.0				24	34	46	ø6/Rc 1/8	ø6/Rc 1/8	ø8/Rc 1/8	16
ZH13D□	1.3				40	70	78	ø8/Rc 1/8	ø10/Rc 1/4	ø10/Rc 1/4	27
ZH15D□	1.5	Body ported type (without silencer)	–88	–53	55	75	95	ø10/Rc 1/4	ø12/Rc 3/8	ø12/Rc 3/8	43
ZH18D□	1.8				65	110	150	ø12/Rc 3/8			55
ZH20D□	2.0				85	135	185	ø12/Rc 3/8	ø16/Rc 1/2	ø16/Rc 1/2	95

* Supply pressure: 0.45MPa.

Refer to page 3.4-1 of Best Pneumatics No. 3 for details.

SMC

How to Order

Note) Refer to tables ① and ② below for SUP/VAC/EXH port connection combinations and port sizes.

Box Type (with Built-in Silencer)

Body Ported Type (without Silencer)

ZH 07 B S 06 06

ZH 07 D S 01 01 01

Nozzle diameter

05	ø0.5mm
07	ø0.7mm
10	ø1.0mm
13	ø1.3mm
15	ø1.5mm
18	ø1.8mm
20	ø2.0mm

Maximum vacuum pressure

S	−88kPa
L	−48kPa

SUP port size Note)

Symbol	Size	Type
06	ø6	One-touch
08	ø8	One-touch
10	ø10	One-touch
12	ø12	One-touch
01	Rc 1/8	Threaded
02	Rc 1/4	Threaded
03	Rc 3/8	Threaded

VAC port size Note)

Symbol	Size	Type
06	ø6	One-touch
10	ø10	One-touch
12	ø12	One-touch
16	ø16	One-touch
01	Rc 1/8	Threaded
02	Rc 1/4	Threaded
03	Rc 3/8	Threaded
04	Rc 1/2	Threaded

EXH port size Note)

Symbol	Size	Type
06	ø6	One-touch
08	ø8	One-touch
10	ø10	One-touch
12	ø12	One-touch
16	ø16	One-touch
01	Rc 1/8	Threaded
02	Rc 1/4	Threaded
03	Rc 3/8	Threaded
04	Rc 1/2	Threaded

Table ① Connection combinations

Body type		SUP	VAC	EXH
Box type (with built-in silencer)	①	One-touch	One-touch	—
	②	One-touch	Threaded	—
	③	Threaded	Threaded	—
Body ported type (without silencer)	①	One-touch	One-touch	One-touch
	②	One-touch	Threaded	One-touch
	③	Threaded	Threaded	Threaded

Table ② Port sizes

Model	Connection (one-touch/threaded)		
	SUP	VAC	EXH
ZH05B	ø6/Rc 1/8	ø6/Rc 1/8	—
ZH07B			
ZH10B			
ZH13B	ø8/Rc 1/8	ø10/Rc 1/4	
ZH05D	ø6/Rc 1/8	ø6/Rc 1/8	ø6/Rc 1/8
ZH07D			
ZH10D	ø6/Rc 1/8	ø6/Rc 1/8	ø8/Rc 1/8
ZH13D	ø8/Rc 1/8	ø10/Rc 1/4	ø10/Rc 1/4
ZH15D	ø10/Rc 1/4	ø12/Rc 3/8	ø12/Rc 3/8
ZH18D	ø12/Rc 3/8		
ZH20D	ø12/Rc 3/8	ø16/Rc 1/2	ø16/Rc 1/2

Refer to page 3.4-1 of Best Pneumatics No. 3 for details.

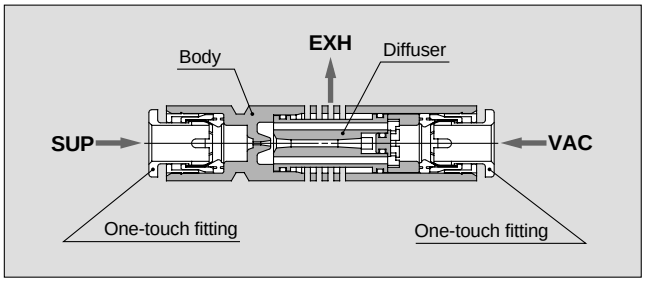
In-line Type Vacuum Ejector
Series ZU

Space-saving ejector that can be installed in-line with the piping

Nozzle diameter: ø0.5, ø0.7

Type S: High vacuum

L: High flow capacity



- Vacuum port and supply port are aligned in a straight line to facilitate piping
- Lightweight construction achieved through the use of a resin body
  Nozzle diameter ø0.5: **6.5g**
  ø0.7: **7.0g**
- The white color matches bright operating environments
- Built-in One-touch fittings (copper free)

How to Order

ZU 05 S

Maximum vacuum pressure

S	–85kPa
L	–48kPa

Nozzle diameter

05	ø0.5mm
07	ø0.7mm

Specifications

Fluid	Air
Maximum operating pressure	0.7MPa
Standard supply pressure	0.45MPa
Operating temperature range	5 to 60°C
Applicable tube O.D.	SUP port: ø6, VAC port: ø6

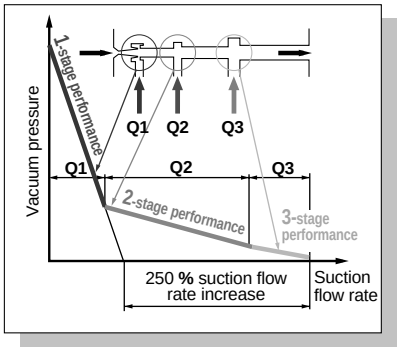
Models

Type	Model	Nozzle diameter ø (mm)	Maximum vacuum pressure* (kPa)	Maximum suction flow l/min (ANR)	Air consumption l/min (ANR)	Weight (g)
High vacuum	**ZU05S**	0.5	–85	7	9.5	6.5
	ZU07S	0.7	–85	12	19.0	7.0
High flow capacity	**ZU05L**	0.5	–48	12	9.5	6.5
	ZU07L	0.7	–48	21	19.0	7.0

* Supply pressure: 0.45 MPa

Energy saving, high flow rate, 3-stage diffuser construction

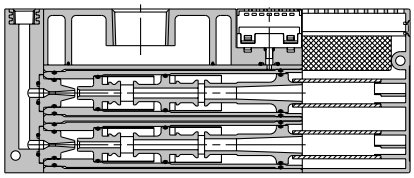
Suction flow rate increased 250% and air consumption reduced 20% with 3-stage diffuser construction
(Versus ø1.3, one-stage model)



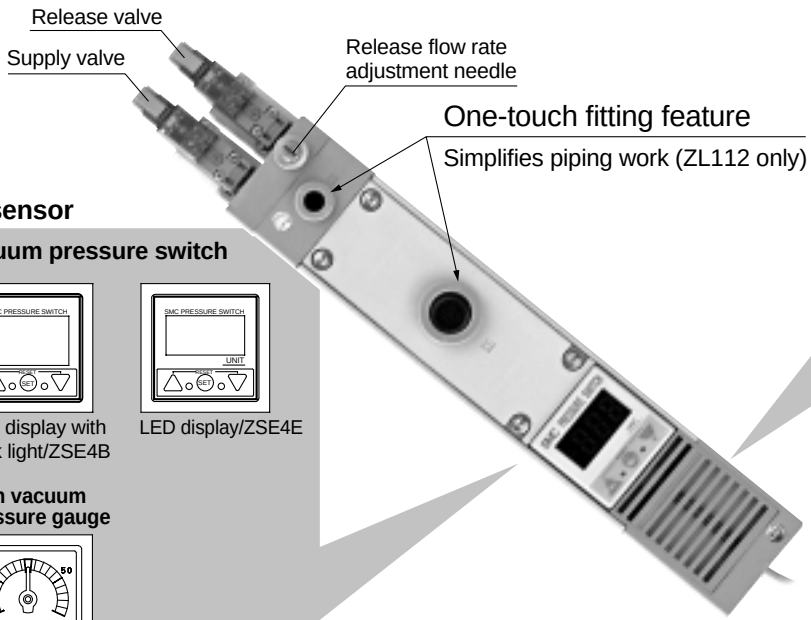
	Maximum suction flow rate /min (ANR)	Air consumption /min (ANR)
ZL112	100	63
ZL212	200	126

Series ZL212

Diffusers stacked and integrated
Compact size and high flow rate
(twice the flow rate of the ZL112)

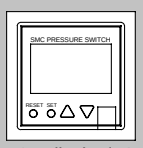


Series ZL112 valve option now available (ZL112 only)



Vacuum pressure sensor

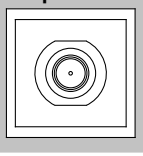
With digital vacuum pressure switch


LCD display/ZSE4

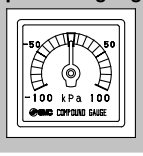
LCD display with back light/ZSE4B

LED display/ZSE4E

With vacuum adapter

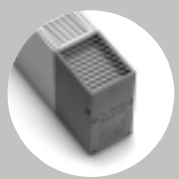


With vacuum pressure gauge



Exhaust port options

Built-in silencer



Ported exhaust

Series variations

Series	Maximum suction flow rate /min (ANR)	Air consumption /min (ANR)	Exhaust port		With valve		Vacuum pressure sensor options				
			Built-in silencer	Ported exhaust	With supply valve/ release valve	With supply valve	Digital vacuum pressure switch ZSE4E	Digital vacuum pressure switch ZSE4B	Digital vacuum pressure switch ZSE4	Vacuum pressure gauge	Vacuum adapter
ZL112	100	63	●	●	●	●	●	●	●	●	●
ZL212	200	126	●	●			●	●	●	●	●

How to Order

Without valve **ZL1 12** □ □

With valve **ZL1 12** □ □ **K1 5 M Z** □ **E 25** □

Nozzle diameter

12	ø1.2mm

Exhaust specification

Nil	Built-in silencer
P	Ported exhaust

Exhaust port thread specification (ported exhaust only)

Nil	Rc 1/2
F	G 1/2
N	1/2-14NPT
T	1/2-14NPTF

Supply valve/Release valve combination

K1	With supply and release valves
K2	With supply valve

Rated voltage

DC specifications	
5	24VDC
6	12VDC
V	6VDC
S	5VDC
R	3VDC
AC specifications (50/60Hz)	
1	100VAC
2	200VAC
3	110VAC [115V]
4	220VAC [230V]

Electrical entry

G	Grommet	Lead wire length 0.3m
H		Lead wire length 0.6m
L	L type plug connector	Lead wire length 0.3m
LN		Without lead wire
LO		Without connector
M	M type plug connector	Lead wire length 0.3m
MN		Without lead wire
MO		Without connector

Manual override

Nil	Non-locking push type
D	Push-turn slotted locking type

Indicator light/Surge voltage suppressor

Nil	Without indicator light/surge voltage suppressor
S	With surge voltage suppressor
Z	With indicator light/surge voltage suppressor
U	With indicator light/surge voltage suppressor (non-polar type)

Note 1) Type "U" is for 24 or 12VDC only.

Note 2) Since surge voltage is prevented by a rectifier in the case of AC, there is no "S" type.

Vacuum pressure sensor

Nil	None
GN	Vacuum adapter Rc 1/8
G	With vacuum pressure gauge
E	With digital vacuum pressure switch ZSE4
EB	With digital vacuum pressure switch ZSE4B
EE	With digital vacuum pressure switch ZSE4E

Digital vacuum pressure switch specification

For E (ZSE4) EB (ZSE4B)		
25	NPN output	Lead wire length 0.5 (2.9)m
26	Analog output	Lead wire length 0.5 (2.9)m
65	PNP output	Lead wire length 0.5 (2.9)m
For EE (ZSE4E)		
27	NPN output	Lead wire length 0.5 (2.9)m
26	Analog output	Lead wire length 0.5 (2.9)m
67	PNP output	Lead wire length 0.5 (2.9)m

∗ Not required when none (Nil), vacuum adapter (GN) or vacuum pressure gauge (G) is specified for vacuum pressure sensor.

Lead wire length

Nil	0.5m
L	2.9m

Series ZL112

Standard type

With valve

With vacuum pressure gauge

Adapter

Ported exhaust

Ejector Specifications

Model	ZL112
Nozzle diameter	ø1.2mm
Maximum suction flow rate	100//min (ANR)
Air consumption	63//min (ANR)
Maximum vacuum pressure	–84kPa
Maximum operating pressure	0.7MPa
Supply pressure range	0.2 to 0.5MPa
Standard supply pressure	0.4MPa
Operating temperature range	5 to 50°C

Supply/Release Valve Specifications

Part Number	SYJ514-□□□
Type of actuation	N.C.
Fluid	Air
Operating pressure range / Internal pilot type	0.2 to 0.5MPa
Ambient and fluid temperature	5 to 50°C
Response time (for 0.5MPa) Note 1)	25ms or less
Maximum operating frequency	5Hz
Manual operation	Non-locking push type, Push-turn slotted locking type
Pilot exhaust type	Pilot valve individual exhaust type, Main valve/pilot valve common exhaust
Lubrication	Not required
Mounting orientation	Free
Impact/Vibration resistance Note 2)	150/30m/s²
Enclosure	Dust proof

Note 1) Based on JIS B8374-1981 dynamic performance test (coil temperature 20°C, at rated voltage, without surge voltage suppressor)

Note 2) Impact resistance: No malfunction when tested with a drop tester in the axial direction and at a right angle to the main valve and armature, one time each in both energized and de-energized states. (initial value)

Vibration resistance: No malfunction when tested with one sweep of 8.3 to 2000Hz in the axial direction and at a right angle to the main valve and armature, one time each in both energized and de-energized states. (initial value)

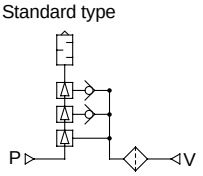
Note 3) Refer to CAT.E143-B "SYJ300/500/700" for details on valves.

Option Specifications

Vacuum pressure gauge specifications

Part number	GZ30S
Fluid	Air
Pressure range	–100 to 100kPa
Scale range (angular)	230°
Accuracy	± 3% F.S. (full span)
Class	Class 3
Operating temperature range	0 to 50°C
Material	Case: Polycarbonate/ABS resin

Symbol
Standard type



Option Specifications

With digital vacuum pressure switch (ZSE4)

Digital vacuum pressure switch specifications

Part number		ZSE4-00-□□-X105	ZSE4B-00-□□-X105	ZSE4E-00-□□-X105
Display		LCD	LCD with back light	LED
Pressure setting range		−101 to 10kPa (−760 to 75mmHg)		
Maximum operating pressure		200kPa		
Indicator light (lights up when ON)		Green		OUT1: Green OUT2: Red
Response frequency		200Hz (5ms)		
Hysteresis	Hysteresis mode	Variable (3 digits or more)		Variable (can be set from 0)
	Window comparator mode	Fixed (3 digits)		
Fluid		Air, Non-corrosive gas		
Temperature characteristics		±3% F.S. or less		
Repeatability		±1% F.S. or less		
Operating voltage		12 to 24VDC (ripple ±10% or less)		
Current consumption		25mA or less	45mA or less	−26, −27: 50mA or less −67: 60mA or less
Pressure indication		3 1/2 digits (character height 8mm)		
Self diagnostic function		(Overcurrent Note)), Excess pressure, Data error, Presence of pressure at zero clear		
Operating temperature range		0 to 50°C (with no condensation)		
Noise resistance		500Vp-p, Pulse width: 1μS, Start up: 1nS		
Withstand voltage		1000VAC 50/60Hz for 1 min. between external terminal block and case		
Insulation resistance		2MΩ (at 500VDC) between external terminal block and case		
Vibration resistance		10 to 500Hz at whichever is smaller, amplitude 1.5mm or acceleration 10G, in X, Y, Z directions for 2hrs. each		
Impact resistance		100G in X, Y, Z directions, 3 times each		

Note) Not available on analog output type.
∗ Refer to CAT.E824-A "Pressure Switch" for details on switches.

Output specifications

ZSE4 ZSE4B	−25 (L)	1 output, NPN open collector 30V, 80mA or less
	−26 (L)	Analog output (1 to 5V)
	−67 (L)	1 output, PNP open collector 80mA or less
ZSE4E	−26 (L)	Analog output (1 to 5V)
	−27 (L)	2 outputs, NPN open collector 30V, 80mA or less
	−67 (L)	2 outputs, PNP open collector 80mA or less

∗ Refer to CAT.E824-A "Pressure Switch" for details on switches.

Refer to CAT.E813-B "Multistage Ejector Series ZL" for details.

How to Order

Standard type

With vacuum pressure gauge

With digital vacuum pressure switch

With adaptor

Ported exhaust

ZL2 12 □ □ □ □

Nozzle diameter

12	ø1.2mm

Exhaust specification

Nil	Built-in silencer
P	Ported exhaust

Vacuum pressure sensor

Nil	None
GN	Adaptor Rc 1/8
G	With vacuum pressure gauge
E	With digital vacuum pressure switch ZSE4
EB	With digital vacuum pressure switch ZSE4B
EE	With digital vacuum pressure switch ZSE4E

Lead wire length

Nil	0.5m
L	2.9m

Digital vacuum pressure switch specification

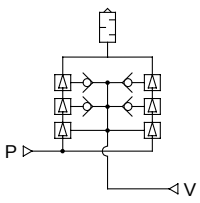
For E (ZSE4) EB (ZSE4B)		
25	NPN output	Lead wire length 0.6 (3.0)m
26	Analog output	Lead wire length 0.6 (3.0)m
65	PNP output	Lead wire length 0.6 (3.0)m
For EE (ZSE4E)		
27	NPN output	Lead wire length 0.6 (3.0)m
26	Analog output	Lead wire length 0.6 (3.0)m
67	PNP output	Lead wire length 0.6 (3.0)m

∗ Not required when none (Nil), vacuum adapter (GN) or vacuum pressure gauge (G) is specified for vacuum pressure sensor.

Ejector Specifications

Model	ZL212
Nozzle diameter	ø1.2mm x 2
Maximum suction flow rate	200ℓ/min (ANR)
Air consumption	126ℓ/min (ANR)
Maximum vacuum pressure	-84kPa
Maximum operating pressure	0.7MPa
Supply pressure range	0.2 to 0.5MPa
Standard supply pressure	0.4MPa
Operating temperature range	5 to 50°C

Symbol
Standard type

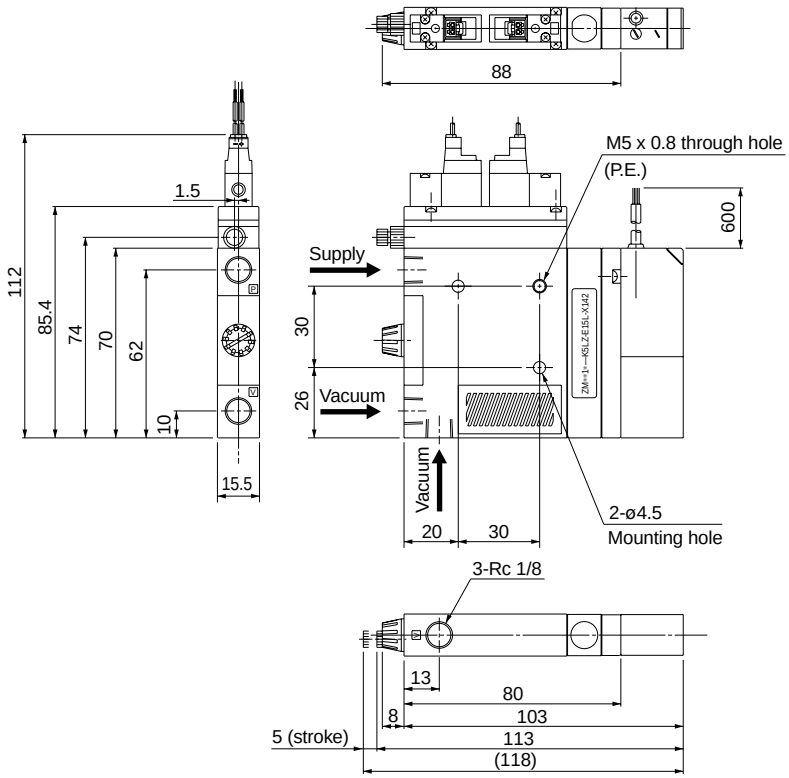


Refer to CAT.E813-B "Multistage Ejector Series ZL" for details.

Vacuum Ejector with Check Valve

Special Order Product

ZM□□1□-K5LZ-E15L-X142



How to Order

ZM □ 1 □ — K 5 L Z — E15 L — X142

Switch type
Conforms to the standard product.

Electrical entry
Conforms to the standard product.

Power supply voltage

24VDC

With air supply valve/ vacuum release valve

Standard supply pressure

H	0.5MPa
M	0.35MPa (except 05)
S	0.45MPa (13, 15 only)

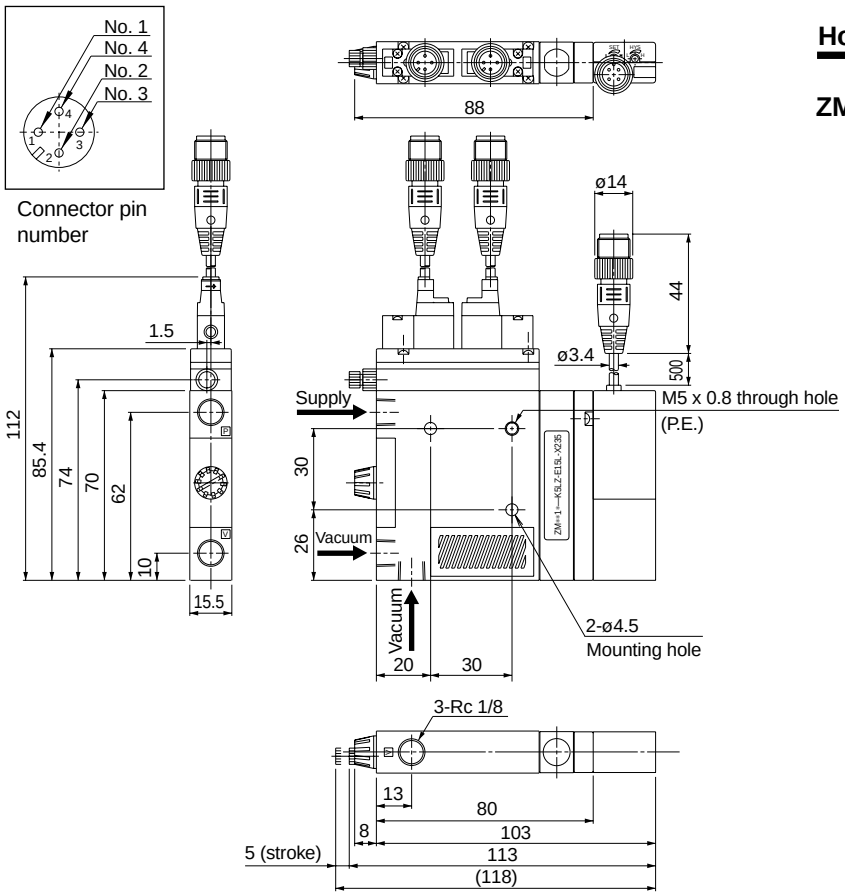
Body type
Conforms to the standard product.

Nozzle diameter

05	0.5mm (H type only)
07	0.7mm (except S type)
10	1.0mm (except S type)
13	1.3mm
15	1.5mm (S type only)

Consult SMC for details.

ZMM□□1□-K5LZ-E15L-X235



How to Order

ZM □ 1 □ — K 5 L Z — E15L — X235

Power supply voltage

24VDC

With air supply valve/ vacuum release valve

Standard supply pressure

H	0.5MPa
M	0.35MPa (except 05)
S	0.45MPa (13,15 only)

Body type
Conforms to the standard product.

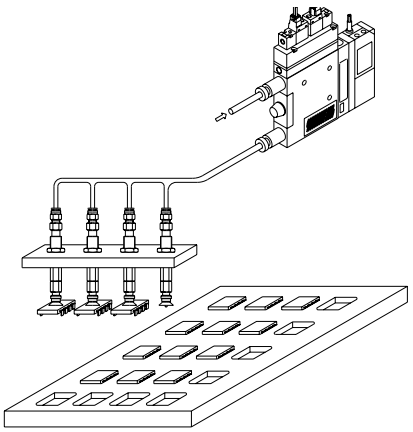
Nozzle diameter

05	0.5mm (H type only)
07	0.7mm (except S type)
10	1.0mm (except S type)
13	1.3mm
15	1.5mm (S type only)

Consult SMC for details.

Pad with Check Valve

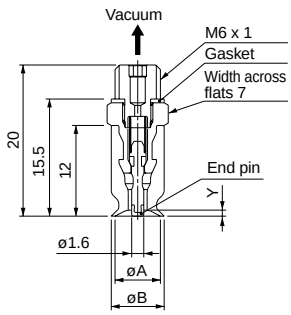
Connecting multiple pads to a single ejector is possible. Prevents leakage from pads that are not used for suction of work pieces.



How to Order

INO-3769-2431-□□U□□

Pad material	N: NBR
	S: Silicon rubber
	U: Urethane rubber
	F: Fluoro rubber
	GN: Conductive NBR
	GS: Conductive silicon
	GF: Conductive fluoro rubber
Pad configuration	U: Flat
Pad diameter	06: ø6
(for ZP06, 08U□□)	08: ø8

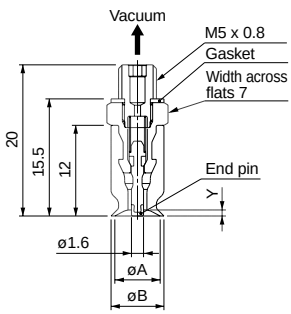


Pad material	End pin material
NBR	Fluoro rubber
Silicon rubber	
Urethane rubber	
Fluoro rubber	
Conductive NBR	Conductive fluoro rubber
Conductive silicon	
Conductive fluoro rubber	

Model	A	B	Y
INO-3769-2431-06U□□	6	7	0.8
INO-3769-2431-08U□□	8	9	1

INO-3769-2478-□□U□□

Pad material	N: NBR
	S: Silicon rubber
	U: Urethane rubber
	F: Fluoro rubber
	GN: Conductive NBR
	GS: Conductive silicon
	GF: Conductive fluoro rubber
Pad configuration	U: Flat
Pad diameter	06: ø6
(for ZP06, 08U □□)	08: ø8

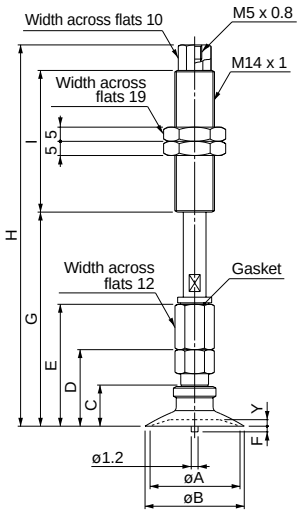


Pad material	End pin material
NBR	Fluoro rubber
Silicon rubber	
Urethane rubber	
Fluoro rubber	
Conductive NBR	Conductive fluoro rubber
Conductive silicon	
Conductive fluoro rubber	

Model	A	B	Y
INO-3769-2478-06U□□	6	7	0.8
INO-3769-2478-08U□□	8	9	1

INO-3769-1964-□□C□□□□□

Buffer stroke	10: 10mm
	20: 20mm
	30: 30mm
	50: 50mm
Buffer specification	J: Without rotation prevention
	K: With rotation prevention
Pad material	N: NBR
	S: Silicon rubber
	U: Urethane rubber
	F: Fluoro rubber
	GN: Conductive NBR
	GS: Conductive silicon rubber
Pad configuration	C: Plain with rib (for ZP20 to 32C□□)
Pad diameter	20: ø20
	25: ø25
	32: ø32



10mm stroke dimensions

Model	A	B	C	D	E	F	G	H	I	Y
INO-3769-1964-20C□□□10	20	23	14	26.5	42.5	2.5	55	120	50	1.7
INO-3769-1964-25C□□□10	25	28								1.8
INO-3769-1964-32C□□□10	32	35	14.5	27	43	2	55.5	120.5		2.3

Dimensions for other strokes

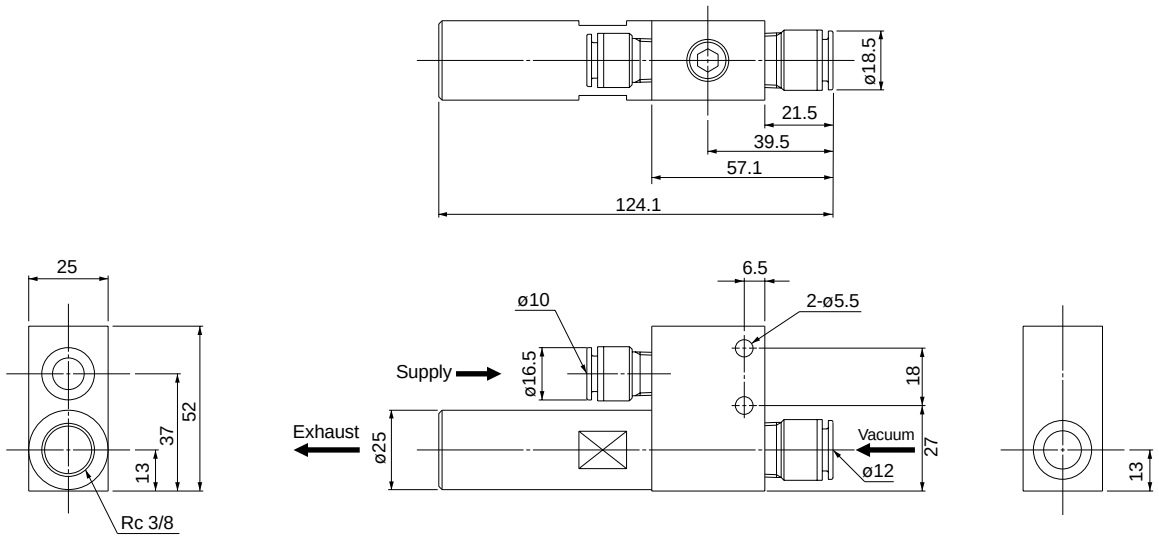
Stroke	G	H	I
20mm	+10	+4	0
30mm	+20	+14	
50mm	+40	+59	+25

Add an appropriate value from the 10mm stroke dimensions table.

Vacuum Ejector for Water Soluble Coolant Removal

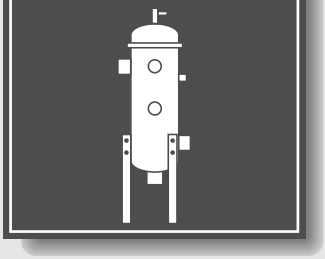
Special Order Product

INO-3971-77-4



Supply pressure	Vacuum pressure	Suction flow	Flow consumption
0.5MPa	-300mmhg	320//min (ANR)	320//min (ANR)

Industrial Filters



	Series	Application	Page
Industrial Filter	**FG**	**Coolant**	**152**
Industrial Filter (Regenerative Element Specification)	**(Made to order)**	**Air line maintenance, Coolant**	**154**

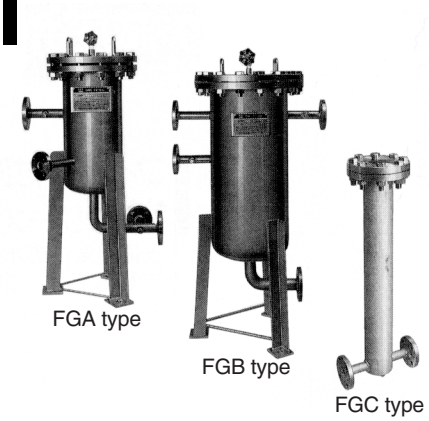
Standard Industrial Filters

Vessel Type

Series FGD, FGE, FGG

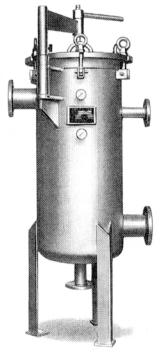
- FGD type:Ideal f or low flow filtration
- FGE type:Ideal f or medium flow rate filtr ation
- FGG type: Ideal for high flow filtration
- Connection: Rc 3/8 to Rc 2
- Number of elements: 1 to 28
- Operating temperature: Maximum 80°C

Series FGA, FGB, FGC



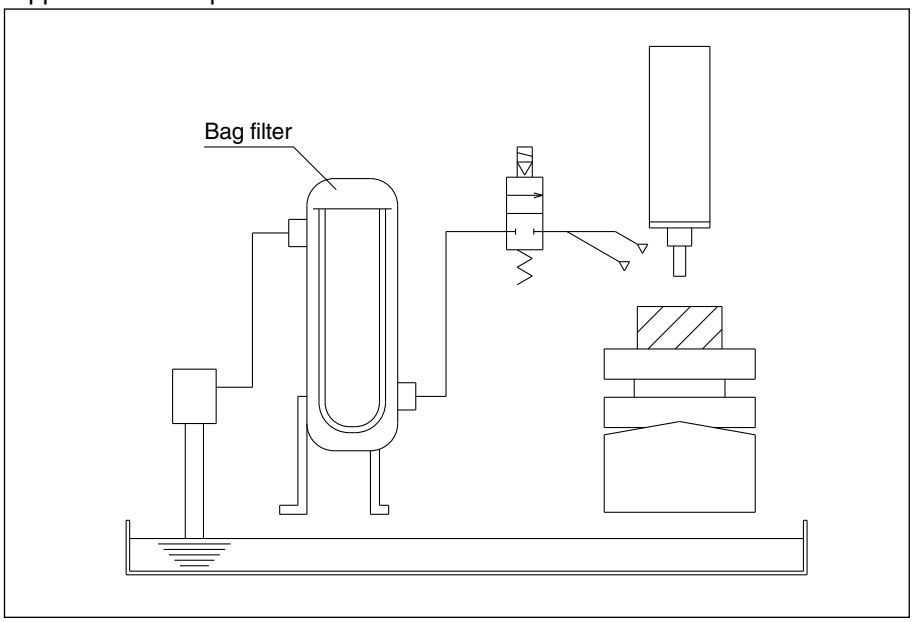
- FGA type:High flo w vertical element type
- FGB type:High flo w suspended type
- FGC type:High pressure lo w flow rate type
- Connection: Flange JIS10K1B to 6B
  Flange JIS and ANS1
  1/2B to 1B (FGC type)
- Number of elements: 1 to 83
- Operating temperature: Maximum 80°C

Bag Filter Series FGF



- Highly effective for filtration of high temperature and high viscosity fluids
- Ideal for high flow filtration
- Easy handling of filtered impurities
- Operating pressure: 0.5MPa
- Operating temperature: 80°C to 120°C
- Connection: Rc 2
- Number of elements: 1, 3, & 5

Application example



Filter Elements

Fiber Element

- Nominal filtration accuracy: 0.5 to 100µm
- Low cost, disposable
- Material can be selected depending on the fluid
- Ideal for relatively large amount of impurities
- Ideal for use as a prefilter
- Material: • Cotton
  • Viscose rayon
  • Glass fiber

Membrane Element

- Absolute filtration accuracy: 0.2, 0.4µm
- Long life due to high porosity rate and low pressure loss
- Ideal for filtration of pure water used for rinsing in the semi conductor field, etc.
- All elements inspected for quality assurance
- 0.2µm item: Pre-rinsed with ultra pure water, germ removal efficiency of LRV = 7 or more

Micromesh Element

- Nominal filtration accuracy: 5 to 105 µm
- High filtration accuracy with stainless steel mesh
- Pleated type provides 3 times larger filtration area than cylinder type
- Easy to wash the element for regeneration

Sintered Stainless Steel Bronze Element

- Nominal filtration accuracy: 2 to 120 µm
- With excellent mechanical strength, thermal resistance, and chemical resistance
- Wide operating temperature range
- High filtration accuracy with sintered fine powder metal
- Element can be washed for regeneration

Bag Element

- Nominal filtration accuracy: 5 to 100 µm
- Low cost, disposable
- Ideal for large amount of impurities
- Easy to handle since all impurities are captured inside the bag element
- Exclusive element for bag filters

Paper Element

- Nominal filtration accuracy: 5, 10, 20µm
- Pleated type cartridge provides large filtration area
- Low cost, disposable
- Material:
  Filter paper (cotton, resin impregnated phenol)

PP Fiber Element EXM-X3 For standard washing

- Nominal filtration accuracy: 5, 10, 20, 50µm
- Large filtration capacity and long element life
- Highly economical fiber element
- For all cleaning solvents and prefilter for high accuracy filters
- Material
  Filter material: Polypropylene
  Core: Polypropylene with brass

HEPO II Element EJ

- Unwoven cloth element with high filtration accuracy of 99% or more prevents drainage of fibers or release of chemical components
- Washing for electronic parts and precision machined parts
- Material
  Filter material: Unwoven long fiber polyester
  Core: Polypropylene

Industrial Filter
(Regenerative Element Specification)

Made to Order

Air Line Maintenance

Coolant

Element replacement not required

Element replacement and daily maintenance inspections not required.
No industrial waste created by elements, etc.

Back flushing can be easily automated with simple control of the cylinder and valve.
Back flushing (automatic) of filter restores its filtration capacity to 100%.
Filtered impurities (chips, etc.) alone can be removed by a drainage filter (optional) after back flushing.

Specifications

Fluid		Cleaning solvents, Coolants
Operating pressure		Maximum 1.0MPa
Operating temperature		80°C
Port size		Rc 1
Main parts	**Case cover**	SUS304, SUS303
	O-ring	NBR, FPM
Element	**Material**	SUS304, SUS303
	Construction	Cylindrical, Multi-level
	Filtration degree	5, 20μm
	Differential pressure resistance	0.6MPa
	Dimension	Type I: ø65 x 250, Type II: ø65 x 500
Rated flow (//min)	**Type I element**	50//min
	Type II element	100//min
Option (special order)	**Reservoir**	Downstream fluid reservoir for back flushing
	Dust removal filter	Removes impurities from discharged drainage when back flushing

How to Order

FN11 [0] [1] [N] — 10 — [S] [020] [ ] X0

Element type

0	Cylindrical (5, 20μm)
1	Multi-level (5μm)

Element dimensions

1	ø65 x 250mm
2	ø65 x 500mm

Seal material

N	NBR
V	FPM

Port size

10	Rc 1

Element material

S	SUS304

Filtration accuracy

005	5μm
020	20μm

Option

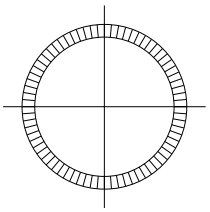
Nil	None
G	Pressure gauge

Principle

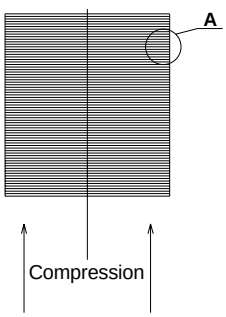
Laminated plates (filter material) are compressed by the cylinder and the fluid is filtered through the gaps in the molded filtration levels. If clogging occurs, back flushing pressure is applied from the OUT side, returning the cylinder to its original position. This opens the filtration holes in the laminated plates and effectively removes impurities in an automatically repeated cycle.

Construction

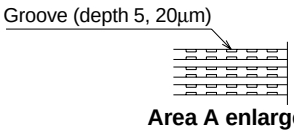
Element



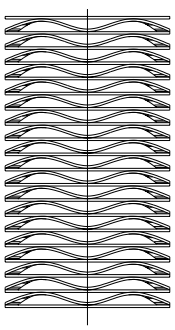
When filtering
Filtration through the compressed grooves in each plate



Filtration by the grooves in both surface

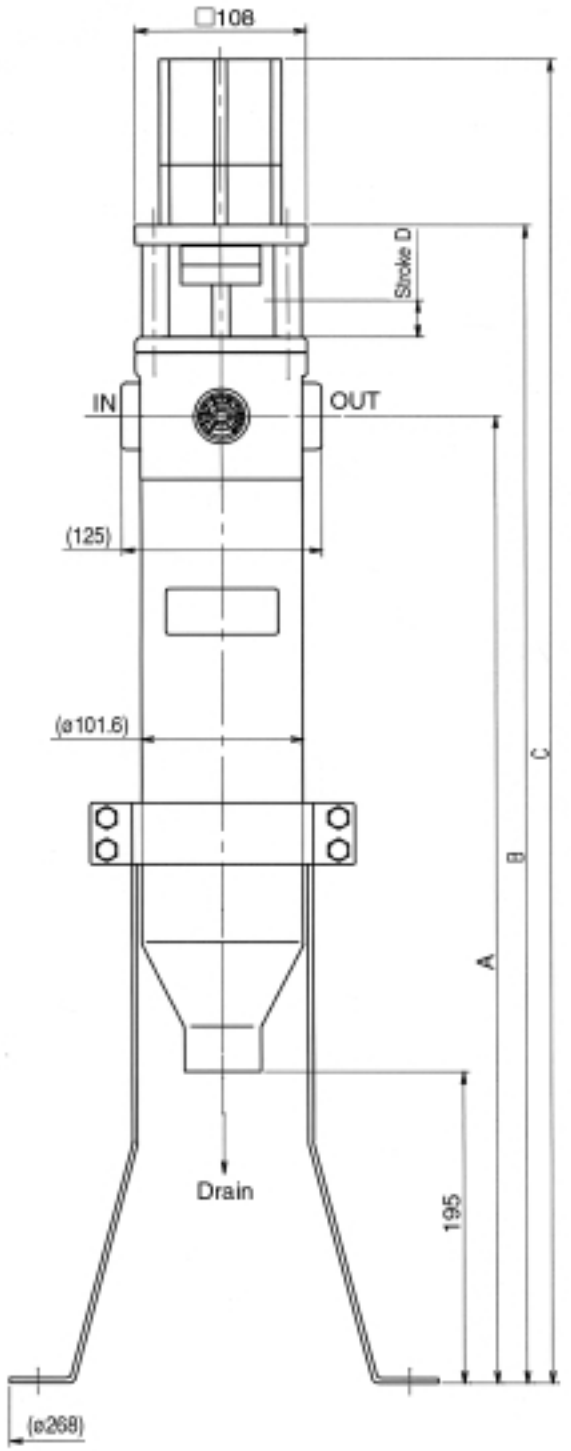


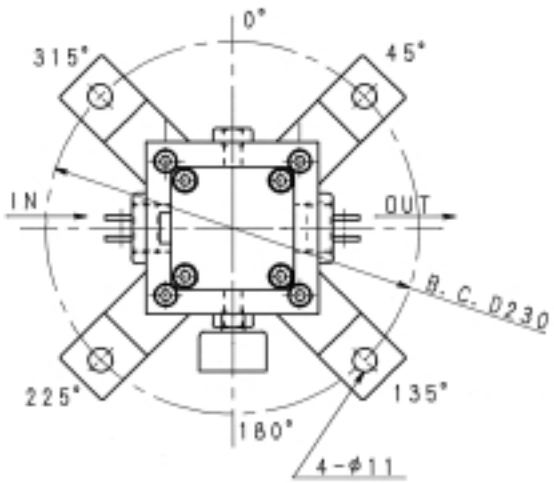
When back flushing
Impurities are removed from the spaces that are opened up



SMC

Dimensions

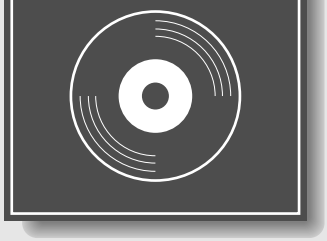




Dimensions mm

	A	B	C	D
FN11□1	610	(730)	(844)	20
FN11□2	860	(1000)	(1134)	40

Other (CD-ROM)



Model Selection Program

Pneumatic Cylinder Drive Systems

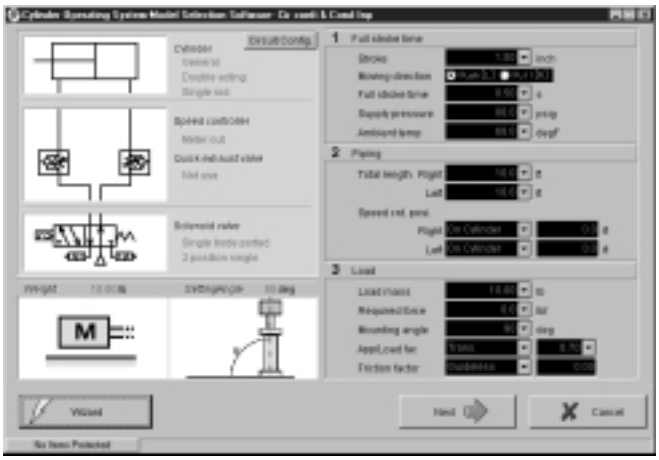
For Windows (Ver.1.00)

Actuator

Automatically selects the optimum and minimum size equipment that meets the energy saving demands.

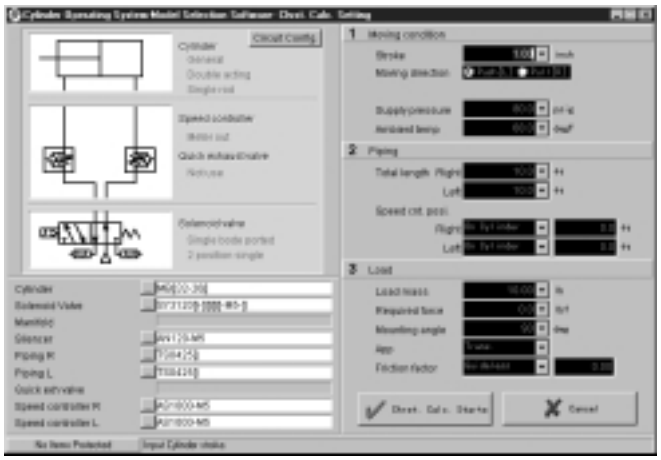
- Highly accurate calculation results are achieved with the introduction of dynamic characteristics analysis, as compared to conventional calculation based on effective areas. (within ± 10%)
- A wide range of circuits and mounting conditions can be processed. Selections are made according to various conditions, such as speed control method and cylinder mounting angle.

Model Selection



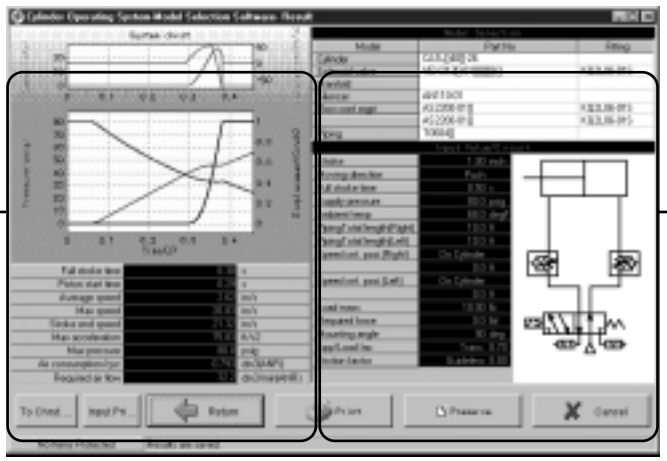
Interactively enter the specifications and operating conditions required. When a series is selected, the software automatically selects the model number of the minimal equipment that meets the requirements and shows the calculation result.

Dynamic Characteristic Calculation



- Use this simulation procedure when the desired model number is known, or when verifying the current system.
- Make changes to the model number and conditions, etc., of the model selection result, and then run a new simulation.

Calculation Result



Displays system characteristics

Displays the model number and input conditions

Refer to P-E99-5A "Model Selection Software" pamphlet for details.

Energy Saving Program

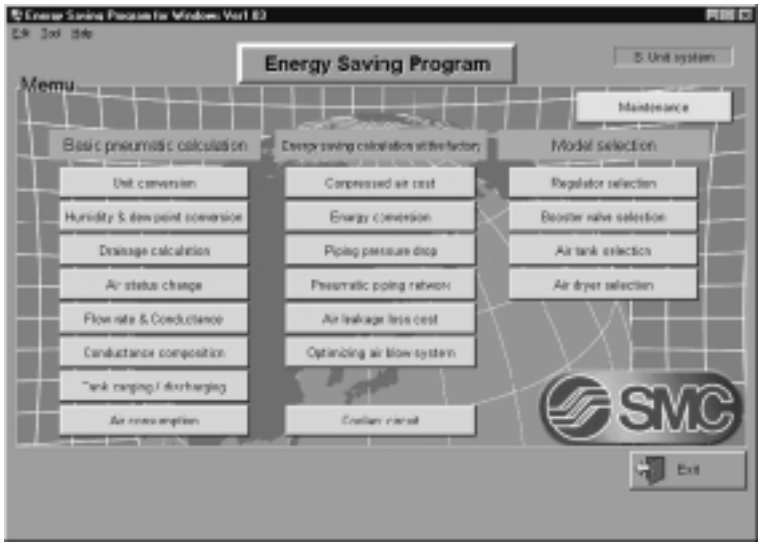
The English version of the "Energy Saving Program" is currently being developed.

Able to perform various calculations necessary for improving energy savings in a pneumatic system

Using the JIS B 8390 flow characteristic measurement methods (conforming to ISO), the program supports measurement units for global use.

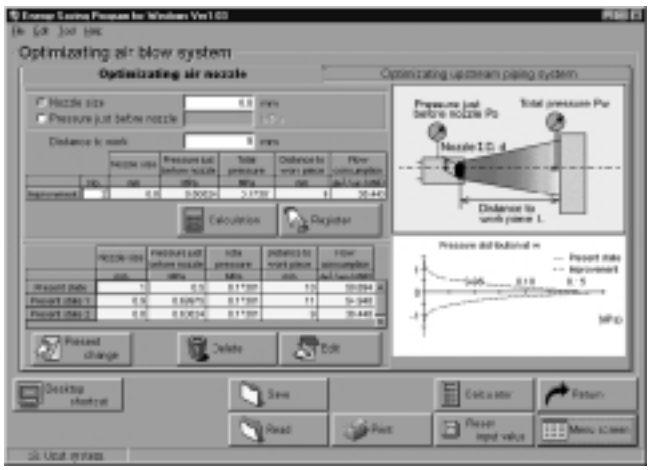
Accuracy is improved by using the latest calculation methods.

Menu screen



1. Calculation for Air Consumption

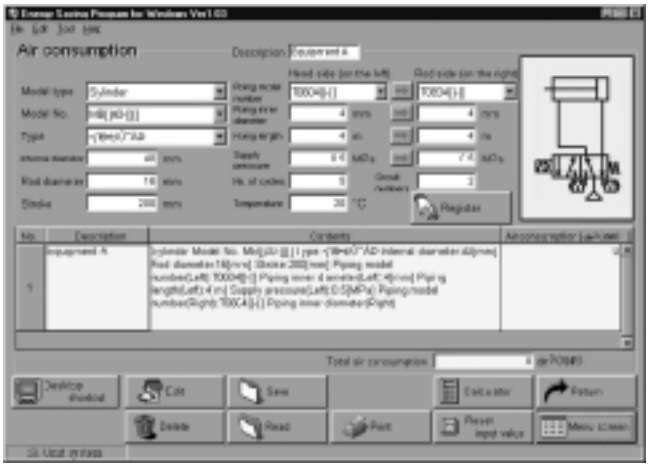
Optimizing air blow system



Calculation of air flow consumption rate is possible.

Optimization can be achieved by changing the nozzle and upstream equipment.

Equipment air consumption



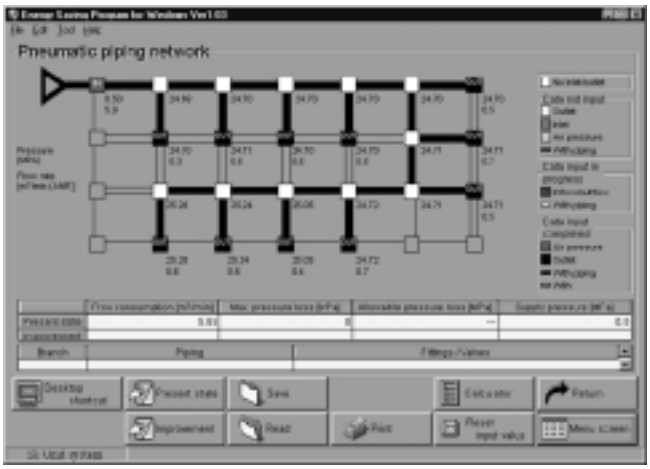
Calculation of air consumption for each component is possible.

Accumulated consumption per line can be calculated.

Accommodates a wide range of actuators.

2. Calculation for Pressure Loss and Flow Rate

Pneumatic piping network



Enables the calculation of pressure loss and flow rate for piping networks such as branched piping and loop piping, which were impossible to calculate accurately.

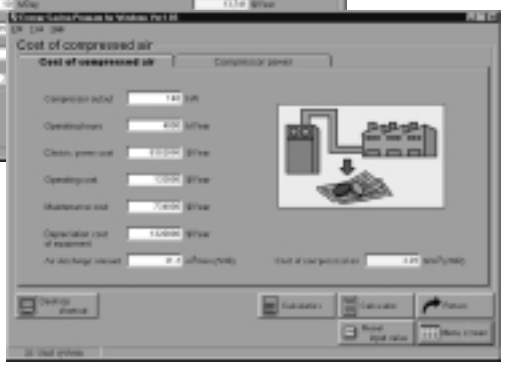
Supports a variety of piping, fittings, and valves.

Also can be applied to coolant circuits.

3. Calculation for Air Leakage and the Cost of Compressed Air

Cost of loss from air leakage

Compressed air cost



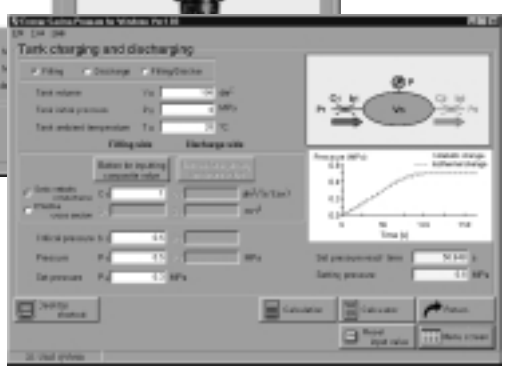
Enables conversion of compressed air into energy cost.

Promotes energy saving awareness by understanding air leakage as an added expense.

4. Model Selection and Tank Filling/Discharging

Regulator selection

Tank filling/discharging



Selection of regulators, booster valves, and air tanks is possible.

"Air tank filling/discharging" let's you see a simulation of the pressure response for simultaneously filling and discharging air.

Complete part numbers and CAD drawings can be generated, displayed and output to file/printer.

Selection of a guide cylinder size is possible.

The software's part number selection feature calculates moments based on load conditions and selects the optimal size and part number.

When the part number is unknown

With a single search, the pinpoint feature enables you to select a part number based on your application, and then allows you to output a CAD drawing of that part number to file and printer.

When the part number has been determined

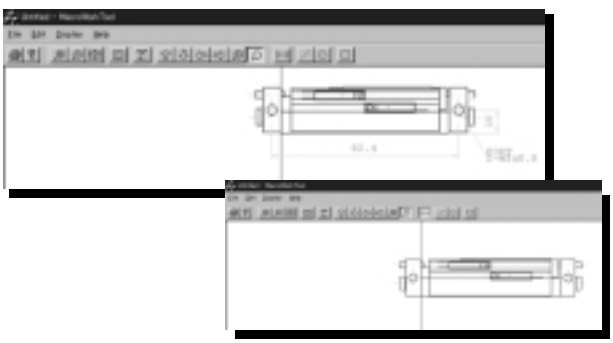
The direct input feature displays a CAD drawing specific to that part number.

Any dimension of a drawing can be displayed.

When a CAD drawing selected with the part number selection feature is displayed, the drawing can be verified by changing the background color (black or white), scaling the drawing, and calculating dimensions.

Dimension display can be selected freely.

Display panes and dimensions can be hidden and line colors can be changed for ease of output.



Various output modes can be applied to the selected CAD drawing data.

The use of a complete part number allows saving the drawing data as a file.

Can be printed without CAD software.

Safety Instructions

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

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

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

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

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

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

⚠ Warning

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

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

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

Compressed air can be dangerous if an operator is unfamiliar with it. Assembly, handling or repair of pneumatic systems should be performed by trained and experienced operators.

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

1. Inspection and maintenance of machinery/equipment should only be performed after confirmation of safe locked-out control positions.
2. When equipment is to be removed, confirm the safety process as mentioned above. Cut the supply pressure for this equipment and exhaust all residual compressed air in the system.
3. Before machinery/equipment is restarted, take measures to prevent shooting-out of cylinder piston rod, etc. (Bleed air into the system gradually to create back pressure.)

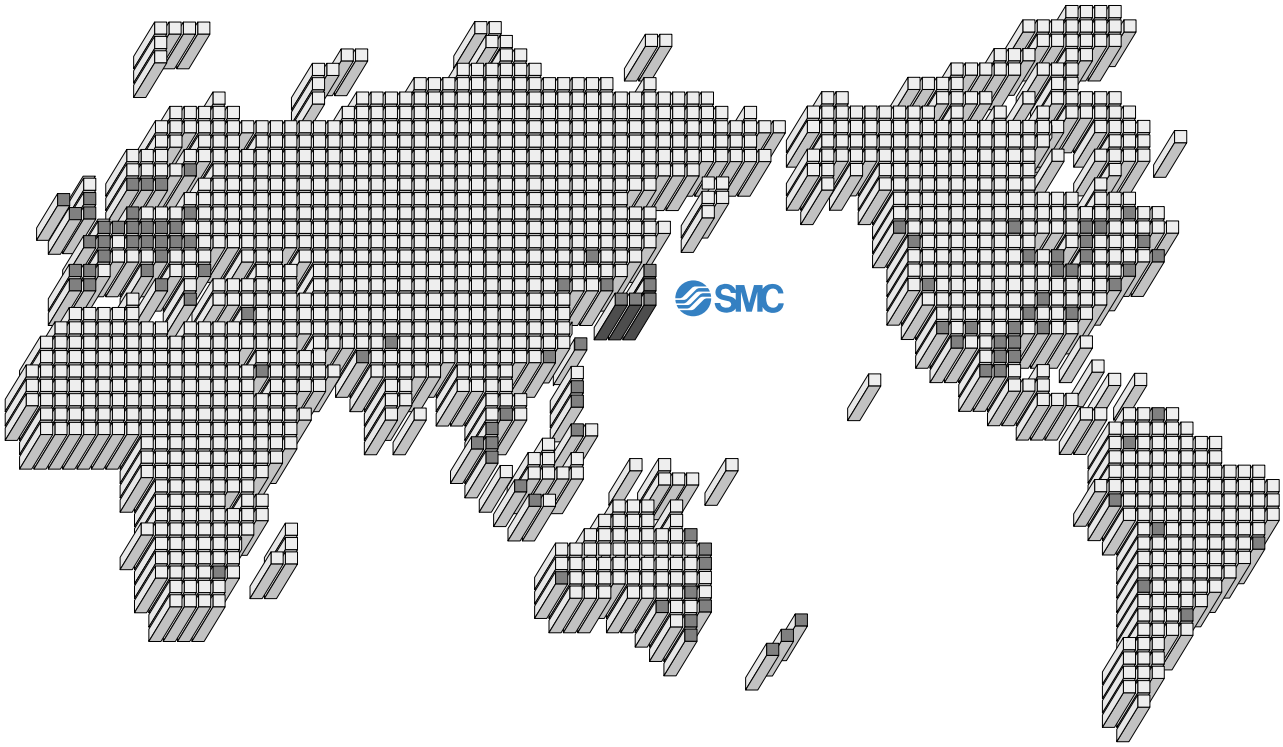
4. Contact SMC if the product is to be used in any of the following conditions:

1. Conditions and environments beyond the given specifications, or if product is used outdoors.
2. Installation on equipment in conjunction with atomic energy, railway, air navigation, vehicles, medical equipment, food and beverages, recreation equipment, emergency stop circuits, press applications, or safety equipment.
3. An application which has the possibility of having negative effects on people, property, or animals, requiring special safety analysis.

⚠ Specific Product Precautions

Be sure to read specific product precautions in each product catalog before handling.

SMC'S GLOBAL MANUFACTURING, DISTRIBUTION AND SERVICE NETWORK



EUROPE

AUSTRIA
SMC Pneumatik GmbH

CZECH
SMC Czech s.r.o.

DENMARK
SMC Pneumatik A/S

FINLAND
SMC Pneumatiikka OY

FRANCE
SMC Pneumatique SA

GERMANY
SMC Pneumatik GmbH

HUNGARY
SMC Hungary Kft.

IRELAND
SMC Pneumatics (Ireland) Ltd.

ITALY
SMC Italia S.p.A.

NETHERLANDS
SMC Pnuematics BV.

NORWAY
SMC Pneumatics Norway A/S

POLAND
SMC Industrial Automation Polska Sp.z.o.o.

ROMANIA
SMC Romania s.r.l.

RUSSIA
SMC Pneumatik LLC.

SLOVAKIA
SMC Slovakia s.r.o.

EUROPE

SLOVENIA
SMC Slovenia d.o.o.

SPAIN/PORTUGAL
SMC España, S.A.

SWEDEN
SMC Pneumatics Sweden AB

SWITZERLAND
SMC Pneumatik AG.

UK
SMC Pneumatics (U.K.) Ltd.

ASIA

CHINA
SMC (China) Co., Ltd.

HONG KONG
SMC Pneumatics (Hong Kong) Ltd.

INDIA
SMC Pneumatics (India) Pvt. Ltd.

MALAYSIA
SMC Malaysia (S.E.A.) Sdn. Bhd.

PHILIPPINES
SMC Pneumatics (Philippines), Inc.

SINGAPORE
SMC Pneumatics (S.E.A.) Pte. Ltd.

SOUTH KOREA
SMC Pneumatics Korea Co., Ltd.

TAIWAN
SMC Pneumatics (Taiwan) Co., Ltd.

THAILAND
SMC Thailand Ltd.

NORTH AMERICA

CANADA
SMC Pneumatics (Canada) Ltd.

MEXICO
SMC Corporation (Mexico) S.A. de C.V.

USA
SMC Corporation of America

SOUTH AMERICA

ARGENTINA
SMC Argentina S.A.

BOLIVIA
SMC Pneumatics Bolivia S.R.L.

BRAZIL
SMC Pneumaticos Do Brazil Ltda.

CHILE
SMC Pneumatics (Chile) S.A.

VENEZUELA
SMC Neumatica Venezuela S.A.

OCEANIA

AUSTRALIA
SMC Pneumatics (Australia) Pty. Ltd.

NEW ZEALAND
SMC Pneumatics (N.Z.) Ltd.

SMC CORPORATION

1-16-4 Shimbashi, Minato-ku, Tokyo 105-0004, JAPAN
Tel: 03-3502-2740 Fax: 03-3508-2480
URL http://www.smcworld.com

1st printing April, 2001 D-SMC.L.A. P-80 (D)
This catalog is printed on recycled paper with concern for the global environment.