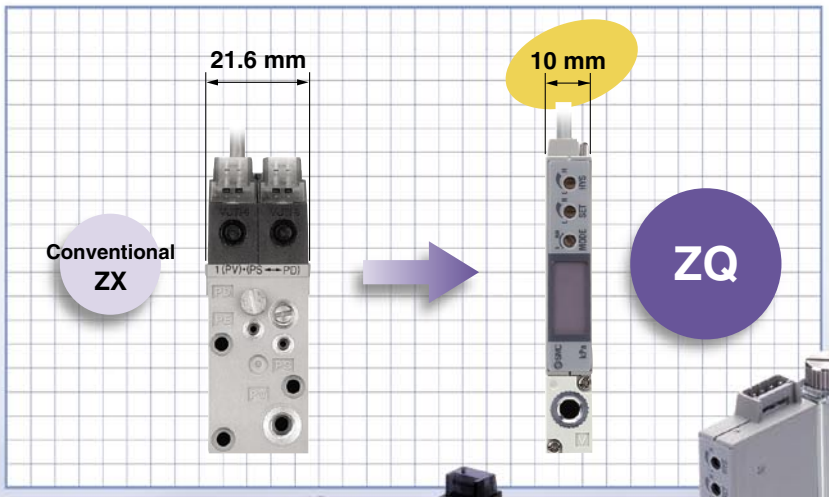
SMC

CE

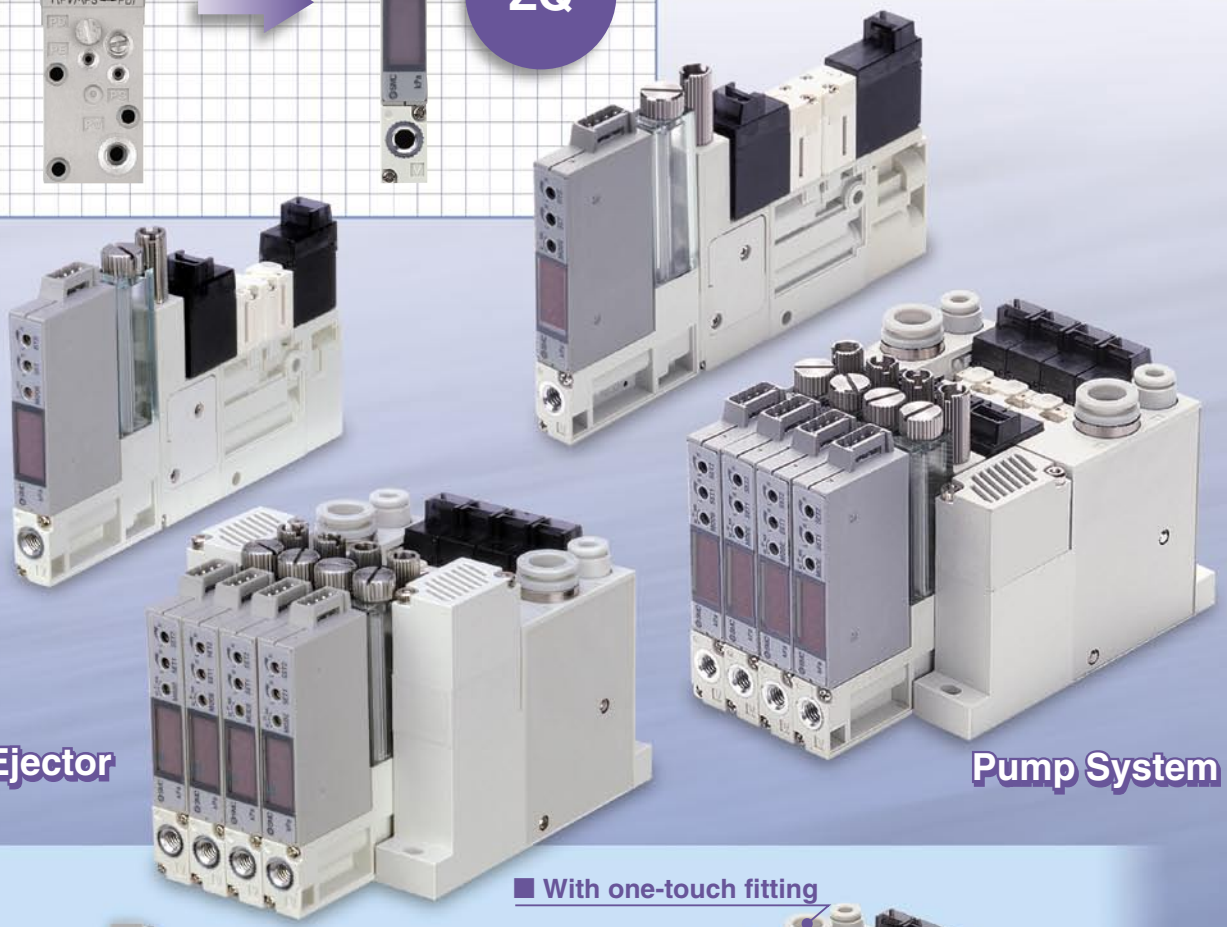
Space Saving Vacuum Ejector & Vacuum Pump System

Series ZQ



Width 10 mm
Weight 109 g

Single unit with vacuum pressure switch and suction filter



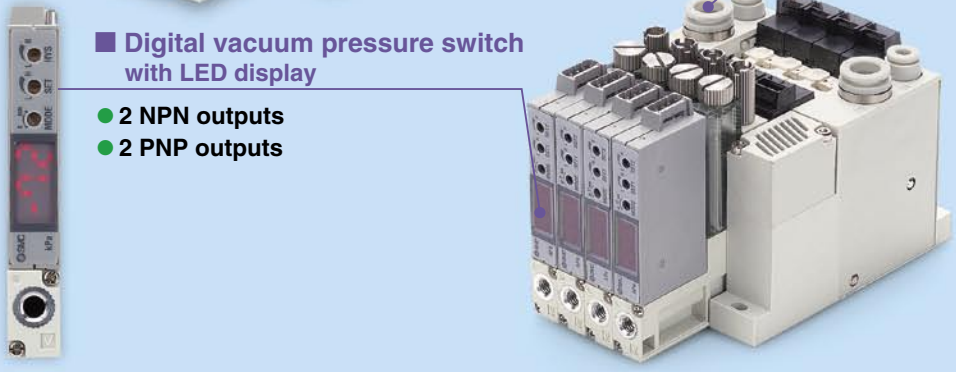
Ejector

Pump System

■ With one-touch fitting

■ Digital vacuum pressure switch with LED display

- 2 NPN outputs
- 2 PNP outputs



Adsorption Transfer System by Ejector

Ejector Module System

Equipment (Ejector supply valve / Vacuum release valve / Restrictor / Vacuum pressure switch / Filter) that is needed for the ejector adsorption transfer system has been integrated to achieve efficient assembly work and a compact design.

Compressor

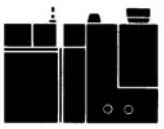
Refrigerated air dryer
Series IDF

Air filter
Series AF

Mist separator
Series AM

Regulator
Series AR

Ejector module



Pressure gauge for vacuum
Series GZ

Ejector System Equipment

Ejector System Equipment

Series	Features	Ejector nozzle dia. (mm)	Equipment: Supply valve	Vacuum release valve	Vacuum switch	Filter
Space saving vacuum ejector ***Series ZQ*** 	• Width 10 mm • Weight 109 g (Single unit with vacuum pressure switch and suction filter)	ø0.5 to ø1.0	●	●	●	●
Vacuum module ***Series ZX*** 	Can also accommodate a vacuum pump for the adsorption transfer of small items such as electronic parts.	ø0.5 to ø1.0	●	●	●	●
Vacuum ejector ***Series ZM*** 	Using an ejector with a 2-stage nozzle, the ejector system can be used more efficiently.	ø0.5 to ø1.3	●	●	●	●
Large vacuum module ***Series ZR*** 	• Double solenoids provide a self-holding function. • Necessary functions can be combined through modular design. • Can also accommodate a vacuum pump.	ø1.0 to ø2.0	●	●	●	●

Single Unit Equipment

Series	Features
Vacuum ejector ***Series ZH*** 	• Nozzle diameter ø0.5 to 1.3 mm • Can be connected with the combination of a one-touch and a screw-in connection.
Multi-stage ejector ***Series ZL*** 	• Suction flow rate increased by a 3-stage diffuser construction. • Functions such as a digital vacuum switch or a vacuum pressure gauge can be selected.
Air suction filter ***Series ZFA*** 	Prevents problems related to vacuum circuits or airborne contaminants. Maximum flow rate 200 ℓ/min (ANR). The collected dust does not remain in the case.
Air suction filter ***Series ZFB*** 	• Prevents problems related to vacuum circuits or airborne contaminants. • Maximum flow rate ℓ/min (ANR) (metric size) • The pipe tubing can be mounted and removed by one-touch operation.
Vacuum pad ***Series ZP*** 	A variety of models (with or without a buffer), pad shapes (flat, flat with ribs, deep, bellows), pad diameters (ø2 to ø250, ø150 and above on special order).
Free mount cylinder for vacuum ***Series ZCUK*** 	In the rectangular, compact cylinder CU series with a high level of mounting precision, a vacuum passage is provided in the rod to facilitate the mounting of a vacuum pad and to save space.
Vacuum switch ***Series ZS*** 	Digital pressure switch/ZSE Diaphragm type pressure switch/ZSM1 Refer to specific catalogue.

Adsorption Transfer System by Vacuum Pump

Equipment (Vacuum switch valve / Vacuum release valve / Restrictor / Vacuum pressure switch / Filter) that is needed for controlling the vacuum pressure has been integrated to achieve efficient assembly work and a compact design.

Compressor

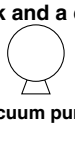
Refrigerated air dryer
Series IDF

Air filter
Series AF

Mist separator
Series AM

Regulator
Series AR

Vacuum regulator or Electro-pneumatic regulator
Vacuum regulator/*Series IRV*
Direct operated vacuum regulator that regulates vacuum pressure
Electro-pneumatic regulator/ *Series ITV209*□
Controls the vacuum pressure in accordance with external electric signals



Vacuum pump

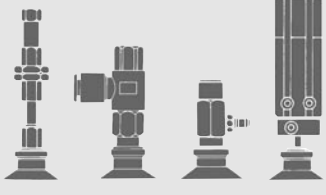
Pressure gauge for vacuum
Series GZ

Control unit/***ZQ1000 ZX100 ZR100***

Note) If the control unit is not used, it is possible to configure the system by using individual units such as a switch valve, vacuum release valve, filter, pressure switch, etc.

Vacuum pad/*Series ZP*

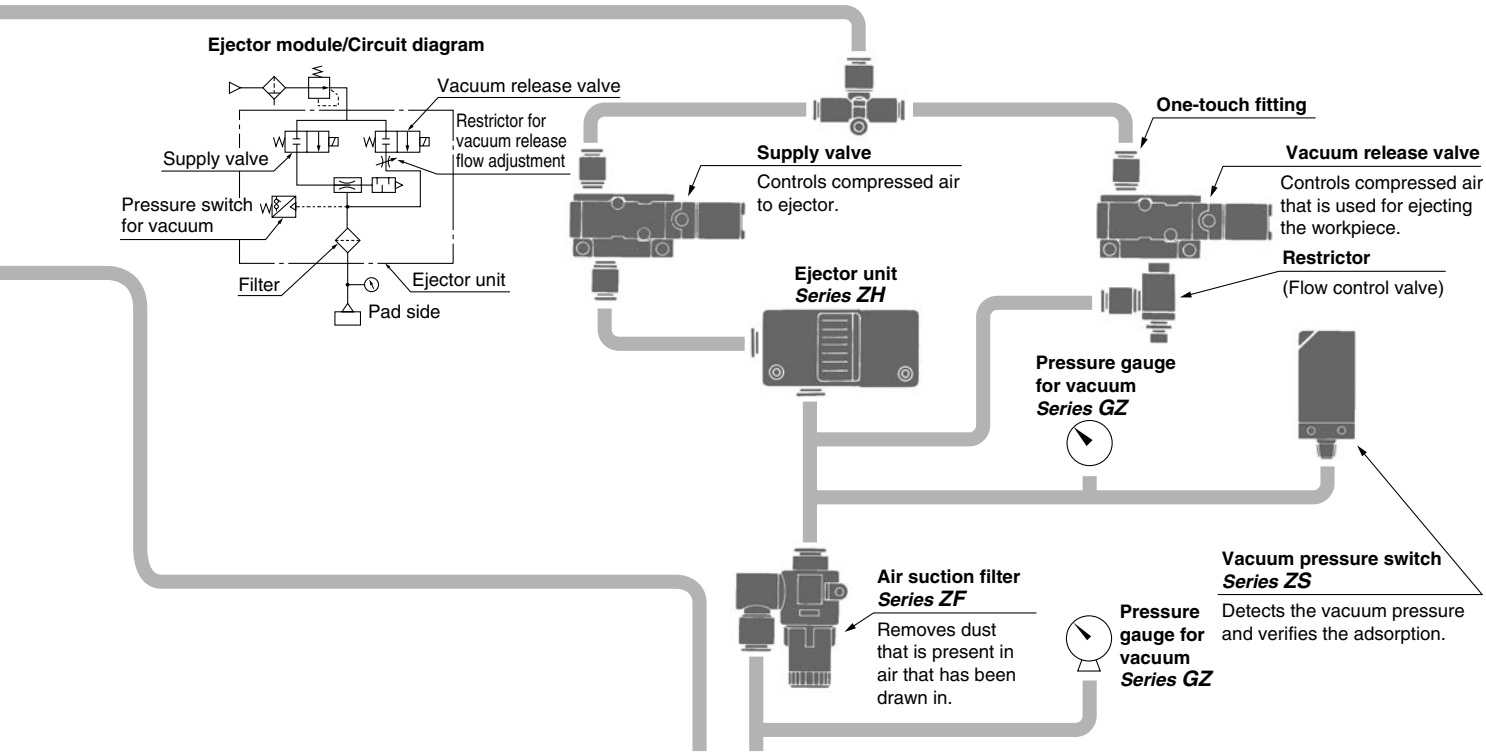
Free mount cylinder for vacuum
Series ZCUK



Workpiece

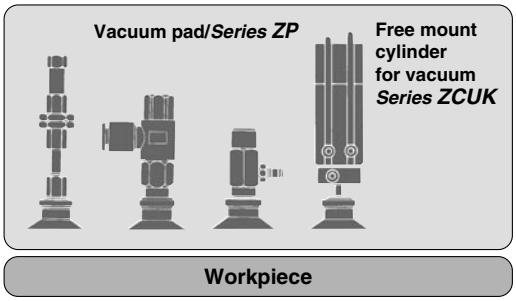
Single Unit System

Equipment such as an ejector is configured as an individual unit. Thus, it is possible to create a flexible system configuration in which the circuit composition and the mounting locations can be selected as desired.



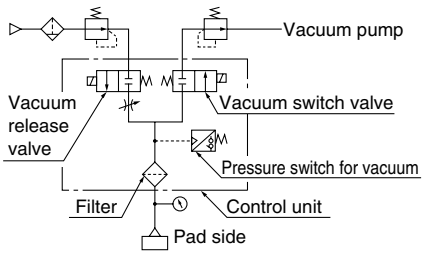
Other Equipment

	Description
Other equipment for vacuum system	Vacuum regulator/Electronic vacuum regulator/Directional control equipment/Pressure gauge for vacuum/Fittings & Tubing/Flow control equipment/Vacuum accessory equipment
Related products	Air filter/Regulator/ Filter regulator/ Mist separator



Vacuum Pump System Equipment

Control unit/Circuit diagram



Ejector System Equipment

Control unit	Applications	Equipment: Vacuum switch valve	Vacuum release valve	Vacuum pressure switch	Filter
Series ZQ1000	• Width 10 mm • Weight 109 g (Single unit with vacuum pressure switch and suction filter)	●	●	●	●
Series ZX100	• Effective area of vacuum switch valve is 3 mm². • Necessary functions can be combined through modular design.	●	●	●	●
Series ZR100	• Double solenoids provide a self-holding function. • Effective area of vacuum switch valve is 8.2 mm². • Necessary functions can be combined through modular design.	●	●	●	●

Other Equipment

Description	Applications
Vacuum regulator ***IRV***	Direct operated vacuum pressure adjustment valve that regulates the vacuum pressure.
Electro-pneumatic regulator ***ITV209□***	Controls the vacuum pressure in accordance with external electric signals.

Vacuum Equipment Model Selection

When an ejector and a vacuum pump are used for picking up a workpiece, the response times for picking up (and discharging), as well as the vacuum pressures during adsorption, vary according to the piping condition and the type of workpiece. Thus, by selecting the proper vacuum equipment, effective utilization of the vacuum system can be

Vacuum Equipment Model Selection

Selection Step

1. Pad selection
- **1-A Theoretical lifting force**
- **1-B Calculation method: Pad diameter**

2. Ejector / Vacuum switch valve selection
- **2-A Calculation method: Adsorption response time**
- **2-B Leakage during workpiece adsorption**
- **2-C Size of ejector and vacuum supply valve (with leakage)**
- **2-D Size of ejector and vacuum supply valve (without leakage)**

Selection Step 1 Pad Selection

The pad diameter is found by means of a pad lift calculation.
The calculated value should be used for reference and confirmed by actual adsorption tests when necessary.
In the lift calculation, consideration should be given to the weight of the workpiece, forces due to acceleration during movement (lifting, stopping, turning, etc.) and a sufficient safety margin should be allowed.
An additional margin should also be allowed when determining the number and arrangement of pads.

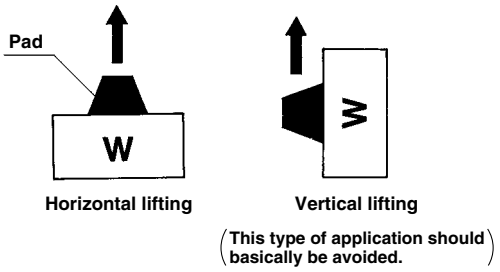
1-A Theoretical Lifting Force

The theoretical lifting force of a pad can be found by calculation or from the theoretical lifting force table (1) shown below.

Calculation

$$W = P \times S \times 0.1 \times \frac{1}{t}$$

W: Lifting force (N)
P : Vacuum pressure (kPa)
S : Pad area (cm^2)
t : Safety factor Horizontal lifting: 4 or more
Vertical lifting: 8 or more



Horizontal lifting **Vertical lifting**

(This type of application should basically be avoided.)

Theoretical Lifting Force

The theoretical lifting force (not including the safety factor) is found from the pad diameter and vacuum pressure.
The required lifting force is then found by dividing the theoretical lifting force by the safety factor.

Lifting force = **Theoretical lifting force** ÷ **t**

(1) Theoretical Lifting Force (Theoretical lifting force = P x S x 0.1)

Unit: N

Pad size (mm)		2 x 4	3.5 x 7	4 x 10	ø2	ø4	ø6	ø8	ø10	ø13	ø16	ø20	ø25	ø32	ø40	ø50
Pad area (cm^2)		0.07	0.21	0.36	0.031	0.126	0.283	0.503	0.785	1.33	2.01	3.14	4.91	8.04	12.6	19.6
Vacuum pressure (kPa)	**–85**	0.60	1.78	3.06	0.264	1.07	2.41	4.28	6.67	11.3	17.1	26.7	41.7	68.3	107	167
	–80	0.56	1.68	2.88	0.248	1.01	2.26	4.02	6.28	10.6	16.1	25.1	39.3	64.3	101	157
	–75	0.53	1.57	2.70	0.233	0.945	2.12	3.77	5.89	9.98	15.1	23.6	36.8	60.3	94.5	147
	–70	0.49	1.47	2.52	0.217	0.882	1.98	3.52	5.50	9.31	14.1	22.0	34.4	56.3	88.2	137
	–65	0.46	1.36	2.34	0.202	0.819	1.84	3.27	5.10	8.65	13.1	20.4	31.9	52.3	81.9	127
	–60	0.42	1.26	2.16	0.186	0.756	1.70	3.02	4.71	7.98	12.1	18.8	29.5	48.2	75.6	118
	–55	0.39	1.15	1.98	0.171	0.693	1.56	2.77	4.32	7.32	11.1	17.3	27.0	44.2	69.3	108
	–50	0.35	1.05	1.80	0.155	0.630	1.42	2.52	3.93	6.65	10.1	15.7	24.6	40.2	63.0	98.0
	–45	0.32	0.94	1.62	0.140	0.567	1.27	2.26	3.53	5.99	9.05	14.1	22.1	36.2	56.7	88.2
	–40	0.28	0.84	1.44	0.124	0.504	1.13	2.01	3.14	5.32	8.04	12.6	19.6	32.2	50.4	78.4

Selection Step 1 Pad Selection

1-B Finding the Pad Diameter

A pad diameter which accounts for a safety factor based upon the workpiece lifting method (horizontal or vertical), can be selected by using the calculation formula or the selection graphs (Below graphs (1) and (2)).

Calculation

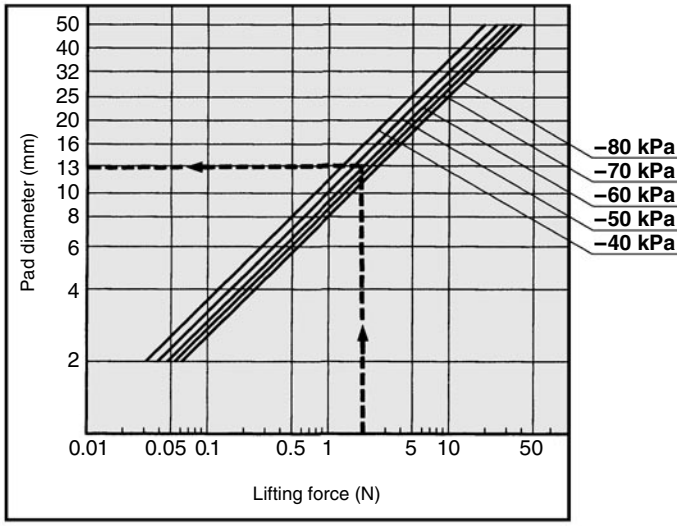
$$D = \sqrt{\frac{4}{3.14} \times \frac{1}{P} \times \frac{W}{n} \times t \times 1000}$$

D : Pad diameter (mm)
n : Number of pads per workpiece
W: Lifting force (N)
P : Vacuum pressure (kPa)
t : Safety factor Horizontal lifting: 4 or more
Vertical lifting: 8 or more

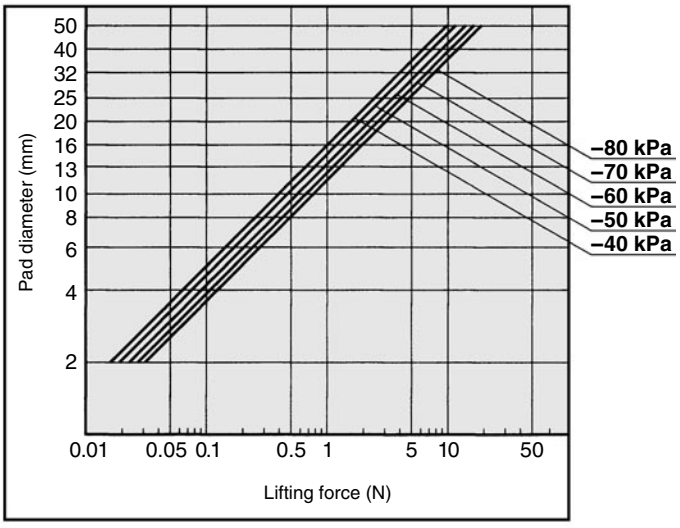
Selection Graph

After establishing the workpiece weight, number of pads to be used, and the vacuum pressure when adsorbing the workpiece, the pad diameters for horizontal lifting and vertical lifting can be found by means of using graphs (1) and (2).

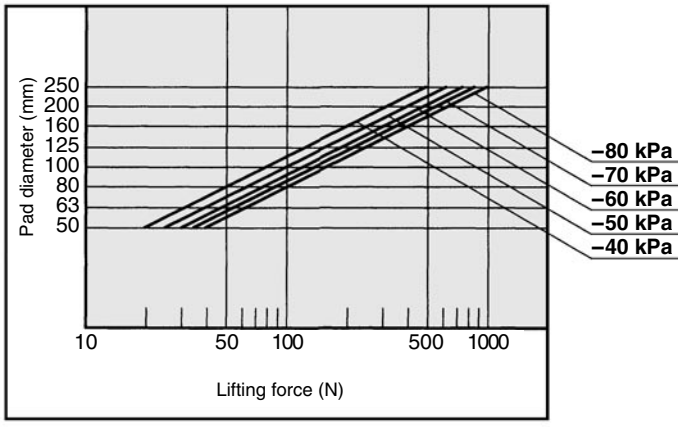
Selection Graph (1)-1 Pad Diameter Selection Graph by Lifting Force Horizontal Lifting (ø2 to ø50)



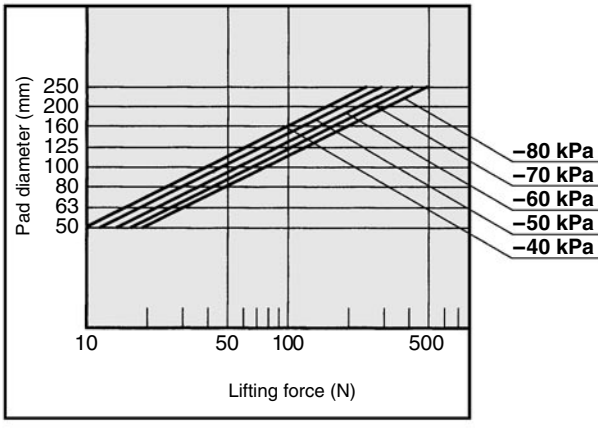
Selection Graph (2)-1 Pad Diameter Selection Graph by Lifting Force Vertical Lifting (ø2 to ø50)



Selection Graph (1)-2 Pad Diameter Selection Graph by Lifting Force Horizontal Lifting (ø50 to ø250)



Selection Graph (2)-2 Pad Diameter Selection Graph by Lifting Force Vertical Lifting (ø50 to ø250)



How to read the graph

Example: Workpiece weight 1 kg (Lifting force: 9.8 N)
: Conditions/Number of pads: 5 pcs.
Vacuum pressure –60 kPa
Horizontal lifting

<Selection procedure>

From the conditions at the left, the lifting force per pad: 9.8 N ÷ 5 pcs. = 2 N, and for horizontal lifting, selection is made from graph (1)-1. Then, extending the intersection point of the lifting force 2 N and with a vacuum pressure of –60 kPa to the left, a pad diameter of 13 mm is obtained. Therefore, a pad diameter of 13 mm or greater should be selected.

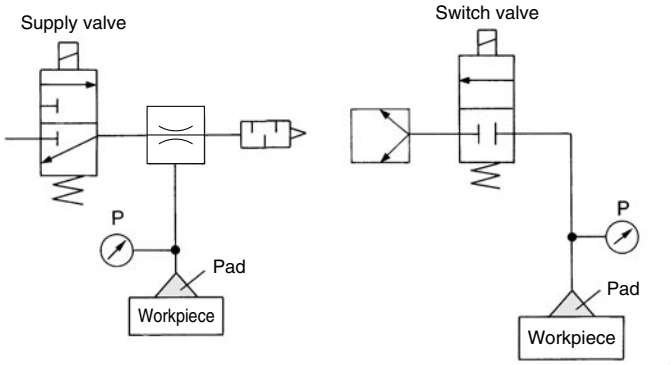
Vacuum Equipment Model Selection

Selection Step 2 Selection of Ejector and Vacuum Switch Valve

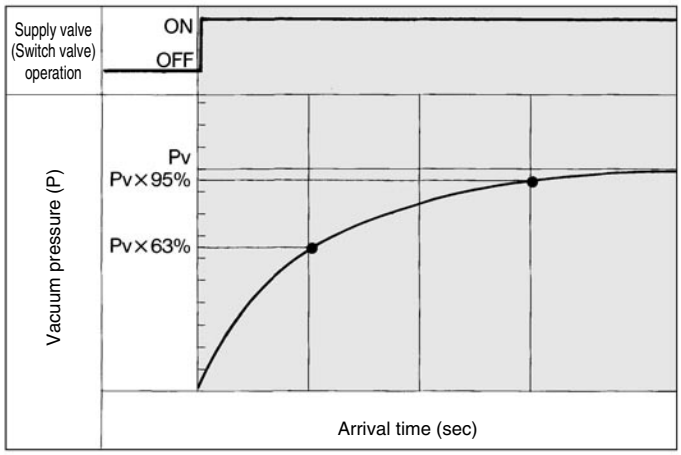
2-A Adsorption Response Time

When a pad is used for the adsorption transport of a workpiece, the approximate adsorption response time can be obtained (the length of time it takes for the pad's internal vacuum pressure to reach the pressure that is required for adsorption after the supply valve {vacuum switch valve} has been operated). An approximate adsorption response time can be obtained through formulas and selection graphs (3) and (4).

Vacuum System Circuit Diagram



Vacuum Pressure and Response Time after Supply Valve (switch valve) is Operated.



Pv: Last vacuum pressure
T1 : Arrival time to 63% of last vacuum pressure Pv
T2 : Arrival time to 95% of last vacuum pressure Pv

Calculation

Adsorption response times T_1 and T_2 can be obtained through the formulas given below.

Adsorption response time T_1

$$= \frac{V \times 60}{Q}$$

Adsorption response time T_2

$$= 3 \times T_1$$

Piping capacity V

$$= \frac{3.14}{4} D^2 \times L \times \frac{1}{1000} (\ell)$$

T_1 : Arrival time to 63% of last vacuum pressure Pv (sec)
T_2 : Arrival time to 95% of last vacuum pressure Pv (sec)
D : Piping diameter (mm)
L : Length from ejector and switch valve to pad (m)
V : Piping capacity from ejector and switch valve to pad (ℓ)
Q : Smaller one between the Q_1 and Q_2 ℓ/min (ANR)
Q_1: Average suction flow (ℓ/min (ANR))

Calculation of average suction flow
- **Ejector**
  Q_1 = (1/2 to 1/3) x Ejector Max. suction flow ℓ/min (ANR)
- **Vacuum pump**
  Q_1 = (1/2 to 1/3) x 11.1 x Effective area of vacuum pump (mm^2)

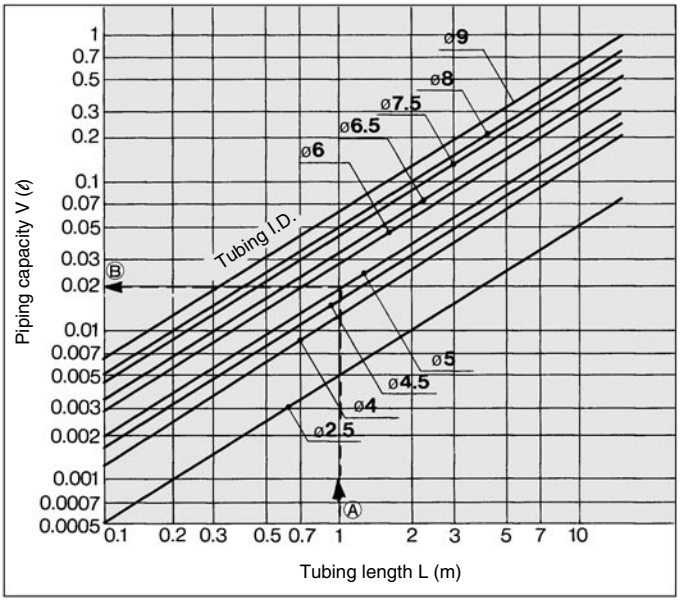
Q_2: Max. flow from ejector and switch valve to pad by piping system
Q_2 = S x 11.1 ℓ/min (ANR)
S : Effective area of piping (mm^2)

Selection Graph

1. Tubing piping capacity

Piping capacity from ejector and switch valve at vacuum pump to pad can be found from selection graph (3).

Selection Graph (3) Tubing I.D. Piping Capacity



How to read the graph

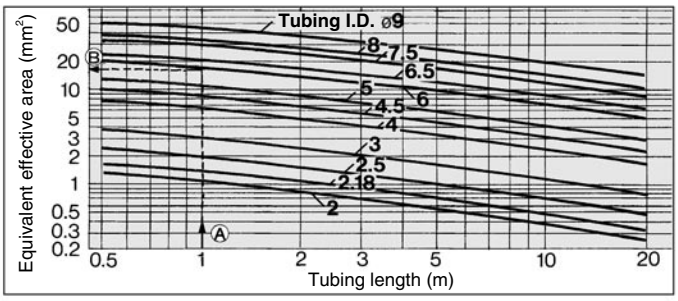
Example: For obtaining the volume of tubing I.D. ø5 mm and 1 meter length.

Selection Procedure

By extending leftward from the point at which the 1 meter tubing length on the horizontal axis intersects the line for a tubing I.D. ø5 mm, the piping volume approximately equivalent to 0.02 ℓ can be obtained, on the vertical axis.
Piping capacity ≈ 0.02 ℓ

2. Effective area of tubing

Effective area of tubing from graph below



How to read the graph

Example: Tubing size ø8/ø6, 1 m

Selection Procedure

From the point of intersection of tubing length 1 m of lateral axis and tubing I.D. ø6 mm, the equivalent effective area at vertical axis can be found as approx. 18 mm^2.
Equivalent effective area ≈ 18 mm^2

Selection Step 2 Selection of Ejector and Vacuum Switch Valve

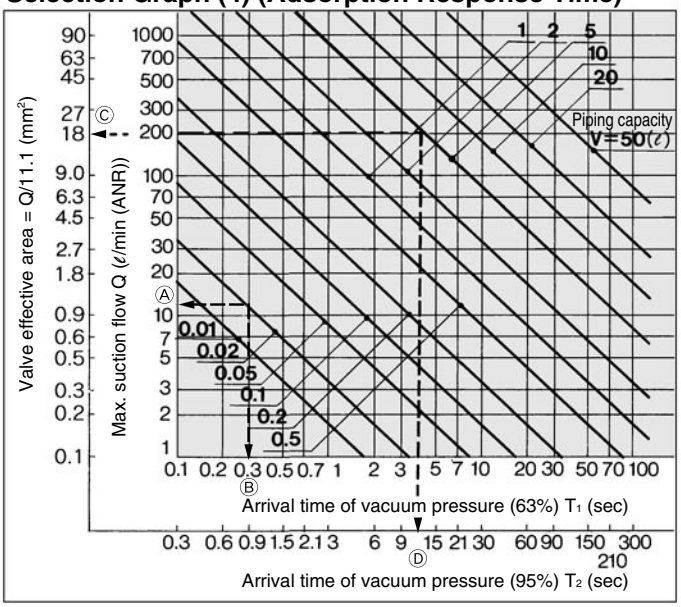
2-A Adsorption Response Time

Selection Graph

3. Obtaining the adsorption response times

By operating the supply valve (switch valve) that controls the ejector (vacuum pump), the adsorption response times T_1 and T_2 that elapsed before the prescribed vacuum pressure is reached can be obtained using the selection graph (4).

Selection Graph (4) (Adsorption Response Time)



∗ Conversely, the size of the ejector or the size of the switch valve of the vacuum pump system can be obtained from the adsorption response time.

How to read the graph

Example 1: For obtaining the adsorption response time until the pressure in the piping system with a piping volume of 0.02 ℓ is discharged to 63% (T_1) of the final vacuum pressure through the use of the vacuum ejector ZH07□S with a maximum suction flow of 12 ℓ/min (ANR).

Selection Procedure

From the point at which the vacuum ejector's maximum suction flow of 12 ℓ/min (ANR) and the piping volume of 0.02 ℓ intersection, the adsorption response time T_1 that elapses until 63% of the maximum vacuum pressure is reached can be obtained. (Sequence in selection graph (4), A→B) **T_1 ≈ 0.3 seconds.**

Example 2: For obtaining the discharge response time until the internal pressure in the 5 ℓ tank is discharged to 95% (T_2) of the final vacuum pressure through the use of a valve with an effective area of 18 mm².

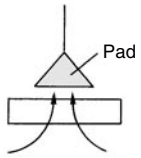
Selection Procedure

From the point at which the valve's effective area of 18 mm² and the piping volume of 5 ℓ intersection, the discharge response time (T_2) that elapses until 95% of the final vacuum pressure is reached can be obtained. (Sequence in selection graph (4), C→D) **T_2 ≈ 12 seconds.**

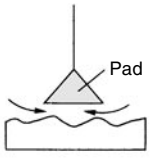
2-B Leakage during Workpiece Adsorption

Leakage

Even if the pad picks up a workpiece, air could be drawn in depending on the type of the workpiece. As a result, the vacuum pressure in the pad becomes reduced and the amount of vacuum that is necessary for adsorption cannot be attained.
When this type of workpiece must be handled, it is necessary to select the proper size of the ejector and the vacuum switch valve by taking into consideration the amount of air that could leak through the workpiece.



Ventilation workpiece



Rough-surfaced workpiece

Leakage from Effective Area of Workpiece

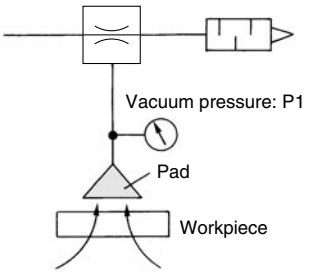
Leakage $Q_L = 11.1 \times S_L$

Q_L: Leakage (ℓ/min (ANR))

S_L: Effective area between a workpiece and a pad, and the workpiece opening area (mm²)

Leakage from Adsorption Test

As described in the illustration below, pick up a workpiece using an ejector, pad and vacuum gauge.
At this time, read the vacuum pressure P_1, and obtain the suction flow using flow characteristics graph for the ejector that is being used, and render this amount as the leakage of the workpiece.



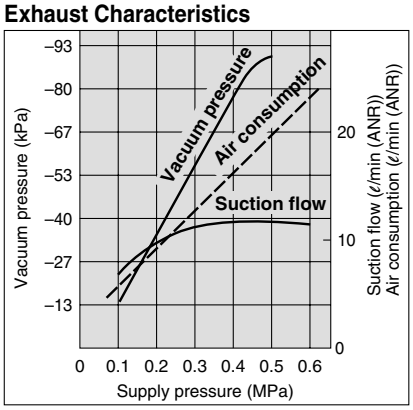
Exercise: Using a supply pressure of 0.45 MPa, when the ejector (ZH07) picks up a workpiece that leaks air, the vacuum gauge indicated a pressure of –53 kPa. Calculate the leakage volume from the workpiece.

Selection Procedure

When the suction flow at –53 kPa is obtained using the ZH07DS flow characteristics graph, the leakage volume is 5 ℓ/min (ANR). (A→B →C)
Leakage ≈ Suction flow 5 ℓ/min (ANR)

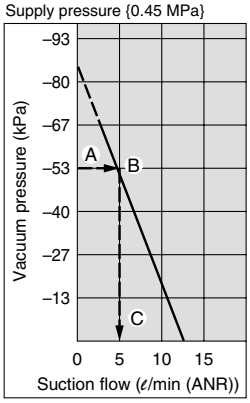
ZH07□S

Exhaust Characteristics



Flow Characteristics

Supply pressure {0.45 MPa}



Selection Step 2 Selection of Ejector and Vacuum Switch Valve

2-C Sizing Ejector and Vacuum Switch Valve (with Leakage)

If there is leakage through a workpiece, the necessary size of the ejector and the vacuum switch valve can be obtained by adding the leakage volume to the maximum suction flow.

Calculation

1. Average suction flow to achieve adsorption response time

$$Q = \frac{V \times 60}{T_1} + Q_L$$

$$T_2 = 3 \times T_1$$

Q : Average suction flow ℓ/min (ANR)
V : Piping capacity (ℓ)
T_1 : Arrival time to stable Pv 63% after adsorption (sec)
T_2 : Arrival time to stable Pv 95% after adsorption (sec)
Q_L : Leakage during workpiece adsorption ℓ/min (ANR)

2. Max. suction flow

Qmax = (2 to 3) x Q ℓ/min (ANR)

Selection Procedure

• Ejector
Select the ejector with the greater maximum suction flow from the Qmax. given above.

• Direct-operated switch valve

$$\text{Effective area } S = \frac{Qmax}{11.1} \text{ (mm}^2\text{)}$$

Note) Select a valve (solenoid valve) having an effective area that is greater than that of the effective area formula given above from the related equipment.

Selection Graph

1. Tubing capacity
Using selection graph (3) (page 3) “Tubing I.D. Piping Capacity”, obtain the tubing capacity.

2. Max. suction flow Qmax
Using selection graph (4) (page 4) “Adsorption Response Time”, obtain the maximum suction flow Q that does not contain the leakage amount Q_L, based on the set adsorption response times (T_1, T_2) and the tubing volume.

Max. suction flow Qmax = Q + (3 x Q_L)

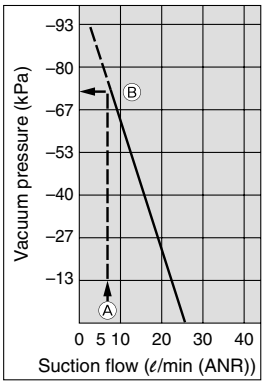
Q : Max. suction flow from selection graph (4) “Adsorption Response Time” on page 4
Q_L: Leakage volume ℓ/min (ANR) (page 4) (2) B from leakage when adsorbing up a workpiece

Selection Procedure

• Ejector
Select an ejector having a greater maximum suction flow than that of Qmax given above. During the selection, verify the pad’s lift force because the vacuum pressure after adsorption will be lower than the maximum vacuum pressure due to the leakage volume Q_L ℓ/min (ANR).

Example: ZH10□S
(Supply pressure 0.45 MPa)
If the leakage volume Q_L is 12 ℓ/min (ANR), the vacuum pressure after adsorption will be –73 kPa.
(A→B)

Flow Characteristics



• Vacuum switch valve
Using selection graph (4) (page 4), move the maximum suction flow Qmax. point parallel to the graduation line of the effective area S of the left valve; then, obtain the effective area of the vacuum switch valve from the intersecting point.

2-D Sizing Ejector and Vacuum Switch Valve (without Leakage)

Calculation

1. Average suction flow

$$Q = \frac{V \times 60}{T_1}$$

$$T_2 = 3 \times T_1$$

Q : Average suction flow ℓ/min (ANR)
V : Piping capacity
T_1 : Arrival time to stable Pv 63% after adsorption (sec)
T_2 : Arrival time to stable Pv 95% after adsorption (sec)

2. Max. suction flow

Qmax = (2 to 3) x Q ℓ/min (ANR)

Selection Procedure

• Ejector
Select the ejector with the greater maximum suction flow from the Qmax. given above.

• Vacuum switch valve

$$\text{Effective area } S = \frac{Qmax}{11.1} \text{ (mm}^2\text{)}$$

Note) Select a valve (solenoid valve) having an effective area that is greater than that of the effective area formula given above from the related equipment.

Selection Graph

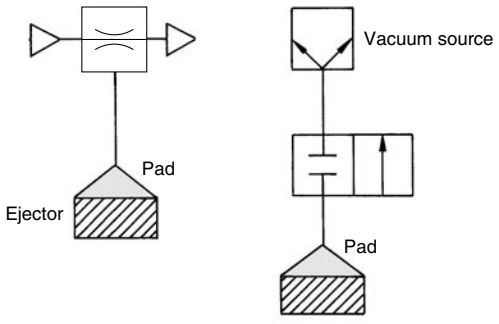
1. Tubing capacity
Using tubing capacity selection graph (3) (page 3) “Tubing I.D. Piping Capacity”, obtain the tubing capacity.

2. Max. suction flow Qmax
Using selection graph (4) (page 4) “Adsorption Response Time”, obtain the maximum suction flow Q based on the set adsorption response times (T_1, T_2) and the tubing volume.

Selection Procedure

• Ejector
Select an ejector having a greater maximum suction flow than that of Qmax. given above.

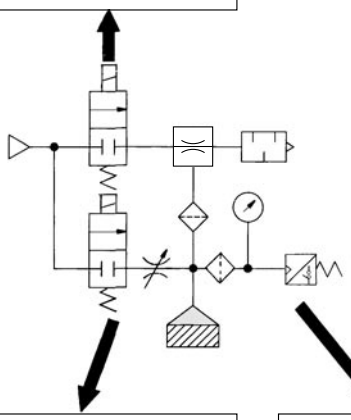
• Vacuum switch valve
Using valve selection graph (4) (page 4), move the maximum suction flow Qmax point parallel to the graduation line of the effective area S of the left valve; then, obtain the effective area of the vacuum switch valve from the intersecting point.



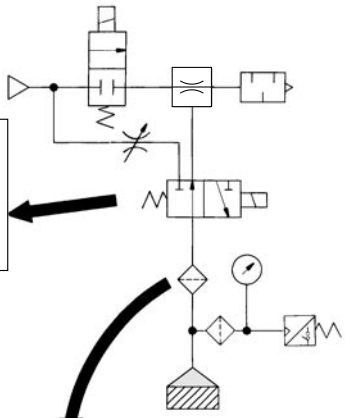
⚠ Caution

Caution on Vacuum Equipment Selection

As a countermeasure for power outages, select a supply valve that is normally open or one that is equipped with a self-holding function.

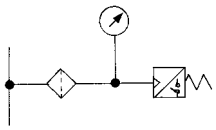


Select a vacuum switch valve that has an effective area that does not reduce the composite effective area consisting of the areas from the pad to the ejector.



For the vacuum release valve, select a 2- or 3-port valve with a low vacuum specification.
Also, use a needle valve to regulate the release flow rate.

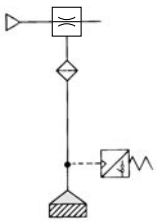
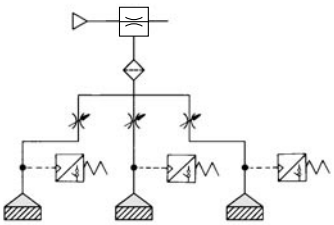
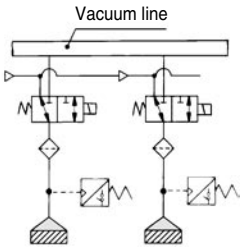
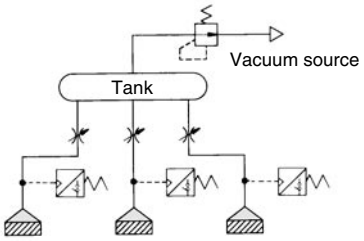
- During the adsorption transport of a workpiece, verification of the vacuum switch is recommended.
- In addition, visually verify the vacuum gauge when handling a heavy or a hazardous item.
- Install a filter (ZFA/ZFB/ZFC series) before the pressure switch if the ambient air is of low quality.



Use a suction filter (ZFA/ZFB/ZFC series) to protect the switch valve and to prevent the ejector from becoming clogged. Also a suction filter must be used with the ZQ series in a dusty environment. If only the unit's filter is used, it will become clogged quickly.

⚠ Caution

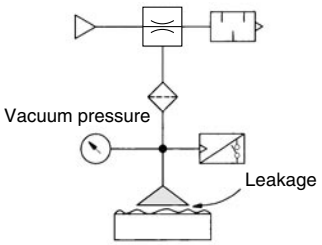
Caution on Matching with Vacuum Circuit Diagram

Ejector and number of pads		Vacuum pump and number of pads	
			
Ideally, one pad should be used for each ejector.	When more than one pad is attached to a single ejector, if one of the workpieces becomes detached, the vacuum pressure will drop, causing other workpieces to become detached. Therefore, the countermeasures listed below must be taken. • Adjust the needle valve to minimise the pressure fluctuation between adsorption and non-adsorption operations. • Provide a vacuum switch valve to each individual pad to minimise the influences on other pads if an adsorption error occurs.	Ideally, one pad should be used for each ejector.	When more than one pad is attached to a single vacuum line, take the countermeasures listed below. • Adjust the needle valve to minimise the pressure fluctuation between adsorption and non-adsorption operation. • Include a tank and a vacuum pressure reduction valve (vacuum pressure regulator valve) to stabilize the source pressure. • Provide a vacuum switch valve to each individual pad to minimise the influences on other pads if an adsorption error occurs.

Vacuum Equipment Model Selection

⚠ Caution

Caution on Ejector Nozzle Diameter Selection



If a considerable amount of leakage occurs between the workpiece and the pad, resulting in incomplete adsorption, or to shorten the adsorption transport time, select an ejector nozzle with a larger diameter from the ZH/ZM/ZR/ZL/ZQ series.

Caution on Pad Selection

Set the operating pressure below the pressure that has been stabilized after adsorption and determine the pad diameter in accordance with the operating pressure.
During the selection of a pad, keep in mind that the vacuum pressure during the adsorption of a workpiece that leaks becomes lower than the maximum vacuum pressure.

Caution on Vacuum Line Equipment Selection

Determine the volume of the suction filter and the effective area of the switching valve in accordance with the maximum suction flow of the ejector and the vacuum pump. Make sure that the effective area is greater than the value that has been obtained through the formula given below. (If the devices are connected in series in the vacuum line, their effective areas must be combined.)

S = Qmax/11.1 **S**: Effective area (mm^2)
Qmax: Max. suction flow ℓ/min (ANR)

Vacuum Switch (Series ZS), Vacuum Gauge (Series GZ)

When adsorbing and transporting a workpiece, verify at the vacuum switch as much as possible (In addition, visually verify the vacuum gauge, especially when handling a heavy or a hazardous item.).
When picking an electronic part or a small precision part, if the suction nozzle is approximately ø1, the difference in pressure between ON and OFF becomes small (although this will also depend on the capacity of the ejector and the vacuum pump) and it cannot be detected by an ejector with a large suction capacity. Therefore, use the ejector with appropriate suction flow. Furthermore, it will become necessary to stabilize the pressure of the ejector and the vacuum pump.

Suction Filter (Series ZFA/ZFB/ZFC)

- To protect the switching valve and the ejector from becoming clogged, a suction filter in the vacuum circuit is recommended.
- When using the ZQ series in a dusty environment, the unit's filter will become clogged quickly, so it is recommended to use the ZFA/ZFB/ZFC series concurrently.

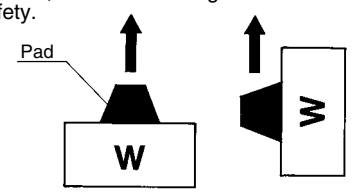
Vacuum Pad Applications

Safety

Because suction is applied to an object during a vacuum adsorption transport, there is a possibility of dropping the object depending on the conditions. Thus, everything should be designed with safety as the number one priority in order to achieve a system design with an excellent margin of safety.

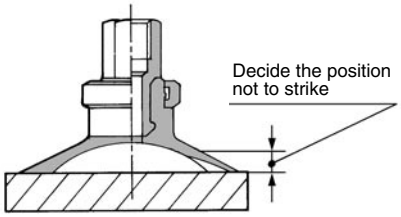
Mounting Position

As a rule, the unit must be installed horizontally. Although a diagonal or a vertical installation should be avoided whenever possible, if the unit must be installed in such a manner, be certain to guarantee absolute safety.



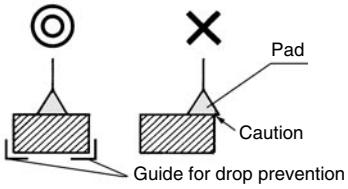
Impact to Pad

When pushing a pad to a workpiece, make sure not to apply an impact or a large force which would lead to premature deformation, cracking, or wearing of the pad. Therefore, the pad should be pushed against the workpiece to the extent that its skirt portion deforms or that its ribbed portion comes into slight contact with the workpiece.
Especially, when using a smaller diameter pad, make sure to locate it correctly.

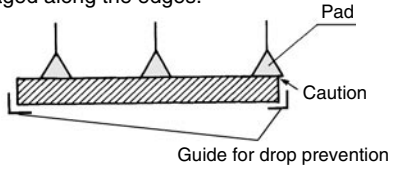


Balance of Pad and Workpiece

Make sure that the pad's suction surface is not larger than the surface of the workpiece to prevent vacuum leakage and unstable picking.



If multiple pads are used for transporting a flat object with a large surface area, properly allocate the pads to maintain balance. Also make sure that the pads are aligned properly to prevent them from becoming disengaged along the edges.



Provide an auxiliary device (example: a guide for preventing the workpieces from dropping) as necessary.

Lifting Force, Moment, Horizontal Force

To lift a workpiece vertically, make sure to take into consideration the acceleration rate, wind pressure, impact, etc., in addition to the weight of the workpiece. (Refer to Fig. 1)
Because the pads are susceptible to moments, mount the pad so as not to allow the workpiece to create a moment. (Refer to Fig. 2)
When a workpiece that is suspended horizontally is moved laterally, the workpiece could shift depending on the extent of the acceleration rate or the size of the friction coefficient between the pad and the workpiece. Therefore, the acceleration rate of the lateral movement must be minimised. (Refer to Fig. 3)

Fig. 1

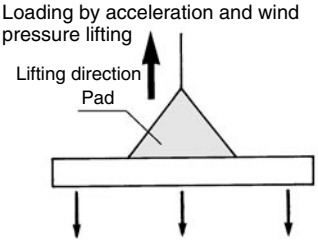


Fig. 2

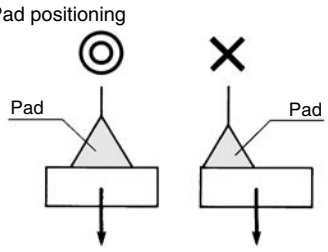
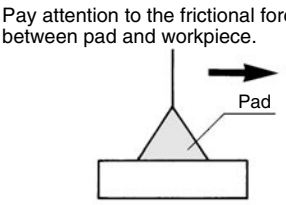
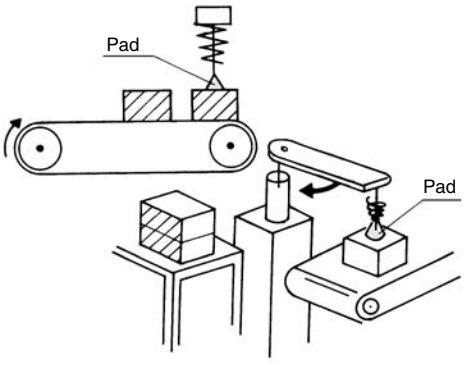


Fig. 3



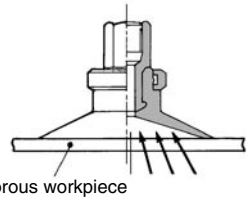
Unsteady Distance between Pad and Workpiece

If the pad and the workpiece cannot be positioned properly, such as when picking a workpiece having an uneven height, use a built-in spring type pad with a buffer. This type of pad acts as a cushion between the pad and the workpiece. If it is necessary to further position the pad and the workpiece, use a non-rotating buffer.



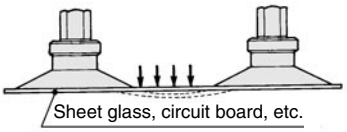
Porous Workpiece

To pick a permeable workpiece such as paper, select a pad with a small diameter that is sufficient to lift the workpiece. Because a large amount of air leakage could reduce the pad's suction force, it may be necessary to increase the capacity of the vacuum pump or enlarge the effective area of the piping passage.



Flat Plate Workpiece

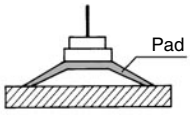
When a workpiece with a large surface area such as sheet glass or PCB is suspended, the workpiece could move in a wavelike motion if a large force is applied by wind pressure or by an impact. Therefore, it is necessary to ensure the proper allocation and size of pads.



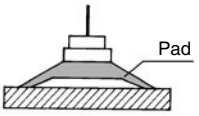
Pad Form Selection by Workpiece

To use an appropriate pad, select the shape of the pad in accordance with the shape and the material of the workpiece.

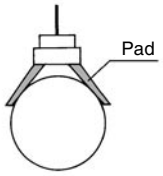
Flat
(For a workpiece that has a flat surface and free of deformation.)



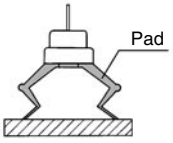
Flat with ribs
(For a workpiece that is susceptible to deformation.)



Deep
(For a workpiece with a curved surface.)

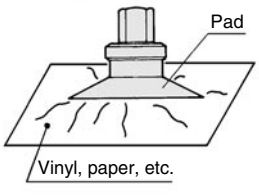


Bellows
(For a workpiece that does not have a space for a buffer, or for a workpiece with a diagonal surface.)



Soft Workpiece

If a soft workpiece such as vinyl, paper, or thin sheet is picked up, the vacuum pressure could cause the workpiece to deform or wrinkle. In such a case, it will be necessary to use a small pad or a ribbed pad and reduce the vacuum pressure.



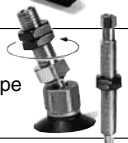
Vacuum Equipment Model Selection

Vacuum Pad: Workpiece Transfer Examples

Materials

Material	Applications
NBR	Transport of general workpiece, Cardboard, Veneer plate, Iron plate and others
Silicon rubber	Semiconductor, Removing from die-casting, Thin workpiece
Urethane rubber	Cardboard, Iron plate, Veneer plate
Fluoro rubber	Chemical workpiece
Conductive NBR	General workpiece of semiconductor (Static electricity resistance)
Conductive silicon rubber	Semiconductor (Static electricity resistance)

Pads

Pad form	Applications
Flat 	For when adsorption surface of a workpiece is flat and not deformed.
Flat with ribs 	For when a workpiece is likely to deform or in the case of releasing a workpiece certainly.
Deep 	For when a workpiece is spherical shape.
Bellows 	For when there is not enough space to install a buffer or adsorption surface of a workpiece is slanted.
Elliptic 	For when a workpiece has limited adsorption surface or length is long and a workpiece is required to locate precisely.
Ball joint type 	For when adsorption surface of a workpiece is not horizontal.
Long stroke buffer 	For when a workpiece height is not even or cushioning toward a workpiece is required.
Large size buffer 	For when a workpiece is heavy weight.
Conductive pad 	As one of the countermeasures against static electricity, rubber material with reduced resistance is used. For antistatic measures

Glossary

Terms	Description
(Max.) suction flow	Volume of air taken in by the ejector. The maximum volume is the flow rate of the air that is taken in without having anything connected to the vacuum port.
Maximum vacuum pressure	The maximum value of the vacuum pressure that is generated by the ejector.
Air consumption	The volume of compressed air that is consumed by the ejector.
Standard supply pressure	The optimal supply pressure for operating the ejector.
Exhaust characteristics	The relationship between the vacuum pressure and the suction flow when the supply pressure to the ejector has been changed.
Flow characteristics	The relationship between the vacuum pressure and the suction flow with the standard supply pressure supplied to the ejector.
Vacuum pressure switch	The pressure switch that is used for verifying the adsorption of a workpiece.
Adsorption verification switch	The switch, based on an air pressure bridge, that is used for verifying the adsorption of a workpiece. It is used when the adsorption pad and the nozzle are extremely small.
(Air) supply valve	The valve that supplies compressed air to the ejector.
(Vacuum) release valve	The valve that supplies positive pressure or air to break the vacuum state of the adsorption pad.
Flow adjustment valve	The valve that supplies positive pressure or air that regulates the flow of the air to break the vacuum.
Release pressure	Pressure that is used for breaking the vacuum.
Pilot pressure	Pressure that is used for operating the ejector valve.
External release	The action of breaking the vacuum using externally supplied air instead of using the ejector unit.
Vacuum port	Port for generating vacuum.
Exhaust port	Port for exhausting the air, which was used by the ejector, and the air taken in by vacuum port.
Supply port	Port for supplying the air, which is used by the ejector.
Back pressure	Pressure inside the exhaust port.
Leakage	The entry of air into the vacuum passage, such as from an area between a workpiece and a pad, or between a joint and tubing. The vacuum pressure decreases when leakage occurs.
Response speed	The time that elapses from when the supply valve or the switching valve is activated until the pressure switch turns ON. It is also called the adsorption response time.
Average suction flow	The suction flow of the ejector or the pump, which is used for calculating the response speed. It is 1/2 to 1/3 of the maximum suction flow.
Conductive pad	A pad with a low electrical resistance that is used as an electrostatic prevention measure.
Vacuum pressure	Any pressure below the atmospheric pressure. When the atmospheric pressure is used as a reference, the pressure is presented by –kPa (G), and when the absolute pressure is used as a reference, the pressure is represented by kPa {abs}. When referencing a piece of vacuum equipment such as an ejector, the pressure is generally represented by –kPa.
(Vacuum) ejector	A device that generates vacuum by means of discharging the compressed air from a nozzle at a high speed, thus utilizing the phenomenon in which the pressure is reduced when the air around the nozzle is sucked.
Suction filter	The vacuum filter that is provided in the vacuum passage in order to prevent the intrusion of dust into the ejector, the vacuum pump, or peripheral equipment.

Effective Diameter of Vacuum Pad

Effective diameter at adsorption is as follows.

Vacuum Area Diameter (Vacuum pressure: –84 kPa) after Vacuum Adsorption by Vacuum Pad (mm)

Part no.	Type	Flat **U**		Flat with ribs **C**		Bellows **B**		Deep **D**		Heavy-duty **H**		Heavy-duty bellows **HB**	
	Material / Nominal size	**NBR**	Silicon rubber	**NBR**	Silicon rubber	**NBR**	Silicon rubber	**NBR**	Silicon rubber	**NBR**	Silicon rubber	**NBR**	Silicon rubber
ZP2004□□	**2004**	2 x 4	2 x 4	—	—	—	—	—	—	—	—	—	—
ZP3507□□	**3507**	3.5 x 7	3.5 x 7	—	—	—	—	—	—	—	—	—	—
ZP4010□□	**4010**	4 x 10	4 x 10	—	—	—	—	—	—	—	—	—	—
ZP02□□	**2**	ø2	ø2	—	—	—	—	—	—	—	—	—	—
ZP04□□	**4**	ø4	ø4	—	—	—	—	—	—	—	—	—	—
ZP06□□	**6**	ø5	ø4	—	—	ø5	ø5	—	—	—	—	—	—
ZP08□□	**8**	ø7	ø7	—	—	ø7	ø5	—	—	—	—	—	—
ZP10□□	**10**	ø10	ø9	ø10	ø9	ø8	ø7	ø10	ø10	—	—	—	—
ZP13□□	**13**	ø11	ø11	ø11	ø11	ø8	ø9	—	—	—	—	—	—
ZP16□□	**16**	ø10	ø9	ø13	ø13	ø10	ø9	ø14	ø12	—	—	—	—
ZP20□□	**20**	ø14	ø12	ø15	ø14	ø13	ø13	—	—	—	—	—	—
ZP25□□	**25**	ø14	ø13	ø18	ø17	ø15	ø15	ø19	ø16	—	—	—	—
ZP32□□	**32**	ø13	ø11	ø21	ø20	ø20	ø19	—	—	—	—	—	—
ZP40□□	**40**	ø20	ø17	ø26	ø24	ø26	ø25	ø24	ø24	ø33	ø32	ø29	ø27
ZP50□□	**50**	ø18	ø17	ø33	ø30	ø35	ø33	—	—	ø42	ø42	ø39	ø36
ZP63□□	**63**	—	—	—	—	—	—	—	—	ø49	ø49	ø46	ø45
ZP80□□	**80**	—	—	—	—	—	—	—	—	ø60	ø60	ø57	ø56
ZP100□□	**100**	—	—	—	—	—	—	—	—	ø78	ø78	ø69	ø71
ZP125□□	**125**	—	—	—	—	—	—	—	—	ø102	ø101	ø92	ø91

Proposals for Using the Vacuum Equipment

Please consider the following items in order to enable the vacuum ejector and the vacuum pump system to operate more effectively.
Graph 1 shows the timing of a typical operational pattern.
The responsiveness can be increased depending on the condition.

1. Timing for generating vacuum

The timing for opening/closing the valve will be counted if a vacuum is generated after the adsorption pad descends to absorb a workpiece. Also, there is a timing delay risk for the generating vacuum since the operational pattern for the verification switch, which is used for detecting the descending adsorption pad, is not even.
To solve this issue, we recommend that vacuum be generated in advance, before the adsorption pad begins to descend to the workpiece.
Adopt this method after confirming that there will be no misalignment resulting from the workpiece's light weight.

2. Adsorption verification

In the case of lifting the adsorption pad after absorbing a workpiece, confirm that there is a suction verification signal from the vacuum switch, before the adsorption pad is lifted. If the adsorption pad is lifted, based on the timing of a timer, etc., there is a risk that the workpiece may be left behind.
In general pick and place applications, the time for absorbing a workpiece is slightly different since the position of the adsorption pad and the workpiece are different after every operation. Therefore, program a sequence in which the suction completion is verified by a vacuum switch, etc. before moving to the next operation.

3. Supply pressure

3.1 Use the vacuum ejector with the standard supply pressure.
When the product is supplied with the standard pressure, the maximum vacuum pressure and the maximum suction flow are performed, resulting in the improved response time for adsorption.
Using a standard supply pressure is also the most effective way to save energy If an excessive supply pressure is used, the ejector peformance is reduced. Do not use the product with more than the standard supply pressure.

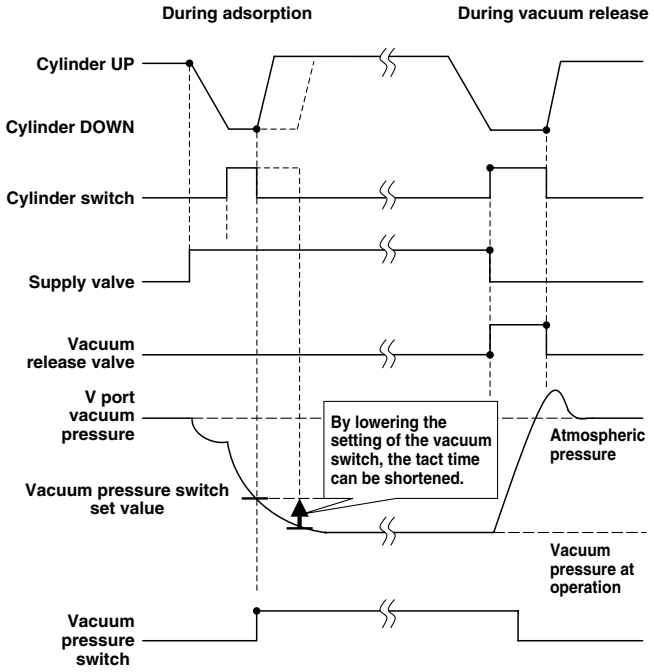
3.2 Excessive supply line pressure may occur when the operation is suspended (holidays, night time, etc.). Please use a separate regulator to gain sufficient flow in the upstream side of the ejector supply pressure pipings.

4. Set pressure for the vacuum pressure switch

Set the optimum value after calculating the required vacuum pressure for lifting a workpiece.
If a higher pressure than required is set, there is a possibility of being unable to confirm the suction even though the workpiece is absorbed. This will result in a suction error.
When the tact time is emphasised, you should set using a lower pressure, with which a workpiece can be adsorped, only after considering the acceleration or vibration when a workpiece is transfered.

5. Equipment with vacuum equipment

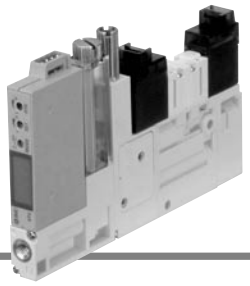
Carefully perform a debugging operation beforehand in equipment having vacuum products such as a handler, chip mounter, etc. Before actually using the equipment, carefully confirm the operation and perform a trial run, etc.



Graph 1. Example of a typical operational pattern timing

Space Saving Vacuum Ejector

Series ZQ



How to Order

Ejector Unit

ZQ1 [05] [1U] – [K1] [ ] [5] [L] [ ] – [D32] [C] [ ] – [ ] [ ] – Q

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫

① Nozzle nominal size

05	ø0.5
07	ø0.7
10	ø1.0

② Exhaust type

1U	With silencer for single unit
3M	With silencer for manifold

③ Solenoid valve combination

Symbol	Supply valve	Vacuum release valve
K1	Normally closed	Normally closed
K2 Note 1)	Normally open	Normally closed
J1	Normally closed	None
J2 Note 1)	Normally open	None
Q1	Latching positive common	Normally closed
Q2	Latching positive common	None
N1	Latching negative common	Normally closed
N2	Latching negative common	None

Note 1) In cases when K2 or J2 (supply valve normally open) is selected for the solenoid valve combination, when vacuum is stopped for long periods of time (10 minutes or more), do not continue to energize the supply valve, and shut off the air supply.

④ Pilot valve

—	Standard (DC: 1 W) Note 2)
Y	DC low wattage type (0.5 W) Note 3)

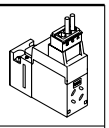
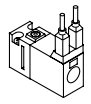
Note 2) Avoid energizing the solenoid valve for long periods of time. (Refer to Design and Selection on Specific Product Precautions 1.)

Note 3) Y option only available for solenoid valve combinations K1 and J1.

⑤ Solenoid valve rated voltage

5	24 VDC
6	12 VDC

⑥ Electrical entry

L	L-type plug connector, with 0.3 m lead wire, with light/surge voltage suppressor	
LO	L-type plug connector, without connector, with light/surge voltage suppressor	
G	Grommet, with 0.3 m lead wire (Latching/AC type: Not applicable)	

⑦ Manual override Note 4)

—	Non-locking push type Latching type: Push-locking type
B	Locking type (Q1/Q2/N1/N2: Not applicable)

Note 4) Latching type supply valve: Available in "—" only. In this case, the supply valve and vacuum release valve come with a lock.

⑧ Vacuum pressure switch suction filter Note 5)

F	With suction filter only
D32	2 NPN outputs, with suction filter, Pressure range –100 to 0 kPa
D52	2 PNP outputs, with suction filter, Pressure range –100 to 0 kPa

Note 5) The filter included in this product is of an simple type, and will become clogged quickly in environments with high quantities of dust or particulates. Please make additional use of an air suction filter of the ZFA, ZFB or ZFC series.

⑨ Vacuum switch electrical entry

C	Connector type, with 0.6 m lead wire
CL	Connector type, with 3 m lead wire

⚠Warning

The filter case of this suction filter is made of nylon. Contact with alcohol or similar chemicals may cause it to be damaged. Also, do not use the filter when these chemicals are present in the atmosphere.

⑩ Check valve Note 6)

—	None
K	With check valve

Note 6) The check valve has a function to prevent the exhaust air from the silencer overflowing to the vacuum port side when a manifold is used. However, depending on usage conditions, it does not always suppress air overflow to the desired extent. During usage, please inspect thoroughly with actual machine. Also, in order to completely prevent the overflow of exhaust air, leave plenty of space between the check valve unit and adjacent ejector to avoid interference from the ejector's exhaust unit.

⚠Warning

① Cannot be used for vacuum retention.
② Use a release valve. (Without a release valve, a workpiece may not be released.)

⑪ Fitting (V port) Note 7)

Symbol	Applicable tubing O.D.	Part no.
0	Without fitting (M5 x 0.8)	—
1	ø3.2 (Straight)	KJS23-M5
2	ø4 (Straight)	KJS04-M5
3	ø6 (Straight)	KJS06-M5
4	ø3.2 (Elbow)	KJL23-M5
5	ø4 (Elbow)	KJL04-M5

Note 7) When neither V port fitting nor P port fitting are needed, enter nothing or –00 in the dotted line above "How to Order".

⑫ Fitting (P port) Note 7,8)

Symbol	Applicable tubing O.D.	Part no.
0	Without fitting (M5 x 0.8)	—
2	ø4 (Straight)	KJS04-M5
3	ø6 (Straight)	KJS06-M5
5	ø4 (Elbow)	KJL04-M5

Note 8) Manifold type: Not applicable

How to Order

Made to Order For "Made to Order", refer to page 24.

Manifold **ZZQ1 07 – B S C**

Number of stations Note)

01	1 station
02	2 stations
⋮	⋮
08	8 stations

Note) Number of stations varies according to nozzle nominal size during simultaneous operation.

Supply port (P port) position

B	Both sides

Exhaust

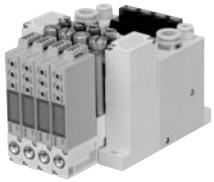
S	With silencers (Both sides)

Vacuum release pressure supply port (PD port)

B	None (Release pressure is supplied from the P port.)
C	Provided (Air can be alternatively supplied from the P port.)

Maximum Number of Stations in Simultaneous Operation

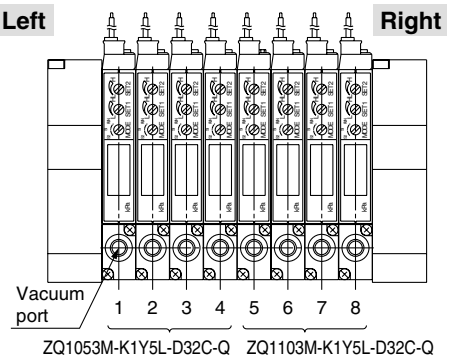
Nozzle nominal size	Maximum number of stations in simultaneous operation
ø0.5	8 stations
ø0.7	6 stations
ø1.0	4 stations



Manifold Ordering Example

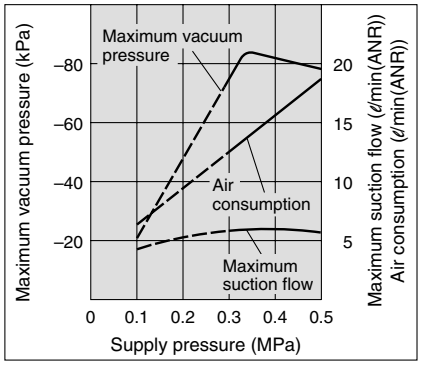
ZZQ108-BSB → 1 pc.
***ZQ1053M-K1Y5L-D32C-Q → 4 pcs. (Stations 1 to 4)**
***ZQ1103M-K1Y5L-D32C-Q → 4 pcs. (Stations 5 to 8)**

Note) The stations are sequentially numbered. When viewed from the side of the vacuum ports, the far left station is designated as station 1.

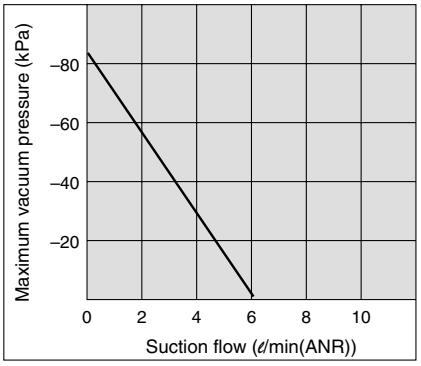


Flow/Exhaust Characteristics

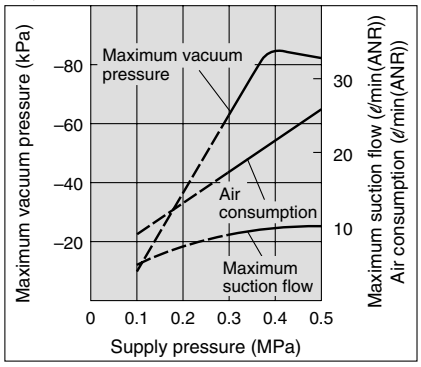
ZQ105 / Exhaust Characteristics



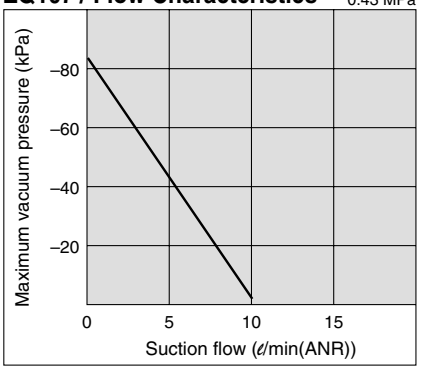
ZQ105 / Flow Characteristics Supply pressure 0.35 MPa



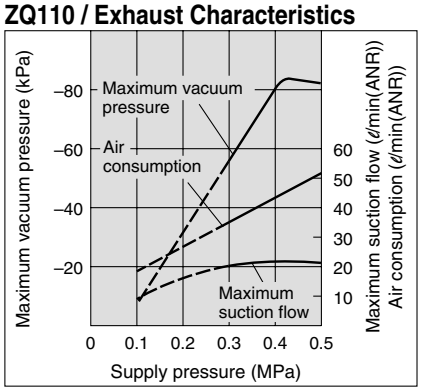
ZQ107 / Exhaust Characteristics



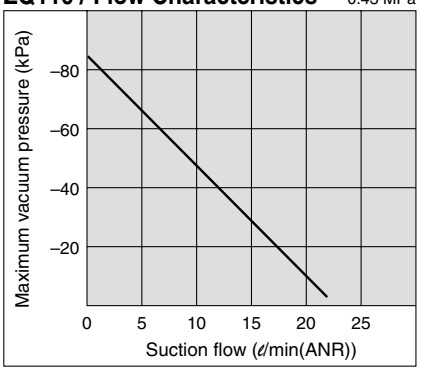
ZQ107 / Flow Characteristics Supply pressure 0.43 MPa



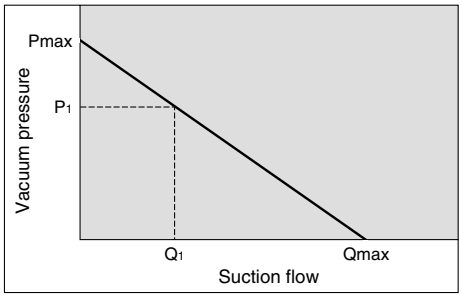
ZQ110 / Exhaust Characteristics



ZQ110 / Flow Characteristics Supply pressure 0.43 MPa



How to Read Flow Characteristics



Flow characteristics are expressed in ejector vacuum pressure and suction flow. If suction flow rate changes, a change in vacuum pressure will also be expressed. Normally this relationship is expressed in ejector standard use.
In the graph, Pmax. is max. vacuum pressure and Qmax is max. suction flow. The valves are specified according to catalogue use. Changes in vacuum pressure are expressed in the below order.

1. When ejector suction port is covered and made airtight, suction flow becomes 0 and vacuum pressure is at maximum value (Pmax).
2. When suction port is opened gradually, air can flow through, (air leakage), suction flow increases, but vacuum pressure decreases. (condition P_1 and Q_1)
3. When suction port is opened further, suction flow moves to maximum value (Qmax), but vacuum pressure is near 0. (atmospheric pressure).

When vacuum port (vacuum piping) has no leakage, vacuum pressure becomes maximum, and vacuum pressure decreases as leakage increases. When leakage value is the same as max. suction flow, vacuum pressure is near 0.
When leaky work must be adsorbed, please note that vacuum pressure will not be high.

⚠ Precautions

Be sure to read this before handling. Refer to the back page 1 through to 2 for Safety Instructions and Common Precautions on the products mentioned this catalogue.

⚠Caution

Refer to page 1 through to 10 for the product selection in the ZQ series and the sizing program.

Specifications

Ejector

Model	ZQ105	ZQ107	ZQ110
Nozzle nominal diameter (mm)	0.5	0.7	1.0
Maximum suction flow (ℓ/min (ANR))	5	10	22
Air consumption (ℓ/min (ANR))	14	23	46
Maximum vacuum pressure	–80 kPa		
Supply pressure range	0.3 to 0.5 MPa (Normally open: 0.3 to 0.45 MPa)		
Supply pressure Note)	0.35 MPa	0.45 MPa	
Operating temperature range	5 to 50°C		

Note) Maximum suction flow can be obtained by standard supply pressure.

Weight

Single unit	With suction filter Note 1)	95 g
	With switch and suction filter Note 2)	109 g
End plate assembly for manifold		122 g

Note 1) Including a 0.3 m connector for supply valve and vacuum release valve.
Note 2) Including a 0.3 m connector for supply valve and vacuum release valve and a 0.6 m connector for switch.

◎ **Calculation of weight for the manifold type**
(Single unit weight) x (Number of stations) + (Weight of end plate assembly for manifold)

Example) Switch + 8 stations with suction filter
109 g x 8 + 122 g = 994 g

Supply Valve / Vacuum Release Valve

Type		Normally closed		Latching type	Normally open
		Standard (1 W)	Low wattage type (0.5 W)		
Model (Refer to "How to Order" for solenoid valves on page 16.)		**VQ110-□**	**VQ110Y-□**	**VQ110$^{L}_{N}$-□**	**ZQ1-VQ120-□**
Fluid		Air / Inert gas			
Maximum operating pressure		0.5 MPa			0.45 MPa
Minimum operating pressure		0.3 MPa			
Ambient and fluid temperature		5 to 50°C			
Lubrication		Not required			
Manual override		Non-locking push type / Locking type (Tool type)		Push-locking type	Non-locking push type / Locking type (Tool type)
Rated coil voltage		12, 24 VDC	12, 24 VDC	12, 24 VDC	12, 24 VDC
Power consumption (current value)	**DC**	1 W	0.5 W	1 W	
Electrical entry		Grommet		L-type plug connector	Grommet
		L-type plug connector (with light/surge voltage suppressor)		(with light/surge voltage suppressor)	L-type plug connector (with light/surge voltage suppressor)

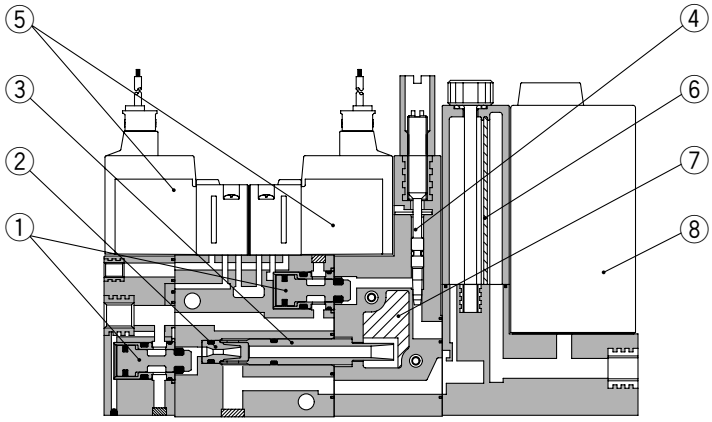
Specifications

Vacuum Pressure Switch

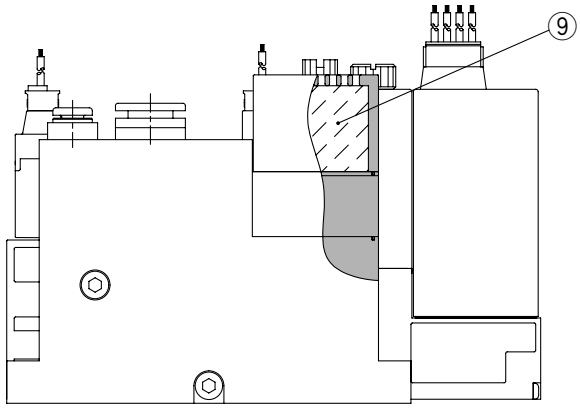
Model (Refer to "How to Order" for vacuum pressure switches on page 16.)		ZQ1S-D32□-□-AS	ZQ1S-D52□-□-AS
Rated pressure range		0 to –100 kPa	
Set pressure range		0 to –99 kPa	
Withstand pressure		0.2 MPa	
Fluid		Air / Non-corrosive/Non-combustible gas	
Power supply voltage		12 to 24 VDC ±10%	
Current consumption		35 mA or less [with power supply voltage of 24 VDC and switch output ON (with no load)]	
Ambient temperature range		5 to 50°C (with no freezing or condensation)	
Ambient humidity range		35 to 85 %RH in operation and saving (with no condensation)	
Withstand voltage		500 VAC for 1 min.	
Insulation resistance		50 MΩ or more (between live parts and pressure port at 500 VDC Mega)	
Switch output		2 NPN outputs	2 PNP outputs
	Maximum load current	80 mA (per output)	
	Maximum applied voltage	30 V (for NPN output)	
	Residual voltage	NPN output: 0.8 V or less (at 80 mA inrush), PNP output: 1.2 V or less (at 80 mA discharge)	
	Response time	2 ms or less	
Hysteresis		0 to 15% F.S. or less (variable)	2% F.S. or less (fixed)
Display		2-digit Red LED	
Display accuracy		±3 %F.S. ±2 digits	
Output indicator light		Illuminates when the output is turned ON. (Red LED for OUT1 and Green LED for OUT2)	
Analog output		(Only applicable to D31 and D51)	
	Output voltage	1 to 5 V ±2.5% F.S. or less	
	Linearity	±0.5 F.S. or less	

Construction

Single unit



Manifold



Component Parts

No.	Description	Material
1	Poppet valve assembly	—
2	Nozzle	Aluminum alloy
3	Diffuser	Aluminum alloy
4	Vacuum release flow adjustment needle	Aluminum alloy

Replacement Parts

No.	Description	Material	Part no.
5	Solenoid valve	—	Refer to page 16.
6	Filter element	PVF	XT534-5-001-AS
7	Sound absorbing material 1 (single unit)	PVF	ZQ-SAE
8	Vacuum pressure switch	—	Refer to page 17.
9	Sound absorbing material 2 (manifold)	PVF	ZZQ-SAE

How to Order

Solenoid Valve

Pilot valve

—	Standard (1 W)
Y	Low wattage type (0.5 W)
L	Latching positive common
N	Latching negative common

Solenoid valve rated voltage

5	24 VDC
6	12 VDC

Actuation

1	Normally closed

VQ1 1 0 □ – 5 L □ – Q

ZQ1-VQ1 2 0 □ – 5 L □ – Q

Actuation

2	Normally open

Pilot valve

—	Standard (1 W)

Solenoid valve rated voltage

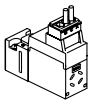
5	24 VDC
6	12 VDC

Manual override Note)

—	Non-locking push type
	Latching type: Push-locking type
B	Locking type

Note) Latching type: Available in "—" only

Electrical entry Note)

L	L-type plug connector, with 0.3 m lead wire	
LO	L-type plug connector, without connector	
G	Grommet, with 0.3 m lead wire (Latching/AC type: Not applicable)	

Note) Mounting screws are attached.

Connector assembly part no.

● **How to order connector assembly**

DC positive common

• **Single** **AXT661-14A-** □

• **Latching** **AXT661-13A-** □

DC negative common

• **Latching** **AXT661-13AN-** □

Connector, socket (3 pcs) only **AXT661-12A**

Lead wire length

—	300 mm
6	600 mm
10	1000 mm
20	2000 mm
30	3000 mm

● **Lead wire length of the plug connector**

The lead wire length for a valve with a lead wire is 300 mm. When in need of a valve with a lead wire longer than 600 mm, place an order for a valve without a connector and connector assembly.

How to Order

Vacuum Pressure Switch

ZQ1S-D 32 C – □ Q – AS

Switch specifications

32	2 NPN outputs, Pressure range –100 to 0 kPa
52	2 PNP outputs, Pressure range –100 to 0 kPa

Electrical entry Note)

C	Connector type, with 0.6 m lead wire
CL	Connector type, with 3 m lead wire

Note) Mounting screws are attached.

Check valve Note)

—	None
K	With check valve

Note) The check valve has a function to prevent the exhaust air from the silencer overflowing to the vacuum port side when a manifold is used, but it is incapable of completely preventing overflow. During usage, please inspect thoroughly with actual machine.
Also, in order to completely prevent the overflow of exhaust air, leave plenty of space between the check valve unit and adjacent ejector to avoid interference from the ejector's exhaust unit.

⚠Warning

① Cannot be used for vacuum retention.
② Use a vacuum release valve. (Without a vacuum release valve, the workpiece may not be released.)

Switch connector part no.

ZQ1-AS-003
ZQ1-AS-004

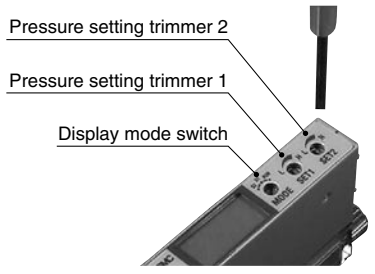
How to Set Vacuum Pressure Switch

How to set pressure

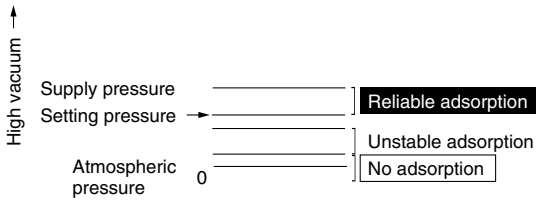
- Pressure trimmer selects the ON pressure. Clockwise rotation increases high vacuum set point.
- When setting, use a flat head screw driver which fits the slot in the trimmer, and turn it gently with your finger tips. (rotational torque: 0.025 N·m or less)

When using ZQ1S-D32/-D52-AS

(a) Set display mode switch (MODE) to "S1".
(b) Set the Switch 1 operating pressure by rotating the pressure setting trimmer 1 (SET1). (The S1 set operating pressure value will be shown on the display.)
(c) Set display mode switch (MODE) to "S2".
(d) Set the Switch 2 operating pressure by rotating the pressure setting trimmer 2 (SET2). (The S2 set operating pressure value will be shown on the display.)
(e) Return the display mode switch (MODE) to "RUN." (The pressure value of the vacuum port will be shown on the display.)

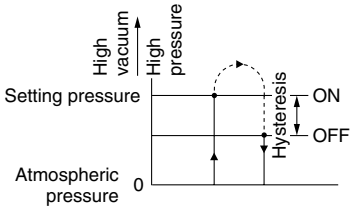


- When using the switch to confirm correct adsorption, the set pressure should be as low as possible, but not so low that a false confirmation signal is given when adsorption is incomplete.



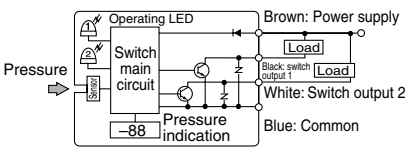
Hysteresis

Hysteresis is the actual pressure variance from set pressure occuring when the output signal turns from ON to OFF. The set pressure is the pressure selected to switch from OFF to ON mode.

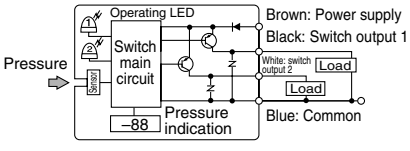


Internal Circuits and Wiring Examples

ZQ1S-D32□-AS

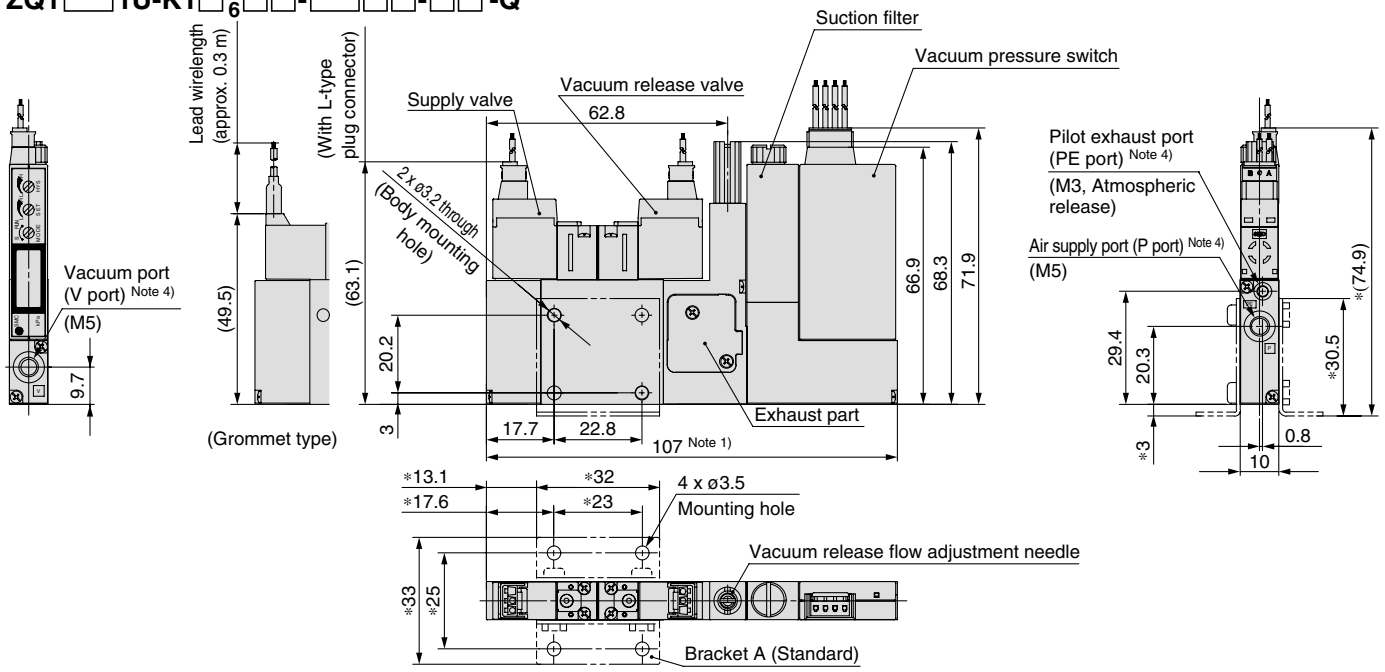


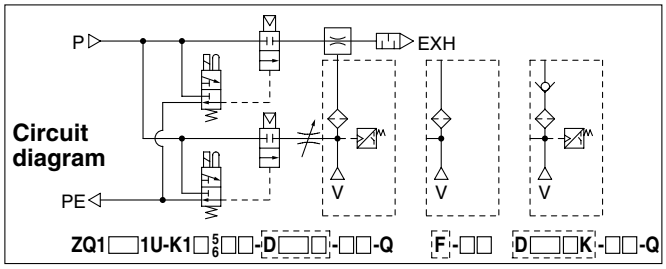
ZQ1S-D52□-AS



Dimensions

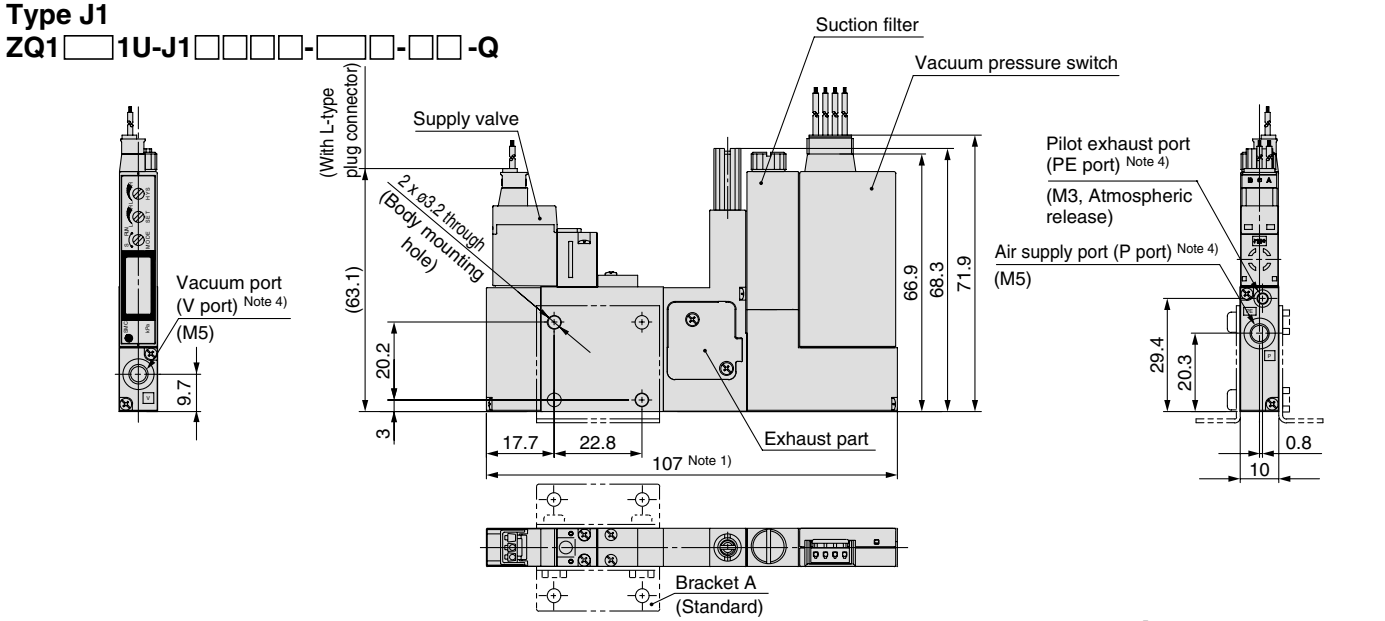
Type K1
ZQ1□1U-K1□$\frac{5}{6}$□□-□□□-□□-Q

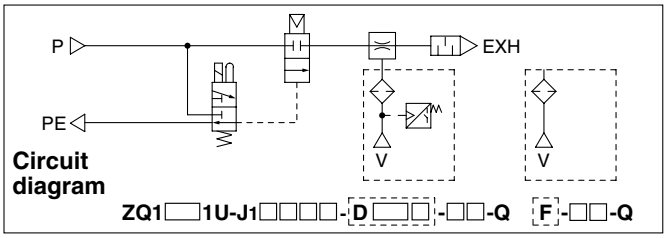




Note 1) The above dimensions are for ZQ1□1U-K1□$\frac{5}{6}$□-D□C□-Q.
In case of ZQ1□1U-K1□$\frac{5}{6}$□□-F□-Q, the overall length is 87.2.
Note 2) Dimensions marked with "∗" are those after bracket A is mounted.
Note 3) When the body is mounted, tighten with a torque of 0.6 ± 0.06 N•m.
Using excessive torque may cause damage to the body.
Note 4) The pitches of P and V ports are determined assuming the use of the KJ series one-touch fittings. If used with other fittings, these may cause interference, dependant on their type and size. Please refer to the catalogue to confirm the sizes of the fittings to be used.

Type J1
ZQ1□1U-J1□□□□-□□-□□-Q

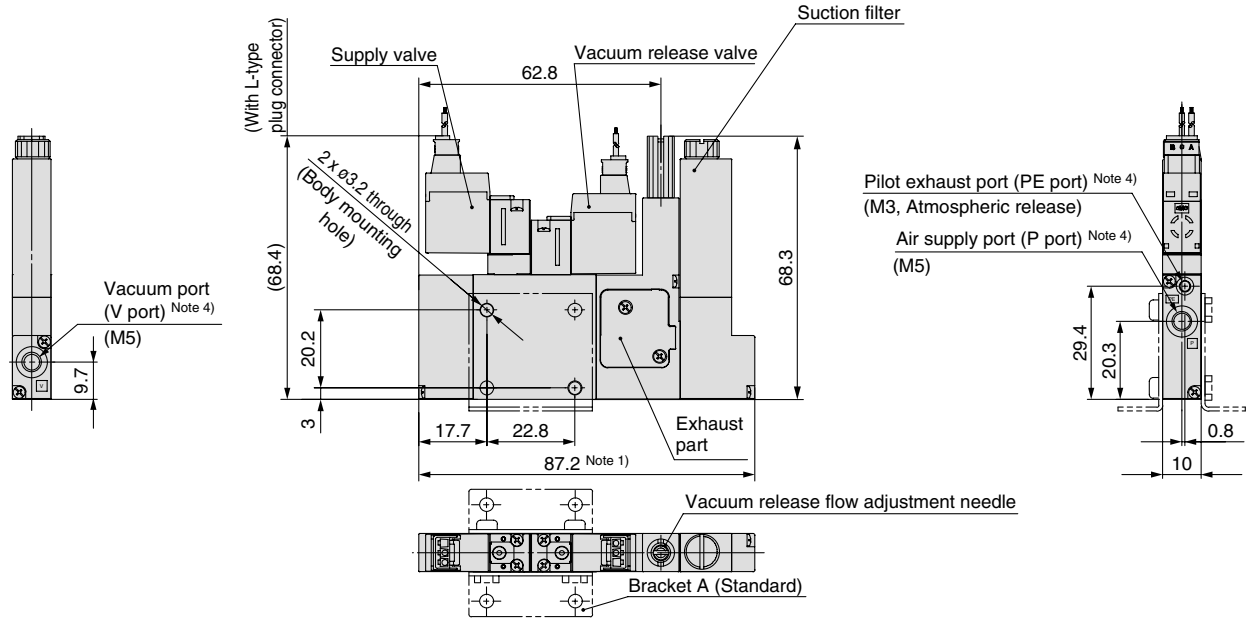


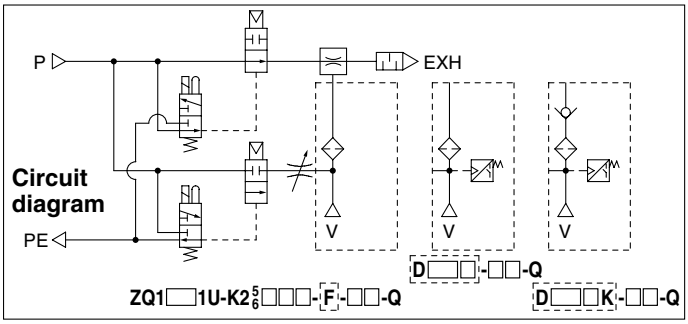


Note 1) The above dimensions are for ZQ1□1U-J1□$\frac{5}{6}$L-D□C-Q.
In case of ZQ1□1U-J1□□□□-F-Q, the overall length is 87.2.
Note 2) The dimensions after bracket A is mounted are the same as those of the K1 type.
Note 3) When the body is mounted, tighten with a torque of 0.6 ± 0.06 N•m.
Using excessive torque may cause damage to the body.
Note 4) The pitches of P and V ports are determined assuming the use of the KJ series one-touch fittings. If used with other fittings, these may cause interference, dependant on their type and size. Please refer to the catalogue to confirm the sizes of the fittings to be used.

Dimensions

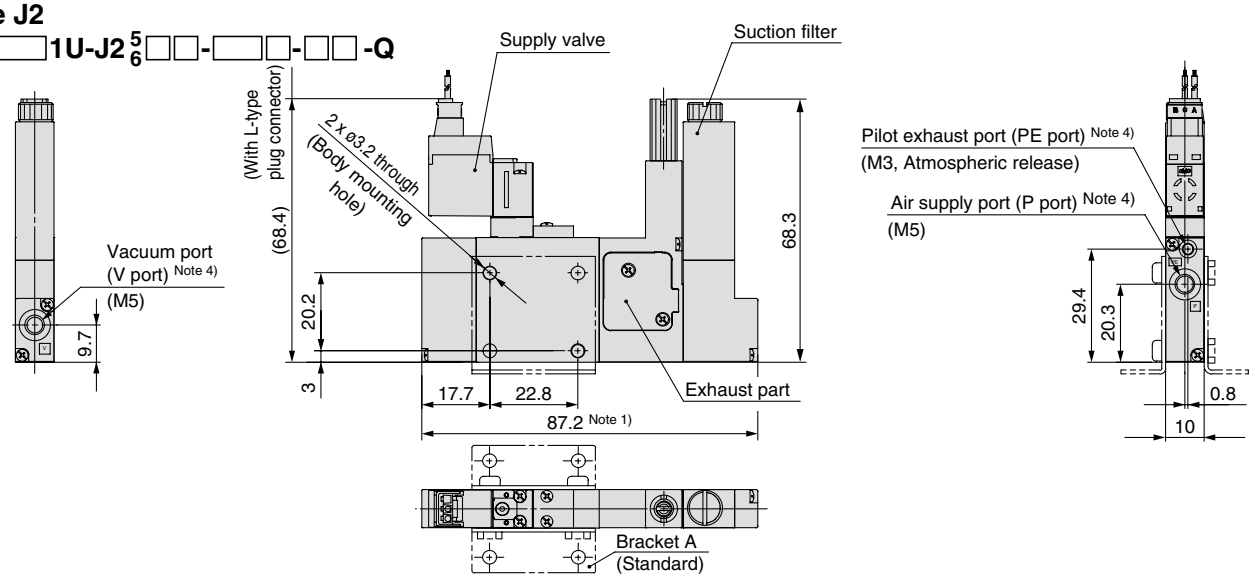
Type K2
ZQ1□1U-K2$\frac{5}{6}$□□-□□□-□□-Q

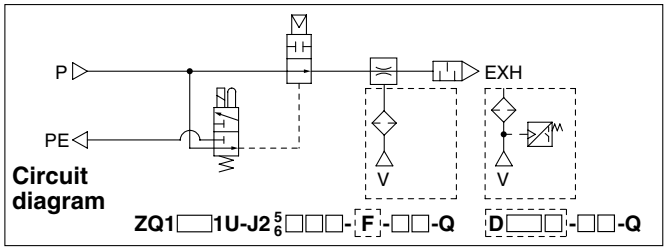




Note 1) The above dimensions are for ZQ1□1U-K2$\frac{5}{6}$L-F□-Q.
In case of ZQ1□1U-K2$\frac{5}{6}$□□-D□□□-Q, the overall length is 107.
Note 2) The dimensions after bracket A is mounted are the same as those of the K1 type.
Note 3) When the body is mounted, tighten with a torque of 0.6 ± 0.06 N•m.
Using excessive torque may cause damage to the body.
Note 4) The pitches of P and V ports are determined assuming the use of the KJ series one-touch fittings. If used with other fittings, these may cause interference, dependant on their type and size. Please refer to the catalogue to confirm the sizes of the fittings to be used.

Type J2
ZQ1□1U-J2$\frac{5}{6}$□□-□□□-□□-Q



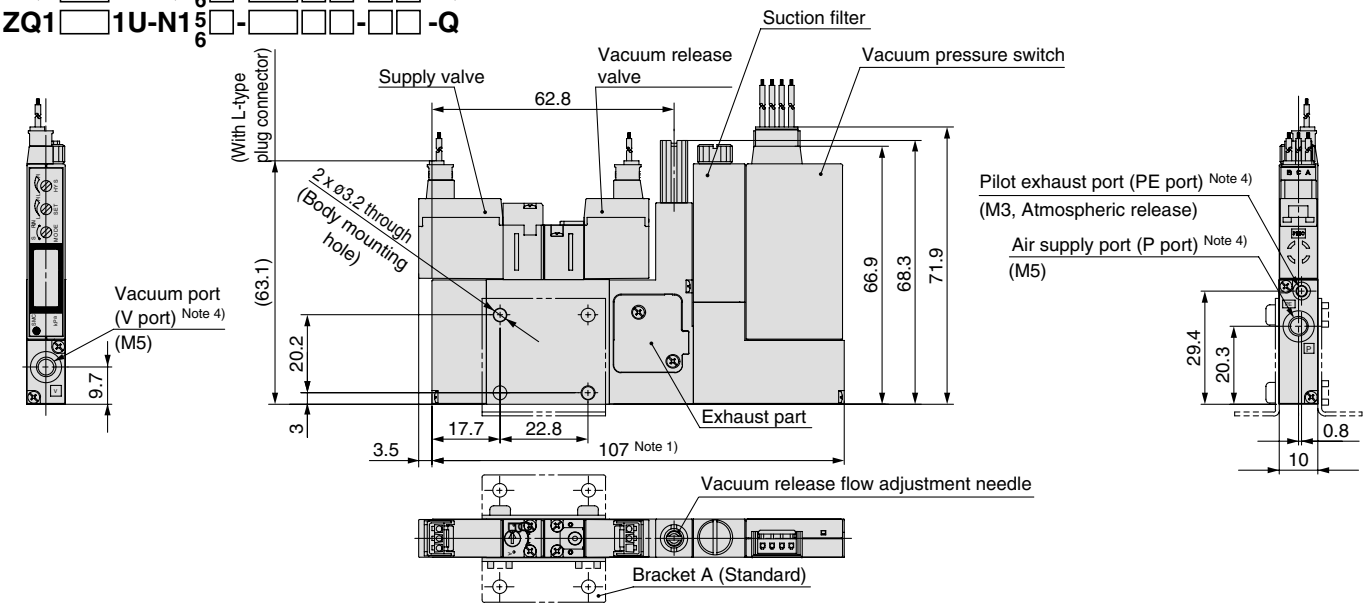


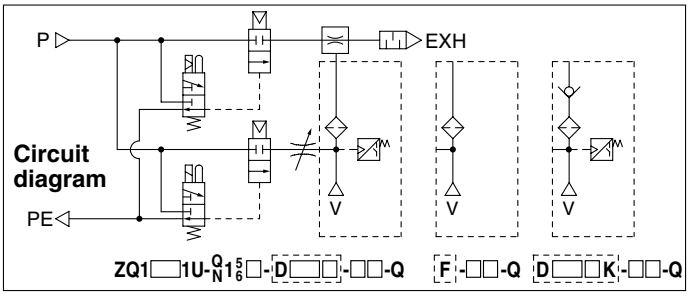
Note 1) The above dimensions are for ZQ1□1U-J2$\frac{5}{6}$L-F-Q.
In case of ZQ1□1U-J2$\frac{5}{6}$□□-D□□-Q, the overall length is 107.
Note 2) The dimensions after bracket A is mounted are the same as those of the K1 type.
Note 3) When the body is mounted, tighten with a torque of 0.6 ± 0.06 N•m.
Using excessive torque may cause damage to the body.
Note 4) The pitches of P and V ports are determined assuming the use of the KJ series one-touch fittings. If used with other fittings, these may cause interference, dependant on their type and size. Please refer to the catalogue to confirm the sizes of the fittings to be used.

Dimensions

Type Q1

ZQ1□1U-Q1$^{5}_{6}$□-□□□-□□ -Q
ZQ1□1U-N1$^{5}_{6}$□-□□□-□□ -Q

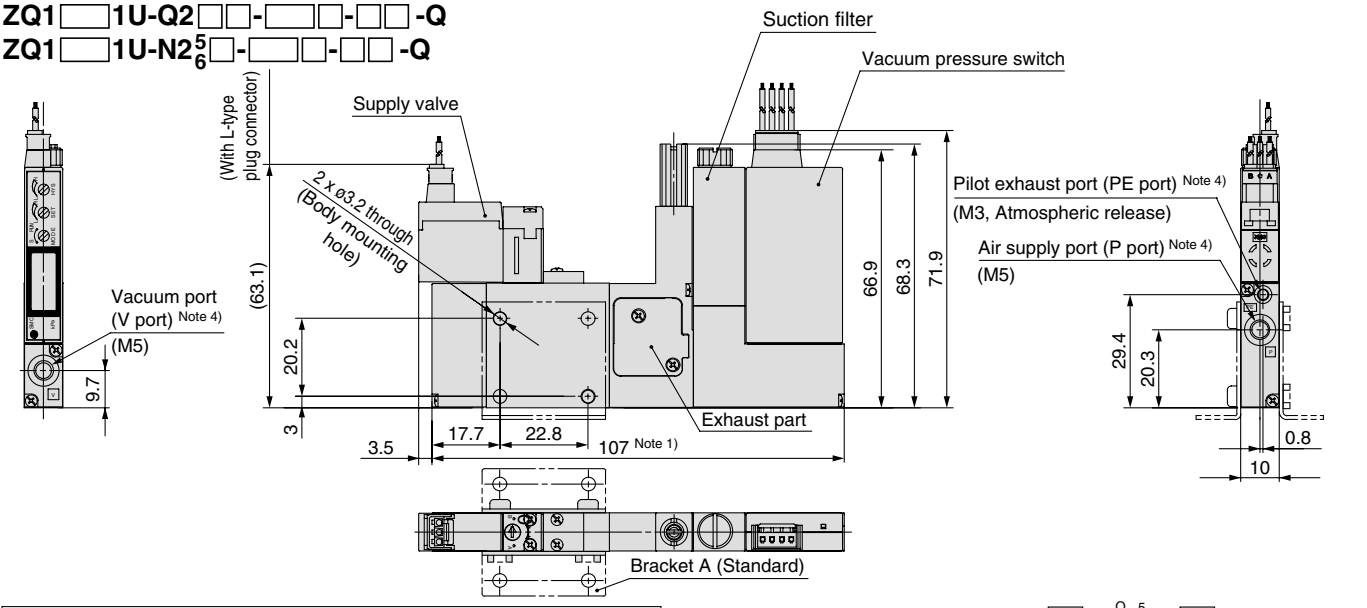


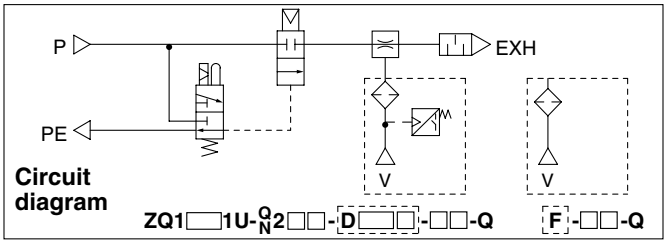


Note 1) The above dimensions are for ZQ1□1U-Q N1 5 6 L-D□C□-Q.
In case of ZQ1□1U-Q N1 5 6 □-F□-Q, the overall length is 87.2.
Note 2) The dimensions after bracket A is mounted are the same as those of the K1 type.
Note 3) When the body is mounted, tighten with a torque of 0.6 ± 0.06 N•m.
Using excessive torque may cause damage to the body.
Note 4) The pitches of P and V ports are determined assuming the use of the KJ series one-touch fittings. If used with other fittings, these may cause interference, dependant on their type and size. Please refer to the catalogue to confirm the sizes of the fittings to be used.

Type Q2

ZQ1□1U-Q2□□-□□□-□□ -Q
ZQ1□1U-N2$^{5}_{6}$□-□□□-□□ -Q

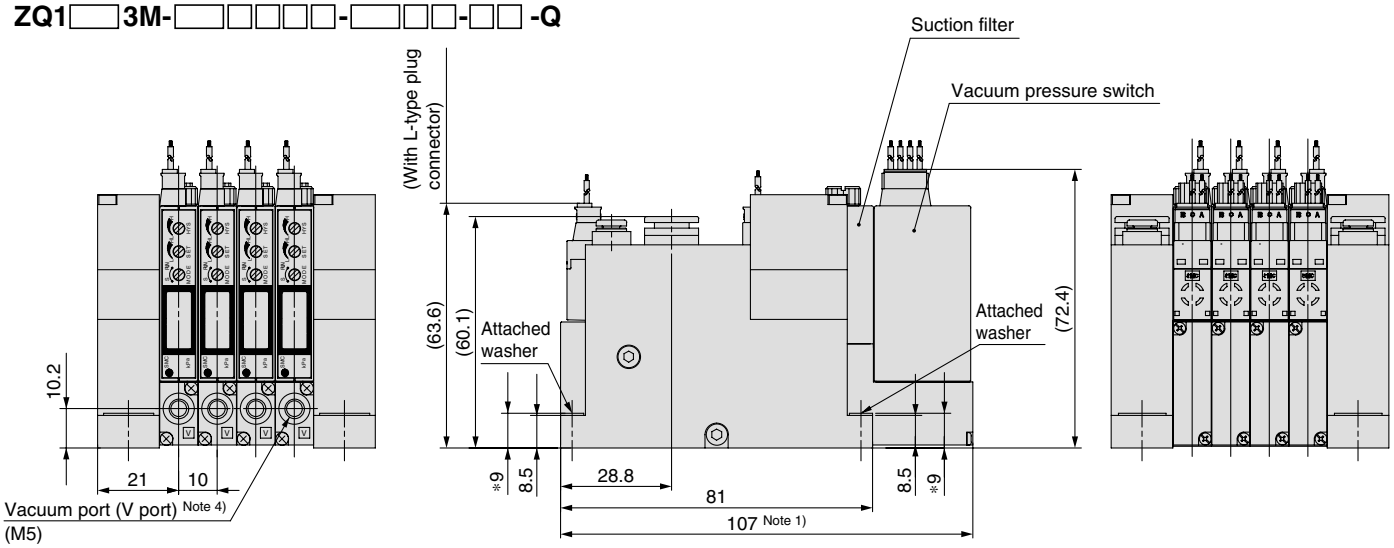


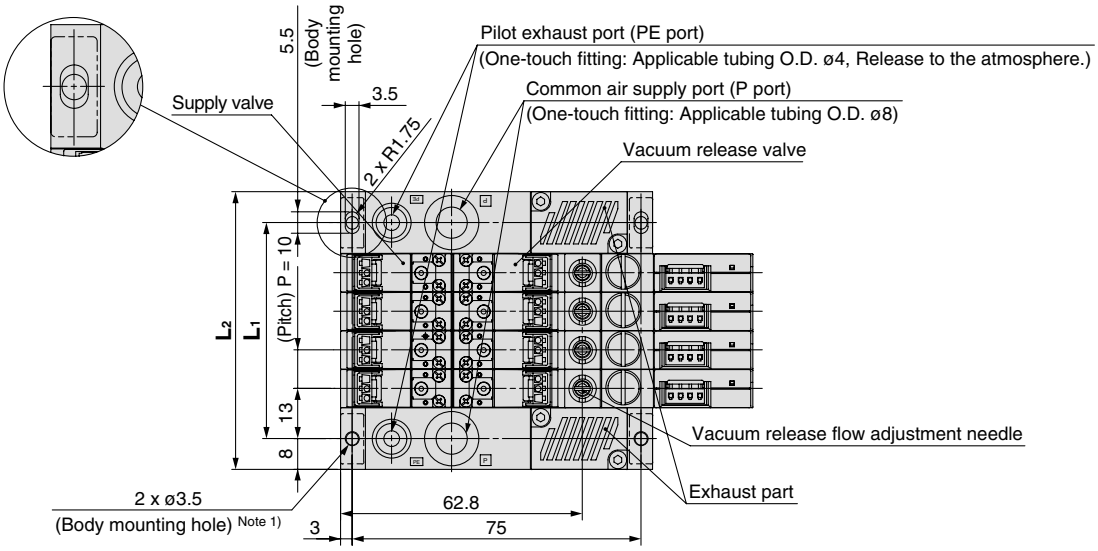


Note 1) The above dimensions are for ZQ1□1U-Q N2 5 6 L-D□C-Q.
In case of ZQ1□1U-Q N2□□-F-Q, the overall length is 87.2.
Note 2) The dimensions after bracket A is mounted are the same as those of the K1 type.
Note 3) When the body is mounted, tighten with a torque of 0.6 ± 0.06 N•m.
Using excessive torque may cause damage to the body.
Note 4) The pitches of P and V ports are determined assuming the use of the KJ series one-touch fittings. If used with other fittings, these may cause interference, dependant on their type and size. Please refer to the catalogue to confirm the sizes of the fittings to be used.

Dimensions

Manifold type (without PD port)
ZZQ1□-BSB
ZQ1□3M-□□□□□-□□□-□□ -Q



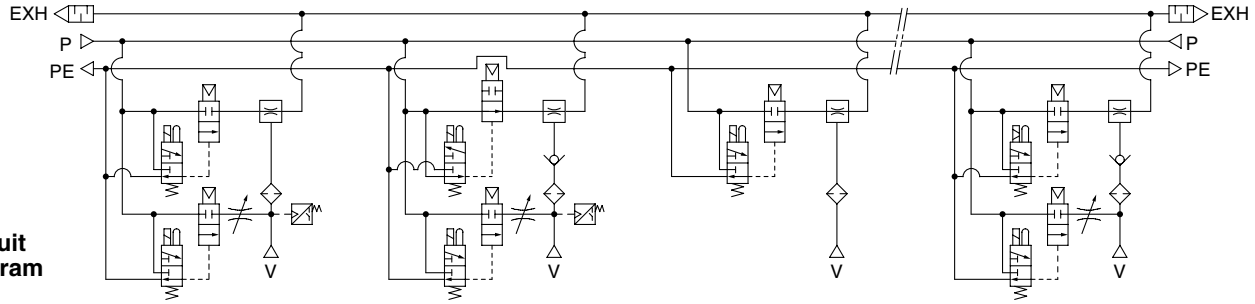


Dimensions (mm)

n	1	2	3	4	5	6	7	8
L1	26	36	46	56	66	76	86	96
L2	42	52	62	72	82	92	102	112

Note 1) The above dimensions are for ZZQ1□-BSB.
ZQ1□3M-K1$\frac{5}{6}$L-D□C□-Q.
In case of ZQ1□3M-□□□□□-F□-Q, the overall length is 87.2.
Note 2) Dimensions marked with "∗" are those after the attached square bracket is mounted.
Note 3) When the body is mounted, tighten with a torque of 0.6 ± 0.06 N•m.
Using excessive torque may cause damage to the body.
Note 4) The pitches of V ports are determined assuming the use of the KJ series one-touch fittings. If used with other fittings, these may cause interference, dependant on their type and size. Please refer to the catalogue to confirm the sizes of the fittings to be used.

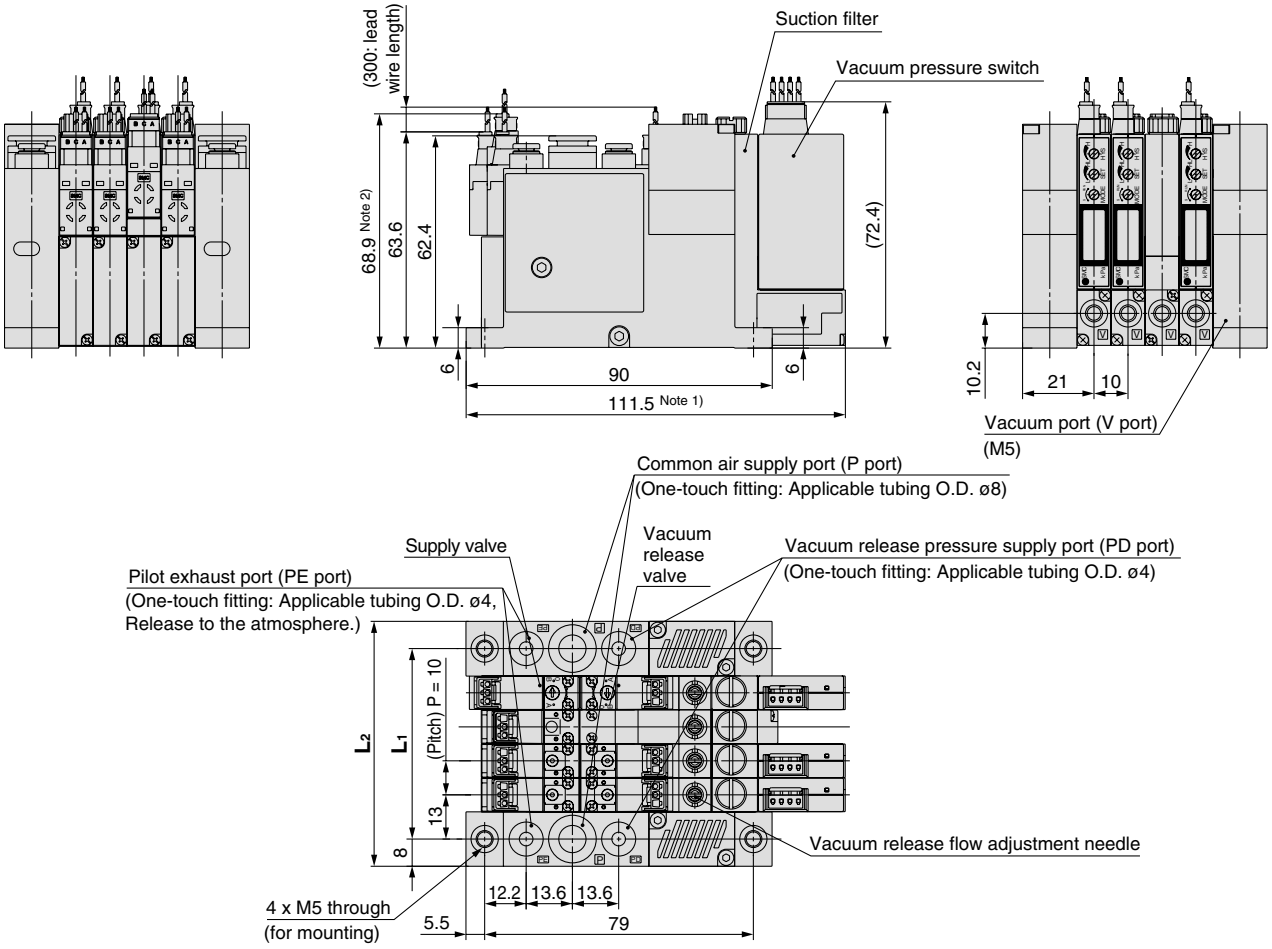
Circuit diagram



ZQ1□3M-K1□□□□-D□□-□□-Q ZQ1□3M-K2□□□-D□□K-□□-Q ZQ1□3M-J1□□□□-F-□□-Q ZQ1□3M-Q1□□-FK-□□-Q

Dimensions

Manifold type (with PD port)
ZZQ1□-BSC
ZQ1□3M-□□□□□-□□□-□□-Q



Dimensions (mm)

n	1	2	3	4	5	6	7	8
L_1	26	36	46	56	66	76	86	96
L_2	42	52	62	72	82	92	102	112

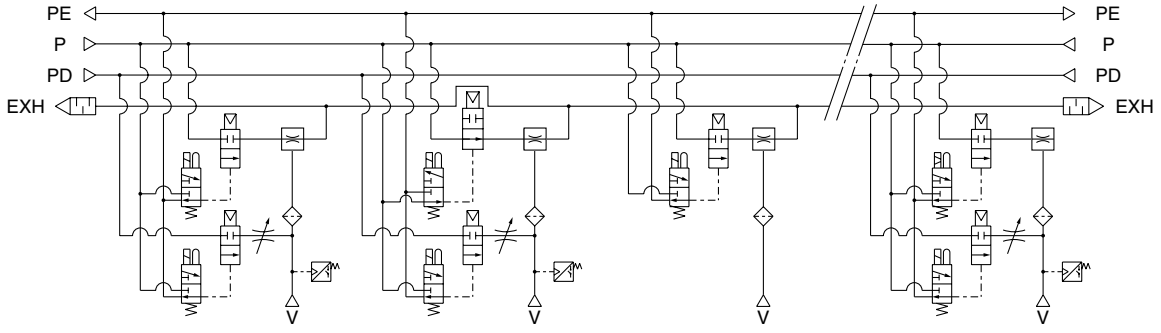
Note 1) The above dimensions are for ZZQ104-BSC.
ZQ1□3M-K1□$^{5}_{6}$L-D□C-Q
ZQ1□3M-K2$^{5}_{6}$L-D□□-Q
ZQ1□3M-J1□$^{5}_{6}$L-F-Q
ZQ1□3M-Q1$^{5}_{6}$L-D□□-Q
In case of ZQ1□3M-□□□□□-F-Q, the overall length is 91.7.
In case of ZQ1□3M-□□□□□-D□C-Q, the overall length is 111.5.

Note 2) The above dimensions are for ZQ1□3M-□$^{K}_{J}$2$^{5}_{6}$□□-□□□-Q.

Note 3) When the body is mounted, tighten with a torque of 0.6 ± 0.06 N•m. Using excessive torque may cause damage to the body.

Note 4) The pitches of V ports are determined assuming the use of the KJ series one-touch fittings. If used with other fittings, these may cause interference, dependant on their type and size. Please refer to the catalogue to confirm the sizes of the fittings to be used.

Note 5) When the vacuum release valve is not used, design the circuit for vacuum release separately in order to release a workpiece.



ZQ1□3M-K1□$^{5}_{6}$□□-D□□-□0-Q **ZQ1□3M-K2□$^{5}_{6}$□-D□□-□0-Q** **ZQ1□3M-J1□□□□-F-□0-Q** **ZQ1□3M-Q1$^{5}_{6}$□-D□□-□0-Q**

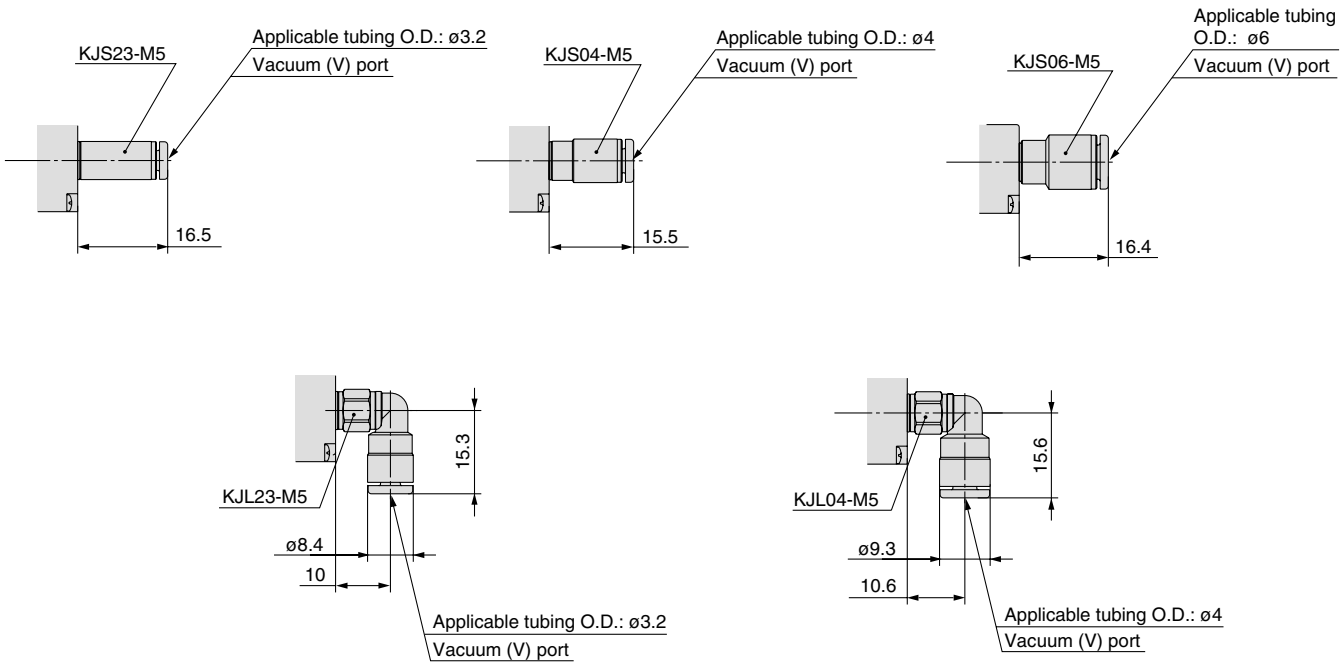
Circuit diagram

Dimensions

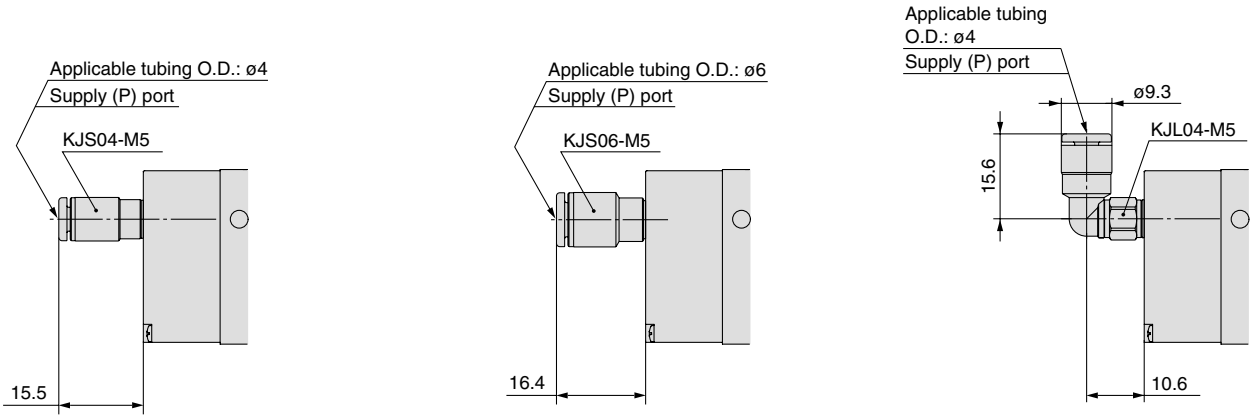
Fittings / Fitting type filter dimensions after installation

V port

(Suction filter, Vacuum pressure switch)



P port



Space Saving Vacuum Ejector
Series ZQ
Made to Order

Please contact SMC for detailed dimensions, specifications, and lead times.

Made to Order

Port Exhaust Specifications

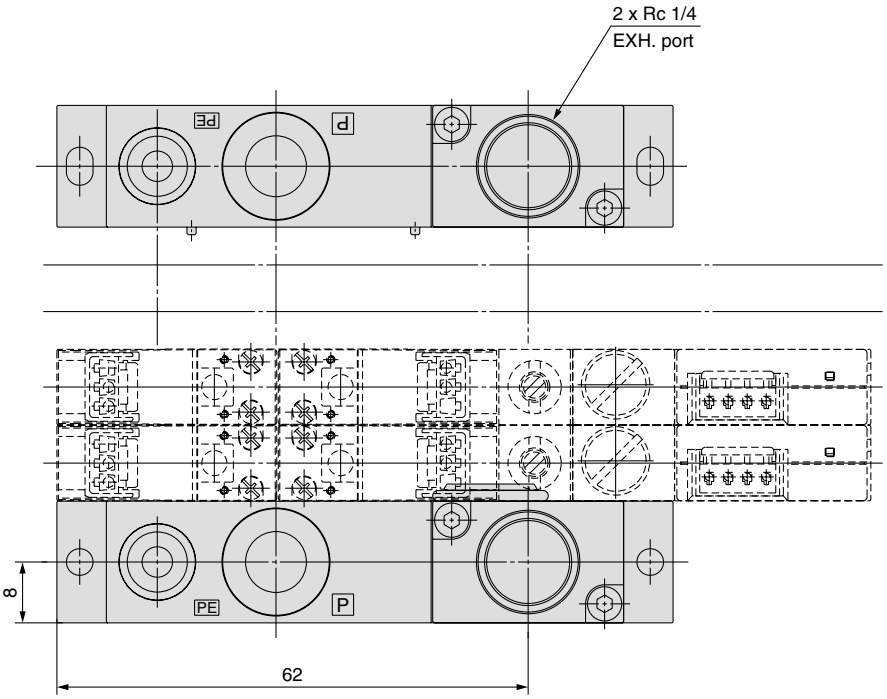
Manifold **ZZQ1** **Stations** **−B2B−X125**

Port exhaust specifications

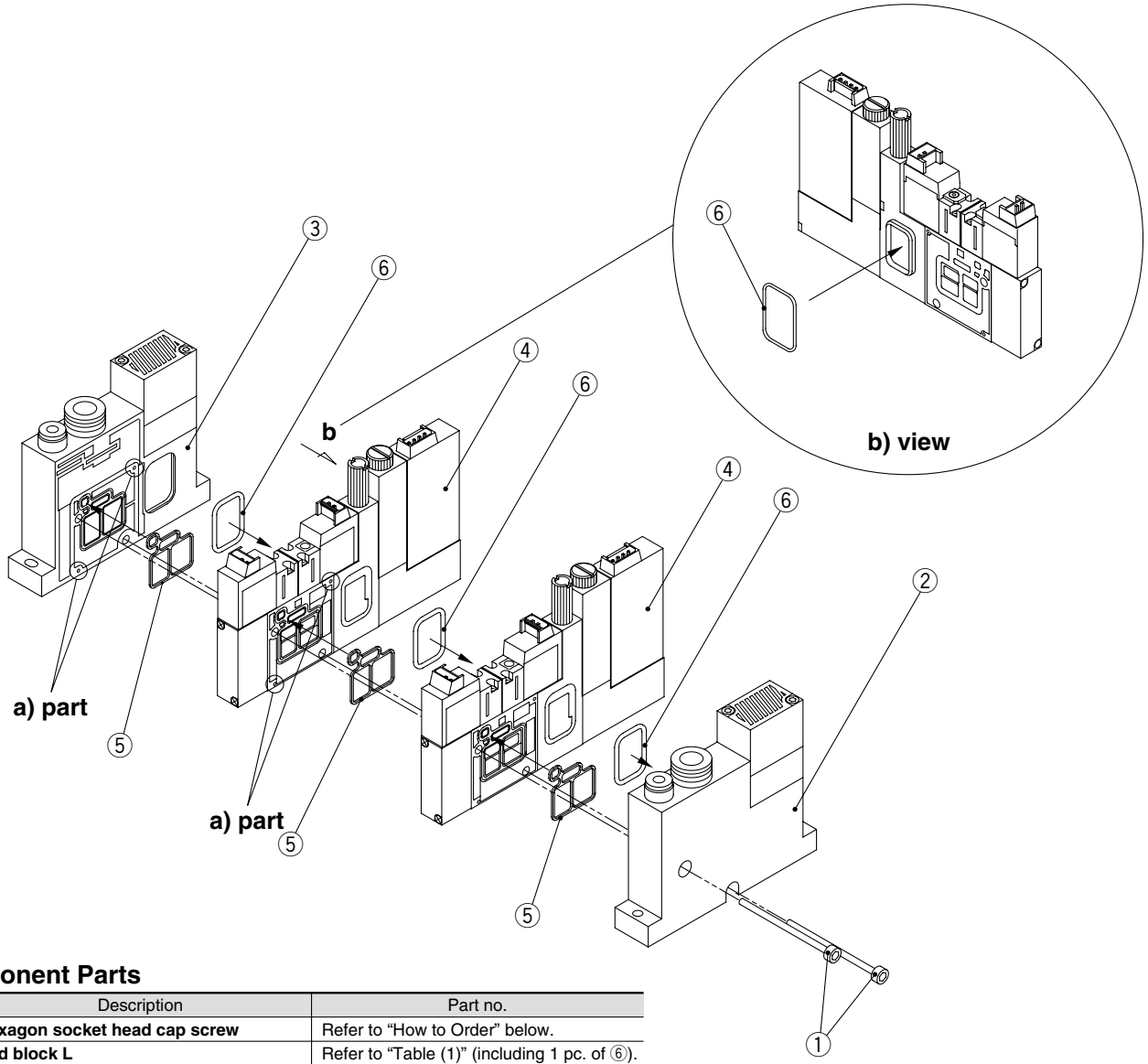
Exhaust port is changed for “Port Exhaust Specifications.”

Dimensions

Manifold type (without PD port)
ZZQ1□-B2B-X125
ZQ1□3M-□□□□□-□□□-Q



Manifold Exploded View



Component Parts

No.	Description	Part no.
1	**Hexagon socket head cap screw**	Refer to "How to Order" below.
2	**End block L**	Refer to "Table (1)" (including 1 pc. of ⑥).
3	**End block R**	Refer to "Table (1)" (including 1 pc. of ⑤).
4	**Ejector assembly**	ZQ1□□3M-□□□□□□-□□□□□-Q Note 1) (1 pc. each in ⑤ and ⑥ is included.)
5	**Ejector body gasket for manifold**	ZQ-3-005-10AS Note 2)
6	**Exhaust block gasket**	ZQ-3-009-10AS Note 2)

Note 1) Refer to pages 11 and 12 for detailed description of "How to Order".
Note 2) 10 pcs. are included in one set.

Table (1)

Description	With PD port	Without PD port
End block L	ZQ1L-2-BSB-AS	ZQ1L-1-BSB-AS
End block R	ZQ1R-2-BSB-AS	ZQ1R-1-BSB-AS

How to Order Hexagon Socket Head Cap Screw

ZQ−STB 05

Number of stations

01	1 station
02	2 stations
⋮	⋮
08	8 stations

Note) 2 pcs. are included in one set.

Working Procedure

Disassembly

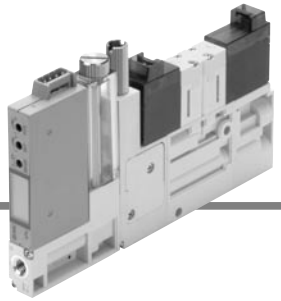
Loosen and remove the hexagon socket head cap bolts ①.

Assembly

1. Install the ejector body gasket for manifold ⑤ into the gasket groove of each ejector assembly ④. Install the exhaust block gasket ⑥ around the projected part.
2. Install the exhaust block gasket ⑥ around the projected part of the end block L ②.
3. Install the ejector body gasket for manifold ⑤ into the gasket groove of the end block R ③.
4. Align the ejector assemblies ④, end block (L) ②, and end block (R) ③ using positioning pins (at the two "a" positions) and fasten with hexagon socket head cap bolts ① (2 pcs.) (with a tightening torque of 0.6 N•m ± 0.06 N•m).

Space Saving Vacuum Pump System

Series ZQ



How to Order

Vacuum Pump Unit

ZQ1000 U – K1 □ 5 L □ – D32 C – □ □ – Q

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩

① Body type

U	For single unit
M	For manifold

② Solenoid valve combination

Symbol	Supply valve	Vacuum release valve
K1	Normally closed	Normally closed
K2 Note 1)	Normally open	Normally closed
J1	Normally closed	None
J2 Note 1)	Normally open	None
Q1	Latching positive common	Normally closed
Q2	Latching positive common	None
N1	Latching negative common	Normally closed
N2	Latching negative common	None

⚠ The air in the adsorption section of this product is not released to the atmosphere at the vacuum suspension state.
As for K1, K2, Q1 and N1, use the vacuum release valve when a workpiece is detached.
Concerning J1, J2, Q2 and N2, devise the circuit for the vacuum release additionally when a workpiece is detached.

Note 1) In cases when K2 or J2 (supply valve normally open) is selected for the solenoid valve combination, when vacuum is stopped for long periods of time (10 minutes or more), do not continue to energize the supply valve, and shut off the air supply.

③ Pilot valve

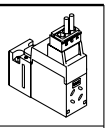
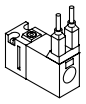
—	Standard (DC: 1 W) Note 2)
Y	DC low wattage type (0.5 W) Note 1,3)

Note 2) Avoid energizing the solenoid valve for long periods of time. (Refer to Specific Product Precautions 1; Caution on Design and Selection.)
Note 3) Y option only available for solenoid valve combinations K1 and J1

④ Solenoid valve rated voltage

5	24 VDC
6	12 VDC

⑤ Electrical entry

L	L-type connector, with 0.3 m lead wire, with light/surge voltage suppressor	
LO	L-type connector, without connector, with light/surge voltage suppressor	
G	Grommet, with 0.3 m lead wire (Latching/AC type: Not applicable)	

⑥ Manual override Note 4)

—	Non-locking push type Latching type: Push-locking type
B	Locking type (Q1/Q2/N1/N2: Not applicable)

Note 4) Latching type supply valve: Available in "Nil" only. In this case, the supply valve and release valve come with a lock.

⑦ Vacuum pressure switch suction filter Note 5)

F	With suction filter only
D32	2 NPN outputs, with suction filter, Pressure range –100 to 0 kPa
D52	2 PNP outputs, with suction filter, Pressure range –100 to 0 kPa

Note 5) The filter included in this product is of an simple type, and will become clogged quickly in environments with high quantities of dust or particulates. Please make additional use of an air suction filter of the ZFA, ZFB or ZFC series.

⑧ Vacuum switch electrical entry

C	Connector type, with 0.6 m lead wire
CL	Connector type, with 3 m lead wire

⚠Warning

The filter case of this suction filter is made of nylon. Contact with alcohol or similar chemicals may cause it to be damaged. Also, do not use the filter when these chemicals are present in the atmosphere.

⑨ Fitting (V port) Note 6)

Symbol	Applicable tubing O.D.	Part no.
0	Without fitting (M5 x 0.8)	—
1	ø3.2 (Straight)	KJS23-M5
2	ø4 (Straight)	KJS04-M5
3	ø6 (Straight)	KJS06-M5
4	ø3.2 (Elbow)	KJL23-M5
5	ø4 (Elbow)	KJL04-M5

Note 6) When neither V port fitting nor PS/PV port fitting are needed, enter nothing or "–00" in the dotted line above "How to Order".

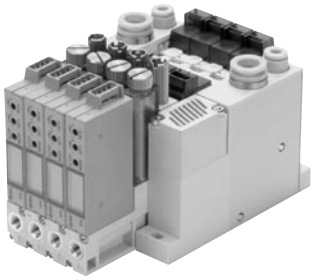
⑩ Fitting (PS / PV port) Note 6, 7)

Symbol	Applicable tubing O.D.	Part no.
0	Without fitting (M5 x 0.8)	—
2	ø4 (Straight)	KJS04-M5
3	ø6 (Straight)	KJS06-M5
5	ø4 (Elbow)	KJL04-M5

Note 7) Manifold type: Not applicable

How to Order

Manifold **ZZQ1 08 – O**



Number of stations

01	1 station
02	2 stations
⋮	⋮
08	8 stations

Vacuum release pressure supply port (PD port)

B	None (Release pressure is supplied from the PS port.)
C	Provided (Air can be alternatively supplied from the PS port.)

Vacuum pressure supply port (PV port) PS port location (Refer to Table (1).)

L	Left side
R	Right side

Table (1) Air Supply Port Location on the Manifold

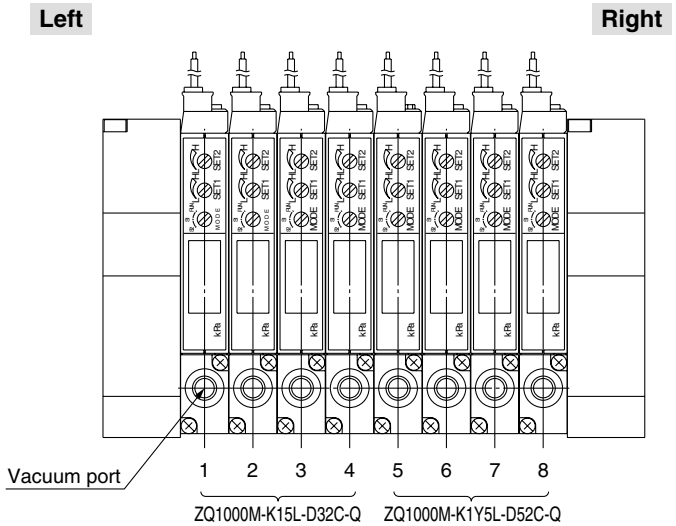
PD port	Manifold / PS port location	Left			Right		
		PS	PV	PD	PS	PV	PD
B	L (Left side)	—	●	—	● Note)	—	—
	R (Right side)	● Note)	—	—	—	●	—
C	L (Left side)	—	●	●	●	—	●
	R (Right side)	●	—	●	—	●	●

Note) The position of each port is shown in terms of its location when vacuum port is in front. Release pressure is supplied from the PS port.

Manifold Ordering Example

ZZQ108-ROB →1 pc.
∗ZQ1000M-K15L-D32C-Q →4 pcs. (Stations 1 to 4)
∗ZQ1000M-K1Y5L-D52C-Q →4 pcs. (Stations 5 to 8)

Note) The stations are sequentially numbered. When viewed from the side of the vacuum ports, the far left station is designated as station 1.



Specifications

Common

Switching method for vacuum/release valve		Piloted
Cv factor		0.11
Supply pressure range	**Vacuum pressure supply port (PV)**	0 to –101.3 kPa
	Pilot/Pressure port (PS)	0.3 to 0.5 MPa (Normally open: 0.3 to 0.45 MPa)
	Supply pressure port for vacuum release (PD)	0.3 to 0.5 MPa (Normally open: 0.3 to 0.45 MPa), and also PD pressure ≤ PS pressure
Operating temperature range		5 to 50°C

Weight

Single unit	With suction filter Note 1)	95 g
	With switch and suction filter Note 2)	109 g
End plate assembly for manifold		122 g

Note 1) Including a 0.3 m connector for the supply valve and vacuum release valve.
Note 2) Including a 0.3 m connector for the supply valve and vacuum release valve and a 0.6 m connector for switch.

◎ **Calculation of weight for the manifold type**
(Single unit weight) x (Number of stations) + (Weight of end plate assembly for manifold)
Example) Switch + 8 stations with suction filter
109 g x 8 + 122 g = 994 g

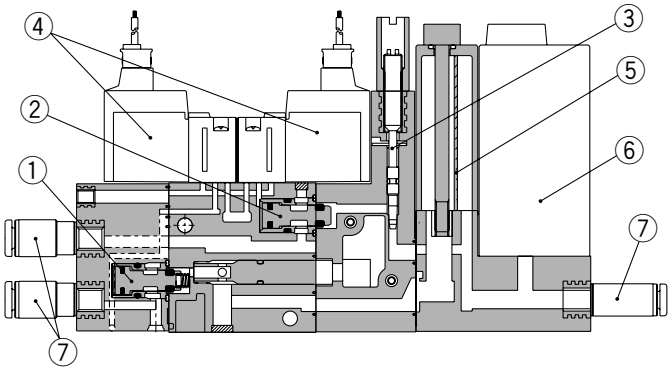
Supply Valve / Vacuum Release Valve

Item \ Type		Normally closed		Latching type	Normally open
		Standard (1 W)	Low wattage type (0.5 W)		
Model (Refer to "How to Order" for solenoid valves on page 31.)		**VQ110-□**	**VQ110Y-□**	**VQ110$^{L}_{N}$-□**	**ZQ1-VQ120-□**
Fluid		Air / Inert gas			
Maximum operating pressure		0.5 MPa			0.45 MPa
Minimum operating pressure		0.3 MPa			
Ambient and fluid temperature		5 to 50°C			
Lubrication		Not required			
Manual override		Non-locking push type / Locking type (Tool type)		Push-locking type	Non-locking push type / Locking type (Tool type)
Rated coil voltage		12, 24 VDC	12, 24 VDC	12, 24 VDC	12, 24 VDC
Power consumption (current value)	**DC**	1 W	0.5 W	1 W	
Electrical entry		Grommet		L-type plug connector	Grommet
		L-type plug connector (with light/surge voltage suppressor)		(with light/surge voltage suppressor)	(with light/surge voltage suppressor)

Output / Display / Negative Pressure

Model (Refer to "How to Order" for vacuum pressure switch on page 31.)		**ZQ1S-D32□-AS**	**ZQ1S-D52□-AS**
Rated pressure range		0 to –100 kPa	
Set pressure range		0 to –99 kPa	
Withstand pressure		0.2 MPa	
Fluid		Air / Non-corrosive/Non-combustible gas	
Power supply voltage		12 to 24 VDC ±10%	
Current consumption		35 mA or less [with power supply voltage of 24 VDC and switch output ON (with no load)]	
Ambient temperature range		5 to 50 ˚C (with no freezing or condensation)	
Ambient humidity range		35 to 85 %RH in operation and saving (with no condensation)	
Withstand voltage		500 VAC for 1 min.	
Insulation resistance		50 MΩ or more (between live parts and pressure port at 500 VDC Mega)	
Switch output		2 NPN outputs	2 PNP outputs
	Maximum load current	80 mA (per output)	
	Maximum applied voltage	30 V (for NPN output)	
	Residual voltage	NPN output: 0.8 V or less (at 80 mA inrush) PNP output: 1.2 V or less (at 80 mA discharge)	
	Response time	2 ms or less	
Hysteresis		0 to 15% F.S. or less (variable)	2% F.S. or less (fixed)
Display		2-digit Red LED	
Display accuracy		±3 %F.S. ±2 digits	
Output indicator light		Illuminates when the output is turned ON. (Red LED for OUT1 and Green LED for OUT2)	
Analog output		(Only applicable to D31 and D51)	
	Output voltage	1 to 5 V ±2.5% F.S. or less	
	Linearity	±0.5 F.S. or less	

Construction



Component Parts

No.	Description	Material
1	**Poppet valve assembly for supply valve**	–
2	**Poppet valve assembly for vacuum release valve**	–
3	**Vacuum release flow adjustment needle**	Aluminum alloy

Replacement Parts

No.	Description	Material	Part no.
4	**Solenoid valve**	–	Refer to the below.
5	**Filter element**	PVF	XT534-5-001-AS
6	**Vacuum pressure switch**	–	Refer to the below.
7	**Fitting**	–	Refer to "How to Order" below.

How to Order

Solenoid Valve

Pilot valve

—	Standard (1 W)
Y	Low wattage type (0.5 W)
L	Latching positive common
N	Latching negative common

Actuation

1	Normally closed

Solenoid valve rated voltage

5	24 VDC
6	12 VDC

VQ1 1 0 □ – 5 L □ – Q

ZQ1-VQ1 2 0 □ – 5 L □ – Q

Actuation

2	Normally open

Pilot valve

—	Standard (1 W)

Solenoid valve rated voltage

5	24 VDC
6	12 VDC

Manual override Note)

—	Non-locking push type Latching type: Push-locking type
B	Locking type

Note) Latching type: not available with "B" option.

Electrical entry Note)

L	L-type plug connector, with 0.3 m lead wire	
LO	L-type plug connector, without connector	
G	Grommet, with 0.3 m lead wire (Latching/AC type: Not applicable)	

Note) Mounting screws are attached.

Connector assembly part no.

● **How to order connector assembly**

DC positive common

• **Single** **AXT661-14A-** □

• **Latching** **AXT661-13A-** □

DC negative common

• **Latching** **AXT661-13AN-** □

Connector, socket (3 pcs) only **AXT661-12A**

Lead wire length

—	300 mm
6	600 mm
10	1000 mm
20	2000 mm
30	3000 mm

● **Lead wire length of the plug connector**

The lead wire length for a valve with a lead wire is 300 mm. When in need of a valve with a lead wire longer than 600 mm, place an order for a valve without a connector and connector assembly.

Vacuum Pressure Switch

ZQ1S-D 32 C – Q – AS

Vacuum pressure switch specifications

D32	2 NPN outputs, Pressure range –100 to 0 kPa
D52	2 PNP outputs, Pressure range –100 to 0 kPa

Electrical entry Note)

C	Connector type, with 0.6 m lead wire
CL	Connector type, with 3 m lead wire

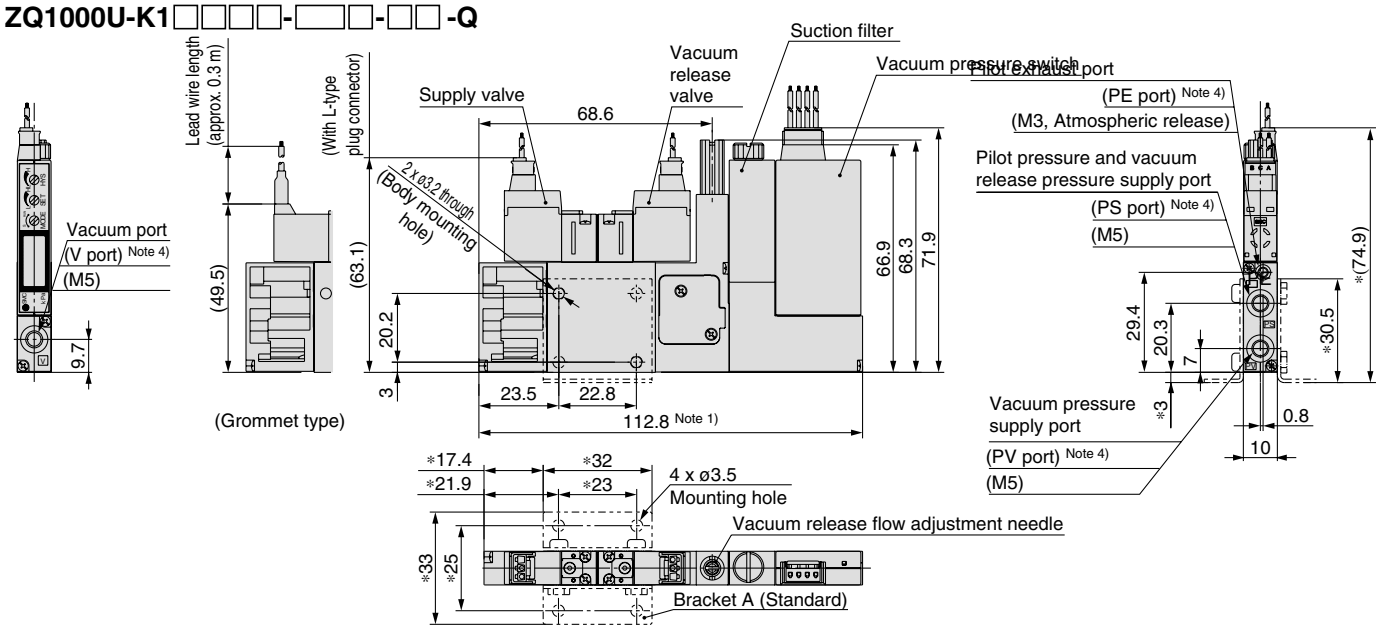
Note) Mounting screws are attached.

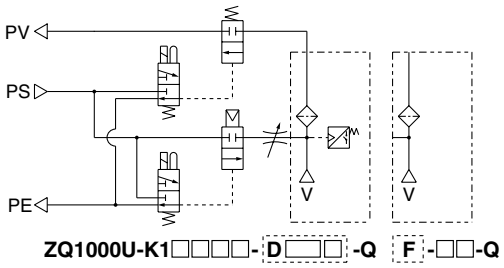
Switch connector part no.

ZQ1-AS-003
ZQ1-AS-004

Dimensions

Type K1
ZQ1000U-K1□□□□-□□□-□□-Q

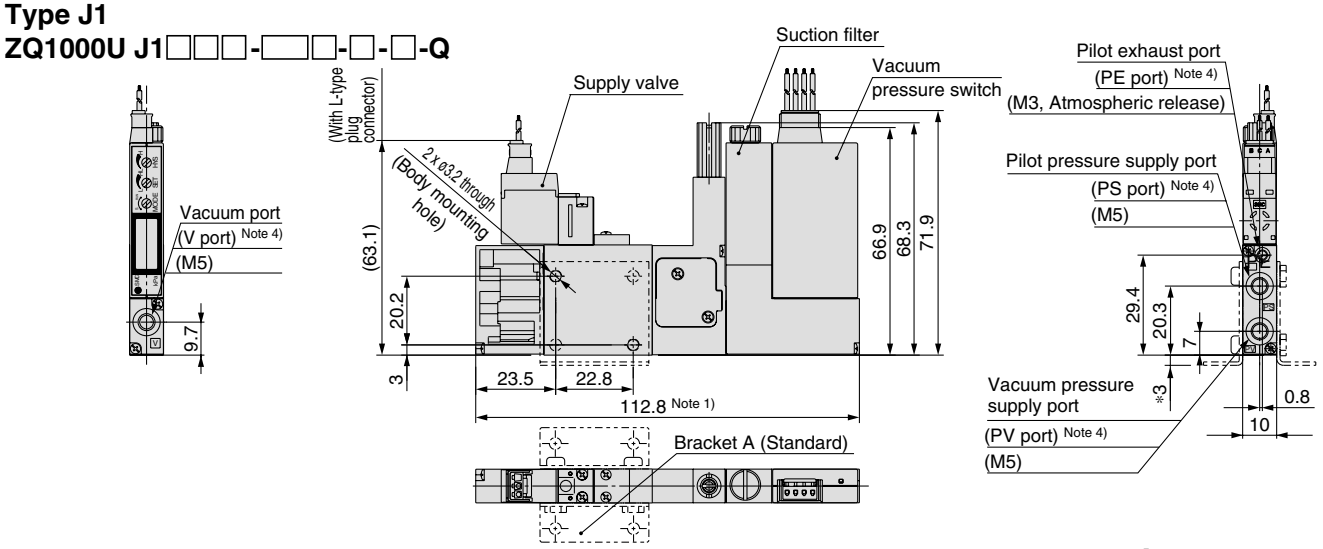


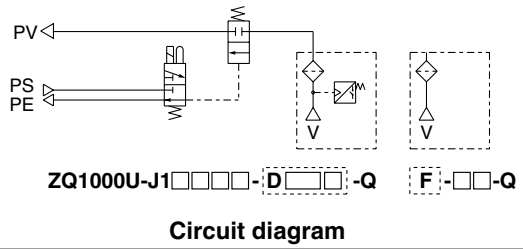


Circuit diagram

Note 1) The above dimensions are for ZQ1001U-K1□$^{5}_{6}$□-D□C-Q.
In case of ZQ1001U-K1□□□□-F-Q, the overall length is 93.
Note 2) Dimensions marked with "*" are those after bracket A is mounted.
Note 3) When the body is mounted, tighten with a torque of 0.6 ± 0.06 N•m.
Using excessive torque may cause damage to the body.
Note 4) The pitches of PS, PV and V ports are determined assuming the use of the KJ series one-touch fittings. If used with other fittings, these may cause interference, dependant on their type and size. Please refer to the catalogue to confirm the sizes of the fittings to be used.

Type J1
ZQ1000U J1□□□-□□□-□-□-Q



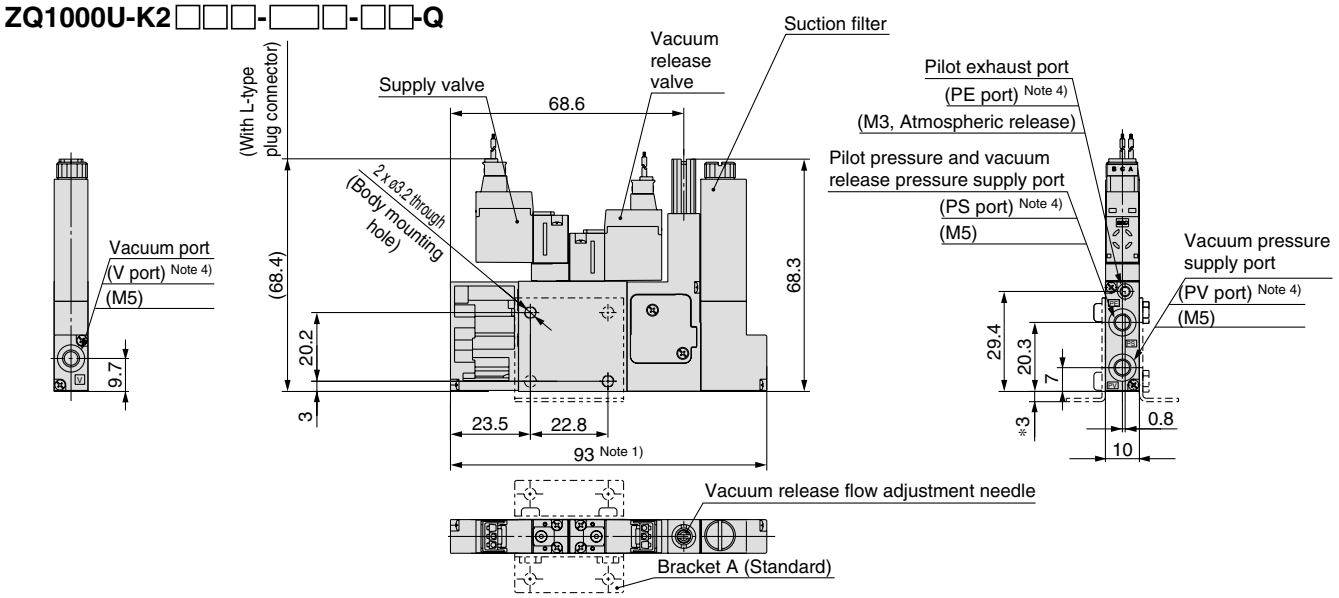


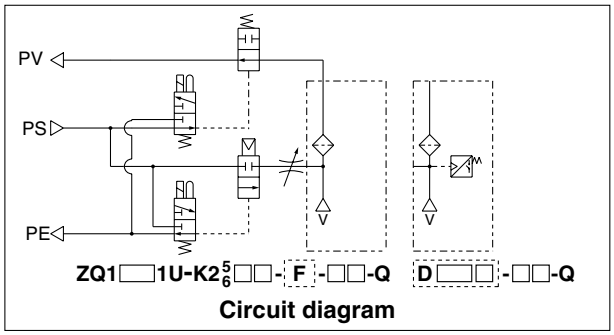
Circuit diagram

Note 1) The above dimensions are for ZQ1000U-J1□$^{5}_{6}$L-D□C-Q.
In case of ZQ1000U-J1□□□□-F-Q, the overall length is 93.
Note 2) Dimensions marked with "*" are those after bracket A is mounted.
Note 3) When the body is mounted, tighten with a torque of 0.6 ± 0.06 N•m.
Using excessive torque may cause damage to the body.
Note 4) The pitches of PS, PV and V ports are determined assuming the use of the KJ series one-touch fittings. If used with other fittings, these may cause interference, dependant on their type and size. Please refer to the catalogue to confirm the sizes of the fittings to be used.
Note 5) In order to release a workpiece, design the circuit for vacuum release separately.

Dimensions

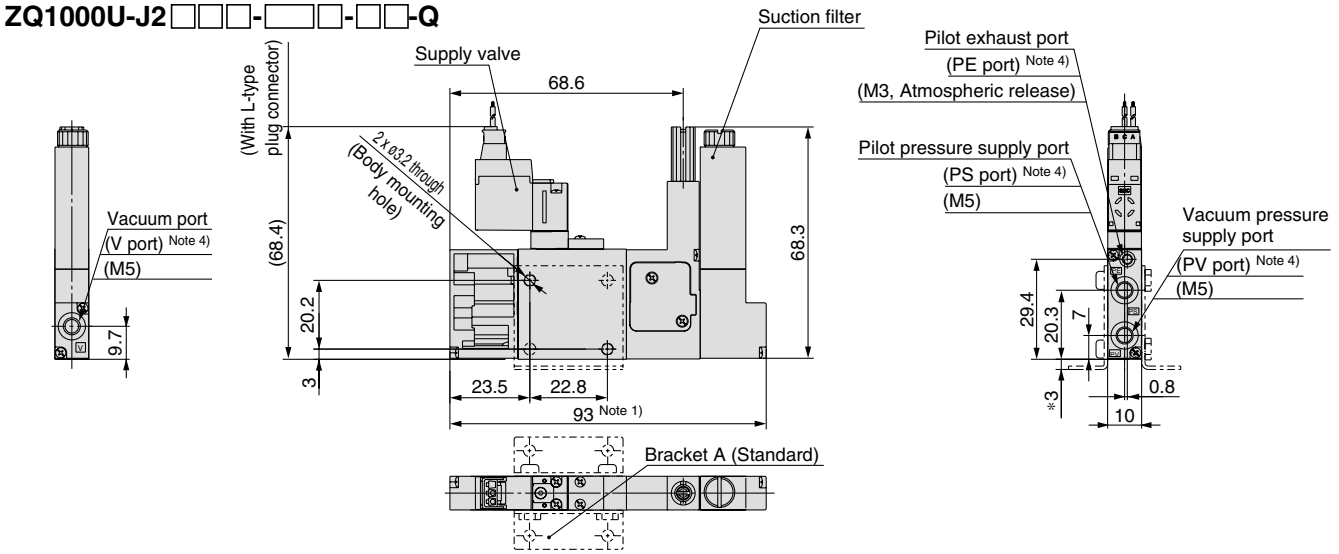
Type K2
ZQ1000U-K2□□□-□□-□□-Q

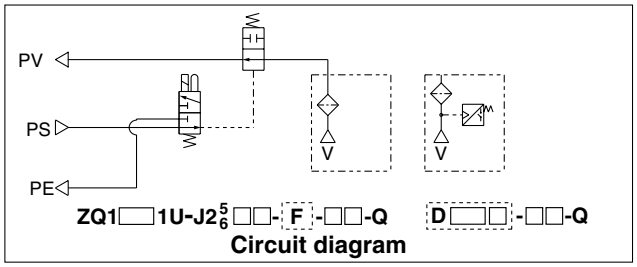




Note 1) The above dimensions are for ZQ1000U-K2 5/6 L-F-Q.
In case of ZQ1000U-K2 5/6 □□-D□C-Q, the overall length is 112.8.
Note 2) Dimensions marked with "*" are those after bracket A is mounted.
Note 3) When the body is mounted, tighten with a torque of 0.6 ± 0.06 N•m.
Using excessive torque may cause damage to the body.
Note 4) The pitches of PS, PV and V ports are determined assuming the use of the KJ series one-touch fittings. If used with other fittings, these may cause interference, dependant on their type and size. Please refer to the catalogue to confirm the sizes of the fittings to be used.

Type J2
ZQ1000U-J2□□□-□□-□□-Q



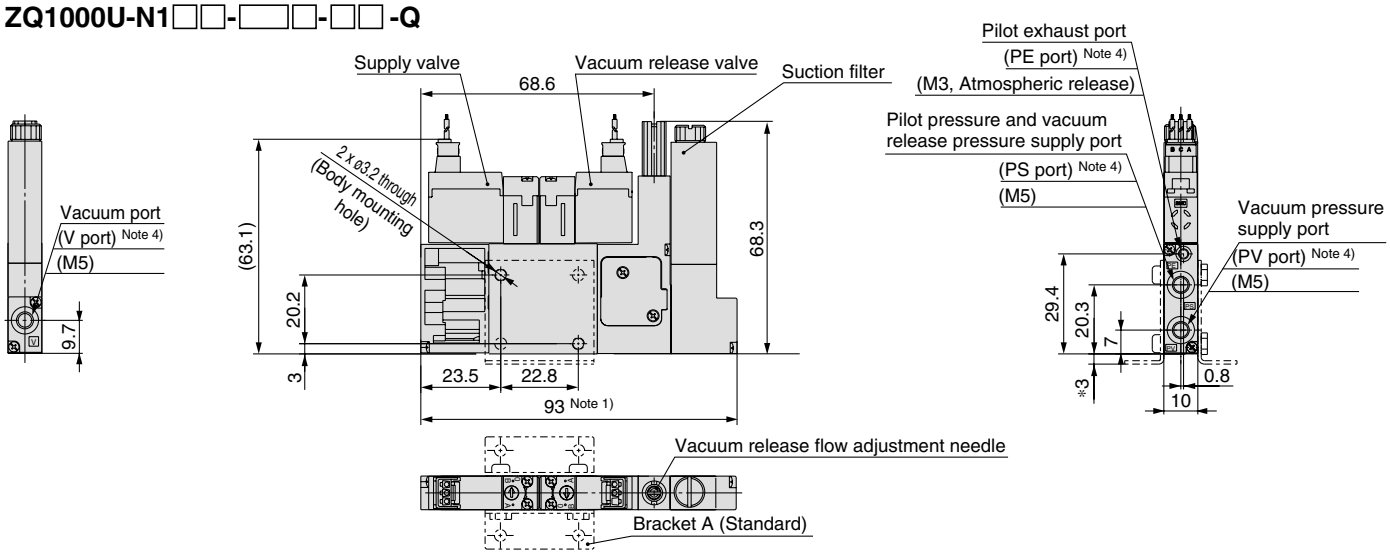


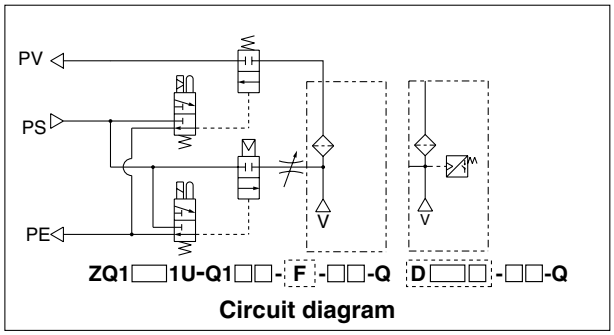
Note 1) The above dimensions are for ZQ1000U-J2 5/6 L-F-Q.
In case of ZQ1000U-J2 5/6 □□-D□C-Q, the overall length is 112.8.
Note 2) Dimensions marked with "*" are those after bracket A is mounted.
Note 3) When the body is mounted, tighten with a torque of 0.6 ± 0.06 N•m.
Using excessive torque may cause damage to the body.
Note 4) The pitches of PS, PV and V ports are determined assuming the use of the KJ series one-touch fittings. If used with other fittings, these may cause interference, dependant on their type and size. Please refer to the catalogue to confirm the sizes of the fittings to be used.
Note 5) In order to release a workpiece, design the circuit for vacuum release separately.

Dimensions

Type Q1, N1

ZQ1000U-Q1□□-□□-□□-□□-Q
ZQ1000U-N1□□-□□-□□-□□-Q



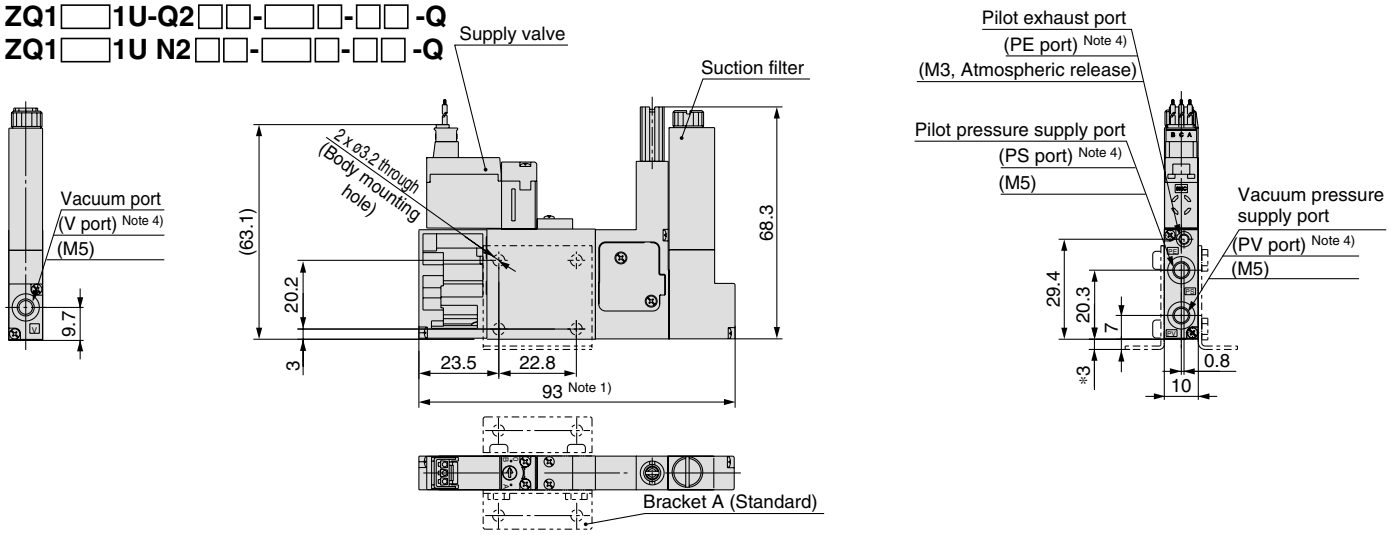


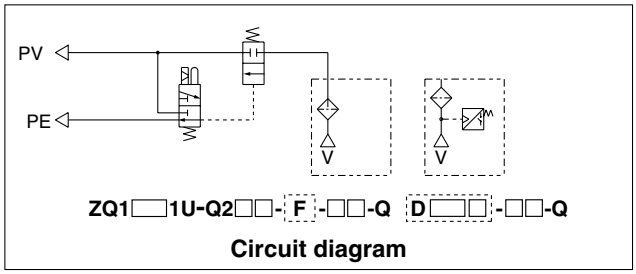
Circuit diagram

Note 1) The above dimensions are for ZQ1000U-$^{Q}_{N}$1$^{5}_{6}$□-F-Q.
In case of ZQ1000U-$^{Q}_{N}$1□□□□-D□□C-Q, the overall length is 112.8.
Note 2) Dimensions marked with "∗" are those after bracket A is mounted.
Note 3) When the body is mounted, tighten with a torque of 0.6 ± 0.06 N•m.
Using excessive torque may cause damage to the body.
Note 4) The pitches of PS, PV and V ports are determined assuming the use of the KJ series one-touch fittings. If used with other fittings, these may cause interference, dependant on their type and size. Please refer to the catalogue to confirm the sizes of the fittings to be used.

Type Q2, N2

ZQ1□□1U-Q2□□-□□-□□-□□-Q
ZQ1□□1U N2□□-□□-□□-□□-Q



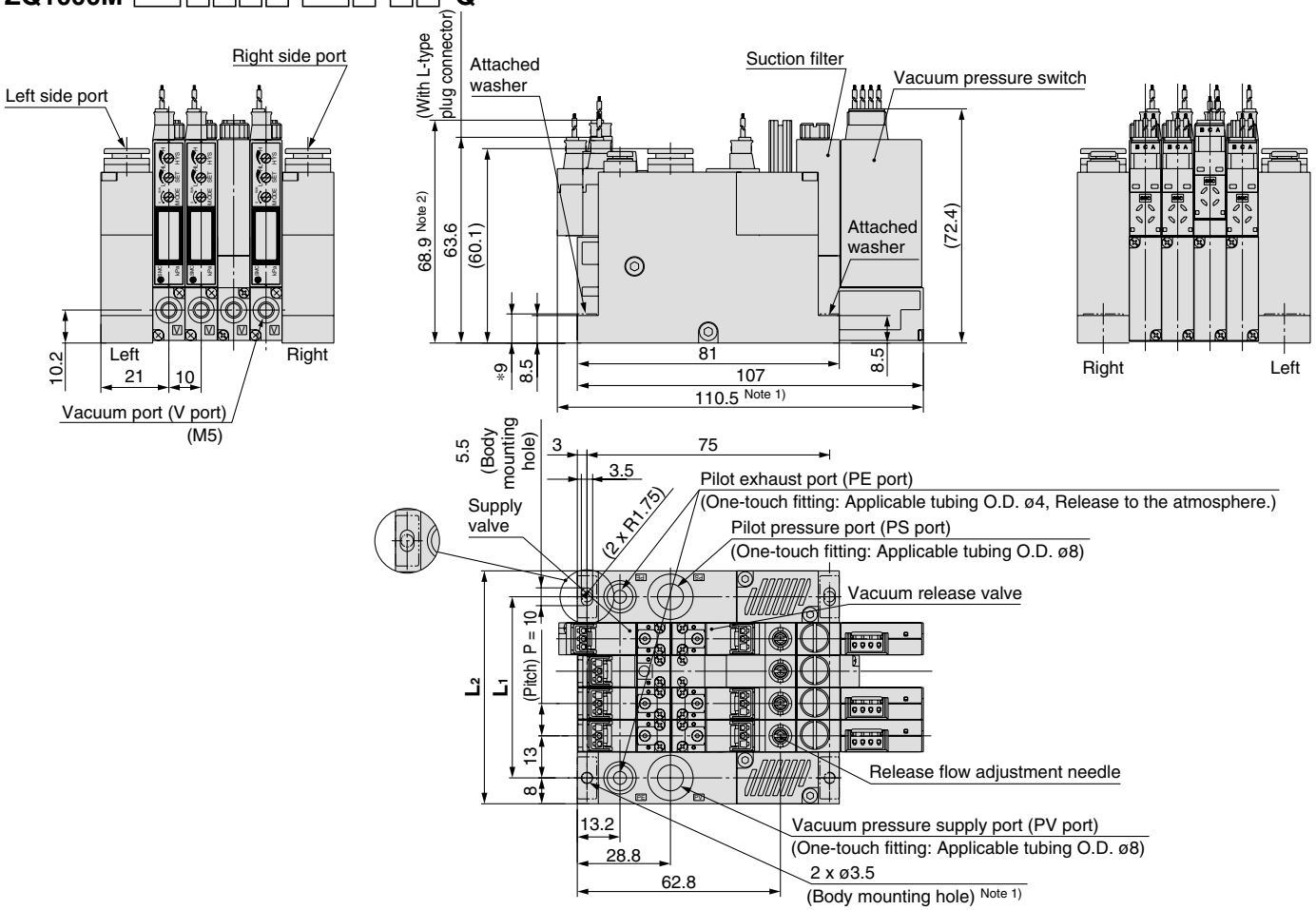


Circuit diagram

Note 1) The above dimensions are for ZQ1000U-$^{Q}_{N}$2□L-F-Q.
In case of ZQ1000U-$^{Q}_{N}$2□L-D□□C-Q, the overall length is 112.8.
Note 2) Dimensions marked with "∗" are those after bracket A is mounted.
Note 3) When the body is mounted, tighten with a torque of 0.6 ± 0.06 N•m.
Using excessive torque may cause damage to the body.
Note 4) The pitches of PS, PV and V ports are determined assuming the use of the KJ series one-touch fittings. If used with other fittings, these may cause interference, dependant on their type and size. Please refer to the catalogue to confirm the sizes of the fittings to be used.
Note 5) In order to release a workpiece, design the circuit for vacuum release separately.

Dimensions

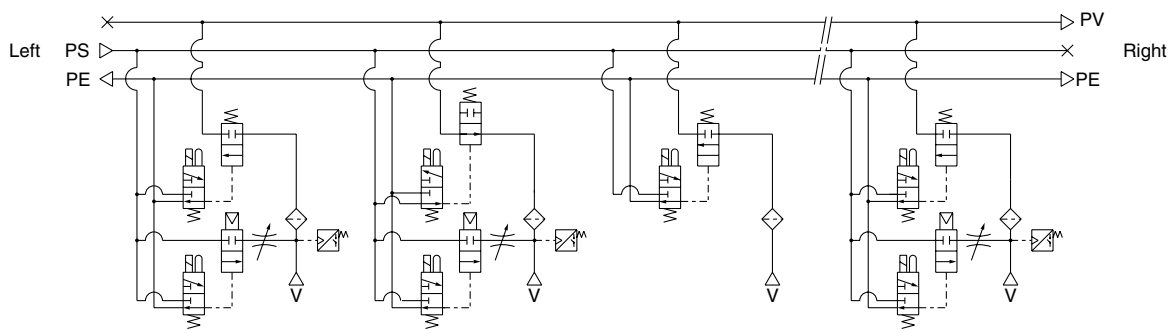
Manifold type (without PD port)
ZZQ1□-□OB
ZQ1000M-□□□□□-□□-□□-Q



Dimensions n: Number of stations (mm)

n	1	2	3	4	5	6	7	8
L1	26	36	46	56	66	76	86	96
L2	42	52	62	72	82	92	102	112

Note 1) The above dimensions are for ZZQ104-LOB.
ZQ1000M-K1□5/6L-D□C-Q
ZQ1000M-K25/6L-D□□-Q
ZQ1000M-J15/6L-F-Q
ZQ1000M-Q15/6L-D□□-Q
In case of ZQ1000M-K/J□□□□□-F-Q, the overall length is 87.2.
In case of ZQ1000M-Q/N□L-F-Q, the overall length is 90.7.
In case of ZQ1000M-K/J□□□□□-D□C-Q, the overall length is 107.
In case of ZQ1000M-Q/N□L-D□C-Q, the overall length is 110.5.
Note 2) The above dimensions are for ZQ1000M-K/J25/6□□-□□□-Q.
Note 3) Dimensions marked with "*" are those after the attached washer is mounted.
Note 4) When the body is mounted, tighten with a torque of 0.6 ± 0.06 N•m. Using excessive torque may cause damage to the body.
Note 5) The pitches of V ports are determined assuming the use of the KJ series one-touch fittings. If used with other fittings, these may cause interference, dependant on their type and size. Please refer to the catalogue to confirm the sizes of the fittings to be used.
Note 6) When the vacuum release valve is not used, design the circuit for vacuum release separately in order to release a workpiece.

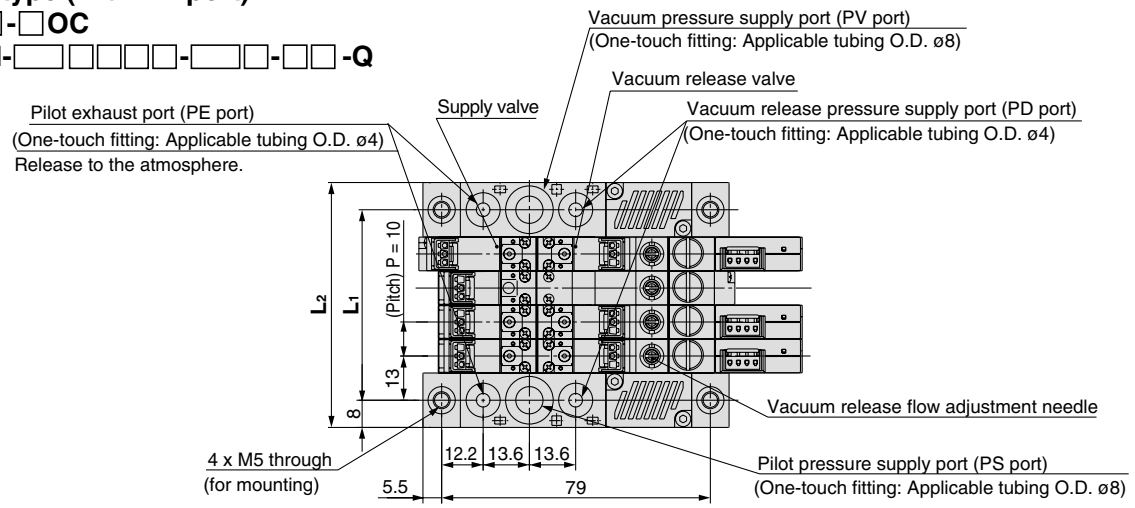


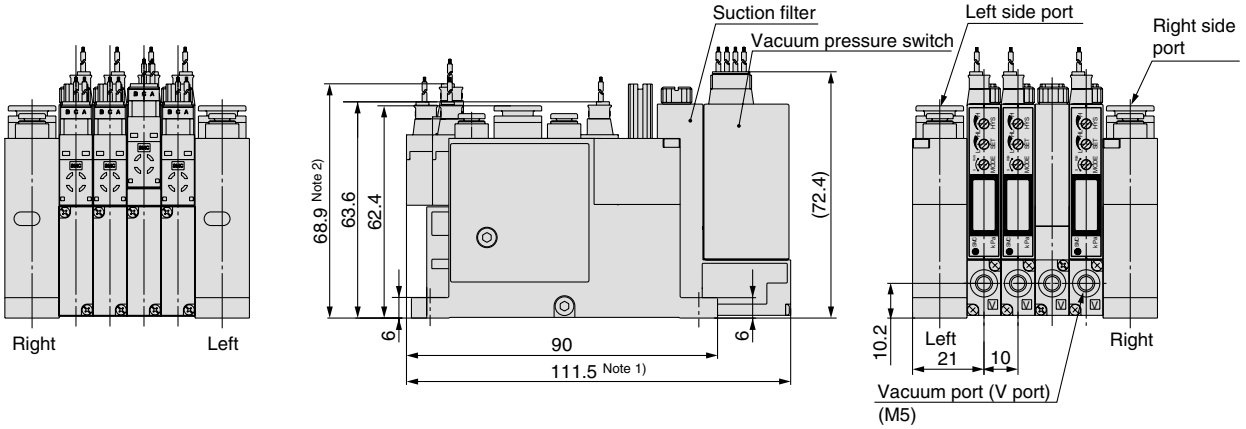
ZQ1000M-K1□□□□-D□□-□□-Q **ZQ1000M-K2□□□-D□□-□□-Q** **ZQ1000M-J1□□□□-F-□□-Q** **ZQ1000M-Q1□□□□-D□□-□□-Q**

Circuit diagram

Dimensions

Manifold type (with PD port)
ZZQ1□-□OC
ZQ1000M-□□□□□-□□-□□-Q





Dimensions n: Number of stations (mm)

n	1	2	3	4	5	6	7	8
L_1	26	36	46	56	66	76	86	96
L_2	42	52	62	72	82	92	102	112

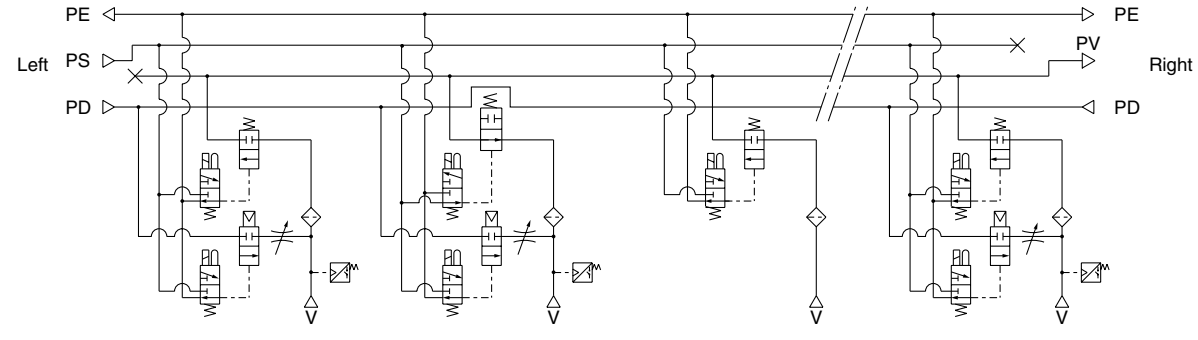
Note 1) The above dimensions are for ZZQ104-ROC.
ZQ1000M-K1□$^{5}_{6}$L-D□C-Q
ZQ1000M-K2□□□□-D□□-Q
ZQ1000M-J1□□□□-F-Q
ZQ1000M-Q1$^{5}_{6}$L-D□□-Q
In case of ZQ1000M-□□□□□-F-Q, the overall length is 91.7.
In case of ZQ1000M-□□□□□-D□C-Q, the overall length is 111.5.

Note 2) ∗ The above dimensions are for ZQ1□3M-$^{K}_{J}2^{5}_{6}$□□-□□□-Q.

Note 3) When the body is mounted, tighten with a torque of 0.6 ± 0.06 N•m. Using excessive torque may cause damage to the body.

Note 4) The pitches of V ports are determined assuming the use of the KJ series one-touch fittings. If used with other fittings, these may cause interference, dependant on their type and size. Please refer to the catalogue to confirm the sizes of the fittings to be used.

Note 5) When the vacuum release valve is not used, design the circuit for vacuum release separately in order to release a workpiece.



ZQ1000M-K1□□□□-D□□-□□-Q **ZQ1000M-K2□□□-D□□-□□-Q** **ZQ1000M-J1□□□□-F-□□-Q** **ZQ1000M-Q1□□□□-D□□-□□-Q**

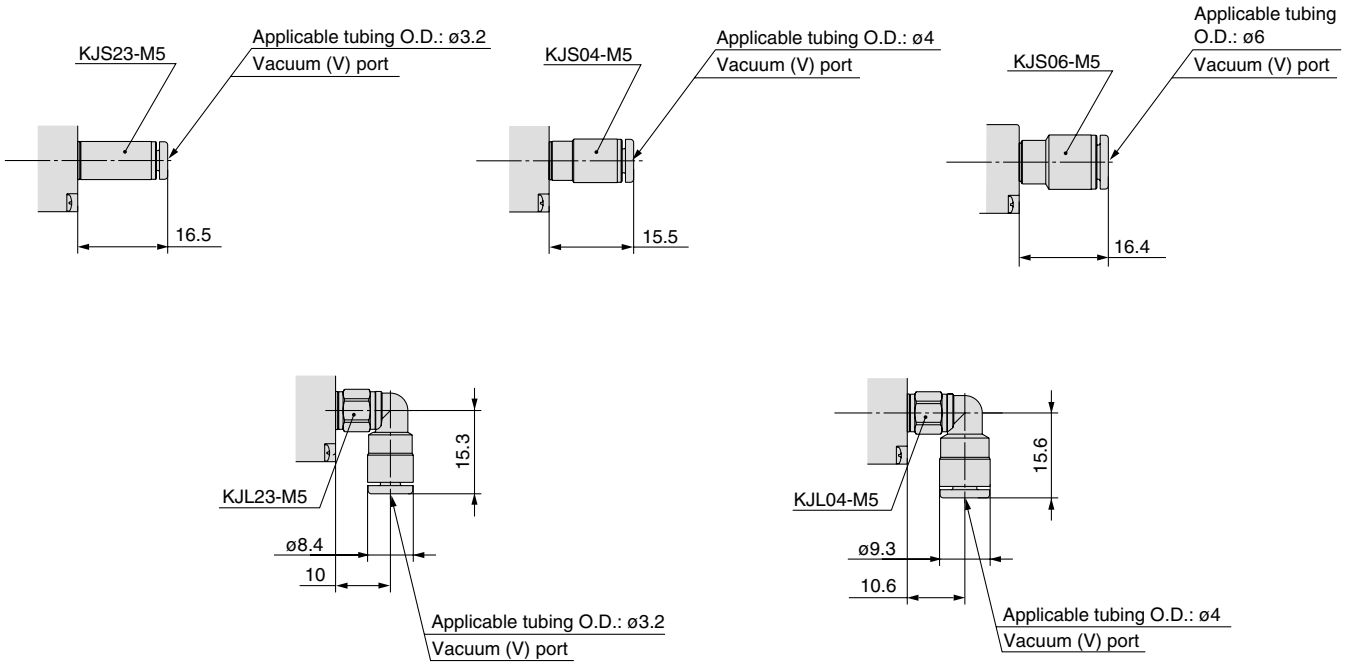
Circuit diagram

Dimensions

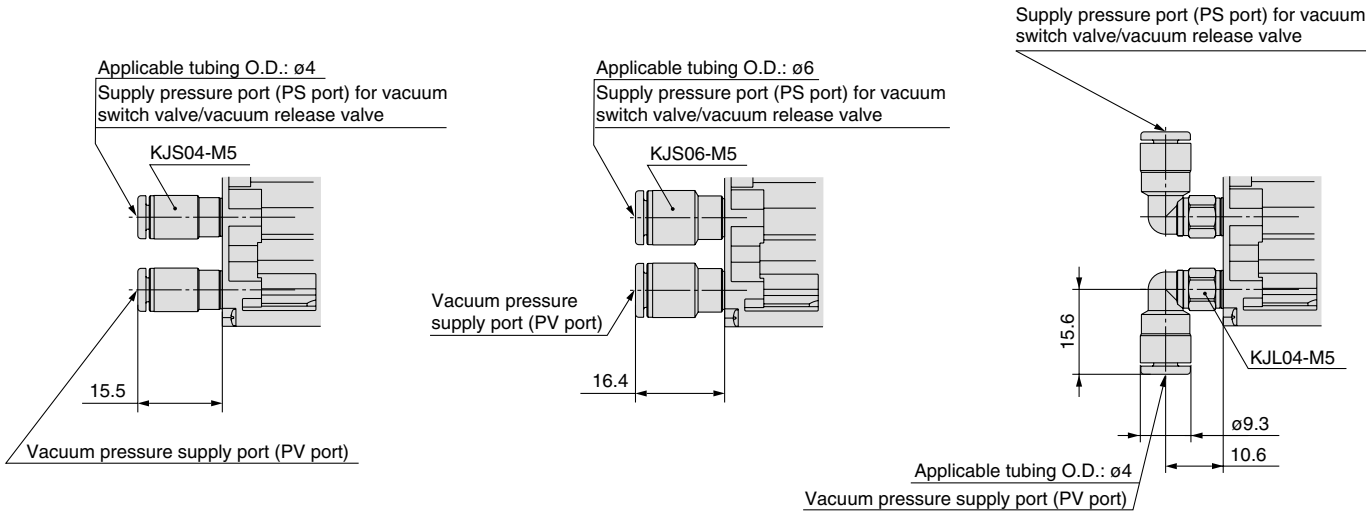
Fittings / Fitting type filter dimensions after installation

V port

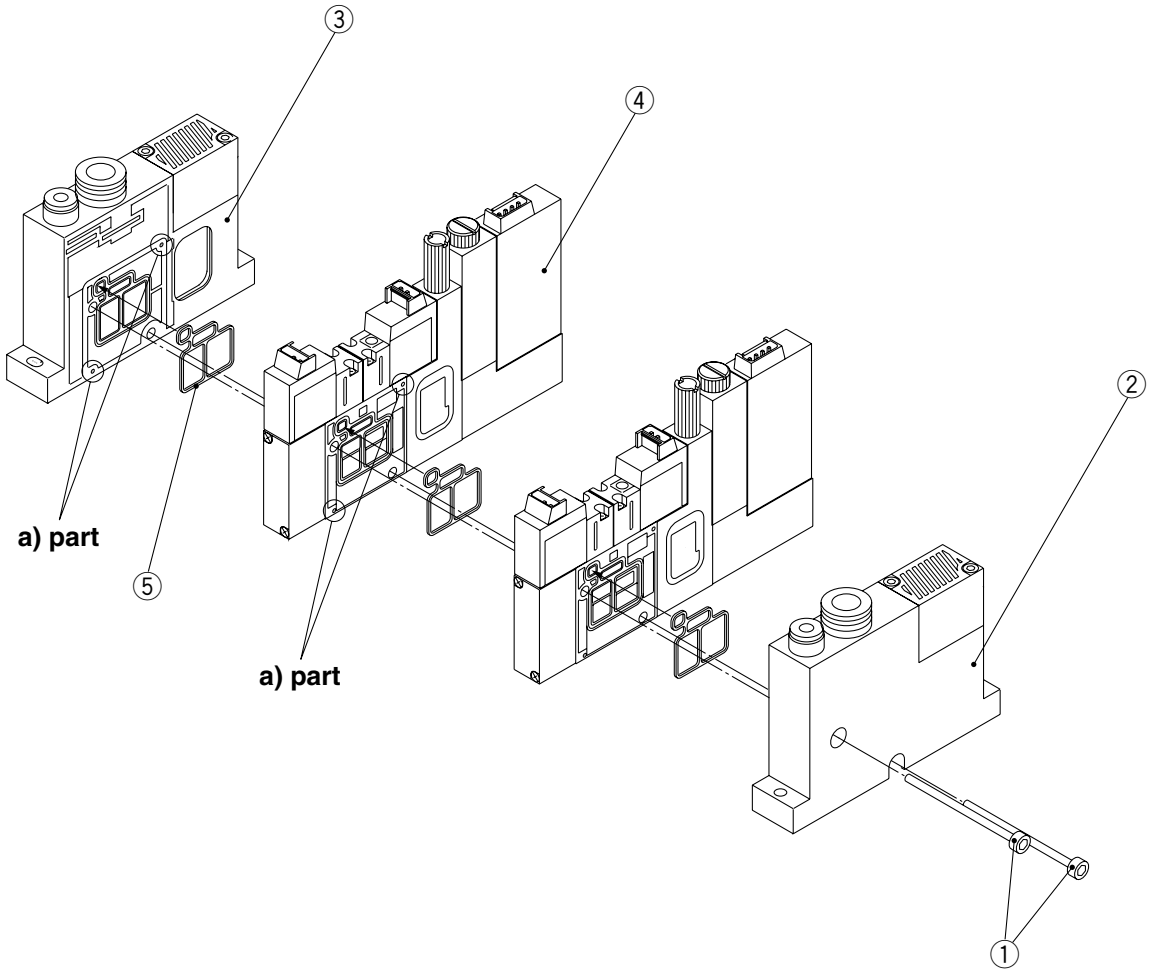
(Suction filter, Vacuum pressure switch)



PS / PV port



Manifold Exploded View



Component Parts

No.	Description	Part no.
1	**Hexagon socket head cap screw**	Refer to "How to Order" below.
2	**End block L**	Refer to "Table (1)".
3	**End block R**	Refer to "Table (2)" (including 1 pc. of ⑤).
4	**Vacuum pump system**	ZQ1000M-□□□□□-□□-□□-Q Note 1) (including 1 pc. of ⑤).
5	**Ejector body gasket for manifold**	ZQ-3-005-10AS Note 2)

Note 1) Refer to page 27 and 28 for detailed description of "How to Order".
Note 2) 10 pcs. are included in one set.

Table (1) End Block L Part No.

PD port specification / PV port location when the V port is viewed in front	With PD port	Without PD port
Right side	ZQ1L-O-S0C	ZQ1L-O-S0B
Left side	ZQ1L-O-V0C	ZQ1L-O-V0B

Table (2) End Block R Part No.

PD port specification / PV port location when the V port is viewed in front	With PD port	Without PD port
Right side	ZQ1R-O-V0C	ZQ1R-O-V0B
Left side	ZQ1R-O-S0C	ZQ1R-O-S0B

How to Order Hexagon Socket Head Cap Screw

ZQ−STB 05

Number of stations

01	1 station
02	2 stations
⋮	⋮
08	8 stations

Note) 2 pcs. are included in one set.

Working Procedure

Disassembly

Loosen and remove the hexagon socket head cap bolts ①.

Assembly

1. Install the ejector body gasket for manifold ⑤ into the gasket groove of each ejector assembly ④.
2. Install the ejector body gasket for manifold ⑤ into the gasket groove of the end block R ②.
3. Align the ejector assemblies ④, end block (L) ②, and end block (R) ③ using positioning pins (at the two "a" positions) and fasten with a clamp rod ① (2 pcs.) (with a tightening torque of 0.6 N•m ± 0.06 N•m).

Safety Instructions

These safety instructions are intended to prevent hazardous situations and/or equipment damage. These instructions indicate the level of potential hazard with the labels of **"Caution," "Warning"** or **"Danger."** They are all important notes for safety and must be followed in addition to International Standards[Note 1)] and other safety regulations.

Note 1) ISO 4414: Pneumatic fluid power – General rules relating to systems.
ISO 4413: Hydraulic fluid power – General rules relating to systems.
IEC 60204-1: Safety of machinery – Electrical equipment of machines. (Part 1: General requirements)
ISO 10218: Manipulating industrial robots - Safety.
etc.

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

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

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

⚠ Warning

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

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

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

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

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

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

4. Contact SMC beforehand and take special consideration of safety measures if the product is to be used in any of the following conditions.

1. Conditions and environments outside of the given specifications, or use outdoors or in a place exposed to direct sunlight.
2. Installation on equipment in conjunction with atomic energy, railways, air navigation, space, shipping, vehicles, military, medical treatment, combustion and recreation, or equipment in contact with food and beverages, emergency stop circuits, clutch and brake circuits in press applications, safety equipment or other applications unsuitable for the standard specifications described in the product catalogue.
3. An application which could have negative effects on people, property, or animals requiring special safety analysis.
4. Use in an interlock circuit, which requires the provision of double interlock for possible failure by using a mechanical protective function, and periodical checks to confirm proper operation.

■ Exemption from Liability

1. SMC, its officers and employees shall be exempted from liability for any loss or damage arising out of earthquakes or fire, action by a third person, accidents, customer error with or without intention, product misuse, and any other damages caused by abnormal operating conditions.

2. SMC, its officers and employees shall be exempted from liability for any direct or indirect loss or damage, including consequential loss or damage, loss of profits, or loss of chance, claims, demands, proceedings, costs, expenses, awards, judgments and any other liability whatsoever including legal costs and expenses, which may be suffered or incurred, whether in tort (including negligence), contract, breach of statutory duty, equity or otherwise.

3. SMC is exempted from liability for any damages caused by operations not contained in the catalogues and/or instruction manuals, and operations outside of the specification range.

4. SMC is exempted from liability for any loss or damage whatsoever caused by malfunctions of its products when combined with other devices or software.

Series ZQ
Specific Product Precautions

For Vacuum Equipment Common Precautions, refer to "Precautions for Handling Pneumatic Devices (M-03-E3A)."

Design and Selection

⚠Warning

1. Avoid energizing the solenoid valve for long periods of time.

If a solenoid valve is energized for a long period of time, the coil will get hot and the performance may be reduced. Additionally, the peripheral equipment in close proximity may also be badly affected. Use a low wattage solenoid valve when the solenoid valve is energized continuously or when the duration of the energization is longer than the non-energized period each day. Periods of energization can be shortened by using a normally opened or latching type solenoid valve. But, do not energize the coil on both A and B sides simultaneously when using the latching type.

Continuous energization of the solenoid valve should be less than 10 minutes in duration and the energization period should be shorter than the non-energized period. Take measures for any heat radiation so that the temperature is within the range of solenoid valve specifications when the solenoid valve is mounted on the control panel. Please pay special attention to any temperature increases when a manifold type with 3 stations or more is energized continuously or when three individual units are placed in close proximity.

2. Use the vacuum equipment within the operating supply pressure range.

When operating with a lower supply pressure, the vacuum performance will be reduced and the poppet valve will cause malfunction.

Never use the vacuum equipment in other than the operating supply pressure range as this may cause damage to the product resulting in potentially dangerous operation.

3. Suspension of operation for long periods of time

Please use caution — as detailed below — when the vacuum equipment is turned off for periods in excess of 6 hours.

- Be sure to turn off the pressure supply to the vacuum equipment.
  Please observe this precautions as the supply pressure will be applied for a extra period of time due to the line pressure increase and may result in damage to the vacuum equipment.
- Be sure to turn off the power supply to the solenoid valve and the pressure switch.
  Please observe this precautions as any heat generated due to the length of energization time may seriously affect the vacuum equipment and peripheral equipment resulting in potentially dangerous operation.

4. Check valve

The check valve has a function to prevent the exhaust air from the silencer overflowing to the vacuum port side when a manifold is used. However, depending on usage conditions, it does not always suppress air overflow to the desired extent. During usage, please inspect thoroughly with actual machine. Also, no guarantee is therefore provided when used for any other purposes. It is especially dangerous if used for the purpose of workpiece drop prevention in the case of operator blackout. Therefore, please take additional measures for providing drop prevention, such as providing a guide.

5. Exhaust port (EXH port) on the vacuum ejector

Please check the exhaust port (EXH port) on the vacuum ejector, so that any exhaust resistance will not be increased due to insulating materials or restrictions in the piping. The exhaust resistance may reduce the ejector's performance. Additionally, never use this product in an application where the exhaust port is blocked when detaching a workpiece. This misuse may result in possible damage to the product.

⚠Warning

6. Vacuum release flow adjustment needle

Adjust the vacuum release flow adjustment needle from the fully closed to the open state by 1/8 to 1/4 turns to detach a workpiece completely during the ON time of a release valve.

Do not supply compressed air while the vacuum release flow adjustment needle is adjusted. Securely lock it with a lock nut after adjustment.

7. How to use the latching type solenoid valve

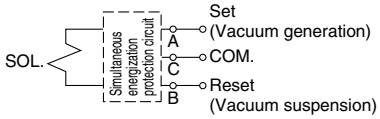
Our Latching type solenoid are fitted with a self-detaining mechanism. Its construction features an armature inside the solenoid which is set or reset using spontaneous energization. (10 ms or greater) Therefore, continuous energization is not required.

How to Use the Latching Type Plug Connector

Wiring specifications

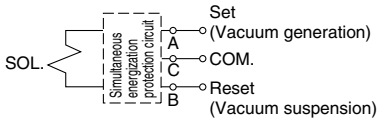
● Wiring should be connected as shown below. Connect with the power supply respectively.

DC positive common



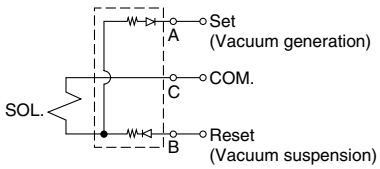
Lead wire colours
(–) Black
(+) Red
(–) White

DC negative common



Lead wire colours
(+) Red
(–) Black
(+) White

AC type



Lead wire colours	100 VAC	200 VAC
Set (Vacuum generation)	Yellow	Yellow
COM.	Blue	Red
Reset (Vacuum suspension)	Grey	Grey

Special care must be taken for the latching type.

1. Avoid using this product with a circuit which electrifies both the set and reset signals simultaneously.
2. The minimum energization time required for self-detaining is 10 ms.
3. Please contact SMC when using this product in locations where there are vibration levels of 30 m/s² or above or highly magnetic fields. No problems arise in normal usage or locations.
4. This valve retains the reset position (Flow path: A → R) at the time of shipment. However, it may alter to the set position during transporatation or due to vibration when mounting the valve. Therefore, confirm the home position either manually or

Mounting

⚠Warning

1. Screw tightening torque for mounting the body should be performed with 0.6 ± 0.06 N•m.

Excessive torque may damage the product.

EUROPEAN SUBSIDIARIES:

Austria
SMC Pneumatik GmbH (Austria).
Girakstrasse 8, A-2100 Korneuburg
Phone: +43 2262-622800, Fax: +43 2262-62285
E-mail: office@smc.at
http://www.smc.at

Belgium
SMC Pneumatics N.V./S.A.
Nijverheidsstraat 20, B-2160 Wommelgem
Phone: +32 (0)3-355-1464, Fax: +32 (0)3-355-1466
E-mail: info@smcpneumatics.be
http://www.smcpneumatics.be

Bulgaria
SMC Industrial Automation Bulgaria EOOD
Business Park Sofia, Building 8 - 6th floor, BG-1715 Sofia
Phone:+359 2 9744492, Fax:+359 2 9744519
E-mail: office@smc.bg
http://www.smc.bg

Croatia
SMC Industrijska automatika d.o.o.
Crnomerec 12, HR-10000 ZAGREB
Phone: +385 1 377 66 74, Fax: +385 1 377 66 74
E-mail: office@smc.hr
http://www.smc.hr

Czech Republic
SMC Industrial Automation CZ s.r.o.
Hudcova 78a, CZ-61200 Brno
Phone: +420 5 414 24611, Fax: +420 5 412 18034
E-mail: office@smc.cz
http://www.smc.cz

Denmark
SMC Pneumatik A/S
Egeskovvej 1, DK-8700 Horsens
Phone: +45 70252900, Fax: +45 70252901
E-mail: smc@smcdk.com
http://www.smcdk.com

Estonia
SMC Pneumatics Estonia OÜ
Laki 12, 106 21 Tallinn
Phone: +372 6510370, Fax: +372 65110371
E-mail: smc@smcpneumatics.ee
http://www.smcpneumatics.ee

Finland
SMC Pneumatics Finland Oy
PL72, Tiistinniityntie 4, SF-02231 ESPOO
Phone: +358 207 513513, Fax: +358 207 513595
E-mail: smcfi@smc.fi
http://www.smc.fi

France
SMC Pneumatique, S.A.
1, Boulevard de Strasbourg, Parc Gustave Eiffel
Bussy Saint Georges F-77607 Marne La Vallee Cedex 3
Phone: +33 (0)1-6476 1000, Fax: +33 (0)1-6476 1010
E-mail: contact@smc-france.fr
http://www.smc-france.fr

Germany
SMC Pneumatik GmbH
Boschring 13-15, D-63329 Egelsbach
Phone: +49 (0)6103-4020, Fax: +49 (0)6103-402139
E-mail: info@smc-pneumatik.de
http://www.smc-pneumatik.de

Greece
SMC Hellas EPE
Anagenniseos 7-9 - P.C. 14342. N. Philadelphia, Athens
Phone: +30-210-2717265, Fax: +30-210-2717766
E-mail: sales@smchellas.gr
http://www.smchellas.gr

Hungary
SMC Hungary Ipari Automatizálási Kft.
Torbágy út 19, H-2045 Törökbálint
Phone: +36 23 511 390, Fax: +36 23 511 391
E-mail: office@smc.hu
http://www.smc.hu

Ireland
SMC Pneumatics (Ireland) Ltd.
2002 Citywest Business Campus, Naas Road, Saggart, Co. Dublin
Phone: +353 (0)1-403 9000, Fax: +353 (0)1-464-0500
E-mail: sales@smcpneumatics.ie
http://www.smcpneumatics.ie

Italy
SMC Italia S.p.A
Via Garibaldi 62, I-20061 Carugate, (Milano)
Phone: +39 (0)2-92711, Fax: +39 (0)2-9271365
E-mail: mailbox@smcitalia.it
http://www.smcitalia.it

Latvia
SMC Pneumatics Latvia SIA
Dzelzavas str. 120g, Riga LV-1021, LATVIA
Phone: +371 67817700, Fax: +371 67817701
E-mail: info@smclv.lv
http://www.smclv.lv

Lithuania
SMC Pneumatics Lietuva, UAB
Oslo g.1, LT-04123 Vilnius
Phone: +370 5 264 81 26, Fax: +370 5 264 81 26

Netherlands
SMC Pneumatics BV
De Ruyterkade 120, NL-1011 AB Amsterdam
Phone: +31 (0)20-5318888, Fax: +31 (0)20-5318880
E-mail: info@smcpneumatics.nl
http://www.smcpneumatics.nl

Norway
SMC Pneumatics Norway A/S
Vollsveien 13 C, Granfos Næringspark N-1366 Lysaker
Tel: +47 67 12 90 20, Fax: +47 67 12 90 21
E-mail: post@smc-norge.no
http://www.smc-norge.no

Poland
SMC Industrial Automation Polska Sp.z.o.o.
ul. Poloneza 89, PL-02-826 Warszawa,
Phone: +48 22 211 9600, Fax: +48 22 211 9617
E-mail: office@smc.pl
http://www.smc.pl

Portugal
SMC Sucursal Portugal, S.A.
Rua de Engº Ferreira Dias 452, 4100-246 Porto
Phone: +351 226 166 570, Fax: +351 226 166 589
E-mail: postpt@smc.smces.es
http://www.smc.eu

Romania
SMC Romania srl
Str Frunzei 29, Sector 2, Bucharest
Phone: +40 213205111, Fax: +40 213261489
E-mail: smcromania@smcromania.ro
http://www.smcromania.ro

Russia
SMC Pneumatik LLC.
4B Sverdlovskaja nab, St. Petersburg 195009
Phone.:+7 812 718 5445, Fax:+7 812 718 5449
E-mail: info@smc-pneumatik.ru
http://www.smc-pneumatik.ru

Slovakia
SMC Priemyselná Automatizáciá, s.r.o.
Fatranská 1223, 01301 Teplicka Nad Váhom
Phone: +421 41 3213212 - 6 Fax: +421 41 3213210
E-mail: office@smc.sk
http://www.smc.sk

Slovenia
SMC industrijska Avtomatika d.o.o.
Mirnska cesta 7, SI-8210 Trebnje
Phone: +386 7 3885412 Fax: +386 7 3885435
E-mail: office@smc.si
http://www.smc.si

Spain
SMC España, S.A.
Zuazobidea 14, 01015 Vitoria
Phone: +34 945-184 100, Fax: +34 945-184 124
E-mail: post@smc.smces.es
http://www.smc.eu

Sweden
SMC Pneumatics Sweden AB
Ekhagsvägen 29-31, S-141 71 Huddinge
Phone: +46 (0)8-603 12 00, Fax: +46 (0)8-603 12 90
E-mail: post@smcpneumatics.se
http://www.smc.nu

Switzerland
SMC Pneumatik AG
Dorfstrasse 7, CH-8484 Weisslingen
Phone: +41 (0)52-396-3131, Fax: +41 (0)52-396-3191
E-mail: info@smc.ch
http://www.smc.ch

Turkey
Entek Pnömatik San. ve Tic. A*.
Perpa Ticaret Merkezi B Blok Kat:11 No: 1625, TR-34386, Okmeydani, Istanbul
Phone: +90 (0)212-444-0762, Fax: +90 (0)212-221-1519
E-mail: smc@entek.com.tr
http://www.entek.com.tr

UK
SMC Pneumatics (UK) Ltd
Vincent Avenue, Crownhill, Milton Keynes, MK8 0AN
Phone: +44 (0)800 1382930 Fax: +44 (0)1908-555064
E-mail: sales@smcpneumatics.co.uk
http://www.smcpneumatics.co.uk

OTHER SUBSIDIARIES WORLDWIDE:

ARGENTINA, AUSTRALIA, BOLIVIA, BRASIL, CANADA, CHILE, CHINA, HONG KONG, INDIA, INDONESIA, MALAYSIA, MEXICO, NEW ZEALAND, PHILIPPINES, SINGAPORE, SOUTH KOREA, TAIWAN, THAILAND, USA, VENEZUELA

http://www.smc.eu
http://www.smcworld.com

SMC CORPORATION Akihabara UDX 15F, 4-14-1, Sotokanda, Chiyoda-ku, Tokyo 101-0021, JAPAN Phone: 03-5207-8249 FAX: 03-5298-5362

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