CKD

Intrinsically Safe Explosion-Proof 3, 5-Port Solenoid Valve

(M)3GD/E EA Series
(M)4GD/E EA Series

- **Single Valve**
- **Manifold (Metal Base)**

EU-type examiination Certification Number IBExU 19ATEX1035
IECEx-type examiination Certification Number IECEx IBE 19.0008
Standards Applied: EN IEC 60079-0:2018
EN 60079-11:2012
IEC60079-0:2017
IEC60079-11:2011

INSTRUCTION MANUAL

SM-A32257-A

- Read this Instruction Manual before using the product.
- Read the safety notes carefully.
- Keep this Instruction Manual in a safe and convenient place for future reference.

CKD Corporation

PREFACE

Thank you for purchasing CKD's **intrinsically safe explosion-proof 3, 5-port solenoid valve**. This Instruction Manual contains basic matters such as installation and usage instructions in order to ensure optimal performance of the product. Please read this Instruction Manual thoroughly and use the product properly.
Keep this Instruction Manual in a safe place and be careful not to lose it.

Product specifications and appearances presented in this Instruction Manual are subject to change without notice.

- The product, which uses control valves such as solenoid valves, motor valves, and air operated valves, is intended for users who have basic knowledge about materials, fluids, piping, and electricity. CKD shall not be responsible for accidents caused by persons who selected or used the product without knowledge or sufficient training with respect to control valves.
- Since there are a wide variety of customer applications, it is impossible for CKD to be aware of all of them. Depending on the application or usage, the product may not be able to exercise its full performance or an accident may occur due to fluid, piping, or other conditions. It is the responsibility of the customer to check the product specifications and decide how the product shall be used in accordance with the application and usage.

SAFETY INFORMATION

When designing and manufacturing any device incorporating the product, the manufacturer has an obligation to ensure that the device is safe. To that end, make sure that the safety of the machine mechanism of the device, the pneumatic or water control circuit, and the electric system that controls such mechanism is ensured.

To ensure the safety of device design and control, observe organization standards, relevant laws and regulations, which include the following:

In order to use our products safely, it is important to select, use, handle, and maintain the products properly.
Observe the warnings and precautions described in this Instruction Manual to ensure device safety.

Although various safety measures have been adopted in the product, customer's improper handling may lead to an accident. To avoid this:

Thoroughly read and understand this Instruction Manual before using the product.

To explicitly indicate the severity and likelihood of a potential harm or damage, precautions are classified into three categories: "DANGER", "WARNING", and "CAUTION".

⚠ **DANGER**	Indicates an imminent hazard. Improper handling will cause death or serious injury to people.
⚠ **WARNING**	Indicates a potential hazard. Improper handling may cause death or serious injury to people.
⚠ **CAUTION**	Indicates a potential hazard. Improper handling may cause injury to people or damage to property.

Precautions classified as "CAUTION" may still lead to serious results depending on the situation.
All precautions are equally important and must be observed.

Other general precautions and tips on using the product are indicated by the following icon.

	Indicates general precautions and tips on using the product.

Precautions on Product Use

⚠ WARNING

The product must be handled by a qualified person who has extensive knowledge and experience.

The product is designed and manufactured as a device or part for general industrial machinery.

Use the product within the specifications.

The product must not be used beyond its specifications. Also, the product must not be modified and additional work on the product must not be performed.
The product is intended for use in devices or parts for general industrial machinery. It is not intended for use outdoors or in the conditions or environment listed below.

- In applications for nuclear power, railroad system, aviation, ship, vehicle, medical equipment, and equipment that directly touches beverage or food.
- For special applications that require safety including amusement equipment, emergency shut-off circuit, press machine, brake circuit, and safety measures.
- For applications where life or properties may be adversely affected and special safety measures are required.

(Exception is made if the customer consults with CKD prior to use and understands the specifications of the product. However, even in that case, safety measures must be taken to avoid danger in case of a possible failure.)

Do not handle the product or remove pipes and devices until confirming safety.

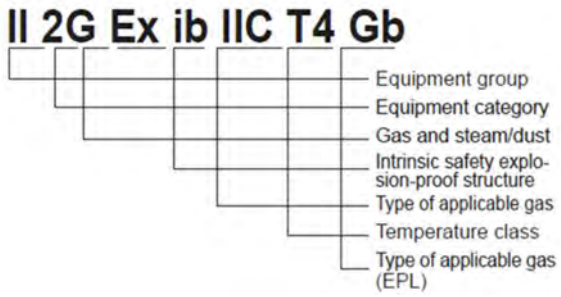
- Inspect and service the machine and devices after confirming the safety of the entire system. Also, turn off the energy source (air supply or water supply) and power to the relevant facility. Release compressed air from the system and use extreme care to avoid water or electric leakage.
- Since there may be hot or live parts even after operation has stopped, use extreme care when handling the product or removing pipes and devices.
- When starting or restarting a machine or device that incorporates pneumatic components, make sure that a safety measure (such as a pop-out prevention mechanism) is in place and system safety is secured.

Explosion-Proof

⚠ WARNING

Do not use the valves in a hazardous area classified as zone 0.
The valves are suitable for use in zones 1 and 2 where combustible gas and vapor are present.
Explosion-proof performance is II 2G Ex ib IIC T4 Gb.
Use the valves in combination with a barrier.
The valves cannot be used independently in hazardous areas.

■Classification of explosion protection
According to the ATEX Directive, the equipment group, category,gas/dust, explosion-proof structure, type of applicable gas, temperature class, and protection level of equipment must be indicatedon the electrical components of explosion-proof structures.For example, explosion-proof solenoid valve II 2G Ex ib II C T4 Gb means classification as follows.



◆Equipment group
I: All other underground facilities
II: All other underground facilities

◆Equipment category
1: Equipment available at Zone 0 and Zone 20
2: Equipment available at Zone 1 and Zone 21
3: Equipment available at Zone 2 and Zone 22

◆Type of applicable gas and temperature class
Based on IEC60079-20-1 classification of gases, it is indicated that gases of the II C type of applicable gas with the danger level of up to the T4 temperature class are usable. Less dangerous gases are also listed that are guaranteed to be explosion-proof.
Types of applicable gases show the danger level of fire coming outside through small gaps and the types are classified into the following groups by considering usage and gaps
Group I: For coal mine
Group II: Gas and steam other than for coal mine
Group III: Dust other than for coal mine
Also, Group II is broken down by II A, II B, and II C of the following table depending on the degree of likelihood of ignition/propagation.

Table 1: Type of applicable gas

	Gas, steam classification	Minimum ignition Current ratio (*1)	Max. safety clearance (Unit: mm) (*2)
High risk ↓	II A	Over 0.8	0.9 or more
	II B	0.45 - 0.8	0.5 - less than 0.9
	II C	Less than 0.45	0.5 or less

(*1) MIC: Minimum ignition current
Ignition current ratio when minimum ignition current of methane is 1.
(*2) MESG: Maximum Experimental Safe Gap
Maximum gap for not igniting when the depth of the gap is 25 mm.

● The temperature class refers to the degree of ignition risk, and is classified into six classes according to the ignition point. It defines the maximum surface temperature of the device corresponding to each class (Table 2). Higher numbers indicate a higher risk that the gas will ignite at low igniting temperatures.

Table 2: Temperature class

Descriptions	Code	Provision
Temp. class	T1	Max. surface temperature 450°C
	T2	300°C
	T3	200°C
	T4	135°C
	T5	100°C
	T6	85°C

Dangerous zones

Situations where explosive gases and air mix at a high enough level to cause an explosion or fire are called “dangerous zones”.The ATEX directive classifies them as shown in the following table.

Zone	Gas and steam/dust	EPL	Descriptions of dangerous zones classification
Zone 0	Gas	Ga	An area where an explosive environment exists continuously or for a long time
Zone 1	Gas	Gb	An area where an explosive environment may be generated when a plant, etc. is under normal operation
Zone 2	Gas	Gc	An area where an explosive environment may not be generated when a plant, etc. is under normal operation, and if it is generated, it exists only for a short time
Zone 20	steam/ dust	Da	An area where an explosive environment exists continuously or for a long time
Zone 21	steam/ dust	Db	An area where an explosive environment may be generated when a plant, etc. is under normal operation
Zone 22	steam/ dust	Dc	An area where an explosive environment may not be generated when a plant, etc. is under normal operation, and if it is generated, it exists only for a short time

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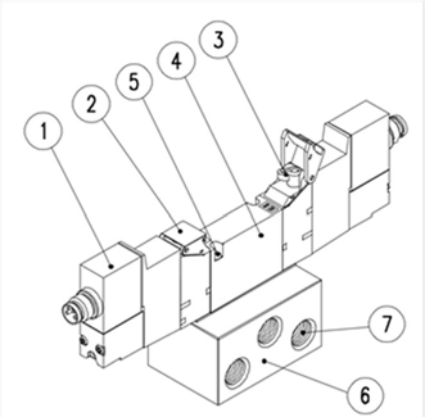
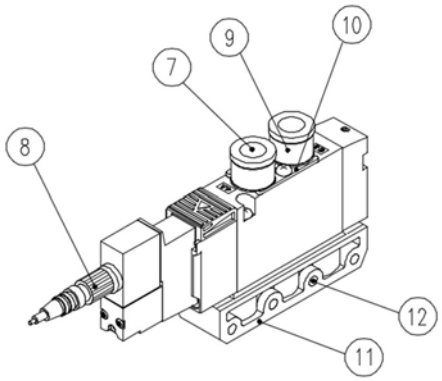
1. PRODUCT OVERVIEW

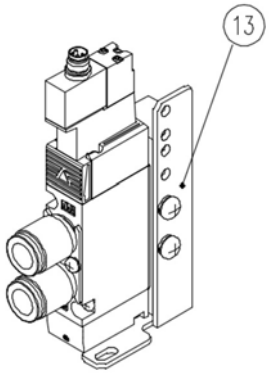
1.1 Part Name



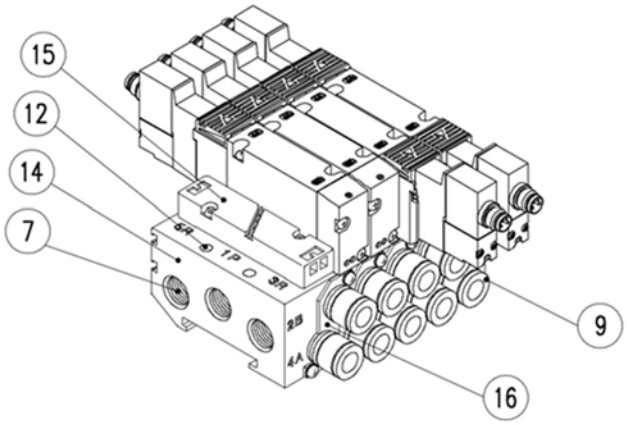
Base piping type single valve



Body piping type single valve



Mounting plate



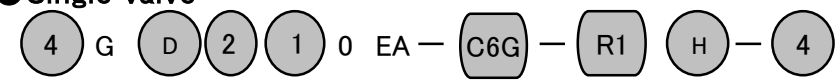
Manifold

No.	Part name	Description
1	Coil assembly	Coil assembly is connected to the power supply with M8 connector and driven at 12 VDC.
2	Manual protection cover	Cover which prevents accidental operation of the manual override and is opened to operate the manual override.
3	Manual override	Manual operation device which has both locking and non-locking overrides.
4	Single valve	Valve equipped with a mechanism which opens/closes an air passage.
5	Single valve mounting screw	Screws used for securing a single valve to various bases (2 screws provided for 4G1 EA to 4G3 EA Series, 3 screws provided for 4G4 EA Series)
6	Subplate	Subplate which comes assembled to a base piping type single valve.
7	Piping port	Port provided for supply, indicated by 1(P); for exhaust, indicated by 3(R2) or 5(R1); for output, indicated by 2(B) or 4(A).
8	M8 connector cable	Straight cable or L-type cable can be selected.
9	Fitting	Cartridge type push-in fitting which can be replaced.
10	Fitting stopper plate	Plate used for securing a cartridge type fitting. Not interchangeable with No. 16.
11	Pipe adaptor	Adaptor which comes assembled to a body piping type single valve. (4GD4 EA Series does not have the piping adaptor.)
12	Mounting hole	Hole used for direct mounting.
13	Mounting plate	Plate used for vertical mounting of a body piping type single valve.
14	Manifold base	Metal base manifold provided with multiple piping ports.
15	Masking plate	Plate replaced by a single valve when adding a valve.
16	Fitting stopper plate	Plate used for securing a cartridge type fitting. Not interchangeable with No. 10.

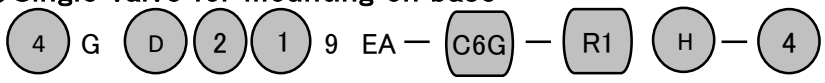
1.2 Model Number Indication

1.2.1 Single valve

●Single valve



●Single valve for mounting on base



(a) (b) (c) (d) (e) (f) (g) (h)

(a) Number of ports		(b) Piping direction		(c) Series		(d) Solenoid position		(e) Port size
Symbol	Description	Symbol	Description	Symbol	Description	Symbol	Description	Note 1
3	3-port valve (two units integrated)	D	Top (body piping)	1	4G1EA	1	2-position Single	
4	5-port valve	E	Side (base piping)	2	4G2EA	2	2-position Double	
				3	4G3EA	3	3-position All ports closed	
				4	4G4EA	4	3-position ABR connection	
						5	3-position PAB connection	
						66	Two 3-port valves integrated type (NC - NC)	

(f) Electrical connection		(g) Option	(h) Rated voltage	
Symbol	Description	Note 2	Symbol	Description
RN	M8 connector without cable		4	12 VDC
R1	M8 connector with straight cable			
R2	M8 connector with L-type cable			

Note 1: (e) Port size

Symbol	Description	
Variation	Ports 4(A), 2(B)	Ports P, R1, R2
C4G	ø4 push-in fitting	M5, G1/8
C6G	ø6 push-in fitting	M5, G1/8, G1/4
C8G	ø8 push-in fitting	G1/8, G1/4
C10G	ø10 push-in fitting	G1/4
C12G	ø12 push-in fitting	G1/4
M5G	M5	M5
06G	G1/8	G1/8
08G	G1/4	G1/4
10G	G3/8	G1/4, G3/8
15G	G1/2	G1/2
00	Single valve for mounting on base	-

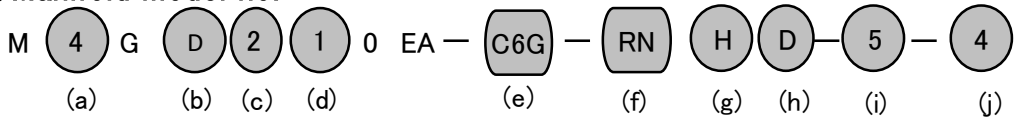
Note 2: (g) Option

Symbol	Description
Blank	Non-locking/locking combination manual override
H	Equipped with exhaust malfunction prevention valves
P	Mounting plate
F	Built-in A/B-port filter

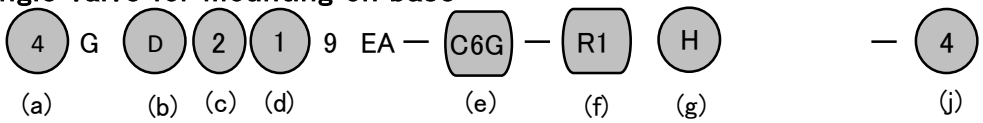
For precautions on selecting the model number, refer to the catalog.

1.2.2 Manifold

●Manifold model no.



●Single valve for mounting on base



(a) Number of ports		(b) Piping direction		(c) Series		(d) Solenoid position		(e) Port size
Symbol	Description	Symbol	Description	Symbol	Description	Symbol	Description	Note 3
3	3-port valve (two units integrated)	D	Top (body piping)	1	M4G1EA	1	2-position Single	
4	5-port valve	E	Side (base piping)	2	M4G2EA	2	2-position Double	
				3	M4G3EA	3	3-position All ports closed	
				4	M4G4EA	4	3-position ABR connection	
						5	3-position PAB connection	
						66	Two 3-port valves integrated type (NC - NC)	
						8	Mixed	

(f) Electrical connection		(g) Option	(h) Mount type		(i) Number of stations		(j) Rated voltage	
Symbol	Description	Note 4	Symbol	Description	Symbol	Description	Symbol	Description
RN	M8 connector without cable		Blank	Direct mount	2 to 20	n stations	4	12 VDC
R1	M8 connector with straight cable							
R2	M8 connector with L-type cable							

Note 3: (e) Port size

Symbol	Description	
Variation	**Ports 4(A), 2(B)**	**Ports P, R1, R2**
C4G	ø4 push-in fitting	G1/8, G1/4
C6G	ø6 push-in fitting	G1/8, G1/4, G3/8
C8G	ø8 push-in fitting	G1/8, G1/4, G3/8
C10G	ø10 push-in fitting	G1/4, G3/8
C12G	ø12 push-in fitting	G1/2
CXG	Mix push-in fitting	G1/8, G1/4, G3/8
M5G	M5	G1/8
06G	G1/8	G1/4
08G	G1/4	G3/8
10G	G3/8	G3/8
15G	G1/2	G1/2
00	Single valve for mounting on base	-

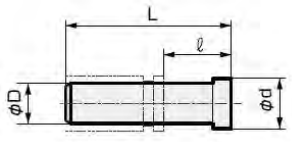
Note 4: (g) Option

Symbol	Description
Blank	Non-locking/locking combination manual override
H	Equipped with exhaust malfunction prevention valves
F	Built-in A/B-port filter
Z1	Air supply spacer
Z3	Exhaust spacer

For precautions on selecting the model number, refer to the catalog.

1.2.3 Related products

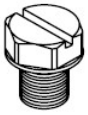
■ Blanking plug



Model	D	L	ℓ	d
GWP4-B	ø4	27	16	6
GWP6-B	ø6	29	11.5	8
GWP8-B	ø8	33	14	10
GWP10-B	ø10	40	18.5	12
GWP12-B	ø12	43	20	14

■ Screw plug

<4G1R-M5P> **<4G□R-□P>**



Model	Applicable port size
4G1R-M5P	M5
4G2R-06GP	G1/8
4G3R-08GP	G1/4
4G3R-10GP	G3/8
4G4-15GP	G1/2

For precautions on selecting the model number, refer to the catalog.

■Zener Barrier

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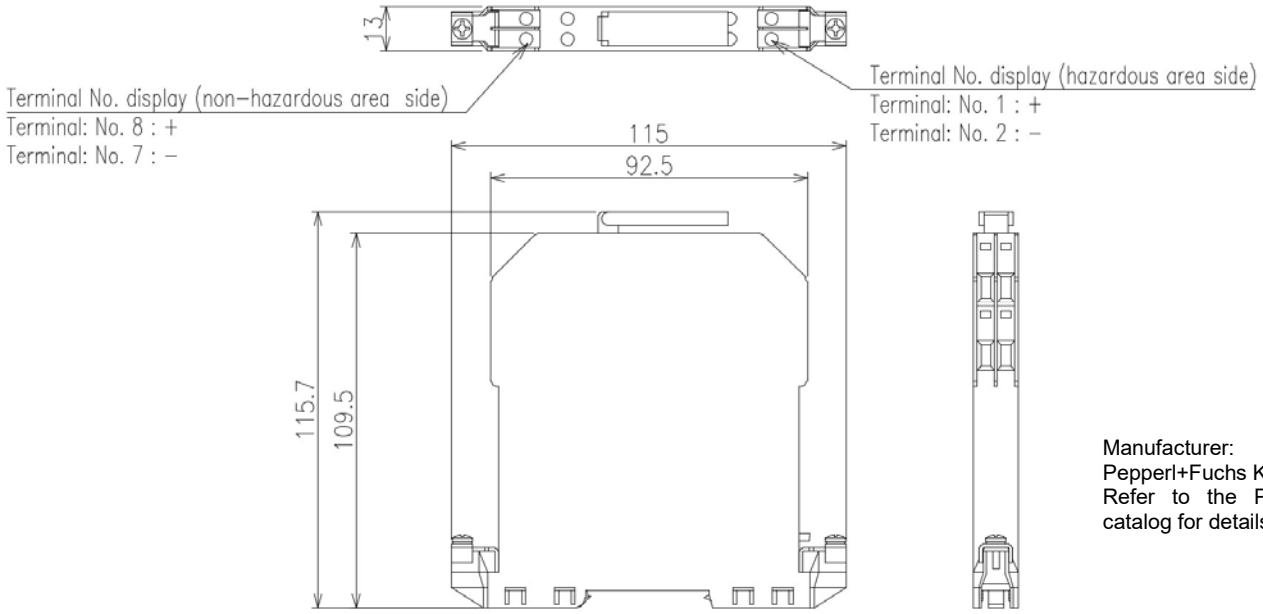


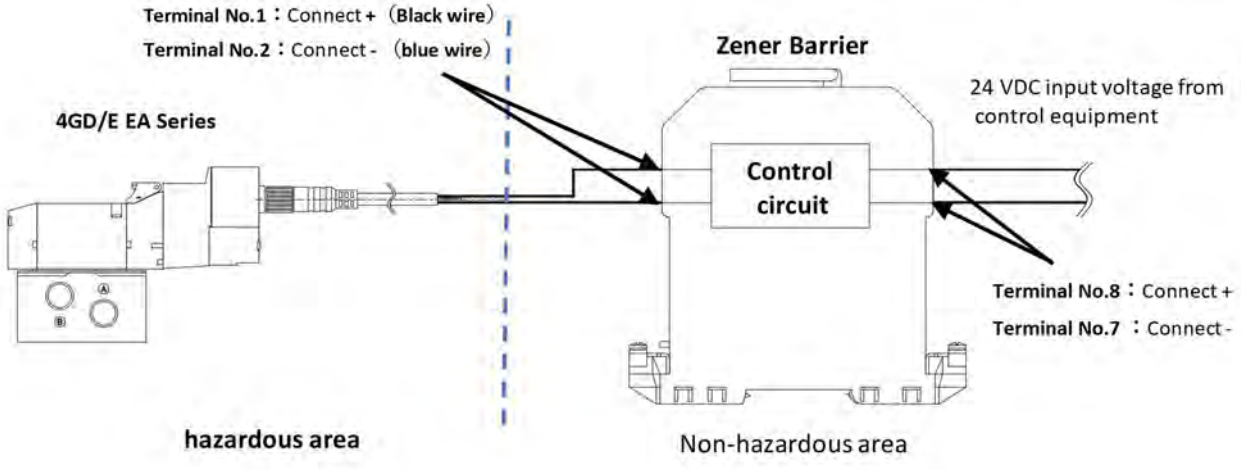
Manufacturer:
Pepperl+Fuchs K.K.
Refer to the P+F K.K. catalog for details.

Barrier intrinsic safety parameters

Descriptions	Content
Intrinsic safety circuit max.voltage Uo	28V
Intrinsic safety circuit max.current Io	93mA
Intrinsic safety circuit max.power Po	0.65W
Intrinsic safety curcuit allowable capacitance Co	0.083 μ F
Intrinsic safety curcuit allowable inductance Lo	3.05mH
Operating ambient temperature rage	−20～60℃
Nominal resistance	300Ω

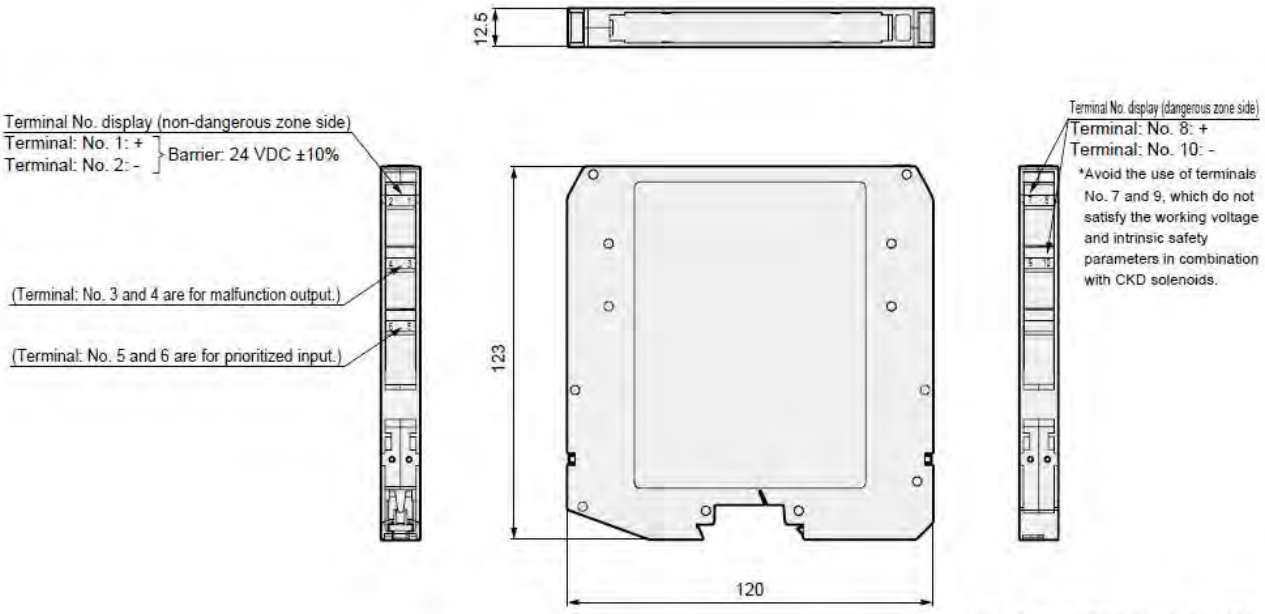
※Always use valves in combination with a barrier
※The connection terminal has polarity.Wiring mistakes will lead to barrier failure.
※Applicable wire cross section is 2.5mm^2
※Barrier degree of protection is IP20
※Ground the barrier to class A.

Connection between valve and barrier



■ Explosion-proof isolated barrier

<D5048S>



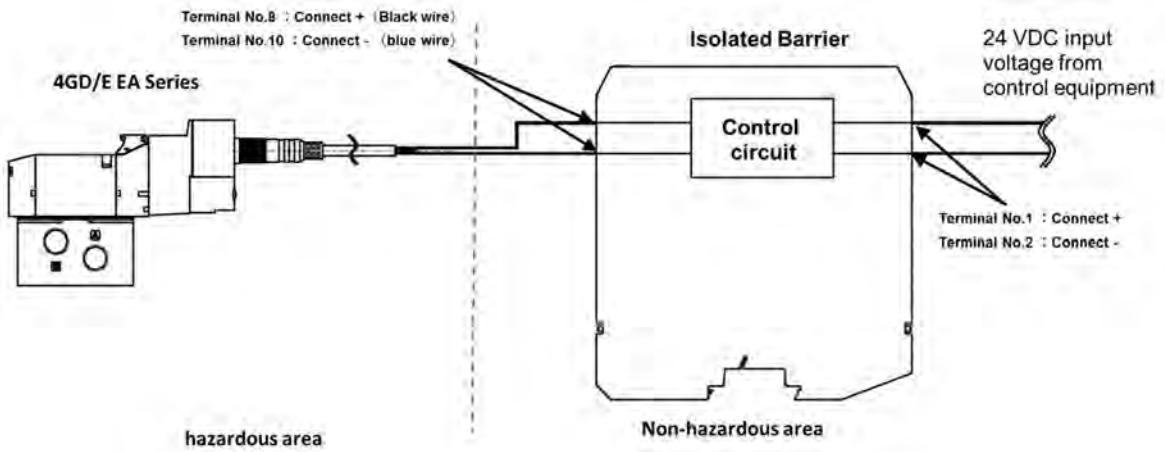
Manufacturer: IDEC Co., Ltd. (G.M.I)
Refer to the IDEC or G.M.I catalog for details.

Barrier intrinsic safety parameters

Descriptions	Between terminals No. 8-10
Intrinsic safety circuit max. voltage Uo	24.8 V
Intrinsic safety circuit max. current Io	108 mA
Intrinsic safety circuit max. power Po	667 mW
Intrinsic safety circuit allowable capacitance Co	0.113 µF
Intrinsic safety circuit allowable capacitance Lo	1.42 mH
Operating ambient temperature range	-40 to 70°C

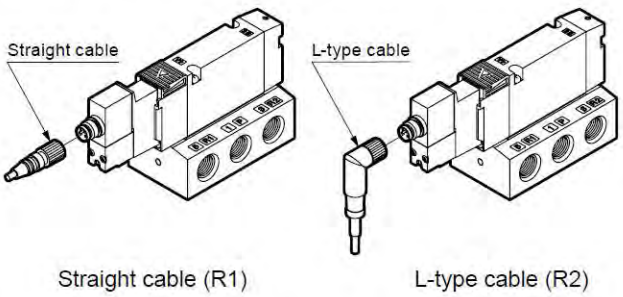
*1. Always use valves in combination with a barrier.
*2. Connection terminals are polarized. Take care to prevent incorrect wiring.
*3. Applicable wire cross section is 0.25 to 2.5 mm^2.
*4. Recommended terminal tightening torque is 0.5 to 0.6 N·m.
*5. Barrier degree of protection is IP20.

Connection between valve and barrier



1.2.4 Kit parts

■ M8 connector cable



Straight cable (R1) L-type cable (R2)

4GEX - M8CC - R1 - 300
Ⓐ Direction Ⓑ Length

Ⓐ Direction	
R1	Straight cable
R2	L-type cable

Ⓑ Length	
300	Cable length 300 mm
500	Cable length 500 mm
1000	Cable length 1000 mm
3000	Cable length 3000 mm

◆Cable capacitance and inductance

Cable type	Capacitance [nF/km] at 1kHz	Inductance [mH/km] at 1kHz
Straight cable	0.058	0.003
L-type cable	0.125	0.003

For precautions on selecting the model number, refer to the catalog.

■ Cartridge type fitting

Model	Part name	Model number
4G1 EA	ø4 straight	4G1R-JOINT-C4
	ø6 straight	4G1R-JOINT-C6
	Plug cartridge	4G1R-JOINT-CPG
4G2 EA	ø4 straight	4G2R-JOINT-C4
	ø6 straight	4G2R-JOINT-C6
	ø8 straight	4G2R-JOINT-C8
	Plug cartridge	4G2R-JOINT-CPG
4G3 EA	ø6 straight	4G3R-JOINT-C6
	ø8 straight	4G3R-JOINT-C8
	ø10 straight	4G3R-JOINT-C10
	Plug cartridge	4G3R-JOINT-CPG
4G4 EA	ø8 straight	4G4-JOINT-C8
	ø10 straight	4G4-JOINT-C10
	ø12 straight	4G4-JOINT-C12

■ Mounting plate kit

Model	Model number	Kit contents
4GD110EA	4G1R-MOUNT-PLATE-KIT	Mounting plate (1), mounting screw (2), nut (2)
4GD210EA	4G2R-MOUNT-PLATE-KIT	Mounting plate (1), mounting screw (2)
4GD310EA	4G3R-MOUNT-PLATE-KIT	Mounting plate (1), mounting screw (2)

■ Fitting stopper plate kit

Model	Model number	Kit contents
M4G1 EA	4G1R-JNT-STP-PLATE-KIT	Fitting stopper plate (1), mounting screw (2)
M4G2 EA	4G2R-JNT-STP-PLATE-KIT	Fitting stopper plate (1), mounting screw (2)
M4G3 EA	4G3R-JNT-STP-PLATE-KIT	Fitting stopper plate (1), mounting screw (2)
M4G4 EA	4GB4-JNT-STP-PLATE-KIT	Fitting stopper plate (1), mounting screw (2)

■ Masking plate kit

Model	Model number	Kit contents
M3G1 EA, M4G1 EA	4G1R-MP	Masking plate (1), gasket (1), mounting screw (2)
M3G2 EA, M4G2 EA	4G2R-MP	Masking plate (1), gasket (1), mounting screw (2)
M4G3 EA	4G3R-MP	Masking plate (1), gasket (1), PR check valve (2), mounting screw (2)
M4GD4 EA	4GA4-MP	Masking plate (1), gasket (1), PR check valve (2), O ring (2), mounting screw (3)
M4GE4 EA	4GB4-MP	Masking plate (1), gasket (1), PR check valve (2), O ring (2), mounting screw (3)

For precautions on selecting the model number, refer to the catalog.

■ Gasket

Model	Model number
3G1 EA, 4G1 EA	4G1R-GASKET
3G1 EA, 4G1 EA (for masking plate)	4G1R-MP-GASKET
3G2 EA, 4G2 EA	4G2R-GASKET
3G2 EA, 4G2 EA (for masking plate)	4G2R-MP-GASKET
4G3 EA	4G3R-GASKET
4GD4 EA	4GA4-GASKET
4GE4 EA	4GB4-GASKET

■ Gasket with exhaust malfunction prevention valve

Model	Model number
3G1 EA, 4G1 EA	4G1R-CHECK-VALVE
3G2 EA, 4G2 EA	4G2R-CHECK-VALVE
4G3 EA	4G3R-CHECK-VALVE

■ PR check valve kit (2 per set)

Model	Model number
3G1 EA, 4G1 EA	4G1R-PR
3G2 EA, 4G2 EA	4G2R-PR
4G3 EA	4G3R-PR
4G4 EA	4G4-PR

■ Mounting screw (10 per set)

Model	Model number
3G1 EA, 4G1 EA	4G1R-SET-SCREW
3G2 EA, 4G2 EA	4G2R-SET-SCREW
4G3 EA	4G3R-SET-SCREW
4G4 EA	4G4-SET-SCREW

For precautions on selecting the model number, refer to the catalog.

1.3 Specifications

1.3.1 Common specifications

Model		4G1 EA, 4G2 EA, 4G3 EA, 4G4 EA
Valve type and operation		Pilot-operated soft spool valve
Working fluid		Compressed air
Max. working pressure	**MPa**	0.7
Min. working pressure	**MPa**	0.2
Proof pressure	**MPa**	1.05
Ambient temperature	**°C**	-5 to 55 (no freezing)
Fluid temperature	**°C**	5 to 55
Manual override		Non-locking/locking combination type (standard)
Pilot air exhaust method		Main valve/pilot valve common exhaust
Lubrication Note 1		Not required
Degree of protection Note 2		IP67
Vibration resistance	**m/s^2**	50 or less
Shock resistance	**m/s^2**	300 or less
Atmosphere		Not for use in corrosive gas atmosphere

Note 1: If lubrication is necessary, use Class 1 ISO VG 32 turbine oil.
Excessive or intermittent lubrication results in unstable operation.

Note 2: Test was conducted according to the test method for IP67(IEC 60529) standards. While the unit is protected from dust and water, it cannot be used immersed in water. If using the unit in environments where it will be constantly exposed to dust or water, take measures, such as using a cover, to protect the unit.

1.3.2 Electrical specifications

Model	4G1 EA, 4G2 EA, 4G3 EA, 4G4 EA
Rated voltage	12 VDC
Voltage fluctuation range	+10% -20%
Holding current A	0.05
Power consumption W	0.6
Thermal class	B

1.3.3 Intrinsic safety explosion-proof specifications

Type of explosion-proof structure	Intrinsic safety explosion-proof structure (ib)
Target gas or above listed ignitability and flame-proof grade	II 2G Ex ib IIC T4 Gb
Intrinsic safety circuit allowable voltage Ui	30 VDC
Intrinsic safety circuit allowable current Ii	0.2 A
Intrinsic safety circuit allowable power Pi	0.68 W
Internal capacitance Ci	Value that can be ignored
Internal inductance Li	Value that can be ignored
Withstand voltage	Comply with 6.3.13 in JNIOSH-TR-46-6 (IEC 60079-11:2011) (withstand voltage: 500V)

1.3.4 Response times

(Unit: ms)

Solenoid position		4GD/E EA Series							
		4GD/E1 EA		4GD/E2 EA		4GD/E3 EA		4GD/E4 EA	
		ON	OFF	ON	OFF	ON	OFF	ON	OFF
Two 3-port valves integrated type		15	35	20	50	-	-	-	-
2-position	Single	15	35	20	40	25	60	100	110
	Double	25	-	30	-	35	-	110	-
3-position	ABR connection	20	40	25	45	35	60	100	160

* They are values determined with a supply pressure of 0.5 MPa, a temperature of 20°C, and no lubrication. Response times vary depending on pressure and quality of lubricant.

1.3.5 Flow characteristics

■ Single valve

Model	Solenoid position		1(P) -> 4(A)/2(B)		4(A)/2(B) -> 5(R1)/3(R2)	
			C [dm³/(s/bar)]	b	C [dm³/(s/bar)]	b
3GD1 EA 4GD1 EA	Two 3-port valves integrated type		0.98	0.45	0.71	0.34
	2-position		1.2	0.47	0.72	0.37
	3-position	All ports closed	1.1	0.39	0.70	0.34
		ABR connection	1.1	0.33	0.72	0.34
		PAB connection	1.3	0.61	0.72	0.36
3GD2 EA 4GD2 EA	Two 3-port valves integrated type		1.8	0.29	2.3	0.32
	2-position		2.4	0.33	2.8	0.30
	3-position	All ports closed	2.2	0.28	2.5	0.28
		ABR connection	2.3	0.26	2.8	0.27
		PAB connection	2.5	0.38	2.4	0.30
4GD3 EA	2-position		3.4	0.29	4.0	0.24
	3-position	All ports closed	3.1	0.27	3.4	0.28
		ABR connection	3.1	0.33	4.1	0.20
		PAB connection	3.5	0.43	3.4	0.32
4GD4 EA	2-position		8.1	0.40	8.0	0.31
	3-position	All ports closed	6.9	0.37	7.5	0.42
		ABR connection	6.9	0.38	8.4	0.34
		PAB connection	8.9	0.37	7.6	0.27
3GE1 EA 4GE1 EA	Two 3-port valves integrated type		0.92	0.08	1.1	0.26
	2-position		1.3	0.27	1.2	0.22
	3-position	All ports closed	1.1	0.31	1.1	0.27
		ABR connection	1.1	0.31	1.3	0.29
		PAB connection	1.4	0.30	1.1	0.26
3GE2 EA 4GE2 EA	Two 3-port valves integrated type		1.7	0.42	2.1	0.26
	2-position		2.6	0.20	2.6	0.19
	3-position	All ports closed	2.3	0.32	2.2	0.22
		ABR connection	2.2	0.23	2.6	0.16
		PAB connection	2.4	0.10	2.4	0.22
4GE3 EA	2-position		4.3	0.24	4.2	0.24
	3-position	All ports closed	3.3	0.40	3.4	0.27
		ABR connection	3.3	0.36	4.2	0.18
		PAB connection	4.5	0.28	3.4	0.30
4GE4 EA	2-position		11.0	0.19	13.0	0.19
	3-position	All ports closed	9.1	0.11	12.0	0.27
		ABR connection	8.8	0.28	13.9	0.25
		PAB connection	10.0	0.06	12.0	0.24

* C: Sonic conductance, b: Critical pressure ratio

■ Manifold

Model	Solenoid position		1(P) -> 4(A)/2(B)		4(A)/2(B) -> 5(R1)/3(R2)	
			C [dm³/(s/bar)]	b	C [dm³/(s/bar)]	b
M3GD1 EA M4GD1 EA	Two 3-port valves integrated type		0.86	0.31	1.1 (0.66)	0.19 (0.22)
	2-position		0.99	0.20	1.2 (0.70)	0.20 (0.12)
	3-position	All ports closed	0.94	0.23	1.1 -	0.20 -
		ABR connection	0.93	0.18	1.3 (0.70)	0.23 (0.02)
		PAB connection	1.1	0.28	1.1 -	0.23 -
M3GD2 EA M4GD2 EA	Two 3-port valves integrated type		1.7	0.40	2.3 (1.7)	0.29 (0.32)
	2-position		2.3	0.36	2.9 (1.7)	0.24 (0.33)
	3-position	All ports closed	2.1	0.35	2.5 -	0.32 -
		ABR connection	2.2	0.37	2.9 (1.8)	0.32 (0.29)
		PAB connection	2.4	0.34	2.5 -	0.33 -
M4GD3 EA	2-position		3.2	0.37	3.8 (2.5)	0.13 (0.28)
	3-position	All ports closed	2.9	0.35	3.3 -	0.35 -
		ABR connection	3.0	0.34	3.8 (2.6)	0.12 (0.27)
		PAB connection	3.3	0.30	3.3 -	0.32 -
M4GD4 EA	2-position		7.3	0.12	9.0 -	0.17 -
	3-position	All ports closed	6.4	0.15	8.2 -	0.22 -
		ABR connection	6.3	0.33	8.9 -	0.26 -
		PAB connection	8.0	0.08	8.3 -	0.22 -
M3GE1 EA M4GE1 EA	Two 3-port valves integrated type		0.86	0.35	1.1 (0.67)	0.22 (0.23)
	2-position		1.1	0.22	1.2 (0.70)	0.20 (0.10)
	3-position	All ports closed	0.98	0.22	1.1 -	0.24 -
		ABR connection	0.97	0.35	1.3 (0.68)	0.22 (0.24)
		PAB connection	1.1	0.38	1.1 -	0.21 -
M3GE2 EA M4GE2 EA	Two 3-port valves integrated type		1.7	0.44	2.1 (1.6)	0.32 (0.30)
	2-position		2.4	0.34	2.7 (1.7)	0.24 (0.31)
	3-position	All ports closed	2.2	0.34	2.4 -	0.29 -
		ABR connection	2.2	0.34	2.8 (1.8)	0.24 (0.27)
		PAB connection	2.4	0.29	2.4 -	0.29 -
M4GE3 EA	2-position		3.5	0.34	3.8(2.6)	0.11(0.27)
	3-position	All ports closed	3.1	0.33	3.3 -	0.22 -
		ABR connection	3.0	0.30	3.8(2.7)	0.11(0.22)
		PAB connection	3.6	0.36	3.3 -	0.28 -
M4GE4 EA G3/8	2-position		6.4	0.42	6.9 -	0.12 -
	3-position	All ports closed	6.0	0.37	6.8 -	0.12 -
		ABR connection	6.0	0.31	7.1 -	0.11 -
		PAB connection	6.0	0.37	6.8 -	0.13 -
M4GE4 EA G1/2	2-position		8.3	0.23	9.0 -	0.21 -
	3-position	All ports closed	7.4	0.15	8.8 -	0.19 -
		ABR connection	7.5	0.28	9.4 -	0.17 -
		PAB connection	7.7	0.21	8.7 -	0.18 -

* C: Sonic conductance, b: Critical pressure ratio
* Formula for converting sonic conductance C to effective cross-sectional area S is S ≈ 5.0 x C.
* Values in ( ) apply to models equipped with exhaust malfunction prevention valves.

1.3.6 Weight

■ 4GD/E EA Series

(Unit: g)

Solenoid position/ electrical connection		3GD1 EA 4GD1 EA	3GD2 EA 4GD2 EA	4GD3 EA	4GD4 EA	3GE1 EA 4GE1 EA	3GE2 EA 4GE2 EA	4GE3 EA	4GE4 EA
2-position	Single	61 (54)	120 (90)	155 (112)	296 (303)	97 (54)	173 (91)	246 (117)	551 (241)
	Double	81 (74)	140 (110)	176 (133)	329 (336)	118 (74)	194 (112)	267 (138)	584 (275)
3-position	ABR connection	84 (77)	148 (118)	187 (143)	361 (367)	120 (77)	202 (120)	277 (148)	616 (306)

* Values in ( ) apply to the weight of the solenoid valve (including mounting screws, the gasket, and the PR check valve) for mounting on base. Values for 4GD1 to 4GD3 do not include the weight of the piping adaptor.
* The two 3-port valves integrated type has the same weight as the 2-position double.
* Values include the weight of M8 connector (straight cable).

■ Manifold base

• Body piping

(Unit: g)

Pilot air exhaust method	M3GD1 EA, M4GD1 EA	M3GD2 EA, M4GD2 EA	M4GD3 EA	M4GD4 EA
	Direct mount	Direct mount	Direct mount	Direct mount
Standard	23n+52	47n+64	74n+88	150n+199

• Base piping

(Unit: g)

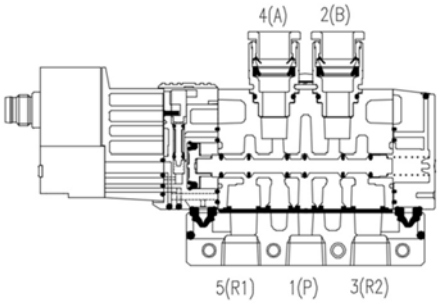
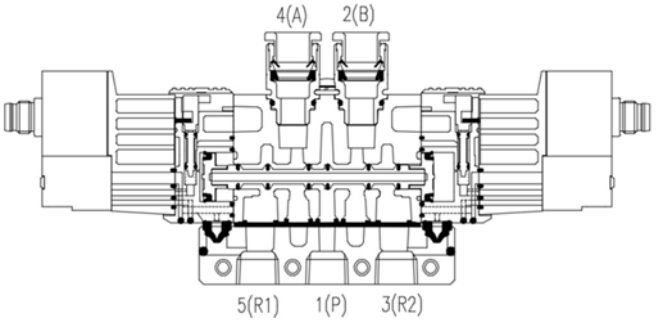
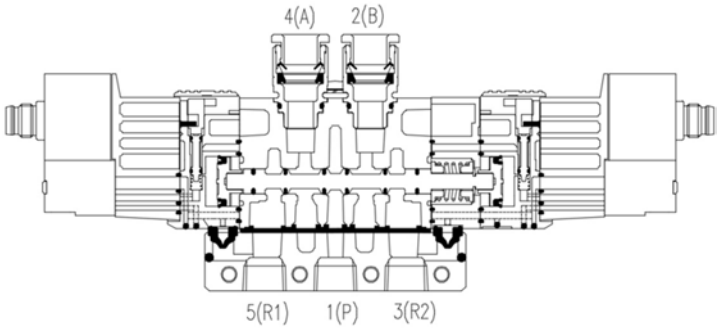
Pilot air exhaust method	M3GE1 EA, M4GE1 EA	M3GE2 EA, M4GE2 EA	M4GE3 EA	M4GE4 EA	
	Direct mount	Direct mount	Direct mount	Direct mount G3/8	Direct mount G1/2
Standard	35n+61	71n+106	113n+170	273n+329	391n+560

* Variable n represents the number of stations.
* Weights in the table above are the weights when the port size is a thread connection.

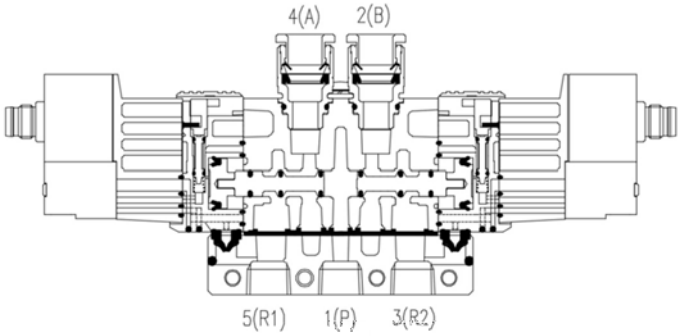
1.4 Internal Structure

1.4.1 Description of operation

■ Valve operation

	Diagram of operation (with 4GD EA Series as an example)	Description of operation
4G☐10EA 2-position Single		De-energized (shown in the diagram) 1(P) -> 2(B) 4(A) -> 5(R1) Energized 1(P) -> 4(A) 2(B) -> 3(R2)
4G☐20EA 2-position Double		SOL a Energized 1(P) -> 4(A) 2(B) -> 3(R2) SOL b Energized (shown in the diagram) 1(P) -> 2(B) 4(A) -> 5(R1) After energized, solenoid position is retained even after electricity is cut off.
4G☐30EA 4G☐40EA 4G☐50EA 3-position		4G☐30EA Energized Same as 2-position double 4G☐30EA De-energized 1(P), 4(A), 2(B), 5(R1), and 3(R2) closed 4G☐40EA Energized Same as 2-position double 4G☐40EA De-energized 1(P) closed 4(A) -> 5(R1) 2(B) -> 3(R2) 4G☐50EA Energized Same as 2-position double 4G☐50EA De-energized 1(P) -> 4(A), 2(B) 5(R1) and 3(R2) closed

* SOL = solenoid

	Diagram of operation (with 3GD EA Series as an example)	Description of operation
3G□660EA Two 3-port valves integrated type		3G□660EA De-energized 4(A) -> 5(R1) 2(B) -> 3(R2) SOL a Energized 1(P) -> 4(A) SOL b Energized 1(P) -> 2(B)

* SOL = solenoid

■ Manifold operation

The main and pilot exhaust air are collected in the manifold base and discharged from the exhaust port.

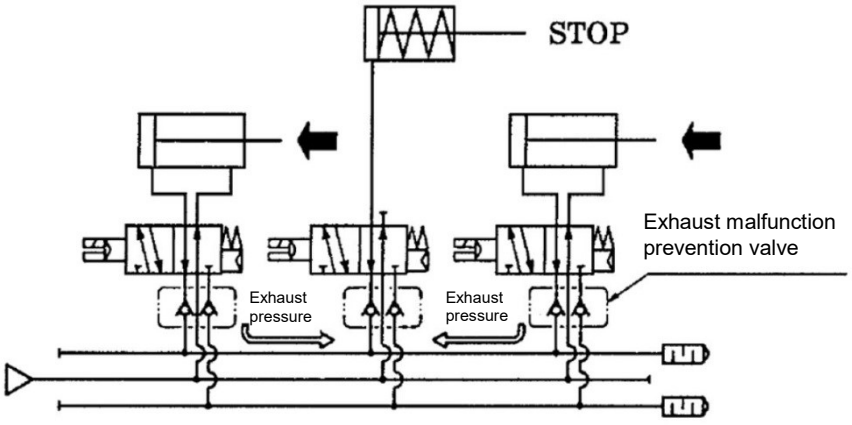
■ Malfunction prevention

PR check valves are provided as a standard.
PR check valves prevent malfunction of the solenoid valve itself caused by pilot back pressure.
In addition, gaskets equipped with exhaust malfunction prevention valves can be selected as an option.
This optional gasket prevents malfunctions in a single-acting cylinder or a double-acting cylinder connected to ABR connection valve due to the flow of back pressure caused by actuation of other cylinders.
Note that this option cannot be selected for valves with all ports closed and PAB connection valves since there is no back pressure flowing.

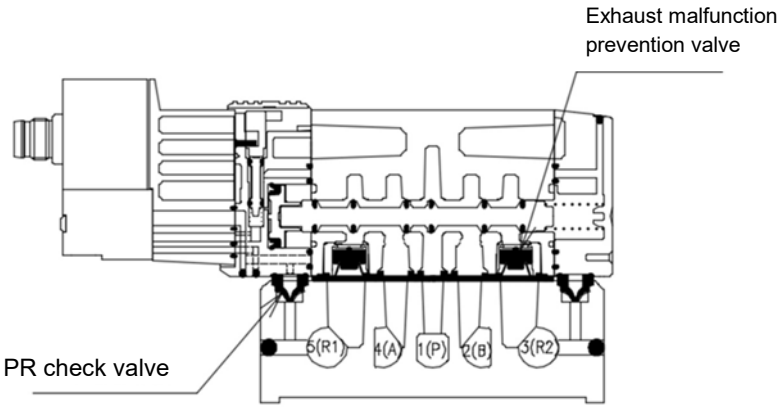
Exhaust malfunction prevention valves are check valves. Do not directly operate the cylinder rod under no pressure, as it causes the check valve to open and prevent the cylinder rod from moving.

<4G EA Series pneumatic pressure system>

- Malfunction prevention for a single-acting cylinder



- PR check valve and exhaust malfunction prevention valve



2. INSTALLATION

2.1 Environment

⚠ WARNING

Do not use the product in an application where water or cutting oil can splash onto the valve directly.

- In an environment where water and cutting oil can splash onto the valve, protect it by installing it under a cover or inside a paneled casing.
- If cutting oil splashes onto the cylinder rod, the oil may enter into the secondary side piping of the solenoid valve through the cylinder, causing a malfunction. Consult CKD before using the product in such an environment.

Observe the following precautions since coils produce heat.

- Appropriate ventilation or heat dissipation measures must be considered if the product is installed in a control board or if the solenoid coil needs to be energized for a long period.
- Be careful when touching the valve since the coil temperature may rise depending on the surrounding temperature and energization time.

Do not use the product in the presence of corrosive gas or solvents.

Do not use the product in an environment where corrosive gases such as sulfur dioxide gas or solvents are present.

Do not use the product in a humid environment.

Condensation may occur due to a change in the temperature.

Do not use the valves in a hazardous area classified as zone 0.

If using the valves in an explosive gas atmosphere, they are suitable for use in zone 1 and 2.

Use the valves in combination with a barrier.

The valves cannot be used independently in hazardous areas.

⚠ CAUTION

Take measures to prevent foreign matters from entering the exhaust port in a dusty environment.

Foreign matters may enter the exhaust port of a solenoid valve when the valve is operated to supply or exhaust air or if the exhaust port is facing up. Install a silencer to prevent foreign matters from entering the exhaust port or mount the valve so that the exhaust port faces down.

Do not use the product where it is subject to vibrations or shocks.

Do not subject the product to vibrations exceeding 50 m/s^2 or shocks exceeding 300 m/s^2.

Use extreme care to avoid deterioration of packings and gaskets when using the product in a place with high ozone concentration (for example, near a beach or in an area with frequent thunderstorms).

Packing and gaskets may deteriorate sooner than usual.

Take measures against lightning surges on the device side.

The product has no resistance to lightning surges.

Take measures for heat dissipation.

Since the internal heat of the coil can be adversely affected, do not paint the surface of the coil actuator or attach a cover.

Take measures against dust.

The accumulation of dust exceeding 5 mm thickness on the surface of the coil actuator is not allowed.

Take measures against static electricity.

Install the product in an appropriate place and clean the product with a wet cloth, as necessary, to prevent generating static electricity.

2.2 Unpacking

⚠ CAUTION

Do not remove the solenoid valves from their packaging bag until just before piping.
If bags are opened before the valves are ready to be piped, foreign matters may enter inside the solenoid valves from the piping ports and may cause a failure or malfunction.

- Check that the model number ordered and the model number indicated on the product are the same.
- Check the exterior of the product for any damage.
- When any cautionary documents are provided with the product, read them, as well as this Instruction Manual, before use.
- Secure sufficient space around the solenoid valve for installation, removal, wiring, and piping.

2.3 Mounting

⚠ CAUTION

Do not use a method of mounting that relies on support from the piping when mounting the solenoid valve.
Mount and secure the solenoid valve body.

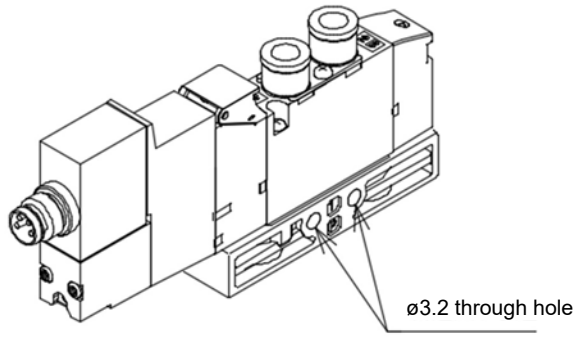
Tighten the screws with the appropriate tightening torque.
If assembly or tightening is not properly done, it may result in air leakage, product falling off, damage to the threads.

2.3.1 How to mount a body piping type single valve

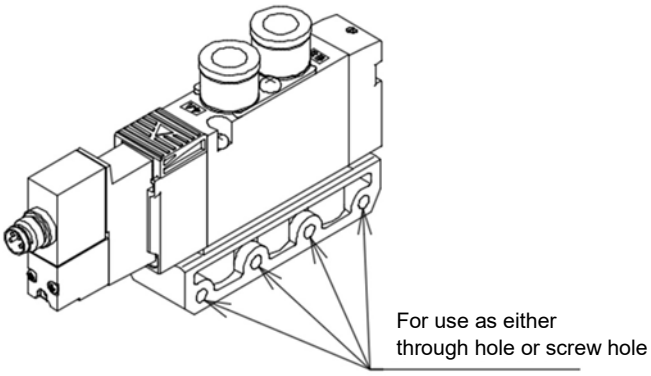
■ Mounting directly

The 4GD EA Series body piping type single valve can be mounted using through holes or screw holes. When using screw holes, the recommended tightening torque is 0.7 N·m to 1.2 N·m.

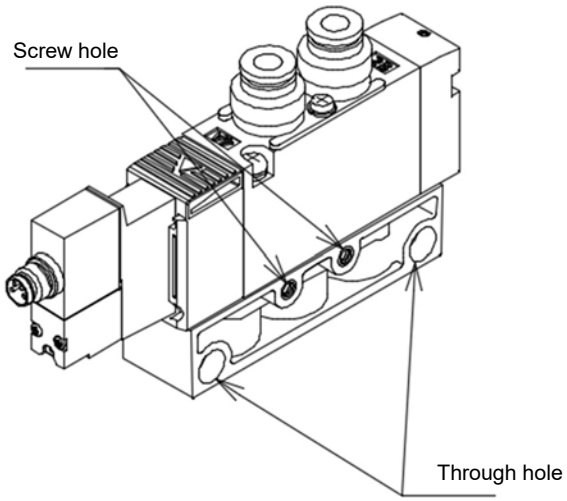
4GD1 EA Series



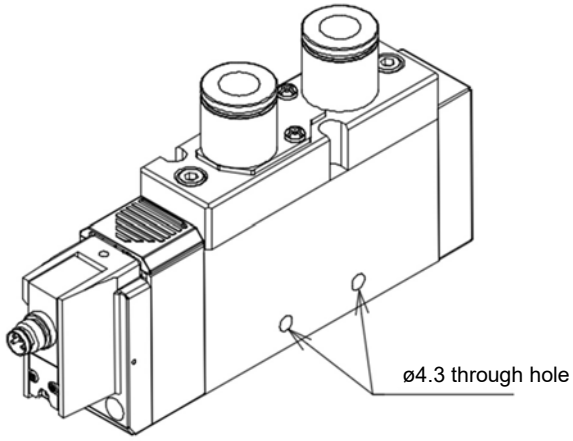
4GD2 EA Series



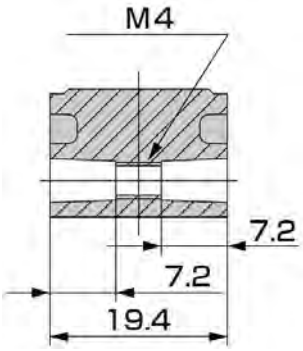
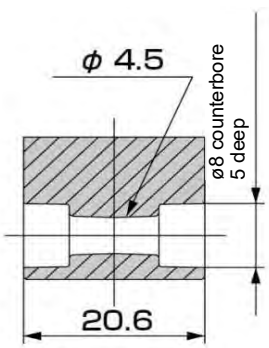
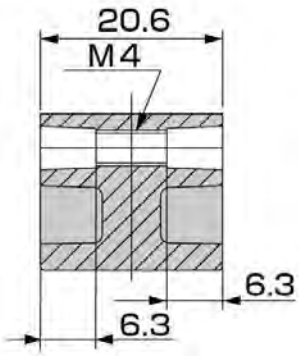
4GD3 EA Series



4GD4 EA Series



<Mounting hole shape>

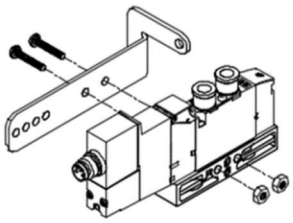
	4GD2 EA Series	4GD3 EA Series	
	For use as either through hole or screw hole	Through hole	Screw hole
Sectional view of mounting hole			

■ Mounting with mounting plate

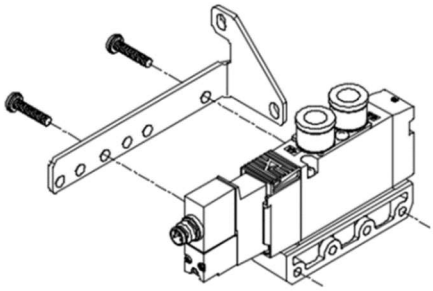
The mounting plate of the body piping type single valve can be mounted only on the 2-position single. Attach the valve and the mounting plate in the right direction and use correct holes since damage can occur if not mounted correctly.

4GD EA Series

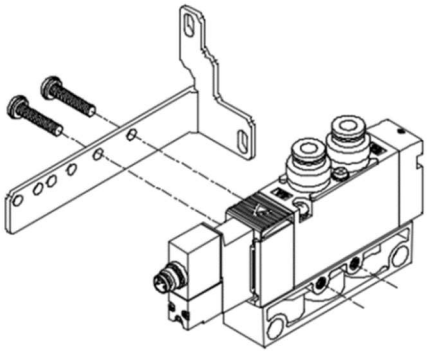
4GD110EA



4GD210EA



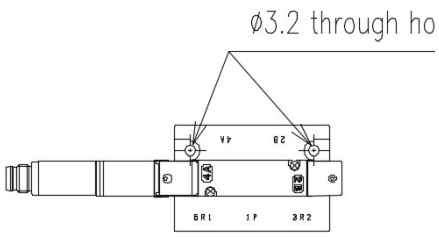
4GD310EA

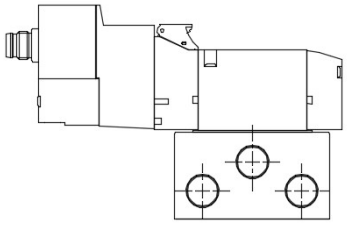


2.3.2 How to mount a base piping type single valve

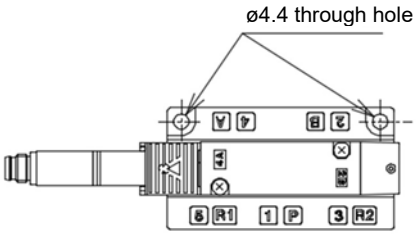
The base piping type single valve can be mounted using through holes in the subbase.

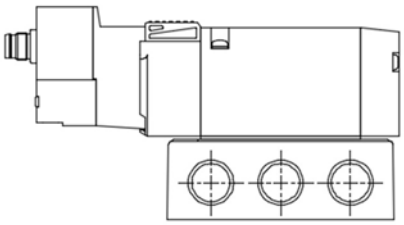
4GE1 EA Series



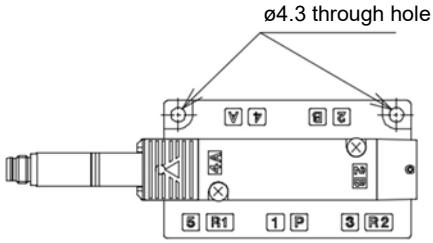


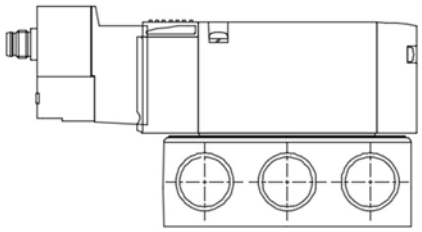
4GE2 EA Series



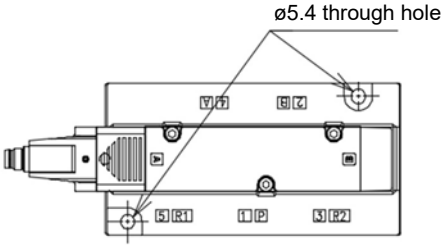


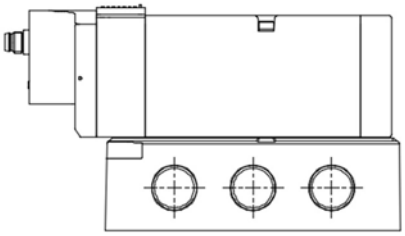
4GE3 EA Series





4GE4 EA Series



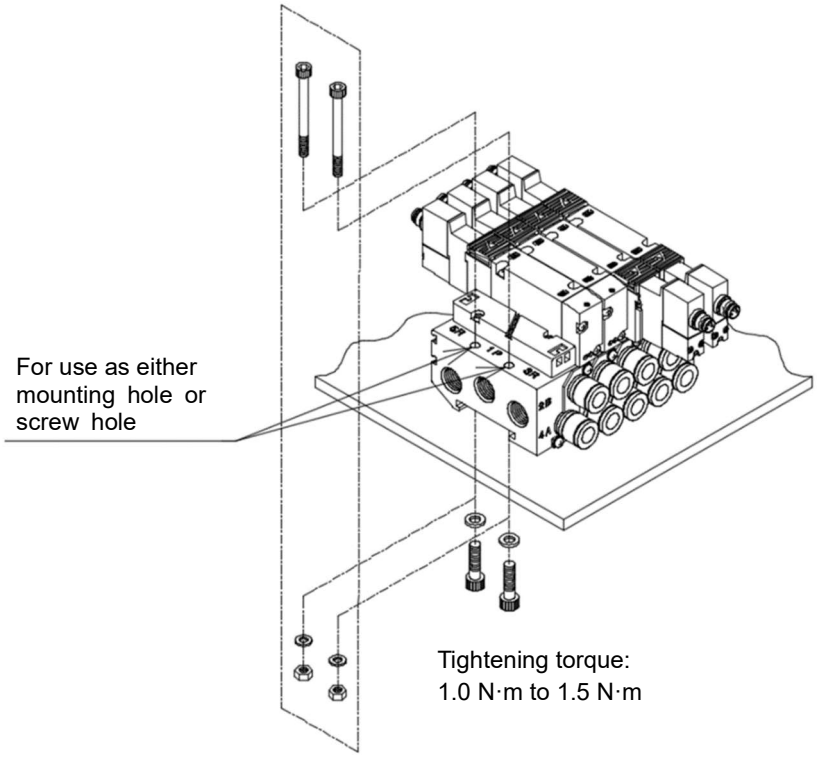


2.3.3 How to mount a manifold

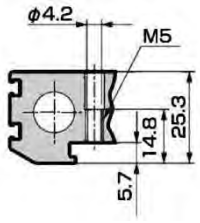
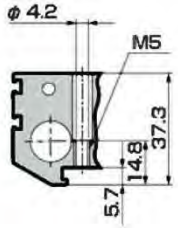
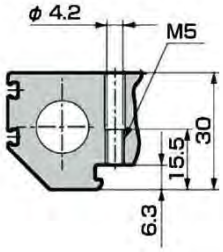
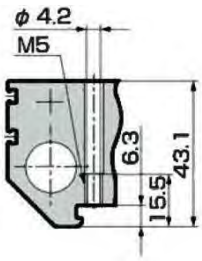
■ Mounting directly

M4G2 EA/M4G3 EA Series can be mounted using through holes or screw holes. When using screw holes, select bolts that can be screwed in by at least 10 threads and tighten them with proper tightening torque. The recommended tightening torque is 1.0 N·m to 1.5 N·m (M4G1 EA/M4G4 EA Series has only through holes).
If not mounted correctly, the threads may become damaged.

M4G2 EA, M4G3 EA Series



<Mounting hole shape (sectional view)>

	Body piping [M4GD EA]	Base piping [M4GE EA]
M4G2 EA		
M4G3 EA		

2.4 Piping

⚠ CAUTION

Tighten the pipes/tubes with the appropriate tightening torque.
Observe the appropriate tightening torque to prevent air leakage and damage to the threads. To prevent damage to the screw threads, first use your hands to lightly tighten the pipe/tube and then use a tool to tighten the pipe/tube further.

Make sure that the pipes/tubes will not be disconnected at the joints by mechanical movements, vibrations or tension.

- If the exhaust piping of the pneumatic pressure circuit is disconnected, the actuator speed cannot be controlled.
- For the chuck holding mechanism, the chuck holding force is lost when the piping is disconnected.

When supplying compressed air for the first time after piping is complete, make sure that there is no air leakage at the joints.

Do not apply high pressure suddenly when supplying compressed air for the first time after connecting the pipes/tubes.
Sudden introduction of highly-pressurized air may cause the tubes to become disconnected and jump around and an accident may occur.

Do not decrease the inside diameter of the piping from any of the solenoid valve exhaust ports to a diameter less than the piping port size.
Smooth exhaust flow is important for normal operation of the actuator. With a manifold, a restriction to the exhaust flow may prevent normal operation of other solenoid valves.

Remove foreign matter.
Rust and other foreign matters in the piping may cause a malfunction or valve seat leakage.
Insert a filter (which removes particles exceeding 5 μm) immediately upstream of the solenoid valve.

Do not restrict the flow of air through the supply piping.
A delay in operation may occur due to a drop in the supply pressure when multiple valves are operated.

2.4.1 Recommended tightening torque

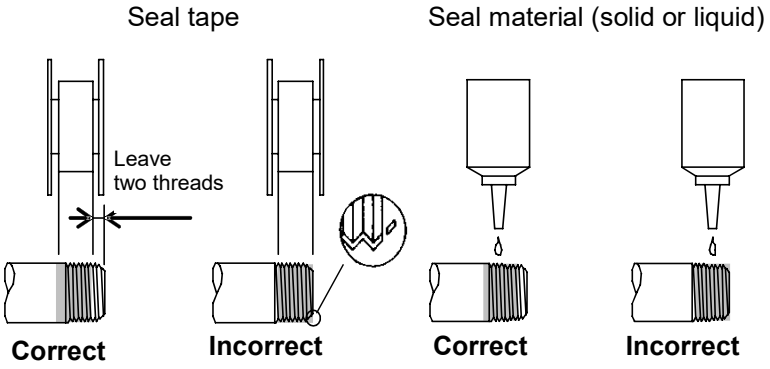
The following table shows the tightening torque for each connection thread.

Connection thread	Tightening torque (N·m)
M5	1.0 to 1.5
G1/8	3 to 5
G1/4	6 to 8
G3/8	13 to 15
G1/2	16 to 18

2.4.2 Seal material

Apply a seal tape or seal material to the screw threads leaving two or more threads at the pipe end uncovered or uncoated. If the pipe end is fully covered or coated, a shred of seal tape or residue of seal material may enter inside of the solenoid valve and cause a failure.

When using a seal tape, wind it around the screw threads in the direction opposite from the screw threads and press it down with your fingers to attach it firmly.
When using a liquid seal material, be careful not to apply it to resin parts. The resin parts can become damaged and this may lead to a failure or malfunction.
Also, do not apply seal material to the internal threads.



2.4.3 Flushing

Before piping, flush the pipes/tubes, solenoid valves, and connected devices to remove foreign matters.

2.4.4 M5 fitting

M5 fitting is sealed using a gasket. Do not retighten when pressure is applied in the pneumatic circuit.
Design and construct the piping system in such a way that the valves can be removed and remounted in case of trouble.

2.4.5 Blow circuit

Do not open the supply port to the atmosphere because a drop in the supply pressure may cause malfunction.

2.4.6 Exhaust port

Blocking the flow of exhaust air causes a delay in the cylinder response. If such delay occurs, adjust the speed between the cylinder and solenoid valve.

2.4.7 Piping connection

■ Appropriate tube

For solenoid valves provided with push-in fitting, use tubes specified by CKD.
- Soft nylon tubes (F-1500 Series)
- Urethane tubes (U-9500 Series)

■ Spatter

In an environment exposed to spatter, use flame-retardant tubes or steel pipes.

■ Hydraulic hose

When piping is for use in both hydraulic and pneumatic systems, use a hydraulic hose.
When the standard push-in fitting is used with a spiral tube, secure the base or end of the tube with a hose clamp. Otherwise, the tube will rotate and lose its clamping ability.
In an atmosphere where the temperature is high, use fastening fittings, not push-in fittings.

■ Commercially available tubes

When using commercially available tubes, check the outside diameter accuracy, wall thickness, and hardness of such tubes. The hardness of a urethane tube should be 93° or more (as measured by a rubber hardness meter).
Using a tube with insufficient diameter accuracy and hardness will cause the chucking force to drop, which makes the tube come off easily or difficult to insert.

Tube dimensions

Outside diameter (mm)	Inside diameter (mm)	
	Nylon	Urethane
ø4	ø2.5	ø2
ø6	ø4	ø4
ø8	ø5.7	ø5
ø10	ø7.2	ø6.5
ø12	ø8.9	ø8

Outside diameter tolerance	
Soft or hard nylon	± 0.1 mm
Urethane ø4, ø6	+0.1 mm -0.15 mm
Urethane ø8, ø10, ø12	+0.1 mm -0.2 mm

■ Minimum allowable bending radius of tubes

Observe the minimum allowable bending radius of tubes. Neglecting the minimum allowable bending radius may cause disconnection or leakage.

Outside diameter (mm)	Minimum allowable bending radius (mm)	
	Nylon	Urethane
ø4	10	10
ø6	20	20
ø8	30	30
ø10	40	40
ø12	55	50

■ Tube cutting

To cut a tube, use a tube cutter to cut the tube perpendicularly to the length of the tube. Inserting an obliquely cut end of a tube may cause air leakage.

■ Tube connections

From the end of the fitting, secure a straight section as long as the outside diameter of the tube and do not bend the tube abruptly at the fitting connection point. The tension applied sideways through the tube should not exceed 40 N.

■ Blanking plug to use

For solenoid valves provided with push-in fitting, use blanking plugs specified by CKD:
- Blanking plug (GWP□-B Series) : ø4 to ø12 push-in fitting

2.5 Wiring

⚠ WARNING

Use the valves in combination with a barrier.
The valves cannot be used independently in hazardous areas.
Refer to “2.5.2 Connecting Conditions” before selecting a barrier.

Turn off the power before wiring.
An electric shock may occur.

Do not touch live parts with bare hands.
An electric shock may occur.

Thoroughly read and understand this Instruction Manual before working on electrical wiring.
The product must be handled by a person who understands the structure and operation principle of solenoid valve and has knowledge to secure the safety.

⚠ CAUTION

Check the power supply voltage and the type of current (AC or DC) before supplying power.

Do not apply stress to the lead wires.
Undue stress may cause such problems as disconnection of the lead wires or the contact terminals.

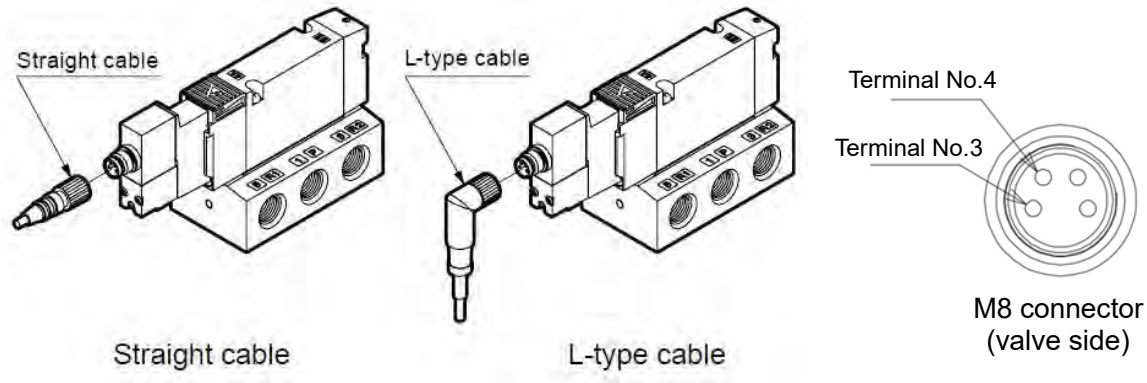
Make sure that the voltage drop on the solenoid does not exceed 20% of the rated voltage.
Voltage drop occurs when energizing solenoids at the same time or depending on the cable length.

Check the polarity of the solenoid before wiring.
Incorrect wiring may cause failure or malfunction of the solenoid valve.

2.5.1 M8 connector

The tightening torque of M8 connector is 0.38 N·m to 0.42 N·m.
The wiring to the M8 connector cable (supplied item) is as follows.

- Black (Terminal No.4) : 12 V
- Blue (Terminal No.3) : 0 V
- Brown, white : Not in use



2.5.2 Connecting conditions

The connecting conditions between intrinsic safety apparatus (4G EA Series) and associated apparatus (safety barriers) shall satisfy the explosion-proof specifications, safety retention rating, and parameters listed below.

Intrinsic safety apparatus	Conditions	Associated apparatus
Level of protection: ia, ib, ic	≤	Level of protection: ia, ib, ic
Equipment group: IIA, IIB, IIC	≤	Equipment group: IIA, IIB, IIC
Ui: Intrinsic safety circuit allowable voltage (maximum voltage that can be applied)	≥	Uo: Maximum voltage (maximum output voltage)
Ii: Intrinsic safety circuit allowable current (maximum current that can be applied)	≥	Io: Maximum current (maximum output current)
Pi: Intrinsic safety circuit allowable power (maximum input power)	≥	Po: Maximum electrical power (maximum output power)
Ci + Cw Ci: Internal capacitance of the intrinsic safety apparatus Cw: Maximum capacitance of intrinsic safety circuit wiring	≤	Co: Allowable capacitance (Maximum capacitance that can be connected)
Li + Lw Li: Internal inductance of intrinsic safety apparatus Lw: Maximum inductance of intrinsic safety circuit wiring	≤	Lo: Allowable inductance (Maximum inductance that can be connected)

The length of the intrinsic safety circuit external wiring can be calculated by the method below using the connecting conditions above.

- The wiring capacitance and inductance shall be Co ≥ Ci + Cw and Lo ≥ Li + Lw, respectively.
- Allowable wiring length shall be equal to or less than the smaller of (Co - Ci)/Cc and (Lo - Li)/Lc.
  Cc: Capacitance per unit length, Lc: Inductance per unit length

3. USAGE

⚠ WARNING

Consult CKD about the specifications before using the product outside the designated specifications or for special applications.

3.1 Safety Instructions

3.1.1 Air quality

⚠ WARNING

Do not supply anything other than compressed air.

Use clean compressed air that does not contain corrosive gases.

Do not use the exhaust malfunction prevention valves for purposes other than to block the back pressure from adjacent air devices.
Its structure cannot retain pressure continuously.

⚠ CAUTION

Improve the quality of air.
Compressed air usually contains a large amount of drainage, oxidized oil, tar, foreign matters, and rust from the piping, which may cause malfunction such as an operation fault and short service life. In addition, the exhaust causes pollution.

Use Class 1 ISO VG 32 turbine oil when lubricating.
Although the product is designed for oil-free operations, if lubricated even once, it will require periodic lubrication from then on. Make sure to keep it lubricated.

Do not use either spindle oil or machine oil.
They induce expansion of the rubber parts, which will cause operation faults.

■ Super-dry air

The super-dry air (humidity class of 0 to 3 as specified in JIS B 8392-1) may cause the lubricant to scatter, resulting in short service life.

■ Lubrication

Generally, the 4G EA Series does not require any lubrication. If lubrication is required, use Class 1 ISO VG 32 turbine oil.
If there is too much lubrication on the product or if the pressure is significantly low, the response time may be delayed. The response time indicated in the catalog shows the data obtained when the product is not lubricated and the pressure is 0.5 MPa.

■ Drainage

- If the temperature inside the pneumatic piping or pneumatic component drops, drainage may occur.
- If drainage enters and momentarily blocks the air passage inside the pneumatic component, it may cause an operation fault.
- If drainage generates rust, it may cause a failure in the pneumatic component.
- If drainage flushes the lubricant, it may cause a lubrication failure.

■ Contamination

- Use compressed air that does not contain oxidized oil, tar, carbon, or other contaminants from the air compressor.
  If oxidized oil, tar, or carbon enters into and adheres to pneumatic components, the resistance of the sliding section may increase and result in operation faults.
  If the supplied lubricant mixes in with oxidized oil, tar, or carbon, the sliding section of the pneumatic components will wear out.
- Use compressed air that does not contain solid foreign matters.
  If solid foreign matters in compressed air enter into the pneumatic components, the sliding section will wear out and contaminants will adhere to the inside.

■ Improvement of air quality

Take measures (such as dehumidifying with an aftercooler or a dryer, removing foreign matters with an appropriate filter, or installing a tar removing filter) in order to improve the quality of air.

3.1.2 Electric circuit

⚠ WARNING

Use the valves in combination with a barrier.
A barrier limits the energy to the solenoid valve and suppresses to a level that will not cause sparks even when the loop is disconnected or short-circuited.

Make sure that the wiring of intrinsic safety explosion-proof circuit does not come into contact with other circuits.
To prevent electromagnetic induction or electrostatic induction from other circuits or contact with other circuits, use a steel duct or a steel metal tubing that has a completely closed structure. Wire independently by using insulated wires or performing cable work.

⚠ CAUTION

Check that the leakage current from external control devices is below the acceptable value to avoid any malfunction of the product.
A leakage current from the control device may prevent the valve from operating correctly even if the solenoid valve is de-energized.
Make sure that the leakage current from the control device output is 1.2 mA or less.

- When energizing a double-solenoid type instantaneously, the energizing time must be 0.1 second or longer. It is recommended to energize while the cylinder is operating when the back pressure of another solenoid valve is conceivable.
- When energizing continuously, the surface temperature of the manifold increases.
  This is not abnormal, but appropriate ventilation or heat dissipation measures must be considered.

3.2 Manual Operation

⚠ WARNING

After operating the manual override, return the cylinder to the original position (initial position) before re-starting operation.

Make sure that nobody is near the cylinder to be activated before performing manual operation.

Release the lock before performing normal operation for non-locking/locking combination manual override.

- Performing normal operation while the manual override is locked causes malfunction.
- If the manual cover is closed, the lock is released.

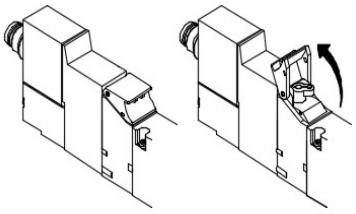
- The 4G EA Series is a pilot operated solenoid valve. If air is not supplied to port P, the main valve does not switch even if the manual override is operated.
- Manual protection cover is provided to this solenoid valve as standard. Since the manual protection cover is closed when shipped out of the factory, open it to operate the manual override. Note that the manual protection cover will not close unless the locking manual override is released.
- Manual override has both locking and non-locking overrides. It is locked by pressing down and turning the lever. When locking, make sure to turn the lever while pressing it down. Turning the lever without pressing it down could damage the manual override and cause air leakage.

3.2.1 Non-locking/locking combination manual override

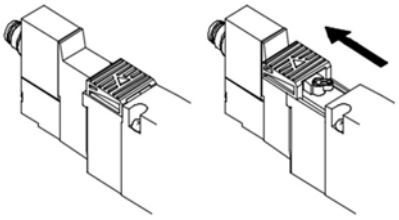
■ How to open and close the manual protection cover

Do not apply excessive force to the manual protection cover when opening and closing the cover. Excessive external force may cause damage (below 5 N).

4G1 EA Series



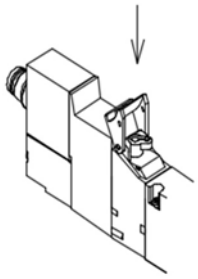
4G2 EA, 4G3 EA, 4G4 EA Series



■ How to operate the manual override

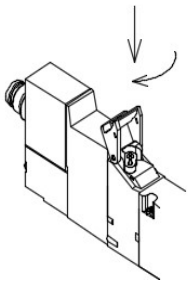
<Non-locking operation>

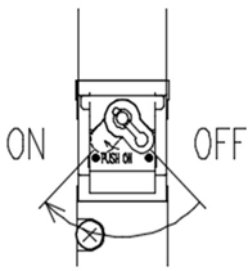
1. Press the lever down in the direction of the arrow until it stops.
   Manual operation can be performed while the lever is pressed down.
2. Release the lever to finish manual operation.
   The lever returns to the original position when released.



<Locking operation>

1. Press the lever down and turn it in the direction of the arrow until it stops.
   The lever is locked in place, maintaining the manual operation state.
2. Return the lever to the original position to disable manual operation.





4. MAINTENANCE AND INSPECTION

4.1 Periodic Inspection

⚠ WARNING

Turn off the power, stop the supply of compressed air, and make sure that there is no residual pressure before maintenance.
Observe the condition to ensure safety.

⚠ CAUTION

Plan and perform daily and periodic inspections so that maintenance can be managed properly.
If maintenance is not properly managed, the product's functions may deteriorate significantly and this may lead to faults (such as short service life, damage, and malfunction) or accidents.

In order to use the product under optimum conditions, perform a periodic inspection once or twice a year.

■ Pressure of supplied compressed air

- Is the set pressure supplied?
- Does the pressure gauge indicate the set pressure during operation of the device?

■ Pneumatic filter

- Is drainage correctly discharged?
- Are the bowl and element clean enough to use?

■ Leakage of compressed air from piping connections

- Are all connections, especially at movable sections, correctly connected?

■ Operation of solenoid valves

- Is there any delay in operation?
- Are the valves exhausting properly?

■ Operation of pneumatic actuator

- Are operations smooth?
- Is the actuator reaching the end stop properly?
- Are loads connected properly?

■ Lubricator

- Is the oil rate correctly adjusted?

■ Lubricant

- Is the specified lubricant supplied?

■ Screws

- Are there any loose screws?

4.2 Disassembling and Assembling

⚠ WARNING

Thoroughly read and understand this Instruction Manual before working on disassembly or assembly of the manifold.

- The product must be handled by a person who understands the structure and operation principle of solenoid valve and has knowledge to secure the safety.
- A level of 2nd grade (or higher) Certified Skilled Professional of Pneumatic Apparatus Assembling is required.

Turn off the power and release the pressure before adding or removing a manifold valve.

Do not disassemble or reassemble the inside of the solenoid valve.

- Disassembling and reassembling the inside of the solenoid valve will impair the sealing performance.
- Disassembling and reassembling the solenoid valve will void the warranty.

4.2.1 Replacement of solenoid valve

When replacing the solenoid valve, use extreme care so that the gasket and pilot check valve do not fall off.

Model	Screw size	Tightening torque (N·m)
4G1 EA	M1.7	0.18 to 0.22
4G2 EA	M2.5	0.35 to 0.40
4G3 EA	M3	0.6 to 0.7
4G4 EA	M3	1.2 to 1.4

4.2.2 How to replace a cartridge type fitting (4GD/E EA)

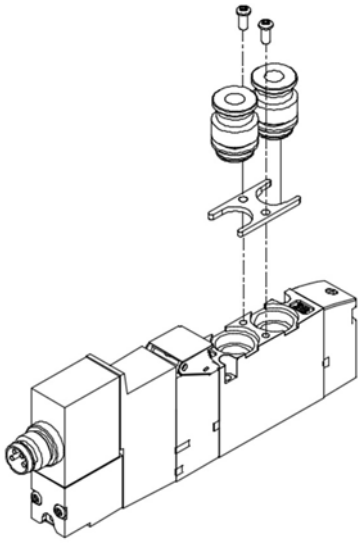
To change the push-in fitting size, check the procedure before replacing. If it is not installed correctly or if the tightening of the mounting screws is insufficient, problems such as air leakage will occur.

■ Body piping (4GD EA) type

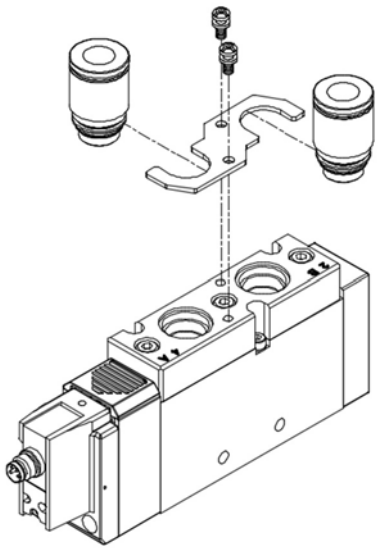
1. Remove the mounting screws.
2. Pull out the fitting stopper plate and fitting at the same time.
3. Adjust the groove on the replacement fitting to the fitting stopper plate and assemble them temporarily.
4. Mount the fitting stopper plate and fitting at the same time and tighten the mounting screw.

Model	Screw size	Tightening torque (N·m)
4G1 EA	M1.7	0.18 to 0.22
4G2 EA	M2.5	0.25 to 0.30
4G3 EA	M3	0.6 to 0.7
4G4 EA	M3	0.6 to 0.7

5. Pull on the fitting and confirm that it is installed correctly.

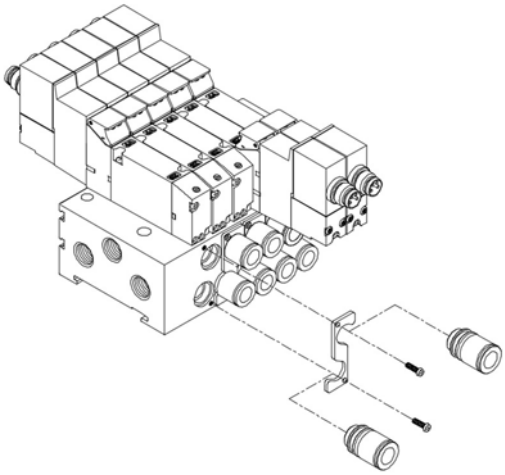


4GD1 EA to 4GD3 EA Series



4GD4 EA Series

■ Base piping (4GE EA) type



1. Remove the mounting screws.
2. Pull out the fitting stopper plate and fitting at the same time.
3. Adjust the groove on the replacement fitting to the fitting stopper plate and assemble them temporarily.
4. Mount the fitting stopper plate and fitting at the same time and tighten the mounting screw.

Model	Screw size	Tightening torque (N·m)
4G1 EA	M1.7	0.18 to 0.22
4G2 EA	M2.5	0.25 to 0.30
4G3 EA	M3	0.6 to 0.7
4G4 EA	M3	0.6 to 0.7

5. Pull on the fitting and confirm that it is installed correctly.

5. TROUBLESHOOTING

5.1 Problems, Causes, and Solutions

If the product does not operate as intended, check the table below for a possible solution.

Problem	Cause	Solution
Does not operate at all	There is no electric signal.	Turn on the power.
	Electric signals are faulty.	Repair the control circuit.
	Voltage or current fluctuation is excessive.	Check the power capacity (voltage fluctuation range: -20% to +10%).
	Wiring is not correct.	Correct the wiring.
	All pilot air exhaust ports are closed.	Inspect and correct the piping.
Does not operate properly	Leakage current is excessive.	Correct the control circuit and/or add a bleed circuit.
	Chattering occurs.	Check the switching system and check for loose wiring.
	Voltage is not as specified on nameplate.	Correct the voltage to meet the specification.
	Coil is damaged or short-circuited.	Replace the solenoid valve.
	Pressure source is disconnected.	Turn on the pressure source.
	Pressure is insufficient.	Readjust the pressure reducing valve or install a valve for increasing pressure.
	Flow rate is insufficient.	Inspect and correct the piping or install a surge tank.
	Pressure is supplied through exhaust port.	Inspect and correct the piping.
	Piping is incorrect or omitted.	Inspect and correct the piping.
	Speed control throttle valve is completely closed.	Readjust the needle.
	Port A or B is left open to atmosphere.	Use a pipe fitting with diameter equal to or smaller than the diameter of port P fitting.
	Valve is frozen.	Take measures against freezing (such as keeping the product warm and draining water).
	Return of plunger is delayed by excessive oil or existence of tar.	Check the quality of the lubricant (Class 1 ISO VG 32 turbine oil). Readjust the lubricator drip rate. Install a tar removing filter.
	Exhaust ports are clogged with dust.	Install a cover or silencer. Clean the exhaust ports periodically.
Requires high pressure to operate	Packing is swelling.	Check the quality of the lubricant (Class 1 ISO VG 32 turbine oil). Use the solenoid valves away from where cutting oil is used. Keep organic chemicals away.
	Port A or B is open to atmosphere.	Inspect and correct the piping.
	Foreign matters are stuck in packing.	Remove foreign matters.

If you have any other questions or concerns, contact your nearest CKD sales office or distributor.

6. REFERENCE INFORMATION

6.1 Port Identification

Piping ports are identified and labeled, such as 1P and 4A, in accordance with ISO and JIS standards.

Port	ISO standard	JIS standard
Supply port	1	P
Output port	4	A
Output port	2	B
Exhaust port	5	R1
Exhaust port	3	R2

7. WARRANTY PROVISIONS

7.1 Warranty Conditions

■ Warranty coverage

If the product specified herein fails for reasons attributable to CKD within the warranty period specified below, CKD will promptly provide a replacement for the faulty product or a part thereof or repair the faulty product at one of CKD's facilities free of charge.
However, following failures are excluded from this warranty:

- Failure caused by handling or use of the product under conditions and in environments not conforming to those stated in the catalog, the Specifications, or this Instruction Manual.
- Failure caused by incorrect use such as careless handling or improper management.
- Failure not caused by the product.
- Failure caused by use not intended for the product.
- Failure caused by modifications/alterations or repairs not carried out by CKD.
- Failure that could have been avoided if the customer's machinery or device, into which the product is incorporated, had functions and structures generally provided in the industry.
- Failure caused by reasons unforeseen at the level of technology available at the time of delivery.
- Failure caused by acts of nature and disasters beyond control of CKD.

The warranty stated herein covers only the delivered product itself. Any loss or damage induced by failure of the delivered product is excluded from this warranty.

■ Confirmation of product compatibility

It is the responsibility of the customer to confirm compatibility of the product with any system, machinery, or device used by the customer.

■ Others

The terms and conditions of this warranty stipulate basic matters.
When the terms and conditions of the warranty described in individual specification drawings or the Specifications are different from those of this warranty, the specification drawings or the Specifications shall have a higher priority.

7.2 Warranty Period

The product is warranted for one (1) year from the date of delivery to the location specified by the customer.