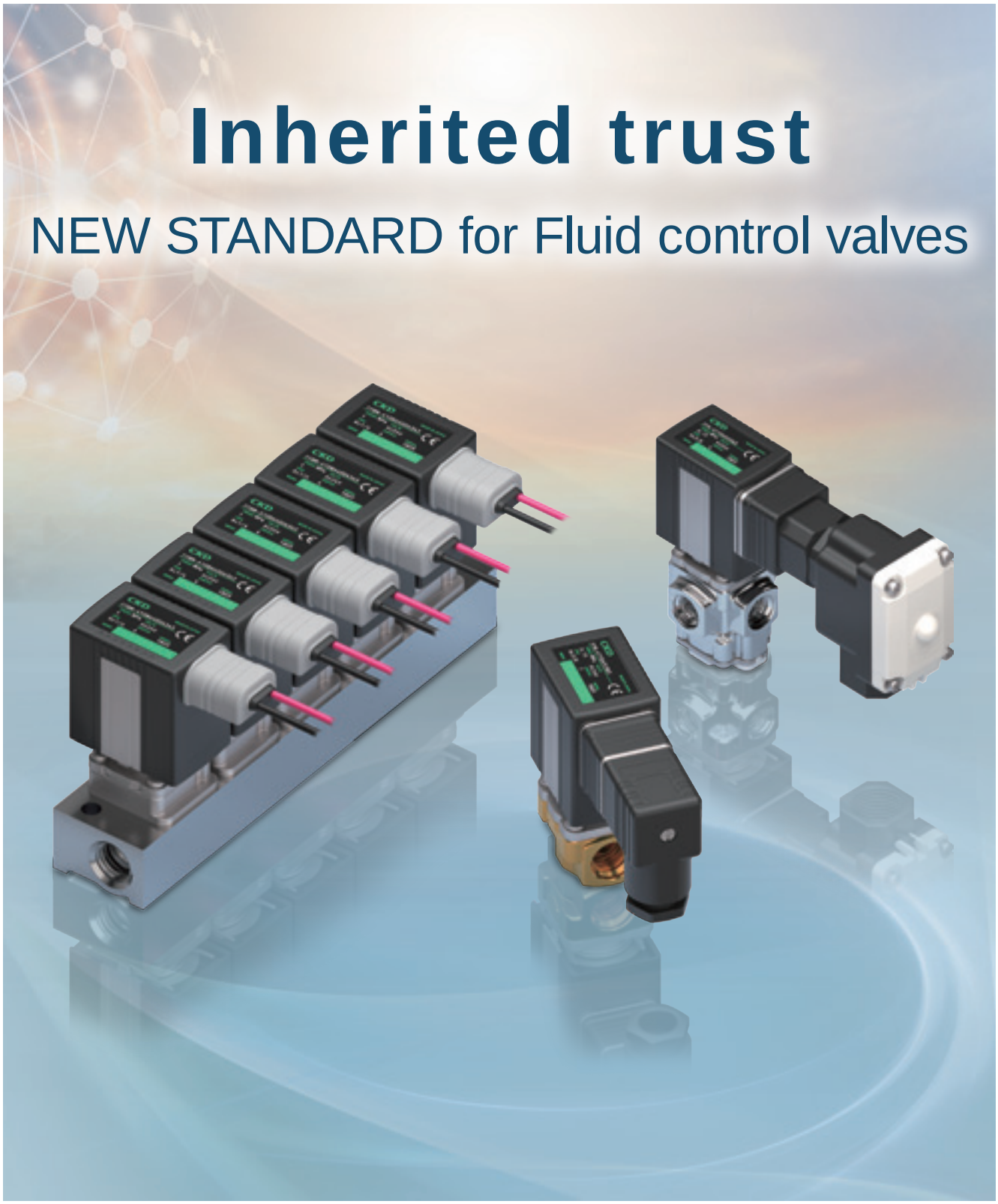
CKD

New Products

Direct Acting 2, 3-port Solenoid Valve (Multi-Fit Valves) FFB/FFG Series



CKD Corporation

CC-1544A 1

High reliability

- 20 million cycle high durability
- Pressure resistant container structure
- High corrosion resistance
- Prevents coil scorching

Multi-Fit Valves

Easy to select

- Supports multiple fluids
- Wide variation

Easy to use

- Increased flexible installation
- Improved maintainability
- Silent structure

Dry air

Dry air (Inert gas)

Compressed air

Compressed air

Water

Water

Vacuum

Vacuum

Oil

Oil

Multi-fit for multiple fluids

The functions required for fluid control valves have been integrated into a single body

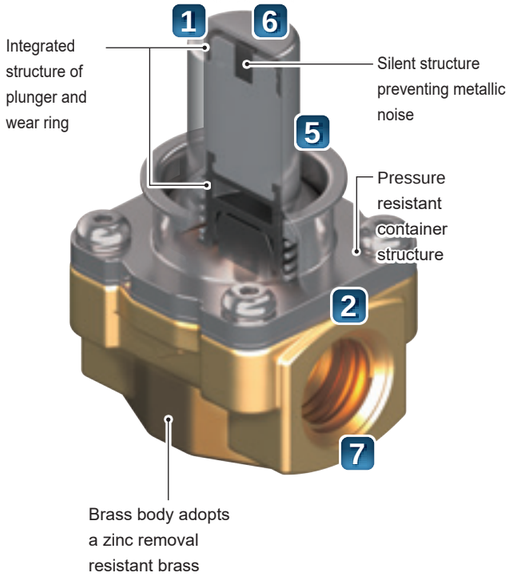
CKD's solenoid valve control technology has a half century track record in fluid control. Multi-fit valves further enhance reliability with the standard features required for solenoid valves in each application, allowing a single series to support a variety of fluids. In addition, we are working to realize a sustainable society by supporting carbon neutrality.

Direct acting 2, 3-port solenoid valve (multi-fit valve)

FFB/FFG Series

High functionality as standard

Coil with full-wave rectifier (AC) used



Integrated structure of plunger and wear ring

Silent structure preventing metallic noise

Pressure resistant container structure

Brass body adopts a zinc removal resistant brass

1 Compatible with dry air (inert gas)

High durability of 20 million cycles realized (Under CKD test conditions)

The integrated structure of the plunger and wear ring achieves durability equivalent to that of general air even with dry air.

2 Improved corrosion resistance of wetted parts

High corrosion resistant materials are used for plunger and flare pipe, and degalvanized copper alloy material is used for the brass body. In addition, the flare pipe is integrally molded so there is no welding.

3 Full-wave rectifier standard equipped (AC)

Prevents coil burning due to buzzing noise and overcurrent unique to AC solenoids.

4 Energy saving

Achieved 11W→4.5W low wattage. (60% reduction compared with CKD: valve size 3)

5 Pressure resistant container structure adopted

Reduces risk of external leakage

The flow path is not exposed during coil replacement, and there is no fluid leakage.

6 Silent structure

Reduces metallic noise

It can be used in quiet environments such as medical facilities and laboratories.

7 Compatible with global standards

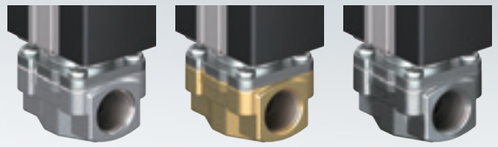
European Standards

CE RoHS

Ample variations

Body material

3 materials compatible with various fluids are available as standard.



Aluminum　Brass　Stainless steel

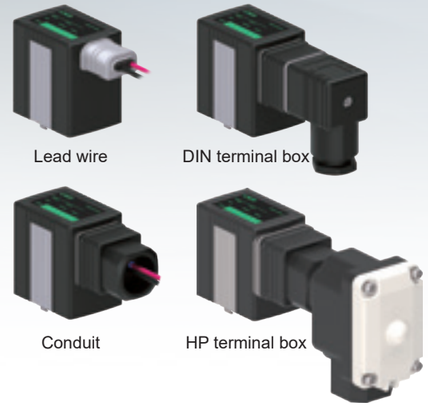
Port thread standards Rc/G/NPT

Sealant

Nitrile rubber, fluoro rubber and ethylene propylene rubber can be selected to support various fluids.

Coil housing

Select the type based on the electrical wiring from four types.

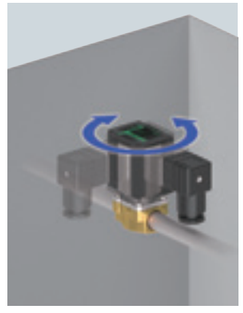


Lead wire　DIN terminal box

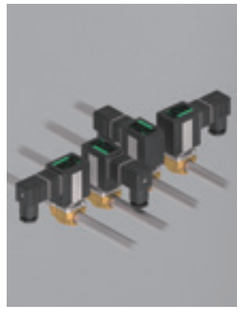
Conduit　HP terminal box

Increased flexible installation

Coil rotates 360°



It enables effective use of narrow spaces, such as installations near the wall.

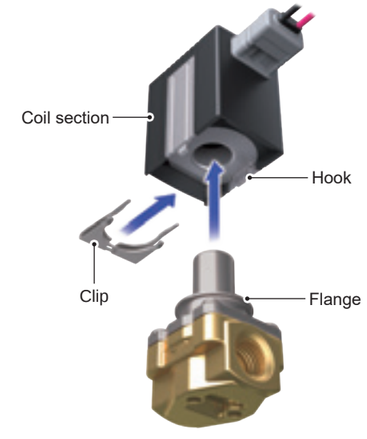


Flexibly supports line expansion.

Improved maintainability

One-touch attachment/removal of coil with clip

The coil and core are not fixed with screws, making it easy to detach the coil.



Series variation

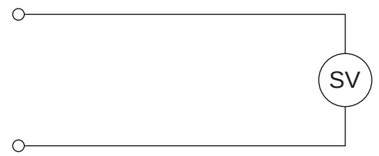
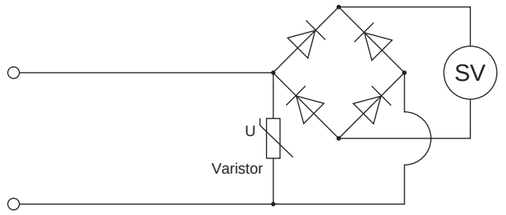
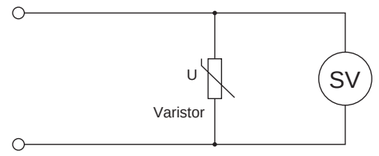
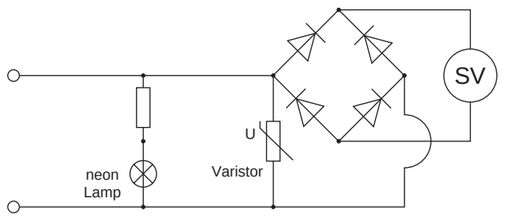
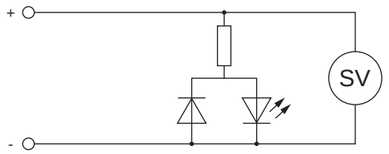
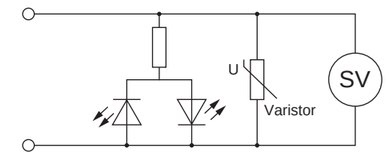
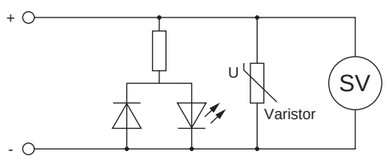
Port	Configuration	Actuation	Coil 4 sizes (width 24 / 30 / 35 / 40)			
			Port size			
			1/8	1/4	3/8	1/2
2WAY	Discrete valve	NC (normally closed)	●	●	●	●
		NO (closed when energized)	●	●	●	
	Manifold	NC common / individual supply	●	●		
3WAY	Discrete valve	Universal	●	●	●	
		NC pressurization	●	●	●	
	Manifold	Universal common supply / common exhaust		●		

Series variation

Direct acting 2, 3-port solenoid valve
Multi-fit

No. of Ports	Model		Configuration	Actuation		Working fluid					Port size Rc/G/NPT				Description Page
						Compressed air	Water	Oil	Medium vacuum	Dry air	1/8	1/4	3/8	1/2	
2-port		FFB-21	Discrete valve	NC (Normally closed) type		●	●	●	●	●	●				1
		FFB-31				●	●	●	●	●	●	●			
		FFB-41				●	●	●	●	●		●	●		
		FFB-51				●	●	●	●	●		●	●	●	
		FFB-32		NO (Closed when energized)		●	●	●		●	●	●			
		FFB-42				●	●	●		●		●	●		
		FFB-52				●	●	●		●		●	●		
		FFBM-21	Manifold	NC (Normally closed) type Common supply		●	●	●	●	●	●				15
		FFBM-31				●	●	●	●	●		●			
		FFBM-41				●	●	●	●	●		●			
		FFBM-51				●	●	●	●	●		●			
		FFBM-25		NC (Normally closed) type Individual supply		●	●	●	●	●	●				
		FFBM-35				●	●	●	●	●		●			
		FFBM-45				●	●	●	●	●		●			
		FFBM-55				●	●	●	●	●		●			
3-port		FFG-21	Discrete valve	Universal		●	●	●		●	●				27
		FFG-31				●	●	●		●	●	●			
		FFG-41				●	●	●		●		●	●		
		FFG-51				●	●	●		●		●	●		
		FFG-33		NC Pressurization		●	●	●		●	●	●			
		FFG-43				●	●	●		●		●	●		
		FFGM-31	Manifold	Universal Common supply Common exhaust		●	●	●		●		●			35
		FFGM-41				●	●	●		●		●			
		FFGM-51				●	●	●		●		●			

Electrical connection circuit diagram

Coil option		Voltage					
		DC			AC		
A	Lead wire (300 mm)	●			●		
B	With DIN terminal box (G1/2)	●			●		
C	With DIN terminal box (Pg9, Pg11)	●			●		
E	Conduit (G1/2)	●			●		
F	Conduit (CTC19)	●			●		
G	With HP terminal box	●			●		
S	DIN coil without terminal box	●			●		
J	Lead wire (300 mm) with surge suppressor	●*1	Product included		*2		
M	Conduit (G1/2) with surge suppressor	●					
P	Conduit (CTC19) with surge suppressor	●					
Q	HP terminal box with surge suppressor	●					
K	DIN terminal box with surge suppressor	●					
D	DIN terminal box with lamp (Pg11)	*3			●*4		
H	HP terminal box with lamp	●			●		
L	DIN terminal box with lamp/surge suppressor	●					
R	HP terminal box with lamp with surge suppressor	●					

*1: The surge suppressor for the coil option "J" for 1:DC voltage is included with the product.
*2: All AC voltages are equipped with a full-wave rectifier circuit.
For this reason, a surge suppressor is not available.
*3: Use "L" DIN terminal box with lamp/surge suppressor.
*4: 230 VAC cannot be selected.

Coil option code

A(DC) J		Grommet lead wire 300 mm Grommet lead wire 300 mm/ With surge suppressor
A(AC)		Grommet lead wire 300 mm
B C K		DIN terminal box DIN terminal box with surge suppressor
D L		DIN terminal box with lamp DIN terminal box / lamp, With surge suppressor
G Q		HP terminal box HP terminal box with surge suppressor
H R		HP terminal box with lamp HP terminal box / lamp, With surge suppressor
E F M P		Conduit (G1/2) Conduit (CTC19) Conduit (G1/2) with surge suppressor Conduit (CTC19) with surge suppressor
S		DIN coil without terminal box

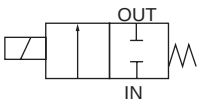
Direct acting 2-port solenoid valve

FFB Series

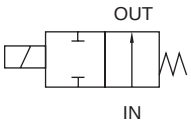
- NC, NO
- Port size: Rc, G, NPT 1/8 to 1/2

JIS symbol

● FFB-*1:NC (Open when energized)



● FFB-*2:NO (Closed when energized)



Common specifications

Item		FFB
Working fluid		Compressed air/water/oil (50mm^2/s or less)/medium vacuum (*2, *3)/dry air
Max. working pressure	MPa	1.4 (refer to working pressure in individual specifications.)
Proof pressure (water pressure)	MPa	2.1 (NC), 1.5 (NO)
Fluid temperature	°C	-10 to 60 (no freezing)
Ambient temperature	°C	-10 to 60 (DC), -10 to 55 (AC)
Thermal class		Class 130 (B)
Atmosphere		Place free of corrosive gas and explosive gas
Valve structure		Direct acting poppet structure
Valve seat leakage	cm^3/min (ANR)	0.2 or less (air)
Valve seat leakage *1	Pa·m^3/sHe	1.33 x 10^{-6} or less
Mounting orientation		Unrestricted
Degree of protection		IP65

*1: Amount of leakage in medium vacuum. (FFB Series NC only)
*2: When using at medium vacuum, vacuum the OUT port side.
*3: When using with medium vacuum, select the material option "G""M".

Electrical specifications

Item		FFB-2							FFB-3						
Rated voltage	V	24 DC	12 DC	100 VAC 50/60Hz	110 VAC 50/60Hz	200 VAC 50/60Hz	220 VAC 50/60Hz	230 VAC 50/60Hz	24 DC	12 DC	100 VAC 50/60Hz	110 VAC 50/60Hz	200 VAC 50/60Hz	220 VAC 50/60Hz	230 VAC 50/60Hz
Voltage fluctuation range		±10%							±10%						
Power consumption	W	3.5	3.5	-	-	-	-	-	4.5	4.5	-	-	-	-	-
Apparent power	VA	-	-	5.1	5.7	6.0	5.3	5.7	-	-	6.2	6.1	6.2	6.2	6.5
Item		**FFB-4**							**FFB-5**						
Rated voltage	V	24 DC	12 DC	100 VAC 50/60Hz	110 VAC 50/60Hz	200 VAC 50/60Hz	220 VAC 50/60Hz	230 VAC 50/60Hz	24 DC	12 DC	100 VAC 50/60Hz	110 VAC 50/60Hz	200 VAC 50/60Hz	220 VAC 50/60Hz	230 VAC 50/60Hz
Voltage fluctuation range		±10%							±10%						
Power consumption	W	7	7	-	-	-	-	-	10.5	10.5	-	-	-	-	-
Apparent power	VA	-	-	8.6	10	9.6	9.5	9.4	-	-	13	13	14	14	13

The leakage current must be less than or equal to the values shown below.

Voltage	AC					DC	
	100V	110V	200V	220V	230V	12V	24V
Leakage current	2 mA or less		1 mA or less			5 mA or less	

Individual specifications

Item / Model No.				Port size Rc/G/NPT	Orifice size (mm)	Working pressure (MPa) *1	Working pressure Pa (abs) *2, *3	Flow Rate Characteristics C[dm³/(s·bar)]	Flow Rate Characteristics b	Flow Rate Characteristics Cv	Weight (kg) *4
NC (Normally Closed)											
FFB-21	06	*	S	1/8	1.5	0 to 1.0	1.3×10^{-2} to 1×10^{6}	0.31	0.42	0.085	0.21
			2		2	0 to 0.6	1.3×10^{-2} to 0.6×10^{6}	0.53	0.34	0.13	
FFB-31	06 08	*	2	1/8 1/4	2	0 to 1.4	1.3×10^{-2} to 1.4×10^{6}	0.56	0.50	0.15	0.36
			3		3	0 to 0.6	1.3×10^{-2} to 0.6×10^{6}	1.2	0.45	0.31	
			5		5	0 to 0.2	1.3×10^{-2} to 0.2×10^{6}	2.9	0.43	0.63	
FFB-41	08 10	*	4	1/4 3/8	4	0 to 1.0	1.3×10^{-2} to 1×10^{6}	1.4	0.52	0.43	0.55
			7		7	0 to 0.15	1.3×10^{-2} to 0.15×10^{6}	4.2	0.43	1.15	
FFB-51	08 10 15	*	5	1/4 3/8 1/2	5	0 to 0.8	1.3×10^{-2} to 0.8×10^{6}	2.7	0.45	0.72	0.85
			7		7	0 to 0.3	1.3×10^{-2} to 0.3×10^{6}	4.7	0.38	1.2	
			X		10	0 to 0.1	1.3×10^{-2} to 0.1×10^{6}	6.9	0.41	2.0	
NO (closed when energized)											
FFB-32	06 08	*	2	1/8 1/4	2	0 to 0.9		0.53	0.46	0.13	0.46
			3		3	0 to 0.5		0.77	0.54	0.19	
			5		5	0 to 0.15		1.4	0.56	0.37	
FFB-42	08 10	*	3	1/4 3/8	3	0 to 0.8		1.2	0.45	0.31	0.71
			4		4	0 to 0.4		1.8	0.38	0.56	
			7		7	0 to 0.12		3.5	0.36	0.95	
FFB-52	08 10	*	4	1/4 3/8	4	0 to 0.8		1.8	0.38	0.56	0.9
			5		5	0 to 0.5		2.8	0.31	0.72	
			7		7	0 to 0.25		3.5	0.36	0.95	

*1: Can be used with low vacuum [1.33×10^{2} Pa (abs)], but valve seat leakage is 0.2 cm^3/min (ANR) or less. (Valve seat leakage at positive pressure) When used in a low vacuum, the lower limit of operating pressure is 1.33×10^{2} Pa (abs), so the upper limit is 0.1 MPa lower.
*2: Working pressure at medium vacuum.
*3: When using at medium vacuum, vacuum the OUT port side.
*4: Brass body DC lead wire weight.

How to order

● NC (Normally Closed)

FFB - 4 1 08 A 4 C 3 C 3 - B

1 Valve Size
Actuation: NC (Normally Closed)
2 Port size
3 Thread and Pressure on nameplate display unit
4 Orifice size
5 Material
6 Coil thermal class
7 Coil option
8 Rated voltage
9 Option

1 Valve size

		Valve size 2	3	4	5
2	Width 24 mm	●			
3	Width 30 mm		●		
4	Width 35 mm			●	
5	Width 40 mm				●

2 Port size

		Valve size 2	3	4	5
06	1/8	●	●		
08	1/4		●	●	●
10	3/8			●	●
15	1/2				●

3 Thread and pressure unit indicated on nameplate

	Thread	Pressure display unit
A	Rc thread	MPa
B	G thread	bar
C	NPT thread	psi *1
D	G thread	MPa *2
E	NPT thread	MPa *2

*1: In compliance with the Measurement Act, the psi display cannot be used in Japan.
*2: "D", "E" is a selection to display the pressure display unit as MPa even with G threads and NPT threads mainly in Japan.

4 Orifice size

		Valve size 2	3	4	5
S	ø1.5	●			
2	ø2	●	●		
3	ø3		●		
4	ø4			●	
5	ø5		●		●*1
7	ø7			●	●
X	ø10				●*2

*1: ❷Not available when port size is "15".
*2: ❷Not available for port size 08.

5 Material

	Body	Seal	Treatment	Working fluid
A	Aluminum	NBR	-	Compressed air / dry air
C	Brass	NBR		Compressed air / Dry air / Water / Oil / Low vacuum *1
D		FKM		Compressed air / Dry air / Water / Oil / Low vacuum *1
G		FKM	Vacuum inspection	Compressed air / Dry air / Medium vacuum *2
H	Stainless steel	NBR	-	Compressed air / Dry air / Water / Oil / Low vacuum *1
J		FKM		Compressed air / Dry air / Water / Oil / Low vacuum *1
M		FKM	Vacuum inspection	Compressed air / Dry air / Medium vacuum *2
N	Brass	NBR	Oil-prohibited	Compressed air / Dry air / Water / Oil / Low vacuum *1
P		FKM		Compressed air / Dry air / Water / Oil / Low vacuum *1
Q		EPDM		Water
S	Stainless steel	NBR		Compressed air / Dry air / Water / Oil / Low vacuum *1
T		FKM		Compressed air / Dry air / Water / Oil / Low vacuum *1
U		EPDM		Water

*1: Although it can be used with low vacuum [1.33×10^2 Pa (abs)], valve seat leakage is 0.2 cm^3/min (ANR) or less. (Valve seat leakage at positive pressure) When used in a low vacuum, the lower limit of operating pressure is 1.33×10^2 Pa (abs), so the upper limit is 0.1 MPa lower.
*2: ❹Not available when the orifice size is "X".

6 Coil thermal class

3	Class 130 (B)

❼ Coil option

			❶ Valve size 2	3	4	5	Voltage DC	AC
A	Lead wire (300 mm)		●	●	●	●	●	●
B	With DIN terminal box (G1/2)		*1	●	●	●	●	●
C	With DIN terminal box (Pg11)		●*2	●	●	●	●	●
D	DIN terminal box with lamp (Pg11)		●*2	●	●	●	*3	●
E	Conduit (G1/2)			●	●	●	●	●
F	Conduit (CTC19)			●	●	●	●	●
G	HP terminal box (G1/2)			●	●	●	●	●
H	HP terminal box with lamp (G1/2)			●	●	●	●	●*5
J	Lead wire (300 mm)	Surge With absorber	●	●	●	●	●*4	
K	With DIN terminal box (Pg11)		●*2	●	●	●	●	
L	DIN terminal box with lamp (Pg11)		●*2	●	●	●	●	
M	Conduit (G1/2)			●	●	●	●	*6
P	Conduit (CTC19)			●	●	●	●	
Q	HP terminal box (G1/2)			●	●	●	●	
R	HP terminal box with lamp (G1/2)			●	●	●	●	
S	DIN coil without terminal box		●	●	●	●	●*7	●*6

*1: Coil option "B" cannot be selected when the valve size of ❶ is "2".
*2: When the valve size of ❶ is "2", the DIN terminal box thread size is Pg9.
*3: Use "L" DIN terminal box with lamp/surge suppressor
*4: The surge suppressor of the DC voltage coil option "J" is included with product.
*5: When the coil option is "H", the rated voltage "K" (230 VAC) cannot be selected.
*6: All AC voltages are equipped with a full-wave rectifier circuit. For this reason, a surge suppressor is not available.
*7: Surge suppressor is not available. Use the terminal box with surge suppressor.

❽ Rated voltage

1	100 VAC 50/60 Hz
2	200 VAC 50/60 Hz
3	24 VDC
4	12 VDC
5	110 VAC 50/60 Hz
6	220 VAC 50/60 Hz
K	230 VAC 50/60 Hz

❾ Option *1

Blank	No	
B	Mounting plate①	*2
M	Mounting plate②	*3, *4
P	Panel mounting plate	

*1: Mounting plate and panel mounting plate are included with the product. Refer to the precautions on page 56 for tightening torque.
*2: Mounting plate ① is compatible with our product FAB or FWB Series.
*3: Not available when the valve size of ❶ is "2".
*4: Mounting plate ② is compatible with our product AB Series.


B: Mounting plate①


M: Mounting plate②


P: Panel mounting plate

Coil option code

A(DC) J		Grommet lead wire 300 mm Grommet lead wire 300 mm/ With surge suppressor
A(AC)		Grommet lead wire 300 mm
B C K		DIN terminal box DIN terminal box with surge suppressor
D L		DIN terminal box with lamp DIN terminal box / lamp, With surge suppressor
G Q		HP terminal box HP terminal box with surge suppressor
H R		HP terminal box with lamp HP terminal box / lamp, With surge suppressor
E F M P		Conduit (G1/2) Conduit (CTC19) Conduit (G1/2) with surge suppressor Conduit (CTC19) with surge suppressor
S		DIN coil without terminal box

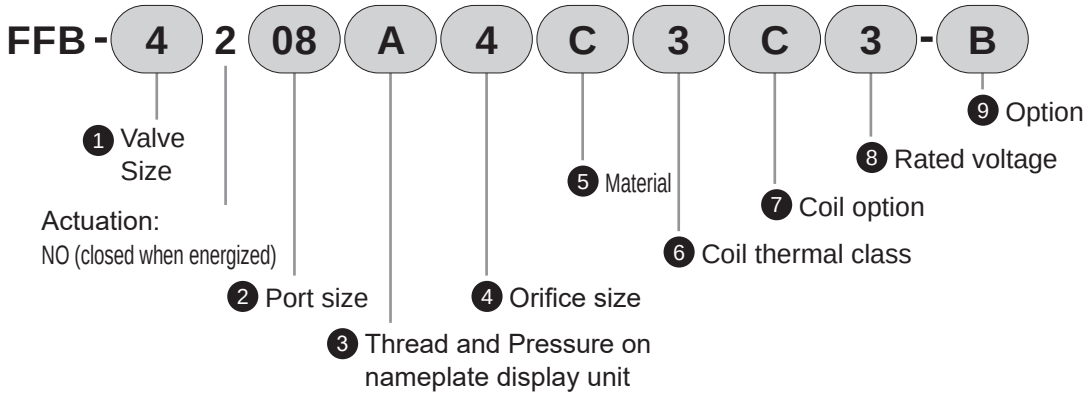
How to order mounting plate

With body mounting screw

	Mounting plate code: B	Mounting plate code: M	Mounting plate code: P
FFB-21	FFB-21-B-MOUNT-PLATE-KIT	No setting	FFB-21-P-MOUNT-PLATE-KIT
FFB-31	FFB-31-B-MOUNT-PLATE-KIT	FFB-31-M-MOUNT-PLATE-KIT	FFB-31-P-MOUNT-PLATE-KIT
FFB-41	FFB-41-B-MOUNT-PLATE-KIT	FFB-31-M-MOUNT-PLATE-KIT	FFB-31-P-MOUNT-PLATE-KIT
FFB-51	FFB-51-B-MOUNT-PLATE-KIT (Aluminum body) FFB-41-B-MOUNT-PLATE-KIT (brass, stainless steel body)	FFB-51-M-MOUNT-PLATE-KIT	FFB-51-P-MOUNT-PLATE-KIT

How to order

● NO (closed when energized)



1 Valve size

		Valve size 3	4	5
3	Width 30 mm	●		
4	Width 35 mm		●	
5	Width 40 mm			●

2 Port size

		Valve size 3	4	5
06	1/8	●		
08	1/4	●	●	●
10	3/8		●	●

3 Thread and pressure unit indicated on nameplate

	Thread	Pressure display unit	
A	Rc thread	MPa	
B	G thread	bar	
C	NPT thread	psi	*1
D	G thread	MPa	*2
E	NPT thread	MPa	*2

*1: In compliance with the Measurement Act, the psi display cannot be used in Japan.
*2: "D", "E" is a selection to display the pressure display unit as MPa even with G threads and NPT threads mainly in Japan.

4 Orifice size

		Valve size 3	4	5
2	ø2	●		
3	ø3	●	●	
4	ø4		●	●
5	ø5	●		●
7	ø7		●	●

5 Material

	Body	Seal	Treatment	Working fluid
A	Aluminum	NBR	-	Compressed air / dry air
C	Brass	NBR		Compressed air / Dry air / Water / Oil / Low vacuum *1
D		FKM		Compressed air / Dry air / Water / Oil / Low vacuum *1
H	Stainless steel	NBR		Compressed air / Dry air / Water / Oil / Low vacuum *1
J		FKM		Compressed air / Dry air / Water / Oil / Low vacuum *1
N	Brass	NBR	Oil-prohibited	Compressed air / Dry air / Water / Oil / Low vacuum *1
P		FKM		Compressed air / Dry air / Water / Oil / Low vacuum *1
Q		EPDM		Water
S	Stainless steel	NBR		Compressed air / Dry air / Water / Oil / Low vacuum *1
T		FKM		Compressed air / Dry air / Water / Oil / Low vacuum *1
U		EPDM		Water

*1: Low vacuum [1.33 × 10^2 Pa (abs)] can be used, but valve seat leakage is 0.2 cm^3/min (ANR) or less. (Valve seat leakage at positive pressure) When used in a low vacuum, the lower limit of operating pressure is 1.33 x 10^2 Pa (abs), so the upper limit is 0.1 MPa lower.

6 Coil thermal class

3	Class 130 (B)

⑦ Coil option

			① Valve size			Voltage	
			3	4	5	DC	AC
A	Lead wire (300 mm)		●	●	●	●	●
B	With DIN terminal box (G1/2)		●	●	●	●	●
C	With DIN terminal box (Pg11)		●	●	●	●	●
D	DIN terminal box with lamp (Pg11)		●	●	●	*1	●
E	Conduit (G1/2)		●	●	●	●	●
F	Conduit (CTC19)		●	●	●	●	●
G	HP terminal box (G1/2)		●	●	●	●	●
H	HP terminal box with lamp (G1/2)		●	●	●	●	●*3
J	Lead wire (300 mm)	Surge With absorber	●	●	●	●*2	*4
K	With DIN terminal box (Pg11)		●	●	●	●	
L	DIN terminal box with lamp (Pg11)		●	●	●	●	
M	Conduit (G1/2)		●	●	●	●	
P	Conduit (CTC19)		●	●	●	●	
Q	HP terminal box (G1/2)		●	●	●	●	
R	HP terminal box with lamp (G1/2)		●	●	●	●	
S	DIN coil without terminal box		●	●	●	●*5	●*4

*1: Use "L" DIN terminal box with lamp/surge suppressor
*2: The surge suppressor of the DC voltage coil option "J" is included with product.
*3: When the coil option is "H", the rated voltage "K" (230 VAC) cannot be selected.
*4: All AC voltages are equipped with a full-wave rectifier circuit. For this reason, a surge suppressor is not available.
*5: Surge suppressor is not available. Use the terminal box with surge suppressor.

⑧ Rated voltage

1	100 VAC 50/60 Hz
2	200 VAC 50/60 Hz
3	24 VDC
4	12 VDC
5	110 VAC 50/60 Hz
6	220 VAC 50/60 Hz
K	230 VAC 50/60 Hz

⑨ Option *1

Blank	No
B	Mounting plate①

*1: Mounting plate is included with the product. Refer to the precautions on page 56 for tightening torque.

Aluminum body

B: Mounting plate①

Brass / stainless steel body

B: Mounting plate①

Coil option code

A(DC) J		Grommet lead wire 300 mm Grommet lead wire 300 mm/ With surge suppressor
A(AC)		Grommet lead wire 300 mm
B C K		DIN terminal box DIN terminal box with surge suppressor
D L		DIN terminal box with lamp DIN terminal box / lamp, With surge suppressor
G Q		HP terminal box HP terminal box with surge suppressor
H R		HP terminal box with lamp HP terminal box / lamp, With surge suppressor
E F M P		Conduit (G1/2) Conduit (CTC19) Conduit (G1/2) with surge suppressor Conduit (CTC19) with surge suppressor
S		DIN coil without terminal box

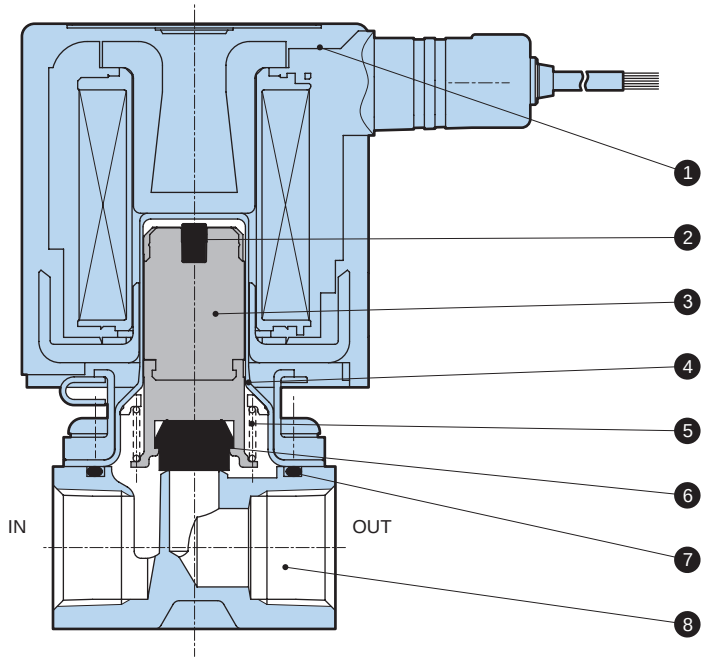
How to order mounting plate

With body mounting screw

	Mounting plate code: B	
	Aluminum body	Brass, stainless steel body
FFB-32	FFB-31-B-MOUNT-PLATE-KIT	FFG-31-B-MOUNT-PLATE-KIT
FFB-42	FFB-41-B-MOUNT-PLATE-KIT	FFG-41-B-MOUNT-PLATE-KIT
FFB-52	FFB-51-B-MOUNT-PLATE-KIT	

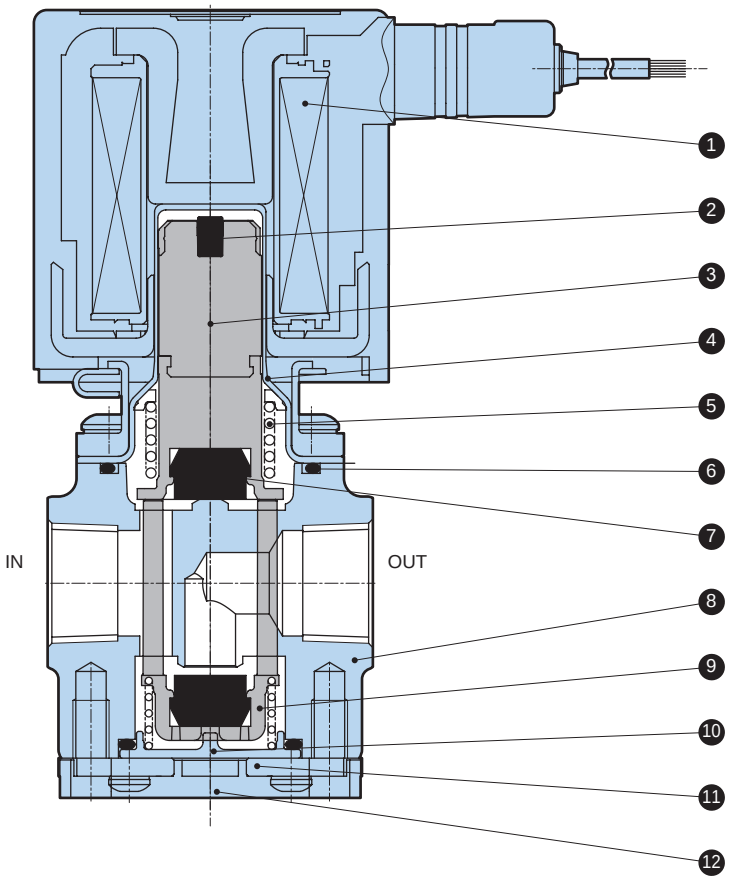
Internal structure / Material

● FFB-*1 Series: NC



Part No.	Name	Material	
1	Coil assembly	-	
2	Noise dampening rubber	HNBR (FKM,EPDM)	Hydrogenated nitrile rubber (fluoro rubber, ethylene propylene rubber)
3	Plunger	SUS,PPS	Stainless steel, polyphenylene sulfide
4	Flare pipe assembly	SUS,PPS	Stainless steel, polyphenylene sulfide
5	Plunger spring	SUS304	Stainless steel
6	Seal	NBR(FKM,EPDM)	Nitrile rubber (fluoro rubber, ethylene propylene rubber)
7	O-ring	NBR(FKM,EPDM)	Nitrile rubber (fluoro rubber, ethylene propylene rubber)
8	Body	Brass (ADC, SCS13)	Brass (aluminum die-casting, stainless steel)

● FFB-*2 Series: NO (Normally open)

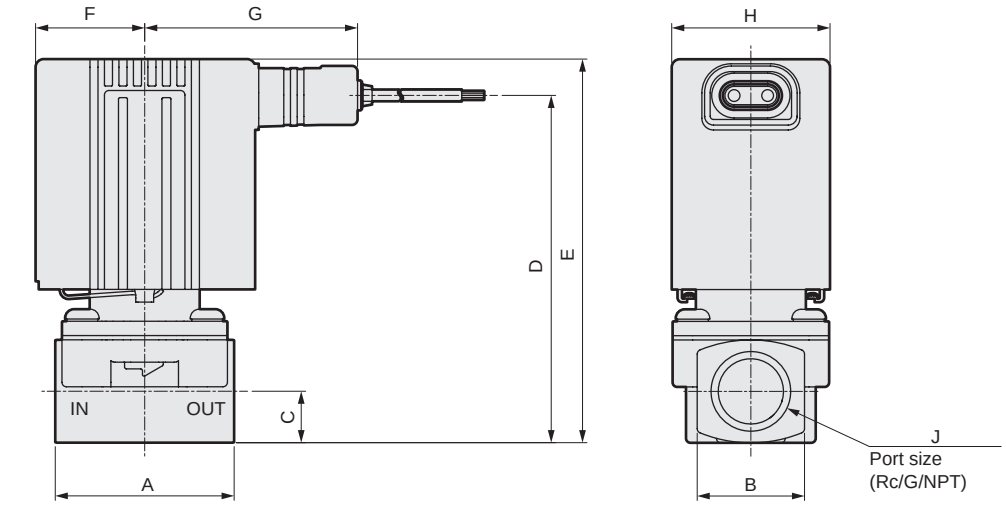


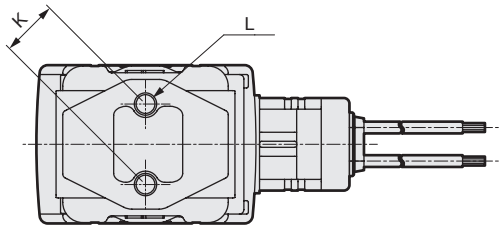
Part No.	Name	Material	
1	Coil assembly	-	
2	Noise dampening rubber	HNBR (FKM,EPDM)	Hydrogenated nitrile rubber (fluoro rubber, ethylene propylene rubber)
3	Plunger	SUS,PPS	Stainless steel, polyphenylene sulfide
4	Flare pipe assembly	SUS,PPS	Stainless steel, polyphenylene sulfide
5	Plunger spring	SUS304	Stainless steel
6	O-ring	NBR(FKM,EPDM)	Nitrile rubber (fluoro rubber, ethylene propylene rubber)
7	Seal	NBR(FKM,EPDM)	Nitrile rubber (fluoro rubber, ethylene propylene rubber)
8	Body	Brass (ADC, SCS13)	Brass (aluminum die-casting, stainless steel)
9	Valving element guide	PPS	Polyphenylene sulfide
10	NO cover	PPS	Polyphenylene sulfide
11	Covers A, B *1	SUS304	Stainless steel
12	Cover A lid *2	POM	Polyacetal

*1: Body material is brass, stainless steel for cover A, aluminum for cover B
*2: Only for brass and stainless steel body

Dimensions FFB-*1 Series: NC

● Lead wire / DC voltage Coil option code: A / J

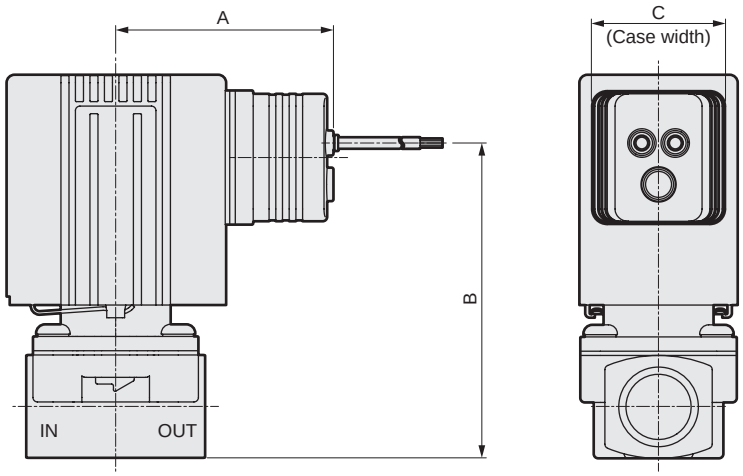




	Port size	Thread depth
FFB-21	G1/8	7.4
FFB-31	G1/8	8.5
	G1/4	10.5
FFB-41	G1/4	12.5
FFB-51	G3/8	11.4
FFB-5110*X (ø10)	G3/8	12.5
FFB-5115	G1/2	15

	A	B	C	D	E	F	G	H	J	K	L
FFB-21	32	17	7.5	54.5	62.5	18.5	42	24	1/8	15	M4 depth 6
FFB-31	36	19	9.5	66.5	74	22	45	30	1/8, 1/4	18	M5 depth 6
FFB-41	40	24	11.5	77.5	86	24.5	47.5	35	1/4, 3/8	18	M5 depth 8
FFB-51	40	24	11.5	86.5	95	27.5	50	40	1/4, 3/8	18	M5 depth 8
FFB-5110*X (ø10) FFB-5115(15A)	50	27	13.5	94.5	102.5	27.5	50	40	3/8,1/2	18	M5 depth 8

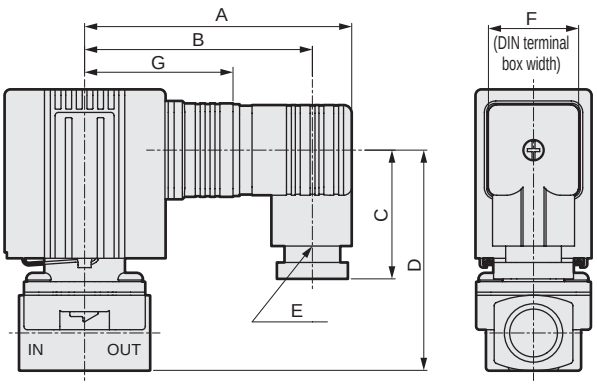
● Lead wire / AC voltage Coil option code: A / J



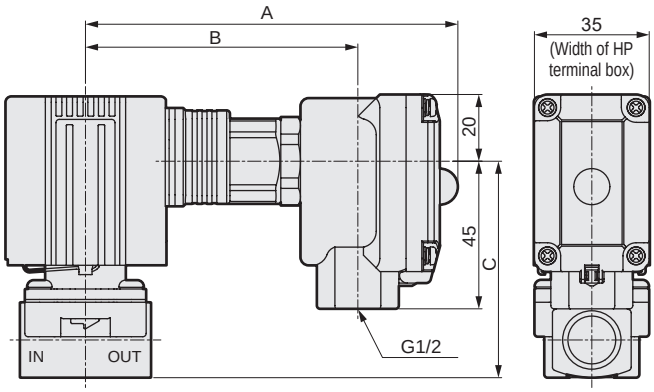
	A	B	C
FFB-21	43	50.5	24
FFB-31	46	59.5	30
FFB-41	48.5	70.5	30
FFB-51	51	79.5	30
FFB-5110*X (ø10) FFB-5115(15A)	51	87.5	30

Option Dimensions FFB-*1 Series: NC

● With DIN terminal box Coil option code: B/C/D/K/L/S
● DIN coil without terminal box



● With HP terminal box Coil option code: G/H/Q/R

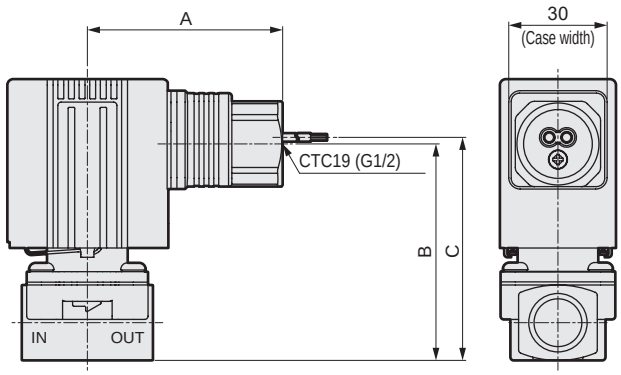


Dimensions shown in ( ) are for G1/2.

	A	B	C	D	E	F	G
FFB-21	73	64	36	47.5	Pg9	21	39
FFB-31	78.5	66.5 (65)	39.5 (41.5)	56	Pg11 (G1/2)	27.5	42
FFB-41	81	69 (67.5)	39.5 (41.5)	67.5	Pg11 (G1/2)	27.5	44.5
FFB-51	83.5	71.5 (70)	39.5 (41.5)	76.5	Pg11 (G1/2)	27.5	47
FFB-5110*X (ø10) FFB-5115(15A)	83.5	71.5 (70)	39.5 (41.5)	84	Pg11 (G1/2)	27.5	47

	A	B	C
FFB-21			
FFB-31	113	82	55
FFB-41	115	85	66
FFB-51	118	87	75
FFB-5110*X (ø10) FFB-5115(15A)	118	87	83

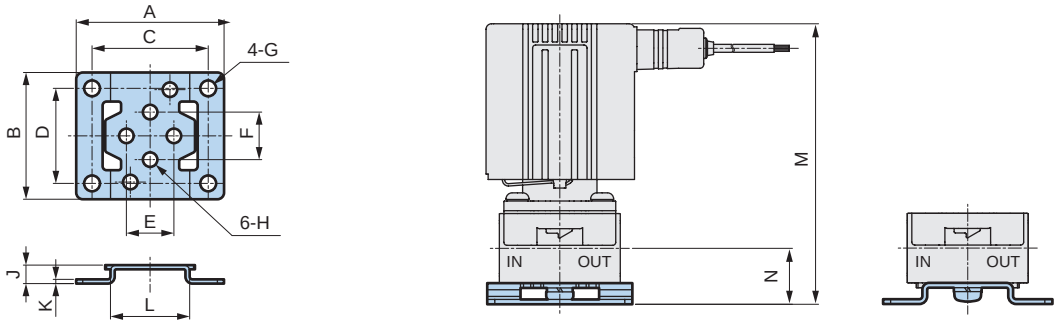
● Conduit Coil option code: E/F/M/P



	A	B	C
FFB-21			
FFB-31	56.5	55	57
FFB-41	59	66	68
FFB-51	61.5	75	77
FFB-5110*X (ø10) FFB-5115(15A)	61.5	83	85

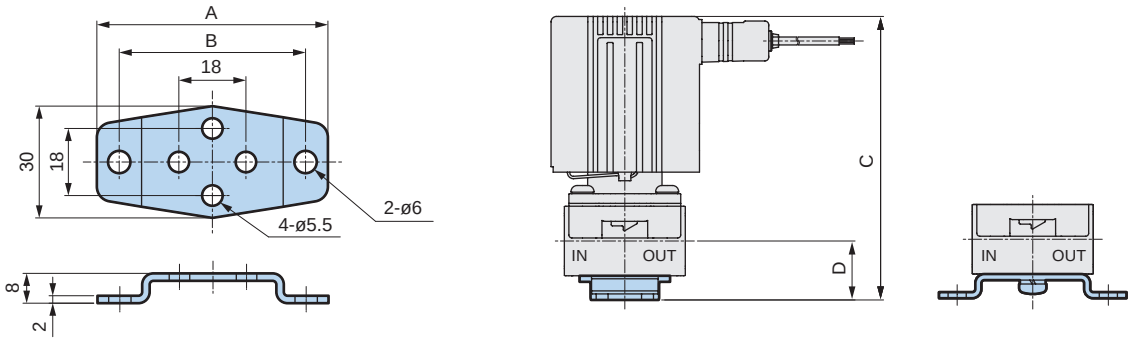
Option Dimensions FFB-*1 Series: NC

● Mounting plate① Option code: B



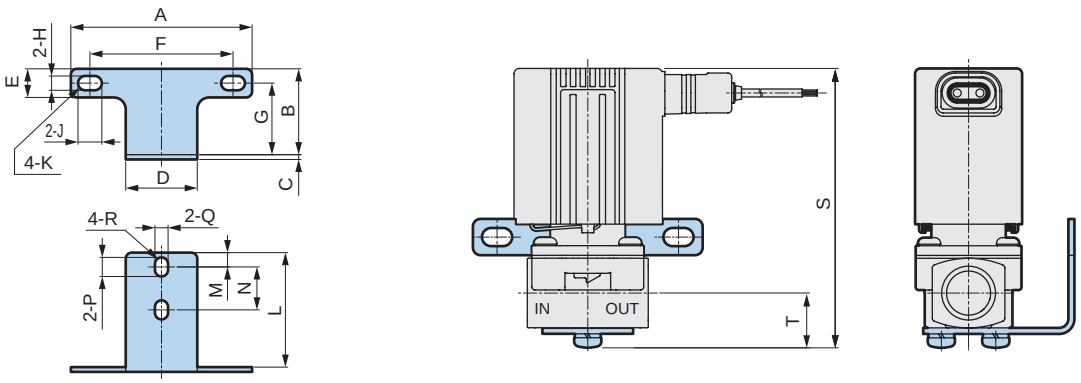
	A	B	C	D	E	F	G	H	J	K	L	M	N
FFB-21	40	34	30	25	15	15	ø5	ø4.5	6	1.2	20	68.5	13.5
FFB-31	52	42	40	30	18	18	ø6	ø5.5	7	1.6	25	81	16.5
FFB-41	56	48	44	36	18	18	ø6	ø5.5	7	1.6	30	93	18.5
FFB-51 Aluminum body	62	50	50	38	18	18	ø6	ø5.5	7	1.6	36	102	18.5
FFB-5110*X (ø10) Aluminum body FFB-5115 (15A) Aluminum body												109.5	20.5
FFB-51 brass / SUS body	56	48	44	36	18	18	ø6	ø5.5	7	1.6	30	102	18.5
FFB-5110*X (ø10) brass / SUS body FFB-5115 (15A) brass / SUS body												109.5	20.5

● Mounting plate② Option code: M



	A	B	C	D
FFB-31	62	50	82	17.5
FFB-41	62	50	94	19.5
FFB-51	70	58	103	19.5
FFB-5110*X (ø10) FFB-5115(15A)			110.5	21.5

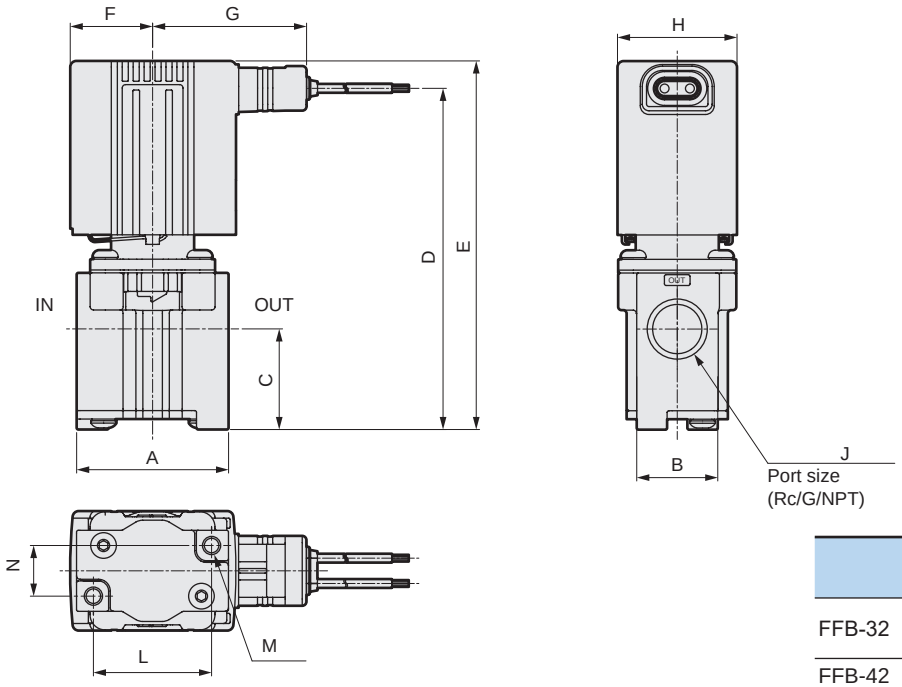
● Panel mounting plate Option code: P



	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T
FFB-21	57	25	1.6	25	10	45	20	5	8	R 2.5	35.4	4.5	15	6	4.5	R2.25	67.5	12.5
FFB-31	66	31	2	30	12	50	25	6	10	R 3	43	6	18	8	5.5	R2.75	80.5	16
FFB-41	66	31	2	30	12	50	25	6	10	R 3	43	6	18	8	5.5	R2.75	92.5	18
FFB-51	76	36	2	30	12	60	30	6	10	R 3	48	6	18	8	5.5	R2.75	101.5	18
FFB-5110*X (ø10) FFB-5115(15A)																	109	20

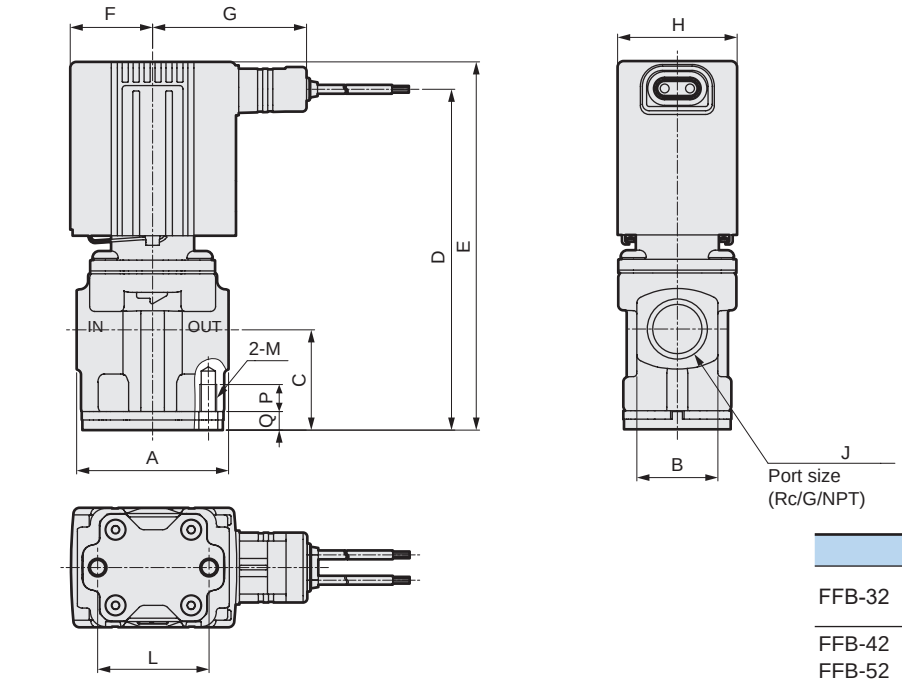
Dimensions FFB-*2 Series: NO (Normally open)

● Lead wire / DC voltage (aluminum body) Coil option code: A / J



	Port size	Thread depth
FFB-32	G1/8	8.5
	G1/4	12.5
FFB-42	G1/4	12.5
FFB-52	G3/8	12.5

● Lead wire / DC voltage (brass body / stainless steel body) Coil option code: A / J

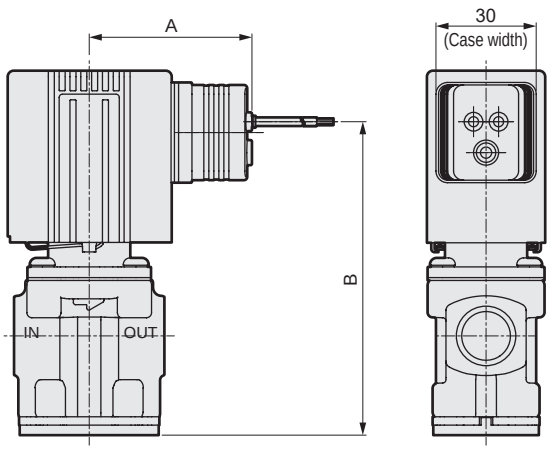


	Port size	Thread depth
FFB-32	G1/8	8.5
	G1/4	12.5
FFB-42	G1/4	12.5
FFB-52	G3/8	12.5

		A	B	C	D	E	F	G	H	J	L	M	N	P	Q
FFB-32	Aluminum body	40	19	26.5	86.5	94	22	45	30	1/8 1/4	32	M5 depth 8	11		
	Brass / SUS body			26	86	93.5					29	M5		6	4.5
FFB-42	Aluminum body	45	24	30	101	109	24.5	47.5	35	1/4 3/8	35	M5 depth 8	15		
	Brass / SUS body										33	M5		8	5.5
FFB-52	Aluminum body	45	24	30	110	118	27.5	50	40	1/4 3/8	35	M5 depth 8	15		
	Brass / SUS body										33	M5		8	5.5

Dimensions FFB-*2 Series: NO (Normally open)

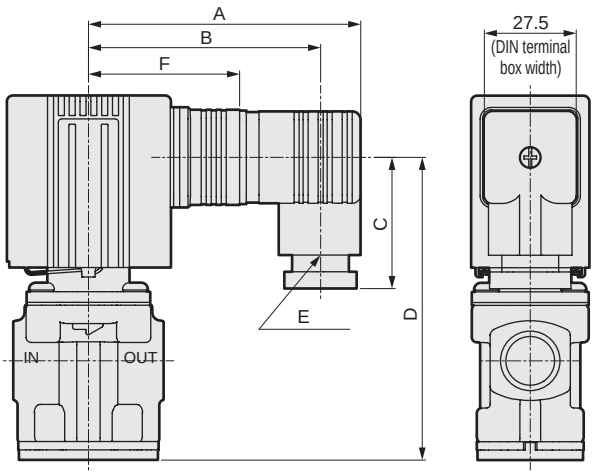
● Lead wire / AC voltage Coil option code: A / J



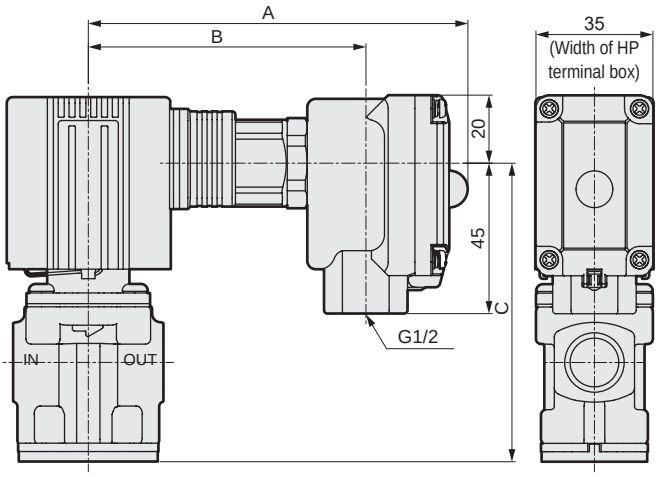
		A	B
FFB-32	Aluminum body	46	79
	Brass / SUS body		78.5
FFB-42	Aluminum body	48.5	94
	Brass / SUS body		
FFB-52	Aluminum body	51	103
	Brass / SUS body		

Option Dimensions FFB-*2 Series: NO (Normally open)

● With DIN terminal box Coil option code: B/C/D/K/L/S
● DIN coil without terminal box



● With HP terminal box Coil option code: G/H/Q/R



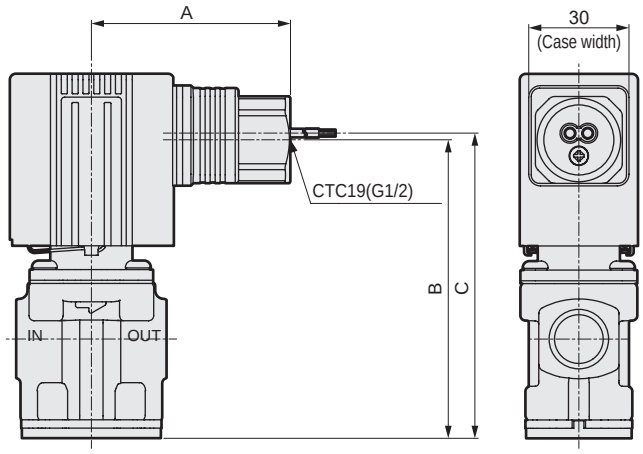
Dimensions shown in ( ) are for G1/2.

		A	B	C	D	E	F
FFB-32	Aluminum body	78.5	66.5 (65)	39.5 (41.5)	76	Pg11 (G1/2)	42
	Brass / SUS body				75.5		
FFB-42	Aluminum body	81	69 (67.5)	39.5 (41.5)	90.5	Pg11 (G1/2)	44.5
	Brass / SUS body						
FFB-52	Aluminum body	83.5	71.5 (70)	39.5 (41.5)	99.5	Pg11 (G1/2)	47
	Brass / SUS body						

		A	B	C
FFB-32	Aluminum body	113	82	74.5
	Brass / SUS body			74
FFB-42	Aluminum body	115	85	89.5
	Brass / SUS body			
FFB-52	Aluminum body	118	87	98.5
	Brass / SUS body			

Option Dimensions FFB-*2 Series: NO (Normally open)

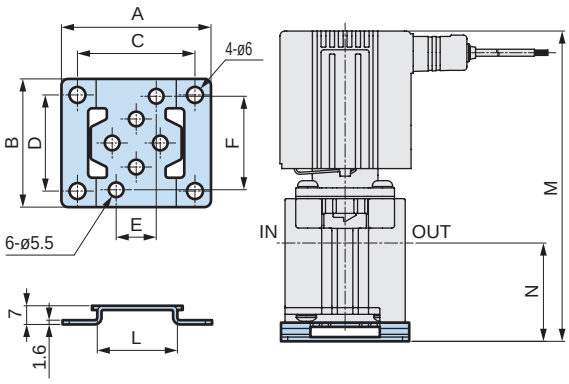
● Conduit Coil option code: E/F/M/P



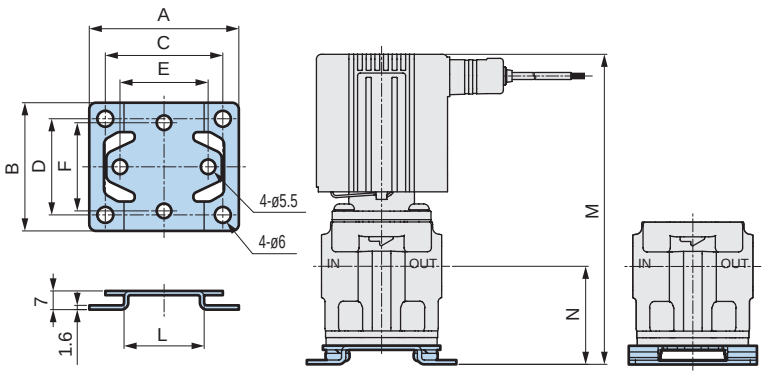
		A	B	C
FFB-32	Aluminum body	56.5	74.5	76.5
	Brass / SUS body		74	76
FFB-42	Aluminum body	59	89.5	91.5
	Brass / SUS body			
FFB-52	Aluminum body	61.5	98.5	100.5
	Brass / SUS body			

● Mounting plate① Option code: B

Aluminum body



Brass / SUS body



		A	B	C	D	E	F	L	M	N
FFB-32	Aluminum body	52	42	40	30	11	32	25	101	33.5
	Brass / SUS body					29	29	26	100.5	33
FFB-42	Aluminum body	56	48	44	36	15	35	30	116	37
	Brass / SUS body					33	33			
FFB-52	Aluminum body	62	50	50	38	15	35	36	125	37
	Brass / SUS body	56	48	44	36	33	33	30		

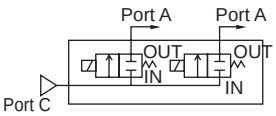
Direct acting 2-port solenoid valve, manifold

FFBM Series

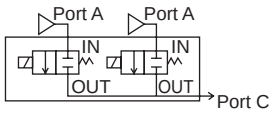
- NC (Normally Closed)
- Port size: Rc, G, NPT 1/8 / 1/4

JIS symbol

● FFBM-*1
(Common supply/port C pressurization)



● FFBM-*5
(Individual supply/port A pressurization)



Common specifications

Item	FFBM
Working fluid	Compressed air/water/oil (50mm^2/s or less)/medium vacuum (*2)/dry air
Max. working pressure MPa	1.4 (refer to working pressure in individual specifications.)
Proof pressure (water pressure) MPa	2.1(NC), 1.5(NO)
Fluid temperature °C	-10 to 40 (no freezing)
Ambient temperature °C	-10 to 40
Thermal class	Class 130 (B)
Atmosphere	Place free of corrosive gas and explosive gas
Valve structure	Direct acting poppet structure
Valve seat leakagecm^3/min (ANR)	0.2 or less (air)
Valve seat leakage *1 Pa·m^3/sHe	1.33 x 10^{-6}or less
Mounting orientation	Unrestricted
Degree of protection	IP65

*1: Amount of leakage in medium vacuum.
*2: When using at medium vacuum, vacuum the OUT port side.

Electrical specifications

Item	FFBM-2							FFBM-3						
Rated voltage V	24 DC	12 DC	100 VAC 50/60Hz	110 VAC 50/60Hz	200 VAC 50/60Hz	220 VAC 50/60Hz	230 VAC 50/60Hz	24 DC	12 DC	100 VAC 50/60Hz	110 VAC 50/60Hz	200 VAC 50/60Hz	220 VAC 50/60Hz	230 VAC 50/60Hz
Voltage fluctuation range	±10%							±10%						
Power consumption W	3.5	3.5	-	-	-	-	-	4.5	4.5	-	-	-	-	-
Apparent power VA	-	-	5.1	5.7	6.0	5.3	5.7	-	-	6.2	6.1	6.2	6.2	6.5
Item	**FFBM-4**							**FFBM-5**						
Rated voltage V	24 DC	12 DC	100 VAC 50/60Hz	110 VAC 50/60Hz	200 VAC 50/60Hz	220 VAC 50/60Hz	230 VAC 50/60Hz	24 DC	12 DC	100 VAC 50/60Hz	110 VAC 50/60Hz	200 VAC 50/60Hz	220 VAC 50/60Hz	230 VAC 50/60Hz
Voltage fluctuation range	±10%							±10%						
Power consumption W	7	7	-	-	-	-	-	10.5	10.5	-	-	-	-	-
Apparent power VA	-	-	8.6	10	9.6	9.5	9.4	-	-	13	13	14	14	13

The leakage current must be less than or equal to the values shown below.

Voltage	AC					DC	
	100V	110V	200V	220V	230V	12V	24V
Leakage current	2 mA or less		1 mA or less			5 mA or less	

Individual specifications

Item / Model No.	Port size Rc/G/NPT Port A	Port size Rc/G/NPT Port C	Orifice size (mm)	Working pressure (MPa) *1	Working pressure Pa (abs) *2	Flow Rate Characteristics C[dm³/(s·bar)]	Flow Rate Characteristics b	Flow Rate Characteristics Cv
NC (Normally Closed)								
FFBM-2$^{1}_{5}$ 06 * S	1/8	1/4	1.5	0 to 1.0	1.3×10^{-2} to 1×10^{6}	0.30	0.48	0.085
FFBM-2$^{1}_{5}$ 06 * 2	1/8	1/4	2	0 to 0.6	1.3×10^{-2} to 0.6×10^{6}	0.52	0.39	0.12
FFBM-3$^{1}_{5}$ 08 * 2	1/4	3/8	2	0 to 1.4	1.3×10^{-2} to 1.4×10^{6}	0.55	0.42	0.12
FFBM-3$^{1}_{5}$ 08 * 3	1/4	3/8	3	0 to 0.6	1.3×10^{-2} to 0.6×10^{6}	1.1	0.25	0.23
FFBM-3$^{1}_{5}$ 08 * 5	1/4	3/8	5	0 to 0.2	1.3×10^{-2} to 0.2×10^{6}	1.8	0.11	0.45
FFBM-4$^{1}_{5}$ 08 * 4	1/4	3/8	4	0 to 1.0	1.3×10^{-2} to 1×10^{6}	1.7	0.11	0.42
FFBM-4$^{1}_{5}$ 08 * 7	1/4	3/8	7	0 to 0.15	1.3×10^{-2} to 0.15×10^{6}	3.3	0.11	0.73
FFBM-5$^{1}_{5}$ 08 * 5	1/4	3/8	5	0 to 0.8	1.3×10^{-2} to 0.8×10^{6}	2.3	0.10	0.55
FFBM-5$^{1}_{5}$ 08 * 7	1/4	3/8	7	0 to 0.3	1.3×10^{-2} to 0.3×10^{6}	3.3	0.11	0.73

*1: Although it can be used with low vacuum [1.33×10^{2} Pa (abs)], valve seat leakage is 0.2 cm^3/min (ANR) or less. (Valve seat leakage at positive pressure)
When used in a low vacuum, the lower limit of operating pressure is 1.33×10^{2} Pa (abs), so the upper limit is 0.1 MPa lower.
*2: Working pressure at medium vacuum.

Weight

●Body material: Aluminum

Model No.	Weight (kg) Actuator only	2 stations	3 stations	4 stations	5 stations	6 stations	7 stations	8 stations	9 stations	10 stations
FFBM-2	0.16	0.4	0.6	0.7	0.9	1.1	1.3	1.5	1.7	1.8
FFBM-3	0.27	0.7	1.0	1.3	1.7	2.0	2.3	2.6	3.0	3.3
FFBM-4	0.41	1.0	1.5	2.0	2.5	3.0	3.5	3.9	4.4	4.9
FFBM-5	0.60	1.4	2.1	2.8	3.5	4.2	4.9	5.6	6.3	7.0

*2: Weight of aluminum sub-plate 24 VDC lead wire.

●Body material: brass / stainless steel

Model No.	Weight (kg) Actuator only	2 stations	3 stations	4 stations	5 stations	6 stations	7 stations	8 stations	9 stations	10 stations
FFBM-2	0.2	0.9	1.3	1.8	2.0	2.5	2.9	3.3	3.8	4.0
FFBM-3	0.35	1.4	2.0	2.9	3.2	4.1	4.7	5.3	6.2	6.5
FFBM-4	0.5	2.0	2.8	4.0	4.5	5.7	6.5	7.4	8.6	9.1
FFBM-5	0.7	2.5	3.5	5.0	5.7	7.1	8.2	9.3	10.7	11.5

*3: Weight of brass sub-plate 24 VDC lead wire.

How to order

FFBM - 4 1 08 A 4 05 C 3 C 3

1 Valve Size
2 Actuation
3 Port size (port A)
4 Thread and pressure unit indicated on nameplate
5 Orifice size
6 Manifold station No.
7 Material
8 Coil thermal class
9 Coil option
10 Rated voltage

1 Valve size

		Valve size 2	3	4	5
2	Width 24 mm	●			
3	Width 30 mm		●		
4	Width 35 mm			●	
5	Width 40 mm				●

2 Actuation

1	NC (open when energized) common supply
5	NC (open when energized) individual supply

3 Port size (port A)

		Valve size 2	3	4	5
06	1/8	●			
08	1/4		●	●	●
00	Actuator only	●	●	●	●

4 Thread and pressure unit indicated on nameplate

	Thread	Pressure display unit	
A	Rc thread	MPa	
B	G thread	bar	
C	NPT thread	psi	*2
D	G thread	MPa	*3
E	NPT thread	MPa	*3

*1: 3 For "00" actuator only, there is no thread. Therefore, select "A" (MPa), "B" (bar), "C" (psi) for the pressure display unit.
*2: In compliance with the Measurement Act, the psi display cannot be used in Japan.
*3: "D", "E" is a selection to display the pressure display unit as MPa even with G threads and NPT threads mainly in Japan.

5 Orifice size

		Valve size 2	3	4	5
S	ø1.5	●			
2	ø2	●	●		
3	ø3		●		
4	ø4			●	
5	ø5		●		●
7	ø7			●	●

6 Manifold station No.

02 to 09	2 stations to 9 stations
10	10 stations
00	Actuator only

7 Material

	Body and sub-plate	Seal	Treatment	Working fluid
A	Aluminum	NBR	-	Compressed air / dry air
C	Brass	NBR	-	Compressed air / Dry air / Water / Oil / Low vacuum *1
D	Brass	FKM	-	Compressed air / Dry air / Water / Oil / Low vacuum *1
G	Brass	FKM	Vacuum inspection	Compressed air / Dry air / Medium vacuum *2
H	Stainless steel	NBR	-	Compressed air / Dry air / Water / Oil / Low vacuum *1
J	Stainless steel	FKM	-	Compressed air / Dry air / Water / Oil / Low vacuum *1
M	Stainless steel	FKM	Vacuum inspection	Compressed air / Dry air / Medium vacuum *2
N	Brass	NBR	Oil-prohibited	Compressed air / Dry air / Water / Oil / Low vacuum *1
P	Brass	FKM	Oil-prohibited	Compressed air / Dry air / Water / Oil / Low vacuum *1
Q	Brass	EPDM	Oil-prohibited	Water
S	Stainless steel	NBR	Oil-prohibited	Compressed air / Dry air / Water / Oil / Low vacuum *1
T	Stainless steel	FKM	Oil-prohibited	Compressed air / Dry air / Water / Oil / Low vacuum *1
U	Stainless steel	EPDM	Oil-prohibited	Water

*1: Although it can be used with low vacuum [1.33×10^2 Pa (abs)], valve seat leakage is 0.2 cm^3/min (ANR) or less. (Valve seat leakage at positive pressure) When used in a low vacuum, the lower limit of operating pressure is 1.33×10^2 Pa (abs), so the upper limit is 0.1 MPa lower.
*2: 2 cannot be selected when Actuation is "1".

❽ Coil thermal class

3	Class 130 (B)

❾ Coil option

			❶ Valve size				Voltage	
			2	3	4	5	DC	AC
A	Lead wire (300 mm)		●	●	●	●	●	●
B	With DIN terminal box (G1/2)		*1	●	●	●	●	●
C	With DIN terminal box (Pg11)		●*2	●	●	●	●	●
D	DIN terminal box with lamp (Pg11)		●*2	●	●	●	*4	●
E	Conduit (G1/2)			●	●	●	●	●
F	Conduit (CTC19)			●	●	●	●	●
G	HP terminal box (G1/2)			●*3	●	●	●	●
H	HP terminal box with lamp (G1/2)			●*3	●	●	●	●*6
J	Lead wire (300 mm)	Surge With absorber	●	●	●	●	●*5	*7
K	With DIN terminal box (Pg11)		●*2	●	●	●	●	
L	DIN terminal box with lamp (Pg11)		●*2	●	●	●	●	
M	Conduit (G1/2)			●	●	●	●	
P	Conduit (CTC19)			●	●	●	●	
Q	HP terminal box (G1/2)			●*3	●	●	●	
R	HP terminal box with lamp (G1/2)			●*3	●	●	●	
S	DIN coil without terminal box		●	●	●	●	●*8	●*7

*1: "B" coil option is not available when the valve size of ❶ is "2".
*2: When the valve size of ❶ is "2", the DIN terminal box thread size is Pg9.
*3: When the material of ❼ is "A" aluminum body, the HP terminal box cannot be selected.
*4: Use "L" DIN terminal box with lamp/surge suppressor.
*5: The surge suppressor of the DC voltage coil option "J" is included.
*6: When the coil option is "H", the rated voltage "K" (230 VAC) cannot be selected.
*7: All AC voltages are equipped with a full-wave rectifier circuit. For this reason, a surge suppressor is not available.
*8: Surge suppressor is not available. Use the terminal box with surge suppressor.

❿ Rated voltage

1	100 VAC 50/60 Hz
2	200 VAC 50/60 Hz
3	24 VDC
4	12 VDC
5	110 VAC 50/60 Hz
6	220 VAC 50/60 Hz
K	230 VAC 50/60 Hz

⚠ How to order

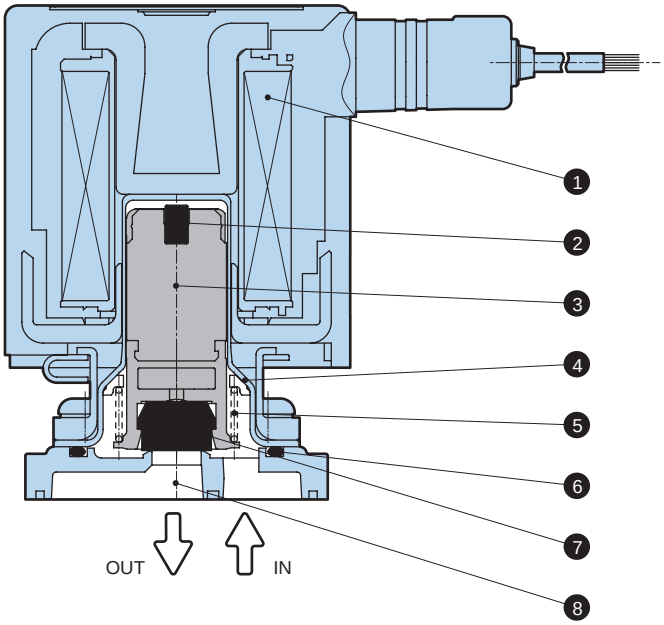
Masking plate orders are also available.
Refer to How to order on pages 21 and 25.

Coil option code

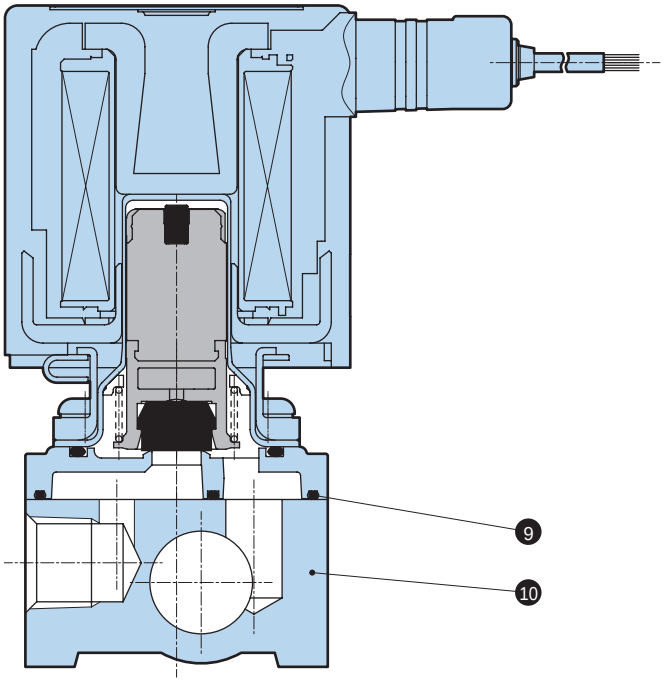
A(DC) J		Grommet lead wire 300 mm Grommet lead wire 300 mm/ With surge suppressor
A(AC)		Grommet lead wire 300 mm
B C K		DIN terminal box DIN terminal box with surge suppressor
D L		DIN terminal box with lamp DIN terminal box / lamp, With surge suppressor
G Q		HP terminal box HP terminal box with surge suppressor
H R		HP terminal box with lamp HP terminal box / lamp, With surge suppressor
E F M P		Conduit (G1/2) Conduit (CTC19) Conduit (G1/2) with surge suppressor Conduit (CTC19) with surge suppressor
S		DIN coil without terminal box

Internal structure / Material Aluminum body

● FFBM actuator



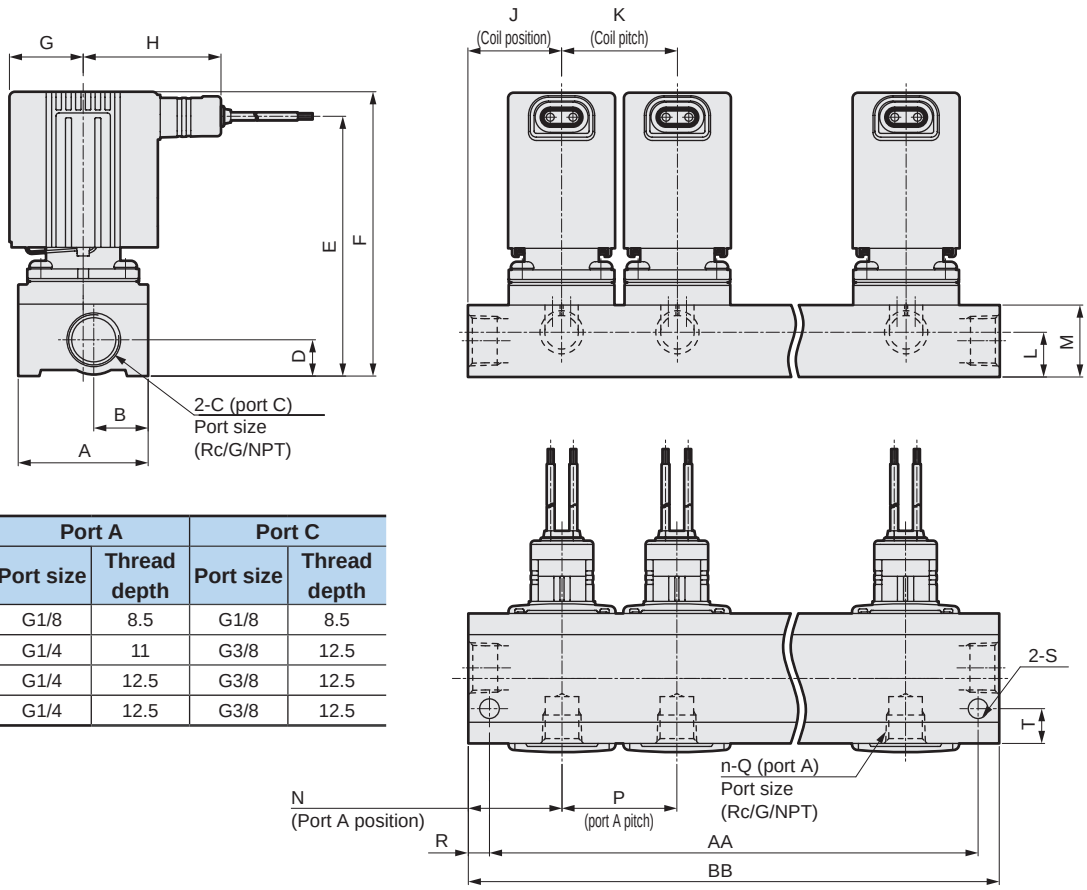
● FFBM manifold



Part No.	Name	Material	
1	Coil assembly	-	
2	Noise dampening rubber	HNBR	Hydrogenated nitrile rubber
3	Plunger	SUS,PPS	Stainless steel, polyphenylene sulfide
4	Flare pipe assembly	SUS,PPS	Stainless steel, polyphenylene sulfide
5	Plunger spring	SUS304	Stainless steel
6	O-ring	NBR	Nitrile rubber
7	Seal	NBR	Nitrile rubber
8	Body	ADC	Aluminum die-casting
9	Gasket	NBR	Nitrile rubber
10	Sub-plate	A6063	Aluminum

Dimensions aluminum body

● Manifold lead wire / DC voltage Coil option code: A / J



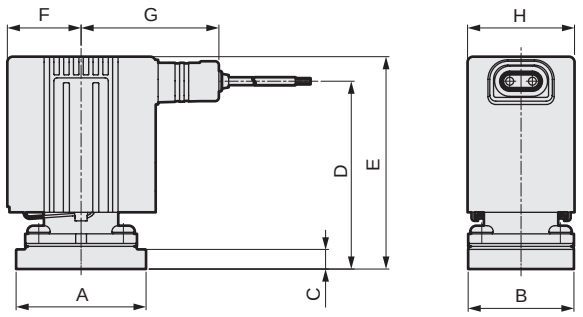
	Port A		Port C	
	Port size	Thread depth	Port size	Thread depth
FFBM-2	G1/8	8.5	G1/8	8.5
FFBM-3	G1/4	11	G3/8	12.5
FFBM-4	G1/4	12.5	G3/8	12.5
FFBM-5	G1/4	12.5	G3/8	12.5

	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T
FFBM-2	30	12	1/8	8	64.5	72.5	18.5	42	21	26	8	16	25	26	1/8	5	ø4.5	9
FFBM-3	36	13	3/8	12	79	87	22	45	28	32	15	24	34.5	32	1/4	7	ø6.5	10
FFBM-4	43	18	3/8	12	86	94	24.5	47.5	31	38	15	24	31	38	1/4	7	ø6.5	11.5
FFBM-5	43	18	3/8	12	95	103	27.5	50	34	46	15	24	34	46	1/4	7	ø6.5	11.5

	Station No. / Code	2	3	4	5	6	7	8	9	10
FFBM-2	AA	58	84	110	136	162	188	214	240	266
	BB	68	94	120	146	172	198	224	250	276
FFBM-3	AA	74	106	138	170	202	234	266	298	330
	BB	88	120	152	184	216	248	280	312	344
FFBM-4	AA	86	124	162	200	238	276	314	352	390
	BB	100	138	176	214	252	290	328	366	404
FFBM-5	AA	100	146	192	238	284	330	376	422	468
	BB	114	160	206	252	298	344	390	436	482

Dimensions aluminum body

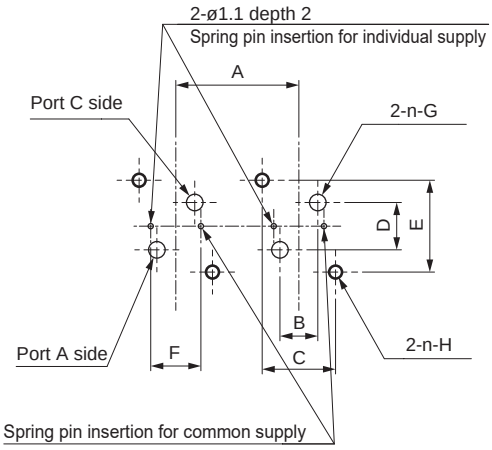
● Actuator lead wire / DC voltage Coil option code: A / J



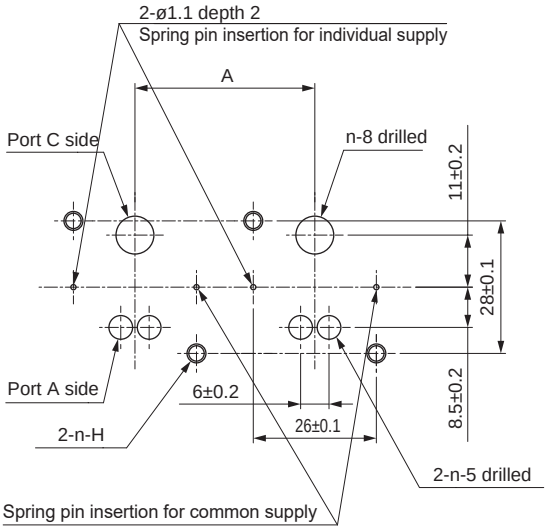
	A	B	C	D	E	F	G	H
FFBM-2	28	22.5	2.5	48.5	57	18.5	42	24
FFBM-3	32.5	29.5	2.5	55.5	63	22	45	30
FFBM-4	43	35	6.5	62	70.5	24.5	47.5	35
FFBM-5	43	35	6.5	71	79.5	27.5	50	40

● Actuator installation dimensions

FFBM-2*, 3*



FFBM-4*, 5*



Note: Machining drawing when using 2 actuators.

	A	B	C	D	E	F	G	H
FFBM-2	26 or more	8±0.15	15.5±0.1	10±0.15	19.4±0.1	10.6±0.1	ø3.5	M3 depth 6 or more
FFBM-3	32 or more	13±0.1	22.4±0.1	11.4±0.1	22.4±0.1	17±0.1	ø5.5	M3 depth 7 or more
FFBM-4	38 or more							M4 depth 7 or more
FFBM-5	46 or more							M4 depth 7 or more

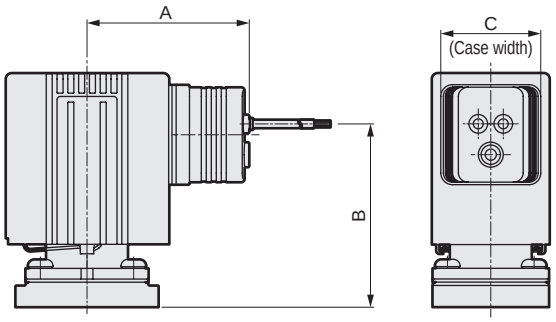
How to order discrete masking plate

O-ring, with mounting screw

	Aluminum body
FFBM-2	FFBM-21A-MP-KIT
FFBM-3	FFBM-31A-MP-KIT
FFBM-4	FFBM-41A-MP-KIT
FFBM-5	FFBM-41A-MP-KIT

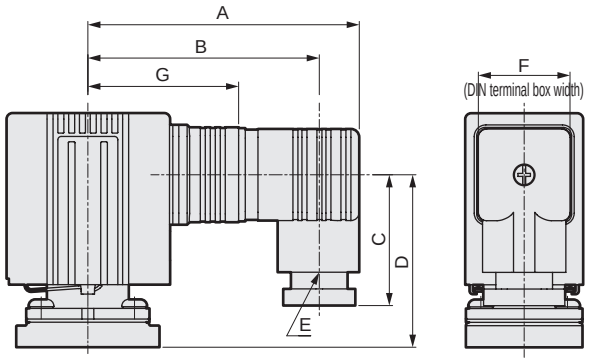
Dimensions aluminum body

Actuator lead wire / AC voltage Coil option code: A / J



	A	B	C
FFBM-2	43	45	24
FFBM-3	46	48.5	30
FFBM-4	48.5	55	30
FFBM-5	51	64	30

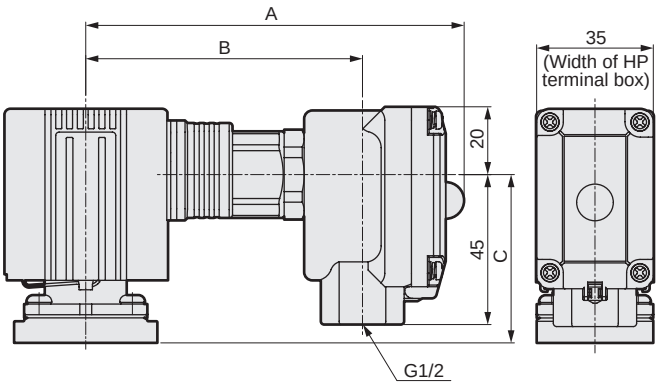
With actuator DIN terminal box Coil option code: B/C/D/K/L/S
Actuator DIN coil without terminal box



Dimensions shown in ( ) are for G1/2.

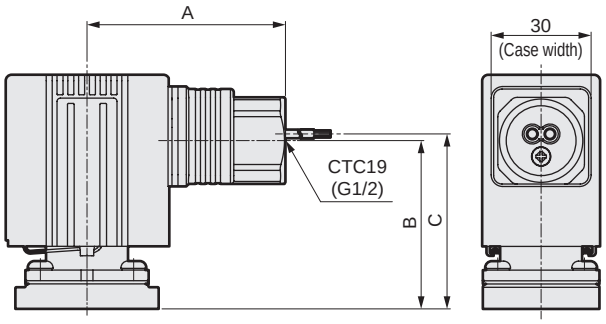
	A	B	C	D	E	F	G
FFBM-2	73	64	36	41.5	Pg9	21	39
FFBM-3	78.5	66.5 (65)	39.5 (41.5)	45	Pg11 (G1/2)	27.5	42
FFBM-4	81	69 (67.5)	39.5 (41.5)	52	Pg11 (G1/2)	27.5	44.5
FFBM-5	83.5	71.5 (70)	39.5 (41.5)	61	Pg11 (G1/2)	27.5	47

With actuator HP terminal box Coil option code: G/H/Q/R



	A	B	C
FFBM-2			
FFBM-3	113	82	44
FFBM-4	115	85	50.5
FFBM-5	118	87	59.5

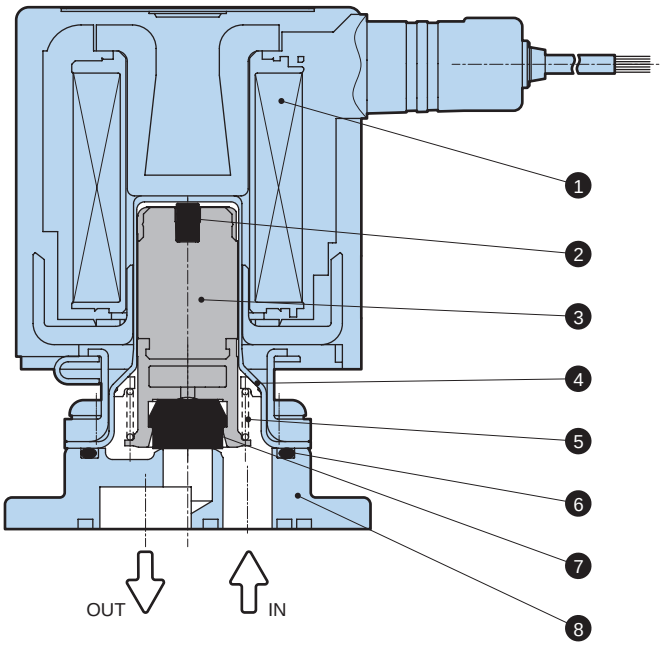
Conduit Coil option code: E/F/M/P



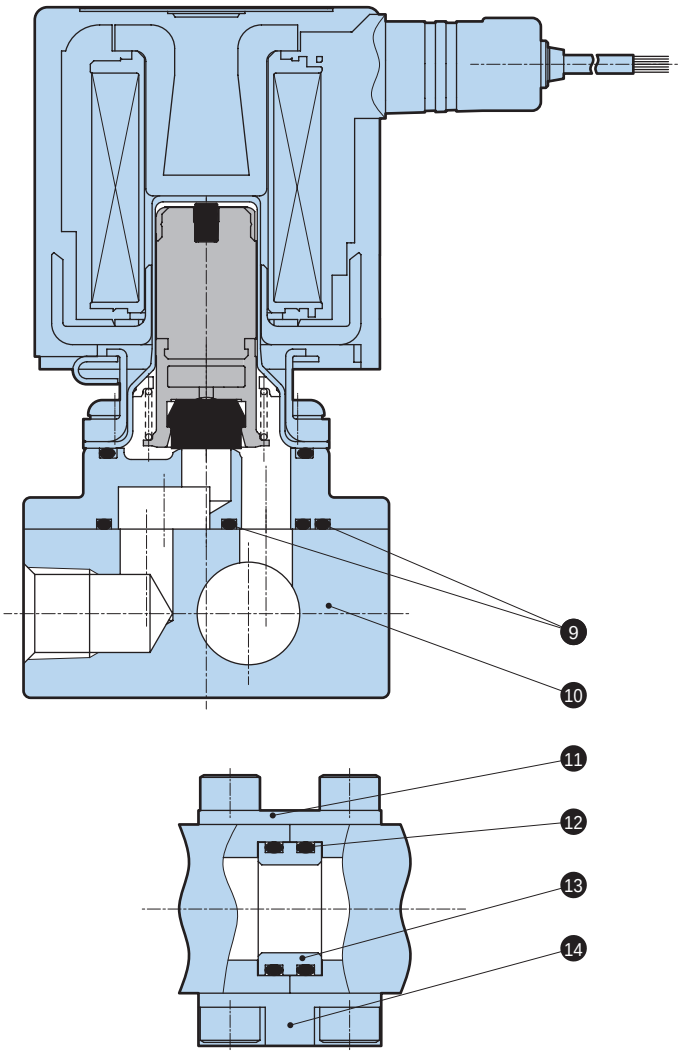
	A	B	C
FFBM-2			
FFBM-3	56.5	44	46
FFBM-4	59	50.5	52.5
FFBM-5	61.5	59.5	61.5

Internal structure / Material brass body / stainless steel body

● FFBM actuator



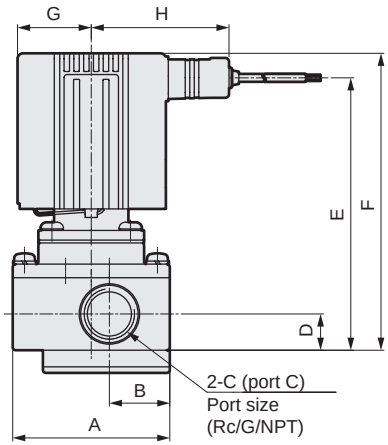
● FFBM manifold

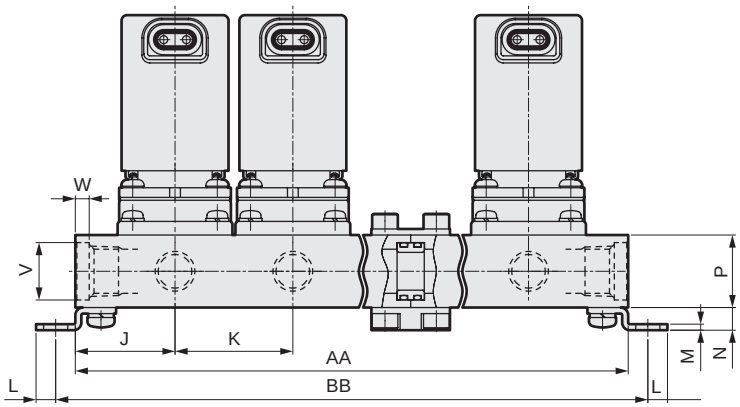


Part No.	Name	Material	
1	Coil assembly	-	
2	Noise dampening rubber	HNBR (FKM,EPDM)	Hydrogenated nitrile rubber (fluoro rubber, ethylene propylene rubber)
3	Plunger	SUS,PPS	Stainless steel, polyphenylene sulfide
4	Flare pipe assembly	SUS,PPS	Stainless steel, polyphenylene sulfide
5	Plunger spring	SUS304	Stainless steel
6	O-ring	NBR(FKM,EPDM)	Nitrile rubber (fluoro rubber, ethylene propylene rubber)
7	Seal	NBR(FKM,EPDM)	Nitrile rubber (fluoro rubber, ethylene propylene rubber)
8	Body	Brass (SCS13)	Brass (stainless steel)
9	O-ring	NBR(FKM,EPDM)	Nitrile rubber (fluoro rubber, ethylene propylene rubber)
10	Sub-plate	C3604(SUS304)	Brass (stainless steel) * same material as body
11	Connecting plate	SPCC	Steel
12	O-ring	NBR(FKM,EPDM)	Nitrile rubber (fluoro rubber, ethylene propylene rubber)
13	Connector	C3604(SUS)	Brass (stainless steel)
14	Connecting plate (bottom)	SS400	Steel

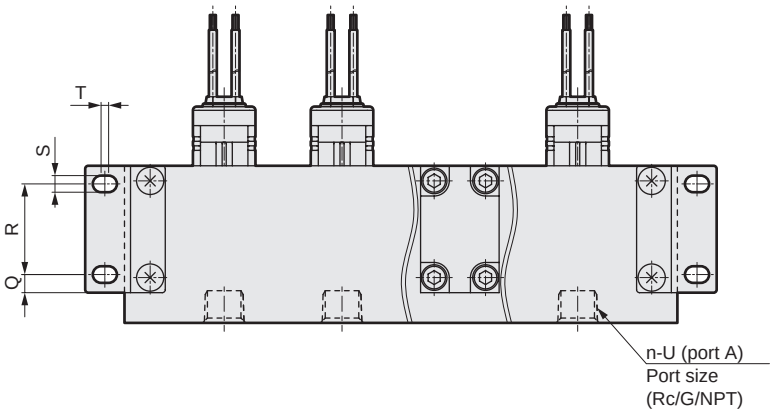
Dimensions brass body / stainless steel body

● Manifold lead wire / DC voltage Coil option code: A / J





	Port A		Port C	
	Port size	Thread depth	Port size	Thread depth
FFBM-2	G1/8	8.5	G1/4	12.5
FFBM-3	G1/4	12.5	G3/8	12.5
FFBM-4	G1/4	12.5	G3/8	12.5
FFBM-5	G1/4	12.5	G3/8	12.5



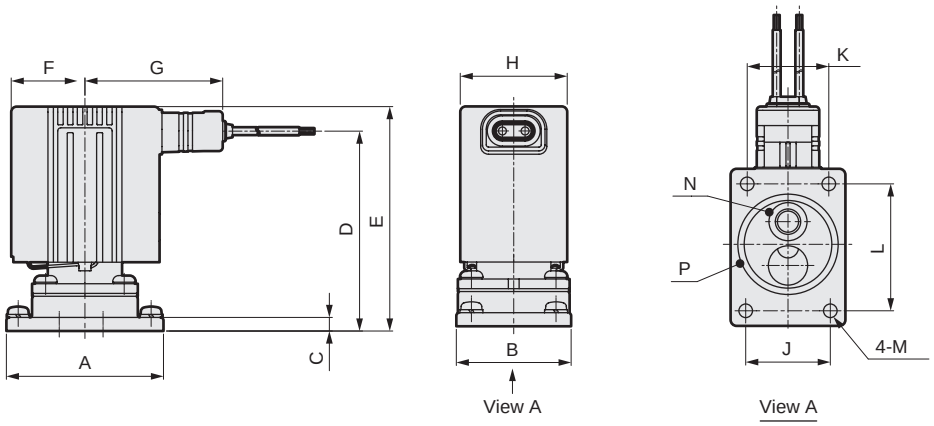
	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	U	V	W
FFBM-2	38	14	1/4	11	71	79.5	18.5	42	26	28	6	1.6	6.5	21	5	22	4.5	2.5	1/8	ø17.3	4
FFBM-3	46	17.5	3/8	12	81	88.5	22	45	30	36	6	2	6.5	24	5	28	4.5	2.5	1/4	ø19	4.6
FFBM-4	52	20	3/8	12	90	98.5	24.5	47.5	33	39	6.5	2	7.5	24	6	30	5.5	2.5	1/4	ø19	4.6
FFBM-5	52	20	3/8	12	99	107.5	27.5	50	36	45	6.5	2	7.5	24	6	30	5.5	2.5	1/4	ø19	4.6

	Station No. / Code	2	3	4	5	6	7	8	9	10
FFBM-2	AA	81	109	162	165	218	246	274	327	330
	BB	93	121	174	177	230	258	286	339	342
FFBM-3	AA	97	133	194	205	266	302	338	399	410
	BB	109	145	206	217	278	314	350	411	422
FFBM-4	AA	106	145	212	223	290	329	368	435	446
	BB	119	158	225	236	303	342	381	448	459
FFBM-5	AA	118	163	236	253	326	371	416	489	506
	BB	131	176	249	266	339	384	429	502	519
Manifold configuration		2 stations x 1	3 stations x 1	2 stations x 2	5 stations x 1	3 stations x 2	5 stations + 2 stations	5 stations + 3 stations	3 stations x 3	5 stations x 2

Note: Manifold configuration combines 2-station, 3-station and 5-station units.

Dimensions brass body / stainless steel body

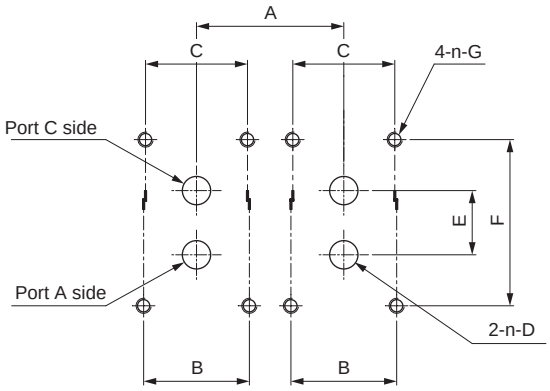
● Actuator lead wire / DC voltage Coil option code: A / J



	A	B	C	D	E	F	G	H	J	K	L	M	Applicable O-ring	
													N	P
FFBM-2	38	27	4.5	50	58.5	18.5	42	24	19(18)	18(19)	30	ø3.5	AS568-009	AS568-018
FFBM-3	46	34	4.5	57	64.5	22	45	30	24(23)	23(24)	38	ø4.5	AS568-011	AS568-022
FFBM-4	52	38	4.5	66	74.5	24.5	47.5	35	28(27)	27(28)	44	ø4.5	AS568-012	AS568-025
FFBM-5	52	38	4.5	75	83.5	27.5	50	40	28(27)	27(28)	44	ø4.5	AS568-012	AS568-025

Dimensions shown in ( ) are for individual supply (FFBM-*5).

● Actuator installation dimensions



Note: Machining drawing when using 2 actuators.

	A	B	C	D	E	F	G
FFBM-2	28 or more	19±0.1	18±0.1	ø3.5	10.6±0.1	30±0.1	M3 depth 6 or more
FFBM-3	36 or more	24±0.1	23±0.1	ø5.5	13.8±0.1	38±0.1	M4 depth 6 or more
FFBM-4	39 or more	28±0.1	27±0.1	ø7.5	17±0.1	44±0.1	M4 depth 6 or more
FFBM-5	45 or more	28±0.1	27±0.1	ø7.5	17±0.1	44±0.1	M4 depth 6 or more

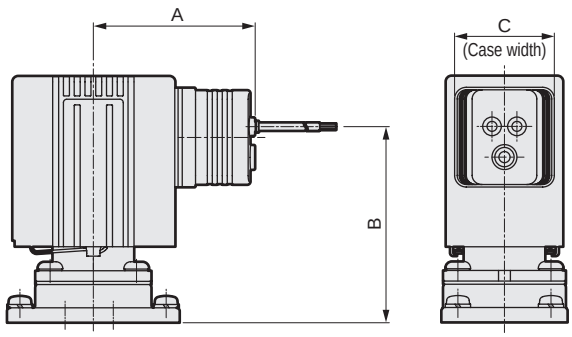
How to order discrete masking plate

O-ring, with mounting screw

	Brass body			Stainless steel body		
Seal	NBR	FKM	EPDM	NBR	FKM	EPDM
FFBM-2	FFBM-21C-MP-KIT	FFBM-21D-MP-KIT	FFBM-21Q-MP-KIT	FFBM-21H-MP-KIT	FFBM-21J-MP-KIT	FFBM-21U-MP-KIT
FFBM-3	FFBM-31C-MP-KIT	FFBM-31D-MP-KIT	FFBM-31Q-MP-KIT	FFBM-31H-MP-KIT	FFBM-31J-MP-KIT	FFBM-31U-MP-KIT
FFBM-4	FFBM-41C-MP-KIT	FFBM-41D-MP-KIT	FFBM-41Q-MP-KIT	FFBM-41H-MP-KIT	FFBM-41J-MP-KIT	FFBM-41U-MP-KIT
FFBM-5	FFBM-41C-MP-KIT	FFBM-41D-MP-KIT	FFBM-41Q-MP-KIT	FFBM-41H-MP-KIT	FFBM-41J-MP-KIT	FFBM-41U-MP-KIT

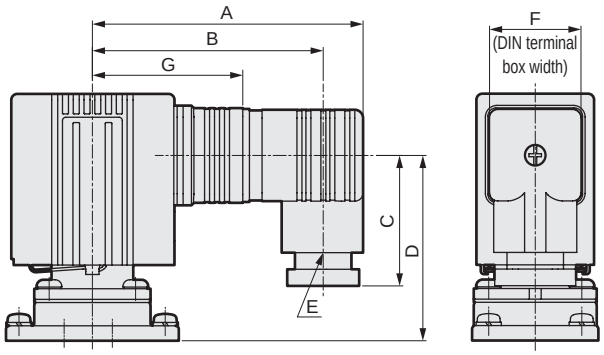
Dimensions brass body / stainless steel body

● Actuator lead wire / AC voltage Coil option code: A / J



	A	B	C
FFBM-2	43	46.5	24
FFBM-3	46	50	30
FFBM-4	48.5	59	30
FFBM-5	51	68	30

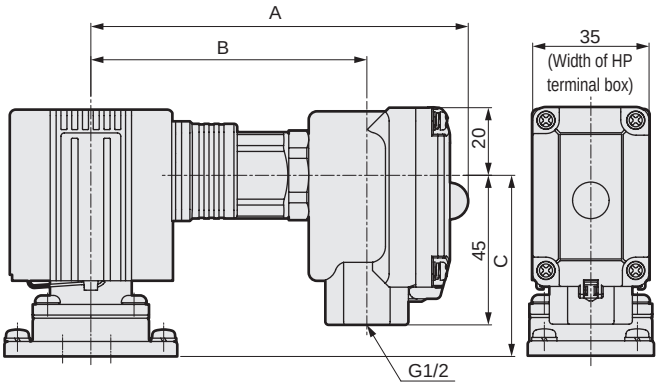
● With actuator DIN terminal box Coil option code: B/C/D/K/L/S
● Actuator DIN coil without terminal box



Dimensions shown in ( ) are for G1/2.

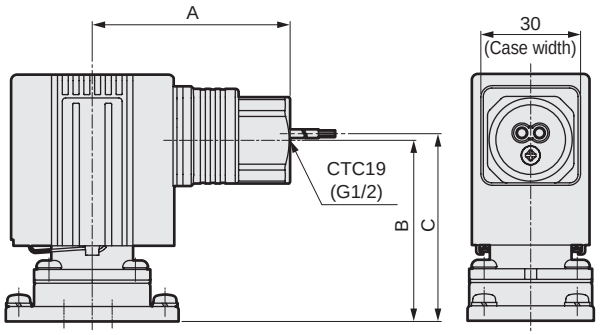
	A	B	C	D	E	F	G
FFBM-2	73	64	36	43	Pg9	21	39
FFBM-3	78.5	66.5 (65)	39.5 (41.5)	46.5	Pg11 (G1/2)	27.5	42
FFBM-4	81	69 (67.5)	39.5 (41.5)	56	Pg11 (G1/2)	27.5	44.5
FFBM-5	83.5	71.5 (70)	39.5 (41.5)	65	Pg11 (G1/2)	27.5	47

● With actuator HP terminal box Coil option code: G/H/Q/R



	A	B	C
FFBM-2			
FFBM-3	113	82	45.5
FFBM-4	115	85	54.5
FFBM-5	118	87	63.5

● Conduit Coil option code: E/F/M/P



	A	B	C
FFBM-2			
FFBM-3	56.5	45.5	47.5
FFBM-4	59	54.5	56.5
FFBM-5	61.5	63.5	65.5

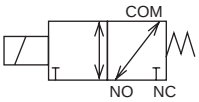
Direct acting 3-port solenoid valve

FFG Series

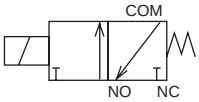
- Universal, NC pressurization
- Port size: Rc, G, NPT 1/8 to 3/8

JIS symbol

● FFG-*1: Universal



● FFG-*3:NC pressurization



Common specifications

Item	FFG
Working fluid	Compressed air/water/oil (50mm^2/s or less)/dry air/low vacuum [1.33×10^{2}Pa (abs)] *1
Max. working pressure MPa	1.2 (refer to working pressure in individual specifications.)
Proof pressure (water pressure) MPa	1.8
Fluid temperature °C	-10 to 60 (no freezing)
Ambient temperature °C	-10 to 60 (DC), -10 to 55 (AC)
Thermal class	Class 130 (B)
Atmosphere	Place free of corrosive gas and explosive gas
Valve structure	Direct acting poppet structure
Valve seat leakage (ANR) cm^3/min	0.2 or less (air)
Mounting orientation	Unrestricted
Degree of protection	IP65

*1: When using at low vacuum, vacuum the NC/NO port side for the universal and the NO port for the NC pressurization.

Electrical specifications

Item	FFG-2							FFG-3						
Rated voltage V	24 DC	12 DC	100 VAC 50/60Hz	110 VAC 50/60Hz	200 VAC 50/60Hz	220 VAC 50/60Hz	230 VAC 50/60Hz	24 DC	12 DC	100 VAC 50/60Hz	110 VAC 50/60Hz	200 VAC 50/60Hz	220 VAC 50/60Hz	230 VAC 50/60Hz
Voltage fluctuation range	±10%							±10%						
Power consumption W	3.5	3.5	-	-	-	-	-	4.5	4.5	-	-	-	-	-
Apparent power VA	-	-	5.1	5.7	6.0	5.3	5.7	-	-	6.2	6.1	6.2	6.2	6.5
Item	**FFG-4**							**FFG-5**						
Rated voltage V	24 DC	12 DC	100 VAC 50/60Hz	110 VAC 50/60Hz	200 VAC 50/60Hz	220 VAC 50/60Hz	230 VAC 50/60Hz	24 DC	12 DC	100 VAC 50/60Hz	110 VAC 50/60Hz	200 VAC 50/60Hz	220 VAC 50/60Hz	230 VAC 50/60Hz
Voltage fluctuation range	±10%							±10%						
Power consumption W	7	7	-	-	-	-	-	10.5	10.5	-	-	-	-	-
Apparent power VA	-	-	8.6	10	9.6	9.5	9.4	-	-	13	13	14	14	13

The leakage current must be less than or equal to the values shown below.

Voltage	AC					DC	
	100V	110V	200V	220V	230V	12V	24V
Leakage current	2 mA or less		1 mA or less			5 mA or less	

Individual specifications

Item / Model No.	Port size Rc/G/NPT	Orifice size (mm)	Usage Pressure (MPa) *1/*2	Flow Rate Characteristics												Weight (kg) *3
				COM→NC			COM→NO			NC→COM			NO→COM			
				C[dm³/(s·bar)]	b	Cv	C[dm³/(s·bar)]	b	Cv	C[dm³/(s·bar)]	b	Cv	C[dm³/(s·bar)]	b	Cv	
Universal																
FFG-21 06 * 1	1/8	1	0 to 0.7	0.12	0.47	0.036	0.11	0.54	0.030	0.12	0.50	0.032	0.11	0.37	0.028	0.27
2		2	0 to 0.15	0.53	0.49	0.13	0.35	0.64	0.10	0.48	0.27	0.10	0.32	0.24	0.085	
FFG-31 06 08 * S	1/8 1/4	1.5	0 to 0.7	0.30	0.49	0.080	0.30	0.48	0.080	0.27	0.46	0.080	0.27	0.42	0.075	0.48
2		2	0 to 0.4	0.55	0.46	0.15	0.49	0.47	0.13	0.49	0.38	0.13	0.49	0.30	0.10	
3		3	0 to 0.15	1.1	0.37	0.27	0.95	0.46	0.20	1.1	0.14	0.24	0.9	0.17	0.17	
FFG-41 08 10 * 2	1/4 3/8	2	0 to 0.7 (0.6)	0.55	0.49	0.16	0.55	0.49	0.15	0.49	0.44	0.14	0.49	0.45	0.13	0.74
3		3	0 to 0.3	1.2	0.40	0.32	1.2	0.39	0.30	1.1	0.29	0.30	1.1	0.22	0.25	
4		4	0 to 0.15	1.9	0.40	0.47	1.8	0.37	0.41	1.9	0.21	0.41	1.8	0.19	0.32	
FFG-51 08 10 * 2	1/4 3/8	2	0 to 1.2 (0.6)	0.55	0.49	0.16	0.55	0.49	0.15	0.49	0.44	0.14	0.49	0.45	0.13	0.93
3		3	0 to 0.6 (0.3)	1.2	0.40	0.32	1.2	0.39	0.30	1.1	0.29	0.30	1.1	0.22	0.25	
4		4	0 to 0.3 (0.15)	1.9	0.40	0.47	1.8	0.37	0.41	1.9	0.21	0.41	1.8	0.19	0.32	
NC pressurization																
FFG-33 06 08 * S	1/8 1/4	1.5	0 to 1.0				0.30	0.48	0.080	0.27	0.46	0.080				0.48
2		2	0 to 0.7				0.49	0.47	0.13	0.49	0.38	0.13				
3		3	0 to 0.3				0.95	0.46	0.20	1.1	0.14	0.24				
FFG-43 08 10 * 2	1/4 3/8	2	0 to 1.2				0.55	0.49	0.15	0.49	0.44	0.14				0.74
3		3	0 to 0.6				1.2	0.39	0.30	1.1	0.29	0.30				
4		4	0 to 0.3				1.8	0.37	0.41	1.9	0.21	0.41				

*1: ( ) is for NO pressurization.
*2: When used in a low vacuum, the lower limit of operating pressure is 1.33 x 10^2 Pa (abs), so the upper limit is 0.1 MPa lower.
*3: Weight of brass body with DC lead wire.

How to order

FFG - 4 1 08 A 4 C 3 C 3 - B

1 Valve Size
2 Actuation
3 Port size
4 Thread and Pressure on nameplate display unit
5 Orifice size
6 Material
7 Coil thermal class
8 Coil option
9 Rated voltage
10 Option

1 Valve size

		Valve size			
		2	3	4	5
2	Width 24 mm	●			
3	Width 30 mm		●		
4	Width 35 mm			●	
5	Width 40 mm				●

2 Actuation

		Valve size			
		2	3	4	5
1	Universal	●	●	●	●
3	NC pressurization		●	●	

3 Port size

		Valve size			
		2	3	4	5
06	1/8	●	●		
08	1/4		●	●	●
10	3/8			●	●

4 Thread and pressure unit indicated on nameplate

	Thread	Pressure display unit	
A	Rc thread	MPa	
B	G thread	bar	
C	NPT thread	psi	*1
D	G thread	MPa	*2
E	NPT thread	MPa	*2

*1: In compliance with the Measurement Act, the psi display cannot be used in Japan.
*2: "D", "E" is a selection to display the pressure display unit as MPa even with G threads and NPT threads mainly in Japan.

5 Orifice size

		Valve size			
		2	3	4	5
1	ø1	●			
S	ø1.5		●		
2	ø2	●	●	●	●
3	ø3		●	●	●
4	ø4			●	●

6 Material

	Body	Seal	Treatment	Working fluid
A	Aluminum	NBR	-	Compressed air / dry air
C	Brass	NBR		Compressed air / Dry air / Water / Oil / Low vacuum*1
D		FKM		Compressed air / Dry air / Water / Oil / Low vacuum*1
H	Stainless steel	NBR	-	Compressed air / Dry air / Water / Oil / Low vacuum*1
J		FKM		Compressed air / Dry air / Water / Oil / Low vacuum*1
N	Brass	NBR	Oil-prohibited	Compressed air / Dry air / Water / Oil / Low vacuum*1
P		FKM		Compressed air / Dry air / Water / Oil / Low vacuum*1
Q		EPDM		Water
S	Stainless steel	NBR		Compressed air / Dry air / Water / Oil / Low vacuum*1
T		FKM		Compressed air / Dry air / Water / Oil / Low vacuum*1
U		EPDM		Water

*1: Although it can be used with low vacuum [1.33×10^2 Pa (abs)], valve seat leakage is 0.2 cm^3/min (ANR) or less. (Valve seat leakage at positive pressure) When used in a low vacuum, the lower limit of operating pressure is 1.33 x 10^2 Pa (abs), so the upper limit is 0.1 MPa lower.

⑦ Coil thermal class

3	Class 130 (B)

⑧ Coil option

			① Valve size				Voltage	
			2	3	4	5	DC	AC
A	Lead wire (300 mm)		●	●	●	●	●	●
B	With DIN terminal box (G1/2)		*1	●	●	●	●	●
C	With DIN terminal box (Pg11)		●*2	●	●	●	●	●
D	DIN terminal box with lamp (Pg11)		●*2	●	●	●	*3	●
E	Conduit (G1/2)			●	●	●	●	●
F	Conduit (CTC19)			●	●	●	●	●
G	HP terminal box (G1/2)			●	●	●	●	●
H	HP terminal box with lamp (G1/2)			●	●	●	●	●*5
J	Lead wire (300 mm)	Surge With absorber	●	●	●	●	●*4	*6
K	With DIN terminal box (Pg11)		●*2	●	●	●	●	
L	DIN terminal box with lamp (Pg11)		●*2	●	●	●	●	
M	Conduit (G1/2)			●	●	●	●	
P	Conduit (CTC19)			●	●	●	●	
Q	HP terminal box (G1/2)			●	●	●	●	
R	HP terminal box with lamp (G1/2)			●	●	●	●	
S	DIN coil without terminal box		●	●	●	●	●*7	●*6

*1: "B" coil option is not available when the valve size is "2".
*2: When the valve size is "2", the DIN terminal box thread size is Pg9.
*3: Use "L" DIN terminal box with lamp/surge suppressor
*4: The surge suppressor of the DC voltage coil option "J" is included with product.
*5: When the coil option is "H", the rated voltage "K" (230 VAC) cannot be selected.
*6: All AC voltages are equipped with a full-wave rectifier circuit. Significant surges generated in the coil by the action of this diode are almost eliminated. For this reason, a surge suppressor is not available.
*7: Surge suppressor is not available. Use the terminal box with surge suppressor.

⑨ Rated voltage

1	100 VAC 50/60 Hz
2	200 VAC 50/60 Hz
3	24 VDC
4	12 VDC
5	110 VAC 50/60 Hz
6	220 VAC 50/60 Hz
K	230 VAC 50/60 Hz

⑩ Option *1

Blank	No
B	Mounting plate①

*1: Mounting plate is included with the product. Refer to the precautions on page 56 for tightening torque.

Aluminum body

B: Mounting plate①

Brass / stainless steel body

B: Mounting plate①

Coil option code

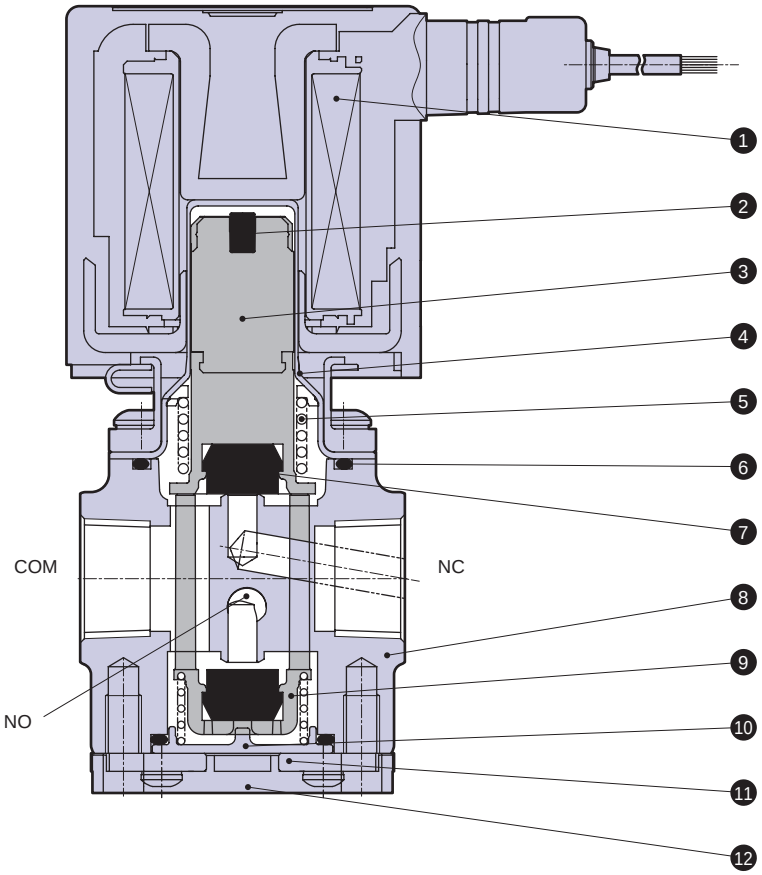
A(DC) J		Grommet lead wire 300 mm Grommet lead wire 300 mm/ With surge suppressor
A(AC)		Grommet lead wire 300 mm
B C K		DIN terminal box DIN terminal box with surge suppressor
D L		DIN terminal box with lamp DIN terminal box / lamp, With surge suppressor
G Q		HP terminal box HP terminal box with surge suppressor
H R		HP terminal box with lamp HP terminal box / lamp, With surge suppressor
E F M P		Conduit (G1/2) Conduit (CTC19) Conduit (G1/2) with surge suppressor Conduit (CTC19) with surge suppressor
S		DIN coil without terminal box

How to order mounting plate

With body mounting screw

	Mounting plate code: B	
	Aluminum body	Brass, stainless steel body
FFG-2	FFB-21-B-MOUNT-PLATE-KIT	FFG-21-B-MOUNT-PLATE-KIT
FFG-3	FFB-31-B-MOUNT-PLATE-KIT	FFG-31-B-MOUNT-PLATE-KIT
FFG-4	FFB-41-B-MOUNT-PLATE-KIT	FFG-41-B-MOUNT-PLATE-KIT
FFG-5	FFB-51-B-MOUNT-PLATE-KIT	

Internal structure / Material



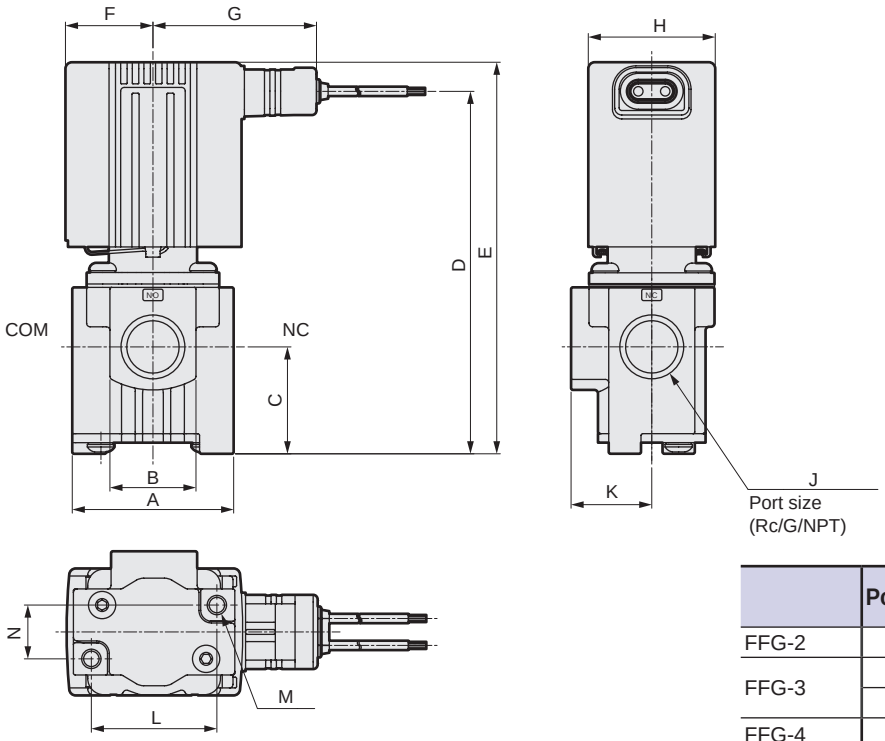
Part No.	Name	Material	
1	Coil assembly	-	
2	Noise dampening rubber	HNBR (FKM,EPDM)	Hydrogenated nitrile rubber (fluoro rubber, ethylene propylene rubber)
3	Plunger	SUS,PPS	Stainless steel, polyphenylene sulfide
4	Flare pipe assembly	SUS,PPS	Stainless steel, polyphenylene sulfide
5	Plunger spring	SUS304	Stainless steel
6	O-ring	NBR(FKM,EPDM)	Nitrile rubber (fluoro rubber, ethylene propylene rubber)
7	Seal	NBR(FKM,EPDM)	Nitrile rubber (fluoro rubber, ethylene propylene rubber)
8	Body	Brass (ADC, SCS13)	Brass (aluminum die-casting, stainless steel)
9	Valving element guide	PPS	Polyphenylene sulfide
10	NO cover	PPS	Polyphenylene sulfide
11	Covers A, B *1	SUS304	Stainless steel
12	Cover cover *2	POM	Polyacetal

*1: Body material is brass, stainless steel for cover A, aluminum for cover B
*2: Only for brass and stainless steel body

Dimensions

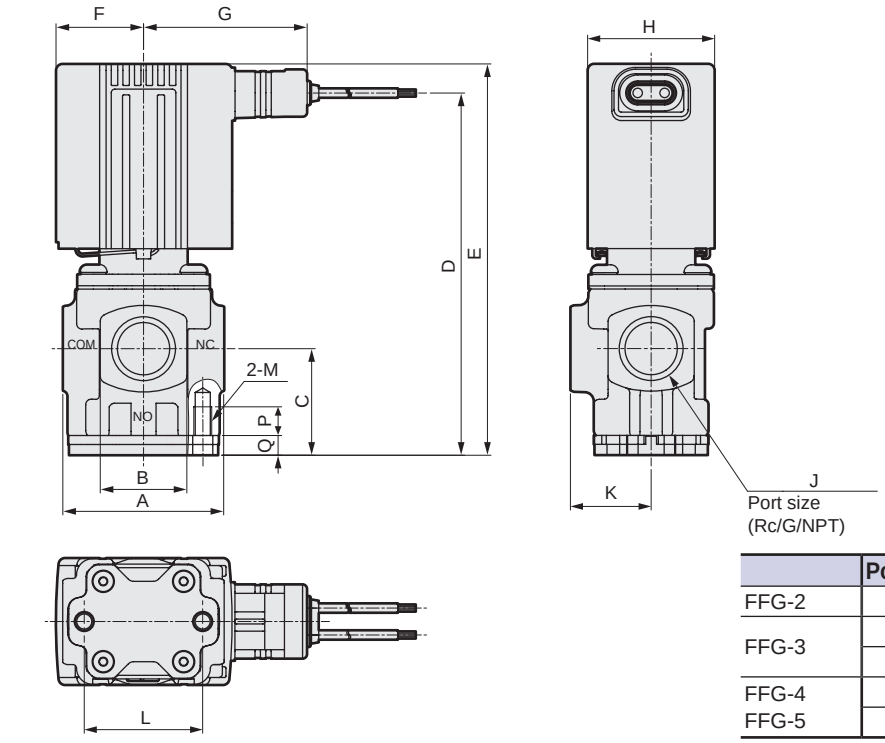
● Lead wire / DC voltage
Aluminum body

Coil option code: A / J



	Port size	Thread depth
FFG-2	G1/8	7.4
FFG-3	G1/8	8.5
	G1/4	10.5
FFG-4	G1/4	12.5
FFG-5	G3/8	11.4

Brass body / stainless steel body

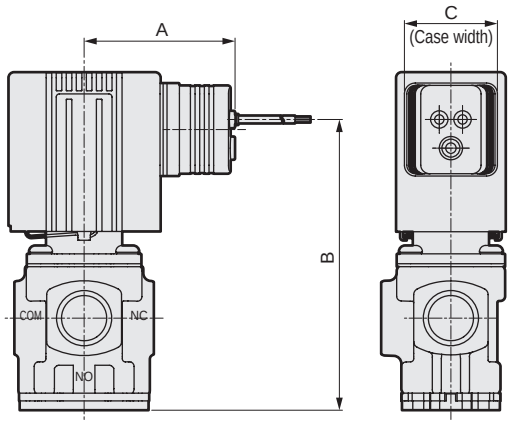


	Port size	Thread depth
FFG-2	G1/8	7.4
FFG-3	G1/8	8.5
	G1/4	10.5
FFG-4	G1/4	12.5
FFG-5	G3/8	11.4

		A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q
FFG-2	Aluminum body	32	17	21	69.5	78	18.5	42	24	1/8	16	25	M4 depth 6	8		
	Brass / SUS body											23.8	M4		6	4.5
FFG-3	Aluminum body	40	19	26.5	86.5	94	22	45	30	1/8	20	32	M5 depth 8	11		
	Brass / SUS body			26	86	93.5				1/4		29	M5		6	4.5
FFG-4	Aluminum body	45	24	30	101	109	24.5	47.5	35	1/4	22.5	35	M5 depth 8	15		
	Brass / SUS body									3/8		33	M5		8	5.5
FFG-5	Aluminum body	45	24	30	110	118	27.5	50	40	1/4	22.5	35	M5 depth 8	15		
	Brass / SUS body									3/8		33	M5		8	5.5

Dimensions

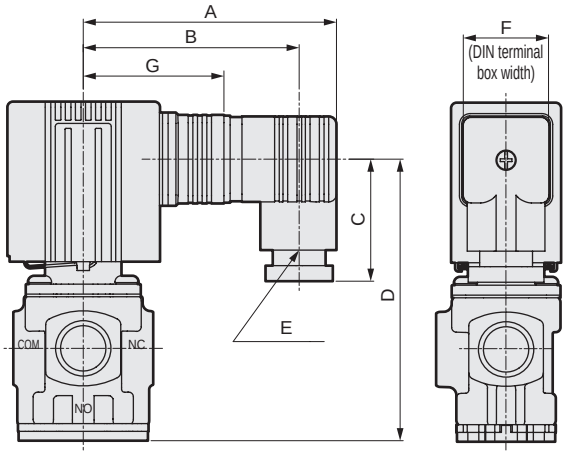
● Lead wire / AC voltage Coil option code: A



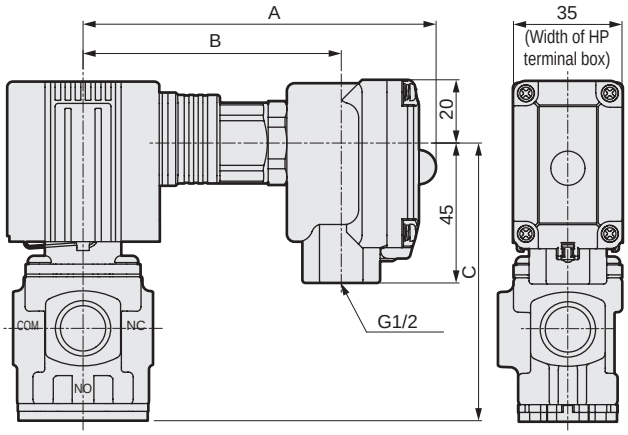
		A	B	C
FFG-2	Aluminum body	43	66	24
	Brass / SUS body			
FFG-3	Aluminum body	46	79	30
	Brass / SUS body		78.5	
FFG-4	Aluminum body	48.5	94	30
	Brass / SUS body			
FFG-5	Aluminum body	51	103	30
	Brass / SUS body			

Optional dimensions

● With DIN terminal box Coil option code: B/C/D/K/L/S
● DIN coil without terminal box



● With HP terminal box Coil option code: G/H/Q/R



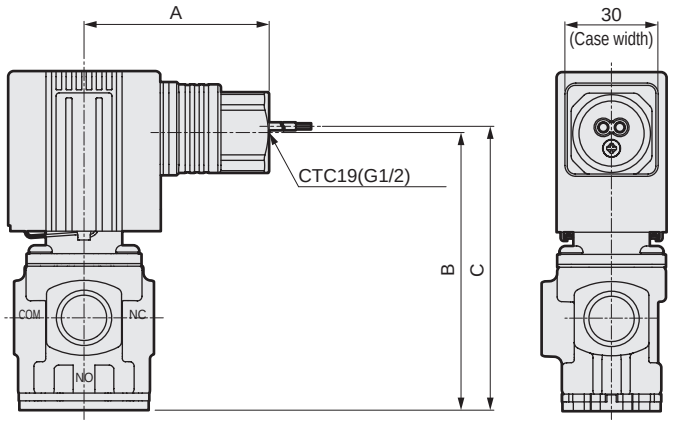
Dimensions shown in ( ) are for G1/2.

		A	B	C	D	E	F	G
FFG-2	Aluminum body	73	64	36	62.5	Pg9	21	39
	Brass / SUS body							
FFG-3	Aluminum body	78.5	66.5 (65.5)	39.5 (41.5)	76	Pg11 (G1/2)	27.5	42
	Brass / SUS body				75.5			
FFG-4	Aluminum body	81	69 (67.5)	39.5 (41.5)	90.5	Pg11 (G1/2)	27.5	44.5
	Brass / SUS body							
FFG-5	Aluminum body	83.5	71.5 (70)	39.5 (41.5)	99.5	Pg11 (G1/2)	27.5	47
	Brass / SUS body							

		A	B	C
FFG-2	Aluminum body			
	Brass / SUS body			
FFG-3	Aluminum body	113	82	74.5
	Brass / SUS body			74
FFG-4	Aluminum body	115	85	89.5
	Brass / SUS body			
FFG-5	Aluminum body	118	87	98.5
	Brass / SUS body			

Optional dimensions

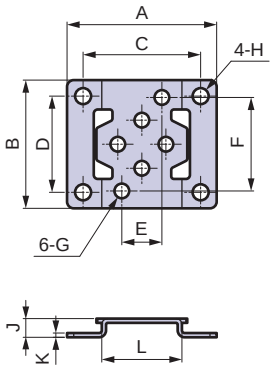
● Conduit Coil option code: E/F/M/P

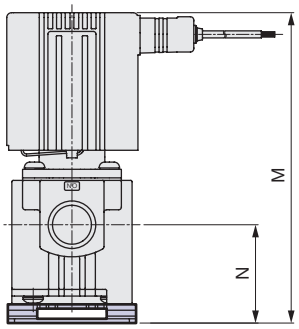


		A	B	C
FFG-2	Aluminum body			
	Brass / SUS body			
FFG-3	Aluminum body	56.5	74.5	76.5
	Brass / SUS body		74	76
FFG-4	Aluminum body	59	89.5	91.5
	Brass / SUS body			
FFG-5	Aluminum body	61.5	98.5	100.5
	Brass / SUS body			

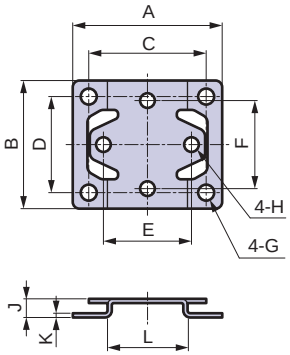
● Mounting plate① Option code: B

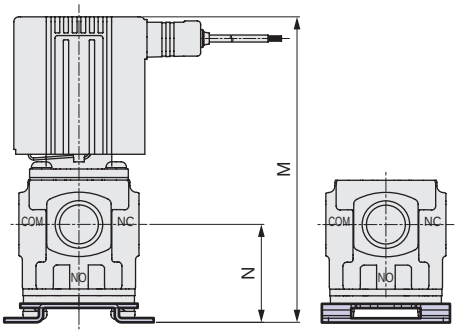
Aluminum body





Brass / stainless steel body





		A	B	C	D	E	F	G	H	J	K	L	M	N
FFG-2	Aluminum body	40	34	30	25	8	25	ø5	ø4.5	6	1.2	20	84	27
	Brass / SUS body					23.8	23.8					19		
FFG-3	Aluminum body	52	42	40	30	11	32	ø6	ø5.5	7	1.6	25	101	33.5
	Brass / SUS body					29	29					26	100.5	33
FFG-4	Aluminum body	56	48	44	36	15	35	ø6	ø5.5	7	1.6	30	116	37
	Brass / SUS body					33	33							
FFG-5	Aluminum body	62	50	50	38	15	35	ø6	ø5.5	7	1.6	36	125	37
	Brass / SUS body	56	48	44	36	33	33					30		

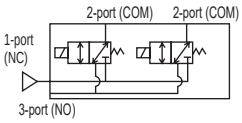
Direct acting 3-port solenoid valve, manifold

FFGM Series

- Universal
- Port size: Rc, G, NPT 1/8, 1/4

JIS symbol

● Common supply/common exhaust



Common specifications

Item	FFGM
Working fluid	Compressed air/water/oil (50mm^2/s or less)/dry air/low vacuum [1.33×10^{2}Pa (abs)] *1
Max. working pressure MPa	1.2 (refer to working pressure in individual specifications.)
Proof pressure (water pressure) MPa	1.8
Fluid temperature °C	-10 to 40 (no freezing)
Ambient temperature °C	-10 to 40
Thermal class	Class 130 (B)
Atmosphere	Place free of corrosive gas and explosive gas
Valve structure	Direct acting poppet structure
Valve seat leakagecm^3/min (ANR)	0.2 or less (air)
Mounting orientation	Unrestricted
Degree of protection	IP65

*1: When using at low vacuum, vacuum the NC/NO port side for the universal and the NO port for the NC pressurization.

Electrical specifications

Item	FFGM-3						
Rated voltage V	24 DC	12 DC	100 VAC 50/60Hz	110 VAC 50/60Hz	200 VAC 50/60Hz	220 VAC 50/60Hz	230 VAC 50/60Hz
Voltage fluctuation range	±10%						
Power consumption W	4.5	4.5	-	-	-	-	-
Apparent power VA	-	-	6.2	6.1	6.2	6.2	6.5

Item	FFGM-4							FFGM-5						
Rated voltage V	24 DC	12 DC	100 VAC 50/60Hz	110 VAC 50/60Hz	200 VAC 50/60Hz	220 VAC 50/60Hz	230 VAC 50/60Hz	24 DC	12 DC	100 VAC 50/60Hz	110 VAC 50/60Hz	200 VAC 50/60Hz	220 VAC 50/60Hz	230 VAC 50/60Hz
Voltage fluctuation range	±10%							±10%						
Power consumption W	7	7	-	-	-	-	-	10.5	10.5	-	-	-	-	-
Apparent power VA	-	-	8.6	10	9.6	9.5	9.4	-	-	13	13	14	14	13

The leakage current must be less than or equal to the values shown below.

Voltage	AC					DC	
	100V	110V	200V	220V	230V	12V	24V
Leakage current	2 mA or less		1 mA or less			5 mA or less	

Individual specifications

Item / Model No.	Port size Rc/G/NPT 2-port	Port size Rc/G/NPT 1-port 3-port	Orifice size (mm)	Usage Pressure (MPa) *1 *2	Flow Rate Characteristics COM→NC C[dm³/(s·bar)]	COM→NC b	COM→NC Cv	COM→NO C[dm³/(s·bar)]	COM→NO b	COM→NO Cv	NC→COM C[dm³/(s·bar)]	NC→COM b	NC→COM Cv	NO→COM C[dm³/(s·bar)]	NO→COM b	NO→COM Cv
Universal																
FFGM-31 08 * S	1/4	1/4	1.5	0 to 0.7	0.31	0.41	0.089	0.31	0.26	0.079	0.28	0.33	0.070	0.27	0.32	0.073
2			2	0 to 0.4	0.54	0.42	0.15	0.52	0.10	0.12	0.49	0.19	0.12	0.48	0.25	0.12
3			3	0 to 0.15	0.92	0.26	0.22	0.85	0.090	0.19	0.86	0.11	0.20	0.88	0.15	0.20
FFGM-41 08 * 2	1/4	1/4	2	0 to 0.7(0.6)	0.56	0.46	0.16	0.56	0.29	0.15	0.52	0.32	0.14	0.50	0.31	0.12
3			3	0 to 0.3	1.2	0.40	0.33	1.1	0.060	0.26	1.1	0.16	0.27	1.1	0.17	0.26
4			4	0 to 0.15	1.8	0.27	0.42	1.3	0.15	0.36	1.6	0.090	0.36	1.5	0.13	0.37
FFGM-51 08 * 2	1/4	1/4	2	0 to 1.2(0.6)	0.56	0.46	0.16	0.56	0.29	0.15	0.52	0.32	0.14	0.50	0.31	0.12
3			3	0 to 0.6(0.3)	1.2	0.40	0.33	1.1	0.060	0.26	1.1	0.16	0.27	1.1	0.17	0.26
4			4	0 to 0.3(0.15)	1.8	0.27	0.42	1.3	0.15	0.36	1.6	0.09	0.36	1.5	0.13	0.37

*1:( ) is for NO pressurization.
*2: When used in a low vacuum, the lower limit of operating pressure is 1.33 x 10^2 Pa (abs), so the upper limit is 0.1 MPa lower.

Weight

●Body material: Aluminum

Model No.	Weight (kg) Actuator only	2 stations	3 stations	4 stations	5 stations	6 stations	7 stations	8 stations	9 stations	10 stations
FFGM-3	0.34	1.0	1.5	2.0	2.5	2.9	3.4	3.9	4.4	4.8
FFGM-4	0.53	1.4	2.1	2.8	3.5	4.2	4.8	5.5	6.2	6.9
FFGM-5	0.72	1.8	2.7	3.6	4.6	5.5	6.4	7.3	8.2	9.1

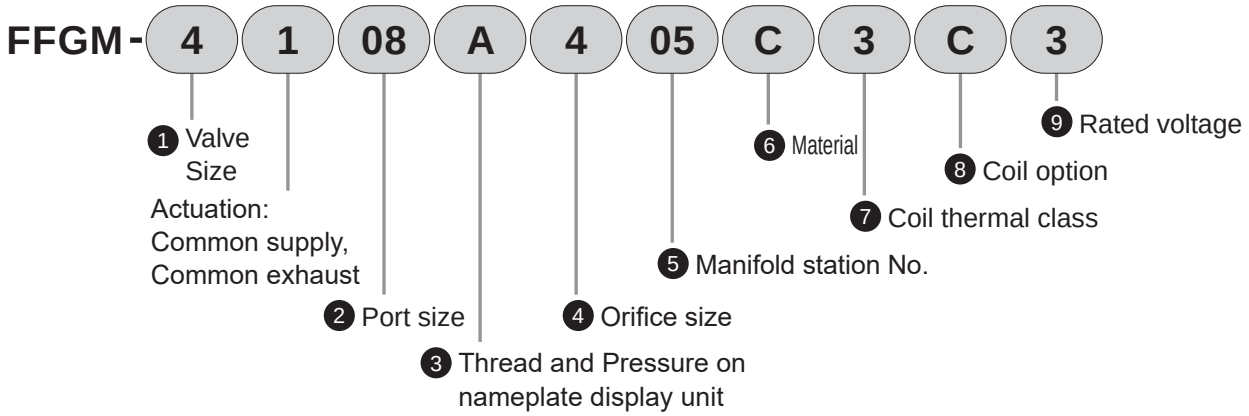
*3: Weight of aluminum sub-plate 24 VDC lead wire.

●Body material: brass / stainless steel

Model No.	Weight (kg) Actuator only	2 stations	3 stations	4 stations	5 stations
FFGM-3	0.49	2.2	3.1	4.1	5.0
FFGM-4	0.78	2.8	4.1	5.4	6.6
FFGM-5	0.97	3.3	4.8	6.4	7.9

*4: Weight of brass body, stainless steel sub-plate 24 VDC lead wire.

How to order



1 Valve size

		Valve size 3	4	5
3	Width 30 mm	●		
4	Width 35 mm		●	
5	Width 40 mm			●

2 Port size

		Valve size 3	4	5
08	1/4	●	●	●
00	Actuator only	●	●	●

3 Thread and pressure unit indicated on nameplate

	Thread	Pressure display unit	
A	Rc thread	MPa	
B	G thread	bar	
C	NPT thread	psi	*2
D	G thread	MPa	*3
E	NPT thread	MPa	*3

*1: When port size of ❷ is "00" actuator only, there is no thread type. Therefore, select "A" (MPa), "B" (bar), "C" (psi) for the pressure display unit.
*2: In compliance with the Measurement Act, the psi display cannot be used in Japan.
*3: "D", "E" is a selection to display the pressure display unit as MPa even with G threads and NPT threads mainly in Japan.

4 Orifice size

		Valve size 3	4	5
S	ø1.5	●		
2	ø2	●	●	●
3	ø3	●	●	●
4	ø4		●	●

5 Manifold station No.

02 to 09	2 stations to 9 stations
10	10 stations
00	Actuator only

Note: For brass or stainless steel body, the manifold station No. is from 2 to 5 stations.

6 Material

	Body	Sub-plate	Seal	Treatment	Working fluid
A	Aluminum		NBR	-	Compressed air / dry air
C	Brass	Stainless steel	NBR		Compressed air / Dry air / Water / Oil / Low vacuum *1
D			FKM		Compressed air / Dry air / Water / Oil / Low vacuum *1
H	Stainless steel		NBR		Compressed air / Dry air / Water / Oil / Low vacuum *1
J			FKM		Compressed air / Dry air / Water / Oil / Low vacuum *1
N	Brass		NBR	Oil-prohibited	Compressed air / Dry air / Water / Oil / Low vacuum *1
P			FKM		Compressed air / Dry air / Water / Oil / Low vacuum *1
S	Stainless steel		NBR		Compressed air / Dry air / Water / Oil / Low vacuum *1
T			FKM		Compressed air / Dry air / Water / Oil / Low vacuum *1

*1: Although it can be used with low vacuum [1.33×10^2 Pa (abs)], valve seat leakage is 0.2 cm^3/min (ANR) or less. (Valve seat leakage at positive pressure) When used in a low vacuum, the lower limit of operating pressure is 1.33 x 10^2 Pa (abs), so the upper limit is 0.1 MPa lower.

❼ Coil thermal class

3	Class 130 (B)

❽ Coil option

			❶ Valve size			Voltage	
			3	4	5	DC	AC
A	Lead wire (300 mm)		●	●	●	●	●
B	With DIN terminal box (G1/2)		●	●	●	●	●
C	With DIN terminal box (Pg11)		●	●	●	●	●
D	DIN terminal box with lamp (Pg11)		●	●	●	*1	●
E	Conduit (G1/2)		●	●	●	●	●
F	Conduit (CTC19)		●	●	●	●	●
G	HP terminal box (G1/2)		●	●	●	●	●
H	HP terminal box with lamp (G1/2)		●	●	●	●	●*3
J	Lead wire (300 mm)	Surge With absorber	●	●	●	●*2	*4
K	With DIN terminal box (Pg11)		●	●	●	●	
L	DIN terminal box with lamp (Pg11)		●	●	●	●	
M	Conduit (G1/2)		●	●	●	●	
P	Conduit (CTC19)		●	●	●	●	
Q	HP terminal box (G1/2)		●	●	●	●	
R	HP terminal box with lamp (G1/2)		●	●	●	●	
S	DIN coil without terminal box		●	●	●	●*5	●*4

*1: Use "L " DIN terminal box with lamp/surge suppressor
*2: The surge suppressor of the DC voltage coil option "J" is included with product.
*3: When the coil option is "H", the rated voltage "K" (230 VAC) cannot be selected.
*4: All AC voltages are equipped with a full-wave rectifier circuit. Significant surges generated in the coil by the action of this diode are almost eliminated. For this reason, a surge suppressor is not available.
*5: Surge suppressor is not available. Use the terminal box with surge suppressor.

❾ Rated voltage

1	100 VAC 50/60 Hz
2	200 VAC 50/60 Hz
3	24 VDC
4	12 VDC
5	110 VAC 50/60 Hz
6	220 VAC 50/60 Hz
K	230 VAC 50/60 Hz

⚠ How to order

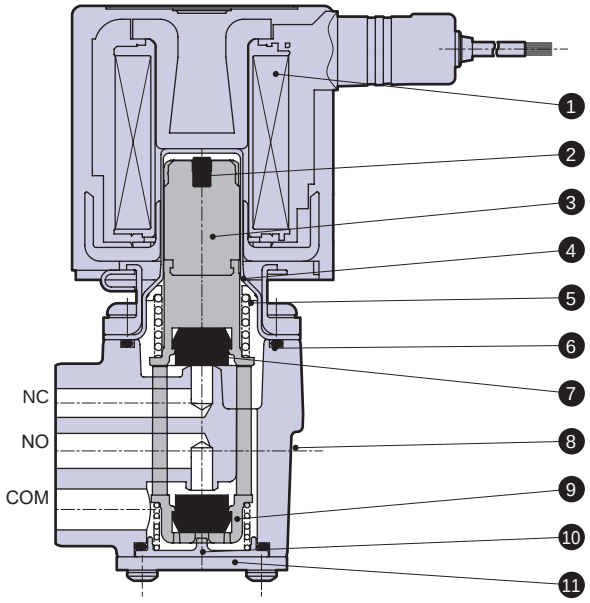
Masking plate orders are also available.
Refer to How to order on page 41.

Coil option code

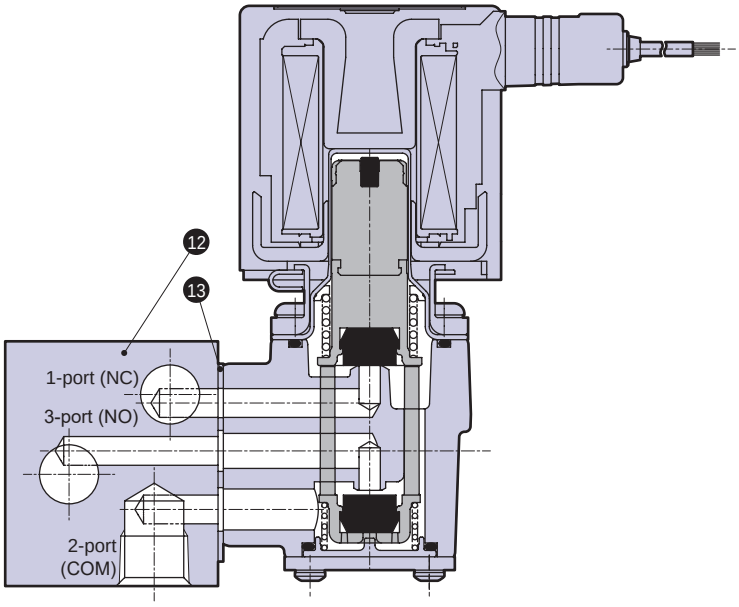
A(DC) J		Grommet lead wire 300 mm Grommet lead wire 300 mm/ With surge suppressor
A(AC)		Grommet lead wire 300 mm
B C K		DIN terminal box DIN terminal box with surge suppressor
D L		DIN terminal box with lamp DIN terminal box / lamp, With surge suppressor
G Q		HP terminal box HP terminal box with surge suppressor
H R		HP terminal box with lamp HP terminal box / lamp, With surge suppressor
E F M P		Conduit (G1/2) Conduit (CTC19) Conduit (G1/2) with surge suppressor Conduit (CTC19) with surge suppressor
S		DIN coil without terminal box

Internal structure / Material

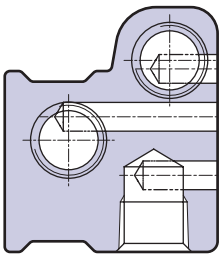
● FFGM actuator



● FFGM manifold



Body material: Brass, SUS



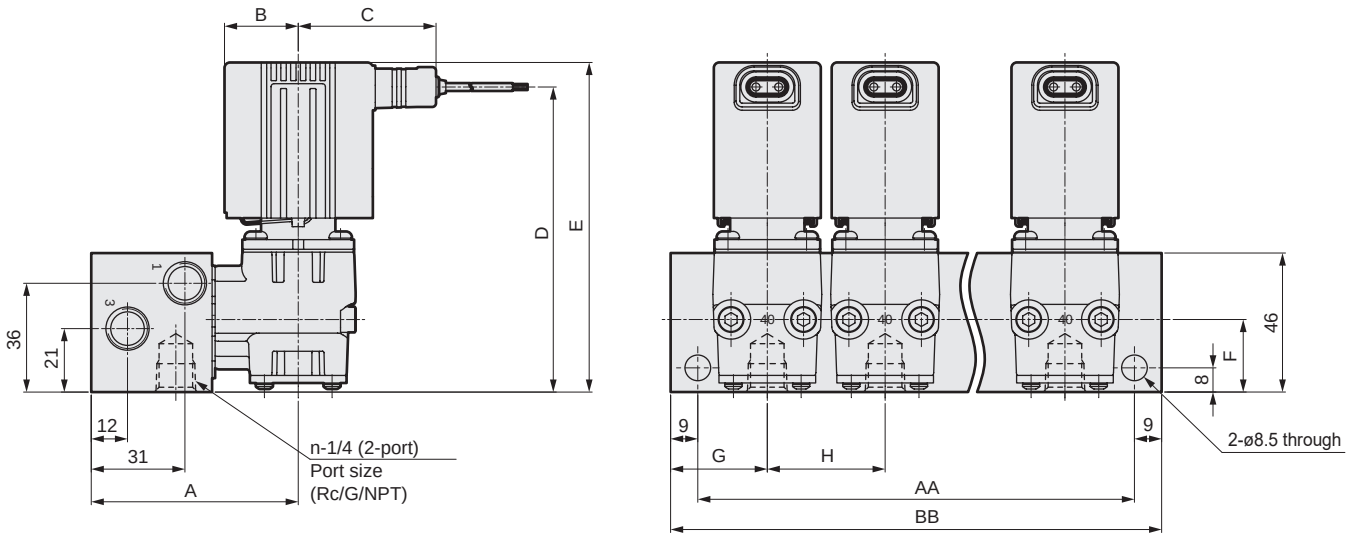
Body material: Aluminum

Part No.	Name	Material	
1	Coil assembly	-	
2	Noise dampening rubber	HNBR (FKM,EPDM)	Hydrogenated nitrile rubber (fluoro rubber, ethylene propylene rubber)
3	Plunger	SUS,PPS	Stainless steel, polyphenylene sulfide
4	Flare pipe assembly	SUS,PPS	Stainless steel, polyphenylene sulfide
5	Plunger spring	SUS304	Stainless steel
6	O-ring	NBR(FKM,EPDM)	Nitrile rubber (fluoro rubber, ethylene propylene rubber)
7	Seal	NBR(FKM,EPDM)	Nitrile rubber (fluoro rubber, ethylene propylene rubber)
8	Body	Brass (aluminum, SCS13)	Brass (aluminum, stainless steel)
9	Valving element guide	PPS	Polyphenylene sulfide
10	NO cover	PPS	Polyphenylene sulfide
11	Cover M	SUS304	Stainless steel
12	Sub-plate	SUS304 (aluminum)	Stainless steel (aluminum) *1
13	Gasket	NBR (FKM)	Nitrile rubber (fluoro rubber)

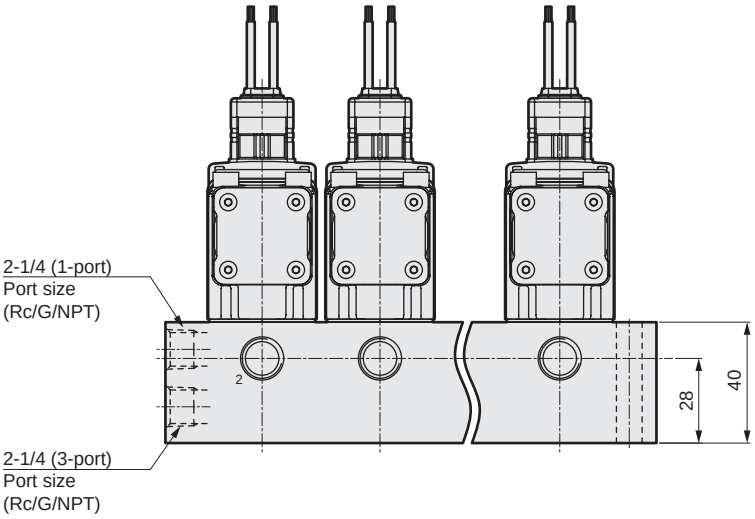
*1: Body material: For brass, the sub-plate material is stainless steel.

Dimensions

● Manifold lead wire / DC voltage Coil option code: A / J



	Port size	Thread depth
FFGM-3	G1/4	12.5
FFGM-4	G1/4	12.5
FFGM-5	G1/4	12.5

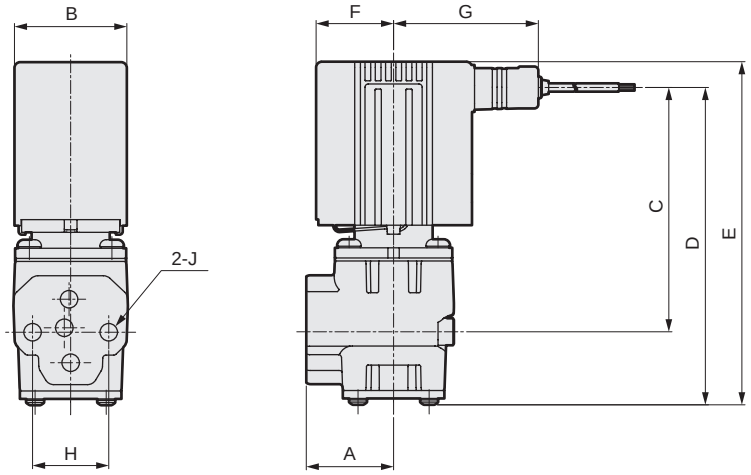


		A	B	C	D	E	F	G	H
FFGM-3	Aluminum body	63.5	22	45	88	95.5	25	32	36
	Brass / SUS body								36
FFGM-4	Aluminum body	68.5	24.5	47.5	101	109	24	32	38
	Brass / SUS body								39
FFGM-5	Aluminum body	68.5	27.5	50	110	118.5	24	32	46
	Brass / SUS body								45

		Station No. / Code	2	3	4	5	6	7	8	9	10
FFGM-3	Aluminum body	AA	82	118	154	190	226	262	298	334	370
		BB	100	136	172	208	244	280	316	352	388
	Brass / SUS body	AA	82	118	154	190					
		BB	100	136	172	208					
FFGM-4	Aluminum body	AA	84	122	160	198	236	274	312	350	388
		BB	102	140	178	216	254	292	330	368	406
	Brass / SUS body	AA	85	124	163	202					
		BB	103	142	181	220					
FFGM-5	Aluminum body	AA	92	138	184	230	276	322	368	414	460
		BB	110	156	202	248	294	340	386	432	478
	Brass / SUS body	AA	91	136	181	226					
		BB	109	154	199	244					

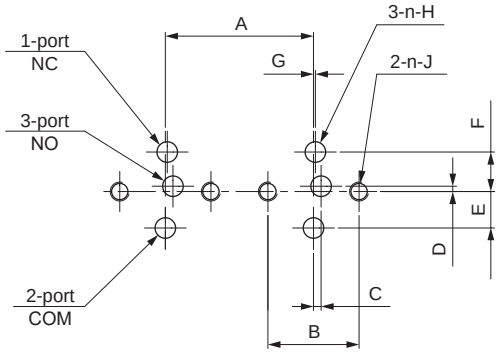
Dimensions

● Actuator lead wire / DC voltage Coil option code: A / J



	A	B	C	D	E	F	G	H	J
FFGM-3	23	30	63	85.5	93	22	45	20	ø4.5
FFGM-4	27.5	35	77	100	108	24.5	47.5	24	ø5.5
FFGM-5	27.5	40	86	109	117	27.5	50	24	ø5.5

● Actuator installation dimensions



Note: Machining drawing when using 2 actuators.

		A	B	C	D	E	F	G	H	J
FFGM-3	Aluminum body	36 or more	20±0.1	1.5±0.1	±0	9±0.2	7.5±0.2	0.5	ø4	M4 depth 10 or more
	Brass / SUS body	36 or more								
FFGM-4	Aluminum body	38 or more	24±0.1	2±0.1	1.4±0.1	9.6±0.2	10.4±0.2	0.5	ø5.4	M5 depth 10 or more
	Brass / SUS body	39 or more								
FFGM-5	Aluminum body	46 or more	24±0.1	2±0.1	1.4±0.1	9.6±0.2	10.4±0.2	0.5	ø5.4	M5 depth 10 or more
	Brass / SUS body	45 or more								

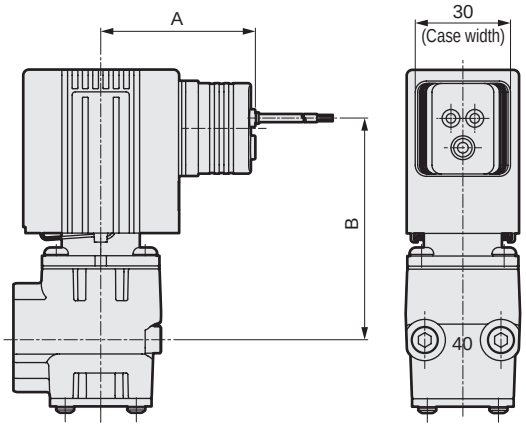
How to order discrete masking plate

With gasket and mounting screws

	Aluminum body	Brass, stainless steel body	
Seal	NBR	NBR	FKM
FFGM-3	FFGM-31A-MP-KIT	FFGM-31H-MP-KIT	FFGM-31J-MP-KIT
FFGM-4	FFGM-41A-MP-KIT	FFGM-41H-MP-KIT	FFGM-41J-MP-KIT
FFGM-5	FFGM-41A-MP-KIT	FFGM-41H-MP-KIT	FFGM-41J-MP-KIT

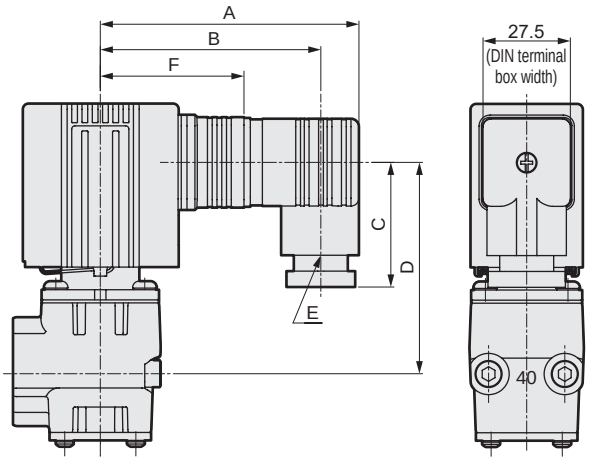
Dimensions

● Actuator lead wire / AC voltage Coil option code: A / J



	A	B
FFGM-3	46	55.5
FFGM-4	48.5	70
FFGM-5	51	79

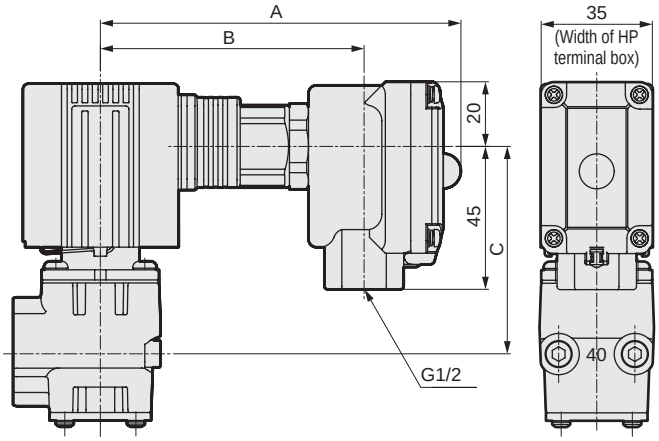
● With actuator DIN terminal box Coil option code: B/C/D/K/L/S
● Actuator DIN coil without terminal box



Dimensions shown in ( ) are for G1/2.

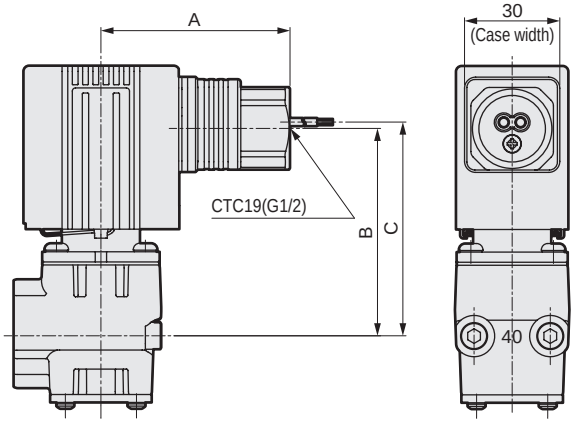
	A	B	C	D	E	F
FFGM-3	78.5	66.5 (65.5)	39.5 (41.5)	52.5	Pg11 (G1/2)	42
FFGM-4	81	69 (67.5)	39.5 (41.5)	66.5	Pg11 (G1/2)	44.5
FFGM-5	83.5	71.5 (70)	39.5 (41.5)	75.5	Pg11 (G1/2)	47

● With actuator HP terminal box Coil option code: G/H/Q/R



	A	B	C
FFGM-3	113	82	51
FFGM-4	115	85	65.5
FFGM-5	118	87	74.5

● Actuator conduit Coil option code: E/F/M/P



	A	B	C
FFGM-3	56.5	51	53
FFGM-4	59	65.5	67.5
FFGM-5	61.5	74.5	76.5

Working fluid check list

Multi-fit

⚠ CAUTION

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[Indicates the compatibility of sealant material, body material and working fluid.]

●:Usable ▲: Usable with conditions x:Unusable

Fluid name	Fluid properties (Indicators the state of the raw material even if the fluid indicates water solubility)	Material combination						Note on model No. selection
		[Body material] Brass			[Body material] Stainless steel			
		[Sealant material] Nitrile rubber	Fluoro rubber	Ethylene propylene	Nitrile rubber	Fluoro rubber	Ethylene propylene	
Acrylic/nitriles	Liquid	x	x	x	x	x	●	Highly Flammable liquid. Toxic substance. Contact CKD during model selection.
Acetylene	Gas	x	x	x	▲	▲	x	Highly explosive gas. Contact CKD during model selection. Explosion-proof(d3G2If specified, CKD solenoid valves cannot be used. Instead use an air operated type.
Acetaldehyde	Liquid	x	x	x	x	x	x	Flammable liquid. If explosion-proof types are specified by the surrounding environment, select General purpose valve explosion-proof(d2G4) from the following specifications.
Acetone	Liquid	x	x	●	x	x	●	Flammable liquid. If explosion-proof types are specified by the surrounding environment, select General purpose valve explosion-proof (d2G4) from the following specifications.
Aniline	Liquid	x	x	x	x	▲	▲	Organic solvents used in paints or dyes.
Linseed oil	Liquid	x	x	x	●	●	x	Take note of viscosity. For direct acting 2-port valves, the fluid viscosity must be 50 mm^2/s or less.
Amyl alcohols	Liquid	x	●	●	x	●	●	Ethylene propylene rubber is more suitable than fluoro-rubber.
Argon	Gas	●	●	●	●	●	●	This is an inert gas so there is no corrosion. Specify oil-prohibited specifications.
Ammonia	Gas	x	x	x	x	x	▲	-
Aqueous ammonia	Liquid	x	x	x	x	x	▲	AKA: Ammonium hydroxide.
Isopropyl alcohol	Liquid	●	●	●	●	●	●	AKA:IPA. Used in semiconductor washers.
Ethyl alcohol (pure)	Liquid	x	●	●	x	●	●	AKA: Ethanol. If explosion-proof types are specified by the surrounding environment, select General purpose valve explosion-proof (d2G2) or (d2G4).
Ethyl alcohol (Industrial)	Liquid	x	x	●	x	x	●	
Ethyl ether	Liquid	x	x	x	x	x	x	In general, these are known as ethers.

[Indicates the compatibility of sealant material, body material and working fluid.]

●:Usable ▲: Usable with conditions x:Unusable

Fluid name	Fluid properties (Indicators the state of the raw material even if the fluid indicates water solubility)	Material combination [Body material] Brass [Sealant material] Nitrile rubber	Material combination [Body material] Brass [Sealant material] Fluoro rubber	Material combination [Body material] Brass [Sealant material] Ethylene propylene	Material combination [Body material] Stainless steel [Sealant material] Nitrile rubber	Material combination [Body material] Stainless steel [Sealant material] Fluoro rubber	Material combination [Body material] Stainless steel [Sealant material] Ethylene propylene	Note on model No. selection
Ethylene oxide gas	Gas	x	x	x	x	x	x	AKA: E.O.G. It is also called ethylene oxide. Boils into gas at 10.4°C. Explosive gas.
Ethylene glycol	Liquid	●	●	●	●	●	●	Used as anti-freeze.
Aqueous ammonium chloride	(Crystal)	x	x	x	x	x	x	Solenoid valves not suitable. Select a completely resin air operated valve.
Ethylene chloride	Gas	x	x	x	x	x	x	AKA: Ethyl chloride. Requires dry conditions. Select a CKD air operated valve for chemical liquids if moisture is present. Flammable gas.
Methyl chloride	Gas	x	x	x	x	x	x	AKA: Chloromethane. Boils into gas at -23°C. Requires dry conditions. Select a CKD air operated valve for chemical liquids if moisture is present.
Methylene chloride	Liquid	x	x	x	x	x	x	AKA: Dichloromethane.
Aqueous potassium chloride	(Crystal)	x	x	x	x	x	x	Cannot be used with metal.
Aqueous magnesium chloride	(Crystal)	x	x	x	x	x	x	Cannot be used with metal.
AE solvent	Liquid (Powder)	x	x	x	x	x	x	Cement hardener.
Ozone (several ppm or less)	Gas	x	x	x	x	▲	▲	-
Sodium perchlorate	Liquid	x	x	x	x	x	x	AKA: Perchlorate soda. Cannot be used with rubber.
Hydrogen peroxide solution	Liquid	x	x	x	x	x	x	Oxidant. Used in disinfectants and sterilization agents. Normal 30 to 50% Aqueous solution.
Caustic soda	(Solid)	x	x	x	●	x	●	Take care when using as crystals may form when fluid dries out. (Crystals may adhere to the OUT side of the valve, causing it to lock)
Aqueous potassium permanganate	(Crystal)	x	x	x	x	x	x	Used for analysis. Strong oxidant. Crystals will form as it dries out.
Gasoline	Liquid	x	▲	x	x	▲	x	Contact CKD during model selection, as it cannot be used even with fluoro rubber in some cases.

Working fluid check list

Multi-fit

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[Indicates the compatibility of sealant material, body material and working fluid.]

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Fluid name	Fluid properties (Indicators the state of the raw material even if the fluid indicates water solubility)	Material combination [Body material] Brass [Sealant material] Nitrile rubber	Material combination [Body material] Brass [Sealant material] Fluoro rubber	Material combination [Body material] Brass [Sealant material] Ethylene propylene	Material combination [Body material] Stainless steel [Sealant material] Nitrile rubber	Material combination [Body material] Stainless steel [Sealant material] Fluoro rubber	Material combination [Body material] Stainless steel [Sealant material] Ethylene propylene	Note on model No. selection
Glycerin	Liquid	●	●	●	●	●	●	Take note of viscosity. The fluid viscosity must be 50mm^2/s or less.
Cresol	Solid(Liquid)	x	x	x	x	▲	x	Disinfectant. AKA: Methyl phenol.
Chloroform	Liquid	x	x	x	x	x	x	AKA: Trichloromethane. Acute toxic substance.
Light oil	Liquid	●	●	x	●	●	x	-
Aqueous sodium silicate	(Crystal)	●	●	●	●	●	●	AKA: Waterglass. Used in phosphate-free detergents. Take note of viscosity and concentration. Select stainless steel for high concentrations, as it is classified as an alkaline aqueous solution.
Isopropyl acetate	Liquid	x	x	x	x	x	x	Flammable liquid. Acute toxic substance. Paint solvent.
Ethyl acetate	Liquid	x	x	x	x	x	x	A solvent for paint. If explosion proof types are specified by the surrounding environment, select General purpose valve explosion-proof (d2G2) or (d2G4).
Sodium acetate	(Solid)	●	●	x	●	●	x	Dye.
Butyl acetate	Liquid	x	x	x	x	x	x	Flammable liquid. Acute toxic substance.
Methyl acetate	Liquid	x	x	x	x	x	x	Flammable liquid. Acute toxic substance.
Oxygen	Gas	x	●	●	x	●	●	Oil-prohibited treatment is required as it may spontaneously ignite when exposed to oil. Contact CKD during model selection.
Aqueous potassium cyanide	Liquid	x	x	x	●	●	●	AKA: Cyanide potash. A poisonous chemical used in plating solutions.
Carbon tetrachloride	Liquid	x	x	x	x	x	x	Flame retardant. A solvent for dry cleaning. Acute toxic substance.
Aqueous potassium dichromate	(Solid)	x	x	x	x	●	●	-
Aqueous sodium bicarbonate	(Solid)	x	x	x	●	●	●	AKA: Baking soda. Used as a food additive.
Heavy oilA	Liquid	▲	▲	x	▲	▲	x	Be careful of sealant selection if additives are present. *1

*1: High calorie heavy oil A is increasingly used for small boilers, etc. Nitrile rubber cannot be used with "high-calorie heavy oil A".

[Indicates the compatibility of sealant material, body material and working fluid.]

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Fluid name	Fluid properties (Indicators the state of the raw material even if the fluid indicates water solubility)	Material combination [Body material] Brass [Sealant material] Nitrile rubber	Material combination [Body material] Brass [Sealant material] Fluoro rubber	Material combination [Body material] Brass [Sealant material] Ethylene propylene	Material combination [Body material] Stainless steel [Sealant material] Nitrile rubber	Material combination [Body material] Stainless steel [Sealant material] Fluoro rubber	Material combination [Body material] Stainless steel [Sealant material] Ethylene propylene	Note on model No. selection
Heavy oilB	Liquid	▲	▲	x	▲	▲	x	-
Heavy oilC	Liquid	x	▲	x	x	▲	x	Take note of viscosity. We recommend the LLO solenoid for heavy oil.
Nitric acid 30%	Liquid	x	x	x	x	x	x	Solenoid valves cannot be used. We recommend a CKD air operated valve for chemical liquids.
Table vinegar	Liquid	x	x	x	x	x	x	AKA: Vinegar. This falls under the same conditions as "acetic acid".
Dimethyl silicone oil	Liquid	●	●	●	●	●	●	In general, this is known as silicone oil.
Vacuum(Medium vacuum)	-	●	●	x	●	●	x	-
Vacuum(High vacuum)	-	x	x	x	x	x	x	We recommend a valve for high vacuum (HVB type).
Aqueous silver nitrate	(Solid)	x	x	x	▲	▲	▲	Used for analysis or as a photosensitive developing agent.
Aqueous calcium hydroxide	(Solid)	x	x	x	●	●	●	AKA: Slaked lime. Used as a neutralizing agent for wastewater treatment. Take note of viscosity. Strong alkali. This resists dissolving in water, so may not be appropriate for solenoid use if it leaves grains behind.
Sodium hydroxide (30%Less than) (AKA: caustic soda)	(Solid)	x	x	x	●	x	●	Take care when using as crystals may form when fluid dries out. (Crystals may adhere to the OUT side of the valve, causing it to lock)
Sodium hydroxide (30%or more)	(Solid)	x	x	x	x	x	▲	Same as above. Same conditions.
Hydrogen	Gas	●	●	●	●	●	●	This forms an explosive gas combination when mixed with air. Explosion-proof (d3G1) is not available. Contact CKD during model selection.
Carbon dioxide	Gas	●	●	●	●	●	●	-
Carbonated water	Liquid	●	●	●	●	●	●	-
Tannic acid	(powder)	x	x	x	●	●	●	-
Nitrogen	Gas	●	●	●	●	●	●	Inert gas. Non-corrosive. Oil-prohibited specifications.
Turpentine	Liquid	▲	▲	x	▲	▲	x	Rosin oil. Used in solvents and pharmaceutical products. Ignition point 35°C.
Natural gas	Gas	●	●	x	●	●	x	AKA: LNG. Specific gravity 0.65. Gas combustion system Component is recommended.
Kerosene	Liquid	▲	▲	x	▲	▲	x	AKA: Kerosene. Jet fuel is known as kerosene.
City gas	Gas	●	●	x	●	●	x	Gas combustion system component is recommended.
Dry air	Gas	●	●	●	●	●	●	-
Trichloroethane	Liquid	x	x	x	x	x	x	The corrosiveness increases when mixed with water.
Trichloroethylene	Liquid	x	x	x	x	x	x	Alias : Trichlene. Acute toxic substance.
Toluene	Liquid	x	x	x	x	x	x	If explosion-proof types are specified by the surrounding environment, select General purpose valve explosion-proof (d2G2) or (d2G4). Note that it is volatile and take care with temperatures. Flammable liquid. Acute toxic substance.

Working fluid check list

Multi-fit

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[Indicates the compatibility of sealant material, body material and working fluid.]

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Flow Body Name	Fluid properties (Indicators the state of the raw material even if the fluid indicates water solubility)	Material combination [Body material] Brass [Sealant material] Nitrile rubber	Material combination [Body material] Brass [Sealant material] Fluoro rubber	Material combination [Body material] Brass [Sealant material] Ethylene propylene	Material combination [Body material] Stainless steel [Sealant material] Nitrile rubber	Material combination [Body material] Stainless steel [Sealant material] Fluoro rubber	Material combination [Body material] Stainless steel [Sealant material] Ethylene propylene	Note on model No. selection
Naphtha	Liquid	x	x	x	x	x	x	
Dichloride benzene	Liquid(Solid)	x	x	x	x	x	x	AKA: Dichlorobenzene.
Lactic acid	Liquid	x	x	x	x	●	●	For brewing, Used for drinking.
Perchloroethylene	Liquid	x	x	x	x	●	x	AKA: Ethylene tetrachloride. Limited to use in environments with well-equipped exhaust equipment for acutely poisonous materials. A volatile solvent for dry cleaning. Contact CKD during model selection.
Castor oil	Non-drying	x	x	x	▲	▲	x	Used as a laxative. Vegetable oils.
Phenol	(Crystal)	x	x	x	x	▲	x	disinfectant, Used as a local anesthetic.
Butane gas	Gas	●	●	x	●	●	x	If explosion-proof types are specified by the surrounding environment, select General purpose valve explosion-proof (d2G2) or (d2G4). Gas combustion system Component is recommended.
Butyl alcohol	Liquid	x	●	●	x	●	●	AKA: Butanol. If explosion-proof types are specified by the surrounding environment, select General purpose valve explosion-proof (d2G2) or (d2G4) from the following specifications. Flammable liquid. Contact CKD during model selection.
Brake fluid	Liquid	x	x	●	x	x	●	-
Propyl alcohol	Liquid	x	●	●	x	●	●	-
Propane gas	Gas	●	●	x	●	●	x	Gas combustion system component is recommended.
Freon gas *1 R 23	Liquid and gas	x	x	x	x	x	x	AKA:HFC23
Freon gas *1 R 32		x	x	●	x	x	●	AKA:HFC32
Freon gas *1 R 125		●	x	●	●	x	●	AKA:HFC125
Freon gas *1 R134a		x	x	x	x	x	x	AKA:HFC134a
Freon gas *1 R143a		●	x	●	●	x	●	AKA:HFC143a
Freon gas *1 R404A		x	x	x	x	x	x	For HFC125/143a/134a mixtures
Freon gas *1 R407C		x	x	x	x	x	x	For HFC32/125/134a mixtures
Freon gas *1 R407E		x	x	x	x	x	x	For HFC32/125/134a mixtures
Freon gas *1 R410A		x	x	●	x	x	●	For HFC32/125 mixtures
Freon gas *1 R507A		●	x	●	●	x	●	For HFC125/143a mixtures

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Flow Body Name	Fluid properties (Indicators the state of the raw material even if the fluid indicates water solubility)	Material combination [Body material] Brass [Sealant material] Nitrile rubber	Material combination [Body material] Brass [Sealant material] Fluoro rubber	Material combination [Body material] Brass [Sealant material] Ethylene propylene	Material combination [Body material] Stainless steel [Sealant material] Nitrile rubber	Material combination [Body material] Stainless steel [Sealant material] Fluoro rubber	Material combination [Body material] Stainless steel [Sealant material] Ethylene propylene	Note on model No. selection
Hexanol	Liquid	x	●	●	x	●	●	AKA: Hexyl alcohol.
Heptane	Liquid	▲	▲	x	▲	▲	x	Flammable liquid. Contact CKD during model selection.
Helium	Gas	●	●	●	●	●	●	Inert gas. Non-corrosive.
Benzine	Liquid	x	x	x	x	x	x	Solvent. Volatile. Flammable liquid. This forms an explosive gas when mixed with air.
Benzol	Liquid	x	x	x	x	x	x	AKA: Benzene. Flammable liquid. Harmful substance. Limited to use in environments with well-equipped exhaust equipment.
Sodium borate	(Crystal)	x	x	x	●	●	●	AKA: Borax(Housha).
Formalin	(Gas)	x	x	x	x	x	●	AKA: Formaldehyde.
Methane gas	Gas	●	●	x	●	●	x	Gas combustion system component is recommended.
Methyl alcohol	Liquid	x	x	●	x	x	●	AKA: Methanol. Flammable liquid. Acute toxic substance. Contact CKD during model selection.
Methyl ether	Gas	x	x	x	x	x	x	
Methyl ethyl ketone	Liquid	x	x	●	x	x	●	AKA:MEK. Highly Flammable liquid. Limited to use in environments with well-equipped exhaust equipment. Contact CKD during model selection.
Cottonseed oil	Semi-drying	x	▲	x	x	▲	x	For food products.
Lacquer	Liquid	x	x	x	x	x	x	If explosion-proof types are specified by the surrounding environment, select General purpose valve explosion-proof (d2G2) or (d2G4) from the following specifications.
Hydrogen sulfide solution	Water + gas	x	x	x	x	x	x	Select a completely resin air operated valve.
Aqueous ammonium sulfate	(Solid)	x	x	x	x	x	x	AKA: Ammonium sulfate. Nitrogen fertilizer.
Aqueous sodium sulfate	(Solid)	x	x	x	x	x	x	AKA: Aqueous sodium sulfide.
Aqueous nickel sulfate	(Solid)	x	x	x	x	x	x	Used as a nickel plating solution.
Aqueous copper sulfate	(Solid)	x	x	x	x	x	x	Used in agricultural chemicals, pigments, and copper plating.
Phosphoric acid	Liquid	x	x	x	x	x	x	-

Calculation method of flow characteristics

1. Flow characteristics display

The catalog specifications indicate the flow rate as follows.

Applicable components	Table indication	item	rule status
Pneumatic components	JIS compliant display	C,b	ISO 6358 : 1989Pneumatic fluid power - components using compressible fluids - Determination of flow characteristics JIS B 8390: 2000 (ISO 6358 translation)
	Conventional indication	S	JIS B 8379:1995 "Pneumatic noise reduction device"
		Cv	ANSI(NFPA)T3. 21. 3:R1-2008
Fluid control components	JIS compliant display	Cv	IEC 60534-2-3: 2015 "Industrial Process Control Valves - Part 2: Flow rate - Part 3: Test Procedure" JIS B 2005-2-3: 2004(IEC 60534-2-3 translation) JIS B 8471: 2004"Solenoid valve for water" JIS B 8472: 2008"Solenoid valve for steam" JIS B 8473: 2007"Solenoid valve for fuel"
	Conventional indication		

2. Pneumatic components description

The flow characteristics of the pneumatic components were conventionally indicated with the effective cross-sectional area S and flow coefficient Cv. However, JIS was revised (JIS B 8390:2000), and these are now indicated with the sonic conductance C and critical pressure ratio b .

- Sonic conductanceC: Value obtained by dividing the passage mass flow of the choked flow component by the product of the upper limit absolute pressure and standard condition density. (sonic conductance) S≈5.0C (C enables sizing as before.)
- Critical pressure ratio b : The value of the ideal restricted cross-sectional area without friction or compressed flow, calculated from the pressure changes inside the air tank when the choked flow is released from the components mounted on the air tank.
- Effective cross-sectional area S (mm^2):The value of the ideal restricted cross-sectional area without friction or compressed flow, calculated from the pressure changes inside the air tank when the choked flow is released from the components mounted on the air tank.

*Choked flow: Flow in which upstream pressure is higher than downstream pressure, and speeds at Components sections reach acoustic velocity. The fluid's mass flow rate is proportional to the upstream pressure, and is not dependent on downstream pressure. (Choked flow)

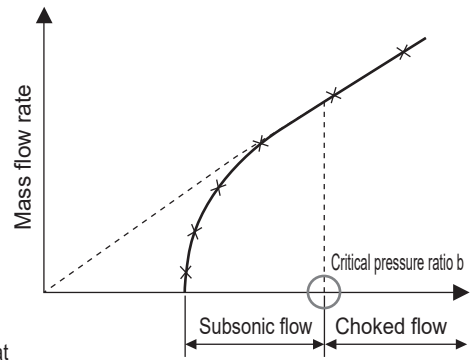


Fig.1 Mass flow characteristics for upstream pressure

Flow rate formula

Depending on the actual unit, they are shown as follows.

- $\frac{P_2}{P_1} \leq b$ When choked flow

$$Q=600xCxP_1x\sqrt{\frac{293}{273+T}} \quad \text{..... (1)}$$

- $\frac{P_2}{P_1} > b$ Subsonic flow

$$Q=600xCxP_1x\sqrt{1-\left[\frac{\frac{P_2}{P_1}-b}{1-b}\right]^2}\sqrt{\frac{293}{273+T}} \quad \text{..... (2)}$$

Q :Flow rate in standard condition L/min(ANR)
C :Sonic conductance $[dm^3/(s/bar)]$
b :Critical pressure ratio
S :Effective cross-sectional area mm^2
P_1 :Primary side absolute pressure MPa(abs)
P_2 :Secondary side absolute pressure MPa(abs)
T :Air temperature °C

When calculating with effective cross-sectional area S, substitute value C obtained with C = S/5 in the above formula.
For subsonic flow, substitute b = 0.5 in formula (2).

3. Fluid control components description

The flow characteristics of the fluid control components were indicated by flow coefficient Cv. To comply with former IEC Standards, there was a move to indicate them with flow coefficient Av to unify indications into SI units. However, the Av value was eliminated from the control valve flow coefficient with "JIS B 2005-2-3:2004" revisions, so that only Kv and Cv are used. Thus, the Cv indication is still used to indicate the flow characteristics of the fluid control components. For Av values, converted values are listed for reference as needed.

● Flow coefficient Cv: This is a non-SI control valve flow coefficient, but is used commonly throughout the world. US gal value which indicates 40 to 100°F city water flow rate per minute passing through the valve (device under test) at pressure differential of 1 psi.

$$Cv=Q\sqrt{\frac{\rho}{\rho w}\frac{1}{\triangle P}} \quad \text{.....} \quad (3)$$

Cv : Flow coefficient
Q : Flow rate[U.S.gal/min](1U.S.gal/min=6 ,309 x 10^{-5} m^3/s)
ρ : Fluid density [1b/ft^3](1b/ft^3 = 16,018kg/m^3)
ρw : Water density of 40°F to 100°F (4°C to 38°C) [1b/ft^3]
△P : Pressure difference[psi](1psi=6.8948 kPa)

● Flow coefficient Av: Value which indicates city water flow rate passing through the valve (test Component) in m3/s unit at pressure difference 1 Pa. Calculated with the following formula:

$$Av=Q\sqrt{\frac{\rho}{\triangle P}} \quad \text{.....} \quad (4)$$

Av : Flow coefficient [m^2]
Q : Flow rate [m^3/s]
ρ : Fluid density [kg/m^3]
△P : Pressure difference [PA]

Flow rate formula

Depending on the actual unit, they are shown as follows.

● Flow coefficient Cv

For liquids:

$$Q=45.58\ Cv\sqrt{\frac{\triangle P}{G}} \quad \text{.....} \quad (5)$$

Cv : Flow coefficient
Q : Flow rate [ℓ/min]
△P : Pressure difference [MPa]
G : Specific gravity
[Water G=1]

For steam:

$P_2 \leq \frac{P_1}{2}$ For $W=\frac{99\ Cv\ P_1}{K}$ ..... (6)

$P_2] \quad \frac{P_1}{2}$ For $W=\frac{198\ Cv\sqrt{(P_1-P_2)P_2}}{K}$ ..... (7)

Cv : Flow coefficient
W : Flow rate [kg/h]
P_1 : Primary side absolute pressure [MPa]
P_2 : Secondary side absolute pressure [MPa]
K : (1+ 0.0013ts) ts : Degree of superheat
(Saturation steam K=1)

Flow rate formula

Depending on the actual unit, they are shown as follows.

● Flow coefficient Av

For liquids:

$$Q=1.9 \times 10^{6} Av \sqrt{\frac{\triangle P}{G}} \quad \text{..... (8)}$$

Q : Flow rate [ℓ /min]
Av : Flow coefficient [m^2]
△P : Pressure difference [MPa]
G : Specific gravity [Water=1]

For steam:

$$Q=8.3 \times 10^{6} Av \sqrt{\triangle P(P_2+0.1)} \quad \text{..... (9)}$$

Q : Flow rate [kg/h]
Av : Flow coefficient [m^2]
△P : Pressure difference [MPa]
P_1 : Upstream pressure Force [MPa]:$\triangle P=P_1-P_2$
P_2 : Downstream pressure [MPa]
P_1,P_2 is gauge pressure

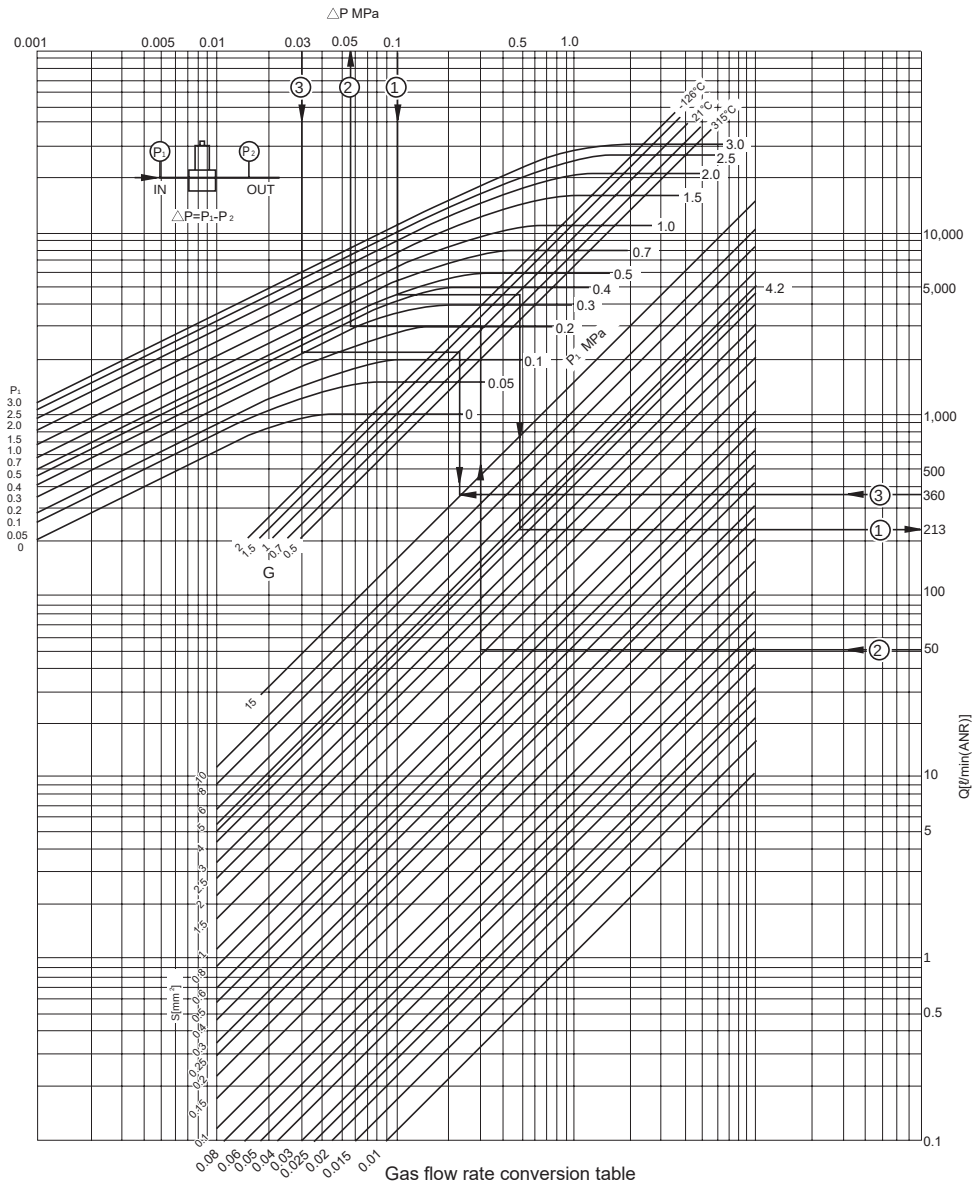
Flow coefficient conversion

$$Av=28 \times 10^{-6}\ Kv=24 \times 10^{-6}\ Cv \quad \text{..... (10)}$$

Kv : Value which indicates 5 to 40°C city water flow rate passing through the valve in m^3/h. unit at pressure difference 1bar.
Cv : Value which indicates 60°F city water flow rate passing through the valve in US gal/min. unit at pressure difference 1lbf/in^2 (psi).
The Kv and Cv for air use different calculation methods, so the values do not match.

Flow rate conversion table

Air



Gas flow rate conversion table

● Example1:
(S = 4.2 mm²) with P1=0.5MPa, P_2=0.4MPa(△P=P1-P2=0.1MPa)
The flow rate when air flows in

Q=226ℓ/min(ANR)

● Example 2:
The pressure loss when air is passed through a S = 1.5 mm2 valve at 50 ℓ/min (ANR) at P_1 = 0.3 MPa is

△P = 0.057 MPa

● Example3 :
What should the valve's effective cross-sectional area be to attain a 360 ℓ/min. (ANR) flow rate at P_1 = 0.3 MPa and △P = 0.03 MPa

S=16.7

*1: The table shows the effective cross-sectional area (S) up to 15. If this value is exceeded, multiply the effective cross-sectional area (S) and flow rate proportionally.
Example:If the effective cross-sectional area (S) is 20, refer to 2 and multiply the flow rate by 10.

*2: Air temperature of 20°C is assumed.

Flow rate calculation method

When calculating from effective sectional area
SI units

● $\frac{P_2}{P_1}$ when ≤0.5 (choked flow)

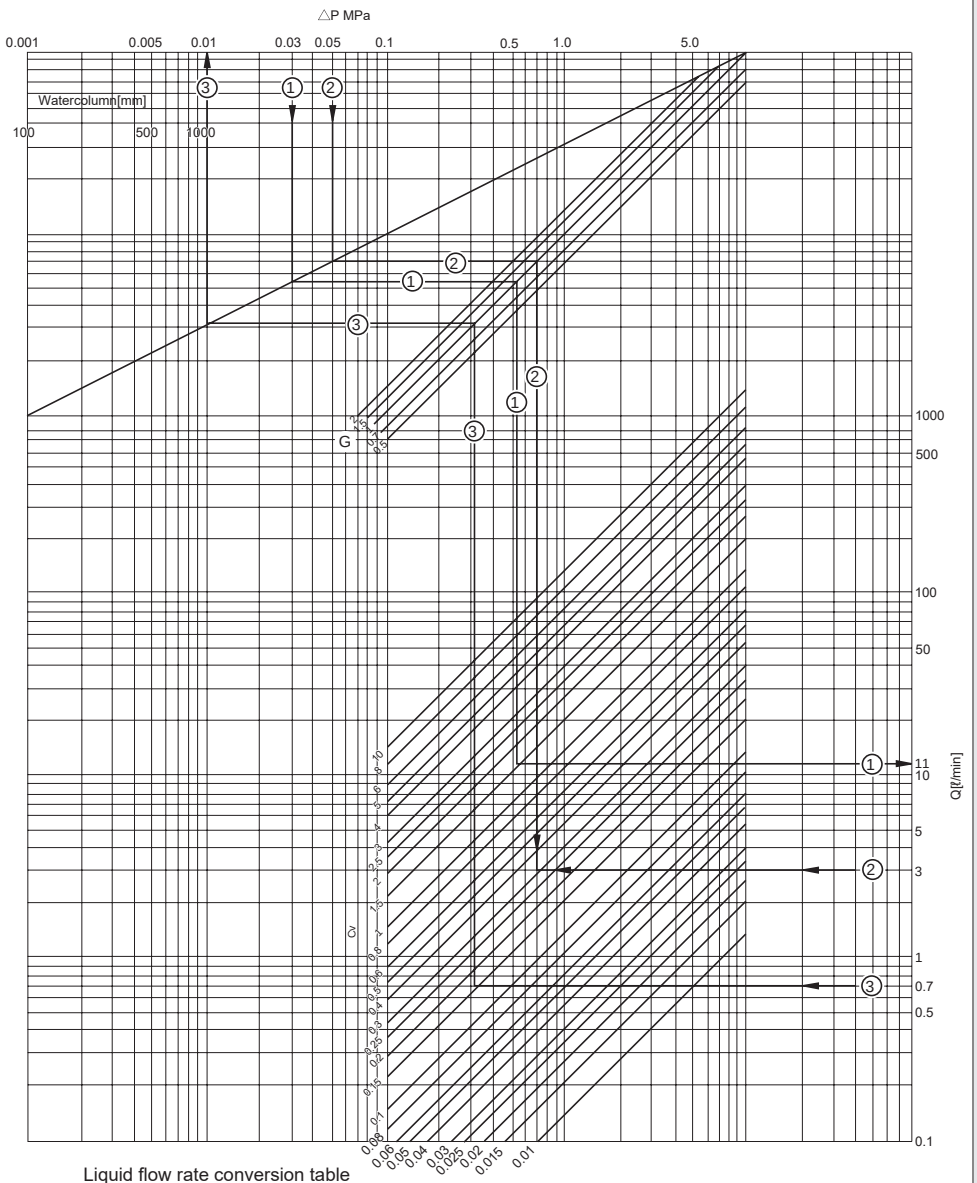
$$Q=120xSxP_1x\sqrt{\frac{293}{273+T}}$$

● $\frac{P_2}{P_1}$] when >0.5 (subsonic flow)

$$Q=240xSx\sqrt{P_2x(P_1-P_2)}\ x\sqrt{\frac{293}{273+T}}$$

Q : Flow rate ℓ/min(ANR)
P_1 : Primary side absolute pressure MPa (abs)
P_2 : Secondary side absolute pressure MPa (abs)
S : Effective cross-sectional area mm²

Water



Liquid flow rate conversion table

● Example1:
What is the flow rate when water (specific gravity =1) is passed through a Cv = 1.5 valve at △P = 0.03 MPa (P1 - P2)?

Q=11.8ℓ/min

● Example 2:
Cv required for water (specific gravity = 1) to flow at 3 ℓ/min at △P=0.05MPa

Cv=0.29

● Example3 :
Pressure loss when water (specific gravity = 1) is passed through a Cv = 0.15 valve at 0.7 ℓ/min

△P = 0.01 MPa

*1: The table shows C V up to 10. If this value is exceeded, multiply the C V value and flow rate Q proportionally.
Example: If C v is 15, refer to 1.5 and multiply the flow rate by 10.

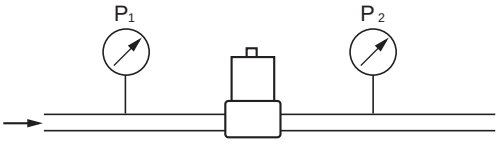
Flow rate calculation method

SI units

$$Q=45.58Cv\frac{\sqrt{P_1-P_2}}{\sqrt{G}}$$

Q : Flow rate ℓ/min

P_1 : Primary pressure MPa (Gauge pressure)
P_2 : Secondary pressure. MPa (Gauge pressure)
G : Specific gravity (Water=1)
Cv : Flow coefficient



Pressure loss
△P
$\triangle P=P_1-P_2$

Safety Precautions

Be sure to read this section before use.

When designing and manufacturing a device using CKD products, the manufacturer is obligated to check that device safety mechanism, pneumatic control circuit, or water control circuit and the system operated by electrical control that controls the devices is secured.
It is important to select, use, handle and maintain the product appropriately to ensure that the CKD product is used safely.
Observe warnings and precautions to ensure device safety.
Check that device safety is ensured, and manufacture a safe device.

WARNING

1 This product is designed and manufactured as a general industrial machine part.
It must be handled by an operator having sufficient knowledge and experience.

2 Use this product in accordance with specifications.

This product must be used within its stated specifications. In addition, never modify or additionally machine this product.
This product is intended for use in general industrial machinery equipment or parts. It is not intended for use outdoors (except for products with outdoor specifications) or for use under the following conditions or environments.
(Note that this product can be used when CKD is consulted prior to its usage and the customer consents to CKD product specifications. The customer should provide safety measures to avoid danger in the event of problems.)

❶ Use for applications requiring safety, including nuclear energy, railways, aircraft, marine vessels, vehicles, medical devices, devices or applications in contact with beverages or foodstuffs, amusement devices, emergency cutoff circuits, press machines, brake circuits, or safety devices or applications.
❷ Use for applications where life or assets could be significantly affected, and special safety measures are required.

3 Observe organization standards and regulations, etc., related to the safety of device design and control, etc.

ISO4414, JIS B 8370 (Pneumatics fluid power - General rules and safety requirements for systems and their components)
JFPS2008 (Principles for pneumatic cylinder selection and use)
Including the High Pressure Gas Safety Act, Industrial Safety and Health Act, other safety rules, organization standards and regulations, etc.

4 Do not handle, pipe, or remove devices before confirming safety.

❶ Inspect and service the machine and devices after confirming safety of all systems related to this product.
❷ Note that there may be hot or charged sections even after operation is stopped.
❸ When inspecting or servicing the device, turn OFF the energy source (air supply or water supply), and turn OFF power to the facility.Discharge any compressed air from the system, and pay attention to possible water leakage and leakage of electricity.
❹ When starting or restarting a machine or device that incorporates pneumatic components, make sure that the system safety, such as pop-out prevention measures, is secured.

5 Observe warnings and cautions in the following pages to prevent accidents.

■ The precautions are ranked as "DANGER", "WARNING" and "CAUTION" in this section.

DANGER: When a dangerous situation may occur if handling is mistaken leading to fatal or serious injuries, and when there is a high degree of emergency to a warning.

WARNING: If handled incorrectly, a dangerous situation may occur, resulting in death or serious injury.

CAUTION: When a dangerous situation may occur if handling is mistaken leading to minor injuries or physical damage.

Note that some items described as "CAUTION" may lead to serious results depending on the situation.
Every item provides important information and must be observed.

Warranty

1 Warranty period

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

2 Warranty coverage

If the product specified herein fails for reasons attributable to CKD within the warranty period specified above, 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:
1) 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 the Instruction Manual.
2) Failure caused by use of the product exceeding its durability (cycles, distance, time, etc.) or caused by consumable parts.
3) Failure not caused by the product.
4) Failure caused by use not intended for the product.
5) Failure caused by modifications/alterations or repairs not carried out by CKD.
6) Failure caused by reasons unforeseen at the level of technology available at the time of delivery.
7) 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.
Note: For details on the durability and consumable parts, contact your nearest CKD sales office.

3 Compatibility check

The customer is responsible for confirming the compatibility of CKD products with the customer's systems, machines and equipment.

Control Component: Warning / Precautions

Be sure to read this section before use.

Design/selection

1. Safety design

⚠WARNING

■This product cannot be used as an emergency shut-off valve.
The valves listed in this catalog are not designed as valves to ensure safety such as emergency shutoff valves. When using in such a system, always take separate measures that will ensure safety.

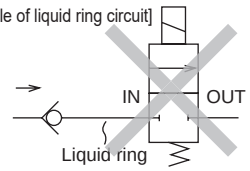
■Take measures to prevent physical harm or property damage in the event of failure of this product.

⚠CAUTION

■Leakage current from other fluid control components
When using a PLC with a CR circuit to absorb the surge voltage generated from switching elements, etc., the leakage current could adversely affect the operation of the solenoid valve. Keep leakage current to less than the value given in the safety precautions for each product in this catalog or the value given for each product.

■Liquid ring
When liquid is to be passed, and a circuit of the liquid seal is formed, the pressure could rise due to changes in the temperature and operation may be disabled; some products may also suffer damage to parts. Prevent a liquid seal circuit by providing a relief valve in the system.

[Example of liquid ring circuit]



■Vibration
Install this product in a place not subject to vibration.

2 . Working fluid

⚠WARNING

■Working fluids
- Do not use any fluid other than the working fluids specified in the catalog.
- Before starting use, check the compatibility between the product and working fluid with the working fluid check list.
- Contact CKD before using this valve for active gas (combustion gas, acetylene gas, etc.).
- When using the brass body in water or hot water, dezincification, erosion, or corrosion may cause malfunction or internal leakage. Stainless steel body is also available. Stainless steel body is recommended for use in water or hot water.
- The fluid viscosity must be 50 mm^2/s or less. Malfunctions could occur if the viscosity is higher than 50 mm^2/s.
- Depending on the model, internal parts may wear when the valve operates. Caution is required because wear chips could enter the secondary side of the valve.
- If rust must be avoided, select a component whose metal sections are not wetted.
- When using tap water with the EPDM sealant for long periods, it may deteriorate due to residual chlorine.

■Fluid quality
Iron rust and debris in the fluid can cause operation faults or leaks and deteriorate product performance. Provide measures to remove foreign matter.

■Fluid temperature
Use the product within the fluid temperature range.

3 . Working environment

⚠WARNING

■Only explosion-proof solenoid valves and air operated valves can be used in an explosive atmosphere.
Select either an explosion-proof solenoid valve or air operated valve for use within an explosive atmosphere.

■Do not use this product in a corrosive gas atmosphere or an atmosphere that could affect the component materials.

■Do not use this product near a heat generating source or in a location where it may be exposed to radiant heat.

■Use this product within the specified ambient temperature range.

■In temperatures below freezing, sealing performance will decrease due to valve seat and noise dampening rubber hardening.

■When using this product in a cold climate, appropriate measures to prevent freezingfor vacuum piping. When wrapping insulation around the solenoid valve, etc., do not wrap around the coil section.

■Catalog specificationsappropriate safeguards for a certain degree of protection provided by. Consult with CKD when using outdoors.

■Take appropriate safeguards when using this product in places where oil or welding spatter, etc., could come in contact with it.

■The degree of protection has passed IEC standard compliant tests, but performance greatly differs based on weather resistance and time, so these values are not guaranteed. Take measures to ensure that water, dust, etc., do not come in direct contact.

■This product is CE-marked, indicating conformity with the EMC Directives.
As a condition of compatibility with the standard EN61000-6-2 pertaining to immunity applied to this product, implement surge immunity measures on the equipment side in the case of DC voltage. For AC voltage, noise is generated due to the full-wave rectifier circuit. Install a capacitor if noise protection is required. Refer to the instruction manual for details.

4 . Securing of space

⚠CAUTION

■Securing maintenance space
Secure sufficient space for maintenance and inspection. Make sure that you have sufficient space for maintenance and troubleshooting safety. To remove the coil, the clip must be removed from the product side. Allow both space on the top of the coil and space on the side where the clip will be removed.

5 . Surge suppressor

⚠CAUTION

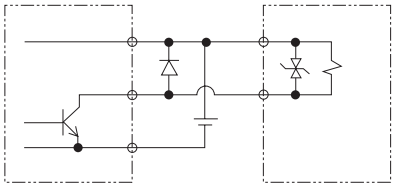
■ The surge suppressor included with the solenoid valve aims to protect the output contact for driving the solenoid valve. There is no protection for other peripheral devices, and those devices may be damaged or malfunction by a surge. The suppressor absorbs a surge voltage generated by other devices, and burns itself out protecting the output contact. The following points must be taken into consideration.

● The surge suppressor functions to limit solenoid valve surge voltage, which can reach several hundred volts, to a low voltage level that the output contact can withstand. Depending on the output circuit used, this may be insufficient and could result in damage or malfunction. Confirm in advance whether the surge suppressor is suitable for the withstand voltage of both the solenoid valve in use and the output device, circuit structure and the degree of return delay time. When necessary, provide other surge countermeasures. CKD's solenoid valve with surge suppressor can counter inverse voltage surge which occurs when the valve is turned OFF to the level shown in the table below.

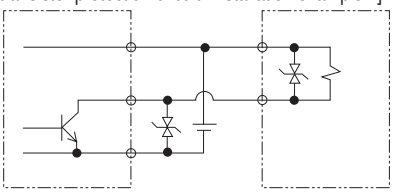
Specification voltage	Inverse voltage when OFF
12 VDC	Approx. 39 V
24 VDC	

● When the output unit is NPN type, the output transistor may be subject to a surge voltage equivalent to the voltage + power supply voltage shown in the above table. Please provide a contact protection circuit.

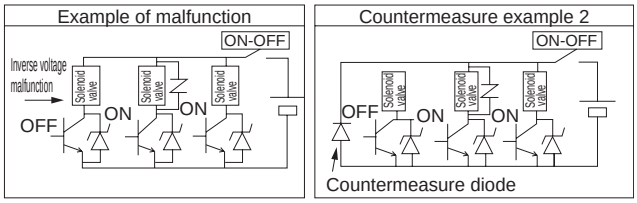
[Output transistor protection circuit: Installation example 1]



[Output transistor protection circuit: Installation example 2]



● If another device or solenoid valve is connected in parallel to the solenoid valve, the inverse voltage surge generated when the valve is OFF would apply to those devices. Even in the case of a solenoid valve with 24 VDC surge suppressor, a surge voltage may reach negative tens of volts for some models. This inverse voltage may cause damage or malfunction to other components connected in parallel. Avoid parallel connection of components susceptible to inverse polarity voltages, e.g. LED indicator lamps. When driving several solenoid valves in parallel, the surge from other solenoid valves could enter the surge suppressor of one solenoid valve and cause it to burn. When driving several solenoid valves with surge suppressors in parallel, surge current could concentrate at the surge suppressor with the lowest voltage limit and cause similar burning. Even if the solenoid valve is the same, the surge suppressor's voltage limit can be inconsistent, and in the worst case, could result in burning. Avoid driving multiple solenoid valves in parallel.



● The surge suppressor incorporated in the solenoid valve will often be short-circuited if it is damaged by overvoltage or overcurrent from other solenoid valves. Where there is a failed surge suppressor, if a large current flows when the output is ON, in the worst case scenario, the output circuit or solenoid valve could be damaged or ignited. Do not continue energizing the solenoid valve if the surge suppressor becomes faulty. Additionally, to prevent large currents from continuing to flow, connect an overcurrent protection circuit to the power supply and drive circuit, or use a power supply with overcurrent protection.

Mounting, installation and adjustment

1. Mounting

⚠CAUTION

■ Be sure to read the instruction manual thoroughly before installing the product.

■ In the case of models with solenoid valves, do not apply external force to the coil during installation.

■ After installation, check for leaks from pipes, for proper wire connections and that the product is installed correctly.

2 . Piping

⚠CAUTION

■ Observe the effective thread length for the piping threads. Chamfer the end of the thread section by approx. a half-pitch.

■ Before piping, flush the inside of the pipe with 0.3 MPa of air, and remove foreign matter such as dirt, metal chips, rust and sealing tape.

■ If excessive sealant (sealing tape, gel-type sealant) is applied when piping, it could enter the product and cause malfunctions.

■ When applying or wrapping sealant on the piping material, apply or wind it from the pipe end along the thread section, and leave 1.5 to 2 threads uncovered.

■ Foreign materials or foreign matter in fluid could prevent the product from functioning correctly. Install an 80 mesh or more filter for water flow, and a 5 μm or less filter for air flow.

■ Make sure not to use the wrong supply port when connecting the pipes to the product.

■ Install a by-pass circuit and use an elbow union for piping to simplify the maintenance and repair work.

■ When controlling fluid in the tank, pipe at a level slightly above the bottom of the tank.

■ When using steam for the working fluid, provide piping that prevents drainage from accumulating on the primary side of the solenoid valve.This may cause malfunction.

- When using this product for water, water hammer may occur depending on the piping conditions. The solenoid valve may be damaged by sudden pressure fluctuations. Provide water hammer countermeasures.
- When attaching the mounting plate to the body, tighten the attached screw with the following tightening torque.
  FFB/FFG-2 Series thread size M4:1.3 to 1.6N·m
  FFB/FFG-3/4/5 Series thread size M5:2.6 to 3.2N·m
- Refer to the table below for the piping tightening torque.

[When body / sub-plate material is aluminum]

Piping nominal diameter	Recommended piping tightening torque (N·m)
Rc1/8	7 to 9
Rc1/4	12 to 14
Rc3/8	22 to 24
Rc1/2	28 to 30
Rc3/4	31 to 33
Rc1	36 to 38

[Body / sub-plateWhen the material is other than aluminum]

Piping nominal diameter	Recommended piping tightening torque (N·m)
Rc1/8	18 to 20
Rc1/4	23 to 25
Rc3/8	31 to 33
Rc1/2	41 to 43
Rc3/4	62 to 65
Rc1	83 to 86

[When using a push-in fitting for pneumatic use]

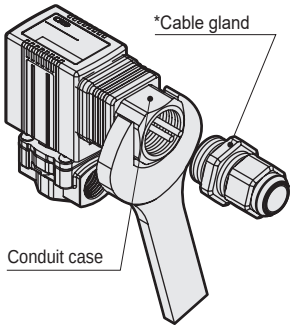
Port thread	Recommended tightening torque values (N·m)
Rc1/8	3 to 5
Rc1/4	6 to 8
Rc3/8	13 to 15
Rc1/2	16 to 18
Rc3/4	19 to 40
Rc1	41 to 70

Note: For NPT threads, values recommended for Rc threads with the same size apply.

3 . Wiring

⚠CAUTION

- Use within the allowable voltage range. Usage outside of the allowable voltage range may lead to malfunction or coil damage.
- Provide a circuit breaker, such as a fuse, on the control circuit to protect electrical equipment.
- If the electric circuit system is vulnerable to solenoid surge, use a solenoid with a surge suppressor (optional), or insert a surge absorber, etc., in parallel to the solenoid. (Note that this does not apply to the motorized ball valve series.)
- As a guide, use a wire with a nominal cross section of 0.5 mm^2 and over. Make sure that excessive force is not applied to the lead wire.
- Use of a switching circuit which does not generate contact chattering will increase the durability of the solenoid valves and motorized valves.
- Coil option: Always hold the conduit case when connecting the cable gland to the conduit. If the coil or body is gripped and connected, the conduit case may be damaged. Tightening torque of cable gland is 0.45 to 0.55 N·m.



*Parts marked with an asterisk are not included with CKD products.

Use/maintenance

1. Maintenance / inspection

⚠WARNING

- Do not touch coils or actuators with hands or body while the power is ON or immediately after it is turned OFF.
  The solenoid valve coil and actuator will heat up when energized. Depending on the product, direct contact could cause burns and so use caution.
- When energized, hand on the electrical wiring connections (bare, live parts) Do not touch or body. at risk of electric shock.
  Touching electrical wiring connections while power is on may lead to electrical shock.
- Use this product under the max. working pressure and max. working pressure differential.
- Periodic inspection to ensure optimum use of the product. Do this every six months. This frequency varies with the frequency of use.

⚠CAUTION

- Do not use valves as a footing or place any heavy objects on top of the valves.
- If the product is continuously energized or not frequently used, periodically inspect it since malfunction may occur depending on the use condition.
- If the product has not been in use for one month or more, perform a test run before starting use.
- Read the instruction manual thoroughly before starting maintenance to ensure correct operation.
- Always turn the power OFF and release any fluids or pressure before starting maintenance.
- Pay attention to clogging of the strainer and filter.

2 . Disassembly/assembly

⚠CAUTION

- When cleaning parts, do not use neutral detergents or other substances that may affect the environment.Use a small amount of cleaning agent. (Note that the rubber parts must be replaced. There is a risk of expansion.)
- When the product will not be used for one month or more after using water or hot water, completely remove any water or hot water left in the product. Water or hot water residue will cause rusting and may lead to malfunction or leaks. If residual water cannot be eliminated, operate the valve several times a day and pass water through to ensure ideal use.
- Contact CKD with questions about consumable parts, etc.
- Coil replacement method

●Removing the clip

Insert a flathead screwdriver into the clip mesh section shown in Fig.1 and pull it in the direction of the arrow to remove. Depending on the coil direction, it is difficult to insert a flathead screwdriver. Rotate the coil in the required position.

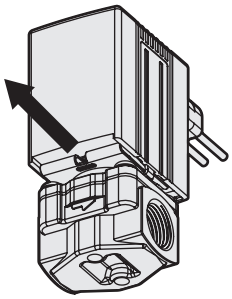


Fig. 1

●CLIP INSERTION METHOD

Push the clip in the direction of the arrow as shown in Figure 2. Clips cannot be inserted from the opposite side of the coil. You cannot insert a clip upside down. Check the following after insertion.

①The top surface of the clip should contact the collar. (Fig.3)

②The bottom of the clip must be on the hook. (Fig.4)

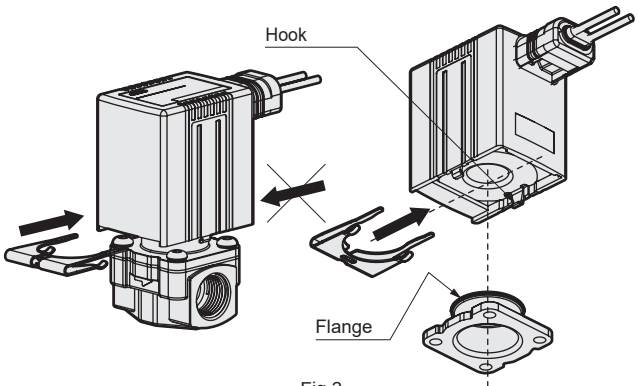


Fig.2

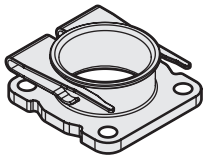


Fig.3

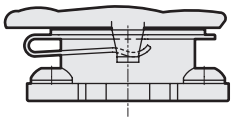


Fig.4

How to connect terminal box

■DIN terminal box (Pg9), DIN terminal box with lamp (P)g9)

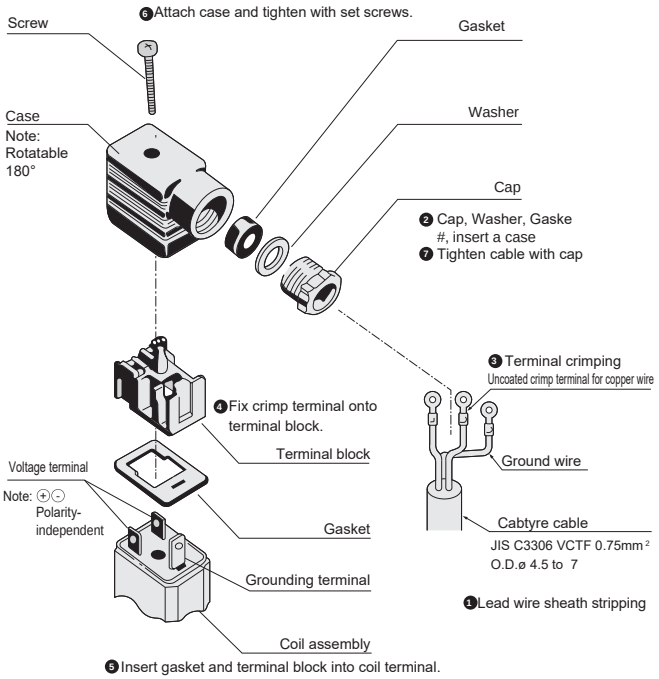
①Cabtyre cable is as followscan be used.

• cord O.D.:ø 4.5 to ø7 • Nominal section area:0.75 mm²

②Put the crimp terminal for copper wire on the cabtyre cable's lead wire and crimp the terminal. The terminal box thread size is M3.

③Tighten the screws with the following GTighten with torque.

• screw tighteningLuk...0.5Nm • terminal screw tightening torque...0.5Nm



Wire according to steps ❶ to ❼.

* The orientation of the cord can be changed by removing the terminal block from the case, rotating it by 180°, and then replacing the block into the case.

■DIN terminal box (G1/2 / Pg11), DIN terminal box with lamp (Pg11)

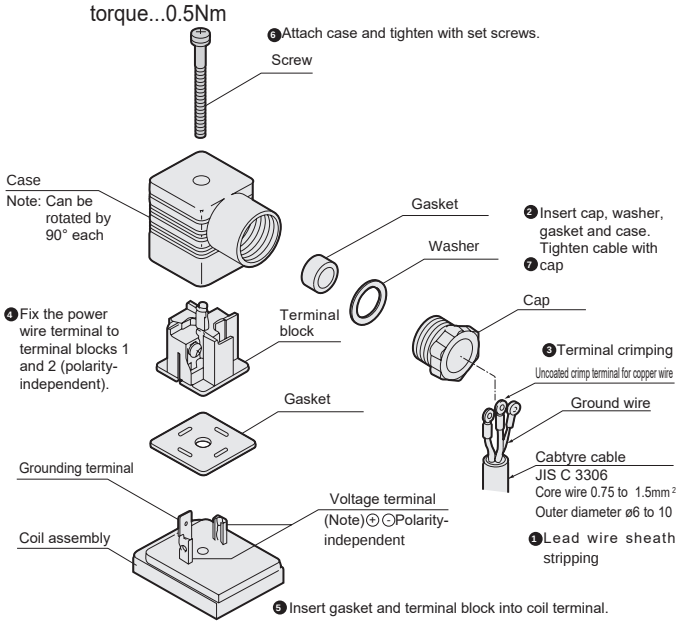
①Use the following cabtyre cable.

• cord O.D.:ø6 to ø10 • Nominal sectional area: 0.5 to 1.5 mm²

②Put the crimp terminal for copper wire on the cabtyre cable's lead wire and crimp the terminal. The terminal box thread size is M3.

③Tighten the screws with the following tightening torque.

• screw tightening torque...0.5Nm • terminal screw tightening torque...0.5Nm



Wire according to steps ❶ to ❼.

* The orientation of the cable lead out port can be changed by removing the terminal block from the case, rotating it by 90°, and then replacing the block into the case.

How to connect terminal box

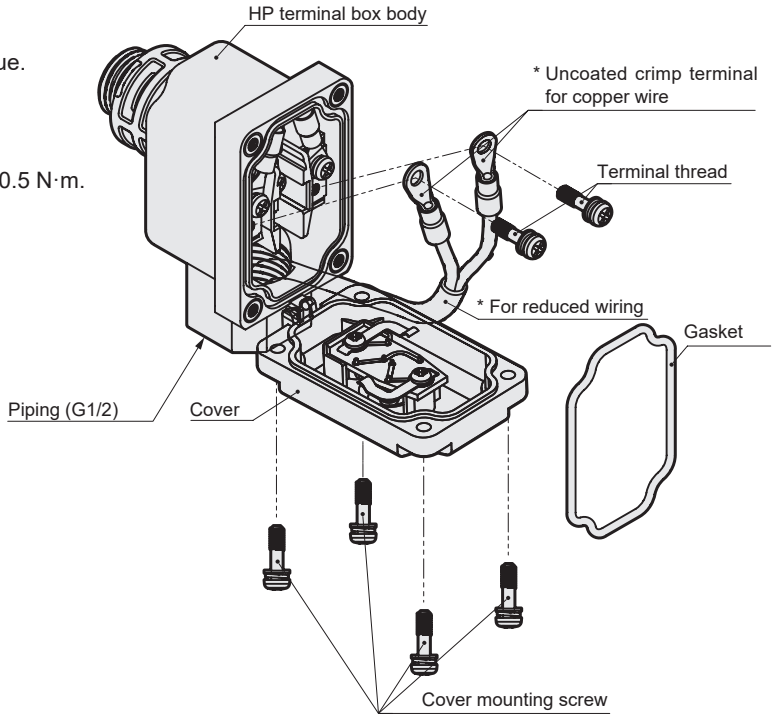
■How to connect HP terminal box

①Put the crimp terminal for copper wire on the electric wire and crimp the terminal.
The terminal screw size is M3.

②Tighten the screws with the following tightening torque.

- Cover mounting screw tightening torque...0.5 N/m
- Terminal screw tightening torque...0.5 N/m

③Tighten the piping (G1/2) with a tightening torque of 0.5 N·m.



Parts marked with an asterisk are not included with CKD products.

④The wiring will be as follows according to the number of lead wires from the coil.

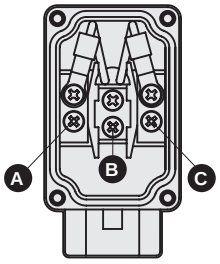
(i) For two lead wires
Wire to the A terminal and C terminal on the terminal board. Polarity-independent except in case of (ii)

(ii) For DC voltage terminal box with lamp and two lead wires
There is polarity, so A Terminal: ⊖pole,C Terminal: ⊕pole

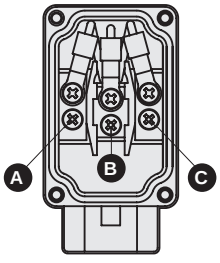
(iii) For three lead wires
Wire according to the working frequency:
- For 50Hz...A Terminal and C Terminal
- For 60Hz...A Terminal and B Terminal

[Wiring diagram]

For two lead wires



For three lead wires



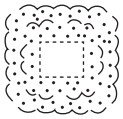
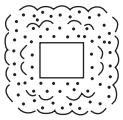
Degree of protection

● Degree of protection
■ IEC (International Electrotechnical Commission) standards (IEC60529)
■ JIS C 0920 : 2003

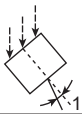
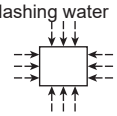
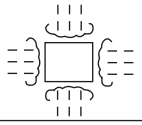
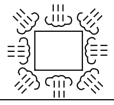
IP- □ □

Protection characteristic codes (International Protection)

1st characteristic No. (degree of protection for foreign solid matter)

1st characteristic No.	Degree of protection	
0	No protection	
1	 ø50 mm	Protection against inflow of solids 50 mm and over in diameter
2	 ø12.5 mm	Protection against inflow of solids 12.5 mm and over in diameter
3	 2.5 mm	Protection against inflow of solids 2.5 mm and over in diameter
4	 1 mm	Protection against inflow of solids 1.0 mm and over in diameter
5	Dust-proof 	No inflow of dust at levels adversely affecting normal device operation or safety
6	Dust resistant 	No inflow of dust

2nd characteristic No. (degree of protection for water entry)

2nd characteristic No.	Degree of protection	
0	No protection	
1	Protection against water dripping 	No harmful effects from water dripping vertically.
2	Protection against dripping water tilted at an angle of up to 15°  15°	Water dripping vertically has no adverse effect when the product is tilted at an angle of up to 15° from its normal position.
3	Protection for watering 	Water that erupts at any angle up to 60 degrees from the vertical has no adverse effect.
4	Protection against splashing water 	Water splashing against the product from any direction has no adverse effect.
5	Protection against water jets 	No harmful effects occur even when water is sprayed with nozzles from all directions.
6	Protection against powerful water jets 	Water projected in powerful jets against the product from any direction has no adverse effect.
7	Protection against immersion 	Water will not enter the product even when it is immersed in water under defined conditions.
8	Protection against immersion 	The product can be used for continuous immersion in water.

Catalog introduction

Pneumatic Cylinders I (Catalog No. CB-029SA)
Pneumatic Cylinders II (Catalog No.CB-030SA)
Pneumatic Valves (Catalog No. CB-023SA)
Pneumatic, Vacuum and Auxiliary components (Catalog No. CB-024SA)
General Purpose Valves (Catalog No. CB-03-1SA)

■ CKD offers a wide variety of products to meet your various needs. Select the ideal product according to your application.

Life Science Components General (Catalog No. CC-1055A)

■ Our Fluid control components respond to the requirements of medical care devices.
Controlling every type of fluid with high purity and high precision for extracting, dispensing, cleaning and disposing.

Equipment for food manufacturing processes FP Series (Catalog No. CC-1271A)

■ Satisfies a variety of needs for food processing
Support for the entire food processing process based on advanced engineering technologies in packaging machines, air pressure/liquid control, and motors
An extensive lineup of everything from air filters to actuators allows for secure and safe use in food processing

FP Food Process®

This logo represents our commitment to support food manufacturing processes with safe CKD products.

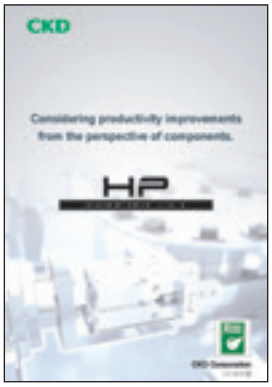
Electric Actuator Motorless General Catalog (Catalog No.CB-055A)

Wide-ranging lineup of motorless electric actuators

■ Slider
For high speed transport EBS-L Series
For high load transport ETS/ECS Series
Long stroke transport ETV/ECV Series
For fast tact transport EKS-L Series

■ Rod
For press fitting and hoisting EBR-L Series

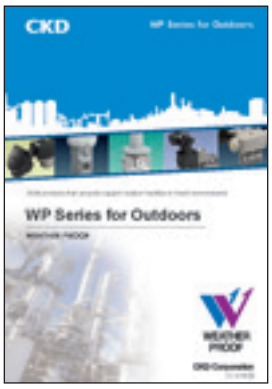
HP Series General Catalog (Catalog No.CC-1421A)



■ For high frequency use (HP1)
Optimized sliding technology for longer life with the same dimensions as conventional products (more than twice the conventional product)

■ For dusty environments (G-HP1)
Cooperative scraper and lube keeping structure improve durability in dusty environments (more than 2-fold compared to conventional models)

Outdoor products WP Series (Catalog No. CC-1276A)



■ A range of products that provide reliable support for outdoor equipment in harsh environments
CKD's outdoor series can withstand long-term use even in harsh outdoor environments.

WEATHER PROOF

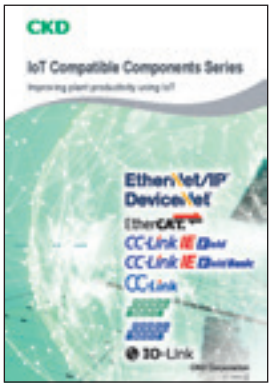
This logo represents CKD's guarantee of its products for outdoor use.

components for rechargeable battery production P4* Series (Catalog No. CC-1226A)

CKD responds to the needs of rechargeable battery manufacturing, with products conforming to production safety in the manufacturing process, from electrode manufacturing to packaging.

■Material Restrictions
■Long service life even in dusty environments
■Suppresses dust generation of metal wear powder
■Long service life even in ultra-dry environments

IoT Component series (Catalog No. CC-1466A)

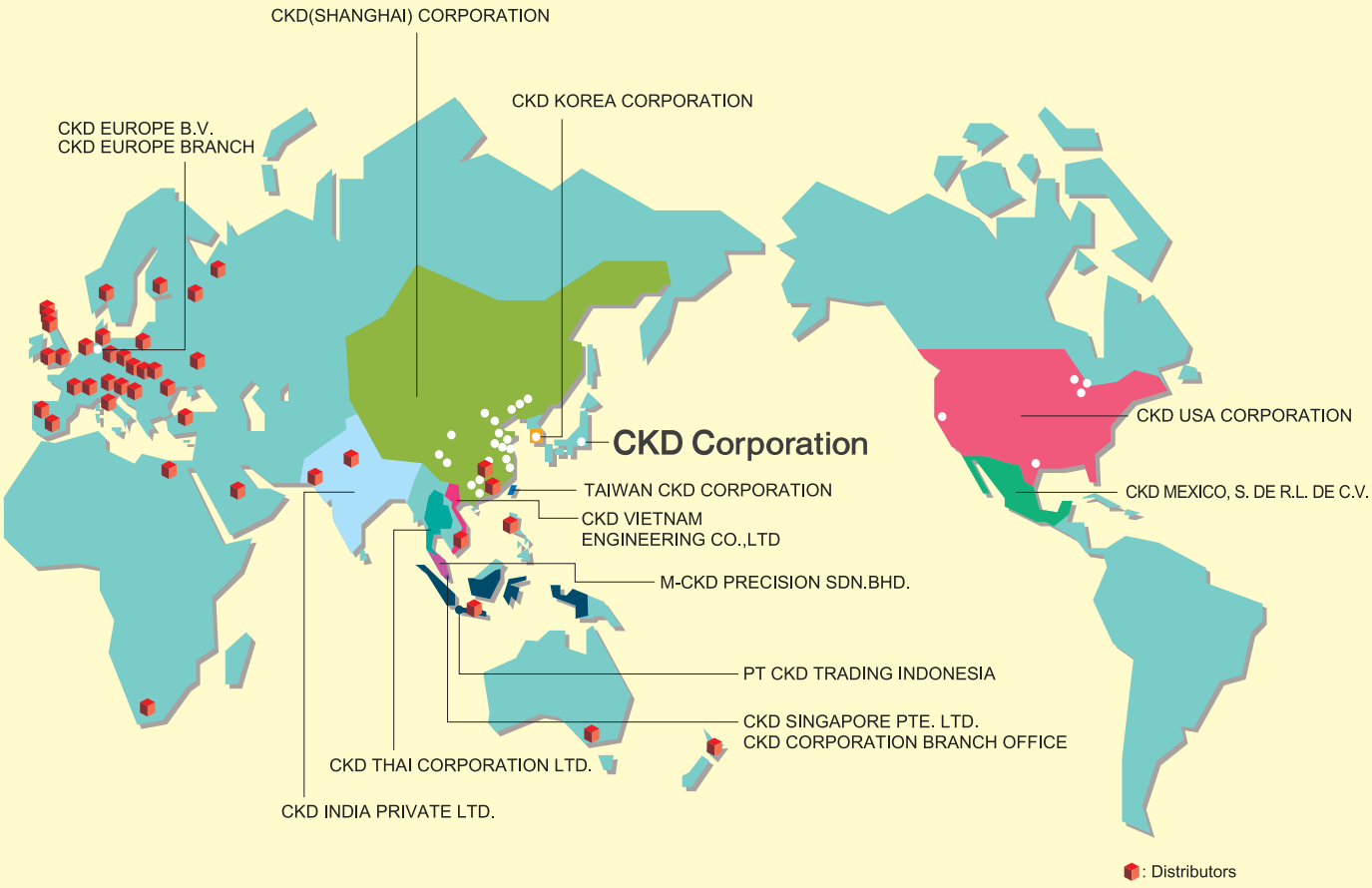


■ Supports various industrial networks to support IoT at production sites. Contributes to making actuators operating within equipment and sensors visible.

■ In addition to electric components such as electric actuators and direct drive motors with high reduced wiring needs, there is a wide lineup of network components with a sensor level that is closer to the workpiece.

■ Since the air and electric components are listed by network, it is possible to reduce the man-hours for examining the network inside the equipment.

WORLD-NETWORK



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2023.2