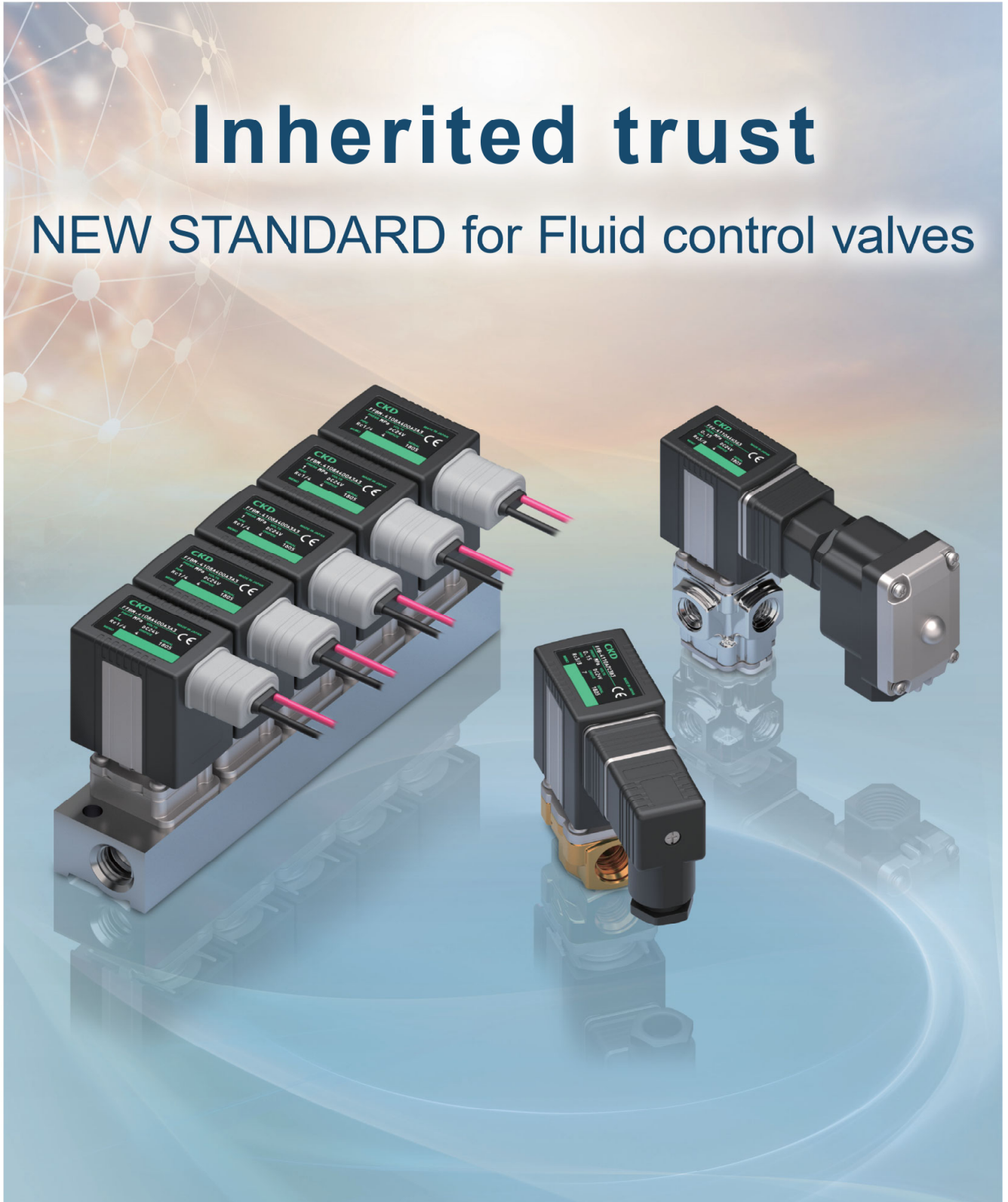


Direct Acting 2, 3-port
Solenoid Valve
(Multi-Fit Valves)
FFB/FFG Series



Inherited trust

NEW STANDARD for Fluid control valves



Multi-Fit Valves

High reliability

- High durability of 20 million cycles
- Pressure resistant container structure
- High corrosion resistance
- Prevents coil scorching

Easy to select

- Supports multiple fluids
- Wide variation

Easy to use

- Increased flexible installation
- Improved maintainability
- Silent structure

Multi-fit for multi-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. The multi-fit valve further improves reliability by providing the standard functions required for various applications as a solenoid valve, and supports a variety of fluids with a single series. In addition, we are working to realize a sustainable society by supporting carbon neutrality.



Dry air
(Inert gas)



Compressed air



Water



Vacuum



Oil

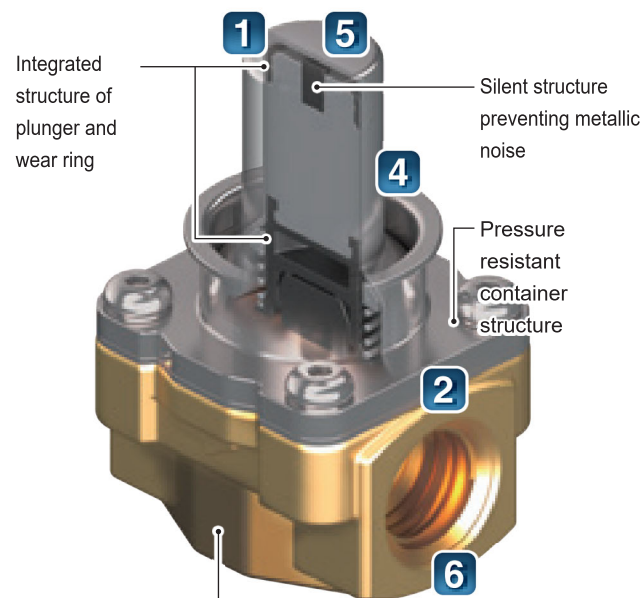
Direct acting 2, 3-port solenoid valve (general purpose valve)

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

Dezincification-resistant copper alloy is adopted for the copper alloy body

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 copper alloy body. In addition, the flare pipe is integrally molded so there is no welding.

3 Coil with full-wave rectifier(AC)

Supports energy savings and prevention of coil burn due to overcurrent

Reduces the buzzing noise specific to AC current and achieves a low wattage of 11W→4.5W. (60% reduction compared with CKD's valve size 3)

4 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.

5 Silent structure

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



6 Compatible with global standards

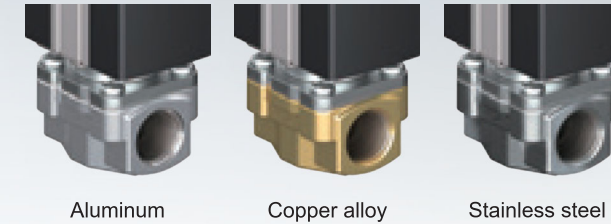
European Standards

CE RoHS

Wide variation

Body material

3 materials compatible with various fluids are available as standard.



Aluminum

Copper alloy

Stainless steel

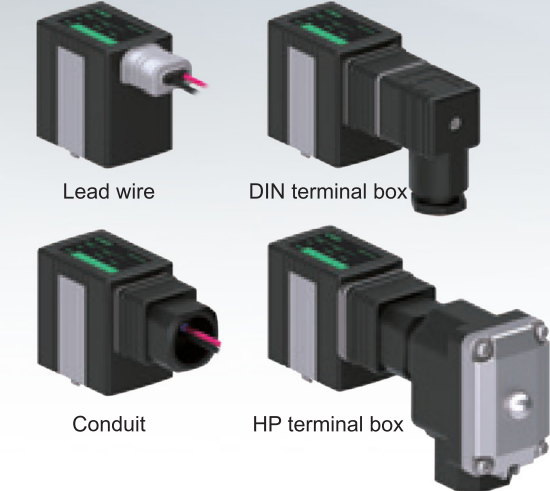
Port thread standards Rc, G, NPT

Sealant

Nitrile rubber, fluoro rubber, or 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

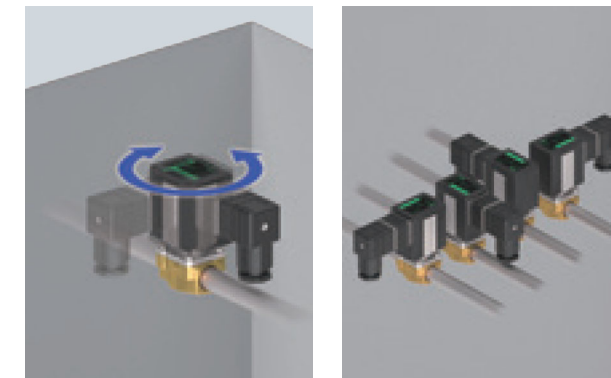
DIN terminal box

Conduit

HP terminal box

Increased flexibility in installation

Coil rotates 360°



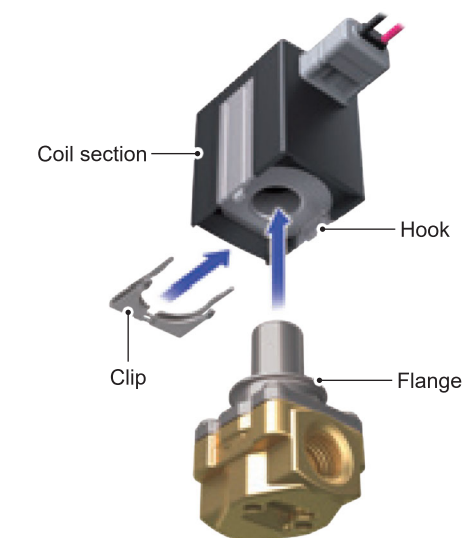
Enables effective use of narrow spaces, such as installations near the wall.

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.



Coil section

Hook

Clip






Flange

Series variation

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

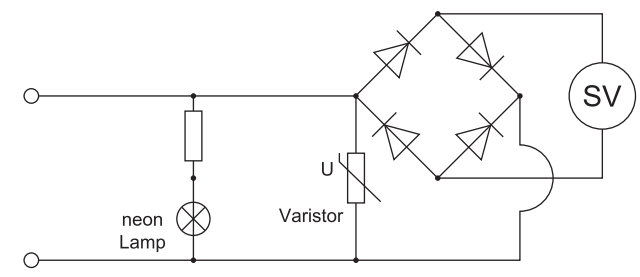
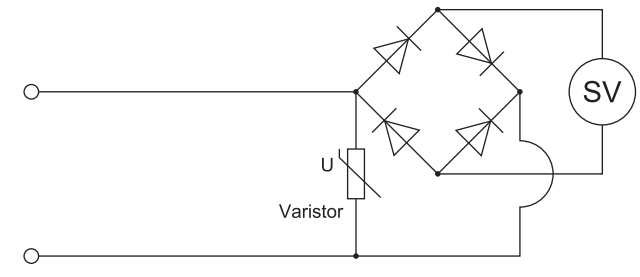
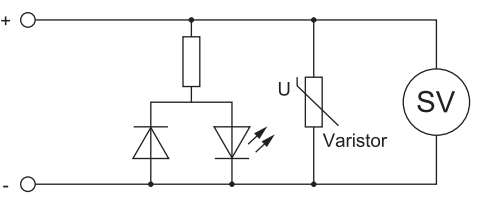
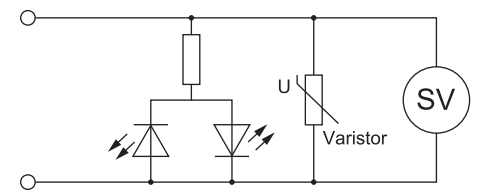
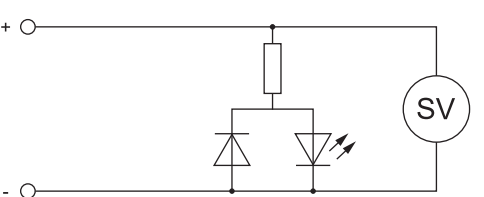
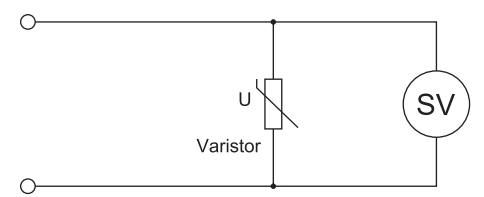
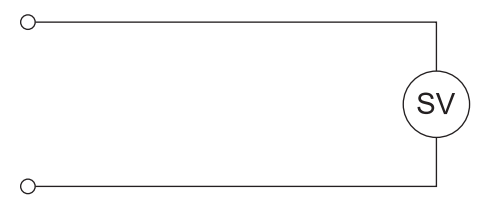
Series variation








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

No. of Ports	Model	Configuration	Actuation		Working fluid					Port size Rc/G/NPT				Page	
					Compressed air	Water	Oil	Med vacuum	Dry air	1/8	1/4	3/8	1/2		
2-port		FFB-21	Discrete valve	NC (open when energized)		●	●	●	●	●	●				1
		FFB-31			●	●	●	●	●	●	●				
		FFB-41			●	●	●	●	●		●	●			
		FFB-51			●	●	●	●	●		●	●	●		
		FFB-32		NO (closed when energized)	●	●	●		●	●	●				
		FFB-42			●	●	●		●		●	●			
		FFB-52			●	●	●		●		●	●			
		FFBM-21		Manifold	NC (open when energized) Common supply		●	●	●	●	●	●			
		FFBM-31	●			●	●	●	●		●				
		FFBM-41	●			●	●	●	●		●				
		FFBM-51	●			●	●	●	●		●				
		FFBM-25	NC (open when energized) 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	●	●
J	Lead wire (300 mm)/with surge suppressor	●*1	*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	●
H	HP terminal box with lamp	●	●
L	DIN terminal box with lamp/surge suppressor	●	
R	HP terminal box with lamp/surge suppressor	●	



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

*1: The surge suppressor for the DC voltage coil option "J" is supplied 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 lamp with surge suppressor.



Direct acting 2-port solenoid valve

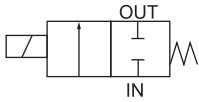
FFB SERIES

- NC(open when energized), NO(closed when energized)
- Port size: Rc, G, NPT 1/8 to 1/2

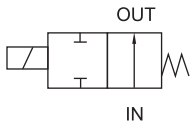


JIS symbol

- 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)/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 leakagecm ³ /min (ANR)	0.2 or less (air)
Valve seat leakage *1Pa·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.

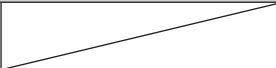
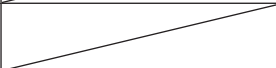
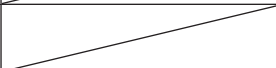

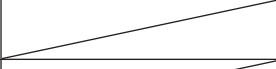
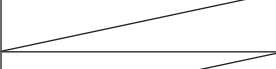
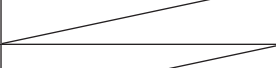

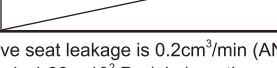
Electrical specifications

Item	FFB-2						FFB-3					
	24 DC	12 DC	100 VAC 50/60Hz	110 VAC 50/60Hz	200 VAC 50/60Hz	220 VAC 50/60Hz	24 DC	12 DC	100 VAC 50/60Hz	110 VAC 50/60Hz	200 VAC 50/60Hz	220 VAC 50/60Hz
Rated voltage V	24 DC	12 DC	100 VAC 50/60Hz	110 VAC 50/60Hz	200 VAC 50/60Hz	220 VAC 50/60Hz	24 DC	12 DC	100 VAC 50/60Hz	110 VAC 50/60Hz	200 VAC 50/60Hz	220 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	-	-	6.2	6.1	6.2	6.2
Item	FFB-4						FFB-5					
	24 DC	12 DC	100 VAC 50/60Hz	110 VAC 50/60Hz	200 VAC 50/60Hz	220 VAC 50/60Hz	24 DC	12 DC	100 VAC 50/60Hz	110 VAC 50/60Hz	200 VAC 50/60Hz	220 VAC 50/60Hz
Rated voltage V	24 DC	12 DC	100 VAC 50/60Hz	110 VAC 50/60Hz	200 VAC 50/60Hz	220 VAC 50/60Hz	24 DC	12 DC	100 VAC 50/60Hz	110 VAC 50/60Hz	200 VAC 50/60Hz	220 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	-	-	13	13	14	14

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

Voltage	AC				DC	
	100V	110V	200V	220V	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 characteristics			Weight (kg) *4
					C[dm ³ /(s·bar)]	b	Cv	
NC (open when energized)								
FFB-21 06 * S	1/8	1.5	0 to 1.0	1.3 x 10 ⁻² to 1 x 10 ⁶	0.31	0.42	0.085	0.21
		2	0 to 0.6	1.3 x 10 ⁻² to 0.6 x 10 ⁶	0.53	0.34	0.13	
FFB-31 06 08 * 2	1/8 1/4	2	0 to 1.4	1.3 x 10 ⁻² to 1.4 x 10 ⁶	0.56	0.50	0.15	0.36
		3	0 to 0.6	1.3 x 10 ⁻² to 0.6 x 10 ⁶	1.2	0.45	0.31	
		5	0 to 0.2	1.3 x 10 ⁻² to 0.2 x 10 ⁶	2.9	0.43	0.63	
FFB-41 08 10 * 4	1/4 3/8	4	0 to 1.0	1.3 x 10 ⁻² to 1 x 10 ⁶	1.4	0.52	0.43	0.55
		7	0 to 0.15	1.3 x 10 ⁻² to 0.15 x 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 x 10 ⁻² to 0.8 x 10 ⁶	2.7	0.45	0.72	0.85
		7	0 to 0.3	1.3 x 10 ⁻² to 0.3 x 10 ⁶	4.7	0.38	1.2	
		X	0 to 0.1	1.3 x 10 ⁻² to 0.1 x 10 ⁶	6.9	0.41	2.0	
NO								
FFB-32 06 08 * 2	1/8 1/4	2	0 to 0.9		0.53	0.46	0.13	0.46
		3	0 to 0.5		0.77	0.54	0.19	
		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	0 to 0.4		1.8	0.38	0.56	
		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	0 to 0.5		2.8	0.31	0.72	
		7	0 to 0.25		3.5	0.36	0.95	

*1: Although it can be used with low vacuum [1.33x10²Pa (abs)], valve seat leakage is 0.2cm³/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 10² Pa (abs), so the upper limit is 0.1 MPa lower.

*2: Working pressure at medium vacuum.

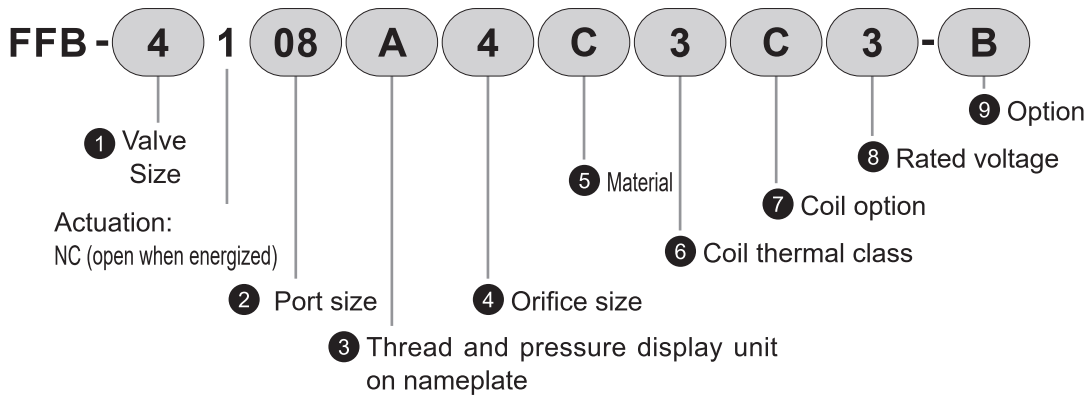
*3: When using at medium vacuum, vacuum the OUT port side.

*4: Weight of copper alloy body with DC lead wire.

Discrete FFB
 Manifold FFBM
 Discrete FFG
 Manifold FFGM
 Working fluid
 check list
 Flow rate formula
 Precautions for
 use

How to order

● NC (open when energized)



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 display unit on nameplate

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

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: "D" and "E" are selected mainly in Japan to indicate MPa as the pressure display unit even for G and NPT threads.

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

5 Material

	Body	Seal	Treatment	Remarks
A	Aluminum	NBR	-	Compressed air/dry air
C	Copper alloy	NBR		Compressed air/dry air/water/oil/low vacuum *1
D		FKM	Compressed air/dry air/water/oil/low vacuum *1	
G	Stainless steel	FKM	Vacuum inspection	Compressed air/dry air/medium vacuum *2
H		NBR	-	Compressed air/dry air/water/oil/low vacuum *1
J	Copper alloy	FKM	-	Compressed air/dry air/water/oil/low vacuum *1
M		FKM	Vacuum inspection	Compressed air/dry air/medium vacuum *2
N	Stainless steel	NBR	Oil-prohibited	Compressed air/dry air/water/oil/low vacuum *1
P		FKM		Compressed air/dry air/water/oil/low vacuum *1
Q	Copper alloy	EPDM	-	Water
S		NBR	-	Compressed air/dry air/water/oil/low vacuum *1
T	Stainless steel	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 $0.2\text{cm}^3/\text{min}$ (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: ● Not available when the orifice size is "X".

6 Coil thermal class

3	Class 130 (B)
---	---------------

7 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	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)	●	●	●	●	●	●
J	Lead wire (300 mm)	●	●	●	●	*4	*5
K	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)	●	●	●	●	●	

- *1: 1 Coil option "B" cannot be selected when valve size is "2".
- *2: 1 When the valve size is "2", the DIN terminal box thread size is Pg9.
- *3: Use "L" DIN terminal box lamp with surge suppressor.
- *4: The surge suppressor for the DC voltage coil option "J" is supplied with the product.
- *5: All AC voltages are equipped with a full-wave rectifier circuit. For this reason, a surge suppressor is not available.

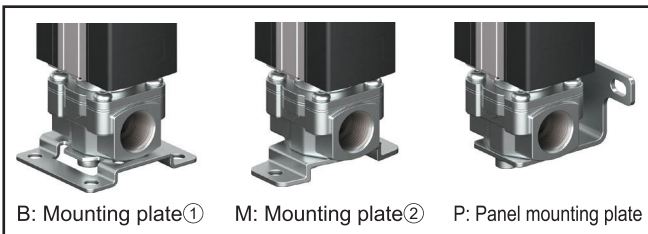
8 Rated voltage

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

9 Option *1

Blank	No	
B	Mounting plate ^①	*2
M	Mounting plate ^②	*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 FAB or FWB Series.
- *3: 1 Not available when valve size is "2".
- *4: Mounting plate^② is compatible with our product AB Series.



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 (Copper alloy, stainless steel body)	FFB-51-M-MOUNT-PLATE-KIT	FFB-51-P-MOUNT-PLATE-KIT

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

Discrete FFB

Direct acting 2-port valve

Manifold FFBM

Discrete FFG

Direct acting 3-port valve

Manifold FFGM

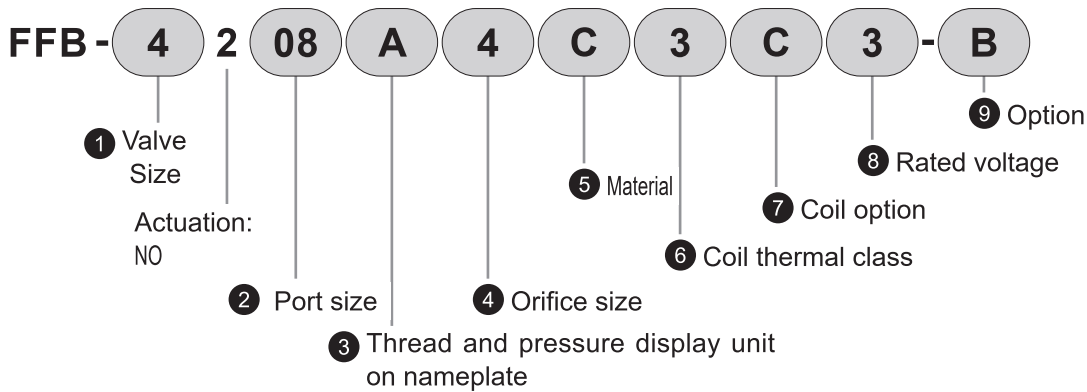
Working fluid
check list

Flow rate formula

Precautions for
use

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 display unit on nameplate

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

4 Orifice size

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

*1: "D" and "E" are selections primarily used in Japan to display the pressure display unit as MPa even with G threads and NPT threads.

5 Material

	Body	Seal	Treatment	Remarks
A	Aluminum	NBR	-	Compressed air/dry air
C	Copper alloy	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	Copper alloy	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	Oil-prohibited	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 0.2cm³/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.

6 Coil thermal class

3	Class 130 (B)
---	---------------

		① Valve size			Voltage	
		3	4	5	DC	AC
7	Coil option					
A	Lead wire (300 mm)	●	●	●	●	●
B	With DIN terminal box (G1/2)	●	●	●	●	●
C	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)	●	●	●	●	●
J	Lead wire (300 mm)	●	●	●	●*2	*3
K	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)	●	●	●	●	
	Surge With absorber					

*1: Use "L" DIN terminal box lamp with surge suppressor.

*2: The surge suppressor for the DC voltage coil option "J" is supplied with the product.

*3: All AC voltages are equipped with a full-wave rectifier circuit. For this reason, a surge suppressor is not available.

8 Rated voltage

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

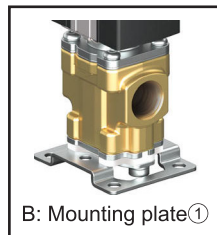
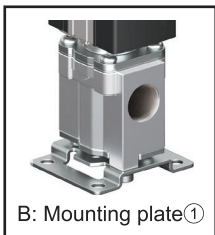
9 Option *1

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

Copper alloy/stainless steel body



How to order mounting plate

With body mounting screw

	Mounting plate code: B	
	Aluminum body	Copper alloy, 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	

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

Discrete FFB

Direct acting 2-port valve

Manifold FFBM

Discrete FFG

Direct acting 3-port valve

Manifold FFGM

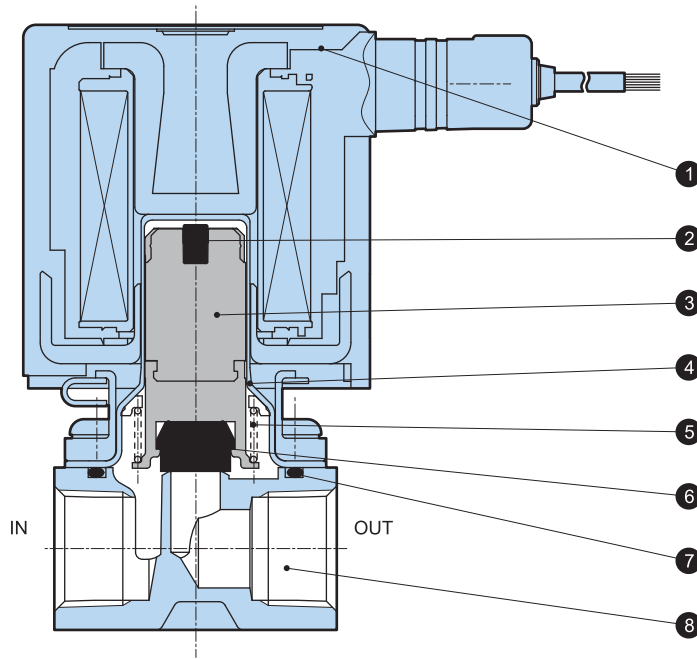
Working fluid
check list

Flow rate formula

Precautions for
use

Internal structure/material

● FFB-*1 Series: NC (open when energized)



Direct acting 2-port valve
Discrete FFB
Manifold FFBM

Direct acting 3-port valve
Discrete FFG
Manifold FFGM

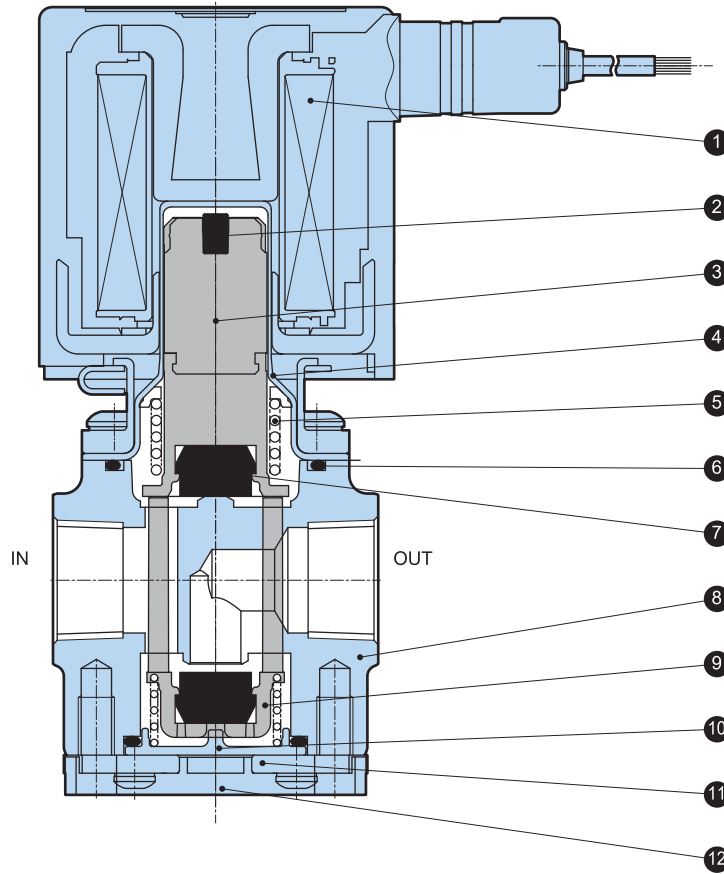
Working fluid
check list

Flow rate formula

Precautions for
use

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	Copper alloy (ADC, SCS13)	Copper alloy (aluminum die-casting, stainless steel)

● FFB-*2 Series: NO (closed when energized)



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	Copper alloy (ADC, SCS13)	Copper alloy (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

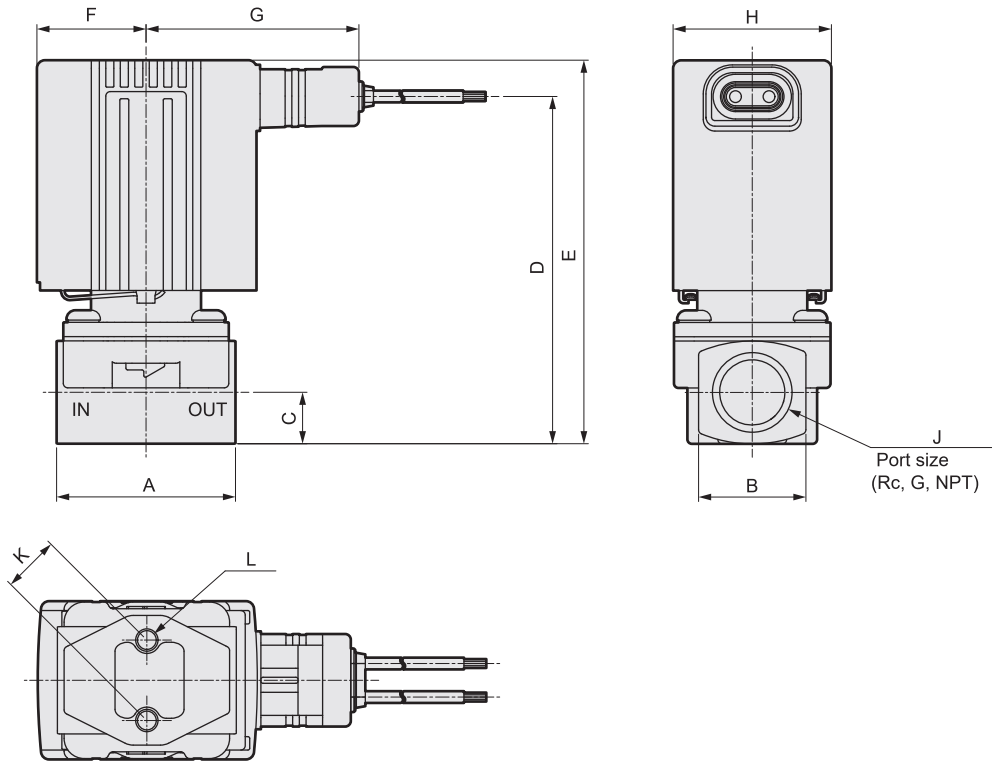
*1: Copper alloy body, stainless steel cover A, aluminum cover B

*2: Only for copper alloy and stainless steel body

Discrete FFB
Manifold FFBM
Discrete FFG
Manifold FFGM
Working fluid check list
Flow rate formula
Precautions for use

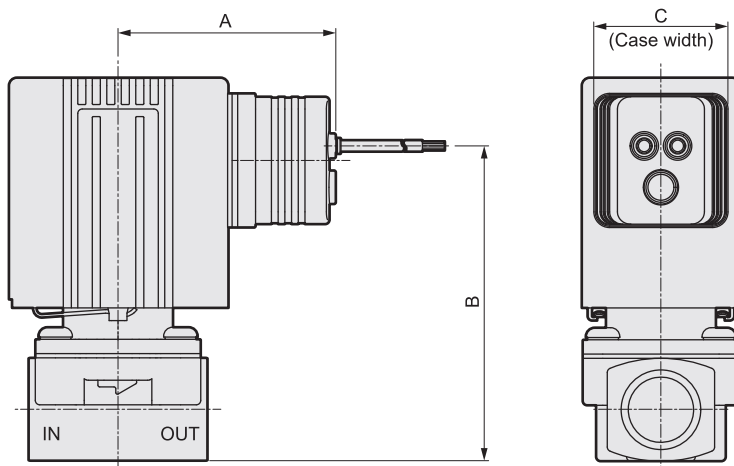
Dimensions FFB-*1 Series: NC (open when energized)

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



	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)	50	27	13.5	94.5	102.5	27.5	50	40	3/8, 1/2	18	M5 depth 8
FFB-5115(15A)											

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

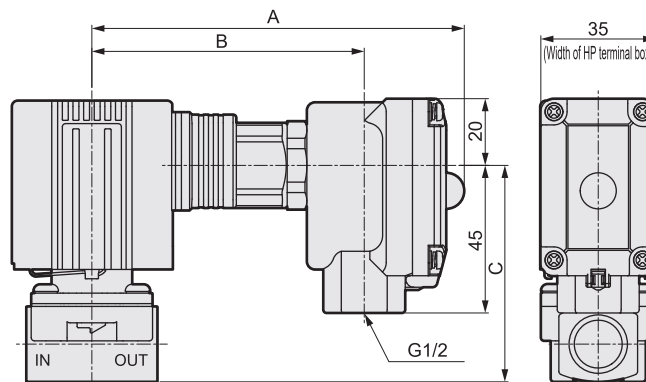
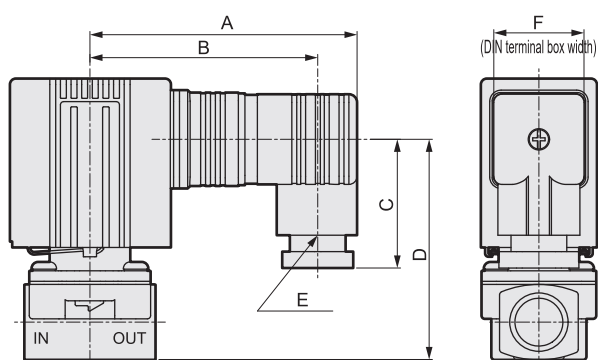


	A	B	C
FFB-21	43	50.5	24
FFB-31	46	59.5	30
FFB-41	48.5	70.5	30
FFB-51	51	79.5	30
FFB-5110*X (ø10)	51	87.5	30
FFB-5115(15A)			

Option Dimensions FFB-*1 Series: NC (open when energized)

● With DIN terminal box Coil option code: B/C/D/K/L

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

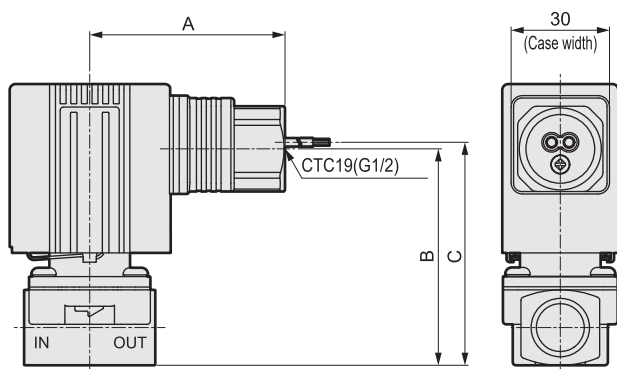


Dimensions shown in () are for G1/2.

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

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

● 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)	61.5	83	85
FFB-5115(15A)			

Discrete FFB

Direct acting 2-port valve

Manifold FFBM

Discrete FFG

Direct acting 3-port valve

Manifold FFGM

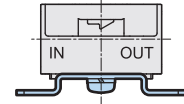
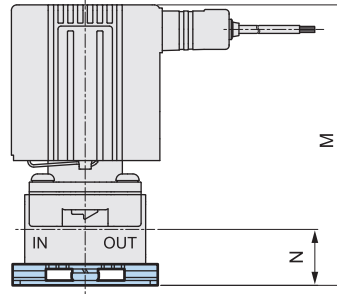
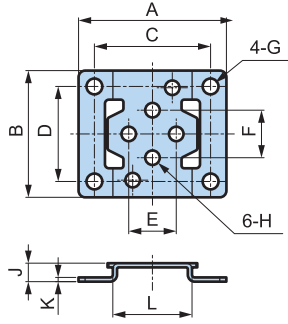
Working fluid
check list

Flow rate formula

Precautions for
use

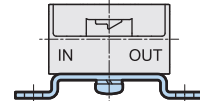
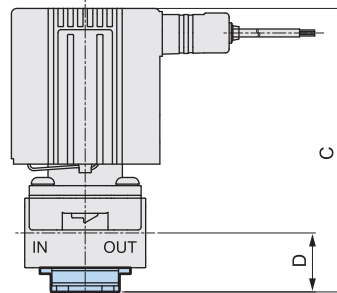
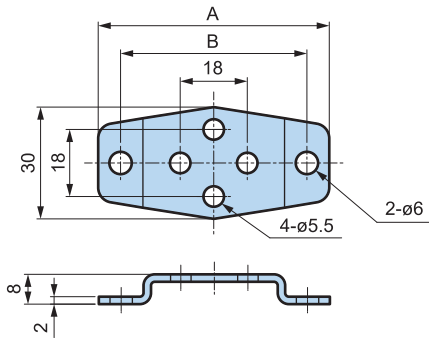
Option Dimensions FFB-*1 Series: NC (open when energized)

● Mounting plate① Option code: B



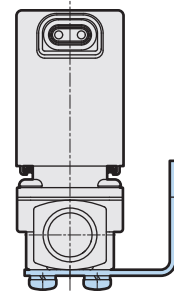
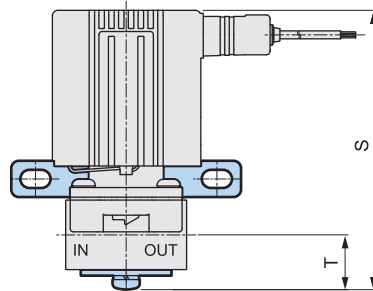
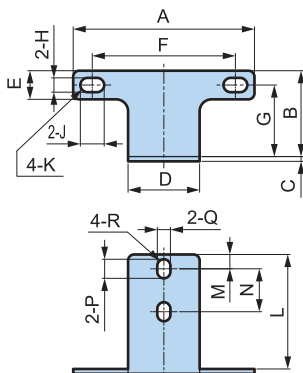
	A	B	C	D	E	F	G	H	J	K	L	M	N
FFB-21	40	34	30	25	15	15	ø5	ø4.5	6	1.2	20	68.5	13.5
FFB-31	52	42	40	30	18	18	ø6	ø5.5	7	1.6	25	81	16.5
FFB-41	56	48	44	36	18	18	ø6	ø5.5	7	1.6	30	93	18.5
FFB-51 Aluminum body	62	50	50	38	18	18	ø6	ø5.5	7	1.6	36	102	18.5
FFB-5110*X (ø10) Aluminum body												109.5	20.5
FFB-5115 (15A) Aluminum body												102	18.5
FFB-51 Copper alloy/SUS body	56	48	44	36	18	18	ø6	ø5.5	7	1.6	30	102	18.5
FFB-5110*X (ø10) Copper alloy/SUS body												109.5	20.5
FFB-5115 (15A) Copper alloy/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)			110.5	21.5
FFB-5115(15A)			110.5	21.5

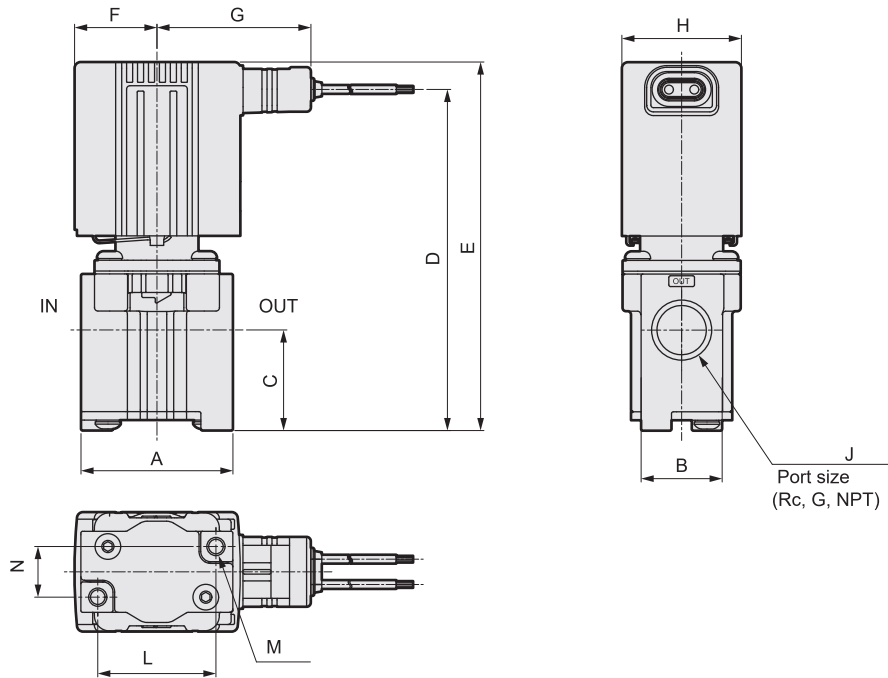
● Panel mounting plate Option code: P



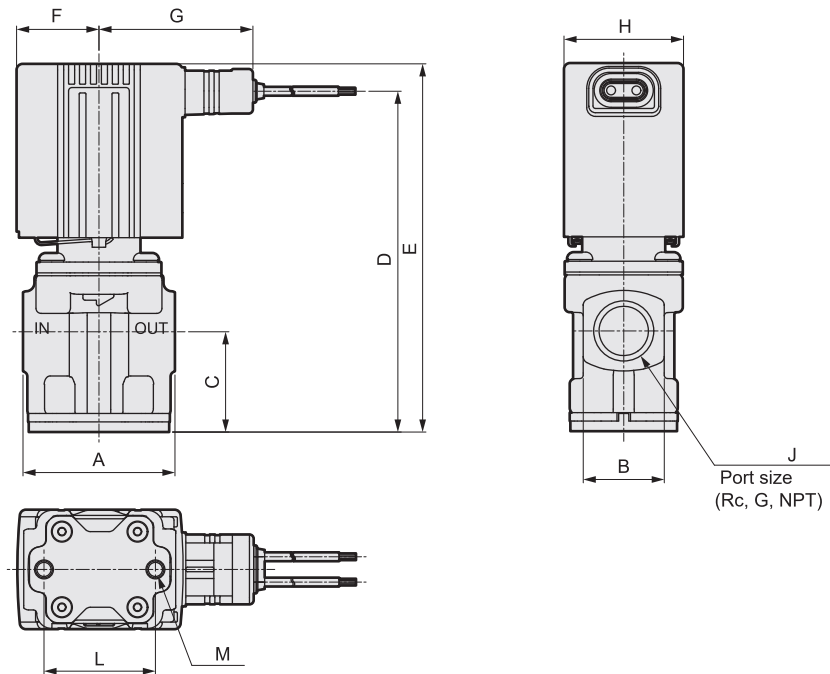
	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T
FFB-21	57	25	1.6	25	10	45	20	5	8	R 2.5	35.4	4.5	15	6	4.5	R 2.25	67.5	12.5
FFB-31	66	31	2	30	12	50	25	6	10	R 3	43	6	18	8	5.5	R 2.75	80.5	16
FFB-41	66	31	2	30	12	50	25	6	10	R 3	43	6	18	8	5.5	R 2.75	92.5	18
FFB-51	76	36	2	30	12	60	30	6	10	R 3	48	6	18	8	5.5	R 2.75	101.5	18
FFB-5110*X (ø10)																	109	20
FFB-5115(15A)																	109	20

Dimensions FFB-*2 Series: NO (closed when energized)

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



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

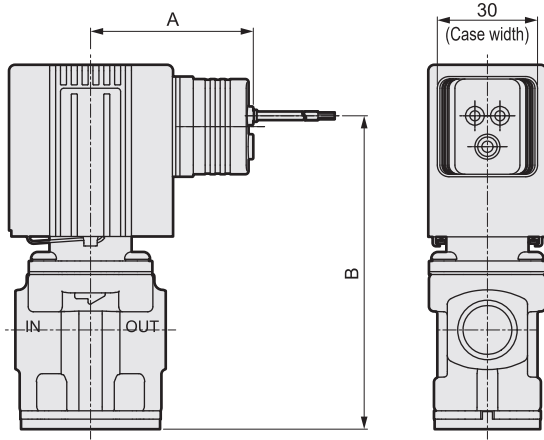


		A	B	C	D	E	F	G	H	J	L	M	N
FFB-32	Aluminum body	40	19	26.5	86.5	94	22	45	30	1/8	32	M5 depth 8	11
	Copper alloy/SUS body			26	86	93.5				1/4		29	
FFB-42	Aluminum body	45	24	30	101	109	24.5	47.5	35	1/4	35	M5 depth 8	15
	Copper alloy/SUS body										33		
FFB-52	Aluminum body	45	24	30	110	118	27.5	50	40	1/4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

Discrete FFB
 Manifold FFBM
 Discrete FFG
 Manifold FFGM
 Direct acting 2-port valve
 Direct acting 3-port valve
 Working fluid check list
 Flow rate formula
 Precautions for use

Dimensions FFB-*2 Series: NO (closed when energized)

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

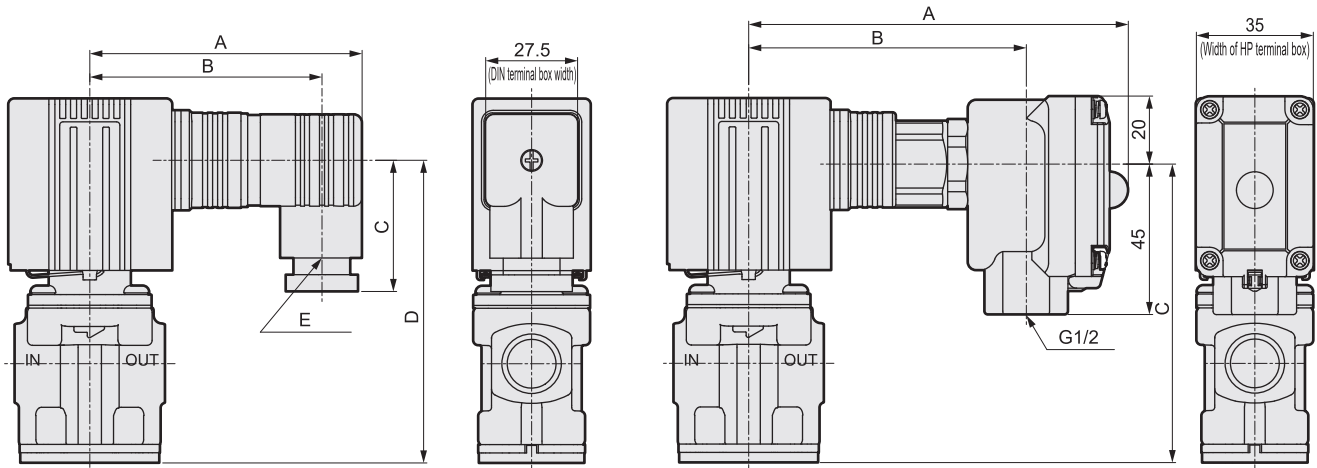


		A	B
FFB-32	Aluminum body	46	79
	Copper alloy/SUS body		78.5
FFB-42	Aluminum body	48.5	94
	Copper alloy/SUS body		
FFB-52	Aluminum body	51	103
	Copper alloy/SUS body		

Option Dimensions FFB-*2 Series: NO (closed when energized)

● With DIN terminal box Coil option code: B/C/D/K/L

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



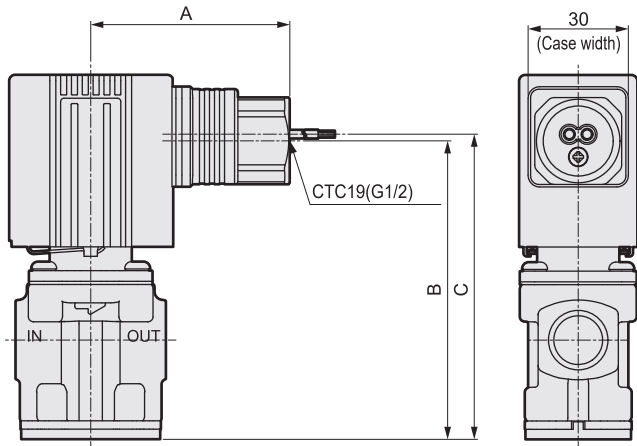
Dimensions shown in () are for G1/2.

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

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

Option Dimensions FFB-*2 Series: NO (closed when energized)

● Conduit Coil option code: E/F/M/P

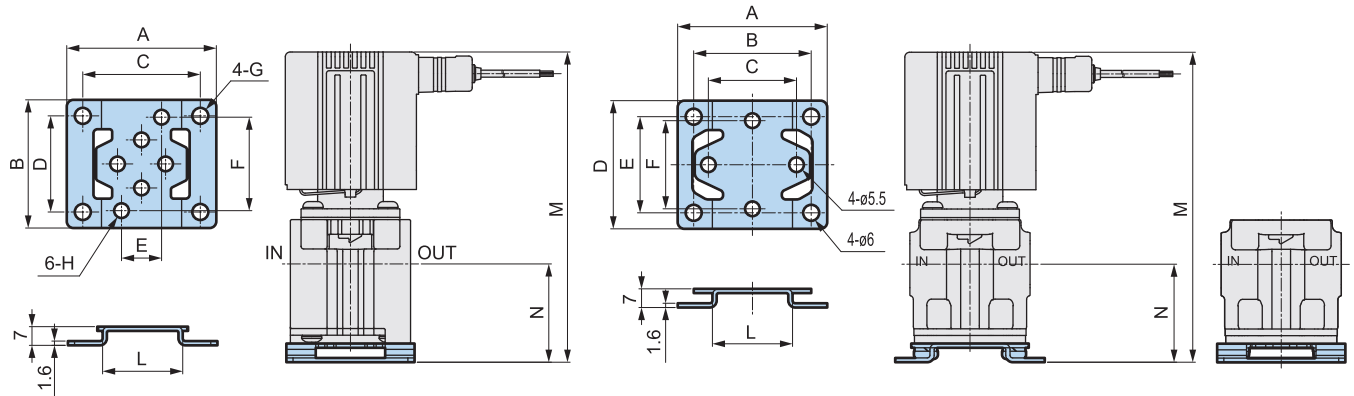


		A	B	C
FFB-32	Aluminum body	56.5	74.5	76.5
	Copper alloy/SUS body		74	76
FFB-42	Aluminum body	59	89.5	91.5
	Copper alloy/SUS body			
FFB-52	Aluminum body	61.5	98.5	100.5
	Copper alloy/SUS body			

● Mounting plate① Option code: B

Aluminum body

Copper alloy/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
	Copper alloy/SUS body					29	29			
FFB-42	Aluminum body	56	48	44	36	15	35	30	116	37
	Copper alloy/SUS body					33	33			
FFB-52	Aluminum body	62	50	50	38	15	35	36	125	37
	Copper alloy/SUS body									

Discrete FFB

Manifold FFBM

Discrete FFG

Manifold FFGM

Working fluid
check list

Flow rate formula

Precautions for
use

Direct acting 2-port valve

Direct acting 3-port valve



Direct acting 2-port solenoid valve, manifold

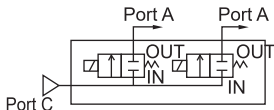
FFBM SERIES

- NC (open when energized)
- Port size: Rc, G, NPT 1/8 / 1/4

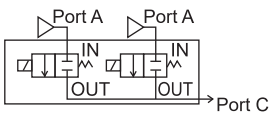


JIS symbol

- 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 leakage ^{m3} /min (ANR)	0.2 or less (air)	
Valve seat leakage *1Pa·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						
	24 DC	12 DC	100 VAC 50/60Hz	110 VAC 50/60Hz	200 VAC 50/60Hz	220 VAC 50/60Hz	24 DC	12 DC	100 VAC 50/60Hz	110 VAC 50/60Hz	200 VAC 50/60Hz	220 VAC 50/60Hz		
Rated voltage	V													
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	-	-	6.2	6.1	6.2	6.2	
Item	FFBM-4							FFBM-5						
	24 DC	12 DC	100 VAC 50/60Hz	110 VAC 50/60Hz	200 VAC 50/60Hz	220 VAC 50/60Hz	24 DC	12 DC	100 VAC 50/60Hz	110 VAC 50/60Hz	200 VAC 50/60Hz	220 VAC 50/60Hz		
Rated voltage	V													
Voltage fluctuation range		±10%							±10%					
Power consumption	W	7	7	-	-	-	-	10.5	10.5	-	-	-	-	
Apparent power	VA	-	-	8.6	10	9.6	9.5	-	-	13	13	14	14	

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

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

Individual specifications

Item	Port size Rc/G*/NPT		Orifice size (mm)	Working pressure (MPa) *1	Working pressure Pa (abs) *2	Flow characteristics		
	Port A	Port C				C[dm ³ /(s·bar)]	b	Cv
NC (open when energized)								
FFBM-2 ¹ / ₅ 06 * S	1/8	1/4	1.5	0 to 1.0	1.3 x 10 ⁻² to 1 x 10 ⁶	0.30	0.48	0.085
			2	0 to 0.6	1.3 x 10 ⁻² to 0.6 x 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 x 10 ⁻² to 1.4 x 10 ⁶	0.55	0.42	0.12
			3	0 to 0.6	1.3 x 10 ⁻² to 0.6 x 10 ⁶	1.1	0.25	0.23
			5	0 to 0.2	1.3 x 10 ⁻² to 0.2 x 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 x 10 ⁻² to 1 x 10 ⁶	1.2	0.11	0.42
			7	0 to 0.15	1.3 x 10 ⁻² to 0.15 x 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 x 10 ⁻² to 0.8 x 10 ⁶	2.3	0.10	0.55
			7	0 to 0.3	1.3 x 10 ⁻² to 0.3 x 10 ⁶	3.3	0.11	0.73

*1: Can be used with NC low vacuum [1.33×10²Pa (abs)], but valve seat leakage is 0.2cm³/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 10² 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

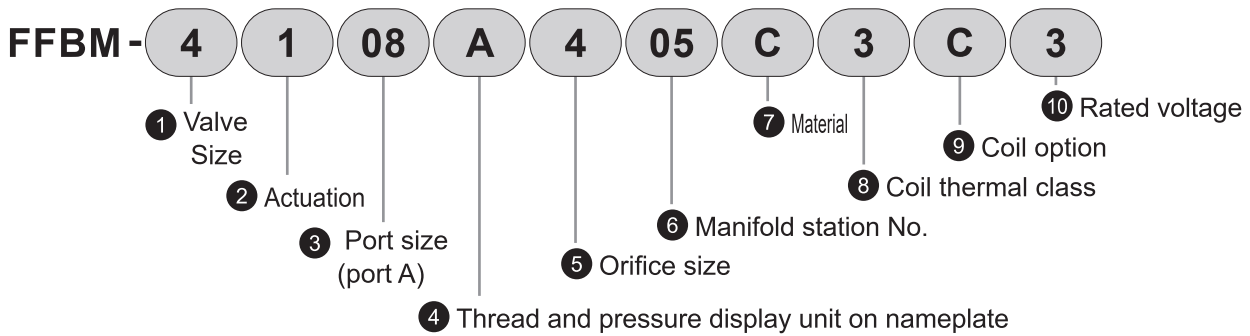
*2: Weight of aluminum sub-plate with 24 VDC lead wire.

● Body material: Copper alloy/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 aluminum sub-plate with 24 VDC lead wire.

How to order



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 display unit on nameplate

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

*1: ④ For "00" actuator only, there is no thread. Therefore, select "A" (MPa), "B" (bar), "C" (psi) for the pressure display unit.

*2: "D" and "E" are selections primarily used in Japan to display the pressure display unit as MPa even with G threads and NPT threads.

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

⑦ Material

	Body and sub-plate	Seal	Treatment	Remarks
A	Aluminum	NBR	-	Compressed air/dry air
C		NBR		Compressed air/dry air/water/oil/low vacuum *1
D	Copper alloy	FKM	-	Compressed air/dry air/water/oil/low vacuum *1
G		FKM		Vacuum inspection
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		NBR	Oil-prohibited	Compressed air/dry air/water/oil/low vacuum *1
P	Copper alloy	FKM		Compressed air/dry air/water/oil/low vacuum *1
Q		EPDM		Water
S		NBR		Compressed air/dry air/water/oil/low vacuum *1
T	Stainless steel	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 0.2cm³/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: ⑦ Cannot be selected when Actuation is "1".

8 Coil thermal class

3	Class 130 (B)
---	---------------

9 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	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	●	●	●	●
J	Lead wire (300 mm)	●	●	●	●	●*5	*6
K	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	●	●	●	

*1: 1 Coil option "B" cannot be selected when valve size is "2".

*2: 1 When the valve size is "2", the DIN terminal box thread size is Pg9.

*3: 1 When the material is "A" aluminum body, the HP terminal box cannot be selected.

*4: Use "L" DIN terminal box lamp with surge suppressor.

*5: The surge suppressor for the DC voltage coil option "J" is supplied with the product.

*6: All AC voltages are equipped with a full-wave rectifier circuit. For this reason, a surge suppressor is not available.








10 Rated voltage

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

How to order

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

Coil option code

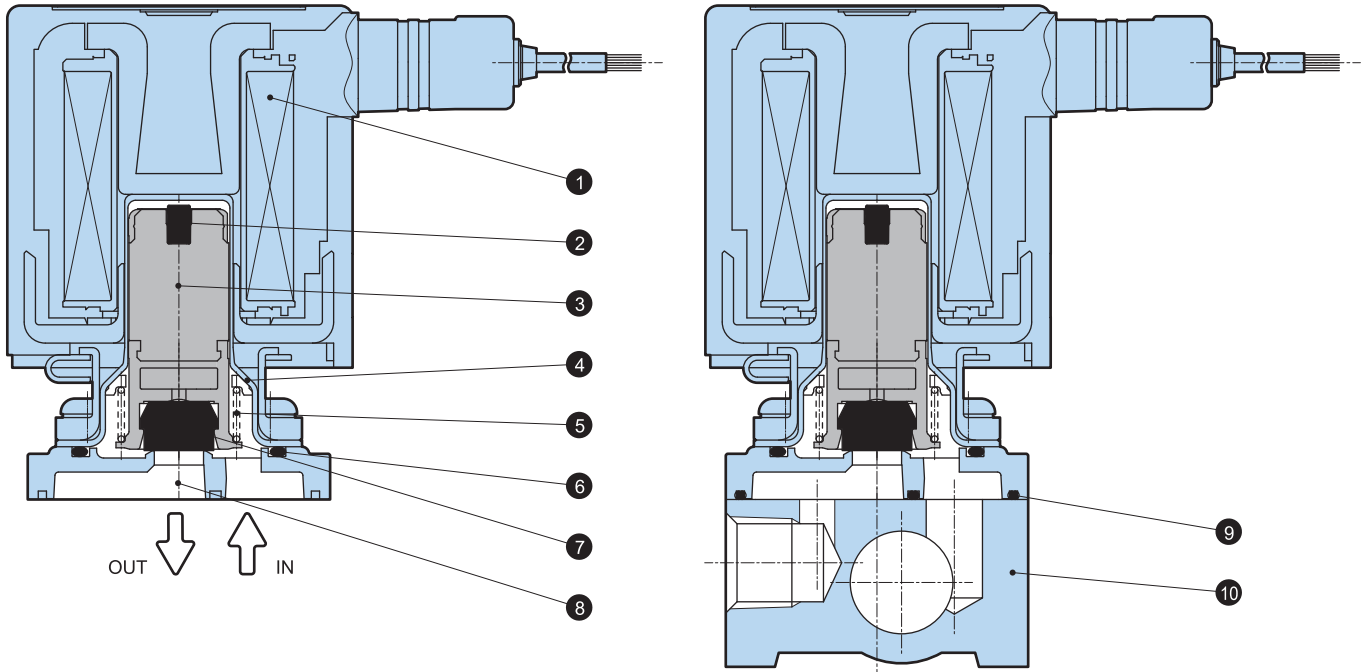
A(DC) J		Grommet lead wire 300 mm Grommet lead wire 300 mm With surge suppressor
A(AC)		Grommet lead wire 300 mm
B C K		DIN terminal box DIN terminal box/with surge suppressor
D L		DIN terminal box/with lamp DIN terminal box/lamp/ With surge suppressor
G Q		HP terminal box HP terminal box/with surge 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

FFBM SERIES

Internal structure/material Aluminum body

● FFBM actuator

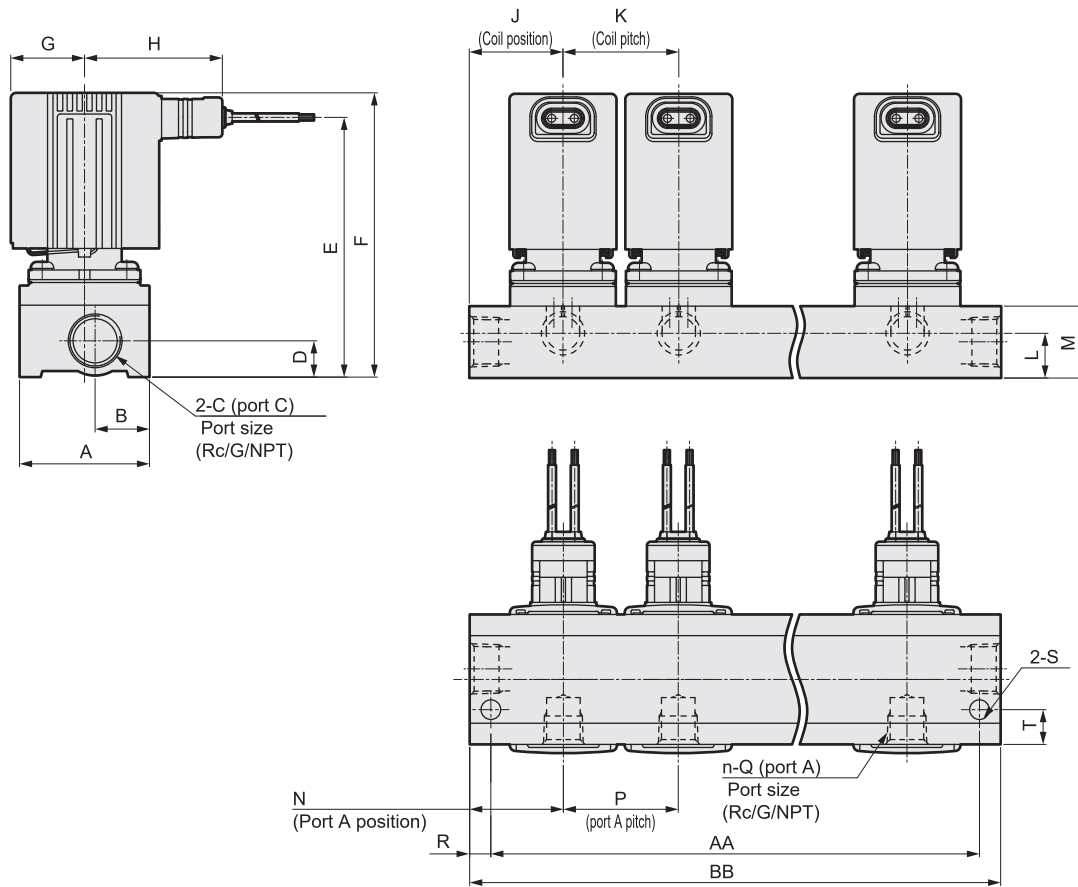
● FFBM manifold



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



	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
	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

Discrete FFB

Manifold FFBM

Direct acting 2-port valve

Discrete FFG

Manifold FFGM

Direct acting 3-port valve

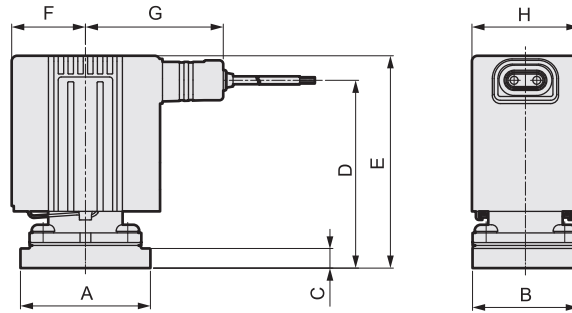
Control fluid
Checklist

Flow rate formula

Safety
Precautions

Dimensions aluminum body

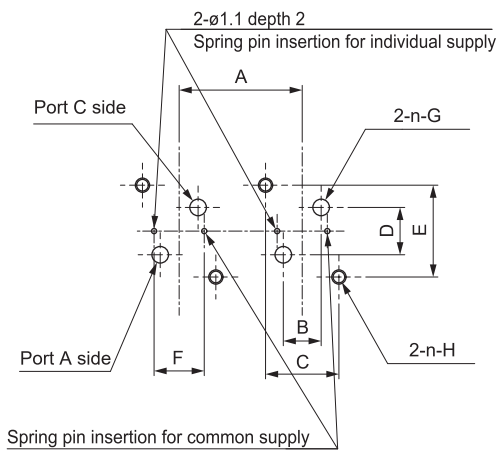
● Actuator lead wire/DC voltage Coil option code: A/J



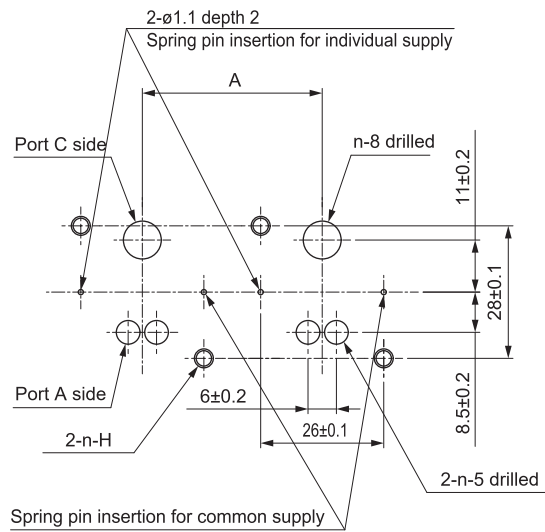
	A	B	C	D	E	F	G	H
FFBM-2	28	22.5	2.5	48.5	57	18.5	42	24
FFBM-3	32.5	29.5	2.5	55.5	63	22	45	30
FFBM-4	43	35	6.5	62	70.5	24.5	47.5	35
FFBM-5	43	35	6.5	71	79.5	27.5	50	40

● Actuator installation dimensions

FFBM-2*/3*



FFBM-4*/5*



Note: Machining diagram 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

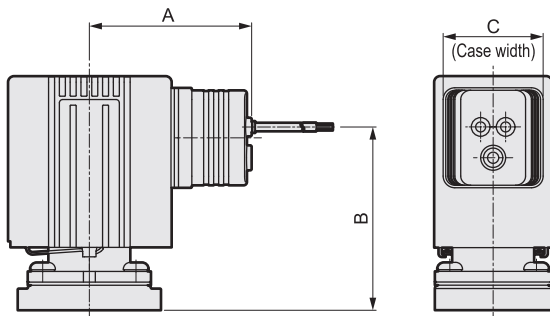
How to order discrete masking plate

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

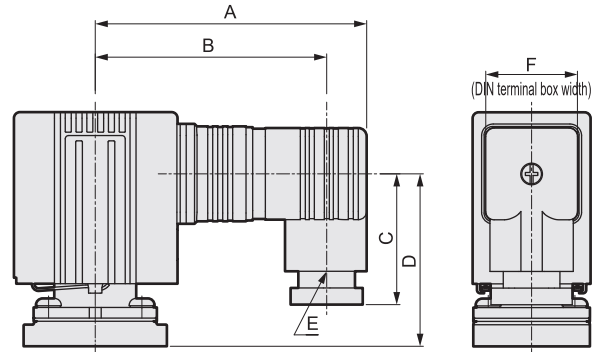
Dimensions aluminum body

● 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

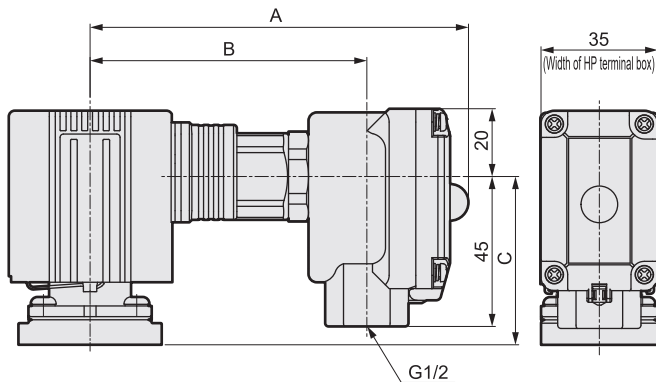
● With actuator DIN terminal box Coil option code: B/C/D/K/L



Dimensions shown in () are for G1/2.

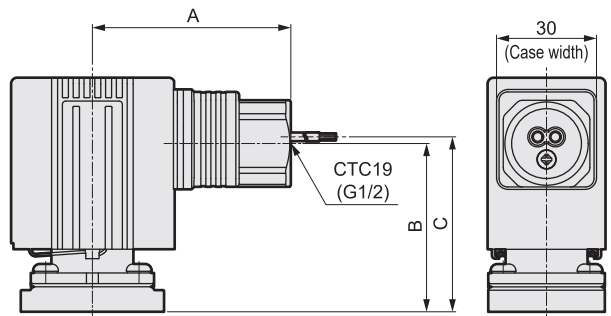
	A	B	C	D	E	F
FFBM-2	73	64	36	41.5	Pg9	21
FFBM-3	78.5	66.5 (65)	39.5 (41.5)	45	Pg11 (G1/2)	27.5
FFBM-4	81	69 (67.5)	39.5 (41.5)	52	Pg11 (G1/2)	27.5
FFBM-5	83.5	71.5 (70)	39.5 (41.5)	61	Pg11 (G1/2)	27.5

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



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

● Conduit Coil option code: E/F/M/P



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

Discrete FFB

Manifold FFBM

Direct acting 2-port valve

Discrete FFG

Manifold FFGM

Direct acting 3-port valve

Control fluid Checklist

Flow rate formula

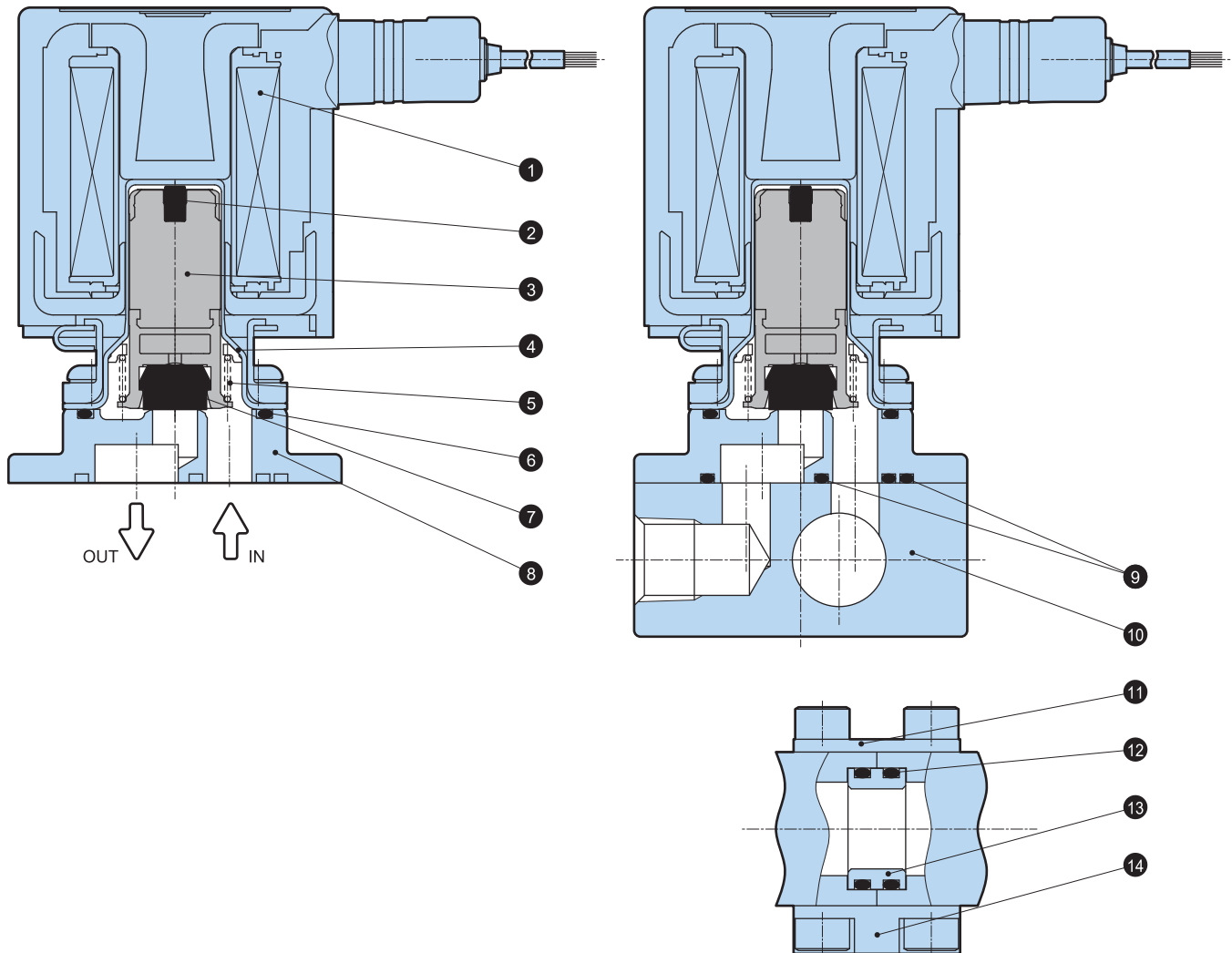
Safety Precautions

FFBM SERIES

Internal structure/Material: Copper alloy body/stainless steel body

● FFBM actuator

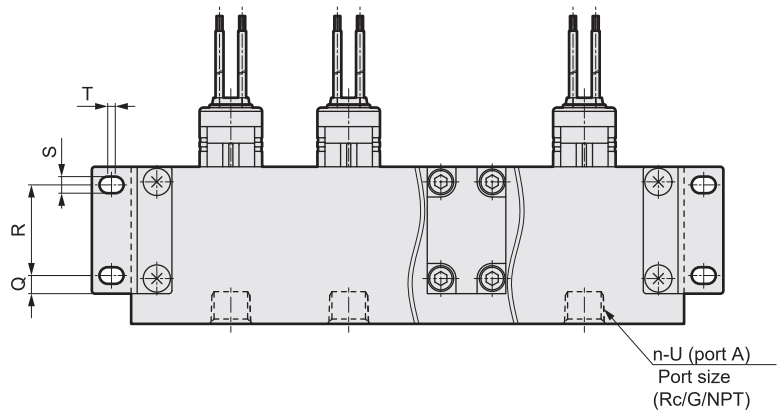
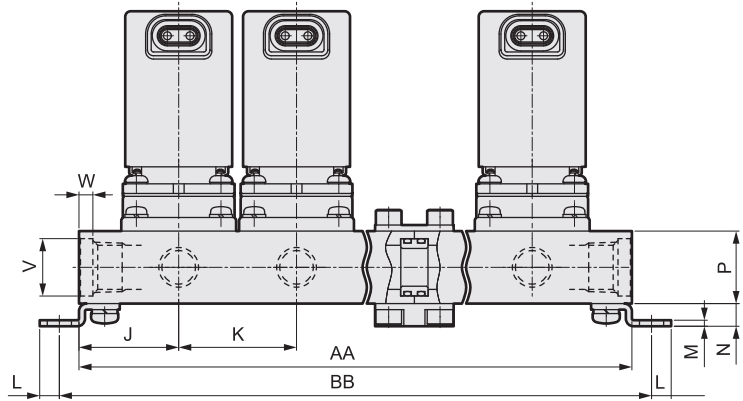
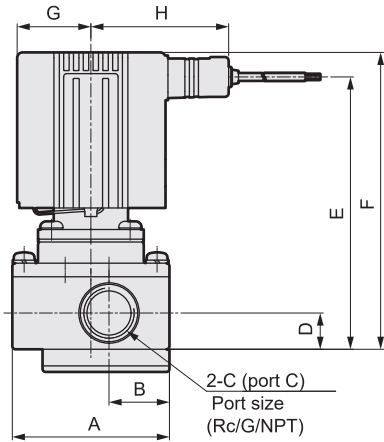
● FFBM manifold



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	Copper alloy (SCS13)	Copper alloy (stainless steel)
9	O-ring	NBR(FKM,EPDM)	Nitrile rubber (fluoro rubber, ethylene propylene rubber)
10	Sub-plate	C3604(SUS304)	Copper alloy (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)	Copper alloy (stainless steel)
14	Connecting plate (bottom)	SS400	Steel

Dimensions copper alloy body/stainless steel body

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



	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

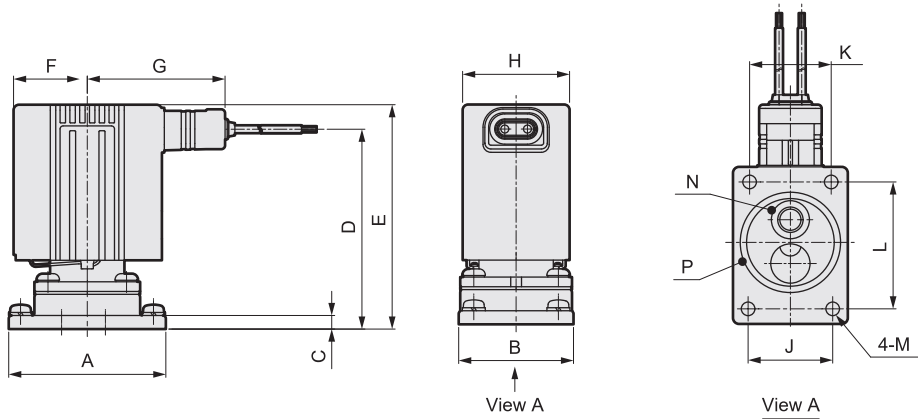
	Station No. Code	2	3	4	5	6	7	8	9	10
		FFBM-2	AA	81	109	162	165	218	246	274
	BB	93	121	174	177	230	258	286	339	342
FFBM-3	AA	97	133	194	205	266	302	338	399	410
	BB	109	145	206	217	278	314	350	411	422
FFBM-4	AA	106	145	212	223	290	329	368	435	446
	BB	119	158	225	236	303	342	381	448	459
FFBM-5	AA	118	163	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.

Discrete FFB Manifold FFBM Discrete FFG Manifold FFGM Control fluid Checklist Flow rate formula Safety Precautions

Dimensions copper alloy body/stainless steel body

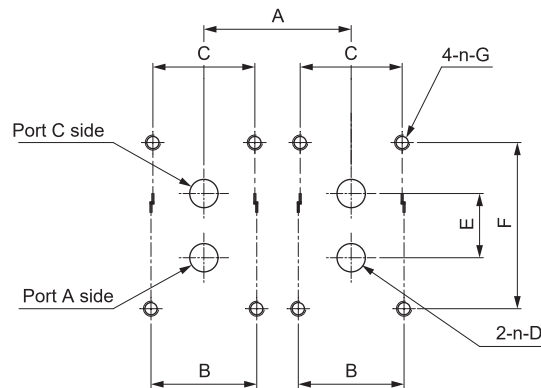
● Actuator lead wire/DC voltage Coil option code: A/J



	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 diagram 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

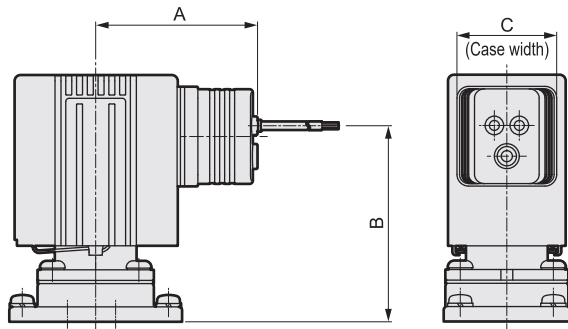
How to order discrete masking plate

O-ring, with mounting screw

Seal	Copper alloy body			Stainless steel body		
	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

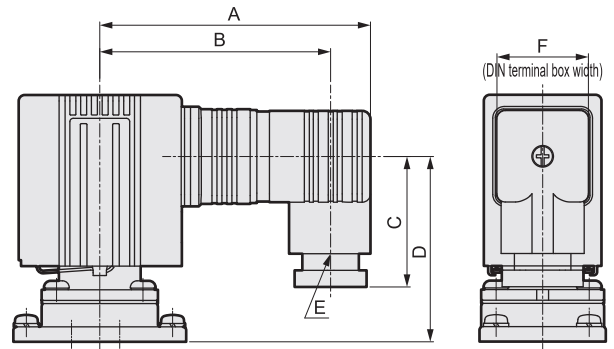
Dimensions copper alloy body/stainless steel body

● 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

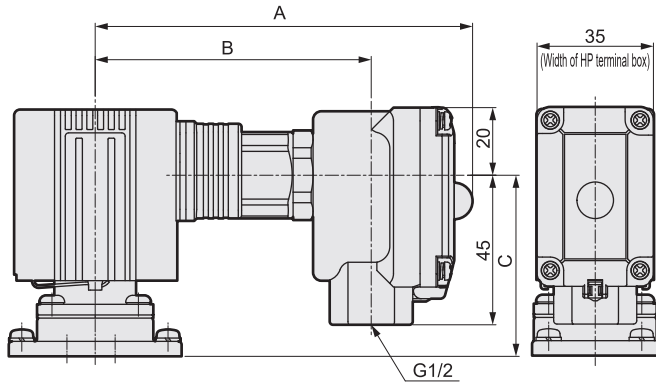
● With actuator DIN terminal box Coil option code: B/C/D/K/L



Dimensions shown in () are for G1/2.

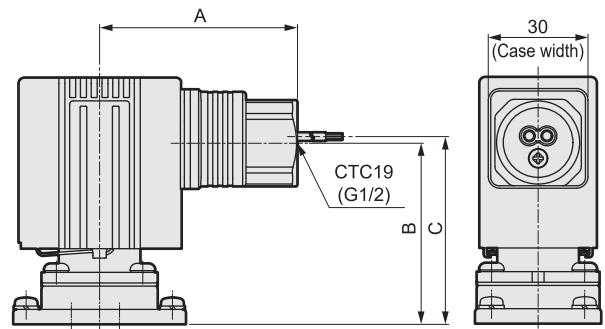
	A	B	C	D	E	F
FFBM-2	73	64	36	43	Pg9	21
FFBM-3	78.5	66.5 (65)	39.5 (41.5)	46.5	Pg11 (G1/2)	27.5
FFBM-4	81	69 (67.5)	39.5 (41.5)	56	Pg11 (G1/2)	27.5
FFBM-5	83.5	71.5 (70)	39.5 (41.5)	65	Pg11 (G1/2)	27.5

● 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

Discrete FFB

Manifold FFBM

Discrete FFG

Manifold FFGM

Control fluid Checklist

Flow rate formula

Safety Precautions

Direct acting 2-port valve

Direct acting 3-port valve



Direct acting 3-port solenoid valve

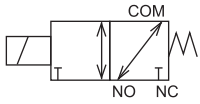
FFG SERIES

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

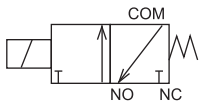


JIS symbol

- 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 cm 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	FFG-2							FFG-3						
	24 DC	12 DC	100 VAC 50/60Hz	110 VAC 50/60Hz	200 VAC 50/60Hz	220 VAC 50/60Hz	24 DC	12 DC	100 VAC 50/60Hz	110 VAC 50/60Hz	200 VAC 50/60Hz	220 VAC 50/60Hz		
Rated voltage V	24 DC	12 DC					24 DC	12 DC						
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	-	-	6.2	6.1	6.2	6.2		

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

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

Voltage	AC				DC	
	100V	110V	200V	220V	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 characteristics												Weight(kg) *3
				COM→NC			COM→NO			NC→COM			NO→COM			
				C[dm ³ /(sbar)]	b	Cv	C[dm ³ /(sbar)]	b	Cv	C[dm ³ /(sbar)]	b	Cv	C[dm ³ /(sbar)]	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	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	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	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	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	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	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	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	0 to 0.7				0.49	0.47	0.13	0.49	0.38	0.13				
		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	0 to 0.6				1.2	0.39	0.30	1.1	0.29	0.30				
		4	0 to 0.3				1.8	0.37	0.41	1.9	0.21	0.41				

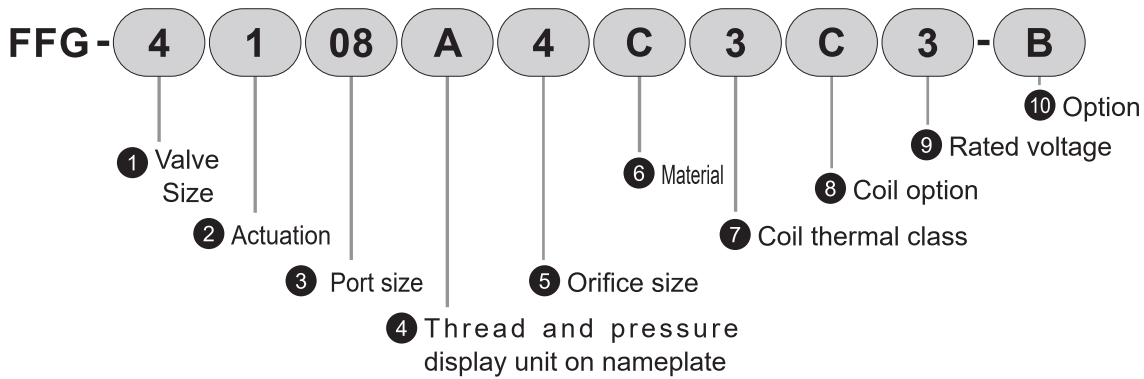
*1: () is for NO pressurization.

*2: When used in a low vacuum, the lower limit of operating pressure is 1.33 x 10³ Pa (abs), so the upper limit is 0.1 MPa lower.

*3: Weight of copper alloy body with DC lead wire.

Discrete FFB
 Manifold FFBM
 Discrete FFG
 Manifold FFGM
 Control fluid
 Checklist
 Flow rate formula
 Safety
 Precautions

How to order



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

*1: "D" and "E" are selected mainly in Japan to indicate MPa as the pressure display unit even for G and NPT threads.

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

⑥ Material		Seal	Treatment	Remarks
A	Aluminum	NBR	-	Compressed air/dry air
C	Copper alloy	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	Copper alloy	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 cm³/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.

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	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)		●	●	●	●	●
J	Lead wire (300 mm)	●	●	●	●	●*4	*5
K	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)		●	●	●	●	

*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: "L" DIN terminal box with lamp/surge suppressor

*4: The surge suppressor of the DC voltage coil option "J" is attached.

*5: All AC voltages have 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.

9 Rated voltage

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

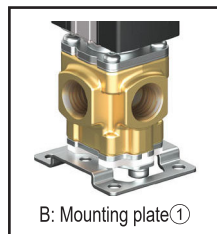
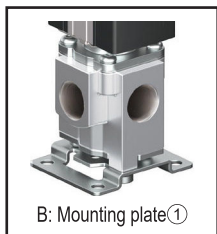
10 Option *1

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

Copper alloy/stainless steel body



How to order mounting plate

With body mounting screw

	Mounting plate code: B	
	Aluminum body	Copper alloy, 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	

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

Discrete FFB

Manifold FFBM

Discrete FFG

Manifold FFGM

Control fluid Checklist

Flow rate formula

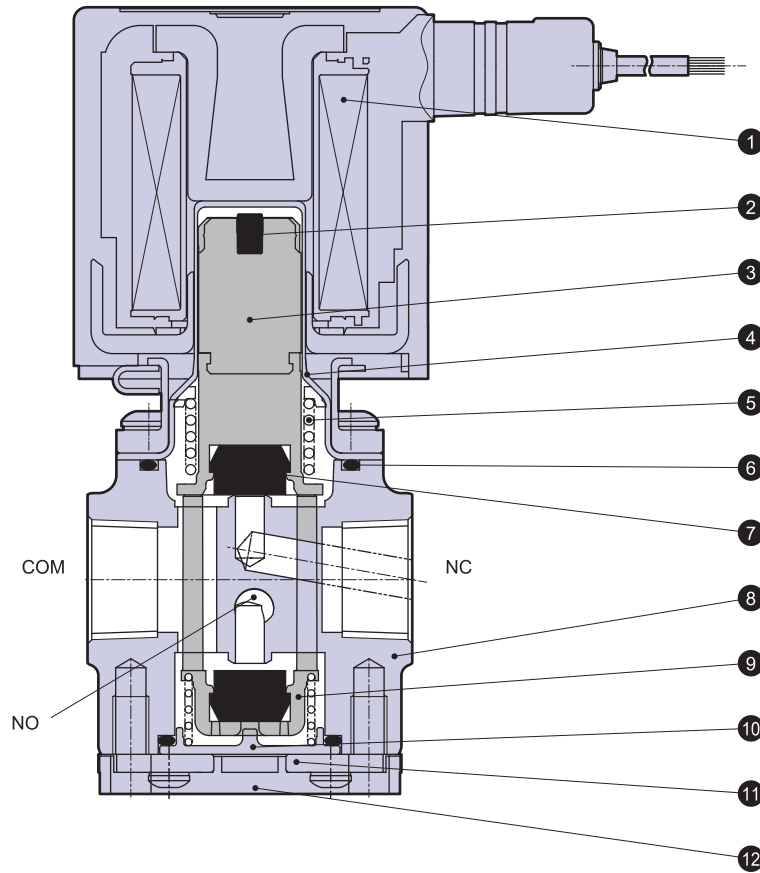
Safety Precautions

Direct acting 2-port valve

Direct acting 3-port valve

Internal structure/material

Direct acting 2-port valve	Discrete FFB
	Manifold FFBM
Direct acting 3-port valve	Discrete FFG
	Manifold FFGM
Control fluid Checklist	
Flow rate formula	
Safety Precautions	



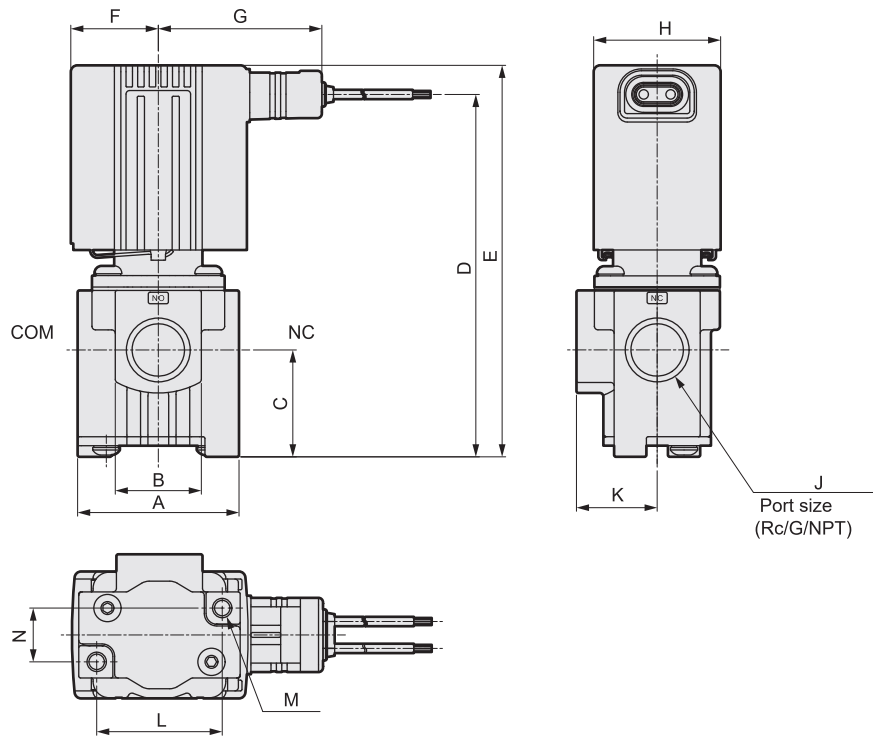
Part No.	Name	Material	
1	Coil assembly	-	
2	Noise dampening rubber	HNBR(FKM,EPDM)	Hydrogenated nitrile rubber (fluoro rubber, ethylene propylene rubber)
3	Plunger	SUS,PPS	Stainless steel, polyphenylene sulfide
4	Flare pipe assembly	SUS,PPS	Stainless steel, polyphenylene sulfide
5	Plunger spring	SUS304	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	Copper alloy (ADC, SCS13)	Copper alloy (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: Copper alloy body, stainless steel cover A, aluminum cover B

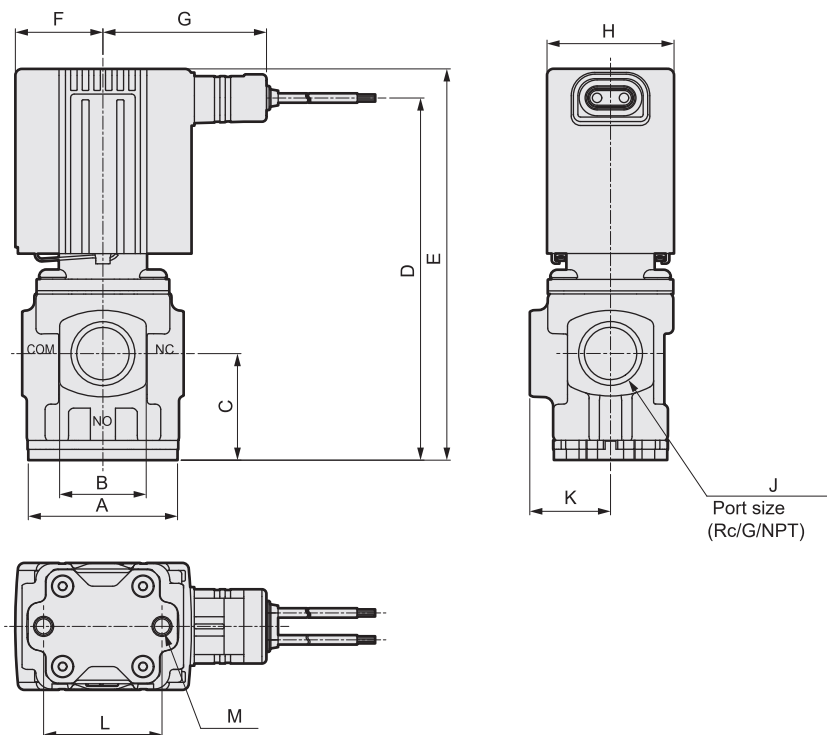
*2: Only for copper alloy and stainless steel body

Dimensions

- Lead wire/DC voltage Coil option code: A/J
- Aluminum body



Copper alloy body/stainless steel body

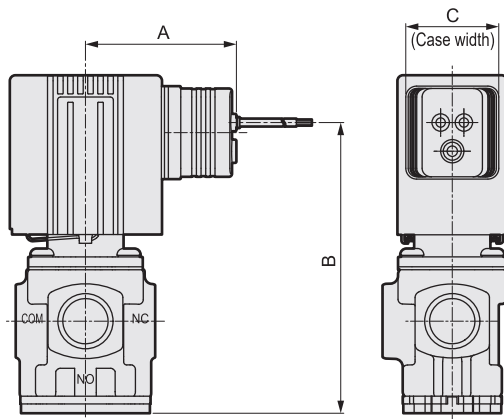


		A	B	C	D	E	F	G	H	J	K	L	M	N
FFG-2	Aluminum body	32	17	21	69.5	78	18.5	42	24	1/8	16	25	M4 depth	8
	23.8											6		
FFG-3	Aluminum body	40	19	26.5	86.5	94	22	45	30	1/8	20	32	M5 depth	11
	26			86								93.5	29	
FFG-4	Aluminum body	45	24	30	101	109	24.5	47.5	35	1/4	22.5	35	M5 depth	15
	33											8	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

Discrete FFB	Direct acting 2-port valve
Manifold FFBM	
Discrete FFG	Direct acting 3-port valve
Manifold FFGM	
Control fluid Checklist	
Flow rate formula	
Safety Precautions	

Dimensions

● Lead wire/AC voltage Coil option code: A

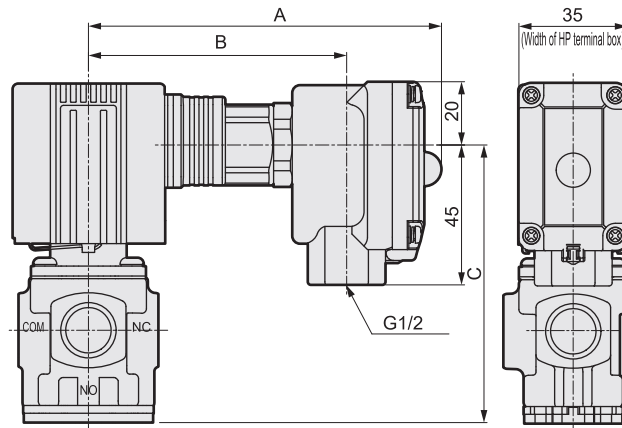
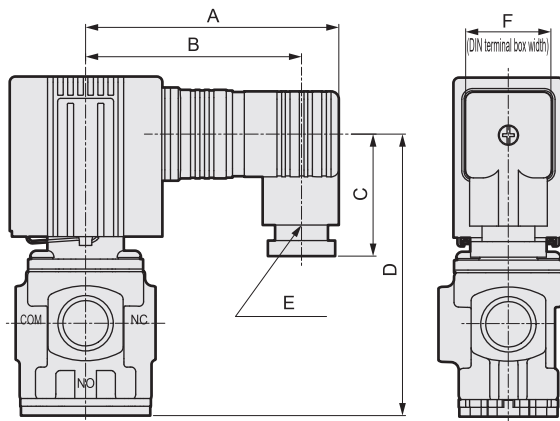


		A	B	C
FFG-2	Aluminum body	43	66	24
	Copper alloy/SUS body			
FFG-3	Aluminum body	46	79	30
	Copper alloy/SUS body		78.5	
FFG-4	Aluminum body	48.5	94	30
	Copper alloy/SUS body			
FFG-5	Aluminum body	51	103	30
	Copper alloy/SUS body			

Optional dimensions

● With DIN terminal box Coil option code: B/C/D/K/L

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



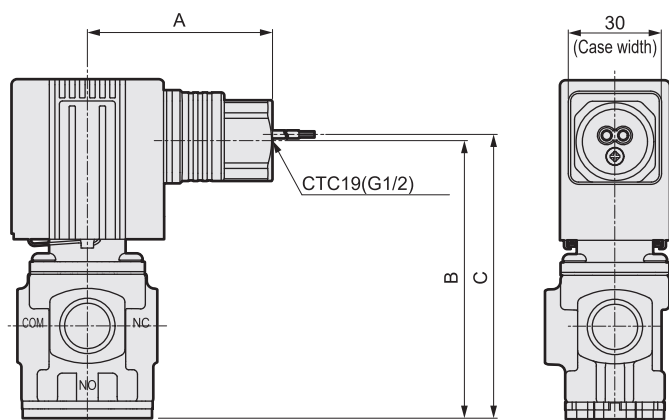
Dimensions shown in () are for G1/2.

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

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

Optional dimensions

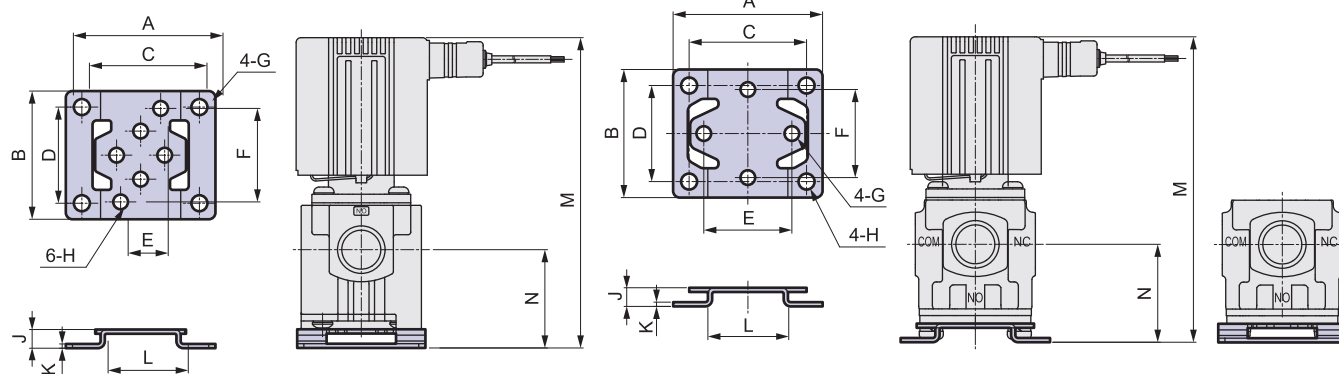
● Conduit Coil option code: E/F/M/P



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

● Mounting plate① Option code: B
Aluminum body

Copper alloy/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
	Copper alloy/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
	Copper alloy/SUS body					29	29					26		
FFG-4	Aluminum body	56	48	44	36	15	35	ø6	ø5.5	7	1.6	30	116	37
	Copper alloy/SUS body					33	33					30		
FFG-5	Aluminum body	62	50	50	38	15	35	ø6	ø5.5	7	1.6	36	125	37
	Copper alloy/SUS body					56	48					44		

Discrete FFB
 Manifold FFBM
 Discrete FFG
 Manifold FFGM
 Control fluid
 Checklist
 Flow rate formula
 Safety
 Precautions

Direct acting 3-port solenoid valve, manifold

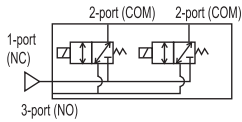
FFGM SERIES

- 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 leakage cm 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						
	24 DC	12 DC	100 VAC 50/60Hz	110 VAC 50/60Hz	200 VAC 50/60Hz	220 VAC 50/60Hz	
Rated voltage V	24 DC	12 DC	100 VAC 50/60Hz	110 VAC 50/60Hz	200 VAC 50/60Hz	220 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	

Item	FFGM-4							FFGM-5				
	24 DC	12 DC	100 VAC 50/60Hz	110 VAC 50/60Hz	200 VAC 50/60Hz	220 VAC 50/60Hz	24 DC	12 DC	100 VAC 50/60Hz	110 VAC 50/60Hz	200 VAC 50/60Hz	220 VAC 50/60Hz
Rated voltage V	24 DC	12 DC	100 VAC 50/60Hz	110 VAC 50/60Hz	200 VAC 50/60Hz	220 VAC 50/60Hz	24 DC	12 DC	100 VAC 50/60Hz	110 VAC 50/60Hz	200 VAC 50/60Hz	220 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	-	-	13	13	14	14

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

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

Individual specifications

Item	Port size Rc/G/NPT		Orifice size (mm)	Usage Pressure (MPa) *1 *2	Flow characteristics												
	Model No.	2-port			1-port 3-port	COM→NC			COM→NO			NC→COM			NO→COM		
						C[dm ³ /(sbar)]	b	Cv	C[dm ³ /(sbar)]	b	Cv	C[dm ³ /(sbar)]	b	Cv	C[dm ³ /(sbar)]	b	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 using at low vacuum, the lower limit of the working pressure is 1.33×10^2 Since it becomes Pa (abs), the upper limit is lowered by 0.1MPa.

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

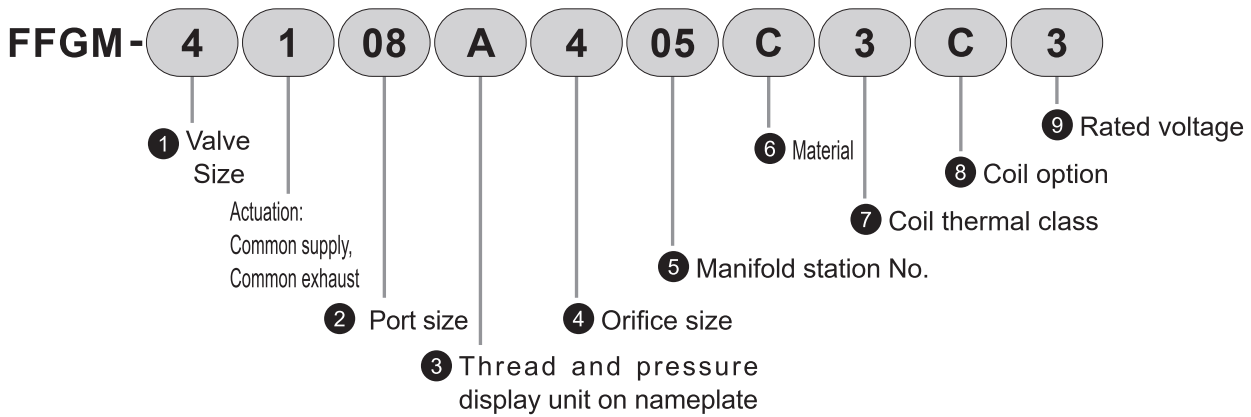
*3: Weight of aluminum sub-plate 24 VDC lead wire.

● Body material: Copper alloy/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 copper alloy 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 display unit on nameplate		
	Thread	Pressure unit indicated
A	Rc thread	MPa
B	G thread	bar
C	NPT thread	psi
D	G thread	MPa *2
E	NPT thread	MPa *2

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

*1: For "00" actuator only, there is no thread. Therefore, select "A" (MPa), "B" (bar), "C" (psi) for the pressure display unit.

*2: "D" and "E" are selections primarily used in Japan to indicate the pressure display unit as MPa even with G and NPT threads.

5 Manifold station No.

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

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

6 Material

	Body	Sub-plate	Seal	Treatment	Remarks
A	Aluminum		NBR		Compressed air/dry air
C	Copper alloy	Stainless steel	NBR	-	Compressed air/dry air/water/oil/low vacuum *1
D			FKM		Compressed air/dry air/water/oil/low vacuum *1
H	NBR		Compressed air/dry air/water/oil/low vacuum *1		
J	FKM		Compressed air/dry air/water/oil/low vacuum *1		
N	Copper alloy		NBR	Oil-prohibited	Compressed air/dry air/water/oil/low vacuum *1
P			FKM		Compressed air/dry air/water/oil/low vacuum *1
S			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 0.2cm³/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.

7 Coil thermal class

3	Class 130 (B)
---	---------------

8 Coil option

		1 Valve size			Voltage	
		3	4	5	DC	AC
A	Lead wire (300 mm)	●	●	●	●	●
B	With DIN terminal box (G1/2)	●	●	●	●	●
C	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)	●	●	●	●	●
J	Lead wire (300 mm)	●	●	●	●*2	*3
K	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)	●	●	●	●	
	Surge With absorber					

*1: "L" DIN terminal box with lamp/surge suppressor

*2: The surge suppressor of the DC voltage coil option "J" is attached.

*3: All AC voltages have 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.








9 Rated voltage

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

! How to order

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

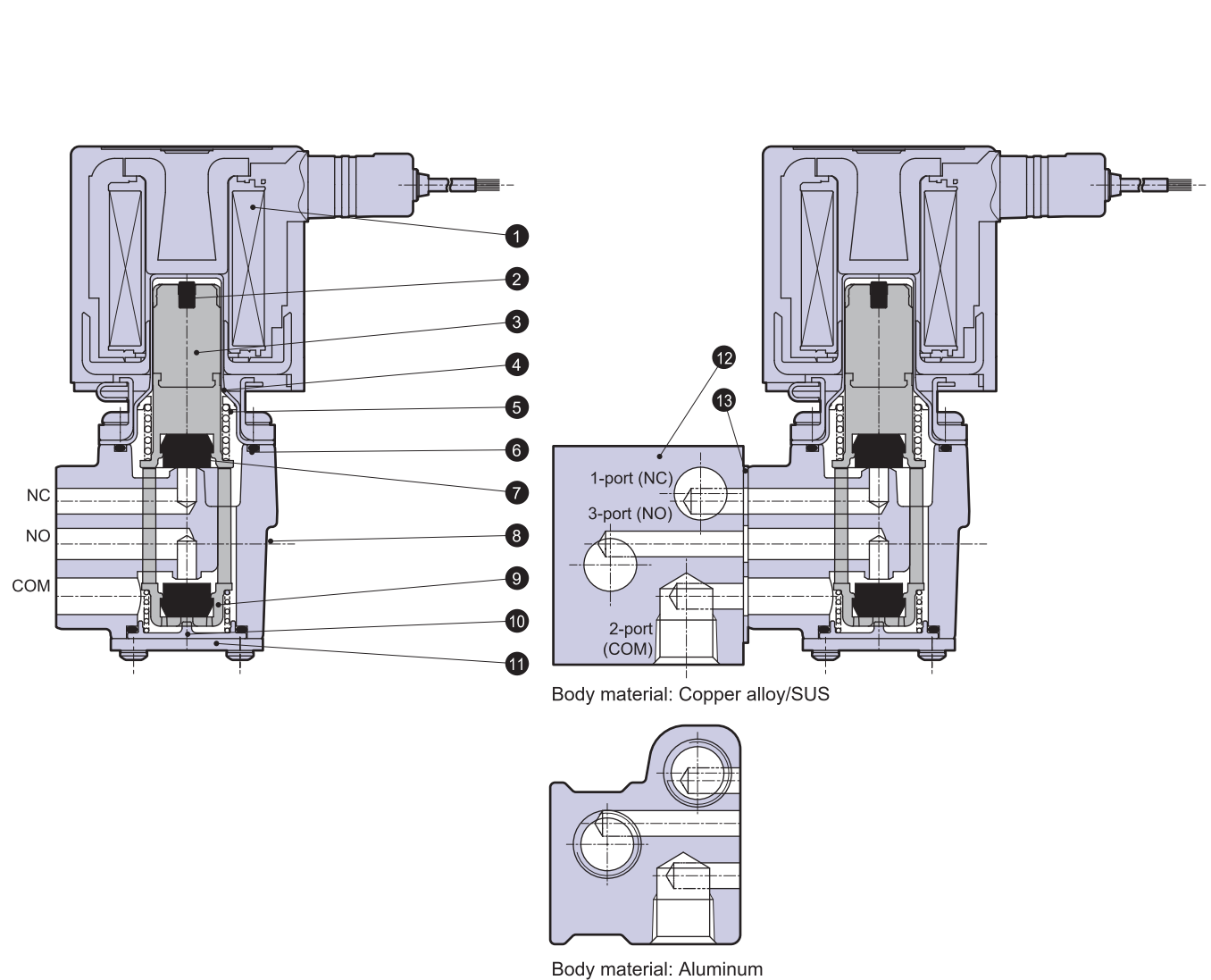
Coil option code

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

Internal structure/material

● FFGM actuator

● FFGM manifold



Body material: Copper alloy/SUS

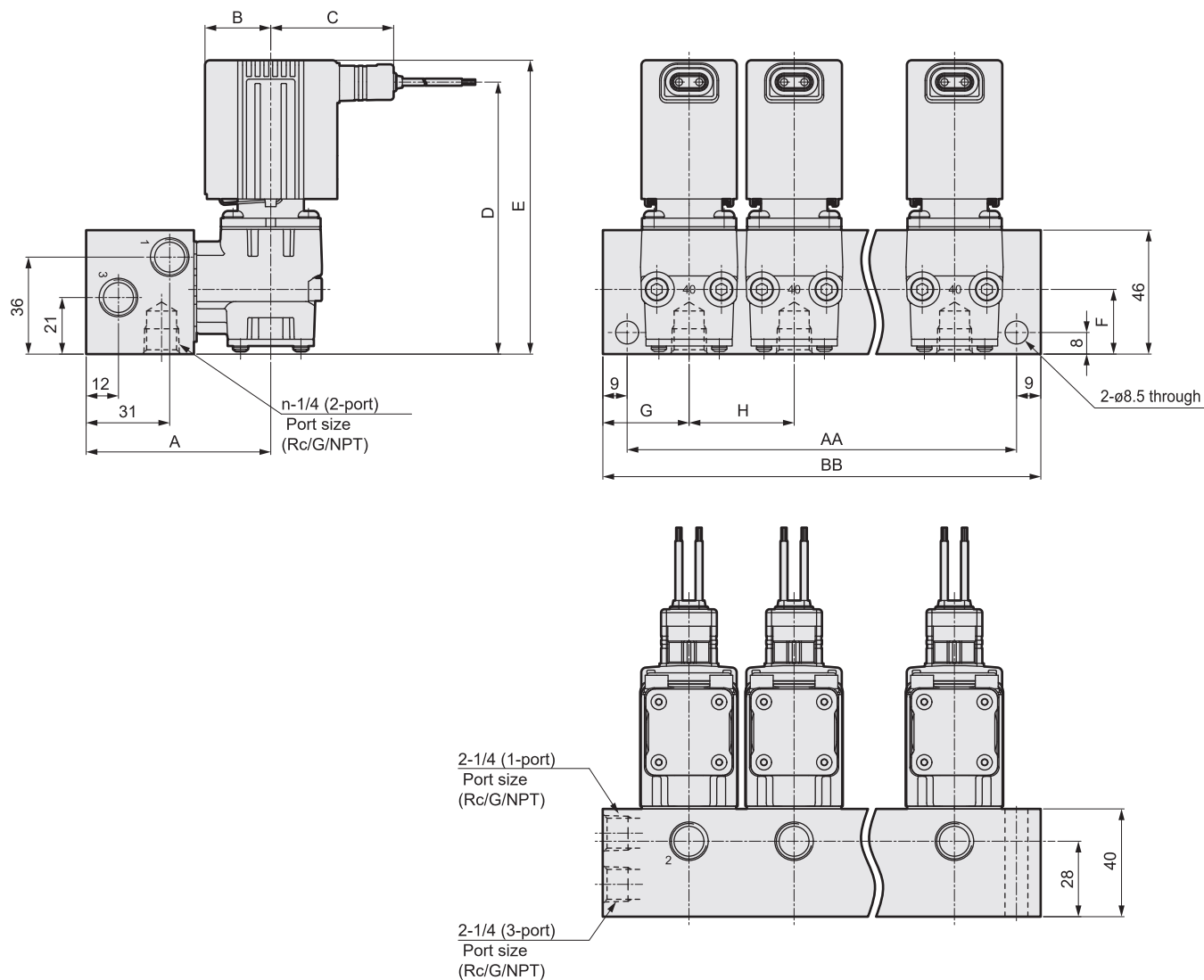
Body material: Aluminum

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	Copper alloy (aluminum, SCS13)	Copper alloy (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: For copper alloy body, the sub-plate material is stainless steel.

Dimensions

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



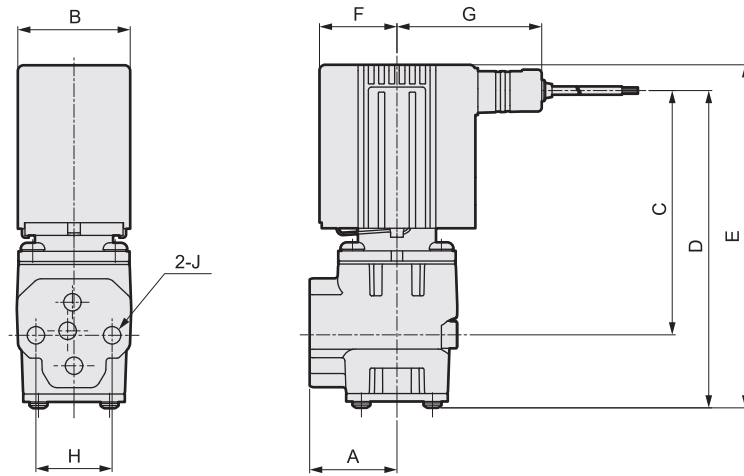
		A	B	C	D	E	F	G	H
FFGM-3	Aluminum body	63.5	22	45	88	95.5	25	32	36
	Copper alloy/SUS body								36
FFGM-4	Aluminum body	68.5	24.5	47.5	101	109	24	32	38
	Copper alloy/SUS body								39
FFGM-5	Aluminum body	68.5	27.5	50	110	118.5	24	32	46
	Copper alloy/SUS body								45

		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	
	Copper alloy/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	
	Copper alloy/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	
	Copper alloy/SUS body	AA	91	136	181	226						
		BB	109	154	199	244						

Discrete FFB
Manifold FFBM
Discrete FFG
Manifold FFGM
Control fluid Checklist
Flow rate formula
Safety Precautions

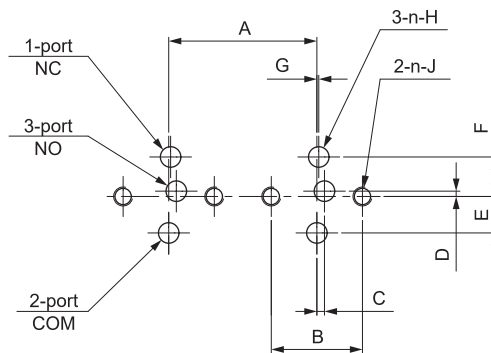
Dimensions

● 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 6 or more
	Copper alloy/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 6 or more
	Copper alloy/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 6 or more
	Copper alloy/SUS body	45 or more								

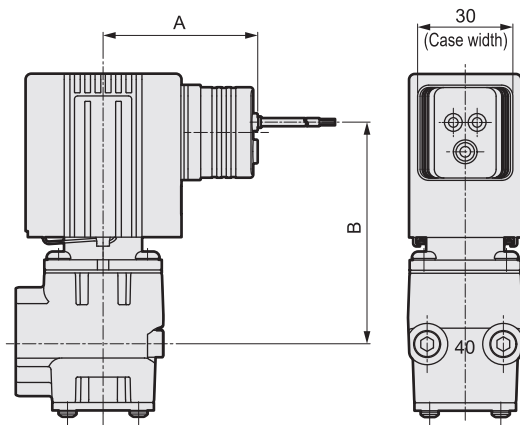
How to order discrete masking plate

With gasket and mounting screws

	Aluminum body	Copper alloy, 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

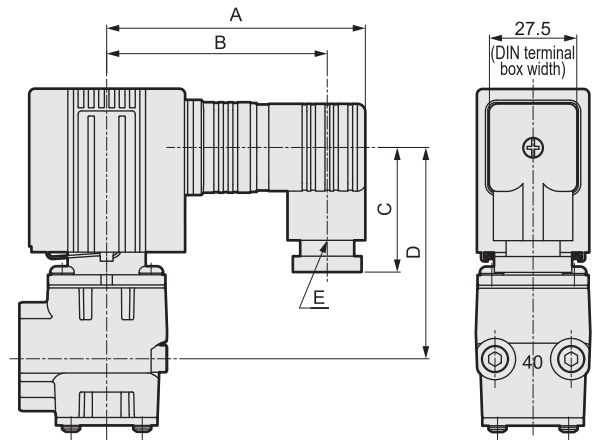
Dimensions

● 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

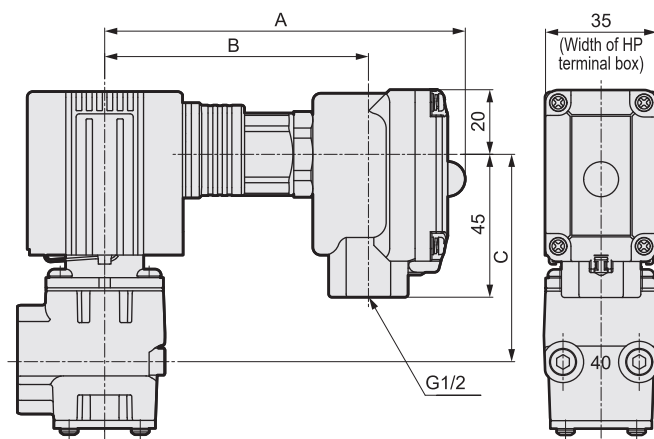
● With actuator DIN terminal box Coil option code: B/C/D/K/L



Dimensions shown in () are for G1/2.

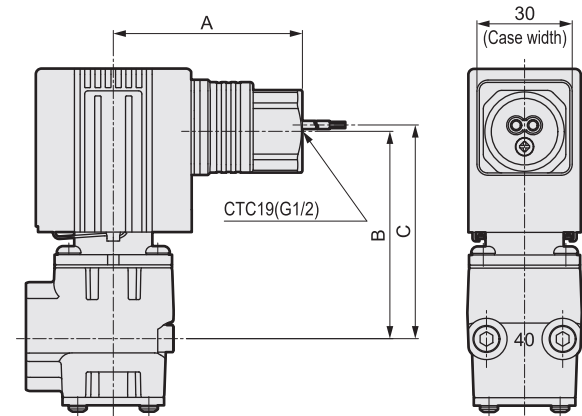
	A	B	C	D	E
FFGM-3	78.5	66.5 (65.5)	39.5 (41.5)	52.5	Pg11 (G1/2)
FFGM-4	81	69 (67.5)	39.5 (41.5)	66.5	Pg11 (G1/2)
FFGM-5	83.5	71.5 (70)	39.5 (41.5)	75.5	Pg11 (G1/2)

● 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

Discrete FFB

Direct acting 2-port valve

Manifold FFBM

Discrete FFG

Direct acting 3-port valve

Manifold FFGM

Control fluid
Checklist

Flow rate formula

Safety
Precautions

Working fluid check list¹

For multi-fit

⚠ CAUTION

This check list displays guidelines for typical corrosion resistance, and does not guarantee the solenoid valve performance. During actual use, there are unpredictable elements. Thus, there may be cases when general specifications do not apply. Therefore, before use, check the compatibility as needed and take the necessary safety measures on the equipment side.

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

●: Usable ▲: Usable with conditions x: Unusable

Fluid name	Fluid properties (Displays the state of the raw material even if the fluid indicates water solubility)	Material combination						Note on model No. selection
		[Body material]			[Body material]			
		Copper alloy			Stainless steel			
		[Sealant material]			[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. If explosion proof (d3G2) is 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 ambient atmosphere, select General purpose valve explosion-proof (d2G4). ^{*1}
Acetone	Liquid	x	x	●	x	x	●	Flammable liquid. If explosion-proof types are specified by the ambient atmosphere, select General purpose valve explosion-proof (d2G4).
Aniline	Liquid	x	x	x	x	▲	▲	Organic solvents used in paints or dyes.
Linseed oil		x	x	x	●	●	x	Take note of viscosity. For direct acting 2-port valves, the fluid viscosity must be 50mm 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 ambient
Ethyl alcohol (Industrial)	Liquid	x	x	●	x	x	●	atmosphere, select General purpose valve explosion-proof (d2G2) or (d2G4).
Ethyl ether	Liquid	x	x	x	x	x	x	In general, these are known as ethers. ^{*1}

*1: General purpose valves may be used. Contact CKD during model selection.

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

●: Usable ▲: Usable with conditions x: Unusable

Fluid name	Fluid properties (Displays the state of the raw material even if the fluid indicates water solubility)	Material combination						Note on model No. selection
		[Body material]			[Body material]			
		Copper alloy			Stainless steel			
		[Sealant material]			[Sealant material]			
		Nitrile rubber	Fluoro rubber	Ethylene propylene	Nitrile rubber	Fluoro rubber	Ethylene propylene	
Ethylene oxide gas	Gas	x	x	x	x	x	x	AKA: E.O.G. 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. *1
Methyl chloride	Gas	x	x	x	x	x	x	AKA: Chloromethane. boiling point-Gasification at 23°C. Requires dry conditions. Select a CKD air operated valve for chemical liquids if moisture is present. *1
Methylene chloride	Liquid	x	x	x	x	x	x	AKA: Dichloromethane. *1
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. *1
Hydrogen peroxide solution	Liquid	x	x	x	x	x	x	Oxidant. Used in disinfectants and sterilization agents. Usually 30 to 50% water soluble.
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. *1
Gasoline	Liquid	x	▲	x	x	▲	x	Contact CKD during model selection, as it cannot be used even with fluoro rubber in some cases. *1

*1: General purpose valves may be used. Contact CKD during model selection.

Discrete FFB Direct acting 2-port valve
 Manifold FFBM
 Discrete FFG Direct acting 3-port valve
 Manifold FFGM
 Control fluid Checklist
 Flow rate formula
 Safety Precautions

Working fluid check list¹

For multi-fit

⚠ CAUTION

This check list displays guidelines for typical corrosion resistance, and does not guarantee the solenoid valve performance. During actual use, there are unpredictable elements. Thus, there may be cases when general specifications do not apply. Therefore, before use, check the compatibility as needed and take the necessary safety measures on the equipment side.

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

●: Usable ▲: Usable with conditions x: Unusable

Fluid name	Fluid properties (Displays the state of the raw material even if the fluid indicates water solubility)	Material combination						Note on model No. selection
		[Sealant material]			[Body material]			
		Nitrile rubber	Fluoro rubber	Ethylene propylene	Copper alloy	Stainless steel		
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. *1
Chloroform	Liquid	x	x	x	x	x	x	AKA: Trichloromethane. Acute toxic substance. *1
Light oil	Liquid	●	●	x	●	●	x	-
Aqueous sodium silicate	(Crystal)	●	●	●	●	●	●	AKA: waterglass. Take note of viscosity and concentration used in phosphate-free detergents. 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. *1
Ethyl acetate	Liquid	x	x	x	x	x	x	A solvent for paint. If explosion-proof types are specified by the ambient atmosphere, select General purpose valve explosion-proof (d2G2) or (d2G4). *1
Sodium acetate	(Solid)	●	●	x	●	●	x	Dye.
Butyl acetate	Liquid	x	x	x	x	x	x	Flammable liquid. Acute toxic substance. *1
Methyl acetate	Liquid	x	x	x	x	x	x	Flammable liquid. Acute toxic substance. *1
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		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. *1
Aqueous potassium dichromate	(Solid)	x	x	x	x	●	●	-
Aqueous sodium bicarbonate	(Solid)	x	x	x	●	●	●	AKA: baking soda. Used as a food additive.
Heavy oil A	Liquid	▲	▲	x	▲	▲	x	Be careful of sealant selection if additives are present. *2

*1: General purpose valves may be used. Contact CKD during model selection.

*2 : 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.]

●: Usable ▲: Usable with conditions x: Unusable

Fluid name	Fluid properties (Displays the state of the raw material even if the fluid indicates water solubility)	Material combination						Note on model No. selection
		[Body material] Copper alloy			[Body material] Stainless steel			
		[Sealant material]		[Sealant material]		[Sealant material]		
		Nitrile rubber	Fluoro rubber	Ethylene propylene	Nitrile rubber	Fluoro rubber	Ethylene propylene	
Heavy oil B	Liquid	▲	▲	x	▲	▲	x	-
Heavy oil C	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 (below 30%) (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) specifications are 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. We recommend gas combustion systems.
Kerosene	Liquid	▲	▲	x	▲	▲	x	AKA: kerosene. Jet fuel is known as kerosene.
City gas	Gas	●	●	x	●	●	x	We recommend gas combustion systems.
Dry air	Gas	●	●	●	●	●	●	-
Trichloroethane	Liquid	x	x	x	x	x	x	The corrosiveness increases when mixed with water. *1
Trichloroethylene	Liquid	x	x	x	x	x	x	Alias : Trichlene. Acute toxic substance. *1
Toluene	Liquid	x	x	x	x	x	x	If explosion-proof types are specified by the ambient atmosphere, select General purpose valve explosion-proof (d2G2) or (d2G4). Note that it is volatile and take care with temperatures. Flammable liquid. Acute toxic substance. *1

*1: General purpose valves may be used. Contact CKD during model selection.

Discrete FFB
Manifold FFBM
Discrete FFG
Manifold FFGM
Control fluid Checklist
Flow rate formula
Safety Precautions

Working fluid check list¹

For multi-fit

⚠ CAUTION

This check list displays guidelines for typical corrosion resistance, and does not guarantee the solenoid valve performance. During actual use, there are unpredictable elements. Thus, there may be cases when general specifications do not apply. Therefore, before use, check the compatibility as needed and take the necessary safety measures on the equipment side.

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

●: Usable ▲: Usable with conditions x: Unusable

Fluid name	Fluid properties (Displays the state of the raw material even if the fluid indicates water solubility)	Material combination						Note on model No. selection
		[Sealant material]			[Body material]			
		Nitrile rubber	Fluoro rubber	Ethylene propylene	Nitrile rubber	Fluoro rubber	Ethylene propylene	
Naphtha	Liquid	x	x	x	x	x	x	*1
Dichloride benzene	Liquid (solid)	x	x	x	x	x	x	AKA: Dichlorobenzene. *1
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	Used as a disinfectant and local anesthetic.
Butane gas	Gas	●	●	x	●	●	x	If explosion-proof types are specified by the ambient atmosphere, select General purpose valve explosion-proof (d2G2) or (d2G4). We recommend gas combustion systems.
Butyl alcohol	Liquid	x	●	●	x	●	●	AKA: Butanol. If explosion-proof types are specified by the ambient atmosphere, select General purpose valve explosion-proof (d2G2) or (d2G4). Flammable liquid. Contact CKD during model selection.
Brake fluid	Liquid	x	x	●	x	x	●	-
Propyl alcohol	Liquid	x	●	●	x	●	●	-
Propane gas	Gas	●	●	x	●	●	x	We recommend gas combustion systems.
Freon gas *1	Liquid and gas	x	x	x	x	x	x	AKA: HFC23
		x	x	●	x	x	●	AKA: HFC32
		●	x	●	●	x	●	AKA: HFC125
		x	x	x	x	x	x	AKA: HFC134a
		●	x	●	●	x	●	AKA: HFC143a
		x	x	x	x	x	x	For HFC125/143a/134a mixtures
		x	x	x	x	x	x	For HFC32/125/134a mixtures
		x	x	x	x	x	x	For HFC32/125/134a mixtures
		x	x	●	x	x	●	For HFC32/125 mixtures
		●	x	●	●	x	●	For HFC125/143a mixtures

*1: General purpose valves may be used. Contact CKD during model selection.

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

●: Usable ▲: Usable with conditions x: Unusable

Fluid name	Fluid properties (Displays the state of the raw material even if the fluid indicates water solubility)	Material combination						Note on model No. selection
		[Body material]			[Body material]			
		Copper alloy	Stainless steel					
		[Sealant material]			[Sealant material]			
		Nitrile rubber	Fluoro rubber	Ethylene propylene	Nitrile rubber	Fluoro rubber	Ethylene propylene	
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. *1
Benzol	Liquid	x	x	x	x	x	x	AKA: Benzene. Flammable liquid. Harmful substance. Limited to use in environments with well-equipped exhaust equipment. *1
Sodium borate	(Crystal)	x	x	x	●	●	●	AKA: Borax.
Formalin	(Gas)	x	x	x	x	x	●	AKA: Formaldehyde.
Methane gas	Gas	●	●	x	●	●	x	We recommend gas combustion systems.
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	*1
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 ambient atmosphere, select General purpose valve explosion-proof (d2G2) or (d2G4) from the following specifications. *1
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	-

*1: General purpose valves may be used. Contact CKD during model selection.

Discrete FFB
 Manifold FFBM
 Discrete FFG
 Manifold FFGM
 Direct acting 2-port valve
 Direct acting 3-port valve
 Control fluid Checklist
 Flow rate formula
 Safety Precautions

Calculation method of flow characteristics

1. Flow characteristics display

The catalog specifications indicate the flow rate as follows.

Applicable components	Display	Code	Standards
Pneumatic components	JIS compliant display	C,b	ISO 6358 : 1989 "Pneumatic fluid power - Compressible fluid Components - Flow characteristics test method" 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-No.2part: Flow rate -No.3 partTest procedure" JIS B 2005-2-3: 2004 (IEC 60534-2-3 translation) JIS B 8471: 2004 "Solenoids for water" JIS B 8472: 2008 "Solenoids for steam" JIS B 8473: 2007 "Solenoids 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 conductance C: 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) $S=5.0C$ (Conventional sizing is possible with "C")
- Critical pressure ratio b: Pressure ratio at which choked flow results if smaller than this value (downstream pressure/upstream pressure) (critical pressure ratio)
- Effective cross-sectional area S (mm²): 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 certain sections of components reach acoustic velocity. The fluid's mass flow rate is proportional to the upstream pressure, and is not dependent on downstream pressure. (Choked flow)

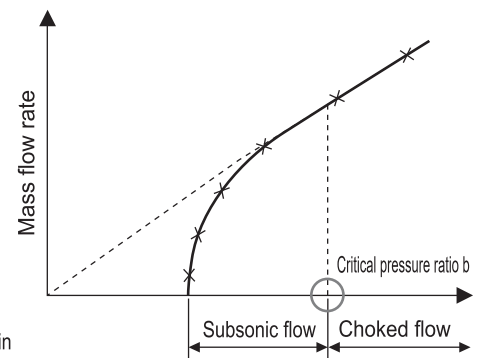


Fig. 1 Mass flow characteristics for upstream pressure

Flow rate formula

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

- Choked flow when $\frac{P_2}{P_1} \leq b$

$$Q=600 \times C \times P_1 \times \sqrt{\frac{293}{273 + T}} \dots (1)$$

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

$$Q=600 \times C \times P_1 \times \sqrt{1 - \left[\frac{\frac{P_2}{P_1} - b}{1-b} \right]^2} \times \sqrt{\frac{293}{273 + T}} \dots (2)$$

Q : Flow rate in standard condition L/min (ANR)
 C : Sonic conductance [dm³/(s·bar)]
 b : Critical pressure ratio
 S : Effective cross-sectional area mm²
 P₁ : Primary side absolute pressure MPa (abs)
 P₂ : 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.

$$Cv=Q \sqrt{\frac{\rho}{\rho_w} \frac{1}{\Delta P}} \dots\dots (3)$$

- Cv : Flow coefficient
- Q : Flow rate[U.S.gal/min](1U.S.gal/min=6,309 x 10⁻⁶m³/s)
- ρ : FluidDensity [1b/ft³](1b/ft³=16,018kg/m³)
- ρ_w : 40°F to 100°F(4°C to 38°C) water density [1b/ft³]
- ΔP : 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:

$$Av=Q \sqrt{\frac{\rho}{\Delta P}} \dots\dots (4)$$

- Av : Flow coefficient [m²]
- Q : Flow rate[m³/s]
- ρ : Fluid density [kg/m³]
- ΔP : Pressure difference [PA]

Flow rate formula

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

- Flow coefficient Cv

For liquids:

$$Q=45.58 Cv \sqrt{\frac{\Delta P}{G}} \dots\dots (5)$$

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

For steam:

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

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

- Cv : Flow coefficient
- W : Flow rate [kg/h]
- P₁ : Primary side absolute pressure [MPa]
- P₂ : 2Next side absolute pressure [MPa]
- K : (1+0.0013ts) ts: Degree of superheat (Saturation steam K = 1)

Direct acting 2-port valve	Discrete FFB
Manifold FFBM	
Direct acting 3-port valve	Discrete FFG
Manifold FFGM	
Control fluid Checklist	
Flow rate formula	
Safety Precautions	

Flow rate formula

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

● Flow coefficient Av

For liquids:

$$Q=1.9 \times 10^6 Av \sqrt{\frac{\Delta P}{G}} \dots\dots\dots (8)$$

Q : Flow rate[l/min]
 Av : Flow coefficient[m²]
 ΔP : Pressure difference[MPa]
 G : Specific gravity[Water=1]

For steam:

$$Q=8.3 \times 10^6 Av \sqrt{\Delta P(P_2+0.1)} \dots\dots (9)$$

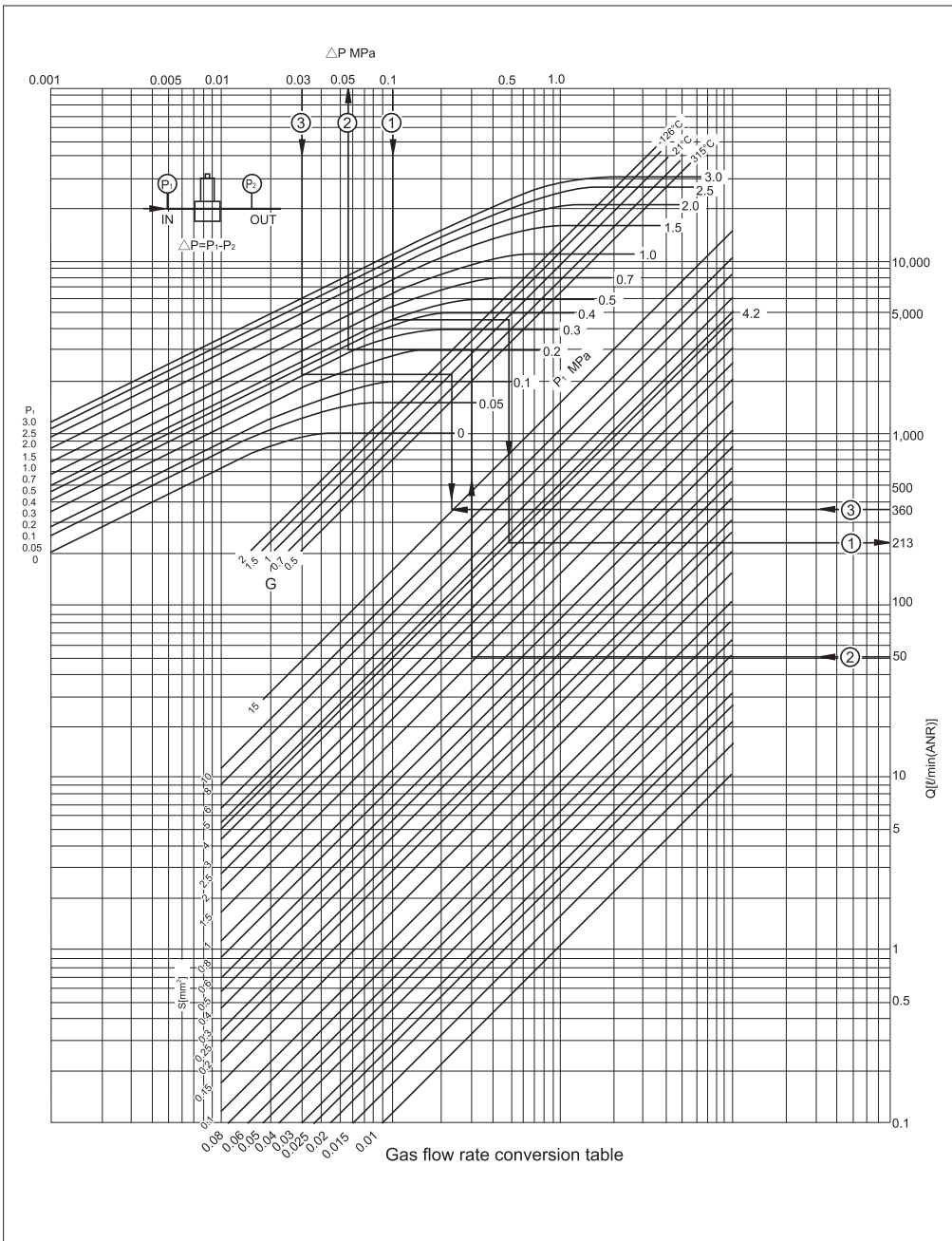
Q : Flow rate [kg/h]
 Av : Flow coefficient [m²]
 ΔP : Pressure difference [MPa]
 P₁ : Upstream pressure [MPa]:ΔP=P₁-P₂
 P₂ :Downstream pressure [MPa]
 P₁,P₂ is gauge pressure

Flow coefficient conversion

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

Kv: Value which indicates 5 to 40°C city water flow rate passing through the valve in m³/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 1bf/in2 (psi). The Kv and Cv for air use different calculation methods, so the values do not match.

Air



● **Example 1:**
Flow rate when air is passed through a S = 4.2 mm² valve at P₁=0.5MPa and P₂=0.4MPa (ΔP=P₁-P₂=0.1MPa) is Q=226 l/min (ANR)

● **Example 2:**
The pressure loss when air is passed through a S=1.5mm² valve at 50 l/min (ANR) at P₁=0.3MPa is ΔP=0.057 MPa

● **Example 3:**
When obtaining a 360 l/min (ANR) flow rate at P₁=0.3MPa and ΔP=0.03MPa, the effective cross-sectional area is 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

● With $\frac{P_2}{P_1} \leq 0.5$ (choked flow)

$$Q = 120 \times S \times P_1 \times \sqrt{\frac{293}{273 + T}}$$

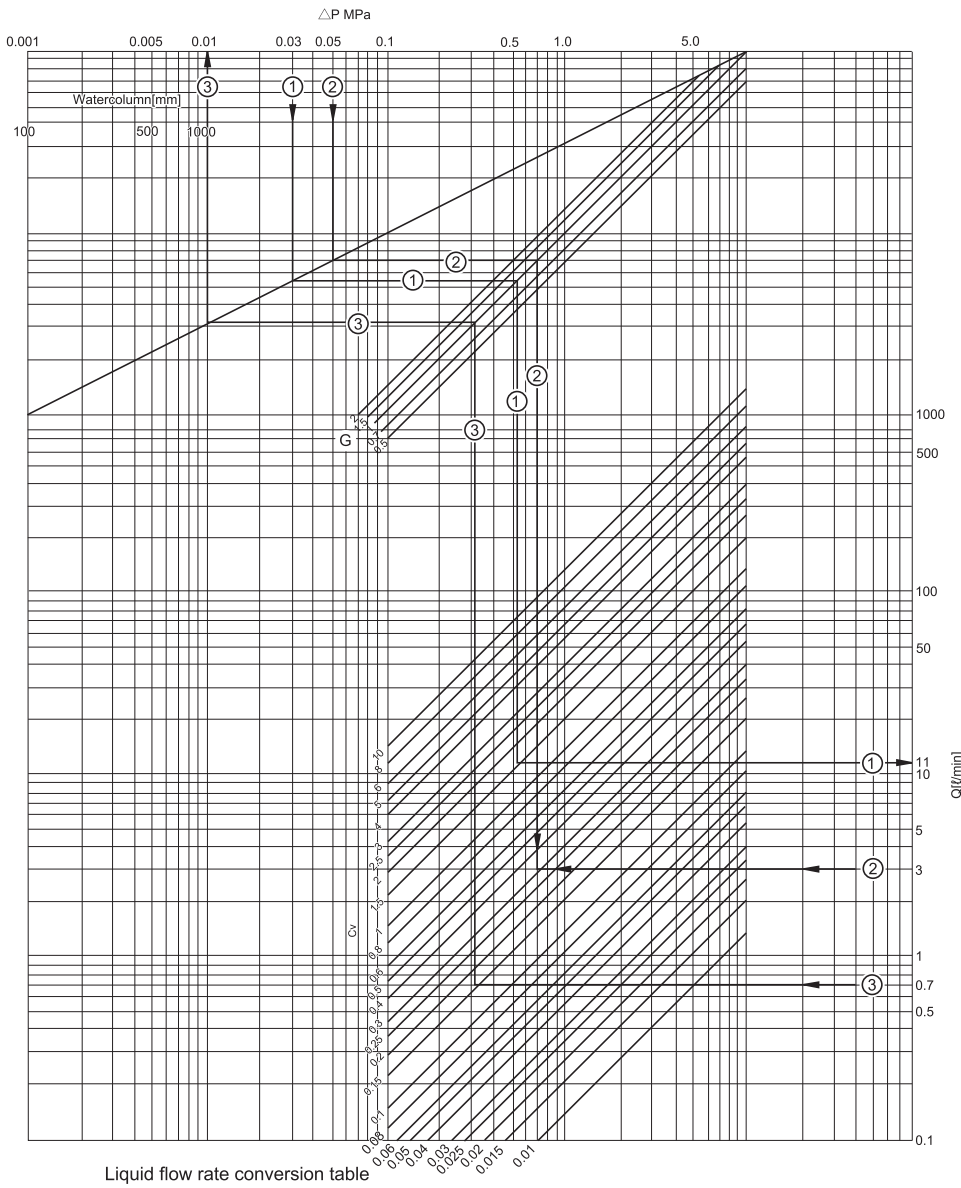
● With $\frac{P_2}{P_1} > 0.5$ (subsonic flow)

$$Q = 240 \times S \times \sqrt{P_2 \times (P_1 - P_2)} \times \sqrt{\frac{293}{273 + T}}$$

- Q :Flow rate l/min (ANR)
- P₁ : Primary side absolute pressure MPa (abs)
- P₂ : Secondary side absolute pressure MPa (abs)
- S : Effective cross-sectional area mm²

- Discrete FFB
- Manifold FFBM
- Discrete FFG
- Manifold FFGM
- Control fluid Checklist
- Flow rate formula
- Safety Precautions

Water



● Example 1:
What is the flow rate when water (specific gravity = 1) is passed through a Cv = 1.5 valve at $\Delta P = 0.03$ MPa ($P_1 - P_2$)

$$Q = 11.8 \text{ l/min}$$

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

$$Cv = 0.29$$

● Example 3:
Pressure loss when water (specific gravity = 1) is passed through a Cv = 0.15 valve at 0.7 l/min

$$\Delta P = 0.01 \text{ MPa}$$

*1: The table shows Cv up to 10. If this value is exceeded, multiply the Cv and flow rate Q proportionally.

Example: If Cv is 15, refer to 1.5 and multiply the flow rate by 10.

Flow rate calculation method

SI units

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

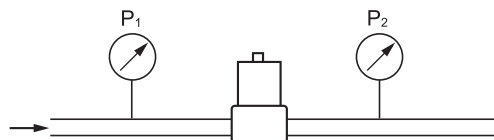
Q: Flow rate l/min

P_1 : Primary pressure MPa (gauge pressure)

P_2 : Secondary pressure MPa (gauge pressure)

G: Specific gravity (water = 1)

C_v : Flow coefficient



Pressure loss

$$\Delta P = P_1 - P_2$$



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.)
 - 1** 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.
 - 2** 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.
 - 1** Inspect and service the machine and devices after confirming safety of all systems related to this product.
 - 2** Note that there may be hot or charged sections even after operation is stopped.
 - 3** 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.
 - 4** 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.



Safety precautions

Fluid Control Components: Warnings and Cautions

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.

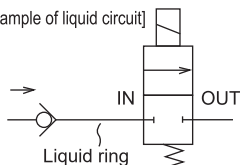
⚠ CAUTION

- 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 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 gases (combustion gas, acetylene gas, etc.).
- When using the copper alloy 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 mm²/s or less. Malfunctions could occur if the viscosity is higher than 50 mm²/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, take the necessary measures to prevent freezing. When wrapping insulation around the solenoid valve, etc., do not wrap around the coil section.
- Take appropriate safeguards according to the degree of protection listed in the catalog specifications. 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 test, 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.

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.
- Dirt or foreign matter in fluid may 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 tankpipe at a level slightly above the bottom of the tank.
- If the working fluid is steam, provide piping that prevents drainage from accumulating on the primary side. 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 the 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

[When the body/sub-plate 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]

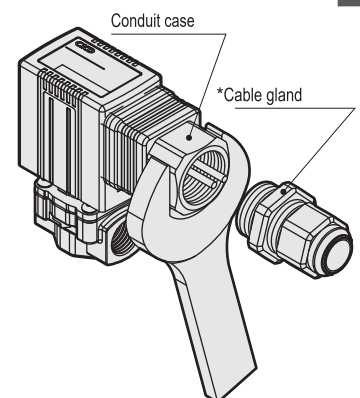
Port thread	Recommended tightening torque values (N·m)
Rc1/8	3 to 5
Rc1/4	6 to 8
Rc3/8	13 to 15
Rc1/2	16 to 18
Rc3/4	19 to 40
Rc1	41 to 70

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 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 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 mm² 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. If the coil or body is gripped and connected, the conduit case may be damaged. Tightening torque of cable gland is 0.45 to 0.55N·m.



Parts marked with * are not included with CKD products.

Use/maintenance

1 . Maintenance and 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.
- Do not touch the electrical wiring connections (bare, live parts) with hands or body when they are energized. 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 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 been out of use for 1 month or more, perform a test run before starting the actual operation.
- 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, use a neutral detergent, etc. Use a low-harm cleaning agent. (Only and replace the rubber parts. 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.

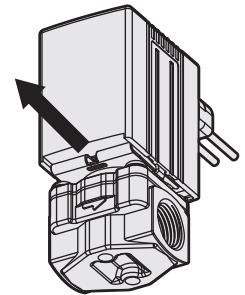


Fig. 1

● 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.

- ① The top surface of the clip should contact the collar. (Fig. 3)
- ② The bottom of the clip must be on the hook. (Fig. 4)

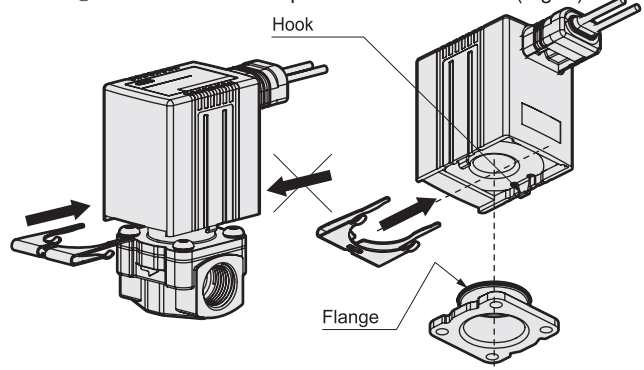


Fig. 2

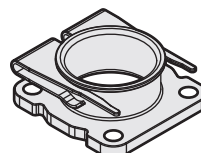


Fig. 3

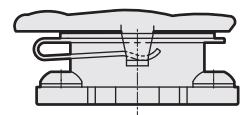
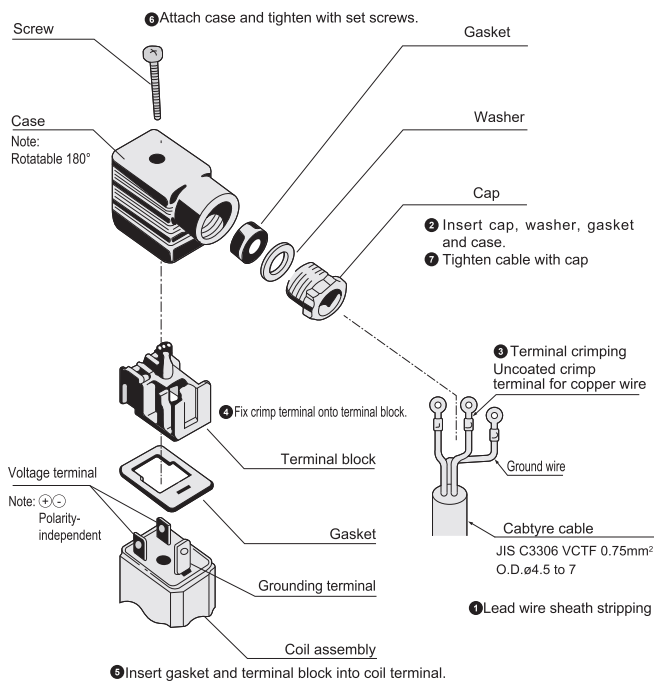


Fig. 4

⚠ How to connect terminal box

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

- ① Cabtyre cable is as follows can be used.
 - Cable O.D.: $\phi 4.5$ to $\phi 7$ • Nominal section area: 0.75 mm^2
- ② Put the crimp terminal for copper wire on the cabtyre cable's lead wire and crimp the terminal. The terminal box thread size is M3.
- ③ Tighten the screws with the following tightening torque.
 - Set screw tightening torque... 0.5 Nm
 - Terminal screw tightening torque... 0.5 Nm

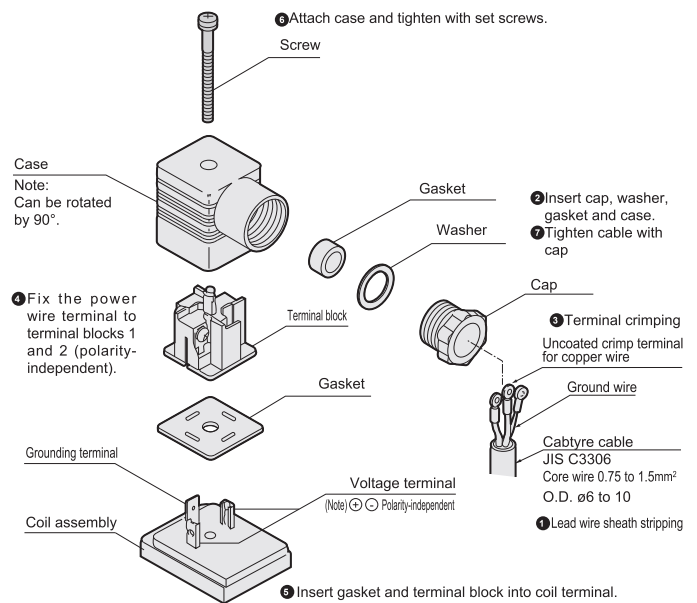


Wire with steps ① to ⑦.

* 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)

- ① Use the following cabtyre cable.
 - Cable O.D.: $\phi 6$ to $\phi 10$ • Nominal section area: 0.5 to 1.5 mm^2
- ② Put the crimp terminal for copper wire on the cabtyre cable's lead wire and crimp the terminal. The terminal box thread size is M3.
- ③ Tighten the screws with the following tightening torque.
 - Set screw tightening torque... 0.5 Nm
 - Terminal screw tightening torque... 0.5 Nm



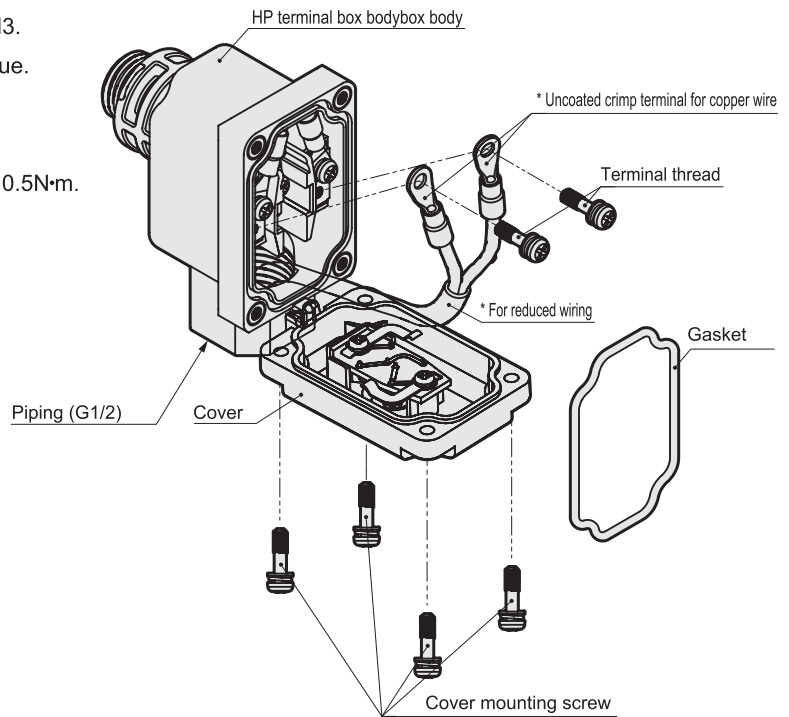
Wire with steps ① to ⑦.

* 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

- ① Put the crimp terminal for copper wire on the electric wire and crimp the terminal. The terminal screw size is M3.
- ② Tighten the screws with the following tightening torque.
 - Cover mounting screw tightening torque...0.5 N·m
 - Terminal screw tightening torque...0.5 N·m
- ③ Tighten the piping (G1/2) with a tightening torque of 0.5N·m.



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

- ④ The 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

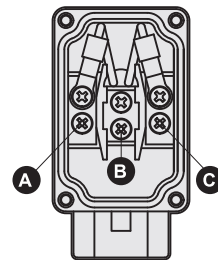
There is polarity, so wire the terminal board's A terminal...⊖ Pole, C terminal...⊕ pole.
 - (iii) For three lead wires

Wire according to the working frequency:

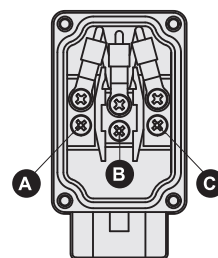
 - For 50 Hz...A terminal and C terminal
 - For 60 Hz...A terminal and B terminal

[Wiring diagram]

For two lead wires



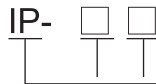
For three lead wires





Degree of protection

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



Protection characteristic codes (International Protection)

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

1st characteristic No.	Degree of protection	
0	No protection	Without protection
1	 ○ ϕ 50 mm	Protection against inflow of solids 50 mm and over in diameter
2	 ○ ϕ 12.5 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 falling as a spray at any angle up to 60° 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.	

Discrete FFB

Manifold FFBM

Discrete FFG

Manifold FFGM

Control fluid Checklist

Flow rate formula

Safety Precautions

Direct acting 2-port valve

Direct acting 3-port valve

Control fluid Checklist

Flow rate formula

Safety Precautions

Catalog introduction

Pneumatic Cylinders I (Catalog No. CB-029SA)

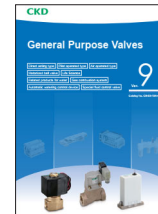
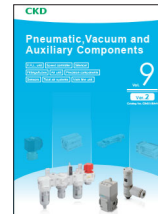
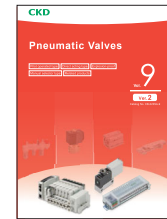
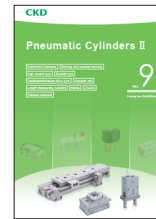
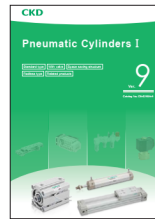
Pneumatic Cylinders II (Catalog No. CB-030SA)

Pneumatic Valves (Catalog No. CB-023SA)

Pneumatic, Vacuum and Auxiliary Components (Catalog No. CB-024SA)

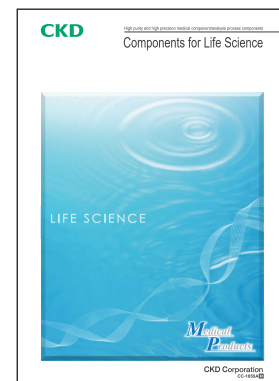
General Purpose Valves (Catalog No. CB-03-1SA)

- 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)

- A fluid control device that meets the needs of medical components. Controlling every type of fluid with high purity and high precision for extracting, dispensing, cleaning and disposing.

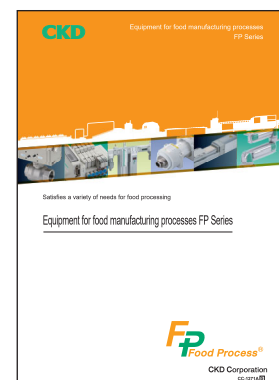


Equipment for food manufacturing processes FP Series (Catalog No. CC-1271A)

- 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.



This logo represents CKD's stance to provide you with safe components for supporting your food manufacturing processes.



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

Wide-ranging lineup of motorless electric actuators

■ Slider

- For high speed transport
- For high load transport
- For long stroke transport
- For fast tact transport

- EBS-L Series
- ETS/ECS Series
- ETV/ECV Series
- EKS-L Series

■ Rod

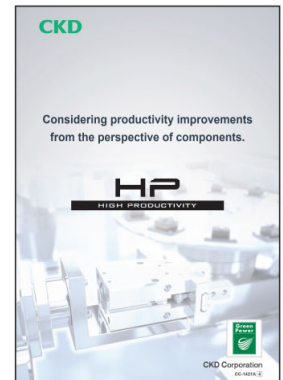
- For press fitting and hoisting

- 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)

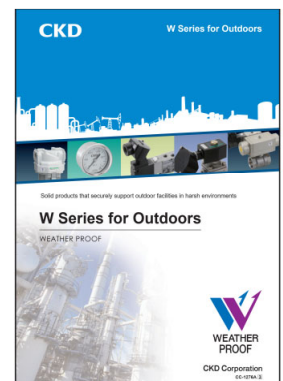


Outdoor products W Series (Catalog No. CC-1276A)

- 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.



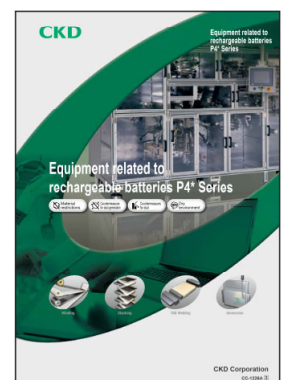
This logo represents CKD's guarantee of its products for outdoor use.



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.

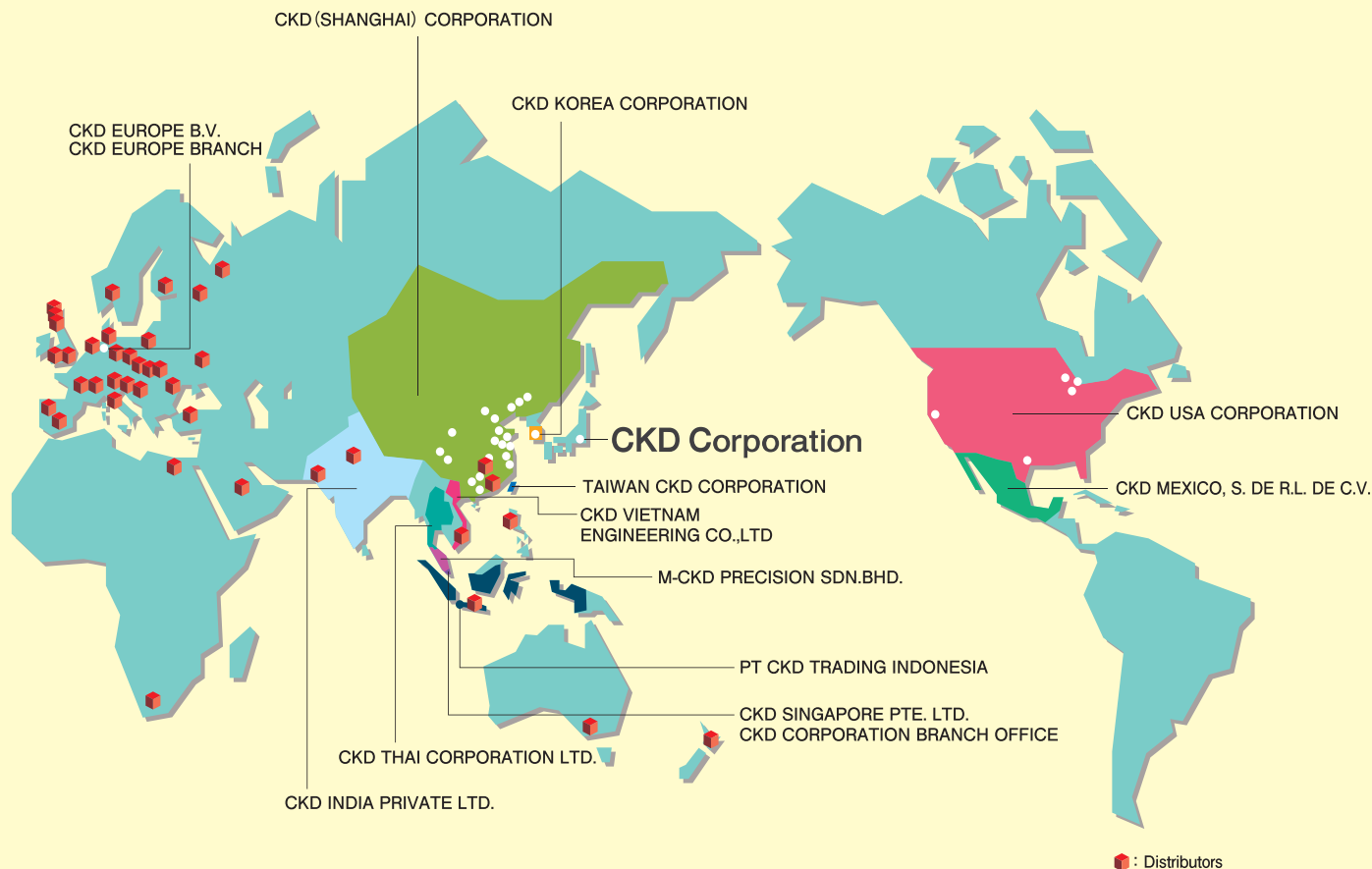
- Limited material for component parts
- Long service life even in dusty environments
- Suppresses dust generation of metal wear powder
- Long service life even in ultra-dry environments



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 motion components such as electric actuators and direct drive motors that require reduced wiring, the lineup includes sensor-level network components that are closer to the workpiece.
- Air components and electric motion components are listed by network to reduce work hours in determining the network for the equipment.





CKD Corporation

Website <https://www.ckd.co.jp/en/>

□ 2-250 Ouji, Komaki City, Aichi 485-8551, Japan
□ PHONE +81-568-74-1338 FAX +81-568-77-3461

ASIA

喜開理(上海)機器有限公司

CKD(SHANGHAI)CORPORATION

● 營業部 / 上海浦西事務所 (SALES HEADQUARTERS / SHANGHAI PUXI OFFICE)
Room 601, 6th Floor, Yuanzhongkeyan Building, No. 1905
Hongmei Road, Xinhui District, Shanghai 200233, China
PHONE +86-21-61911888 FAX +86-21-60905356

- 上海浦東事務所 (SHANGHAI PUDONG OFFICE)
- 寧波事務所 (NINGBO OFFICE)
- 杭州事務所 (HANGZHOU OFFICE)
- 無錫事務所 (WUXI OFFICE)
- 昆山事務所 (KUNSHAN OFFICE)
- 蘇州事務所 (SUZHOU OFFICE)
- 南京事務所 (NANJING OFFICE)
- 合肥事務所 (HEFEI OFFICE)
- 成都事務所 (CHENGDU OFFICE)
- 武漢事務所 (WUHAN OFFICE)
- 鄭州事務所 (ZHENGZHOU OFFICE)
- 長沙事務所 (CHANGSHA OFFICE)
- 重慶事務所 (CHONGQING OFFICE)
- 西安事務所 (XI'AN OFFICE)
- 廣州事務所 (GUANGZHOU OFFICE)
- 中山事務所 (ZHONGSHAN OFFICE)
- 深圳西事務所 (WEST SHENZHEN OFFICE)
- 深圳東事務所 (EAST SHENZHEN OFFICE)
- 東莞事務所 (DONGGUAN OFFICE)
- 廈門事務所 (XIAMEN OFFICE)
- 福州事務所 (FUZHOU OFFICE)
- 瀋陽事務所 (SHENYANG OFFICE)
- 大連事務所 (DALIAN OFFICE)
- 長春事務所 (CHANGCHUN OFFICE)
- 北京事務所 (BEIJING OFFICE)
- 天津事務所 (TIANJIN OFFICE)
- 青島事務所 (QINGDAO OFFICE)
- 濰坊事務所 (WEIFANG OFFICE)
- 濟南事務所 (JINAN OFFICE)
- 烟台事務所 (YANTAI OFFICE)

CKD INDIA PRIVATE LTD.

- HEADQUARTERS
Unit No. 607, 6th Floor, Welldone Tech Park, Sector 48,
Sohna Road, Gurgaon-122018, Haryana, India
PHONE +91-124-418-8212 FAX +91-(0) 124-418-8216
- BANGALORE OFFICE
- PUNE OFFICE

PT CKD TRADING INDONESIA

- HEAD OFFICE
Menara Bidakara 2, 18th Floor, Jl. Jend. Gatot Subroto Kav.
71-73, Pancoran, Jakarta 12870, Indonesia
PHONE +62-21-2938-6601 FAX +62-21-2906-9470
- MEDAN OFFICE
- BEKASI OFFICE
- KARAWANG OFFICE
- SEMARANG OFFICE
- SURABAYA OFFICE

CKD KOREA CORPORATION

- HEADQUARTERS
(3rd Floor), 44, Sinsu-ro, Mapo-gu, Seoul 04088, Korea
PHONE +82-2-783-5201 ~ 5203 FAX +82-2-783-5204
- 水原營業所 (SUWON OFFICE)
- 天安營業所 (CHEONAN OFFICE)
- 蔚山營業所 (ULSAN OFFICE)

M-CKD PRECISION SDN.BHD.

- HEAD OFFICE
Lot No.6, Jalan Modal 23/2, Seksyen 23, Kawasan MIEL,
Fasa 8, 40300 Shah Alam, Selangor Darul Ehsan, Malaysia
PHONE +60-3-5541-1468 FAX +60-3-5541-1533
- JOHOR BAHRU BRANCH OFFICE
- PENANG BRANCH OFFICE

CKD SINGAPORE PTE. LTD.

No. 33 Tannery Lane #04-01 Hoesteel Industrial
Building, Singapore 347789, Singapore
PHONE +65-67442623 FAX +65-67442486

CKD CORPORATION BRANCH OFFICE

No. 33 Tannery Lane #04-01 Hoesteel Industrial
Building, Singapore 347789, Singapore
PHONE +65-67447260 FAX +65-68421022

CKD THAI CORPORATION LTD.

- HEADQUARTERS
19th Floor, Smooth Life Tower, 44 North Sathorn Road,
Silom, Bangkok, Bangkok 10500, Thailand
PHONE +66-2-267-6300 FAX +66-2-267-6304-5
- NAVANAKORN OFFICE
- EASTERN SEABOARD OFFICE
- LAMPHUN OFFICE
- KORAT OFFICE
- AMATANAKORN OFFICE
- PRACHINBURI OFFICE
- SARABURI OFFICE

台灣喜開理股份有限公司

TAIWAN CKD CORPORATION

- HEADQUARTERS
16F-3, No. 7, Sec. 3, New Taipei Blvd., Xinzhuang Dist.,
New Taipei City 242, Taiwan
PHONE +886-2-8522-8198 FAX +886-2-8522-8128
- 新竹營業所 (HSINCHU OFFICE)
- 台中營業所 (TAICHUNG OFFICE)
- 台南營業所 (TAINAN OFFICE)
- 高雄營業所 (KAOHSIUNG OFFICE)

CKD VIETNAM ENGINEERING CO.,LTD.

- HEADQUARTERS
18th Floor, CMC Tower, Duy Tan Street, Cau Giay
District, Hanoi, Vietnam
PHONE +84-24-3795-7631 FAX +84-24-3795-7637
- HO CHI MINH OFFICE

EUROPE

CKD EUROPE B.V.

- HEADQUARTERS
Beechavenue 125A, 1119 RB Schiphol-Rijk, the Netherlands
PHONE +31-23-554-1490
- CKD EUROPE GERMANY OFFICE
- CKD EUROPE UK
- CKD EUROPE CZECH O.Z.

CKD CORPORATION EUROPE BRANCH

Beechavenue 125A, 1119 RB Schiphol-Rijk, the Netherlands
PHONE +31-23-554-1490

NORTH AMERICA & LATIN AMERICA

CKD MEXICO, S. DE R.L. DE C.V.

Cerrada la Noria No. 200 Int. A-01, Querétaro Park II,
Parque Industrial Querétaro, Santa Rosa Jáuregui,
Querétaro, C.P. 76220, México
PHONE +52-442-161-0624

CKD USA CORPORATION

- HEADQUARTERS
1605 Penny Lane, Schaumburg, IL 60173, USA
PHONE +1-847-648-4400 FAX +1-847-565-4923
- LEXINGTON OFFICE
- SAN ANTONIO OFFICE
- SAN JOSE OFFICE/ TECHNICAL CENTER
- DETROIT OFFICE
- BOSTON OFFICE

The goods and/or their replicas, the technology and/or software found in this catalog are subject to complementary export regulations by Foreign Exchange and Foreign Trade Law of Japan.

If the goods and/or their replicas, the technology and/or software found in this catalog are to be exported from Japan, Japanese laws require the exporter makes sure that they will never be used for the development and/or manufacture of weapons for mass destruction.