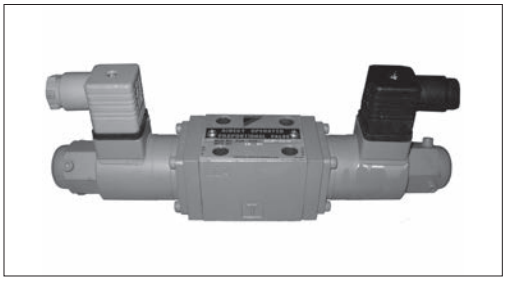
Direct Operated Type Solenoid Operated Proportional Directional Control Valve



Features

- These four-way proportional directional control valves enable control of the forward and reverse motion of an actuator.
- The valve can be used alone as a shockless directional control valve.

- With differential transformer
  - ○ These proportional directional control valves perform spool position feedback control by directly driving the spool with the proportional solenoid and detecting the displacement with the differential transformer.
  - ○ Combining the valve with a pressure compensation valve and the dedicated driver achieves highly accurate proportional flow rate control.
- Without differential transformer
  - ○ Installed with the dedicated driver (ZDN-2-10).
  - ○ The valve can be used as a simple flow control valve by combining it with a pressure compensation valve.

Nomenclature

- **Nominal diameter 02**

KSP	-	G	02	-	※※※	※	※	-	10	-	※	-	※※※
1		2	3		4	5	6		7		8		9

- **Nominal diameter 03**

KSP	-	G	03	-	※※※	※	-	10	-	※※※
1		2	3		4	5		7		9

1 Model No.
(Applicable fluids: petroleum-based hydraulic oil)
KSP: Solenoid operated proportional directional control valve

2 Connections
G: Gasket mount type

3 Nominal diameter
02: ¼
03: ⅜

4 Spool type and spool operating method (See the spool type table)

5 Rated flow rate (the values at 1 land differential pressure: ΔP = 1 MPa {10 kgf/cm²})
1: 10 L/min (Applicable only to KSP-G02)
2: 18 L/min (Applicable only to KSP-G02)
3: 30 L/min (Applicable only to KSP-G02 equipped with differential transformer (option code M))
4: 40 L/min (Applicable only to KSP-G03)
5: 50 L/min (Applicable only to KSP-G03)

6 Solenoid code *1
P: DC 24 V solenoid
N: DC 12 V solenoid

7 Design No.
(The design No. is subject to change)

8 Option code *2
No designation: Without differential transformer, with driver ZDN-2-10
N: Without differential transformer, without driver ZDN-2-10
M: With differential transformer
Note: Models with a differential transformer or with a driver are not available with nominal diameter 03 (⅜).

9 Auxiliary spool type (See the spool type table)

Note: *1 The solenoid code applies only to option code N.
*2 The option code applies only to nominal diameter 02 (¼)

Specifications

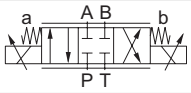
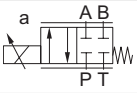
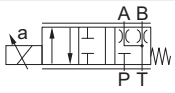
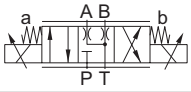
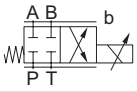
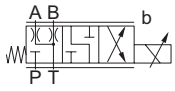
Model code	Nominal diameter	Maximum operating pressure MPa {kgf/cm²}	Rated flow rate *3 L/min	Permissible back pressure MPa {kgf/cm²}	Hysteresis, resolution, repeatability	Mass kg	
						Double solenoid	Single solenoid
KSP-G02-※※※1※-10	¼	35 {350}	10	2.5 { 25}	5% maximum	2.7	2.1
KSP-G02-※※※2※-10			18				
KSP-G02-※※※1※-10-M			10		1% maximum	3.1	2.5
KSP-G02-※※※2※-10-M			18				
KSP-G02-※※※3※-10-M			30				
KSP-G03-※※※4※-10	⅜		40	16 {160}	8% maximum	6.5	4.8
KSP-G03-※※※5※-10			50				

Note: *3 The rated flow rate indicates the value at 1 land differential pressure: ΔP = 1 MPa {10 kgf/cm²}.

Applicable driver model code

Valve model code	Solenoid Code	Solenoid	Maximum current (20°C) mA	Coil resistance (20°C) Ω	Applicable driver	
					Model code	Power supply voltage
KSP-G02-※※※※-10	–	DC 12 V	1400	6.5	ZDN-2-10	DC 24 V
KSP-G02-※※C※N-10-N	N				EPD-03-10	
KSP-G02-※※A(B)※N-10-N					EPK-02-10	
KSP-G02-※※C※P-10-N	P	DC 24 V	700	26	KC-6-10	AC 100, 200, 220 V (Common for 50 and 60 Hz)
KSP-G02-※※A(B)※P-10-N						
KSP-G02-※※C※-10-M	–	DC 12 V	1600	6.5	EPKD-02-10	DC 24 V
KSP-G02-※※A(B)※-10-M					EPKF-02-10	
KSP-G03-※※C※-10			1800	4.2	EPD-03-10	
KSP-G03-※※A(B)※-10					EPK-03-10	

4 9: Spool type table

Spool type and spool operating method	JIS graphic symbols for hydraulic system	Spool type and spool operating method	JIS graphic symbols for hydraulic system	Spool type and spool operating method	JIS graphic symbols for hydraulic system
2C		2A…H2		81A…H44	
44C		2B…2T		8B…44T	

Note: The model code after ... indicates the model of the auxiliary spool.

Sub-plate model code

- The sub-plate is not provided with the valve. Order it separately as required by specifying the model code given in the table below.

Model code	Nominal diameter	Connection port diameter	Mass kg
JS-01M02	¼	Rc¼	0.64
JS-02M03		Rc⅜	2.3
JS-03M	⅜	Rc⅜	2.5
JS-03M04		Rc½	2.2

Refer to Page S-9 for the dimensions of the sub-plate.

Accessories

Model No.	Hexagon socket head cap bolt	Quantity	Tightening torque N·m {kgf·cm}
KSP-G02	M5 × 45	4	6.5 to 8.5 { 65 to 85}
KSP-G03	M6 × 35	4	12 to 15 {120 to 150}

Handling

- Directly connect the tank piping of the valve to the tank without merging it with other tank piping.
- The input voltage - flow rate characteristics of these valves vary from valve to valve.
  Even when using valves of the same model, the flow rates of individual valves have to be finely adjusted.
  The degree of variation can be corrected by adjusting the maximum and minimum values with the dedicated driver's MAX/MIN trimmer.
- Do not touch the zero adjusting screw of the differential transformer since it is factory adjusted.
- Use this valve in combination with a pressure compensation valve. Order a pressure compensation valve separately by referring to the table below as necessary.

Model No.	Bypass type pressure compensation valve	Reduction type pressure compensation valve
KSP-G02-※※C	MRS-02W-※※-70	MGS-02W-※※-70
KSP-G02-※※A	MRS-02A-※※-70	MGS-02A-※※-70
KSP-G02-※※B	MRS-02B-※※-70	MGS-02B-※※-70
KSP-G03-※※C	–	MGS-03W-※※-70
KSP-G03-※※A	–	MGS-03A-※※-70
KSP-G03-※※B	–	MGS-03B-※※-70

- When using the valve in combination with a pressure compensation valve, maintain a pressure difference between port P and the load port within the control range shown in the minimum operating pressure characteristics curve to ensure good pressure compensation performance.
- When using the valve in combination with a bypass type pressure compensation valve, maintain a bypass flow rate of 10 L/min minimum.
- When using the valve in combination with a pressure compensation valve, meter-in control is applied to all flow rate controls.
- When a differential circuit is constructed using this valve, combined use with a pressure compensation valve is not possible.

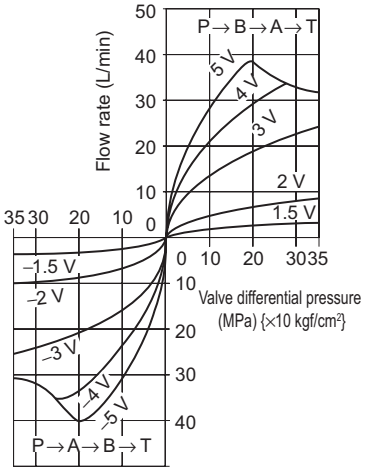
Refer to Pages J-45 to 48 for the specifications and external dimensions of pressure compensation valves.

Refer to Pages J-86 to 87 for the specifications and external dimensions of the driver (ZDN-2-10).

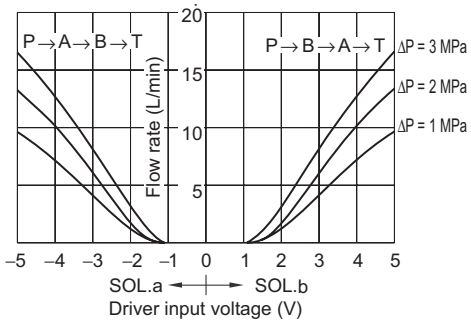
Performance curves (viscosity: 32 mm²/s {cSt})

● KSP-G02-2C1※-10-M

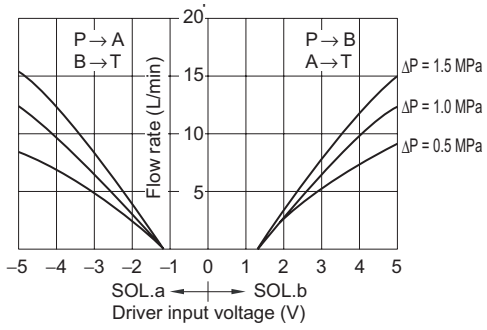
Differential pressure - Flow rate characteristics



Input voltage - Flow rate characteristics (4-way flow)
ΔP: Valve differential pressure

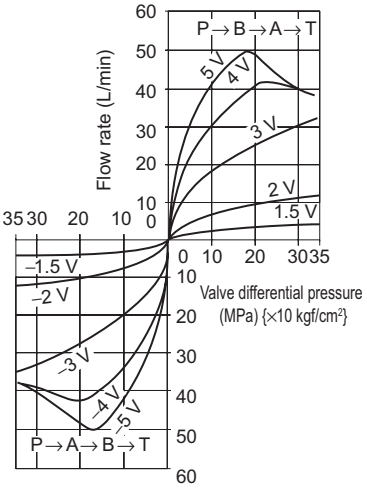


Input voltage - Flow rate characteristics (single side flow)
ΔP: 1 land differential pressure

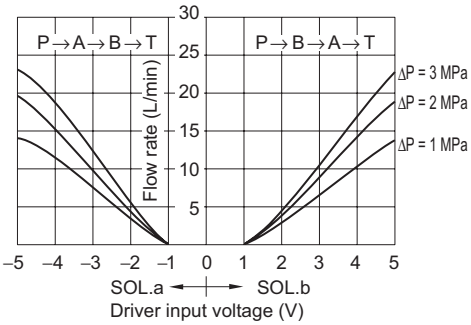


● KSP-G02-2C2※-10-M

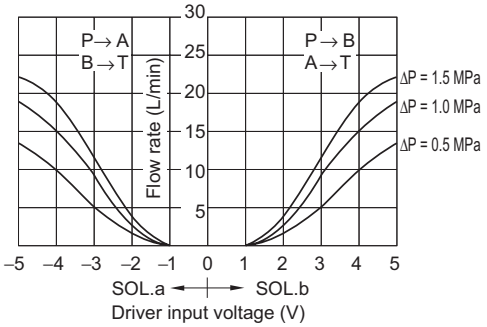
Differential pressure - Flow rate characteristics



Input voltage - Flow rate characteristics (4-way flow)
ΔP: Valve differential pressure

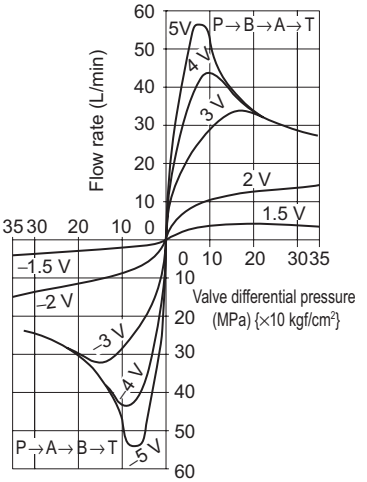


Input voltage - Flow rate characteristics (single side flow)
ΔP: 1 land differential pressure

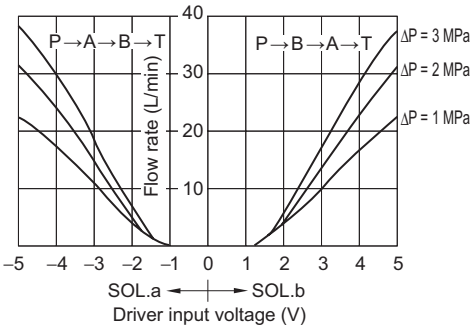


● KSP-G02-2C3※-10-M

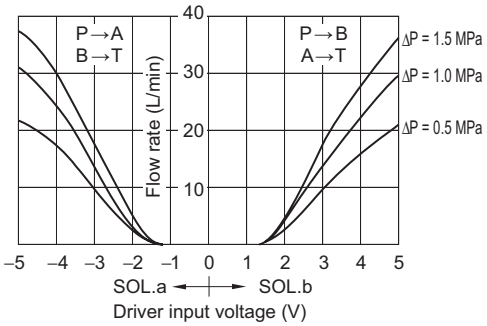
Differential pressure - Flow rate characteristics



Input voltage - Flow rate characteristics (4-way flow)
ΔP: Valve differential pressure



Input voltage - Flow rate characteristics (single side flow)
ΔP: 1 land differential pressure



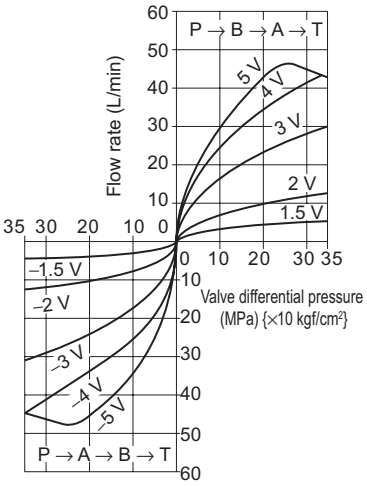
Note: ○ The input voltage - flow rate characteristics are the characteristics when the valve is used in combination with a pressure compensation valve (MRS-02, MGS-02).
○ For the characteristic curves of single solenoid models, see the characteristic curves indicated in the table below.

Spool type and spool operating method	Performance curve for reference	
	Spool type and spool operating method	Flow direction
2A-H2	2C	P → A → B → T
2B-2T	2C	P → B → A → T

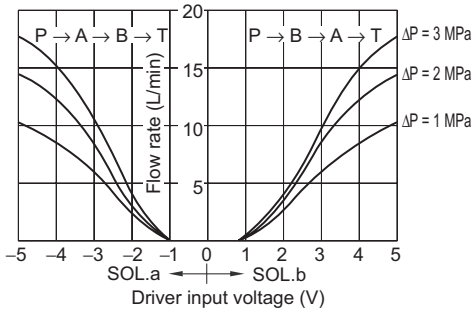
Performance curves (viscosity: 32 mm²/s {cSt})

● KSP-G02-44C1※-10-M

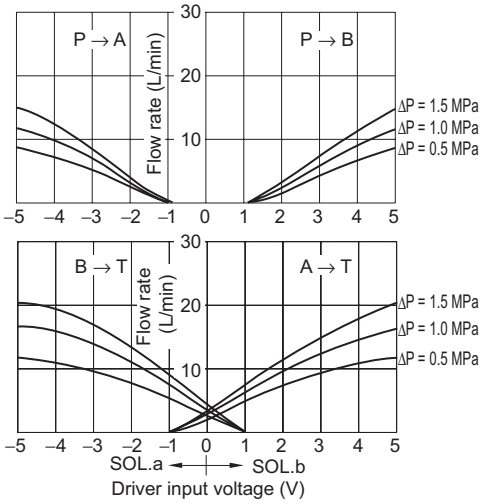
Differential pressure - Flow rate characteristics



Input voltage - Flow rate characteristics (4-way flow)
ΔP: Valve differential pressure

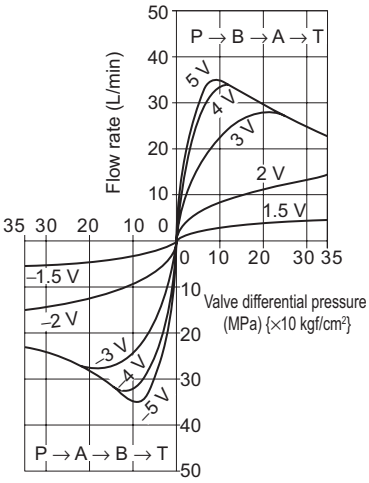


Input voltage - Flow rate characteristics (single side flow)
ΔP: 1 land differential pressure

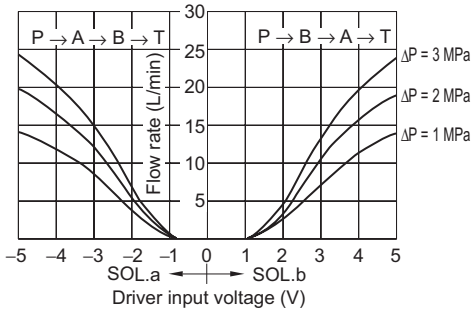


● KSP-G02-44C2※-10-M

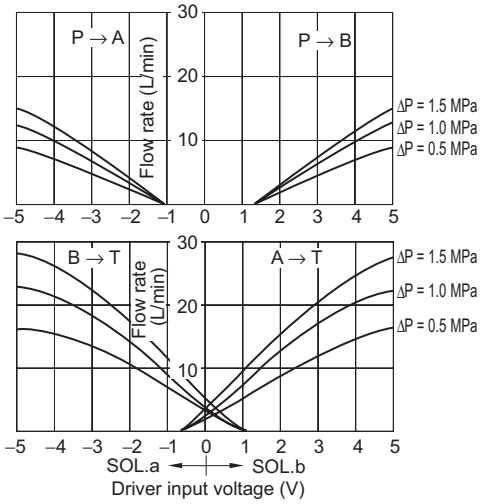
Differential pressure - Flow rate characteristics



Input voltage - Flow rate characteristics (4-way flow)
ΔP: Valve differential pressure

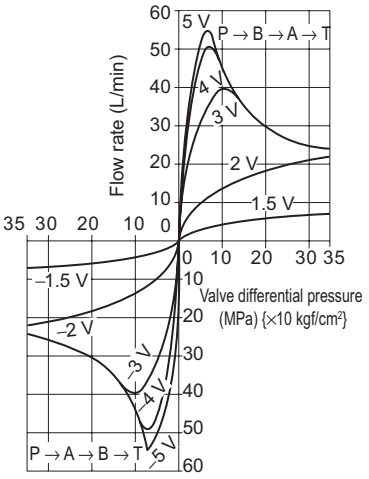


Input voltage - Flow rate characteristics (single side flow)
ΔP: 1 land differential pressure

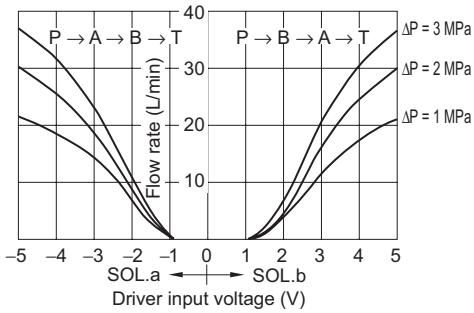


● KSP-G02-44C3※-10-M

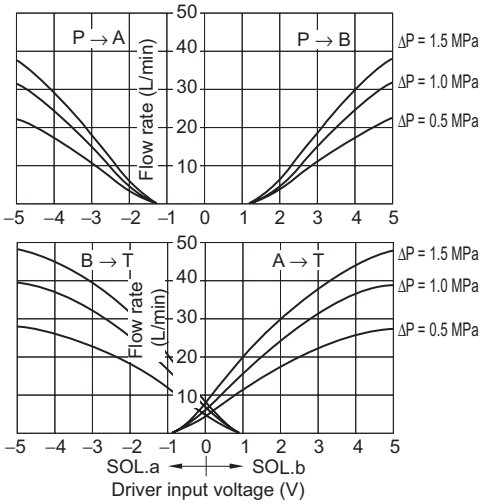
Differential pressure - Flow rate characteristics



Input voltage - Flow rate characteristics (4-way flow)
ΔP: Valve differential pressure



Input voltage - Flow rate characteristics (single side flow)
ΔP: 1 land differential pressure



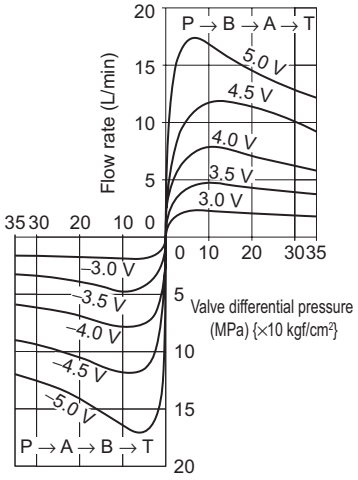
Note: ○ The input voltage - flow rate characteristics are the characteristics when the valve is used in combination with a pressure compensation valve (MRS-02, MGS-02).
○ For the characteristic curves of single solenoid models, see the characteristic curves indicated in the table below.

Spool type and spool operating method	Performance curve for reference	
	Spool type and spool operating method	Flow direction
81A-H44	44C	P → A → B → T
8B-44T	44C	P → B → A → T

Performance curves (viscosity: 32 mm²/s {cSt})

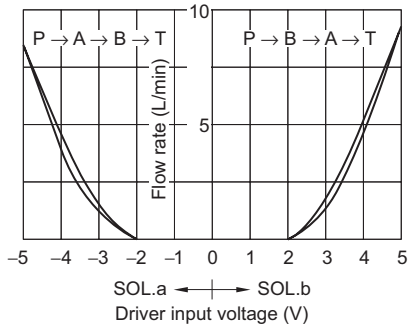
● KSP-G02-2C1※-10

Differential pressure - Flow rate characteristics



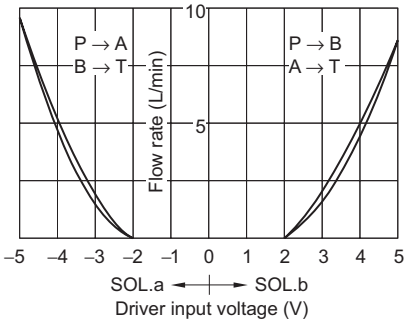
Input voltage - Flow rate characteristics (4-way flow)

Valve differential pressure ΔP = 1 MPa {10 kgf/cm²}



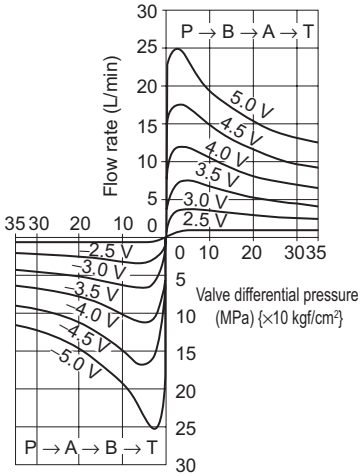
Input voltage - Flow rate characteristics (single side flow)

1 land differential pressure ΔP = 0.5 MPa {5 kgf/cm²}



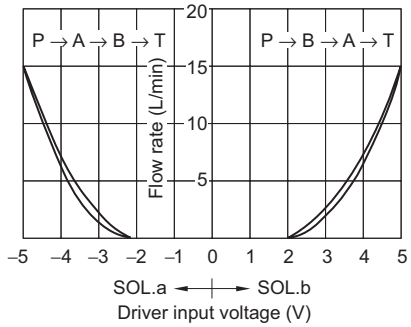
● KSP-G02-2C2※-10

Differential pressure - Flow rate characteristics



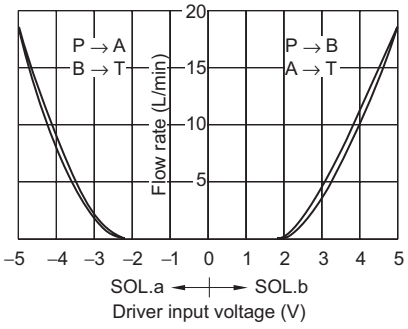
Input voltage - Flow rate characteristics (4-way flow)

Valve differential pressure ΔP = 1 MPa {10 kgf/cm²}



Input voltage - Flow rate characteristics (single side flow)

1 land differential pressure ΔP = 0.5 MPa {5 kgf/cm²}

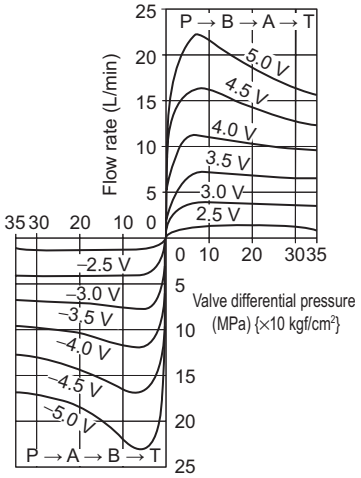


Note: ○ The input voltage - flow rate characteristics are the characteristics when the valve is used in combination with a pressure compensation valve (MRS-02, MGS-02).
○ For the characteristic curves of single solenoid models, see the characteristic curves indicated in the table below.

Spool type and spool operating method	Performance curve for reference	
	Spool type and spool operating method	Flow direction
2A-H2	2C	P → A → B → T
2B-2T	2C	P → B → A → T

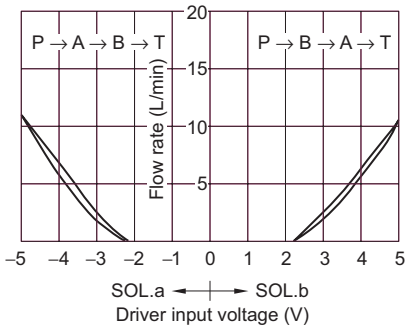
● KSP-G02-44C1※-10

Differential pressure - Flow rate characteristics



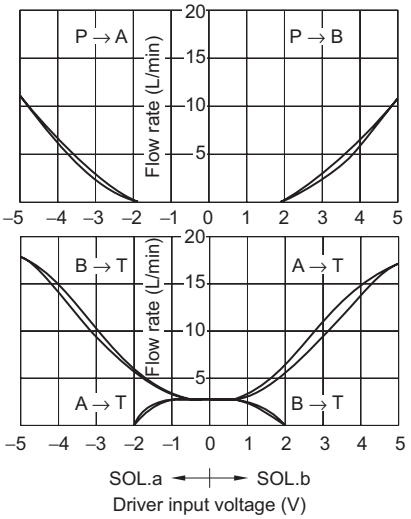
Input voltage - Flow rate characteristics (4-way flow)

Valve differential pressure ΔP = 1 MPa {10 kgf/cm²}



Input voltage - Flow rate characteristics (single side flow)

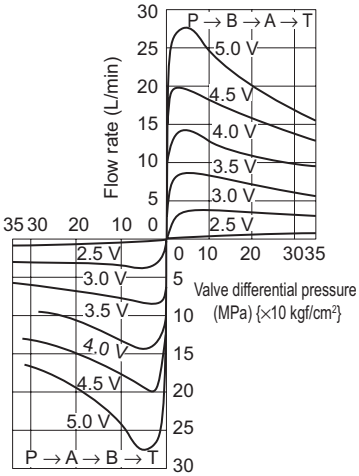
1 land differential pressure ΔP = 0.5 MPa {5 kgf/cm²}



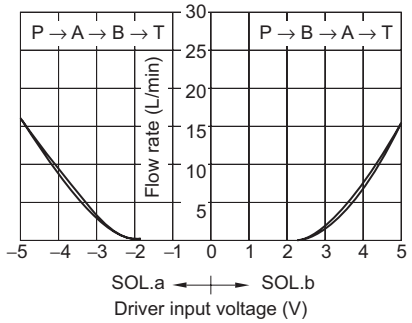
Performance curves (viscosity: 32 mm²/s {cSt})

● KSP-G02-44C2※-10

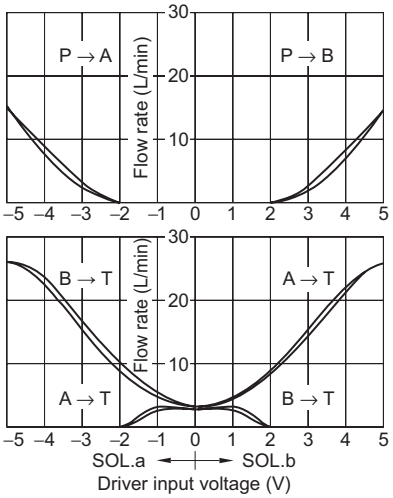
Differential pressure - Flow rate characteristics



Input voltage - Flow rate characteristics (4-way flow)
Valve differential pressure ΔP = 1 MPa {10 kgf/cm²}



Input voltage - Flow rate characteristics (single side flow)
1 land differential pressure ΔP = 0.5 MPa {5 kgf/cm²}



Note: ○ The input voltage - flow rate characteristics are the characteristics when the valve is used in combination with a pressure compensation valve (MRS-02, MGS-02).
○ For the characteristic curves of single solenoid models, see the characteristic curves indicated in the table below.

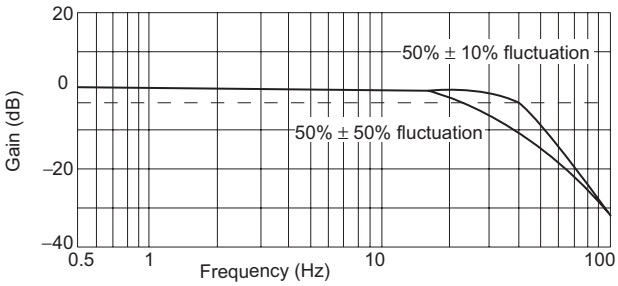
Spool type and spool operating method	Performance curve for reference	
	Spool type and spool operating method	Flow direction
81A-H44	44C	P → A → B → T
8B-44T	44C	P → B → A → T

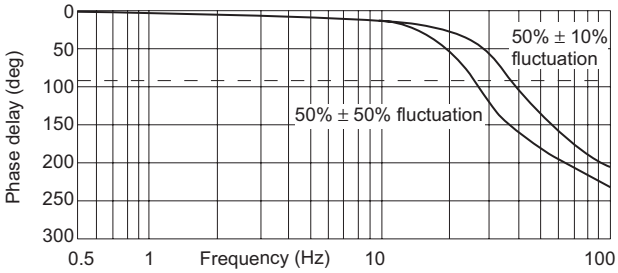
● KSP-G02-M

Frequency response characteristics

Pressure at port P: 2 MPa {20 kgf/cm²}

Note: Frequency characteristics of the spool displacement voltage in reference to input voltage



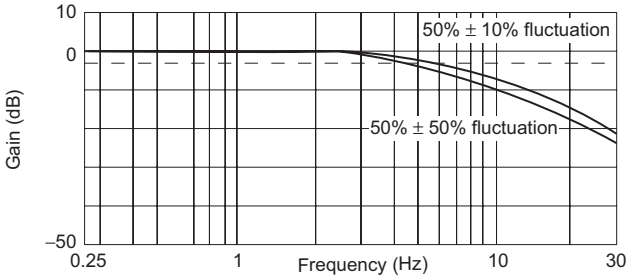


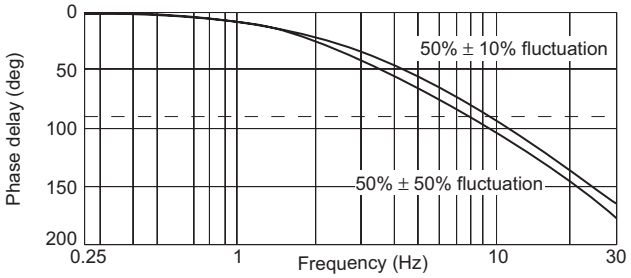
● KSP-G02

Frequency response characteristics

Pressure at port P: 2 MPa {20 kgf/cm²}

Note: Frequency characteristics of the spool displacement voltage in reference to input voltage

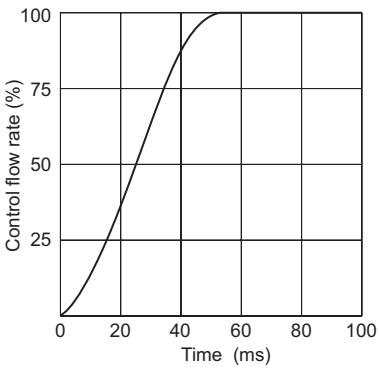




● KSP-G02-M

Step response characteristics

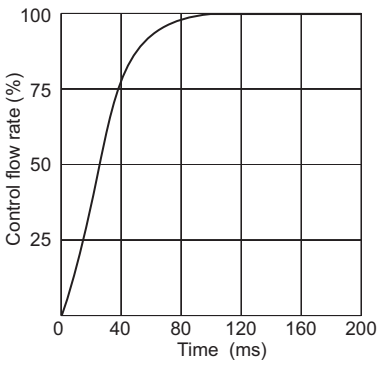
Pressure at port P: 7 MPa {70 kgf/cm²}



● KSP-G02

Step response characteristics

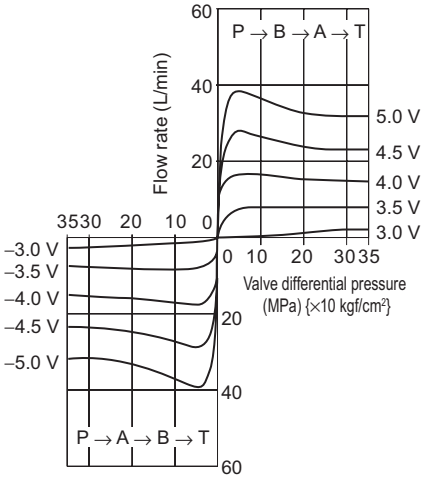
Pressure at port P: 7 MPa {70 kgf/cm²}



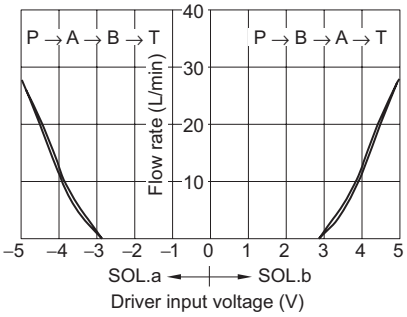
Performance curves (viscosity: 32 mm²/s {cSt})

● KSP-G03-2C4※-10

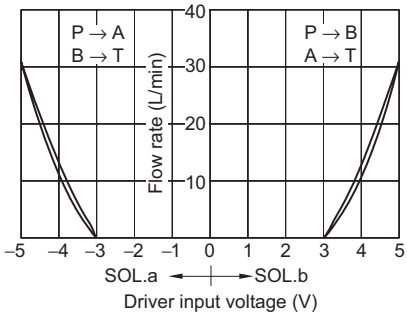
Differential pressure - Flow rate characteristics



Input voltage - Flow rate characteristics (4-way flow)
Valve differential pressure ΔP = 1 MPa {10 kgf/cm²}

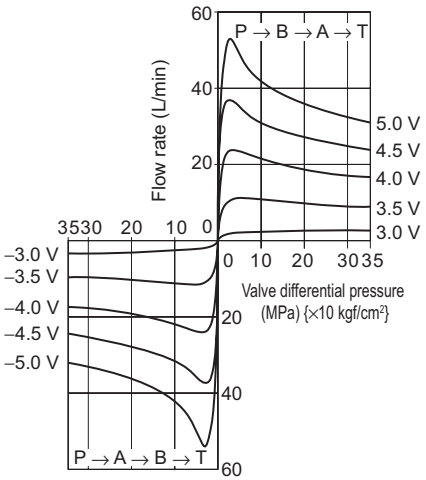


Input voltage - Flow rate characteristics (single side flow)
1 land differential pressure ΔP = 0.5 MPa {5 kgf/cm²}

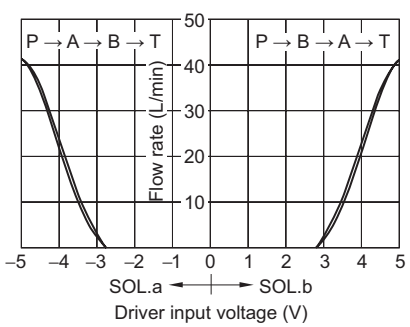


● KSP-G03-2C5※-10

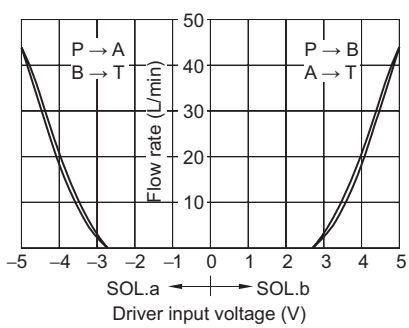
Differential pressure - Flow rate characteristics



Input voltage - Flow rate characteristics (4-way flow)
Valve differential pressure ΔP = 1 MPa {10 kgf/cm²}

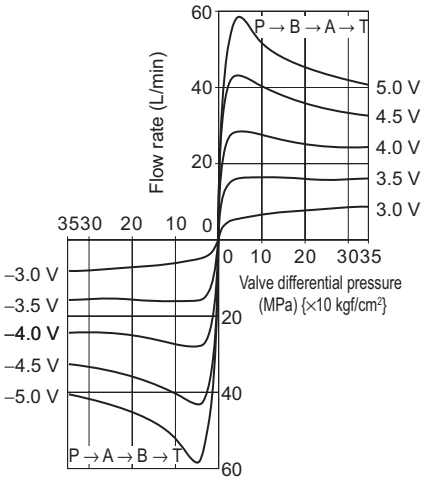


Input voltage - Flow rate characteristics (single side flow)
1 land differential pressure ΔP = 0.5 MPa {5 kgf/cm²}

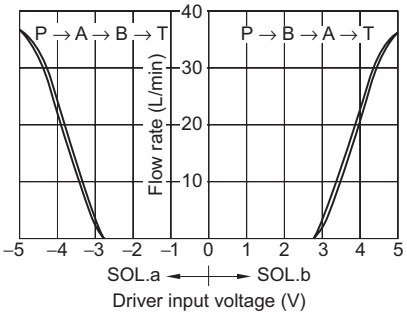


● KSP-G03-44C4※-10

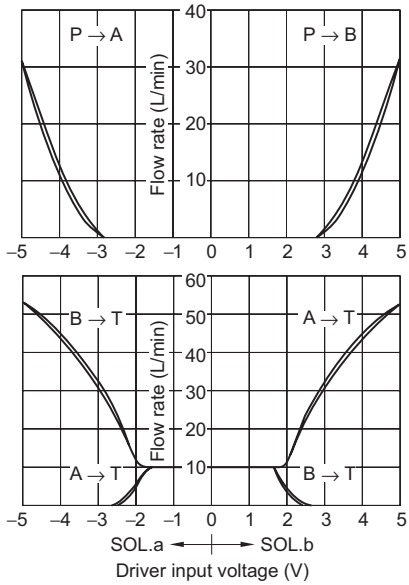
Differential pressure - Flow rate characteristics



Input voltage - Flow rate characteristics (4-way flow)
Valve differential pressure ΔP = 1 MPa {10 kgf/cm²}



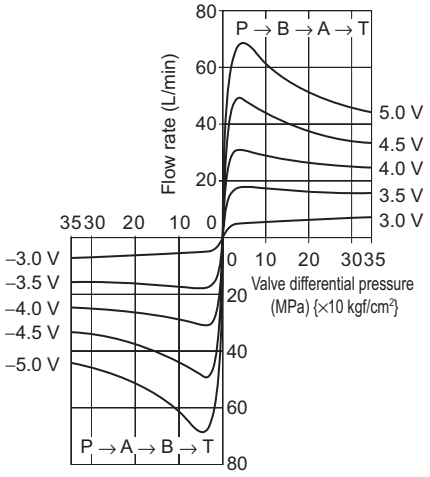
Input voltage - Flow rate characteristics (single side flow)
1 land differential pressure ΔP = 0.5 MPa {5 kgf/cm²}



Performance curves (viscosity: 32 mm²/s {cSt})

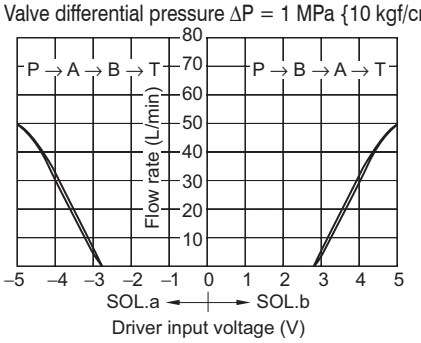
● KSP-G03-44C5※-10

Differential pressure
- Flow rate characteristics



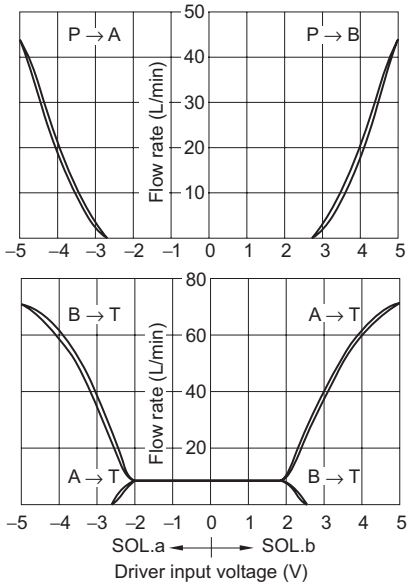
Input voltage
- Flow rate characteristics (4-way flow)

Valve differential pressure ΔP = 1 MPa {10 kgf/cm²}



Input voltage -
Flow rate characteristics (single side flow)

1 land differential pressure ΔP = 0.5 MPa {5 kgf/cm²}



Note: ○ The input voltage - flow rate characteristics are the characteristics when the valve is used in combination with a pressure compensation valve (MGS-03).
○ For the characteristic curves of single solenoid models, see the characteristic curves indicated in the table below.

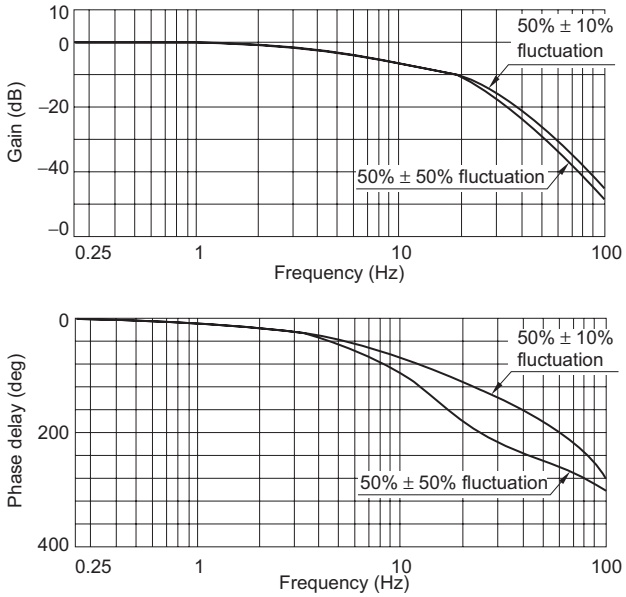
Spool type and spool operating method	Performance curve for reference		Spool type and spool operating method	Performance curve for reference	
	Spool type and spool operating method	Flow direction		Spool type and spool operating method	Flow direction
2A-H2	2C	P → A → B → T	81A-H44	44C	P → A → B → T
2B-2T	2C	P → B → A → T	8B-44T	44C	P → B → A → T

● KSP-G03

Frequency response characteristics

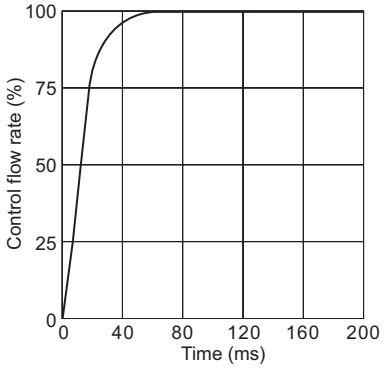
Pressure at port P: 7 MPa {70 kgf/cm²}

Note: Frequency characteristics of the spool displacement voltage in reference to input voltage



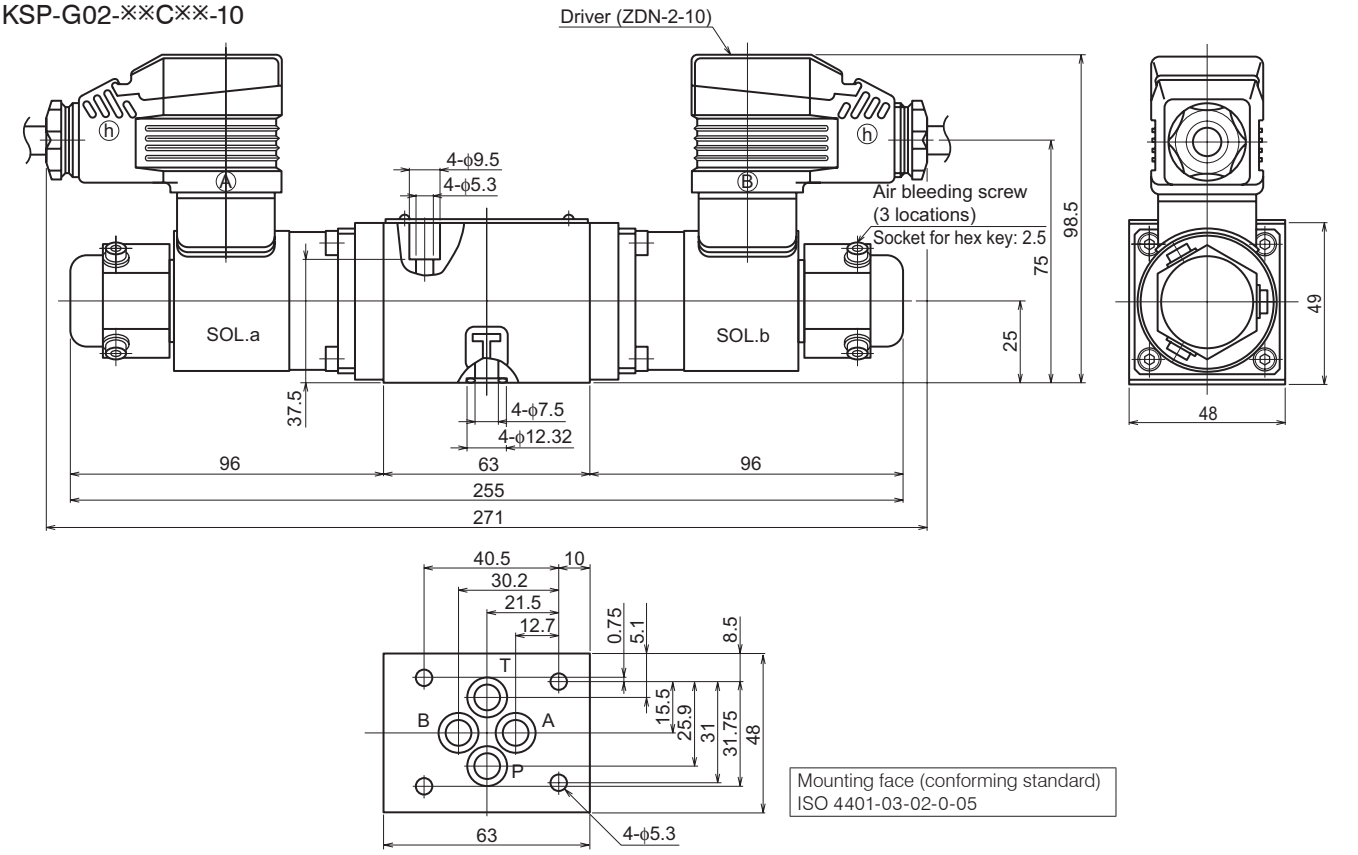
Step response characteristics

Pressure at port P: 7 MPa {70 kgf/cm²}

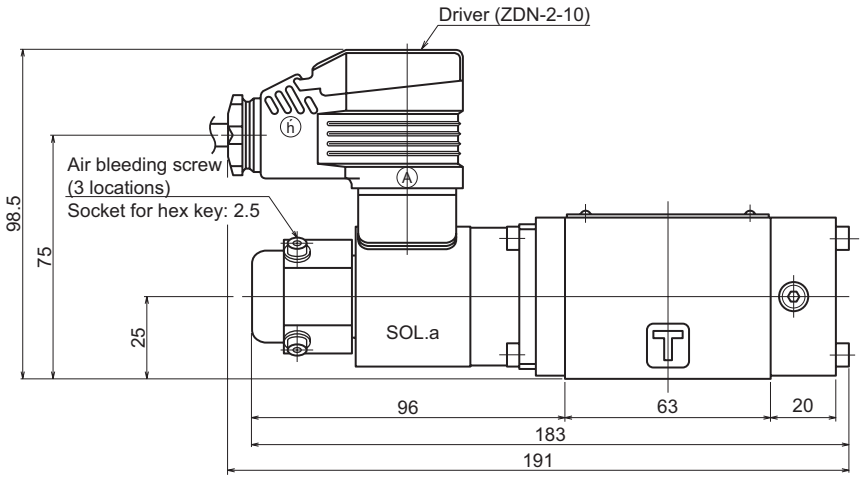


External dimension diagram

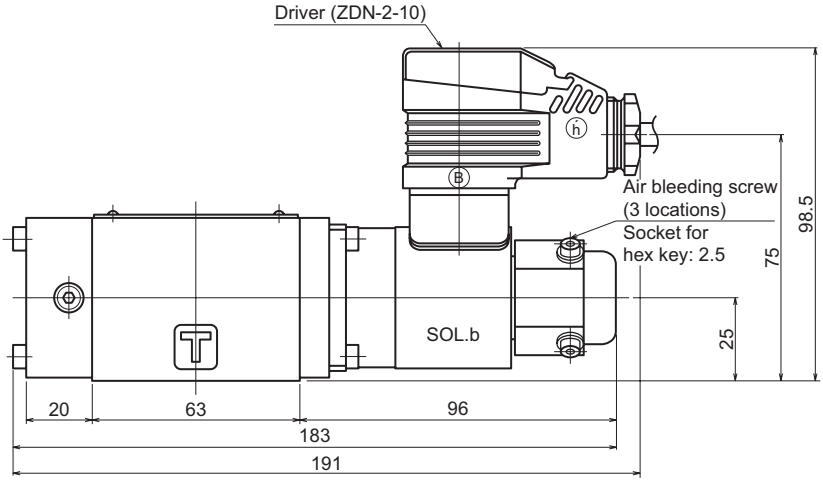
KSP-G02-※※C※※-10



KSP-G02-※※A※※-10

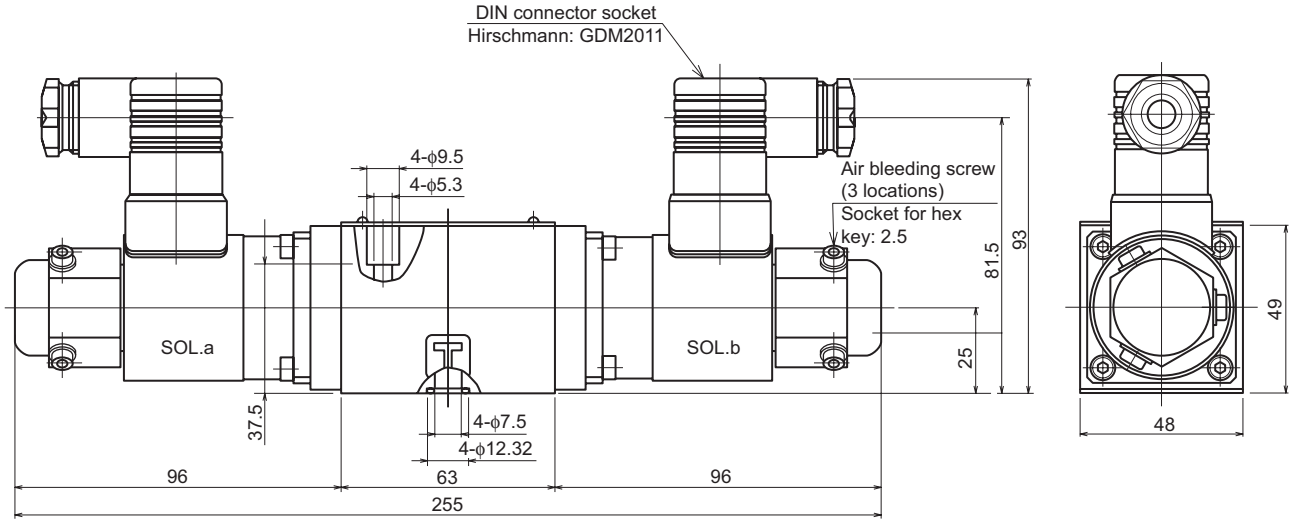


KSP-G02-※※B※※-10

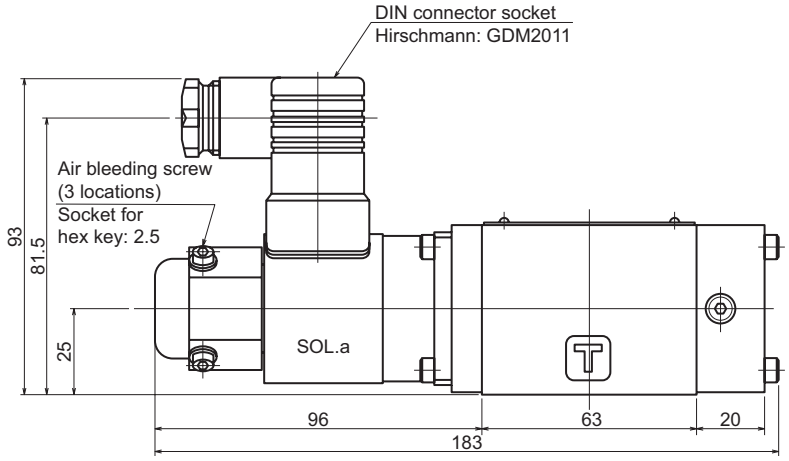


External dimension diagram

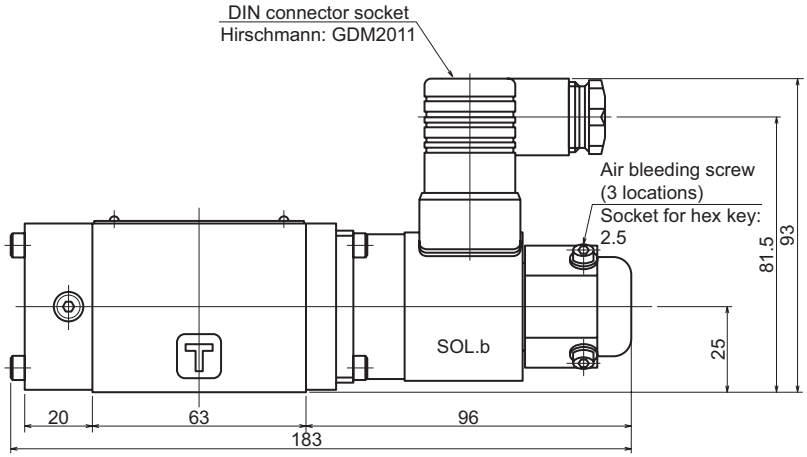
KSP-G02-※※C※※-10-N



KSP-G02-※※A※※-10-N

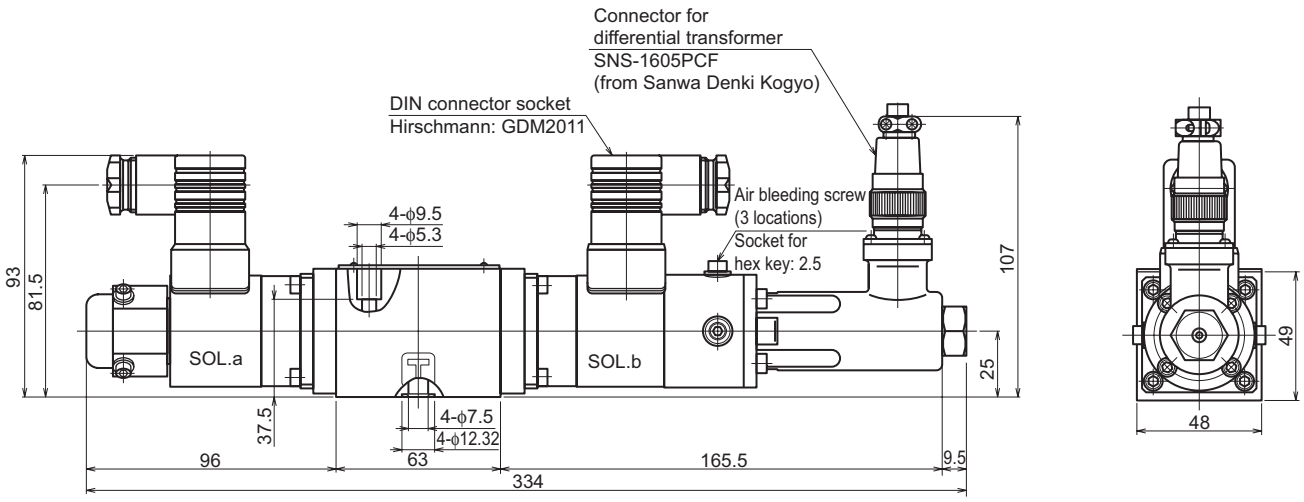


KSP-G02-※※B※※-10-N

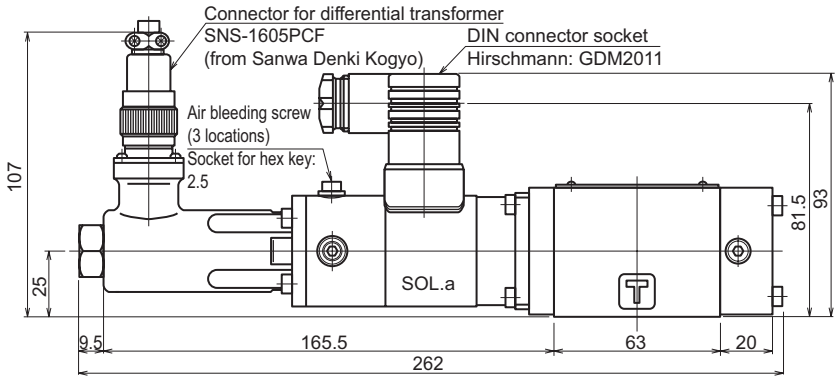


External dimension diagram

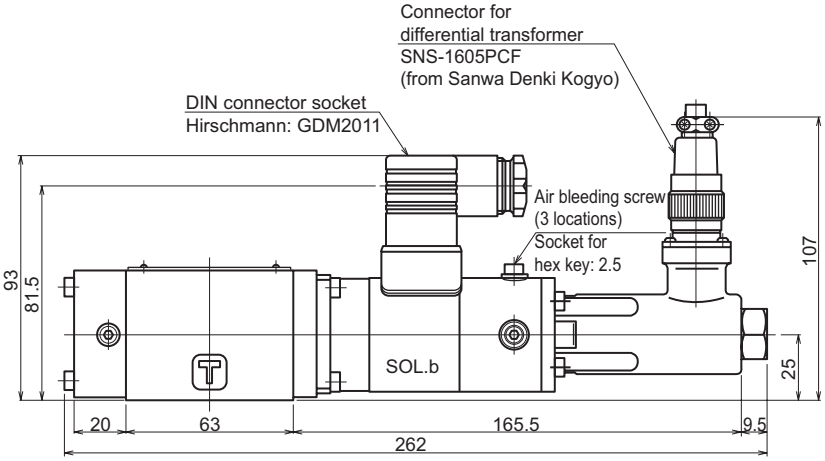
KSP-G02-※※C※※-10-M



KSP-G02-※※A※※-10-M

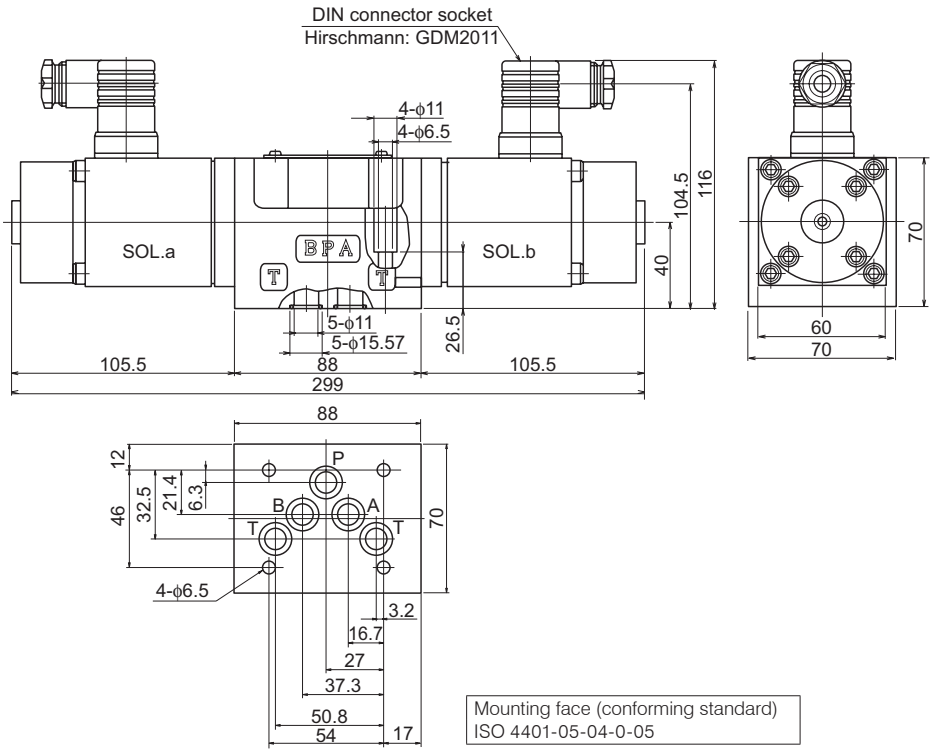


KSP-G02-※※B※※-10-M

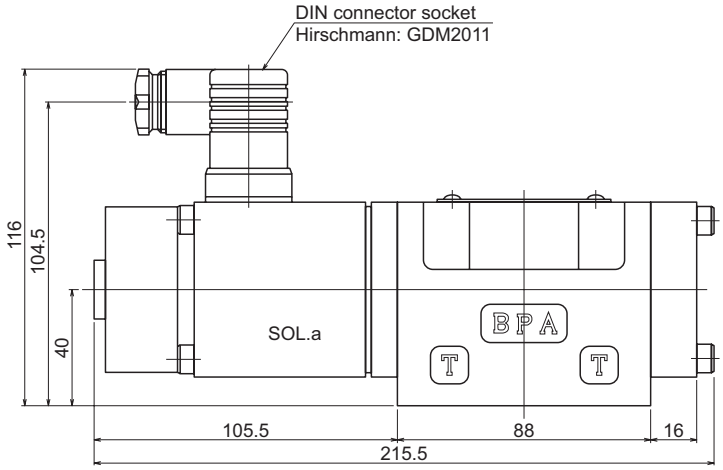


External dimension diagram

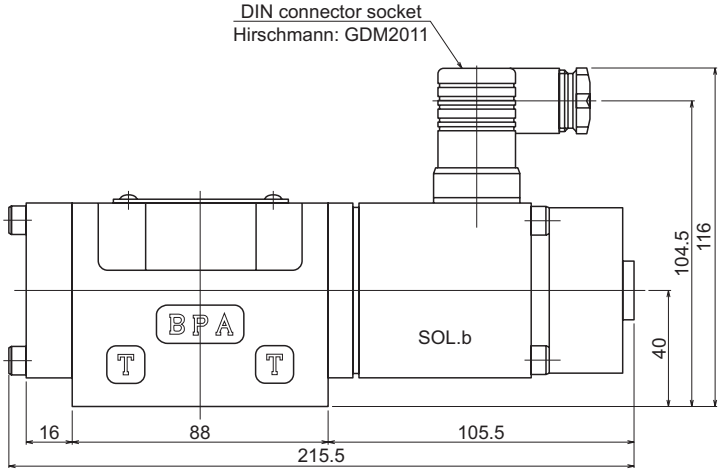
KSP-G03-※※C※※-10



KSP-G03-※※A※※-10

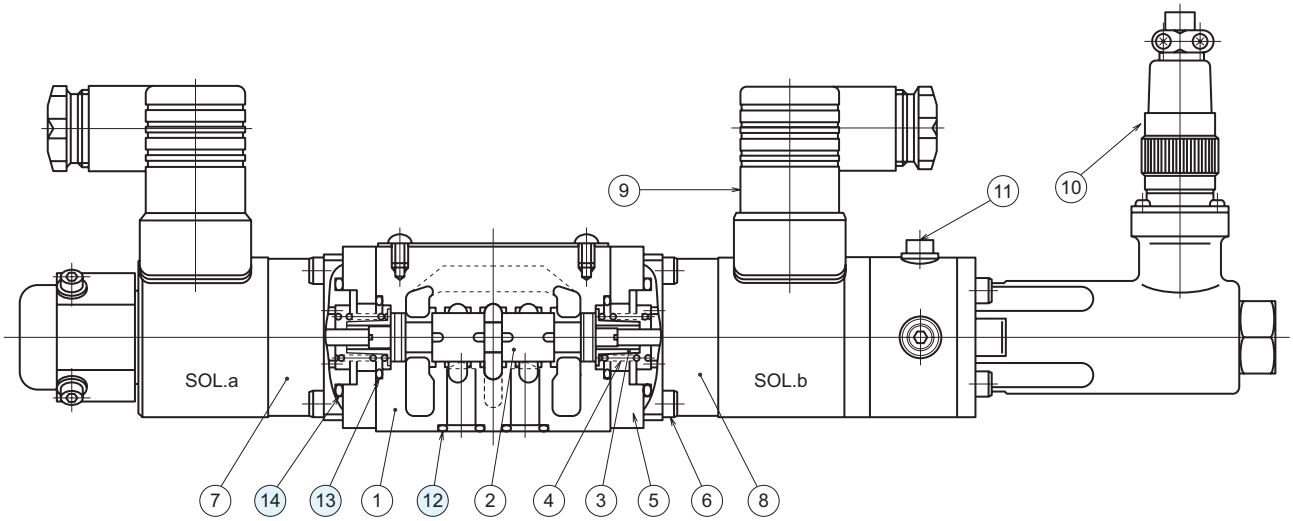


KSP-G03-※※B※※-10



Sectional structural diagram

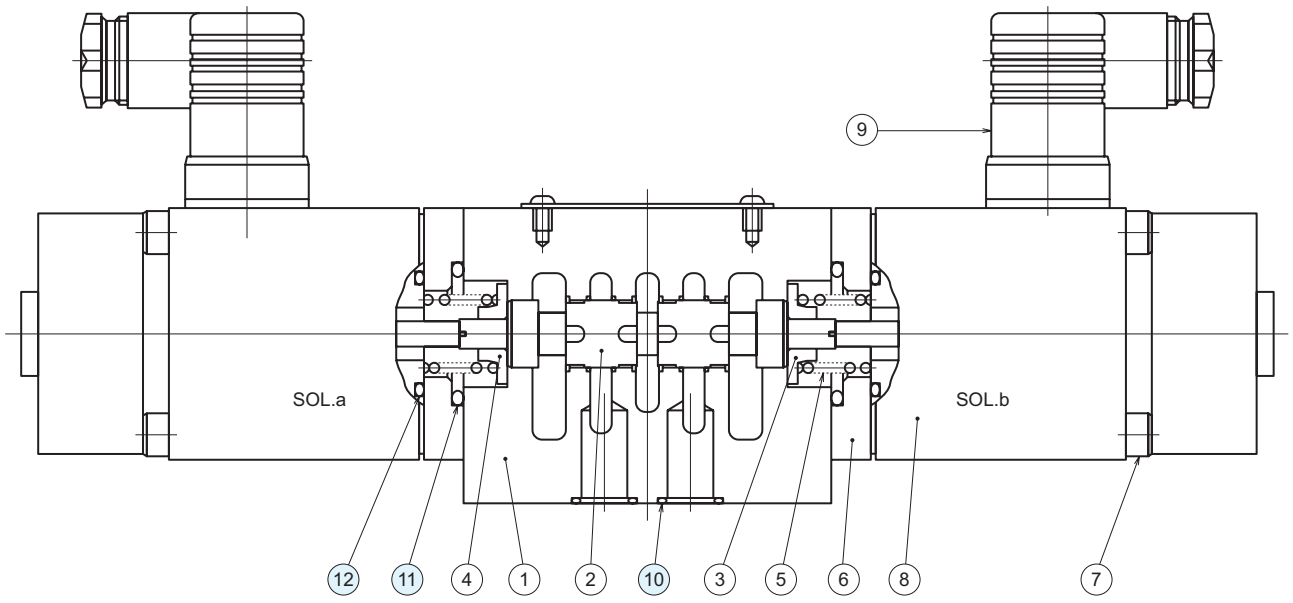
KSP-G02-※※C※※-10-M



Sealing part table

Part No.	Name	Quantity		Part specifications
		Type C	Type A/B	
12	O-ring	4	4	AS568-012 (NBR, Hs90)
13	O-ring	2	2	JIS B 2401 1B P18
14	O-ring	2	1	AS568-121 (NBR, Hs90)

KSP-G03-※※C※※-10



Sealing part table

Part No.	Name	Quantity		Part specifications
		Type C	Type A/B	
10	O-ring	5	5	AS568-014 (NBR, Hs90)
11	O-ring	2	2	JIS B 2401 1B P28
12	O-ring	2	1	AS568-120 (NBR, Hs90)