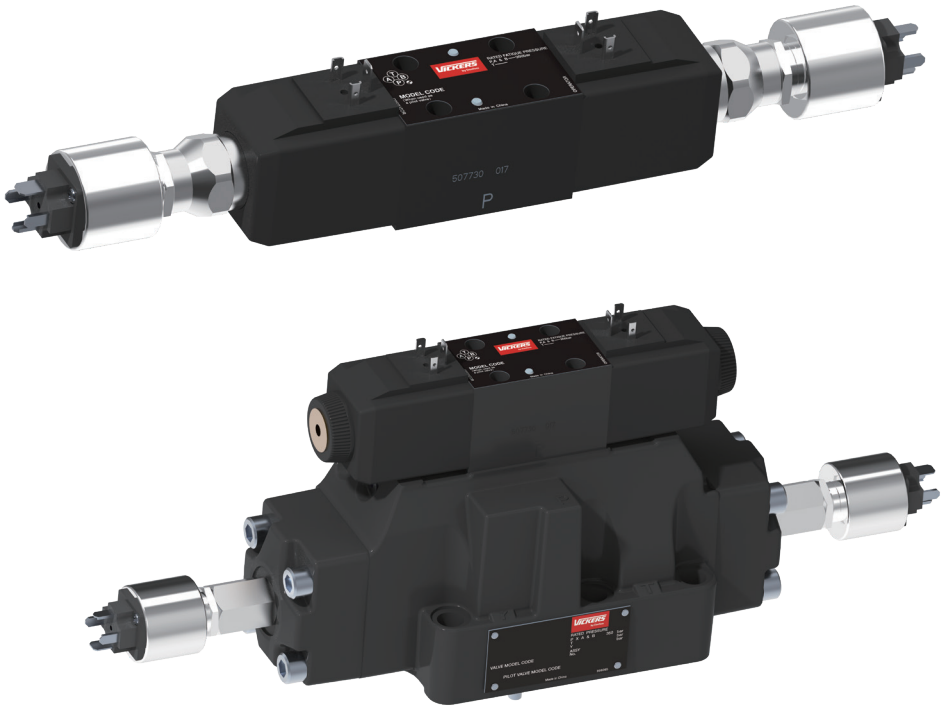
ENGINEERING
TOMORROW

Technical Catalog

Solenoid Directional Valves DG-S9 Series with Spool Position Monitoring Function



VICKERS
by Danfoss

AF458770480968en-000101

Revision History

Date	Revision content	Version
JUN 2019	Initial release	001
APR 2021	Monitoring instructions, spare parts and ordering instructions were added.	002
OCT 2021	Monitoring instructions were revised; D7/M7 option was removed.	003
AUG 2023	Format upgrade & document No. update	004

Contents

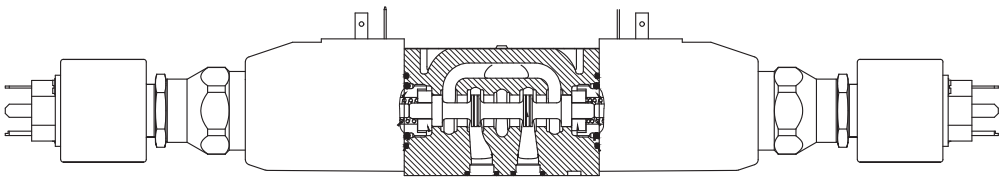
Overview

Typical Applications

This catalog introduces the Solenoid Directional Valve DG-S9 Series with spool position monitoring function. This series are used in the working conditions requiring real-time monitoring of spool position with strict reliability requirements for solenoid directional valves spools, and are widely used in industries with high requirements for safety operation such as machine tools, hydropower, metallurgy, mining, ships and ports. This series of valves are equipped with non-contact electromagnetic induction proximity switches. After the spool reaches the monitoring position, the switch signal is triggered, and the spool status is fed back to the upper computer for processing, thus improving the safety level of the equipment.
Typical applications include hydraulic presses, injection molding machines, bottle blowing machines, hydraulic hoists, ship locks, etc.

Principle

DG-S9 series solenoid directional valves are designed based on the standard solenoid directional valves with the addition of inductive proximity switch. After the spool reaches the monitoring position, the inductive proximity switch is triggered, and the switch signal is generated. The typical section layout is as follows:



According to different wiring modes, the switch signal of the inductive proximity switch can be monitored by two signal states, namely, normally closed (Pin 2) or normally open (Pin 4). The normally closed or normally open signal is output to the upper computer through the DIN plug or M12 plug configured by users as the signal source for safety monitoring.
DG-S9 series solenoid directional valves can accurately monitor the working position of the solenoid directional valve spool. According to different installation positions of sensors and adjustment positions of switching points, different combinations of monitoring positions can be achieved. See the section of model code and monitoring instructions for detailed description. [Note: In order to ensure safety and reliability, the main valve spool is directly monitored without monitoring the pilot valve spool in the double-stage directional valve.]

S9 Characteristics

DG-S9 Characteristics

- The position of the solenoid directional valve spool can be monitored directly without intermediate steps such as guide rods
- No mechanical contact, long service life
- High precision, good repeatability
- No dynamic seal, high reliability
- Optional normally closed/normally open output signal; various combinations are available, with multiple combinations of end position monitoring and center position monitoring
- Integrated inductive proximity switch with polarity protection, short-circuit protection, overload protection and surge protection
- IP65/IP67
- CE EN61000-6-2/4 EMC compatibility

Technical Data

Hydraulic Valve Parameters

Features		DG4V3	DG4V5	DG5V7	DG5V8
Max. pressure P/A/B	**bar**	350	315	350	
Max. pressure T	**bar**	210			
Max. flow rate	**L/min**	80	120	300	700
Oil temperature	**°C**	-20 °C ~ +70 °C			
IP rating		IP65 (DIN plug fitted correctly) IP67 (M12 plug fitted correctly)			
EMC compatibility		EN61000-6-2/4			

Technical Data

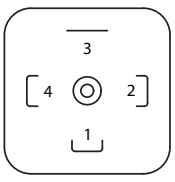
Sensor Parameters

Features		Technical parameters
Supply voltage	**V**	DC 24 ± 20%
Voltage drop	**V**	≤2.5
No-load current	**mA**	≤40
Load capacity	**mA**	≤400
Allowable residual voltage	**V**	≤1
Repeatability precision (@ +25°C)	**mm**	≤0.02
Hysteresis loop (@ +25°C)	**mm**	≤0.05
Thermal drift (0~+80°C)	**mm**	≤±0.15

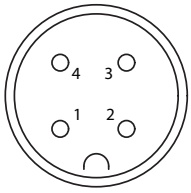
Wiring Instructions

Sensor Wiring

DG-S9 solenoid directional valve inductive switch can be connected as normally open or normally closed. If the corresponding electrical plug is needed, it should be ordered separately (please refer to the Accessory Information on the order number of the electrical plug).

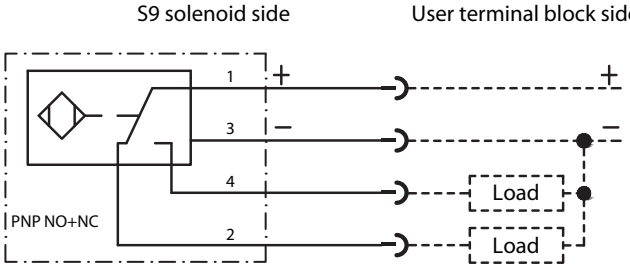


DIN



M12

1. Power supply +
2. Output: Normally closed contact
3. Power supply -
4. Output: Normally open contact



Wiring Notes

In order to protect the user's electrical cabinet, the valve base plate, solenoid and cable shielding should be connected to a grounding point. In any case, valves and cables should be kept as far away as possible from any electromagnetic radiation source as possible, such as heavy-current cables, relays and certain types of portable radio transmitters. In a worse environment, additional shielding may be needed to avoid interference.
For M12 plug, IP67 can only be achieved if the wires with plugs and cables fused together are configured. If the mode of plugs and cables being welded on site is used and the plug and cable connections are not performed with special protection treatment, only IP54 can be achieved.

Model Code

DG4 Single-stage Valve Model Code

1	2	3	4	5	6	7	8	9	10	11	12	13	14
DG4V	*	(*)*	*(L)		M	S9	*	*	U	H	*	**	EN ***

1 Valve type

DG4V	Base plate mounted directional control valve, solenoid controlled

2 Mounting interface and maximum port pressure

3	CETOP 3 /NG6	Port pressure of port P, A, and B Max. 350bar
5	CETOP 5 /NG10	Port pressure of port P, A, and B Max. 315bar

3 Spool type

(*)*	See page 9 for valve function diagram

4 Spool spring arrangement

A	Spring offset, end-to-end
AL	Same as “A” but left hand build
B	Spring offset, end to center
BL	Same as “B” but left hand build
C	Spring centered
N	No-spring detented

5 Manual override option

	Plain override on solenoid end only

6 Marking symbols

M	Electrical features and options

7 Spool position indicator switch

S9	With spool position monitoring function

8 Sensor connector type

D	DIN 43650 (recommended option)
M	M12

9 Monitoring position

0	De-energized position *	* Suitable for single solenoid valve. The sensor is located opposite the solenoid
1	Energized position *	
2	Energized position a and energized position b Δ	Δ Suitable for double solenoid valve
3	Energized position a Δ	
4	Energized position b Δ	
5	De-energized position ☐	☐ Suitable for single solenoid valve. The sensor is located on the solenoid side
6	Energized position ☐	

10 Coil type

U	ISO 4400 (DIN 43650), mounting base, without plug

11 Coil voltage rating

H	24V DC
G	12V DC

12 Port T pressure value

7	210 bar

13 Design number

6*	CETOP 3 /NG6
2*	CETOP 5 /NG10

14 Special improvements

EN *	Omitted if not required

Model Code

DG5 Double-stage Valve Model Code

1	2	3	4	5	6	7	8	9
**-	DG5V	*	(R)	**	*(L)	S9	*	***

1 Seals

Blank	Anti-wear hydraulic fluid (L-HM)
F3	Same as above or phospholipid (L-HFD)
F6	Water glycol (L-HFC)

2 Directional pilot valve

DG5V	Subplate mounted, hydraulic two-stage Port pressure max. 350 bar@ P, A, B, X, 210 bar@T, Y

3 Valve size

7	Valve specification CETOP 7, NFPA D07
8H	Valve specification CETOP 8, NFPA D08

4 Pressure reducer module

R	With reducer (can be omitted when pilot pressure is less than 210 bar)

5 Spool type

0	Open center position (all ports)
2	Closed center position (all ports)
3	Closed center position (P and B closed) A through T
6	Closed center position (P port closed) A and B through T
7	Open center position (P to A and B) T closed
8	Bypass center position (P to T)
31	Closed center position (P and B closed) B through T
33	Closed center position, B and A throttle and through T
52	Closed center position (all ports), differential by solenoid “A”
521	Closed center position (all ports), differential by solenoid “B”

6 Spool spring arrangement

A	Spring offset, end-to-end
AL	Same as “A” but left hand build
B	Spring offset, end to center
BL	Same as “B” but left hand build
C	Spring centered
N	No-spring detented

7 Spool position indicator switch

S9	With spool position monitoring function

8 Sensor connector type

D	DIN 43650 (recommended option)
M	M12

9 Main stage spool monitoring positions

PCA	Single sensor, located on the A side of the main valve port, monitoring the reversing position on the b side
PCB	Single sensor, located on the B side of the main valve port, monitoring the reversing position on the a side
PDC	Double sensors, monitoring that the spool is in the c center position
PDB	Double sensors, monitoring that the spool is at the a-side reversing position of the b-side reversing position

Model Code

DG5 Double-stage Valve Model Code

	10	11	12	13	14	15	16	17	18	19
	(E)	(T)	(K)	(*)	M	*****	**	*	**	EN ***

10 External pilot oil supply

Blank	Internal pilot oil supply
E	External pilot oil supply

11 Internal pilot drain

Blank	External pilot drain
T	Internal pilot drain

12 Minimum pilot pressure generator (“P” port option)

Blank	No generator
K	0.35 bar opening pressure

13 Manual override option (no override on non-solenoid side of single solenoid valve)

Blank	Manual override on solenoid side only
H	Waterproof manual operator on solenoid side only
Z	No manual override on both ends

14 Electrical marking symbols

M	Pilot valve features and options

15 Coil form

U	ISO 4400 (DIN 43650), mounting base, without plug
KUP5	Integrated Deutsch plug
FW	1/2'' NPT threaded terminal box
FTWL	Lighted 1/2'' NPT threaded terminal box and terminal block

16 Coil voltage rating (see standard catalog E-VLVI-CC002-E for further parameters)

B	110V AC 50Hz/120V AC 60Hz
D	220V AC 50Hz/240V AC 60Hz
DS	28V DC
G	12V DC
H	24V DC

17 Port T pressure value

7	210 bar

18 Design number

5*	CETOP 7 /NG16
1*	CETOP 8 /NG25

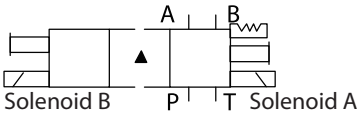
19 Special improvements

EN ***	Omitted if not required

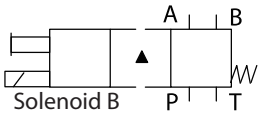
Model Code

Solenoid Standard

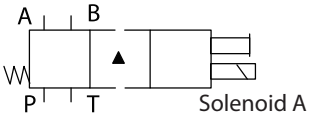
Double solenoid valve, two-position, with positioning



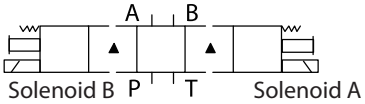
Single solenoid valve, solenoid at port A



Single solenoid valve, solenoid at port B



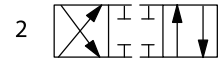
Double solenoid valve with spring-centered



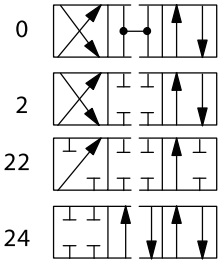
▲ *Transient state only*

Valve Function Diagram

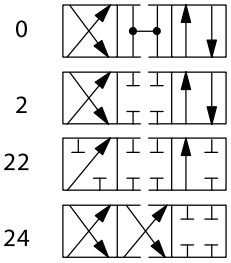
DG4V-3(S)-*N



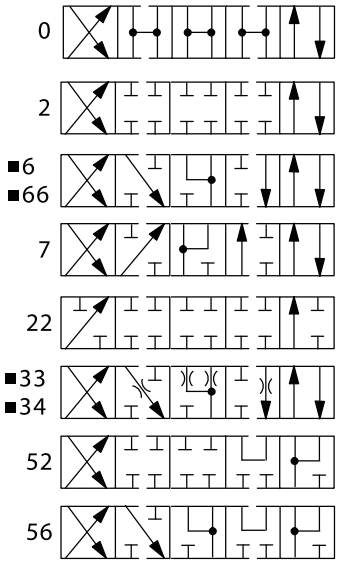
DG4V-3(S)-*A



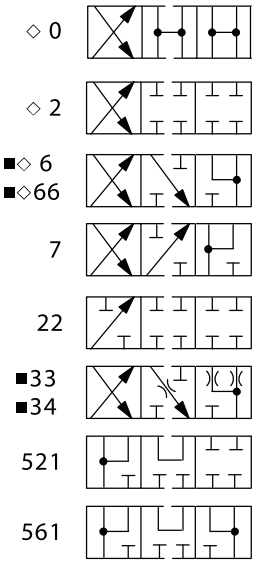
DG4V-3(S)-*AL



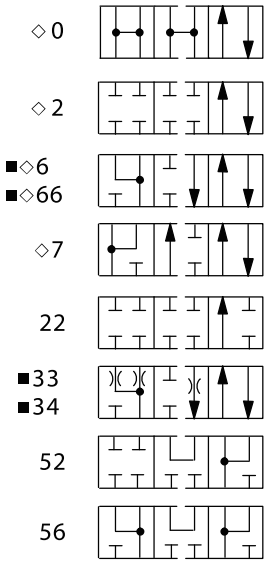
DG4V-3(S)-*C



DG4V-3(S)-*B/F



DG4V-3(S)-*BL/FL



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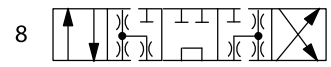
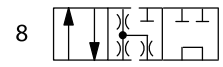
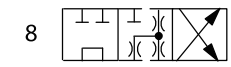


DG4V-3(S)-8BL

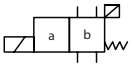
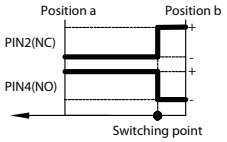
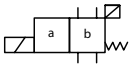
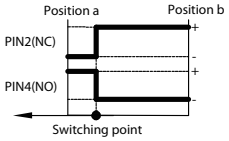
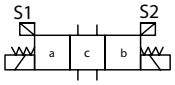
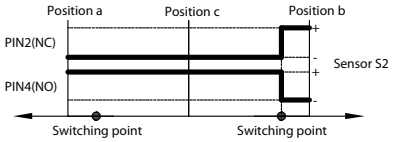
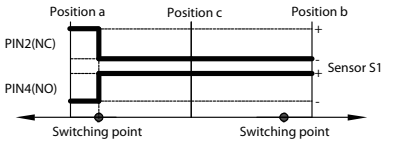
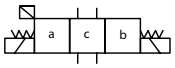
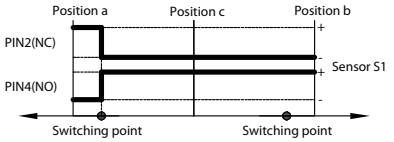
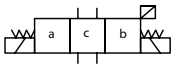
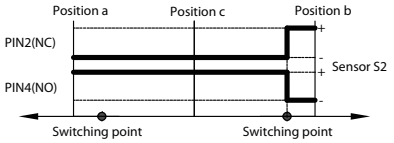
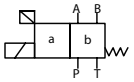
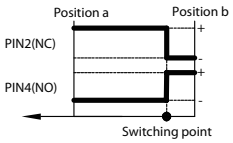
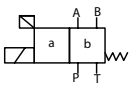
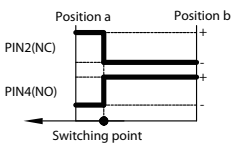


DG4V-3(S)-8B



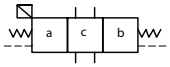
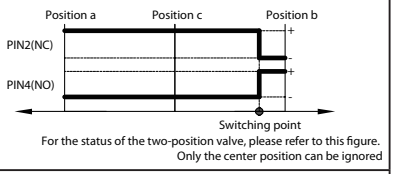
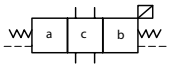
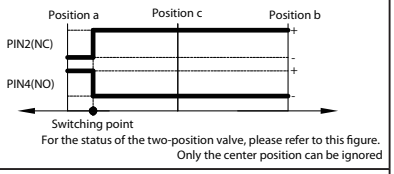
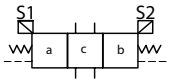
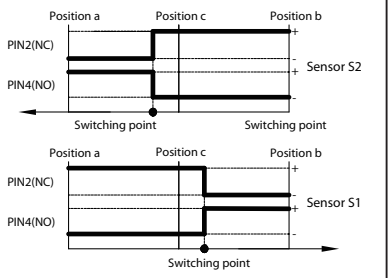
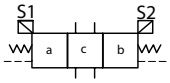
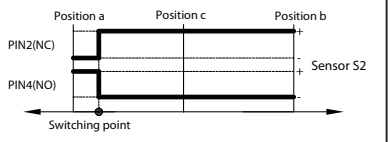
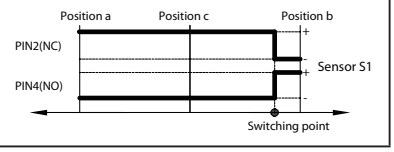
Monitoring Instructions

DG4 Single-stage Valve Monitoring Instructions

Monitoring position code	Proximity switch mounting position	Monitoring position	Signal schematic diagram
0		Position b (de-engerized position)	
1		Position a (energized position)	
2		Position b (energized position)	
		Position a (energized position)	
3		Position a (energized position)	
4		Position b (energized position)	
5		Position b (de-engerized position)	
6		Position a (energized position)	

Monitoring Instructions

DG5 Double-stage Valve Monitoring Instructions

Monitoring position code	Proximity switch mounting position	Monitoring position	Signal schematic diagram
PCA		Position b (energized position)	
PCB		Position a (energized position)	
PDC		Position c (de-engerized position)	
PDB		Position a (energized position)	
		Position b (energized position)	

Example

For DG4V-5-0A-M-S9D0-U-H7-20, the proximity switch is mounted opposite the solenoid (see the mounting position of the proximity switch), and the factory adjusted switching point is close to position b (see signal diagram), so that whether the spool is in position b can be reliably monitored.

Working process: When PIN1 and PIN3 of the proximity switch are powered on and the solenoid is not energized, the spool is in position b (de-energized position). At this time, PIN2 of the proximity switch remains in the closed (+) state, and PIN4 remains in the open (-) state; energize the solenoid. When the solenoid is charged, the spool starts to move from the de-energized position (see the direction of the arrow in the signal diagram). When the spool moves to the switching point, PIN2 switches from closed to open and PIN4 switches from open to closed, and the output signal is reversed, indicating that the spool has left the target monitoring position. When the solenoid is de-energized, the spool returns to position b, PIN2 returns to the closed state again, and PIN4 returns to the open state again.

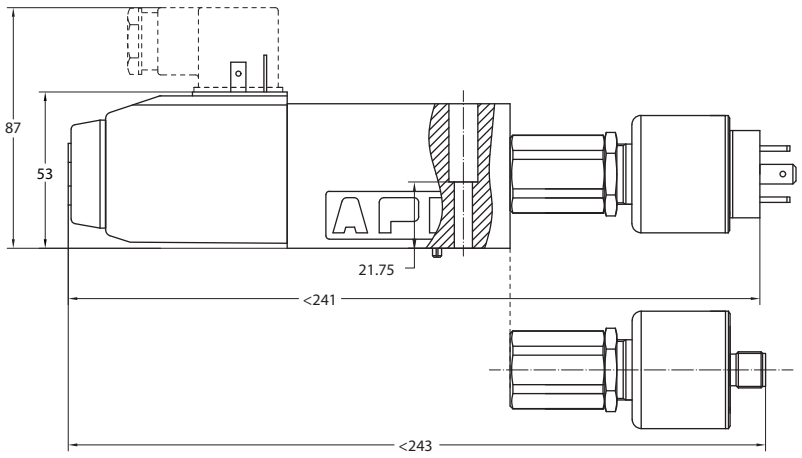
Warning

Users are not allowed to adjust or replace the position monitoring components themselves. If necessary, please contact Danfoss technical service personnel.

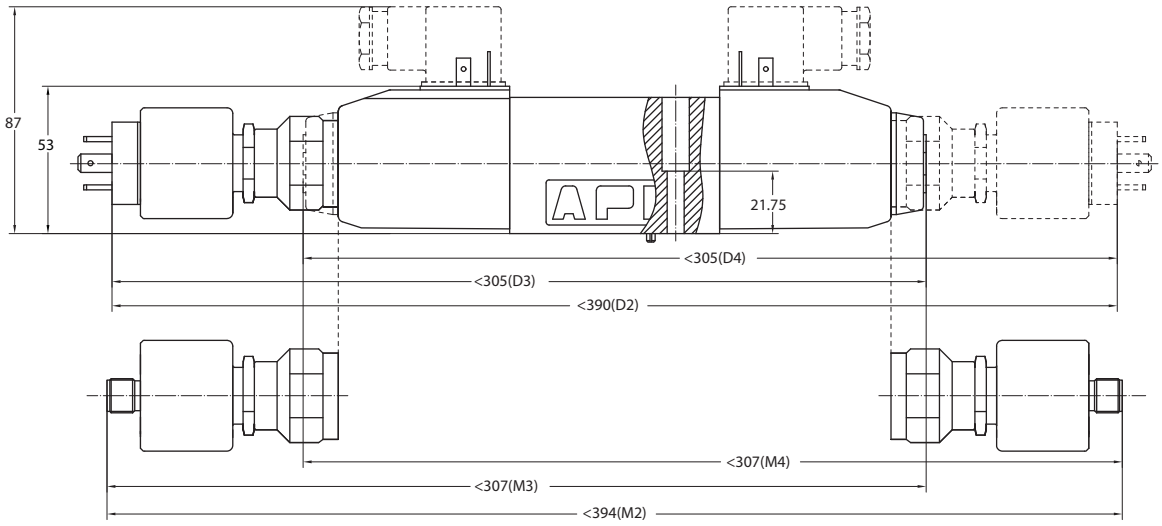
Dimensions

DG4V3 Single-stage Valve (mm)

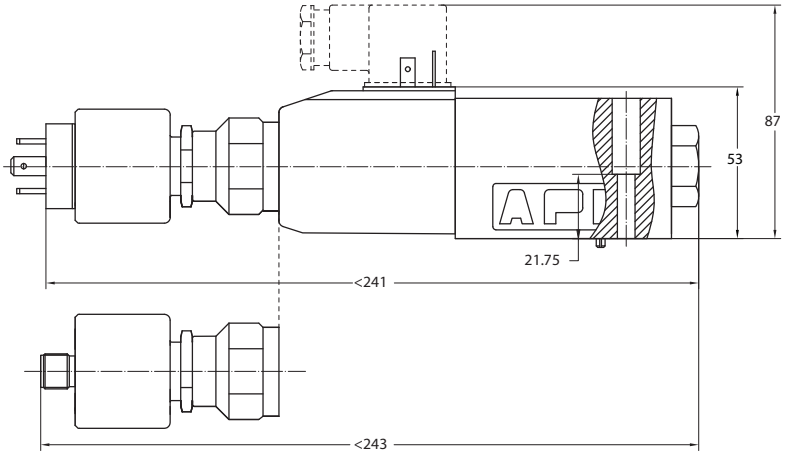
S9 *0/1



S9 *2/3/4



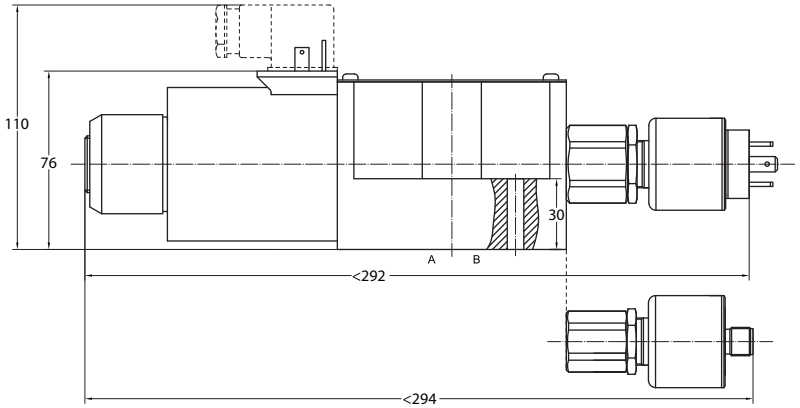
S9 *5/6



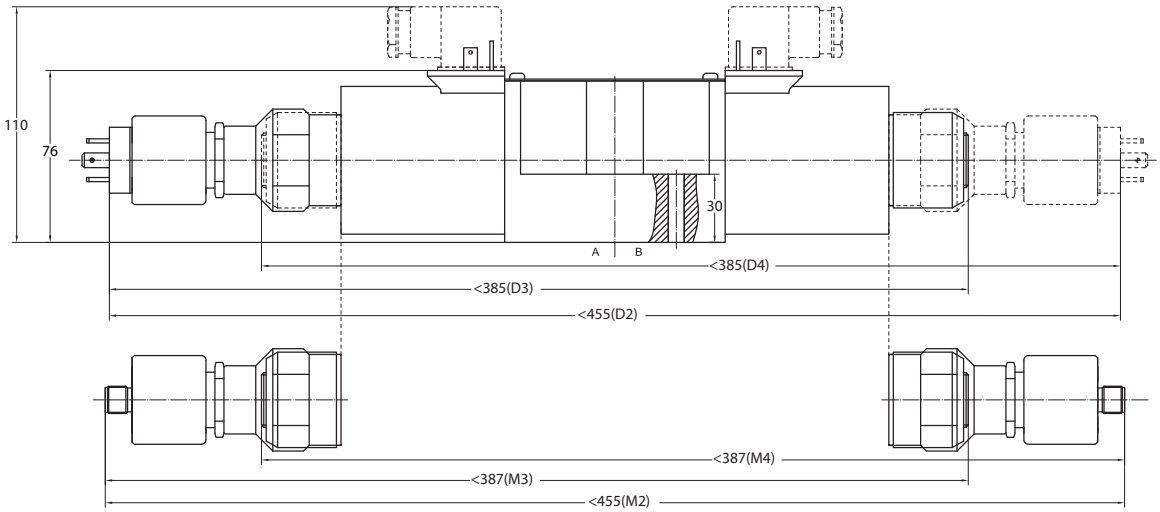
Dimensions

DG4V5 Single-stage Valve (mm)

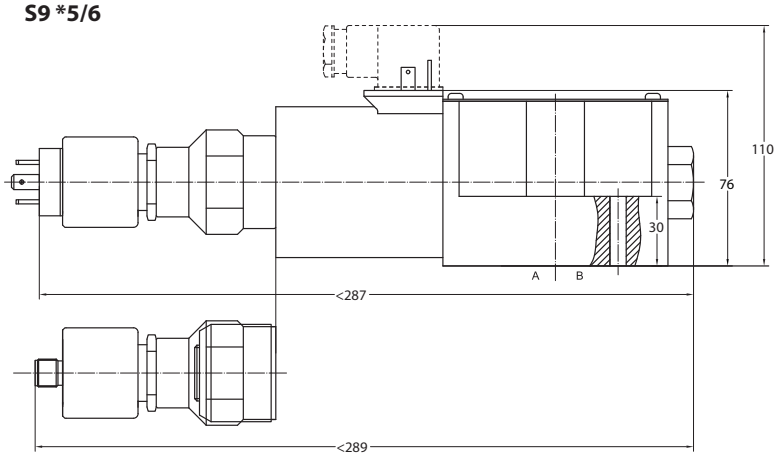
S9 *0/1



S9 *2/3/4



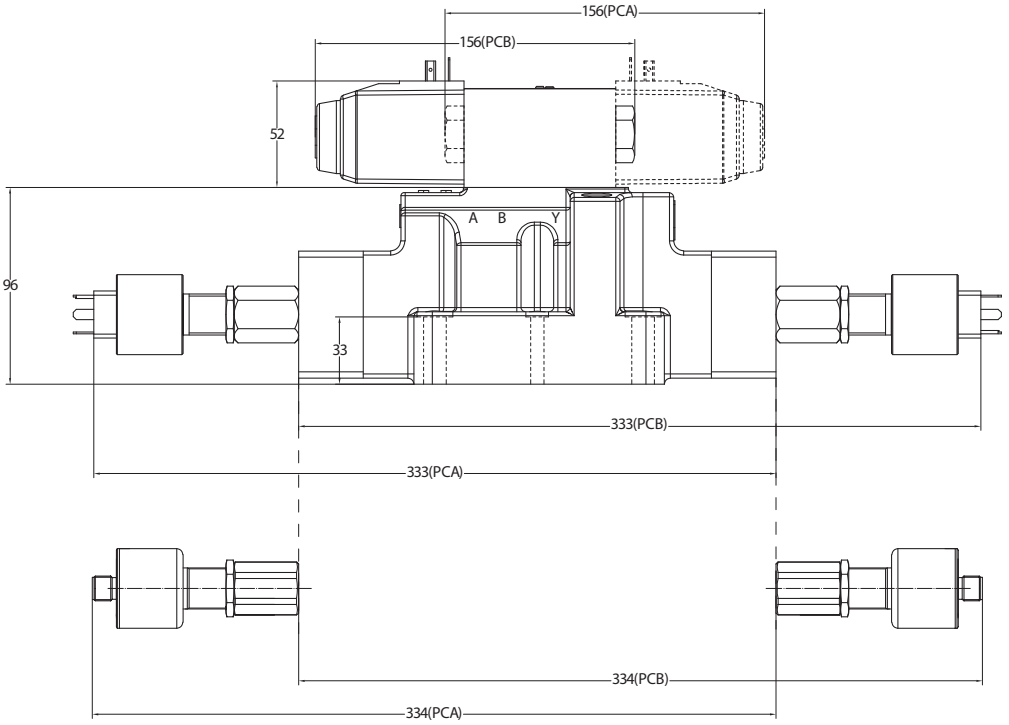
S9 *5/6



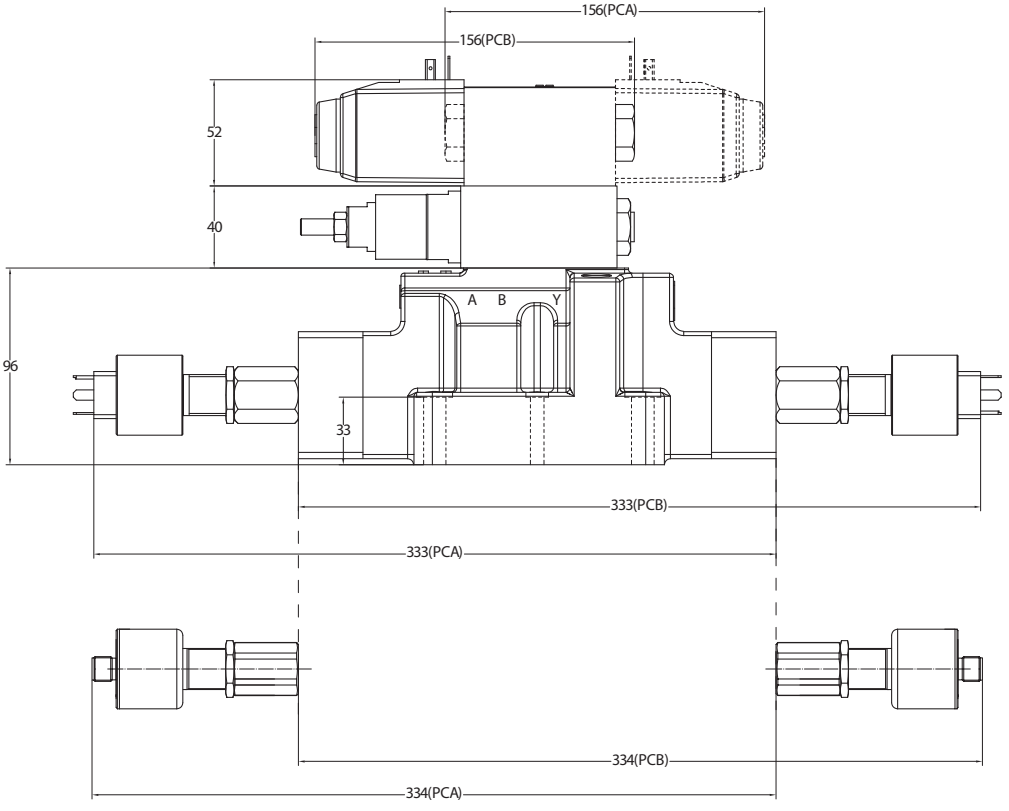
Dimensions

DG5V7 Double-stage Valve (mm)

PCA/PCB



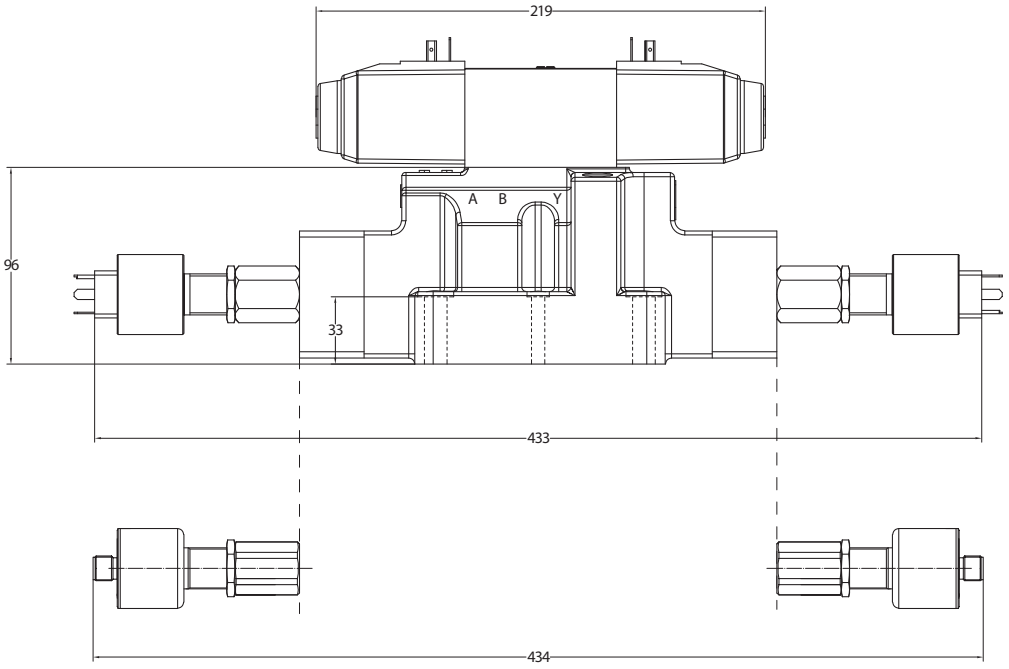
PCA/PCB with pressure reducer



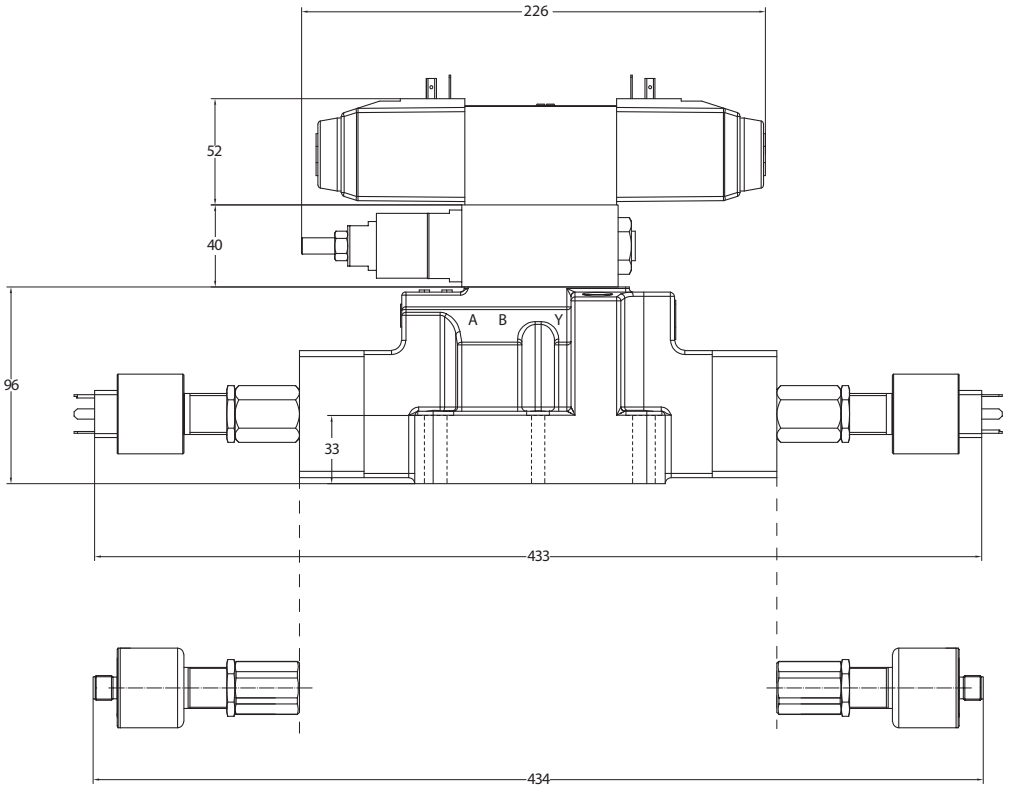
Dimensions

DG5V7 Double-stage Valve (mm)

PDB/PDC



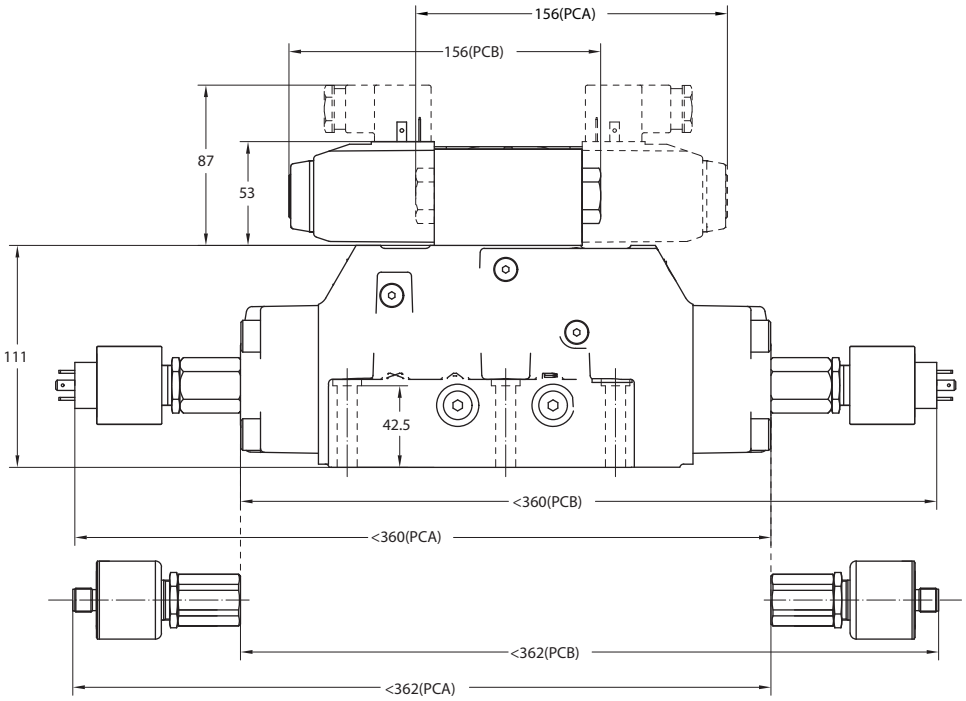
PDB/PDC with pressure reducer



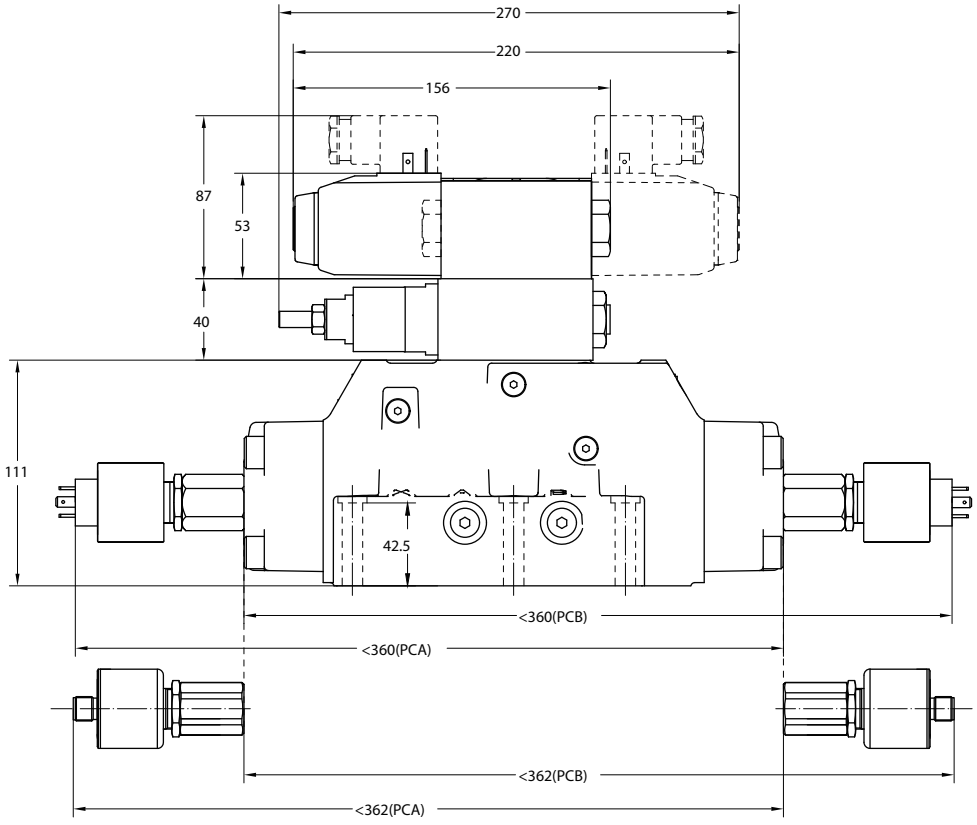
Dimensions

DG5V8 Double-stage Valve (mm)

PCA/PCB



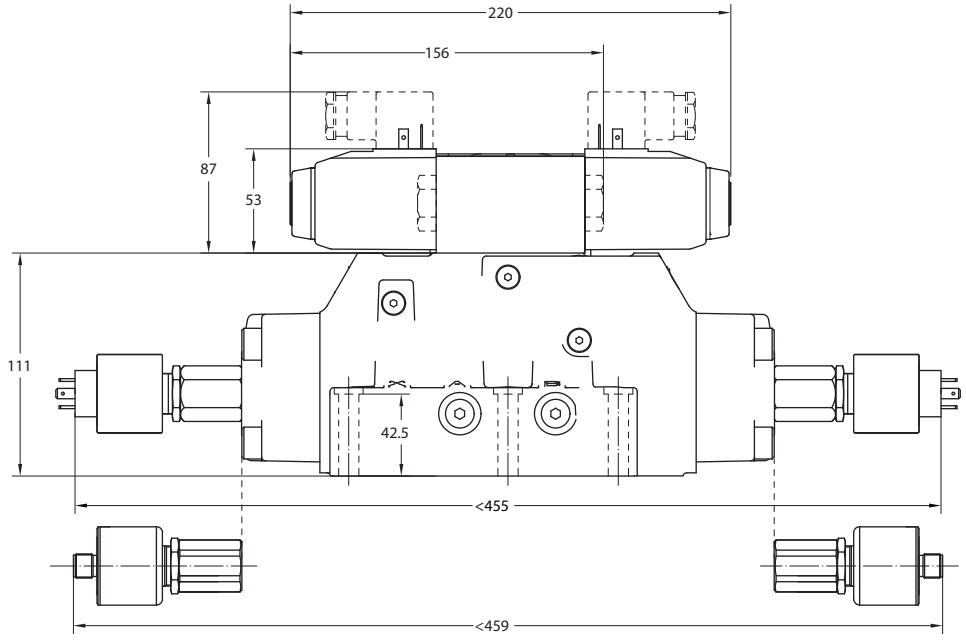
PCA/PCB with pressure reducer



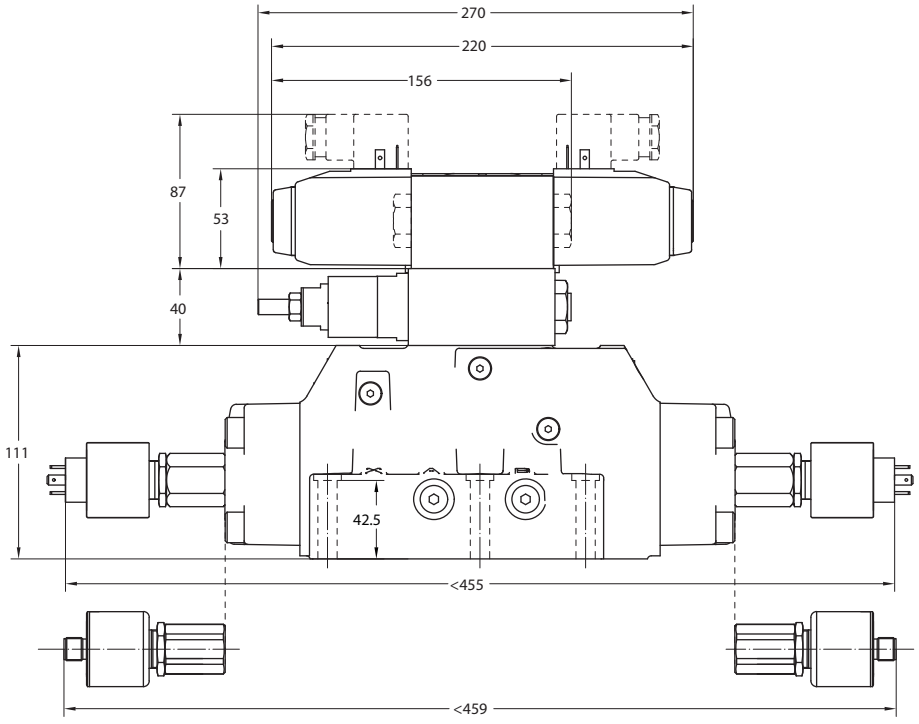
Dimensions

DG5V8 Double-stage Valve (mm)

PDB/PDC



PDB/PDC with pressure reducer



Accessories

Seals

Valve type	Seal material	PTAB port		XY port	
		Specifications	Order number	Specifications	Order number
DG4V3	Blank (FKM)	9.25x1.78	262332	—	—
DG4V5	Blank (FKM)	12.42X1.78	262334	—	—
DG5V7	Blank/F6(NBR)	21.89x2.62	170255	9.19x2.62	154007
	F3(FKM)	21.89x2.62	252357	9.19x2.62	262349
DG5V8	Blank/F6(NBR)	26.57X3.53	200140	18.64X3.53	118202
	F3(FKM)	26.57X3.53	02-324910	18.64X3.53	02-321195

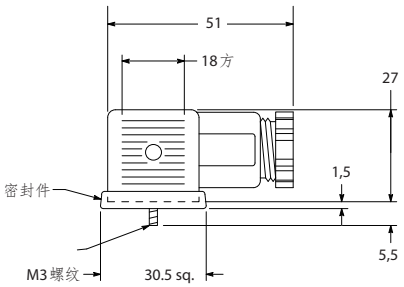
Bolt and Torque

Valve type	Mounting bolts	
	Size	Torque
DG4V3	M5	5~7
DG4V5	M6	9-14
DG5V7	M10	49-59
	M6	9-14
DG5V8	M12	103-127

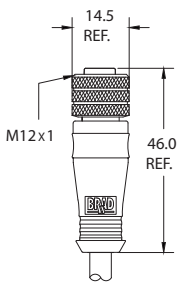
Electrical Plug

Plug type	Order number	Description
DIN plug	C18309N21	4PIN DIN43650 PLUG
M12 plug straight type	804000W03M020W	4Pin female M12 2M
M12 plug 90° angle type	804001W03M020W	4Pin female M12 90D 2M

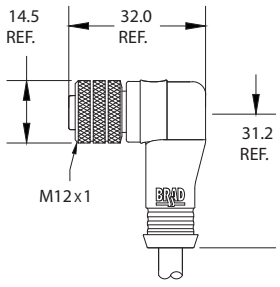
DIN plug



M12 plug straight type



M12 plug 90° angle type



Accessories

Approximate Weight

Single-stage valve	DG4V3 (kg)	DG4V5 (kg)
S9*0/1/5/6	1.8	4.6
S9*2	2.6	6.4
S9*3/4	2.4	6.2

Two-stage valve	DG5V7 (kg)	DG5V8 (kg)
PCA/PCB	9.5	14.0
PDB/PDC	10.3	14.6

Ordering Information

Common Part Numbers

Order number	Description
6034983-001	DG4V-3-0A-M-S9D0-U-H7-60
6040519-001	DG4V3-0B-M-S9D0-U-H7--60
6040517-001	DG4V-3-0C-M-S9D2-U-H7-60
6041049-001	DG4V-3-2AL-M-S9D0-U-H7-60
6036288-001	DG4V-3-2AL-M-S9D1-U-H7-60
6039298-001	DG4V-3-2AL-M-S9D6-U-H7-60
6034984-001	DG4V-3-2A-M-S9D0-U-H7-60
6035082-001	DG4V-3-2A-M-S9D1-U-H7-60
6045272-001	DG4V-3-2A-M-S9D6-U-H7-60
6040524-001	DG4V-3-2BL-M-S9D1-U-H7-60
6040617-001	DG4V-3-2B-M-S9D1-U-H7-60
6040516-001	DG4V-3-2C-M-S9D2-U-H7-60
6040506-001	DG4V-3-6C-M-S9D2-U-H7-60
6044882-001	DG4V-5-0CJ-M-S9D2-U-H7-20
6034981-001	DG4V-5-2AJ-M-S9D0-U-H7-20
6035080-001	DG4V5-2AJ-M-S9D1-U-H7-20
6036289-001	DG4V5-2ALJ-M-S9D0-U-H7-20
6035079-001	DG4V-5-2A-M-S9D1-U-H7-20
6045181-001	DG4V5-2BJ-M-S9D0-U-H7-20
6046408-001	DG4V-5-2CJ-M-S9D2-U-H7-20
6045666-001	DG4V-5-52CJ-M-S9D2-U-H7-20
6040860-001	DG4V-5-6CJ-M-S9D2-U-H7-20
6046038-001	DG5V-8H-6C-S9-D-PDB-T-M-U-H7-10

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