



Start 

MOOG

Shaping the way our world moves™

MOOG PRODUCT PRESENTATION

DOV – DIRECT OPERATED VALVES

Marketing | May 2024 | Version 1

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EXTERNAL

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PRODUCT OVERVIEW
TECHNICAL OVERVIEW
TECHNICAL FEATURES
HOW TO LEARN MORE
CONTACT US

MOOG DIRECT OPERATED VALVES

WHAT'S UNIQUE ABOUT IT

ROBUST

RELIABLE

PERFORMANT

COMPACT DESIGN

COST OPTIMIZED DESIGN

SHORT LEADTIME



It's not a valve, it's a MOOG!

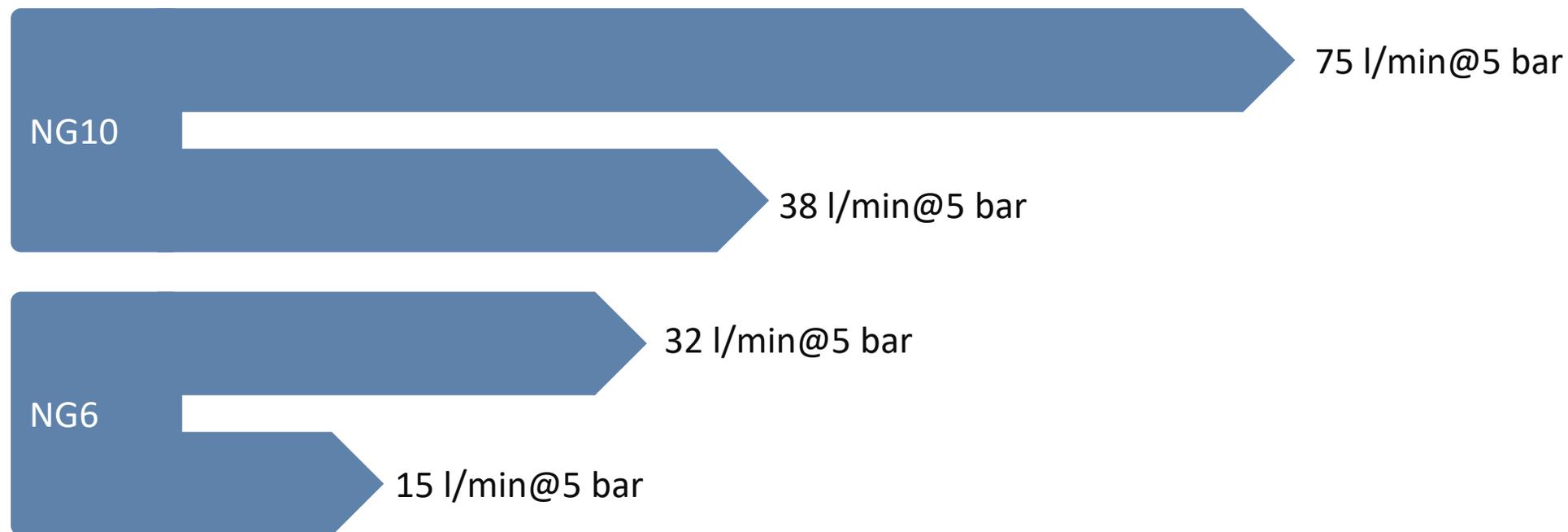
PRODUCT OVERVIEW

PRODUCT PORTFOLIO OVERVIEW

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PRODUCT SERIES OF DIRECT OPERATED SERVO-PROPORTIONAL VALVES

 [More Details](#)



PRODUCT PORTFOLIO OVERVIEW

D936

D926

D937

NG 6 4/4-way Servo-proportional	NG 6 4/3-way Proportional	NG 10 4/4-way Servo-proportional	NG 10 4/3-way Proportional
Spool in bushing (BSA)	Spool in body (SiB)	Spool in bushing (BSA)	Spool in body (SiB)
One solenoid for both directions (200% stroke)	One solenoid per direction (100% stroke)	One solenoid for both directions (200% stroke)	One solenoid per direction (100% stroke)
Short stroke	Long stroke	Short stroke	Long stroke
High dynamic performance	Medium dynamic performance	High dynamic performance	Medium dynamic performance



Tap to see less

PRODUCT OVERVIEW

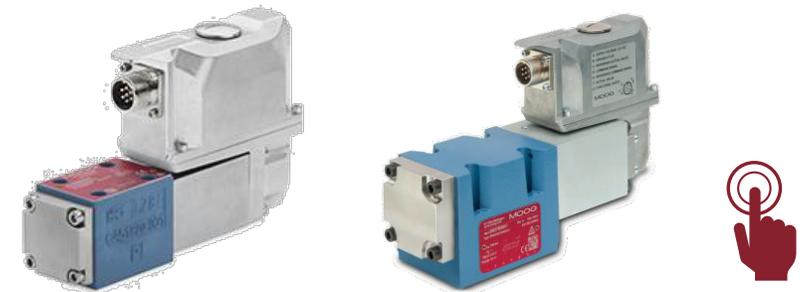
MOOG DIRECT OPERATED VALVES - **DOV** - COMPRISES D92X AND D93X

D92x



- integrated electronics
- closed-loop spool position control
- dual proportional solenoid operated
- 4/3- & 4/2-way spool-in-body design
- Failsafe option: safe midposition

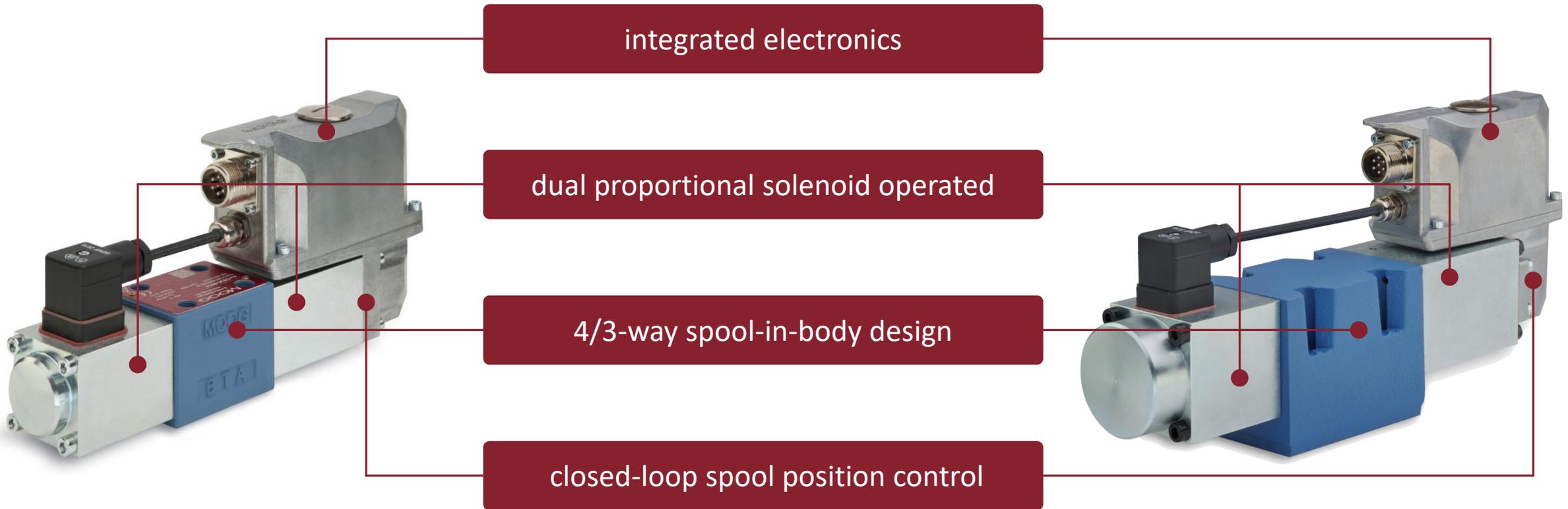
D93x



- integrated electronics
- closed-loop spool position control
- single proportional solenoid operated
- 4/4-way bushing-spool design
- Failsafe option: 4th position

D92X SERIES - PRODUCT OVERVIEW

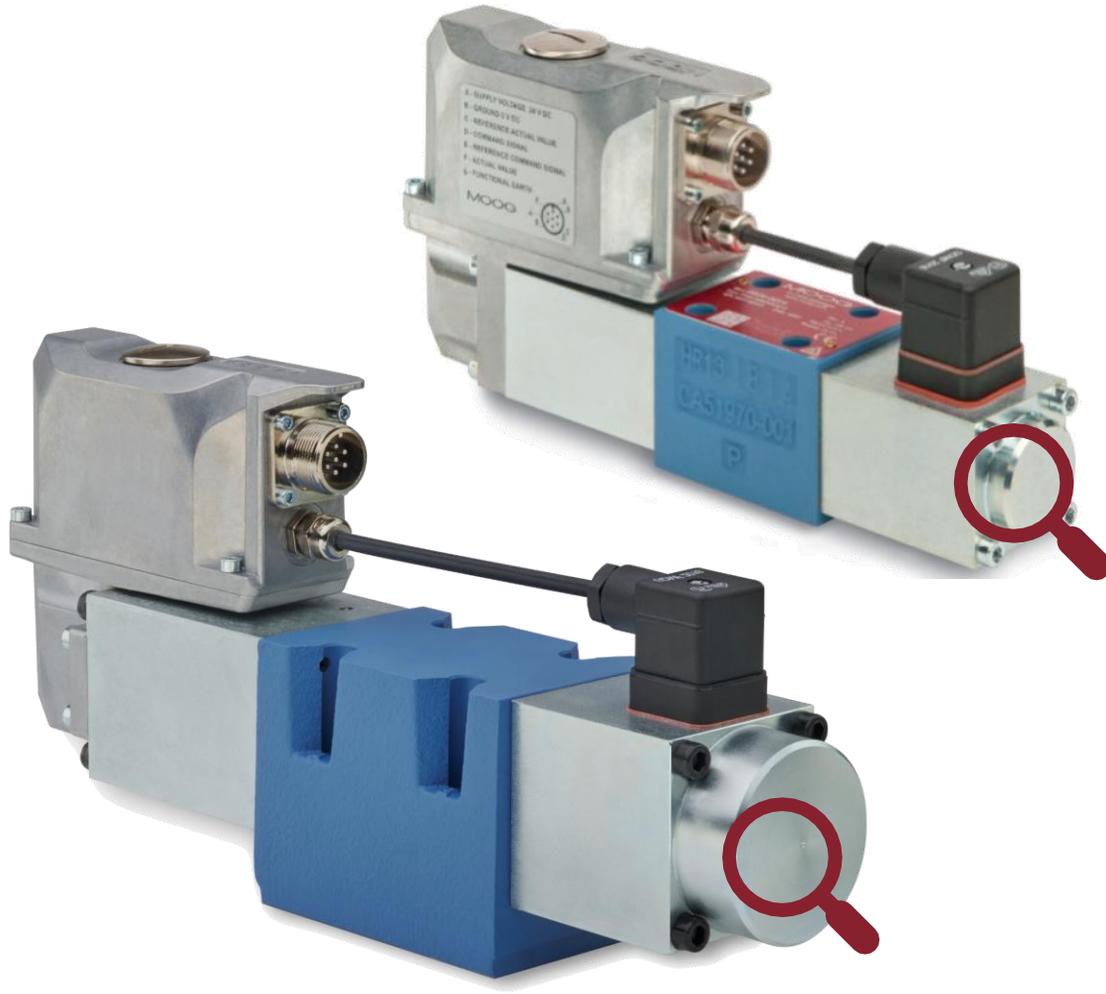
MOOG DIRECT-OPERATED PROPORTIONAL VALVE



TECHNICAL OVERVIEW

TECHNICAL DATA D92X

[Previous](#) [Next](#)



Size NG6 & NG10

Rated flow up to 32 l/min & 75l/min (@5 bar)

4/3-way and 4/2-way design

Failsafe option: safe midposition

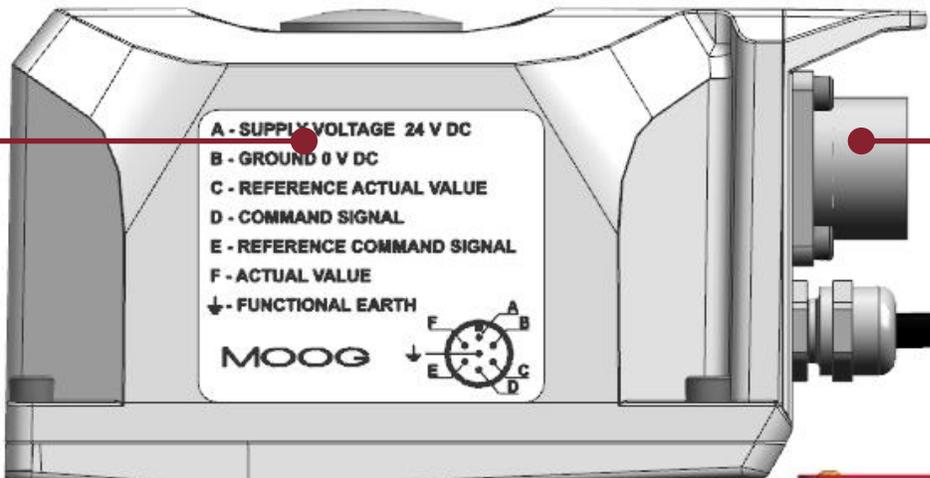
Rated pressure 350 bar

Pressure tank port 280bar (NG6) & 250 bar (NG10)

VALVE DESIGN

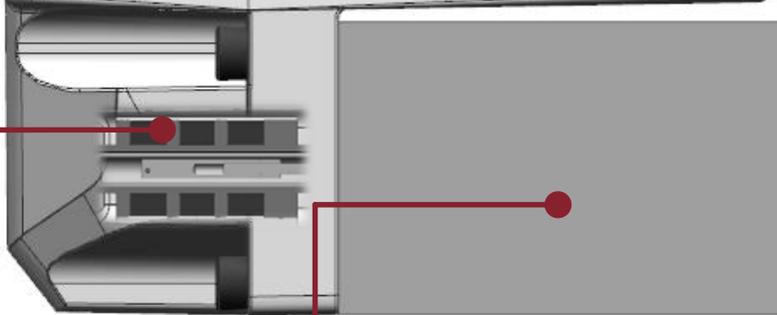
 Display Cutaway

Electronics Cover with Valve Electronics



Valve Connector

Electronics Cover with Position Transducer (LVDT)

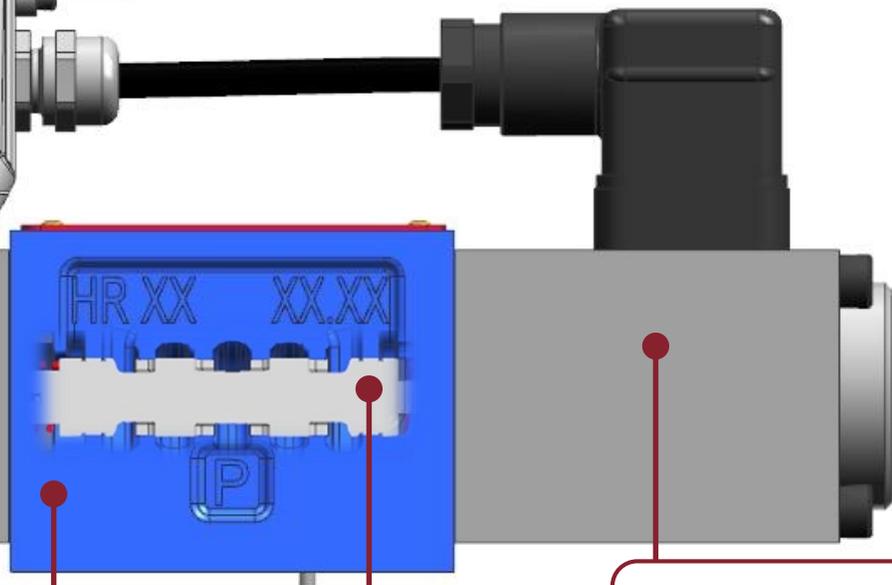


Proportional Solenoid

Valve Housing

Spool

Proportional Solenoid



VALVE DESIGN

 Display Cutaway

Electronics Cover with Valve Electronics

Valve Connector

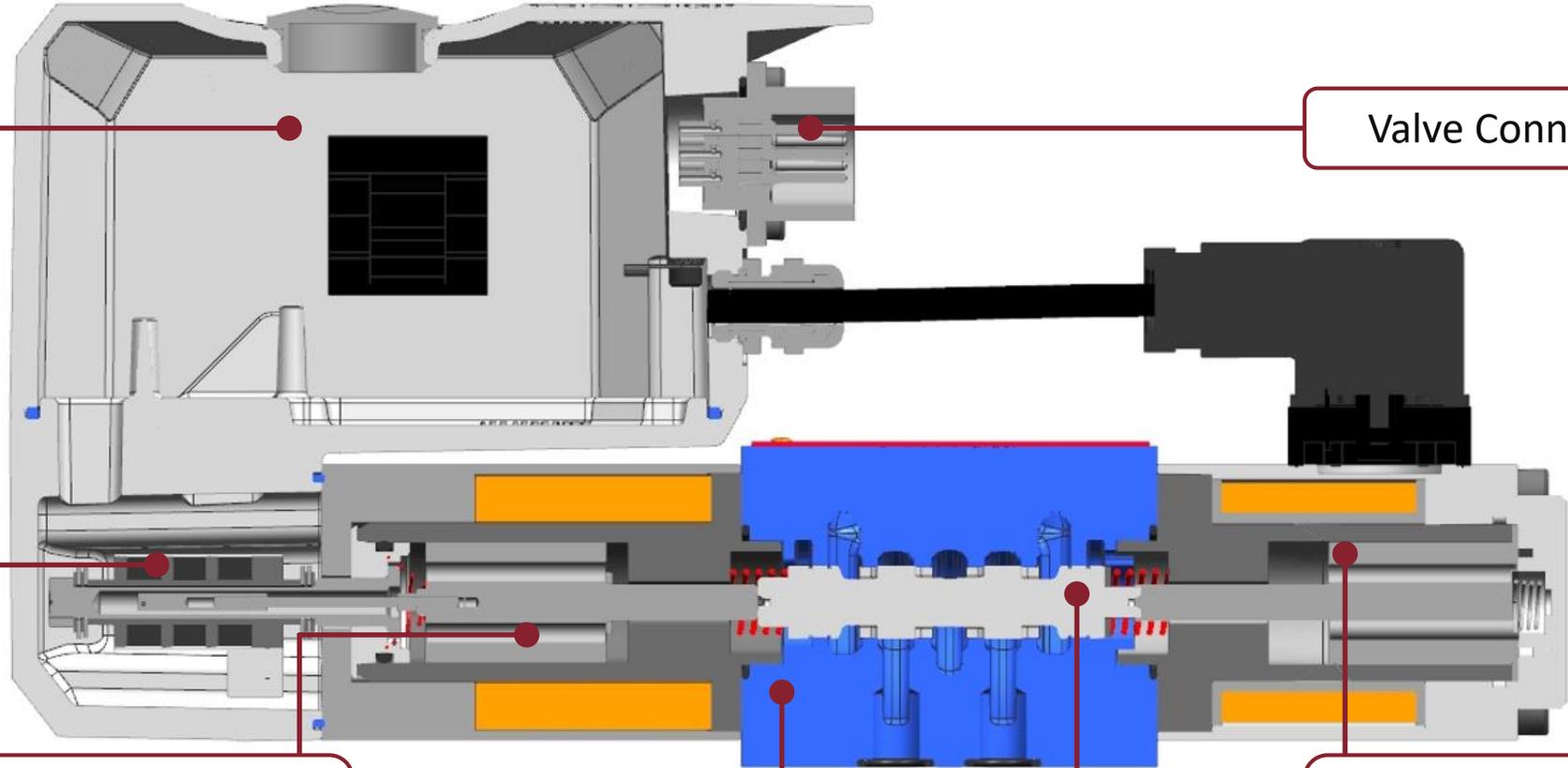
Electronics Cover with Position Transducer (LVDT)

Proportional Solenoid

Valve Housing

Spool

Proportional Solenoid



VALVE DESIGN

 Display Cutaway

Electronics Cover with Valve Electronics

Valve Connector

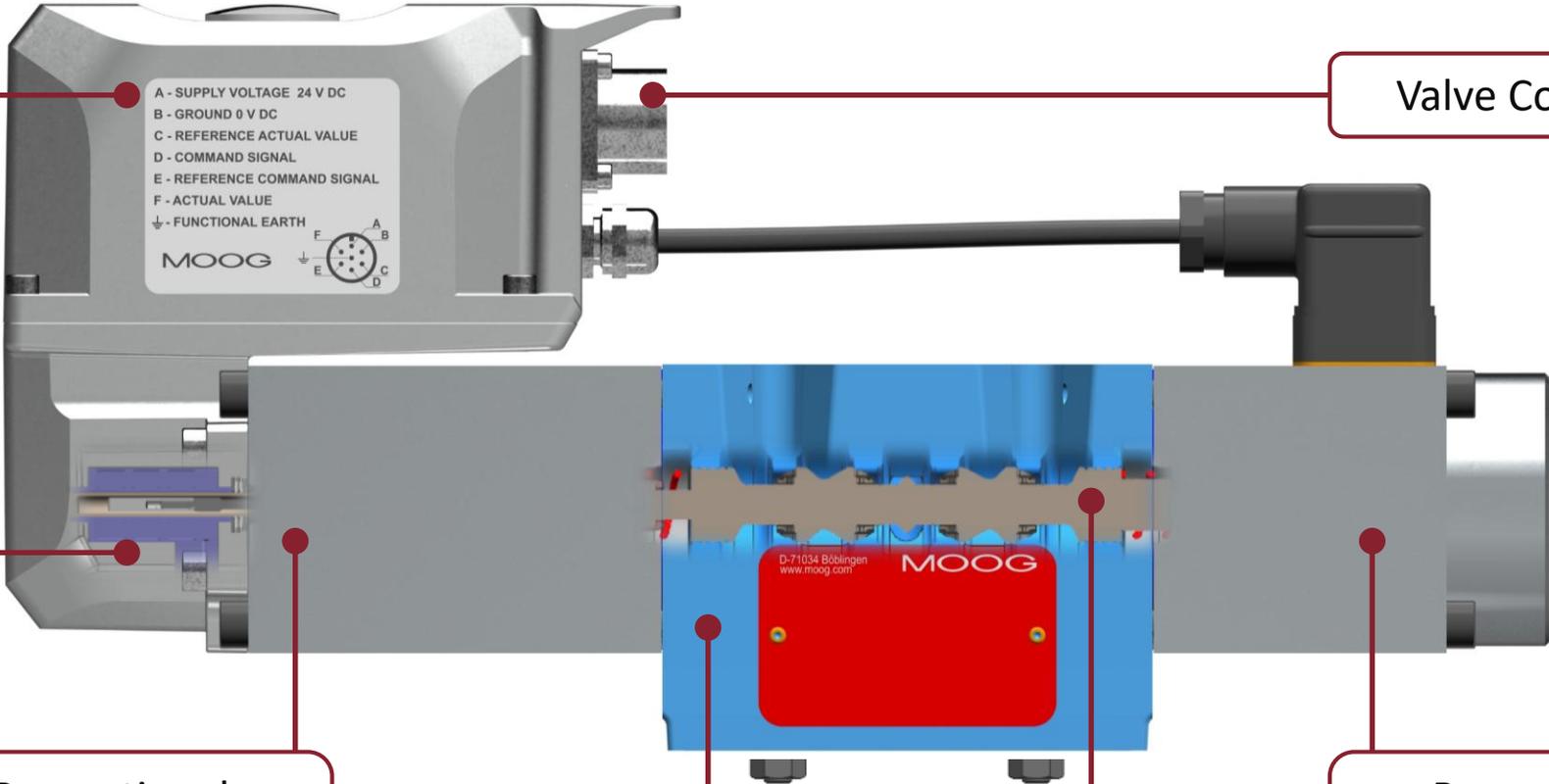
Electronics Cover with Position Transducer (LVDT)

Proportional Solenoid

Valve Housing

Spool

Proportional Solenoid



VALVE DESIGN



Electronics Cover with Valve Electronics

Valve Connector

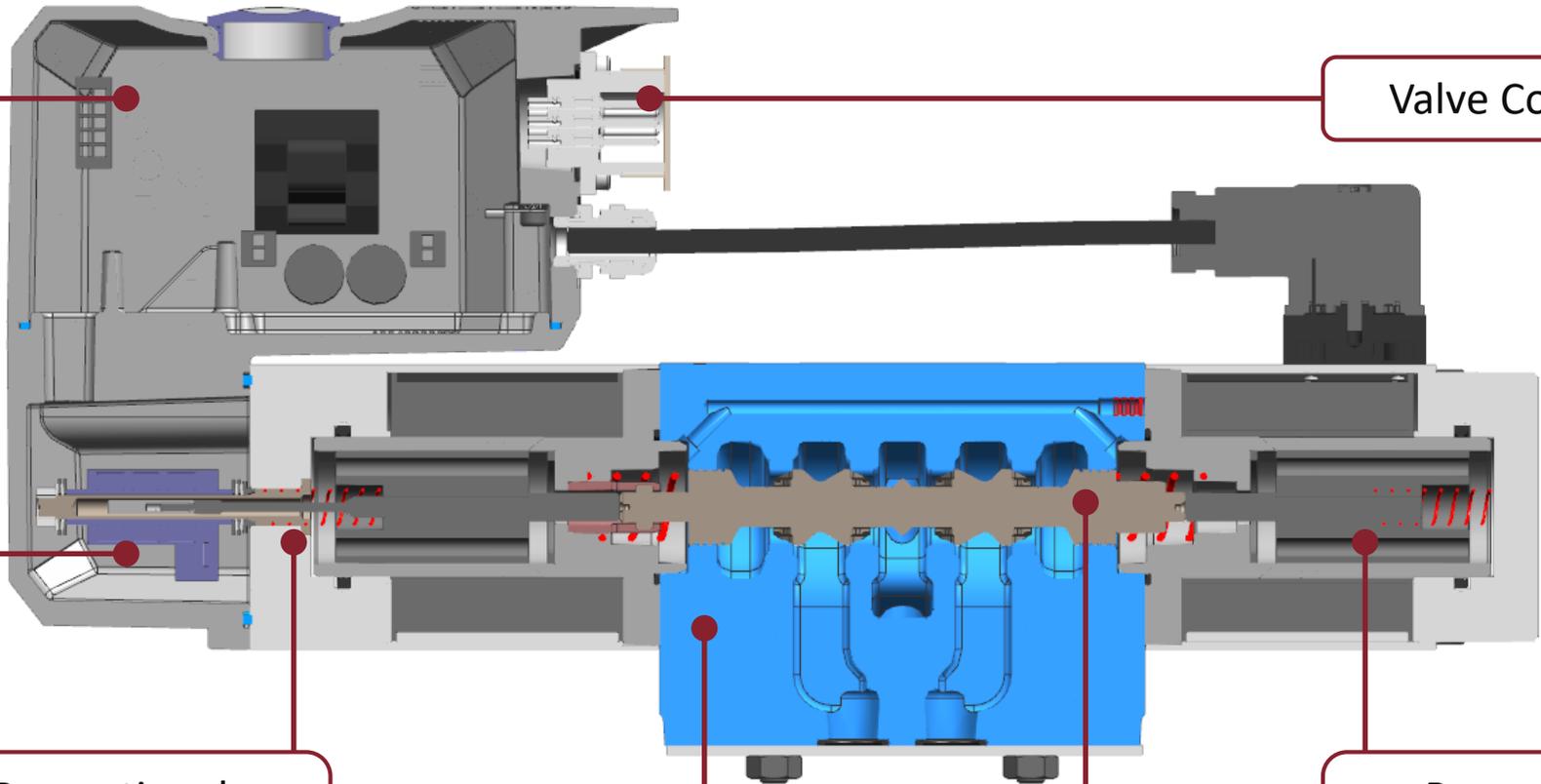
Electronics Cover with Position Transducer (LVDT)

Proportional Solenoid

Valve Housing

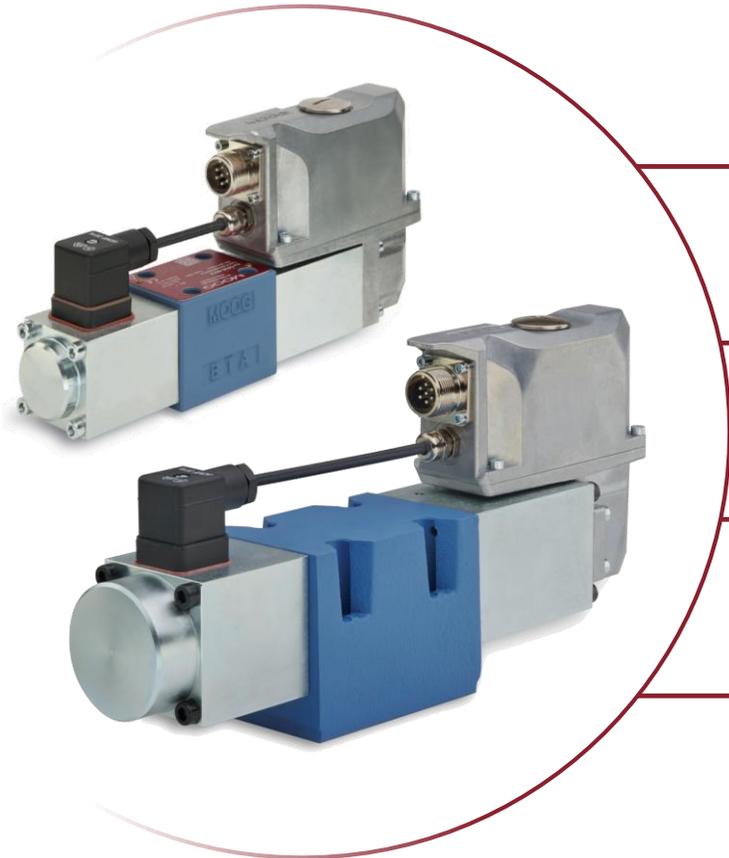
Spool

Proportional Solenoid



TECHNICAL FEATURES

TECHNICAL FEATURES



Available Flow Options

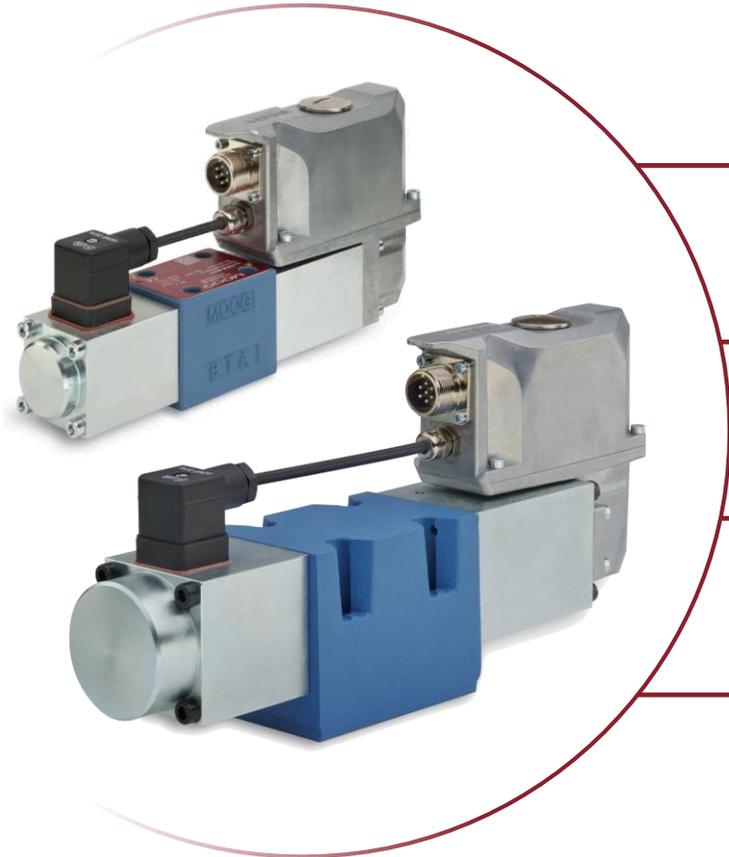
FailSafe Options

Electrical Interface and Signals

Robustness

TECHNICAL FEATURES

AVAILABLE FLOW OPTIONS



D926 

32 spool options

4 rated flows
(4, 8, 16, 32 l/min@5 bar)

area ratio (1:1 and 2:1)

overlap conditions (<3 up to 15%)

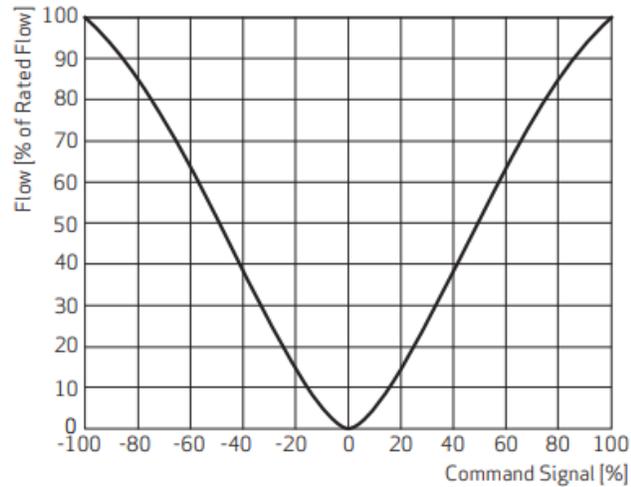
D927 

24 spool options

3 rated flows
(20, 50 and 75 l/min@5 bar)

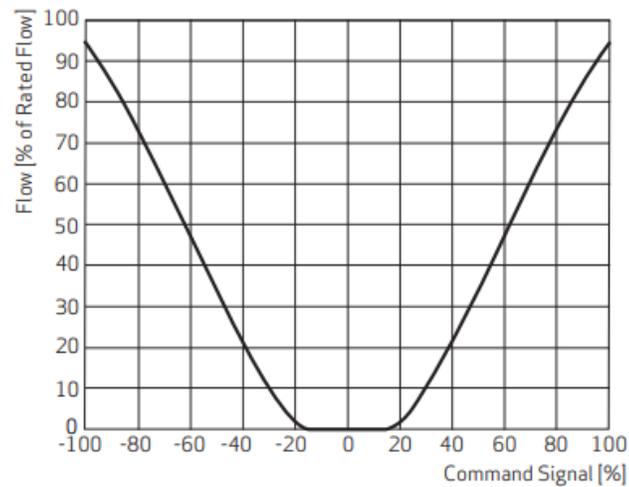
TECHNICAL FEATURES D926

Flow Signal Characteristic for Spool Design L



4/3-way	Area Ratio	1:1	L
	A:B	2:1	3

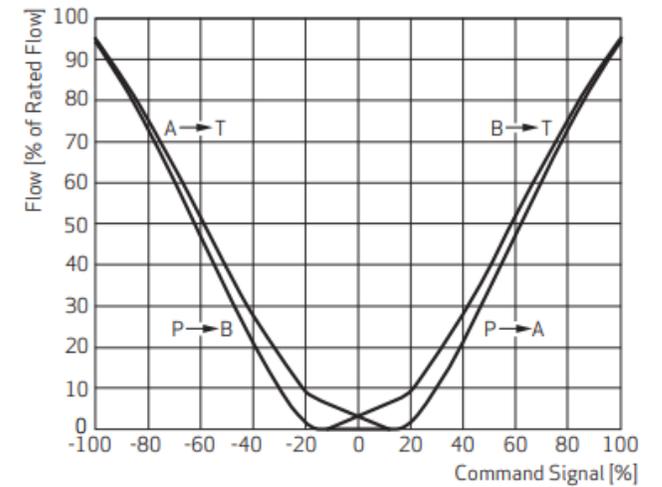
Flow Signal Characteristic for Spool Design 1



4/3-way	Area Ratio	1:1	1
	A:B	2:1	4

4/2-way	Area Ratio	1:1	6
	A:B		

Flow Signal Characteristic for Spool Design 2



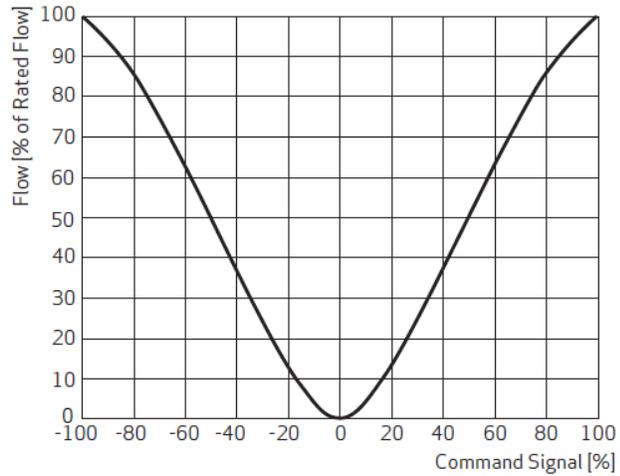
4/3-way	Area Ratio	1:1	2
	A:B	2:1	5

4/2-way	Area Ratio	1:1	7
	A:B		

Tap to see less

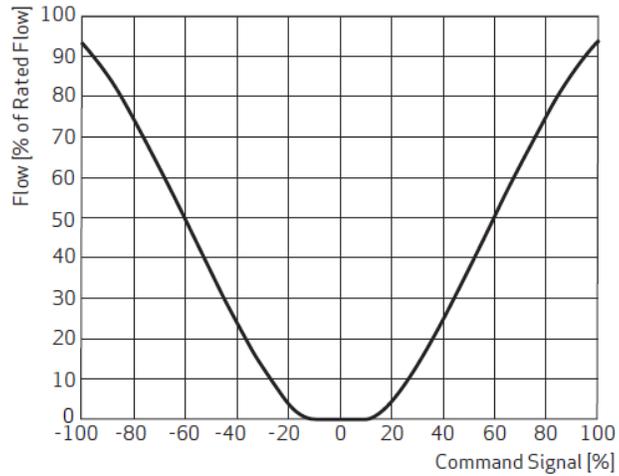
TECHNICAL FEATURES D927

Flow Signal Characteristic for Spool Design L



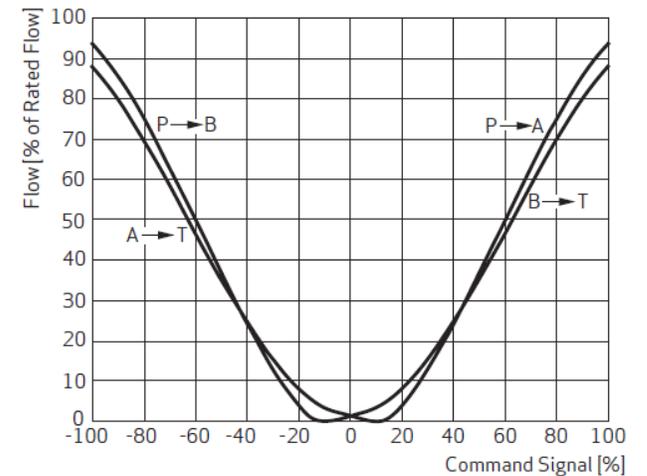
4/3-way	Area Ratio	1:1	L
	A:B	2:1	3

Flow Signal Characteristic for Spool Design 1



4/3-way	Area Ratio	1:1	1
	A:B	2:1	4

Flow Signal Characteristic for Spool Design 2



4/3-way	Area Ratio	1:1	2
	A:B	2:1	5

4/2-way	Area Ratio	1:1	6
	A:B		

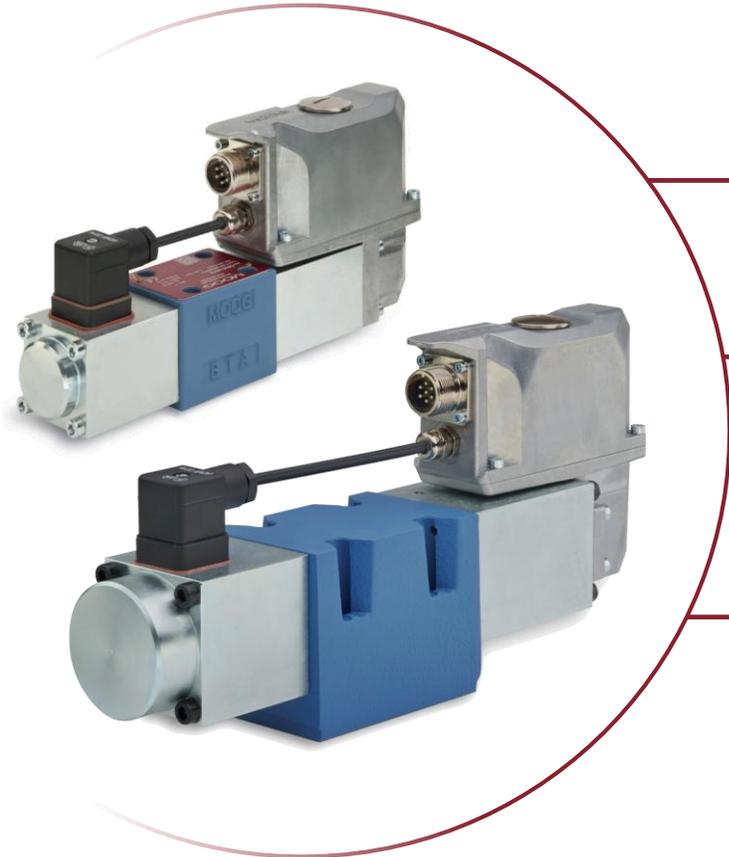
4/2-way	Area Ratio	1:1	7
	A:B		

Tap to see less

TECHNICAL FEATURES

FAILSAFE OPTIONS

 [More Details](#)

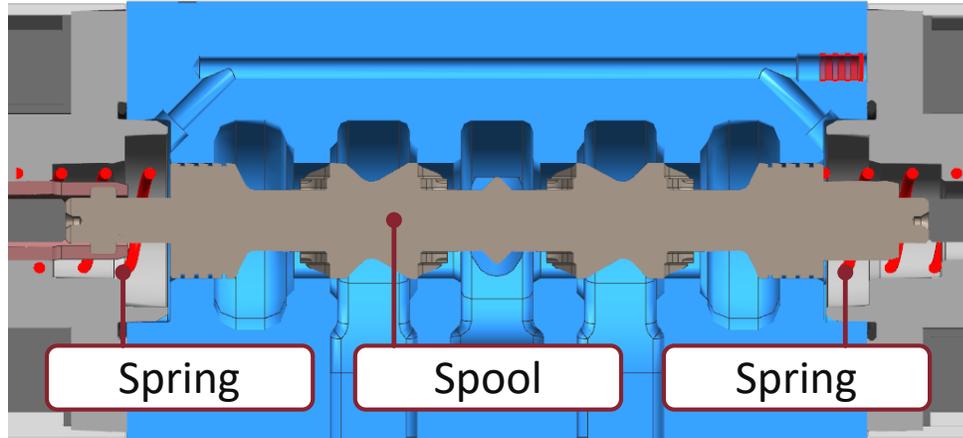


Spring centered in mid position

Without spring retainer for improved axis controllability
For spools with < 3% overlap

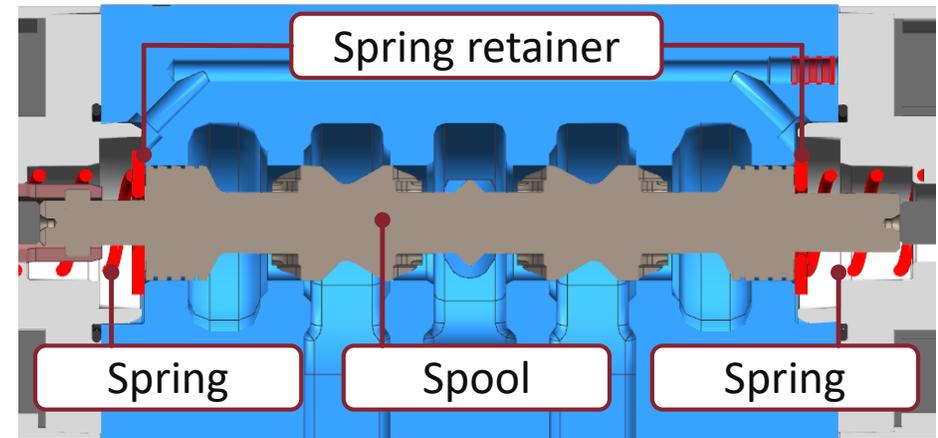
With spring retainer for secured mid position
For spools with 15% overlap

TECHNICAL FEATURES



- Spool with overlap <math>< 3\%</math>
- Spring centered spool position does not equally split P-A & P-B overlap

During operation: Improved controllability of axis
When shut off: **axis can't be securely kept in position**



- Spool with overlap <math>< 15\%</math>
- Spring retainer ensure mid position of spool

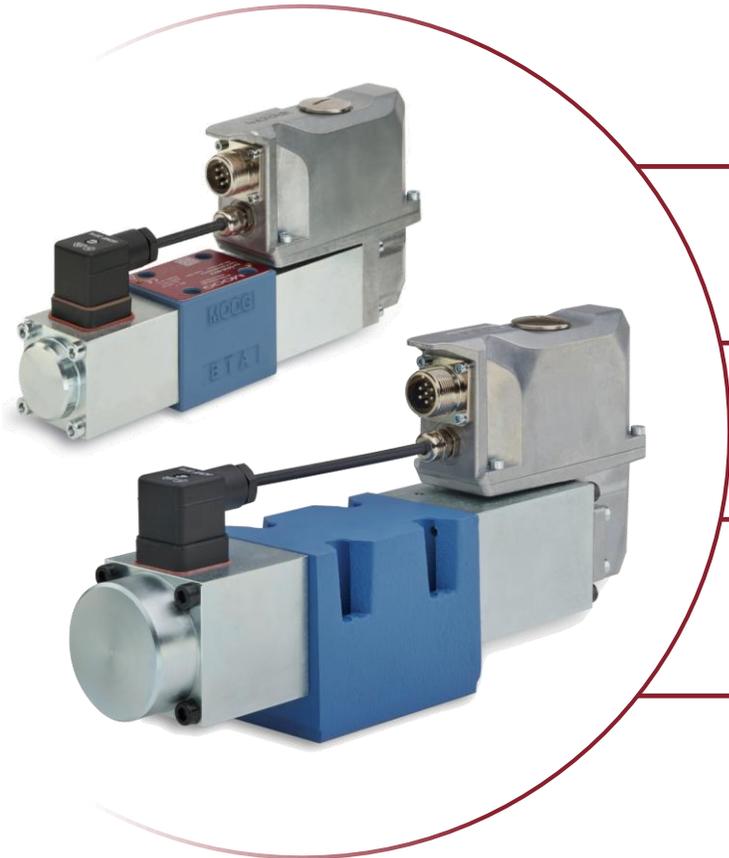
When shut off: **axis can securely be kept in position**

Tap to see less

TECHNICAL FEATURES

ELECTRICAL INTERFACE AND SIGNALS

 [More Details](#)



6-PE connector

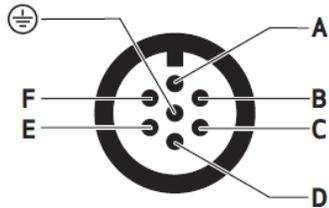
3 signal types for input

2 signal types for output

Deadband compensation available

TECHNICAL FEATURES

INTERFACE



Pin Pin assignment

A	Supply Voltage
B	GND
C	Reference point actual value (Pin F)
D	Command signal
E	Reference point command signal (Pin D)
F	Actual value
	Protective earth (PE)

SIGNAL

Command signal

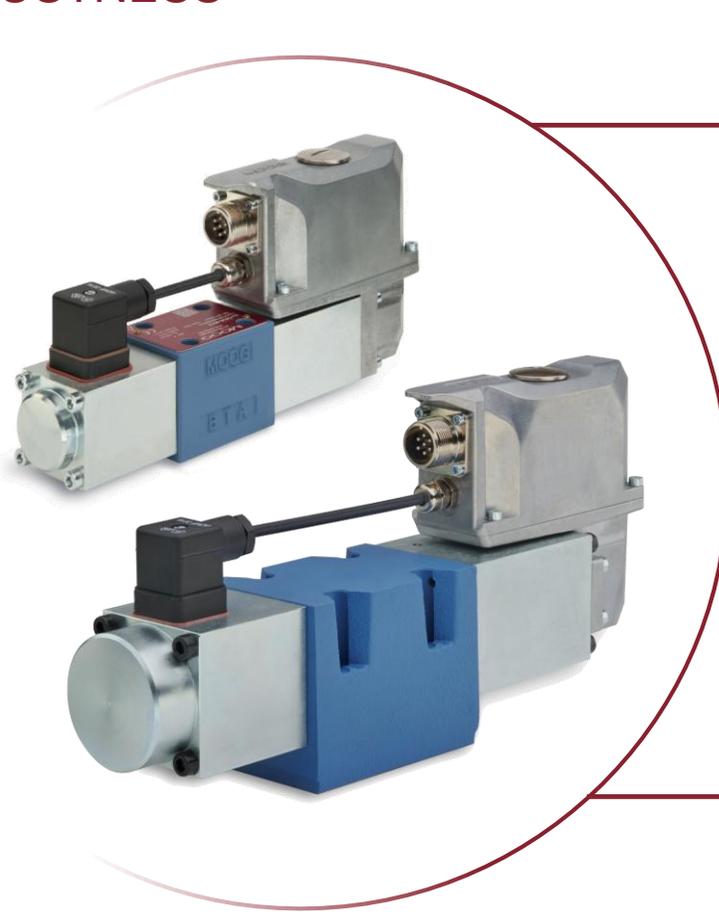
	Command Signal	Actual Value	
H	$\pm 10 \text{ V}$	$\pm 10 \text{ V}$	
E	4 to 20 mA	4 to 20 mA	
X	$\pm 10 \text{ mA}$	4 to 20 mA	
J	$\pm 10 \text{ V}$	$\pm 10 \text{ V}$	with deadband compensation
W	4 to 20 mA	4 to 20 mA	with deadband compensation
U	$\pm 10 \text{ mA}$	4 to 20 mA	with deadband compensation

The dead band compensation is intended to compensate for the overlap of the spool. Thus, it is recommended for spools 1, 2, 4, 5, 6 and 7. (Not for spools L and 3.)

Tap to see less

TECHNICAL FEATURES

ROBUSTNESS



Vibration

- 20/30 g, 3 axis, 10 Hz to 2 kHz

Shock

- 50 g, 6 axis, 3 ms

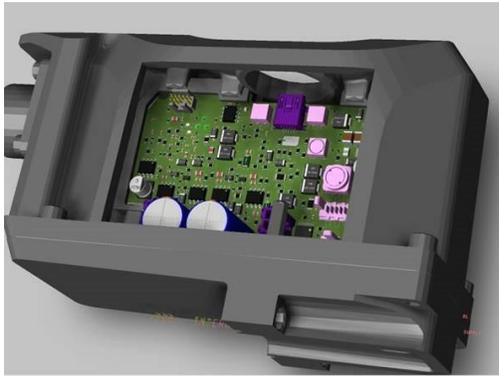
Temperature

- Storage -40 to +80 °C
- Ambient -20 to +60 °C
- Fluid -20 to +80 °C



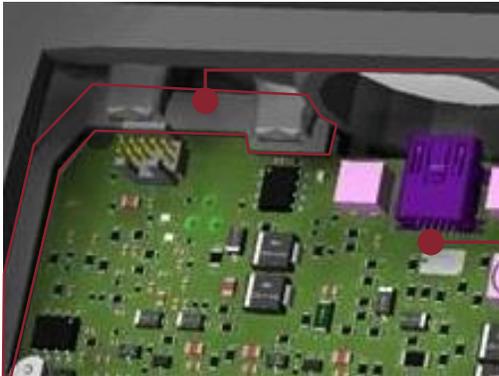
ROBUSTNESS

D92X SHOCK AND VIBRATION RESISTANCE



D926: Resistant up to 30 g (3 axis, 10 Hz to 2 kHz)

D927: Resistant up to 20 g (3 axis, 10 Hz to 2 kHz)



decoupling of the electronics from the housing via a rubber frame

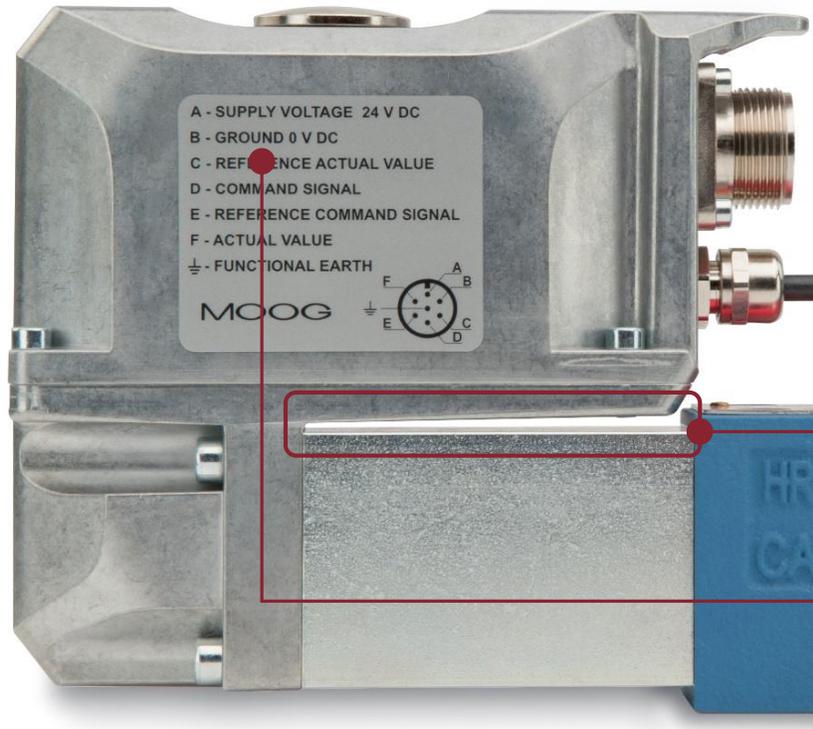
heavy components glued to the printed circuit board

Tap to see less

Temperature

ROBUSTNESS

D926 TEMPERATURE RESISTANCE



Storage temperature	-40 to +80 °C
Ambient temperature	-20 to +60 °C
Fluid temperature	-20 to +80 °C

thermal uncoupling of electronics housing and solenoid

usage of energy efficient components in the electronics

Tap to see less

Temperature

FEATURES AND BENEFITS

LONG ELECTRONICS LIFETIME

ROBUST

RELIABLE

PERFORMANT

OPTIMIZED SPACE REQUIREMENTS



High rated flows

Spool-in-Body design

Long spool stroke

High vibration resistance

Uncoupled electronic

Glued components

Low thermal stress

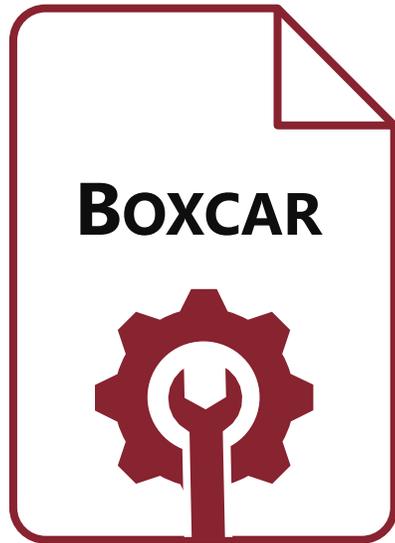
Energy efficient components

Uncoupled electronics housing

High accuracy and wear resistance

Next-generation electronics with digital core

HOW TO LEARN MORE



D92X CONFIGURATION OPTIONS

Model Number (assigned at the factory) Type Designation

D92_ - - P [] [] [] [] [] [] [] [] [] [] [] [] - []

Size												12 Enable Function	
6	Size 03											0	No enable signal
7	Size 05												
Model Designation													
1 Valve Type													
P	Proportional valve with integrated digital electronics												
2 Rated Flow per Spool Land for $\Delta p_N = 5$ bar (75 psi)													
	D926	D927											
04	•	–	4 l/min (1.06 gpm)										
08	•	–	8 l/min (2.1 gpm)										
16	•	–	16 l/min (4.2 gpm)										
25	–	•	25 l/min (6.6 gpm)										
32	•	–	32 l/min (8.5 gpm)										
50	–	•	50 l/min (13.2 gpm)										
75	–	•	75 l/min (19.8 gpm)										
3 Maximum Operating Pressure													
K	350 bar (5,000 psi)												
4 Spool Design													
	D926	D927											
L	1.5 to 3 % positive overlap, progressive flow characteristic												
1	4/3-way	15 % positive overlap, progressive flow characteristic										10 % positive overlap, progressive flow characteristic	
		P→A, P→B: 15 % overlap; A→T, B→T: 12 % underlap, progressive flow characteristic										P→A, P→B: 10 % overlap, A→T, B→T: 7 % underlap, progressive flow characteristic	
2	1.5 to 3 % positive overlap, progressive flow characteristic, A:B = 2:1												
3	15 % positive overlap, progressive flow, A:B = 2:1												
4	P→A, P→B: 15 % overlap, A→T, B→T = 12 % underlap, progressive flow characteristic, A:B = 2:1												
5	10 % positive overlap, progressive flow characteristic												
6	4/2-way	15 % positive overlap, progressive flow characteristic										10 % positive overlap, progressive flow characteristic	
7		P→A, P→B: 15 % overlap; A→T, B→T: 12 % underlap, progressive flow characteristic										P→A, P→B: 10 % overlap, A→T, B→T: 7 % underlap, progressive flow characteristic	
5 Proportional Solenoid													
8 2 proportional solenoids, LVDT on A side													
0	4/2-way: Single proportional solenoid and LVDT on A side												
6 Spool Position Without Electrical Supply													
M	Center position ¹⁾												
7 Y Port													
0	No Y port, p_{Tmax} D926 = 280 bar (4,000 psi); p_{Tmax} D927 = 250 bar (3,600 psi)												
3	With Y port, p_{Tmax} = 350 bar (5,000 psi) (only D926)												
8 Seal Material													
H	HNBR												
V	FKM												
9 Valve Connector X1													
S	6-pole + PE EN 175201-804												
10 Command Signals													
	Command signal	Actual value											
H	±10V	±10V											
E	4 to 20 mA	4 to 20 mA											
X	±10 mA	4 to 20 mA											
J	±10V	±10V with deadband compensation											
W	4 to 20 mA	4 to 20 mA with deadband compensation											
U	±10 mA	4 to 20 mA with deadband compensation											
11 Supply Voltage													
2	24 V _{DC} , for more information, see section "Electronics"												

D926



D927



Note: Preferred options marked in **bold**.

¹⁾ For spools with 1.5 to 3 % overlap, the spring centered position may not correspond with the hydraulic zero position.

PRODUCT PAGE

MOOG D926 AND D927 PRODUCT PAGE

- Product Catalog
- Datasheet
- Introduction Video
- Installation Drawing
- 3D Model Files
- Installation and commissioning instructions
- And more!

MOOG

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Products / Servo Valves and Proportional Valves / Industrial / Servo and Proportional Valves with Electronics / Direct Operated Proportional Valves | D926 and D927 Series

Series D926 and D927 - Direct Operated Valves (DOV) for flow control with analog interface

The Moog D926 and D927 series valves are direct operated proportional valves with integrated electronics and analog interface. The proportional valves of the D926 and D927 series are driven by two proportional solenoids, which moves the valve spool directly and eliminates the need for pilot oil. This design allows for 4/3- and 4/2-way operation and ensured centered fail-safe position. They are available in nominal sizes 03 (D926) and 05 (D927) in accordance with ISO 4401.

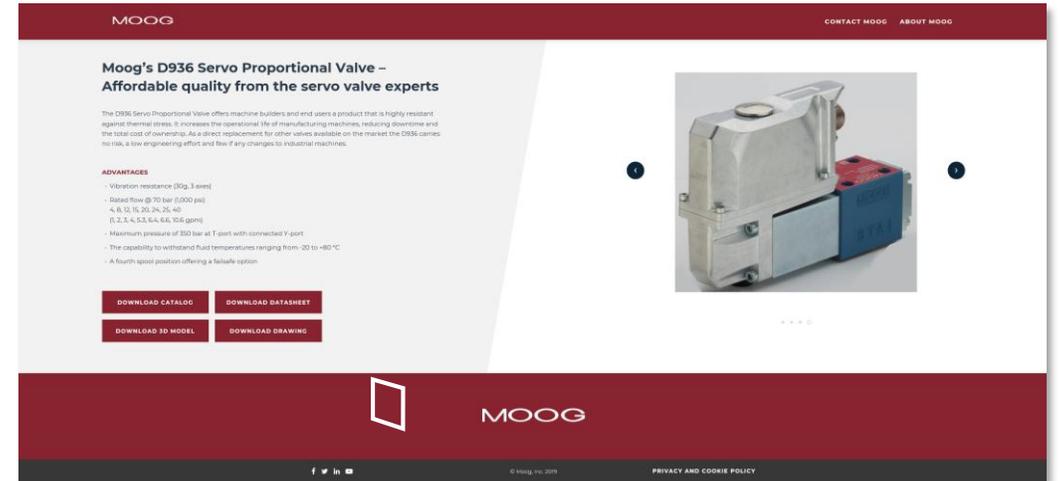
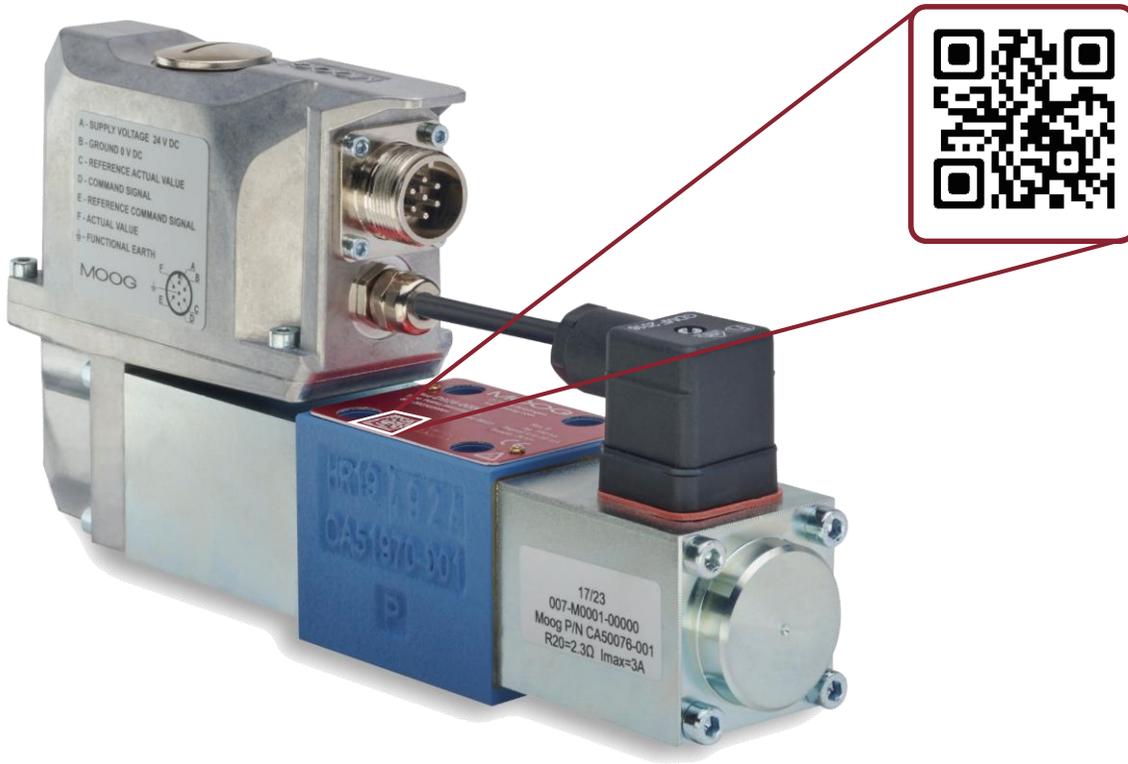
These proportional valves were designed to offer high resistance to thermal stress and vibration. The compact design allows space saving system design and seamlessly integration into your machine.

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PRODUCT PAGE

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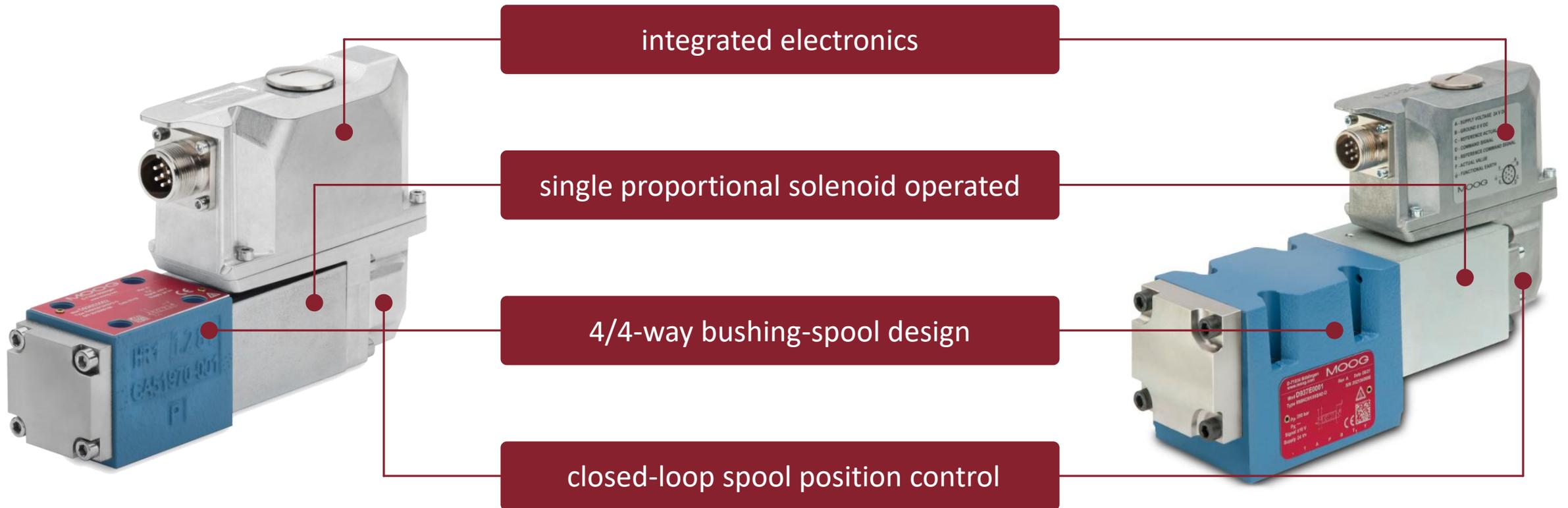


- 3D model
- drawing
- datasheet
- catalog

D93X SERIES - PRODUCT OVERVIEW



MOOG DIRECT-OPERATED SERVO-PROPORTIONAL VALVE



TECHNICAL OVERVIEW

TECHNICAL DATA D93X



Size NG6 & NG10

Rated flow up to 15l/min & 38 l/min (@5 bar)

4/4-way design

Failsafe option: 4th position

Rated pressure 350 bar

Pressure tank port 350bar (NG6) & 250 bar (NG10)

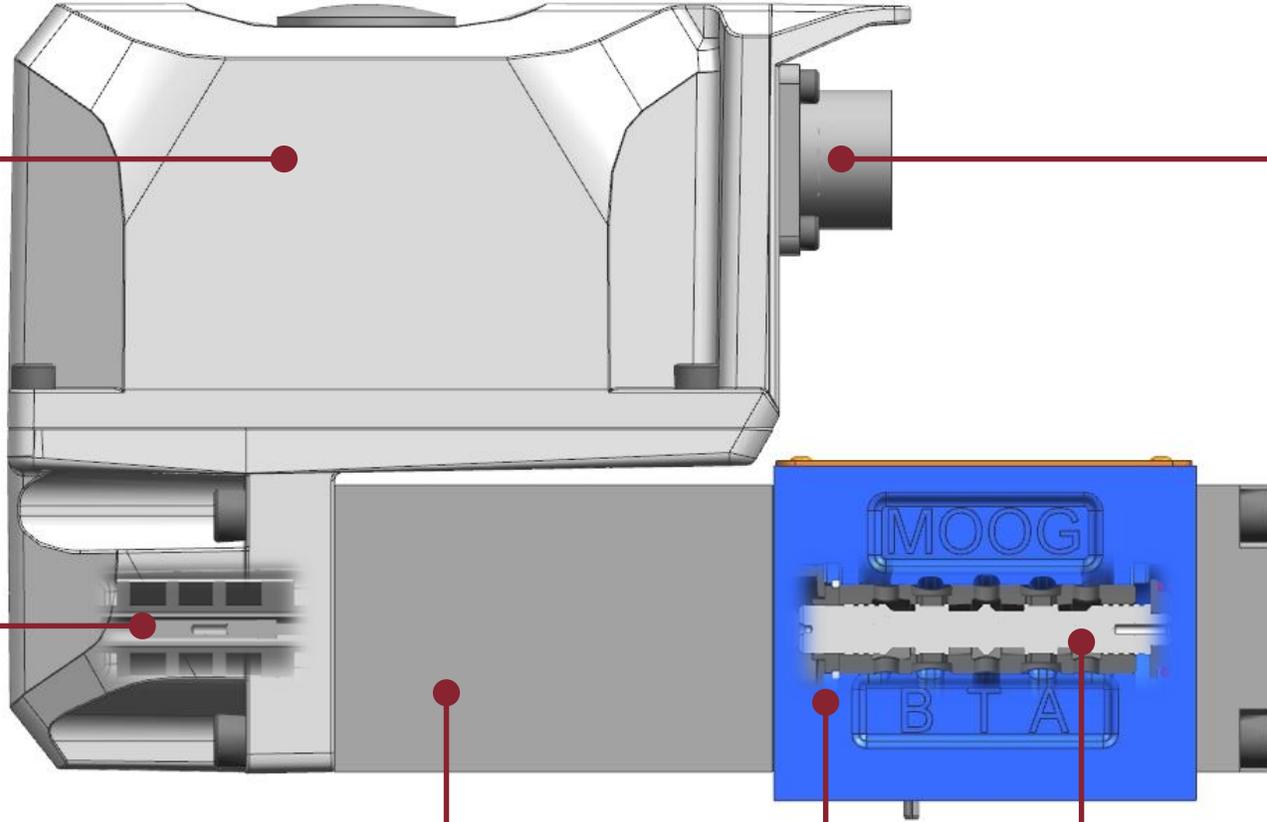
VALVE DESIGN D936

 Display Cutaway

Electronics Cover with Valve Electronics

Valve Connector

Electronics Cover with Position Transducer (LVDT)



Proportional Solenoid

Valve Housing

Spool

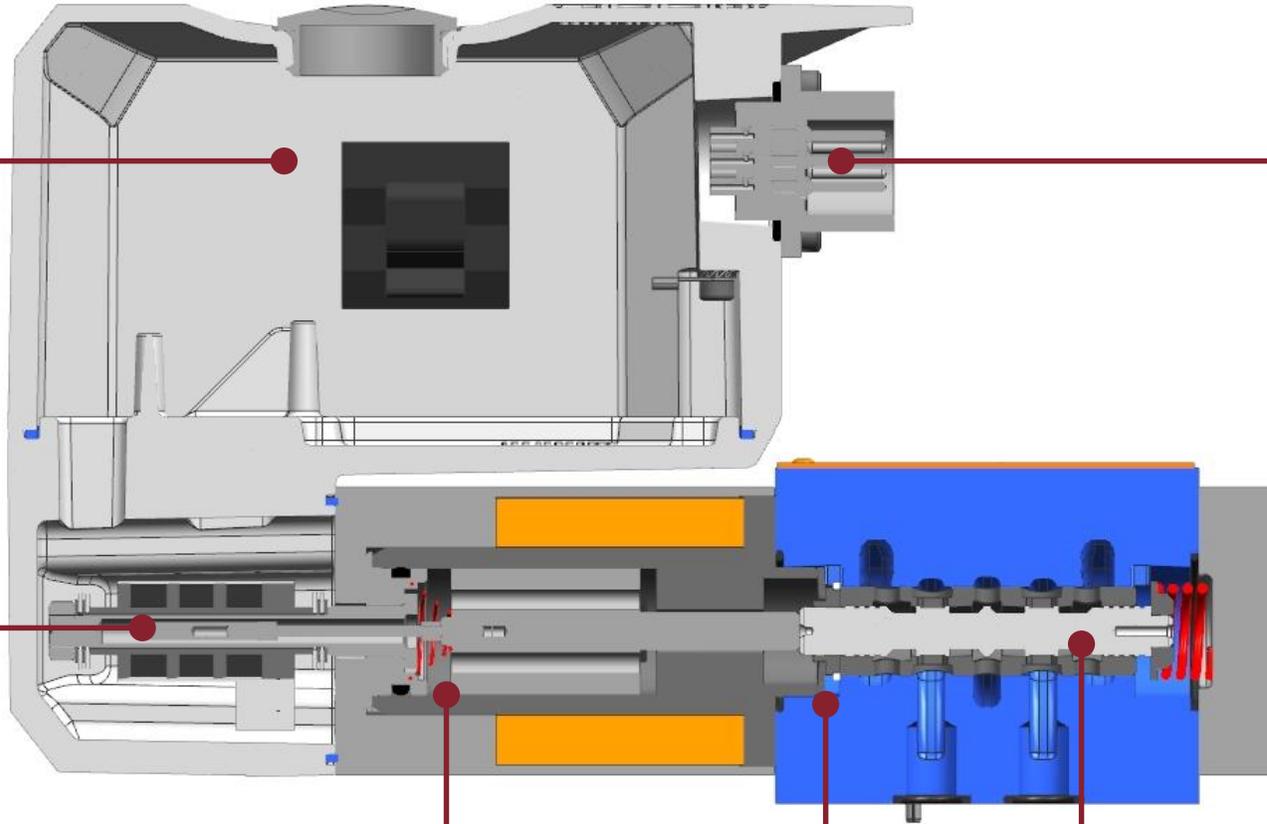
VALVE DESIGN D936

 Display Cutaway

Electronics Cover with Valve Electronics

Valve Connector

Electronics Cover with Position Transducer (LVDT)



Proportional Solenoid

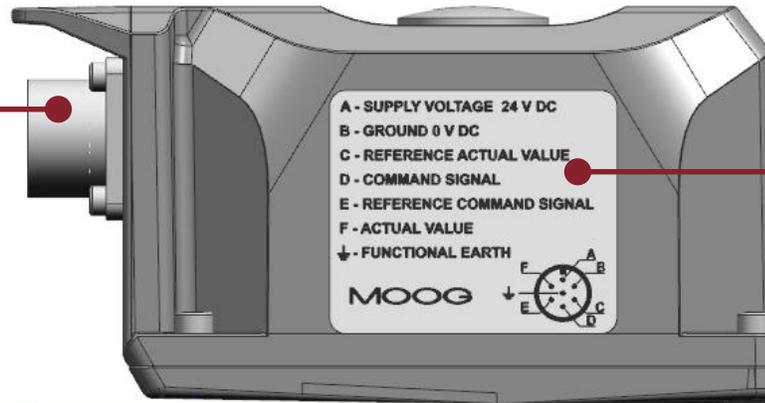
Valve Housing

Spool

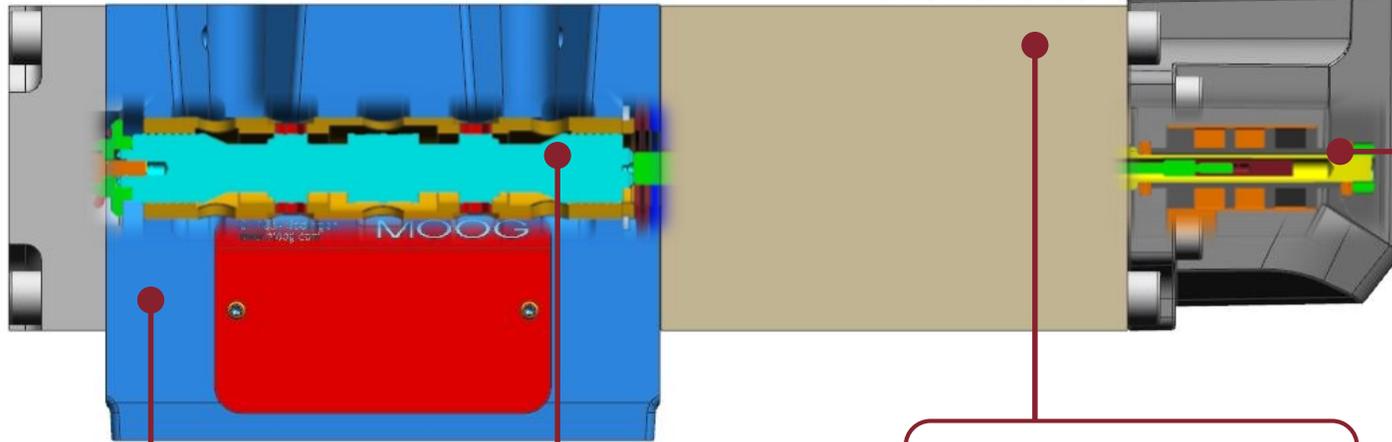
VALVE DESIGN D937



Valve Connector



Electronics Cover with Valve Electronics



Electronics Cover with Position Transducer (LVDT)

Valve Housing

Bushing & Spool

Proportional Solenoid

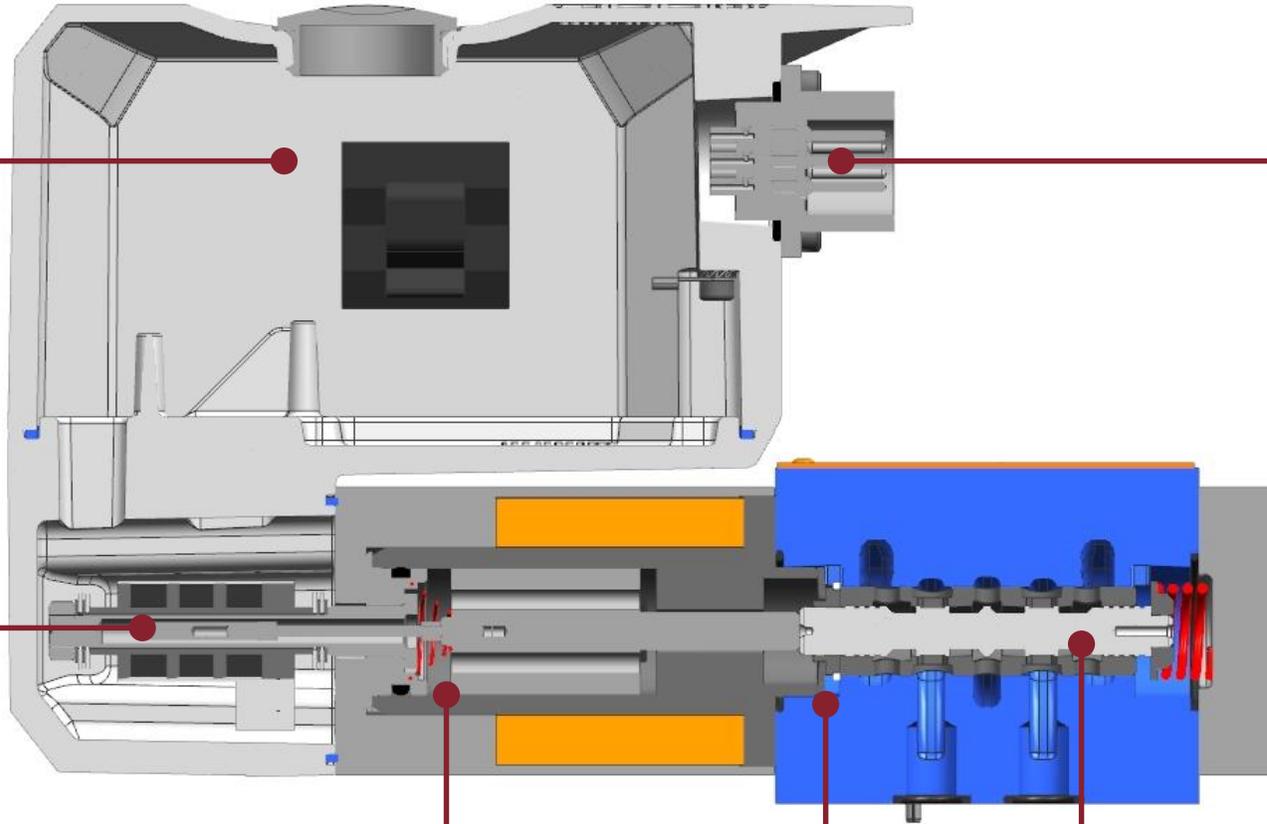
VALVE DESIGN D936

 Display Cutaway

Electronics Cover with Valve Electronics

Valve Connector

Electronics Cover with Position Transducer (LVDT)



Proportional Solenoid

Valve Housing

Spool

TECHNICAL FEATURES

TECHNICAL FEATURES



Available Flow Options

4th Safe Spool Position

Electrical Interface and Signals

Robustness

TECHNICAL FEATURES

AVAILABLE FLOW OPTIONS



D936 

16 spool options

8 rated flows
(1.5, 3.0, 4.5, 5.7, 7.6, 9.1, 9.5 and 15 l/min@5 bar)

area ratio (1:1 and 2:1)

zero lapped spools with 3 flow characteristics

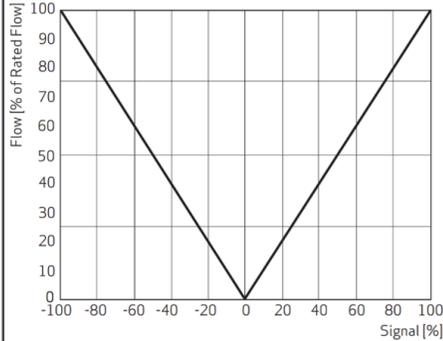
D937 

9 spool options

2 rated flows
(19 and 38 l/min@5 bar)

TECHNICAL FEATURES D936

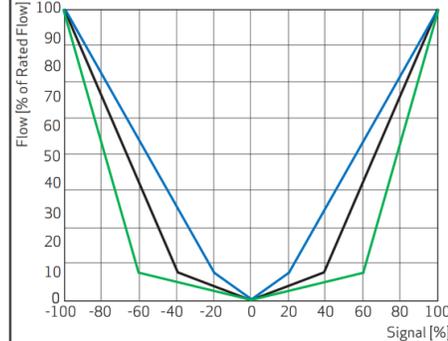
Spool Option „O“



Available for:

- 1.5 l/min @5bar
- 4.5 l/min @5bar
- 9.1 l/min @5bar
- 15 l/min @5bar

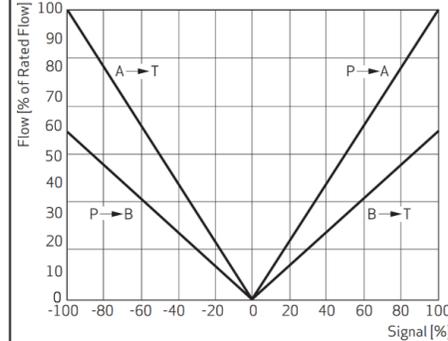
Spool Option „Y“



Available for:

- 1.5 l/min @5bar
- 5.7 l/min @5bar
- 9.5 l/min @5bar
- 15 l/min @5bar

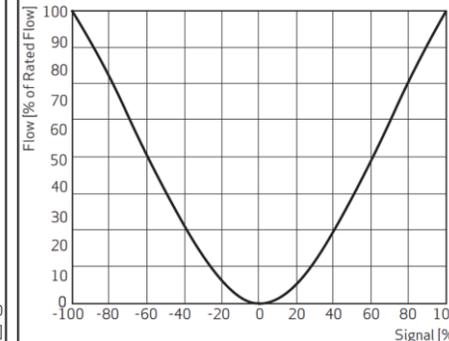
Spool Option „J“



Available for:

- 1.5 l/min @5bar
- 4.5 l/min @5bar
- 9.1 l/min @5bar
- 15 l/min @5bar

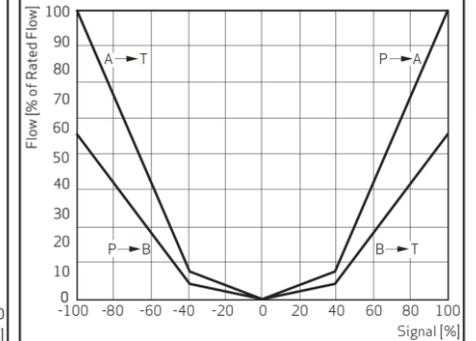
Spool Option „L“



Available for:

- 3.0 l/min @5bar
- 7.6 l/min @5bar
- 15 l/min @5bar

Spool Option „E“



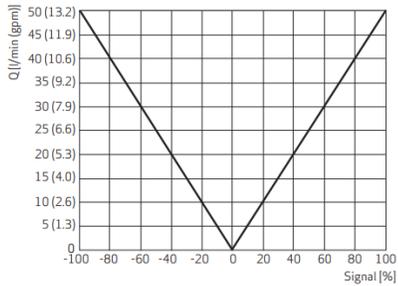
Available for:

- 15 l/min @5bar

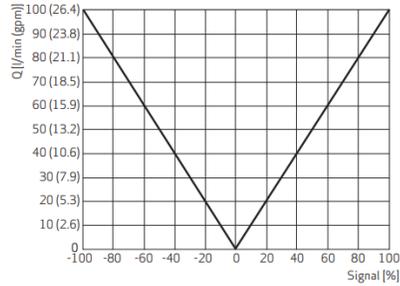
Tap to see less

TECHNICAL FEATURES D937

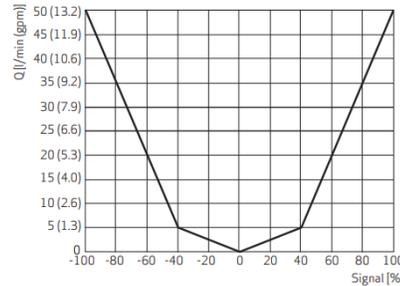
Rated flow 50 l/min



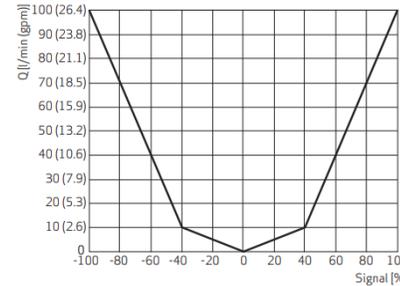
Rated flow 100 l/min



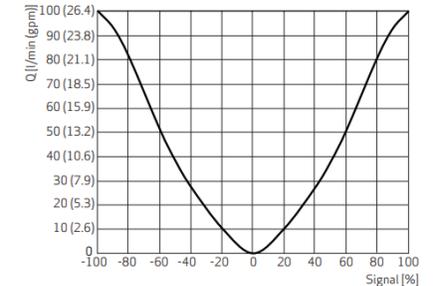
Rated flow 50 l/min



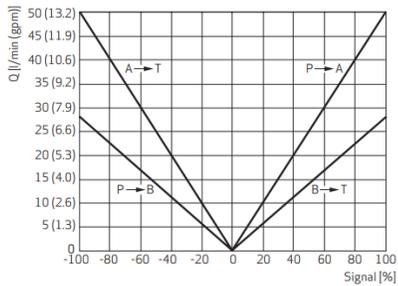
Rated flow 100 l/min



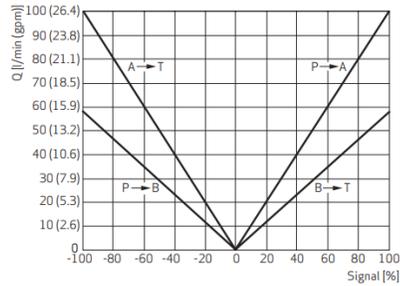
Rated flow 100 l/min



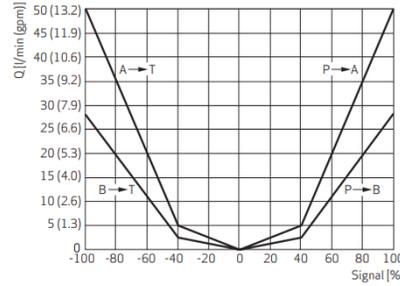
Rated flow 50 l/min



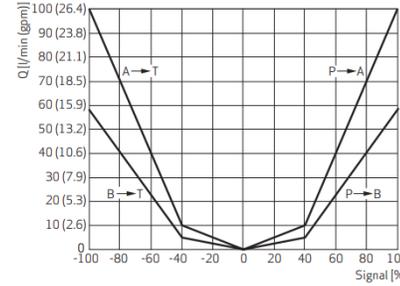
Rated flow 100 l/min



Rated flow 50 l/min



Rated flow 100 l/min



4/4-way	Area Ratio A:B	1:1	O
		2:1	J

4/4-way	Area Ratio A:B	1:1	Y
		2:1	E

4/4-way		
Area Ratio A:B	1:1	L

Tap to see less

TECHNICAL FEATURES

FAILSAFE OPTIONS

 [More Details](#)

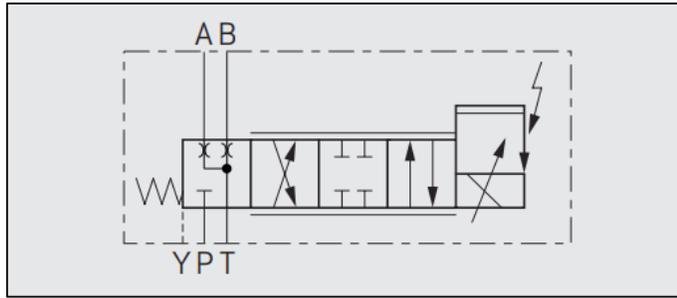


4th position by spring force

3 options for spool cut in 4th position

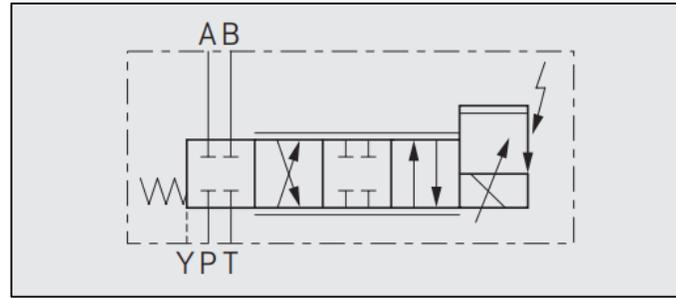
TECHNICAL FEATURES

Option "1"



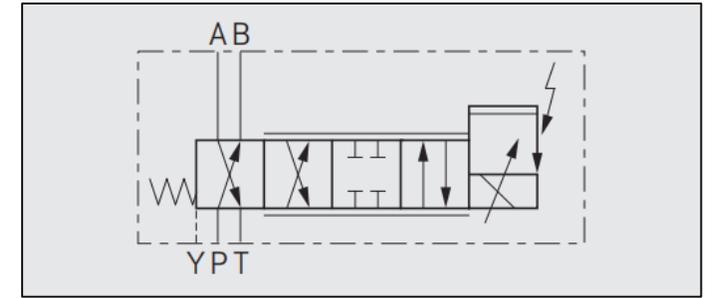
Ports A&B connected with port T

Option "2"



All ports blocked

Option "F"



P connected with B
A connected with T

- To achieve 4th position the spool travels through fully open position P→B and A→T, there will be full flow for a short period of time.
- Limited switching force limits the maximum pressure drop at which the 4th position can be achieved.
- The maximum pressure drop for leaving the failsafe position is also limited.

Tap to see less

TECHNICAL FEATURES

ELECTRICAL INTERFACE AND SIGNALS

 [More Details](#)



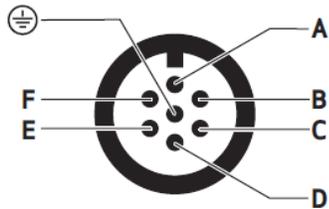
6-PE connector

3 signal types for input

2 signal types for output

TECHNICAL FEATURES

INTERFACE



Pin Pin assignment

A	Supply Voltage
B	GND
C	Reference point actual value (Pin F)
D	Command signal
E	Reference point command signal (Pin D)
F	Actual value
	Protective earth (PE)

SIGNAL

Command signal

	Command Signal	Actual Value
H	± 10 V	± 10 V
E	4 to 20 mA	4 to 20 mA
X	± 10 mA	4 to 20 mA

Tap to see less

TECHNICAL FEATURES

ROBUSTNESS



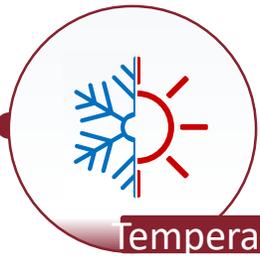
Vibration

- 20/30 g, 3 axis, 10 Hz to 2 kHz



Shock

- 50 g, 6 axis, 3 ms



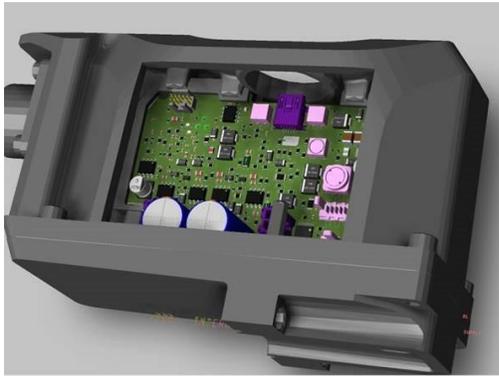
Temperature

- Storage -40 to +80 °C
- Ambient -20 to +60 °C
- Fluid -20 to +80 °C



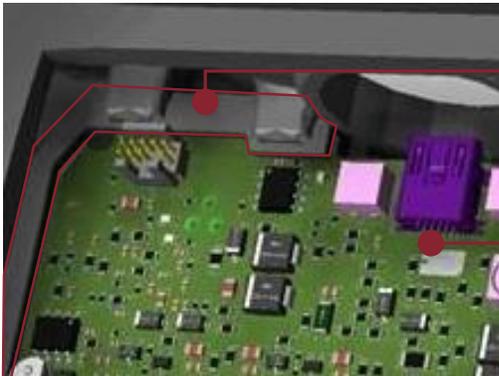
ROBUSTNESS

D93X SHOCK AND VIBRATION RESISTANCE



D936: Resistant up to 30 g (3 axis, 10 Hz to 2 kHz)

D937: Resistant up to 20 g (3 axis, 10 Hz to 2 kHz)



decoupling of the electronics from the housing via a rubber frame

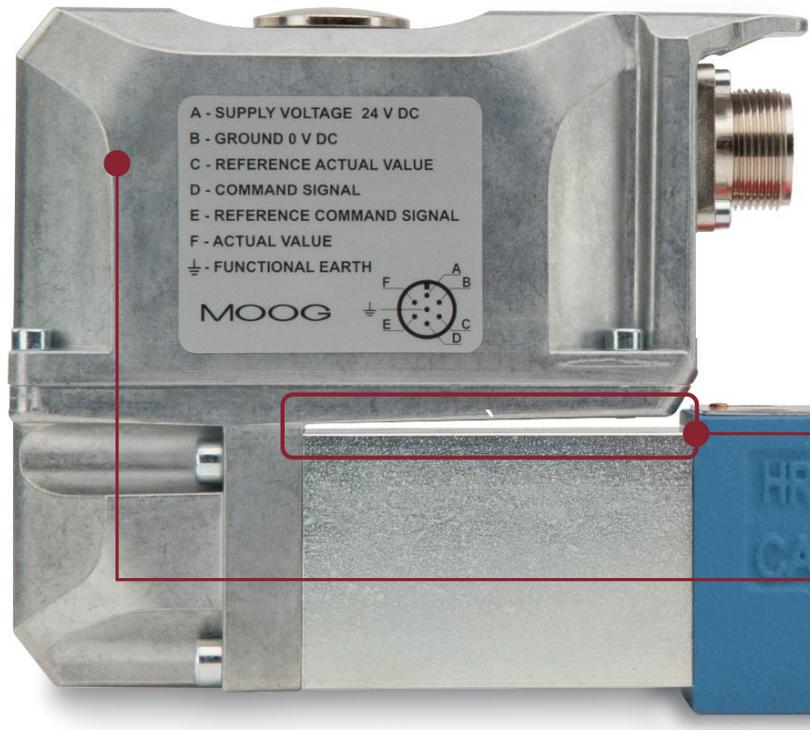
heavy components glued to the printed circuit board

Tap to see less

Temperature

ROBUSTNESS

D93X TEMPERATURE RESISTANCE



Storage temperature	-40 to +80 °C
Ambient temperature	-20 to +60 °C
Fluid temperature	-20 to +80 °C

thermal uncoupling of electronics housing and solenoid

usage of energy efficient components in the electronics

Tap to see less

Temperature

FEATURES AND BENEFITS

LONG ELECTRONICS LIFETIME

ROBUST

RELIABLE

PERFORMANT

OPTIMIZED SPACE REQUIREMENTS



High Dynamic

Spool-in-Bushing (BSA) design

Short spool stroke

High vibration resistance

Uncoupled electronic

Glued components

Low thermal stress

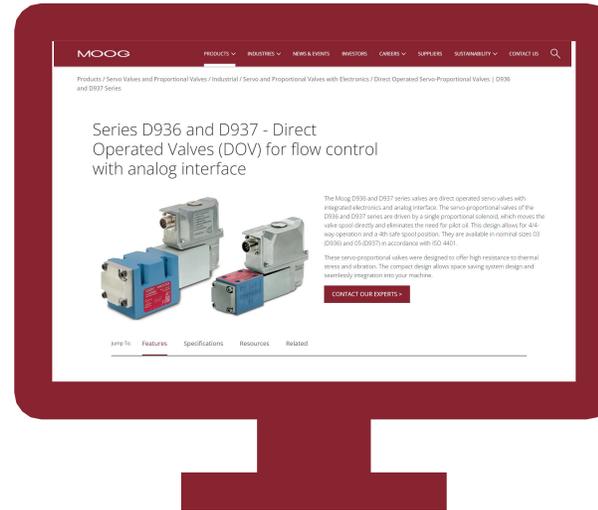
Energy efficient components

Uncoupled electronics housing

High accuracy and wear resistance

Next-generation electronics with digital core

HOW TO LEARN MORE



D93X CONFIGURATION OPTIONS

Model number (assigned at the factory)

D93_

Type designation

1 2 3 4 5 6 7 8 9 10 11 13
R K 9 S 2 0

Size

- 6 Size 03
- 7 Size 05

Model designation

1 Valve type

- R Servo-proportional valve with integrated digital electronics

2 Rated flow per spool land [l/min (gpm)]¹⁾

Size	For $\Delta p_s = 35$ bar (500 psi)	For $\Delta p_s = 5$ bar (75 psi)
04 D936	4 (1.06)	1.5 (0.4)
08 D936	8 (2.1)	3.0 (0.8)
12 D936	12 (3.2)	4.5 (1.2)
15 D936	15 (4.0)	5.7 (1.5)
20 D936	20 (5.3)	7.6 (2.0)
24 D936	24 (6.3)	9.1 (2.4)
25 D936	25 (6.6)	9.5 (2.5)
40 D936	40 (10.6)	15.1 (4.0)
50 D937	50 (13.2)	18.9 (5.0)
99 D937	100 (26.4)	37.8 (10.0)

3 Pressure range [bar (psi)]

- Maximum operating pressure
- K 350 (5,000)

4 Bushing/spool design¹⁾

- O 4-way: zero lap, linear flow characteristic
- J 4-way: zero lap, linear flow characteristic, A:B = 2:1
- Y 4-way: zero lap, dual gain flow characteristic
- E 4-way: zero lap, dual gain flow characteristic, A:B = 2:1
- L 4-way: zero lap, progressive flow characteristic

5 Proportional solenoid

- 9 Proportional solenoid on B side

6 Spool position without electrical supply

- 1 Port P blocked, ports A and B connected to T
- 2 Ports P, A, B and T blocked
- F P → B, A → T connected

7 Size Y port

- 0 D936 No Y port, $p_{Tmax} = 280$ bar (4,000 psi)
- 0 D937 No Y port, $p_{Tmax} = 250$ bar (3,625 psi)
- 3 D936 With Y port, $p_{Tmax} = 350$ bar (5,000 psi)
- 3 D937 Not available

13 Enable function

- 0 No enable signal

11 Supply voltage

- 2 24 V_{DC}, for more information, see section "Electronics"

10 Command signals

Command signal Actual value

- H ± 10 V ± 10 V
- E 4 to 20 mA 4 to 20 mA
- X ± 10 mA 4 to 20 mA

9 Valve connector X1

- S 6-pole + PE EN 175201-804

8 Seal material

- H HNBR
- V FKM

D936



D937



PRODUCT PAGE

MOOG D936 AND D937 PRODUCT PAGE

- Product Catalog
- Datasheet
- Introduction Video
- Installation Drawing
- 3D Model Files
- Installation and commissioning instructions
- And more!



Products / Servo Valves and Proportional Valves / Industrial / Servo and Proportional Valves with Electronics / Direct Operated Servo-Proportional Valves | D936 and D937 Series

Series D936 and D937 - Direct Operated Valves (DOV) for flow control with analog interface



The Moog D936 and D937 series valves are direct operated servo valves with integrated electronics and analog interface. The servo-proportional valves of the D936 and D937 series are driven by a single proportional solenoid, which moves the valve spool directly and eliminates the need for pilot oil. This design allows for 4/4-way operation and a 4th safe spool position. They are available in nominal sizes 03 (D936) and 05 (D937) in accordance with ISO 4401.

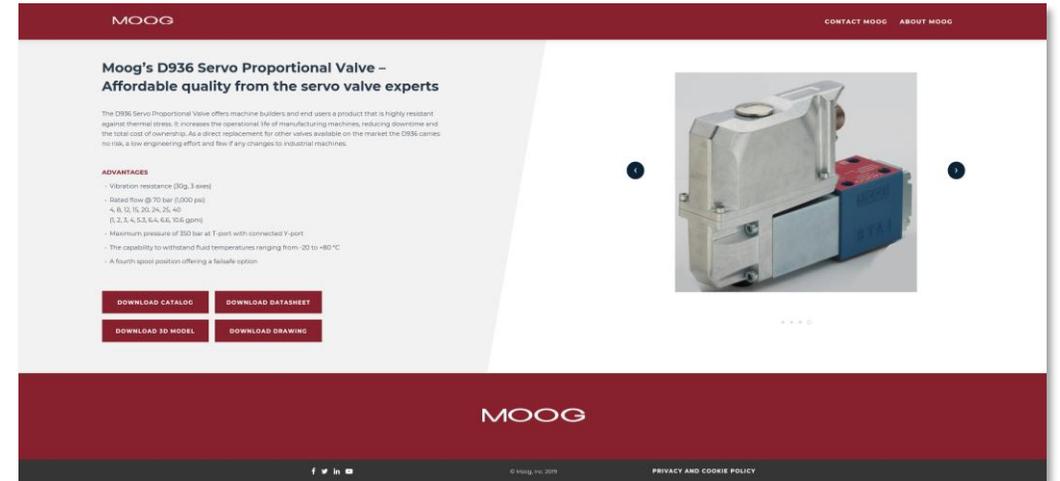
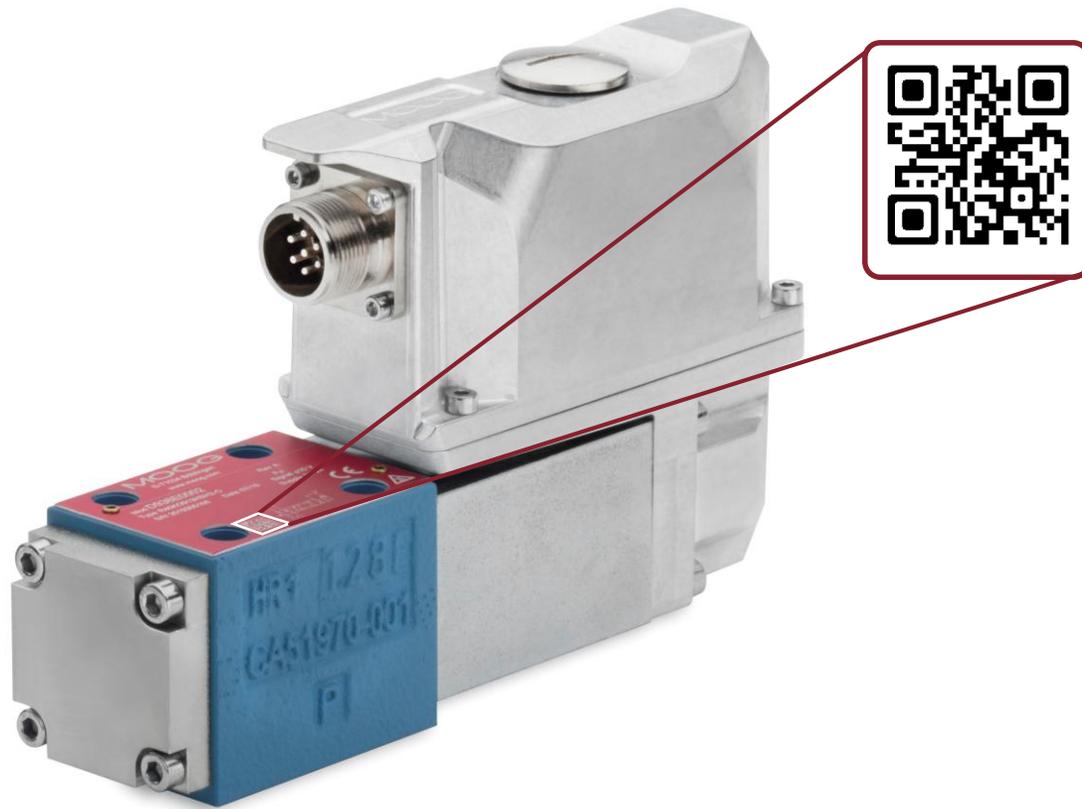
These servo-proportional valves were designed to offer high resistance to thermal stress and vibration. The compact design allows space saving system design and seamless integration into your machine.

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- 3D model
- drawing
- datasheet
- catalog

MOOG

/ THANK YOU /

LETS MAKE THE IMPOSSIBLE POSSIBLE
TOGETHER

