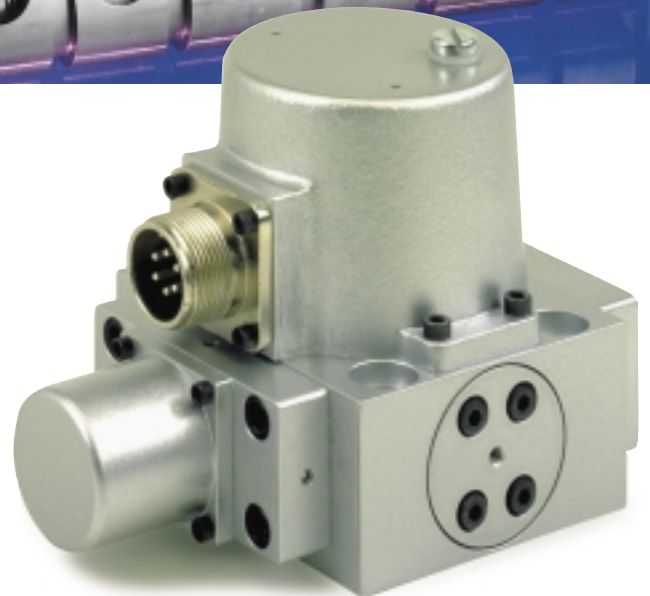


**D765 Series**  
**Servovalves with Electronic Feedback**  
**and Integrated Electronics**  
ISO 10372 Size 04



# D765 SERIES TWO STAGE SERVOVALVES

## D765 SERIES SERVOVALVES

The D765 Series flow control servovalves are throttle valves for 3- and preferably 4-way applications.

The design of these valves is based on the well known 760 and D761 Series. The mechanical feedback has been replaced by a position transducer for electrical feedback. Integrated electronics close the position loop for the main spool.

These valves are suitable for electrohydraulic position, speed, pressure or force control systems with high dynamic response requirements.

### Principle of operation

An electrical command signal (flow rate set point) is applied to the integrated position controller to the torque motor coils, and creates a magnetic force which acts on the ends of the pilot stage armature. This causes a deflection of armature/flapper assembly within the flexure tube. Deflection of the flapper

restricts fluid flow through one nozzle, which is carried through to one spool end, displacing the spool.

Movement of the spool opens the supply pressure port (P) to one control port while simultaneously opening the tank port.

The position transducer (LVDT), which is excited via an oscillator, measures the position of the spool (actual value, position voltage). The signal is then demodulated and fed back to the controller where it is

compared with the command signal. The controller drives the pilot stage until the error between command signal and feedback signal will be zero. Thus, the position of the main spool is proportional to the electrical command signal.

**CE** The valve D765 Series described in this catalog has successfully passed EMC tests required by EC Directive. Please take notice of the respective references in the electronics section.

## VALVE FEATURES

- 2-stage design with dry torque motor
- Low friction double nozzle pilot stage
- High spool control forces
- Electrical feedback with pressure isolated position transducer (LVDT)

- Integrated electronics with built in false polarity protection
- High resolution, low hysteresis
- Completely set-up at the factory
- Field replaceable pilot stage filter

The actual flow is dependent upon electrical command signal and valve pressure drop. The flow for a given valve pressure drop can be calculated using the square root function for sharp edge orifices:

$$Q = Q_N \sqrt{\frac{\Delta p}{\Delta p_N}}$$

$Q$  [gpm] = calculated flow

$Q_N$  [gpm] = rated flow

$\Delta p$  [psi] = actual valve pressure drop

$\Delta p_N$  [psi] = rated valve pressure drop

## EXTERNAL PILOT PRESSURE

If large flow rates with high valve pressure drop are required an appropriate higher pilot pressure has to be chosen to overcome the flow forces. An approximate value can be calculated as follows:

$$P_x \geq 2.5 \cdot 10^{-2} \cdot \frac{Q}{A_k} \cdot \sqrt{\Delta p}$$

$Q$  [gpm] = max. flow

$\Delta p$  [psi] = valve pressure drop with  $Q$

$A_k$  [in<sup>2</sup>] = spool drive area

$P_x$  [psi] = pilot pressure

The pilot pressure  $p_x$  has to be at least 215 psi above the return pressure of the pilot stage.

Our Quality Management System is certified in accordance with DIN EN ISO 9001.

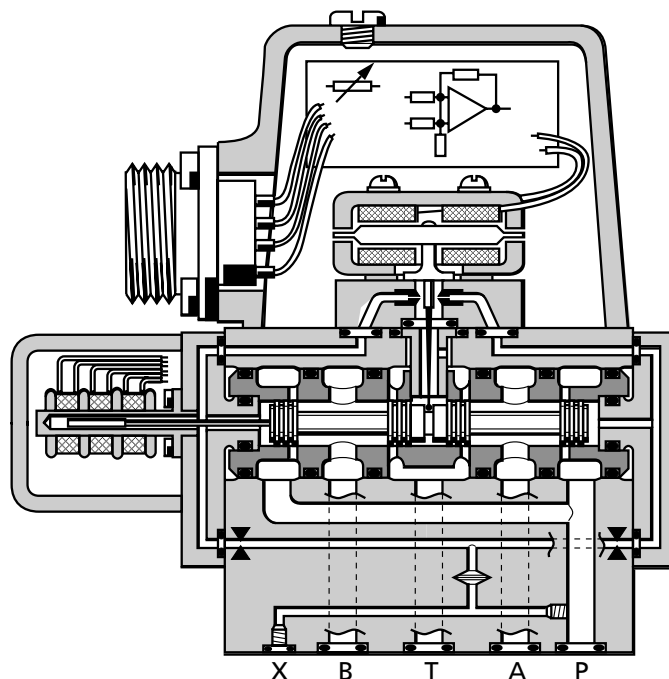
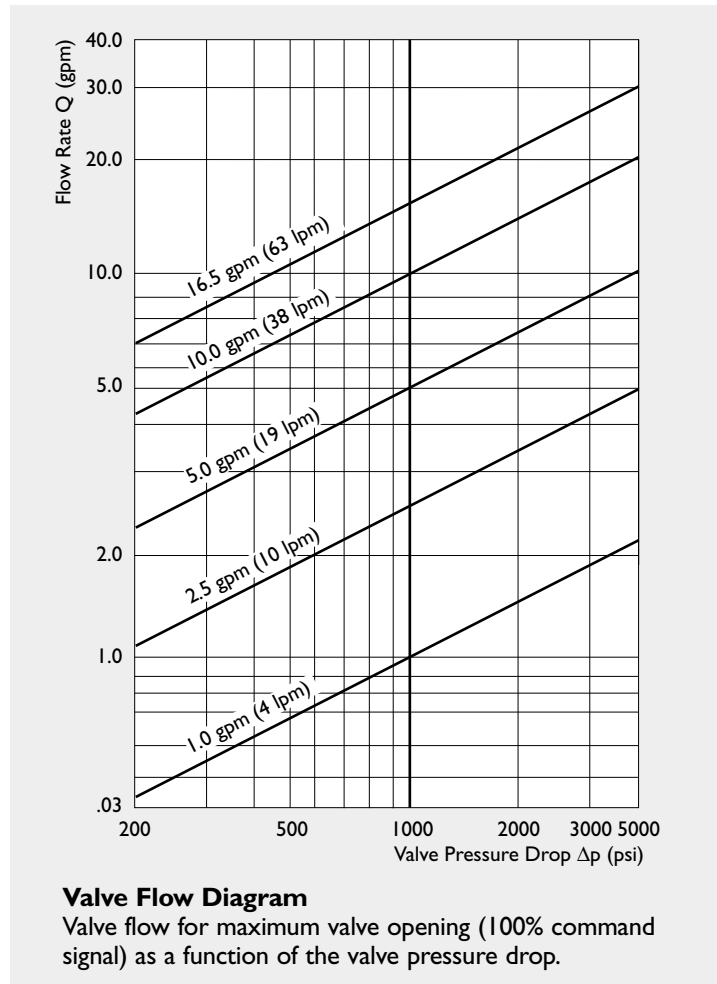


This catalog is for users with technical knowledge. To ensure that all necessary characteristics for function and safety of the system are given, the user has

to check the suitability of the products described here. In case of doubt, please contact Moog.

**D765 SERIES**  
**GENERAL TECHNICAL DATA**

<b>Operating Pressure</b>	ports P, X, A and B port T	up to 4,500 psi (315 bar) up to 3,000 psi (210 bar)
<b>Temperature Range</b>	Ambient Fluid	-4°F to 140°F (-20°C to 60°C) -4°F to 176°F (-20°C to 80°C)
<b>Seal Material</b>		Fluorocarbon, others on request
<b>Operating Fluid</b>		Compatible with common hydraulic fluids, other fluids on request.
	Recommended viscosity	60 – 450 SUS @ 100°F
<b>System Filtration:</b>	High pressure filter (without bypass, but with dirt alarm) mounted in the main flow and, if possible, directly upstream of the valve.	
<b>Class of Cleanliness:</b>	The cleanliness of the hydraulic fluid greatly effects the performance (spool positioning, high resolution) and wear (metering edges, pressure gain, leakage) of the servovalve.	
<b>Recommended Cleanliness Class</b>		
	For normal operation	ISO 4406 < 14/11
	For longer life	ISO 4406 < 13/10
<b>Filter Rating</b> recommended		
	For normal operation	$\beta_{10} \geq 75$ (10 $\mu$ m absolute)
	For longer life	$\beta_5 \geq 75$ (5 $\mu$ m absolute)
<b>Installation Operations</b>	Any position, fixed or movable.	
<b>Vibration</b>	30 g, 3 axes	
<b>Weight</b>	2.43 lbs (1.1 kg)	
<b>Degree of Protection</b>	EN60529P: class IP65, with mating connector mounted.	
<b>Shipping Plate</b>	Delivered with an oil sealed shipping plate.	



# D765 SERIES TECHNICAL DATA

**Model...Type**  
**Mounting Pattern**  
**Valve Body Version**

**D765-.....**

ISO 10372 - 04 - 04 - 0 - 92

4-way

2-stage with spool-bushing assembly

Nozzle/Flapper, High flow

X

**Pilot Stage**

**Pilot Connection**

Optional, Internal or External

**Rated Flow**

(±10%) at  $\Delta p_N = 1,000$  psi

Standard	[gpm]	1.0	2.5	5.0	10.0	16.5
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High Response	[gpm]	1.0	2.5	5.0	10.0	—
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**Response Time\***

Standard	[ms]	4	4	4	4	8
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High Response	[ms]	2	2	2	3	—
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**Threshold\***

[%] < 0.1

**Hysteresis\***

[%] < 0.3

**Null Shift**

at  $\Delta T = 100^\circ F$  [%] < 1.0

**Null Leakage Flow\***

max. [gpm] 0.40 to 0.61

**Pilot Leakage Flow\***

typical [gpm] 0.21

**Pilot Flow\***

For 100% Step Input [gpm] 0.11

**Spool Drive Area**

Standard [in<sup>2</sup>] 0.08

High Response [in<sup>2</sup>] 0.05

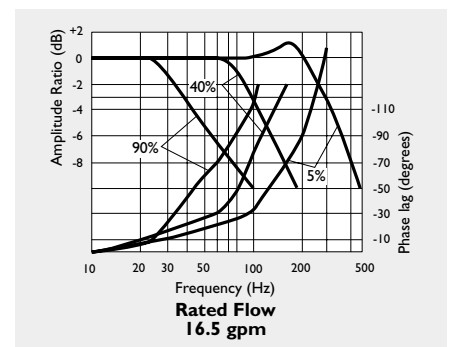
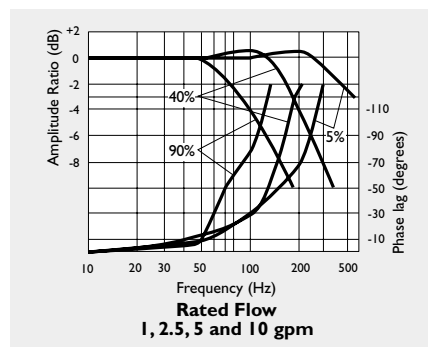
\* Measured at 3,000 psi (210 bar) pilot or operating pressure, and fluid viscosity of 32 mm<sup>2</sup>/s

**Flow Gain** in the null region (±3% signal) typically 50 to 200% nominal gain

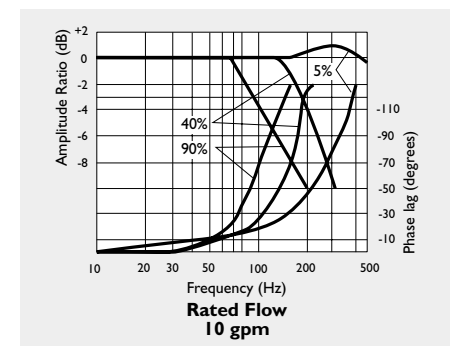
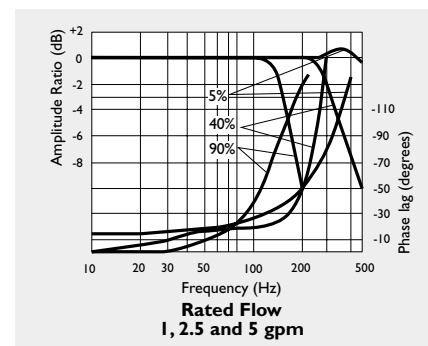
## Typical Characteristic Curves

with ±5%, ±40% and ±90% input signal, measured at 3,000 psi (210 bar) pilot or operating pressure respectively, and fluid viscosity of 32mm<sup>2</sup>/s and fluid temperature of 104°F (40°C).

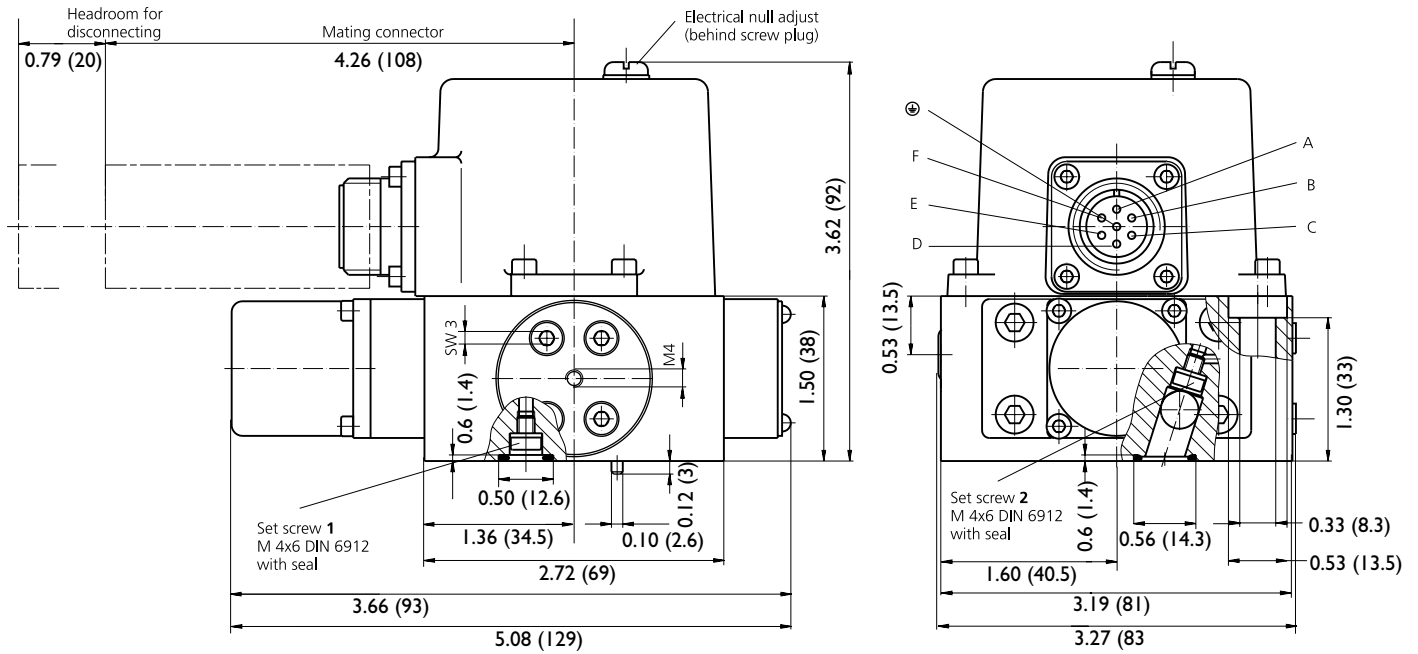
## Standard Valves



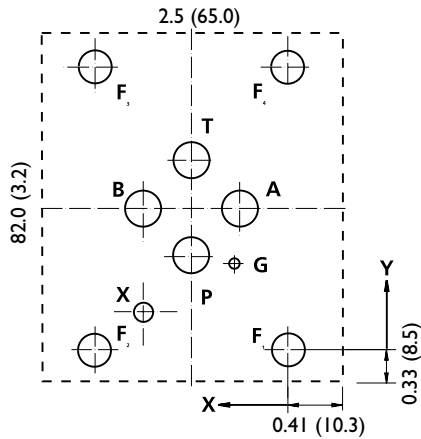
## High Response Valves



# D765 SERIES INSTALLATION DRAWINGS



**The mounting manifold must conform to ISO 10372-04-04-0-92.** Mounting surface needs to be flat within 0.005 [0.01mm]. Average surface finish value, Ra, better than 0.8µm.



	P	A	T	B	G	X
<b>DIA</b>	0.32	0.32	0.32	0.32	0.14	0.20
<b>X</b>	0.87	0.44	0.87	1.31	0.48	1.31
<b>Y</b>	0.84	1.28	1.72	1.28	0.78	0.34
	<b>F1</b>	<b>F2</b>	<b>F3</b>	<b>F4</b>		
<b>THD</b>	M8	M8	M8	M8		
<b>X</b>	0	1.75	1.75	0		
<b>Y</b>	0	0	2.56	2.56		

## CONVERSION INSTRUCTION

For operation with internal or external pilot connection.	Pilot flow supply	Set screw bore I (M4 X 6 DIN 6912) 2	
	Internal P	closed	open
External X	open	open	closed

## SPARE PARTS AND ACCESSORIES

O-Rings (included in delivery), for P,T,A and B	FPM 85 Shore ID 0.426 x 0.070	42082-022	Mounting Bolts (not included in delivery) M8 x 45 DIN EN ISO 4762-10.9 (4 pieces)	A03665-080-045
for X	ID 0.364 x 0.070	42082-013	Required torque	13.3 ft-lbs
Mating Connector, waterproof IP 65 (not included in delivery) 6+PE-pole	EN 175201 part 804*	B97007-061	Replaceable Filter	A67999-065
Flushing Plate		55127-001 (int.) 55127-002 (ext.)	O-Rings for Filter Change (2 pieces)	A25163-013-015
			Screw Internal/External M4 x 6 DIN 6912	76689-040-006
			Seal for Screw Internal/External	A25528-040
			Seal for Null Adjust Screw Plug	76425-050

## D765 SERIES ELECTRICAL CONNECTIONS

### Command signal 0 to $\pm 10$ mA Valves with current command input, floating

The spool stroke of the valve is proportional to  $I_D = -I_E$ . 100% valve opening P  $\blacktriangleright$  B and A  $\blacktriangleright$  T is achieved at  $I_D = +10$  mA. At 0 mA command, the spool is in centered position.

The input pins D and E are inverting. Either pin D or E is used according to the required operating direction. The other pin is connected to signal ground  $\perp$  (0V) at cabinet side.

### Command signal 0 to $\pm 10$ V Valves with voltage command input

The spool stroke of the valve is proportional to differential input ( $U_D - U_E$ ). 100% valve opening P  $\blacktriangleright$  B and A  $\blacktriangleright$  T is achieved at  $(U_D - U_E) = +10$  V. At 0V command, the spool is in centered position.

If only one command signal is available, pin D or E is connected to signal ground according to the required operating direction (to be done at cabinet side).

### Actual value 0 to $\pm 10$ mA Valves with current command input

The actual spool position value can be measured at pin F. This signal can be used for monitoring and fault detection purposes.

The spool stroke range corresponds to  $\pm 10$  mA. +10 mA corresponds to 100% valve opening P  $\blacktriangleright$  B and A  $\blacktriangleright$  T.

### Actual value 0 to $\pm 10$ V Valves with voltage command input

The actual spool position value can be measured at pin F. This signal can be used for monitoring and fault detection purposes.

The spool stroke range corresponds to  $\pm 10$  V. +10V corresponds to 100% valve opening P  $\blacktriangleright$  B and A  $\blacktriangleright$  T.

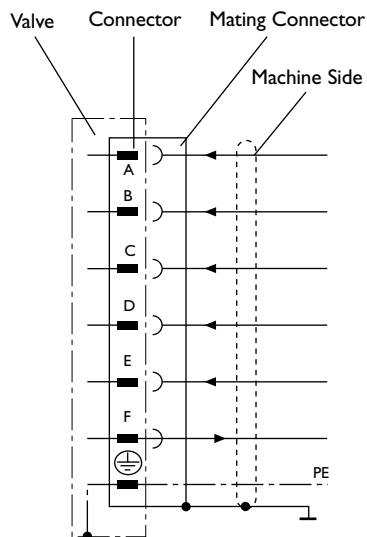
## GENERAL REQUIREMENTS

- > Supply  $\pm 15$  VDC  $\pm 3\%$ . Ripple  $< 50$  mV<sub>pp</sub>. Current consumption max.  $\pm 100$  mA
- > All signal lines, all those of external transducers, shielded
- > Shielding connected radially to  $\perp$  (0V), power supply side, and connected to the mating connector housing (EMC)
- > **EMC:** Meets the requirements of EN 55011/03.91 class B, EN 50081-1/01.92 and EN 50082-2/03.95, performance criterion class A.

- > Minimum cross section of all leads  $\geq 0.75$  mm<sup>2</sup>. Consider voltage losses between cabinet and valve.
- > Note: When making electrical connections to the valve (shield, protective grounding), appropriate measures must be taken to ensure that locally different earth potentials do not result in excessive ground currents. See also Moog Application Note AM 353 E.

## CONNECTOR WIRING

Valve with 6+PE pole connector to EN 175201 part 804<sup>1</sup> and mating connector (type R and S, metal shell) with leading protective earth connection ( $\perp$ ).



Function	Voltage Command	Current Command
Supply	+15 VDC $\pm 3\%$ , ripple $< 50$ mV <sub>pp</sub>	
Supply	-15 VDC $\pm 3\%$ , ripple $< 50$ mV <sub>pp</sub>	
Supply / Signal Ground	$\perp$ (0V)	
Input Command Valve Flow	0... $\pm 10$ VDC Input Resistance = 10 k $\Omega$	0... $\pm 10$ mA Load Resistance (diff.) = 1 k $\Omega$
Input Inverted Command Valve Flow	0... $\pm 10$ VDC Input Resistance = 10 k $\Omega$	0... $\pm 10$ mA Load Resistance (diff.) = 1 k $\Omega$
Output Actual Value* Spool Position	0... $\pm 10$ VDC Load Resistance min. = 1 k $\Omega$	0... $\pm 10$ mA Load Resistance max. = 1 k $\Omega$
Protective Earth		

**D765 SERIES  
ORDERING INFORMATION  
SPARE PARTS AND ACCESSORIES**

**Model Number**

**D765** • • • • •

**Type Designation**

• • • • • • • • • • • • • • • • •

Specification Status	
–	Series specification
E	Preseries specification
Z	Special specification

Model Designation	
	Assigned at the factory

**Factory Identification (Revision Level)**

Valve Version	
S	Standard response
H	High response

Rated Flow		
	$Q_N$ [gpm] at $\Delta p_N = 1,000$ psi	
	Standard	High Response
04	1.0	1.0
10	2.5	2.5
19	5.0	5.0
38	10.0	10.0 (only to 3625 psi)
63	16.5	—

Maximum Operating Pressure $p_p$ and Body Material	
F	3,000 psi aluminum
J	4,500 psi aluminum
K	5,000 psi steel

Bushing Spool Type	
O	4-way / axis cut / linear
	Others upon request

Electrical Supply	
0	$\pm 15$ VDC $\pm 3\%$ , ripple $< 50$ mV <sub>pp</sub>

Signals for 100% Spool Stroke		
	Command	Output
A	$\pm 10$ V	$\pm 10$ V
X	$\pm 10$ mA, floating	$\pm 10$ mA

Valve Connector		
R	6 + PE pole DIN 43563	over port A
S	6 + PE pole DIN 43563	over port B

Seal Material	
V	Fluorocarbon
	Others on request

Pilot Connections and Pressure		
	Pressure [psi]	Supply
A	215 to 3,000	internal
C	215 to 3,000	external
E	215 to 4,500	internal
G	215 to 4,500	external
J	350 to 5,000	internal
L	350 to 5,000	external

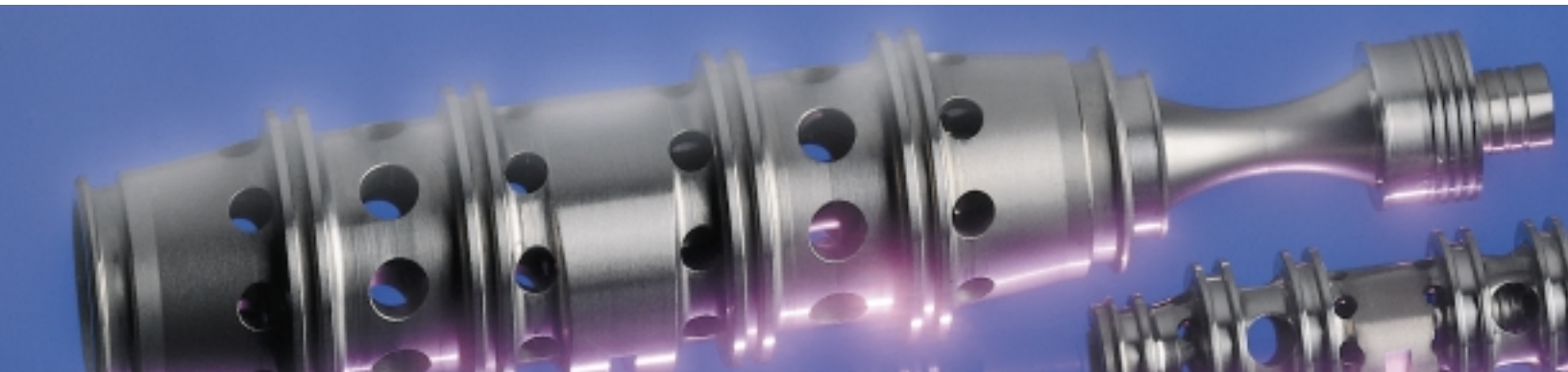
Spool Position without Electrical Signal	
A	P $\updownarrow$ B, A $\updownarrow$ T
B	P $\updownarrow$ A, B $\updownarrow$ T
M	Mid position

Pilot Stage	
G	with additional mechanical feedback

**Preferred configurations highlighted.  
All combinations may not be available.  
Options may increase price and delivery.  
Technical changes are reserved.**



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