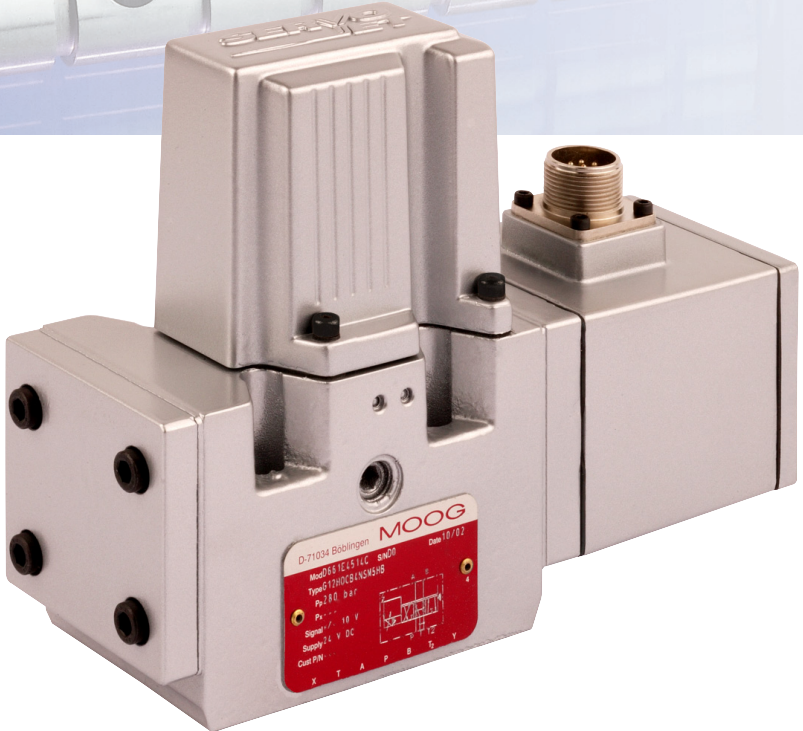
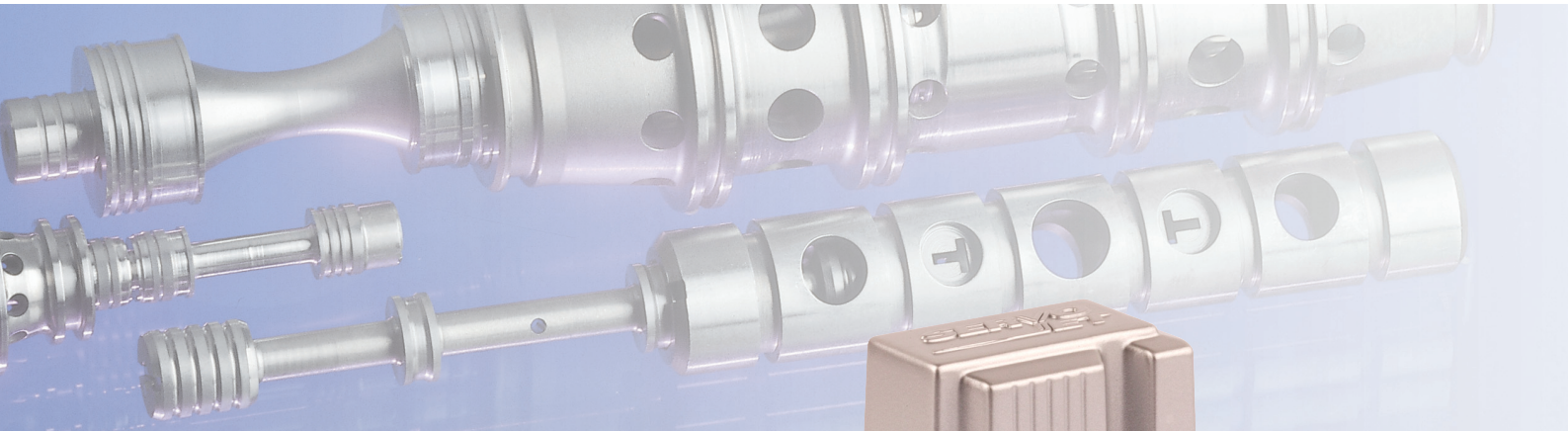


## Servo valve with Bushing and integrated 24 Volt Electronics D661 Highresponse Series ISO 4401 Size 05



# D661 Highresponse Series

## Two stage servovalves

### with highresponse pilot stage

The flow control servovalves D661 Highresponse Series are throttle valves for 2-, 3- and 4-way applications. These valves are suitable for electrohydraulic position, velocity, pressure or force control systems including those with high dynamic response requirements.

The spool of the main stage is driven by a jet pipe pilot stage in an electrically closed loop.


The integrated electronics of the valve is a new development featuring SMD technology and requires 24 VDC power supply.

#### Operational features of the ServoJet Highresponse pilot stage

The ServoJet Highresponse pilot stage consists mainly of torque motor, jet pipe and receiver.

A current through the coil displaces the jet pipe from neutral. This displacement combined

with the special shape of the nozzle directs a focussed fluid jet more into one receiver opening than the other. The jet now produces a pressure difference in the control ports. This pressure difference results in a pilot flow which in turn causes a spool displacement. The pilot stage drain is through the annular area around the nozzle to tank.

 The valve series described in this catalogue has successfully passed EMC tests required by EC Directive. Please take notice of the respective references in the electronics section.

The actual flow depends on the electrical command signal and the valve pressure drop. For different values of valve pressure drop, the flow may be calculated by the square root function for a sharp edged orifice:

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

- Q [l/min] = calculated flow
- Q<sub>N</sub> [l/min] = rated flow
- Δp [bar] = actual valve pressure drop
- Δp<sub>N</sub> [bar] = rated valve pressure drop

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:

$$p_x \geq 1,7 \cdot 10^{-2} \cdot \frac{Q}{A_K} \cdot \sqrt{\Delta p}$$

- Q [l/min] = max. flow
- Δp [bar] = valve pressure drop with Q
- A<sub>K</sub> [cm<sup>2</sup>] = spool drive area
- p<sub>x</sub> [bar] = pilot pressure
- The pilot pressure p<sub>x</sub> has to be at least 25 bar above the return pressure of the pilot stage.

#### Principle of operation

An electric command signal (flow rate setpoint) is applied to the integrated control amplifier which drives the pilot stage. Thus the deflected ServoJet highresponse system produces a pressure difference across the drive areas of the spool and effects its movement. The position transducer which is supplied via an oscillator measures the position

of the spool (actual value, position voltage). This actual value is being rectified by a demodulator and fed back to the control amplifier where it is compared with the command value. The control amplifier drives the torque motor until command voltage and feedback voltage are equal. Thus, the position of the spool is proportional to the electric command signal.

**Our quality management system is conformed to DIN EN ISO 9001.**

This catalogue 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 herein. In case of doubt please contact MOOG.

# D661 Highresponse Series

## General technical data

### Operating pressure range

Ports P, A and B up to 350 bar (5000 psi)  
 Ports T, T<sub>2</sub> for Y internal up to 210 bar (3000 psi)  
 Ports T, T<sub>2</sub> for Y external up to 350 bar (5000 psi)

### Temperature range

Ambient -20° C to +60° C (-4° F to +140° F)  
 Fluid -20° C to +80° C (-4° F to +176° F)

### Seal material

NBR, FPM and others on request

### Operating fluid

mineral oil based hydraulic fluid (DIN 51524, part 1 to 3), other fluids on request

Viscosity recommended 15 to 100 mm<sup>2</sup>/s (0,02 to 0,16 in<sup>2</sup>/s)  
 allowable 5 to 400 mm<sup>2</sup>/s (0,008 to 0,62 in<sup>2</sup>/s)

**System filtration: Pilot stage:** high pressure filter (without bypass, but with dirt alarm) mounted in the main flow and if possible directly upstream of the valve. **Main stage:** high pressure filter as for the pilot stage. In combination with a fast regulating variable displacement pump an off-line filter is recommended.

**Class of cleanliness** The cleanliness of the hydraulic fluid particularly effects the performance (spool positioning, high resolution) and wear (metering edges, pressure gain, leakage) of the valve.

### Recommended cleanliness class

ISO 4406: 1999  
 For normal operation: < 19 / 16 / 13  
 For longer life: < 17 / 14 / 11

### Filter rating recommended

For normal operation:  $\beta_{15} \geq 75$  (15µm absolute)  
 For longer life:  $\beta_{10} \geq 75$  (10µm absolute)

### Installation options

any position, fixed or movable

### Vibration

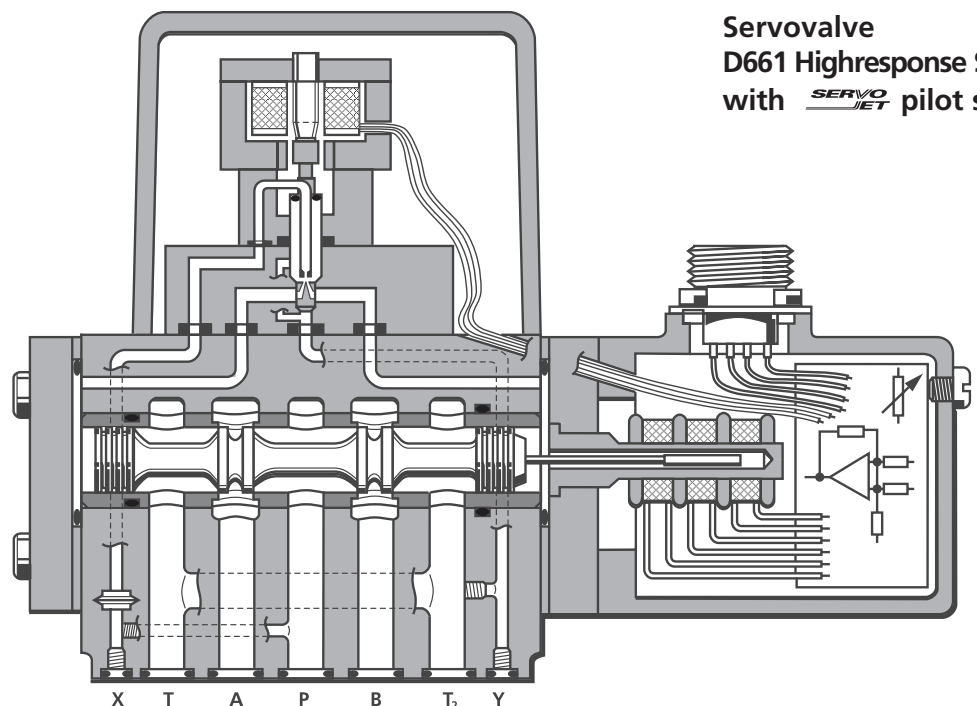
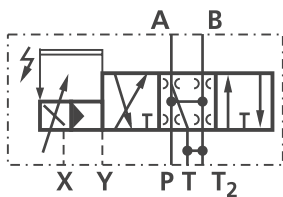
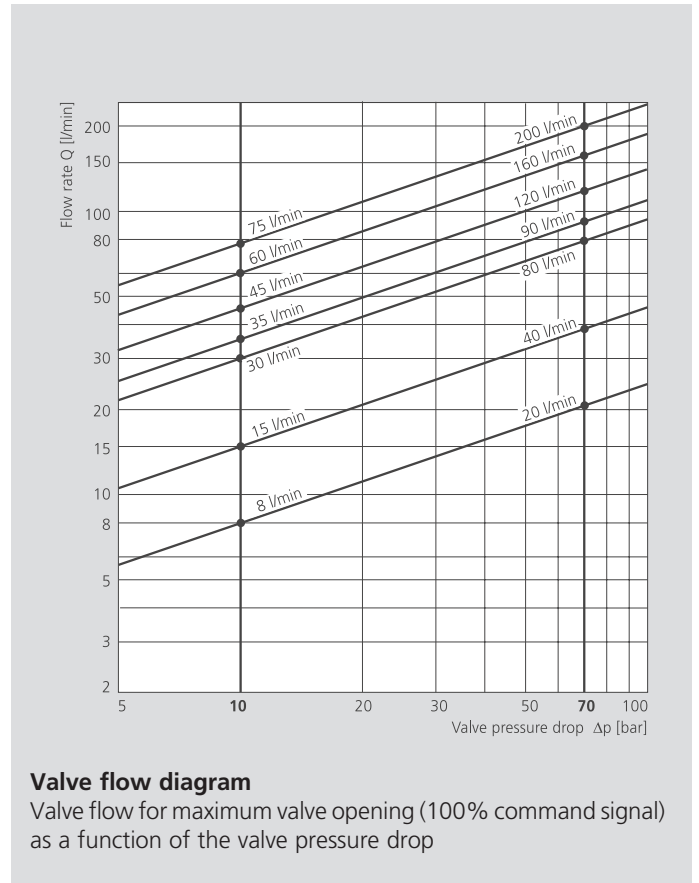
30 g, 3 axes

### Degree of protection

EN 60529 class IP 65, with mating connector mounted

### Shipping plate

Delivered with an oil sealed shipping plate



# D661 Highresponse Series

## Technical data

### Model . . . Type

**Mounting pattern** ISO with additional 2<sup>nd</sup> T-port  
**Valve version**

### D661 - . . . . . G . . . . . C

ISO 4401 - 05 - 05 - 0 - 94

4-way

2- stage with bushing spool assembly  
 highresponse

### Pilot stage

ServoJet

### Pilot connection

Optional, internal or external

### Mass

[kg (lb)]

### Rated flow

(±10%) at  $\Delta p_N = 35$  bar (500 psi) per land [l/min (gpm)]

### Operating pressure

max.

Main stage:

ports P with X external, A, B [bar (psi)]

port T, T<sub>2</sub> with Y internal [bar (psi)]

port T, T<sub>2</sub> with Y external [bar (psi)]

Pilot stage:

regular version [bar (psi)]

with dropping orifice (on request) [bar (psi)]

for 0 to 100 % stroke [ms]

### Response time\*

### Threshold\*

### Hysteresis\*

### Null shift

with  $\Delta T = 55$  K

### Null leakage flow\*

total max. (~ critical lap)

### Pilot leakage flow\*

### Pilot flow\*

max., for 100% step input

### Spool stroke

### Spool drive area

\* at operating or pilot pressure 210 bar (3000 psi), fluid viscosity of 32 mm<sup>2</sup>/s (0.05 in<sup>2</sup>/s) and fluid temperature of 40° C (104° F)

X and Y

5,7 (12.6)

**20/90 (5.3/23.8)**

X and Y

5,7 (12.6)

**40/80 (10.6/21.1)**

X and Y

5,7 (12.6)

**120/160/200 (31.7/42.3/52.8)**

350 (5000)

210 (3000)

350 (5000)

280 (4000)

350 (5000)

**6,5**

< 0,1

< 0,4

< 2,0

3,9/5,4 (1.0/1.4)

2,6 (0.7)

**2,6 (0.7)**

± 1,3 (0.051)

1,35 (0.21)

350 (5000)

210 (3000)

350 (5000)

280 (4000)

350 (5000)

**11**

< 0,08

< 0,3

< 1,5

4,7 (1.2)

2,6 (0.7)

**2,6 (0.7)**

± 2,0 (0.079)

1,35 (0.21)

350 (5000)

210 (3000)

350 (5000)

280 (4000)

350 (5000)

**14**

< 0,05

< 0,2

< 1,0

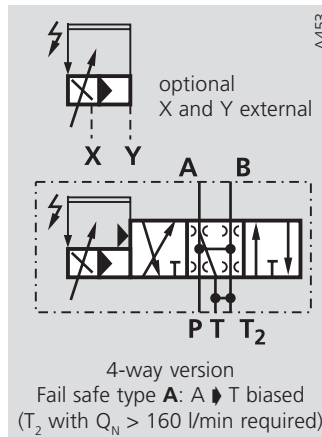
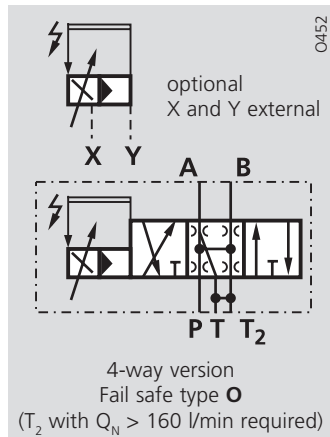
5,4 (1.4)

2,6 (0.7)

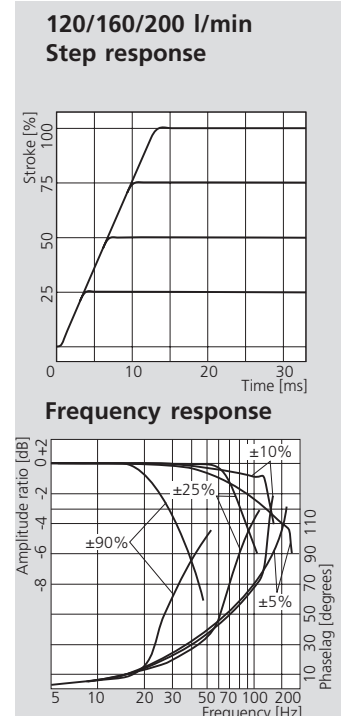
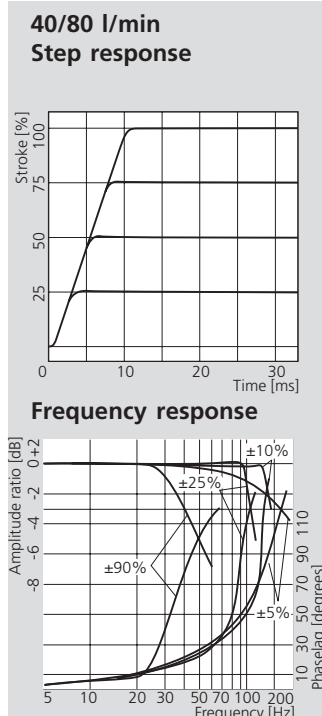
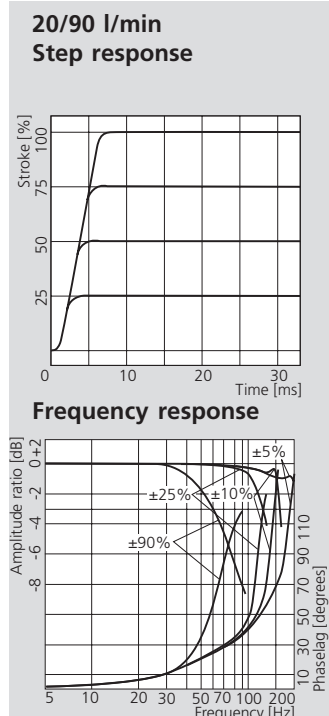
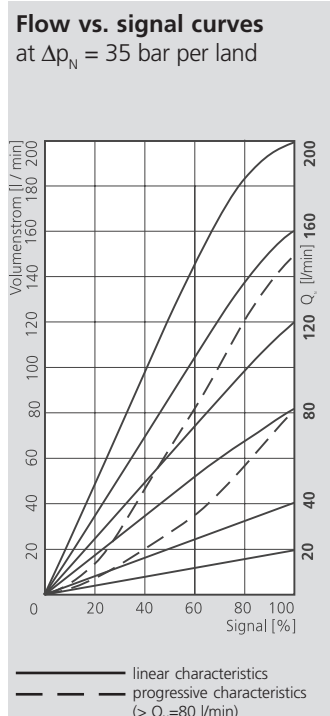
**2,6 (0.7)**

± 3,0 (0.118)

1,35 (0.21)



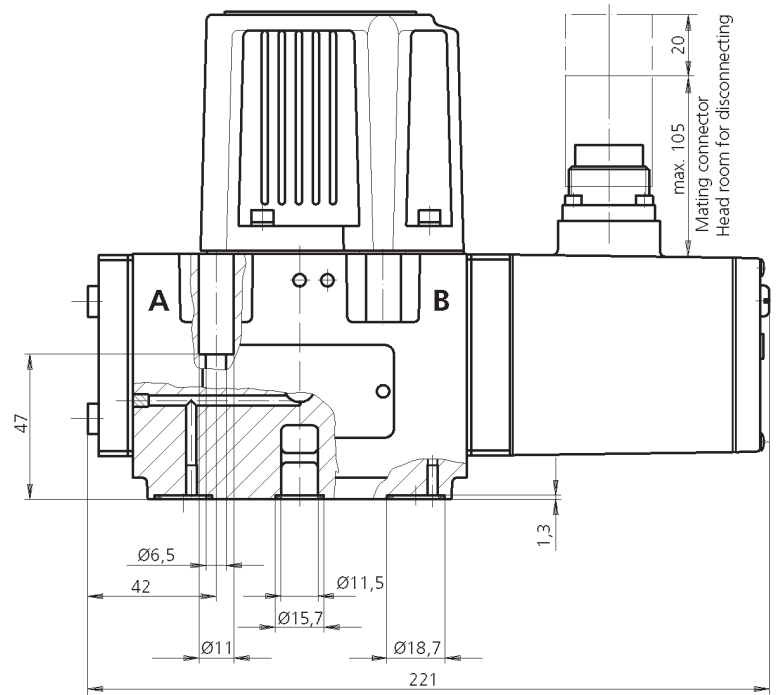
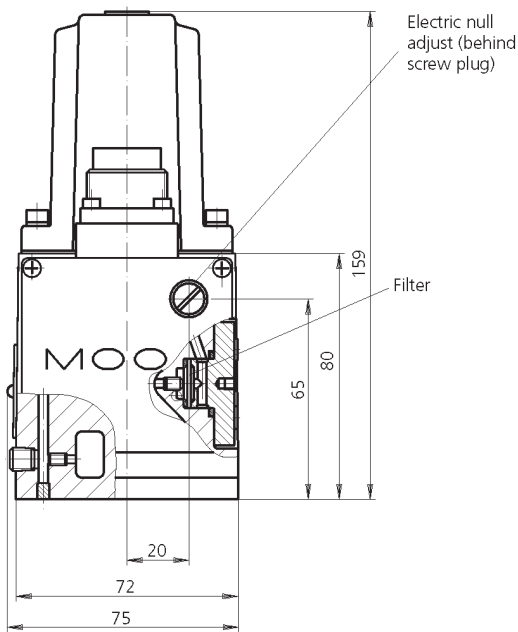
**Typical characteristic curves** at operating or pilot pressure 210 bar (3000 psi), fluid viscosity of 32 mm<sup>2</sup>/s (0.05 in<sup>2</sup>/s) and fluid temperature of 40° C (104° F)



# D661 Highresponse Series

## Installation drawing

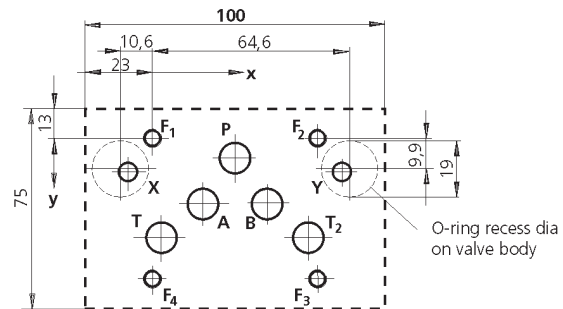
### Spare parts, Accessories



**The mounting manifold must conform to ISO 4401-05-05-0-94. Attention: Mounting length min. 100 mm. Notice O-ring recess dia of X and Y ports.**

For valves in 4-way version with  $Q_N > 160 \text{ l/min}$  the non standard 2<sup>nd</sup> return port  $T_2$  must be used. For maximum flow the manifold

ports P, T, A and B require to have **11,5 mm dia** (deviation from standard). Mounting surface needs to be flat within 0,01 mm over a distance of 100 mm. Average surface finish value, Ra, better than 0,8  $\mu\text{m}$ .



	P	A	B	T	T <sub>2</sub>	X	Y	F <sub>1</sub>	F <sub>2</sub>	F <sub>3</sub>	F <sub>4</sub>
	Ø11,5	Ø11,5	Ø11,5	Ø11,5	Ø11,5	Ø6,3	Ø6,3	M6	M6	M6	M6
x	27	16,7	37,3	3,2	50,8	-8	62	0	54	54	0
y	6,3	21,4	21,4	32,5	32,5	11	11	0	0	46	46

### Spare parts and Accessories

O-rings (included in delivery)								NBR 85 Shore	FPM 85 Shore		
for P, T, T <sub>2</sub> , A, B		5 pieces ID 12,4 x Ø 1,8						45122 004	42082 004		
for X, Y		2 pieces ID 15,6 x Ø 1,8						45122 011	42082 011		
Mating connector, waterproof IP65 (not included in delivery)											
6+PE pole		B97007 061		EN 175201-804							
Flushing plates		for P, A, B, T, T <sub>2</sub> , X, Y		for P, T, T <sub>2</sub> , X, Y							
		B67728 001		B67728 002							
								B67728 003			
Mounting manifolds		see special data sheet									
Mounting bolts (not included in delivery)				required torque				required			
M 6 x 60 DIN EN ISO 4762-10.9		A03665 060 060		13 Nm				4 pieces			
Replaceable filter		A67999 200		200 $\mu\text{m}$ nominal							
O-rings for filter change				HNBR 85 Shore							
filter		1 piece ID 12 x Ø 2,0		—				NBR 85 Shore	FPM 85 Shore		
filter cover		1 piece ID 17,1 x Ø 2,6		B97009 080				66117 012 020	A25163 012 020		

# D661 Highresponse Series

## Valve electronics with supply voltage 24 Volt

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

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

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

The spool stroke of the valve is proportional to  $(U_D - U_E)$ . 100 % valve opening P  $\rightarrow$  A and B  $\rightarrow$  T is achieved at  $(U_D - U_E) = +10$  V. At 0 V command the spool is in centred position. The input stage is a differential amplifier. If only one command signal is available, pin D or E is connected to signal ground at cabinet side, according to the required operating direction.

### Actual value 4 to 20 mA

The actual spool position value can be measured at pin F (see diagram below). This signal can be used for monitoring and fault detection purposes. The spool stroke range corresponds to 4 to 20 mA. The centred position is at 12 mA. 20 mA corresponds to 100 % valve opening P  $\rightarrow$  A and B  $\rightarrow$  T.

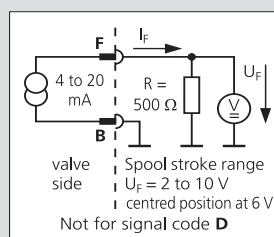
The position signal output 4 to 20 mA allows to detect a cable break when  $I_F = 0$  mA.

For failure detection purposes it is advised to connect pin F of the mating connector and route this signal to the control cabinet.

### General requirements

- Supply 24 VDC, min. 18 VDC, max. 32 VDC  
Current consumption max. 300 mA
- All signal lines, also those of external transducers, shielded.
- Shielding connected radially to  $\perp$  (0 V), power supply side, and connected to the mating connector housing (EMC).
- EMC:** Meets the requirements of EN 55011:1998, class B, EN 50082-2:1995, 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 electric connections to the valve (shield, protective earth) 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.

### Circuit diagram for measurement of actual value $I_F$ (position of main spool)



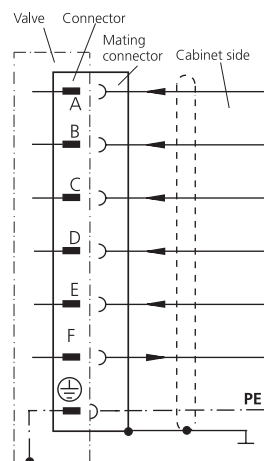
### Note: Enable input

- With enable signal off, the main spool will move to a safe position.
- a) Centred position (unbiased pilot valve) function code **A**<sup>1)</sup>
  - b) End position (biased pilot valve) function code **B**<sup>1)</sup>

<sup>1)</sup> see type designation

### Wiring for valves with 6+PE pole connector

to EN 175201 Part 804 <sup>2)</sup>, and mating connector (type R and S, metal shell) with leading protective earth connection ( $\perp$ ). See also wiring instructions AM 426 E.



Function	Voltage command	Current command
Supply	24 VDC (min. 18 VDC, max. 32 VDC). $I_{max} = 300$ mA	
Supply / Signal ground	$\perp$ (0 V)	
Enabled Not enabled	$U_{C-B} > +8,5$ VDC $U_{C-B} < +6,5$ VDC	$I_e = 2,0$ mA at 24 VDC (see note above)
Input rated command (differential)	$U_{D-E} = 0$ to $\pm 10$ V $R_e = 10$ k $\Omega$	Input command $I_D = -I_E$ : 0 to $\pm 10$ mA ( $R_e = 200$ $\Omega$ ) Input command (inverted) $I_E = -I_D$ : 0 to $\pm 10$ mA ( $R_e = 200$ $\Omega$ ) Input voltage for $U_{D-B}$ and $U_{E-B}$ for both signal types is limited to min. $-15$ V and max. $+32$ V
Output actual value spool position	$I_{F-B} = 4$ to 20 mA. At 12 mA spool is in centred position. $R_L = 100$ to 500 $\Omega$ Signal code <b>D</b> (see page 7): $U_{F-B} = 2$ to 10 V. At 6 V spool is in centred position. $R_a = 500$ $\Omega$	
Protective earth		

<sup>2)</sup> formerly DIN 43563

# D661 Highresponse Series

## Ordering information

Model-Number

Type designation

**D661**

. . . . .

**G . . . . . C . . . . S . 2 H .**

### Specification status

-	Series specification
<b>K</b>	Explosion proof version on request
<b>Z</b>	Special specification

### Model designation

assigned at the factory

### Factory identification

### Valve version

**G** Standard spool

### Rated flow

	Q <sub>N</sub> [l/min] at Δp <sub>N</sub>		stroke [mm]
	70 bar	10 bar	
<b>08</b>	20	8	±1,3
<b>15</b>	40	15	±2,0
<b>30</b>	80	30	±2,0
<b>35</b>	90	35	±1,3
<b>45</b>	120	45	±3,0
<b>60</b>	160	60	±3,0
<b>75</b>	200	75	±3,0

### Maximum operating pressure

<b>B</b>	70 bar
<b>H</b>	280 bar. At p <sub>x</sub> ≤ 280 bar (X and Y external) operating pressure in ports P, A, B and T up to 350 bar allowed.
<b>K</b>	350 bar

### Bushing / spool type

<b>O</b>	4- way: critical lap, linear characteristic
<b>S</b>	4- way: critical lap, curvilinear characteristic, > Q <sub>N</sub> = 80 l/min
<b>X</b>	Special bushing on request

### Pilot stage version

**C** ServoJet-Highresponse

### Function code

<b>O</b>	No enable input. Pin C not used
<b>A</b>	Without enable signal applied the spool moves to adjustable centred position
<b>B</b>	Without enable signal applied the spool moves to defined position A ↗ T or B ↗ T

### Valve dynamics

**H** High performance

### Electric supply

**2** 24 V DC (18 to 32 VDC)

### Signals for 100% spool stroke

	Command	Output
<b>D</b>	± 10 V	2 to 10 V
<b>M</b>	± 10 V	4 to 20 mA
<b>X</b>	± 10 mA	4 to 20 mA

### Valve connector

**S** 6 + PE - pole EN 175201-804 Type R or S

### Seal material

<b>N</b>	NBR Standard
<b>V</b>	FPM (Viton) option

### Pilot connections

	Supply	Return
<b>4</b>	internal	internal
<b>5</b>	external	internal
<b>6</b>	external	external
<b>7</b>	internal	external

### Spool position without electric supply

**O** undefined (no fail safe function)

	Mechanical fail safe versions	achieved at
<b>A</b>	P ↗ B, A ↗ T connected	p <sub>x</sub> > 25 bar
<b>B</b>	P ↗ A, B ↗ T connected	p <sub>x</sub> > 25 bar

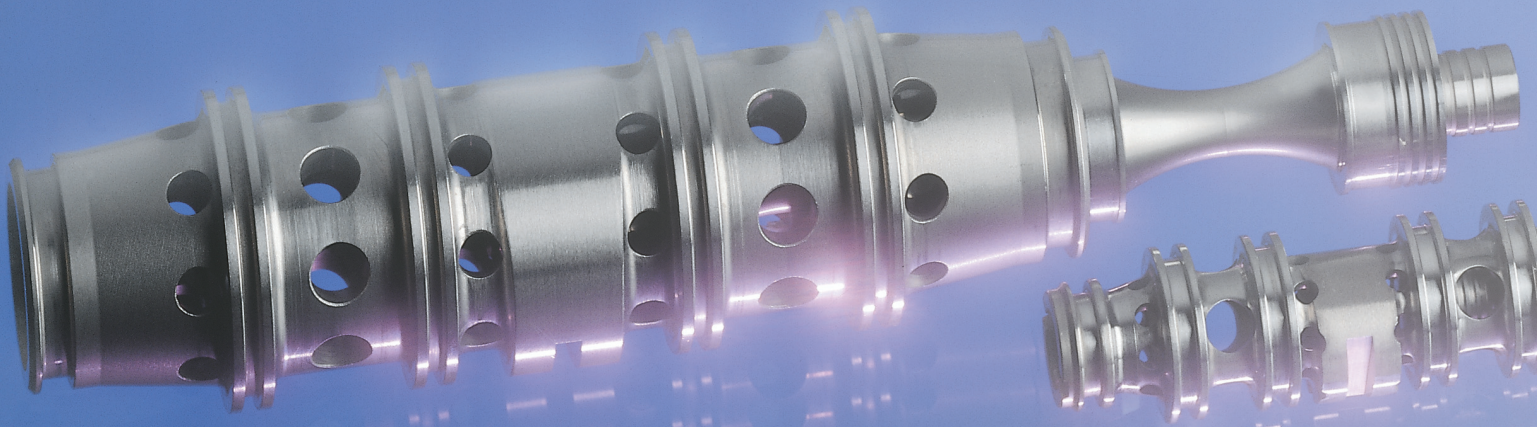
Options may increase price.  
All combinations may not be available.

Preferred configurations are highlighted.  
Technical changes are reserved.

# MOOG



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<b>Australia</b>	Melbourne
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**D661-G.C-EN / 04.03**