

Servovalves
with integrated Electronics
D791 and D792 Series

D791 and D792 Series

Three stage servovalves

The flow control servovalves D791 and D792 Series are throttle valves for 3-way and preferably 4-way applications. These three stage servovalves have been especially developed for such demanding applications where high flow rates and at the same time extreme dynamic performance requirements must be met. The design of these valves is based on the well known D079 Series. The integrated electronics has been replaced by a new design applying SMD technology. The valves are

offered with pilot valves of D761 or D765 Series, optional standard response or high response versions are available. Series D791 can deliver rated flow up to 250 l/min, Series D792 is available with rated flow up to 1000 l/min.

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

Principle of operation

An electrical command signal (set point, input signal) is applied to the integrated control amplifier which drives a current through the pilot valve coils. The pilot valve produces differential pressure in its control ports. This pressure difference results in a pilot flow which causes main spool displacement.

The position transducer which is excited via an oscillator measures the position of the main spool (actual value, position voltage).

This signal then is demodulated and fed back to the control amplifier where it is compared with the command signal. The control amplifier drives the pilot valve until the error between command signal and feedback signal is zero. Thus, the position of the main spool is proportional to the electrical command signal.

Operational features

- Electrical position feedback with pressure isolated position transducer (LVDT), no wear
- Integrated SMD electronics with false polarity protection
- Optional external pilot supply and return connections via fifth and sixth port in valve body
- Low threshold and hysteresis, excellent null stability
- Preadjusted at factory

The actual flow depends on the electrical command signal and the valve pressure drop, and may be calculated using the square root function for a sharp-edged orifice.

The flow value Q calculated in this way should not exceed an average flow velocity of 30 m/s in ports P, A, B and T.

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

Q [l/min] = calculated flow

Q_N [l/min] = rated flow

Δp [bar] = actual valve pressure drop

Δp_N [bar] = rated valve pressure drop

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

$$p_x \geq 2,5 \cdot 10^{-2} \cdot \frac{Q}{A_K} \sqrt{\Delta p}$$

Q [l/min] = max. flow

Δp [bar] = valve pressure drop with Q

A_K [cm²] = spool drive area

p_x [bar] = pilot pressure

The pilot pressure p_x has to be at least 15 bar above the return pressure of the pilot stage.



The valves D791 and D792 Series described in this catalogue have successfully passed EMC tests required by EC Directive. Please take notice of the respective references in the electronics section.

Our quality management system is certified in accordance with 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 here. In case of doubt please contact MOOG.

Operating pressure range

Main stage

Ports P, A and B with X internal	up to 315 bar
with X external	up to 350 bar
Port T with Y internal	up to 210 bar
Port T with Y external	up to 350 bar

Pilot valve

Ports P, A and B D761, D765 Series	up to 315 bar
Port T	up to 210 bar

Temperature range

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

Seal material

FPM, others on request

Operating fluid

Mineral oil based hydraulic fluid (to DIN 51524), others on request recommended 15 to 100 mm²/s
 The cleanliness of the hydraulic fluid greatly effects the performance (spool positioning, high resolution) and wear (metering edges, pressure gain, leakage) of the valve.

Class of cleanliness

Viscosity

Recommended cleanliness class

for normal operation:	ISO 4406 < 14/11
for longer life:	ISO 4406 < 13/10

System filtration

Pilot valve: High pressure filter (without bypass, but with dirt alarm) mounted in the mainflow and if possible, directly upstream of the servovalve.
 Main stage: Main stage: high pressure filter as for the pilot stage. In combination with a fast regulating VD-pump a bypass filter is possible.

Filter rating recommended

for normal operation:	$\beta_{10} \geq 75$ (10 μm absolute)
for longer life:	$\beta_5 \geq 75$ (5 μm absolute)

Installation options

any position, fixed or movable

Vibration

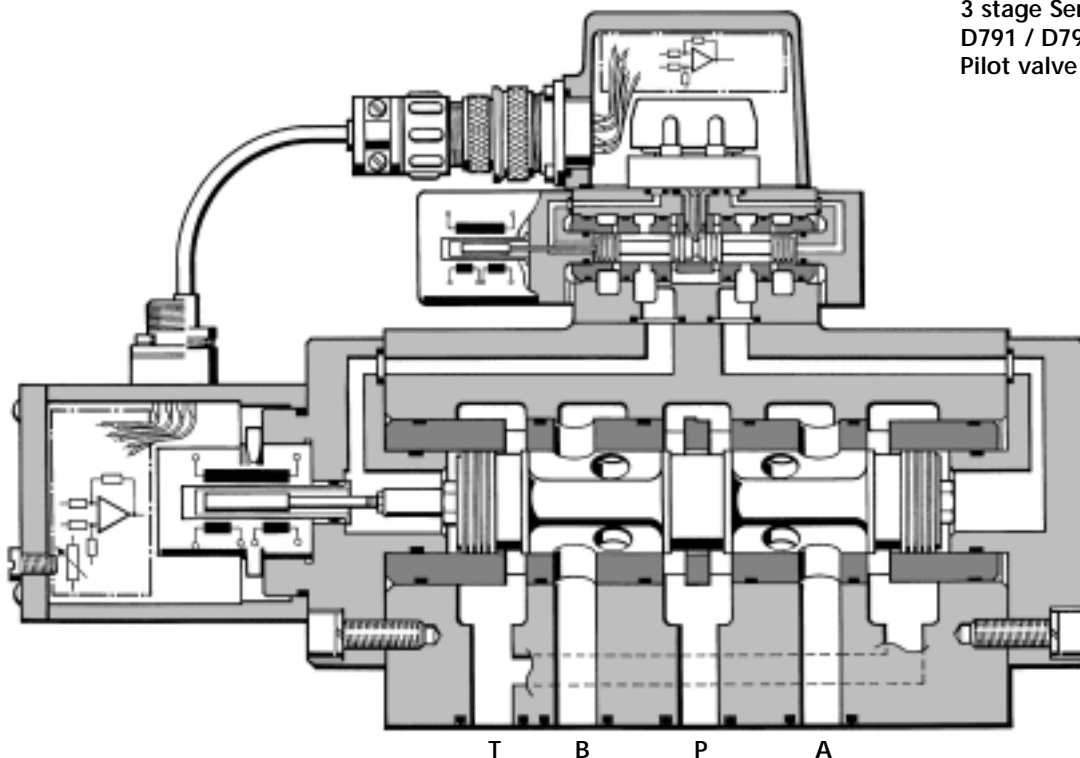
30 g, 3 axes

Degree of protection

EN 60529: IP 65 (with mating connector mounted)

Shipping plate

Delivered with an oil sealed shipping plate



**3 stage Servovalve
 D791 / D792 Series with
 Pilot valve D765 Series**

D791 Series

Technical data

Model . . . Type

Mounting pattern

ISO, but X and Y do **not** correspond to ISO

D791 S . . .

ISO 10372-06-05-0-92

Valve body version

4-way

3-stage with bushing spool assembly
2-stage, optional D761 or D765 Series

Pilot valve

Pilot connection

optional, internal or external

X and Y

Mass

[kg]

13

Rated flow

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

100

160

250

Response time*

for 0 to 100% stroke (dependent on pilot valve) [ms]

3 to 10

Threshold*

[%]

< 0,2

Hysteresis*

[%]

< 0,5

Null shift

with $\Delta T = 55$ K [l/min]

< 2

Null leakage flow*

total, max. [l/min]

5

7

10

Pilot leakage flow*

max., for 100% step input (dependent on pilot valve) [l/min]

4 to 11

Main spool stroke

[mm]

1,6

1,6

2,0

Main spool drive area

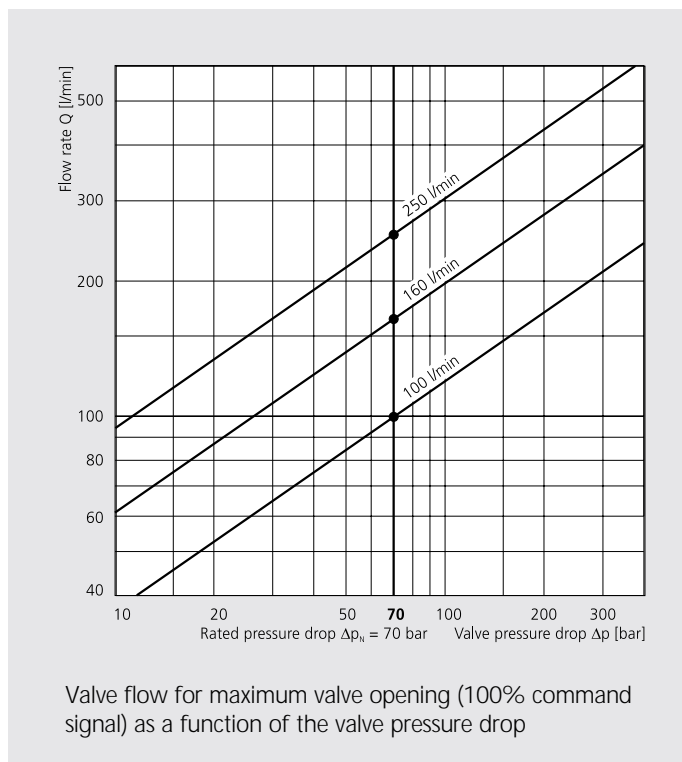
[cm²]

2,85

* measured at 210 bar pilot or operating pressure, fluid viscosity of 32 mm²/s and fluid temperature of 40 °C

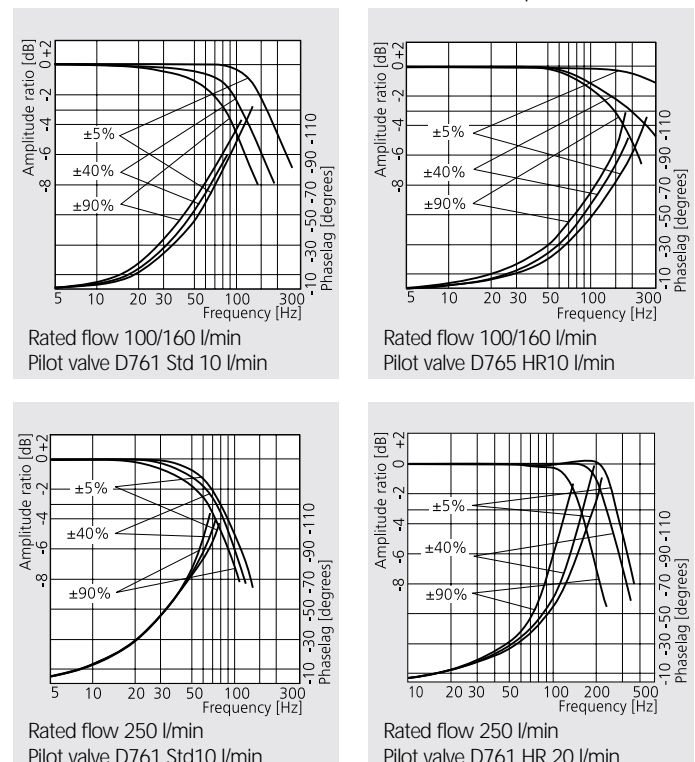
Typical characteristic curves measured at 210 bar pilot or operating pressure, fluid viscosity of 32 mm²/s and fluid temperature of 40 °C

Valve flow diagram



Frequency response

for valves with different rated flows and different pilot valves



Model Type
Mounting pattern
Valve body version

D792 S . . .

Moog Standard

4-way

3-stage with bushing spool assembly

2-stage, optional D761 or D765 Series

X and Y

17

Pilot valve

Pilot connection

optional, internal or external

Mass

[kg]

Rated flow

(± 10%) at $\Delta p_N = 35$ bar

[l/min]

400

630

800

1000

Response time*

for 0 to 100% stroke (dependent on pilot valve)

[ms]

4 to 12

Threshold*

[%]

< 0,2

Hysteresis*

[%]

< 0,5

Null shift

with $\Delta T = 55$ K

[%]

< 2

Null leakage flow*

total, max.

[l/min]

10

14

14

14

Pilot leakage flow*

max., for 100% step input (dependent on pilot valve)

[l/min]

6 to 16

Main spool stroke

[mm]

1,8

1,9

2,6

4,0

Main spool drive area

[cm²]

3,8

7,14

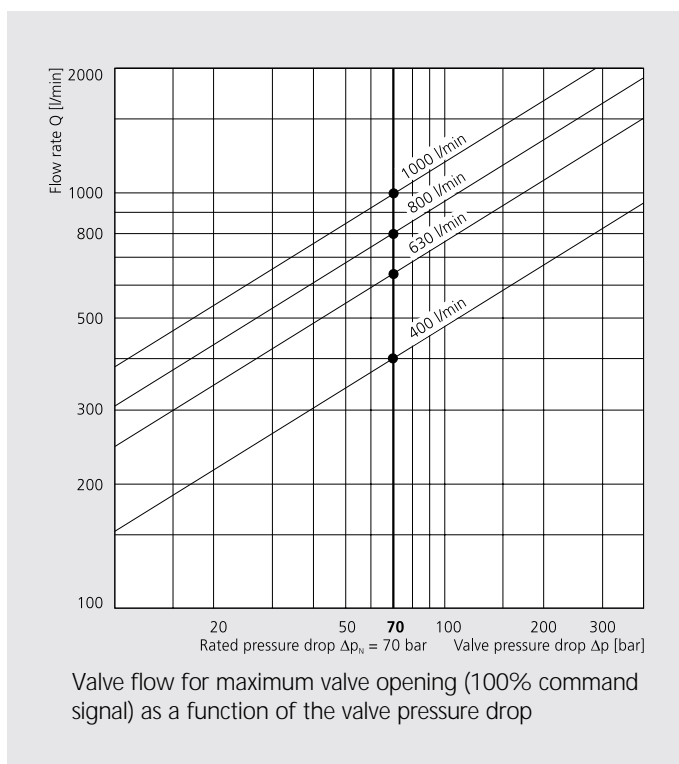
7,14

7,14

* measured at 210 bar pilot or operating pressure, fluid viscosity of 32 mm²/s and fluid temperature of 40 °C

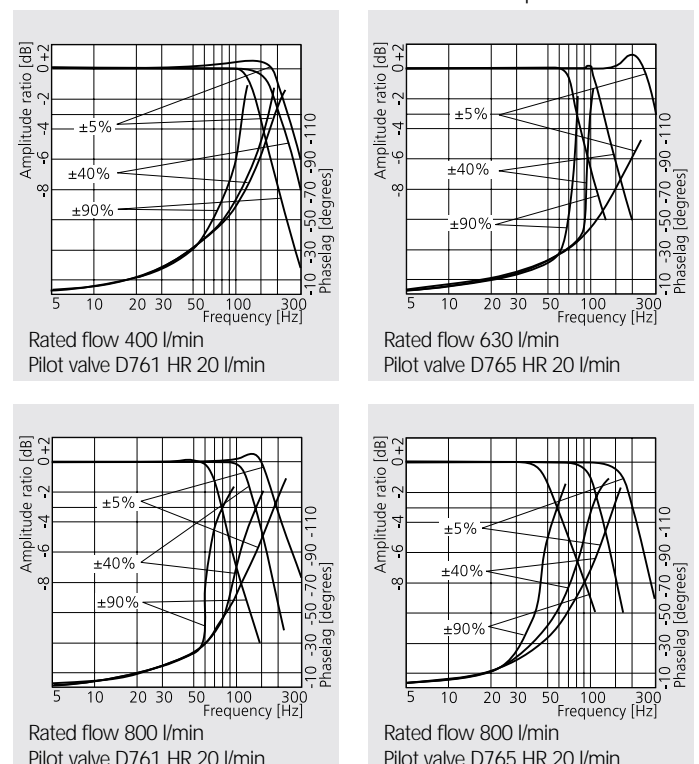
Typical characteristic curves measured at 210 bar pilot or operating pressure, fluid viscosity of 32 mm²/s and fluid temperature of 40 °C

Valve flow diagram



Frequency response

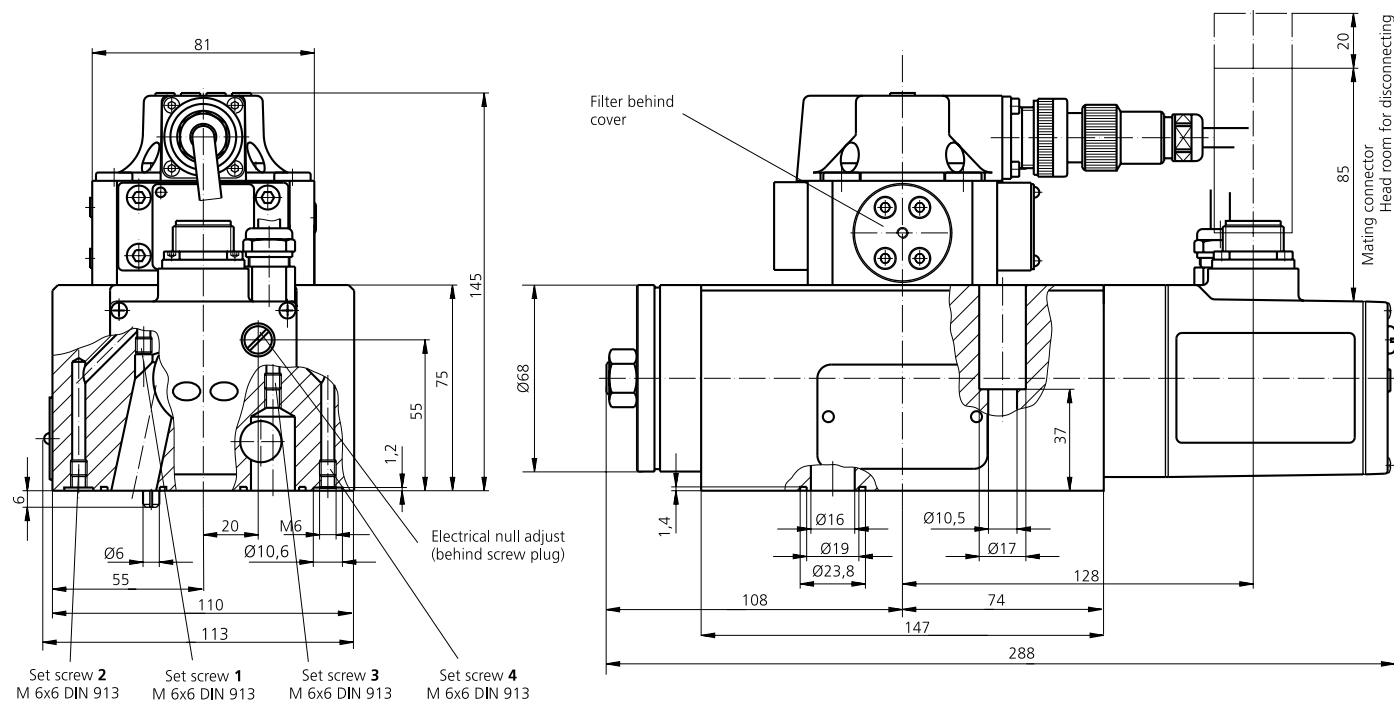
for valves with different rated flows and different pilot valves



D791 Series

Installation drawing with Pilot valve D761 Series

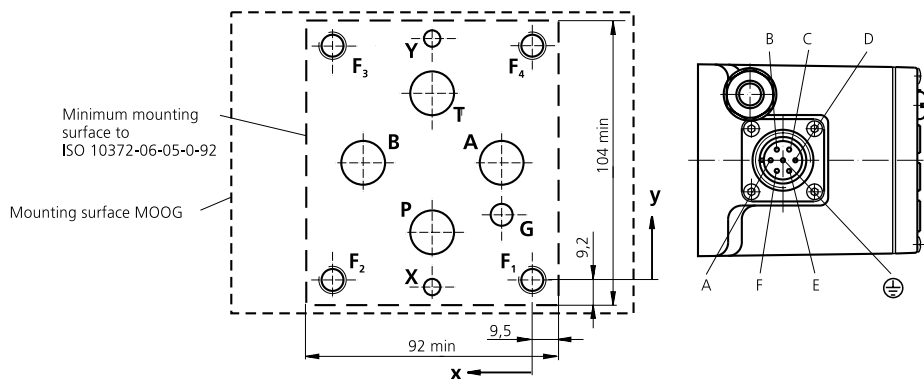
Conversion instruction



The mounting manifold must conform to ISO 10372-06-05-0-92.

Note: The X port to ISO Standard must **not** be machined. The X and Y ports of MOOG valve body do **not** correspond to ISO Standard.

Mounting surface needs to be flat within 0,02 mm. Average surface finish value, Ra, better than 1µm.

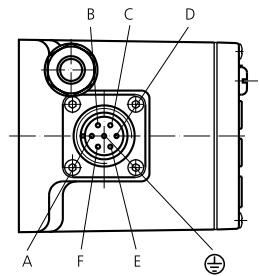
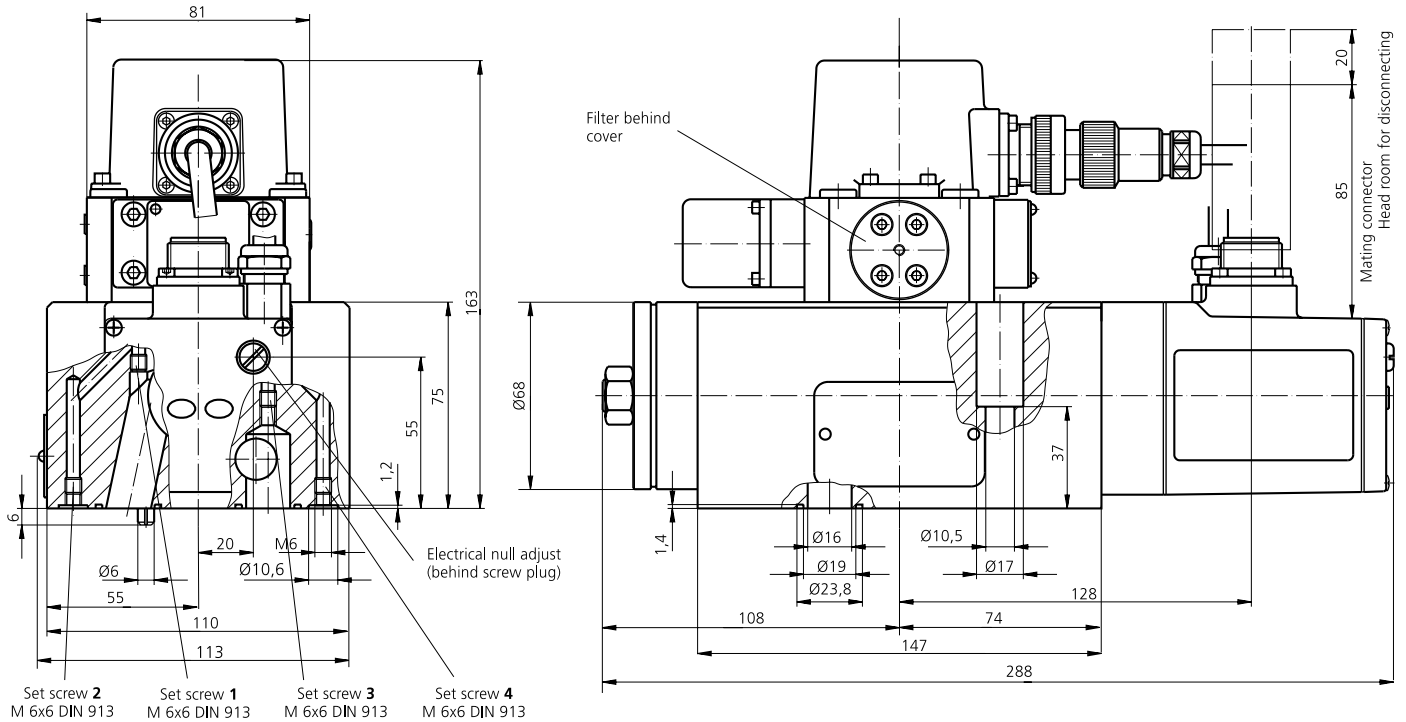


	P	A	B	T	G	X	Y	F1	F2	F3	F4
	Ø16	Ø16	Ø16	Ø16	Ø8	Ø6	Ø6	M10	M10	M10	M10
x	36,5	11,1	61,9	36,5	11,1	36,5	36,5	0	73	73	0
y	17,4	42,8	42,8	68,2	23,7	-2,6	88,2	0	0	85,6	85,6

Conversion instruction

for main stage operation with internal or external pilot connection	Pilot flow Supply	Set screw M 6 x 6 Bore 1	Set screw M 6 x 6 Bore 2	Pilot flow Return	Set screw M 6 x 6 Bore 3	Set screw M 6 x 6 Bore 4
Internal P	open	open	closed	Internal T	open	closed
External X	closed	closed	open	External Y	closed	open

D791 Series
 Installation drawing with
 Pilot valve D765 Series
 Spare parts, Accessories



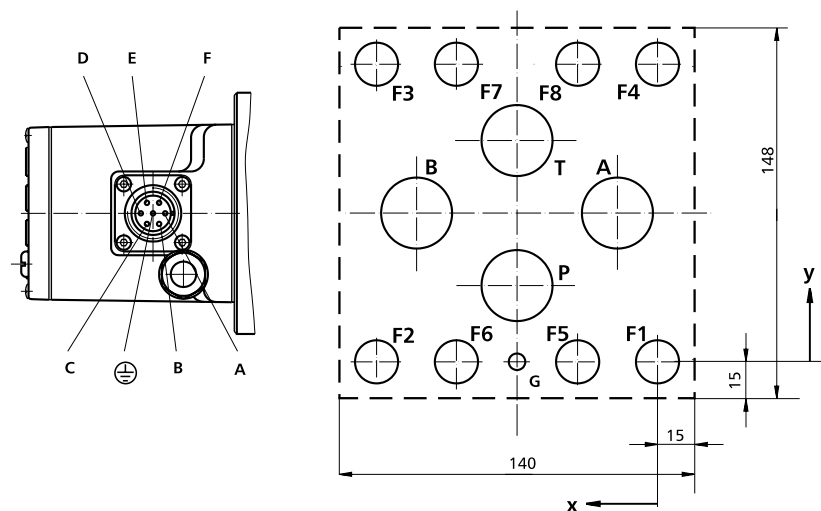
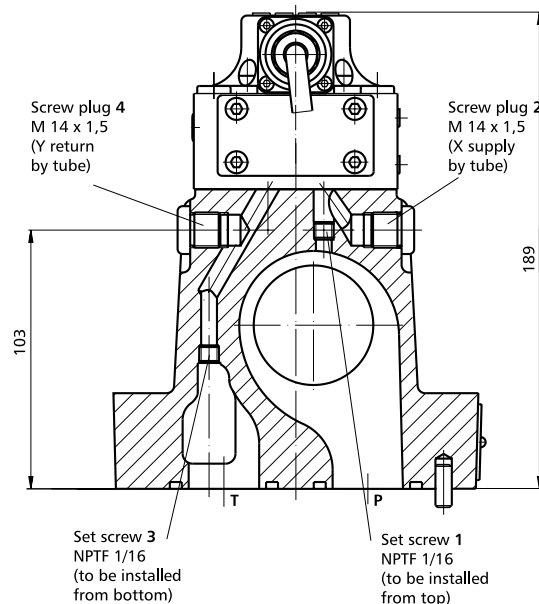
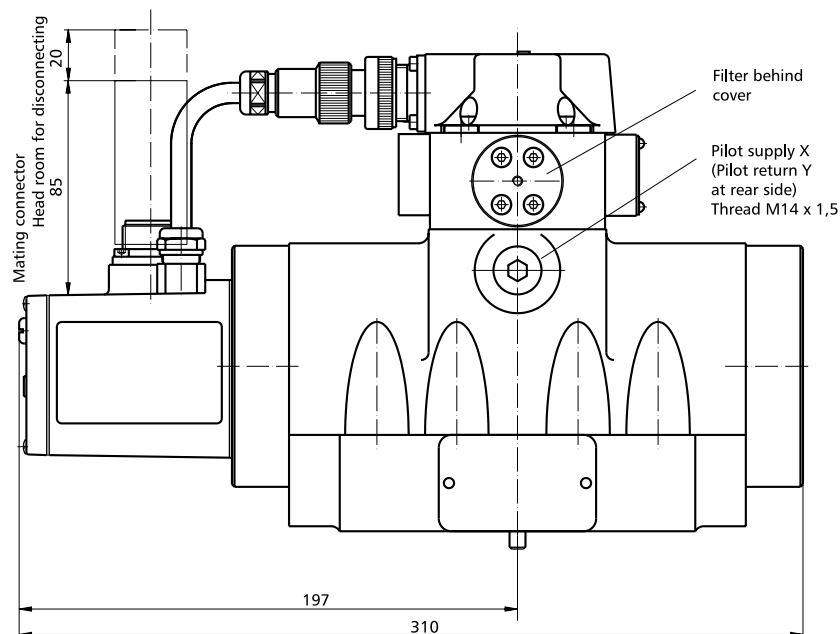
Spare parts and accessories for D791 Series

O-rings (included in delivery)			
for P, T, A, B	4 pieces	ID 20,3 x 1,78	FPM 85 Shore 42082 040
for X, Y	2 pieces	ID 7,65 x 1,78	42082 012
Mating connector, waterproof IP 65 (not included in delivery)		for cable dia	
6+PE-pole DIN 43563		min. Ø 10 mm, max. Ø 12 mm	B97007 061
Flushing plate (internal supply)			55118 001
(external supply)			A26133
Mounting bolts (not included in delivery)			
M 10 x 50 DIN 912-10.9	4 pieces	required torque 65 Nm	A03665 100 050
Replaceable filter for pilot valve		65 µm nominal	A67999 065
O-rings for filter replacement			FPM 85 Shore
	2 pieces	ID 13 x Ø 1,5	A25163 013 015
Set screws for X and Y	2pieces	M 6 x 6 DIN 13	66166 060 006

D792 Series

Installation drawing with Pilot valve D761 Series

Conversion instruction



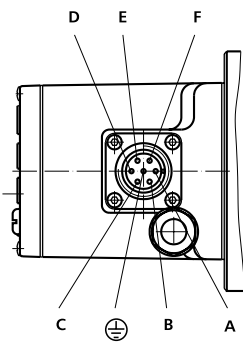
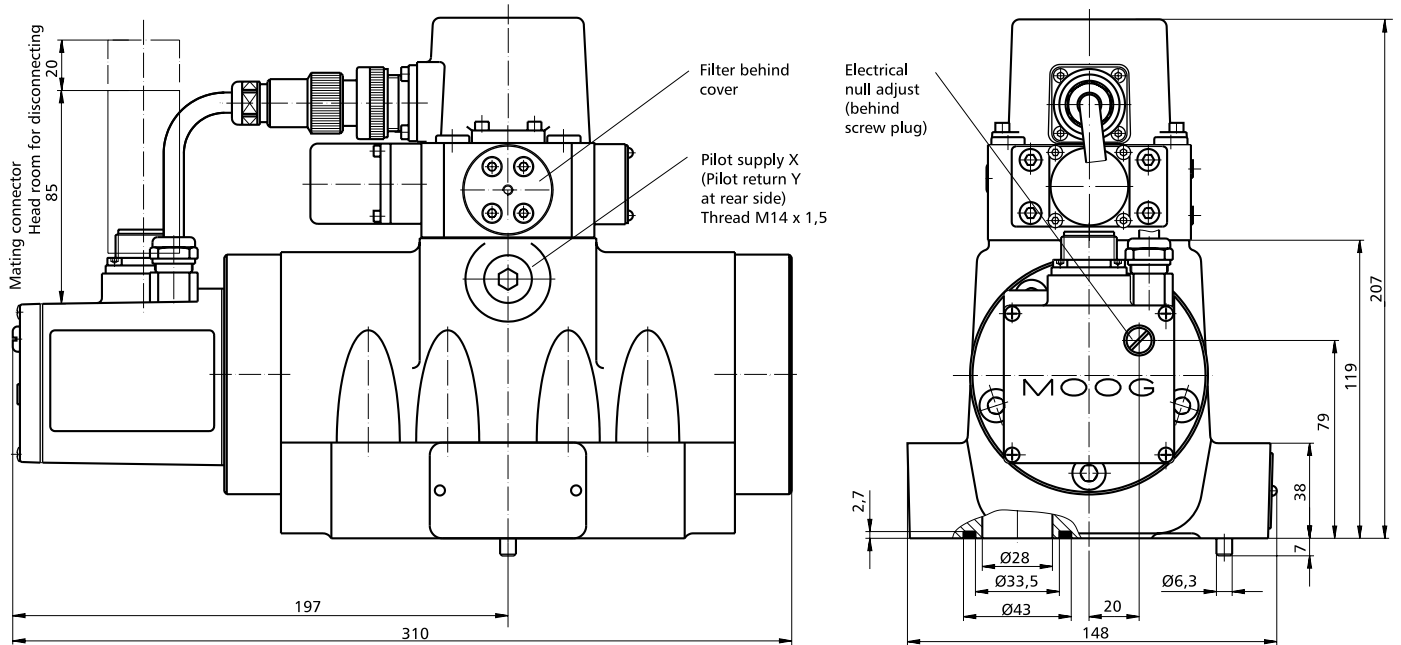
Note: The X and Y tubes have to be connected to the MOOG valve body by fittings. Mounting surface needs to be flat within 0,02 mm. Average surface finish value, Ra, better than 1µm.

	P	A	B	T	G	F1	F2	F3	F4	F5	F6	F7	F8
	Ø28	Ø28	Ø28	Ø28	Ø8	M16	M16	M16	M16	M16	M16	M16	M16
x	55,4	15,8	95,0	55,4	55,4	0	110,8	110,8	0	31,5	79,3	79,3	31,5
y	30,1	58,7	58,7	87,3	0	0	0	117,4	117,4	0	0	117,4	117,4

Conversion instruction

for main stage operation with internal or external pilot connection (externally by tubes)	Pilot flow Supply	Set screw 1 NPTF 1/16	Screw plug 2 M14 x 1,5	Pilot flow Return	Set screw 3 NPTF 1/16	Screw plug 4 M14 x 1,5
	Internal P	open	closed	Internal T	open	closed
	External X	closed	Tube	External Y	closed	Tube

D792 Series
 Installation drawing with
 Pilot valve D765 Series
 Spare parts, Accessories



Spare parts and accessories for D792 Series

O-rings (included in delivery) for P, T, A, B	4 pieces	ID 36 x 3,5	FPM 85 Shore 42082 264
Mating connector, waterproof IP 65 (not included in delivery) 6+PE-pole DIN 43563		for cable dia min. Ø 10 mm, max. Ø 12 mm	B97007 061
Flushing plate			76216 001
Mounting bolts (not included in delivery) required M 16 x 60 DIN 912-10.9	8 pieces	required torque 290 Nm	A03665 160 060
Replaceable filter for pilot valve		65 µm nominale	A67999 065
O-rings for filter replacement	2 pieces	ID 13 x Ø 1,5	FPM 85 Shore A25163 013 015
Screw plug (X and Y ports) with seal	2 pieces	M 14 x 1,5	66149 014
Set screw (X and Y ports)	2 pieces	1 / 16 NPTF	A03668 001

D791 and D792 Series

Valve electronics with supply voltage ± 15 Volt

Command signal 0 to ± 10 V Valves with voltage command input

The spool stroke of the valve is proportional to $(U_D - U_E)$. 100% valve opening P \blacktriangleright A and B \blacktriangleright T is achieved at $(U_D - U_E) = +10$ V. At 0 V command the spool is in a 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 \perp (pin C) according to the required operating direction (to be done at the mating connector).

Command signal 0 to ± 10 mA Valves with current command input

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

Either pin D or E is used according to the required operating direction. The unused pin is left open (not connected at the mating connector). The input pins D and E are inverting.

Actual value 0 to ± 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 ± 10 V. 100% valve opening P \blacktriangleright A and B \blacktriangleright T corresponds to +10 V.

Actual value 0 to ± 10 mA or 4 to 20 mA Valves with current command input

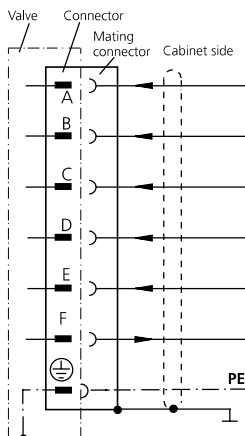
The actual spool position value can be measured at pin F. This signal can be used for monitoring and fault detection purposes.

The spool stroke range corresponds to ± 10 mA (4 to 20 mA). 100% valve opening P \blacktriangleright A and B \blacktriangleright T corresponds to +10 mA (20 mA).

General requirements

- Supply ± 15 VDC $\pm 3\%$. Ripple < 50 mV_{pp}. Current consumption max. ± 250 mA
- All signal lines, also 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
- Protective grounding lead $\geq 0,75$ mm²
- 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.

Wiring for valves with 6+PE pole connector to DIN 43563 and mating connector (metal shell) with leading protective grounding connection (\perp).



Function	Voltage command	Current command
Supply	+ 15 VDC ± 3	
Supply	- 15 VDC ± 3	
Supply / signal ground	\perp (0V)	
Input rated command Valve flow	0 to ± 10 V Input resistance 100 k Ω	0 to ± 10 mA load resistance 400 Ω
Input inverted rated command Valve flow	0 to ± 10 V Input resistance 100 k Ω	0 to ± 10 mA load resistance 400 Ω
Output actual value Main spool position	0 to ± 10 V Output resistance 10 k Ω	0 to ± 10 mA / 4 to 20 mA load resistance max. 500 Ω
Protective grounding		

D791 und D792 Series Ordering information

MOOG

Model-Number		Type designation																				
D791, D792		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Specification status		Supply voltage																				
-	Series specification	0 ± 15 VDC ± 3%, Ripple < 50 mV _{pp}																				
E	Preseries specification	Signals for 100% spool stroke																				
Z	Special specification	Command Output																				
Model designation		A ±10 V ±10 V																				
assigned at the factory		B ±10 mA ±10 mA																				
Factory identification		P ±10 mA 4 to 20 mA																				
assigned at the factory		Valve connector																				
Valve version		S 6 + PE-pole DIN 43563																				
S Servovalve 3-stage		Seal material																				
Rated flow		U FPM (Viton), PUR (Ultrathan) only for bushing, only D791																				
	Q _N [l/min] at Δp _N = 35 bar per land	Series																				
10	100	D791																				
16	160	D791																				
25	250	D791																				
40	400	D792																				
63	630	D792																				
80	800	D792																				
99	1 000	D792																				
Maximum operating pressure p_p		Pilot connections and pressure																				
J	315 bar. At p _x ≤ 315 bar (X and Y external) operating pressure in ports P, A, B and T up to 350 bar possible	Pressure [bar]			Supply X			Return Y														
K	350 bar	E 15 to 315			F 15 to 315			G 15 to 315			H 15 to 315											
Main spool type		J 25 to 350			K 25 to 350			L 25 to 350			M 25 to 350											
O 4-way: axis cut, linear characteristic		internal			external			external			internal											
Pilot valve		J 25 to 350			K 25 to 350			L 25 to 350			M 25 to 350											
P	D761 Standard	internal			external			external			internal											
Q	D761 High response	internal			external			external			internal											
R	D765 High response	internal			external			external			internal											
S	D765 Standard	internal			external			external			internal											
Spool position of main stage without electrical supply		Position Pilot pressure [bar]																				
		O undefined ≥15																				
		A P ↔ B, A ↔ T ≥15																				
		B P ↔ A, B ↔ T ≥15																				

Preferred configurations are highlighted.
All combinations may not be available.

Options may increase price.
Technical changes are reserved.

Australia	Melbourne
Austria	Vienna
Brazil	São Paulo
Denmark	Birkerød
England	Tewkesbury
Finland	Espoo
France	Rungis
Germany	Böblingen

Hong Kong	Kwai Chung
India	Bangalore
Ireland	Ringaskiddy
Italy	Malnate
Japan	Hiratsuka
Korea	Kwangju
Philippines	Baguio
Russia	Pavlovo
Singapore	Singapore
Spain	Orio
Sweden	Gotenborg
USA	East Aurora (NY)

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