Servo valves
with integrated Electronics
D765 Series
ISO 10372 Size 04
D765 Series
Two stage 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 wellknown D761 Series. The mechanical feedback has been replaced by an electric feedback with a position transducer. An integrated electronics closes the position loop for the spool. These valves are suitable for electrohydraulic position, velocity, pressure or force control systems with extremely high dynamic response requirements.

**Principle of operation**
An electric command signal (flow rate set point) is applied to the integrated position controller which drives the pilot stage. The thereby deflected nozzle flapper system produces a pressure difference across the drive areas of the spool and effects its movement. The position transducer (LVDT) which is excited via an oscillator measures the position of the spool (actual value, position voltage). This 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 spool is proportional to the electric command signal.

\[ Q = Q_n \sqrt{\frac{\Delta p}{\Delta p_n}} \]

- \( Q \) [l/min] = calculated flow
- \( Q_n \) [l/min] = rated flow
- \( \Delta p \) [bar] = actual valve pressure drop
- \( \Delta p_n \) [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:

\[ p_x \geq 2.5 \cdot 10^{-2} \cdot \frac{Q}{A_k} \cdot \sqrt{\Delta p} \]

- \( Q \) [l/min] = max. flow
- \( \Delta p \) [bar] = valve pressure drop
- \( A_k \) [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.

**Operational features**
- 2-stage design with dry torque motor
- Low friction double nozzle pilot stage
- High spool control forces
- Electric feedback with pressure isolated position transducer (LVDT), wear free
- Integrated electronics with built in false polarity protection
- High resolution, low hysteresis
- Completely adjusted at the factory
- Protection filter easy to replace

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

The D765 Series valve described in this catalogue has 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.
D765 Series
General technical data

**Operating pressure**
- Ports P, X, A and B 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 (DIN 51524 part 1 to 3), other fluids on request
  - Viscosity recommended: 15 to 100 mm²/s

**System filtration:** High pressure filter (without bypass, but with dirt alarm) mounted in the main flow and if possible directly upstream of the valve.

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

**Recommended cleanliness class**
- For normal operation: ISO 4406 < 14/11
- For longer life: ISO 4406 < 13/10

**Filter rating**
- For normal operation: ϒ 10 ≈ 75 (10 µm absolute)
- For longer life: ϒ 5 ≈ 75 (5 µm absolute)

**Installation options**
- any position, fixed or movable

**Vibration**
- 30 g, 3 axes

**Mass**
- 1.1 kg

**Degree of protection**
- EN 60529: class IP 65, with mating connector mounted
  - Delivered with an oil sealed shipping plate

**Valve flow diagram**
Valve flow for maximum valve opening (100% command signal) as a function of the valve pressure drop
D765 Series
Technical data

Model ... Type
Mounting pattern
Valve body version

Pilot stage
Pilot connection
Rated flow

(± 10 %) at \( \Delta p_h = 35 \) bar per land
Standard [l/min] 4 10 19 38 63
High response [l/min] 4 10 19 38 —

Response time*
Standard, typical [ms] 4 4 4 4 8
High response, typical [ms] 2 2 2 3 —

Threshold*

Hysteresis*

< 0.1
< 0.3
< 1
< 1

Null shift
with \( \Delta T = 55 \) K [%]

Null leakage flow*
max. [l/min] 1.5 to 2.3

Pilot leakage flow* typical [l/min] 0.8

Pilot flow* for 100 % step input [l/min] 0.4

Spool drive area
Standard [cm²] 0.49
High response [cm²] 0.34

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

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

Typical characteristic curves
with ± 5 %, ± 40 % and ± 90 % input signal, at 210 bar pilot or operating pressure, fluid viscosity of 32 mm²/s and fluid temperature of 40 °C

Standard valves

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

Conversion instruction

<table>
<thead>
<tr>
<th>for operation with internal or external pilot connection</th>
<th>Pilot flow supply</th>
<th>Set screw (M 4 x 6 DIN 6912)</th>
<th>1 closed</th>
<th>2 open</th>
</tr>
</thead>
<tbody>
<tr>
<td>internal P</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>external X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Spare parts and accessories

O-rings (included in delivery).
- for P, T, A and B ID 10.82 x 1.78 42082 022
- for X ID 9.25 x 1.78 42082 013
Mating connector, waterproof IP 65 (not included in delivery)
- 6+PE-pole EN 175201 part 804* B97007 061
Flushing plate, (int.) 55127 001 (ext.) 55127 002

Mounting bolts (not included in delivery)
- M 8 x 45 DIN EN ISO 4762-10.9 (4 pieces) A03665 080 045
  required torque 18 Nm
Replaceable filter A67999 065
O-rings for filter change (2 pieces) A25163 013 015
Screw internal/external M 4 x 6 DIN 6912 76689 040 006
Seal for screw internal/external A25528 040
Seal for null adjust screw plug 76425 050

* formerly DIN 43563
D765 Series
Valve electronics with supply voltage ±15 Volt

Command signal 0 to ±10 mA
Valves with current command input, floating
The spool stroke of the valve is proportional to \( I_c = -I_r \). 100% valve opening \( P \leftrightarrow B \) and \( A \leftrightarrow T \) is achieved at \( I_c = +10 \) 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 \( ∫ (0 \) V) at cabinet side.

Command signal 0 to ±10 V
Valves with voltage command input
The spool stroke of the valve is proportional to differential input \( (U_c - U_r) \). 100% valve opening \( P \leftrightarrow B \) and \( A \leftrightarrow T \) is achieved at \( (U_c - U_r) = +10 \) V. At 0 V command the spool is in centred 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 ±10 V
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. +10 mA corresponds to 100% valve opening \( P \leftrightarrow B \) and \( A \leftrightarrow T \).

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

General requirements
- Supply ±15 VDC ±3%. Ripple < 50 mV
  
  Consumption max. ± 100 mA
- All signal lines, also those of external transducers, shielded
- Shielding connected radially to \( ∫ (0 \) V), 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 ≥ 0.75mm².
  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.

Wiring for valves with 6+PE pole connector
to EN 175201 part 8041 and mating connector (type R and S, metal shell) with leading protective earth connection ☼.

<table>
<thead>
<tr>
<th>Function</th>
<th>Current command</th>
<th>Voltage command</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply</td>
<td>+ 15 VDC ±3 %, ripple &lt; 50 mV</td>
<td></td>
</tr>
<tr>
<td>Supply</td>
<td>- 15 VDC ±3 %, ripple &lt; 50 mV</td>
<td></td>
</tr>
<tr>
<td>Supply / signal ground</td>
<td>∫ (0V)</td>
<td></td>
</tr>
<tr>
<td>Input rated command Valve flow</td>
<td>0 to ±10 mA</td>
<td>0 to ±10 V</td>
</tr>
<tr>
<td>Load resistance (diff.) 1 kΩ</td>
<td>Input resistance 10 kΩ</td>
<td></td>
</tr>
<tr>
<td>Input inverted rated command Valve flow</td>
<td>0 to ±10 mA</td>
<td>0 to ±10 V</td>
</tr>
<tr>
<td>Load resistance (diff.) 1 kΩ</td>
<td>Input resistance 10 kΩ</td>
<td></td>
</tr>
<tr>
<td>Output actual value ☼ Spool position</td>
<td>0 to ±10 mA</td>
<td>0 to ±10 V</td>
</tr>
<tr>
<td>Load resistance max. 1 kΩ</td>
<td>Load resistance min. 1 kΩ</td>
<td></td>
</tr>
</tbody>
</table>

1) formerly DIN 43563 2) referenced to ∫ (0V)
## D765 Series

### Ordering information

<table>
<thead>
<tr>
<th>Model number</th>
<th>Type designation</th>
</tr>
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<tbody>
<tr>
<td>D765</td>
<td></td>
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</tbody>
</table>

#### Specification status
- Series specification
- Preseries specification
- Special specification

#### Model designation
- assigned at the factory

#### Factory identification

#### Valve version
- S Standard
- H High response

#### Rated flow
<table>
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<tr>
<th></th>
<th>Standard</th>
<th>High response</th>
</tr>
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<tbody>
<tr>
<td>04</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>10</td>
<td>10</td>
<td>10</td>
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<tr>
<td>19</td>
<td>19</td>
<td>19</td>
</tr>
<tr>
<td>38</td>
<td>38</td>
<td>38 (only to 250 bar)</td>
</tr>
<tr>
<td>63</td>
<td>63</td>
<td></td>
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</tbody>
</table>

#### Maximum operating pressure $p_P$ and body material
- F 210 bar · aluminum
- J 315 bar · aluminum
- K 350 bar · steel

#### Bushing spool type
- O  Axis cut, linear characteristic
- others on request

#### Supply voltage
- $0 \pm 15 \text{ VDC} \pm 3\%$, ripple $< 50 \text{ mV}_r$

#### Signals for 100% spool stroke
<table>
<thead>
<tr>
<th>Command</th>
<th>Output</th>
</tr>
</thead>
</table>
| A       | $\pm 10 \text{ V}$  
| X       | $\pm 10 \text{ mA}$, floating $\pm 10 \text{ mA}$ |

#### Valve connector
- R 6 + PE pole EN 175201 part 804 over port A
- S 6 + PE pole EN 175201 part 804 over port B

#### Seal material
- V FPM (Viton)
- others on request

#### Pilot connections and pressure
<table>
<thead>
<tr>
<th>Pressure [bar]</th>
<th>Supply</th>
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<tbody>
<tr>
<td>A</td>
<td>15 to 210 internal</td>
</tr>
<tr>
<td>C</td>
<td>15 to 210 external</td>
</tr>
<tr>
<td>E</td>
<td>15 to 315 internal</td>
</tr>
<tr>
<td>G</td>
<td>15 to 315 external</td>
</tr>
<tr>
<td>J</td>
<td>25 to 350 internal</td>
</tr>
<tr>
<td>L</td>
<td>25 to 350 external</td>
</tr>
</tbody>
</table>

#### Spool position without electric supply
- A $P \leftrightarrow B$, $A \leftrightarrow T$
- B $P \leftrightarrow A$, $B \leftrightarrow T$
- M Mid position

#### Pilot stage
- G with additional mechanical feedback

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**Preferred configurations are highlighted.**
**All combinations may not be available.**
**Please contact MOOG.**

**Options may increase price.**
**Technical changes are reserved.**
<table>
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<td>Sweden</td>
<td>Gothenburg</td>
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<tr>
<td>USA</td>
<td>East Aurora</td>
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</table>

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