79 Series Servo valves
79 SERIES SERVOVALVES

The 79 Series flow control servovalves are throttle valves for 3 and preferably 4-way applications. These three stage servovalves were developed for applications that require high flow rates and high performance. The 79 series covers the range of rated flow from 30 to 200 gpm at 1,000 psi valve drop. These valves are offered with 760 Series pilot valves, in either standard or high performance configurations.

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 (set point, input signal) is applied to the external 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). The 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.

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### VALVE FEATURES

- Electrical feedback on the main spool for low hysteresis and excellent linearity
- Optional external pilot supply and return connections
- High spool control forces
- High dynamics
- Rugged, long-life design
- High resolution, low hysteresis
- Completely set-up at the factory
- Excellent null stability

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.

The actual flow is given by:

\[ Q = Q' \sqrt{\frac{\Delta p}{\Delta p' n}} \]

- \( Q \) [gpm] = calculated flow
- \( Q' \) [gpm] = rated flow
- \( \Delta p \) [psi] = actual valve pressure drop
- \( \Delta p' \) [psi] = 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:

\[ p_i \geq 5.6 \cdot 10^2 \cdot \frac{Q}{A_k} \cdot \sqrt{\Delta p} \]

- \( Q \) [gpm] = max. flow
- \( \Delta p \) [psi] = valve pressure drop with \( Q \)
- \( A_k \) [in²] = spool drive area
- \( p_i \) [psi] = pilot pressure

The pilot pressure \( p_i \) has to be at least 215 psi above the return pressure of the pilot stage.

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ISO 9001 CERTIFIED

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 Inc.
**Operating Pressure**

- **Main Stage**
  - Ports P, A and B with X internal up to 5,000 psi with High Pressure Pilot
  - with X external up to 5,000 psi
  - Port T with Y internal up to 3,000 psi
  - Port T with Y external up to 5,000 psi
- **Pilot valve (760 series)**
  - Ports P, A and B up to 5,000 psi
  - Port T up to 3,000 psi

**Temperature Range**
- Fluid: 0°F to 180°F
- Ambient: 0°F to 180°F

**Seal Material**: Fluorocarbon, others on request

**Operating Fluid**: Mineral oil based hydraulic fluid
- Recommended viscosity: 60-450 SUS @ 100°F

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

**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 main flow and if possible, directly upstream of the servovalve.
- 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**
- 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 moveable.
- Vibration: 30 g, 3 axes
- Weight
- Shipping Plate: Delivered with an oil sealed shipping plate.

* Maximum special order is 5,000 psi
### Model Type:
- ISO, but X and Y do not correspond to ISO

### Mounting Pattern:
- ISO, but X and Y do not correspond to ISO ISO 10372-06-05-0-92

### Valve Body Version:
- 4-way

### Pilot Valve:
- 3-stage with spool-bushing assembly

### Pilot Connection:
- Optional, internal or external

### Mass:
- 24 lbs (10.9 kg)

### Rated Flow:
- (± 10%) at \( \Delta p_N = 1,000 \) psi: 30.0 gpm, 60.0 gpm

### Response Time:
- for 0 to 100% stroke: 14 ms, 14 ms

### Threshold:
- < 0.5%

### Hysteresis:
- < 1.0%

### Null Shift:
- with \( \Delta T = 50^\circ C \): < 2.5%

### Null Leakage Flow:
- total, max.: 0.8 gpm, 1.6 gpm

### Main Spool Stroke:
- 0.075 in

### Main Spool Drive Area:
- 0.44 in²

*measured at 3,000 psi pilot or operating pressure, respectively, and fluid viscosity 32 mm²/s

### Typical Characteristic Curves:
- measured at 3,000 psi pilot or operating pressure, respectively, and fluid kinematic viscosity of 32 mm²/s.

### Set-up and Operation:

#### Frequency Response
- for valves with different rated flows and different pilot valves

#### Valve Flow Diagram
- Flow rate vs. pressure drop for maximum valve opening (100% command signal) as a function of the valve pressure drop.
Model ...Type
Mounting Pattern
Valve Body Version

Pilot Valve
Pilot Connection
Mass
Rated Flow
Response Time*
Threshold*
Hysteresis*
Null Shift
Null Leakage Flow*
Main Spool Stroke
Main Spool Drive Area

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79-200
Moog Standard
3-stage with spool-bushing assembly
2-stage, 760 series
X and Y
35.5 lbs. [16.1 kg]

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* measured at 3,000 psi pilot or operating pressure, respectively, and fluid viscosity 32 mm²/s

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Typical Characteristic Curves measured at 3,000 psi pilot or operating pressure, respectively, and fluid kinematic viscosity of 32 mm²/s.

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Frequency Response for valves with different rated flows and different pilot valves.
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.

Surface to which valve is mounted requires a $\Delta \Delta$ finish, flat within 0.001[0.03] TIR.
**79-100 SERIES**

**TYPICAL SUBPLATE MANIFOLD**

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**THE MOUNTING MANIFOLD MUST CONFORM TO ISO 10372-06-05-0-92**

*NOTE:* The X port to the ISO standard must not be machined.

The X and Y ports of the Moog valve do not correspond to ISO standard.

Surface to which the valve is mounted requires a 32 finish ([AAA]), flat within .0001 (.03) TIR.
79-200 SERIES (STANDARD)
INSTALLATION DRAWING
WITH PILOT VALVE 760 SERIES

TYPICAL SUBPLATE MANIFOLD

Note: The X and Y tubes have to be connected to the Moog valve body by fittings.
Surface to which valve is mounted requires a \( \Delta \) finish, flat within 0.001 [0.03] TIR.

CONVERSION INSTRUCTION

for main stage operation with internal or external pilot connection (externally by tubes)

<table>
<thead>
<tr>
<th>Pilot flow supply</th>
<th>Set screw 1 N PTF 1/16</th>
<th>Screw plug 2 M14 x 1.5</th>
<th>Pilot flow Return</th>
<th>Set Screw 3 N PTF 1/16</th>
<th>Screw plug 4 M14 x 1.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal P</td>
<td>open</td>
<td>closed</td>
<td>Internal T</td>
<td>open</td>
<td>closed</td>
</tr>
<tr>
<td>External X</td>
<td>closed</td>
<td>Tube</td>
<td>External Y</td>
<td>closed</td>
<td>Tube</td>
</tr>
</tbody>
</table>
79-200 SERIES (HIGH RESPONSE)
INSTALLATION DRAWINGS
WITH PILOT VALVES 760 SERIES

O-rings (included in delivery)
for P, T, A, B
ID 1.418 x 0.138
42082-264
49054F1452S (MS3106F145-2S)
49054F1455S (MS3106F145-5S)

Mating connector, waterproof IP 65 (not included in delivery)
Flushing Block Kit
Mounting bolts (not included in delivery)
5/8 - 11 UNC x 2.25
8 pieces
required torque 215 lb.-ft.
B40052-218B

SPARE PARTS AND ACCESSORIES FOR 79-200 SERIES
SET-UP AND OPERATION

Servocontroller

The Moog Model N121-132A is a convenient servocontroller for use with 79 Series servovalves. The Model N123-134 exciter/demodulator is available for operation of the spool position LVDT.

The AC excitation is adjustable between ±10 and ±14 volts peak-to-peak. The recommended frequency is 2000 Hz (N123-134) to achieve good servovalve response; however, a lower frequency may be necessary if a long cable run is required.

The sensitivity of the spool position LVDT can be determined from Figure 1; the demodulated gain of the N123-134 can be determined from its data sheet.

Inner Loop Gain Set-up

» Connect the pilot valve coils to servocontroller terminals 12 and 13 per the schematic below.
» Ground servocontroller terminal 7 and apply a +1.0 VDC signal to servocontroller terminal 6 (with the LVDT demodulated signal from the N123-134 disconnected).
» Monitor the valve current by measuring the voltage drop across the 20 Ω sensing resistor R31 (test point lsv to TP11). The valve current scale factor is 50 mA per volt measured at lsv.
» Adjust the GAIN 2 pot to obtain the desired servocontroller gain (see equations to the right). It may not be possible to operate with satisfactory valve stability at the maximum servocontroller gain as both the pilot valve and LVDT have ±10% gain tolerances. It is recommended that the servocontroller gain be turned down the first time pressure is applied.

Standard Electrical Configuration

Typical Valve Schematic*

*Refer to specific model installation for wiring details.

Servovalve Loop Gain

The inner loop gain of the 79 Series Servovalves, when operating with 3,000 psi pilot supply pressure and with the pilot valve coils wired in parallel, can be determined by:

\[
K_{IL} = \frac{K_n K_{PV} K_{X}}{\Delta x}
\]

where:

- \(K_n\) = servovalve inner loop gain (sec\(^{-1}\))
- \(K_{PV}\) = pilot valve gain in 3/sec (mA/VDC)
- \(K_{X}\) = LVDT gain (vrms/inch)
- \(\Delta x\) = power spool end area

\[
= \frac{Z \text{ gpm} \times 3.85}{\text{gpm} \sqrt{3000 \text{ psi}}} \cdot \sqrt{\frac{1000 \text{ psi}}{15 \text{ mA}}}
\]

where \(Z\) = 2.5 for 79-100, 5.0 for 79-200 standard, and 4.0 for 79-200 High Response.

- \(K_0\) = demodulator gain (VDC/vrms)
- \(K_x\) = LVDT gain (vrms/inch)
- \(\Delta x\) = power spool end area

The required servocontroller gain can be found by:

\[
K_{x} = \frac{K_0 A_x}{K_m K_n K_{X}}
\]

Outer ServoLoop Gain

The nominal gain of the 79 Series for the outer loop will be:

\[
K_{VAL} = \frac{K_S}{K_0 K_x}
\]

where:

- \(K_{VAL}\) = overall valve gain (in/\text{sec/VDC})
- \(K_S\) = power spool flow gain (see specifications)
- \(K_0\) = demodulator gain (VDC/vrms)
- \(K_x\) = LVDT gain (vrms/inch)

Note that the power spool flow gain is specified for operation at 1000 psi supply. This gain must be corrected for operation at other supply pressures by multiplying it by a correction factor of the square root of the available hydraulic pressure divided by 1000 psi.

The summing section of the model N121-132A servocontroller can be used for summing the load servo command and feedback signals. The GAIN 1 pot provides a convenient loop gain adjustment.
## 79 SERIES

### ORDERING INFORMATION

<table>
<thead>
<tr>
<th>Model Designation</th>
<th>Assigned at the factory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model Number</td>
<td>79-1, 79-2</td>
</tr>
<tr>
<td>Type Designation</td>
<td>* * *</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Response</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valve Version</td>
<td>Standard response</td>
</tr>
<tr>
<td>H</td>
<td>High response (79-2 only)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rated Flow</th>
<th>Q [(gpm) at ∆pN = 1,000 psi]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>Series</td>
</tr>
<tr>
<td>Standard</td>
<td>79-100 - 30</td>
</tr>
<tr>
<td>79-100</td>
<td>60</td>
</tr>
<tr>
<td>79-200</td>
<td>10</td>
</tr>
<tr>
<td>79-200</td>
<td>20</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Maximum Operating Pressure pN and Body Material</th>
<th>F 3,000 psi</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>K 5,000 psi steel</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Main Spool Type</th>
<th>O 4-way / axis cut / linear characteristic</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>Special spool*</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pilot Stage</th>
<th>P 760 Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q</td>
<td>760 High response</td>
</tr>
<tr>
<td>X</td>
<td>760 Super high response</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Valve Electronics</th>
<th>7 Customer Supplied Electronics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signal for 100% Spool Stroke</td>
<td>Command</td>
</tr>
<tr>
<td>A ±10 V</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LVDT Electrical Connector</th>
<th>5 Pin</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Seal Material</th>
<th>N NBR (Buna)</th>
</tr>
</thead>
<tbody>
<tr>
<td>V Fluorocarbon</td>
<td></td>
</tr>
<tr>
<td>Others on request*</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Pilot Connections</th>
<th>Supply [X]</th>
<th>Return [Y]</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 internal</td>
<td>internal</td>
<td></td>
</tr>
<tr>
<td>1 external</td>
<td>internal</td>
<td></td>
</tr>
<tr>
<td>2 external</td>
<td>external</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Spool Position without Electrical Signal</th>
<th>Position</th>
<th>Pilot Pressure [psi]</th>
</tr>
</thead>
<tbody>
<tr>
<td>O Undefined</td>
<td>≥ 215</td>
<td></td>
</tr>
<tr>
<td>A P R A T</td>
<td>≥ 215</td>
<td></td>
</tr>
<tr>
<td>B P R A T</td>
<td>≥ 215</td>
<td></td>
</tr>
</tbody>
</table>

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

* Optional designs are available with special spool bushing lap configuration.
Available seal materials: Fluorocarbon (std.), BUNA or EPR.