MOOG

79 Series
Servovalves

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.

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 flow value Q calculated in this way should not exceed an average flow velocity of 100 ft/s in ports P, A, B and T.

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

Q [gpm] = calculated flow
Q_N [gpm] = rated flow
Δp [psi] = actual valve pressure drop
Δp_N [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:

$$p_x \geq 5.6 \bullet 10^{-2} \bullet \frac{Q}{A_K} \bullet \sqrt{\Delta p}$$

Q [gpm] = max. flow
Δp [psi] = valve pressure drop with Q
A_k [in^2] = 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.

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.

GENERAL TECHNICAL DATA

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 (to DIN 51524), others on request

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 recommended

For normal operation	$ß_{10} \geq 75$ (10 µm absolute)
For longer life	$ß_5 \geq 75$ (5 µm absolute)

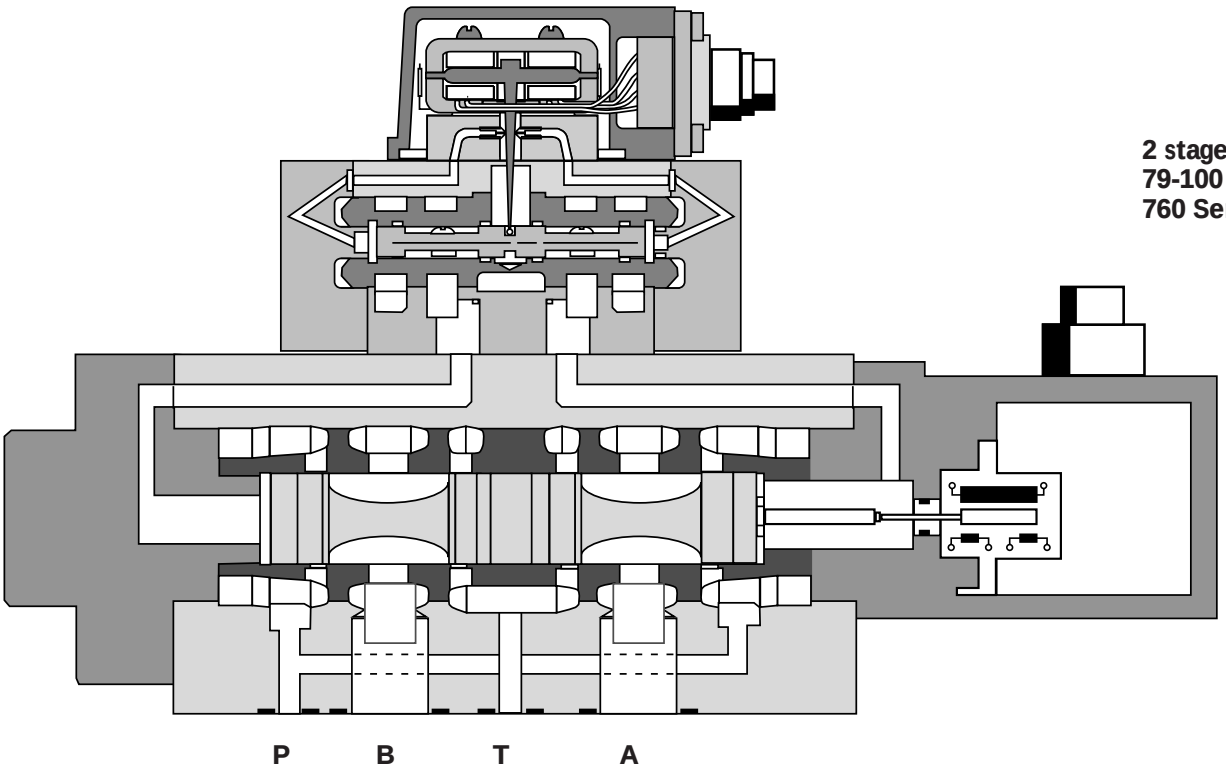
Installation Options Any position, fixed or moveable.

Vibration 30 g, 3 axes

Weight

Shipping Plate Delivered with an oil sealed shipping plate.

* Maximum special order is 5,000 psi



2 stage Servovalve 79-100 Series with a 760 Series pilot valve

Model . . . Type			**79-100**	
Mounting Pattern	ISO, but X and Y do **not** correspond to ISO		ISO 10372-06-05-0-92	
Valve Body Version			4-way 3-stage with spool-bushing assembly	
Pilot Valve			2-stage, 760 series	
Pilot Connection	Optional, internal or external		X and Y	
Mass			24 lbs [10.9 kg]	
Rated Flow	(± 10%) at Δp_N = 1,000 psi	[gpm]	30.0	60.0
Response Time*	for 0 to 100% stroke	[ms]	14	14
Threshold*		[%]	< 0.5%	
Hysteresis*		[%]	< 1.0%	
Null Shift	with ΔT = 50°C	[%]	< 2.5%	
Null Leakage Flow*	total, max.	[gpm]	0.8	1.6
Main Spool Stroke		[in]	.075	
Main Spool Drive Area		[in²]	0.44	

* 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

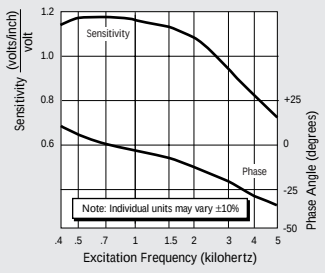
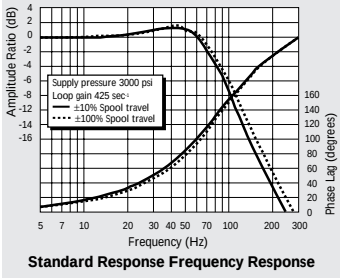
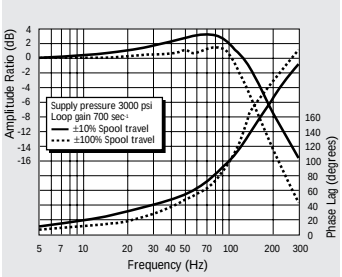


Figure 1

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

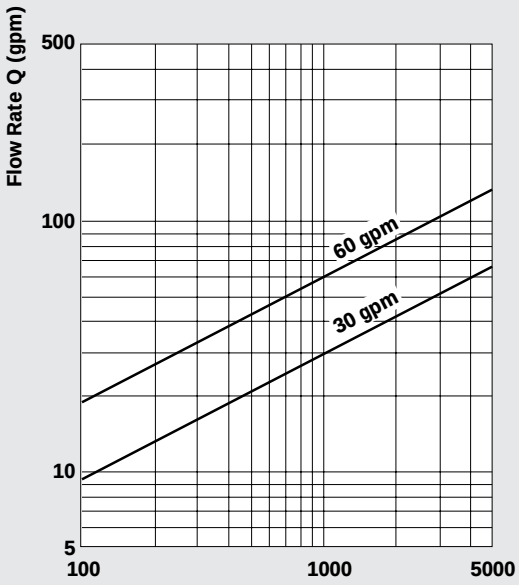


Standard Response Frequency Response



Optional High Response Frequency Response

Valve Flow Diagram



Rated pressure drop Δp_N= 1,000 psi Valve pressure drop Δp_N [psi]

Valve flow for maximum valve opening (100% command signal) as a function of the valve pressure drop.

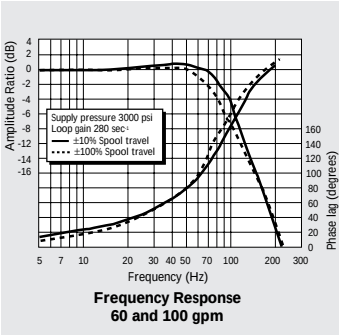
Model . . . Type			**79-200**				
Mounting Pattern			Moog Standard				
Valve Body Version			4-way				
			3-stage with spool-bushing assembly				
Pilot Valve			2-stage, 760 series				
Pilot Connection	Optional, internal or external		X and Y				
Mass			35.5 lbs. [16.1 kg]				
Rated Flow	(± 10%) at Δp_N = 1,000 psi	[gpm]	60	100		130	200
Response Time*	for 0 to 100% stroke Standard	[ms]	15	15		15	15
	High Response	[ms]	6	6		6	6
Threshold*		[%]			< 0.5%		
Hysteresis*		[%]			< 0.5%		
Null Shift	with ΔT = 50°C	[%]			< 2.0%		
Null Leakage Flow*	total, max.	[gpm]	2.5	2.5		2.5	2.5
Main Spool Stroke		[in]			0.130		
Main Spool Drive Area	Standard	[in²]			1.107		
	High Response	[in²]			0.442		

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

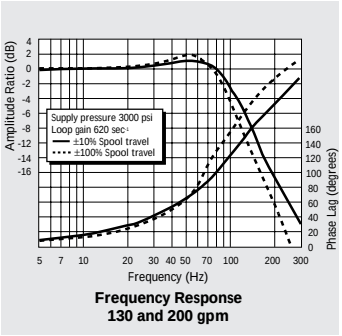
Typical Characteristic Curves measured at 3,000 psi pilot or operating pressure, respectively, and fluid kinematic viscosity of 32 mm²/s.

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

Standard Valves

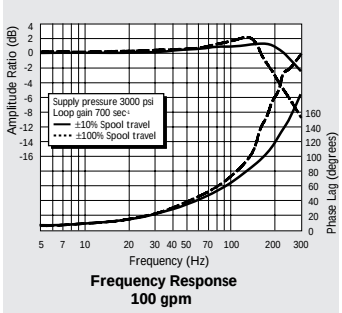


Frequency Response 60 and 100 gpm

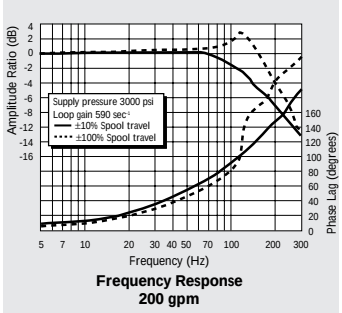


Frequency Response 130 and 200 gpm

High Response Valves

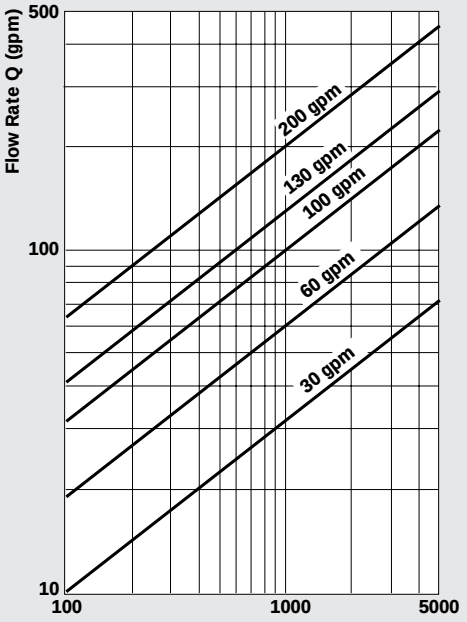


Frequency Response 100 gpm



Frequency Response 200 gpm

Valve Flow Diagram



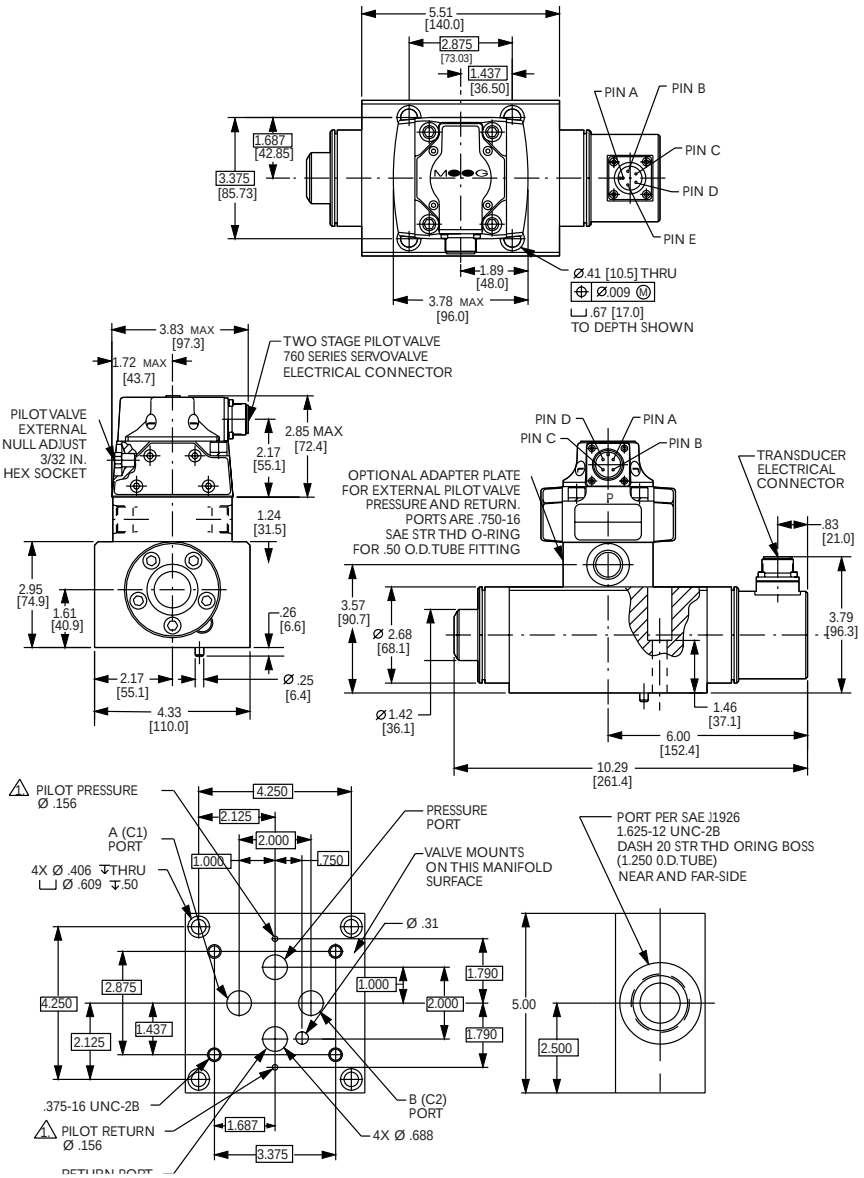
Rated pressure drop Δp_N = 1,000 psi Valve pressure drop Δp_N [psi]

Valve flow for maximum valve opening (100% command signal) as a function of the valve pressure drop.

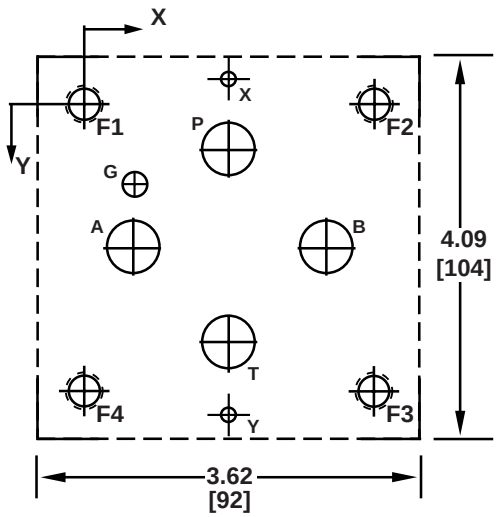
INSTALLATION DRAWINGS WITH PILOT VALVES 760 SERIES

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 32 [ΔΔ] finish, flat within 0.001[0.03] TIR.



79-100 SERIES
TYPICAL SUBPLATE MANIFOLD



US	P	A	T	B	G	X*	Y*	F1	F2	F3	F4
	Ø.63	Ø.63	Ø.63	Ø.63	Ø.32	Ø.156	Ø.156	5/8 11	5/8 11	5/8 11	5/8 11
X	1.44	0.43	1.44	2.44	0.43	1.44	1.44	0	2.87	2.87	0
Y	0.69	1.69	2.69	1.69	0.93	-0.1	3.48	0	0	3.37	3.37

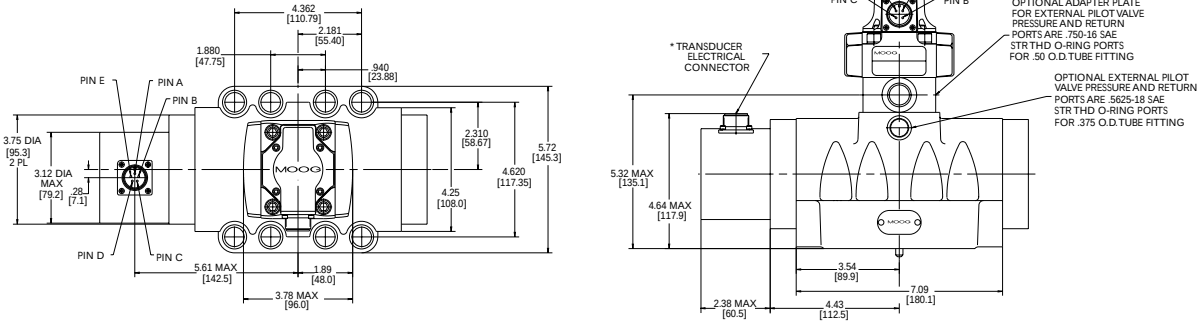
METRIC	P	A	T	B	G	X*	Y*	F1	F2	F3	F4
	Ø16	Ø16	Ø16	Ø16	Ø8	Ø4	Ø4	M10	M10	M10	M10
X	36,5	11,1	36,5	61,9	11,1	36,6	36,6	0	73	73	0
Y	17,4	42,8	68,2	42,8	23,7	2,5	88,4	0	0	85,6	85,6

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

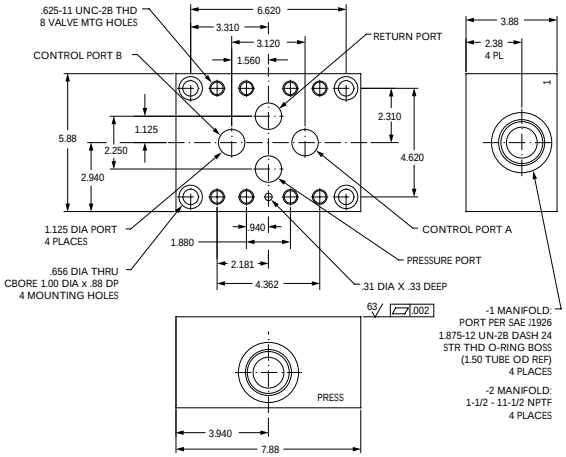
* **NOTE:** The X port to the ISO standard must not be machined.
The X and Y ports of the Moog valve do **not** correspond to ISO standard.

Surface to which the valve is mounted requires a 32 finish [ΔΔ], flat within .0001 [.03] TIR.

79-200 SERIES (STANDARD)
INSTALLATION DRAWING WITH PILOT VALVE 760 SERIES



TYPICAL SUBPLATE MANIFOLD



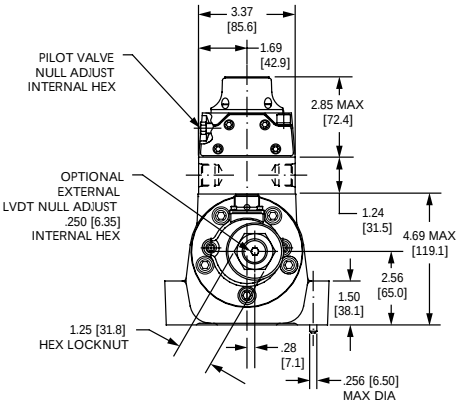
Note: The X and Y tubes have to be connected to the Moog valve body by fittings.

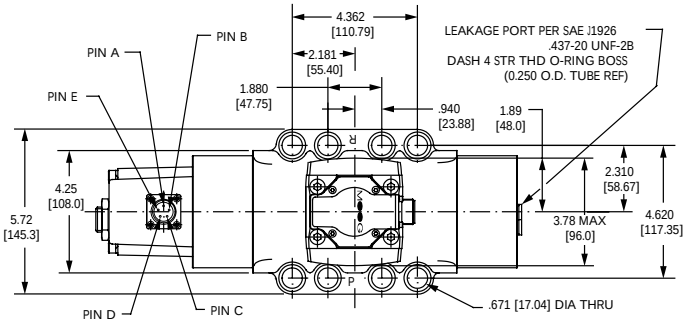
Surface to which valve is mounted requires a 32 [ΔΔ] finish, flat within 0.001 [0.03] TIR.

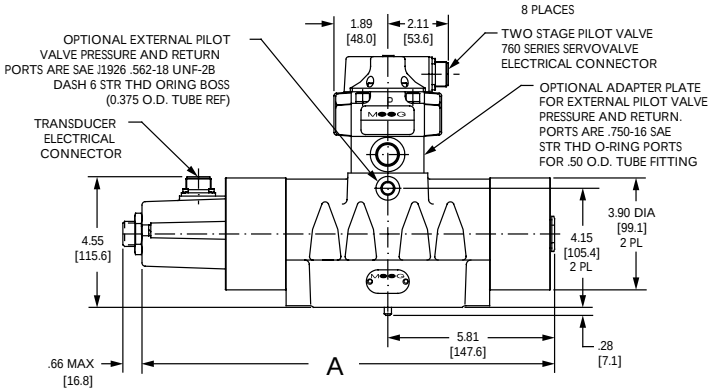
CONVERSION INSTRUCTION

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

INSTALLATION DRAWINGS WITH PILOT VALVES 760 SERIES







SPARE PARTS AND ACCESSORIES FOR 79-200 SERIES

O-rings (included in delivery)			
for P, T, A, B	4 pieces	ID 1.418 x 0.138	42082-264
Mating connector, waterproof IP 65 (not included in delivery)		pilot valve	49054F14S2S (MS3106F14S-2S)
		LVDT	49054F14S5S (MS3106F14S-5S)
Flushing Block Kit			43949-1K1
Mounting bolts (not included in delivery)			
5/8 - 11 UNC x 2.25	8 pieces	required torque 215 lb.-ft.	B40052-218B

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.

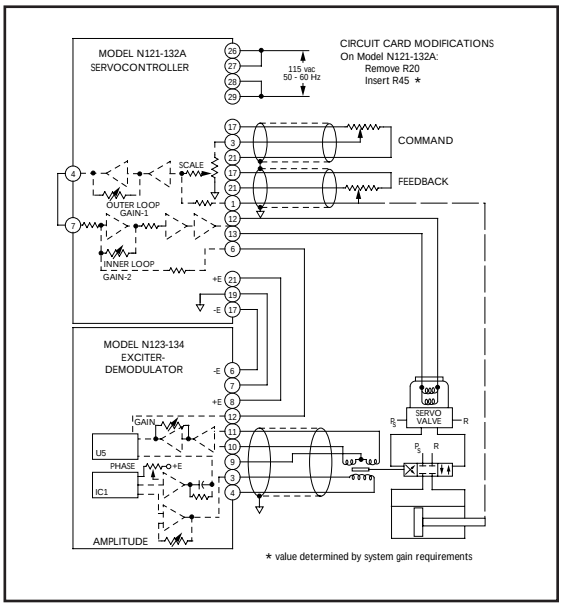
The AC excitation is adjustable between ±10 and ±14 volts peak-to-peak. The recommended frequency is 2000 Hz (N123-134) to achieve good servovalve response; however, a lower frequency may be necessary if a long cable run is required.

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.

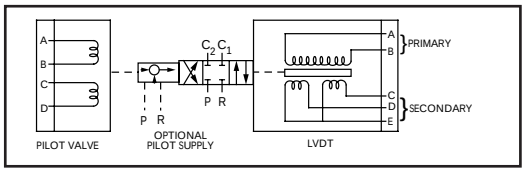
Inner Loop Gain Set-up

- ➢ 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 Isv to TP11). The valve current scale factor is 50 mA per volt measured at Isv.
- ➢ 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:

$$K_{IL} = \frac{K_A K_{PV} K_D K_X}{\Delta_X}$$

where:

K_{IL} = servovalve inner loop gain (sec^{-1})
K_A = servocontroller gain (mA/VDC)
K_{PV} = pilot valve gain $\left(\frac{\text{in}^3/\text{sec}}{\text{mA}}\right)$

$$= \frac{Z \text{ gpm} \times 3.85 \; \frac{\text{in}^3/\text{sec}}{\text{gpm}} \sqrt{\frac{3000 \text{ psi}}{1000 \text{ psi}}}}{15 \text{ mA}}$$

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

K_D = demodulator gain (VDC/vrms)
K_x = LVDT gain (vrms/inch)
Δ_X = power spool end area = 1.107 in^2 for 79-200 standard
= 0.442 in^2 for 79-200 High Response and 79-100

The required servocontroller gain can be found by:

$$K_A = \frac{K_{IL} A_S}{K_{PV} K_D K_X}$$

Outer Servoloop Gain

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

$$K_{VAL} = \frac{K_S}{K_D K_X}$$

where:

K_{VAL} = overall valve gain $\left(\frac{\text{in}^3/\text{sec}}{\text{VDC}}\right)$
K_S = power spool flow gain (see specifications)
K_D = 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.

ORDERING INFORMATION

Model Number

79-1, 79-2 • • • •

Type Designation

• • • • • • • • • • • • •

Model Designation

	Assigned at the factory

Response

	Standard

Valve Version

S	Standard response
H	High response (79-2 only)

Rated Flow

	Q_N[gpm] at Δp_N = 1,000 psi	
	Standard	Series
10	30	79-100
25	60	79-100
04	100	79-200
08	200	79-200
10	260	79-200

Maximum Operating Pressure p_p and Body Material

F	3,000 psi
K	5,000 psi steel

Main Spool Type

O	4-way / axis cut / linear characteristic
X	Special spool*

Pilot Stage

P	760 Standard
Q	760 High response
X	760 Super high response

Valve Electronics

7	Customer Supplied Electronics

Signal for 100% Spool Stroke

	Command
A	±10 V

LVDT Electrical Connector

5	Pin

Seal Material

N	NBR (Buna)
V	Fluorocarbon
	Others on request*

Pilot Connections

	Supply [X]	Return [Y]
0	internal	internal
1	external	internal
2	external	external

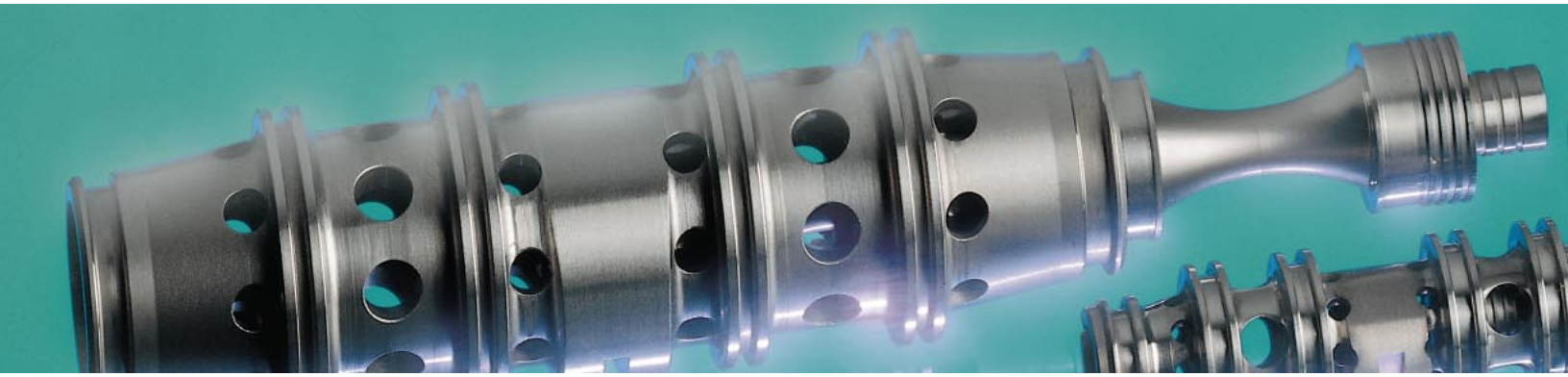
Spool Position without Electrical Signal

	Position	Pilot Pressure [psi]
O	Undefined	≥ 215
A	P ◗ B, A ◗ T	≥ 215
B	P ◗ B, A ◗ T	≥ 215

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.

Argentina
Australia
Austria
Brazil
China
England
Finland
France
Germany



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