DIRECT DRIVE DIGITAL CONTROL SERVO VALVES

D636 SIZE 03
D637 SIZE 05

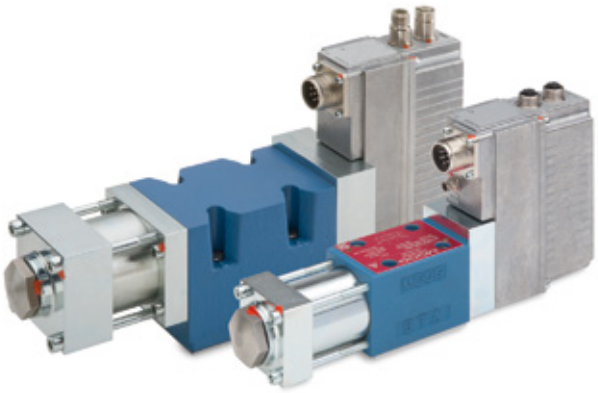
Rev. D, May 2019

HIGH PRODUCTIVITY FOR DEMANDING APPLICATIONS THAT REQUIRE A HIGHLY DYNAMIC RESPONSE, FLEXIBLE INTEGRATION AND ADVANCED MAINTENANCE.

WHAT MOVES YOUR WORLD

MOOG

Whenever the highest levels of motion control performance and design flexibility are required, you'll find Moog expertise at work. Through collaboration, creativity and world-class technological solutions, we help you overcome your toughest engineering obstacles. Enhance your machine's performance, and help take your thinking further than you ever thought possible.



PRODUCT OVERVIEW

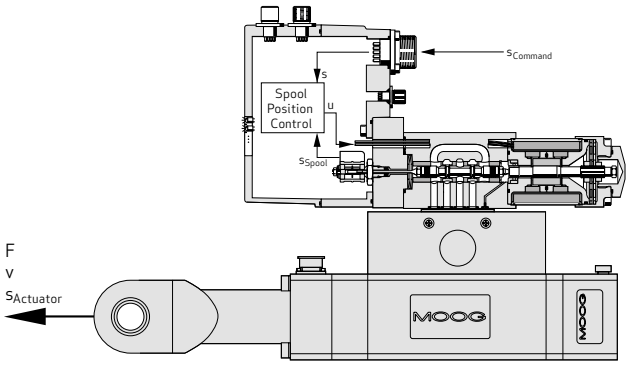
Moog Digital Control Valves (DCV) are closed-loop hydraulic products that are used in industrial machinery to precisely control flow, position, velocity or force using advanced digital fieldbuses for communication (e.g. EtherCAT, PROFIBUS-DP, CANopen) or analog interfaces.

For maximum flexibility, customers can choose to have an analog interface, fieldbus interface or both combined in the same valve. The D636 and D637 valve series have world-class, proven technology that makes them the performance leader in providing advanced functionality such as higher dynamics, easy parameter tuning and adaptation of flow characteristics.

With a robust design that offers proven reliability in some of the world's most demanding environments such as oil rigs, offshore wind turbines and steel mills, these valves can be tailored to your exact performance requirements. With proven hydraulic motion control and application expertise, Moog can help you select the version that best meets your needs.

This Servo Valve series is also available as explosion proof version with hot-swappable connectors and proven ability to withstand vibration and heavy use.

Control loop consisting of valve with integrated spool position control and cylinder



F	Force
$s_{Actuator}$	Actuator position
$s_{Command}$	Spool position command signal
s_{Spool}	Spool position
u	Correcting variable
v	Velocity

	D636 Servo Valve	D637 Servo Valve
Valve design	1-stage, with spool and bushing	
Size according ISO 4401	03	05
Mounting pattern	ISO 4401-03-03-0-05 (with or without leakage oil connection Y)	ISO 4401-05-05-0-05 (with or without leakage oil connection Y)
Rated flow at Δp_N 35 bar (500 psi)/spool land	5/10/20/40 l/min (1.3/2.6/5.3/10.6 gpm)	60/100 l/min (15.9/26.4 gpm)
Maximum flow	75 l/min (19.8 gpm)	180 l/min (47.6 gpm)
Maximum operating pressure – port P, A, B	350 bar (5000 psi)	
Step response time for 0 to 100 % stroke	8 ms	14 ms

PRODUCT OVERVIEW
Direct Drive Digital Control Valves with Spool Position Control

Direct Drive Servo Valves

The D636 and D637 Series Valves, sizes 03 an 05 are Direct Drive Servo Valves.

The valves are control valves for 2-, 2x2-, 3- and 4-way applications and are suitable for electrohydraulic control of position, speed, pressure and force even under high dynamic requirements.

Design and Application

A permanent magnet linear force motor is used to drive the spool. In contrast to proportional solenoid drives, the linear force motor drives the spool in both working directions from the spring-centered middle position. The strong actuating force of the spool, provides Moog Servo Valves with excellent static and dynamic characteristics.

Digital Electronics

The digital driver and control electronics are integrated in the valve. The valve electronics contain a microprocessor system which executes all the important functions via the valve to be controlled across the full range of operation, with significantly reduced influence from temperature and drift.

Fieldbus Interface

A built-in fieldbus interface (e.g CAN open, Profibus-DP or EtherCAT) enables operating parameters to be set, activates the valve and monitors its performance. To reduce wiring, the fieldbus interface is provided with two connectors. Thus, valves may be integrated into the bus without any external T-joints. In addition, up to two analog input commands and up to two analog actual value outputs are available.
Optionally, the valves are available without a fieldbus interface. In this case, the valve is controlled using analog inputs. Valve parameters are set using the integrated M8 service connector.

Spool Position Control

In this operating mode of the servo valve, the spool position is controlled. The command signal is proportional to a desired spool position. A position transducer (LVDT) measures the spool's actual position and forwards this information to the valve electronics. The electronic system compares the actual spool position and the command signal, and generates a signal to drive the linear force motor, which then brings the spool into the correct position. The position command can be influenced by parameters in the valve software (i.e: linearization, ramping, dead band, sectionally defined amplification, etc).

Optional Valve Features

Moog offers a range of optional features. These include options to ruggedize valves for operation in extremely demanding environments, and valves designed for special applications and fluids. The following sections provide short overviews of these functions. Please contact Moog for more detailed information.

Valves for Operation with Ester Based Fluids

Standard hydraulic seal materials such as HNBR and FKM, are frequently incompatible with fire resistant phosphate ester based fluids. In order to use valves with this type of fluid, Moog offers them as special seal versions that are mineral oil and phosphate ester resistant. Please note: These valve types are tested by Moog using mineral oil, remnants of which will remain in the valve after testing.

Pressure Control

A pressure control function can be added to the valve as an additional option. These valves provide full pressure (p) and flow combined with a pressure limiting (pQ) function. For further information please see our digital control valves with p and pQ control catalogs.

Axis Control

Optionally, an axis control functionality can be added to the valve. This enables the valve to close external control loops, e.g. flow, position, velocity or force control. Data from external sensors can be read by up to 3 analog inputs (V/A), an SSI interface or a Wheatstone Bridge.

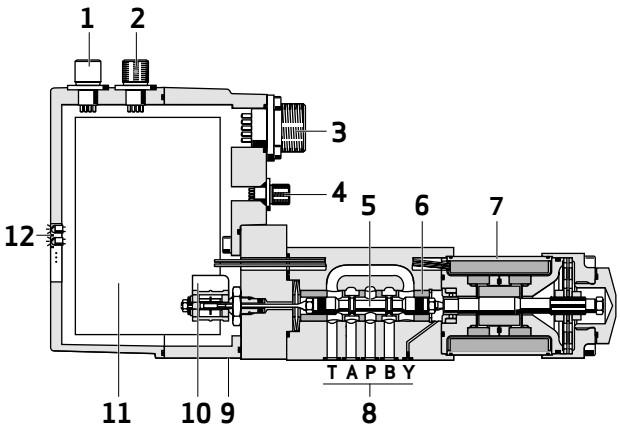
Please ask us about special versions of our valves.

DESCRIPTION OF OPERATION

Main Features of Direct Drive Servo Valves with Integrated Digital Electronics

- Direct drive with permanent magnet linear force motor that provides high actuating force, works in 2 directions
- Direct operated - no pilot oil required
- Pressure-independent dynamic response
- Low hysteresis and high response characteristics
- Diagnostic capabilities: Integrated monitoring of important ambient and internal parameters; valve parameters may be changed on site or remotely
- Flexibility: Since parameters may be downloaded using the fieldbus or a high level PLC program, valve parameters may be tuned during a machine cycle while the machine is operating
- Lower power demand in and around the spool center position. This results in lower energy consumption during the majority of operating and stand by times
- If the electrical supply fails, a cable breaks or emergency stop is activated, the spool returns to the predefined spring-centered position without passing a fully open control port position increasing safety

D636 Series Direct Drive Servo Valve



1 Fieldbus connector X4
2 Fieldbus connector X3
3 Valve connector X1
4 Service connector X10
5 Spool
6 Bushing
7 Linear force motor
8 Ports
9 Electronic housing
10 Position transducer (LVDT)
11 Digital electronics
12 LED

Description of Operation of the Permanent Magnet Linear Force Motor

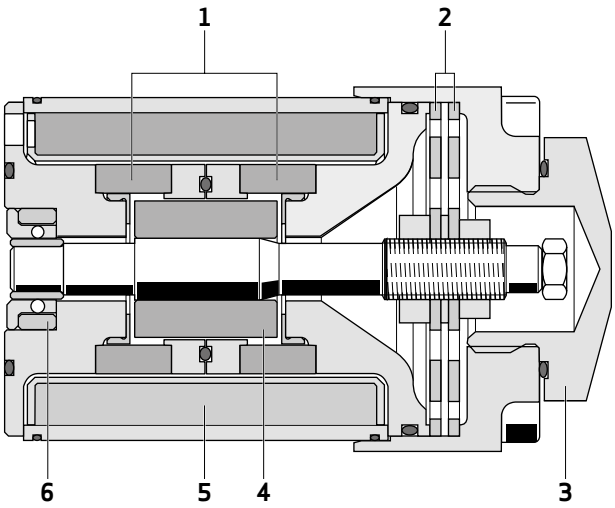
The Linear Force Motor (LFM) is a permanent magnet excited differential motor.

The LFM's armature (4) is connected to the valve spool via a rod. Also connected to this rod are the centering springs (2), which keep the LFM in its center position. The permanent magnets (1) supply part of the motor's force. In combination with the force created by the coil (5), the force level of a Linear Force Motor is higher than that of a proportional solenoid of similar size.

The LFM has a neutral mid-position from which it generates force and stroke in both directions. This is an advantage over a proportional solenoid drive, which can only operate in one direction. The LFM's force is roughly proportional to the coil current. To move out of the center position, a PWM current is applied to the coil and the spool is deflected against the centering springs. To move back towards the center position, a reverted PWM current is applied to the coil, which causes the LFM to actively move the spool towards the center. This movement is supported by the centering springs.

Due to the high force levels of the LFM it is able to overcome flow and frictional forces and still guarantee a precise and dynamic positioning of the spool.

D636 Series Linear Motor



1 Permanent magnets
2 Centering springs
3 Screw plug
4 Armature
5 Coil
6 Bearing

DESCRIPTION OF OPERATION

2-way and 2x2-way operation

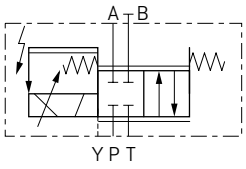
In 2-way and 2x2-way operation the servo valves can be used to control the flow in one direction (used as 2-way throttle valves).
In 2x2-way operation the valve can be used in 2-way applications for higher flows. It is necessary to connect ports P with B and A with T externally for this purpose.

4-way and 3-way operation

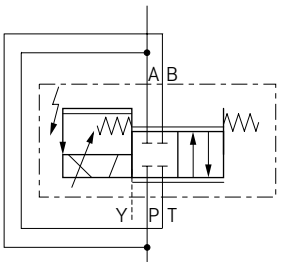
In 4-way operation the servo valves can be used to control the flow in ports A and B (used as 4/3-way throttle valves). Port A or B must be closed in order to obtain 3-way operation. Leakage port Y must be used if the pressure in tank port T exceeds a value of 50 bar (725 psi). The valves are available with zero lap, less than 3 % or 10 % positive overlap.

Hydraulic Symbols for D636 Servo Valve

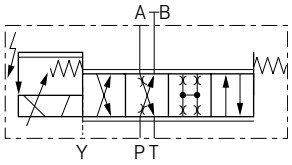
2-way operation



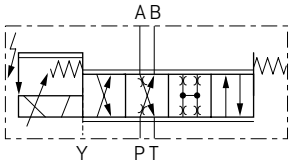
2x2-way operation



3-way operation with failsafe option F



4- way operation with failsafe option F



FEATURES AND BENEFITS

Features	Benefits
D636 and D637 Series Servo Valves	
Direct operated servo valves	No pilot oil required, valve dynamics are not dependent on constant pilot pressure
Linear Force Motor with high force level and push-pull operation	Precise and dynamic valve operation even at high pressure drops
Precise spool positioning with low hysteresis and threshold	High control accuracy for demanding closed loop control tasks
High valve dynamics	Supports highly dynamic control tasks
Spool slides in precisely manufactured and fully hardened steel bushing	Low internal leakage, high control accuracy and high wear resistance
Electronics mounted in rubber frame for vibration isolation	High resistance against shock and vibration in harsh environments
Electronics components with high energy efficiency and high temperature resistance	High durability even at high environmental and fluid temperatures
All Digital Control Valves	
Moog offers the ability to exactly tailor hardware, configurations and functionality to the customer's application need	Optimize machine performance to gain competitive advantages
Improved dynamics over traditional proportional valve technology due to high performance design of hardware and software	Increases machine performance in areas such as higher acceleration, improved accuracy, leading to enhanced machine productivity
Availability of FM, ATEX and IECEx approved versions with hot-swappable connectors and proven ability to withstand vibration and heavy use	Proven, reliable product for use in hazardous environments such as Oil and Gas Production
Reduced cabling and analog input/outputs (I/O) in complex systems when compared to traditional analog	Save space and costs while obtaining more machine flexibility
Availability of diagnostic and condition monitoring data in the valve	Helps customers manage life cycle of the valve in order to optimize maintenance costs
Factory preset parameters optimized for flow control functionality	Valves are plug-and-play from the factory, offering higher accuracy and reducing your risk of installing new technology
Advanced tuning functionality such as non-linear flow curves and a variety of other parameters for complex machine operations via Moog Configuration software	Allows machine optimization and tailoring to exact customer specifications

SIZE 03 – D636 SERVO VALVE

General Technical Data

Valve design	1-stage, with spool and bushing
Mounting pattern	ISO 4401-03-03-0-05 (with or without leakage oil connection Y)
Installation position	Any
Weight	2.5 kg
Storage temperature range	-40 to +80 °C (-40 to +176 °F)
Ambient temperature range	-20 to +60 °C (-4 to +140 °F)
Vibration resistance	30 g, 3 axis, 10 Hz to 2 kHz
Shock resistance	50 g, 6 directions, 3 ms
$MTTF_d$ value according to EN ISO 13849-1	150 years

Hydraulic Data

Maximum operating pressure				
Port P, A, B	350 bar (5000 psi)			
Port T without Y	50 bar (725 psi)			
Port T with Y	350 bar (5000 psi)			
Port Y	Depressurized to tank[1)]			
Rated flow at Δp_N 35 bar (500 psi)/spool land	5 l/min (1.3 gpm)	10 l/min (2.6 gpm)	20 l/min (5.3 gpm)	40 l/min (10.6 gpm)
Maximum flow	75 l/min (19.8 gpm)			
Leakage flow (rate) (≈ zero lap)[2)]	0.15 l/min (0.04 gpm)	0.3 l/min (0.08 gpm)	0.6 l/min (0.16 gpm)	1.2 l/min (0.32 gpm)
Hydraulic fluid	Hydraulic oil as per DIN 51524 parts 1 to 3 and ISO 11158. Other fluids upon request.			
Temperature range	-20 to +80 °C (-4 to +176 °F)			
Viscosity range				
Recommended viscosity range at 38 °C (100 °F)	15 to 100 mm^2/s (cSt)			
Maximum permissible viscosity range at 38 °C (100 °F)	5 to 400 mm^2/s (cSt)			
Recommended cleanliness class as per ISO 4406				
For functional safety	18/15/12			
For longer service life	17/14/11			

Typical Static and Dynamic Data[2)]

Step response time for 0 to 100 % stroke	8 ms
Threshold, typical	< 0.05 %
Threshold, maximum	< 0.1 %
Hysteresis, typical	< 0.05 %
Hysteresis, maximum	< 0.1 %
Null shift at ΔT = 55 K (131 °F)	< 1.5 %
Sample deviation of rated flow	< 3 %

1) In order to avoid an emptying of the return line, a back-pressure of 2 bar (29 psi) should be maintained on the T, T1 and Y connections.
2) Measured at 140 bar (2,000 psi) pilot or system pressure, oil viscosity 32 mm^2/s and oil temperature 40 °C (104 °F)

SIZE 03 – D636 SERVO VALVE

Electrical Data

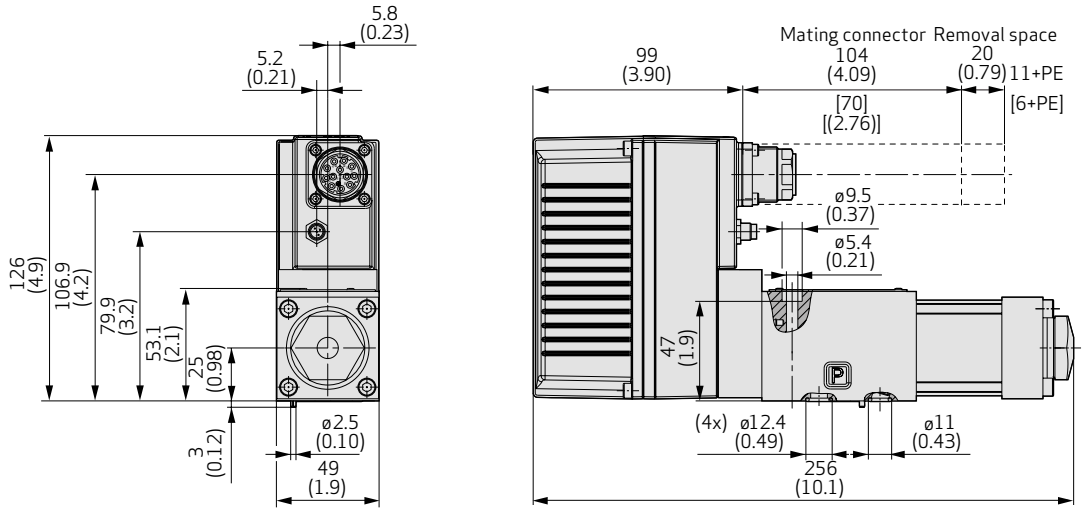
Duty cycle	100 %
Degree of protection according to IEC/EN 60529	IP65 with mounted mating plugs
Supply voltage[3)]	18 to 32 V_{DC}
Permissible ripple of supply voltage[4)]	±3 V_{RMS}
Maximum current consumption[5)]	1.7 A
Power consumption of the motor in middle position	9.6 W (0.4 A at 24 V_{DC})
Power consumption maximum	28.8 W (1.2 A at 24 V_{DC})
Fuse protection, external, per valve	2 A (slow)
EM compatibility	• Emitted interference as per DIN EN 61000-6-4 (CAN open and PROFIBUS-DP) • Emitted interference as per DIN EN 61000-6-3 (EtherCAT) • Immunity to interference as per DIN EN 61000-6-2 (evaluation criterion A)

3) All connected circuits must be isolated from the mains supply by „electrical separation“ in accordance with IEC/EN 61558-1 and IEC/EN 61558-2-6. Voltages must be limited to the safety extra-low voltage range in accordance with EN 60204-1. We recommend the use of SELV/PELV power packs.

4) Frequency from 50 Hz to 10 kHz

5) Measured at ambient temperature 25 °C (77 °F) and supply voltage 24 V

Installation drawing

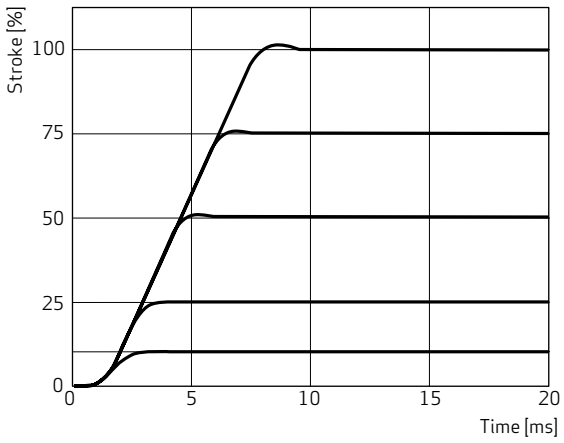


Note: See section „Installation Drawing Electronic Housing“ for valves with fieldbus interface.

SIZE 03 – D636 SERVO VALVE

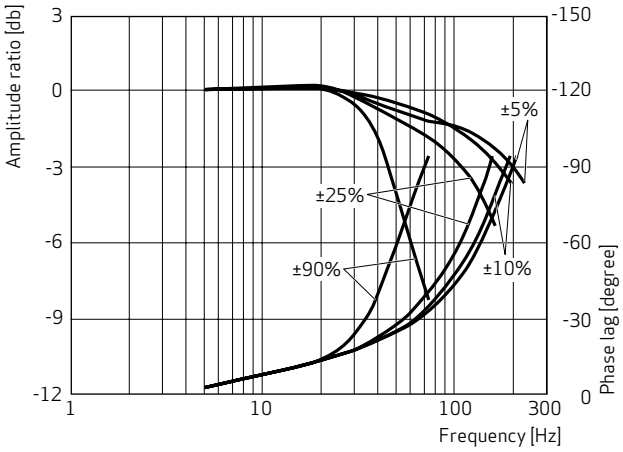
Step Response

5/10/20/40 l/min



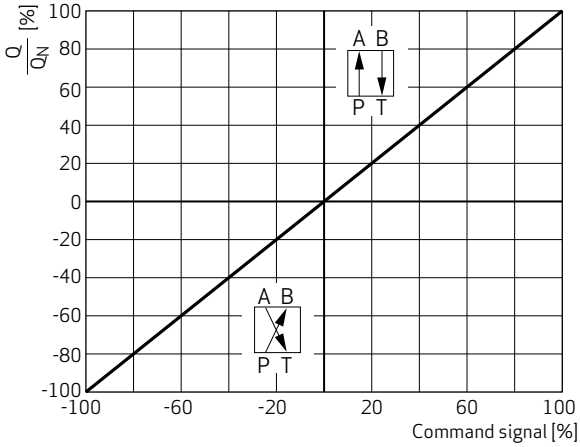
Frequency Response

5/10/20/40 l/min



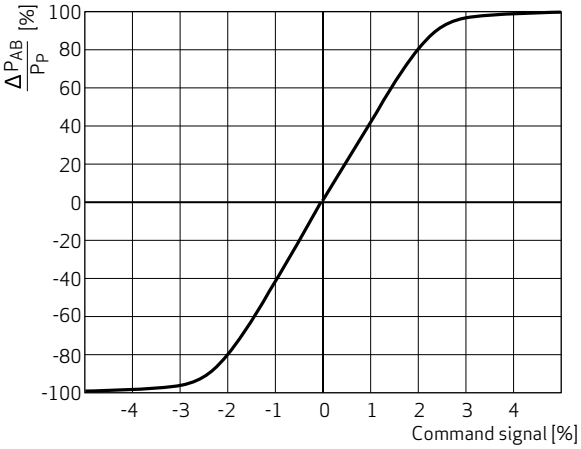
Flow Signal

Flow signal characteristic



Pressure Signal

Pressure signal characteristic – position controlled

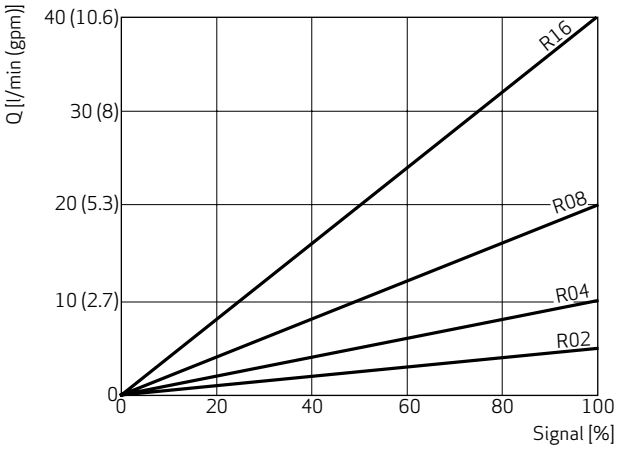


Note: Measured with system pressure p_p of 140 bar (2,000 psi), oil viscosity 32 mm²/s and oil temperature of 40°C (104°F).

SIZE 03 – D636 SERVO VALVE

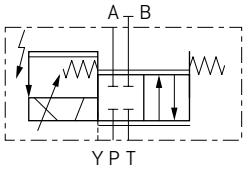
Typical Characteristic Curves

Flow signal curves at Δp_N = 35 bar (500 psi) per spool land

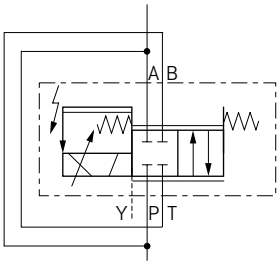


Hydraulic Symbol

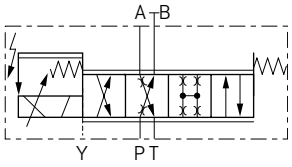
2-way operation



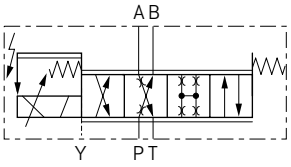
2x2-way operation



3-way operation with failsafe option F



4-way operation with failsafe option F

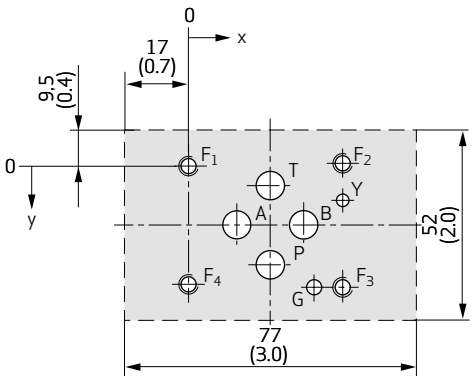


Port Pattern of Mounting Surface

The mounting surface must conform to ISO 4401-03-03-0-05. Observe mounting length of minimum 77 mm (3.0 in) and O-ring recesses for Y.

For maximum flow the ports for P, T, A and B must be designed with Ø 7.5 mm (0.3 in), not according to the standard.

Evenness of connecting surface has to be 0.01 mm (0.0004 in) over 100 mm (3.94 in), average surface finish R_a better than 0.8 µm (0.0000314 in).



Designation		P	A	B	T	Y	F_1	F_2	F_3	F_4	G
Size Ø	**mm**	7.5	7.5	7.5	7.5	3.3	M5	M5	M5	M5	4.0
	in	0.30	0.30	0.30	0.30	0.13	M5	M5	M5	M5	0.16
Position X	**mm**	21.5	12.7	30.2	21.5	40.5	0	40.5	40.5	0	33
	in	0.846	0.5	1.189	0.846	1.594	0	1.594	1.594	0	1.299
Position Y	**mm**	25.9	15.5	15.5	5.1	9	0	-0.75	31.75	31	31.75
	in	1.02	0.61	0.61	0.201	0.354	0	-0.03	1.25	1.22	1.25

SIZE 05 – D637 SERVO VALVE

General Technical Data

Valve design	1-stage, with spool and bushing
Mounting pattern	ISO 4401-05-05-0-05 (with or without leakage oil connection Y)
Installation position	Any
Weight	7.9 kg
Storage temperature range	-40 to +80 °C (-40 to +176 °F)
Ambient temperature range	-20 to +60 °C (-4 to +140 °F)
Vibration resistance	30 g, 3 axis, 10 Hz to 2 kHz
Shock resistance	50 g, 6 directions, 3 ms
$MTTF_d$ value according to EN ISO 13849-1	150 years

Hydraulic Data

Maximum operating pressure		
Port P, A, B	350 bar (5000 psi)	
Port T without Y	50 bar (725 psi)	
Port T with Y	210 bar (3000 psi)	
Port Y	Depressurized to tank[1)]	
Rated flow at Δp_N 35 bar (500 psi)/spool land	60 l/min (15.9 gpm)	100 l/min (26.4 gpm)
Maximum flow	180 l/min (47.6 gpm)	
Leakage flow (rate) (≈ zero lap)[2)]	1.2 l/min (0.32 gpm)	2.0 l/min (0.53 gpm)
Hydraulic fluid	Hydraulic oil as per DIN 51524 parts 1 to 3 and ISO 11158. Other fluids upon request.	
Temperature range	-20 to +80 °C (-4 to +176 °F)	
Viscosity range		
Recommended viscosity range at 38 °C (100 °F)	15 to 100 mm^2/s (cSt)	
Maximum permissible viscosity range at 38 °C (100 °F)	5 to 400 mm^2/s (cSt)	
Recommended cleanliness class as per ISO 4406		
For functional safety	18/15/12	
For longer service life	17/14/11	

Typical Static and Dynamic Data[2)]

Step response time for 0 to 100 % stroke	14 ms
Threshold, typical	< 0.05 %
Threshold, maximum	< 0.1 %
Hysteresis, typical	< 0.05 %
Hysteresis, maximum	< 0.1 %
Null shift at ΔT = 55 K (131 °F)	< 1.5 %
Sample deviation of rated flow	< 3 %

1) In order to avoid an emptying of the return line, a back-pressure of 2 bar (29 psi) should be maintained on the T, T1 and Y connections.
2) Measured at 140 bar (2,000 psi) pilot or system pressure, oil viscosity 32 mm^2/s and oil temperature 40 °C (104 °F)

SIZE 05 – D637 SERVO VALVE

Electrical Data

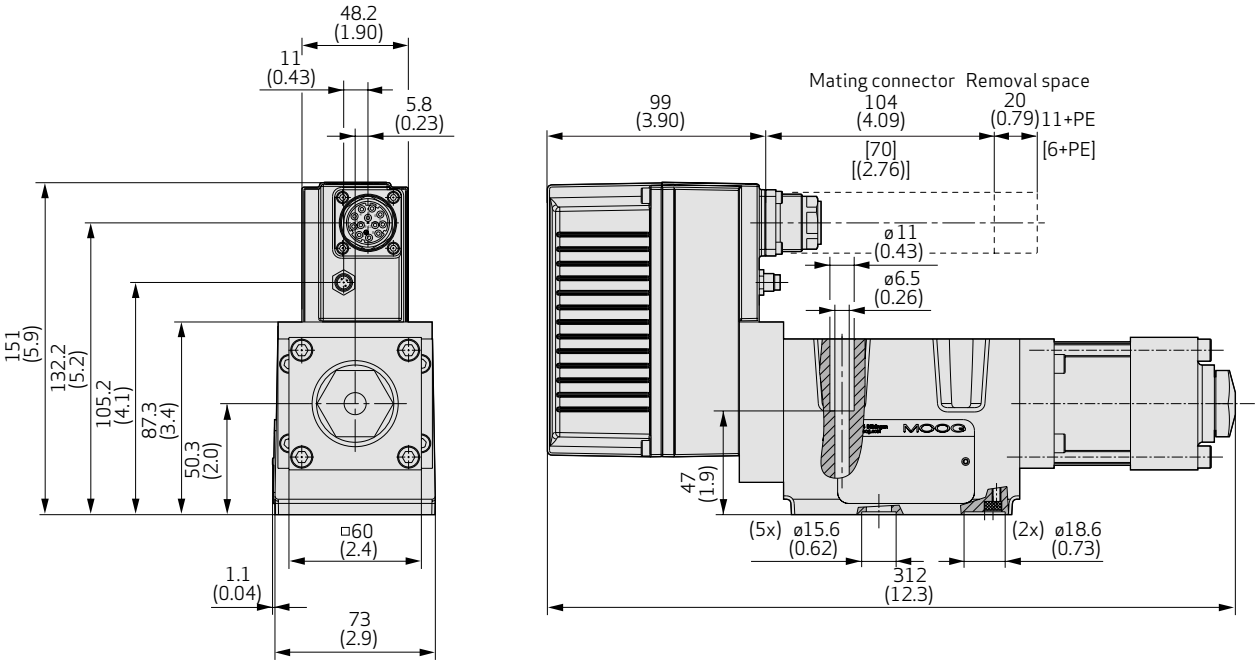
Duty cycle	100 %
Degree of protection according to IEC/EN 60529	IP65 with mounted mating plugs
Supply voltage[3)]	18 to 32 V_{DC}
Permissible ripple of supply voltage[4)]	±3 V_{RMS}
Maximum current consumption[5)]	3.0 A
Power consumption of the motor in middle position	9.6 W (0.4 A at 24 V_{DC})
Power consumption maximum	55.2 W (2.3 A at 24 V_{DC})
Fuse protection, external, per valve	3.15 A (slow)
EM compatibility	• Emitted interference as per DIN EN 61000-6-4 (CAN open and PROFIBUS-DP) • Emitted interference as per DIN EN 61000-6-3 (EtherCAT) • Immunity to interference as per DIN EN 61000-6-2 (evaluation criterion A)

3) All connected circuits must be isolated from the mains supply by „electrical separation“ in accordance with IEC/EN 61558-1 and IEC/EN 61558-2-6. Voltages must be limited to the safety extra-low voltage range in accordance with EN 60204-1. We recommend the use of SELV/PELV power packs.

4) Frequency from 50 Hz to 10 kHz

5) Measured at ambient temperature 25 °C (77 °F) and supply voltage 24 V

Installation drawing

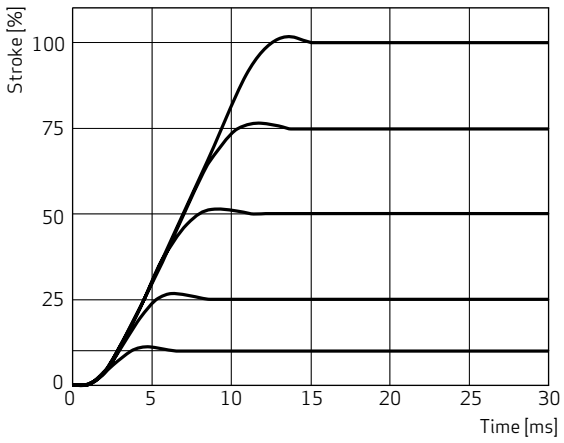


Note: See section „Installation Drawing Electronic Housing“ for valves with fieldbus interface.

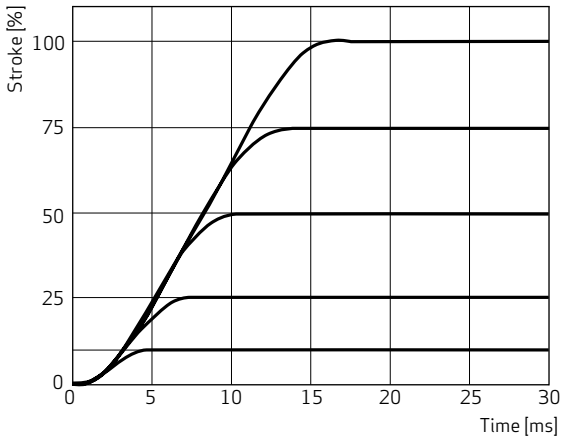
SIZE 05 – D637 SERVO VALVE

Step Response

60 l/min

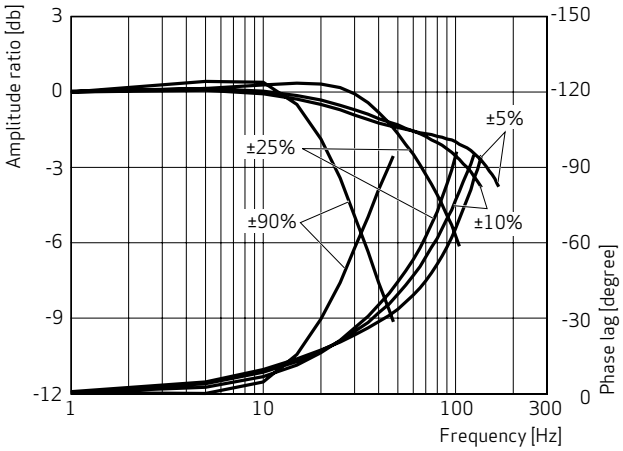


100 l/min

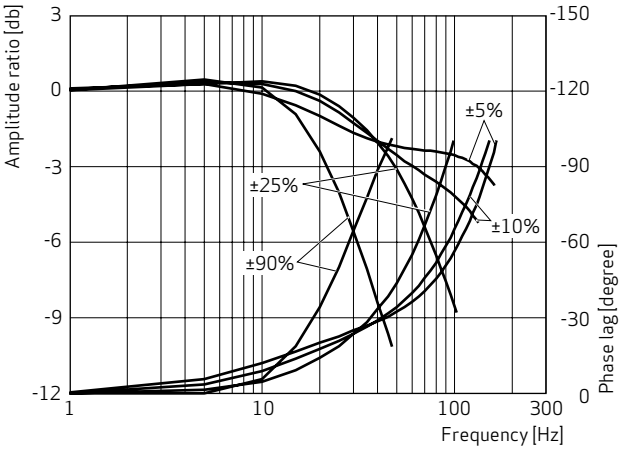


Frequency Response

60 l/min

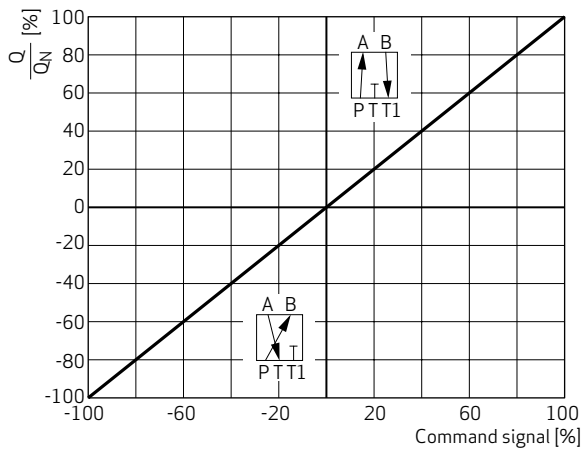


100 l/min



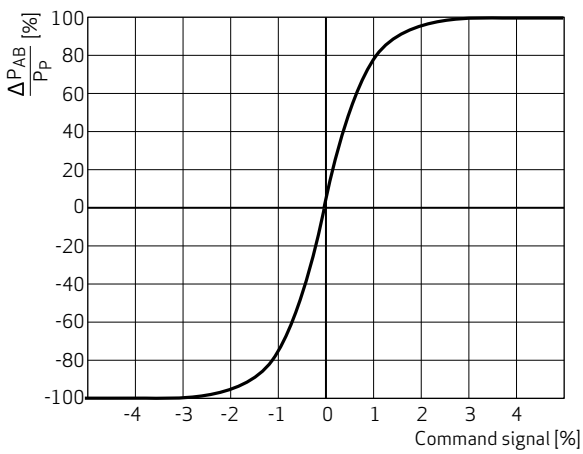
Flow Signal

Flow signal characteristic



Pressure Signal

Pressure signal characteristic - position controlled

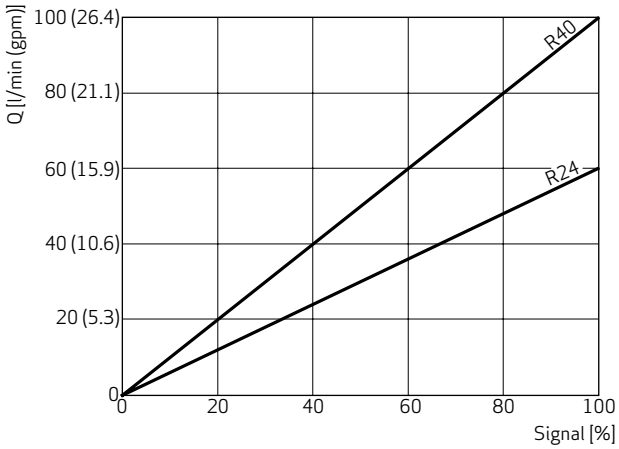


Note: Measured with system pressure p_p of 140 bar (2,000 psi), oil viscosity 32 mm²/s and oil temperature of 40°C (104°F).

SIZE 05 – D637 SERVO VALVE

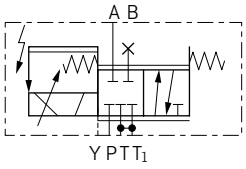
Typical Characteristic Curves

Flow signal curves at Δp_N = 35 bar (500 psi) per spool land

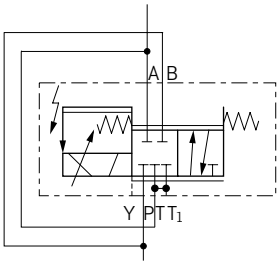


Hydraulic Symbol

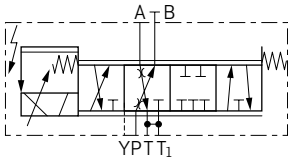
2-way operation



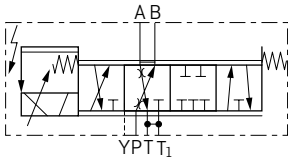
2x2-way operation



3-way operation with failsafe option F



4-way operation with failsafe option F

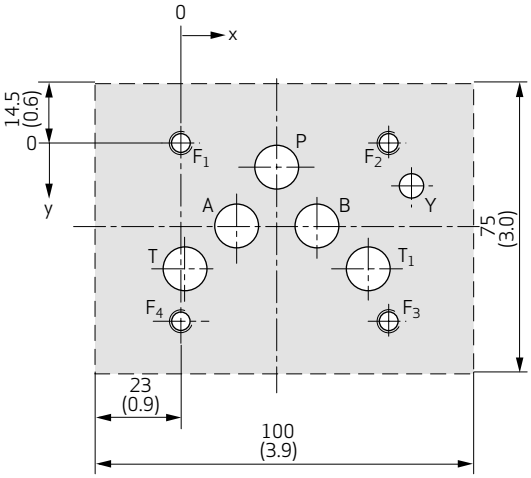


Port Pattern of Mounting Surface

The mounting pattern must confirm to ISO 4401-05-05-0-05 with additional T_1. Observe mounting length of minimum 100 mm (3.94 in) and O-ring recesses for Y. For 4-way valves with Q > 60 l/min (15.9 gpm) the second tank port T_1 is required.

For maximum flow the ports for P, T, T_1, A and B must be designed with Ø 11.5 mm (0.45 in), not according to the standard.

Evenness of connecting surface has to be 0.01 mm (0.0004 in) over 100 mm (3.94 in), average surface finish R_a better than 0.8 µm (0.0000314 in).

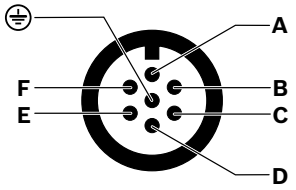


Designation		P	A	B	T	T_1	Y	F_1	F_2	F_3	F_4
Size Ø	**mm**	11.2	11.2	11.2	11.2	11.2	6.3	M6	M6	M6	M6
	in	0.44	0.44	0.44	0.44	0.44	0.25	M6	M6	M6	M6
Position X	**mm**	27	16.7	37.3	3.2	50.8	62	0	54	54	0
	in	1.063	0.657	1.469	0.126	2	2.441	0	2.126	2.126	0
Position Y	**mm**	6.3	21.4	21.4	32.5	32.5	11	0	0	46	46
	in	0.248	0.843	0.843	1.28	1.28	0.433	0	0	1.811	1.811

ELECTRONICS

Pin Assignment for Valves with 6-pole + PE Connector, Pin Contacts (X1)

According to EN 175201-804, mating connector (type R or S, metal) with preleading protective earth pin (⏚)



Pin	Pin assignment	Signal type[1]	
		Voltage floating	**Current floating[2]**
A	**Supply voltage**	U_{Supply} = 24 V_{DC} (18 to 32 V_{DC}) referenced to GND (reverse polarity protected against GND)	
B	**GND**	Power ground/signal ground	
C	**Enable input**	U_{CB} > 8.5 to 32 V_{DC} referenced to GND: Valve ready for operation (enabled) U_{CB} < 6.5 V_{DC} referenced to GND: Valve disabled The input resistance is 10 kΩ	
D	**Command signal - spool position**	$U_{in} = U_{DE}$ R_{in} = 20 kΩ	$I_{in} = I_D = -I_E$ R_{in} = 200 Ω I_{max} = ±25 mA
E	**Reference point Input rated command**	Reference for pin D[3]	
F	**Actual value - spool position**	U_{F-B} = 2 to 10 V; U_{F-B} is proportional to the spool position; 6 V corresponds to the spool center position; R_L = 500 Ω	I_{out} = 4 to 20 mA referenced to GND; I_{out} is proportional to the spool position; 12 mA corresponds to the spool center position; the output is short-circuit-proof; R_L = 0 to 500 Ω
⏚	**Protective earth (PE)**	Connected with valve body	

1) Signal ranges see next page.
2) Command signals I_{in} < 3 mA (due to cable break, for example) indicates a failure of 4 to 20 mA signals. The valve reaction to this failure may be customized and activated by the customer.
3) The potential difference between pins D or E referenced to pin B must be between -15 and +32 V.

ELECTRONICS

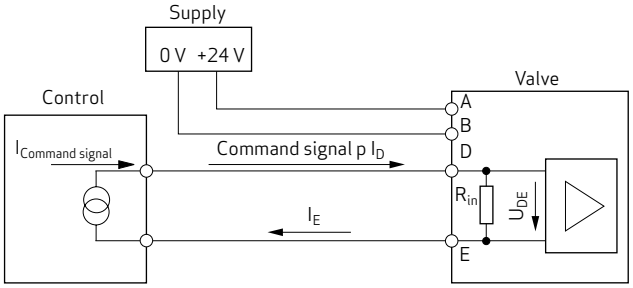
Ordering Codes and Signals for Valves with 6-pole + PE Connector (X1)

Ordering code	Command signal ±100% spool position		Actual value ±100 % spool position	
M	U_D - U_E	-10 to +10 V	I_F	4 to 20 mA
X	I_D	-10 to +10 mA	I_F	4 to 20 mA
E	I_D	4 to 20 mA	I_F	4 to 20 mA
D	U_D - U_E	-10 to +10 V	U_F - U_B	2 to 10 V

Note: See inside back cover for complete ordering information.

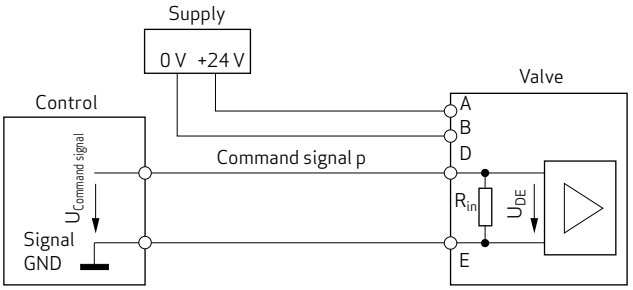
Command Signal Current Floating, Ordering Code X or E

The spool position is proportional to $I_D = - I_E$.
For a command signal I_D = 20 mA (code E) or +10 mA (code X) the spool moves to 100 % P → A and B → T.
For a command signal I_D = 12 mA (code E) or 0 mA (code X) the spool is in the defined center position.



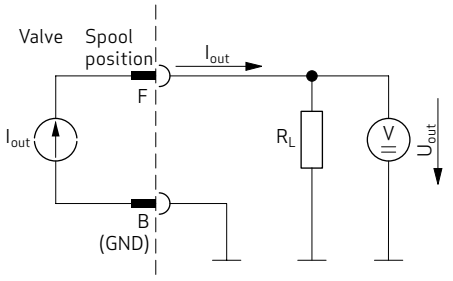
Command Signal Voltage Floating, Ordering Code D or M

The spool position is proportional to $U_D - U_E$.
For a command signal $U_D - U_E$ = +10 V the spool moves to 100 % P → A and B → T.
For a command signal $U_D - U_E$ = 0 V the spool is in the defined center position.



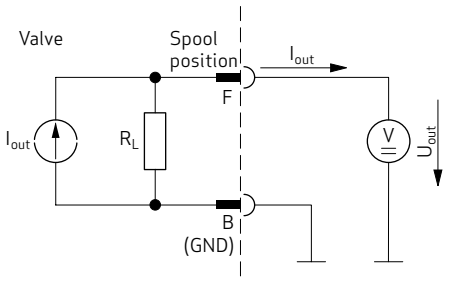
Actual Value 4 to 20 mA, Ordering Code M, X or E

The signal can be used for monitoring and fault detection purposes. The spool position is proportional to I_{out}. The spool position corresponds to 4 to 20 mA. At 12 mA the spool is in center position.
20 mA corresponds to 100 % valve opening P → A and B → T. A cable fault is detected by I_{out} = 0 mA.
Optional use: Actual value U_{out} = 2 to 10 V with resistor R_L = 500 Ω (0.25 W) provided by customer.



Actual Value 2 to 10 V, Ordering Code D

The signal can be used for monitoring and fault detection purposes. The spool position is proportional to U_{out}. The spool position corresponds to 2 to 10 V. At 6 V the spool is in center position.
10 V corresponds to 100 % valve opening P → A and B → T.
A cable fault is detected by U_{out} = 0 V.
RL = 500 Ω (0.25 W).

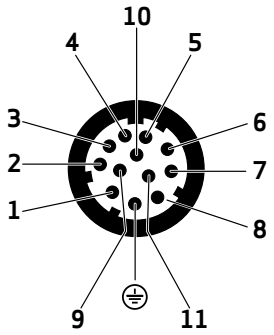


Note: For more information see Technical Notes TN 353 „Protective Grounding and Electrical Shielding of Valves“ and TN 494 „Maximum Permissible Length of Electric Cables for Valves with Integrated Electronics“. Visit www.moog.com/industrial/literature to download document.

ELECTRONICS

Pin Assignment for Valves with 11-pole + PE Connector, Pin Contacts (X1)

According to EN 175201-804, mating connector (type E, metal) with preleading protective earth pin (⏚)



Pin	Pin assignment	Signal type[1]	
		Voltage floating	Current floating[2]
1	Not used		
2			
3	Enable input	U_{3-10} > 8.5 to 32 V_{DC} referenced to GND: Valve ready for operation (enabled) U_{3-10} < 6.5 V_{DC} referenced to GND: Valve disabled The input resistance is 10 kΩ	
4	Command signal - spool position	$U_{in} = U_{4-5}$ R_{in} = 20 kΩ	$I_{in} = I_4 = -I_5$ R_{in} = 200 Ω I_{max} = ±25 mA
5	Reference point Input rated command	Reference for pin 4[3]	
6	Actual value - spool position	U_{6-10} = 2 to 10 V . At 6 V spool is in centered position. R_L = 500 Ω	4 to 20 mA referenced to GND (I_{out} is proportional to the spool position, 12 mA corresponds to the valve middle position, the output is short-circuit-proof); R_L = 0 to 500 Ω
7	Not used		
8	Digital output - valve status	U_{out} > U_{Supply} - 2 V: Valve ready for operation (enabled and supply OK). U_{out} < 2 V: Valve disabled. Load type: Ohmic, inductive, lamp load. I_{max} = 1.5 A (short-circuit-proof).	
9	Supply voltage	U_{Supply} = 24 V_{DC} (18 to 32 V_{DC}) referenced to GND (reverse polarity protected against GND)	
10	GND	Power ground/signal ground (enable and output)	
11	Digital output - error monitoring	U_{out} > U_{Supply} - 2 V: No error. U_{out} < 2 V: Indicates error[4]. Load type: Ohmic, inductive, lamp load. I_{max} = 1.5 A (short-circuit-proof)[5].	
⏚	Protective earth (PE)	Connected with valve body	

1) Signal ranges see next page.
2) Command signals I_{in} < 3 mA (due to cable break, for example) indicates a failure of 4 to 20 mA signals. The valve reaction to this failure may be customized and activated by the customer.
3) The potential difference between pins 4 or 5 referenced to pin 10 must be between -15 and +32 V.
4) Output can be programmed at the factory, enable function ordering code: K and L - safe position of spool, M and R - command signal/ actual valve deviation, others upon request.
5) The currents drawn at the outputs pin 8 and 11 (referenced to GND) must be added to the valve supply current. The valve fuse must be configured for the total current.

See inside back cover for complete ordering information.

ELECTRONICS

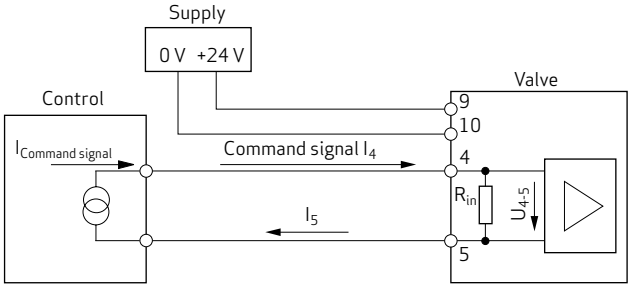
Ordering Codes and Signals for Valves with 11-pole + PE Connector (X1)

Ordering code	Command signal ±100% spool position		Actual value ±100 % spool position	
M	U_4 - U_5	-10 to +10 V	I_6	4 to 20 mA
X	I_4	-10 to +10 mA	I_6	4 to 20 mA
E	I_4	4 to 20 mA	I_6	4 to 20 mA
D	U_4 - U_5	-10 to +10 V	U_6 – U_{10}	2 to 10 V

Note: See inside back cover for complete ordering information.

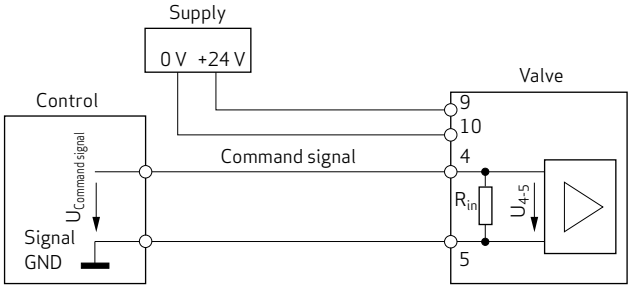
Command Signal Current Floating, Ordering Code X or E

The spool position is proportional to I_4 – I_5.
For a command signal I_4 = 20 mA (code E) or +10 mA (code X) the spool moves 100 % P → A and B → T .
For a command signal I_4 = 12 mA (code E) or 0 mA (code X) the spool is in the defined center position.



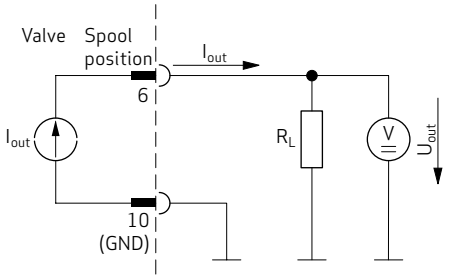
Command Signal Voltage Floating, Ordering Code M or D

The spool position is proportional to U_4 – U_5.
For a command signal U_4 – U_5 = +10 V the spool moves 100 % P → A and B → T.
For a command signal U_4 – U_5 = 0 V the spool is in the defined center position.



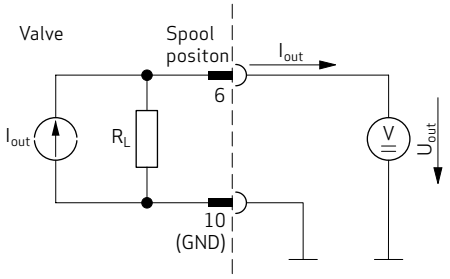
Actual Value 4 to 20 mA, Ordering Code M, X or E

The signal can be used for monitoring and fault detection purposes. The spool position is proportional to I_{out}. The spool position corresponds to 4 to 20 mA. At 12 mA the spool is in center position.
20 mA corresponds to 100 % valve opening P → A and B → T. A cable fault is detected by I_{out} = 0 mA.
Optional use: Actual value U_{out} = 2 to 10 V with resistor R_L = 500 Ω (0.25 W) provided by customer.



Actual Value 2 to 10 V, Ordering Code D

The signal can be used for monitoring and fault detection purposes. The spool position is proportional to U_{out}. The spool position corresponds to 2 to 10 V. At 6 V the spool is in center position.
10 V corresponds to 100 % valve opening P → A and B → T.
A cable fault is detected by U_{out} = 0 V.
R_L = 500 Ω (0.25 W).



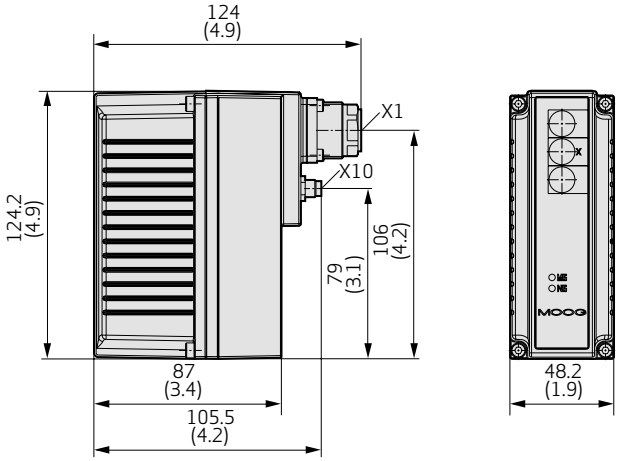
Note: For more information see Technical Notes TN 353 „Protective Grounding and Electrical Shielding of Valves“ and TN 494 „Maximum Permissible Length of Electric Cables for Valves with Integrated Electronics“. Visit www.moog.com/industrial/literature to download document.

ELECTRONICS
Installation Drawings Electronic Housing

Installation Drawing for Valves with Analog Activation

Ordering code[1] O: Without fieldbus connector

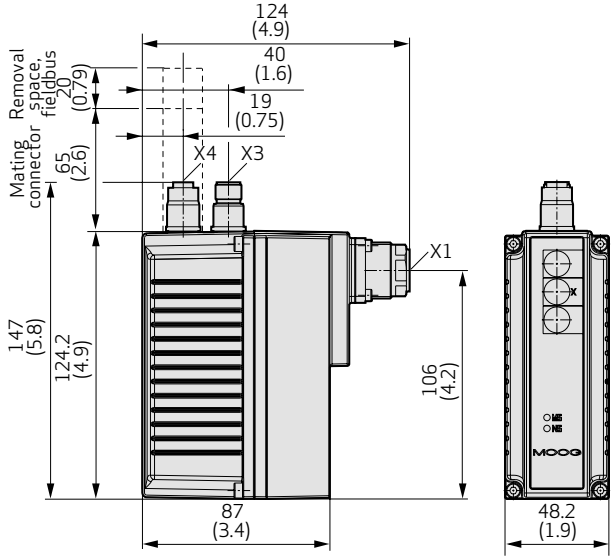
X1 Valve connector
X10 Service connector



Installation Drawing for Valves with CANopen Fieldbus Connector

Ordering code[1] C: CANopen

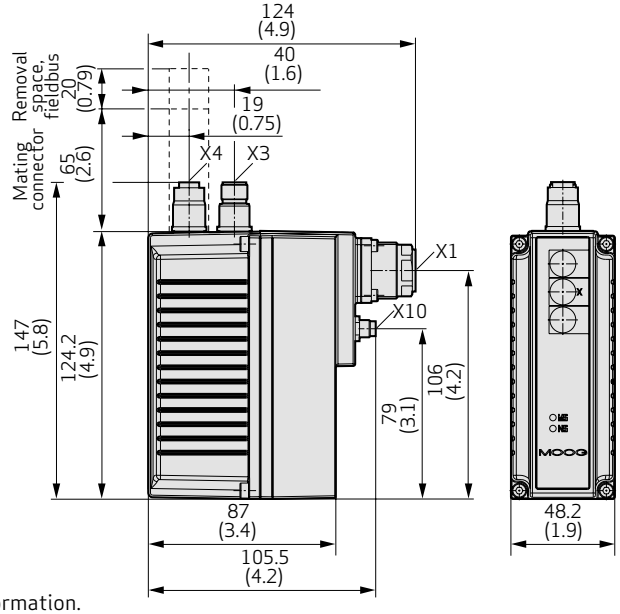
X1 Valve connector
X3 Fieldbus connector
X4 Fieldbus connector



Installation Drawings for Valves with EtherCAT or PROFIBUS-DP Fieldbus Connector

Ordering code[1] E: EtherCAT
Ordering code D: PROFIBUS-DP

X1 Valve connector
X3 Fieldbus connector
X4 Fieldbus connector
X10 Service connector



1) See position 14 on the inside back cover for complete ordering information.

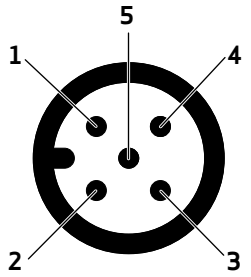
ELECTRONICS
Fieldbus Connectors

CANopen Connectors (X3, X4)

- Ordering Code[1] C: CANopen
- Coding A
- Thread M12x1
- 5-pole

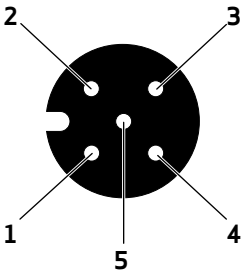
Pin	Signal X3, X4	Description
1	CAN_SHLD	Shield
2	CAN_V+	Not connected in the valve
3	CAN_GND	Mass
4	CAN_H	Transceiver H
5	CAN_L	Transceiver L

External thread, pin contact



View on CAN connector X3

Internal thread, socket contact



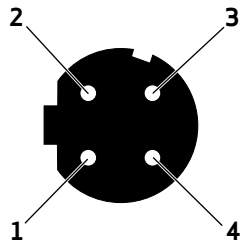
View on CAN connector X4

EtherCAT IN/OUT Connectors (X3, X4)

- Ordering Code[1] E: EtherCAT
- Coding D
- Thread M12x1
- 4-pole

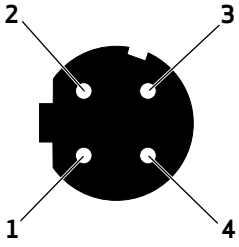
Pin	Signal X4 IN	Signal X3 OUT	Description
1	TX + IN	TX + OUT	Transmit
2	RX + IN	RX + OUT	Receive
3	TX – IN	TX – OUT	Transmit
4	RX – IN	RX – OUT	Receive

Internal thread, socket contact



View on EtherCAT connector X3

Internal thread, socket contact



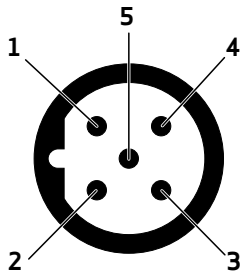
View on EtherCAT connector X4

PROFIBUS-DP Connectors (X3, X4)

- Ordering Code[1] D: PROFIBUS-DP
- Coding B
- Thread M12x1
- 5-pole

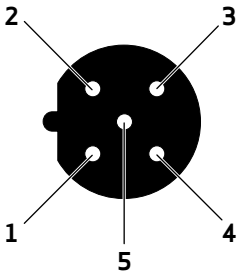
Pin	Signal X3, X4	Description
1	Profi V+	Power supply 5 V of terminal resistors
2	Profi A	Receive/transmit data –
3	Profi GND	Mass
4	Profi B	Receive/transmit data +
5	Shield	Shield

External thread, pin contact



View on PROFIBUS-DP connector X3

Internal thread, socket contact



View on PROFIBUS-DP connector X4

[1] See inside back cover for complete ordering information.

FLOW CALCULATION

When the valve is open, the prevailing flow is dependent not only on the spool position, (i.e. the opening cross section of the valve), but also on the pressure drop at the individual lands. When the valve is deflected at 100 %, it delivers the rated flow with the rated pressure drop.

The rated flow of a servo valve corresponds to a pressure drop of 35 bar (500 psi) per land, equating to 70 bar (1,000 psi) for two lands. When a valve is opened at 100 %, the flow can be calculated as a function of the actual pressure drop with the aid of the formula below or taken from the diagram.

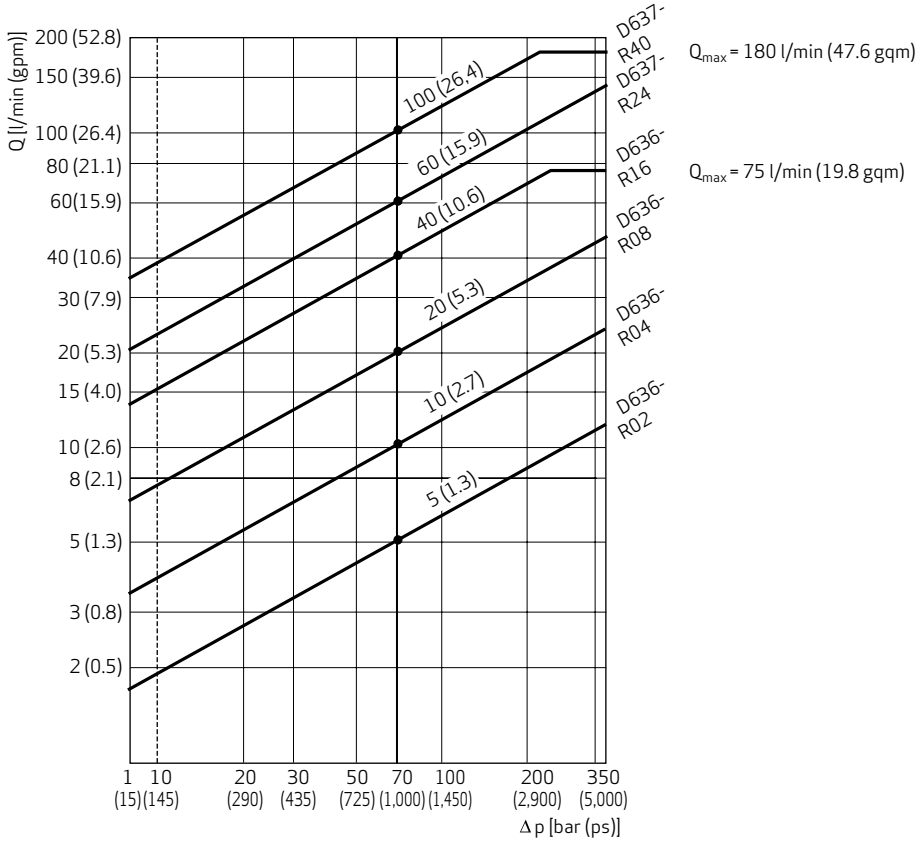
$$Q = Q_N \cdot \sqrt{\frac{\Delta p}{\Delta p_N}}$$

Q [l/min (gpm)]	actual flow
Q_N [l/min (gpm)]	rated flow
Δp [bar (psi)]	actual pressure drop per spool land
Δp_N [bar (psi)]	rated pressure drop per spool land

The actual flow in the valve ports must not exceed a mean flow velocity of approximately 30 m/s (96.5 ft/s) due to the risk of cavitation. When operating the valves close to these application limits, it is necessary to drill the ports to the maximum possible diameters (see specifications for the respective valve).

For ISO 4401 size 05 mounting surfaces the second tank port must additionally be connected starting from a flow Q exceeding 60 l/min (15.9 gpm).

Flow diagram



Q_{max} = 180 l/min (47.6 gqm)

Q_{max} = 75 l/min (19.8 gqm)

ELECTRONICS

Digital Valve Electronics

The valve electronics is based on microprocessor hardware with corresponding A/D-D/A converters for analog input and output signals. All functions of the valve are integrated in the firmware. The digital electronics offer the following advantages over conventional analog electronics:

- Greater flexibility: Ability to change the valve parameters easily using configuration software and the possibility of linearizing flow curves
- Higher reliability due to integrated monitoring functions
- Easier maintenance due to diagnostic capability and recording the fault history
- Remote maintenance and setup

Using the optional fieldbus interface cuts down the amount of wiring needed and eliminates the need for control interfaces in the PLC.

In the basic version the valve has a standard connector, and service connector and does not include the fieldbus interface. In this case the valve is actuated via an analog command signal.

The service connector offers the possibility to connect the valve to a PC or Notebook via an USB-to-CAN adaptor (see accessories). Its CANopen interface offers access to the valve parameters, which can be changed and monitored, as well as diagnosing valve performance and possible faults.

The flexibility of the integrated firmware enables the user to optimize the valve characteristic on-site as required by the application:

- Adapting the valve flow curve to the needs of the controlled system
- Adjusting the maximum valve opening separately for each direction of motion
- Defining fault reactions

The results obtained by the parameter changes can be viewed and analyzed directly using the built-in data logger. The parameters optimized during commissioning can be saved and copied. When the valve is replaced or used for series applications no tuning is required. The valves are supplied with a predefined parameter set if required.

Optional Fieldbus Interface

When the valves are operated with a fieldbus, they are parameterized, activated and monitored via the fieldbus. CANopen, PROFIBUS-DP or EtherCAT interfaces are available. Other fieldbus communication protocols are available upon request. The fieldbus interface is equipped with two bus connectors (IN/OUT) for cost-effective wiring. Valves can be integrated directly into the bus without any external T-joints. The electrically isolated fieldbus interface ensures reliable data transfer. Data from additional analog inputs or from SSI and encoders can be transmitted via fieldbus (inputs available upon request).

ELECTRONICS LOGIC FUNCTIONS

The onboard electronics of the D636 and D637 Series Valves are equipped with several logic functions. Short descriptions of these functions are given in the following. For more detailed information, please refer to the Moog technical note TN 435: "Description of Logic Functions".

Enable Input

The enable input is used to activate or deactivate the valve while the electric supply is powered. If the enable input is switched to HIGH, the valve is in normal operation mode. If the enable input is switched to LOW, there are two possible modes:

1. The main spool moves to the defined safe position P→A or P→B. To achieve this, the control current to the Linear Force Motor is switched off and the valve's spool moves to its spring centered position, which is about 10 to 20 % open towards P→A or P→B, or the center position, depending on the option chosen for pos. 6 of the ordering code.
2. The valve stays in closed-loop control mode and gets an internal command signal that moves it to its center position. The external command signal is ignored.

Digital Outputs for Monitoring

The D636 and D637 Series Valves can be equipped with monitoring functions. Valves with an 11-pole + PE connector have 2 digital outputs for monitoring functions:

1. Valve Status Output

   This output indicates whether the valve is operational. If the supply voltage is sufficient and the enable signal is HIGH, the valve status signal is also HIGH. If either the supply voltage is below 18 V or the enable signal is LOW, the valve status signal is LOW.

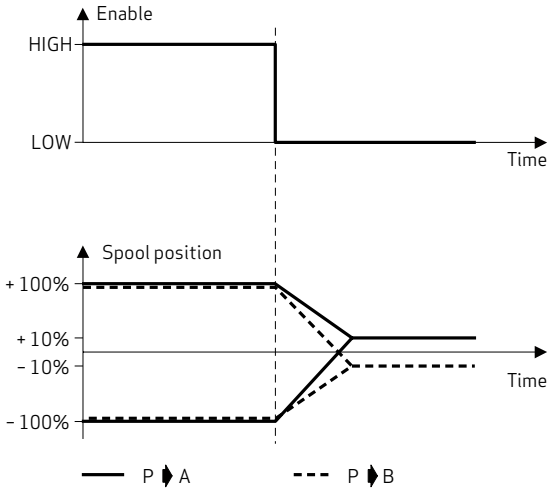
2. Error Monitoring Output

   Two options are available for the error monitoring output:

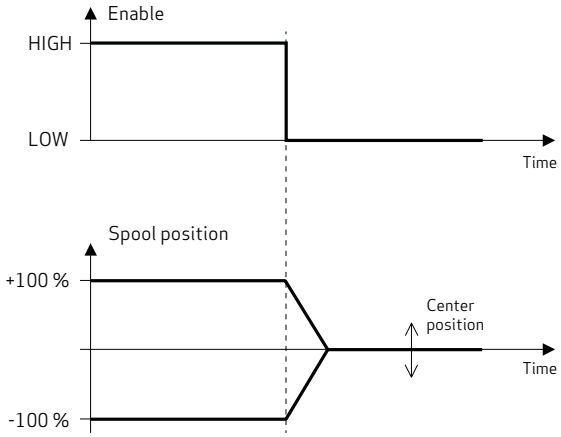
   a) Spool control deviation monitoring: If the control deviation of the spool controller is larger than a certain threshold (default is 30 %) for a certain time, the output is switched to LOW, which indicates an error. As long as the control deviation is within the threshold, the output is HIGH, indicating normal operation. This is used to detect if the main spool is stuck, e.g. due to contamination.

   b) Spool position monitoring: This function monitors whether the spool is within a certain position range. As long as the spool is within this position range, the output signal is HIGH. If the spool is outside this range, the output is switched to LOW. This can be used, e.g. for safety functions to monitor whether the spool is within its overlap range or not.

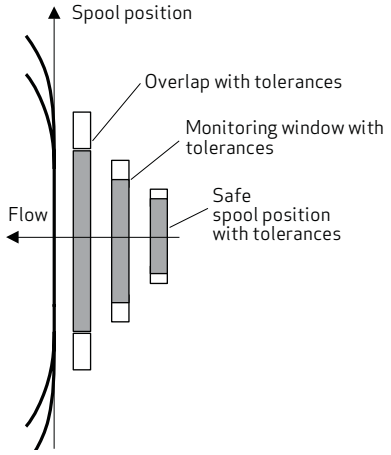
Move spool to spring centered +10% or -10% open position



Move spool to center position



Safe spool positions



FIELDBUS INTERFACE

Modern automation technology is characterized by an increasing decentralization of processing functions via serial data communication systems. The use of serial bus systems in place of analog signal transfer guarantees greater system flexibility with regard to alterations and expansions.

There is also considerable potential for saving project planning and installation costs in many areas of industrial automation. Further possibilities of parameterization, better diagnostics and a reduction of the number of variants are advantages which have only been made possible by the use of field buses.

VDMA Profile Fluid Power Technology

In a working group within the VDMA (German Machinery and Plant Manufacturers' Association), a device profile was created in collaboration with numerous well-known hydraulic system manufacturers. This profile describes the communication between hydraulic components via a fieldbus and defines uniform functions and parameters. In this way, a standardized exchange format covering all manufacturers was created.

DCVs and ACVs can be equipped with the following fieldbus interfaces: CANopen, PROFIBUS-DP or EtherCAT.

CANopen

According to ISO 11898, IEC/EN 61800-7 CAN bus was originally developed for use in automobiles, but has also been used for years in a variety of industrial applications. The CAN bus is primarily designed for transmission reliability and speed.

- The CAN bus has the following general features:
- Multi-master system: Each node can transmit and receive
- Topology: Line structure with short stub cables
- Network expansion and transmission rates:
  - Up to 25 m (80.4 ft) at 1 Mbit/s
  - Up to 5,000 m (16,090 ft) at 25 kbit/s
- Addressing type: Message-orientated via identifiers. Priority assignment of messages possible via identifiers
- Safety: Hamming distance=6, i.e. up to 6 individual errors per message are detected
- CiA408: Device profile fluid power technology for proportional valves and hydrostatic transmissions
- Other used CiA specifications: CiA102, CiA301, CiA303, CiA305 and CiA306
- Bus physics: ISO 11898
- Maximum number of nodes: 127

PROFIBUS-DP

According to EN 61158, PROFIBUS-DP was developed for process and manufacturing industries. It is thereby supported by numerous control system manufacturers.

PROFIBUS-DP has the following features:

- Multi-master system: The masters share access time and initiate communication. The slaves react only upon request
- Topology: Line structure with short stub cables
- Network expansion and transmission rates:
  - Up to 100 m (321.8 ft) at 12 Mbit/s
  - Up to 1,200 m (3,861.6 ft) at 9,6 kbit/s per segment
- Use of repeaters possible
- Addressing type: Address-orientated. Priority/cycle time assignment of messages via master configuration
- Bus physics: EIA-485
- Maximum number of nodes: 126

EtherCAT

According to IEC 61800-7 EtherCAT was developed as an industry bus based on Ethernet to meet the increasing demands for faster cycle times. The EtherCAT bus is designed for high data transmission rates and fast cycle times.

The EtherCAT bus has the following features:

- Single-master system: The master initiates communication. The slaves react only upon request
- Topology: Line, star, tree and ring structure based on the daisy chain principle
- Network expansion and transmission rates: 100 m (321.8 ft) between two nodes at 100 Mbit/s
- Addressing type: Address-orientated, one telegram for all nodes
- Bus physics: Fast Ethernet 100 Base Tx
- Maximum number of nodes: 65,535

CONFIGURATION SOFTWARE

The Windows-based "Moog Valve and Pump Configuration Software" enables fast and convenient commissioning, diagnostics and configuration of the valve. It is possible to transfer data from the PC to the valve or to process the valve's current settings on the PC. The valve can be controlled by means of graphical control elements. Status information, command signals, actual values and characteristic curves are represented in graphical form. System parameters can be recorded and visualized via an integrated data logger.

System Requirements

The configuration software can be installed on a computer with the following minimum requirements:

- PC / Laptop with Windows 7/8.1/10
- Internet Explorer 9
- 1 GB RAM
- 1 GB free hard disk space
- Monitor resolution 1024 x 768 pixels
- Keyboard, mouse

Equipment

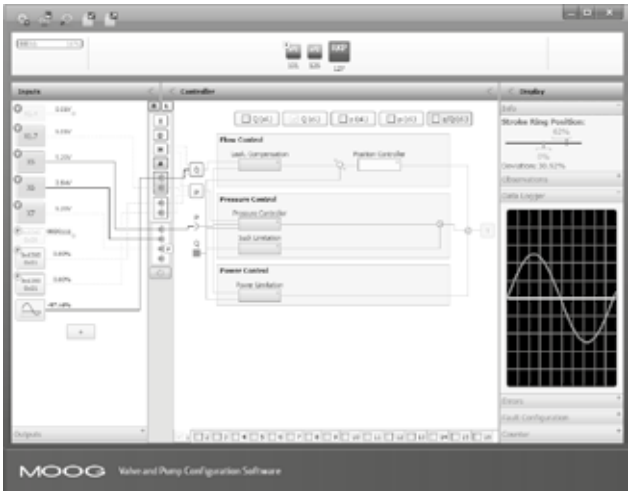
The following equipment is also required to be able to use the software (see also list of accessories):

- USB port
- USB to CAN adapter
- Configuration/commissioning cable
- Adapter for service connector (not required for CANopen fieldbus)
- Valve electrically connected and power supply switched on

Note

Configuration or commissioning with the "Moog Valve and Pump Configuration Software" can be performed via:

- Fieldbus connectors on valves with CANopen fieldbus
- Integrated service connector on valves with PROFI-BUS-DP or EtherCAT fieldbus or on valves with analog activation



Download

The software is available free of charge from Moog upon request. Please visit www.moogsoftwaredownload.com to download the software.

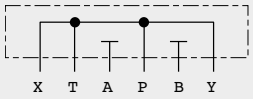
ACCESSORIES AND SPARE PARTS

Series-specific Accessories and Spare Parts

Spare Parts Direct Drive DCV - Size 03 - D636 Servo Valve

Part name	Description	Material	Part number
O-ring for ports P, T, A, B	4 pieces, inner Ø 9.25 mm (0.36 in) x Ø 1.8 mm (0.07 in)	FKM 90 Shore	CB35150-013
		HNBR 90 Shore	B97009-013
O-ring for port Y	1 piece, ID 7.65 x Ø 1.8 (ID 0.3 x Ø 0.07)	FKM 90 Shore	CB35150-012
		HNBR 90 Shore	B97009-012
Service sealing set	O-rings for ports P, T, A, B, Y	FKM 90 Shore	B97215-V630F63
		HNBR 90 Shore	B97215-H630F63

Accessories Direct Drive DCV - Size 03 - D636 Servo Valve

Part name	Description	Remark	Part number
Flushing plate	P, A, B, T, X, Y		B46634-002
Mounting screws	4 pieces M5x55, ISO 4762-10.9, tightening torque 6.8 Nm (60 lbf in)		A03665-050-055
Shipping plate	1 piece		B46035-001

Documents Direct Drive DCV - Size 03 - D636 Servo Valve

Part name	Description	Remark	Part number
ATEX and IECEx manuals D636 and D638 Series Servo Valves	Manuals	Visit www.moog.com/industrial/literature to download a document using the part number in a search	CDS29587
Manual D636 and D638 Series Servo Valves			B95872

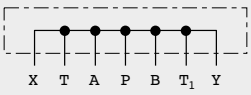
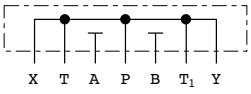
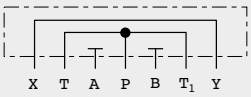
ACCESSORIES AND SPARE PARTS

Series-specific Accessories and Spare Parts

Spare Parts Direct Drive DCV - Size 05 - D637 Servo Valve

Part name	Description	Material	Part number
O-ring for ports P, T, T_1, A, B	5 pieces, inner Ø 12.4 mm (0.49 in) x Ø 1.8 mm (0.07 in)	FKM 90 Shore	CB35150-004
		HNBR 90 Shore	B97009-004
O-ring for ports X, Y	2 pieces, inner Ø 15,6 mm (0.6 in) x Ø 1,8 mm (0.07 in)	FKM 90 Shore	CB35150-011
		HNBR 90 Shore	B97009-011
Service sealing set	Contains the following O-rings: • 5 pieces for P, T, T_1, A, B inner Ø 12.4 mm (0.49 in) x Ø 1.8 mm (0.07 in) • 2 pieces for X, Y inner Ø 15.6 mm (0.61 in) x Ø 1.8 mm (0.07 in) • 1 piece for filter inner Ø 12.0 mm (0.47 in) x Ø 2.0 mm (0.08 in) • 1 piece for filter cover inner Ø 17.1 mm (0.67 in) x Ø 2.6 mm (0.10 in)	FKM 90 Shore	B97215-V681-10
		HNBR 90 Shore	B97215-H681-10

Accessories Direct Drive DCV - Size 05 - D637 Servo Valve

Part name	Description	Remark	Part number
Flushing plate	P, A, B, T, T_1, X, Y		B67728-001
	P, T, T_1, X, Y		B67728-002
	P, T, T_1 and X, Y		B67728-003
Mounting screws	4 pieces M6x60, ISO 4762-10.9, tightening torque 11 Nm (97 lbf in)		A03665-060-060
Shipping plate	1 piece		A40503

Documents Direct Drive DCV - Size 05 - D637 Servo Valve

Part name	Description	Remark	Part number
ATEX and IECEx manuals D637 and D639 Series Servo Valves	Manuals	Visit www.moog.com/industrial/literature to download a document using the part number in a search	CDS29577
Manual D637 and D639 Series Servo Valves			CA61892

ACCESSORIES AND SPARE PARTS

Series-independent Accessories

Accessories Direct Drive DCV - D636 and D637 Servo Valves

Part name	Description	Remark	Part number
Dust protection cap for fieldbus connectors X3, X4	For external thread M12x1, metal	Required for operation without mating connector (IP protection)	C55823-001
	For internal thread M12x1, metal		CA24141-001
Dust protection cap for service connector X10	For internal thread M8x1, plastics		CA23105-080-010
Mains power connection	Power supply cable, length 2 m (6.4 ft)		B95924-002
	SELV power pack 24 V_{DC} 10 A		D137-003-001
Mating connector	Cable with straight mating connector 11-pole + PE	5, 10, 20 or 25 m, e.g. for 5 m specify 005, other length upon request	C21031-xxx-001
	Cable with straight mating connector 6-pole + PE		C21033-xxx-001
	Mating connector, elbow 6-pole + PE	In accordance with EN 175201-804, type S, metal, IP65, cable Ø 8 to 12 mm (0.31 to 0.47 in)	B97069-061
	Mating connector, straight 11-pole + PE	In accordance with EN 175201-804, type R, metal, IP65, cable Ø 11 to 13 mm (0.433 to 0.512 in)	B97067-111
	Mating connector, straight 6-pole + PE	In accordance with EN 175201-804, type R, metal, IP65, crimp contact Ø 0.75 to 1.5 mm^2 (0.0012 to 0.0023 in^2), conus Ø 12.2 mm (0.48 in), cable Ø 9 to 12 mm (0.35 to 0.47 in), sealing element Ø 9 to 13 mm (0.35 to 0.51 in)	B97007-061
Service and commissioning set	Adapter for service connector X10, M8x1 to M12x1		CA40934-001
	Configuration/commissioning cable 2 m (6.4 ft), M12x1 to EIA-232		TD3999-137
	USB to CAN adapter (IXXAT)		C43094-001
	Moog Valve and Pump Configuration Software	Download software free of charge at www.moogsoftwaredownload.com	

ACCESSORIES AND SPARE PARTS

Documents Direct Drive DCV - D636 and D637 Servo Valves

Part name	Description		Part number
ATEX and IECEx manuals D636 and D638 Series Servo Valves	Manuals	Visit www.moog.com/industrial/literature to download a document using the part number in a search	CDS29587
ATEX and IECEx manuals D637 and D639 Series Servo Valves			CDS29577
Installation Instruction D636, D637, D638 and D639 Series Servo Valves	Installation Instructions		B97072-636
Manual DCV Electrical Interfaces	Manuals		CA63420
Manual DCV with CANopen Interface			CDS33853
Manual DCV with EtherCAT Interface			CDS33722
Manual DCV with PROFIBUS Interface			CDS33854
Technical Note TN 353	Protective Grounding and Electrical Shielding of Hydraulic Valves with Integrated Electronics		CA58437
Technical Note TN 494	Maximum Permissible Length of Electric Cables for Valves with Integrated Eletronics		CA48851

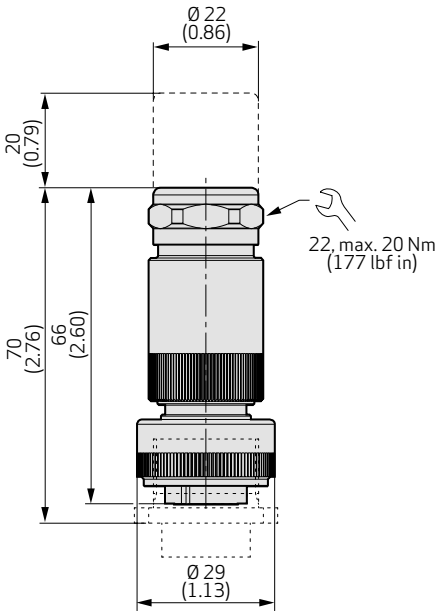
ACCESSORIES AND SPARE PARTS

Accessories - Installation Drawings

Mating Connector, Straight 6-pole + PE

In accordance with EN 175201-804, type R, metal, IP65, crimp contact Ø 0.75 to 1.5 mm² (0.0012 to 0.0023 in²), conus Ø 12.2 mm (0.48 in), cable Ø 9 to 12 mm (0.35 to 0.47 in), sealing element Ø 9 to 13 mm (0.35 to 0.51 in)

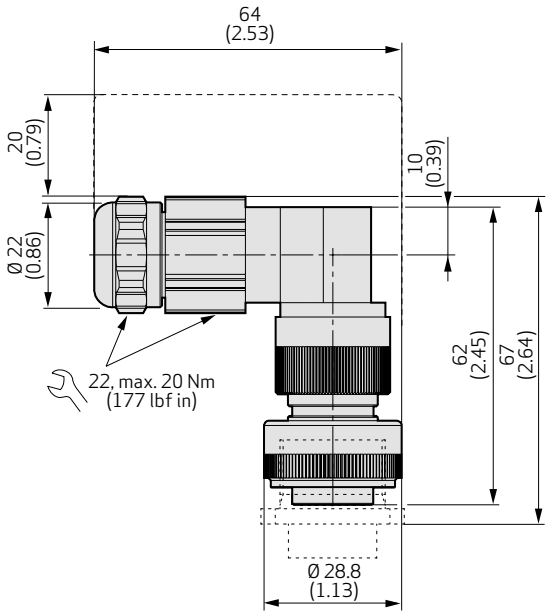
Part number B97007-061



Mating Connector, Elbow 6-pole + PE

In accordance with EN 175201-804, type S, metal, IP65, cable Ø 8 to 12 mm (0.31 to 0.47 in)

Part number B97069-061



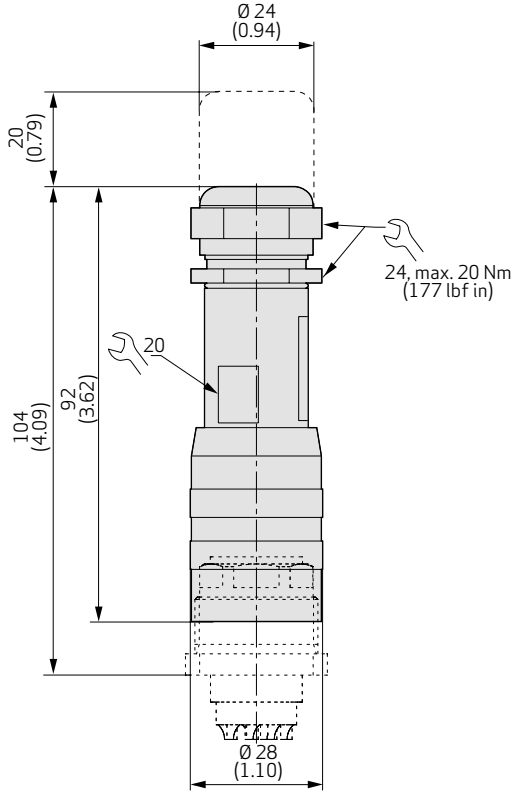
ACCESSORIES AND SPARE PARTS

Accessories - Installation Drawings

Mating Connector, Straight 11-pole + PE

In accordance with EN 175201-804, type R, metal, IP65, cable Ø 11 to 13 mm (0.433 to 0.512 in)

Part number B97067-111



MOOG GLOBAL SUPPORT

Moog Global Support is our promise to offer world-class Repair and Maintenance Services delivered expertly by our trained technicians. With the reliability only available from a leading manufacturer with facilities around the world, Moog offers you service and expertise you can count on to keep your equipment operating as it should.

This promise offers many benefits to our customers including:

- Reduce your downtime by keeping critical machines running in peak performance
- Protect your investment by ensuring reliability, versatility and long-life of products
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- Repair services using OEM parts are performed by trained technicians to the latest specifications
- Stock management of spare parts and products to prevent unplanned downtime
- Flexible programs, tailored to your needs such as upgrades, preventative maintenance and annual/ multi-year contracts
- On-site services bring the expertise to you, providing quicker commissioning, set-up and diagnostics
- Access to reliable services that are guaranteed to offer consistent quality anywhere in the world

For more information on Moog Global Support visit www.moog.com/industrial/service.

ORDERING CODE

Model number (assigned at the factory)

Type designation

												1	2	3	4	5	6	7	8
D636 or D637							-					**R**		**K**						...

Specification status	
–	Series specification
Z	Special specification

Model designation

Variant

1	**Valve type**
R	Servo valve with integrated digital electronics

2	**D636: Rated flow per spool land [l/min (gpm)]**	
	For Δp_N = 35 bar (500 psi)	For Δp_N = 5 bar (75 psi)
02	5 (1.3)	2 (0.5)
04	10 (2.7)	4 (1.0)
08	20 (5.3)	8 (2.1)
16	40 (10.6)	16 (4.2)

2	**D637: Rated flow per spool land [l/min (gpm)]**	
	For Δp_N = 35 bar (500 psi)	For Δp_N = 5 bar (75 psi)
24	60 (15.9)	24 (6.3)
40	100 (26.4)	40 (10.6)

3	**Pressure range [bar (psi)]**
	Maximum operating pressure
K	350 (5,000)

4	**Bushing/spool design**
0	4-way: Zero lap, linear flow characteristic
A	4-way: 1.5 to 3 % positive overlap, linear flow characteristic
D	4-way: 10 % positive overlap, linear flow characteristic
J	4-way: Zero lap, A:B = 2:1, linear flow characteristic
Z	2x2-way: P→A and B→T, only with Y port
X	Special spool design upon request

5	**Linear force motor**	**Series**
1	Standard	D636
2	Standard	D637

6	**Spool position without electrical supply**
M	Center position[1)]
F	P→B, A→T connected (approximately 10 % open for bushing/spool designs 0, A and J)
D	P→A, B→T connected (approximately 10 % open for bushing/spool designs 0, A and J)

7	**Y port**
0	Closed with screw plug p_{Tmax} = 50 bar (725 psi)
3	Open with filter element p_T >50 bar (725 psi), $p_{T\,max}$ see maximum operating pressure in ordering code position 3

8	**Seal material**
H	HNBR
V	FKM
	Other seal material upon request

ORDERING CODE

9	10	11	12	13	14	15		16	
…		**2**	**–**					**A**	**1**

16 Device capability

A1	Spool position closed loop control

15 Service connector X10

O1	Without[7)]
K1	With[6)]

14 Fieldbus connector X3, X4

C	CANopen
D	PROFIBUS-DP[5)]
E	EtherCAT[5)]
O	Without fieldbus connector[5)]

13 Enable function

A	B	K	L	M	R	
X	–	X	–	X	–	If the enable signal is low: The spool moves to a closed loop controlled neutral position (the HOLD position).
–	X	–	X	–	X	If the enable signal is low: The linear force motor is de-energized. The spool moves to its spring centered position (as defined at position 6 of the order code).
–	–	X	X	–	–	Monitoring of the safe position of the spool at pin 11[4)]. The range of the safe position can be freely defined (the default range is around the spring centered position). HIGH: Within the safe position range LOW: Outside of the safe position range
–	–	–	–	X	X	Monitoring of the spool control error at pin 11[4)]. The threshold for the spool control error can be freely defined (the default value is >30 % of maximum spool stroke after 500 ms). HIGH: Control error is below the threshold LOW: Control error is above the threshold

12 Valve function

–	Not used

11 Supply voltage

2	24 V_{DC}, for more information, see section “Technical Data“

10 Signals for position control

	Command signal	Actual value
M	± 10 V	4 to 20 mA
D	± 10 V	2 to 10 V
X	± 10 mA	4 to 20 mA
E	4 to 20 mA	4 to 20 mA
9	Fieldbus[3)]	Fieldbus[3)]
Y	Others upon request	

9 Valve connector X1

S	6-pole + PE EN 175201-804
E	11-pole + PE EN 175201-804[2)]

2) With monitoring at pin 11

3) Only in conjunction with fieldbus connector “C, D, E“ (changeover to analog signals “M, X, E“ possible)

4) Only in combination with valve connector X1 “E“

5) Valve parameterization with commissioning software “Moog Valve and Pump Configuration Software“ using M8 service connector

6) Only in conjunction with fieldbus connector “D, E, O“

7) Only in conjunction with fieldbus connector “C“

More Products. More Support.

Moog designs a range of motion control products to complement those featured in this document.
Moog also provides service and support for all of our products. For more information, contact the Moog facility closest to you.

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