MOOG

DDV Direct Drive Valve Pressure Control Valve with integrated Electronics Cetop 3 · Series D 635

General

The series D635 is a direct driven pressure control valve (PCV) of size NG 6 (Cetop 3). The PCV consists of a DDV servovalve, pressure control electronics, pressure sensor and ramp circuit for the pressure command signal. All elements are integrated in a compact unit. This provides the control of the PCV direct from the machine control without interface electronics.

MOOG DDV PCV features the following advantages:

- Direct drive with high force level permanent magnet linear motor for high reliability
- No pilot stage oil flow
- Low hysteresis, high resolution, excellent linearity
- Pressure independent dynamic performance of servo valve
- Pressure control in mainstream and bypass function
- Standardised, accurate pressure feedback signal for monitoring
- 2 x 2 way operation extends the flow capacity in bypass mode
- At loss of supply voltage, the valve returns to its spring centered safe position and connects ports A with T or P with A.
- Improved false polarity protection and over voltage protection
- IP 65 (DIN 40050) degree of protection

Our quality management system is certified in accordance with DIN EN ISO 9001.

DIN ISO 9001 certified BVQI

This catalogue is for users with technical knowledge.
To ensure that all necessary characteristics for function and safety of the system are given, the user has to check the suitability of the products described here.
In case of doubt please contact MOOG.

Pressure Control function
The actual pressure in port A is measured by a pressure transducer and the output signal is conditioned and compared with the pressure command signal. If there is an error between pressure command signal and actual pressure value, the pressure controller changes current to the linear motor in such a way that the error becomes zero.

The pressure command signal can be directed via a ramp circuit with 20 s ramp up / ramp down time or direct to the comparison point (see block diagram page 3).

Valve Flow function
The valve flow function is a sub function within the pressure control valve and not controllable externally. With zero current through the linear motor, the output force is zero and the centering spring moves the spool to its neutral position, where port A is connected to port T, and port P to B. Port B is normally blanked off. This position is defined as fail safe, (e.g. at loss of supply voltage).
As the motor current increases, the flow paths A → T and P → B start to close and eventually are fully closed. For the 2 x 2 way version (valve in bypass) this is the case at 90 % and for the 3 - way version at approx. 50 % of total spool stroke (see flow functions page 4).
Further increasing of the current through the linear motor in the 3-way version causes the flow paths to open again to their max. opening for max. valve flow Q (Q_N at Δp_N).

Valve Flow and Pressure Drop

At maximum valve opening, the valve flow at rated valve pressure drop, $\Delta p_N = 5$ bar per metering land, is rated flow, Q_N per land. For other than rated pressure drop, the valve flow changes at constant valve opening according to the following function for a sharp edged orifice (metering land).

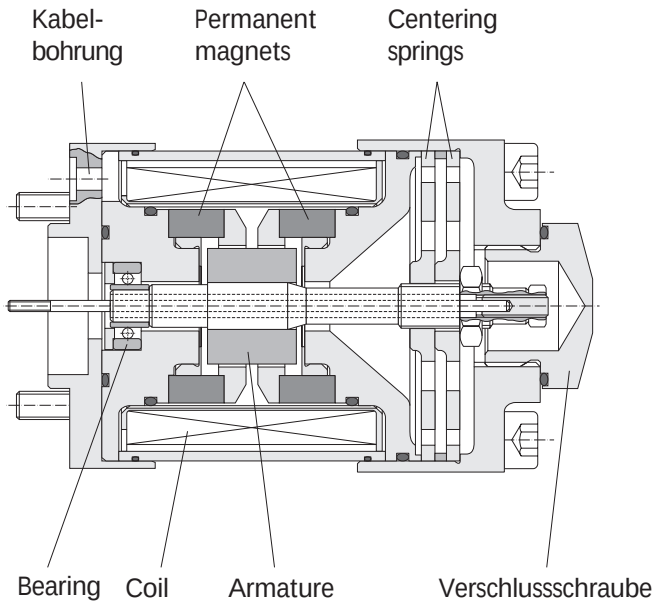
The valve flow Q calculated in this way should result in an average flow velocity in ports P, A, B or T of no more than 30 m/s.

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

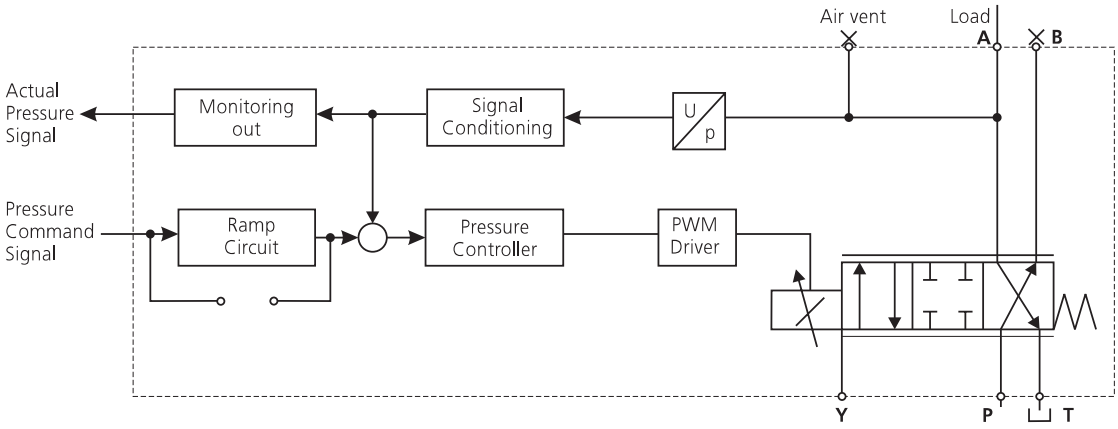
Q	[l/min]	=	calculated flow per land at Δp
Q_N	[l/min]	=	rated flow per land at Δp_N
Δp	[bar]	=	actual valve pressure drop per land
Δp_N	[bar]	=	rated valve pressure drop per land

Principle of Permanent magnet linear motor operation

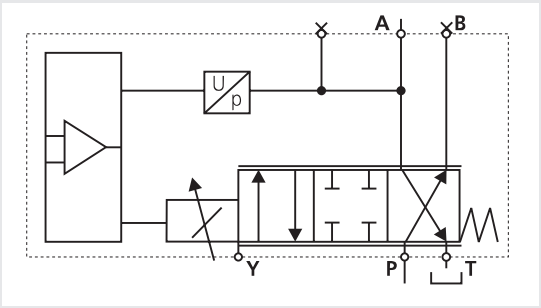
The linear motor is a permanent magnet excited differential motor. The permanent magnets provide a part of the required magnet force. For a linear motor, the current needed is considerably lower than would be required for a comparable proportional solenoid.
The spool driving linear motor has a neutral position at zero coil current given by the centering spring. The spool driving force is proportional to coil current and moving the spool against the centering spring. The linear motor needs no current in the spring centered (neutral) position. The high spool driving force ensures a reliable spool movement against flow and friction forces. This makes the valve very insensitive to contamination.



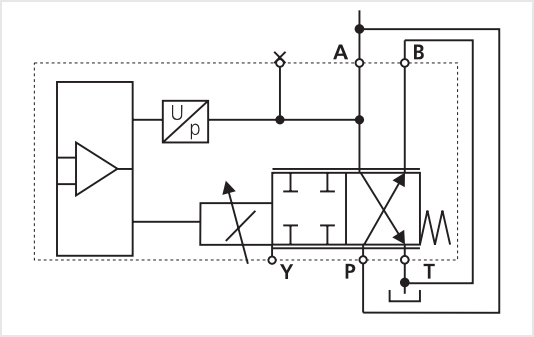
Block Diagram



Hydraulic Symbols

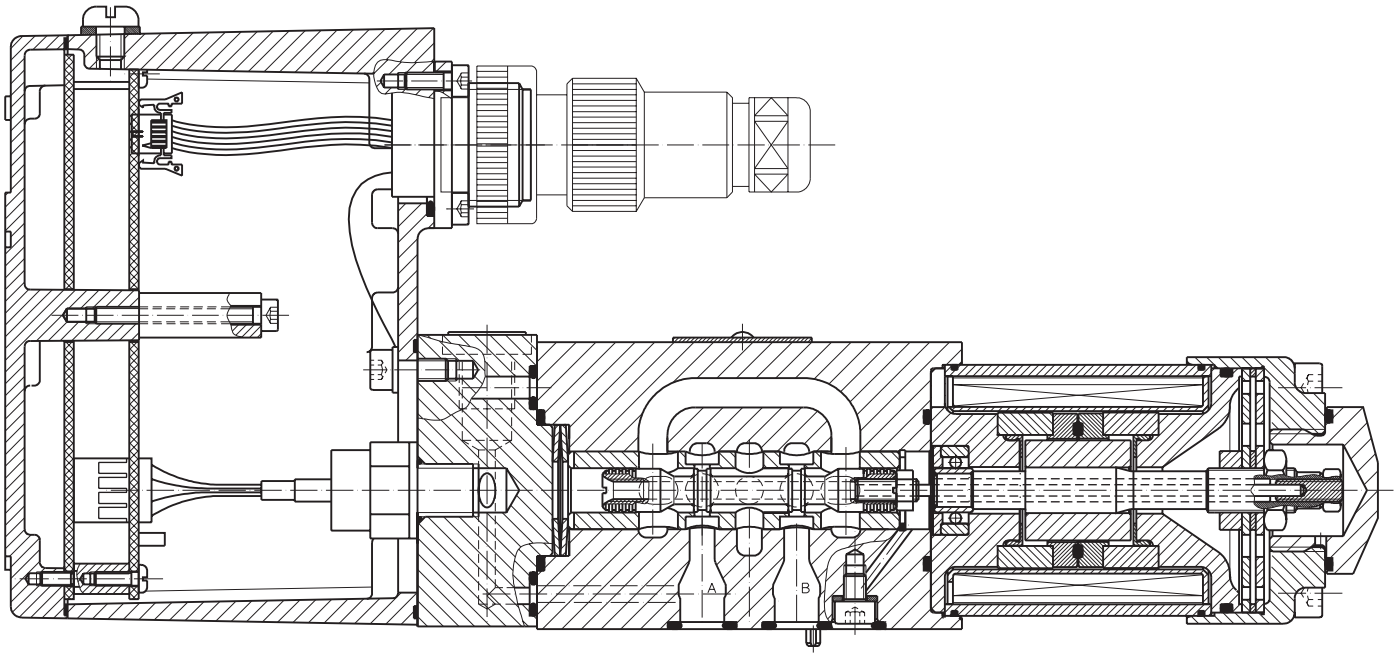


3 - Way - Function



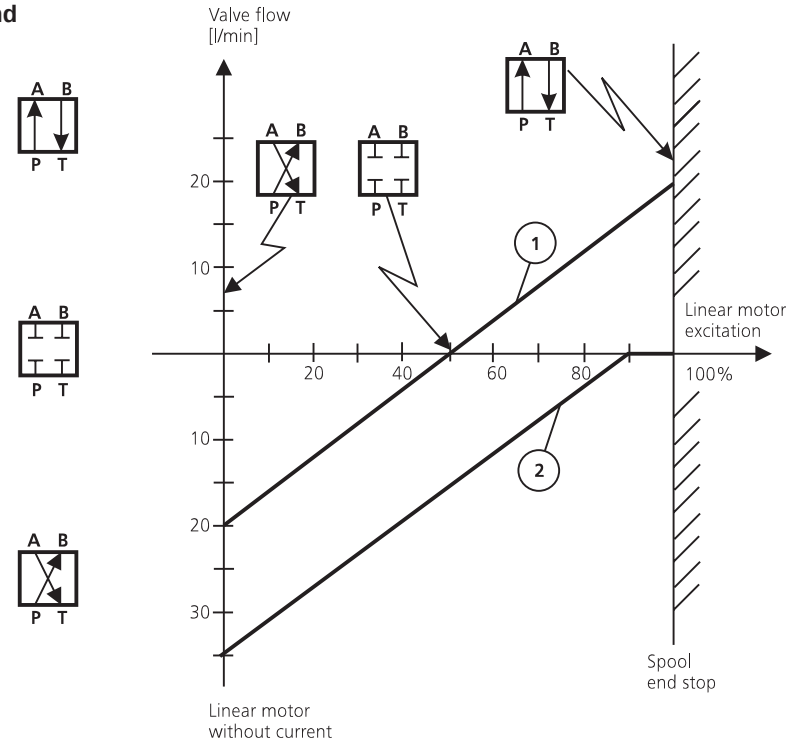
2 x 2 - Way - Function

Sectional View

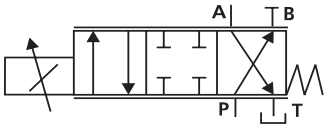


Typical Characteristic Curves

Flow Function
at Δp_N = 35 bar per land



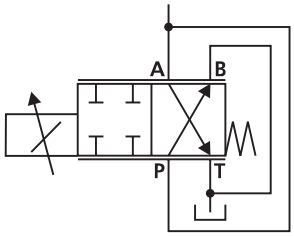
3 - Way function



Example (1):

Symmetric flow characteristic with Q_N = 20 l/min

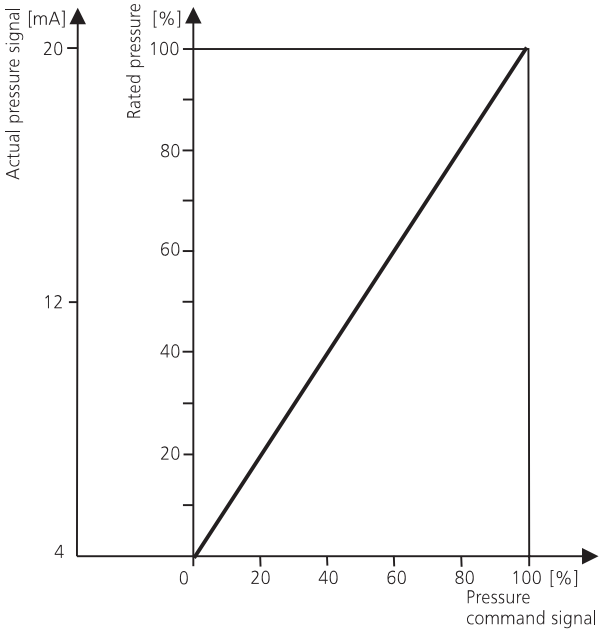
2 x 2 - Way function



Example (2):

By-pass flow characteristic (standard) with Q_N = 36 l/min per land
Double flow: 2 x Q_N = 72 l/min

Pressure control function
Pressure in port A



Application note

The pressure controller needs to be adapted to the load to optimise dynamic performance.

The load is mainly influenced by:
valve rated flow Q_N, actual valve pressure drop per land Δp, fluid volume to be controlled connected to port A, mechanical load stiffness etc.

Contact our application engineers for assistance.

Valve design	Spool type, single stage with bushing
Actuation	Direct with permanent magnet linear motor
Mounting pattern DIN 24340 / ISO 4401 / Cetop	Form A6 / Cetop 3 with or without leakage port Y [2]
Port diameter P, A, B, T	7,9 mm
Pilot supply	none
Mounting direction	any (air vent of valve must be possible)
Seal material	NBR, FPM
Degree of protection DIN 40050, with mating connector	IP 65
Mass	2,5 kg
Rated flow Q_N	2,5 / 5 / 10 / 20 / 40 (at 3-way function)
at Δp_N = 35 bar per land, tolerance ± 10 %	4,5 / 9 / 18 / 36 (at 2-way function)
	2 x 36 (at 2 x 2 way function)
Null leakage flow Q_L [1]	0,15 / 0,3 / 0,6 / 1,2 l/min
max. Operating pressure p_{max}, static	
ports P, A, B	350 bar
port T without Y	50 bar
port T with Y	350 bar
port Y	direct to tank
Mating connector standard (DIN 43563)	6 + PE
Supply voltage for integrated electronics U_{nom}	+ 24 V DC
Tolerance range U_{min}	+ 19 V DC
U_{max}	+ 32 V DC
Current consumption at U_{nom} = + 24 V DC	
I_{min} at pressure command zero (linearmotor without current)	0,150 A
I_{max}	1 A
Pressure command signals	0 to 10 V, 0 to 10 mA, 4 to 20 mA
Actual pressure signal	+ 4 to + 20 mA
Ramp up time = Ramp down time	20 s
Relative duty cycle	100 % ED
External fuse per valve	1,6 A T (slow blow)
Threshold [1]	< 0,1 %
Hysteresis [1]	< 0,2 %
Nullshift at ΔT = 55 K	< 1,5 %
Linearity	< 0,5 %
Operating fluid DIN 51524	Mineral oil based hydraulic fluid, others on request
Fluid temperatur range	– 20 ... + 80 ° C
Viscosity recommended	15 ... 45 mm²/s
allowable	5 ... 400 mm²/s
Filter rating recommended	$ß_x \geq 75$
allowable	$ß_x \geq 75$
	x ≤ 6 (6 µm absolute) [3]
	x ≤ 10 (10 µm absolute) [3]
Class of cleanliness according to	NAS 1638 at least 6 [3]
	ISO 4406 at least 15 / 11 [3]
System filter	High pressure filter, mounted in the main flow without bypass, but with contamination indicator

1) measured at p_P = 140 bar pressure and viscosity of ν = 32 mm²/s
2) leakage port Y must be used at p_T > 50 bar
3) for long life wear protection of metering lands

Series D635
Connector wiring
Dimensions

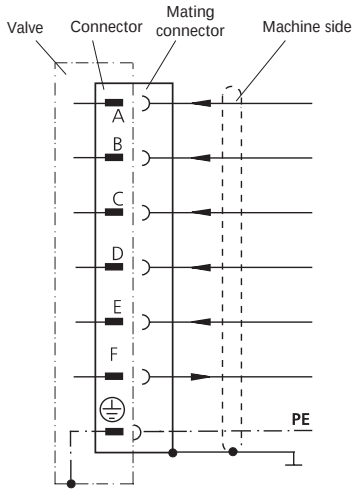
Notes:

Supply voltage U_{nom} = + 24 VDC.
Current consumption I_{max} = 1 A
Power supply according to VDE 0551

All signal lines (also those of external transducers) are shielded.
Shielding connected radially to ⊥ (0V) on power supply

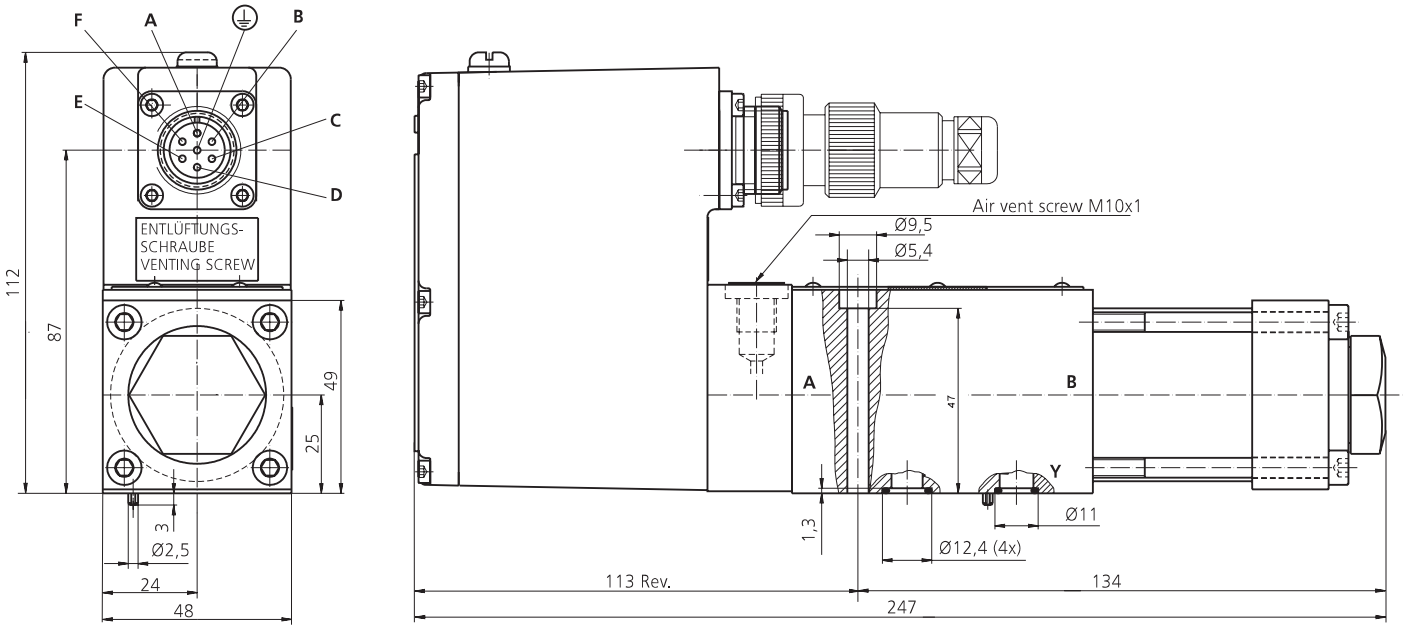
Connector wiring

Valve with 6+PE pole connector to DIN 43563 and mating connector (metal shell) with leading protective grounding connection (⏚).
Thread 7/8-20 UNF 2A.



Function	Voltage command 0 to ± 10 VDC	Current command 0 to ± 10 mA	Current command + 4 to + 20 mA
Supply	+ 24 VDC (19 to 32 VDC)		
Supply / Signal ground	⊥ (0 V)		
Not used			
Pressure command signal	0 to + 10 VDC Input resistance 10 kΩ	0 to + 10 mA load resistance 200 Ω	+ 4 to + 20 mA load resistance 200 Ω
Pressure inverted command signal	0 to – 10 VDC Input resistance 10 kΩ	0 to – 10 mA load resistance 200 Ω	Not used
Actual pressure value	+ 4 to + 20 mA load resistance 300 to 500 Ω, with respect to ⊥ (0 V)		
Protectiv grounding			

Dimensions



Ordering information

D635 ●

Specification status

–	Series-Specification
E	Preseries-Specification
Z	Special-Specification

Model designation

	assigned at the factory

Factory identification

Valve version

P	Proportional valve

Rated flow

	Q_N (l/min) at Δp_N per land	
	5 bar	35 bar
01	1	2,5
02	2	5
04	4	10
08	8	20
16	16	40

Pressure ranges

	Rated pressure	max. operating pressure
C	100	100
F	210	250
J	315	400
K	350	400
X	Special range on request	

Bushing / spool type

B	3 way: P ◗ A, A ◗ T: ~ Axis cut, linear characteristic
Z	2 x 2 way: P ◗ B, A ◗ T: 10 % overlap, linear characteristic (only bypass)
X	Special version on request

Valve type

	Pressure control without ramp
B	Valve in by-pass
M	Valve in main stream
	Pressure control with ramp
P	Valve in by-pass
R	Valve in main stream

Electrical supply

2	+ 24 VDC (19 to 32 VDC)

Signals for pressure control

	Command	Output
M	0 to 10 V	+4 to +20 mA
P	0 to 10 mA	+4 to +20 mA
S	+4 to +20 mA	+4 to +20 mA

Valve connector

S	6 + PE-pole DIN 43563

Seal material

N	NBR (Buna N) Standard version
V	FPM (Viton) Special version
	others on request

Y - Port

0	Closed with plug	p_{Tmax} = 50 bar
1	Open, with filter insert	p_T > 50 bar

Spool position without electrical supply

A	defined end position A ◗ T connected
B	defined end position P ◗ A connected

Linear motor

1	Standard

All combinations may not be available. Options may increase price.
Technical changes are reserved.

MOOG

Australia	Melourne
Austria	Vienna
Brazil	São Paulo
Denmark	Birkerød
England	Tewkesbury
Finland	Espoo
France	Rungis

This catalougue is for users with some basic technical knowledge. To ensure that all necessary characteristics for function and safety of the system are con-sidered, the user is cautioned to check the suitability of the products.

If there are questions or concerns, please contact MOOG.

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D 635 E / Rev. 3 / 08.99