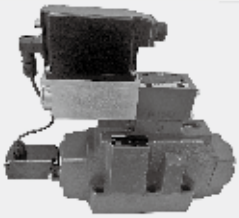
6.18

Pilot operated proportional directional valves

Type 4WRLE

Sizes 10 to 27
Up to 350 bar
Up to 600L/min



Contents

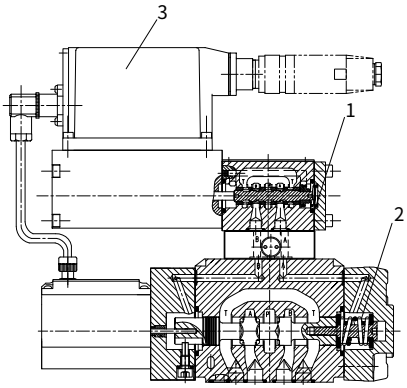
Features

- Pilot valve NG6, with control spool and sleeve in servo quality, actuated on one side, 4/4 fail-safe position whenswitched off
- Control solenoid with electrical position feedback and electronics for position transducer (Lvdt DC/DC)
- Main stage in servo quality with position feedback
- Pilot operated 4/3-way servo solenoid directional control valves NG10 to NG27

Function and configuration

Construction

The valve consists of three main assemblies:
- Pilot valve (1) with control spool and sleeve, return springs, control solenoid and inductiveposition transducer
- Main stage (2) with centering springs and position feedback
- On-board trigger electronics (3)



Type 4WRLE 10 ...–L4X...

Functional description

When the control solenoid is not actuated, the control spool is held by springs in the fail-safe position, and the main stage spool remains in its spring-centered mid position.

In the on-board electronics, the pre-defined setpoint is compared with the actual value for the position of the main stage control spool. In the event of an error signal, the control solenoid is actuated, and the pilot spool is moved as the magnetic force changes.

The flow released through the control cross-sections causes the main control spool to move. The spool stroke is controlled proportionately to the setpoint of 0.5...10V between 20...100 %.

If the input setpoint is < ±0.5V, the control spool is held in the springcentered, overlapped mid position.

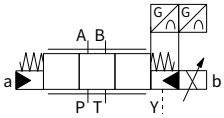
Power failure

In the event of a power failure or an open circuit, the onboard electronics cut off the electricity to the control solenoid and the pilot spool moves to the fail-safe position, relieving the control oil chambers of the main stage. The main stage control spool is held by springs in mid position.

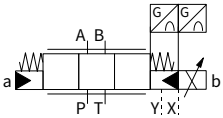
06

Symbols

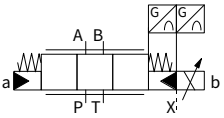
Type 4WRLE...–L4X...E.



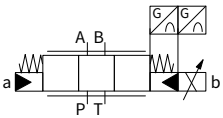
Type 4WRLE...–L4X...



Type 4WRLE . –L4X . . T .



Type 4WRLE...–L4X...ET.



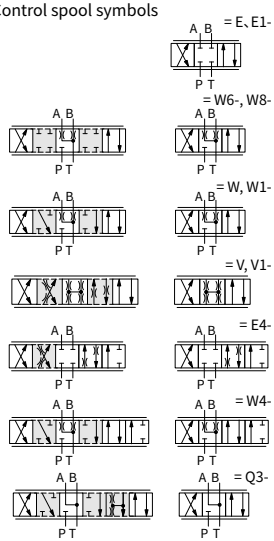
Ordering code

4WRL	E				– L4X / G24		/		*

With on-board electronics = E

NG10 = 10
NG16 = 16
NG25 = 25
NG27 [1] = 27

Control spool symbols



Transitional symbols

With symbols:
E1-, E4-, W1-, W4-, W8-, V1-:
P →A : qv B→T : qv/2
P →B : qv/2 A→T : qv

[1] NG27 is a high-flow version of NG25, ports P, A, B and T have Φ32 mm in the main stage.
Contrary to standard ISO 4401-08-08-0-05, ports P, A, B and T may be drilled to max. Φ30 mm in the control block.
These valves therefore offer higher flow rates $Q_A : Q_B$

Further information in plain text

V = FKM seals
No code = NBR seals

Interface
A1= Command value input ±10V
F1=Command value input 4 to 20mA

K31= Without plug-in connector
Z31= With plug-in connector

Pilot oil supply and drain
No code = Pilot oil supply external, Pilot oil drain external
E = Pilot oil supply internal, Pilot oil drain external
ET = Pilot oil supply internal, Pilot oil drain internal
T = Pilot oil supply external, Pilot oil drain internal

Power supply of trigger electronics
G24 = +24V DC

L4X = Unit series 40 to 49 (installation and connectiondimensions unchanged)

Flow characteristic:
M = Progressive with linear fine metering (Only for symbol Q3), other sizes available upon request
L = Linear

Nominal flow rate at 10 bar valve pressure difference (5 bar per metering notch)

NG10	100 L/min
NG16	200 L/min (Only for symbol W6- and W8-)
	250 L/min (Only for symbol E、E1、V、V1- and Q3-)
NG25	350 L/min (Only for symbol W6- and W8-)
	400 L/min (Only for symbol E、E1、V、V1- and Q3-)
NG27	430 L/min (Only for symbol W6- and W8-)
	600 L/min (Only for symbol E、E1、V、V1- and Q3-)

Technical data

General			NG10	NG16	NG25	NG27
Design			Spool type valve, pilot operated			
Construction			Servo solenoid directional control valve NG6, with position controller for pilot valve and main stage			
Type of mounting			Subplate, mounting hole configuration NG10...27 to ISO 4401-...			
Installation position			Optional			
Ambient temperature range		°C	–20...+50			
Weight		kg	8.35	10	18	18
Vibration resistance, test condition			Max.25g, shaken in 3 dimensions (24 h)			

Hydraulic (measured with HLP 46, ϑ_{oil} = 40°C ±5°C)						
Pressure fluid			Hydraulic oil to DIN 51524...535, other fluids after prior consultation			
Viscosity range	Recommended	mm^2/s	20...100			
	Max. permitted	mm^2/s	10...800			
Maximum permissible degree of contamination of pressure fluid. Purity class to ISO 4406 (c)			Class 18/16/13 [1]			
Flow direction			See symbol			
Nominal flow at Δ p = 5 bar per notch [2]		L/min	see ordering code			
Max. working pressure	Ports P, A, B External control oil inlet	bar	350	350	350	280
	Ports P, A, B Internal control oil inlet	bar	280			
	Ports T, X, Y	bar	250			
Min. control oil pressure in "pilot stage"		bar	10			
Q_{max}		L/min	170	450	900	1000
Q_N pilot valve Δp = 35 bar		L/min	4	12	24	24
Leakage of pilot valve at 100 bar		L/min	< 180	< 350	< 500	< 500
Leakage of main stage (symbols "E") at 100 bar		L/min	<0.25	< 0.4	< 0.6	< 0.6

Static/Dynamic						
Hysteresis		%	< 0.1, scarcely measurable			
Manufacturing tolerance for Q_{max}		%	≦ 10			
Response time for signal change	at X = 100 bar	0...100 %	25	26	32	32
		0...10 %	14	15	18	18
	at X = 10 bar	0...100 %	85	80	120	120
		0...10 %	50	30	50	50
Switch-off behavior			After electrical switch-off: pilot valve in fail-safe. Main stage moves to spring-centered "mid position"			
Thermal drift			Zero point displacement < 1% at ΔT = 40°C			
Zero adjustment			Adjustable ±5% via valve amplifier			

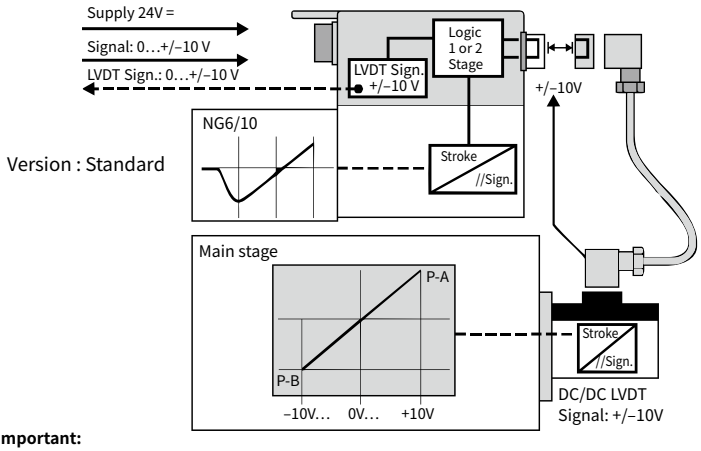
[1] The purity classes stated for the components must be complied with in hydraulic systems.
Effective filtration prevents problems and also extends the service life of components.

Technical data

Electric pilot valve NG6, trigger electronics integrated in the valve			
Cyclic duration factor	%	100 ED	
Degree of protection		IP 65 to DIN 40050 and IEC 14434/5	
Connection		Plug-in connector 6P+PE, DIN 43563	
Power supply Terminal A: Terminal B: 0V		24 V DC min. 21 V DC/max. 40 V DC Ripple max. 2 V DC	
Power consumption		40 VA max.	
External fuse	A_F	2.5	
Input,"Standard"version Terminal D: U^E Terminal E:		Differential amplifier, R_i = 100 kΩ 0... ± 10 V 0 V	
Max. differential input voltage at 0V		D → B E → B	max. 18V DC
Test signal, "Standard" version Terminal F: U_{test} Terminal C:		LVDT 0... ± 10 V Reference 0 V	
Protective conductor and screen		See pin assignment	
Recommended cable		See pin assignment Up to 20m 7×0.75mm² Up to 40m 7×1mm²	
Calibration		Overlap and P–A at +8V, calibrated at the factory, see valve characteristic curve	

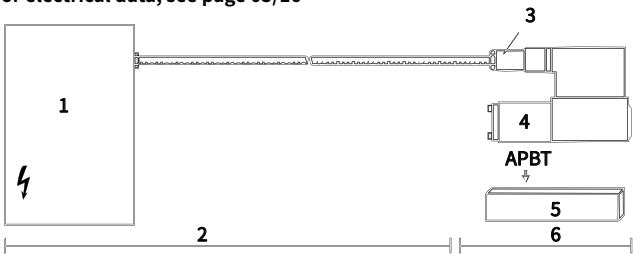
06

Electrical connection



Important:
Pilot operated 4/3-way servo solenoid directional control valves with positive overlap perform their function in open or closedloop-controlled axes and have approx. 20 % overlap when switched off.This condition does not constitute an active fail-safe position.
For this reason, many applications require the use of "external check valves" or certain sandwich-mounted valves, which must be taken into account during the On/Off switching sequence.

For electrical data, see page 05/16



1 Control
2 Provided by customer
3 Plug-in connector
4 Valve
5 Connecting surface
6 Provided by Lixin

Technical data for the cable

Version:	- Multi-core wire - Litz wire structure, extra fine wire according to VDE 0295, class 6 - Protective earthing conductor, green-yellow - Cu shielding braid
Number of wires:	- Determined by the valve type, connector type and signal configuration
Line Ø:	- 0.75 mm² to 20 m of length - 1.0 mm² to 40 m of length
OuterØ:	- 9.4...11.8 mm - 12.7...13.5 mm

Supply voltage 24 VDC_{nom}

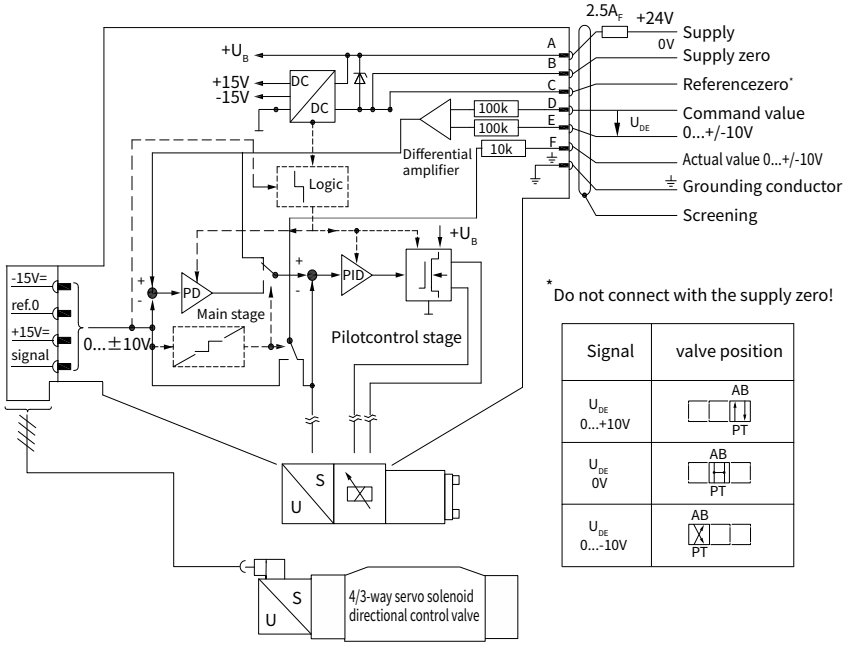
If the value falls below 18 VDC, a fast shut-down takes place internally, comparable with "Enable OFF".

Also with version "F1":
$I_{D-E} \geqslant$ 3mA, valve is active.
$I_{D-E} \leqslant$ 2mA, Valve is deactivated.

Electric signals taken out via control electronics (e.g. actual value) must not be used for switching off safety-relevant machine functions!
(see also the European standard "Safety requirements for fluid power systems and their components – Hydraulics", EN ISO 982)

On-board electronics

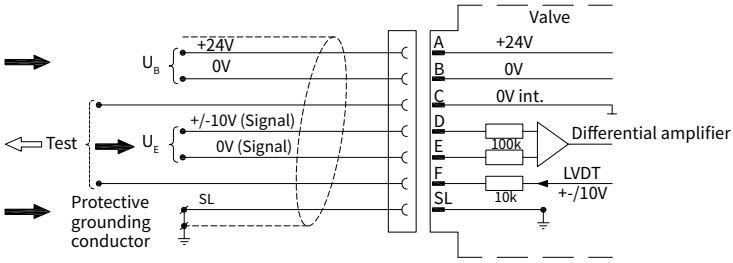
Block diagram/pin assignment
Version A1: U_{D-E} ±10V



* Do not connect with the supply zero!

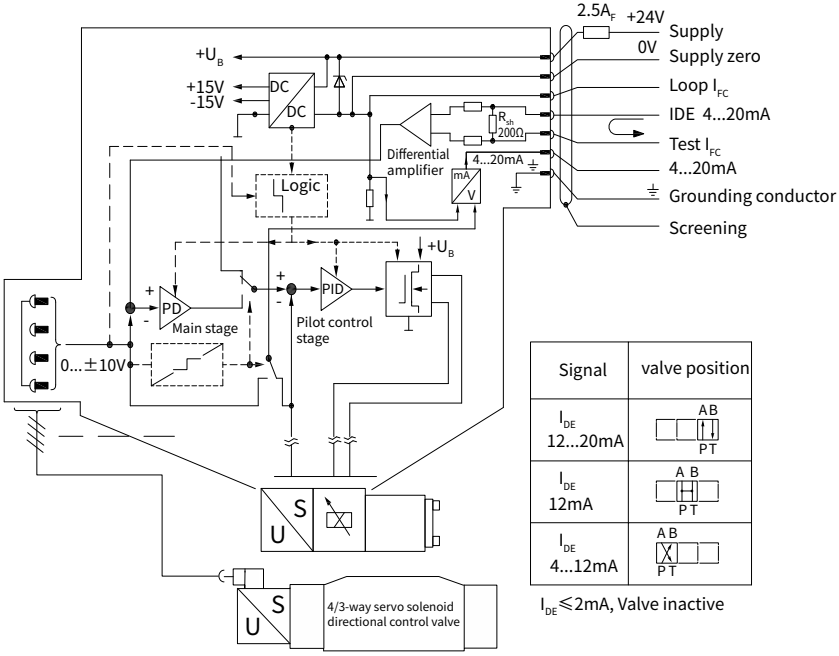
Signal	valve position
U_{DE} 0...+10V	AB PT
U_{DE} 0V	AB PT
U_{DE} 0...-10V	AB PT

Pin assignment 6P+PE
A1: U_{D-E} ± 10V (Ri=100KΩ)



Integrated electronics

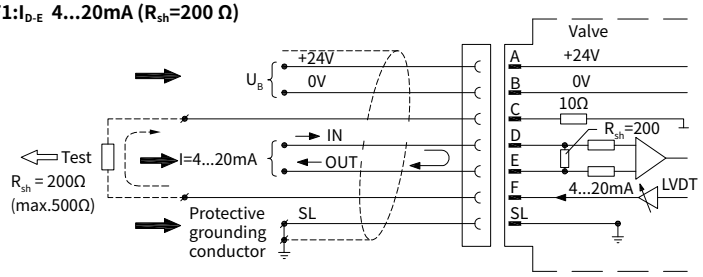
Block diagram/Pinout
Version F1: I_{D-E} 4...20mA



Signal	valve position
I_{DE} 12...20mA	A B P T
I_{DE} 12mA	A B P T
I_{DE} 4...12mA	A B P T

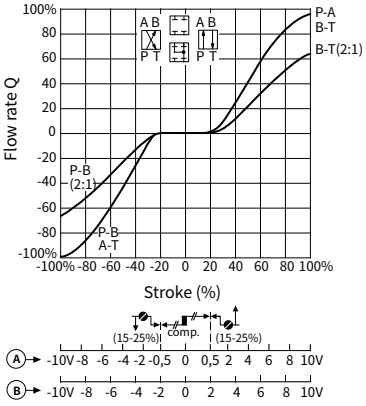
$I_{DE} \leqslant 2$mA, Valve inactive

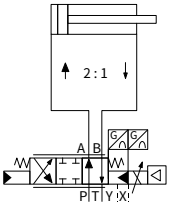
Pin assignment 6P+PE
F1:I_{D-E} 4...20mA (R_{sh}=200 Ω)



Characteristic curves (measured with HLP46, ϑ_{oil}=40°C ±5°C)

Flow rate – signal function Q = f (U_E)
Symbol E, W (Q_A: Q_B= 1 : 1)
E1, W1 (Q_A: Q_B= 2 : 1)

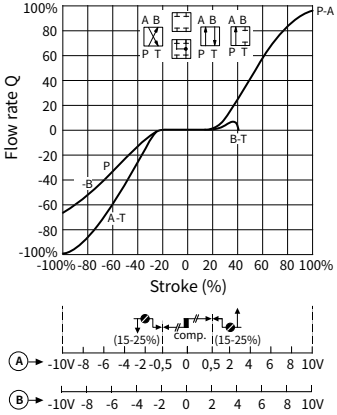




Control spool with asymmetric metering notches
Control spools with asymmetric metering notches are available in a ratio of 2:1 for the purpose of adaptation to differential cylinders.

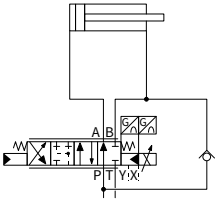
Flow in mid position, "leakage oil pressure relief"With symbol "E", leakage oil in the two work chambers A and B of the control piston gives rise to a build-up of pressure in A or B, which then causes a connecting cylinder to drift out of position.
In many cases, the "W" symbol is a better solution. With a setpoint of "0", the control piston moves into the over-lapped mid position. In this mid position, pressure is then relieved from ports A and B with 1% +0.5% QN to T. This also supports the function of external check valves.

Symbol E4, W4 (Q_A: Q_B= 1 :2)



A with ramp
B without ramp

Control spools in a differential circuit
In order to produce differential circuits, valve spools with a 4th position are available. It is sufficient to install a non-return valve in the consumer lines.
In addition, a control spool (symbol) with internal B-P connection is employed for certain branch-oriented solutions. However, we recommend that you consult Hengli hydraulic with regard to these special symbols, as a simulation or knowledge of this type of system is usually required.

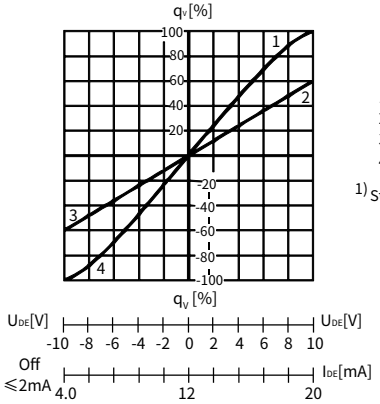


Characteristic curves (measured with HLP46, ϑ_{oil}=40°C ±5°C , Δp=5 bar/control edge)

Flow signal function

Flow characteristic "L"

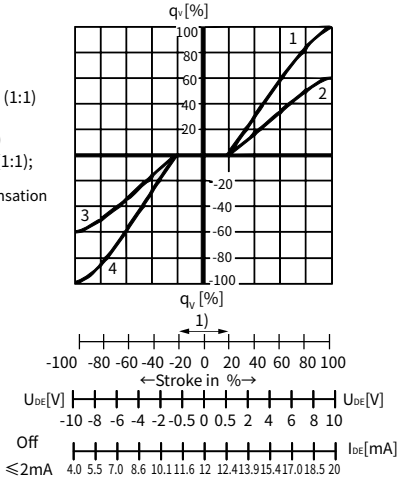
Symbol V,V1-



1 P–A; B–T (1:1)
2 B–T (2:1)
3 P–B (2:1)
4 P–B A–T(1:1);

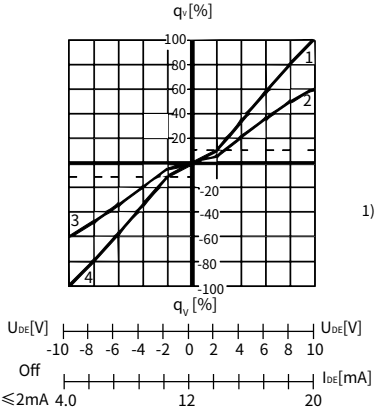
1) Step compensation

Symbol E1,E1-,W6,W8-



Flow characteristic "P"

Symbol V, V1-

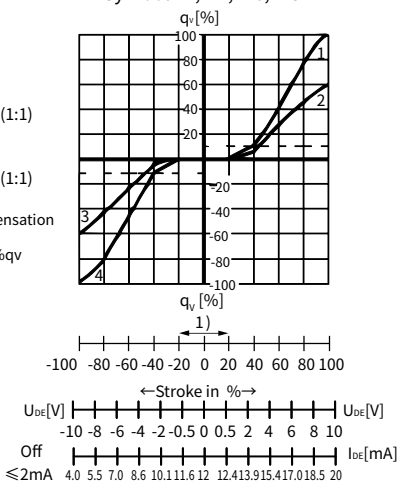


1 P–A;B–T (1:1)
2 B–T (2:1)
3 P–B(2:1)
4 P–B; A–T(1:1)

1) Step compensation

------ 10%qv

Symbol E1,E1-, W6, W8-

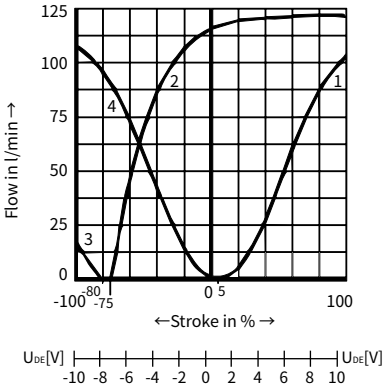


Characteristic curves (measured with HLP46, ϑ_{oil}=40°C ±5°C , Δp=5 bar/control edge)

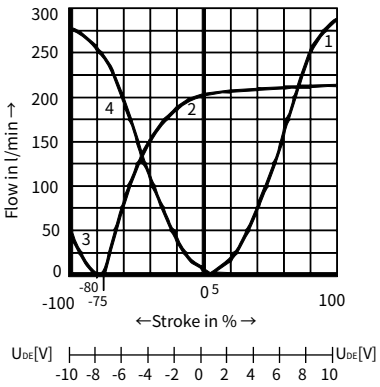
Flow signal function

Flow characteristic "M"

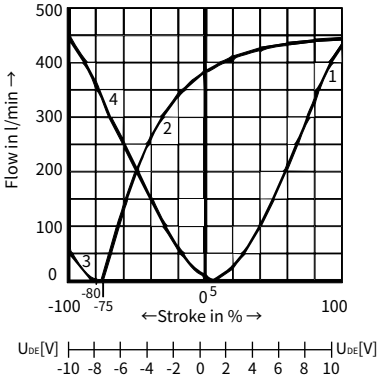
Symbol Q3,version"100"



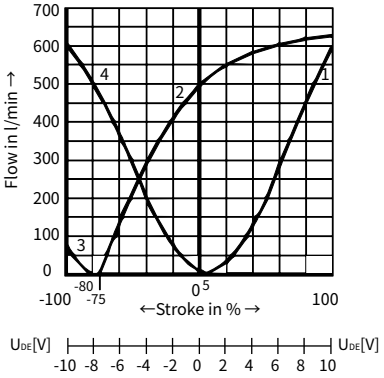
Symbol Q3,version"250"



Symbol Q3,version "400"



Symbol Q3,version "600"



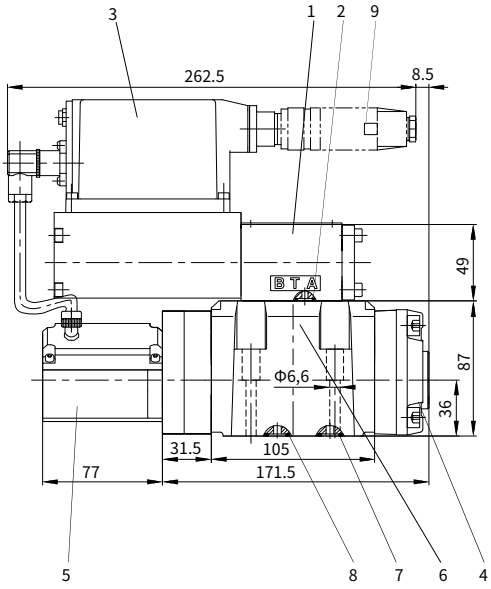
1 P–A 3 P–B
2 B–T 4 A–T

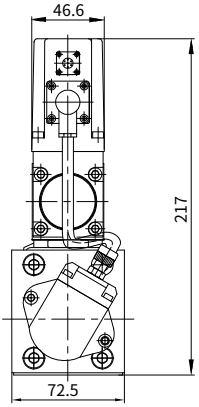
06

Unit dimensions

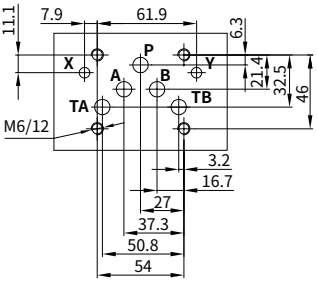
(Dimensions in mm)

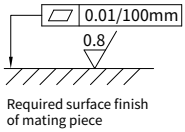
NG 10





Machined valve mounting surface





Required surface finish of mating piece

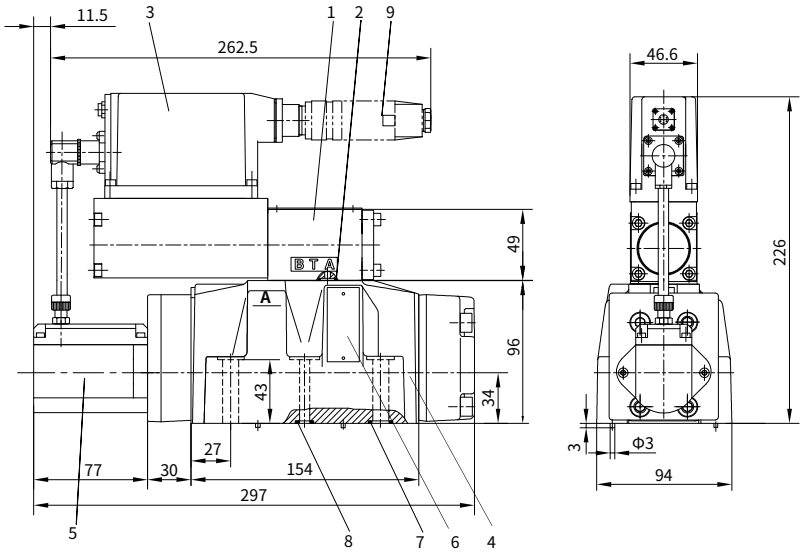
1 Pilot control valve
2 R-ring 9.81×1.5×1.78 (ports P, A, B, T)
3 On-board electronics
4 Main valve
5 Inductive position transducer (main valve)
6 Nameplate
7 R-ring 13×1.6×2, ports A, B, P, T
8 R-ring 11.18×1.6×1.78, ports X and Y
9 Plug-in connector not included in delivery (order separately)

Valve fixing screws:
4- M6×45 ISO 4762-10.9; M_A=13.5Nm

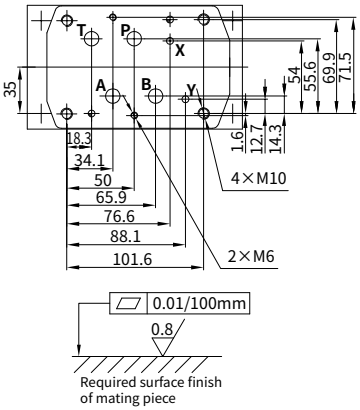
Unit dimensions

(Dimensions in mm)

NG 16



Machined valve mounting surface



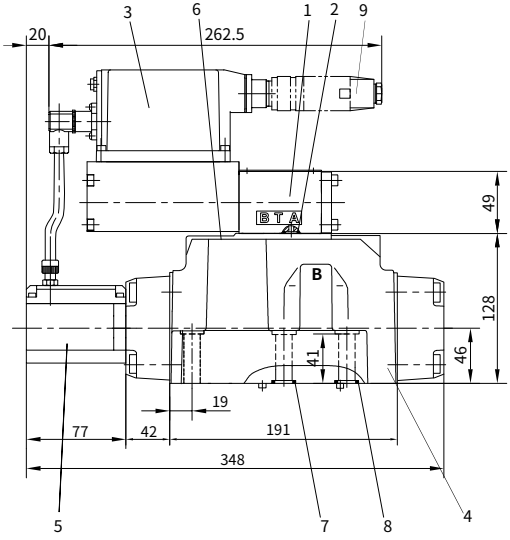
1 Pilot control valve
2 R-ring 9.81×1.5×1.78 (ports P, A, B, T)
3 On-board electronics
4 Main valve
5 Inductive position transducer (main valve)
6 Nameplate
7 R-ring 22.53×2.3×2.62, ports A, B, P, T
8 R-ring 10×2×2, ports X and Y
9 Plug-in connector not included in delivery (order separately)

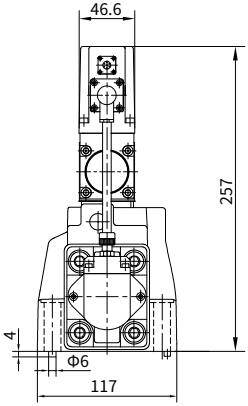
Valve fixing screws:
2- M6×60 ISO 4762-10.9; M_A =14 Nm
4- M10×60 ISO 4762-10.9; M_A =60 Nm

Unit dimensions

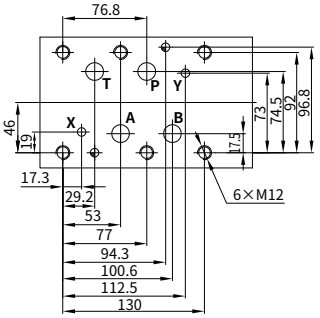
(Dimensions in mm)

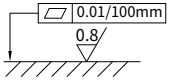
NG 25





Machined valve mounting surface





Required surface finish of mating piece

1 Pilot control valve
2 R-ring 9.81×1.5×1.78 (ports P, A, B, T)
3 On-board electronics
4 Main valve
5 Inductive position transducer (main valve)
6 Nameplate
7 R-ring 27.8×2.6×3, ports A, B, P, T
8 R-ring 19×3×3, ports X and Y
9 Plug-in connector not included in delivery (order separately)

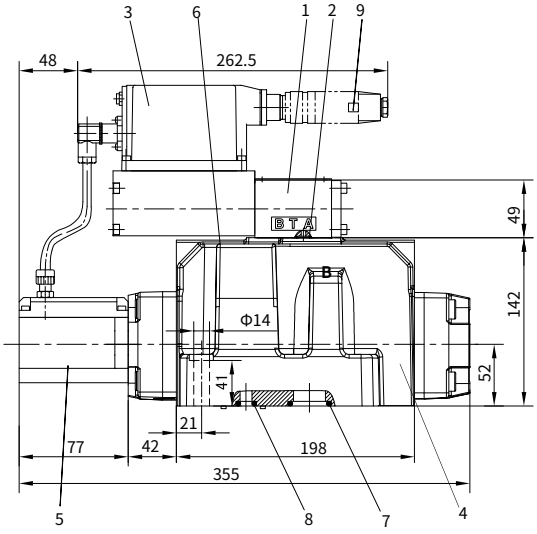
Valve fixing screws:

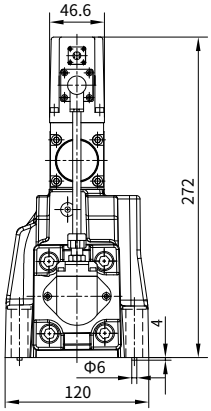
6- M12×60 ISO 4762-10.9; M_A =100 Nm

Unit dimensions

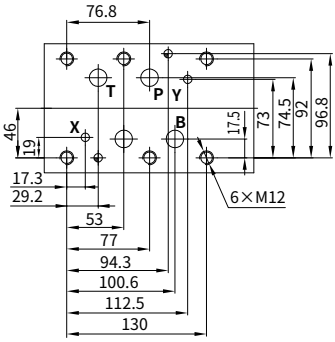
(Dimensions in mm)

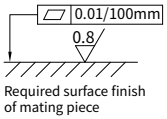
NG 27





Machined valve mounting surface





1 Pilot control valve
2 R-ring 9.81×1.5×1.78 (ports P, A, B, T)
3 On-board electronics
4 Main valve
5 Inductive position transducer (main valve)
6 Nameplate
7 R-ring 34.52×3.53×3.53 (ports A, B, P, T)
8 R-ring 19×3×3, ports X and Y
9 Plug-in connector not included in delivery (order separately)

Valve fixing screws:

6- M12×60 ISO 4762-10.9; M_A =100 Nm