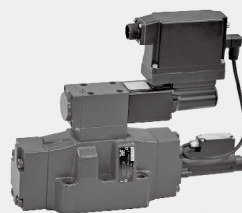


6.14

Pilot operated proportional directional valves

Type 4WRTE16...L1X

NG 16
Up to 350 bar
Up to 450 L/min



Contents

Function and configuration	02
Technical data	03
Ordering code	03
Analog integral driver -Options	04
Characteristic curves	05
Unit dimensions	06

Features

- Pilot operated 2-stage fast response valve, closed loop control of the direction and flow.
- Suitable for closed loop control of position, velocity, pressure and force.
- Main spool and pilot spool with electrical position feedback.
- With integrated control electronics
- Subplate mounting, Porting pattern to ISO4401-07-07.

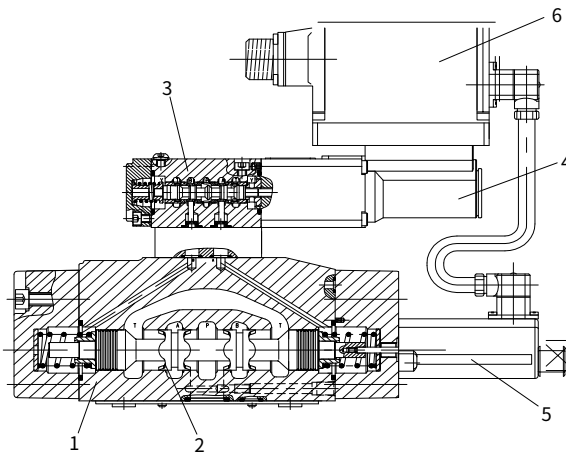
Function and configuration

4WRTE16 are 2-stage proportional valves with integrated amplifier, which provide both directional and non compensated flow control according to the electronic reference signal.

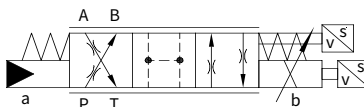
The proportional directional valves mainly consist of main housing (1), main spool (2), pilot actuated proportional valve (3), position transducers for pilot stage (4) and main stage (5) and integrated control electronics.

The main spool (2), sliding into in the main housing (1), is piloted in closed loop by the proportional valve (3) type 4WRPEH6.

The integrated control electronics ensures factory presetting, fine functionality plus valve-to-valve interchangeability and simplified wiring and installation.



Symbols



4WRTE16...L1X

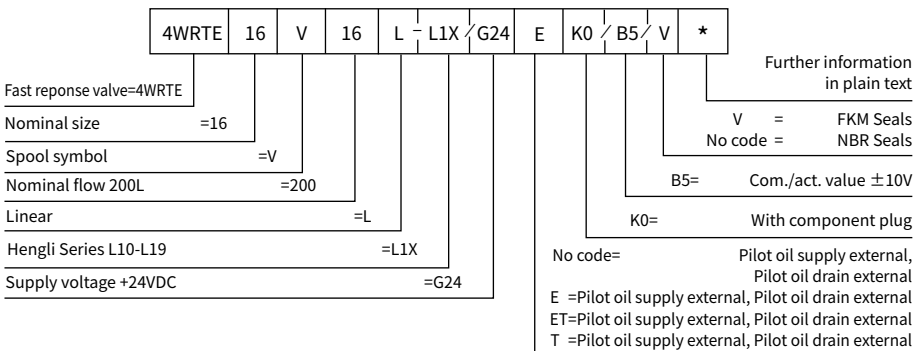
Technical data

Weight	kg	13	
Nominal flow , at ΔP=10 bar	L/min	200	
Hysteresis	%	≤ 0.1	
Repeatable accuracy	%	±0.1	
Response time	ms	<25	
Temperature drift	%	<1 , atΔT=40°C	
Operating pressure	Ports A,B,P,X	bar	350 bar
	Port Y	bar	<10 bar
	Port T	bar	250 bar
Pressure fluid	Mineral oil-Suitable for FKM and NBR seals Phosphate oil- Suitable for FKM seals		
Fluid temperature range	-20...+80°C		
Viscosity range	mm ² /s	20 to 380(preferably 30 to 45)	
Degree of contamination	Max. permissible degree is to NAS1638 Class 9 and ISO440620/18/Class15		

Electrical			
Control electronics			
Power Supply	Nominal voltage	+24VDC	
	consumption	Vrms=21~32Vmax(Max. peak 10%Vpp)	
Power, Max.	W	50W	
Input reference signal	Voltage ±10VDC		
	Current 4~20mA		
Monitor signal	±10VDC(Max. resistance current 5mA)		
Enable signal	Voltage 0~5VDC(unable), 9~24VDC(enable)		
Working temperature	°C	-20...+50	
Degree of valve protection	IP 67		
Recommended connection cable	LiYCY shield cable, recommend 0.5mm ² cable within length of 40m, others choose 1.5mm ²		

06

Ordering code



Analog integral driver -Options

Standard driver execution provides on the 7 pin main connector:

- Power supply** -24VDC must be appropriately stabilized or rectified and filtered.
- Reference input signal** -analog differential input with $\pm 10\text{VDC}$ nominal range (pin D,E), proportional to desired coil current.
- Monitor output signal** -analog output signal proportional to the actual valve's coil current.

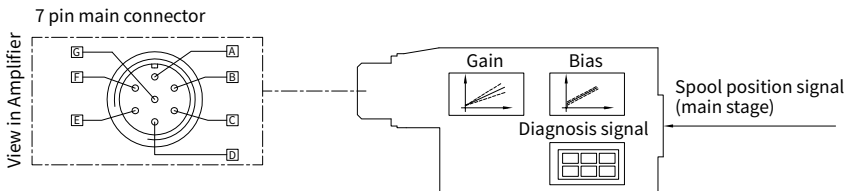
Following options are available to adapt standard execution to special application requirements:

1. Option / I

It provides 4~20mA current reference signal instead of the standard $\pm 10\text{VDC}$. It's normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise

2. Option / Q

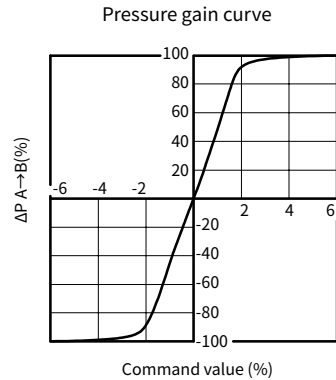
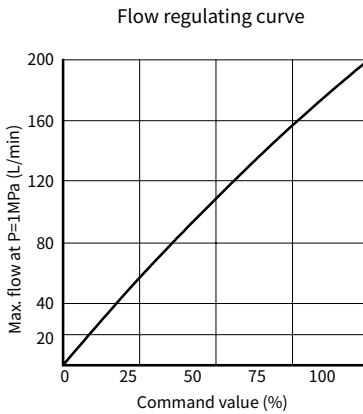
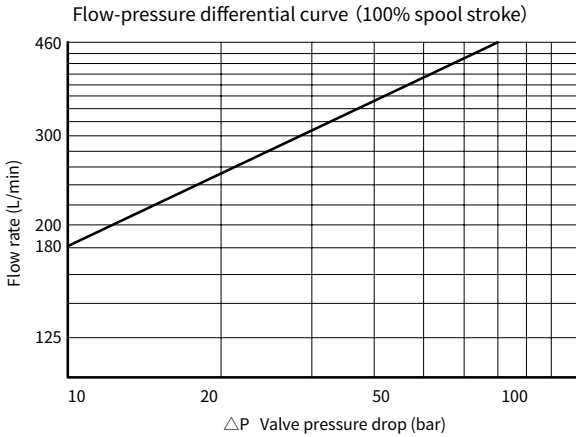
It provides the possibility to enable or disable the valve functioning without cutting the power supply, (the valve functioning is disabled but the driver current output stage is still active) .



Main connector - 7 pin

Mark	Contact	Signal
Supply voltage	A	24 VDC input power supply
	B	GND
Input dif-ferential	C	ref. potential (contact F) enable signal
	D	Command value ($\pm 10\text{V}$ / 4~20mA)
	E	0V ref. potential
	F	Monitor point ($\pm 10\text{V}$)

Characteristic curves (measured with HLP at $\vartheta_{oil} = 40^\circ\text{C} \pm 5^\circ\text{C}$)



Notes:

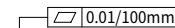
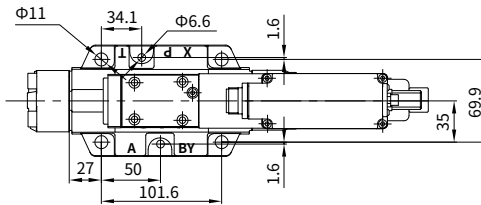
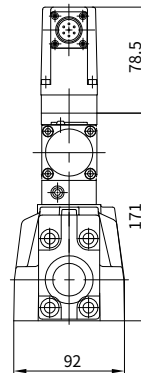
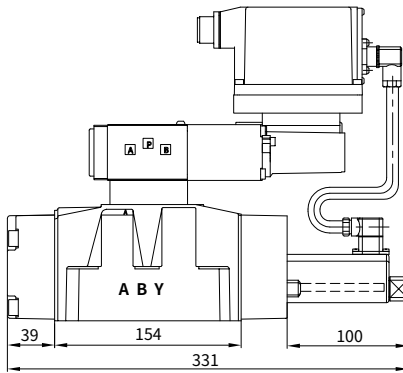
Hydraulics symbol and input signal

Input signal : 0 ~ + 10V
 12~20mA } P→A/B→T

Input signal : 0 ~ - 10V
 4~12mA } P→B/A→T

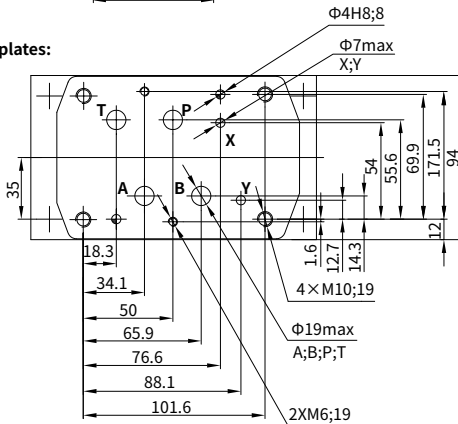
Unit dimensions

(Dimensions in mm)



0.8
Required surface finish of mating piece

Subplates:



Valve fixing screws:

4-M10×60 GB/T70.1-10.9;

$M_A=70\text{Nm}$

2-M6×55 GB/T70.1-10.9;

$M_A=15.5\text{Nm}$

P = High pressure port

A, B= Working ports

T = Oil gallery

X = External control port

Y = Leakage port

Ports P, T, A, B, O-Ring: 22×2.5

Ports X, Y, O-Ring: 10×2

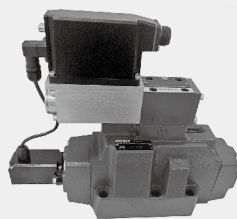


Pilot operated proportional directional valves

6.15

Type 4WRLE

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



Contents

Function and configuration	02
Symbols	02
Ordering code	03
Technical data	04-05
Electrical connection	06
Technical data for the cable	06
On-board electronics	07
Integrated electronics	08
Characteristic curves	09-11
Unit dimensions	12-15

Features

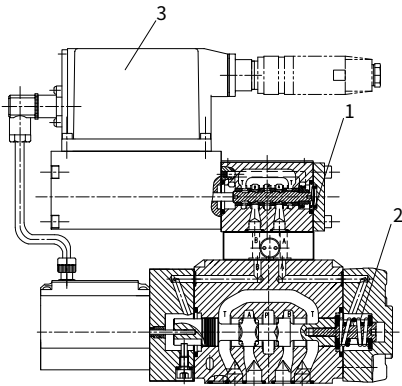
- Pilot valve NG6, with control spool and sleeve in servo quality, actuated on one side, 4/4 fail-safe position when switched off
- Control solenoid with electrical position feedback and electronics for position transducer (LvdT DC/DC)
- Main stage in servo quality with position feedback
- Pilot operated 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 inductive position 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...10 V between 20...100 %.

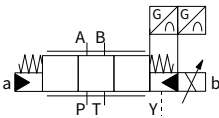
If the input setpoint is $< \pm 0.5$ V, the control spool is held in the springcentered, overlapped mid position.

Power failure

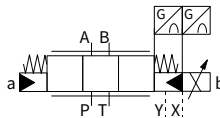
In the event of a power failure or an open circuit, the onboard electronics cut off the electricity to the control solenoid and the pilot spool moves to the fail-safe position, relieving the control oil chambers of the main stage. The main stage control spool is held by springs in mid position.

Symbols

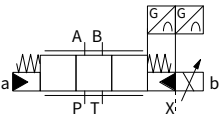
Type 4WRLE...-L4X...E.



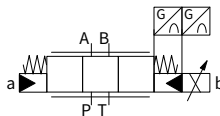
Type 4WRLE...-L4X...



Type 4WRLE . -L4X . . T .



Type 4WRLE...-L4X...ET.



Ordering code

	4WRLE	E				L4X / G24	K0 /			*
--	-------	---	--	--	--	-----------	------	--	--	---

<p>With on-board electronics = E</p> <p>NG10 = 10 NG16 = 16 NG25 = 25 NG27¹⁾ = 27</p> <p>Control spool symbols</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>A, B = E, E1-</p> <p>P T</p> </div> <div style="text-align: center;"> <p>A, B = W6-, W8-</p> <p>P T</p> </div> </div> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>A, B = W, W1-</p> <p>P T</p> </div> <div style="text-align: center;"> <p>A, B = V, V1-</p> <p>P T</p> </div> </div> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>A, B = E4-</p> <p>P T</p> </div> <div style="text-align: center;"> <p>A, B = W4-</p> <p>P T</p> </div> </div> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>A, B = Q3-</p> <p>P T</p> </div> </div>	<p>Further information in plain text</p> <p>D3 = ZDR6DP0-L4X/40YM With pressure reducing valve</p> <p>V = FKM seals No code = NBR seals</p> <p>Interface</p> <p>A1= Command value input ±10V F1= Command value input 4 to 20mA</p> <p>Electrical connection:</p> <p>K0 = without plug-in connector, with plug to DIN 43563-AM6, order plug-in connector separately</p> <p>Control oil inlet "x" control oil return "y"</p> <p>No desg. = "x" = external, "y" = external E = "x" = internal, "y" = external ET = "x" = internal, "y" = internal T = "x" = external, "y" = internal</p> <p>Power supply of trigger electronics +24V DC</p> <p>G24 =</p> <p>L4X = Unit series 40 to 49 (installation and connection dimensions unchanged)</p> <p>M =</p> <p>L =</p> <p>Flow characteristic: Progressive with linear fine metering Linear</p> <p>Nominal flow rate at 10 bar valve pressure difference (5 bar per metering notch)</p> <table style="width:100%;"> <tr> <td style="width:50%;"></td> <td style="width:25%; text-align:center;">NG10:</td> <td style="width:25%;"></td> </tr> <tr> <td>55 =</td> <td style="text-align:center;">55 l/min</td> <td>370 =</td> </tr> <tr> <td>100 =</td> <td style="text-align:center;">100 l/min</td> <td></td> </tr> <tr> <td></td> <td style="text-align:center;">NG16:</td> <td></td> </tr> <tr> <td>120 =</td> <td style="text-align:center;">120 l/min</td> <td>430 =</td> </tr> <tr> <td>200 =</td> <td style="text-align:center;">200 l/min</td> <td></td> </tr> <tr> <td></td> <td style="text-align:center;">NG25:</td> <td></td> </tr> <tr> <td></td> <td></td> <td>370 l/min</td> </tr> <tr> <td></td> <td style="text-align:center;">NG27:</td> <td></td> </tr> <tr> <td></td> <td></td> <td>430 l/min</td> </tr> </table>		NG10:		55 =	55 l/min	370 =	100 =	100 l/min			NG16:		120 =	120 l/min	430 =	200 =	200 l/min			NG25:				370 l/min		NG27:				430 l/min
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	NG27:																														
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□ 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 $\Phi 32$ 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. $\Phi 30$ mm in the control block.

These valves therefore offer higher flow rates $Q_A; Q_B$

Technical data

General				
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	NG10 8.35	NG16 10
Vibration resistance, test condition		Max.25g, shaken in 3 dimensions(24 h)		

Hydraulic (measured with HLP 46, $\vartheta_{oil} = 40^{\circ}\text{C} \pm 5^{\circ}\text{C}$)				
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 $\Delta p = 5$ bar per notch ²⁾		L/min	NG10	NG16
		see Ordering code		
Max. working pressure	Ports P, A, B External control oil inlet	bar	350	350
	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
Q_N pilot valve $\Delta p = 35$ bar		L/min	4	12
Leakage of pilot valve at 100 bar		L/min	< 180	< 350
Leakage of main stage (symbols "E") at 100 bar		L/min	< 0.25	< 0.4
			< 0.6	< 0.6

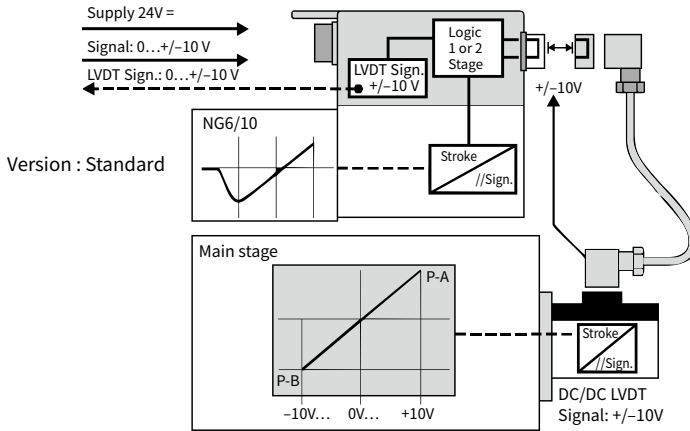
Static/Dynamic				
Hysteresis		%	< 0.1, scarcely measurable	
Manufacturing tolerance for Q_{max}		%	≤ 10	
Response time for signal change (at X = 100 bar)	0...100 %		25	26
	0...10 %		14	15
Response time for signal change (at X = 10 bar)	0...100 %		85	80
	0...10 %		50	30
Switch-off behavior		After electrical switch-off: pilot valve in fail-safe. Main stage moves to spring-centered "mid position"		
Thermal drift		Zero point displacement < 1 % at $\Delta T = 40^{\circ}\text{C}$		
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		24 V DC
Terminal A:		min. 21 V DC/max. 40 V DC
Terminal B: 0 V		Ripple max. 2 V DC
Power consumption		40 VA max.
External fuse	A _F	2.5
Input, "Standard" version		Differential amplifier, R _i = 100 kΩ
Terminal D: U ^E		0... ± 10 V
Terminal E:		0 V
Max. differential input voltage at 0 V	D → B E → B	max. 18V DC
Test signal, "Standard" version		LVDT
Terminal F: U _{test}		0... ± 10 V
Terminal C:		Reference 0 V
Protective conductor and screen		See pin assignment
Recommended cable		See pin assignment Up to 20m 7×0.75mm ² Up to 40m 7×1mm ²
Calibration		Overlap and P-A at +8 V, calibrated at the factory, see valve characteristic curve

Electrical connection



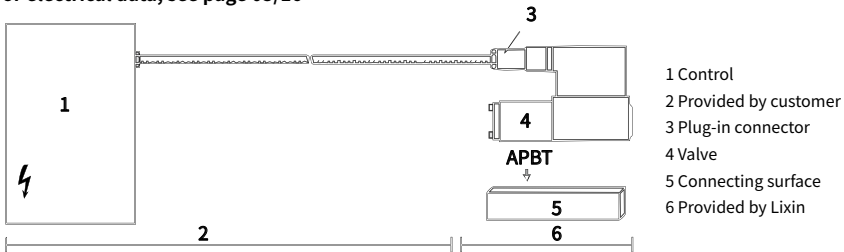
Version : Standard

Important:

Pilot operated 4/3-way servo solenoid directional control valves with positive overlap perform their function in open or closed-loop-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



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

Outer Ø: - 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".

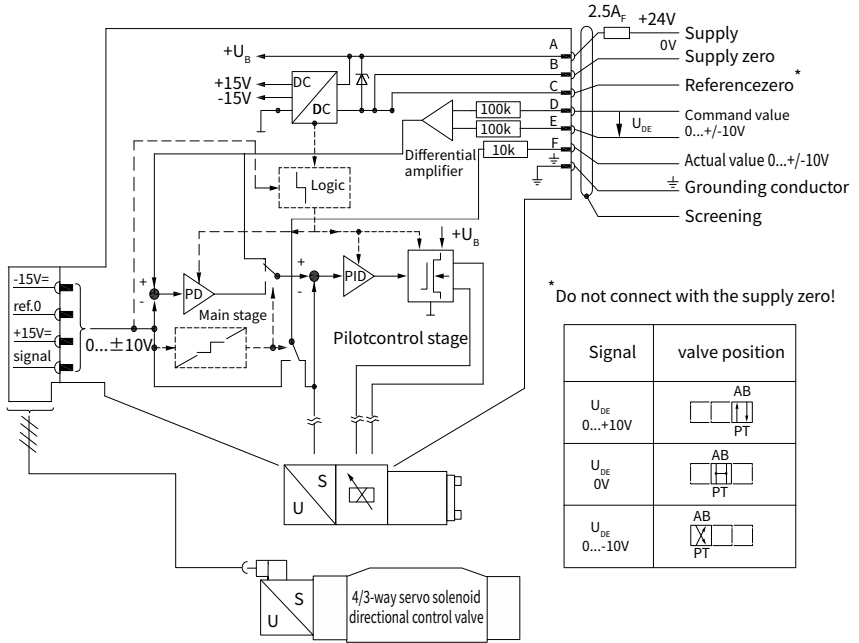
Also with version "F1":
 $I_{D,E} \geq 3 \text{ mA}$ - valve is active.
 $I_{D,E} \leq 2 \text{ mA}$ - Valve is deactivated.

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

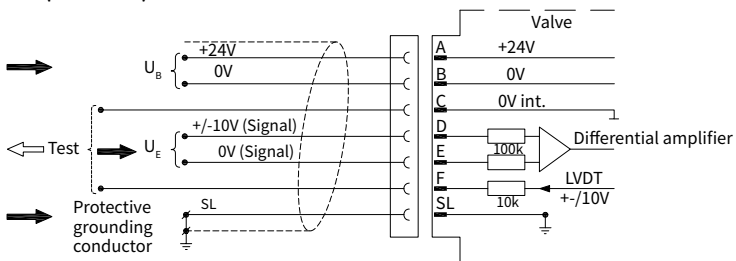
Block diagram/pin assignment

Version A1: $U_{D-E} \pm 10V$



Pin assignment 6P+PE

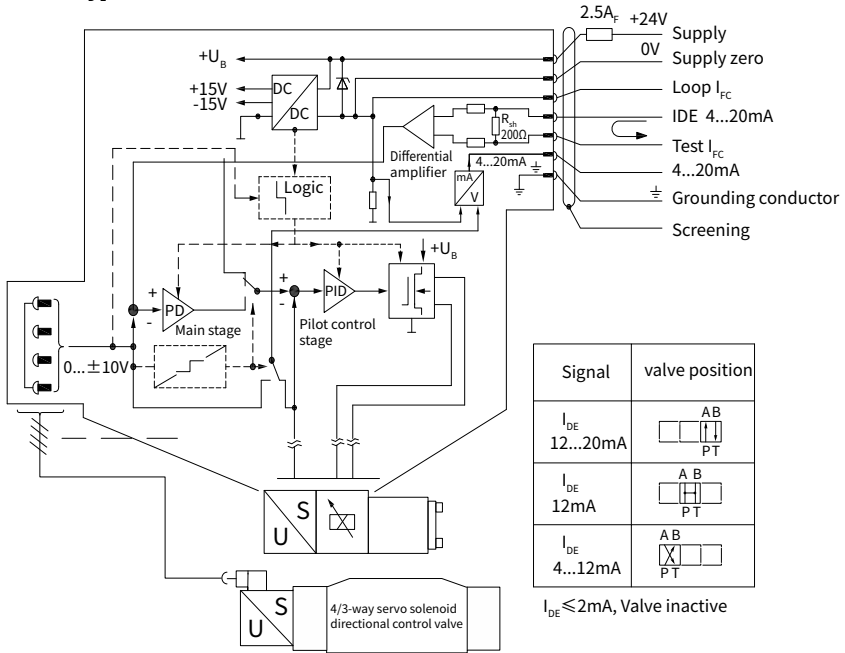
A1: $U_{D-E} \pm 10V$ ($R_i=100K\Omega$)



Integrated electronics

Block diagram/ Pinout

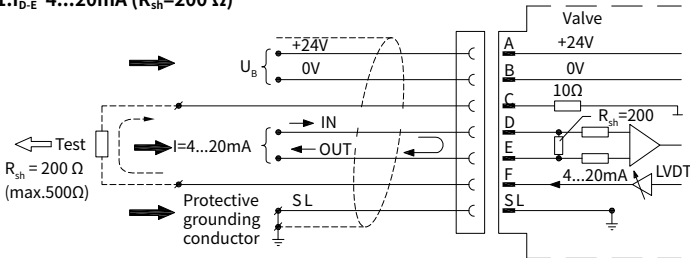
Version F1: I_{D-E} 4...20mA



06

Pin assignment 6P+PE

F1: I_{D-E} 4...20mA ($R_{sh}=200\ \Omega$)

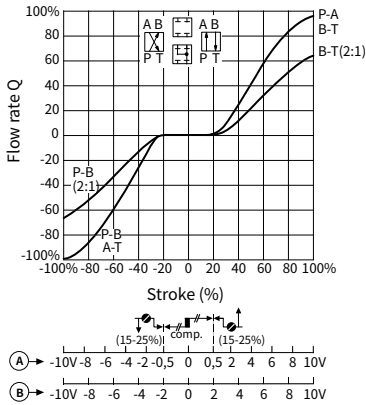


Characteristic curves (measured with HLP46, $\vartheta_{oil}=40^{\circ}\text{C} \pm 5^{\circ}\text{C}$)

Flow rate - signal function $Q = f(U_e)$

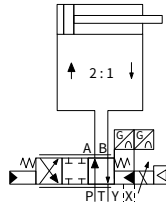
Symbol E, W ($Q_A: Q_B = 1 : 1$)

E1, W1 ($Q_A: Q_B = 2 : 1$)



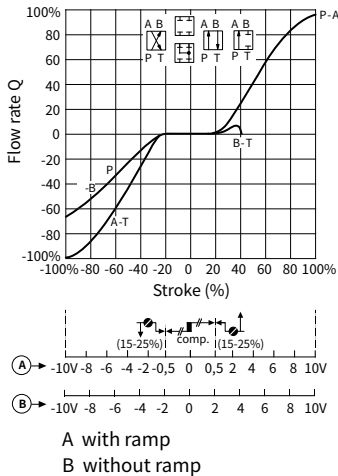
Control spool with asymmetric metering notches

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.

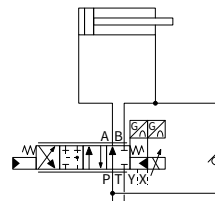
Symbol E4, W4 ($Q_A: Q_B = 1 : 2$)



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.

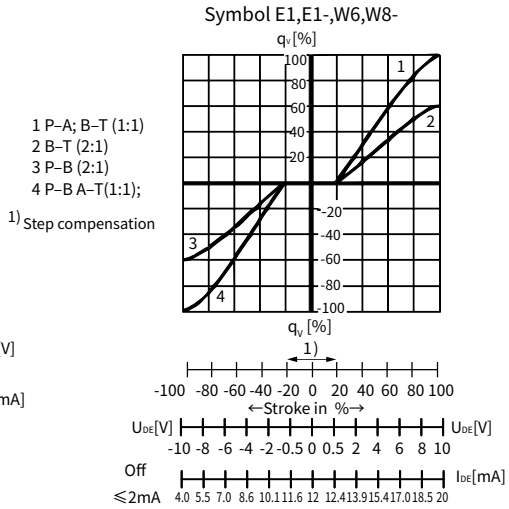
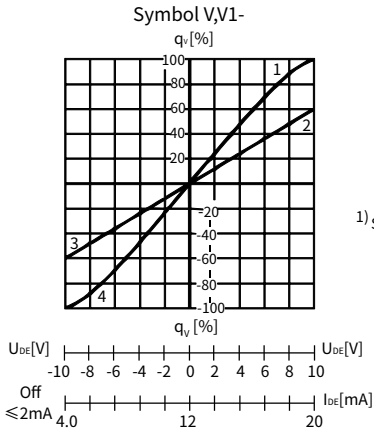
In addition, a control spool (symbol) with internal B-P connection is employed for certain branch-oriented solutions. However, we recommend that you consult Hengli hydraulic with regard to these special symbols, as a simulation or knowledge of this type of system is usually required.



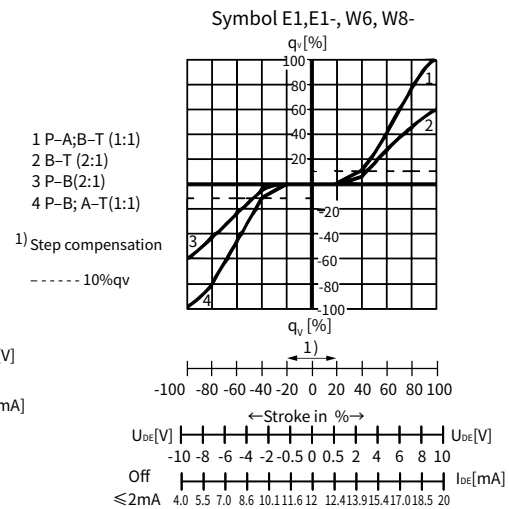
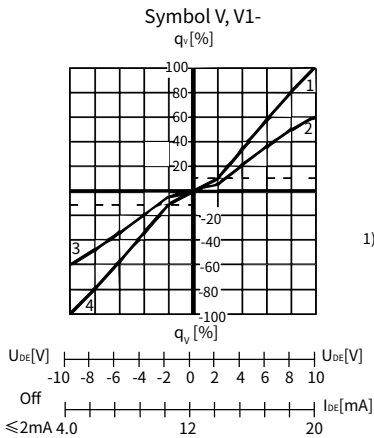
Characteristic curves (measured with HLP46, $\vartheta_{oil}=40^{\circ}\text{C} \pm 5^{\circ}\text{C}$, $\Delta p=5\text{ bar/control edge}$)

Flow signal function

Flow characteristic "L"



Flow characteristic "P"

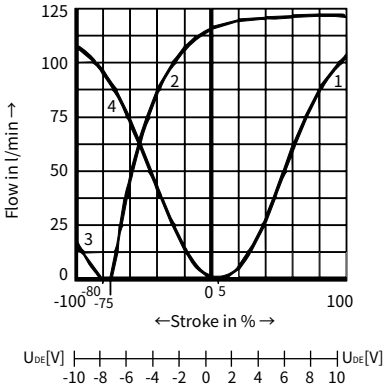


Characteristic curves(measured with HLP46, $\vartheta_{oil} = 40^{\circ}\text{C} \pm 5^{\circ}\text{C}$, $\Delta p = 5 \text{ bar/control edge}$)

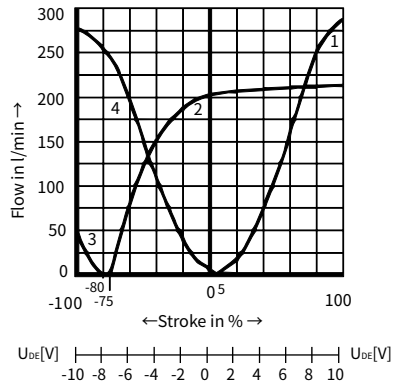
Flow signal function

Flow characteristic "M"

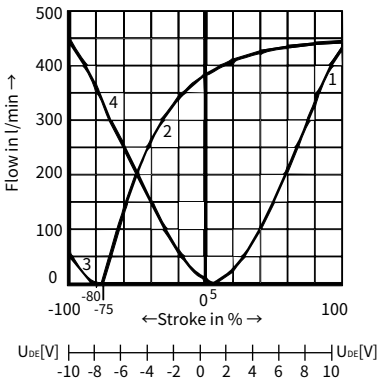
Symbol Q3,version "100"



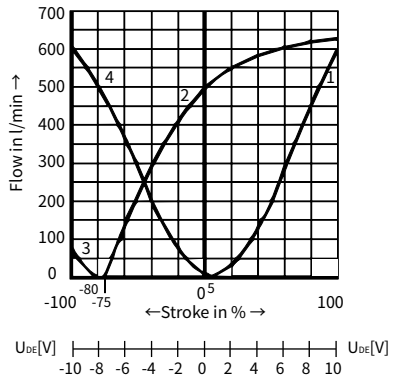
Symbol Q3,version "250"



Symbol Q3,version "400"



Symbol Q3,version "600"



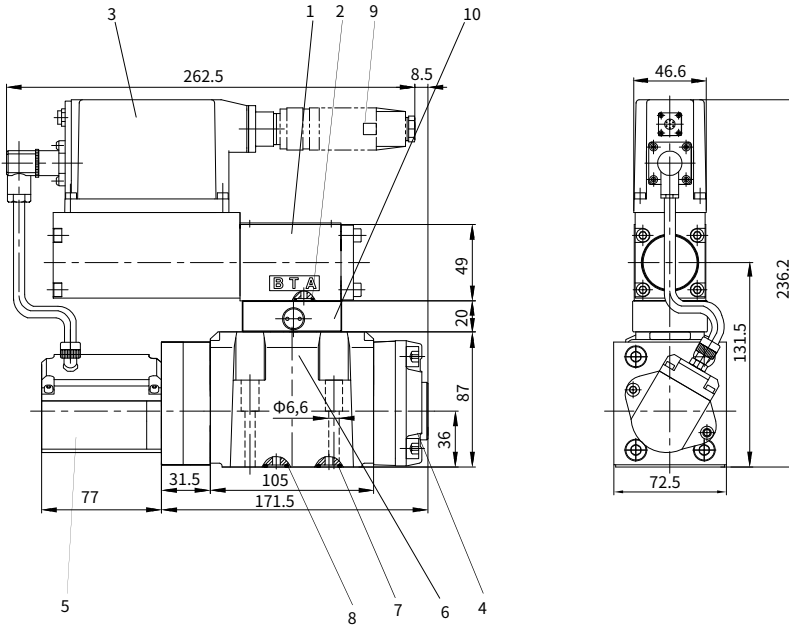
- 1 P-A 3 P-B
- 2 B-T 4 A-T

06

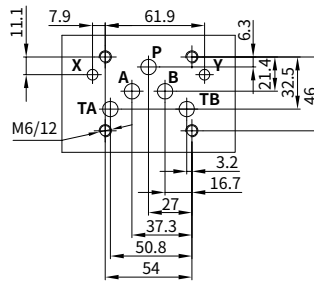
Unit dimensions

(Dimensions in mm)

NG 10



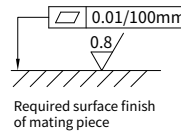
Machined valve mounting surface



- 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)
- 10 Pressure reducing valve

Valve fixing screws:

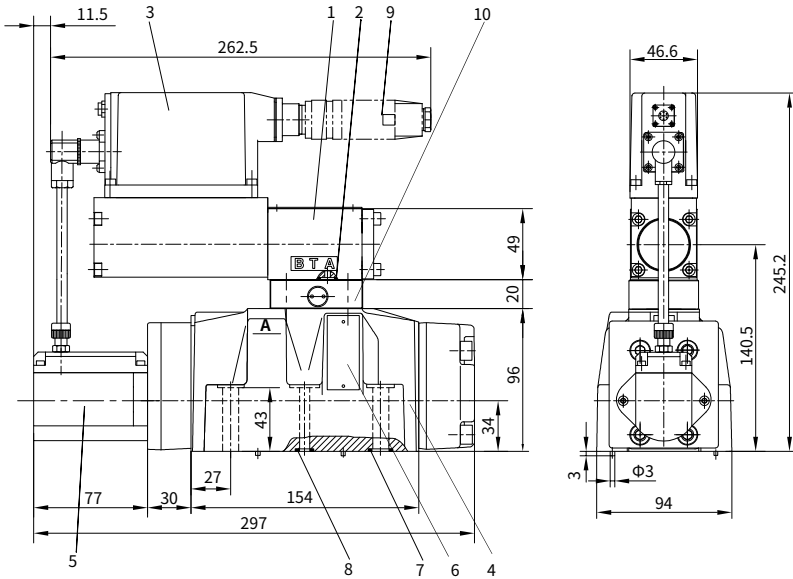
4- M6 × 45 ISO 4762-10.9; $M_A = 13.5 \text{ Nm}$



Unit dimensions

(Dimensions in mm)

NG 16

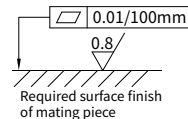
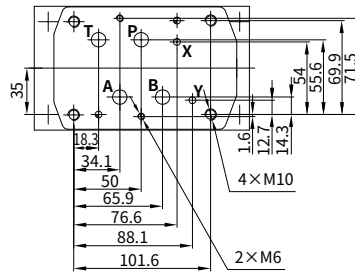


- 1 Pilot control valve
- 2 R-ring 9.81×1.5×1.78(ports P, A, B, T)
- 3 On-board electronics
- 4 Main valve
- 5 Inductive position transducer (main valve)
- 6 Nameplate
- 7 R-ring 22.53×2.3×2.62, ports A, B, P, T
- 8 R-ring 10×2×2, ports X and Y
- 9 Plug-in connector not included in delivery (order separately)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

Valve fixing screws:

- 2- M6×60 ISO 4762-10.9; $M_A=14\text{ Nm}$
- 4- M10×60 ISO 4762-10.9; $M_A=60\text{ Nm}$

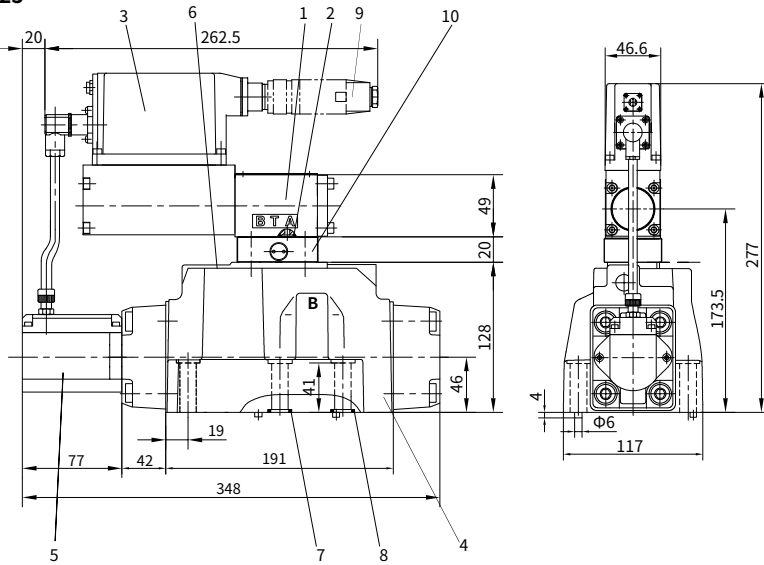
Machined valve mounting surface



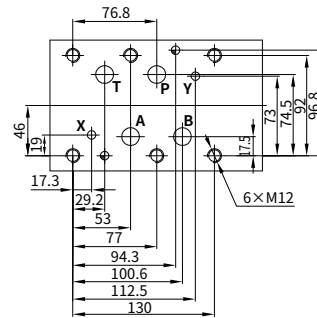
Unit dimensions

(Dimensions in mm)

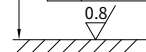
NG 25



Machined valve mounting surface



0.01/100mm



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)
- 10 Pressure reducing valve

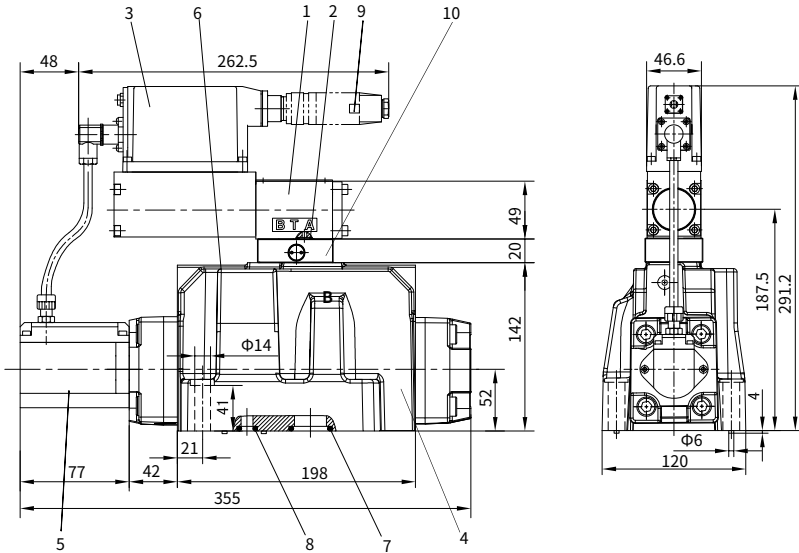
Valve fixing screws:

6- M12×60 ISO 4762-10.9; $M_A = 100$ Nm

Unit dimensions

(Dimensions in mm)

NG 27



- 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)
- 10 Pressure reducing valve

Valve fixing screws:

6- M12×60 ISO 4762-10.9; $M_A=100$ Nm

