

4WRPEH-2X

High-response directional control valves, direct operated, with electrical position feedback and integrated electronics (OBE)

Nominal sizes: NS 6 and NS 10

series: 2X

Max. operating pressure: 315bar

Rated flow: 2 ... 100 L/min ($\Delta p = 70\text{bar}$)



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Features

- 1 - High-response directional control valves, direct operated, with electrical position feedback
- 1 - High quality - control spool and sleeve in servo quality
- 3 - Actuated on one side, 4/4 fail-safe position in switched off condition
- 4 - Control solenoid with integral position feedback and electronics for position transducer (LVDT DC/DC)
- 5 - Integrated control electronics(OBE), using 32-bit high-speed processor, optimized PID position control algorithm, interface A1 or F1
- 8 - Precise - high response sensitivity and little hysteresis
- 11 - Suitable for electro-hydraulic servo control system with high precision of position, speed and pressure control.
- 14 - For subplate mounting: porting pattern to ISO4401-03-02-0-05 (NS 6) and ISO4401-05-04-0-05 (NS 10)
- Electrical connection: 6P+PE

Ordering Code

4WRP	E	H	6	C3	B	04	L	-	2X	/	G24	K0	/	A1	M	*
01	02	03	04	05	06	07	08		09		10	11		12	13	14

01	4WRP	4 main ports design, directional control valve, direct operated
02	E	With integrated control electronics(OBE)
03	H	Control spool/sleeve
04	6	NS 6
	10	NS 10

Symbols

05	C3	C, C1, C3, C4, C5; See hydraulic symbol table for details
06	B	The inductive position transducer is on the side of the B oil port. (Standard)
	A	The inductive position transducer is on the side of the A oil port.

4WRP	E	H	6	C3	B	04	L	-	2X	/	G24	K0	/	A1	M	*
01	02	03	04	05	06	07	08		09		10	11		12	13	14

Rated flow at 70 bar valve pressure difference ($\Delta p = 35\text{bar}$ / metering notch)

07			Flow characteristic		
			"L"	"P"	
	02	2 L/min	✓	—	NS 6
	04	4 L/min	✓	✓ (Inflection 20%)	
	12	12 L/min	✓	—	
	15	15 L/min	—	✓ (Inflection 60%)	
	24	24 L/min	✓	—	
	25	25 L/min	—	✓ (Inflection 60%)	
	40	40 L/min	✓	✓ (Inflection 40%)	NS 10
	50	50 L/min	✓	✓ (Inflection 40%)	
	100	100 L/min	✓	✓ (Inflection 40%)	

Flow characteristic

08	L	Linear
	P	Inflected characteristic curve, linear

09	2X	Series 20 to 29 (20 to 29: unchanged installation and connection dimensions)
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10	G24	Supply voltage : 24VDC
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Electrical connections

11	K0	7-pin sockets conforming to DIN EN 175201-804 (plugs need to be ordered separately), see page 8
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Command value of amplifier

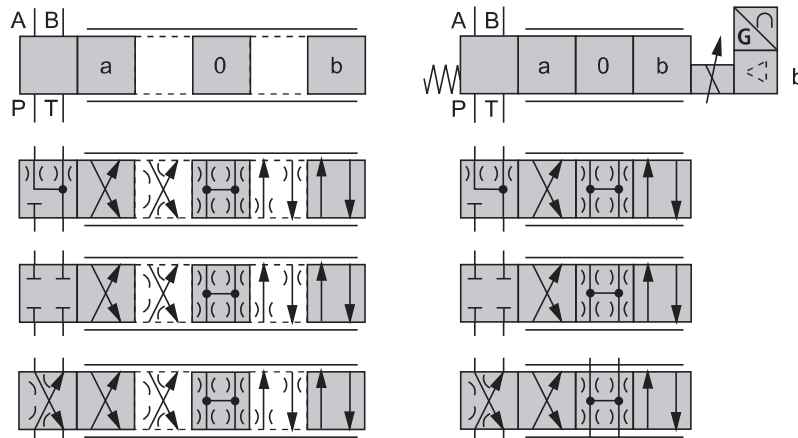
12	A1	Command value input 0 ... ± 10 V
	F1	Command value input 4 ... 20 mA

Sealing material

13	M	NBR seals
	V	FKM seals

14	*	Further details in the plain text
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Symbols



C3

C5

C4

C1

C

With symbols C1 and C5: ¹⁾

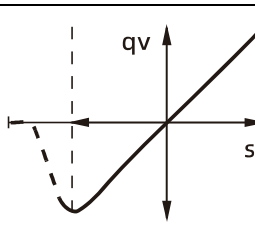
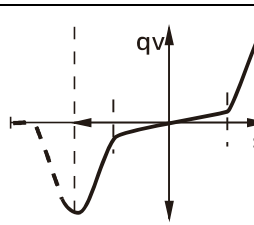
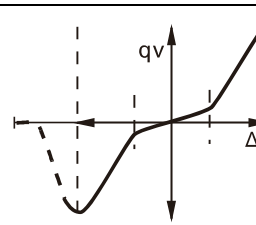
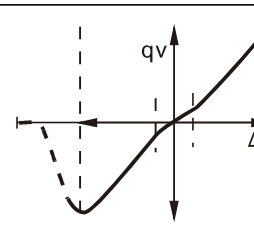
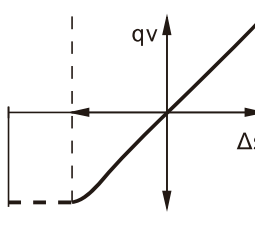
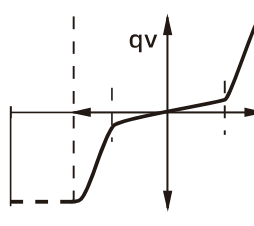
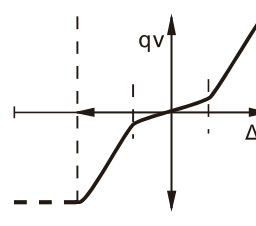
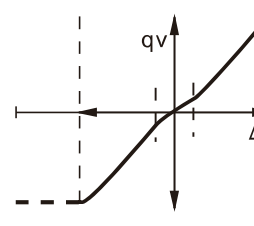
$P \rightarrow A: q_{V \text{ nom}}$ $B \rightarrow T: q_{V \text{ nom}} / 2$

$P \rightarrow B: q_{V \text{ nom}} / 2$ $A \rightarrow T: q_{V \text{ nom}}$

1) $q_{V \text{ nom}}$ 2:1 in connection with flow characteristic "L" only rated flow 2 L/min has no symbols C1 and C5.

$q_{V \text{ nom}}$ 2:1 in connection with flow characteristic "P" only for rated flow 40 L/min.

Flow characteristic

Symbols	Linear characteristic curve (version "L")	Inflected characteristic curve (version "P")		
		Inflection 60%	Inflection 40%	Inflection 20%
C3, C5 C4, C1				
C				

Functions, section

Normal state

After the valve is powered on normally, the inductive position transducer of the solenoid (1) feeds back the actual displacement of the spool to the external controller, and the external controller compares the actual displacement value with the instruction value. If the actual value deviates from the instruction value, the electromagnetic thrust of the electromagnet will change until the new electromagnetic thrust is equal to the feedback spring thrust, so as to ensure that the actual displacement value is equal to the instruction value.

The control throttle area of the spool / sleeve is proportional to the spool displacement, that is, proportional to the instruction value of the valve. If the instruction value of the valve is zero, the spool is in the middle position. If the instruction value is not zero, the spool works in the position corresponding to the instruction value.

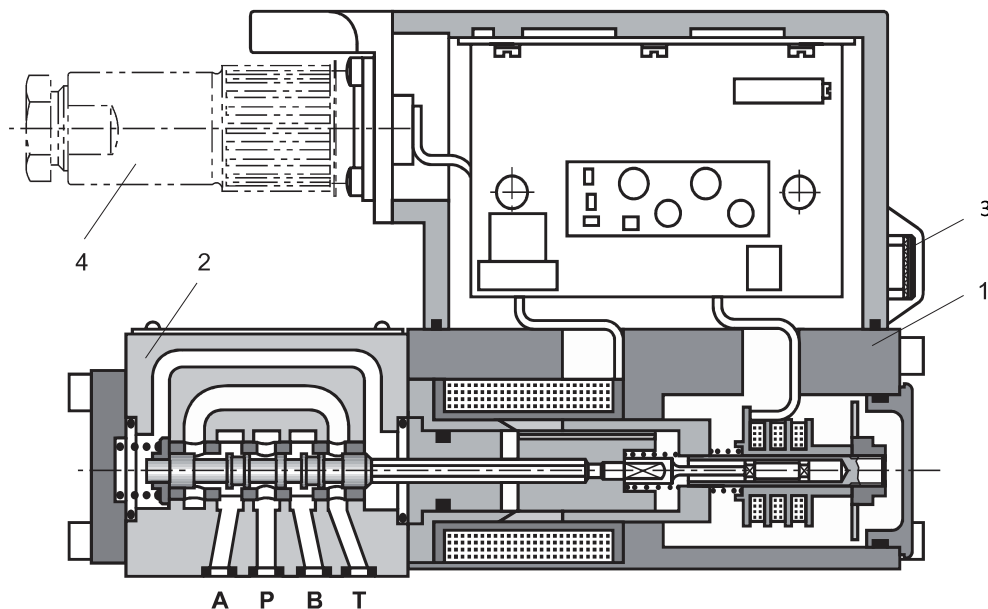
Fault state

In the following fault cases, the external controller will power off the electromagnet and the spool will move to a safe position immediately under the action of the feedback spring force.

→ Below the minimum power supply voltage.

→ For interface "F1" of external controller : when the command value is lower than 2 mA (including control cable disconnection)

In the process of the spool moving from the working position to the safe position, the spool passes through the P-B and A-T, which may cause actuator action. This situation needs to be taken into account in the process of designing hydraulic systems.



1. Control solenoid and inductive position transducer
2. Valve housing
3. Reserved interface for inductive position transducer of the main valve.
4. Connector conforming to DIN EN 175301-803 (Need to order separately)

Technical data, 4WRPEH6 (for applications outside these parameters, please consult us!)

General

Design		Spool type valve, operated directly, with steel sleeve
Actuation		Proportional solenoid with position control, with amplifier
Type of connection		Subplate, mounting hole configuration NG 6 (ISO4401-03-02-0-05)
Installation position		Optional -
Ambient temperature range	°C	25...+50
Weight	Kg	2.9

Hydraulic (with HLP46 at 40 °C ±5 °C)

Max. operating pressure	Ports A, B, P	bar	315					
	Port T	bar	250					
Nominal flow $q_{V\ nom}$ ($\Delta p = 35\text{bar}$ / metering notch) ¹⁾		L/min	2	4	12	15	24	40
Leakage flow ($P_s=100\text{bar}$)	Linear characteristic curve "L"	mL/min	<150	<180	<300	-	<500	<900
	Inflected characteristic curve "P"	mL/min	-	<150	-	<180	<300	<450
Limitation of use (Δp) with regard to the transition to fail-safe (values apply to summated edge)	C, C3, C5	bar	315	315	315	315	315	160
	C4, C1	bar	315	315	315	280	250	100
Hydraulic fluid	DIN51524...535 other fluids after prior consultation							
Hydraulic fluid temperature range (flown-through)		°C	-20 ... +70					
Viscosity range		mm ² /s	10 ... 800 (preferably: 20 ... 100)					
Degree of contamination			ISO4406:1999 18/16/13 ²⁾					

Fail- safe position

Rated flow ($\Delta p = 35\text{bar}$ / metering notch)	Symbol C	L/min	2	4	10	13	18	20
Leakage flow ($P_s=100\text{bar}$)	Symbols C3, C5	mL/min	50 (P→A)					
		mL/min	70 (P→B)					
Rated flow ($\Delta p = 35\text{bar}$ / metering notch)	Symbols C3, C5	L/min	10 ... 20 (A→T)					
		L/min	7 ... 20 (B→T)					
Leakage flow ($P_s=100\text{bar}$)	Symbols C4, C1	mL/min	50 (P→A)					
		mL/min	70 (P→B)					
		mL/min	70 (A→T)					
		mL/min	50 (B→T)					
Response time to reach fail-safe position	0bar	ms	7					
	100bar	ms	10					

Static/Dynamic

Hysteresis	%	≤0.1
Manufacturing tolerance for $q_{V\ max}$	%	<10
Response time for signal change 0...100%	ms	≤10
Thermal drift	%	<1 (at $\Delta T=40^\circ\text{C}$)
Zero compensation	%	±1 (Set up before leaving the factory)

1) Flow rate at a different Δp : $q_x = q_{V\ nom} \cdot \sqrt{\frac{\Delta p_x}{35}}$

- 2) 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, 4WRPEH10 (for applications outside these parameters, please consult us!)

General

Design		Spool type valve, operated directly, with steel sleeve
Actuation		Proportional solenoid with position control, with amplifier
Type of connection		Subplate, mounting hole configuration NG 6 (ISO4401-05-04-0-05)
Installation position		Optional
Ambient temperature range	°C	-20...+50
Weight	Kg	7.1

Hydraulic (with HLP46 at 40 °C ± 5 °C)

Max. operating pressure	Ports A, B, P	bar	315			
	Port T	bar	250			
Rated flow $q_{V\ nom}$ ($\Delta p = 35\text{bar}$ / metering notch)		L/min	50 (1: 1)	50 (2: 1)	100 (1: 1)	100 (2: 1)
Leakage flow ($P_s=100\text{bar}$)	Linear characteristic curve "L"	mL/min	<1200	<1200	<1500	<1000
	Inflected characteristic curve "P"	mL/min	<600	<500	<600	<600
Limitation of use (Δp) with regard to the transition to fail-safe (values apply to summated edge)	C, C3, C5	bar	315	315	160	160
	C4, C1	bar	250	250	100	100
Hydraulic fluid	DIN51524..535 other fluids after prior consultation					
Hydraulic fluid temperature range (flown-through)		°C	-20 ... +70			
Viscosity range		mm ² /s	10 ... 800 (preferably: 20 ... 100)			
Degree of contamination			ISO4406: 1999 18/16/13 ²⁾			

Fail-safe position

Rated flow ($\Delta p = 35\text{bar}$ / metering notch)	Symbol C	L/min	50	50	100	100
Leakage flow ($P_s=100\text{bar}$)	Symbols C3, C5	mL/min	50 (P→A)			
		mL/min	70 (P→B)			
Rated flow ($\Delta p = 35\text{bar}$ / metering notch)	Symbols C3,	L/min	10...100 (A→T)			
		L/min	10...25 (B→T)			
C5Leakage flow ($P_s=100\text{bar}$)	Symbols C4,	mL/min	50 (P→A)			
		mL/min	70 (P→B)			
		mL/min	70 (A→T)			
		mL/min	50 (B→T)			
Response time to reach fail-safe position	0bar	ms	12			
	100bar	ms	16			

Static/Dynamic

Hysteresis	%	≤ 0.1
Manufacturing tolerance for $q_{V\ max}$	%	<10
Response time for signal change 0...100%	ms	≤ 25
Thermal drift	%	<1 (at $\Delta T=40^\circ\text{C}$)
Zero compensation	%	± 1 (Set up before leaving the factory)

1) Flow rate at a different Δp : $q_x = q_{V\ nom} \cdot \sqrt{\frac{\Delta p_x}{35}}$

- 2) 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

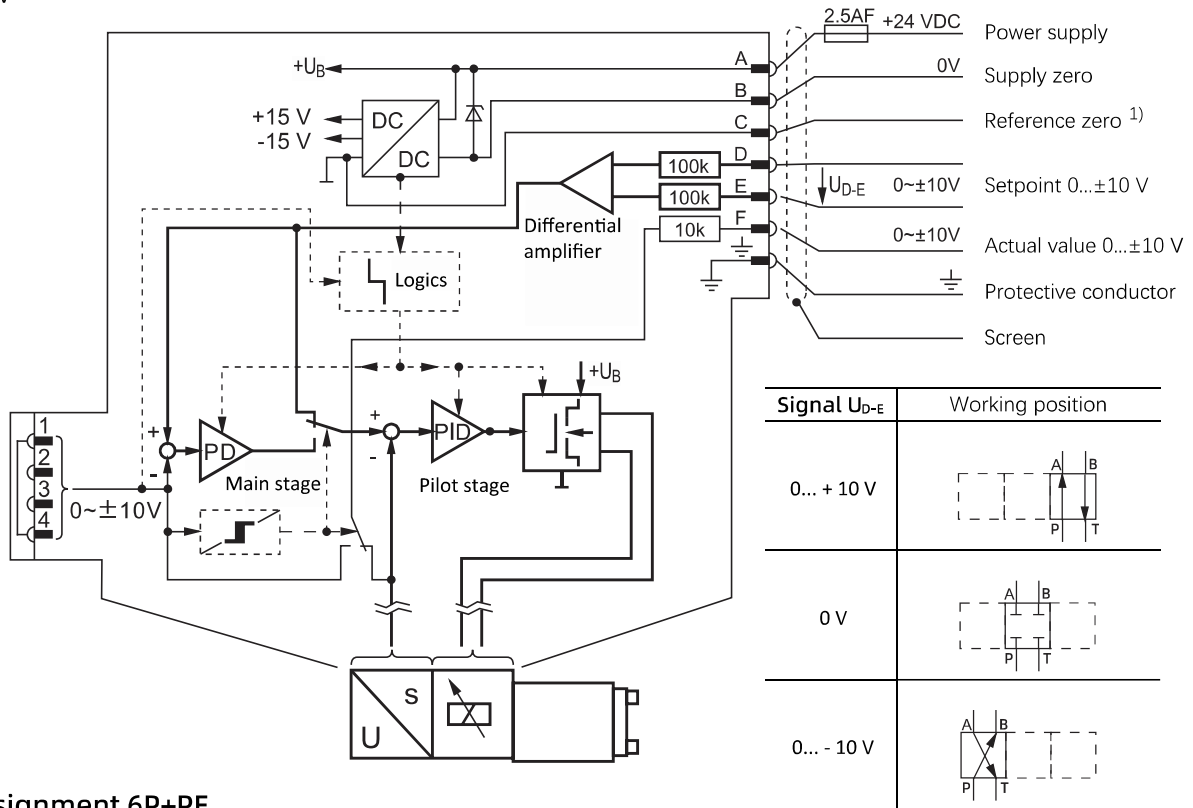
Electrical, integrated electronics (OBE) - Interface "A1" and "F1"

Relative duty cycle		%	100
Degree of protection according to EN 60529			IP65
Supply voltage		VDC	24V, (Maximum admissible residual ripple: 2 V)
	Terminal A	VDC	Min. 21 / Max. 40
	Terminal B	VDC	0
Maximum power consumption		W	40
Fuse protection, external		A _F	2.5
Input signal			Differential input, R _i =100kΩ
A1	Terminal D	VDC	0~±10
	Terminal E	VDC	0
F1			Burden R _i =200Ω
	Terminal D	mA	4...(12)...20
	Terminal E		Current loop I _{D-E}
Maximum voltage of the differential inputs against 0 V			D→B; E→B (Max. 18V)
Test signal			LVDT
A1	Terminal F (U _{Test})	VDC	0~±10
	Terminal C		Reference 0V
F1		mA	LVDT signal 4...(12)...20, external load 200~500Ω
	Terminal F (I _{F-C})	mA	4...(12)...20 (output)
	Terminal C (I _{F-C})		Current loop I _{F-C}
Functional ground and screening			See pin assignment on page 8 and 9 (CE-compliant installation)
Adjustment			Calibrated in the plant, see valve characteristic curves page 11 ... 13
Electromagnetic compatibility			Conforms to EN61000-6-2RV 2005-08 and EN61000-6-3RV 2007-01

On-board electronics

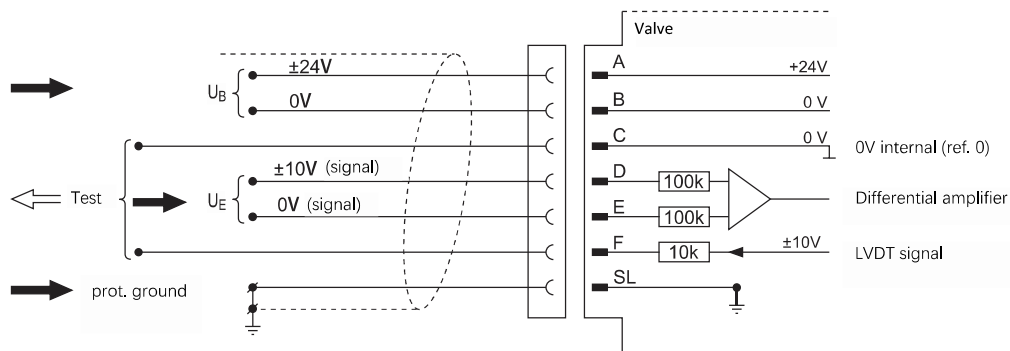
Block diagram/pin assignment

$U_{D-E} = \pm 10V$



Pin assignment 6P+PE

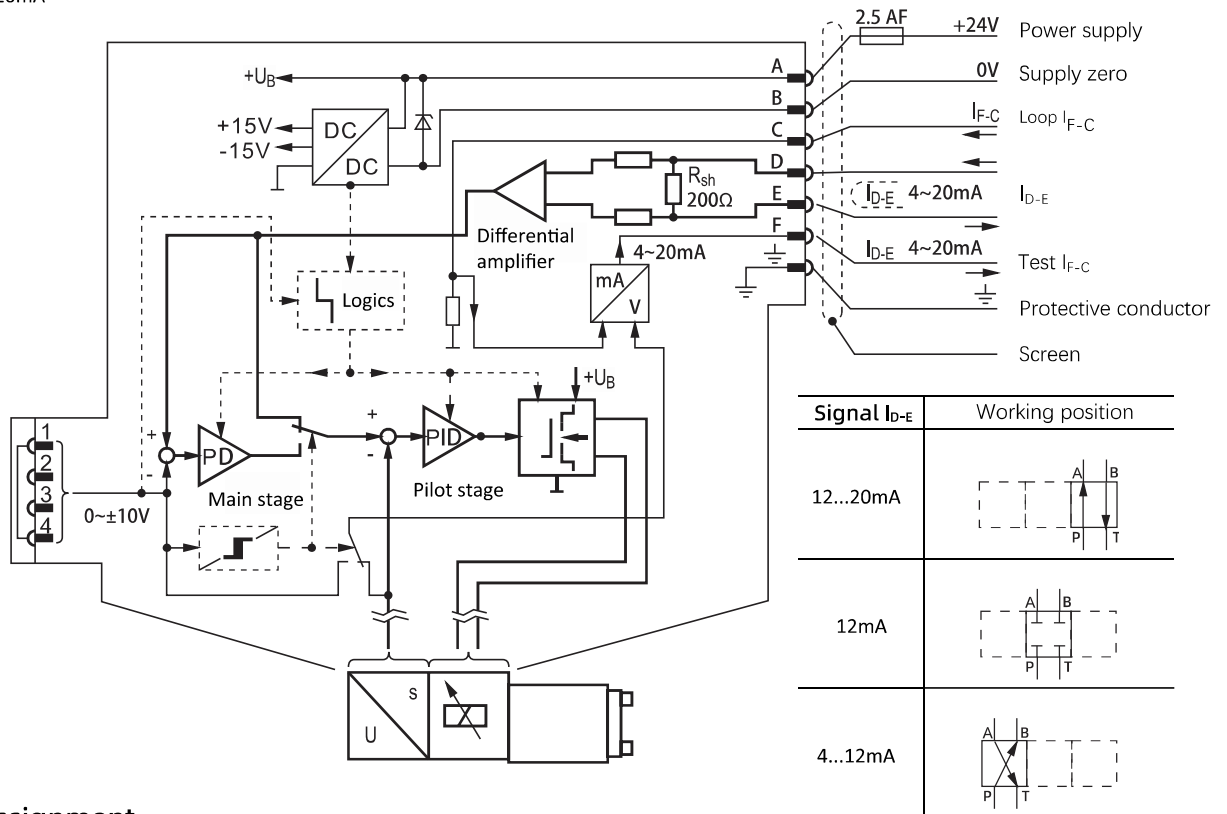
$U_{D-E} = \pm 10V$ ($R_i = 100k\Omega$)



1) Do not connect to supply zero!

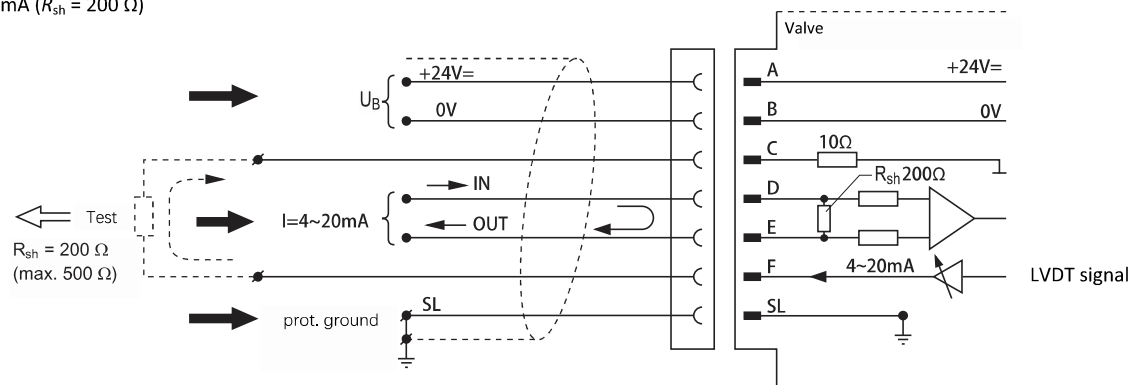
Block diagram/pin assignment

$I_{D-E}=4...20\text{mA}$

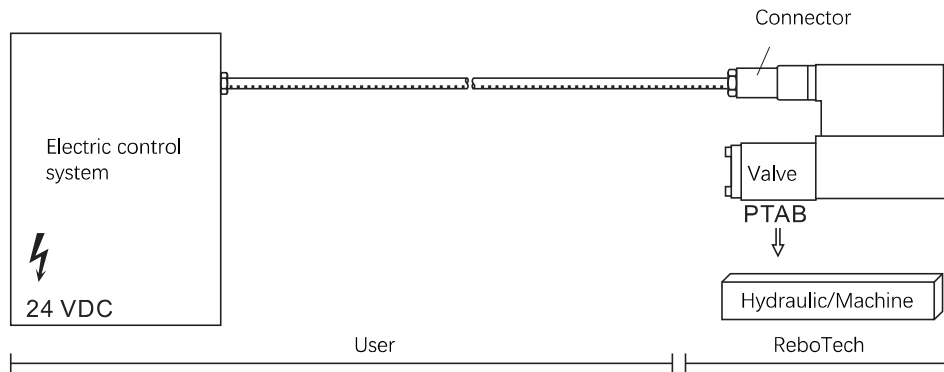


Pin assignment

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



Connection



- Types:**
- Multi-wire cable
 - Extra-finely stranded wire to VDE 0295, Class 6
 - Protective conductor, green/yellow
 - Cu braided screen

No. of wires: Determined by type of valve, plug types and signal assignment.

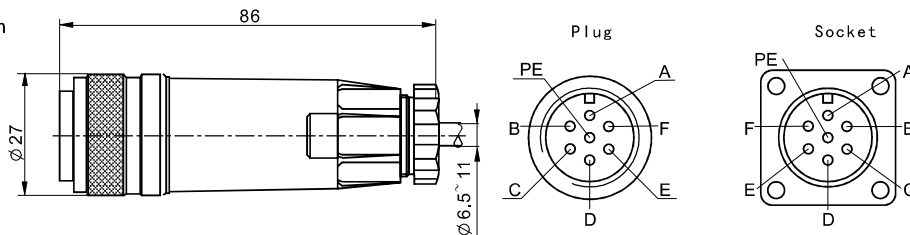
Cable Ø: 0.75 mm² to 20 m length; 1.0 mm² to 40 m length

Outside Ø: 9.4...11.8 mm; 12.7...13.5mm

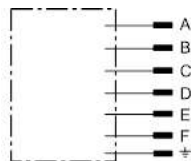
- Note:**
- Voltage supply 24 V DCnom
 - If voltage drops below 18 V DC, rapid shutdown resembling "Enable OFF" takes place internally.
 - For type F1:
 - $I_{D-E} \geq 3 \text{ mA}$, Valve is active.
 - $I_{D-E} \leq 2 \text{ mA}$, Valve is deactivated.
 - Electrical signals emitted via the trigger electronics (e.g. actual values) must not be used to shut down safety relevant machine functions!

Seven - pin plug compliant with DIN EN 175201 - 804 (ordered separately)

Dimensions in mm



Plug pin assignment



Metal nut structure (preferred model)

To be ordered separately. Order number: R00050406

Plastic nut structure

To be ordered separately. Order number: R00050408

All - metal structureT

o be ordered separately. Order number: R00050407

Electrical connection with a 7 - pin plug

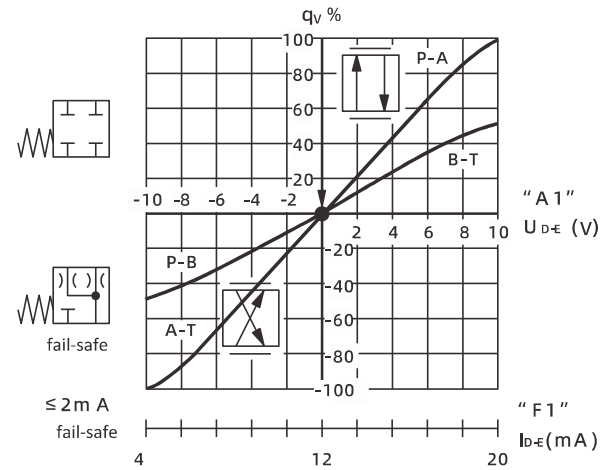
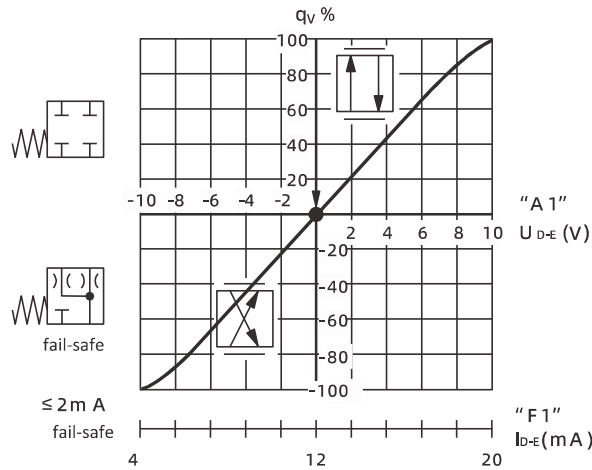
Design	Slot	Allocation interface A1	Allocation interface F1	Allocation interface C2	Allocation interface A5	Allocation interface F5	Allocation interface C6
Supply power+	A	24VDC (21~40VDC)				GND,enable the reference potential	
Supply power -	B	GND					
	C	Feedback value reference point				(Enable input 24VDC enable $\geq 11\text{VDC}$, disable $\leq 5\text{VDC}$)	
Command input+	D	$\pm 10\text{V com. value:}$ $R_e > 50\text{k}\Omega$	$4\sim 20\text{mA com. value}$ $R_e < 250\Omega$	$4\sim 20\text{mA com. value}$ $R_e < 250\Omega$	$\pm 10\text{V com. value:}$ $R_e > 50\text{k}\Omega$	$4\sim 20\text{mA com. value}$ $R_e < 250\Omega$	$\pm 10\text{V com. value:}$ $R_e < 250\Omega$
Command input-	E	Input command				Reference potential	
Position feedback	F	Actual value: $\pm 10 \text{ V}$ Maximum load: 5 mA	Actual value; $4\sim 20\text{mA}$ Maximum load; 300Ω	Actual value; $4\sim 20\text{mA}$ Maximum load; 300Ω	Actual value: $\pm 10 \text{ V}$ Maximum load: 5 mA	Actual value; $4\sim 20\text{mA}$ Maximum load; 300Ω	Actual value; $4\sim 20\text{mA}$ Maximum load; 300Ω
	PE	Connected with cooling body and valve housing					

Characteristic curves (HLP46 at 40 °C ± 5 °C, $\Delta'' = 35$ bar/control edge)

4WRPEH6 flow characteristic $Q = f(U_{D-E})$, $Q = f(I_{D-E})$

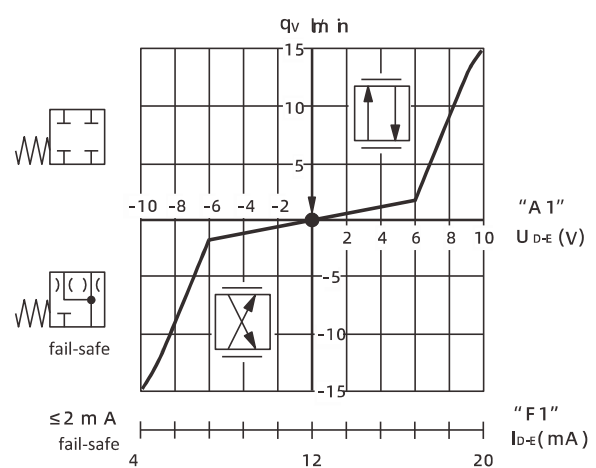
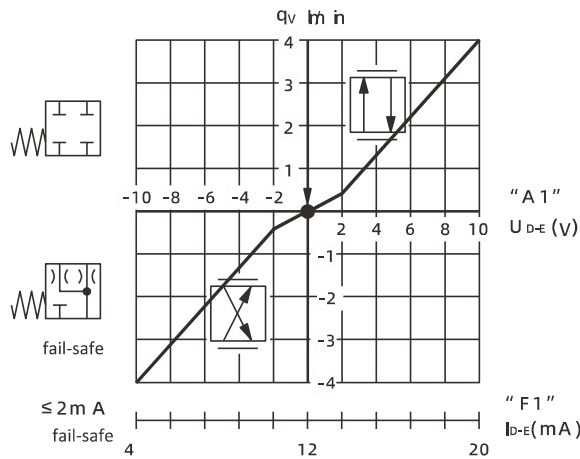
"L" linear symbols C3 C4 and C

"L" linear: symbols C1 and C5



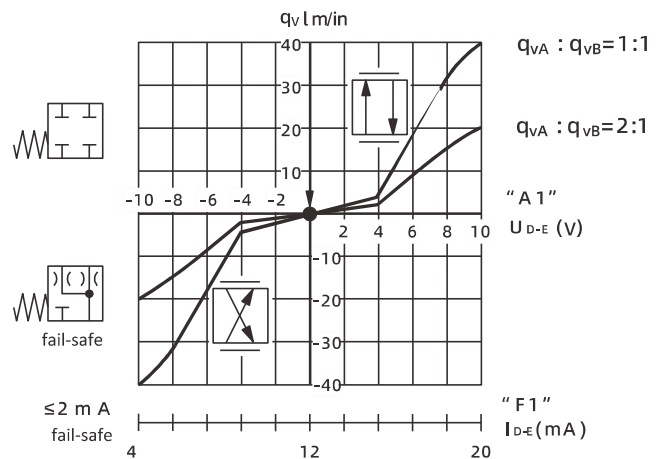
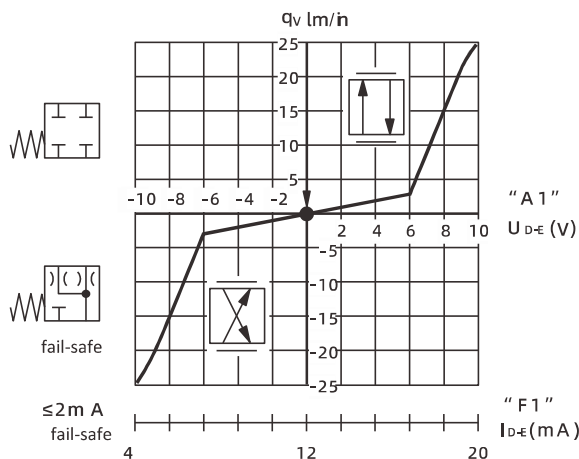
04P (Inflection 20%) : 4 L/min

15P (Inflection 60%) : 15 L/min



25P (Inflection 60%) : 25 L/min

40P (Inflection 40%) : 40 L/min

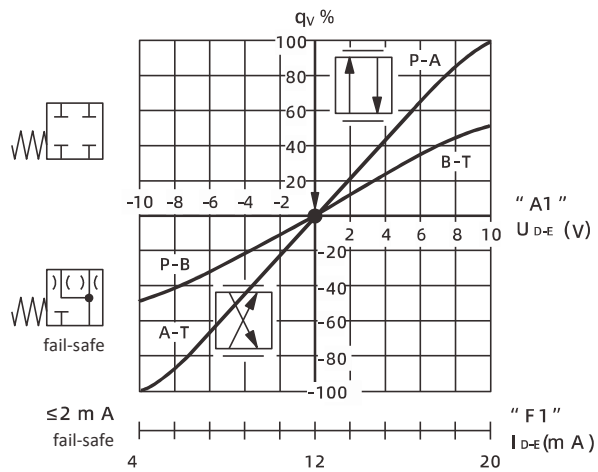
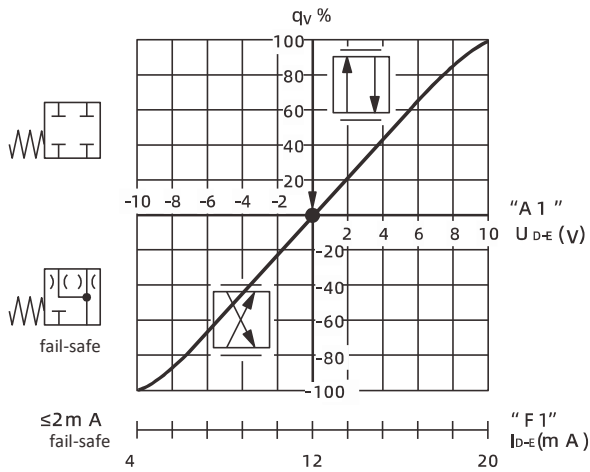


Characteristic curves (HLP46 at 40 °C ± 5 °C, Δp = 35 bar/control edge)

4WRPEH10 flow characteristic $Q = f(U_{D-E})$, $Q = f(I_{D-E})$

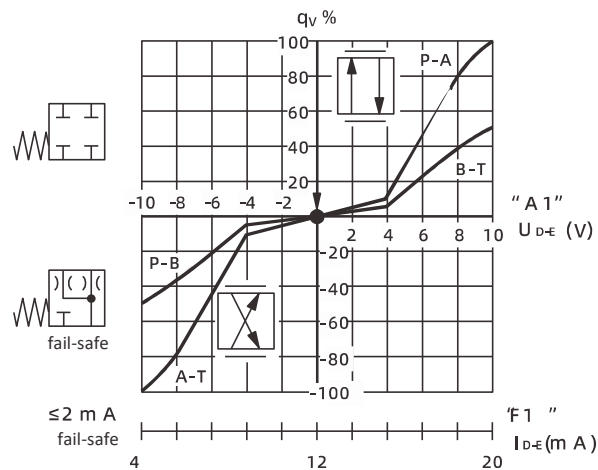
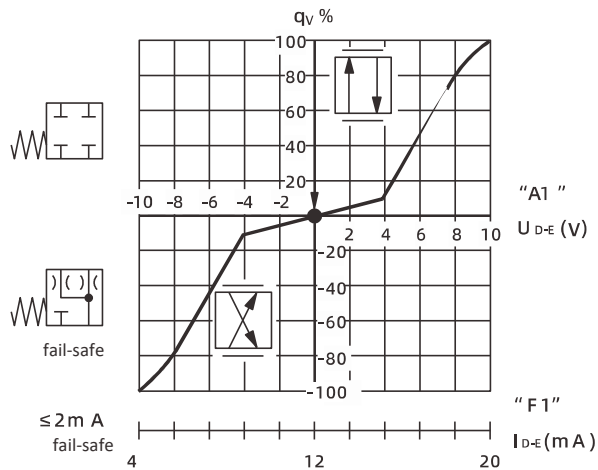
"L" linear: symbols C3, C4 and C

"L" linear: symbols C1 and C5



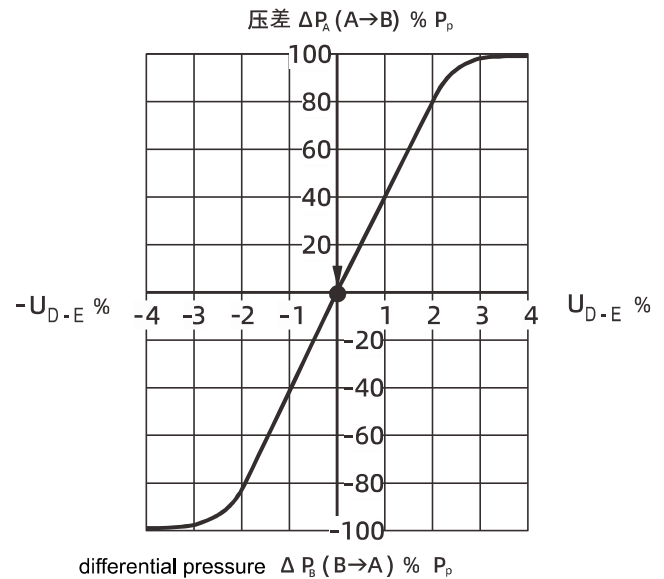
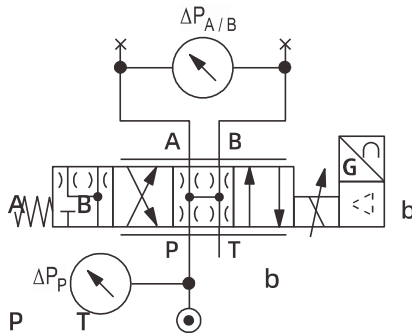
P (Inflection 40%) : symbols C3, C4 and C

P (Inflection 40%) : symbols C1 and C5

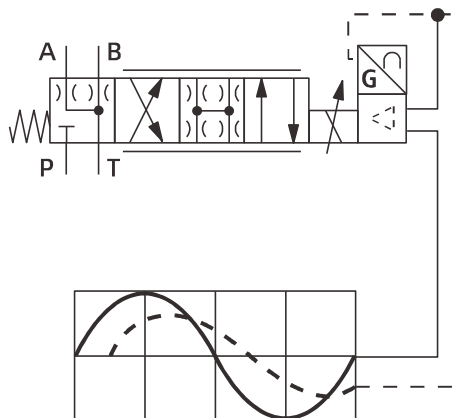


Characteristic curves (HLP46 at 40 °C ± 5 °C)

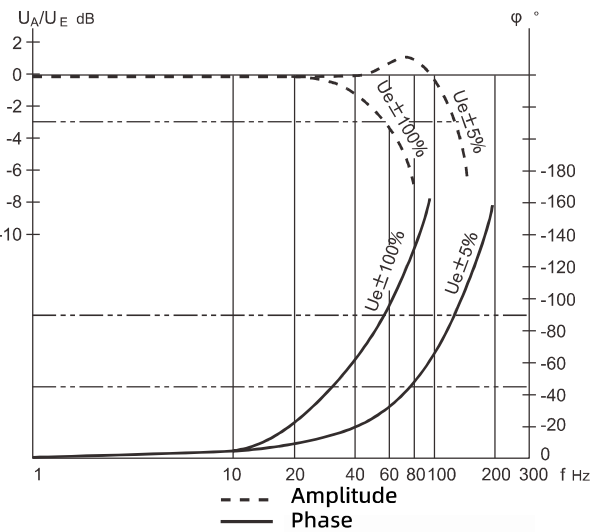
Pressure gain



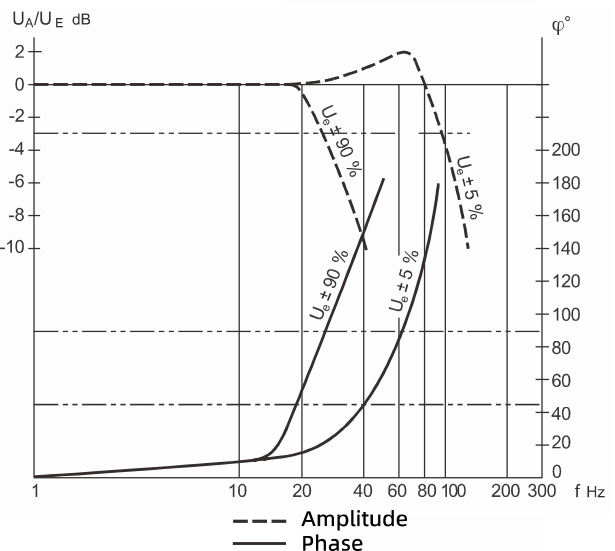
Frequency response characteristic curves



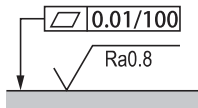
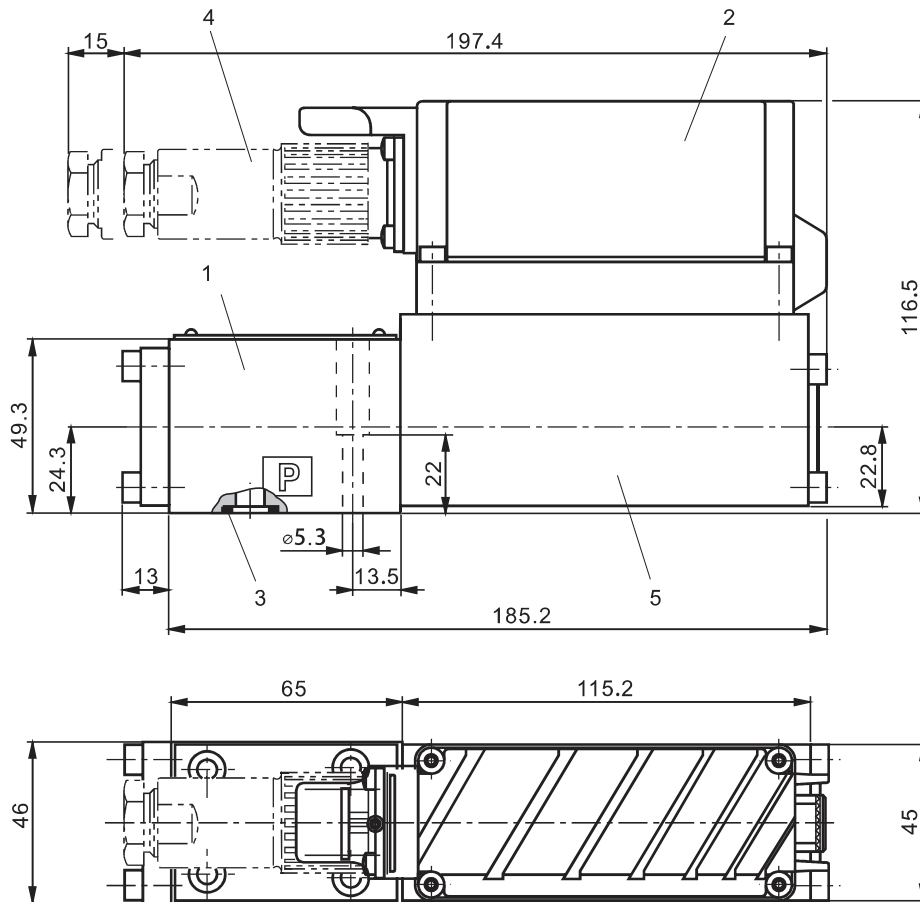
4WRPEH6



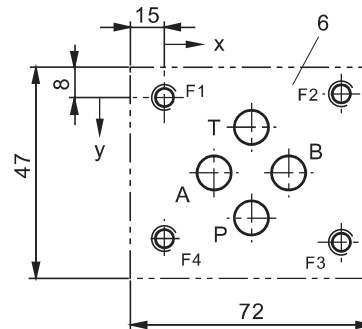
4WRPEH10



Unit dimensions: NS 6 (Dimensions in mm)



Required surface finish of mating piece

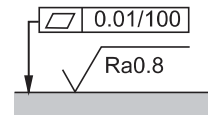
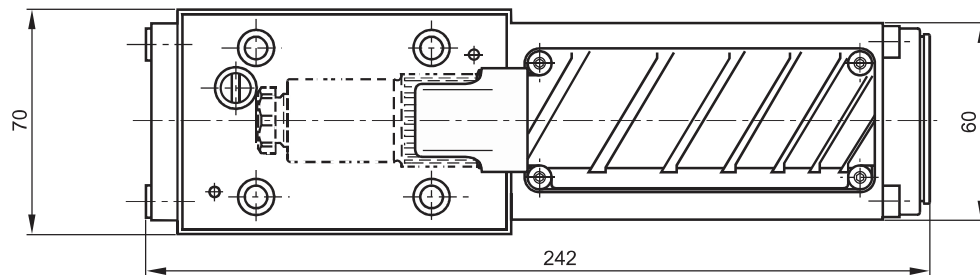
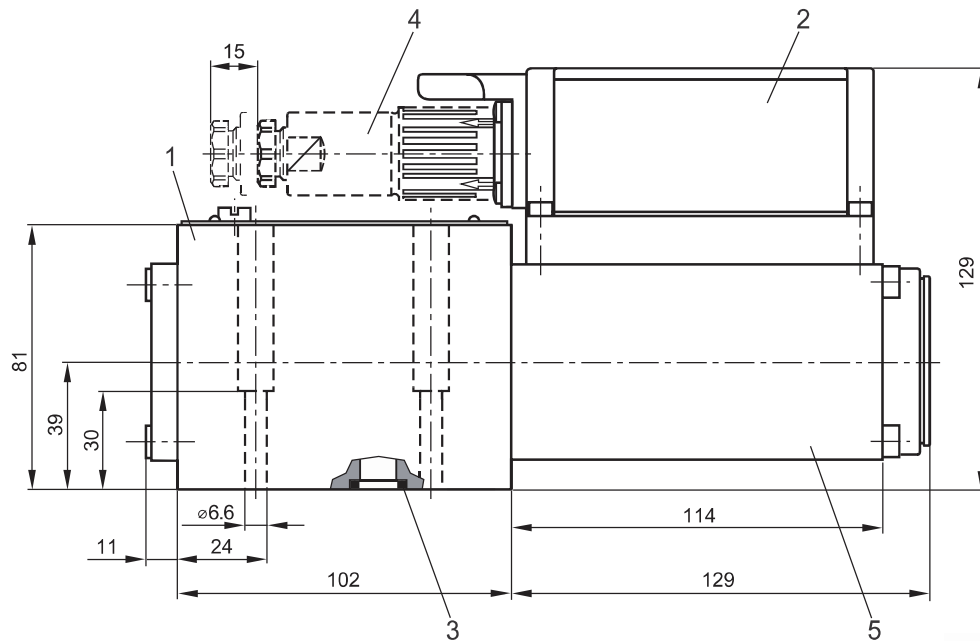


Dimensions in mm	P	A	B	T	Y	F1	F2	F3	F4	G
Diameters/threads	$\phi 7.5$	$\phi 7.5$	$\phi 7.5$	$\phi 7.5$	$\phi 3.3$	M5	M5	M5	M5	$\phi 4$
x	21.5	12.7	30.2	21.5	40.5	0	40.5	40.5	0	33
y	25.9	15.5	15.5	5.1	9	0	-0.75	31.75	31	31.75

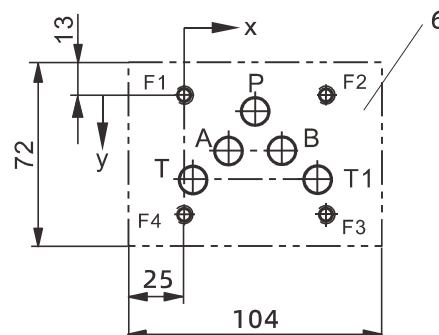
1. Valve housing
 2. On-board electronics
 3. R-ring 9.81 x 1.5 x 1.78 (ports A, B, P, T)
 4. Plug-in connector not included in scope of delivery (order separately)
 5. Control solenoid with position transducer
 6. Mounting surface, in accordance with ISO4401-03-02-0-05 oil port connection position and standard tolerances
- Diameters of the ports P, A, B and T are 7.5 mm

Fixing screws: 4 GB/T 70.1 - M5 x 50 10.9
 Torque: 8.9 Nm $\pm$ 10 %

Unit dimensions: NS 10 (Dimensions in mm)



Required surface finish of mating piece



Dimensions in mm	P	A	T	(T1)	B	F1	F2	F3	F4
Diameters/threads	ø11.2 max	ø11.2 max	ø11.2 max	ø11.2 max	ø11.2 max	M6	M6	M6	M6
x	27	16.7	3.2	50.8	37.3	0	54	54	0
y	6.3	21.4	32.5	32.5	21.4	0	0	46	46

1. Valve housing
2. On-board electronics
3. R-ring 13.0 x 1.6 x 2.0 (ports A, B, P, T)
4. Plug-in connector not included in scope of delivery (order separately)
5. Control solenoid with position transducer
6. Mounting surface, in accordance with ISO4401-05-04-0-05 oil port connection position and standard tolerances
Diameters of the ports P, A, B and T are 11.2 mm

Fixing screws: 4 GB/T 70.1 - M6 x 40 10.9

Torque: 15.5 Nm ± 10 %