HENGLI HYDRAULIC
Hydraulic Components

Industrial hydraulic control valves

Proportional pressure valves
Part 6 : Proportional directional valves
Proportional amplifier

Product
Catalog

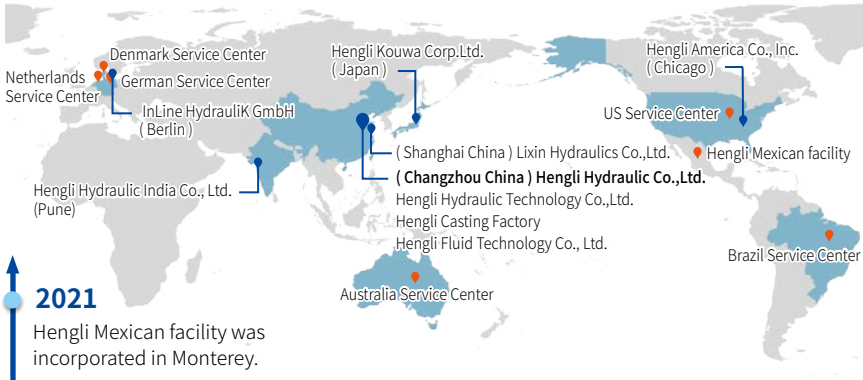





www.henglihydraulic.com Version Date HL2021-11

Company Profile

Through 30 years of continuous dedication and innovation, Hengli has developed from a hydraulic cylinder manufacturer to a leading comprehensive enterprise integrating hydraulic components, precision castings, pneumatic components and hydraulic system solutions. Today Hengli is the benchmark hydraulic solution provider, serving over 2000 top customers worldwide.



2021

Hengli Mexican facility was incorporated in Monterey.

2020

Establishment of market service department in India.

2018

Hengli has acquired the Japanese hydraulic parts manufacturer- Hattori Seiko Co., Ltd.

2012

Subsidiaries in American and Japan established.
Acquired Shanghai Lixin Hydraulic Co.,Ltd.
Hengli casting factory established and started production of precise hydraulic castings.

2017

Hengli US factory (located in Chicago) built and put into operation.

2015

Started the strategic cooperation with HAWE, and financed InLine Hydraulik GmbH.

2014

Developed multi-way valve and plunger variable pump for 8T excavators.
Jiangsu Hengli Hydraulic Technology Co., Ltd. established.

2011

Hengli cylinders production base in Wujin industrial zone was established.
Hengli was successfully listed on Shanghai Stock Exchange.

Started developing and manufacturing large cylinders for ports and metallurgical equipment.

1997

Hengli Hydraulic Cylinder Co.,Ltd established and started mass production of excavator cylinders and tailor-made cylinders .

2005

1990

Wuxi Hengli Hydro pneaumatic Co.,Ltd was founded and produced cylinders and pneumatic valves.

1999

Development of high pressure cylinders for excavators began.

2010

Approved supplier of Caterpillar, marking our entrance to the supply system of high end excavators.

Hengli Hydraulic Co.,Ltd.

- She is the world's leading cylinder production base.
- Total Investment: 230million USD.
- Building area: 290,000 square meters.
- Annual Capacity: 1100K pcs excavator cylinders, 240K pcs customized cylinders, and 3K pcs ceramic coating rods.

Hengli Hydraulic Technology Co.,Ltd.

- Total Investment: 300 million USD.
- Building area: 400,000 square meters.
- Annual Capacity: 600K pcs industrial directional valves, 200K pcs mobile machinery control valves, 600K pcs pilot control devices, 300K pcs piston pumps, 150K pcs piston motors, and various integrated hydraulic systems.

Hengli Hydraulic Casting Branch Company

- Total Investment: 260 million USD.
- Building area: 118,000 square meters.
- Annual Capacity: 75k tons of casting.

Hengli Cold-drawn workshop

- Building area: 20K square meters.
- Annual Capacity: 60K ton cold-drawn tubes.

Lixin Hydraulics Co.,Ltd.

- Started in 1967, Lixin is one of the earliest manufacturers for hydraulic elements and systems.
- Introduced Rexroth's technology in 1984 which enabled us to produce Rexroth's series pressure, flow and directional, and various hydraulic systems.

Hengli Pneumatic Technology Co., Ltd.

- Established in 1990.
- Building area: 34,000 square meters.
- Annual Capacity: 300K pcs pneumatic actuation and control components, 250K pcs pneumatic control valves, 100K pcs processing and control pneumatic integration systems.

InLine Hydraulik GmbH

- Founded in 1973, produce high performance axial piston pumps.
- Located in Berlin, Germany.
- Building area: 8, 500 square meters.
- Nov 2015 Hengli a global strategic partnership agreement with HAWE and acquired InLine Hydraulik company.

Hengli America Co.,Inc.

- Established in 2012, in Chicago, speed up the development of the North America Market.
- Building area: 4,300 square meters.

Hattori Seiko Co., Ltd.

- Started in 1947, in Japan.
- Building area: 13,500 square meters.
- In 2018, Hengli has acquired the Japanese hydraulic parts manufacturer-Hattori Seiko Co., Ltd.

Hengli Hydraulic India Co., Ltd.

- Established in 2020, in India.
- Total Investment: 77 million USD.
- Building area: 60,000 square meters.
- Support speeding up the globalization progress of the construction machinery OEM customers.

6 Proportional pressure valves Proportional directional valves Proportional amplifier

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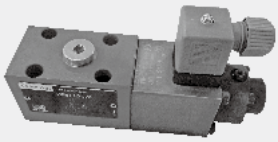
6.1

Proportional pressure relief valve

Type DBET...L5X

NG 6
Up to 350 bar
Up to 2 L/min



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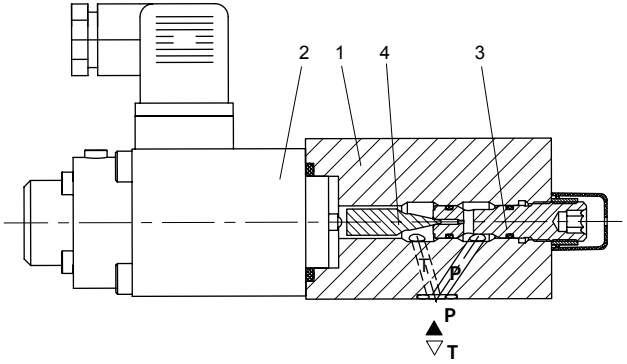
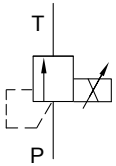
Features

- Direct actuated valve for the limitation of a system pressure
- For subplates: Porting pattern to ISO 4401-03-02-0-05
- 5 pressure stage
- Control electronics for type DBET: Matching electronic amplifier VT-2000 or plug amplifier VT-SSPA1-...-L2X (separate order)

Function and configuration

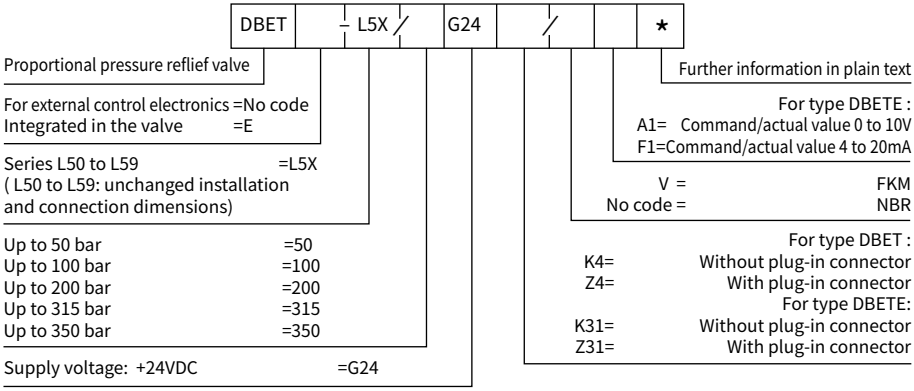
The type DBET proportional pressure relief valves are remoted controled valves with poppet valve design and are used to limit the pressure of the system. They are actuated by a proportional solenoid. With these valves, the system pressure to be limited can be set infinitely in relationship to the electrical command value.
These valves mainly consist of the housing (1), a proportional solenoid (2), the valve seat (3) and the valve poppet (4).
The proptional solenoid converts electrical current proportionally into mechanical force. An increase in the current causes a proportionally higher solenoid force. The armature chamber of the solenoid is filled with pressure fluid and is pressure tight.
The setting of the system pressure is a carried out command value dependent from the proportional solenoid (2). The solenoid force pushes the valve poppet (4) onto the seat (3). The pressure present in port P of the system acts on the valve poppet (4) and thus against the force of the proportional solenoid. If the hydraulic force on the valve poppet (4) is equal to the solenoid force then the valve controls the set pressure by lifting the valve poppet off the valve seat (3), and thus permitting pressure fluid to flow from P to T. The minimum setting pressure is set with minimum control current related to the zero command value.





Symbol

Ordering code



Technical data

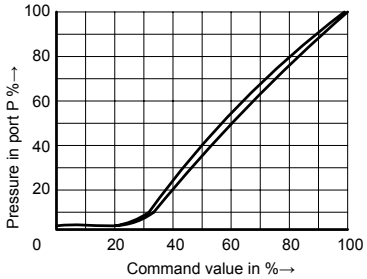
Pressure fluid		Mineral oils (HL, HLP) to DIN 51 524
		Further pressure fluids on request!
Pressure fluid temperature range	°C	-30 to +80 (NBR)
		-20 to +80 (FKM)
Viscosity range	mm^2/s	15 to 380
Degree of contamination		Maximum permissible degree of fluid contamination: Class 9. NAS 1638 or 20/18/15, ISO4406
Operating pressure (port P)	bar	350
Max. set pressure	bar	50; 100; 200; 315; 350
Min. settable pressure		see characteristic curves
Min. settable pressure at 0 command value		=Min. settable pressure
Return pressure (port T)	bar	Separate and at zero pressure to tank
Max.Flow	L/min	2
Linearity		± 3.5 % of max. settable pressure
Hysteresis (See setting pressure characteristic curve)		± 1.5 % of max. settable pressure
Repeatability		< ± 2 % of max. settable pressure
Switching time	ms	30 bis 150 (system dependent)

Electrical data

Supply voltage		24V DC
Min. control current	mA	100
Max. control current	mA	800
Coil resistance		5.5Ω Cold value at 20°C ; Max. warm value: 8.05Ω
Duty		Continuous
Electrical connections		Plug-in connector to DIN EN 175301-803/ISO 4400
Valve protection to DIN 40 050		IP 65
Amplifier		VT-2000 or VT-SSPA1-...-L2X

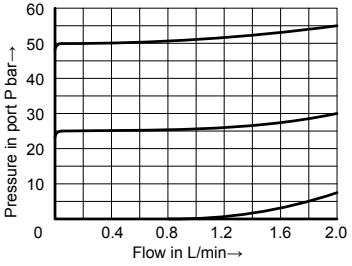
Characteristic curves (measured with HLP46, ϑ_{oil}=40°C ±5°C)

· Pressure in port P in relation to the command value (q_v=0.8 L/min)

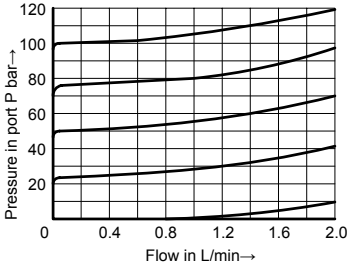


· Pressure in port P in relation to the flow

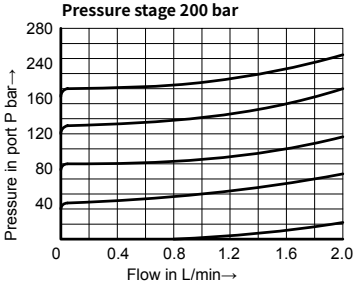
Pressure stage 50 bar



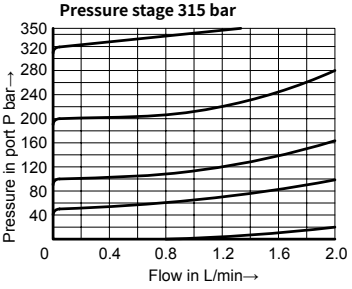
Pressure stage 100 bar



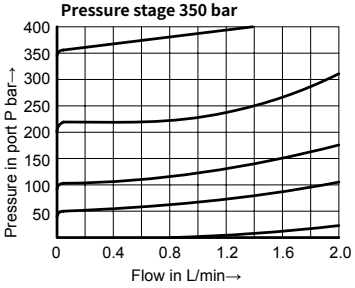
Pressure stage 200 bar



Pressure stage 315 bar



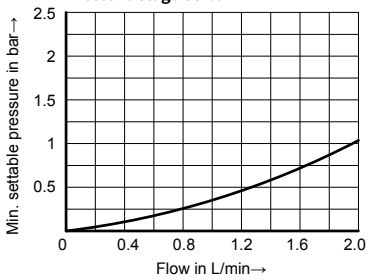
Pressure stage 350 bar



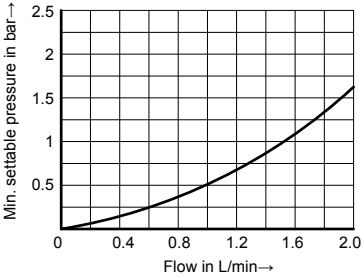
Characteristic curves (measured with HLP46, ϑ_{oil}=40°C ±5°C)

· Min. settable pressure in port P with command value 0

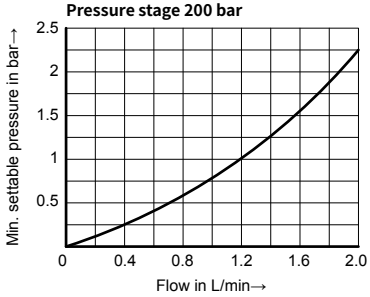
Pressure stage 50 bar



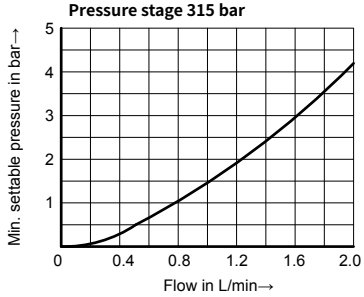
Pressure stage 100 bar



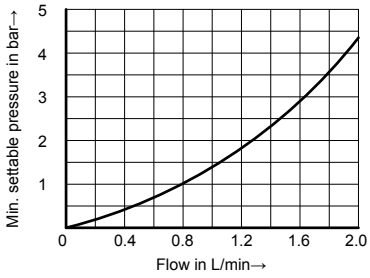
Pressure stage 200 bar



Pressure stage 315 bar

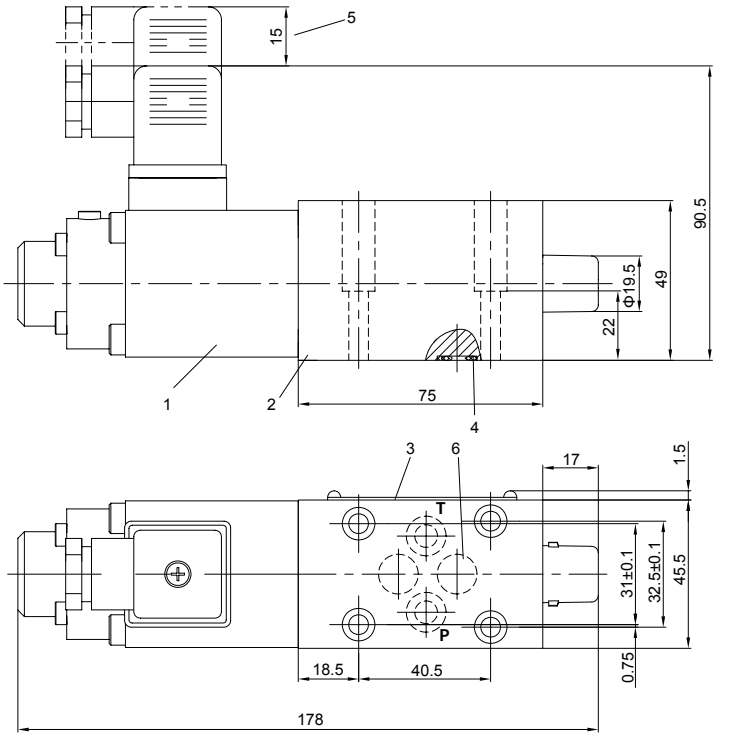


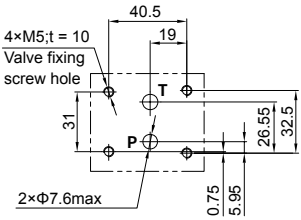
Pressure stage 350 bar



Unit dimensions

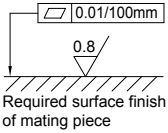
(Dimensions in mm)





1 Proportional solenoid
2 Valve housing
3 Name plate
4 R-rings 9.81×1.5×1.78
5 Space required to remove the plug-in connector
6 Blind counter bore

Valve fixing screws:
4-M5×30 GB/T 70.1-10.9;
Tightening torque, M_A =8.9 Nm

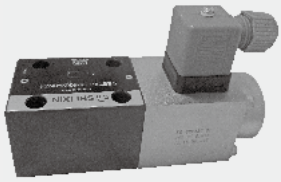


6.2

Proportional pressure relief valve

Type DBETX...L1X

NG 6
Max pressure 315bar
Nominal flow 1L/min



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Features

- Direct operated valves for limiting system pressure
- Adjustable by means of the solenoid current, see performance curve, Technical data and selected valve electronics
- Pressure limitation to a safe level even with electric failure (solenoid current I > Imax)
- For subplate attachment, mounting hole configuration to ISO 4401-03-02
- External trigger electronics with ramps and valve calibration (order separately)

Function and configuration

Type DBETX proportional pressure relief valves are remote controlled (pilot) valves in conical seat design. They are used to limit system pressure. The valves are actuated by means of a proportional solenoid. The interior of the solenoid is connected to port T and is filled with pressure fluid. With these valves, the system pressure that needs to be limited can be infinitely adjusted by the valve amplifier electronics in relation to the solenoid current, at an oil flow < 1L that is as close as possible to constant.

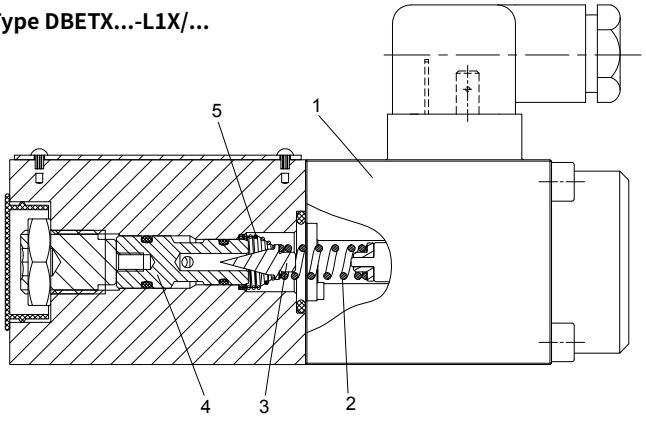
Basic principle

To adjust the system pressure, a setpoint is set in the trigger electronics. Based on this setpoint, the electronics control the solenoid coil(1) with regulated PWM (pulse-width-modulated) current. The proportional solenoid converts the current to a mechanical force, which acts on a main spring(2) by means of the armature plunger. An "additional" spring(5) between the cone(3) and the seat(4) contributes to stability and a minimal residual pressure. The spring force acting on the cone and the pressure in the valve seat balance one another at a constant oil flow (0.7...1L/min). The "pmax" pressure stage is determined by the cone and seating bore configuration.

Pressure limitation for maximum safety

If a fault occurs in the electronics, so that the solenoid current (Imax) would exceed its specified level in an uncontrolled manner, the pressure cannot rise above the level determined by the maximum spring force.

Type DBETX...-L1X/...



Technical data

General		
Construction		Poppet valve, direct drive
Actuation		Proportional solenoid without position control, external amplifier
Connection type		Subplate, mounting hole configuration NG6 (ISO 4401-03-02-0-05)
Mounting position		Optional
Ambient temperature range	°C	-20...+50
Weight	Kg	about 2.1
Vibration resistance, test condition		Max. 25 g, 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				
Pressure fluid temperature range		°C	-20...+80				
Maximum permitted degree of contamination of pressure fluid Purity class to ISO 4406 (c)			Class 18/16/13				
Direction of flow			See symbol				
Max. set pressure (at Qmax. = 1 l/min)		bar	50	80	180	250	315
Minimum pressure (at Qmin. = 1 l/min)		bar	2	3	4	5	8
Max. working press.		bar	Port P: 315				
			Port T: 250				
Max. mechanical pressure limitation level, e.g. when solenoid current $I>I_{max}$		bar	< 55	< 85	< 186	< 258	< 325

Static/Dynamic		
Hysteresis	%	⩽ 4
Response time 100% signal change	ms	On < 60 / Off < 70
Range of inversion	%	⩽ 3

Electrical		
Cyclic duration factor	%	100 ED
Degree of protection		IP 65 to DIN 40050 and IEC 14434/5
Solenoid connection		Plug-in connector to DIN EN 175301-803/ISO 4400
Power		24VDCnom

Ordering code

DBETX –	L1X /	G24 –	8	N	Z4	V	★

Proportional pressure reflief valve

Series L10~L19 = L1X

Max. pressure stage
up to 50 bar =50
up to 80 bar =80
up to 180 bar =180
up to 250 bar =250
up to 315 bar =315

Voltage supply of trigger electronics
24V DC =G24

Further details in the plain text

V = FKM
No code= NBR

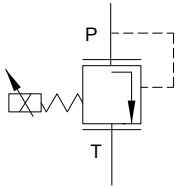
Electrical connection
K4= Without plug-in connector
Z4= With plug-in connector

N= Manual auxiliary override

Solenoid type(current)
8= Solenoid current 0.8A max.
25= Solenoid current 2.5A max.

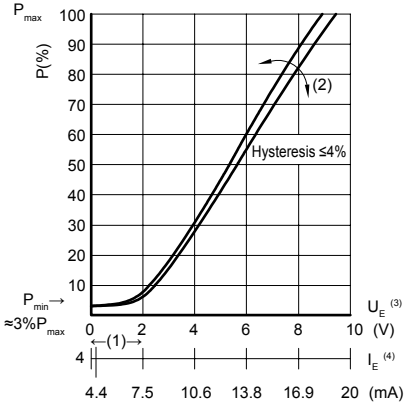
Symbols

For external trigger electronics



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

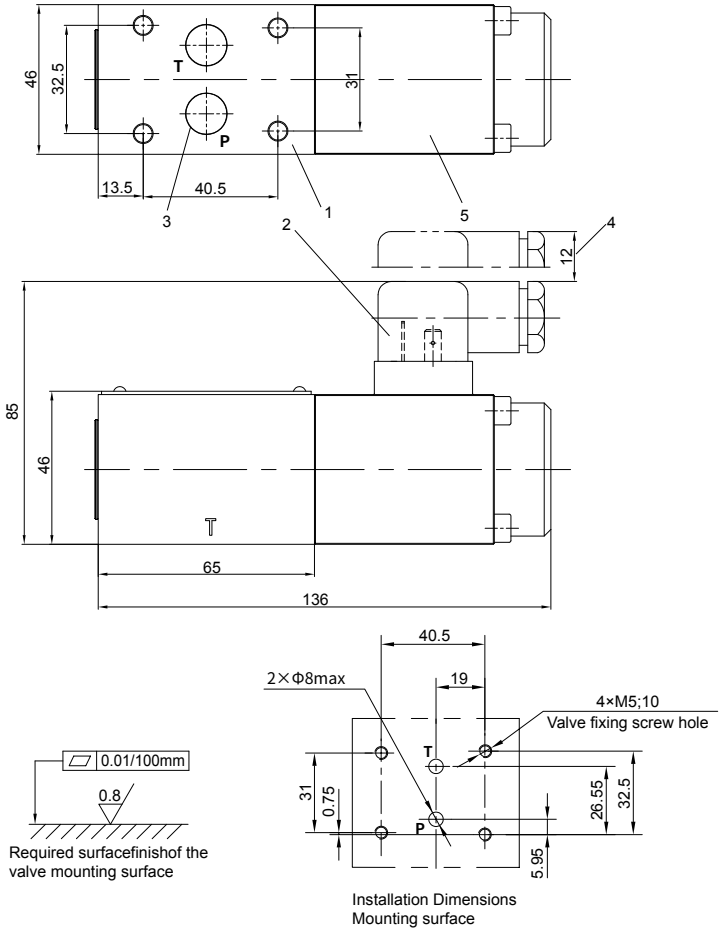
Pressure in port P as a function of the setpoint
Nominal flow Q_{nom}=1L/min



(1) Zero adjustment
(2) Sensitivity adjustment
(3) Version: U_E=0...10V
(4) Version: I_E=4...20mA

Unit dimensions

(nominal dimensions in mm)



1 Valve housing
2 Plug-in connector
3 Identical seal rings for ports P and T (O-ring 9.25×1.78)
4 Space required to remove the plug-in connector
5 Proportional solenoid

Valve fixing screws

The following valve fixing screws are recommended:

- 4 GB / T 70.1 - M5×30 - 10.9
- Tightening torque M_A=6 Nm

China
+86 400 101 8889

America
+01 630 995 3674

Germany
+49 172 3683463

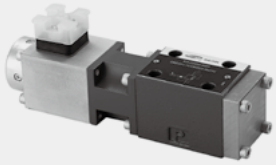
Japan
+81 03 6809 1696

6.3

Proportional pressure relief valve, pilot operated

Type DBE6X...L1X

Size 6
Up to P 315bar，T 250bar
Up to 40 L/min



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Features

—Pilot operated valves (pilot valves) for limiting system pressure (pilot oil internal only).
—Adjustable by means of the solenoid current, see Characteristic curve, technical data and selected valve electronics.
—Solenoid versions Imax =0.8A or Imax=2.5A
—Pressure limitation to a safe level even with faulty electronics (solenoid current I > Imax).
—For subplate attachment, mounting hole configuration to ISO 441-03-02-0-94.
—Plug-in connector to DIN 43650-AM2 included in scope of delivery.
—External trigger electronics with ramps and valve calibration in the following versions/ designs VT-SSPA1-508/516/525-L2X/V0/*

Function and configuration

General

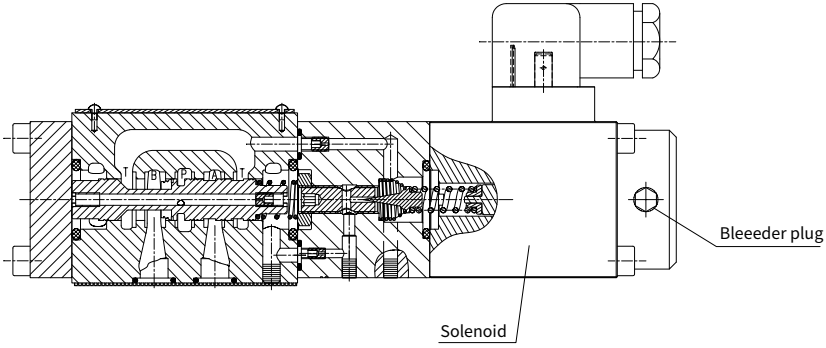
Type DBE6X proportional pressure relief valves are pilot operated pressure relief valves.
The internal pilot stage in the conical seat version and the main stage in the spool version are located in the valve body. The valves are actuated by means of a proportional solenoid.
The solenoid is cushioned by restrictors in the armature to aid dynamic stability. The interior of the solenoid is connected to port T and is filled with pressure fluid. Bleeding is achieved by means of a screw plug. With these valves, the system pressure that needs to be limited can be infinitely adjusted in relation to the solenoid current.

Basic principle

To adjust the system pressure, a setpoint is set in the trigger electronics. Based on this setpoint, the electronics control the solenoid coil with regulated PWM (pulse-width-modulated) current.
The regulated current is additionally modulated with a dither, ensuring low hysteresis. The proportional solenoid converts the current to a mechanical force, which acts on a main spring in the pilot stage by means of the armature plunger. The pilot stage is supplied with pilot oil via a bore at < 0.6 l/min. The "Pmax" pressure stage is determined by the cone and seating bore configuration.

Pressure limitation for maximum safety

If a fault occurs in the electronics, so that the solenoid current (Imax) would exceed its specified level in an uncontrolled manner, the pressure cannot rise above the level determined by the maximum spring force.



Ordering code

DBE6X – L1X / G24 – 8 N9 / V *

Proportional pressure relief valve NG6 pilot operated

With integrated electronics(OBE) =E
For external control electronics =No code

Series L10~L19 =L1X

Max. pressure stage
up to 80 bar = 80
up to 180 bar = 180
up to 250 bar = 250
up to 315 bar = 315

Voltage supply of trigger electronics
24V DC =G24

Solenoid type (current)
Solenoid current 0.8A max. =8
Solenoid current 2.5A max. =25

Further details in the plain text

V = FKM
No code = NBR

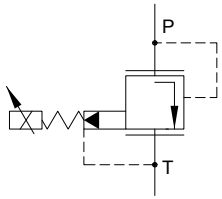
For type DBE6XE
A1= Command/actual value 0 to 10V
F1= Command/actual value 4 to 20mA

For type DBE6XE:
K31= Without plug-in connector
Z31= With plug-in connector
For type DBE6X :
K4= Without plug-in connector
Z4= With plug-in connector

N9 = Manual auxiliary override

06

Symbols



Technical data

General			
Construction	Pilot stage		Poppet valve
	Main stage		Spool valve
Construction			Proportional solenoid without position control, external amplifier
Connection type			Subplate, mounting hole configuration NG6 (SIO 4401-03-02-094)
Mounting position			Optional
Ambient temperature range		℃	-20 至 +50
Weight		Kg	2.2
Vibration resistance, test condition			Max. 25 g, shaken in 3 dimensions (24 h)

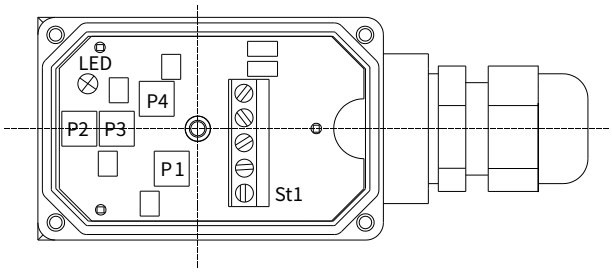
Hydraulic (measured with HLP 46, ϑ_{oil} = 40℃ ±5℃)						
Pressure fluid			Hydraulic oil to DIN 51524...535, other fluids after prior consultation			
Viscosity range	recommended	mm^2/s	20...100			
	max. permitted	mm^2/s	10...800			
Pressure fluid temperature range		℃	-20...+80			
Maximum permitted degree of contamination of pressure fluid Purity class to ISO 4406 (c)			Class 18/16/13			
Direction of flow			See symbol			
Max. set pressure (at Qmax=1 L/min)		bar	80	180	250	315
Min. pressure (at Qmin=1 L/min)		bar	7	8	9	10
Max. working pressure		bar	Port P: 315			
			Port T: 250			
Max. mechanical pressure limitation level, e.g. when solenoid current I>I_{max}		bar	< 90	< 190	< 260	< 325
Pilot oil flow		L/min	Approx. 0.6			
Max. flow		L/min	40			

Electrical			
Cyclic duration factor	%	100 ED	
Degree of protection		IP 65 to DIN 40050 and IEC 14434/5	
Solenoid connection		Plug-in connector to DIN 43650/ISO 4400, M16X1.5(2P+PE)	
Valve with solenoid type		0.8A	2.5A
Max. solenoid current	Imax	0.8A	2.5A
Coil resistance R20	Ω	22	3
Max. power consumption at 100% load and operating temperature	VA	25	30

Static/Dynamic		
Hysteresis	%	⩽ 4
Range of inversion	%	⩽ 3
Manufacturing tolerance for Pmax	%	⩽ 10
Response time 100% signal change	ms	On 200 / Off <250

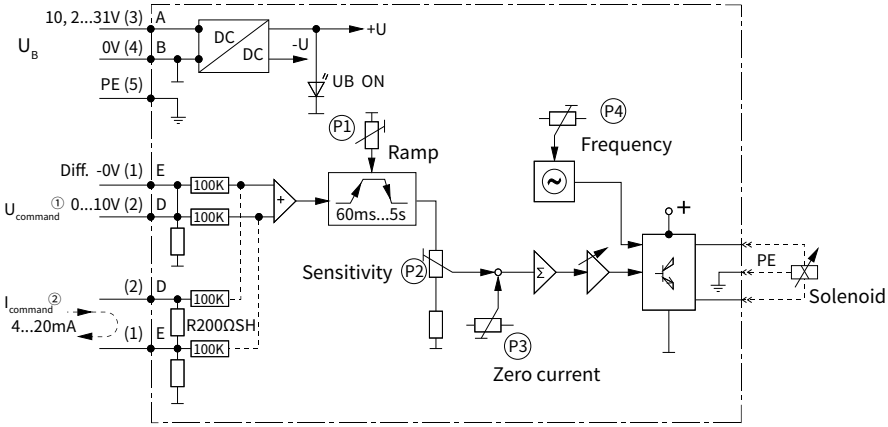
Valve with external trigger electronics

Connections and adjustment



P1 – Ramp time
P2 – Sensitivity
P3 – Zero point
P4 – Dither frequency
St 1 – Connection terminal
LED – Display U_B

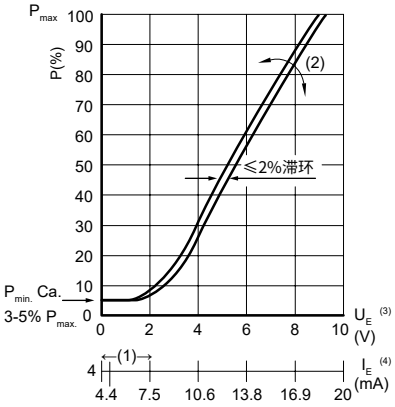
Block diagram and pin assignment



① Version with 0...+10 V signal
② Version with 4...20 mA signal

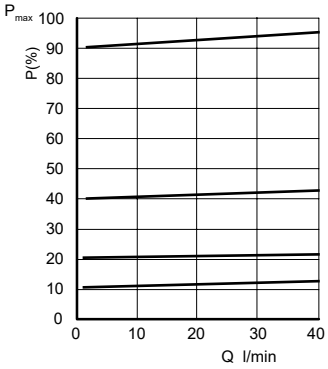
Characteristic curves (measured with HLP46, ϑ_{oil}=40°C ±5°C)

Pressure in port P as a function of the setpoint



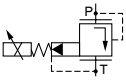
(1) Zero adjustment
(2) Sensitivity adjustment
(3) Version: U_E=0...10V
(4) Version: I_E=4...20mA

Pressure in port P proportionate to the maximum flow of the main stage



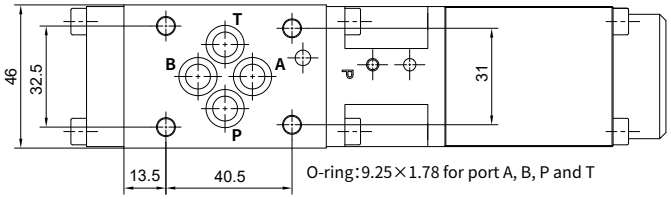
Set pressure

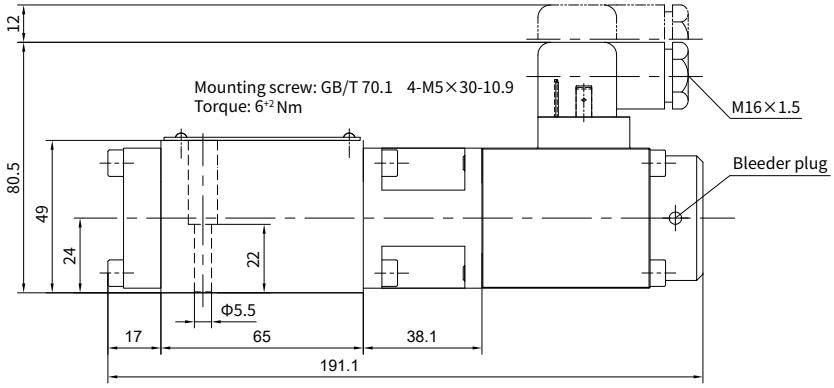
p' = f (Q_{P-T})



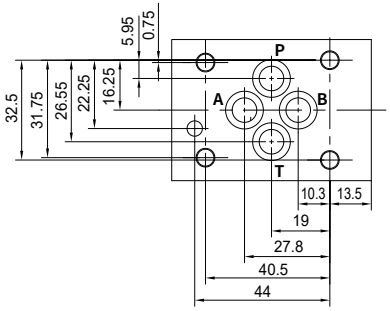
Unit dimensions

(nominal dimensions in mm)

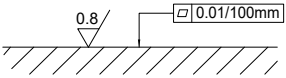




Mouting hole configuration:
NG6(ISO 4401-03-02-0-94)



Installation Dimensions
Mounting surface



Required surfacefinishof the
valve mounting surface

China
+86 400 101 8889

America
+01 630 995 3674

Germany
+49 172 3683463

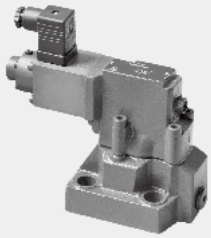
Japan
+81 03 6809 1696

6.4

Proportional pressure relief valve

Type DBE(E)/DBEM(E)...30

Sizes 10, 25 and 32
Up to 315 bar
Up to 600 L/min



Contents

Function and configuration	02
Ordering code	03
Symbols	03
Technical data	04
Proportional amplifier	05
Electrical connections, plug-in connectors	05-06
Characteristic curves	07-08
Unit dimensions	09-11

Features

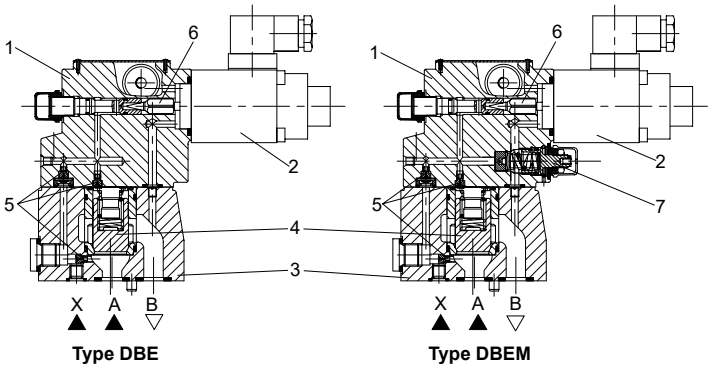
-Sub-plate mounting:
- Porting pattern to DIN 24 340 form E and ISO 6264
- For installation in manifolds
- 4 pressure ratings
- Max. pressure limitation , optional
- Amplifier type VT-2000 (must be ordered separately)

Function and configuration

DBE valves are pilot operated pressure relief valves. They are used to continuously set the pressure in hydraulic systems by electrical signal.
Basically these valves consist of a pilot valve (1) with proportional solenoid (2) and the main valve (3) with main spool insert (4).

Type DBE...
The pressure limit is in relation to the electrical current value and set by the proportional solenoid (2). The system pressure is applied to the main spool (4). At the same time the pressure is applied to the spring loaded side of the main spool (4) and the pilot poppet (6) via orifice (5) at the pilot valve (1). If the hydraulic force exceeds the solenoid force, the pilot poppet (6) opens. Pilot fluid can flow back to tank and pressure drop caused by the orifices effects the main spool (4). Then main spool (4) opens the channel from pump to tank.

Type DBEM···
Optionally the valve can be supplied with an additional spring loaded pilot control valve (7) for maximum pressure safety (redundant pressure safety).



Ordering code

DBE | | | | – 30 / | | G24 | / / | | *

Without maximum pressure safety =No code
With maximum pressure safety =M

Pilot operated =No code
Pilot operated valve with main spool (enter nom. size 30) =C
Pilot operated valve without main spool (do not enter nom. size) =C
Pilot operated valve for remote controlling =T

For external control electronics =No code
With integrated electronics (OBE) =E

Nominal size 10 = 10
Nominal size 25 = 20
Nominal size 32 = 30

Series 30 = 30

Max. pressure 50 bar = 50
Max. pressure 100 bar = 100
Max. pressure 200 bar = 200
Max. pressure 315 bar = 315

Y= Pilot oil supply internal and drain external
Not for DBE(M)(E)C and DBE(M)(E)T without main spool
XY= Pilot oil supply external and drain external (only for with the pilot valve and main spool)

For type DBE(M)E, Supply voltage:
G24= +24VDC

For type DBE(M) :
K4= Without plug-in connector
Z4= With plug-in connector
For type DBE(M)E:
K31= Without plug-in connector
Z31= With plug-in connector

A1= Command/ actual value 0 to 10V
F1= Command/ actual value 4 to 20 mA

Further information in plain text

V= FKM seals
No code=NBR seals

Pilot oil drain port Y
No code= Inch threaded
2 = Metric threaded

Symbols

10
DBE20-30/...Y
30
DBEC30-30/...Y

10
DBE20-30/...XY
30

DBE C/T -30/

10
DBEM20-30/...Y
30
DBEMC30-30/...Y

10
DBEM20-30/...XY
30

DBEM C/T -30/

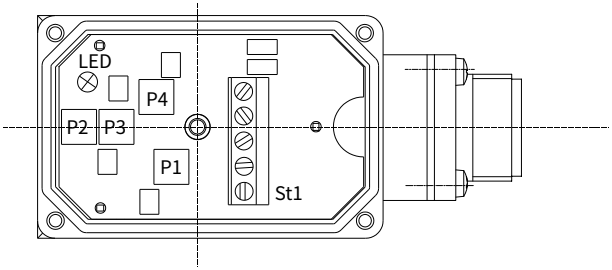
Technical data

Fluid		Mineral oil suitable for NBR and FKM seal		
		Phosphate ester for FKM seal		
Fluid temperature range	°C	-30 to +80 (NBR seal)		
		-20 to +80 (FKM seal)		
Viscosity range	mm^2/s	2.8 to 380		
Degree of contamination		Maximum permissible degree of fluid contamination: Class 9. NAS 1638 or 20/18/15, ISO4406		
Max.operating pressure Port A, B, X	bar	315		
Max.setting pressure	bar	50; 100; 200; 315		
Min.setting pressure		In relation to Flow (Q), see characteristic curves		
Pressure at zero command value		= min.setting pressure		
Return oil pressure port Y	bar	Separate and at zero pressure to tank		
Max. pressure safety (infinitely adjustable)		setting pressure	Pressure range under Max. safety pressure	
		50 bar	10-60^{+20} bar	
		100 bar	10-120^{+20} bar	
		200 bar	10-220^{+20} bar	
		315 bar	10-340^{+20} bar	
Max. pressure safety setting condition		When rated pressure is 50 bar, between 60 bar and 80 bar		
		When rated pressure is 100 bar, between120 bar and 140 bar		
		When rated pressure is 200 bar, between 220 bar and 240 bar		
		When rated pressure is 315 bar, between 340 bar and 360 bar		
Nominal size		10	25	32
Max. flow-rate	L/min	200	400	600
Pilot oil (for pilot valve)	L/min	0.7 to 2		
Linearity		±3.5%		
Repeatability		<±2%		
Hysteresis		with shimmy		without shimmy
		±1.5% P max (200Hz, amplitude 200mAssl)		±4.5% P max
Shifting time		30~150ms (undependent with the system)		

Electrical data		
Power source		DC
Min. solenoid current	mA	100
Max. solenoid current	mA	800
Coil resistance		19.5Ω at 20°C , Max. warm value : 28.8Ω
Working status		Continuous
Max. working enviromental temperature		+50°C
Electrical connection		Plug-in connector to DIN EN 175301-803/ISO 4400
Insulation to DIN 40 050		IP 65
Ampilfier		VT2000

Proportional amplifier (Can be ordered separately)

·Connections and adjustment



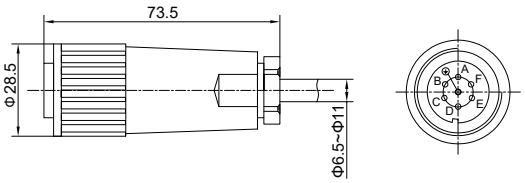
P1 – Ramp time
P2 – Sensitivity
P3 – Zero point
P4 – Dither frequency
St 1 – Connection terminal
LED – Display U_B

Electrical connections, plug-in connectors

·For type DBE(M)E-30 (with integrated electronics (OBE))

For pin allocation also
see block circuit diagram.

Plug-in connector to DIN EN 175201-804



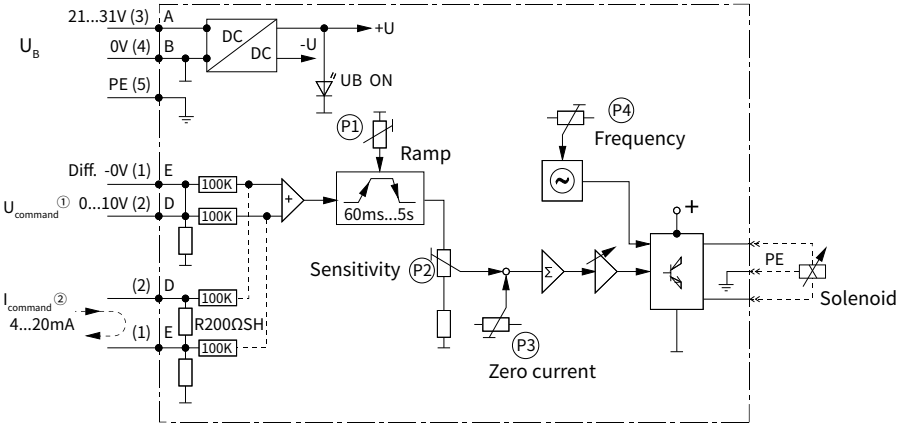
· Component plug allocation

	Contact	Interface A1 signal	Interface F1 signal
Supply voltage	A	24 VDC(U(t)=21V to 31V)	
	B	GND	
	C	n.c. [1)]	
Differential amplifier input	D	±10V， Re>50KΩ	4 to 20mA， Re>100Ω
	E	reference potentional command value	
	F	n.c. [1)]	

[1)]Contacts C and F must not be connected!

Electrical connections, plug-in connectors

· Block diagram and pin assignment

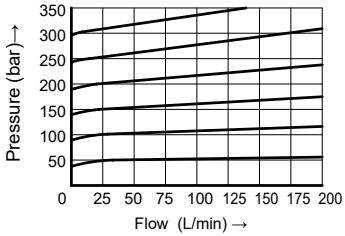


① Version with 0...+10 V signal
② Version with 4...20 mA signal

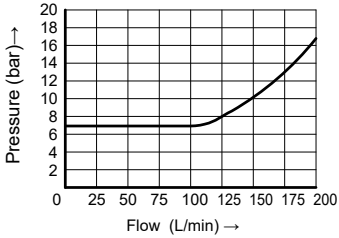
Characteristic curves (Measured at ϑ_{oil}=40°C ±5°C , using HLP46)

Operating pressure in relation to the flow

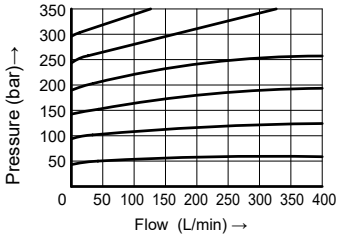
DBE10

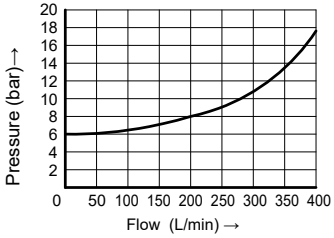


Min. setting pressure in relation to the flow

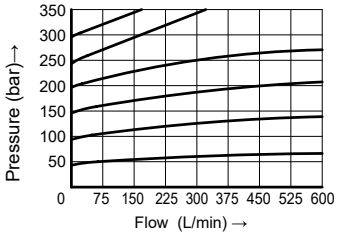


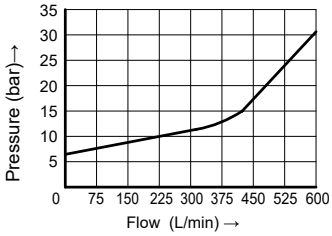
DBE20





DBE30

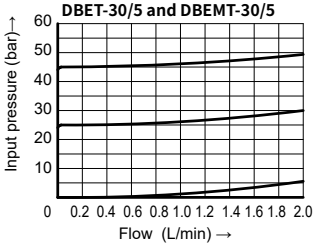




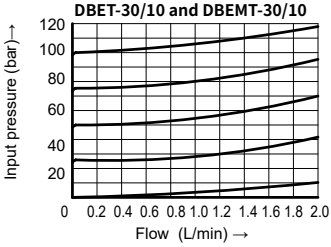
Characteristic curves

(Measured at ϑ_{oil}=40°C ±5°C , using HLP46)

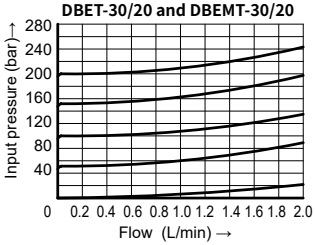
DBET-30/5 and DBEMT-30/5



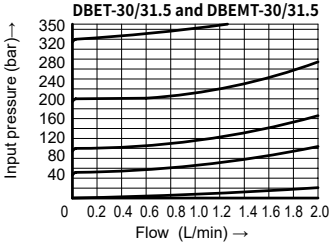
DBET-30/10 and DBEMT-30/10



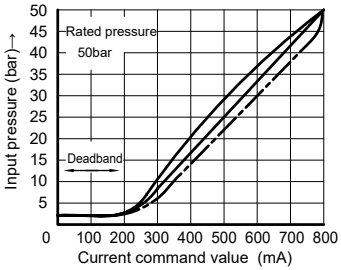
DBET-30/20 and DBEMT-30/20

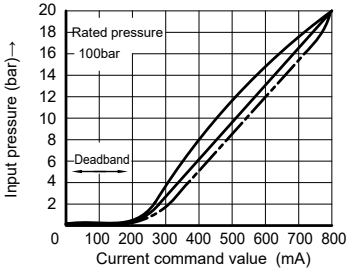


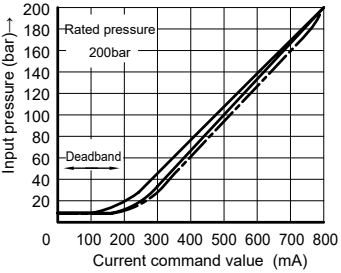
DBET-30/31.5 and DBEMT-30/31.5

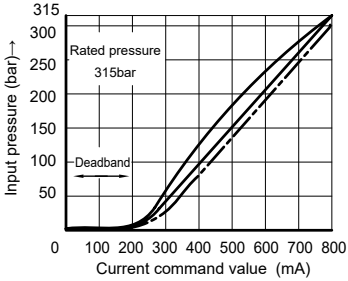


Inputting pressure/current demand curve type DBE10, 20 and 30/DBET









Measured under flow 27L/min of type DBE10, 20 and 30.
Measured under flow 0.8L/min of type DBET.

Note: To get min. preset pressure,
pilot current is not permitted to exceed 100mA .

Hysteresis

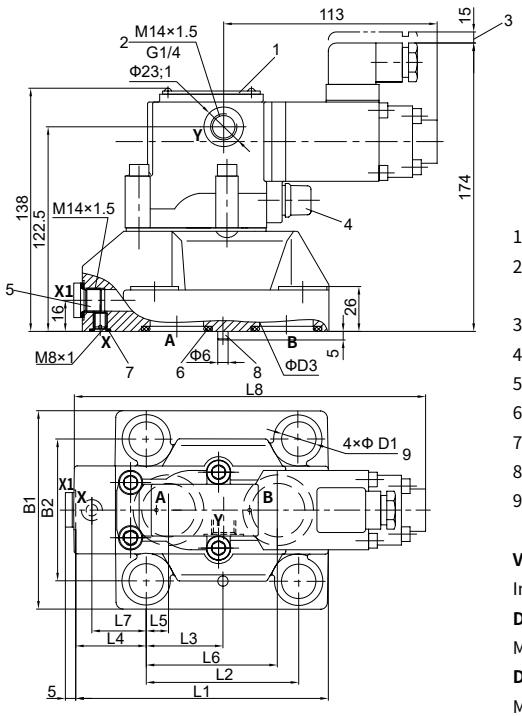
With shimmy ————

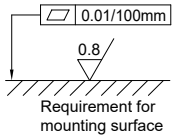
Without shimmy —·—·—

Unit dimensions

(Dimensions in mm)

Pressure relief valve of type DBE/DBEM





1 Name plate
2 (Port Y)pilot oil drain always external and separate to tank at zero pressure.
3 Space required to remove plug-in connector.
4 Max. pressure limitation
5 External pilot supply (X and X1, optional)
6 O-ring (port A and B)
7 O-ring 9.25×1.78(port X)
8 Locating pin
9 Fixing screw hole

Valve fixing screws:

Internal hexagon screw GB/T 70.1-10.9,

DBE/DBEM10: M12×45, tightening torque, M_A=130 Nm

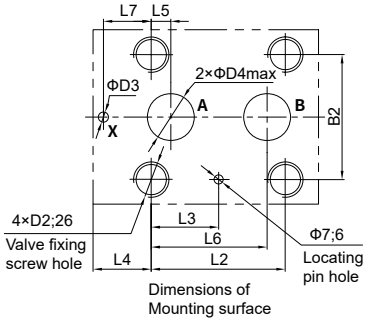
DBE/DBEM20: M16×50, tightening torque, M_A=310 Nm

DBE/DBEM30: M18×50, tightening torque, M_A=430 Nm

Type		B1	B2	Weight	O-ring (Port A and port B)
DBEM DBE	10	78	53.8	4.4kg	17.12×2.62
DBEM DBE	20	100	70	4.8kg	28.17×3.53
DBEM DBE	30	115	82.6	7.1kg	34.52×3.53

Type		L1	L2	L3	L4	L5	L6
DBEM DBE	10	91	53.8	22.1	27.5	22.1	47.5
DBEM DBE	20	116	66.7	33.4	33.3	11.1	55.6
DBEM DBE	30	147.5	88.9	44.5	41	12.7	76.2

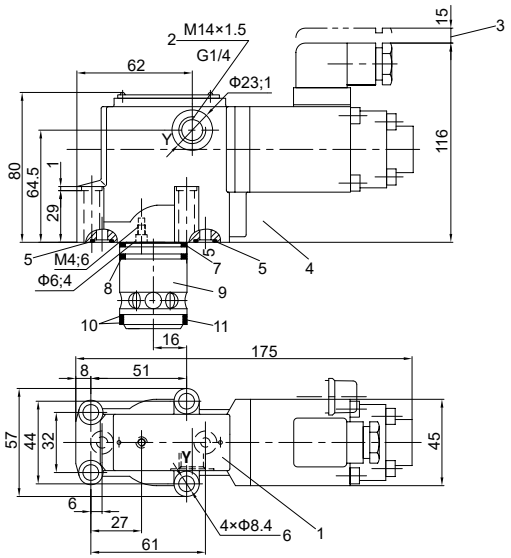
Type		L7	L8	D1	D2	D3	D4
DBEM DBE	10	0	176.5	14	M12	6	12
DBEM DBE	20	23.8	190	18	M16	6	22
DBEM DBE	30	31.8	200	20	M18	7	30



Unit dimensions

(Dimensions in mm)

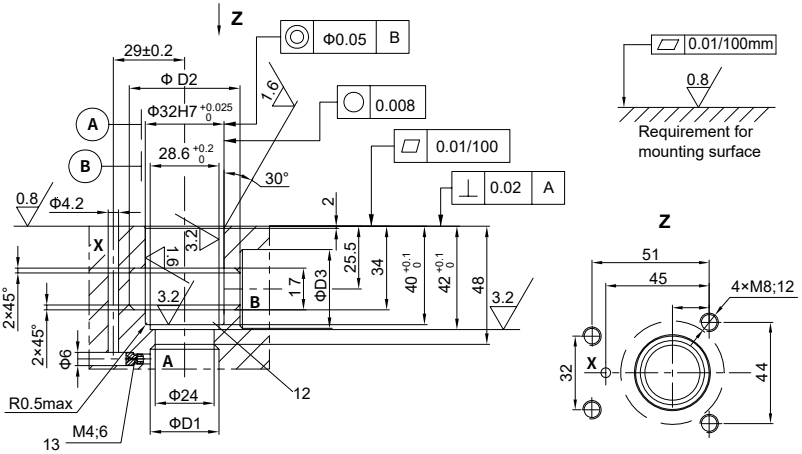
Plug-in valve



1 Name plate
2 (Port Y) pilot oil drain always External and separate to tank at zero pressure
3 Space required to remove plug-in connector
4 Max. pressure limitation
5 O-ring 9.25×1.78(port X and Y)
6 Fixing screw hole
7 O-ring 28×2.65
8 O-ring 28×1.8
9 Main spool assembly
10 Retaining ring 28.4×32×0.8
11 O-ring 27.3×2.4
12 Retaining ring and O-ring shall be fixed onto the hole before fixing the main spool
13 The throttle shall be ordered separately

06

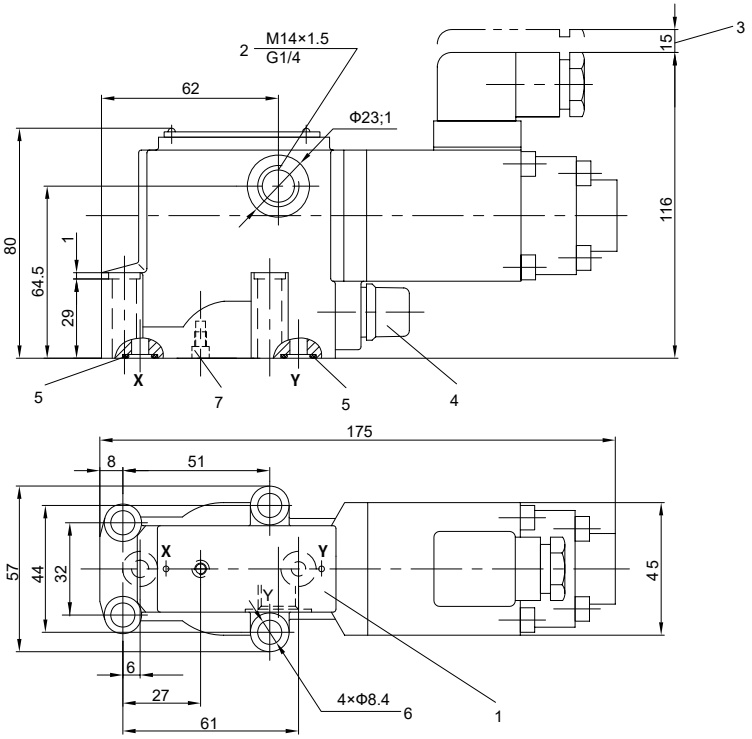
Size	D1	D2	D3	Main spool assembly code		Valve fixing screw	Tighting touque	Weight
10	10	40	10	307341 (NBR)	307342 (FKM)	4-M8×40 internal hexagon GB/T70.1-10.9	20Nm	2.9kg
20	25	45	25					
30	32	45	32					



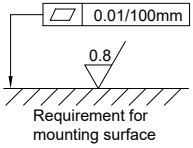
Unit dimensions

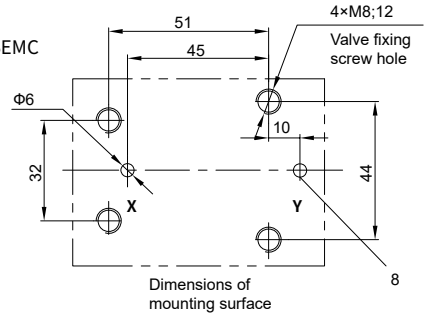
(Dimensions in mm)

Pressure relief valve as remote controller of valve type DBET/DBEMT
Pilot valve without main spool assembly of valve type DBEC/DBEMC



1 Name plate
2 Pilot oil drain port, optional
3 Space required to remove plug-in connector
4 Max. pressure limitation
5 O-ring 9.25×1.78 (port X and Y)
6 Fixing screw hole
7 Blocked up in valve type DBET/DBEMT
Fixed with throttle hole in valve type DBEC/DBEMC
8 Pilot oil drain port, optional





Valve fixing screws:
Internal hexagon screw
GB/T 70.1-10.9, 4-M8×40
Tightening torque M_A=20Nm

China
+86 400 101 8889

America
+01 630 995 3674

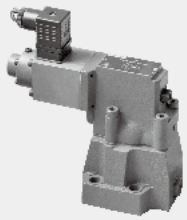
Germany
+49 172 3683463

Japan
+81 03 6809 1696

6.5

Proportional pressure reducing valve

Type DRE(E)/ DREM(E)...30



Sizes 10 , 25 and 32
Up to 315 bar
Up to 300 L/min

Proportional amplifier (Can be ordered separately)

Contents

Function and configuration	02
Symbols	03
Ordering code	03
Technical data	04
Proportional amplifier	05
Electrical connections, plug-in connectors	05-06
Characteristic curves	07
Unit dimensions	08-09

Features

- For sub-plate mounting:
- Porting pattern to DIN 24 340 form D and ISO 5781
- For installation in manifolds
- 4 pressure ratings
- Maximum pressure limitation, optional
- Digital amplifier type VT-2000 of modular design (must be ordered separately)

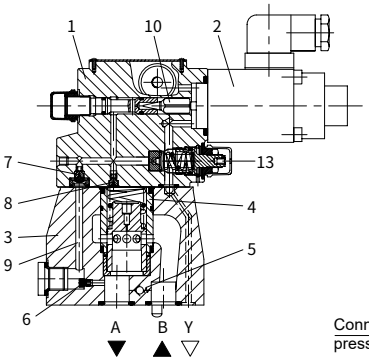
Function and configuration

The valve types DRE/DREM are pilot operated pressure reducing valves. They are used for pressure reduction . The valves consist of the pilot valve (1) with proportional solenoid (2), main valve (3) with main spool assembly (4), as well as an optional check valve (5).

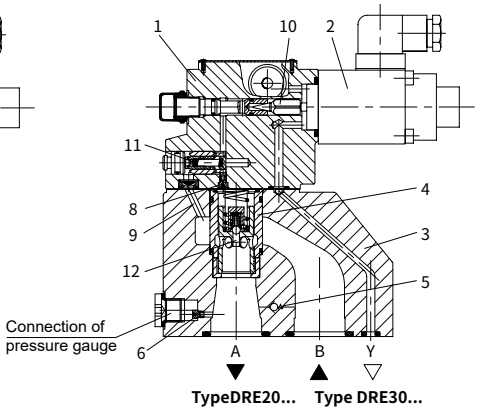
Type DRE10...
The setting of the pressure in port A is dependent on the voltage present at the proportional solenoids (2). At static, proportional solenoids (2) breakaway, the connection from B to A opens and fluid can flow freely from Port B to port A via main spool (4). When valve works, pressure fluid from port A acts on the spring load side of the main spool (4) via pilot valve with throttle (6), (7) and (8), and at the same time acts on spool (10) effected by electromagnetic force. If pressure at port A exceeds the preset value of the corresponding proportional solenoid (2) , then the spool (10) opens.
Signal and pilot fluid is from port A, and fluid flows to tank through spool (10) and port Y . There is pressure differential on main spool (4) which makes itself into controller position and keeps flow constant pressure in port A as same as the setting value of the proportional solenoids (2). If the pressure in the port A increases and the main spool (4) is closed, little fluid will flow to tank via hole (9) and port Y. In order to allow free-flow from port A to B a check valve (5) can be fitted.

Type DRE20...and DRE30...
Same principle with DRE10 in function and pilot oil drains out from channel (9) and port B. There is a flow control valve (11) fixed in the pilot valve (1) to relief the pilot oil. And the overload protector (12) in the port A can prevent the pressure from abnormally high when flow Q=0.

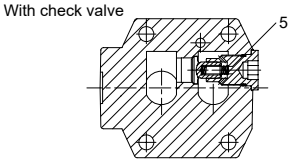
Type DREM...
A spring loaded pressure relief valve (13) can be optionally installed to prevent higher pressure in port A caused by abnormal peak voltage of proportional solenoids.



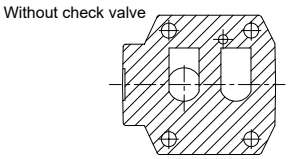
Type DREM10...



TypeDRE20... Type DRE30...

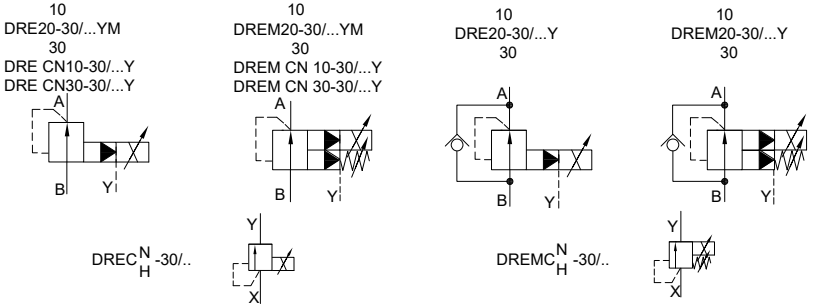


DRE..-30/..Y



DRE..-30/..YM

Symbols



Ordering code

DRE | | | | – 30 / | | | G24 | / | / | | ★

Without maximum pressure safety =No code
With maximum pressure safety = M

Pilot operated = No code
Pilot operated valve for size 10 = CN
(do not enter nom. size)
Pilot operated valve for size 20 and 30 = CH
(do not enter nom. size)
Pilot operated valve with = CN
main spool assembly for size 10
(enter nom. size 10)
Pilot operated valve with = CH
main spool assembly for size 30
(enter nom. size 30)

For external control electronics =No code
With integrated electronics (OBE) =E

Nominal size 10 = 10
Nominal size 25 = 20
Nominal size 32 = 30

Series 30 = 30

Max. pressure 50 bar = 50
Max. pressure 100 bar = 100
Max. pressure 200 bar = 200
Max. pressure 315 bar = 315

Y= Pilot oil drain always external, separate and zero pressure to the tank

No code= Without check valve
M = With check valve

G24= For type DBE(M)E, Supply voltage + 24 V DC

K4= For type DRE(M) : Without plug-in connector
Z4= With plug-in connector
K31= For type DRE(M)E: Without plug-in connector
Z31= With plug-in connector

A1= For type DRE(M)E: Command/actual value 0 to 10V
F1= Command/actual value 4 to 20 mA

No code = Pilot oil drain port Y Inch threaded
2 = Metric threaded

V = FKM seals
No code = NBR seals

Further information in plain text

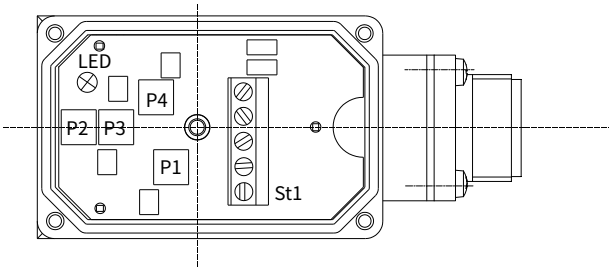
Technical data

Fluid			Mineral oil suitable for NBR and FKM seal		
			Phosphate ester for FKM seal		
Fluid temperature range		°C	-30 to +80 (NBR seal)		
			-20 to +80 (FKM seal)		
Viscosity range		mm^2/s	2.8 to 380		
Degree of contamination			Maximum permissible degree of fluid contamination: Class 9. NAS 1638 or 20/18/15, ISO4406		
Max. operating pressure	Port A, B	bar	315		
	Port Y		Back to tank with zero pressure		
Max. setting pressure	Port A	bar	50; 100; 200; 315		
Min. setting pressure	Port A		Dependent with Q, see characteristic curves		
Pressure at current value 0 in port A			=Min. settable pressure (see characteristic curves)		
Max. pressure limitation(stepless)			Setting pressure	setting range under max. pressure limition	
			50 bar	10-60^{+20} bar	
			100 bar	10-120^{+20} bar	
			200 bar	10-220^{+20} bar	
			315 bar	10-340^{+20} bar	
Max. pressure limition setting range			When rated pressure=50 bar, between 60~80 bar		
			When rated pressure=100 bar, between 120~140 bar		
			When rated pressure=200 bar, between 220~240 bar		
			When rated pressure=315 bar, between 340~360 bar		
Nominal size			10	25	32
Max. flow-rate		L/min	80	200	300
Pilot flow-rate (for pilot valve)		L/min	0.7 to 2		
Linearity			±3.5%		
Repeatability			<±2%		
Magnetic creeping			with shimmy		without shimmy
			±2.5% P max (200Hz, amplitude 200mAss)		±4.5% P max
Shifting time			100 to 300ms (dependent with the system)		

Electrical data		
Supply voltage		DC
Min. solenoid current	mA	100
Max. solenoid current	mA	800
Coil resistance		19.5Ω at 20°C , Max. warm value :28.8Ω
Working status		Continuous
Max. working enviromental temperature		+50°C
Electrical connection		Plug-in connector to DIN EN 175301-803/ISO 4400
Valve protection to DIN 40 050		IP 65
Ampilfier		VT2000

Proportional amplifier (Can be ordered separately)

·Connections and adjustment



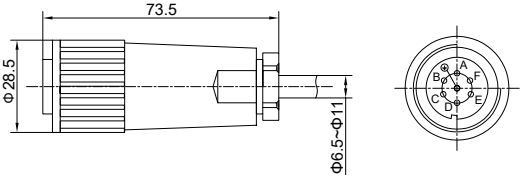
P1 – Ramp time
P2 – Sensitivity
P3 – Zero point
P4 – Dither frequency
St 1 – Connection terminal
LED – Display U_B

Electrical connections, plug-in connectors

·For type DRE(M)E-30 (with integrated electronics (OBE))

For pin allocation also
see block circuit diagram.

Plug-in connector to DIN EN 175201-804



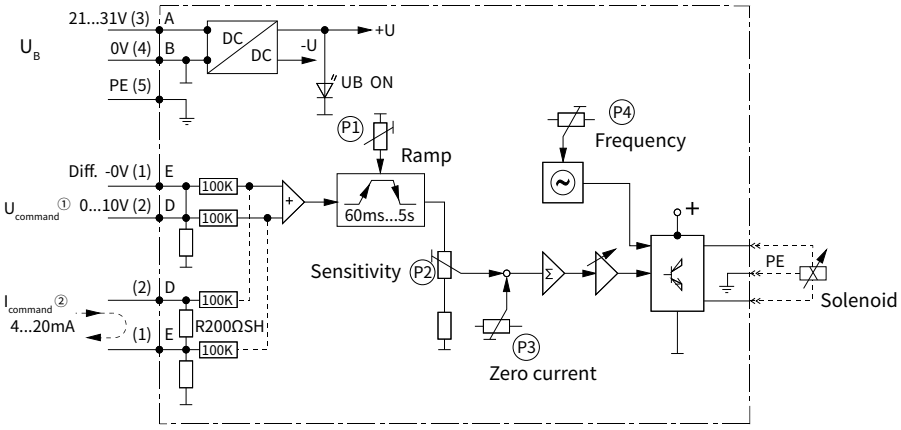
· Component plug allocation

	Contact	Interface A1 signal	Interface F1 signal
Supply voltage	A	24 VDC(U(t)=21V 至 31V)	
	B	GND	
	C	n.c. [1)]	
Differential amplifier input	D	±10V， Re>50KΩ	4 至 20mA， Re>100Ω
	E	reference potentional command value	
	F	n.c. [1)]	

[1)]Contacts C and F must not be connected!

Electrical connections, plug-in connectors

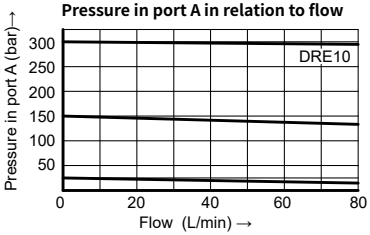
· Block diagram and pin assignment



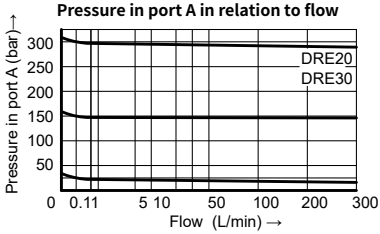
① Version with 0...+10 V signal
② Version with 4...20 mA signal

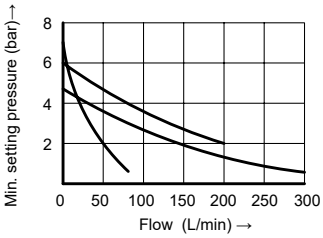
Characteristic curves (Measured at ϑ_{oil}=40°C ±5°C , using HLP46)

Pressure in port A in relation to flow

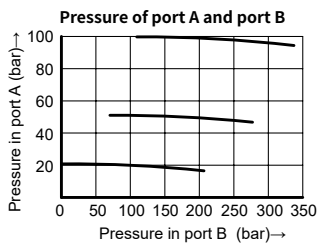


Pressure in port A in relation to flow

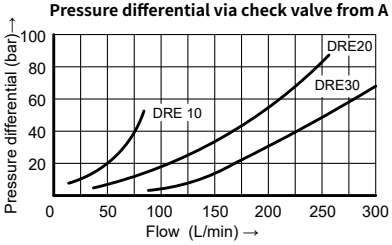


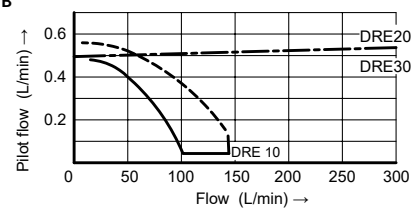


Pressure of port A and port B



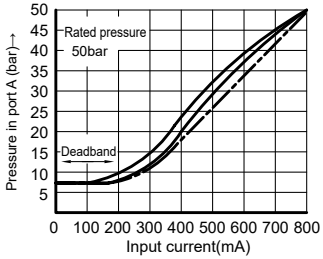
Pressure differential via check valve from A to B

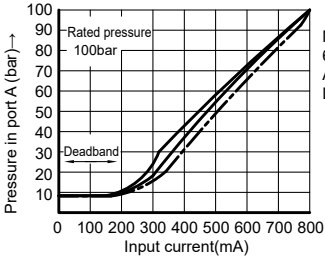




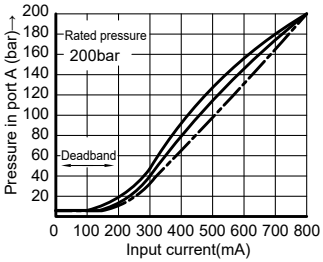
----- =20bar ΔP DRE10
——— =100bar ΔP DRE10
—·— =20bar and 100bar ΔP DRE20/30

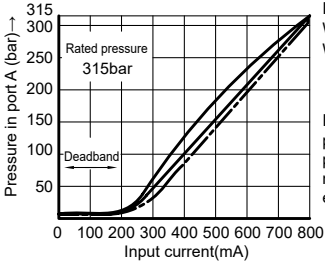
Input pressure/current of DRE10,20 and 30





Measured flow 6L/min from A to B of type DRE10, 20 and 30.



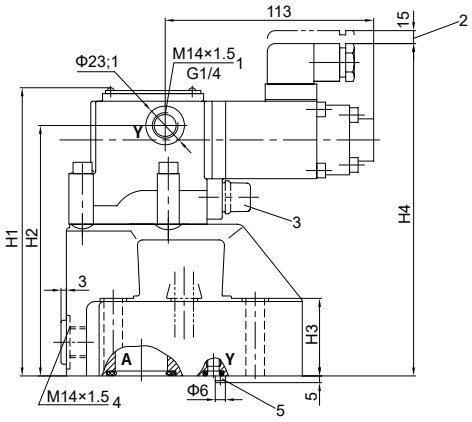


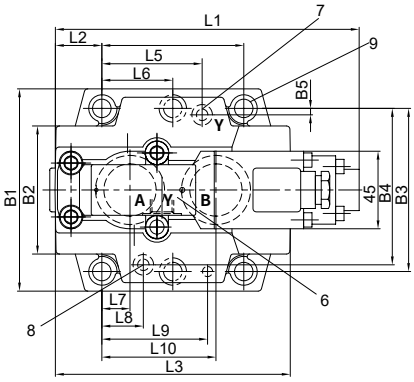
Magnetic creeping
With flutter ———
Without flutter —·—

Note: To get min. preset pressure pilot current is not permitted to exceed 100mA

Unit dimensions

(Dimensions in mm)

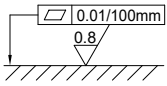


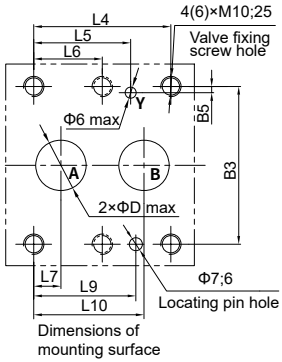


1 As supplied, this port is plugged.
After removal of this plug this port can also be used as an external pilot oil drain.
2 Space required to remove plug-in connector.
3 Max. pressure limitation
(its application see hereinbefore "note")
4 Port X used for remote controlling the DRE10 and pressure gauge connection on DRE20 and DRE30
5 Locating pin
6 Name plate
7 Pilot oil drain always external and separate to tank at zero pressure.
8 Dead hole
9 Valve fixing screw holes
4 (DRE10 and 20); 6 (DRE30)

Valve fixing screws:

Internal hexagon screw GB/T 70.1-10.9,
DRE10:M10×50, DRE20:M10×60
DRE10:M10×70
Tightening torque, M_A =75 Nm



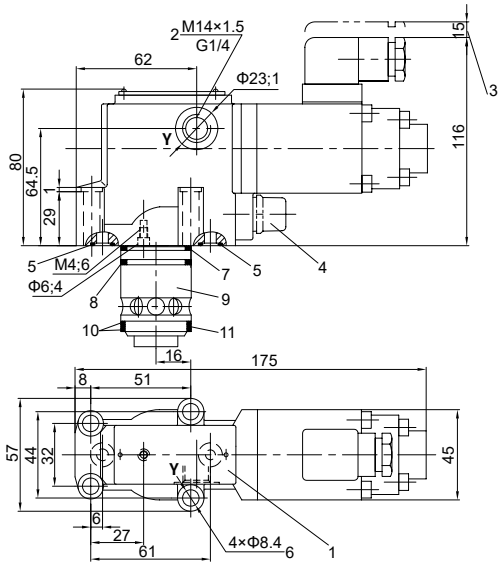


Size	B1	B2	B3	B4	B5	O-ring (port A and B)				O-ring (port X and Y)			D	H4
10	85	50	66.7	58.8	7.9	17.12×2.62				9.25×1.78			13	188
25	102	59.5	79.4	73	6.4	28.17×3.53				9.25×1.78			22	198
32	120	76	96.8	92.8	3.8	34.52×3.53				9.25×1.78			30	206
Size	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	H1	H2	H3	Weight
10	181	35.5	96	42.9	21.5	-	7.2	21.5	31.8	35.8	152	136.5	28	5.2kg
25	177	33.5	112	60.3	39.7	-	11.1	20.6	44.5	49.2	162	146.5	38	6.3kg
32	176.5	28	140	84.2	59.5	42.1	16.7	24.6	62.7	67.5	170	154.5	46	8.6kg

Unit dimensions

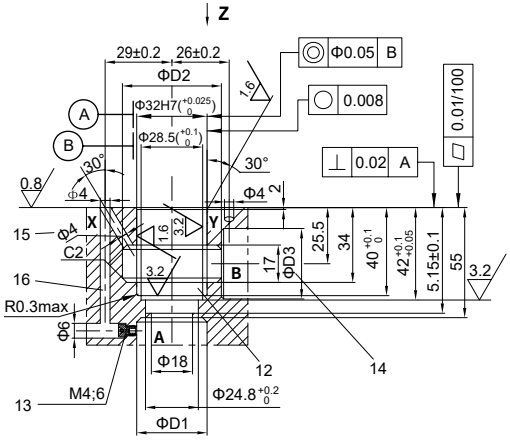
(Dimensions in mm)

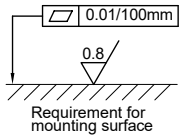
Insert cartridge valve

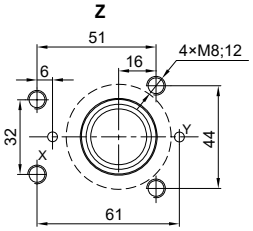


1 Name plate
2 (Port Y)pilot oil drain always external and separate to tank at zero pressure.
3 Space required to remove plug-in connector.
4 Max. pressure limitation (its application see hereinbefore "note")
5 O-ring 9.25×1.78
6 Valve fixing screw hole
7 O-ring 28×2.65
8 O-ring 28×1.8
9 Main spool assembly
10 Retaining ring 28.4×32×0.8
11 O-ring 27.3×2.4
12 Retaining ring and O-ring should be fixed onto the hole before fixing the main spool.
13 The throttle in the DREC10 must be ordered separately; and the cartridge assembly includes the main spool and throttle.
14 Cannelure's diameter D2 can meet hole diameter D3, but must pay attention don't damage the port and the valve fixing holes.
15 Pilot lines of DRE CH20 and DRE CH30.
16 Pilot lines of DRE CH10.

Size	D1	D2	D3	Main spool assembly ordering code		Valve fixing screws	Tightening torque	Weight
10	10	40	10	306 727	306 728	4pcs M8×40 GB/T70.1-10.9 Internal hexagon screw	20Nm	3kg
25	20	45	20	306 729	306 730			
32	30	45	30	(NBR)	(FKM)			







China
+86 400 101 8889

America
+01 630 995 3674

Germany
+49 172 3683463

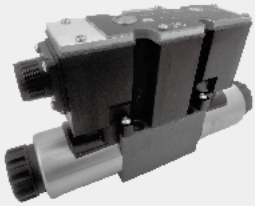
Japan
+81 03 6809 1696

6.6

3-way Proportional pressure reducing valve

Type 3DREP and 3DREPE

NG 6
Max pressure 100 bar
Max flow 15 L/min



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Symbols	03
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Technical data	04
Electrical connections, plug-in connectors	05
Characteristic curves	06
Unit dimensions	07-08

Features

-Directly controlled proportional valves for the control of the pressure and direction of a flow
-3-Way design and standard ISO 4401-03 mounting
-Operated via proportional solenoids with central thread and removable coil
-Spring centred control spool
-Hand override, optional
-3DREP: available module amplifier
-3DREPE: integrated electronics (OBE) with voltage input or current input (A1 resp. F1)

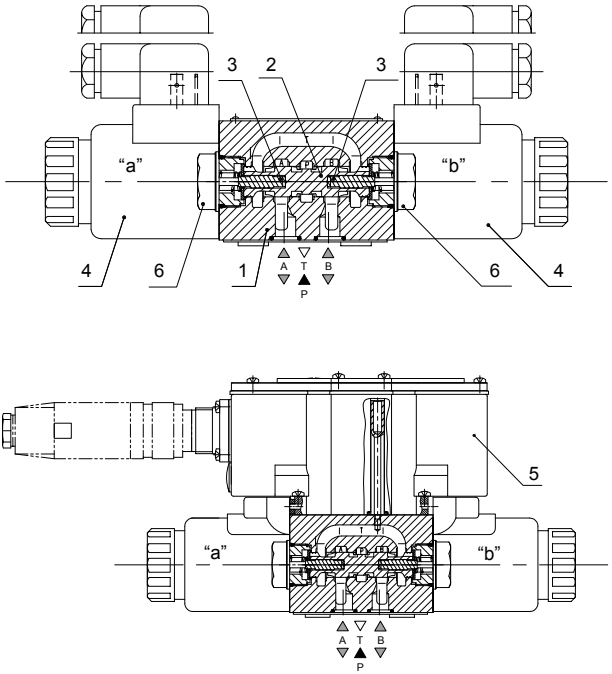
Function and configuration

General:
The 3-way pressure reducing valve type 3DREP 6... is directly actuated by proportional solenoids. They convert an electrical input signal into a proportional pressure output signal.

Design:
The valve mainly comprises of:Housing (1) with mounting surface, Control spool (2) with pressure measuring spools (3), Solenoids (4) with control thread and Optional integrated valve electronics (5).

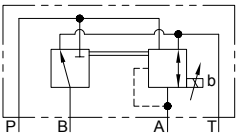
Function:
With the solenoids (4) de-energized the control spool (2) is held in its centeres position by compression springs. The control spool (2) is directly actuated when one of the solenoids is energised E.g. by energizing solenoid "a" . The pressure measuring spool (3) and control spool (2) move to the right in proportion to the electrical input signal. The connection from P to B and A to T is via orifice form cross-sections with progressive flow Characteristics – De-energization of the solenoid (4). The control spool (2) is returned to its centre position by the compression springs.
In the middle postion the connections A and B to T are open, therefore, the pressure fluid can freely flow to tank.

Type 3DREP6...-L2X/...

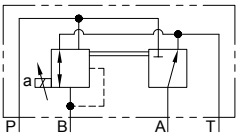


Symbols

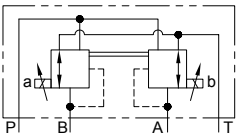
Type 3DREP6... A -L2X/...



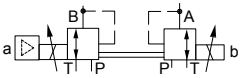
Type 3DREP6... B -L2X/...



Type 3DREP6... C -L2X/...



Type 3DREPE6...C L2X/... (simplified)
Example of a valve with integrated control electronics



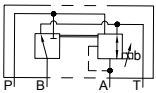
Ordering code

3DREP		6	– L2X /	E	G24		/		★

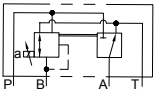
Without integrated =No code
With integrate = E

Nominal size 6 =6

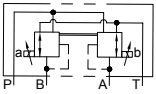
Spool symbols



=A



=B



=C

Series L20~L29 =L2X
(L20 to L29,unchanged installation and connection dimensions)

16= Pressure stage 16 bar
25= Pressure stage 25 bar
45= Pressure stage 45 bar

E = Proportional solenoid with removable coil

G24= Power supply voltage 24VDC
Supply voltage for the control electronics

No code = Without hand override
N9 = With protected hand override

3DREP: Z4= With plug-in connector
K4= Without plug-in connector
3DREPE: K31= Without plug-in connector
Z31= With plug-in connector

3DREP: No code
Interface A1 or F1 for 3DREPE:
A1= Command value input ±10V
F1= Command value input 4 to 20mA

V = FKM seals
No code = NBR seals

Further information in plain text

Technical data

Hydraulic				
Valve type			3DREP6...L2X	3DREPE6...L2X
Installation			optional, preferably horizontal	
Weight		KG	2.0	2.2
Ambient temperature range		°C	-20 to +70	-20 to +50
Max. flow		L/min	15 (Δp = 50 bar)	
Hysteresis		%	⩽ 5	
Repeatability accuracy		%	⩽ 1	
Response sensitivity		%	⩽ 0.5	
Operating pressure range	Port P	bar	20 to 100 for pressure stage 16	
			30 to 100 for pressure stage 25	
			50 to 100 for pressure stage 45	
	Port T		0 to 3	
Pressure fluid			Mineral oil (HL, HLP) to DIN 51524	
			other pressure fluids on request	
Pressure fluid temperature range		°C	-20 to +80	
Viscosity range		mm^2/s	20 to 380 (preferably 30 to 46)	
Degree of contamination			Maximum permissible degree of contamination of the pressure fluid is to NAS 1638 class 9 or 20/18/15, ISO4406	

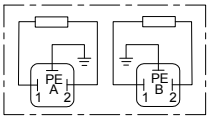
Electrical				
solenoid				
Valve type			3DREP6...L2X	3DREPE6...L2X
Voltage type			DC	
Command value signal Voltage input "A1"			-	±10V
Max. current per solenoid		A	1.5	2.5
Solenoid coil resistance	Cold value at 20 °C	Ω	4.8	2
	Max. warm value		7.2	3
Duty		%	ED100%	
Coil temperature		°C	up to 150	
Valve protection to EN 60529			IP 65 with mounted and fixed plug-in connector	
Amplifier			VT-VSPA2-...-L2X	integrated
Supply voltage	Nominal voltage	VDC	24	
	Lower limiting value	V	19	
	Upper limiting value	V	35	
Amplifier current consumption	I_{max}	A	1.8	
	Impulse current	A	4	

Electrical connections, plug-in connectors

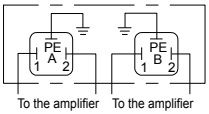
· For type 3DREP6...L2X (without integrated electronics)

Connections on the component plug

Plug-in connector to DIN EN 175301-803 or ISO 4400



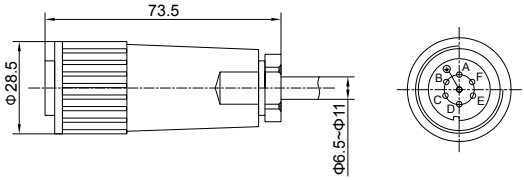
Connections on the plug-in connector



· For type 3DREPE6...L2X (with integrated electronics (OBE))

For pin allocation also see block circuit diagram.

Plug-in connector to DIN EN 175201-804



· Integrated control electronics for type 3DREPE6

Component plug allocation

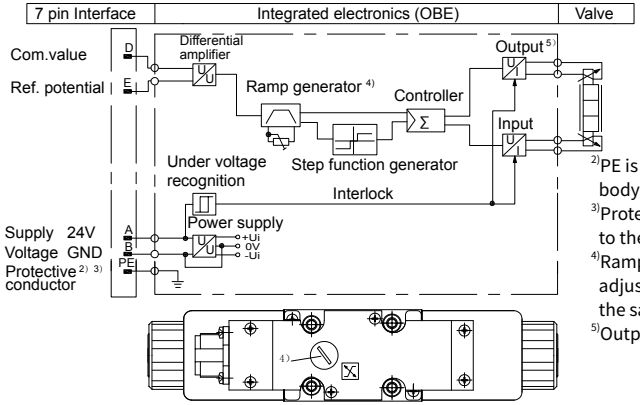
	Contact	Interface A1 signal	Interface F1 signal
Supply voltage	A	24 VDC(U(t)=19V to 35V)	
	B	GND	
	C	n.c. [1]	
Differential amplifier input	D	±10V, Re>50KΩ	4 to 20mA, Re>100Ω
	E	reference potentional command value	
	F	n.c. [1]	

[1]Contacts C and F must not be connected!

Connection cable:
Recommended:
– up to 25 m cable length type LiYCY 7×0.75 mm²;
– up to 50 m cable length type LiYCY 7×1.0 mm².
For outside diameter see plug-in connector sketch.
Only connect screen to PE on the supply line.

Command value:
Reference potential at E and positive command value (0 to +10V or 12 to 20mA) at D result in pressure in A.
Reference potential at E and positive command value (0 to -10V or 12 to 4mA) at D result in pressure in B.
With valves with 1 solenoid on side b (design A): Reference potential at E and positive command value at D result in pressure in A.
With valves with 1 solenoid on side b (design B): Reference potential at E and positive command value at D result in pressure in B.

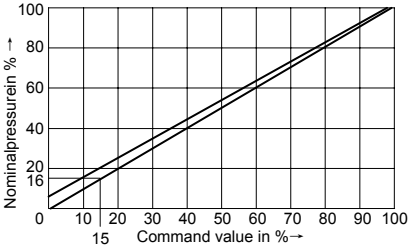
· Integrated electronics (OBE) for type 3DREPE6



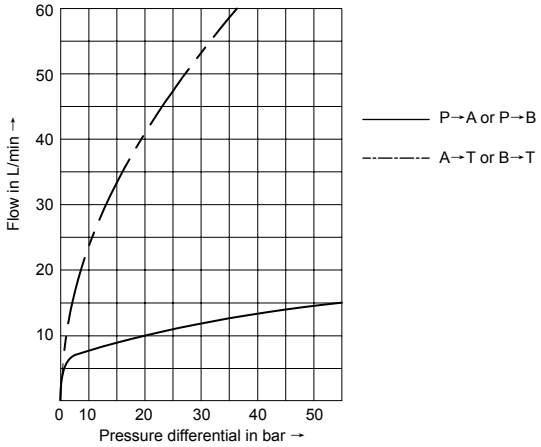
[2]PE is connected to the cooling body and the valve housing!
[3]Protective conductor screwed to the valve housing and cover.
[4]Ramp can be externally adjusted from 0 to 5s, the same applies for T_{up} and T_{down}.
[5]Output stages current regulated.

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

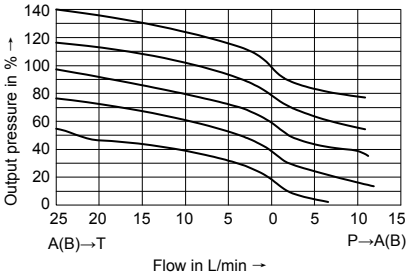
Pressure stages 16, 25 and 45 bar



Pressure stages 16, 25 and 45 bar



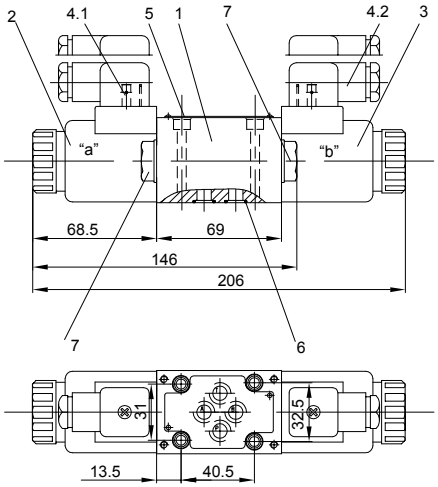
Pressure-flow relationship

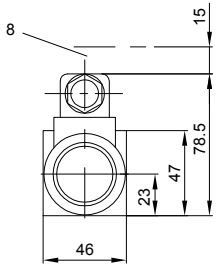


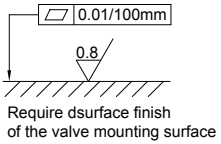
Unit dimensions

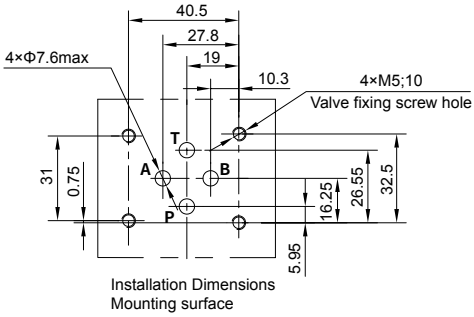
(nominal dimensions in mm)

Type 3DREP6...L2X









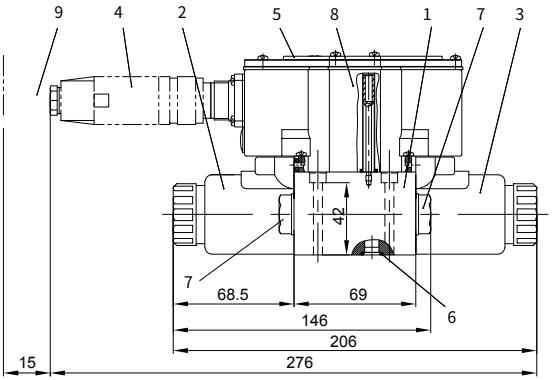
Valve fixing screws:
The following valve fixing screws are recommended:
- 4 S.H.C.S.ISO 4762 - M5×50 - 10.9
- 4 GB / T 70.1 - M5×50 - 10.9
- Tightening torque M_A = 8.9 Nm ± 10%

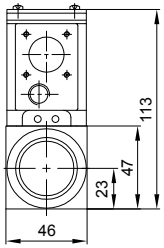
1 Valve housing
2 Proportional solenoid "a"
3 Proportional solenoid "b"
4.1 Plug-in connector "A"
4.2 Plug-in connector "B"
5 Name plate
6 Identical seal rings for ports A, B, P and T (R-ring 9.81×1.5×1.78 or O-ring 9.25×1.78)
7 Plug for valves with one solenoid (2 switching positions, versions A or B)
8 Space required to remove the plug-in connector

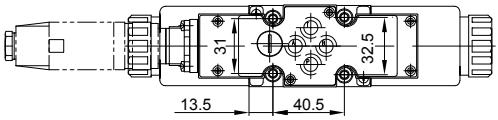
Unit dimensions

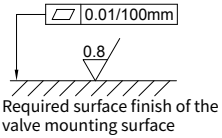
(Nominal dimensions in mm)

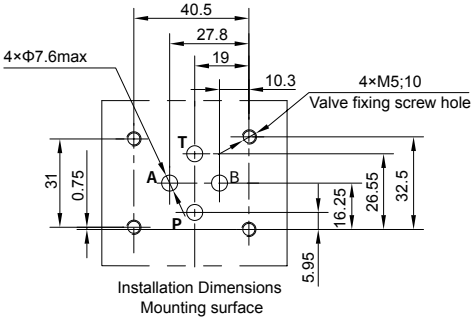
Type 3DREPE6...L2X











Valve fixing screws:
The following valve fixing screws are recommended:
- 4 S.H.C.S.ISO 4762 - M5×50 - 10.9
- 4 GB / T 70.1 - M5×50 - 10.9
- Tightening torque M_A = 8.9 Nm ± 10%

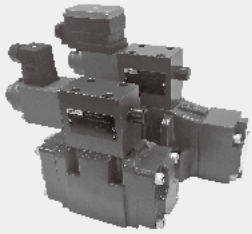
1 Valve housing
2 Proportional solenoid "a"
3 Proportional solenoid "b"
4 Plug-in connector
5 Name plate
6 Identical seal rings for ports A, B, P and T (R-ring 9.81×1.5×1.78 or O-ring 9.25×1.78)
7 Plug for valves with one solenoid (2 switching positions, versions A or B)
8 Integrated electronics (OBE)
9 Space required to remove the plug-in connector

6.7

3-way Proportional pressure reducing valve, pilot operated

Type 3DRE(M) and 3DRE(M)E

Component series L6X
NG 10 and 16
Max pressure 315 bar
Max flow: 125L/min(size 10) 300L/min(size 16)



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Integrated electronics (OBE) of Types DREE and DREME	07-08
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Pilot oil supply	12

Features

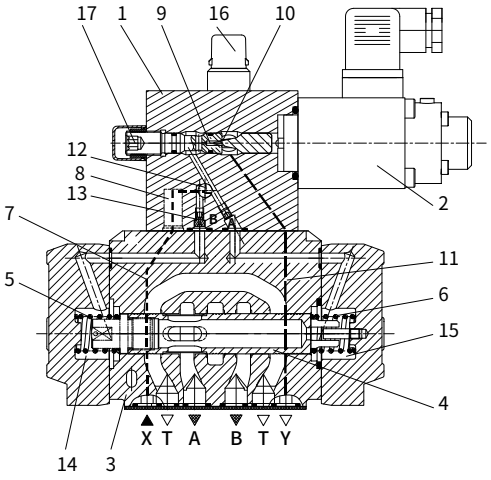
- Pilot operated valve for reducing a pressure (P to A) and limiting (A to T) a system pressure
- Actuation by proportional solenoid
- Maximum pressure relief function, optional
- Valve and control electronics from a single source
- Control electronics for type 3DRE(M):
  - Analogue amplifier type VT-VSPA1(K)-1in Euro-card format
  - Digital amplifier type VT-VSPD-1 in Euro-card format
  - Analogue amplifier type VT 11131 of modular design
- Linear command value/pressure characteristic curve
- Integrated electronics (OBE) with type 3DRE(M)E:
  - Low manufacturing tolerance of the command value/ pressure characteristic curve
  - Ramp times can be adjusted separately for pressure build-up

Function and configuration

Valves of types 3DRE(M) and 3DRE(M)E are electrically pilot operated 3-way pressure reducing valves with pres-sure relief function for the actuator. They are used to reduce a system pressure.

Technical structure:
The valves consist of three main assemblies:
1) Pilot valve (1) optionally with maximum pressure relief function (16)
2) Proportional solenoid (2)
3) Main valve (3) with main spool (4)

Function:
General function:
Command value-related adjustment of the pressure to be reduced in channel A by proportional solenoid (2).
When no pressure is applied in port P, main spool (4) is held by springs (5) and (6) in the central position. Here,the connections from P to A and A to T are closed. Pilot oil flows from bore (7) via flow controller (8), pilot valve (1) to orifice (9), throttling gap (10), pipe (11) to port Y. This port must be connected at zero pressure to the tank.



Type 3DREM10P-L6X/...G24K4V

Pressure reduction:
Build-up of pilot pressure in control chamber (12) as a function of the command value. Pressure is built up in spring chamber (14) via orifice (13) and the main spool is shifted to the right. Hydraulic fluid flows from P to A. The actuator pressure in port A is applied to spring chamber (15).
An increase in the pressure in port A to the pressure set on pilot valve (1) causes main spool (4) to be pushed to the left. The pressure in port A becomes virtually the same as the pressure set on pilot valve (1).

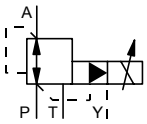
Pressure relief function:
When the pressure in port A exceeds the pressure set on pilot valve (1), main spool (4) is shifted further to the left. This causes the connection from A to T to open and limits the pressure applied in port A to the set command value.

Type 3DREM:
The valve is optionally available with an additional spring-loaded pilot valve (16) to provide a maximum pressure relief function.

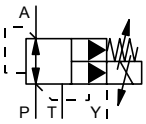
Types 3DREE and 3DREME
– with integrated electro-nics (OBE):
In terms of function and structure, these valves correspond to types 3DRE and 3DREM, except for the integrated electronics.
The electronics receives the supply and command value voltage via cable socket.
The command value/pressure characteristic curve (zero point on spindle (17) and the gradient are adjusted in the factory with narrow tolerances on the *Imax* potentiometer in the electronics.
The ramp time for pressure build-up and pressure reduction can be adjusted independently of each other with the help of two potentiometers.

Symbols

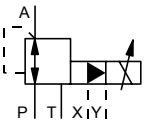
3DRE…Y…



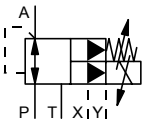
3DREM…Y…



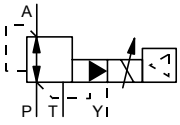
3DRE…XY…



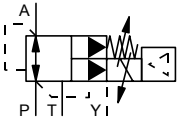
3DREM…XY…



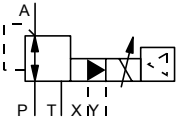
3DREE…Y…



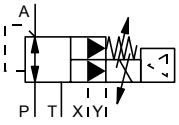
3DREME…Y…



3DREE…XY…



3DREME…XY…



Ordering code

3DRE				P	–	L6X	/		G24		/	V	*

Without maximum pressure relief function = No code
With maximum pressure relief function = M

For external control electronics = No code
With integrated electronics (OBE)=E

Size 10 = 10
Size 16 = 16

Subplate mounting = P

Component series 60 to 69 = L6X
(60 to 69: unchanged installation and connection dimensions)

Pressure stage
50bar = 50
100bar = 100
200bar = 200
250bar (size 16 only) = 250
315bar (size 10 only) = 315

Supply voltage for control electronics
G24 = 24V DC

Pilot oil supply and pilot oil drain
Y = Pilot oil supply internal, pilot oil drain external
XY = Pilot oil supply external, pilot oil drain external

For type 3DRE(M) :
K4= Without plug-in connector
Z4= With plug-in connector
For type 3DRE(M)E:
K31= Without plug-in connector
Z31= With plug-in connector

For type 3DRE(M) :
A1= Command/actual value 0 to 10V
F1=Command/actual value 4 to 20mA

V= FKM seals, suitable for phosphate ester(HFD-R)
No code= NBR seals

Further details inclear text

Technical data

General				
Size			10	16
Weight	3DRE and 3DREM	kg	7.7	10.2
	3DREE and 3DREME	kg	7.8	10.3
Installation orientation			Optional, preferably horizontal	
Storage temperature range		°C	-20 to +80	
Ambient temperature range	3DRE and 3DREM	°C	-20 to +70	
	3DREE and 3DREME	°C	-20 to +50	

Hydraulic (measured with HLP46; ϑ_{oil}=40°C ±5°C and p = 100bar)						
Size			10		16	
Max. operating pressure	Ports P, A and X	bar	315		P and X=315; A=250	
	Port Y	bar	separately and at zero pressure to tank			
Max. set pressure in channel A	Pressure stage50bar	bar	50		50	
	Pressure stage100bar	bar	100		100	
	Pressure stage200bar	bar	200		200	
	Pressure stage250bar	bar			250	
	Pressure stage315bar	bar	315			
Min. set pressure channel A at zero command value			see characteristic curves			
Maximum pressure relief function (infinitely adjustable)	Pressure stage 50bar	bar	Pressure adjustment range	30 to 70	Factor setting	to 70bar
	Pressure stage 100bar	bar		50 to 130		to 130bar
	Pressure stage 200bar	bar		90 to 230		to 230bar
	Pressure stage 250bar	bar		100 to 250		to 250bar
	Pressure stage 315 bar (size 10 only)	bar		150 to 350		to 350bar
Max. permissible flow		L/min	125		300	
Pilot oil flow		L/min	1			
Hydraulic fluid			Mineral oil (HL, HLP) to DIN 51524; further hydraulic fluids on enquiry!			
Hydraulic fluid temperature range		°C	-20 to +70			
Viscosity range		mm^2/s	20 to 380			
Degree of contamination			Maximum permissible degree of fluid contamination: Class 9.NAS 1638 or 20/18/15, ISO4406			
Hysteresis		%	±2 of max. set pressure			
Repeatability		%	< ±2 of max. set pressure			
Linearity		%	±3.5 of max. set pressure			
Manufacturing tolerance of command value/pressure char. curve, referred to hysteresis curve, increasing pressure	3DRE and 3DREM	%	±2.5 of max. set pressure			
	3DREE and 3DREME	%	±1.5 of max. set pressure			
Switching time		ms	100 to 200 (depending on system)			

Technical data

Electrical			
Supply voltage		V	24 V DC
Min. control current		mA	100
Max. control current	3DRE and 3DREM	mA	1600
	3DREE and 3DREME	mA	1440 to 1760
Solenoid coil resistance	Cold value at 20 ° C	Ω	5.4
	Max. hot value	Ω	7.8
Duty cycle		%	100
Electrical connection	3DRE and 3DREM		With component plug to DIN EN 175301-803
			Cable socket to DIN EN 175301-803
	3DREE and 3DREME		With component plug to E DIN EN 175201-804
			Cable socket to DIN EN 175201-804
Type of protection of the valve to EN 60529			Ip65 with cable socket mounted and locked

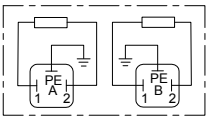
Control electronics			
Integrated electronics (OBE) with types 3DREE and 3DREME			Integrated in the valve
External control electronics for types 3DRE and 3DREM	Amplifier in Euro-card format	analogue	VT-VSPA1(K)-1
		digital	VT-VSPD-1
	Amplifier of modular design	analogue	VT 11131

Electrical connections, plug-in connectors

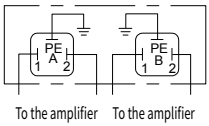
· For type 3DRE(M) ((without integrated electronics))

Connections on the component plug:

Cable socket to
DIN EN 175301-803
or ISO4400

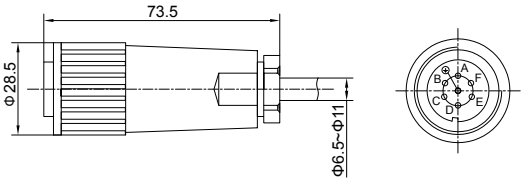


Connections on the plug-in connector:



· For type 3DRE(M)E (with integrated electronics (OBE))

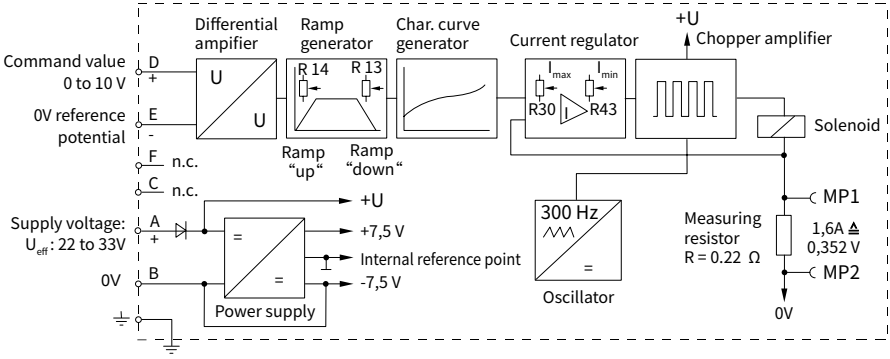
For pin allocation also
see block circuit diagram.
Plug-in connector to
DIN EN 175201-804



Integrated electronics (OBE) of Types DREE and DREME

Function:
The integrated electronics is controlled via the two differential amplifier connections D and E.
The ramp generator generates from a command value step change (0 to 10 V or 10 to 0 V) a delayed increase or drop of the solenoid current.
Potentiometer R14 can be used to adjust the rise time, potentiometer R13 to adjust the drop time of the solenoid current.
The maximum ramp time of 5s is only possible over the full command value range. In the case of minor changes in the command value, the ramp time shortens accordingly.
The command value/solenoid current characteristic curve is adjusted to the valve by means of the characteristic curve generator so that non-linearities in the hydraulic system are compensated for and a linear command value/pressure characteristic curve is obtained.

The current regulator regulates the solenoid current independently of the solenoid coil resistance.
Potentiometer R30 can be used to change the gradient of the command value/current characteristic curve and hence the gradient of the command value/pressure characteristic curve of the proportional pressure control valve.
Potentiometer R43 serves for adjusting the biasing current. This setting should not be changed. If required, adjust the zero point of the command value/pressure characteristic curve onthe valve seat.
A chopper amplifier forms the power stage of the electronics for controlling the proportional valve. It is pulsewidth-modulated with a clock frequency of 300 Hz.
The solenoid current can be measured at both measuring sockets MP1 and MP2. A voltage drop of 0.352V at the measuring resistor corresponds to a solenoid current of 1.6 A.

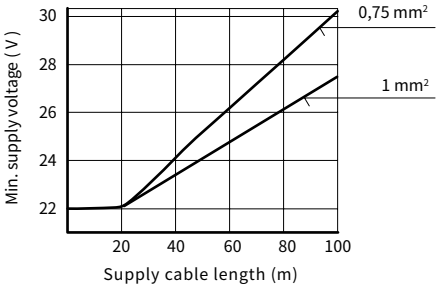


Block circuit diagram / pin assignment of integrated electronics

Integrated electronics (OBE) of Types DREE and DREME

· Supply voltage

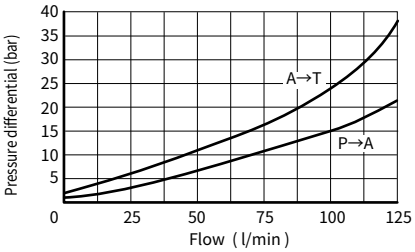
Power supply unit with rectifier.
Single-phase rectification or three-phase current bridge: U_{eff} =22 to 33V
Residual ripple content on the power supply unit : < 5 %
Output current: I_{eff} = max. 1.4A
Supply cable:
– **Recommended:** 5-wire, 0.75 or 1 mm² with protective conductor and shield
– Outer diameter 6.5 to 11 mm
– Shield to 0 V supply voltage
– Max. permissible length 100 m



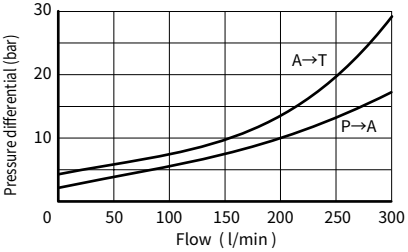
The minimum supply voltage of the power supply unit depends on the length of the supply cable (see diagram). In the case of lengths >50 m, a capacitor of 2200µ must be provided in the supply cable in the vicinity of valve.

Characteristic curves (measured with HLP46, ϑ_{oil}=40°C ±5°C and p=100bar)

Size 10

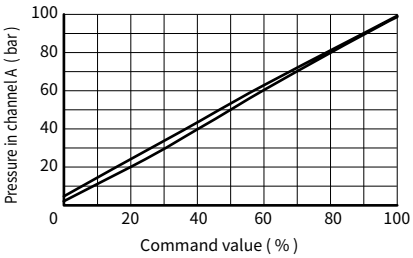


Size 16



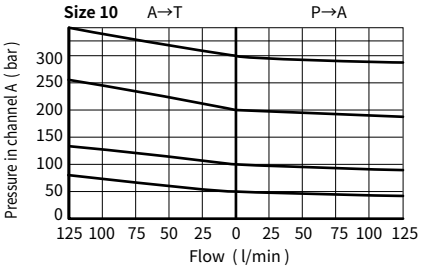
· Pressure in channel A -command value (measured at flow 0 L/min)

Size 10 and 16

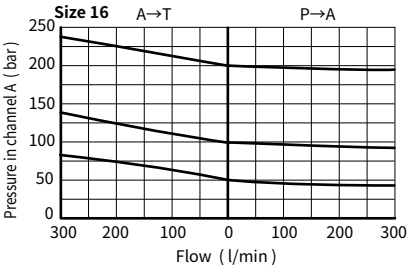


· Pressure in channel A – flow

Size 10

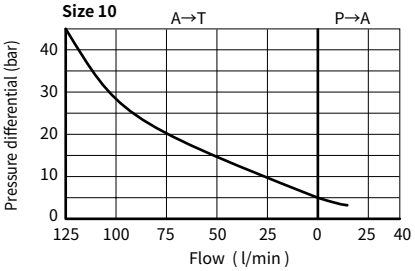


Size 16

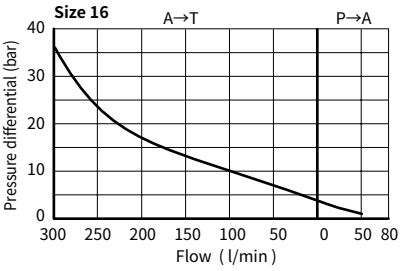


· Min. set pressure – flow

Size 10



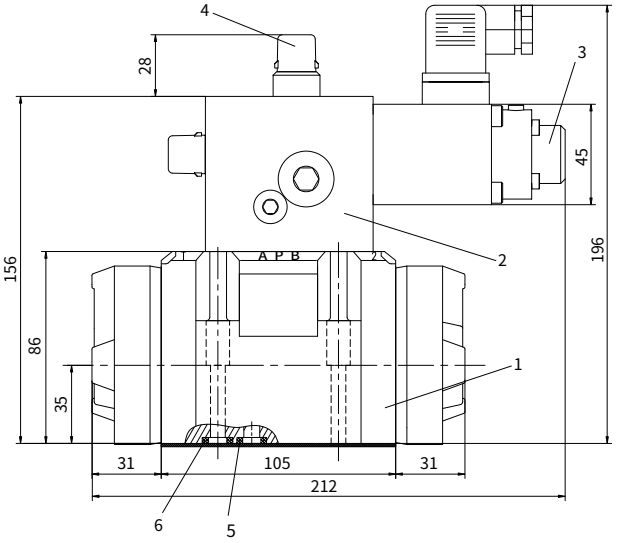
Size 16



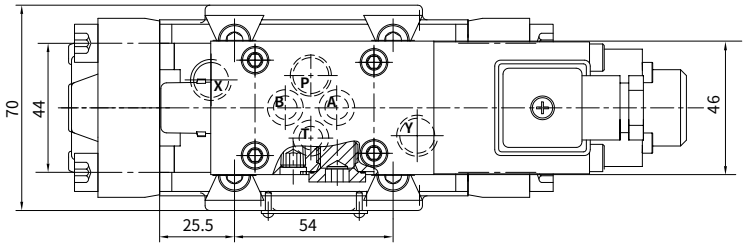
Unit dimensions

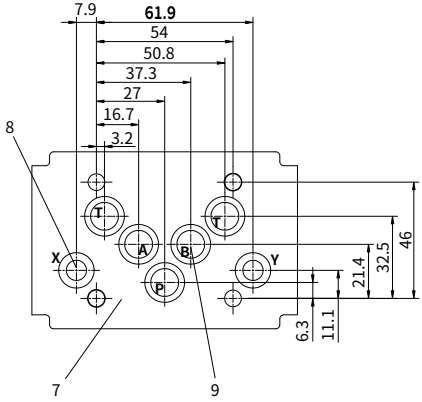
(nominal dimensions in mm)

Size 10

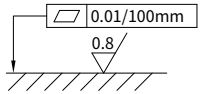


1 Main valve
2 Pilot valve
3 Proportional solenoid
4 Maximum pressure relief function (Type 3DREM...)
5 Identical seal rings for ports A, B, P, T (R-ring 13×1.6×2),
6 Identical seal rings for ports X and Y (11.18×1.6×1.78),
7 Machined mounting face, position of ports to DIN24 340 A, ISO 4401 and CETOP-RP 121 H
8 In the case of "internal" pilot oil supply (version Y), port X on the subplate must be plugged.
9 Port B on the subplate must be plugged





Valve fixing screws:
4 socket head cap screws
M6×45 GB/T 70.1-10.9;
tightening torque M_A=15.5Nm

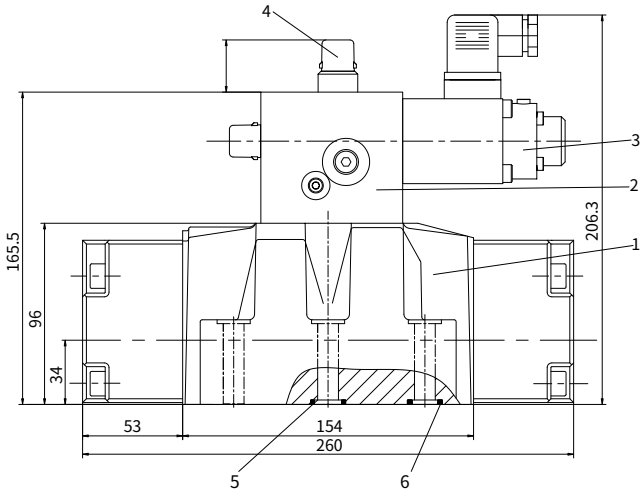


Required surface quality of mouting face

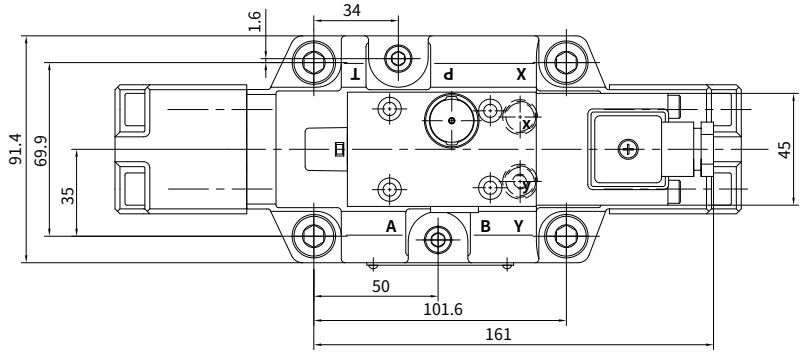
Unit dimensions

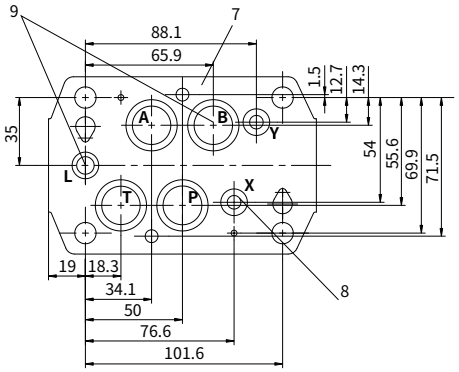
(nominal dimensions in mm)

Size 16

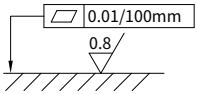


1 Main valve
2 Pilot valve
3 Proportional solenoid
4 Maximum pressure relief function (Type 3DREM...)
5 Identical seal rings for ports A, B, P, T (22.53×2.3×2.62),
6 Identical seal rings for ports X and Y (10×2×2),
7 Machined mounting face, position of ports to DIN24 340 A, ISO 4401 and CETOP-RP 121 H
8 In the case of "internal" pilot oil supply (version Y), port X on the subplate must be plugged.
9 Ports B and L on the subplate must be plugged





Valve fixing screws:
4 socket head cap screws
M10×60 GB/T 70.1-10.9;
tightening torque M_A=73Nm
2 socket head cap screws
M6×55 GB/T 70.1-10.9;
tightening torque M_A=15.5Nm



Required surface quality of mouting face

Pilot oil supply

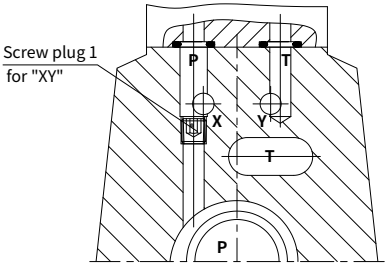
- **Type 3DRE...-...XY** Pilot oil supply external
  Pilot oil drain external

With this version, the pilot oil is supplied from a separate control circuit (external).
The pilot oil drain is not directed to the T-channel of the main valve,
but fed separately to the tank via port Y (external).

- **Type 3DRE...-.../...Y⋯** Pilot oil supply internal
  Pilot oil drain external

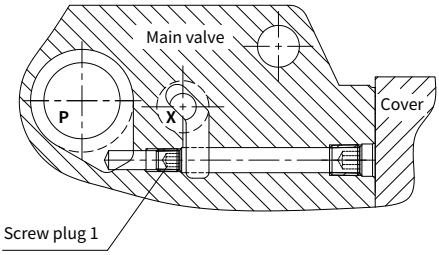
With this version, the pilot oil is supplied from the P-channel of the main valve (internal).
The pilot oil drain is not directed to the T-channel of the main valve,
but fed separately to the tank via port Y (external).
Port X on the subplate must be plugged.

Size 10



Pilot oil supply	external: 1 Closed internal: 1 Open
Pilot oil drain	external

Size 16



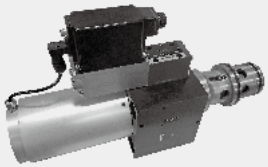
Pilot oil supply	external: 1 Closed internal: 1 Open
Pilot oil drain	external

6.8

2-and 3-way high-response flow valve

Type WRCE...L2X

NG 32~50
Up to 420 bar
Up to 4000 L/min



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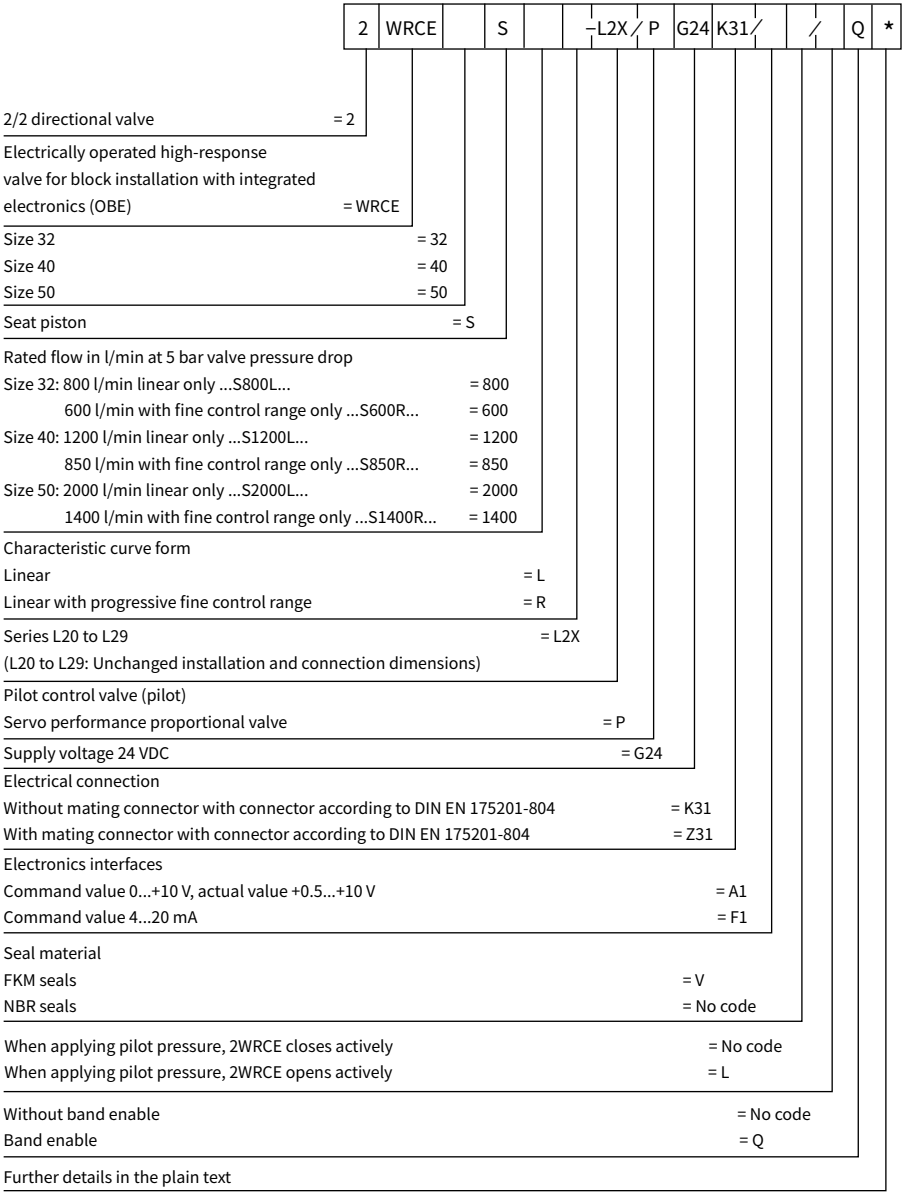
Features

-Pilot operated 2- and 3-way high-response valve in block installation design
-Suitable for closed-loop controlling of position, pressure, force and velocity
-Pilot control valve (pilot):
Directly actuated controlled directional valve, with control spool and sleeve in servo quality
-Main stage: closed-loop position controlled
-Integrated open and closed-loop control electronics (OBE)
-Typical applications:
· Plastic injection machines
· Die-casting machines
· Ceramics machines

Ordering code



Ordering code

3	WRCE				–L2X/	P	G24	K31/		/	Q	*

3/2 directional valve = 3

Electrically operated high-response valve for block installation with integrated electronics (OBE) = WRCE

Size 32 = 32
Size 40 = 40
Size 50 = 50

Control spool, zero overlap (+0.5...+1.5%) = V
Control spool, with 10...13% positive overlap = E

Rated flow in l/min at 5 bar valve pressure drop
Size32: 330l/min linear only...V330L... = 330
280 l/min with fine control range only ...E280P... = 280
Size 40: 420 l/min linear only ...V420L... = 420
360 l/min with fine control range only ...E360P... = 360
Size 50: 780 l/min linear only ...V780L... = 780
670 l/min with fine control range only ...E670P... = 670

Characteristic curve form
Linear = L
Linear with linear fine control range = P

Series L20 to L29 = L2X
(L20 to L29:Unchanged installation and connection dimensions)

Pilot control valve (pilot)
Servo performance proportional valve = P

Supply voltage 24 VDC = G24

Electrical connection
Without mating connector with connector according to DIN EN 175201-804 = K31
With mating connector with connector according to DIN EN 175201-804 = Z31

Electronics interfaces
Command value ±10 V, actual value ±10 V = A1
Command value 4...20mA, actual value 4...20 mA = F1

Seal material
FKM seals = V
NBR seals = No code

When applying pilot pressure, 3WRCE closes actively (from A to T) = No code
When applying pilot pressure, 3WRCE opens actively (from P to A) = L

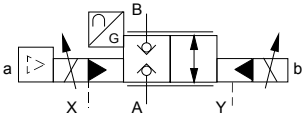
Without band enable = No code
Band enable = Q

Further details in the plain text

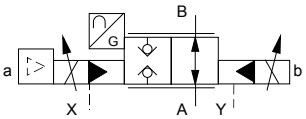
Symbols: 2WRCE

Simplified:

2WRCE..-L2X/P...

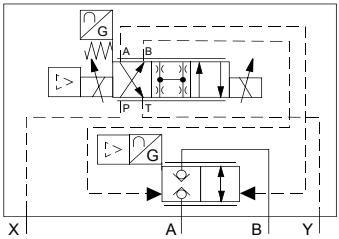


2WRCE..-L2X/P...L...

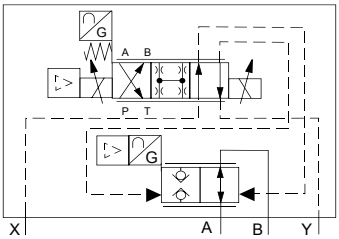


Detailed:

2WRCE..-L2X/P...



2WRCE..-L2X/P...L...

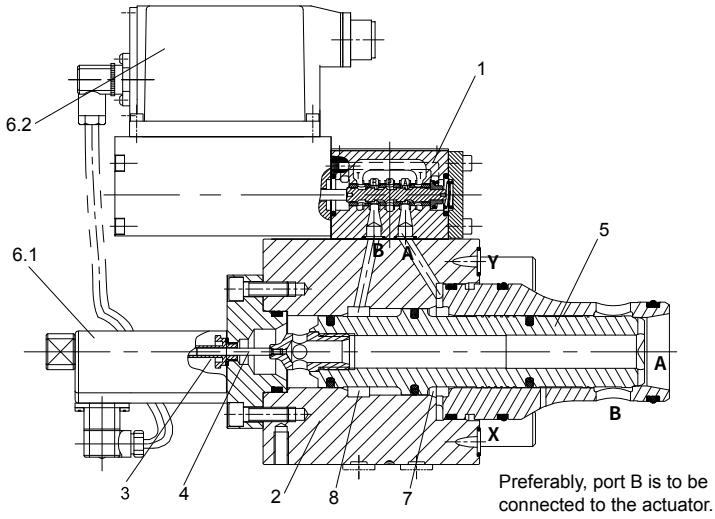


Function and configuration 2WRCE

Valves of type 2WRCE...-L2X/P... are 2-stage high-response valves.
They control the quantity and direction of a flow and are mainly used in control loops.

Set-up:
They consist of the following assemblies:
–The pilot control valve (1) as 1-stage proportional valve (pilot),
with a solenoid as electro-mechanical converters and a piston that is connected to the integrated pilot electronics via electrical feedback (6.2).
–The second stage (2) for flow control.
–An inductive position transducer (3) the core (4) of which is attached to the piston (5) of the second stage.
–Integrated LVDT electronics(6.1).

Type 2WRCE40...-L2X/P...

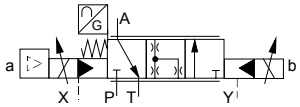


Function
The integrated electronics (OBE) compares command and actual values and the solenoids of the pilot control valve are actuated with a proportional current according to the control deviation.
The pilot control valve takes a proportionally controlled position and controls the flow in and out of the control chambers A (7) and B (8) that actuate the main spool (5) through the closed valve control loop up to 0 control deviation.
This means that the stroke of the main spool is regulated proportionally to the command value. It must be noted that the flow also depends on the valve pressure drop.

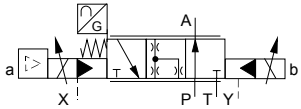
Symbols: 3WRCE

Simplified

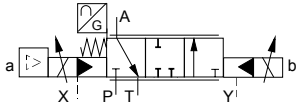
3WRCE..V...-L2X/P...



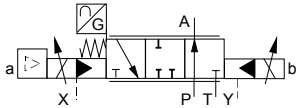
3WRCE..V...-L2X/P...L...



3WRCE..E...-L2X/P...

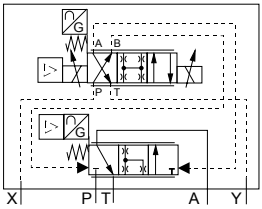


3WRCE..E...-L2X/P...L...

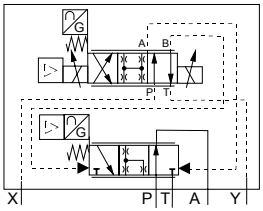


Detailed

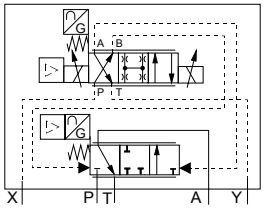
3WRCE..V...-L2X/P...



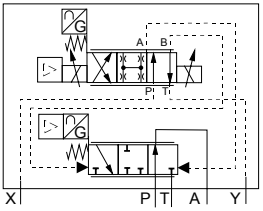
3WRCE..V...-L2X/P...L...



3WRCE..E...-L2X/P...



3WRCE..E...-L2X/P...L...



Function and configuration 3WRCE

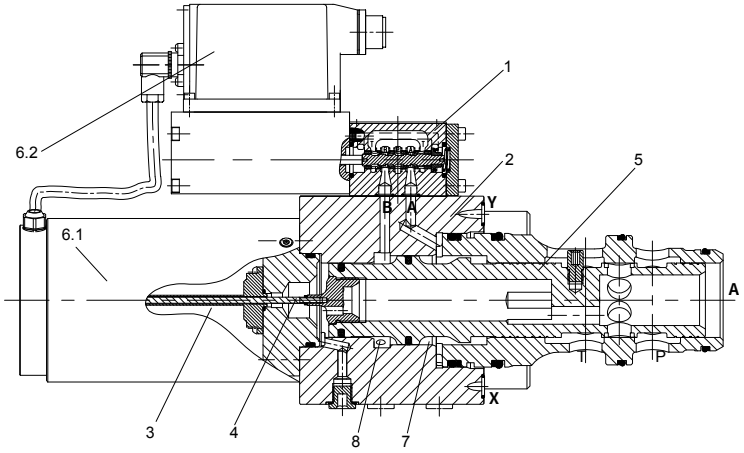
Valves of type 3WRCE...-L2X/P... are 2-stage high-response valves.They control the quantity and direction of a flow and are mainly used in control loops.

Set-up

They consist of the following assemblies:

– The pilot control valve (1) as 1-stage proportional valve (pilot), with a solenoid as electro-mechanical converters and a piston that is connected to the integrated pilot electronics via electrical feedback (6.2).
– The second stage (2) for flow control.
– An inductive position transducer (3) the core (4) of which is attached to the piston (5) of the second stage.
– Integrated LVDT electronics(6.1).

Type 3WRCE50..-L2X/P...



Function

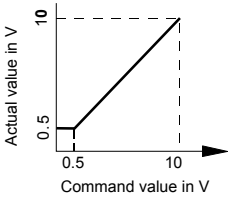
The integrated electronics (OBE) compares command and actual values and the solenoids of the pilot control valve are actuated with a proportional current according to the control deviation.
The pilot control valve takes a proportionally controlled position and controls the flow in and out of the control chambers A (7) and B (8) that actuate the main spool (5) through the closed valve control loop up to 0 control deviation.
This means that the stroke of the main spool is regulated proportionally to the command value. It must be noted that the flow also depends on the valve pressure drop.

Technical data Type 2WRCE

General					
Sizes			32	40	50
Weight		kg	11.2	17.3	24.6
Weight with shut-off valve ...../...WK or .../...WL...		kg	12.5	18.6	25.9
Size of the pilot control valve (pilot)		Size	6	6	6
Installation position			Any, preferably horizontal		
Storage temperature range		°C	–20 to +80		
Ambient temperature range		°C	–20 to +50		
Hydraulic (measured with HLP32, ϑ_{oil}=40°C ±5°C)					
Maximum operating pressures	– Main stage ports A, B	bar	350 for NG32~40,420 for NG50		
	– Pilot control valve port X	bar	315		
	– Pilot control valve port Y	bar	210		
Rated flow at Δp = 5 bar	– Design ...S...L (linear)	L/min	800	1200	2000
	– Design ...S...R (linear with progressive fine control range)		600	850	1400
Nominal flow of pilot valve at Δp=70 bar		L/min	12	40	40
Leakage of pilot valve at P = 100 bar		L/min	0.3	0.7	0.7
Hydraulic fluid			Mineral oil (HL,HLP) to DIN 51524		
Hydraulic fluid temperature range		°C	–20 to +80; preferably +40 to +50		
Viscosity range		mm^2/s	20 to 380; preferably 30 to 45		
Maximum admissible degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c)			Class 20/18/15		
Hysteresis		%	⩽ 0.2		
Range of inversion		%	⩽ 0.1		
Response sensitivity		%	⩽ 0.1		
Response time 0 ~ 100% step signal		ms	⩽ 20		

Electric					
Voltage type			Direct voltage		
Type of signal			Analog		
Opening point calibration		%	⩽ 1		
Zero shift upon change of:	– Hydraulic fluid temperature	%/10 K	⩽ 0.3	⩽ 0.3	⩽ 0.3
	– Pilot pressure in X	%/100 bar	⩽ 0.7	⩽ 0.7	⩽ 0.7
	– Return flow pressure in Y	%/bar	⩽ 0.3	⩽ 0.3	⩽ 0.3
Protection class of the valve according to EN60529			IP65 with mating connector mounted and locked		

Nominal command value range for 2WRC:
0 to +10 V ≙ 0 to 100%
In the command value range of 0 to 0.5 V, the actual value remains constant at 0.5 V.
In case of a slow command value modification from 0.5 V to +10 V, the actual value follows the command value within ±0.15 V.

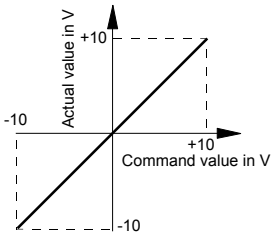


Technical data — Type 3WRCE

General					
Sizes			32	40	50
Weight		kg	12.6	18.3	25.6
Weight with shut-off valve ...../...WK or .../...WL...		kg	13.9	19.6	26.9
Size of the pilot control valve (pilot)		Size	6	6	6
Installation position			Any, preferably horizontal		
Storage temperature range		°C	–20 to +80		
Ambient temperature range		°C	–20 to +50		
Hydraulic (measured with HLP32, ϑ_{oil}= 40 °C ±5 °C)					
Maximum operating pressures	– Main stage ports A, B	bar	350 for NG32~40, 420 for NG50		
	– Pilot control valve port X	bar	315		
	– Pilot control valve port Y	bar	210		
Rated flow at Δ p = 5 bar	– Design ...S...L (linear)	L/min	330	420	780
	– Design ...S...R (linear with progressive fine control range)	L/min	280	360	670
Nominal flow of pilot valve at Δp = 70 bar		L/min	12	24	40
Leakage of pilot valve at P = 100 bar		L/min	0.3	0.5	0.7
Hydraulic fluid			Mineral oil (HL,HLP) to DIN 51524		
Hydraulic fluid temperature range		°C	–20 to +80; preferably +40 to +50		
Viscosity range		mm^2/s	20 to 380; preferably 30 to 45		
Maximum admissible degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c)			Class 20/18/15		
Hysteresis		%	⩽ 0.2		
Range of inversion		%	⩽ 0.1		
Response sensitivity		%	⩽ 0.1		
Response time 0 ~ 100% step signal		ms	⩽ 28		

Electric					
Voltage type			Direct voltage		
Type of signal			Analog		
Opening point calibration		%	⩽ 1		
Zero shift upon change of:	– Hydraulic fluid temperature	%/10 K	⩽ 0.3	⩽ 0.3	⩽ 0.3
	– Pilot pressure in X	%/100 bar	⩽ 0.7	⩽ 0.7	⩽ 0.7
	– Return flow pressure in Y	%/bar	⩽ 0.3	⩽ 0.3	⩽ 0.3
Protection class of the valve according to EN60529			IP65 with mating connector mounted and locked		

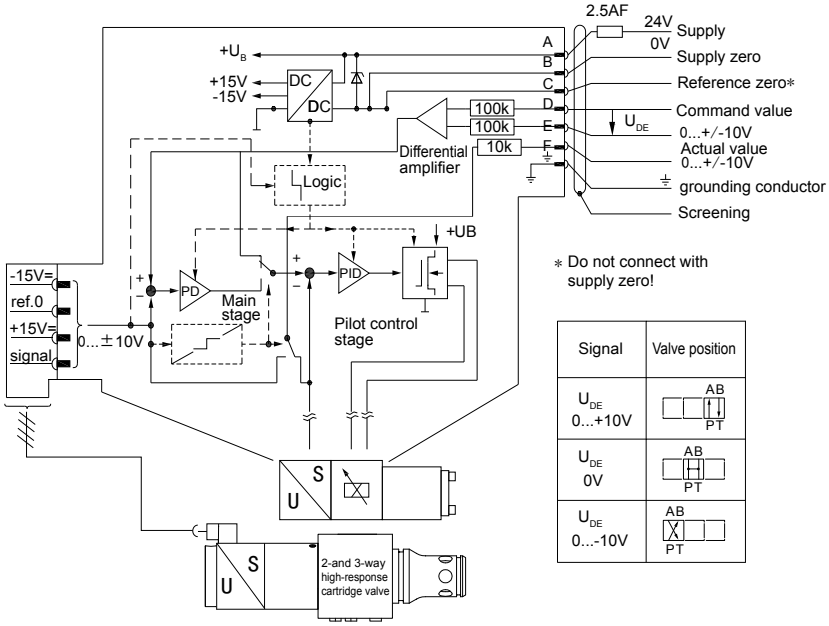
Nominal command value range for 3WRC:
0 to +10 V ≙ 0 to 100%
In the command value range of 0 to 0.5V, the actual value remains constant at 0.5 V.
In case of a slow command value modification from 0.5 V to +10 V, the actual value follows the command value within ±0.15 V.



06

Integrated electronics

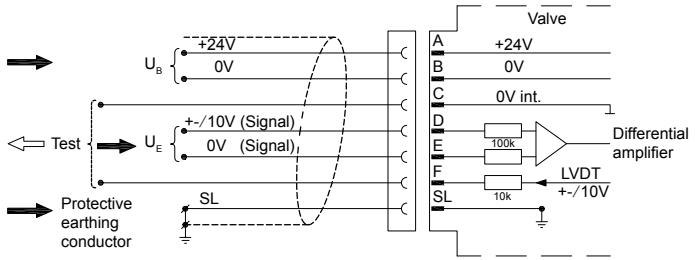
Block diagram/Pinout
Version A1: U_{D-E} 0...±10V



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

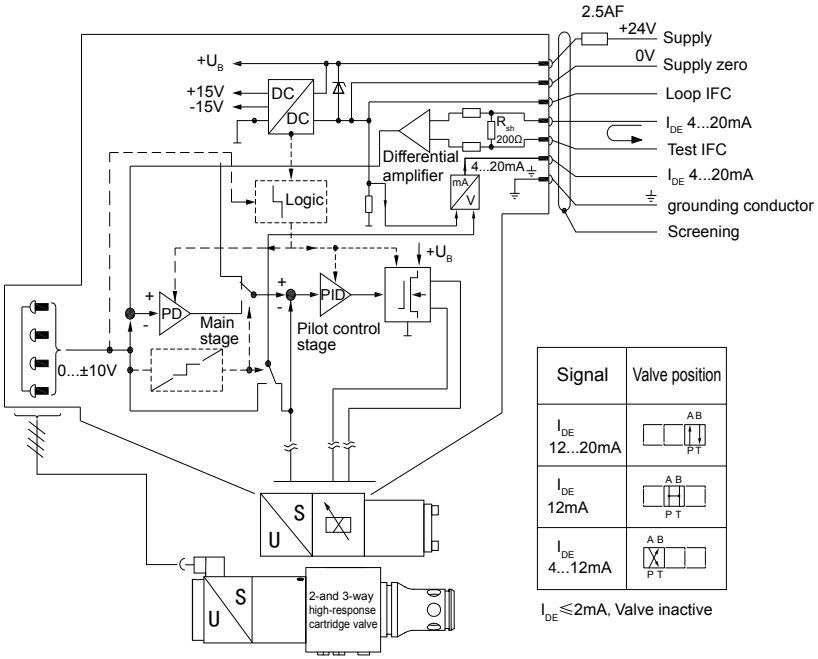
06

Pin assignment 6P+PE
Version A1: U_{D-E} 0...±10V



Integrated electronics

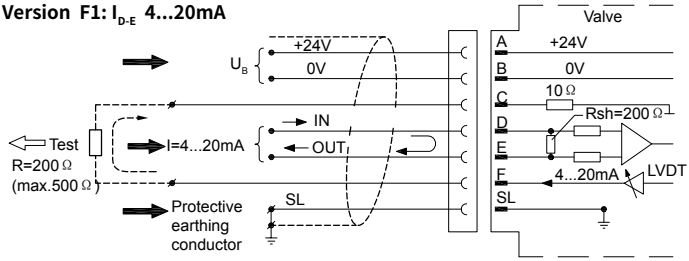
Block diagram / Pinout
Version F1: I_{D-E} 4...20mA



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

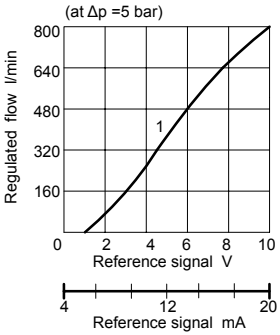
Pin assignment 6P+PE
Version F1: I_{D-E} 4...20mA

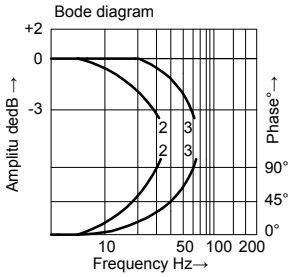


06

Characteristic curves (measured with HLP46, ϑ_{oil}=50°C , P=100bar)

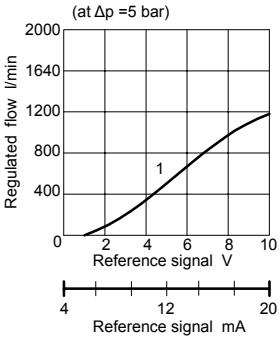
Type: 2WRCE32S800L-L2X/P...

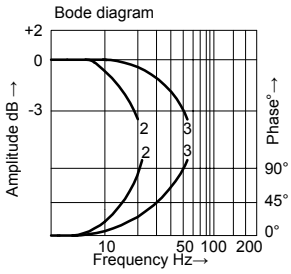




1= Ratedflow line
2= Command value:
10% ←→ 90%
3= Command value:
50% ± 5%

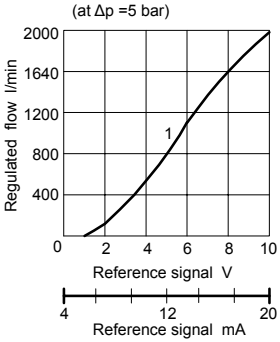
Type: 2WRCE40S1200L-L2X/P...

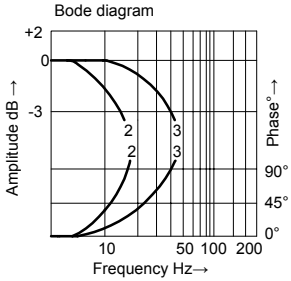




1= Ratedflow line
2= Command value:
10% ←→ 90%
3= Command value:
50% ± 5%

Type: 2WRCE50S2000L-L2X/P...

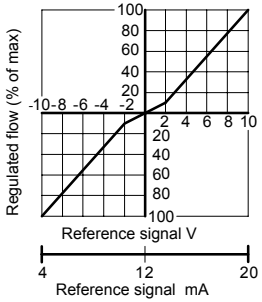




1= Ratedflow line
2= Command value:
10% ←→ 90%
3= Command value:
50% ± 5%

Characteristic curves (measured with HLP46, ϑ_{oil}=50°C , P=100bar)

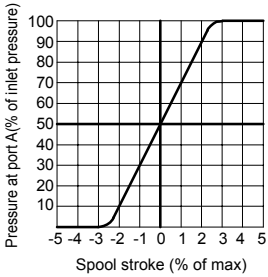
Type:3WRCE...-L2X/P...(all sizes)



Hydraulic configuration vs. reference signal:

Reference signal: 0 → 10V, 2 → 120mA P → A

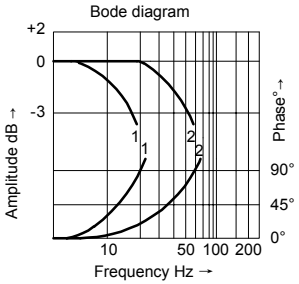
Reference signal: 0 → -10V, 4 → 12mA A → T



Type:3WRCE30V330L2X/P...

1= Command value: ±90%

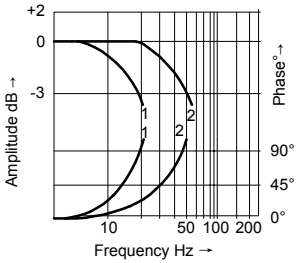
2= Command value: ± 5%



Type:3WRCE40V420L-L2X/P...

1= Command value: ±90%

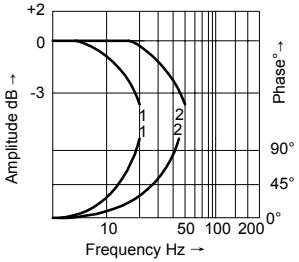
2= Command value: ± 5%



Type:3WRCE50V780L-L2X/P...

1= Command value: ±90%

2= Command value: ± 5%

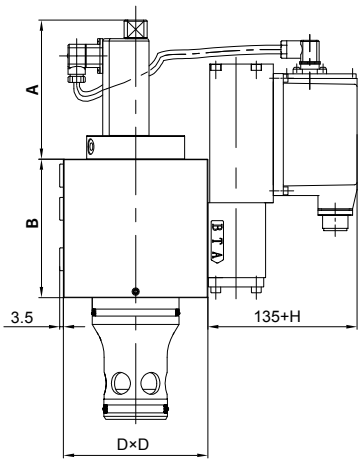


06

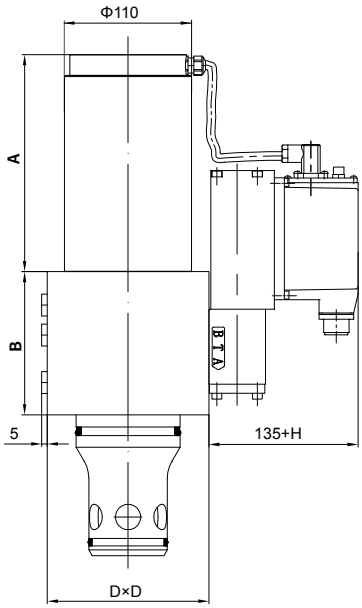
Unit dimensions: Types 2WRCE

(nominal dimensions in mm)

Size 32/40



Size 50

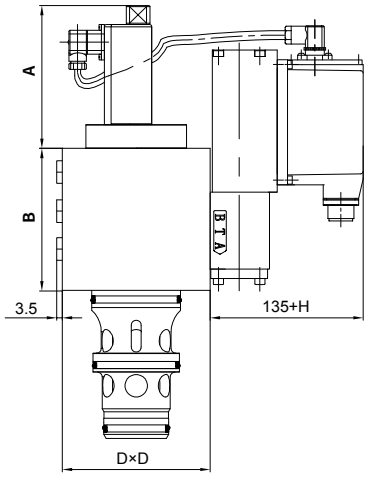


Size	A	B	C	H only for 2WRCE... WK15... 2WRCE... WL15...	Fastening bolts class 12.9	Tightening torque
32	135	105	100	50	4- M16×60	300 Nm
40	148	120	125	50	4- M20×70	600 Nm
50	188	124	140	50	4- M20×80	600 Nm

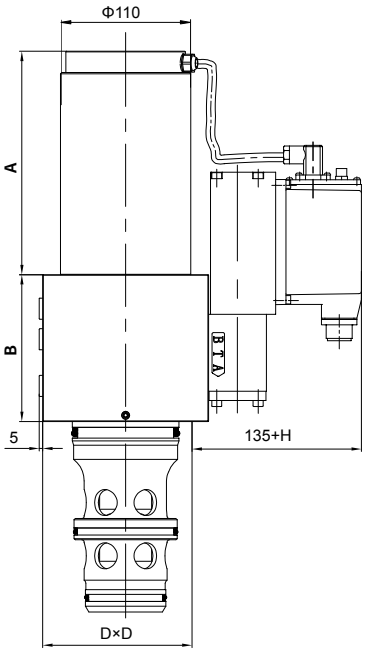
Unit dimensions: Types 3WRCE

(nominal dimensions in mm)

Size 32/40



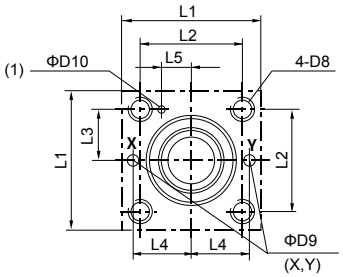
Size 50



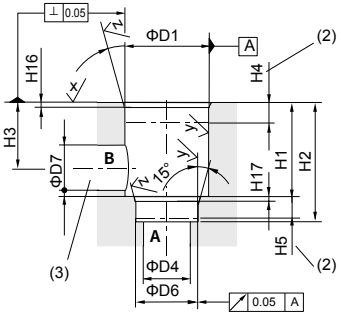
Size	A	B	C	H only for 3WRCE... WK15... 3WRCE... WL15...	Fastening bolts class 12.9	Tightening torque
32	123	105	100	50	4- M16×60	300 Nm
40	123	120	125	50	4- M20×70	600 Nm
50	188	124	140	50	4- M20×80	600 Nm

Installation dimensions according to DIN ISO 7368

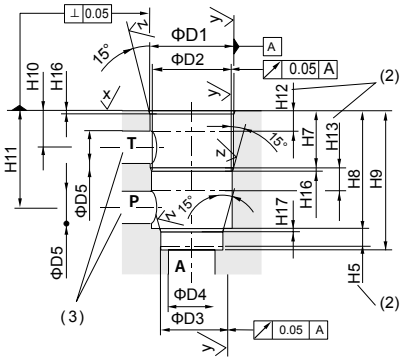
(dimensions in mm)



Installation bore type 2WRCE



Installation bore type 3WRCE



Size	32	40	50
L1	105	125	140
L2±0.2	70	85	100
L3±0.2	35	42.5	50
L4±0.2	41	50	58
L5	17	23	30
$\Phi D1^{H7}$	60	75	90
$\Phi D2^{H7}$	58	73	87
$\Phi D3^{H7}$	55	55	68
ΦD4	32	40	50
ΦD5	24	30	35
$\Phi D6^{H7}$	45	55	68
ΦD7	32	40	50
D8	M16	M20	M20
max.ΦD9	8	10	10
ΦD10	6	6	8
$H1\ ^{+0.2}_{0}$	70	87	100
$H2\ ^{+0.2}_{0}$	85	105	122
H3	52	64	72
H4	30	30	35
H5	13	15	17
H7	43.5	54	87
H8	85	105	143
H9	100	125	165
H10	30	36	66
H11	70.5	87	122
H12	18	21	48
H13	15	18	18
H16	2.5	3	4
H17	2.5	3	3
H18	35	45	45

$\sqrt{^{x}} = \sqrt{R_{max}\,4}$

$\sqrt{^{y}} = \sqrt{R_{max}\,8}$

$\sqrt{^{z}} = \sqrt{R_{z}\,10}$

(1) Locating hole for locking pin

(2) Depth of fit minimum dimension

(3) The ports P, T and B can be positioned around the central axis of port A.
Sufficient distance from the mounting bores and control bores is to be observed.

6.9

Proportional directional valves

Type 4WRA and 4WRAE

NG 6 and 10
Up to 315 bar
Up to 75 L/min

Contents

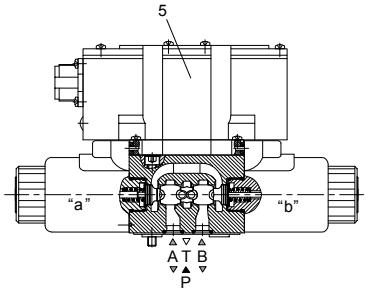
Function and configuration	02
Symbols	03
Ordering code	03
Technical data	04
Electrical connections,	05
plug-in connectors	05
Characteristic curves	06-08
Unit dimensions	09-12

Features

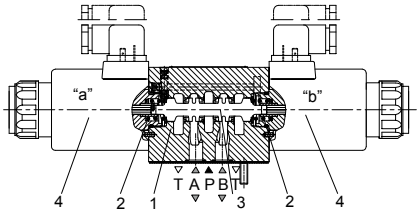
- Direct operated proportional directional valve to control the direction and magnitude of a flow
- For subplate mounting: Porting pattern conforms to ISO4401
- Actuation by means of proportional solenoids with central thread and removable coil
- Spring centred control spool
- Control electronics 4WRAE...L2X: integrated electronics (OBE) with voltage input or current input (A1 resp. F1)
  4WRA...L2X: available module amplifier

Function and configurations

The 4/2- and 4/3-way proportioanl directional valves are designed as direct operated components for subplate mounting. They are actuated by means of proportional solenoids with central thread and removable coil. The solenoids are controlled either by external control electronics (type 4WRA...L2X) or by integrated control electronics (type 4WRAE...L2X).
The valves basically consist of: Body (1) with mounting surface, Control spool (3) with compression springs (2), Solenoids (4) with central thread, Optional integrated electronics (5)
With the solenoids (4), de-energised, the control spool (3) is held in the central position by the compression springs (2).
Direct operation of the control spool (3) by energising one of the proportional solenoids(4) e.g. control of solenoid right, then movement of the control spool (3) to the left in proportion to the electrical input signal, and connection from P to A and B to T via orifice-like crosssections with progressive flow characteristics.

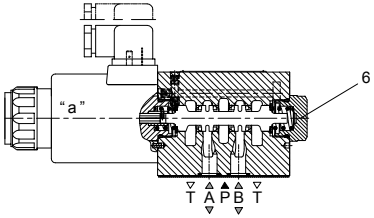


Type 4WRAE 6...-L2X/...

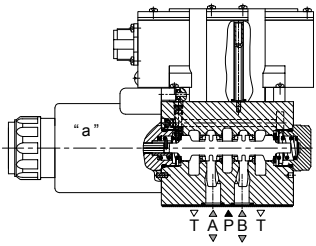


Type 4WRA 10...-L2X/...

4WRA(E)...A-L2X the 2 switched position valves are however only fitted with solenoid "a".
A plug (6) is fitted in place on the "b" proportional solenoid.



Type 4WRA 10...A-L2X/...

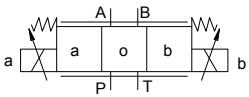


Type 4WRAE 10...A-L2X/...

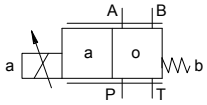
Symbols

Without integrated electronics

Type 4WRA...-L2X/...

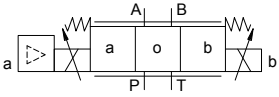


Type 4WRA...A-L2X/...

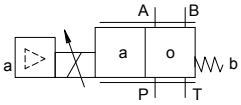


With integrated electronics

Type 4WRAE...-L2X/...



Type 4WRAE...A-L2X/...



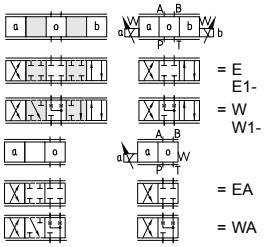
Ordering code

4WRA | | | | – L2X / G24 | | | / | | *

Without integrated =No code
With integrate = E

Nominal size 6 =6
Nominal size 10 =10

Spool symbols



☐ Transitional symbols

With symbols E1 -and W1-:
P → A: q_{vmax} B → T: $q_v/2$
P → B: $q_v/2$ A → T: q_{vmax}

Note: For spools W and WA there is, in the neutral position, aconnection between A to T and B to T with approx.3% of the elevant nominal crossse-ction.

Further information in plain text

V = FKM
No code = NBR

No code = for 4WRA
Interface A1 or F1 for 4WRAE:
A1= Command value input ±10V
F1=Command value input 4 to 20mA

4WRA: Z4= With plug-in connector
K4= Without plug-in connector
DT= Without plug-in Deutsch connector
4WRAE: K31= Without plug-in connector
Z31= With plug-in connector

No code = Without hand override
N9 = With protected hand override

Solenoid type(current)
No code= Solenoid current 2.5A
-15= Solenoid current 1.5A
- 8= Solenoid current 0.8A

Power supply voltage of electric control device:
G24= Power supply voltage 24VDC

L2X= Series L20~L29
(L20 to L29, unchanged installation and connection dimensions)

Nominal flow at a valve pressure differential ΔP=10bar
NG6: 07= 7L/min
15= 15L/min
30= 26L/min
NG 10: 30= 30L/min
60= 60L/min

06

Technical data

1. Hydraulic					
Installation			Optional, preferably horizontal		
Nominal size			6		10
Weight	4WRA...L2X	Kg	2.0		6.6
	4WRAE...L2X		2.2		6.8
Nominal flow Q_{vnom} at Δp = 10 bar		L/min	7,15,26		30,60
Hysteresis		%	⩽ 5		
Reversal span		%	⩽ 1		
Response sensitivity		%	⩽ 0.5		
Max.operating pressure	Ports A, B, P	bar	315		
	Port T	bar	210		
Pressure fluid			Mineral oil (HL, HLP) to DIN 51524		
			Other pressure fluids on request!		
Ambient air temperature range	4WRA...L2X	°C	-20°C to 70°C (-4° F to 158° F)		
	4WRAE...L2X	°C	-20°C to 50°C (-4° F to 122° F)		
Viscosity range		mm^2/s	20 to 380 (preferably 30 to 46)		
Fluid Cleanliness Class			NAS1638 class9 or ISO 4406 class 20/18/15		

2. Electrical					
1) Solenoid data					
Voltage type			DC		
Command value signal for 4WRAE			±10V or 4 ～ 20mA		
Max.current per solenoid		A	2.5	1.5	0.8
Solenoid coil resistance	Cold value at 20°C	Ω	2	4.8	19.5
	Max.warm value		3	7.2	28.8
Duty		%	ED100%		
Max.coil temperature		°C	150		
Valve protection to EN 60529			IP 65		
2) Control electronics					
Amplifier	4WRA...L2X		VT-VSPA2-...-L2X		
	4WRAE...L2X		Integrated in the valve(OBE)		
Supply voltage	Nominal voltage	VDC	24		
	Lower limiting value	V	21/22(4WRA), 19(4WRAE)		
	Upper limiting value	V	35		
Amplifier power consumption	I_{max}	A	<1.8		
	Impulse current	A	3		

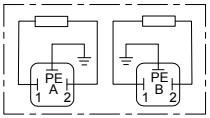
Electrical connections, plug-in connectors

nominal dimensions in mm

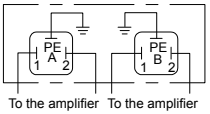
· **For type 4WRE...L2X** (without integrated electronics)

Connections on the component plug

Plug-in connector to DIN EN 175301-803 or ISO 4400



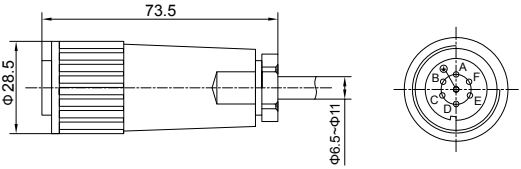
Connections on the plug-in connector



· **For type 4WRAE...L2X** (with integrated electronics (OBE))

For pin allocation also see block circuit diagram.

Plug-in connector to DIN EN 175201-804



· Integrated control electronics for type 4WRAE

Component plug allocation

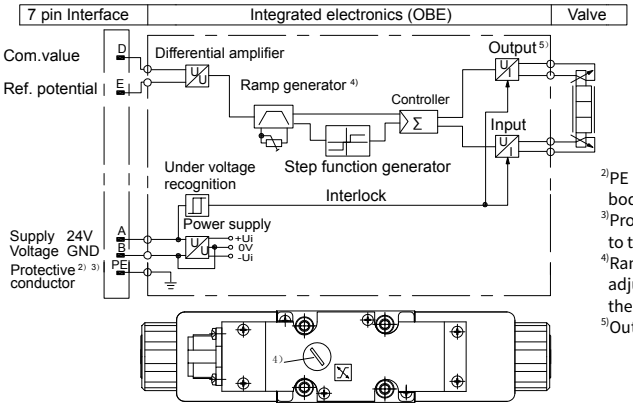
	Contact	Interface A1 signal	Interface F1 signal
Supply voltage	A	24 VDC(U(t)=19V to 35V)	
	B	GND	
	C	n.c. [1]	
Differential amplifier input	D	±10V, Re>50KΩ	4 to 20mA, Re>100Ω
	E	reference potentional command value	
	F	n.c. [1]	

[1] Contacts C and F must not be connected!

Connection cable:
Recommended:
– up to 25 m cable length type LiYCY 7x0.75 mm²;
– up to 50 m cable length type LiYCY 7x1.0 mm².
For outside diameter see plug-in connector sketch.
Only connect screen to PE on the supply line.

Command value:
A positive command value 0 to +10 V (or 12 to 20 mA) at D and the reference potential at E results in a flow from P to A and B to T. A negative command value 0 to –10 V (or 12 to 4 mA) at D and the reference potential at E results in a flow from P to B and A to T.
For a valve with 1 solenoid on side a (e.g. spool variants EA and WA) a positive command value at D and the reference potential at E results in a flow from P to B and A to T.

· Integrated electronics (OBE) for type 4WRAE...L2X



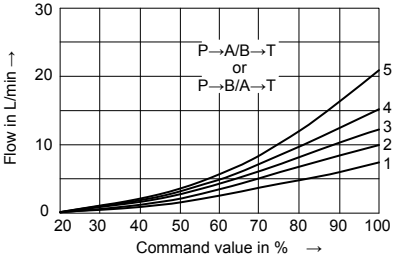
[2] PE is connected to the cooling body and the valve housing!
[3] Protective conductor screwed to the valve housing and cover.
[4] Ramp can be externally adjusted from 0 to 2.5s, the same applies for T_{up} and T_{down}.
[5] Output stages current regulated.

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

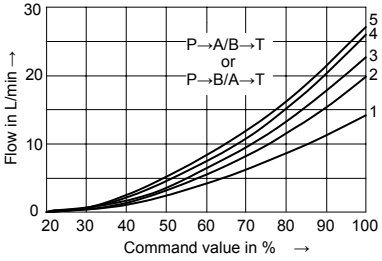
· Type 4WRAE (NG 6 and 10)

NG 6

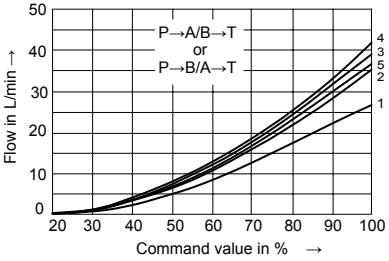
7 L/min nominal flow at a 10 bar valve pressure differential



15 L/min nominal flow at a 10 bar valve pressure differential



30 L/min nominal flow at a 10 bar valve pressure differential

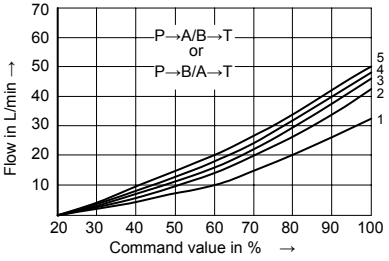


1 Δp=10bar constant
2 Δp=20bar constant
3 Δp=30bar constant
4 Δp=50bar constant
5 Δp=100bar constant

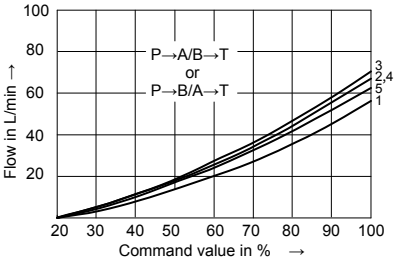
Δp=Valve pressure differential
(inlet pressure p_p minus loadpressure $p_L$minus return pressure p_T)

NG 10

30 L/min nominal flow at a 10 bar valve pressure differential



60 L/min nominal flow at a 10 bar valve pressure differential

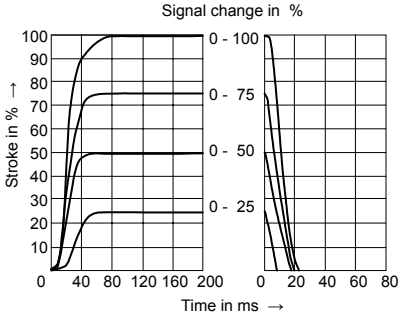


1 Δp=10bar constant
2 Δp=20bar constant
3 Δp=30bar constant
4 Δp=50bar constant
5 Δp=100bar constant

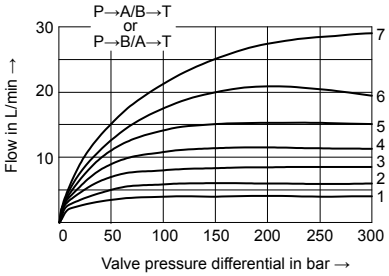
Δp=Valve pressure differential
(inlet pressure p_p minus load pressure p_L minus return pressure p_T)

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

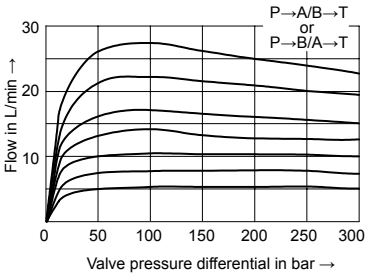
NG 6 Transient function with a stepped form of electrical input sign



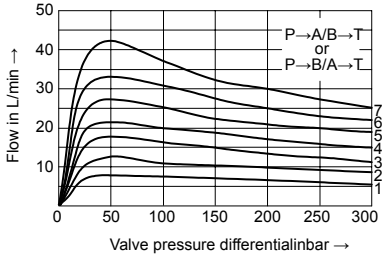
Performance limit, nominal flow 7 l/min



Performance limit, nominal flow 15 l/min



Performance limit, nominal flow 30 l/min

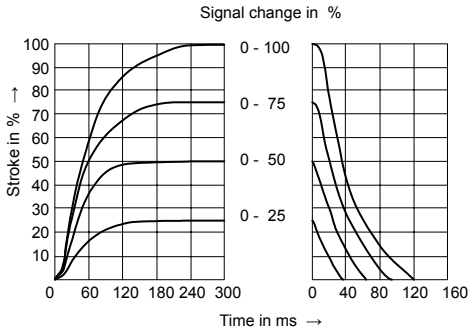


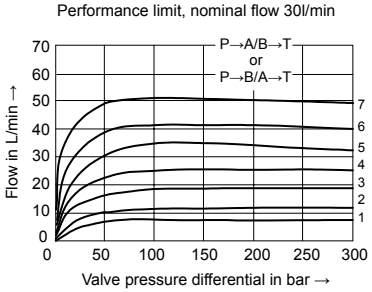
1.Com. value = 40 %
2.Com. value = 50 %
3.Com. value = 60 %
4.Com. value = 70 %
5.Com. value = 80 %
6.Com. value = 90 %
7.Com. value = 100 %

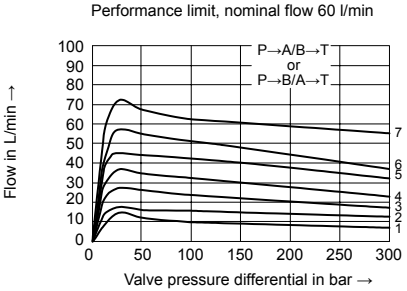
If the performance limits are exceeded then flow forces occur which lead to uncontrolled spool movements.

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

NG 10 Transient function with a stepped form of electrical input sign







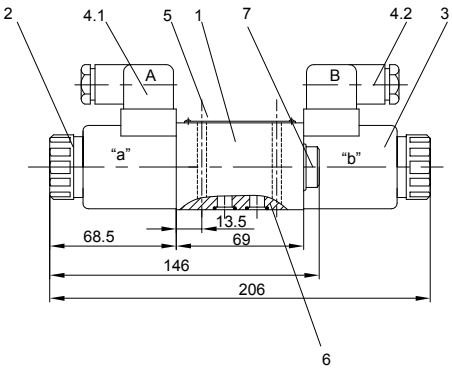
1.Com. value = 40 %
2.Com. value = 50 %
3.Com. value = 60 %
4.Com. value = 70 %
5.Com. value = 80 %
6.Com. value = 90 %
7.Com. value = 100 %

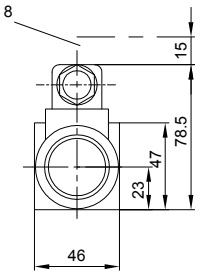
If the performance limits are exceeded then flow forces occur which lead to uncontrolled spool movements.

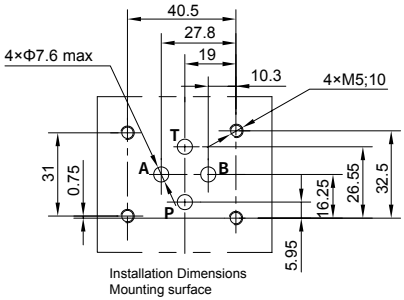
Unit dimensions

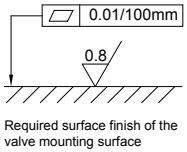
(nominal dimensions in mm)

Type 4WRA6...L2X









1 Valve housing
2 Proportional solenoid "a"
3 Proportional solenoid "b"
4.1 Plug-in connector "A"
4.2 Plug-in connector "B"
5 Name plate
6 Identical seal rings for ports A, B, P and T
(R-ring 9.81×1.5×1.78 or O-ring 9.25×1.78)
7 Plug for valves with one solenoid
(2 switching positions, versions EA or WA)
8 Space required to remove the
plug-in connector

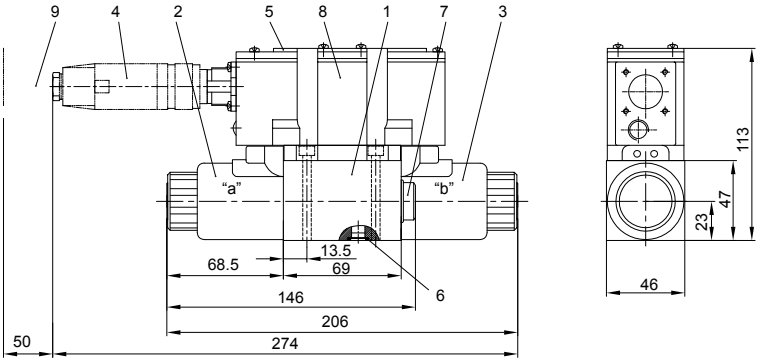
Valve mounting screws
The following valve fixing screws
are recommended:
- 4 S.H.C.S.ISO 4762 - M5×50 - 10.9
- 4 GB / T 70.1 - M5×50 - 10.9
- Tightening torque M_A = 8.9 Nm ± 10%

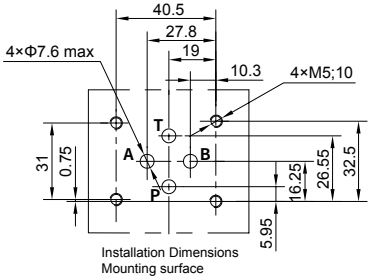
06

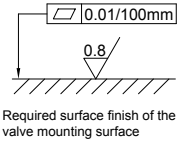
Unit dimensions

(nominal dimensions in mm)

Type 4WRAE6...L2X







1 Valve housing
2 Proportional solenoid "a"
3 Proportional solenoid "b"
4 Plug-in connector
5 Name plate
6 Identical seal rings for ports A, B, P and T
(R-ring 9.81×1.5×1.78 or O-ring 9.25×1.78)
7 Plug for valves with one solenoid
(2 switching positions, versions EA or WA)
8 Integrated electronics (OBE)
9 Space required to remove
the plug-in connector

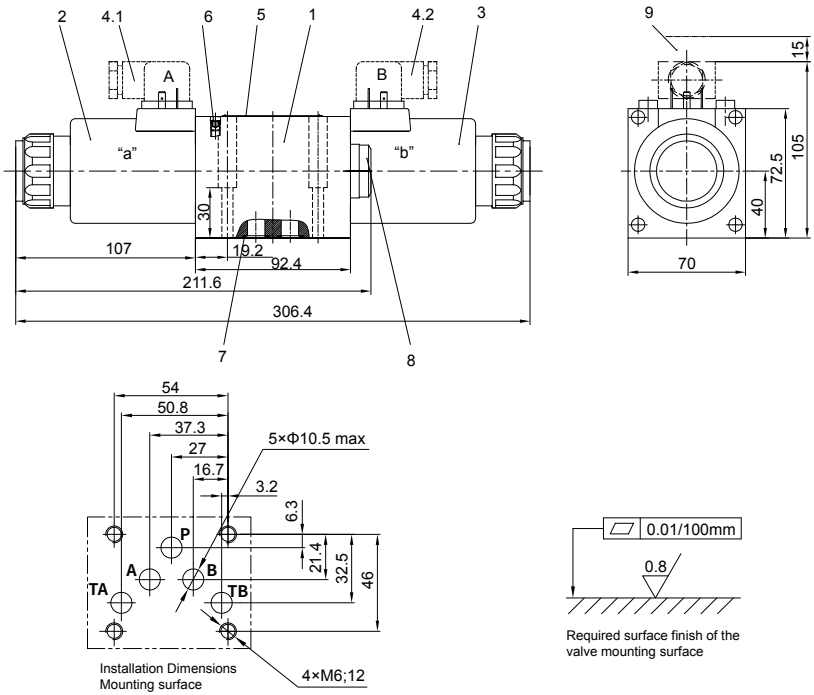
Valve mounting screws

The following valve fixing screws are recommended:
- 4 S.H.C.S.ISO 4762 - M5×50 - 10.9
- 4 GB / T 70.1 - M5×50 - 10.9
- Tightening torque M_A = 8.9 Nm ± 10%

Unit dimensions

(nominal dimensions in mm)

Type 4WRA10...L2X



1 Valve housing
2 Proportional solenoid "a"
3 Proportional solenoid "b"
4.1 Plug-in connector "A"
4.2 Plug-in connector "B"
5 Name plate
6 Valve bleed screw
7 Identical seal rings for ports A, B, P and T
(R-ring 13×1.6×2 or O-ring 12×2)
8 Plug for valves with one solenoid
(2 switching positions, versions EA or WA)
9 Space required to remove the plug-in connector

Valve mounting screws

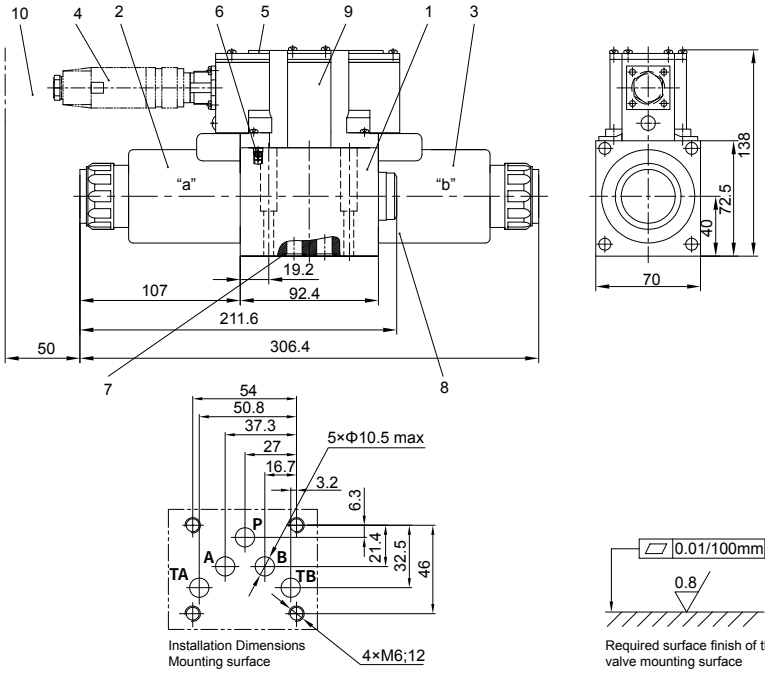
The following valve fixing screws are recommended:

- 4 S.H.C.S.ISO 4762 - M6×40 - 10.9
- 4 GB / T 70.1 - M6×40 - 10.9
- Tightening torque
M_A = 15.5 Nm ± 10%

Unit dimensions

(nominal dimensions in mm)

Type 4WRAE10...L2X



1 Valve housing
2 Proportional solenoid "a"
3 Proportional solenoid "b"
4 Plug-in connector
5 Name plate
6 Valve bleed screw
7 Identical seal rings for ports A, B, P and T
(R-ring 13×1.6×2 or O-ring 12×2)
8 Plug for valves with one solenoid
(2 switching positions, versions EA or WA)
9 Integrated electronics (OBE)
10 Space required to remove the plug-in connector

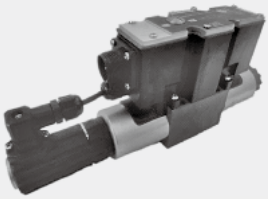
Valve mounting screws
The following valve fixing screws are recommended:
- 4 S.H.C.S.ISO 4762 - M6×40 - 10.9
- 4 GB / T 70.1 - M6×40 - 10.9
- Tightening torque M_A = 15.5 Nm ± 10%

6.10

Proportional directional valves

Type 4WRE and 4WREE

NG 6 and 10
Up to 315 bar
Up to 180 L/min



Contents

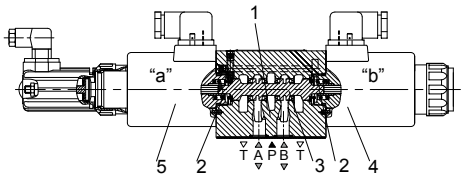
Function and configuration	02
Symbols	03
Ordering code	03
Technical data	04
Electrical connections, plug-in connectors	05
Integrated electronics	06-07
Characteristic curves	07-10
Unit dimensions	11-14

Features

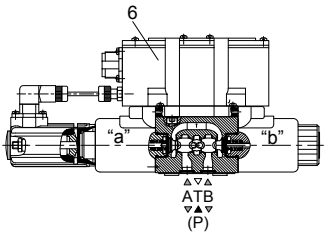
- Direct operated proportional directional valve with electrical position feedback
- Closed loop control of the direction and size of a flow
- Operation is by proportional solenoids with a central thread and removable coil
- For subplate mounting: Porting pattern conforms to ISO 4401
- Spring centred control spool
- Integrated electronics (OBE) with voltage input or current input (A1 resp. F1)
- 4WRE separate order: analogue module amplifier

Function and configurations

4WRE(E) are operated by proportional solenoids with central thread and removalbe coil. The solenoids are optionally controlled by either external electronics (type 4WRE) or by the integrated electronics (type 4WREE).
The valve basically consists of: Housing (1), Compression springs (2), Control spool (3), and Solenoid (4 and 5) with central thread, Solenoid(5) with position transducer and optional integrated control electronics (6).
In the de-energised condition the spool (3) is held in a mechanical centre position by the solenoid return springs (2).
– With the solenoids (4), de-energised, the control spool (3) is held in the central position by the compression springs (2).
– Direct operation of the control spool (3) by energising one of the proportional solenoids (4, 5) e.g. control of solenoid right, then movement of the control spool (3) to the left in proportion to the electrical input signal, and connection from P to A and B to T via orifice-like crosssections with progressive flow characteristics.

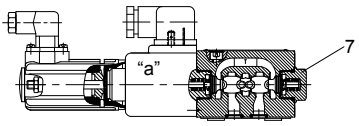


Type 4WRE 10...-L2X/...

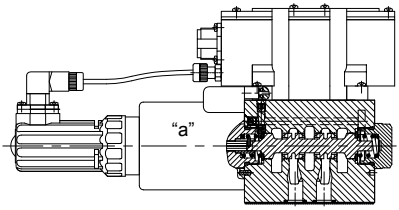


Type 4WREE 6...-L2X/...

4WRE(E)...A-L2X the 2 switched position valves are however only fitted with solenoid "a".
A plug (7) is fitted in place on the "b" proportional solenoid.



Type 4WRE 6...A-L2X/...

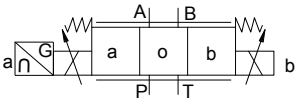


Type 4WREE 10...A-L2X/...

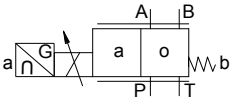
Symbols

Without integrated electronics

Type 4WRE...-L2X/...

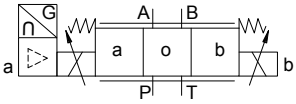


Type 4WRE...A-L2X/...

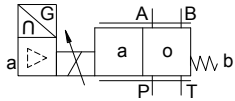


With integrated electronics

Type 4WREE...-L2X/...



Type 4WREE...A-L2X/...



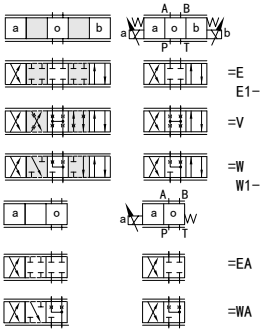
Ordering code

4WRE | | | | – L2X / G24 | | | * |

Without integrated =No code
With integrate = E

Nominal size 6 =6
Nominal size 10 =10

Spool symbols



☐ Transitional symbols

With symbols E1 -and W1-:
P → A: $q_{v\,max}$ B → T: $q_v/2$
P → B: $q_v/2$ A → T: $q_{v\,max}$

Note: For spools W and WA there is, in the neutral position, aconnection between A to T and B to T with approx.3% of the elevant nominal crossse-ction.

Further information in plain text
V = FKM
No code = NBR

No code = For 4WRE:
Interface A1 or F1 for 4WREE:
A1= Command value input ±10V
F1= Command value input 4 to 20mA

4WRE: Z4= With plug-in connector
K4= Without plug-in connector
4WREE: K31= Without plug-in connector
Z31= With plug-in connector

Power supply voltage of electric control device:
G24= Power supply voltage 24VDC

L2X= Series L20~L29
(L20 to L29,unchanged installation and connection dimensions)

Nominal flow at a valve pressure differential		ΔP=10bar
NG 6:	08=	8L/min
	16=	16L/min
	32=	32L/min
NG 10:	25=	25L/min
	50=	50L/min
	75=	75L/min

Technical data

1. Hydraulic				
Installation			Optional, preferably horizontal	
Nominal size			6	10
Weight	4WRE...L2X	Kg	2.2	6.3
	4WREE...L2X		2.4	6.5
Nominal flow q_{nom} at Δp = 10 bar		L/min	8, 16, 32	25, 50, 75
Hysteresis		%	⩽ 0.1	
Reversal span		%	⩽ 0.05	
Response sensitivity		%	⩽ 0.05	
Max.operating pressure	Ports A, B, P	bar	315	
	Port T	bar	210	
Pressure fluid			Mineral oil (HL, HLP) to DIN 51524	
			Other pressure fluids on request!	
Ambient air temperature range	4WRA...L2X	°C	-20°C to 70°C (-4° F to 158° F)	
	4WRAE...L2X	°C	-20°C to 50°C (-4° F to 122° F)	
Viscosity range		mm^2/s	20 to 380 (preferably 30 to 46)	
Fluid Cleanliness Class			NAS1638 class9 or ISO 4406 class 20/18/15	

2. Electrical				
1) Solenoid data				
Nominal size			6	10
Voltage type			DC	
Command value signal for 4WREE			±10V or 4 ~ 20mA	
Max.current per solenoid		A	2.5	
Solenoid coil resistance	Cold value	Ω	2.7	3.7
	Max.warm value		4.05	5.55
Duty		%	ED100%	
Max.coil temperature		°C	150	
Valve protection to EN 60529			IP 65	
2) Control electronics				
Amplifier	4WRE...L2X		VT-VSPA2-...-L2X	
	4WREE...L2X		integrated in the valve(OBE)	
Supply voltage	Nominal voltage	VDC	24	
	Lower limiting value	V	19.4	
	Upper limiting value	V	35	
Amplifier power consumption	Imax	A	< 2	
	Impulse current	A	3	

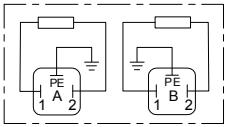
Electrical connections, plug-in connectors

nominal dimensions in mm

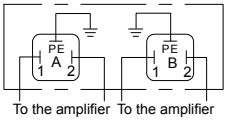
· **For type 4WRE...L2X** (without integrated electronics)

Connections on the component plug

Plug-in connector to DIN EN 175301-803 or ISO 4400



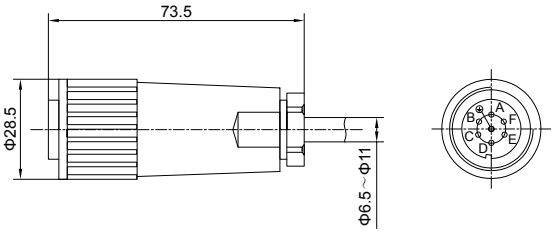
Connections on the plug-in connector



· **For type 4WREE...L2X** (with integrated electronics (OBE))

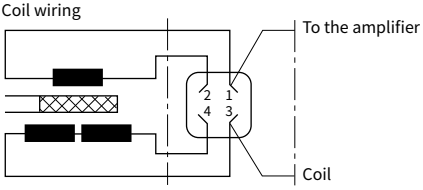
For pin allocation also see block circuit diagram.

Plug-in connector to DIN EN 175201-804

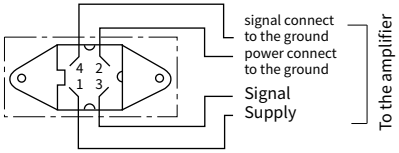


· **Inductive position sensor**

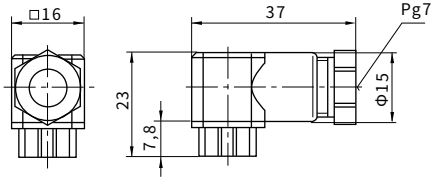
Coil wiring



connect to the plug



Plug connector 4 pin Pg7-G4W1F
Connecting cables:
Recommend: For cables up to 50 m in length,
Please use a cable of type LiYCY 4×0.25 mm²
Connect the shield to the PE only on the supply side.



06

Integrated control electronics for type 4WREE

Component plug allocation

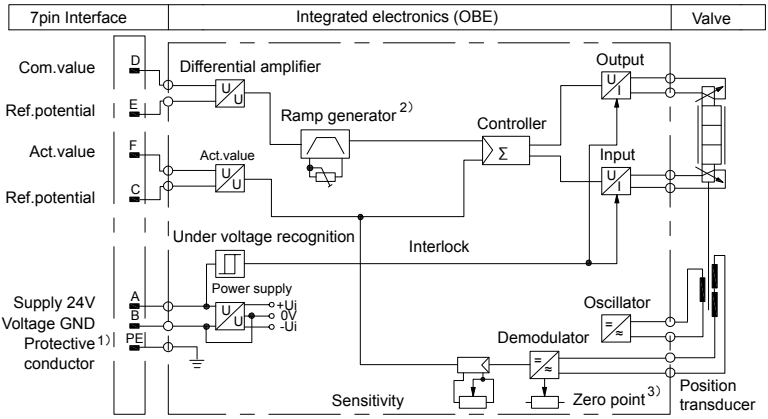
	Contact	Interface A1 signal	Interface F1 signal
Supply voltage	A	24 VDC(U(t)=19.4V to 35V), I_{max} =2A	
	B	0V	
Reference potential (actual value)	C	ref.contact F, Re>50KΩ	ref.contact F, Re<10Ω
Differential amplifier input	D	±10V, Re>50KΩ	4 to 20mA, Re>100Ω
	E	Reference potentional command value	
Measurement output (actual value)	F	±10 V actual value (limiting load 5 mA)	4 to 20 mA actual value, load resistance max.300Ω
	PE	Connected with cooling body and valve housing	

Command value: A positive command value 0 to +10V (or 12 to 20 mA) at D and the reference potential at E results in a flow from P to A and B to T.
A negative command value 0 to –10V (or 12 to 4 mA) at D and the reference potential at E results in a flow from P to B and A to T.
For a valve with 1 solenoid on side a (e.g. spool variants EA and WA) a positive command value at D and the referencepotential at E results in a flow from P to B and A to T.

Actual value: A positive actual value 0 to +10V (or 12 to 20mA) at F and the reference potential at C results in flow from P to A and B to T,
A negative actual value 0 to –10V (or 4 to 12mA) at F and the reference potential at C results in flow from P to B and A to T.
With valves with 1 solenoid, a positive actual valueat F and referencepotential at C results in flow from P to B and A to T.

Connection cable: Recommended: – up to 25 m cable length type LiYCY 7×0.75 mm²
– up to 50 m cable length type LiYCY 7×1.0 mm²
For outside diameter see plug-in connector sketch
Only connect screen to PE on the supply line.

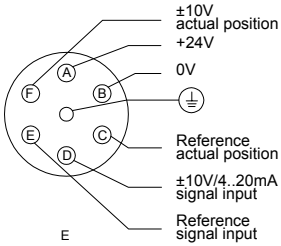
Integrated electronics (OBE) for type 4WREE...L2X

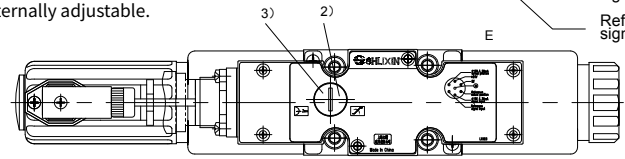


Integrated control electronics for type 4WREE

Note: Electrical signals processed by control electronics (e.g. actual value) must not be used for switching off safety relevant machine functions!

1) The protective conductor (PE) is connected to the cooling body and the valve housing!
2) The ramp is externally adjustable from 0 to 2.5 s, the same applies for T_{up} and T_{down}.
3) Zero point is externally adjustable.



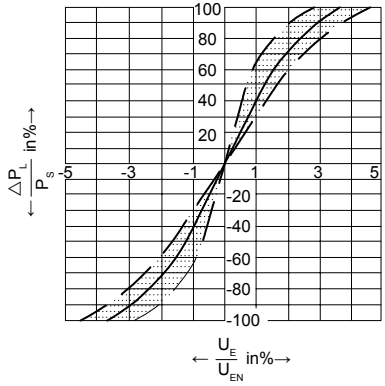


Characteristic curves (measured with HLP46, ϑ_{oil}=40°C ±5°C)

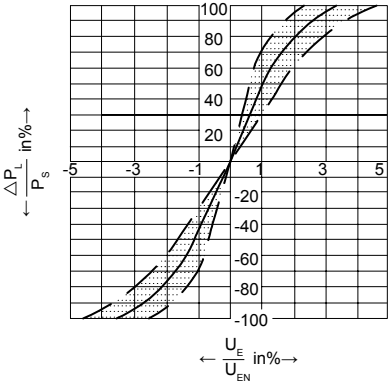
· Type 4WREE (NG 6 and 10)

Pressure-signal-characteristic curves (V spool, Ps = 100 bar)

NG 6

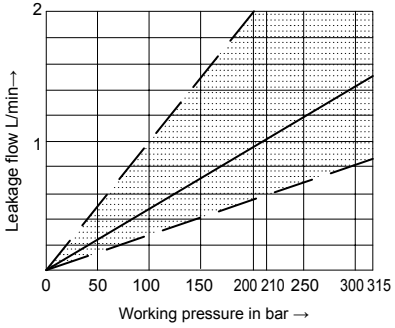


NG 10

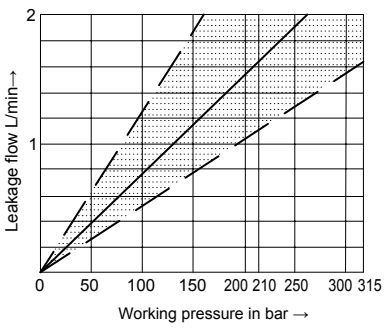


Leakage flow with the spool in the central position

Type 4WREE6 V32



Type 4WREE10 V75

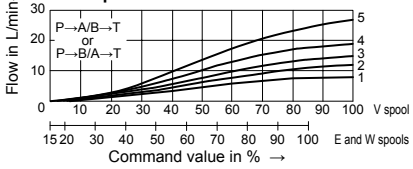


Characteristic curves (measured with HLP46, ϑ_{oil}=40°C ±5°C , P=100bar)

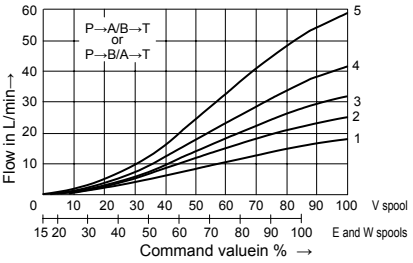
· Type 4WREE (NG 6 and 10)

NG 6

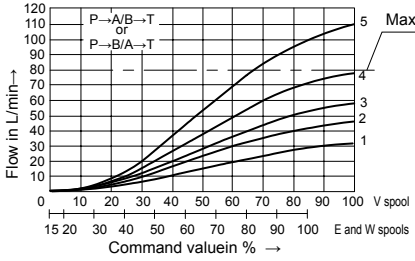
8L/min nominal flow at a 10 bar valve pressure differential



16L/min nominal flow at a 10 bar valve pressure differential



32L/min nominal flow at a 10 bar valve pressure differential

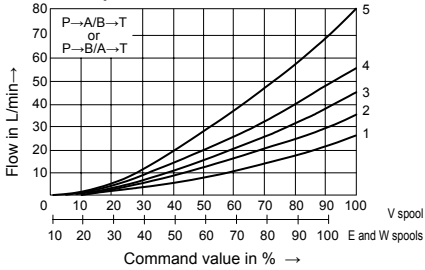


1 Δp=10bar constant
2 Δp=20bar constant
3 Δp=30bar constant
4 Δp=50bar constant
5 Δp=100bar constant

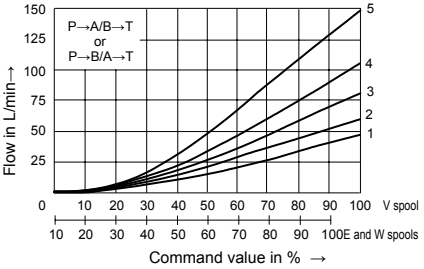
Δp=Valve pressure differential (inlet pressure p_P minus load pressure p_L minus return pressure p_T)

NG 10

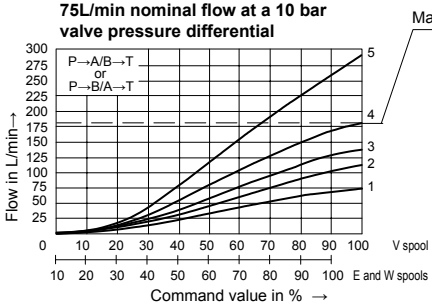
25L/min nominal flow at a 10 bar valve pressure differential



50L/min nominal flow at a 10 bar valve pressure differential



75L/min nominal flow at a 10 bar valve pressure differential

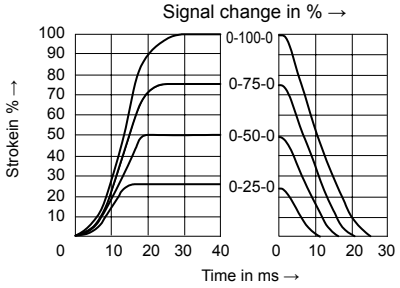


1 Δp=10bar constant
2 Δp=20bar constant
3 Δp=30bar constant
4 Δp=50bar constant
5 Δp=100bar constant

Δp=Valve pressure differential (inlet pressure p_P minus load pressure p_L minus return pressure p_T)

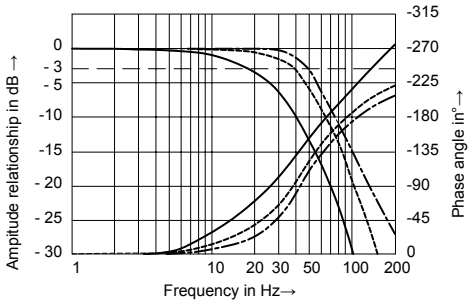
Characteristic curves (measured with HLP46, ϑ_{oil}=40°C ±5°C , P=100bar)

· Type 4WREE (NG 6)



Transient function with a stepped form of electrical input signal

4/3 valve version,
Spool symbol “E”



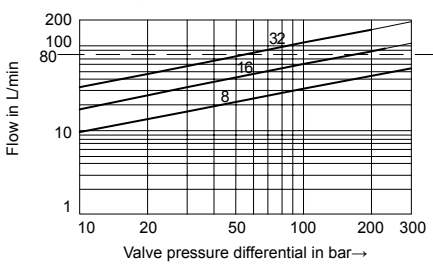
Frequency response characteristic curves

4/3 valve version,
Spool symbol “V”

—·— Signal±10%
- - - - - Signal±25%
—— Signal±100%

Flow-pressure differential curve

Load function with maximum valve opening.
Nominal flows 8, 16 and 32 L/min.
Spool symbol “V”



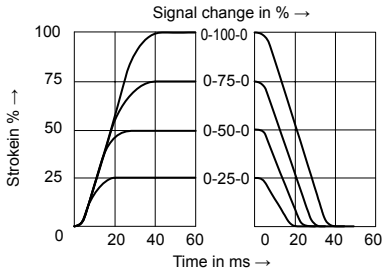
Max.permissible flow

P→A/B→T
or
P→B/A→T

Take the maximum permissible flow of 80 L/min into account!

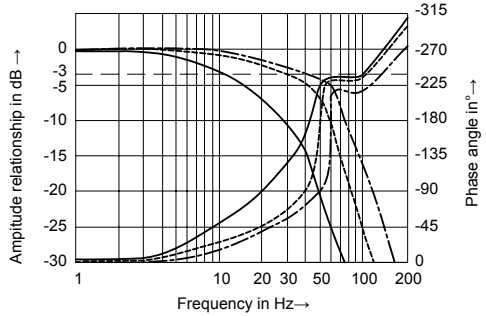
Characteristic curves (measured with HLP46, ϑ_{oil}=40°C ±5°C , P=100bar)

· Type 4WREE (NG 10)



Transient function with a stepped form of electrical input signal

4/3 valve version,
Spool symbol “E”



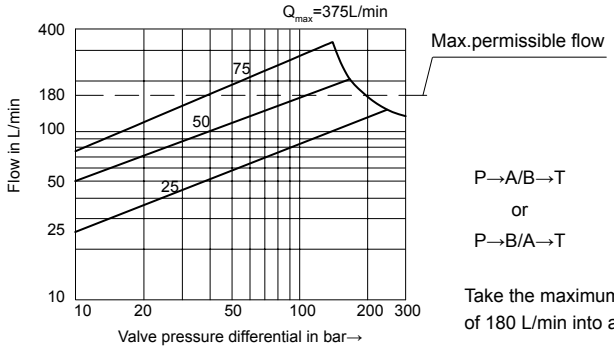
Frequency response characteristic curves

4/3 valve version,
Spool symbol “V”

—·— Signal±10%
---------- Signal±25%
—— Signal±100%

Flow-pressure differential curve

Load function with maximum valve opening.
Nominal flows 25, 50 and 75 L/min.
Spool symbol “V”



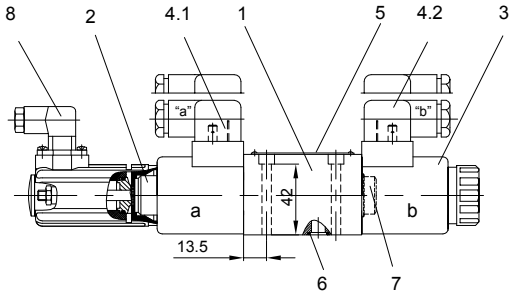
P→A/B→T
or
P→B/A→T

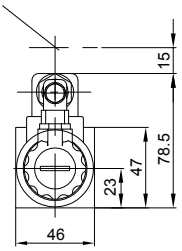
Take the maximum permissible flow of 180 L/min into account!

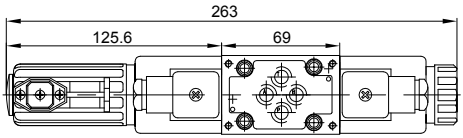
Unit dimensions

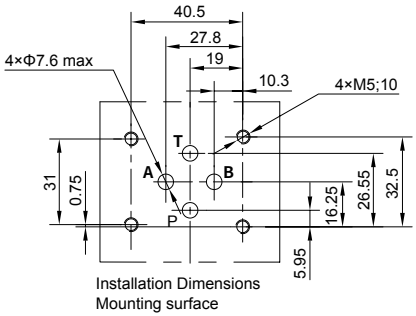
(nominal dimensions in mm)

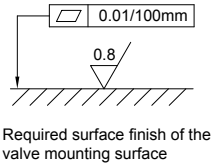
Type 4WRE6...L2X











1 Valve housing
2 Proportional solenoid "a" with inductive position transducer
3 Proportional solenoid "b"
4.1 Plug-in connector "A"
4.2 Plug-in connector "B"
5 Name plate
6 Identical seal rings for ports A, B, P and T (R-ring 9.81×1.5×1.78 or O-ring 9.25×1.78)
7 Plug for valves with one solenoid (2 switching positions, versions EA or WA)
8 Plug-in connector for inductive position transducer
9 Space required to remove the plug-in connector

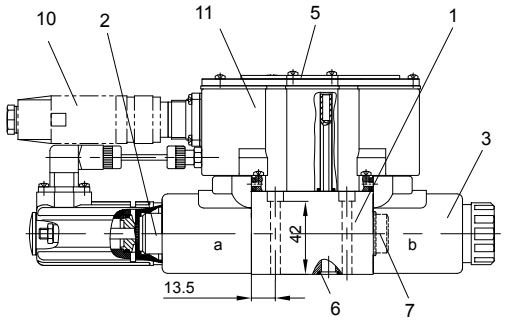
Valve mounting screws

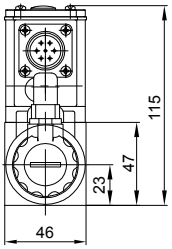
The following valve fixing screws are recommended:
- 4 S.H.C.S.ISO 4762 - M5×50 - 10.9
- 4 GB / T 70.1 - M5×50 - 10.9
- Tightening torque M_A = 8.9 Nm ± 10%

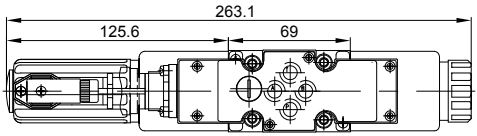
Unit dimensions

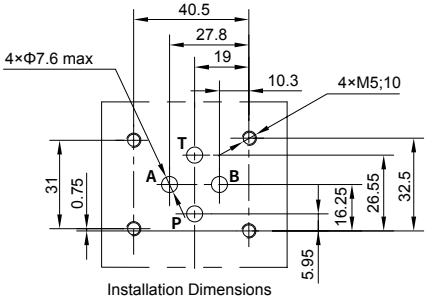
(nominal dimensions in mm)

Type 4WREE6...L2X

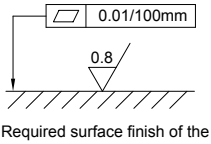








Installation Dimensions
Mounting surface



Required surface finish of the valve mounting surface

1 Valve housing
2 Proportional solenoid "a" with inductive position transducer
3 Proportional solenoid "b"
5 Name plate
6 Identical seal rings for ports A, B, P and T (R-ring 9.81×1.5×1.78 or O-ring 9.25×1.78)
7 Plug for valves with one solenoid (2 switching positions, versions EA or WA)
10 Plug-in connector
11 Integrated electronics (OBE)

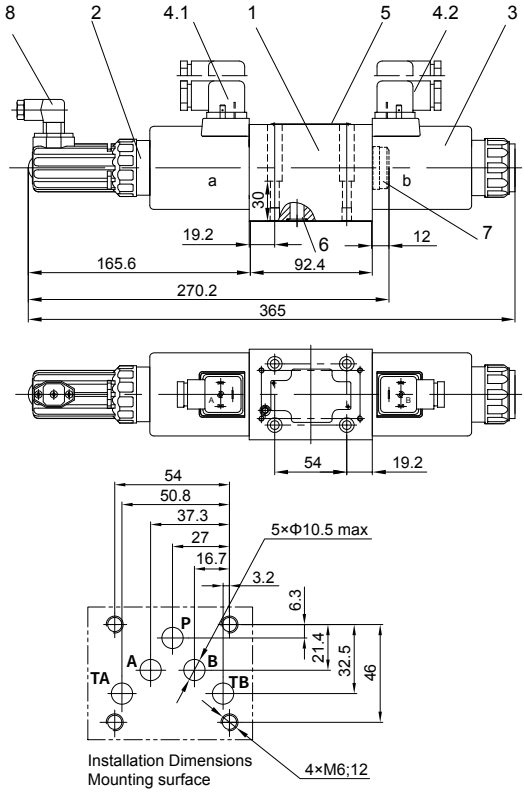
Valve mounting screws

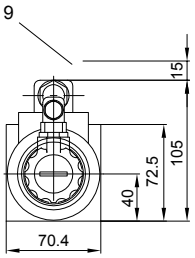
The following valve fixing screws are recommended:
- 4 S.H.C.S.ISO 4762 - M5×50-10.9
- 4 GB / T 70.1 - M5×50 - 10.9
- Tightening torque M_A = 8.9 Nm ± 10%

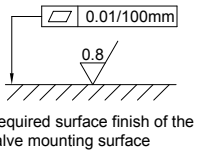
Unit dimensions

(nominal dimensions in mm)

Type Type 4WRE10...L2X







1 Valve housing
2 Proportional solenoid "a" with inductive position transducer
3 Proportional solenoid "b"
4.1 Plug-in connector "A"
4.2 Plug-in connector "B"
5 Name plate
6 Identical seal rings for ports A, B, P and T (R-ring 13×1.6×2 or O-ring 12×2)
7 Plug for valves with one solenoid (2 switching positions, versions EA or WA)
8 Plug-in connector for inductive position transducer
9 Space required to remove the plug-in connector

Valve mounting screws

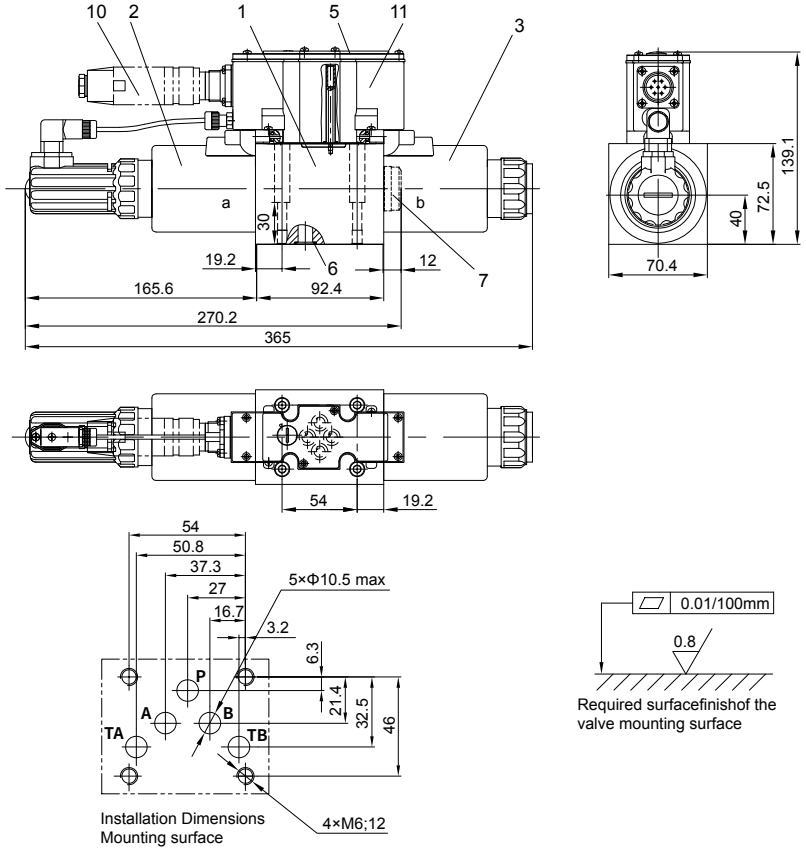
The following valve mounting screws are recommended:

- 4 S.H.C.S.ISO 4762 - M6×40 - 10.9
- 4 GB / T 70.1 - M6×40 - 10.9
- Tightening torque M_A = 15.5 Nm ± 10%

Unit dimensions

(nominal dimensions in mm)

Type 4WREE10...L2X



1 Valve housing
2 Proportional solenoid "a" with inductive position transducer
3 Proportional solenoid "b"
4 Name plate
5 Identical seal rings for ports A, B, P and T (R-ring 13×1.6×2 or O-ring 12×2)
6 Plug for valves with one solenoid (2 switching positions, versions EA or WA)
7 Plug-in connector
8 Integrated electronics (OBE)

Valve mounting screws

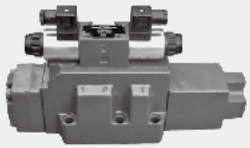
The following valve fixing screws are recommended:
- 4 S.H.C.S.ISO 4762-M6×40-10.9
- 4 GB/T 70.1-M6×40-10.9
- Tightening torque M_A=15.5Nm±10%

6.11

Pilot operated proportional directional valves

Type 4WRZ(E) and 4WRH

NG 10 to 32
Up to 350 bar
Up to 1600 L/min



Contents

Function and configuration	02-03
Ordering code	04
Symbols	05
Technical data	06
Electrical connections, plug-in connectors	07
Integrated electronics	07
Characteristic curves	08-11
Unit dimensions	12-15

Features

- Pilot operated proportional directional valve to control the direction and magnitude of a flow
- Operation is by proportional solenoids with central thread and detachable coil
- For subplate mounting:
  Porting pattern to ISO 4401 and DIN 2430
- Spring centered control spool
- 4WRZE: Integrated electronics (OBE) with voltage input or current input (A1 resp. F1)
- 4WRZ: associated control electronics (separate order)

Function and configuration

· Pilot valve type 3DREP 6...

The pilot valve is a proportional solenoid operated 3-way pressure reducing valve. It is used to convert an electrical input signal into a proportional pressure output signal and is used on all 4WRZ...valves.

The proportional solenoids are controllable DC wet pin solenoids with central thread and detachable coil. The solenoid is optionally controlled by external electronics (type WRZ...) or integrated electronics (type WRZE...).

Design:

The valve basically consists of:

– Housing (1)
– Control spool (2) with pressure measuring spools (3 and 4)
– Solenoids (5 and 6) with central thread
– Optionally with integrated electronics (8)

Work principle

– When the solenoids (5 and 6) are in the de-energized condition, the control spool (2) is held by compression springs in the central position

– Direct operation of the control spool (2) by energizing a proportional solenoid, e.g. energization of solenoid "a" (5). Pressure measuring spool (3) and control spool (2) are shifted to the left in proportion to the electrical input signal; Connection from P to B and A to T through the orifice-like cross sections with progressive flow characteristics; De-energization of the solenoid (5), control spool (2) is returned to the central position by the compression spring, In the central position, ports A and B are open to T, i.e. the hydraulic fluid can flow to the tank without any restrictions.

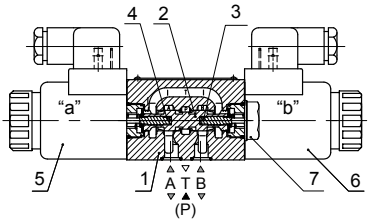
– Manual override, optional, with the help of it, the control spool (2) can be moved without requiring the energization of the solenoid.

Notes:

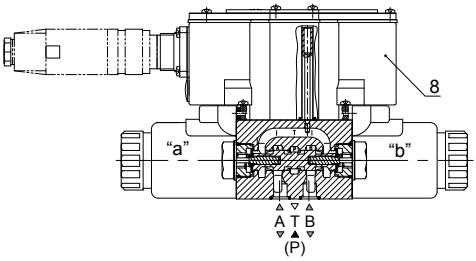
Type 3DREP 6: Draining of the tank line must be prevented. In the case of a corresponding installation situation, a pre-load valve is to be installed (pre-load pressure approx. 2 bar).

Pilot valve with two spool positions (Type 3DREP 6...B...)

In principle, the function of this valve version corresponds to that of the valve with three spool positions. However, this 2-position valve is provided with solenoid "a" (5) only. Instead of the 2nd proportional solenoid, a plug screw (7) is fitted.



Type 3DREP6...



Type 3DREPE6...

Function and configuration

· Pilot operated proportional directional valves Type 4WRZ...

Valves of type 4WRZ... are pilot operated 4-way directional valves with operation by proportional solenoids. They control the direction and magnitude of a flow.

Design:

The valves basically consist of:

– A pilot valve (9) with proportional solenoids (5 and 6), control spool (2) and orifice plugs (15)

– A main valve (10) with main spool (11) and centering spring (12)

Work principle

– When the solenoids (5 and 6) are de-energised, the main spool (11) is held by centering springs (12) in the central position.

– Operation of the main spool (11) through the pilot valve (9), the main spool is moved proportionally, depending on the spool position, flow from P to A and B to T(R) or P to B and A to T(R).

e.g. by energising solenoid "b" (6), the control spool (2) is shifted to the right, pilot oil is fed through the pilot valve (9) into the pressure chamber (13) and moves the main spool (11) in proportion to the electrical input signal; Connection from P to A and B to T through orifice-like cross-sections with progressive flow characteristics.

De-energization of the solenoid (6), the control spool (2) and main spool (11) are returned to the central position.

– Pilot oil supply to the pilot valve internally via port P or externally via port X.

– With the help of an optional manual override the control spool (2) can be moved without requiring the energization of the solenoid.

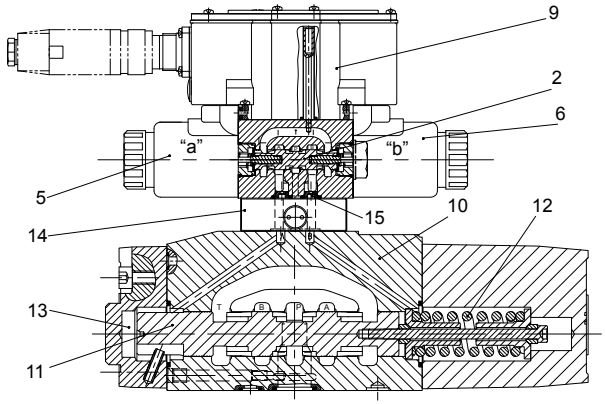
Notes:

Type WRH:

The pilot pressure in the main valve must not exceed 25 bar.

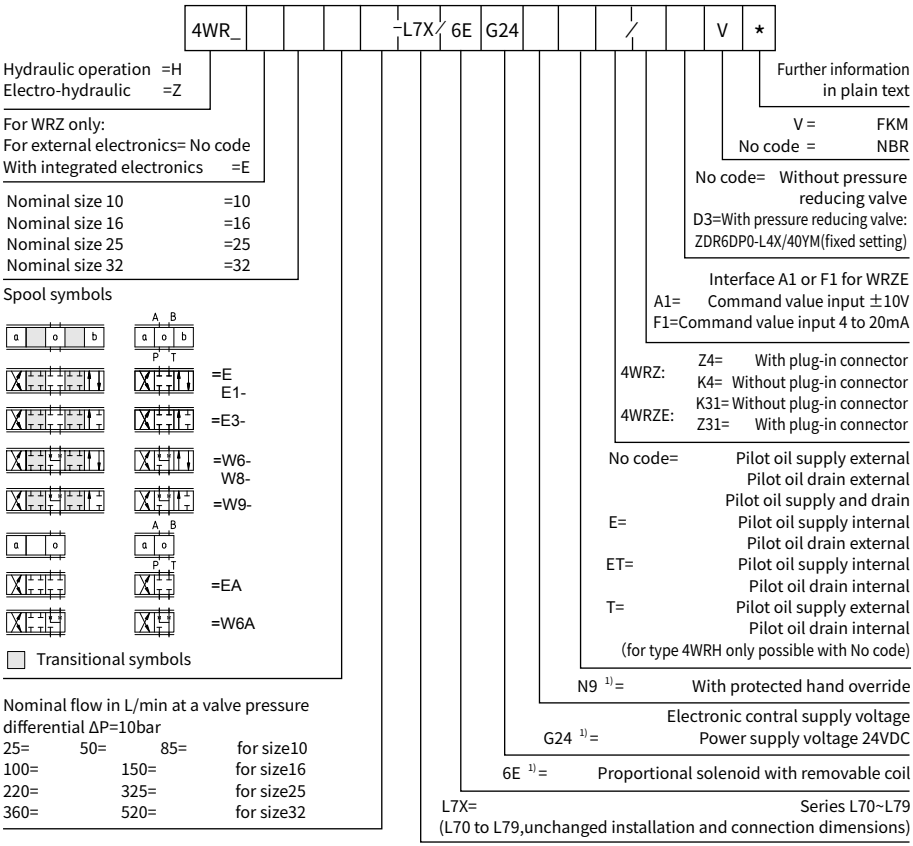
Type WRZ:

For system pressures above 100bar the type D3 pilot pressure reducing module(14) must be fitted between pilot valve (9) and main valve (10).



Type 4WRZE...

Ordering code



Note: With symbols E1- and W8-:
$P \rightarrow A: q_{v\,max}$ $B \rightarrow T: q_{v/2}$
$P \rightarrow B: q_{v/2}$ $A \rightarrow T: q_{v\,max}$

With symbols E3- and W9-:
$P \rightarrow A: q_{v\,max}$ $B \rightarrow T$: closed
$P \rightarrow B: q_{v/2}$ $A \rightarrow T: q_{v\,max}$

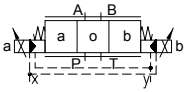
With spools W6-, W8-, W9- and W6A in the neutral position, there is a connection from A to T and B to T with approx. 2% of the relevant nominal cross-section.

1) Omitted for 4WRH and 4WRZ without pilot valve.

Symbols(simplified)

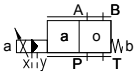
With electrohydraulic operation and for external electronics

Type 4WRZ...-L7X/...

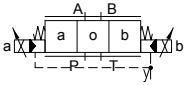


X=external
Y=external

Type 4WRZ...A-L7X/...

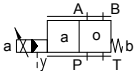


Type 4WRZ...-L7X/...E...

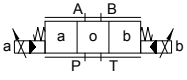


X=external
Y=external

Type 4WRZ...A-L7X/...E...

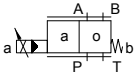


Type 4WRZ...-L7X/...ET...

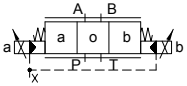


X=external
Y=external

Type 4WRZ...A-L7X/...ET...

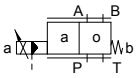


Type 4WRZ...-L7X/...T...



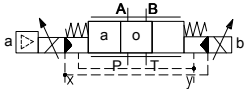
X=external
Y=external

Type 4WRZ...A-L7X/...T...



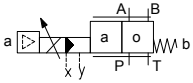
With electrohydraulic operation and for external electronics

Type 4WRZE...-L7X/...

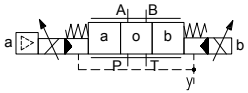


X=external
Y=external

Type 4WRZE...A-L7X/...



Type 4WRZE...-L7X/...E..



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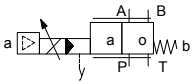
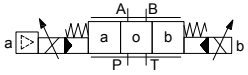
Type 4WRZE...A-L7X/...E...

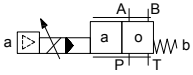


Type 4WRZE...-L7X/...ET

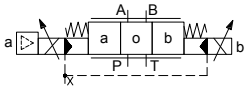


X=external
Y=external

Type 4WRZE...A-L7X/...ET...

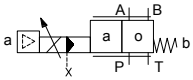


Type 4WRZE...-L7X/...T...



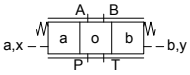
X=external
Y=external

Type 4WRZE...A-L7X/...T...

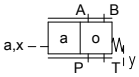


With hydraulic operation

Type 4WRH...-L7X/...



Type 4WRH...A-L7X/...



06

Technical data

General					
Valve type				WRZ	WRZE
Installation				optional, preferably horizontal	
Storage temperature range			°C	-20 to +80	
Ambient temperature range			°C	-20 to +70	-20 to +50
Weight	NG10		kg	7.8	8.0
	NG16		kg	13.4	13.6
	NG25		kg	18.2	18.4
	NG32		kg	42.2	42.4

Hydraulic (measured with HLPAG.p=100bar : 40 °C ± 5 °C)							
Nominal size				10	16	25	32
Operating pressure	-Pilot valve	External pilot oil supply	bar	30 to 100 bar			
		Internal pilot oil supply	bar	100 to 350 with "D3" only			
	-Main valve		bar	up to 315	up to 350	up to 350	up to 350
Return flow pressure	-Port T (port R) (external pilot oil drain)		bar	up to 315	up to 250	up to 250	up to 150
	-Port T(internal pilot oil drain)		bar	up to 30	up to 30	up to 30	up to 30
	-Port Y		bar	up to 30	up to 30	up to 30	up to 30
Pilot oil volume input signal 0- 100 %			cm^3	1.7	4.6	1 0	26.5
Pilot oil flow in port X and Y with a stepped input signal 0- 100 %			L/min	3.5	5.5	7	15.9
Flow of the main valve			L/min	up to 170	up to 460	up to 870	up to 1600
Hydraulic fluid				Mineral oil (HL, HLP) to DIN 51524 Further fluids on enquiry!			
Hydraulic fluid temperature range			°C	-20 to +80 (preferably +40 to +50)			
Viscosity range			mm^2/s	20 to 380 (preferably 30 to 46)			
Degree of contamination	Maximum permissible degree of contamination of the pressure fluid is to NAS 1638 or ISO 4406(c)			A filter with a minimum retention rate of βx ⩾ 75 is recommended			
	- Pilot valve	NAS 1638 class 7		x=5			
	- Main valve	NAS 1638 class 9		x=15			
Hysteresis			%	⩽ 6			

Electrical				
Valve type			WRZ	WRZE
Type of protection of the valve to EN 60529			IP65 with cable socket mounted and locked	
Voltage type			DC	
Command value overlap		%	15	
Max. current		A	1.5	2.5
Solenoid coil resisance	Cold value at 20°C	Ω	4.8	2
	Max. warm value	Ω	7.2	3
Duty		%	100	
Coil temperature		°C	up to 150	
Valve protection to EN 60529			IP65 with mounted and fixed plug-in connector	

Control electronics			
External amplifier for type WRZ			VT-VSPA2-1-L2X/...
Command value signal	-Voltage input "A1"	V	±10
	-Current input "F1"	mA	4 to 20

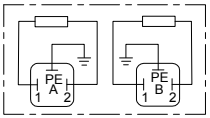
Electrical connections, plug-in connectors

nominal dimensions in mm

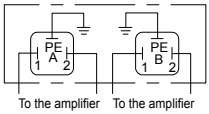
· For type 4WRZ...L7X (without integrated electronics)

Connections on the component plug

Plug-in connector to DIN EN 175301-803 or ISO 4400



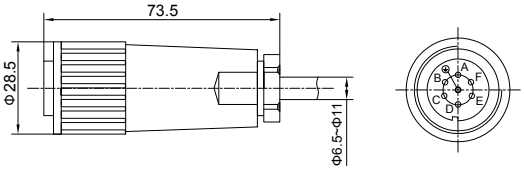
Connections on the plug-in connector



· For type 4WRZE ...L7X (with integrated electronics (OBE))

For pin allocation also see block circuit diagram.

Plug-in connector to DIN EN 175201-804



· Integrated control electronics for type 4WRZE ...L7X

Component plug allocation

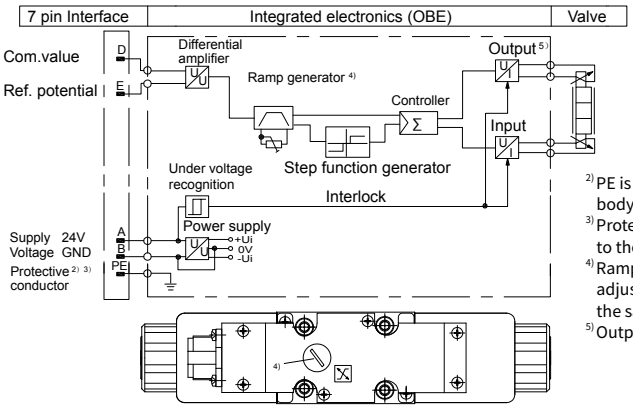
	Contact	Interface A1 signal	Interface F1 signal
Supply voltage	A	24 VDC(U(t)=19V to 35V)	
	B	GND	
	C	n.c. [1]	
Differential amplifier input	D	±10V, Re>50KΩ	4 to 20mA, Re>100Ω
	E	reference potentional command value	
	F	n.c. [1]	

[1] Contacts C and F must not be connected!

Connection cable:
Recommended:
– up to 25 m cable length type LiYCY 5×0.75 mm²;
– up to 50 m cable length type LiYCY 5×1.0 mm².
For outside diameter see plug-in connector sketch.
Only connect screen to PE on the supply line.

Command value:
A positive command value 0 to +10V (or 12 to 20 mA) at D and the reference potential at E results in a flow from P to A and B to T.
A negative command value 0 to –10V (or 12 to 4 mA) at D and the reference potential at E results in a flow from P to B and A to T.
For a valve with 1 solenoid on side a (e.g. spool variants EA and WA) a positive command value at D and the reference potential at E results in a flow from P to B and A to T.

· Integrated electronics (OBE) for type 4WRZE...L7X

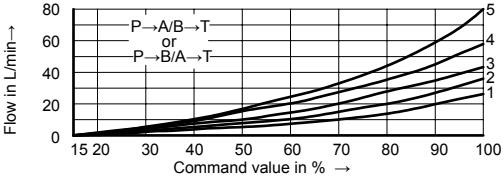


[2] PE is connected to the cooling body and the valve housing!
[3] Protective conductor screwed to the valve housing and cover.
[4] Ramp can be externally adjusted from 0 to 2.5s, the same applies for T_{up} and T_{down}.
[5] Output stages current regulated.

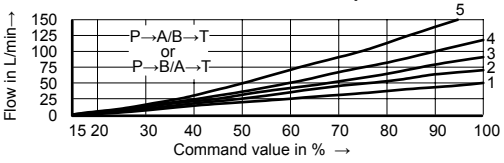
Characteristic curves (measured with spools "E, W6-, EA, W6A" and HLP46, ϑ_{oil}=40°C ±5°C , P=100bar)

NG 10

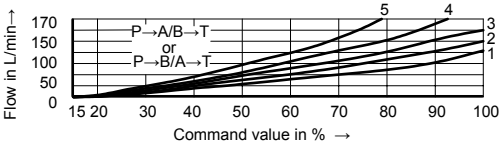
25L/min nominal flow at a 10 bar valve pressure differential



50L/min nominal flow at a 10 bar valve pressure differential



85L/min nominal flow at a 10 bar valve pressure differential



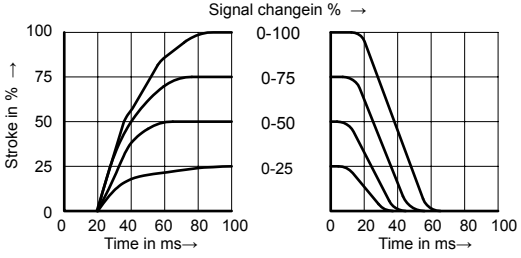
1 Δp=10bar constant
2 Δp=20bar constant
3 Δp=30bar constant
4 Δp=50bar constant
5 Δp=100bar constant

Δp=Valve pressure differential (inlet pressure p_p minus load pressure p_L minus return pressure p_T)

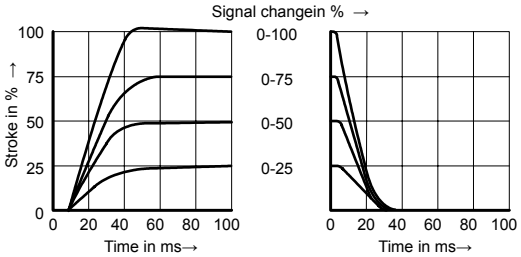
06

Transient function with a stepped form of electrical input signal P_{st}= 50bar

Type 4WRZ



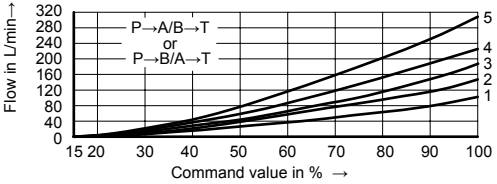
Type 4WRZE



Characteristic curves (measured with spools "E, W6-, EA, W6A" and HLP46, ϑ_{oil}=40°C ±5°C , P=100bar)

NG 16

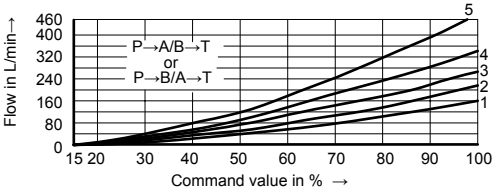
100L/min nominal flow at a 10 bar valve pressure differential



1 Δp=10bar constant
2 Δp=20bar constant
3 Δp=30bar constant
4 Δp=50bar constant
5 Δp=100bar constant

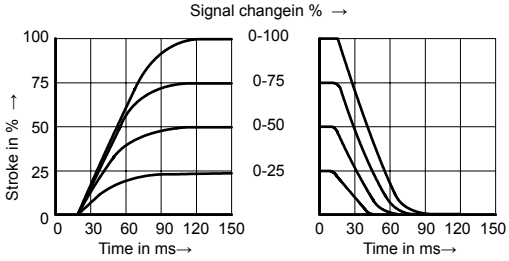
Δp=Valve pressure differential (inlet pressure p_p minus load pressure p_L minus return pressure p_T)

150L/min nominal flow at a 10 bar valve pressure differential

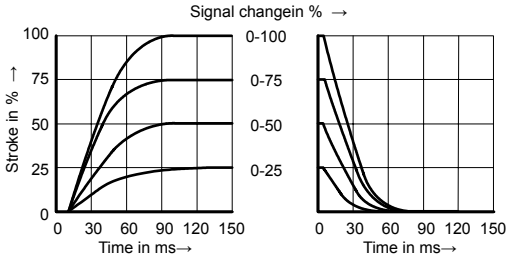


Transient function with a stepped form of electrical input signal P_{st}= 50bar

Type 4WRZ



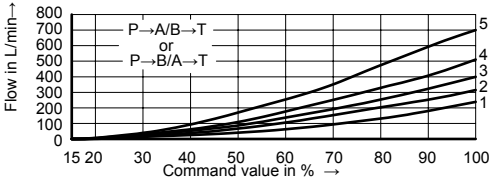
Type 4WRZE



Characteristic curves (measured with spools "E, W6-, EA, W6A" and HLP46, ϑ_{oil}=40°C ±5°C , P=100bar)

NG 25

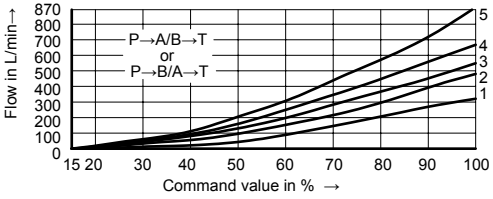
220L/min nominal flow at a 10 bar valve pressure differential



1 Δp=10bar constant
2 Δp=20bar constant
3 Δp=30bar constant
4 Δp=50bar constant
5 Δp=100bar constant

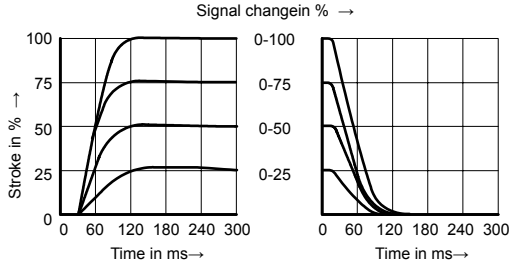
Δp=Valve pressure differential (inlet pressure p_P minus load pressure p_L minus return pressure p_T)

325L/min nominal flow at a 10 bar valve pressure differential

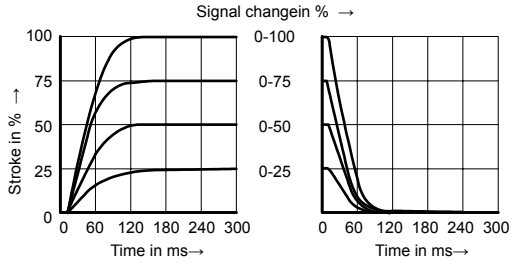


Transient function with a stepped form of electrical input signal P_{st}= 50bar

Type 4WRZ



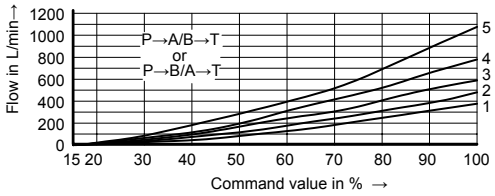
Type 4WRZE



Characteristic curves (measured with spools "E, W6-, EA, W6A" and HLP46, ϑ_{oil}=40°C ±5°C , P=100bar)

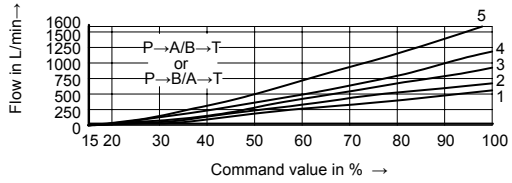
NG 32

360L/min nominal flow at a 10 bar valve pressure differential



1 Δp=10bar constant
2 Δp=20bar constant
3 Δp=30bar constant
4 Δp=50bar constant
5 Δp=100bar constant

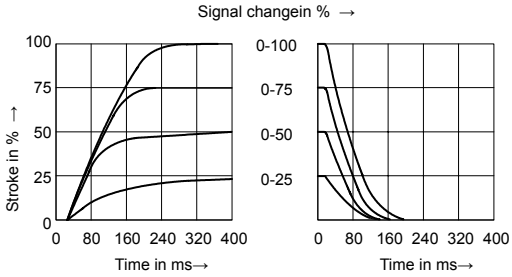
520L/min nominal flow at a 10 bar valve pressure differential



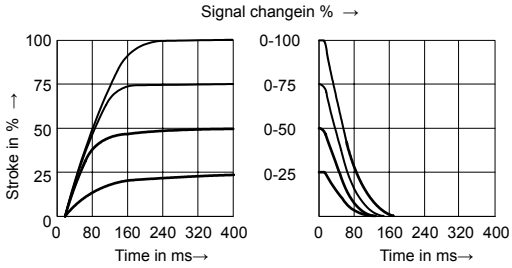
Δp=Valve pressure differential (inlet pressure p_p minus load pressure p_L minus return pressure p_T)

Transient function with a stepped form of electrical input signal P_{st}= 50bar

Type 4WRZ



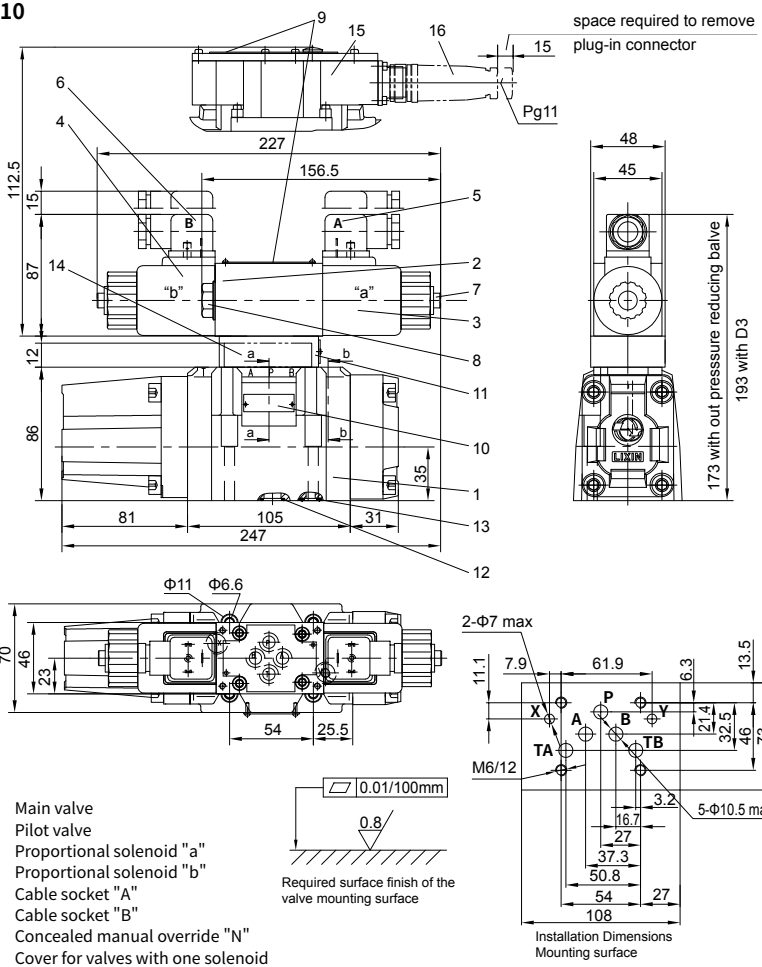
Type 4WRZE



Unit dimensions

(Dimensions in mm)

NG 10



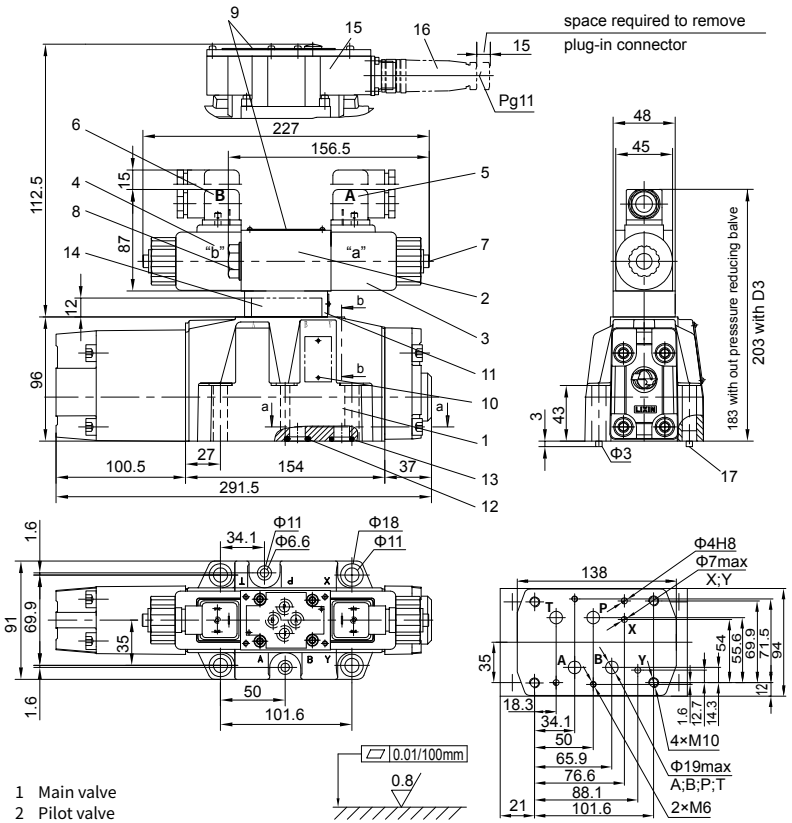
1 Main valve
2 Pilot valve
3 Proportional solenoid "a"
4 Proportional solenoid "b"
5 Cable socket "A"
6 Cable socket "B"
7 Concealed manual override "N"
8 Cover for valves with one solenoid
9 Nameplate for pilot valve
10 Name plate for main valve
11 Pressure reducing valve "D3"
12 Identical seal rings for ports A, B, P and T)
(R-ring 13×1.6×2 or O-ring 12×2
13 Identical seal rings for ports X and Y)
(R-ring 11.18×1.6×1.78 or O-ring 10.82×1.78
14 Interconnection plate (type 4WRH...)
15 Integrated electronics (OBE)
16 Plug- in connector to DIN EN 175201-804

Valve fixing screws:
The following valve fixing screws are recommended:
- 4 GB/T 70.1-M6×40-10.9
- Tightening torque M_A=15.5Nm±10%

Unit dimensions

(Dimensions in mm)

NG 16



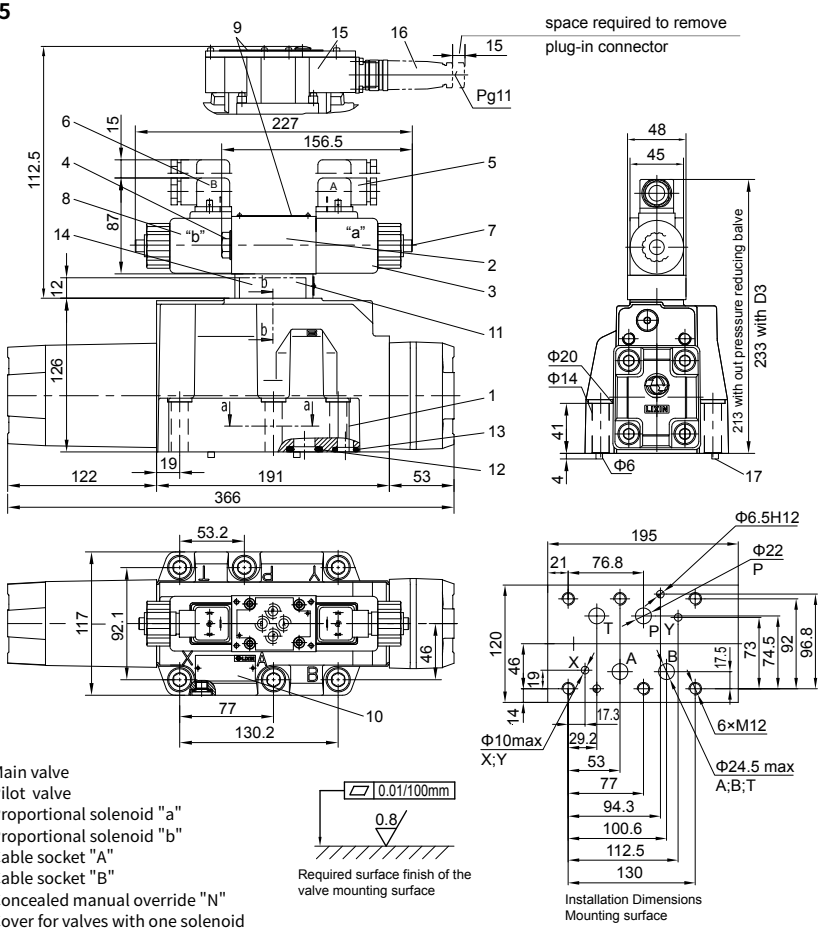
1 Main valve
2 Pilot valve
3 Proportional solenoid "a"
4 Proportional solenoid "b"
5 Cable socket "A"
6 Cable socket "B"
7 Concealed manual override "N"
8 Cover for valves with one solenoid
9 Nameplate for pilot valve
10 Nameplate for main valve
11 Pressure reducing valve "D3"
12 Identical seal rings for ports A, B, P and T)
(R-ring 22.53×2.3×2.62 or O-ring 22×2.5)
13 Identical seal rings for ports X and Y)
(R-ring 12×2×2 or O-ring 10×2)
14 Interconnection plate (type 4WRH...)
15 Integrated electronics (OBE)
16 Plug- inconnector to DIN EN 175201-804
17 Locating pin

Valve fixing screws
The following valve fixing screws are recommended:
- 4 GB/T 70.1-M10×60-10.9
- Tightening torque M_A=15.5Nm±10%
- 2 GB/T 70.1-M6×55-10.9
- Tightening torque M_A=15.5Nm±10%

Unit dimensions

(Dimensions in mm)

NG 25



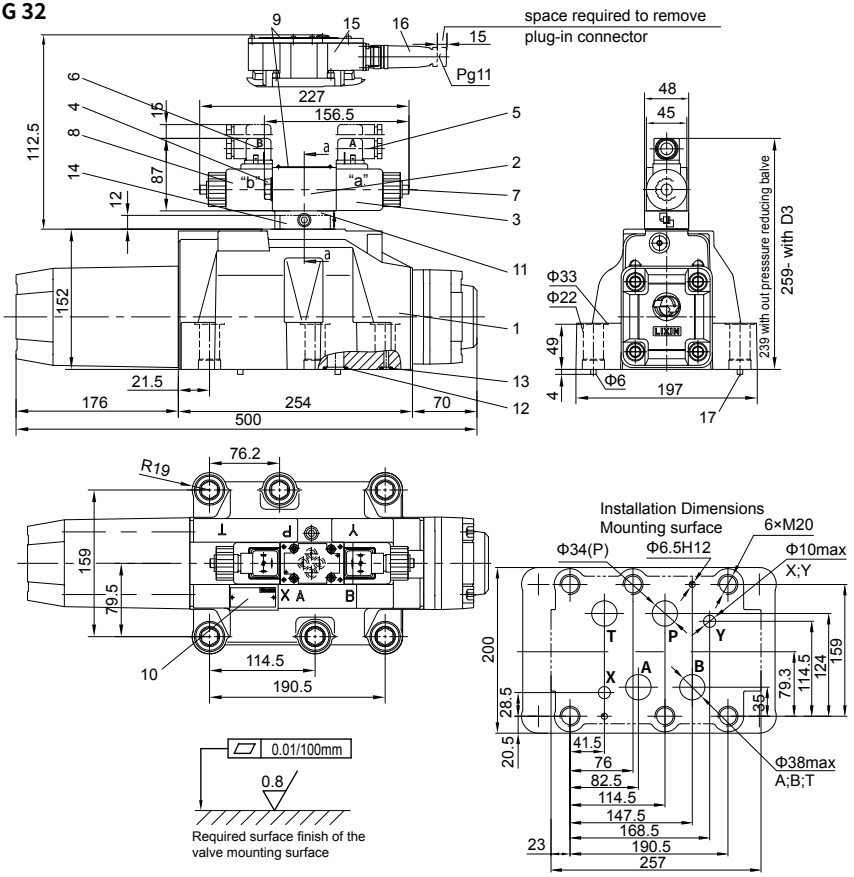
1 Main valve
2 Pilot valve
3 Proportional solenoid "a"
4 Proportional solenoid "b"
5 Cable socket "A"
6 Cable socket "B"
7 Concealed manual override "N"
8 Cover for valves with one solenoid
9 Nameplate for pilot valve
10 Nameplate for main valve
11 Pressure reducing valve "D3"
12 Identical seal rings for ports A, B, P and T (R-ring 27.8×2.6×3 or O-ring 27×3)
13 Identical seal rings for ports X and Y (R-ring 19×3×3 or O-ring 19×3)
14 Interconnection plate (type 4WRH...)
15 Integrated electronics (OBE)
16 Plug- inconnector to DIN EN 175201-804
17 Locating pin

Valve fixing screws
The following valve fixing screws are recommended:
- 6 GB/T 70.1 - M12×60-10.9
- Tightening torque M_A=130Nm±20%

Unit dimensions

(Dimensions in mm)

NG 32



1 Main valve
2 Pilot valve
3 Proportional solenoid "a"
4 Proportional solenoid "b"
5 Cable socket "A"
6 Cable socket "B"
7 Concealed manual override "N"
8 Cover for valves with one solenoid
9 Nameplate for pilot valve
10 Nameplate for main valve
11 Pressure reducing valve "D3"
12 Identical seal rings for ports A, B, P and T
(R-ring 42.5×3×3 or O-ring 42×3)
13 Identical seal rings for ports X and Y
(R-ring 19×3×3 or O-ring 19×3)
14 Interconnection plate (type 4WRH...)
15 Integrated electronics (OBE)
16 Plug- inconnector to DIN EN 175201-804
17 Locating pin

Valve fixing screws
The following valve fixing screws
are recommended:
- 6 GB / T 70.1 - M20×60 - 10.9
- Tightening torque M_A = 430Nm ± 20%

China
+86 400 101 8889

America
+01 630 995 3674

Germany
+49 172 3683463

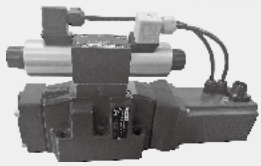
Japan
+81 03 6809 1696

6.12

Pilot operated proportional directional valves

Type 4WRKE...L3X

NG 10 to 35
Up to 350 bar
Up to 3000L/min



Contents

Function and configuration	02
Symbols	03
Ordering code	03
Technical data	04
Electrical connections	05
Characteristic curves	06-08
Unit dimensions	09-14

Features

- Pilot operated 2-stage proportional directional valve
- Valve for the control of the size and direction of a flow
- For subplate mounting, porting pattern to DIN 24 340 form A
- Spring centred main spool
- Integrated control electronics

Function and configuration

· Proportional directional valve:
type 4WRKE...L3X...

The type 4WRKE valves are 2-stage proportional directional control valves. They control the size and direction of a flow.
The main stage is closed loop position controlled so that the spool position is also independent of flow forces at larger flows.

Structure

The valves basically consists of the pilot control valve (1), housing (8), main spool (7), covers (5 and 6), centering spring (4), inductive position transducer (9) and the pressure reducing valve (3).

Function

— If no input signal is being applied then the main spool (7) is held in the centere position by the centering spring (4). The two control chambers in the covers (5 and 6) are connected via the valve spool (2) to tank.
— The main spool (7) is connected to suitable control electronics via the inductive position transducer (9). The positional change of the main spool (7) as well as the alteration of the command value at the summation point of the amplifier produces a differential voltage.
With the command value/actual value comparison a possible control deviation is recognised via the electronics and an electrical current is applied to the proportional solenoid of the pilot valve (1).

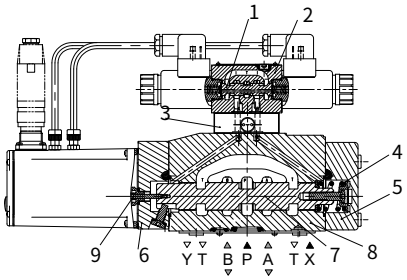
The current induces, within the solenoid, a force which is passed on to the solenoid pin which in turn actuates the control spool. The flow which is provided via the control cross sections causes the main spool to move.

· Pilot control valve :
type 4WRAP 6 W7...-L3X/G24...(1st stage)

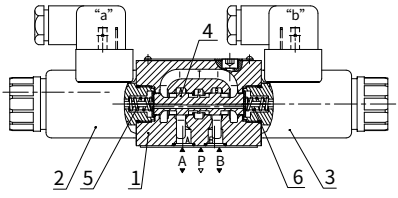
The pilot control valve is a direct operated proportional valve. The control edge geometrics were designed and optimised for the use as a pilot control valve for the proportional directional valves type 4WRKE.
The proportional solenoids are pressure tight, oil-immersed DC solenoids with removable coil. They convert an electrical current proportionally into a mechanical force. An increase in the current strength causes an appropriately higher solenoid force.

Structure

The pilot control valve basically consists of the housing (1), proportional solenoids (2 and 3), valve spool (4) and springs (5 and 6).
In the de-energised condition both actuator ports are connected to tank. If one of the two solenoids (2 or 3) is energised, then the solenoid force moves the valve spool (4) against the spring (6 or 5). Once the overlap area is overcome, the connection to tank of one of the two actuator ports is blocked and the connection to the pressure chamber is established. There is flow from P to the control chamberof the main stage.



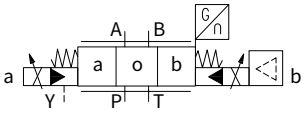
Type 4WRKE 16 ...–L3X...



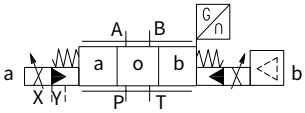
Type 4WRAP 6 W7...L3X/G24...

Symbols (simplified)

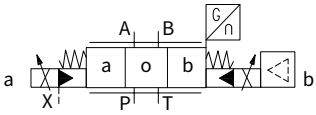
Type 4WRKE...–L3X...E.



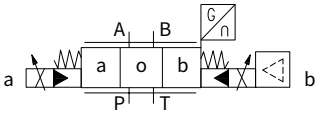
Type 4WRKE...–L3X...



Type 4WRKE ...–L3X ... T .



Type 4WRKE...-L3X...ET



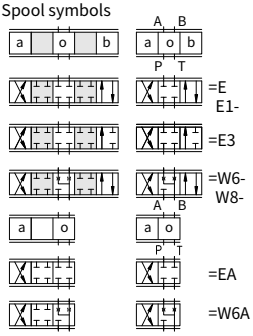
Ordering code

4WRKE [ ] [ ] [ ] – L3X / 6E G24 [ ] / [ ] [ ] [ ] *

Electrically operated
2-stage proportional
directional valve of
4-way design with
integrated electronics

Nominal size 10 =10
Nominal size 16 =16
Nominal size 25 =25
Nominal size 27 =27
Nominal size 32 =32
Nominal size 35 =35

Spool symbols



☐ Transitional symbols

Nominal flow in L/min at 10 bar
valve pressure differential

25= or 50= or 100= Nominal size 10
125= or 200= Nominal size 16
220= or 350= Nominal size 25
500= Nominal size 27
400= or 600= Nominal size 32
1000= Nominal size 35

Further information
in plain text

V = FKM Seals
No code = NBR Seals

D3 = With pressure reducing valve
ZDR6DP0-L4X/40YM(fixed setting)

Interface:
C1= Command value input ±10mA
A1= Command value input ±10V
F1= Command value input 4 to 20mA

Electrical connections
K31 = With component plug,
Without plug-in connector
Z31 = With component plug and
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

Supply voltage
G24= + 24 V DC

6E= Proportional solenoid with removable coil

L3X= L30 to L39: unchanged installation and connection dimensions

Characteristic curve form
L= Linear
P= Linear with fine control range

Note: With symbol E1-, W8-:
P → A: $q_{v\,max}$ B → T: $q_v/2$ P → B: $q_v/2$ A → T: $q_{v\,max}$
With the spools W6, W8 there is a connection from A to T and B to T in the zero position with approx. 2 % of the applicable nominal crosssection.

Technical data

General								
Nominal size			10	16	25	27	32	35
Installation and commissioning guidelines			Optional, preferably horizontal					
Storage temperature range		°C	– 20 to + 80					
Ambient temperature range		°C	– 20 to + 50					
Weight		kg	8.7	11.2	16.8	17	31.5	34

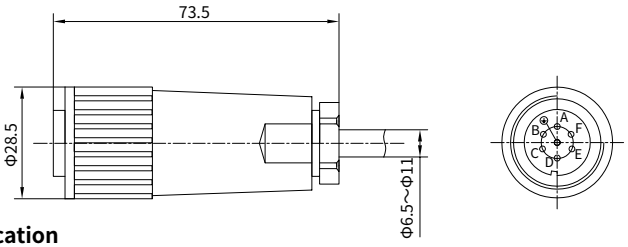
Hydraulic(measured at p=100bar,with HLP46 at ϑ_{oil}=40°C ±5°C)									
Operating pressure	-Pilot control valve	Pilot oil supply	bar	25 to 315					
	-Main valve	Ports P, A, B	bar	Up to 315	Up to 350	Up to 350	Up to 210	Up to 350	Up to 350
Return pressure	Port T (Pilot oil drain)	Internal	bar	Static < 10					
		External	bar	Up to 315	Up to 250	Up to 250	Up to 210	Up to 250	Up to 250
	Port Y		bar	Static < 10					
Nominal flow q_{vnom} ±10% at Δp=10bar (Δp = valve pressure differential)			L/min	25 50	- 125	- 220	- -	- 440	- -
				100	180	350	500	600	1000
Flow of main valve (max. permissible)			L/min	170	460	870	1000	1600	3000
Pilot oil flow at port X or Y with a step form of input signal from 0 to 100 % (315 bar)			L/min	4.1	8.5	11.7	11.7	13	13
Pressure fluid				Mineral oil(HL,HLP)to DIN 51 524 Phosphate ester (HFD-R)					
Pressure fluid temperature range			°C	10 to 80, preferably 40 to 50					
Viscosity range			mm^2/s	20 to 380, preferably 30 to 45					
Degree of contamination			Maximum permissible degree of contamination of the pressure fluid is to NAS 1638.		A filter with a minimum retention rate of βx = 75 is recommended				
	Pilot control valve		Class 7		x = 5				
	Main valve		Class 9		x = 7				
Hysteresis			%	⩽ 1					
Response sensitivity			%	⩽ 0.5					

Electrical		
Voltage type		DC
Electrical connection		Plug-in connector to DIN EN175 201-804
Power, max.	W	72 (average = 24W)
Control electronics		Integrated into the valve

Electrical connections, plug-in connector

For pin allocation also
see block circuit diagram.

Plug-in connector to
DIN EN 175201-804



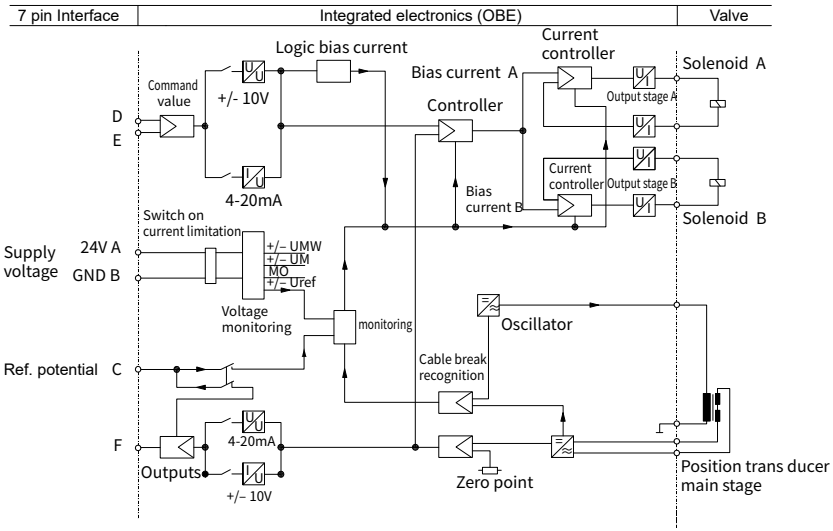
Component plug allocation

	Contact	Signal
Supply voltage	A	24 VDC (18 to 35 VDC); I_{max} = 1, 5 A; impulse load ⩽ 3 A
	B	0V
Ref. (actual value)	C	Ref. potential for actual value (contact F)
Differential amplifierinput (command value)	D	±10V or 4 – 20mA
	E	0V ref. potentional
Measurement output (act. value)	F	±10V or 4 – 20 mA
	PE	Connected with cooling body and valve housing

Command value:
Referance potential at E and a positive command value at D results in a flow from P to A and B to T.
Referance potential at E and a negative command value at D results in a flow from P to B and A to T.

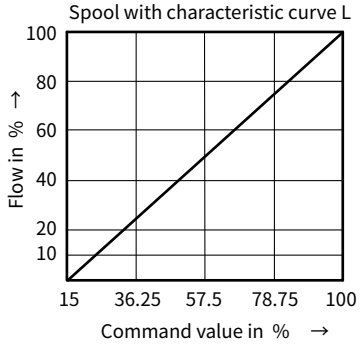
Connection cable:
Recommendation: – Up to 25m cable length type LiYCY 7×0.75 mm^2
– Up to 50m cable length type LiYCY 7×1.0 mm^2
External diameter: – 6.5 to 11mm (plastic plug-in connection)
– 8 to 12mm (metal plug-in connector)
Connect screen to ⊥ only on supply side.

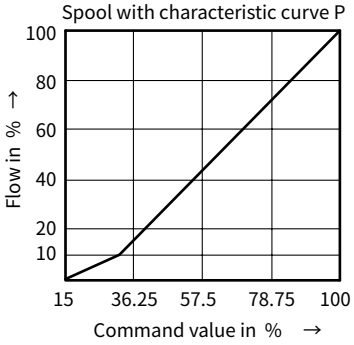
Blockcircuit diagram / connection allocation of the integrated control electronics for type 4WRKE



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

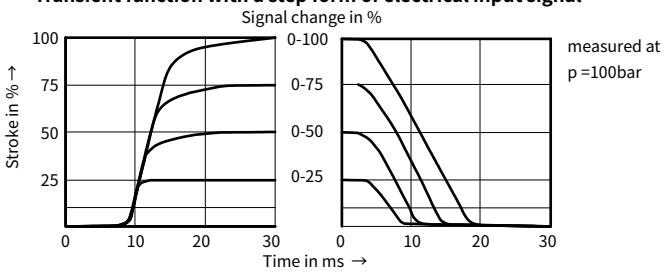
Flow - command value curve





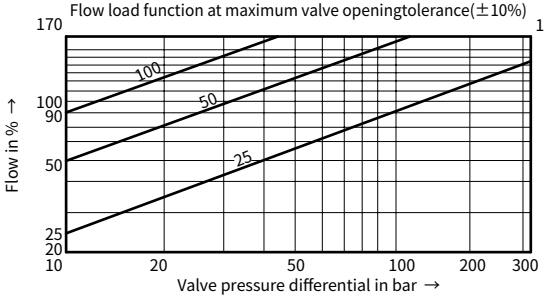
NG 10

Transient function with a step form of electrical input signal



Flow-pressure differential curve

Flow load function at maximum valve openingtolerance(±10%)

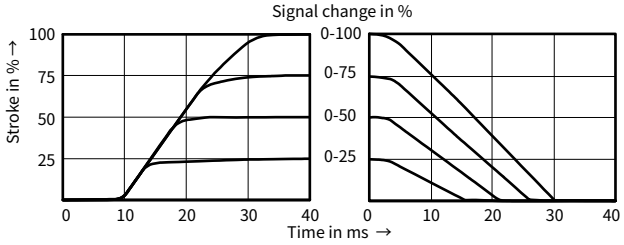


1= Recommended flow limitation (flow velocity 30 m/s)

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

NG 16

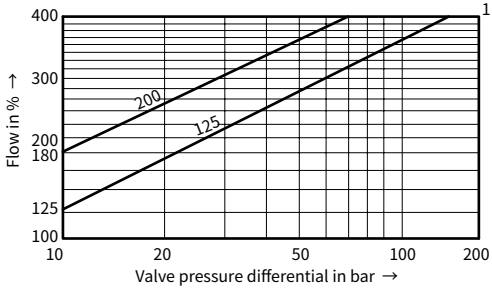
Transient function with a step form of electrical input signal



measured at p =100bar

Flow-pressure differential curve

Flow load function at maximum valve openingtolerance(±10%)

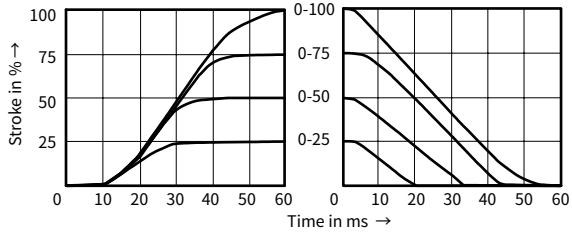


1= Recommended flow limitation (flow velocity 30 m/s)

NG 25, 27

Transient function with a step form of electrical input signal

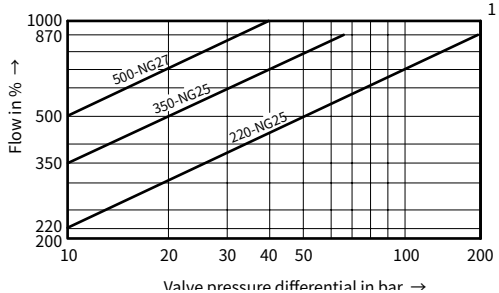
Signal change in %



measured at p =100bar

Flow-pressure differential curve

Flow load function at maximum valve openingtolerance(±10%)



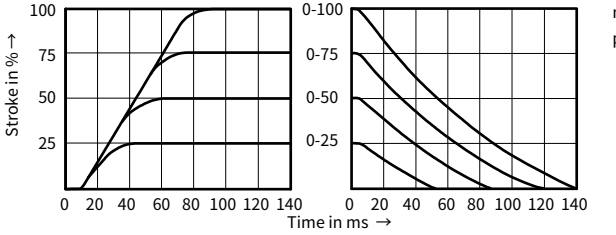
1= Recommended flow limitation (flow velocity 30 m/s)

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

NG 32

Transient function with a step form of electrical input signal

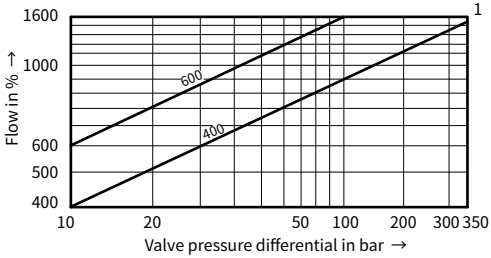
Signal change in %



measured at p =100bar

Flow-pressure differential curve

Flow load function at maximum valve openingtolerance(±10%)



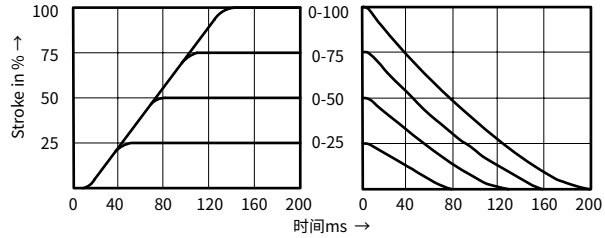
1= Recommended flow limitation (flow velocity 30 m/s)

06

NG 35

Transient function with a step form of electrical input signal

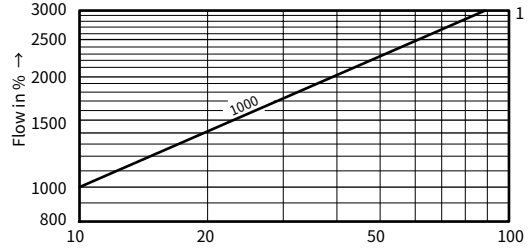
Signal change in %



measured at p =100bar

Flow-pressure differential curve

Flow load function at maximum valve openingtolerance(±10%)

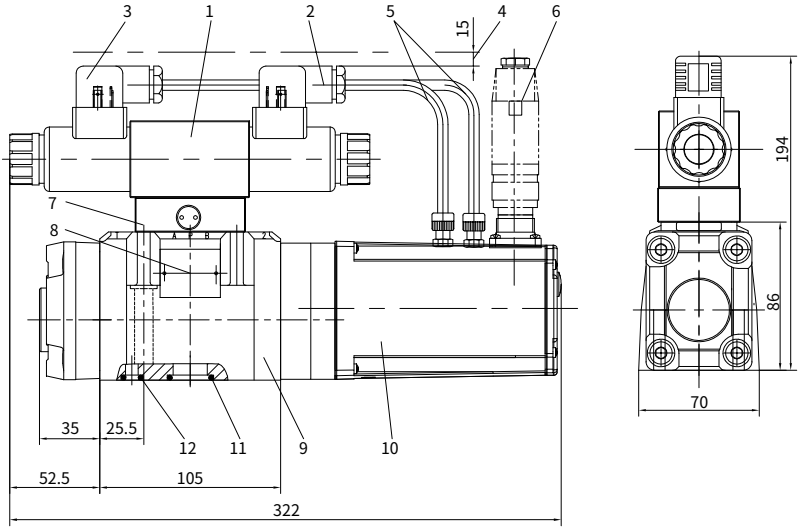


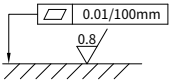
1= Recommended flow limitation (flow velocity 30 m/s)

Unit dimensions

(Dimensions in mm)

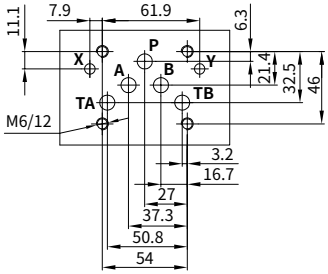
NG 10





Required surface finish of mating piece

Machined valve mounting surface



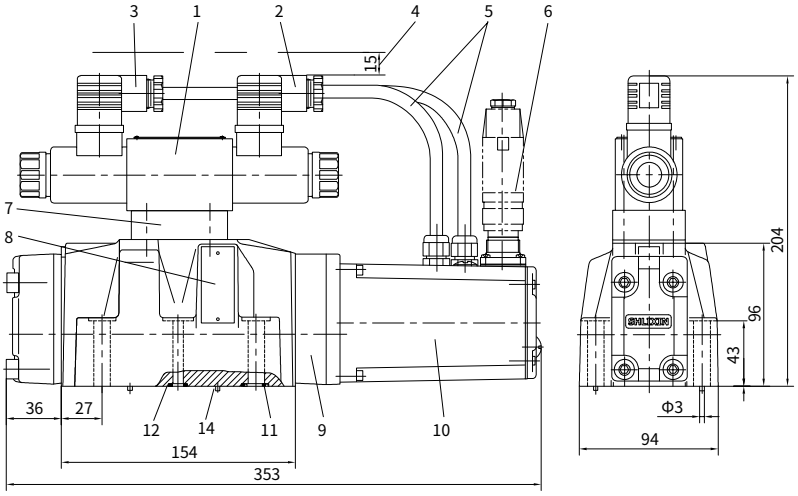
1 Pilot control valve
2 Plug-in connector "A"
3 Plug-in connector "B"
4 Space required to remove the plug-in connector
5 Cable
6 Plug-in connector
7 Pressure reducing valve
8 Name plate
9 Main valve
10 Integrated control electronics
11 R-ring 13×1.6×2, ports A, B, P, T
12 R-ring 11.18×1.6 ×1.78, ports X and Y

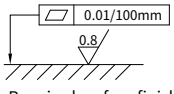
Valve mounting screws:
4- M6×45 GB/T 70.1-10.9;
M_A =13.5 Nm

Unit dimensions

(Dimensions in mm)

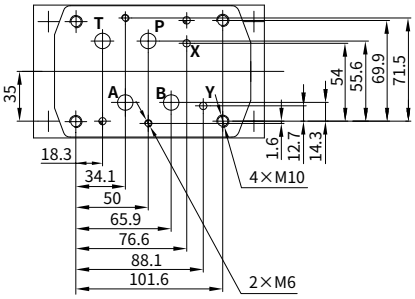
NG 16





Required surface finish of mating piece

Machined valve mounting surface



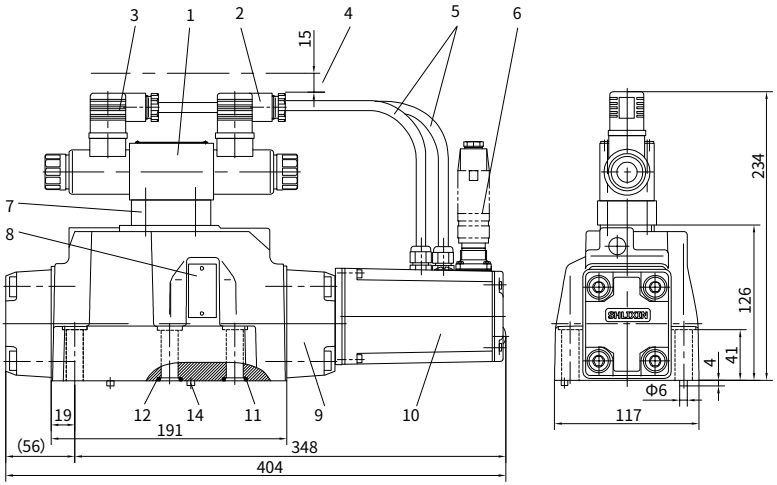
1 Pilot control valve
2 Plug-in connector "A"
3 Plug-in connector "B"
4 Space required to remove the plug-in connector
5 Cable
6 Plug-in connector
7 Pressure reducing valve
8 Name plate
9 Main valve
10 Integrated control electronics
11 R-ring 22.53×2.3×2.62, ports A, B, P, T
12 R-ring 10×2×2, ports X and Y
14 Locating pin

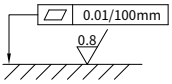
Valve mounting screws:
2- M6×55 GB/T 70.1-10.9; M_A =14 Nm
4- M10×60 GB/T 70.1-10.9; M_A =58 Nm

Unit dimensions

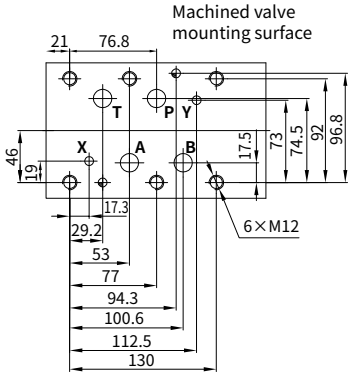
(Dimensions in mm)

NG 25





Required surface finish of mating piece



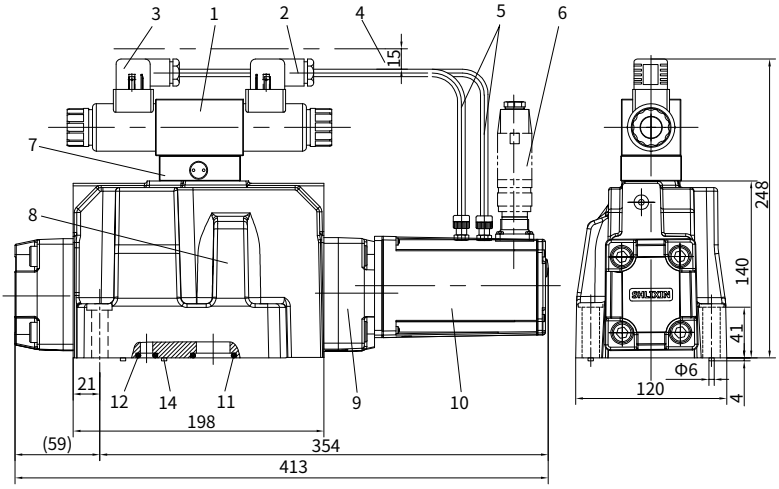
1 Pilot control valve
2 Plug-in connector "A"
3 Plug-in connector "B"
4 Space required to remove the plug-in connector
5 Cable
6 Plug-in connector
7 Pressure reducing valve
8 Name plate
9 Main valve
10 Integrated control electronics
11 R-ring 27.8×2.6×3, ports A, B, P, T
12 R-ring 19×3×3, ports X and Y
13 Locating pin

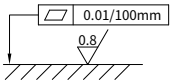
Valve mounting screws:
6- M12×60 GB/T 70.1-10.9;
M_A =100 Nm

Unit dimensions

(Dimensions in mm)

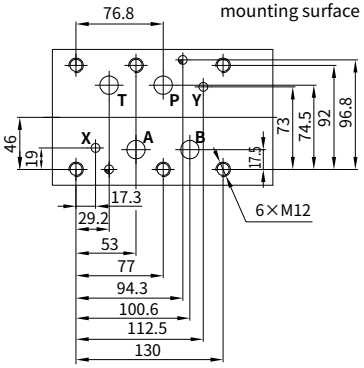
NG 27





Required surface finish
of mating piece

Machined valve
mounting surface



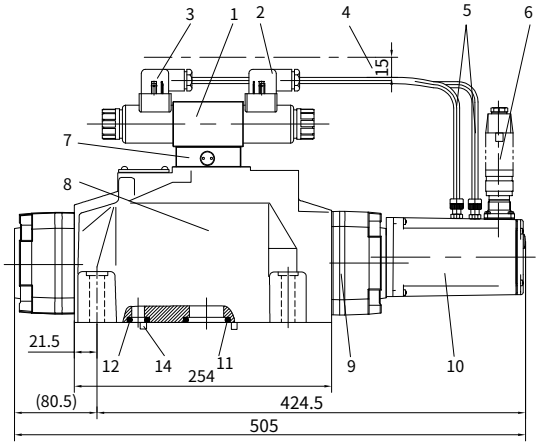
1 Pilot control valve
2 Plug-in connector "A"
3 Plug-in connector "B"
4 Space required to remove the plug-in connector
5 Cable
6 Plug-in connector
7 Pressure reducing valve
8 Name plate
9 Main valve
10 Integrated control electronics
11 R-ring 34.52×3.53×3.53, ports A, B, P, T
12 R-ring 19×3×3, ports X and Y
14 Locating pin

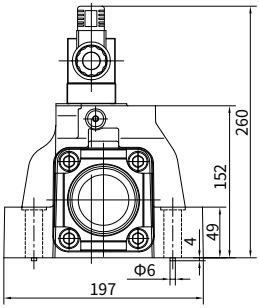
Valve mounting screws:
6- M12×60 GB/T 70.1-10.9; M_A =100 Nm

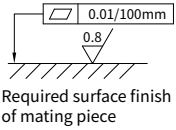
Unit dimensions

(Dimensions in mm)

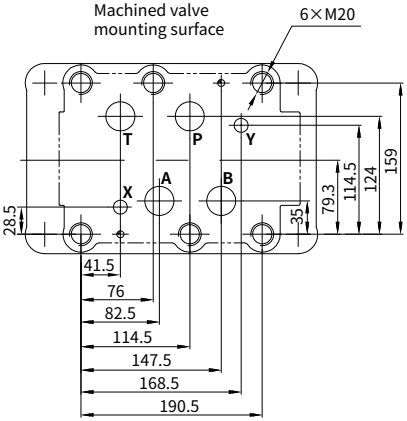
NG 32







Required surface finish
of mating piece



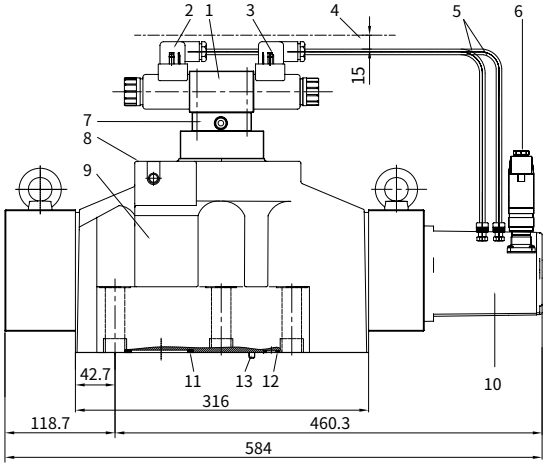
1 Pilot control valve
2 Plug-in connector "A"
3 Plug-in connector "B"
4 Space required to remove the plug-in connector
5 Cable
6 Plug-in connector
7 Pressure reducing valve
8 Name plate
9 Main valve
10 Integrated control electronics
11 R-ring 42.5×3×3,ports A, B, P, T
12 R-ring 19×3×3, ports X and Y
13 Locating pin

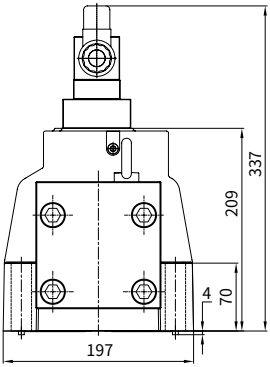
Valve mounting screws:
6- M20×80 GB/T 70.1-10.9;
M_A =340 Nm

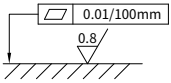
Unit dimensions

(Dimensions in mm)

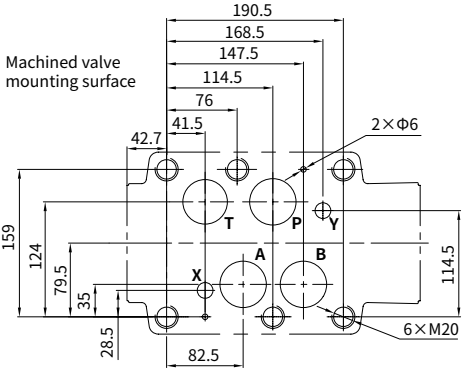
NG 35







Required surface finish of mating piece



1 Pilot control valve
2 Plug-in connector "A"
3 Plug-in connector "B"
4 Space required to remove the plug-in connector
5 Cable
6 Plug-in connector
7 Pressure reducing valve
8 Name plate
9 Main valve
10 Integrated control electronics
11 O-ring 53.57×3.53, ports A, B, P, T
12 O-ring 12.1×2.65, ports X and Y
13 Locating pin

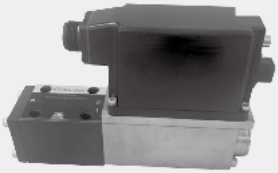
Valve mounting screws:
6- M20×100 GB/T 70.1-10.9;
M_A =360 Nm

6.13

Proportional directional valves

Type 4WRPEH6...L2X

NG 6
Up to 315 bar
Up to 40L /min



Contents

Function and configuration	02
Ordering code	03
Symbols	03
Technical data	04
Electrical connection	05
Technical data for the cable	05
Integrated electronics (OBE)	06-07
Characteristic curves	08-09
Unit dimensions	10

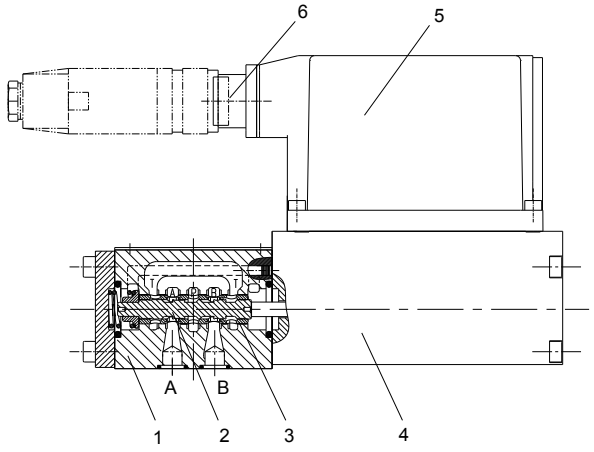
Features

- With control spool and sleeve in servo quality
- Operated on one side, 4/4-fail-safe position in switched off state
- Electric position feedback and integrated electronics(OBE), calibrated in the factory
- Electrical connection 6P+PE signal input differential amplifier with interface"A1": ±10V or interface"F1": 4...20mA (R_{sh} =200Ω)
- Subplate mounting, porting pattern to ISO 4401-03-02

Function and configuration

The 4WRPEH type high-response valve is a pilot-operated directional control valve with electrical position feedback and integrated electronics (OBE).
The valves basically consists of the housing(1),spool(2),sleeve(3),control solenoid with position transducer(4) and so on.
The specified command value is compared with the actual position value in the integrated electronics (OBE).In the event of a control deviation, the stroke solenoid is activated, which adjusts the control spool against the spring due to the change in the magnetic force.
Lifting/control cross-section is proportionally regulated to the command value. In case of a command value presetting of 0 V, the electronics adjusts the control spool against the spring to central position. In deactivated condition, the spring is untensioned to a maximum and the valve is in fail-safe position.
Switch-off behavior
With the electronics switched off, the valve moves immediately into the relevant safe basic position (fail-safe). The switch position P–B/A–T is passed through during this process, which can result in movements on the controlled component. This must be taken into account in system

Type 4WRPEH6...-L2X/G24...



Ordering code

4WRP	E	H	6				–L2X	/	G24	/			*

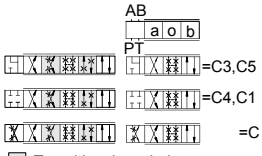
Directional control valve direct operated

With integrated electronics

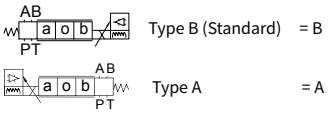
Control spool/sleeve =H

NG 6 =6

Spool symbols



Solenoid position



Further information in plain text

V = FKM Seals
No code = NBR Seals

A1= Command/ actual value ±10 V
F1 = Command/ actual value 4 to 20 mA

K31= With component plug, Without plug-in connector
Z31= With component plug and plug-in connector

Supply voltage of the control electronics
G24= + 24 V DC

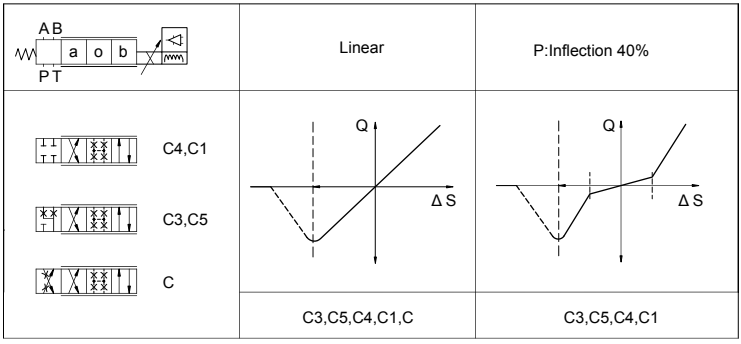
L2X= L20 to L29: unchanged installation and connection dimensions

Flow characteristics:
L= Linear
P= Inflected characteristic curve

Rated flow of with 70 bar pressure differential (35bar/control edge)
02=2 L/min 04=4 L/min 12=12L/min
24=24L/min 40=40L/min

06

Symbols



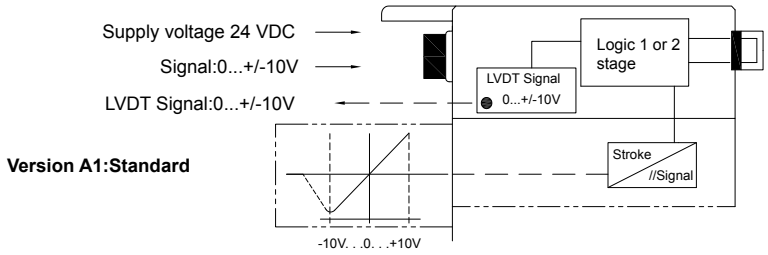
Technical data

General							
Design			Spool valve, direct operated, with steel sleeve				
Actuation			Proportional solenoid with position control, OBE				
Connection type			Subplate mounting, porting pattern according to ISO 4401-03-02-0-05				
Installation position			Any				
Ambient temperature range		°C	-20~+50				
Weight		Kg	~2.75				
Maximum vibration resistance (test condition)			Max. 25 g, space vibration test in all directions (24h)				
Hydraulic (measured at p=100bar, with HLP46 at ϑ_{oil} = 40°C ±5°C)							
pressure fluid			Mineral oil (HL, HLP)to DIN 51 524				
Viscosity range	Recommended	mm^2/s	20…100				
	Maximum admissible	mm^2/s	10…800				
Hydraulic fluid temperature range		°C	-20 to +70				
Maximum admissible degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c)			Class 18/16/13				
Rated flow (Δp = 35 bar per edge)		L/min	2	4	12	24	40
Maximum operating pressure		bar	Port A, B, P: 315				
Maximum operating pressure		bar	Port T: 250				
Leakage flow at 100 bar	Linear	cm^3/min	< 150	< 180	< 300	< 500	< 900
	Nonlinear	cm^3/min	—	—	—	< 300	< 450
Static/Dynamic							
Hysteresis		%	⩽ 0.2				
Actuating time for signal step 0 ... 100%		ms	10				
Temperature drift			Zero shift < 1% at ΔT=40°C				
Zero compensation			Ex factory ±1%				

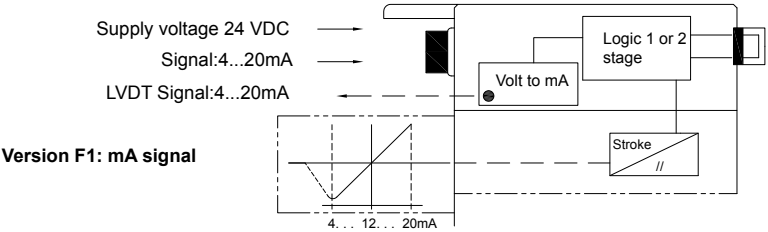
Electric, control electronics integrated in the valve		
Relative duty cycle	%	100ED
Protection class according to EN 60529		IP 65.
Connection		Plug-in connector 6P+PE, DIN 43563
Supply voltage		$24VDC_{nom}$
Terminal A		min. 21VDC / max. 40VDC
Terminal B		0V (ripple max. 2)
Fuse protection, external	A_F	2.5
Input, version "A1"		Differential amplifier, Ri = 100 kΩ
Terminal D (U_E)		0...±10V
Terminal E		0V
Input, version "F1"		Load, R_{sh} = 200 Ω
Terminal D (I_{D-E})		4...12...20mA
Terminal E (I_{D-E})		Current loop I_{D-E} return
Test signal, version "A1"		LVDT
Terminal F (U_{Test})		0...±10V
Terminal C		Reference 0 V
Test signal, version "F1"		LVDT signal 4 ... (12) ... 20 mA on external load 200 ... 500 Ωmaximum
Terminal F (I_{F-C})		4 ... (12) ... 20mA (output)
Terminal C (I_{F-C})		Current loop I_{F-C} return
Adjustment		calibrated before delivery, see characteristic curves

[1] The cleanliness level of the component must be reached in the hydraulic system. Effective filtering prevents failures and increases the service life of components.

Electrical connection

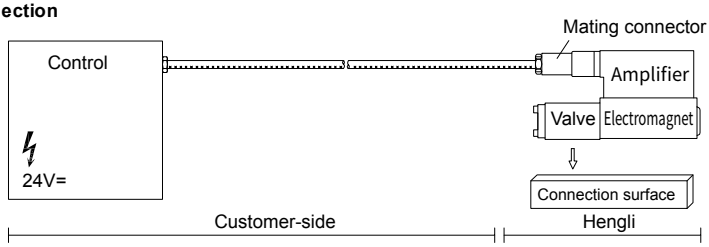


Version A1:Standard



Version F1: mA signal

Connection



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

Note:
Supply voltage 24 V DC_{nom}

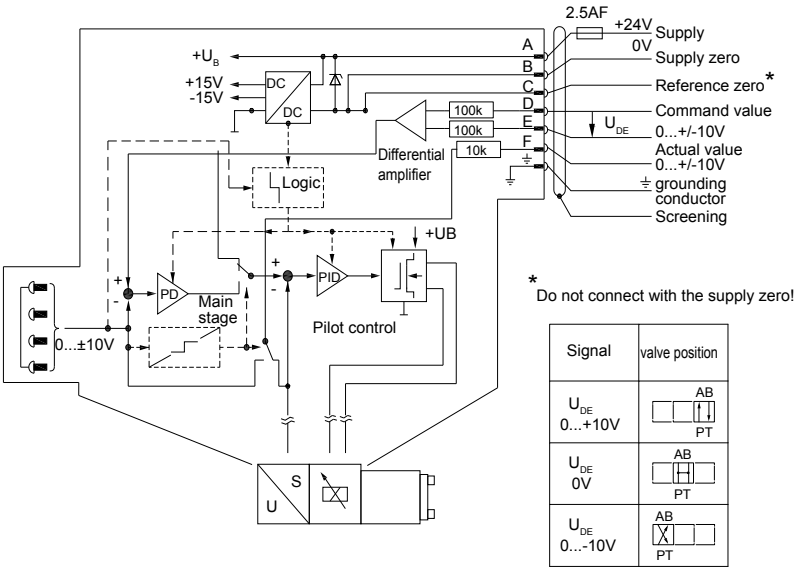
if the value falls below 18V = an internal fast switch-off is effected which can be compared with "Release OFF".

Additionally for 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) may not Abe used for the switch-off of safety-relevant machine functions! (See also the European standard "Safety requirements for fluid power systems and their components - Hydraulics", EN 982.)

Integrated electronics (OBE)

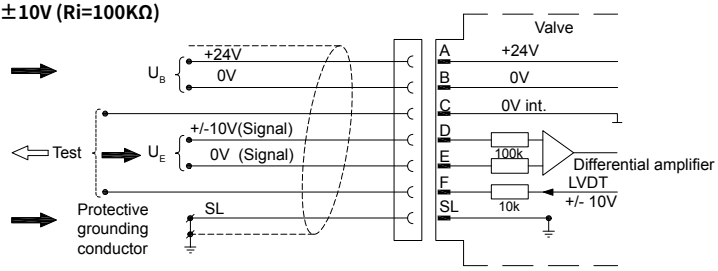
Block diagram/pin assignment
A1:U_{D-E} 0...±10V



* Do not connect with the supply zero!

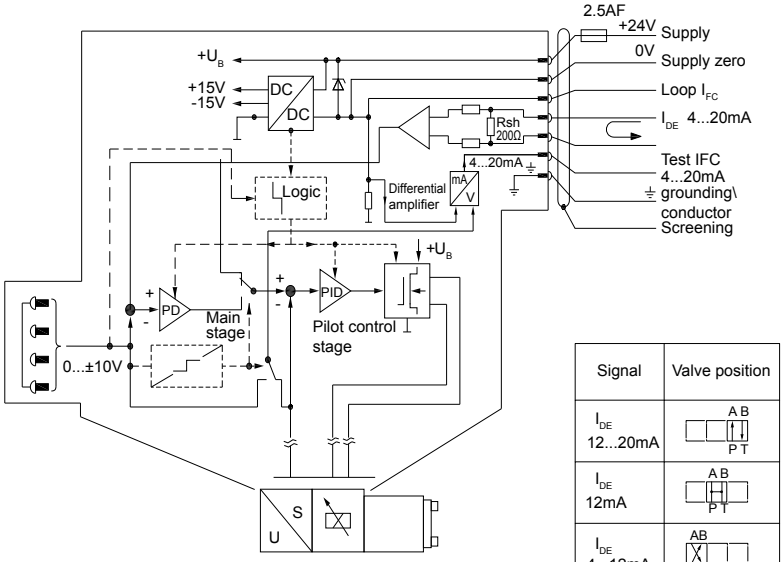
Signal	valve position
U_{DE} 0...+10V	AB PT
U_{DE} 0V	AB PT
U_{DE} 0...-10V	AB PT

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



Integrated electronics (OBE)

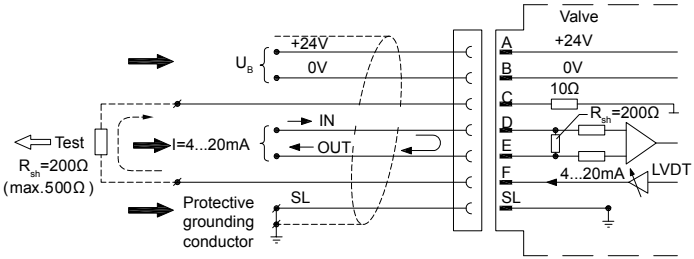
Block diagram/pin assignment
F1: $I_{D\text{-}E}$ 4...20mA



Signal	Valve position
I_{DE} 12...20mA	A B P T
I_{DE} 12mA	A B P T
I_{DE} 4...12mA	AB PT

I_{DE}≤2mA,Valve inactive

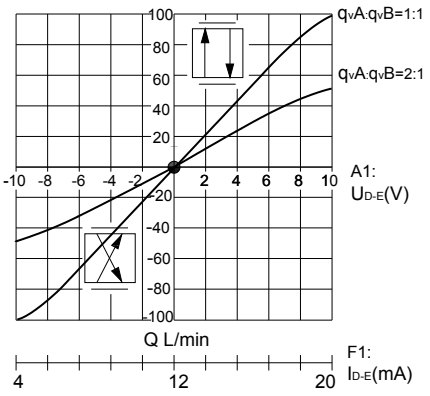
In assignment 6P+PE
F1: $I_{D\text{-}E}$ 4...20mA (Rsh =200 Ω)

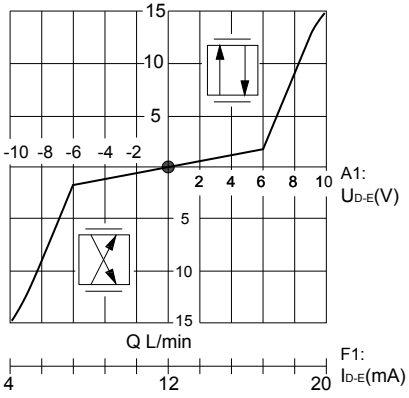


Characteristic curves (measured at p =100bar, with HLP46, ϑ_{oil}=40°C ±5°C)

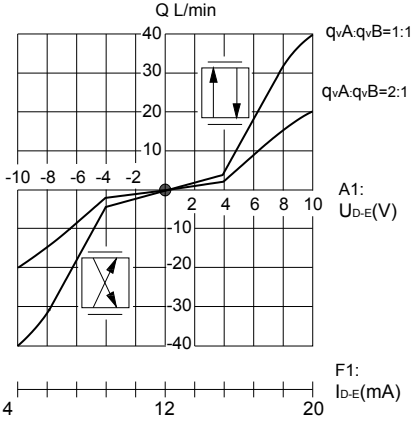
Flow-signal function $q_v=f(U_{D-E})$, $q_v=f(I_{D-E})$

Linear characteristic curve (version "L")

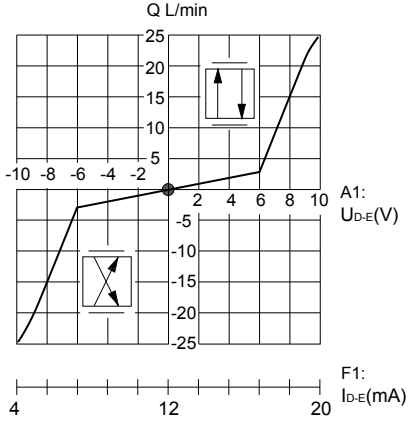




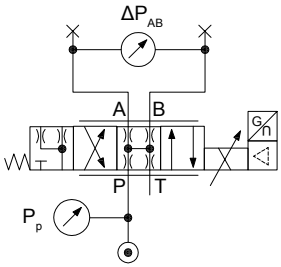
Inflected characteristic curve"P", inflection at 40%

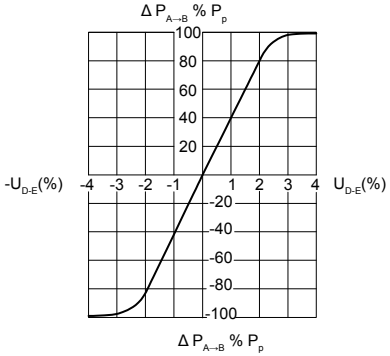


Inflected characteristic curve"P", inflection at 60%

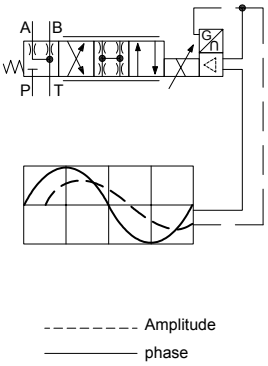


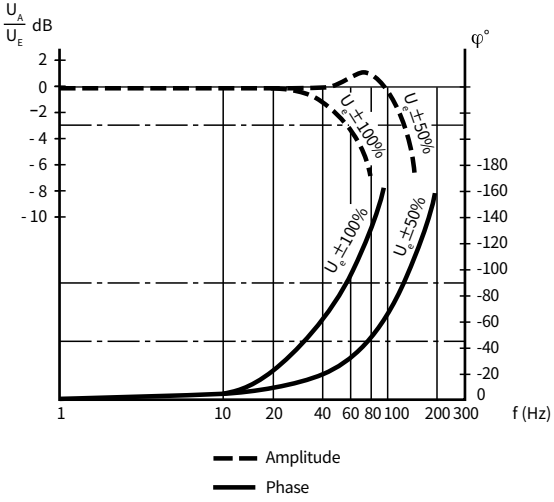
Characteristic curves: Pressure amplification (measured at p =100bar, with HLP46, ϑ_{oil} =40°C ±5°C)





Characteristic curves: Bode diagram (measured at p =100bar, with HLP46, ϑ_{oil} =40°C ±5°C)

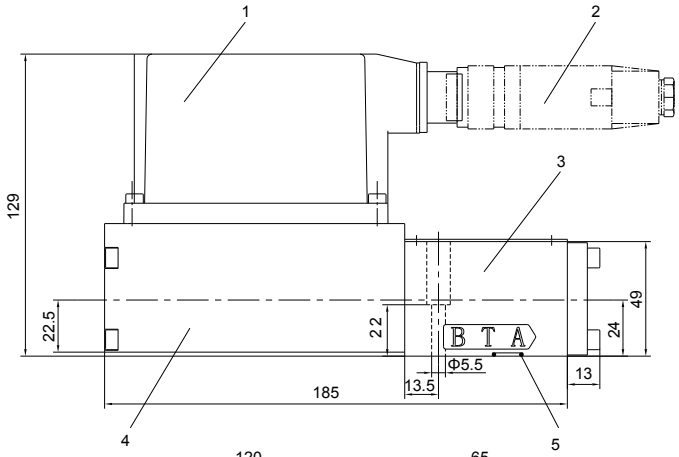


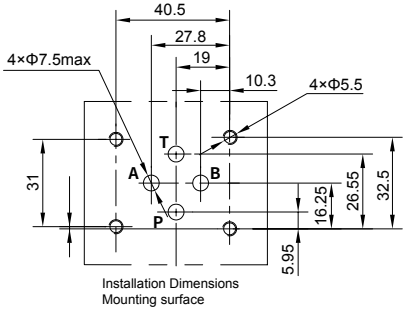


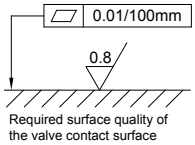
06

Unit dimensions

(Dimensions in mm)







1 Integrated electronics (OBE)
2 Mating connectors
3 Valve housing
4 Control solenoid with position transducer
5 O-ring 9.25×1.78 (for ports P, A, B, T)

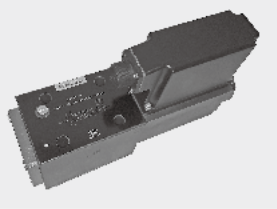
Valve mounting screws:
4- M5×30 GB/T 70.1-10.9;
M_A =7.9 Nm±10%

6.14

Proportional directional valves

Type 4WRPEH10...L2X

NG 10
Up to 315 bar
Up to 100 L/min



Contents

Function and configuration	02
Ordering code	03
Symbols	03
Technical data	04
Electrical connection	05
Technical data for the cable	05
Integrated electronics	06-07
Characteristic curves	08-09
Unit dimensions	10

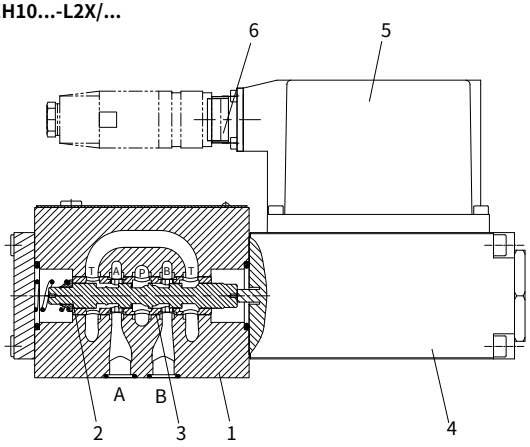
Features

- Directly actuated controlled directional valve, with control spool and sleeve in servo quality
- Single-side operated, 4/4 fail-safe position in deactivated state
- Electric position feedback and integrated electronics (OBE), calibrated in the factory
- Electric port 6P+PE Signal input of differential amplifier with interface A1: ±10 V or interface F1: 4...20mA (Rsh=200Ω)
- Subplate mounting, porting pattern to ISO 4401-05-04

Function and configuration

The 4WRPEH type high-response valve is a pilot-operated directional control valve with electrical position feedback and integrated electronics (OBE).
The valves basically consists of the housing(1),spool(2),sleeve(3),control solenoid with position transducer(4) and so on.
The specified command value is compared with the actual position value in the integrated electronics (OBE).In the event of a control deviation, the stroke solenoid is activated, which adjusts the control spool against the spring due to the change in the magnetic force.
Lifting/control cross-section is proportionally regulated to the command value. In case of a command value presetting of 0 V, the electronics adjusts the control spool against the spring to central position. In deactivated condition, the spring is untensioned to a maximum and the valve is in fail-safe position.
With the electronics switched off, the valve moves immediately into the relevant safe basic position (fail-safe). The switch position P–B/A–T is passed through during this process, which can result in movements on the controlled component. This must be taken into account in system designs.

Type 4WRPEH10...-L2X/...



Ordering code

4WRP	E	H	10				– L2X/	G24	/	V	*

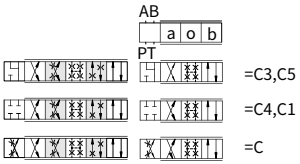
Directional control valve direct operated

With integrated electronics =E

Control spool/sleeve =H

NG 10 =10

Spool symbols



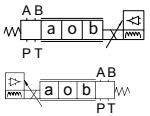
Transitional symbols

With symbols C5 and C1:

P→A : qv B→T : qv/2

P→B : qv/2 A→T : qv

Installation side of the inductive position transducer



Further information in plain text

V = FKM Seals

No code = NBR Seals

Interface of the control electronics

A1= Command/ actual value ±10 V

F1 = Command/ actual value 4 to 20 mA

K31= Without plug-in connector

Z31= With plug-in connector

Supply voltage of the control electronics

G24 = +24V direct current

L2X= Component series L20 to L29

Flow characteristics

L= Linear

P= Inflected characteristic curve

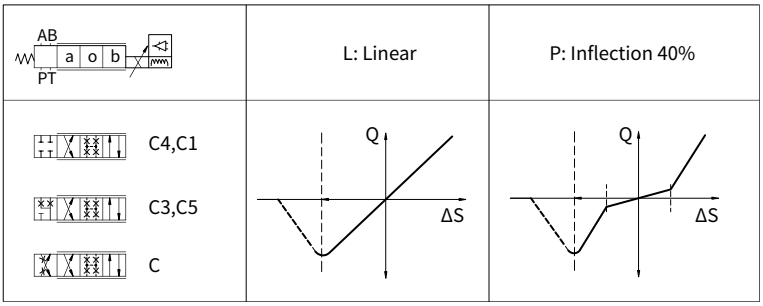
Rated flow at 70 bar valve pressure difference

50= 50L/min

100= 100L/min

06

Symbols



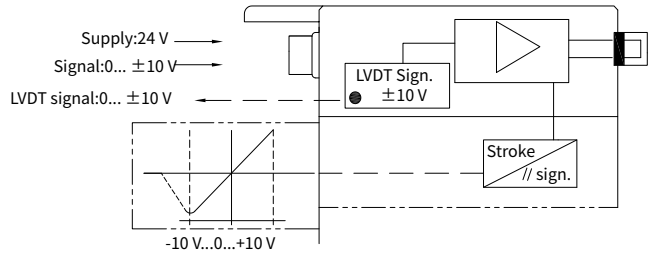
Technical data

General				
Design			Spool valve, directly operated, with steel sleeve	
Actuation			Proportional solenoid with position control, OBE	
Connection type			Plate port, porting pattern (ISO 4401-05-04-0-05)	
Installation position			Any	
Ambient temperature range		°C	-20...+50	
Weight		Kg	7.1	
Maximum vibration resistance (test condition)			Max. 25 g, space vibration test in all directions (24h)	
Hydraulic (measured with HLP 46, ϑ_{oil} =40°C ±5°C)				
Hydraulic fluid			Hydraulic oil according to DIN 51524...535	
Viscosity range	Recommended	mm²/s	20...100	
	Max. admissible	mm²/s	10...800	
Hydraulic fluid temperature range		°C	-20 to +70	
Max. admissible degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c)			Class 18/16/13	
Rated flow (Δp = 35 bar per edge)		L/min	50	100
Maximum operating pressure		bar	Port P, A, B: 315	
Maximum operating pressure		bar	Port T: 250	
Leakage flow at 100 bar	Linear	cm³/min	<1200	<1500
	Nonlinear	cm³/min	<600	<600
Static/Dynamic				
Hysteresis		%	⩽ 0.2	
Actuating time for signal step 0 ... 100%		ms	25	
Temperature drift			Zero shift < 1% at ΔT=40°C	
Zero compensation			Ex factory ±1%	

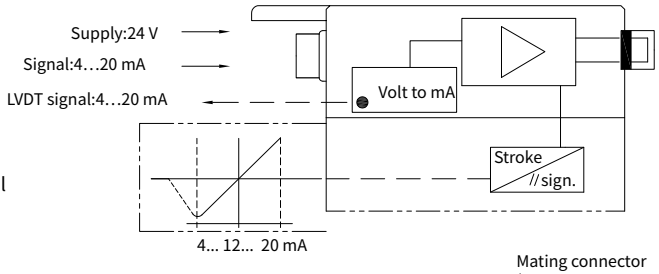
Electric, control electronics integrated in the valve		
Relative duty cycle	%	100ED
Protection class		IP 65 (with mating connector mounted and locked)
Connection		Mating connector 6P+PE, DIN 43563
Supply voltage		24VDC$_{nom}$
Terminal A		min. 21VDC / max. 40VDC
Terminal B: 0V		Ripple max. 2 VDC
Fuse protection, external	A_F	2.5
Input, version "A1"		Differential amplifier, Ri = 100 kΩ
Terminal D (U_E)		0...±10V
Terminal E		0V
Input, version "F1"		Load, R_{sh} = 200 Ω
Terminal D (I_{D-E})		4...12...20mA
Terminal E (I_{D-E})		Current loop I_{D-E} return
Test signal, version "A1"		LVDT
Terminal F (U_{Test})		0...±10V
Terminal C		Reference 0 V
Test signal, version "F1"		LVDT
Terminal F (I_{F-C})		4...20 mA output
Terminal C (I_{F-C})		Current loop I_{F-C} feedback

Electrical connection

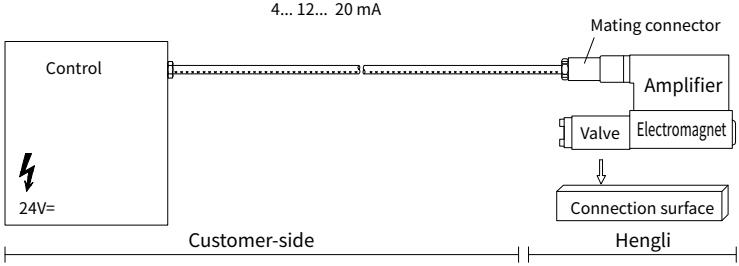
Version A1:Standard



Version F1: mA signal



Connection



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

Note:
Supply voltage 24 V DC_{nom}

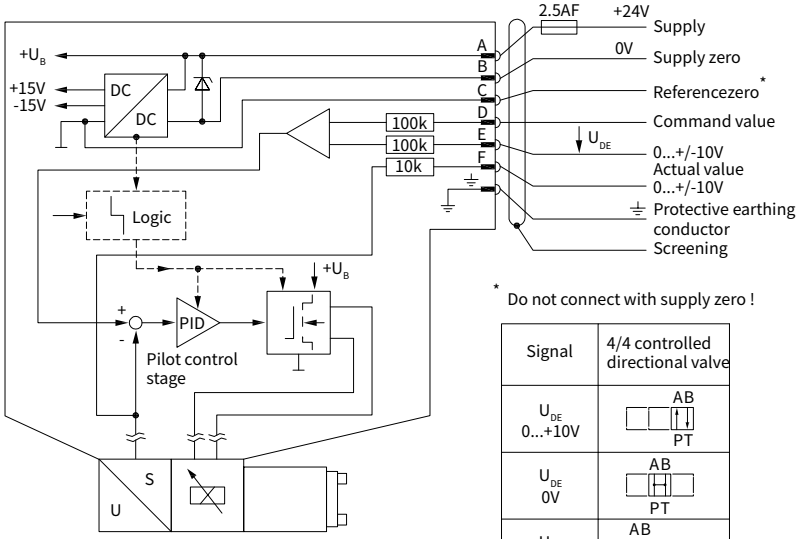
if the value falls below 18V DC= an internal fast switch-off is effected which can be compared with "Release OFF".

Additionally for version F1:
$I_{D\text{-}E} \geqslant$ 3mA - valve is active
$I_{D\text{-}E} \leqslant$ 2mA - valve is deactivated.

Electric signals taken out via control electronics (e.g. actual value) may not Abe used for the switch-off of safety-relevant machine functions! (See also the European standard "Safety requirements for fluid power systems and their components - Hydraulics", EN 982.)

Integrated electronics

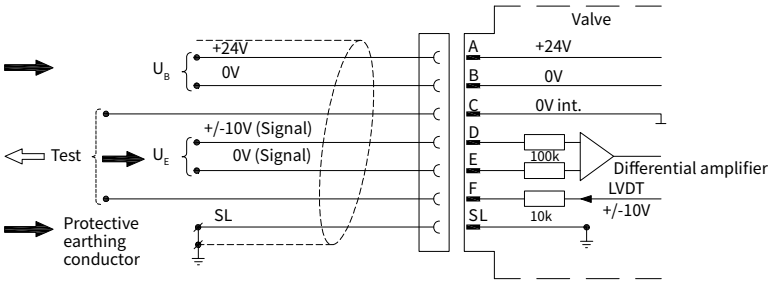
Block diagram/pin assignment
Version A1: $U_{D\text{-}E}$ 0...±10V



* Do not connect with supply zero !

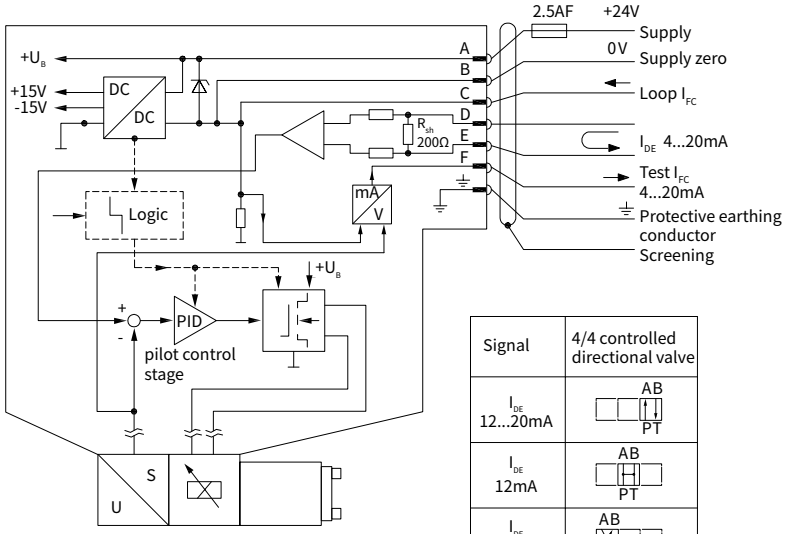
Signal	4/4 controlled directional valve
U_{DE} 0...+10V	AB PT
U_{DE} 0V	AB PT
U_{DE} 0...-10V	AB PT

Pin assignment 6P+PE
Version A1: $U_{D\text{-}E}$ 0...±10V



Integrated electronics

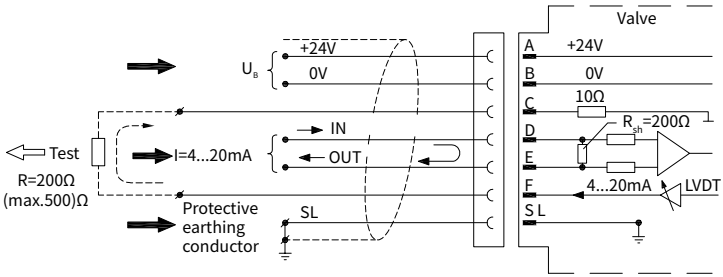
Block diagram/Pinout
Version F1: I_{D-E} 4...20mA



Signal	4/4 controlled directional valve
I_{DE} 12...20mA	AB PT
I_{DE} 12mA	AB PT
I_{DE} 4...12mA	AB PT

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

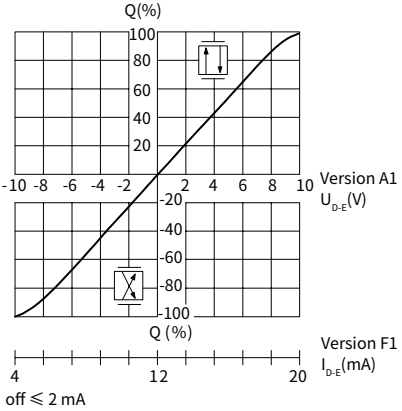
Pin assignment 6P+PE
Version F1: I_{D-E} 4...20mA



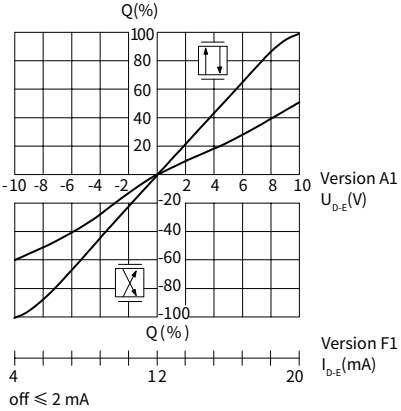
Characteristic curves (measured with HLP46, ϑ_{oil}=40°C ±5°C)

Flow-signal function Q=f (U_{D-E}), Q= f (I_{D-E})

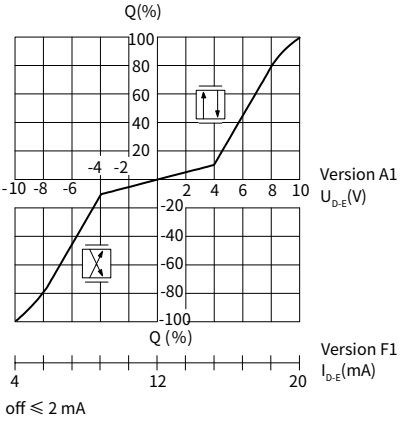
Linear characteristic curve (version "L"), 1 : 1



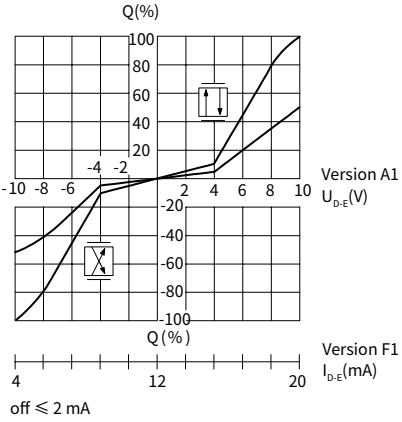
Linear characteristic curve (version "L"), 2 : 1



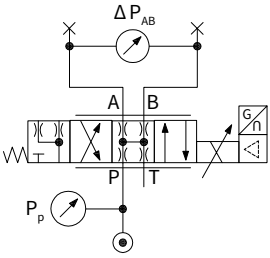
Inflected characteristic curve"P", inflection at 40% , 1 : 1

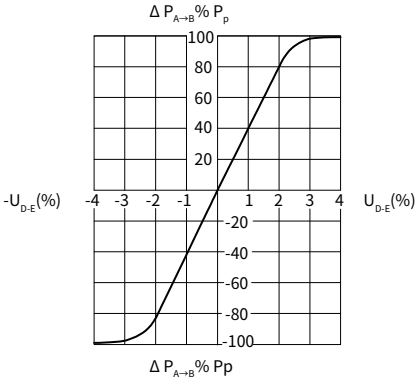


Inflected characteristic curve"P", inflection at 40% , 2 : 1

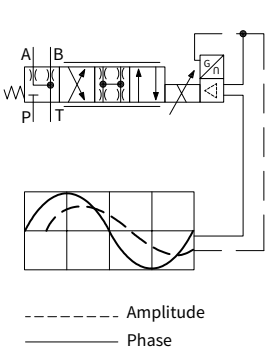


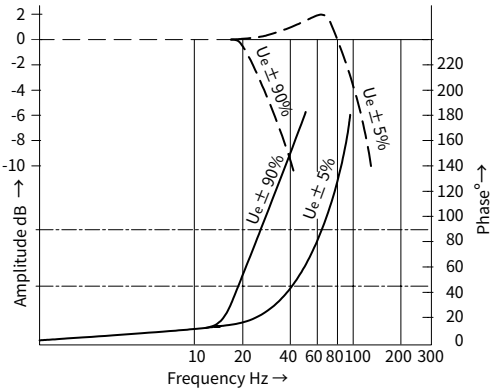
Characteristic curves: Pressure amplification (measured with HLP46, ϑ_{oil}=40°C ±5°C)





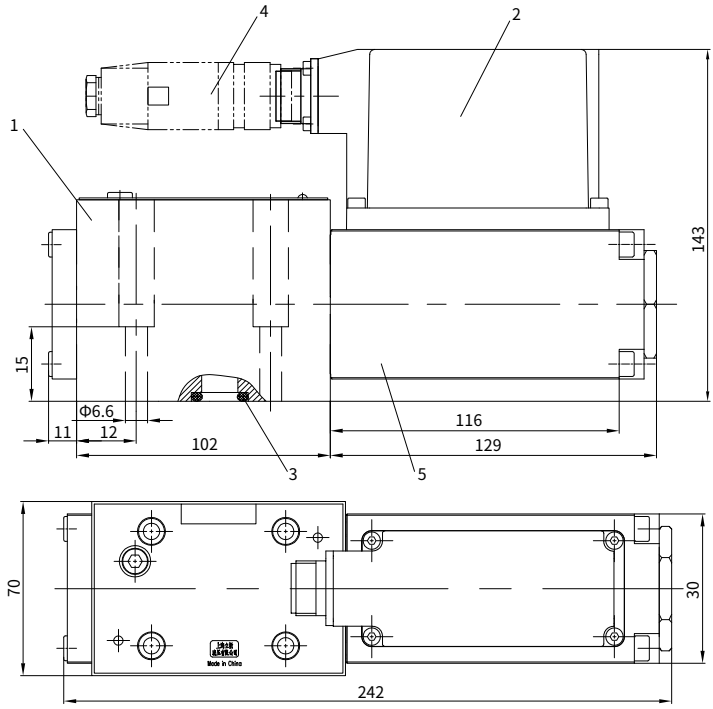
Characteristic curves: Bode diagram

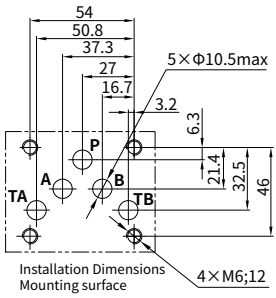




Unit dimensions

(nominal dimensions in mm)



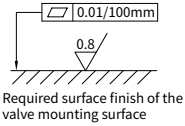


1 Valve housing
2 Integrated electronics
3 Identical seal rings for ports A, B, P and T (O-ring 12×2)
4 Plug-in connector
5 Proportional solenoid with inductive position transducer

Valve mounting screws

The following valve fixing screws are recommended:

- 4 GB/T 70.1 - M6×40 - 10.9
- Tightening torque M_A = 11+3 Nm

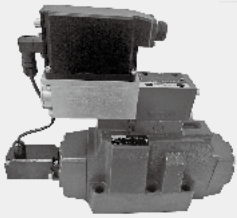


6.15

Pilot operated proportional directional valves

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

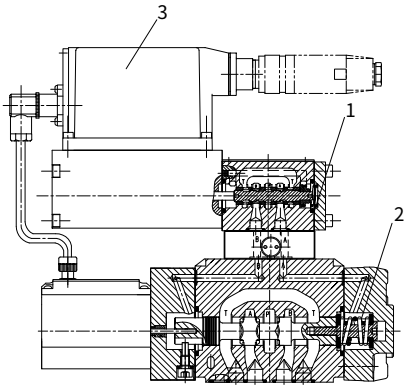
Features

- Pilot valve NG6, with control spool and sleeve in servo quality, actuated on one side, 4/4 fail-safe position 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...10 V between 20...100 %.
If the input setpoint is < ± 0.5 V, the control spool is held in the springcentered, overlapped mid position.

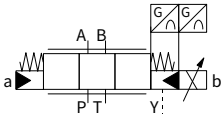
Power failure

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.

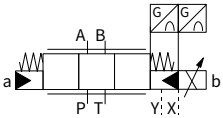
06

Symbols

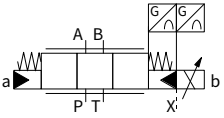
Type 4WRLE...–L4X...E.



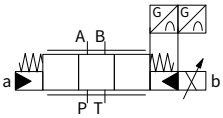
Type 4WRLE...–L4X...



Type 4WRLE . –L4X . . T .



Type 4WRLE...–L4X...ET.



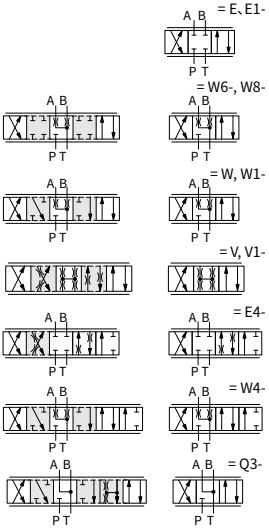
Ordering code

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

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
L = Linear

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

NG10:		NG25:	
55 =	55 l/min	370 =	370 l/min
100 =	100 l/min		
NG16:		**NG27:**	
120 =	120 l/min	430 =	430 l/min
200 =	200 l/min		

[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 $Q_A : Q_B$

06

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	NG25 18	NG27 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	NG10	NG16	NG25	NG27
			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

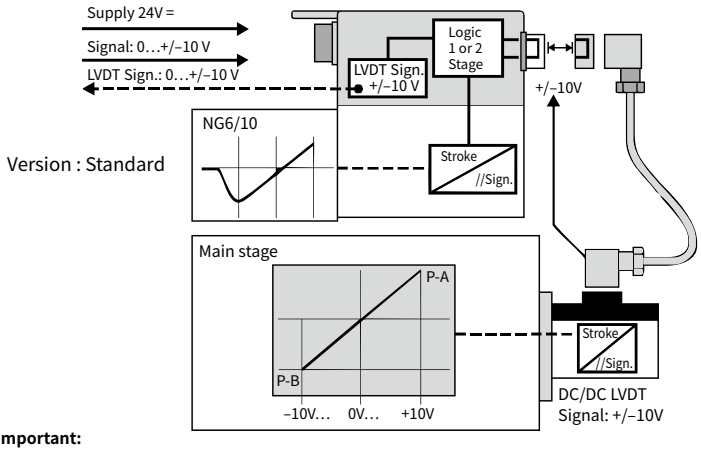
Static/Dynamic						
Hysteresis		%	< 0.1, scarcely measurable			
Manufacturing tolerance for Q_{max}		%	≦ 10			
Response time for signal change (at X = 100 bar)	0...100 %		25	26	32	32
	0...10 %		14	15	18	18
Response time for signal change (at X = 10 bar)	0...100 %		85	80	120	120
	0...10 %		50	30	50	50
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

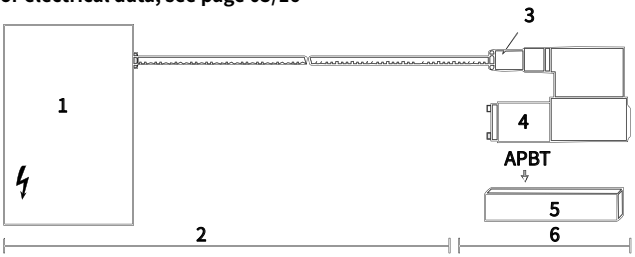
Electric pilot valve NG6, trigger electronics integrated in the valve		
Cyclic duration factor	%	100 ED
Degree of protection		IP 65 to DIN 40050 and IEC 14434/5
Connection		Plug-in connector 6P+PE, DIN 43563
Power supply Terminal A: Terminal B: 0 V		24 V DC min. 21 V DC/max. 40 V DC Ripple max. 2 V DC
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 0 V		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 +8 V, calibrated at the factory, see valve characteristic curve

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}

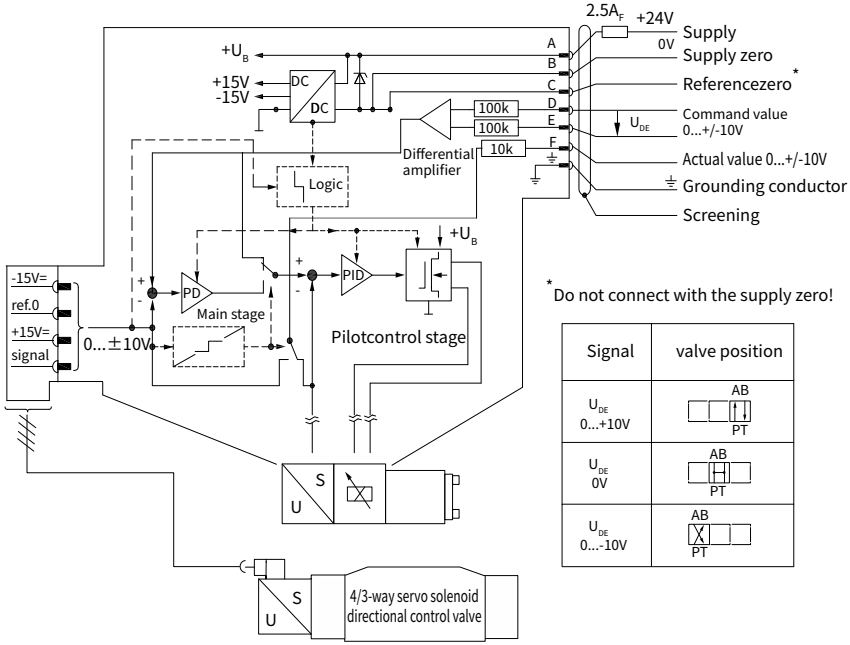
If the value falls below 18 VDC, a fast shut-down takes place internally, comparable with "Enable OFF".

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

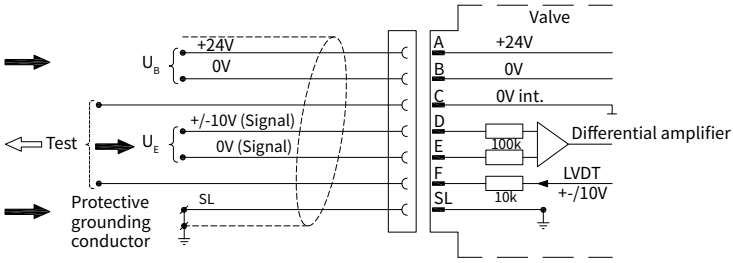
Block diagram/pin assignment
Version A1: U_{D-E} ±10V



* 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

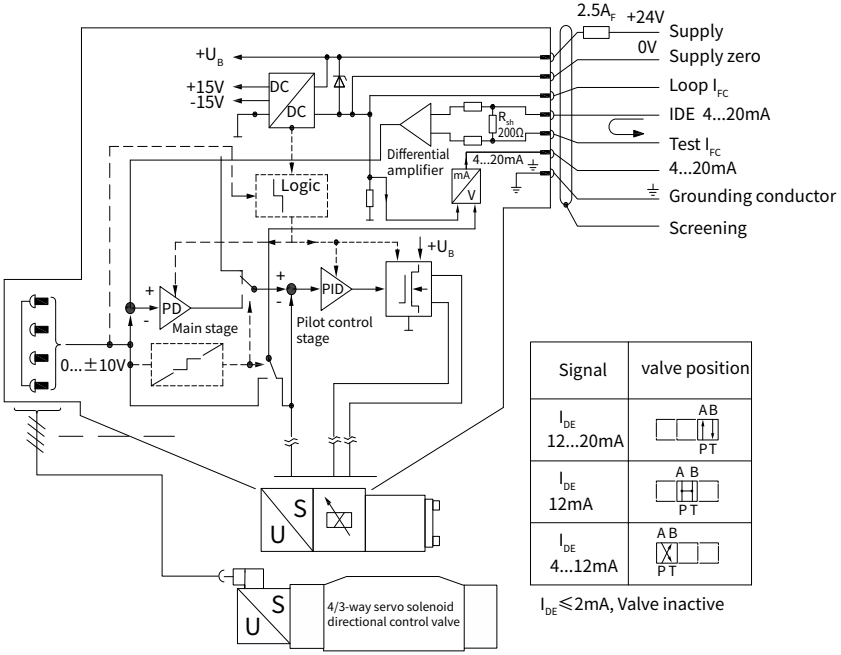
Pin assignment 6P+PE
A1: U_{D-E} ± 10V (Ri=100KΩ)



06

Integrated electronics

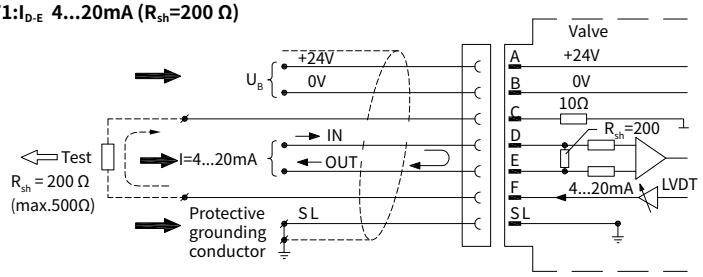
Block diagram/Pinout
Version F1: I_{D-E} 4...20mA



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

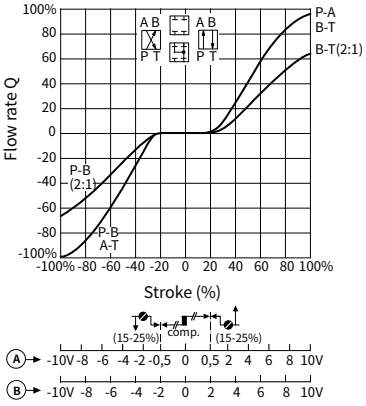
$I_{DE} \leqslant 2$mA, Valve inactive

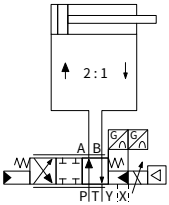
Pin assignment 6P+PE
F1:I_{D-E} 4...20mA (R_{sh}=200 Ω)



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)

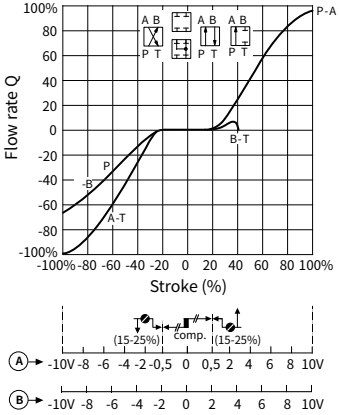




Control spool with asymmetric metering notches
Control spools with asymmetric metering notches are available in a ratio of 2:1 for the purpose of adaptation to differential cylinders.

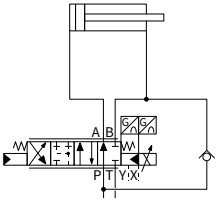
Flow in mid position, "leakage oil pressure relief"With symbol "E", leakage oil in the two work chambers A and B of the control piston gives rise to a build-up of pressure in A or B, which then causes a connecting cylinder to drift out of position.
In many cases, the "W" symbol is a better solution. 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.

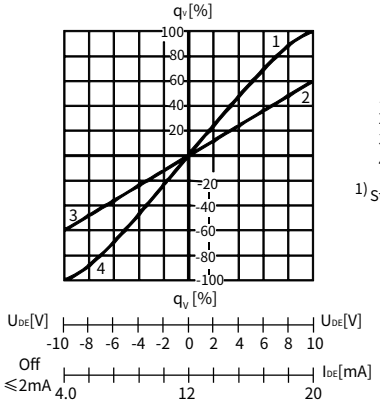


Characteristic curves (measured with HLP46, ϑ_{oil}=40°C ±5°C , Δp=5 bar/control edge)

Flow signal function

Flow characteristic "L"

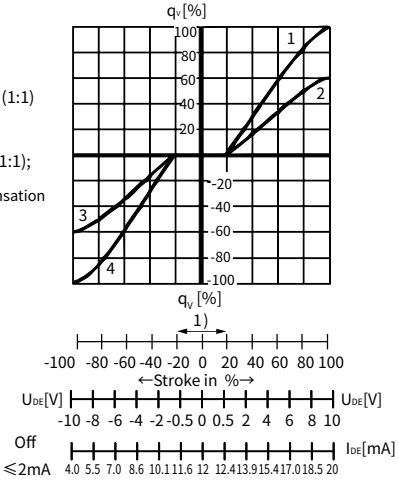
Symbol V,V1-



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

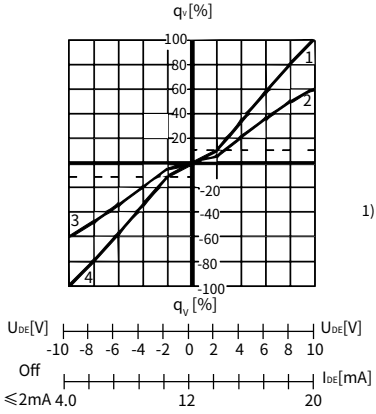
1) Step compensation

Symbol E1,E1-,W6,W8-



Flow characteristic "P"

Symbol V, V1-

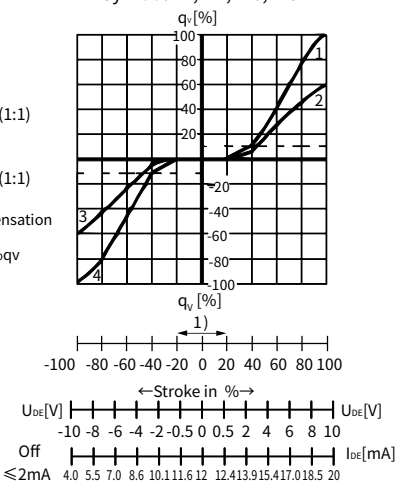


1 P–A;B–T (1:1)
2 B–T (2:1)
3 P–B(2:1)
4 P–B; A–T(1:1)

1) Step compensation

------ 10%qv

Symbol E1,E1-, W6, W8-

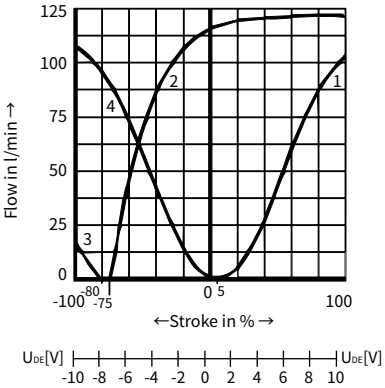


Characteristic curves(measured with HLP46, ϑ_{oil}=40°C ±5°C , Δp=5 bar/control edge)

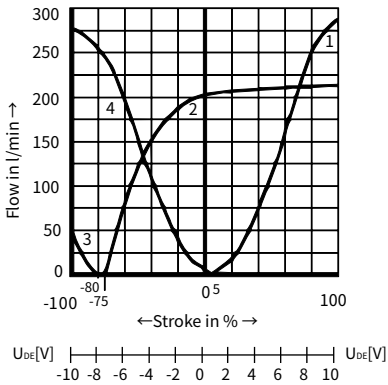
Flow signal function

Flow characteristic "M"

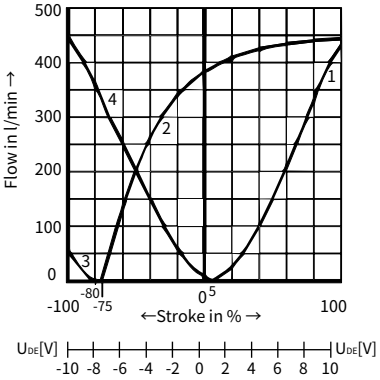
Symbol Q3,version"100"



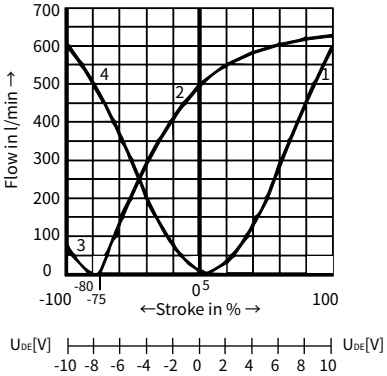
Symbol Q3,version"250"



Symbol Q3,version "400"



Symbol Q3,version "600"

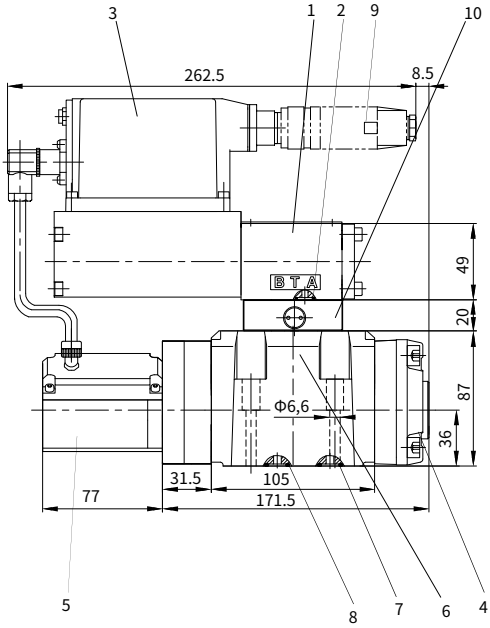


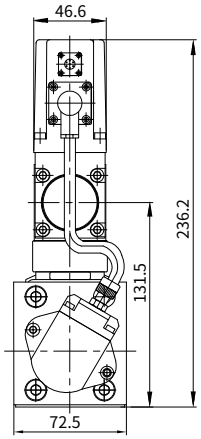
1 P–A 3 P–B
2 B–T 4 A–T

Unit dimensions

(Dimensions in mm)

NG 10

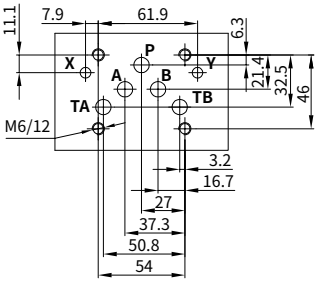


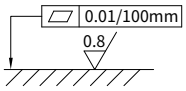


1 Pilot control valve
2 R-ring9.81×1.5×1.78 (ports P, A, B, T)
3 On-board electronics
4 Main valve
5 Inductive position transducer (main valve)
6 Nameplate
7 R-ring 13×1.6×2, ports A, B, P, T
8 R-ring 11.18×1.6×1.78, ports X and Y
9 Plug-in connector not included in delivery (order separately)
10 Pressure reducing valve

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

Machined valve mounting surface



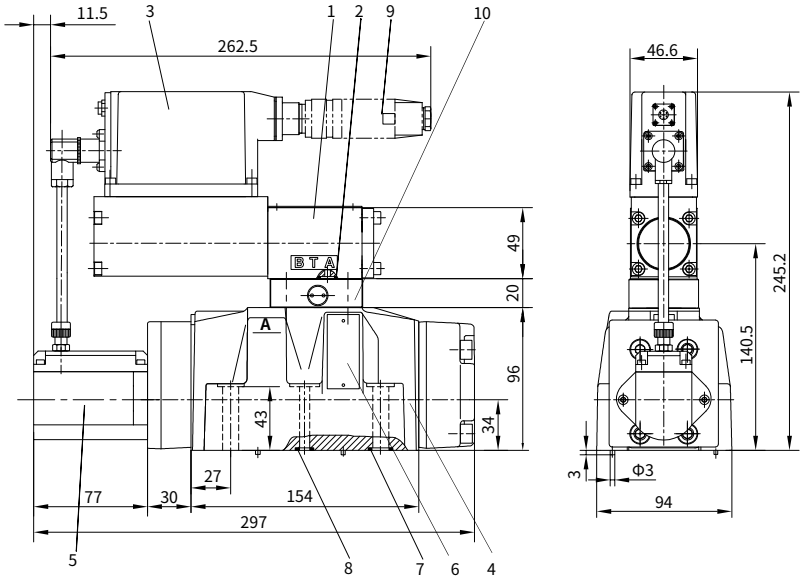


Required surface finish of mating piece

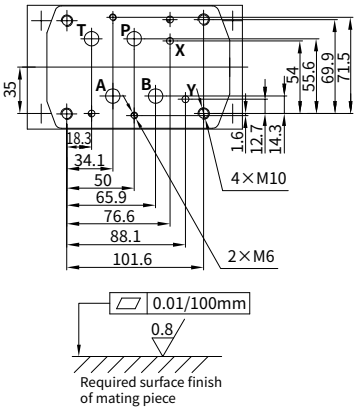
Unit dimensions

(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)
10 Pressure reducing valve

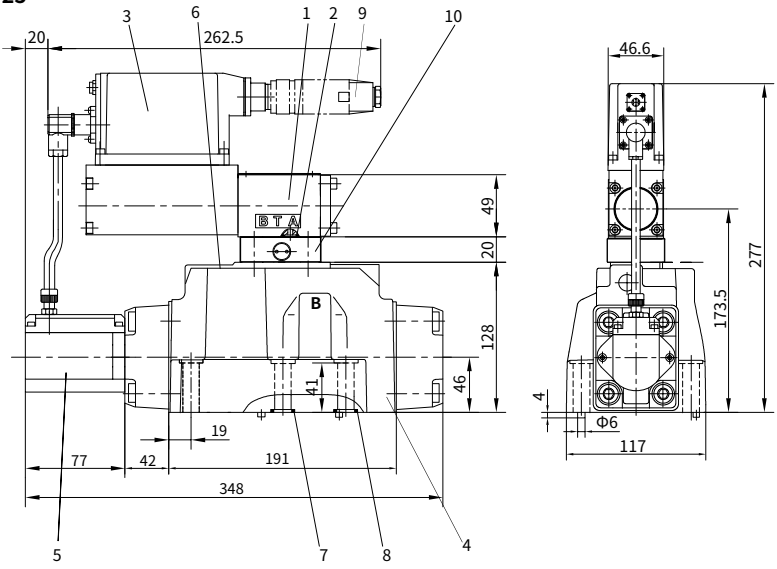
Valve fixing screws:

2- M6×60 ISO 4762-10.9; M_A =14 Nm
4- M10×60 ISO 4762-10.9; M_A =60 Nm

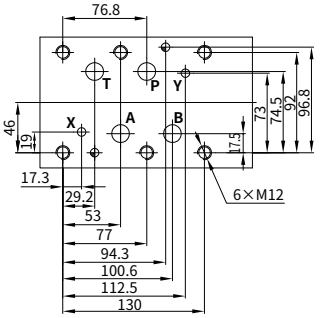
Unit dimensions

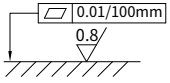
(Dimensions in mm)

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)
10 Pressure reducing valve

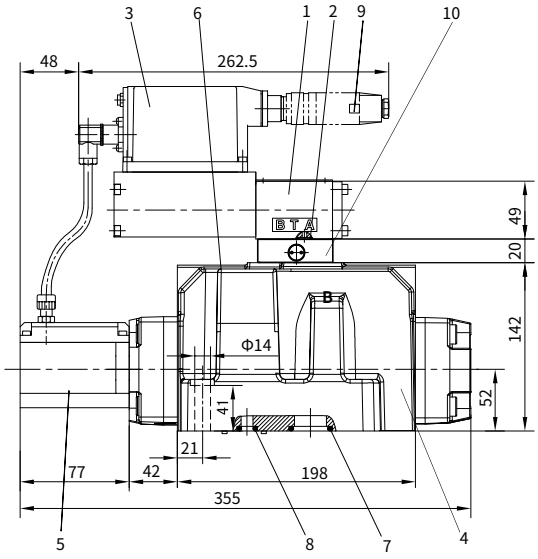
Valve fixing screws:

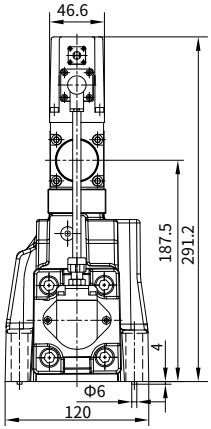
6- M12×60 ISO 4762-10.9; M_A =100 Nm

Unit dimensions

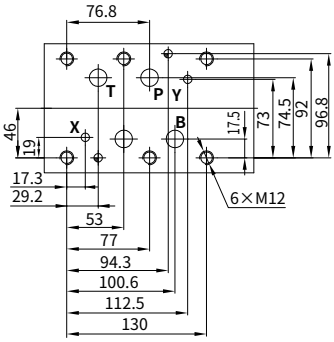
(Dimensions in mm)

NG 27





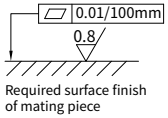
Machined valve mounting surface



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)
10 Pressure reducing valve

Valve fixing screws:

6- M12×60 ISO 4762-10.9; M_A =100 Nm



China
+86 400 101 8889

America
+01 630 995 3674

Germany
+49 172 3683463

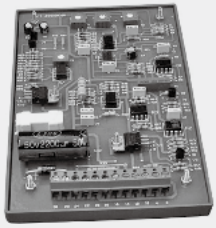
Japan
+81 03 6809 1696

6.16

Proportional amplifier

Type VT 2000

For controlling proportional pressure valve.
EURO circuit board structure.



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Application specification: VT-2000BS40G	04
Outline dimension: VT-2000BS40G	05
Wiring diagram of amplifier : VT-2000BK40	06
Application specification: VT-2000BK40	07
Outline dimension : VT-2000BK40	08

Features

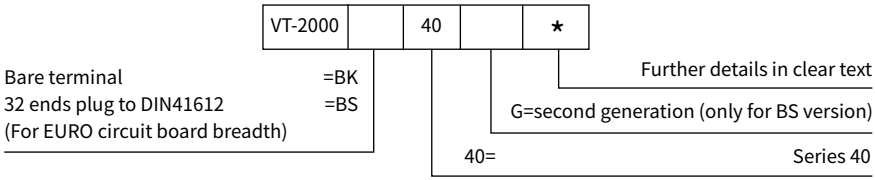
VT-2000 is a proportional power amplifier and consists of:

- Voltage regulator
- Two input circuits of differential and potentiometer
- Controllable constant current generator
- Ramp generator
- Oscillator 200Hz
- Ramp adjustable for time of "up" and "down"

Technical data

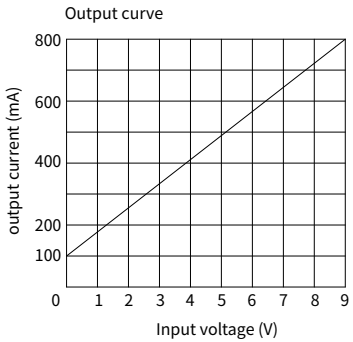
Weight	m	Approx. 0.15kg
Voltage	U	DC 24V (-5%~+10%)
Power	P	30VA
Fuse wire	Is	1.2AT
Control voltage	U	Input differential 0~+10V
		Manual potentiometer input 0~+9V
Min. load resistance for control vloltage	R	500Ω
Max. output current	I_{max}	800mA
Max. load resistance	R	30Ω
Pilot current	I	100mA
Vibration current frequency	f	200Hz
Ambient temperature	t	0~40 °C
Temperature drift		0.5‰ (max. current value)/ °C

Ordering code



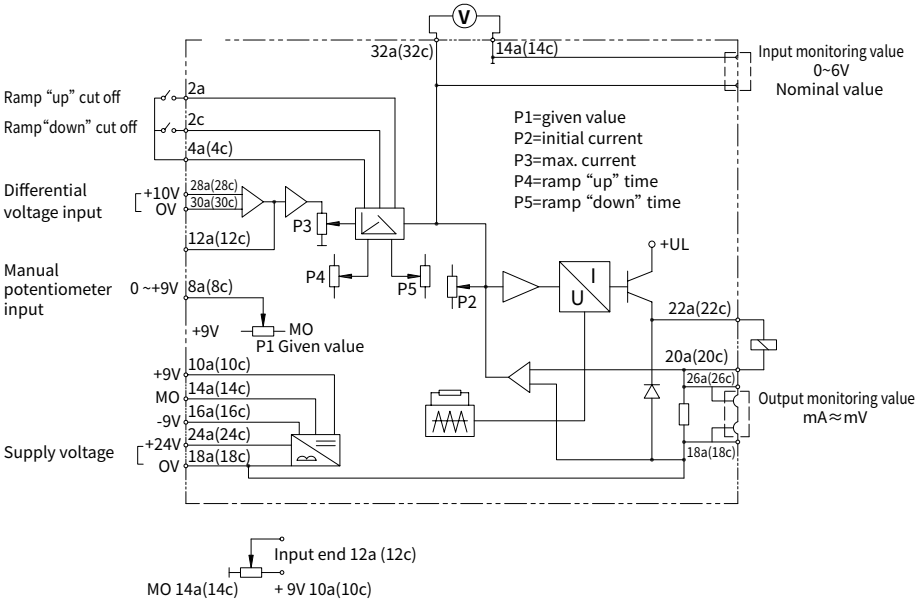
06

Characteristic curve



Wiring diagram of amplifier

Type VT-2000BS40G



Application specification

Type VT-2000BS40G

Principle chart of Hydro-electric proportional amplifier type VT-2000BS40G see Wiring Chart

1. 20a (20c), 22a (22c) in the right of the dotted line, connects with proportional solenoid coil, And 22a (22c) is the high electric potential and 20a(20c) is the low electric potential.

2. 24a (24c), 18a (18c, 16a, 16c) in the left of the dotted line, connects with DC 24V power, among them, 24a (24c) connects the positive pole, 18a (18c, 16a, 16c) connects the negative pole. The controller's power shall be separate with the differential input power, namely 30a (30c) can't connect the 14a (14c) and 18a (18c, 16a, 16c), otherwise, it could be damage the controller.

3. Two controlling methods:

(1). manual control:

a: External potentiometer (provided by user themselves, suggesting to use one with resistance greater than 5K and smaller than 10K but smaller than 2K is not permitted; Power is not limited), one end connects 10a (10c) (+9), another end connects 14a (14c) (M0 is the measurement zero); and the slide end connects 12a (12c). Input the voltage value 0~ +9 V into 12a (12c) end by adjusting the potentiometer, and 100~800mA square wave pulse current will proportionally appears from the proportional solenoid.

b: The controller has a built-in input potentiometer P1, the amplifier panel <given value> potentiometer, which can replace of external potentiometer. When using P1, put through 8a (8c)and 12a (12c), then it can get 100~800mA current from the solenoid to control the solenoid outputting force.

06

(2). Automatic control:

Differential voltage signal from the programmable controller (PLC), function generator and so on inputs from 28a (28c), 30a (30c), and 28a (28c) connects high frequency, while 30a (30c) low frequency. Correspondingly appearing 100~800mA in the solenoid when the differential changes at range of 0~10V. Notes: Don't make the 30a (30c) connected with the 14a (14c)(M0) or negative end 18a (18c), 16a (16c) of the DC24V power, namely the PLC and the proportional controller can't use one power or have mutual grounding.

When the requiring current is less than 800mA, it can limit the max. current by adjusting the P3 in the amplifier panel, e.g. input +9V to end 12, it can limit the output current 800mA into 600mA or other values by adjusting the potentiometer P3.

Two potentiometer P4 and P5 in the amplifier panel is respectively used for adjusting the time of ramp "up" and "down", and the adjustable time range is 0.2~5 seconds.

There is two pairs test holes, the 0~+6V test hole for monitoring the input voltage signal, mV ≈ mA hole for monitoring the output current and the mV measured by the voltage meter approx. equal the mA value in the solenoid.

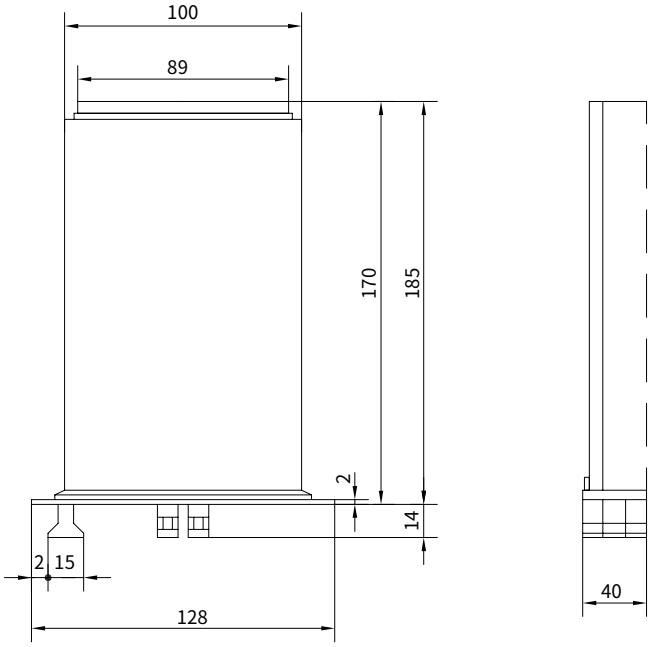
Potentiometer P2 (initial current) on the panel is used for adjusting the pilot current with the range 0~400mA; and preset current is 100mA before dispatch from factory.

Note:

Other potentiometers on the panel have been adjusted before shipment from the factory, if you modify them, the performance parameter given by the manual will not be effective. This amplifier can be plugged in and off only under the electric breakaway.

Outline dimension

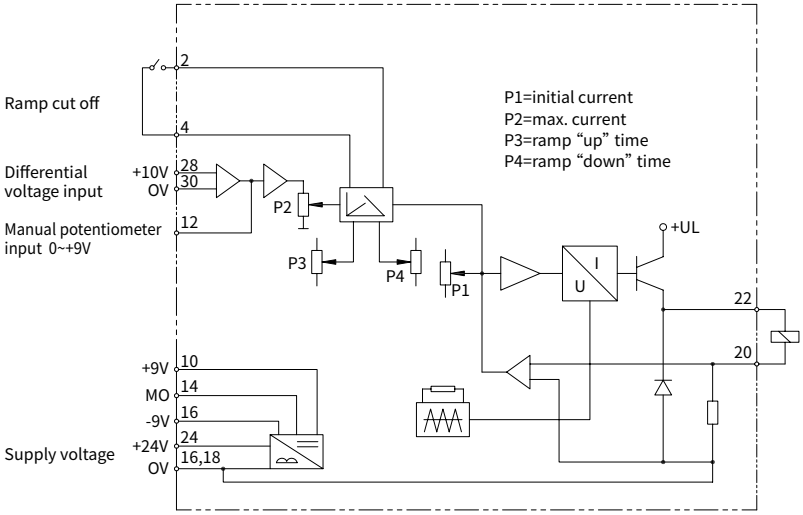
Type VT-2000BS40G

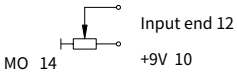


Amplifier type VT-2000BS40G circuit outline dimension adopts Europe standard 100×160 mm, connecter is Europe 32 ends plug. and it has a stand type VT-3002L forming a complete set.

Wiring diagram of amplifier

Type VT-2000BK40





Application specification

Type VT-2000BK40

Principle chart of Hydro-electrical proportional amplifier type VT-2000BK40 see Wiring Chart.
1. End 20 and 22 in the right of the dotted line, connects with proportional solenoid coil (22 is the high electric potential and 20 is the low electric potential.)

2. End 24, 18 (or 16) in the left of the dotted line, connects with DC 24V power, among them, 24 connects the positive pole, 18 or 16 connects the negative pole. The controller's power shall be separate with the differential input power, namely end 30 can't connect the 14 and 18 or 16, otherwise, it could be damage the controller.

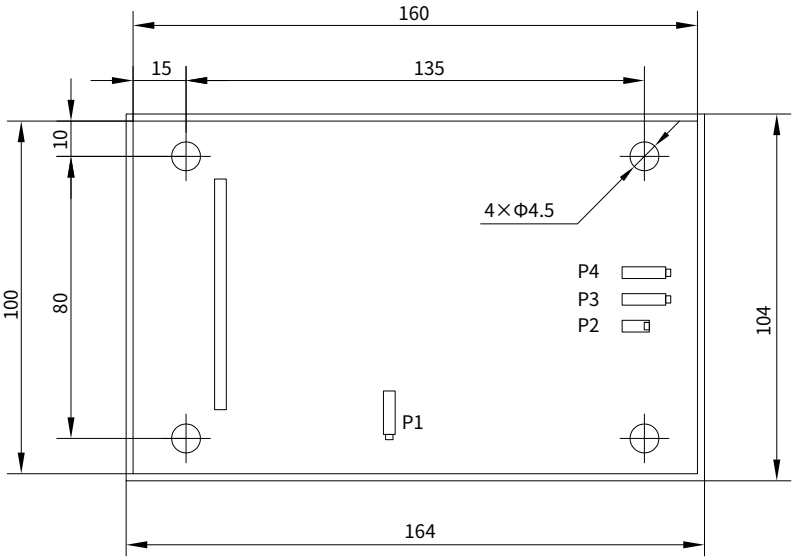
3. Two controlling methods:
(1) Manual control:
External potentiometer (provided by user themselves, suggesting to use one with resistance greater than 5K and smaller than 10K but smaller than 2K is not permitted; Power is not limited), one end connects 10 (+9), another end connects 14 (M0 is the measurement zero); and the slide end connects 12. Input the voltage value 0~+9V into end12 by adjusting the potentiometer, and 100~800 mA square wave pulse current will proportionally appear from the proportional solenoid to actuate it.

(2) Automatic control:
Differential voltage signal from the programmable controller (PLC), function generator and so on inputs from end 28 and 30, among them, end 28 connects high frequency, while 30 low frequency. Correspondingly appearing 100~800mA in the solenoid when the differential changes at range of 0~10V.
Notes: Don't make the end 30 connected with the 14 (M0) or negative end 18, 16 of the DC24V power, namely the PLC and the proportional controller can't use one power or have mutual grounding.
When the requiring current is less than 800mA, it can limit the max. current by adjusting the P2 in the amplifier panel, e.g. input +9V to end 12, it can limit the output current 800mA into 600mA or other values by adjusting the potentiometer P2.
Two potentiometer P3 and P4 in the amplifier panel is respectively used for adjusting the time of ramp "up" and "down", and the Max. time of ramp is 5 seconds. If system needn't ramp time, 2 and 4 can be short-circuited.
Potentiometer P1 on the panel is used for adjusting the pilot current with the range 0~400mA ; and preset current is 100mA before dispatch from factory.

Note:
Other potentiometers on the panel have been adjusted before shipment from factory, if you modify it, the performance parameter given by the manual will not be assured.

Outline dimension

Type VT-2000BK40



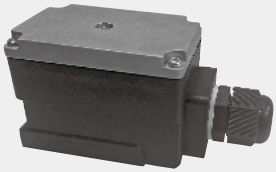
Amplifier type VT-2000BK40 circuit outline dimension adopts Europe standard 100×160 mm, with plastics supporting board (1mm thick), the wring terminal can connects the cable directly.

6.17

Plug-in amplifier

Type VT-SSPA1

Analog amplifier for controlling proportional valves
(pressure and directional valves) without position control.



Contents

Function and configuration	02
Ordering code, accessories	02
Technical data	03
Valve with external trigger electronics	04
Characteristic curves	05-06
Unit dimensions	07

Features

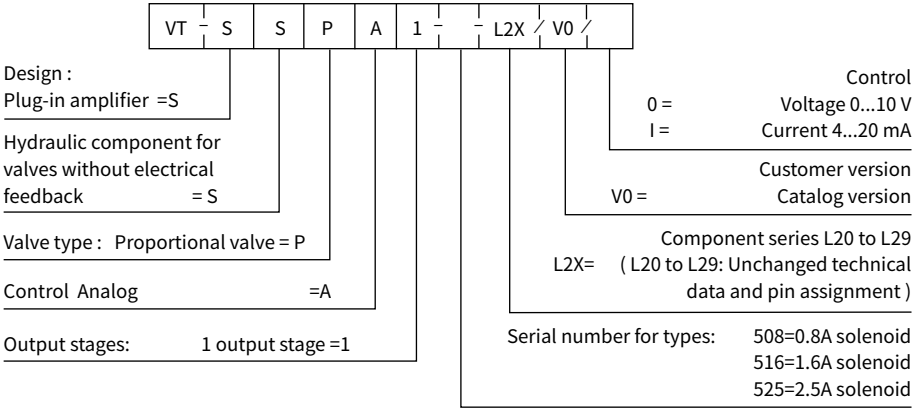
- Differential input
- Ramp time adjustable (60 ms...5 s)
- Sensitivity, valve zero point, dither frequency adjustable
- Operating voltage 24 V

Function and configuration

The active connector is used for controlling proportional valves without position control. It is directly attached to the solenoid plug of the valve. Theconnection cable on the control side (U_B, command value) is led through a gland fitting and connected. An LED signals the available supply voltage. Depending on the type of the active connector, the command value is specified as voltage 0...10V or as cur-rent 4...20mA.

The command value can be adjusted with regard to zero point and sensitivity. In case of voltage specification, a differential input is available. Apart from that, the command value can be led via a ramp. In order to allow for adjustment to special applications, thedither amplitude was designed variably. Upon delivery, the dither amplitude has already been set to a perfect value so that another adjustment is only necessary in the above-mentioned special cases.

Ordering code, accessories

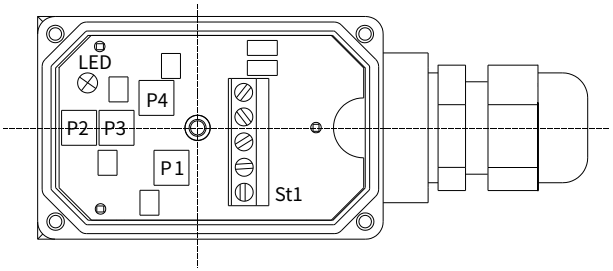


Technical data

Supply voltage nom. 24 V =	Solenoid2.5A	Battery voltage 10.2...31V Rectified voltage 10.2...27V
	Solenoid1.6A	Battery voltage 18...31V Rectified voltage 18...27V
	Solenoid0.8A	Battery voltage 21...31V Rectified voltage 21...27V
	Residual ripple	< $2V_{SS}$
Power consumption max.	Va	55 (see valve data)
Command value		0...10V
		4...20 mA
Output		I_{max}=2.5A(rectangular voltage, pulse-modulated) I_{max}=0.8A(rectangular voltage, pulse-modulated) I_{max}=1.6A(rectangular voltage, pulse-modulated)
Ramp time		60ms...5s
Dither frequency range	Hz	95...340
Zero point calibration range		See characteristic curves
Sensitivity adjustment range		
Special features		LED (green): Supply voltage is available, Clocked output stage, Fast energization for short actuating times, Adjustments via trimming potentiometer.
Protection class		IP 65, in plugged condition
Electro-magnetic compatibility tested according to		EN 61000-6-2: 2002-08 EN 61000-6-3: 2002-08
Design		Connector housing
Connections	– Solenoid – U_B，command value	DIN 43650 Cable 5×0.75mm^2, shielded incl. PE
Ambient temperature	° C	-20...+70
Storage temperature range	° C	-20...+85
Weight	m	0.23 kg

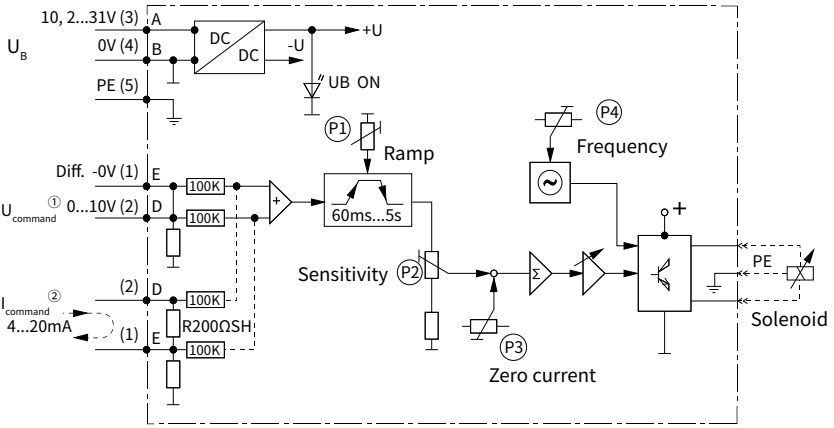
Valve with external trigger electronics

Connections and adjustment



P1 – Ramp time
P2 – Sensitivity
P3 – Zero point
P4 – Dither frequency
St 1 – Connection terminal
LED – Display U_B

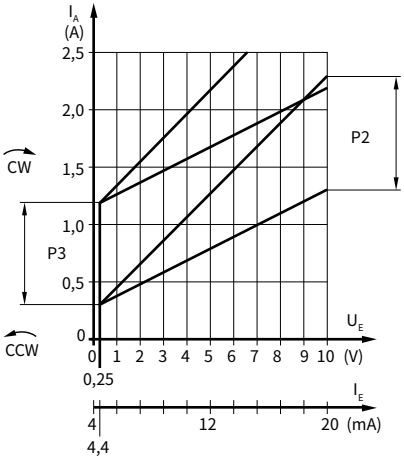
Block diagram and pin assignment

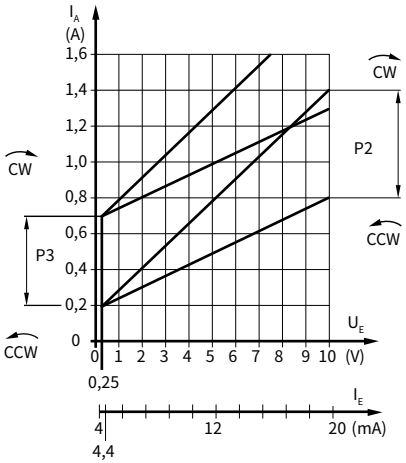


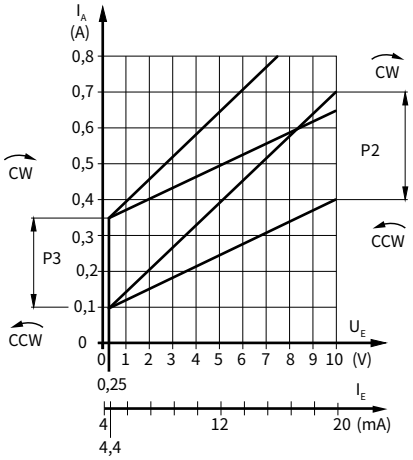
① Version with 0...+10 V signal
② Version with 4...20 mA signal

Characteristic curves

Commissioning and adjustment



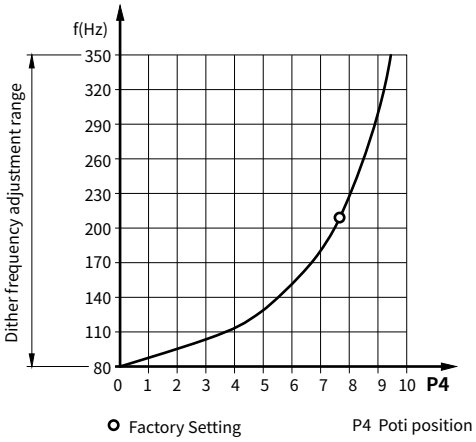




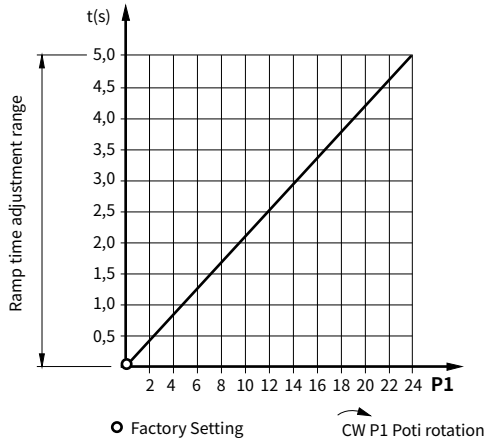
P2 Sensitivity range
P3 Zero current range

Characteristic curves

Commissioning and adjustment



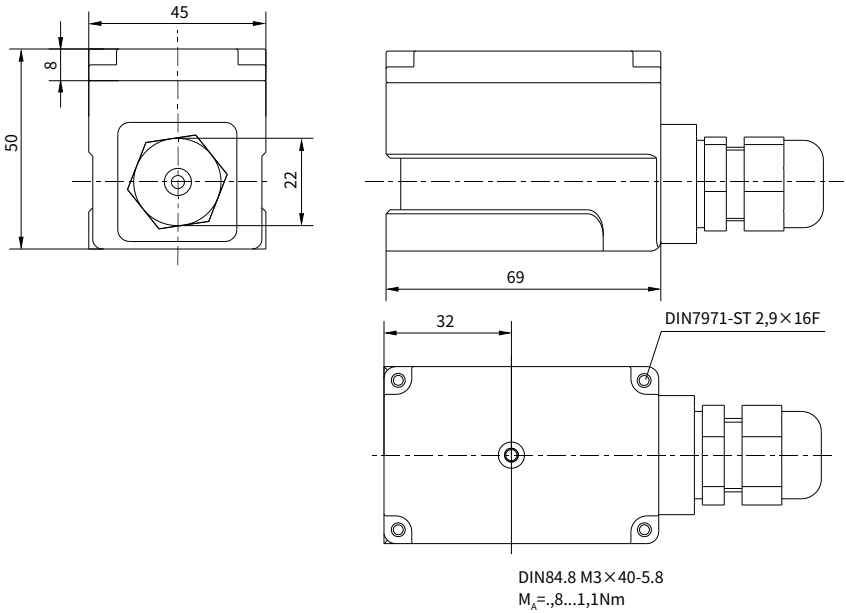
1.Dither frequency adjustment
→ Poti P4.
The dither frequency has already been correctly adjusted upon delivery.
For special applications, correction may be necessary.



2. Ramp time adjustment (accelerations and braking)
→ Poti P1

Unit dimensions

(dimensions in mm)



China
+86 400 101 8889

America
+01 630 995 3674

Germany
+49 172 3683463

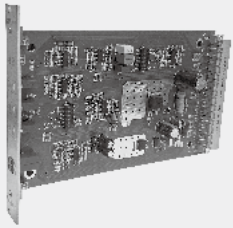
Japan
+81 03 6809 1696

6.18

Proportional amplifier

Type VT-VSPA1-1
Type VT-VSPA1K-1

Component series L1X



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Indicator / adjustment elements	09-10
Meaning of the DIL switches	11
Unit dimensions	12

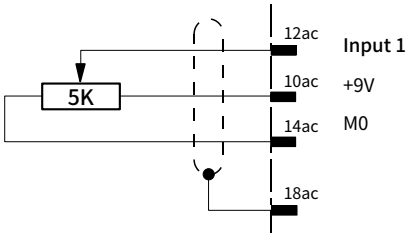
Features

- Suitable for controlling all direct and pilot operated proportional pressure control valves without electrical position feedback and only one solenoid as actuator that are available at the time of publication of this data sheet
- Differential input, can be switched between voltage and current input
- Additional command value input, 0 to +9V
- Ramp generator, can be adjusted separately for up and down ramps
- Signal "ready for operation" (VT-VSPA1K-1 only with LED indicator lamp)
- Reverse polarity protection for voltage supply
- Cable break detection of current input 4 to 20 mA
- Short-circuit protection of solenoid cable
- Cable break detection of solenoid cable

Function and configuration

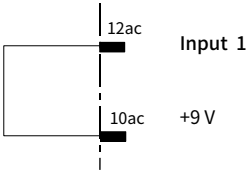
The command value voltage is applied to command value input 1 either directly or via an external command value potentiometer with the help of the regulated + 9V voltage from the power supply unit [14]. The following is valid for this input: +9 V ≙ +100 %

· External command value feedforward:

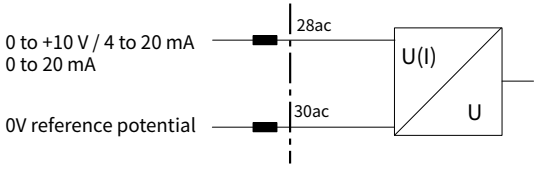


Note:
When an external command value potentiometer is used, internal potentiometer "Gw" [3] must be set to maximum or the required maximum pressure.

· Internal command value feedforward:



· Differential input (input 2):



Additions to the pin designations in brackets are only valid for type VT-VSPA1-1.

Command value input 2 is a differential input [1] (0 to + 10 V). With the help of DIL switches [2)] it can be configured as current input (4 to 20mA or 0 to +20mA). If the command valueis fed forward by external electronics with a different reference potential (e.g. by a PLC), this input must be used. When the command value voltage is applied or withdrawn, care must be taken that both signal cables are disconnected from or connected to the input.

Before being passed on, both command values are summated [2] and then fed to a potentiometer [3] that is accessible on the front panel and acts as attenuator and limits the maximum command value.

The downstream ramp generator [4] generates a ramp-shaped out put signal from a stepped input signal. The time constant of this signal can be adjusted separately for "up" and "down" ramps with the help of two potentiometers. The specifi ed ramp time refers to a command value step-change of 100% and can be approx. 1s or 5s, depending on the setting of a DIL switch [2)]. If a command value step-change of less than 100% is fed to the input of the ramp generator or when attenuator [3] is effective, the pamp time shortens accordingly.

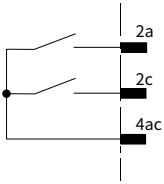
Function and configuration

The following is valid for type VT-VSPA1-1:
The up and down ramp times can be set separately to their minimum value (ap-prox. 30ms) with the help of the external contacts "ramp up/down OFF".

The following is valid for type VT-VSPA1K-1:
The up and down ramp times can be set collectively to their minimum value (ap-prox. 30ms) with the help of the external contact

· Ramp "up/down" OFF :

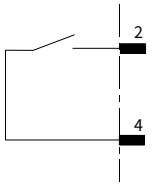
VT-VSPA1-1



Ramp "up" OFF

Ramp "down" OFF

VT-VSPA1K-1

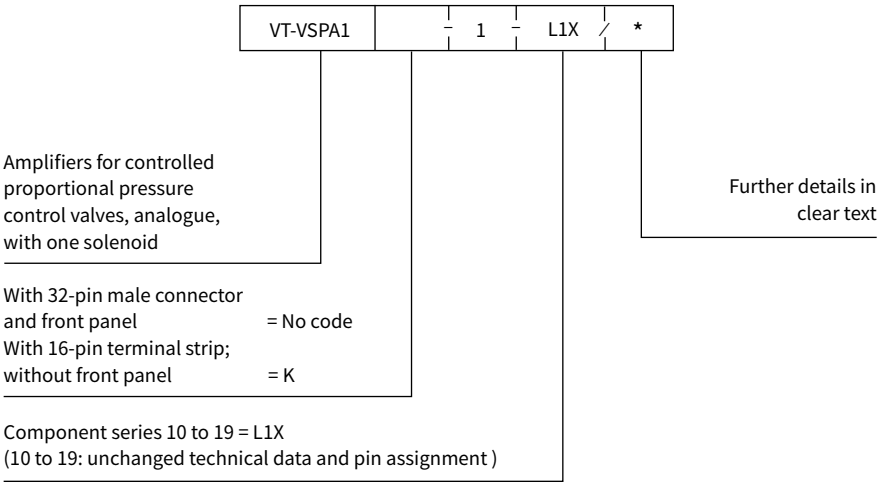


Ramp OFF

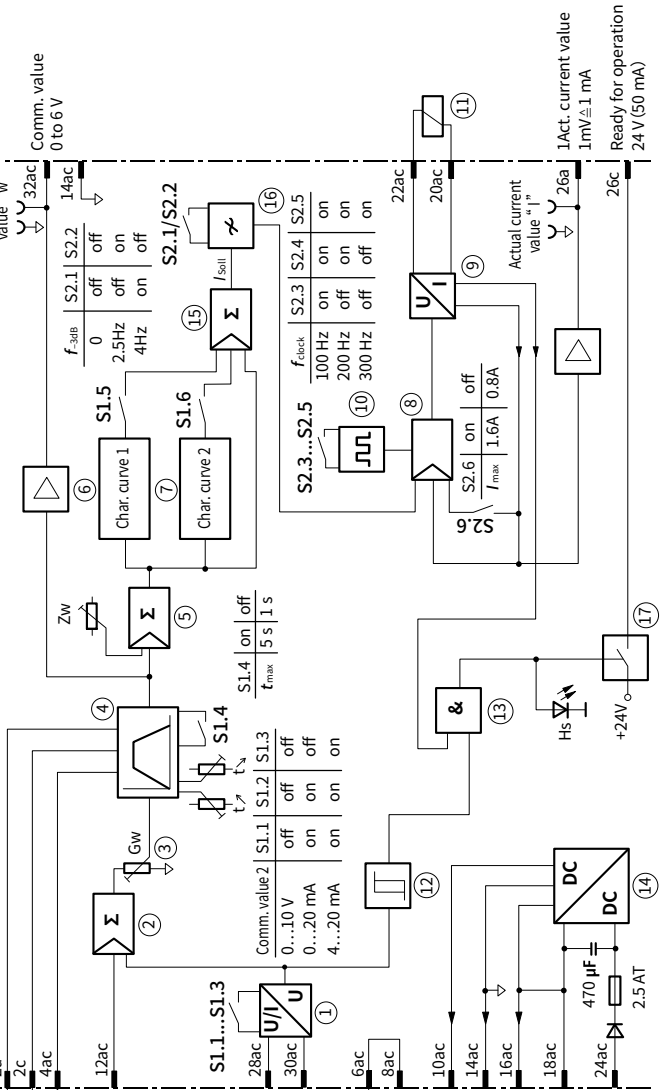
The output signal of ramp generator [4] is fed as current command value to the summing amplifier [5]. Here, a command value of 100 % corresponds to a voltage of +6 V.
Suming amplifier [15] adds the output signals of the characteristic curve generators [6 or 7] to the command value (can be selected by means of DIL switches depending on the valve to be controlled). The current command value can alsvo be filtered through a lowpass filter that can be cut in.
Current out-put stage [9] is controlled via current regulator[8]. In addition, the current regulator modulates the current command value with clock-pulse encoder signal [10] (the frequency can be programmed with the help of DIL switches.
The clocked actual current value acts in the solenoid of the valve like a constant current with overlaid dither signal. Type VT-VSPA1-1 is provided with measuring sockets for the internal command value and the actual value.
The following is valid for the command value: +6 V ≙ 100%
The following is valid for the actual value: 1 mV ≙ 1mA

The signal "ready for operation" is output and LED "Hs"
on the front panel (with VSPA1-1) or LED "Hs" (with VSPA1K-1) is lit,
When:
– The solenoid cables are not short-circuited and the output stage is not overloaded,
– a command value is applied (cable break detection),
– there is no cable break present on the solenoid cable.

Ordering code

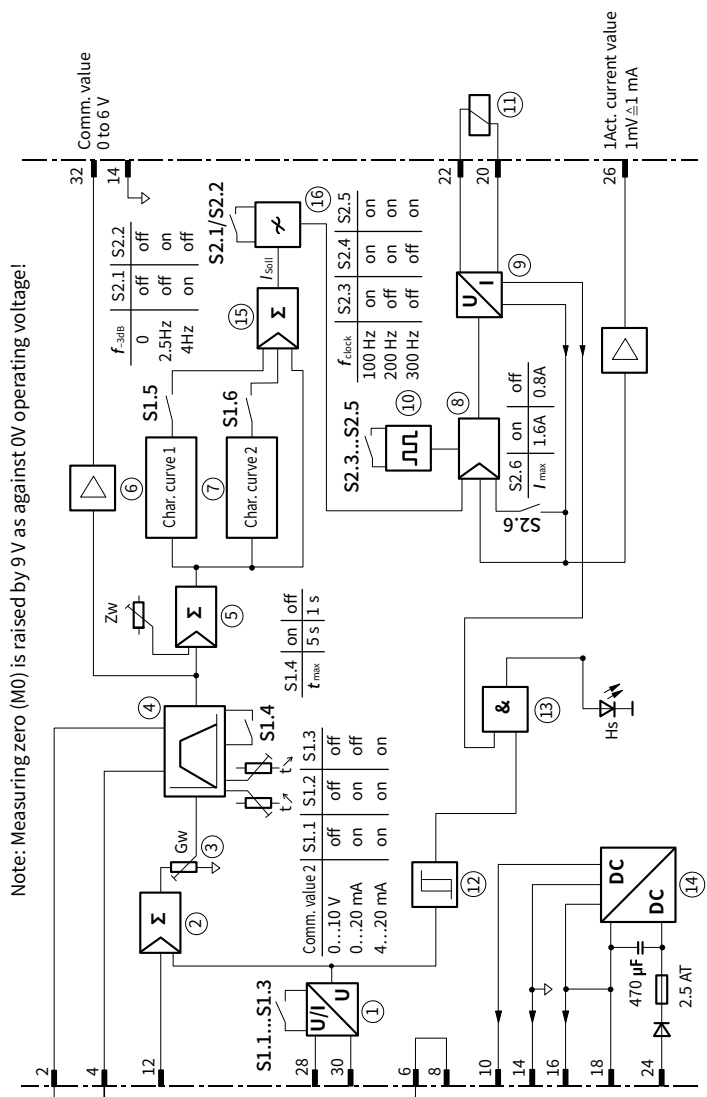


Block circuit diagram / pin assignment: VT-VSPA1-1



1. Differential input
2; 5; 15 Summator
3. Max. command value attenuator
4. Ramp generator
6. Characteristic curve generator 1
7. Characteristic curve generator 2
8. Current regulator
9. Current output stage
10. Clock-pulse generator
11. Proportional solenoid of valve
12. Command value monitoring
13. Monitors
14. Power supply unit
16. Low-pass filter
17. Output "ready for operation"
Hs = Signal "ready for operation"
Gw = Command value attenuation
T = Ramp time adjustment
Zw = Additional biasing current adjustment
(0 to 300mA or 0 to 600mA)

Block circuit diagram / pin assignment: VT-VSPA1K-1



1. Differential input
2. 5; 15 Summator
3. Max. command value attenuator
4. Ramp generator
6. Characteristic curve generator 1
7. Characteristic curve generator 2
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9. Current output stage
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14. Power supply unit
16. Low-pass filter

HS = Signal "ready for operation"
Gw = Command value attenuation
T = Ramp time adjustment
Zw = Additional biasing current adjustment (0 to 300 mA or 0 to 600 mA)

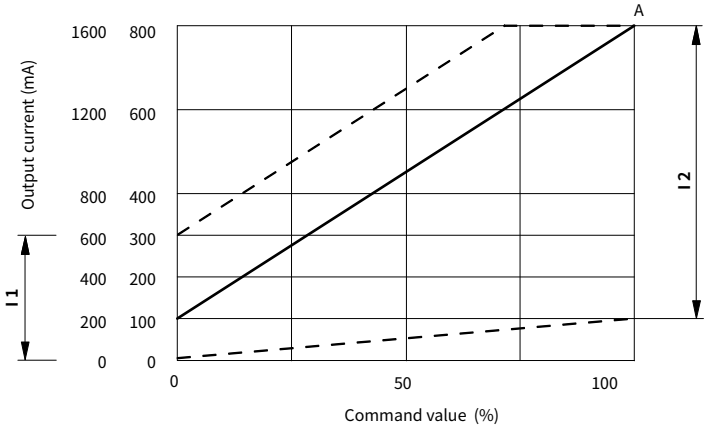
Technical data

Operating voltage	U_0	+24VDC +40% –5%
Operating range:		
- Upper limit value	$U_0(t)_{max}$	+35 V
- Lower limit value	$U_0(t)_{min}$	+22 V
Max. power consumption	Ps	＜ 50 VA
Max. current consumption	I	＜ 1.8 A
Fuse	I_F	2.5 AT
Inputs:		
- Command value 1	U_i	0 to +9 V (reference potential is M0)
- Command value 2 (differential input)	U_i	0 to +10V； R_e =100KΩ ┐ depending on setting with S11 to S13
or	I_i	4 to 20 mA (load R_B =100Ω) ┘
or	I_i	0 to 20 mA (load R_B =100Ω)
Ramp time (adjustment range)	t	30 ms to approx. 1s or 5s (depending on setting with S14)
Outputs:		
- Output stage		
·Solenoid current/resistance	I_{max}	800mA +20% , R_{20} =19.5Ω ┐ depending on setting with S26 [1]
or	I_{max}	1600mA +20% , R_{20} =5.4Ω ┘
·Biasing current at I_{max} =800 mA	I_v	50mA or 100mA ┐ depending on setting with S26 [1] and "Zw"
at I_{max} =1600 mA	I_v	100mA ┘
additionally at I_{max} =800 mA	I_v	0 to 300mA +20% ┐ Adjustable by means of "Zw" on the printed-circuit board
at I_{max} =1600 mA	I_v	0 to 600mA +20% ┘
·Clock frequency	f	100 Hz, 200 Hz, 300 Hz or 370 Hz ±10%each (depending on setting with S23 to S25)
- Signal "ready for operation" (only with VT-SPA1-1)		
·Rready for operation	U	approx. U_0 , 50mA ┐ Load resistance >10kΩ
·Break down	U	0V, R_i = 10kΩ ┘
	U	
- Regulated voltage	U	±9V ± 1 %, ±25 mA externally laodable
- Measuring sockets		
·Command value "w"	U	0 to +6 V (+6V ≙ 100% solenoid current), R_i =1kΩ
·Actual current value "I"		0 to 1600mV ≙ 0 to 1600mA ±20mA
	U	
	U	
Type of connection:		
- VT-VSPA1-1		32-pin male connector, DIN 41612, form D
- VT-VSPA1K-1		16-pin terminal strip
Card dimensions:		Euro-card 100 x 160 mm, DIN 41494
Front panel dimensions		
- Height		3HE(128.4mm)
- Width soldering side		1TE(5.08mm)
- Width component side		3TE
Permissible operating temperature range	ϑ	0 to + 50°C
Storage temperature range	ϑ	–25 to + 85°C
Weight	m	0.1kg

[1] The maximum current I_{max} can be set to the required value by means of command value attenuator potentionmeter "Gw".

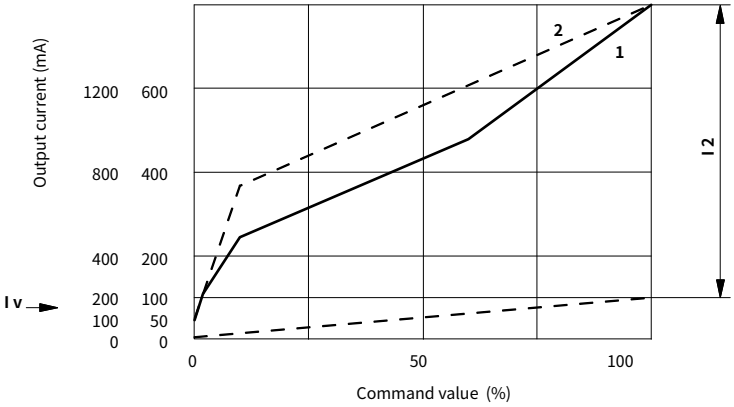
Output characteristic curves

Linear output charcteristic curve (basic characteristic curve)



I 1 Adjustment range of biasing current Ib by means of potentiometer "Zw" on the printed-circuit board
I 2 Adjustment range of maximum command value by means of potentiometer "Gw"
A Characteristic curve with factory setting

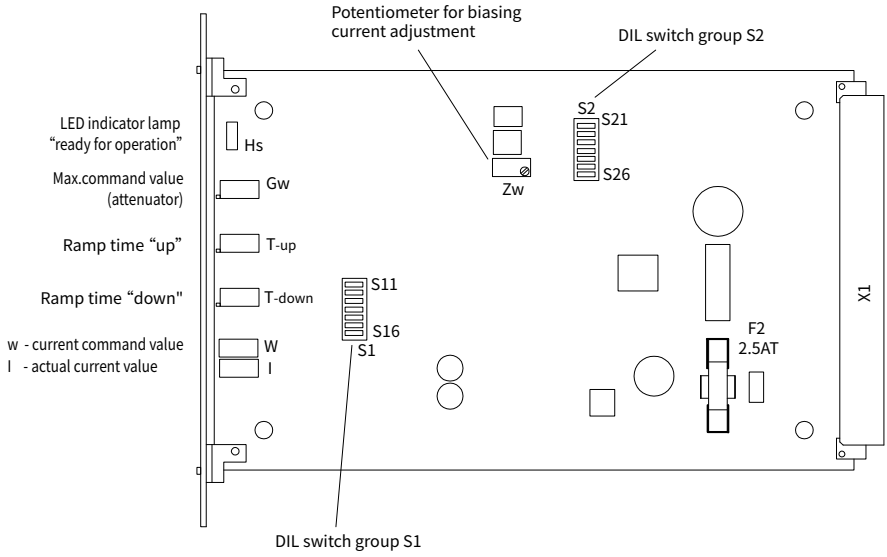
Output characteristic curve with firmly set characteristics



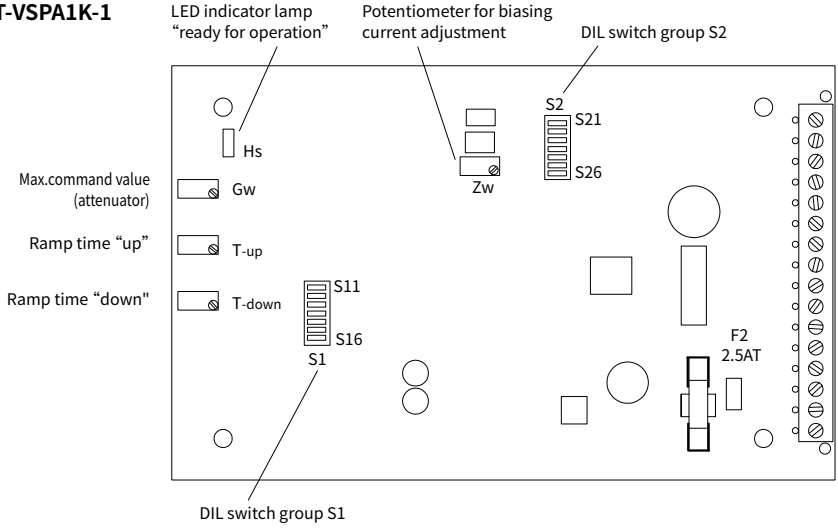
I v Biasing current curve 2 (qualitative representation)
I 2 Adjustment range of maximum command value by means of potentio meter "Gw"
1 Characteristic curve 1 (qualitative representation)
2 Characteristic curve 2 (qualitative representation)

Indicator / adjustment elements

· **VT-VSPA1-1，** from component series 11



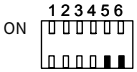
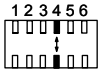
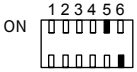
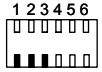
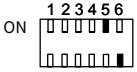
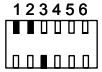
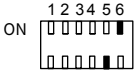
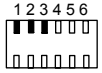
· **VT-VSPA1K-1**



06

Indicator / adjustment elements

Assignment of DIL switch setting on the card to the valve type (see also lable on the printed-circuit board)

setting for valve types:	S15 ...S16	S21 ...S26 [2]	Setting valid for all valve types:	S11 ...S14
DBE(M)T, DBE(M)30, DRE(M)30, 3DRE(M)10 [1], 3DRE(M)16 [1], DBEP6A, DBEP6B, 3DREP6A, 3DREP6B pumps			Ramp time 5s 1s	
DRE(M)10-L5X, DRE(M)20-L5X		 X	Command valve 2 +10V	
DBE(M)10-L5X, DBE(M)20-L5X, 3DRE(M)10P-L6X, 3DRE(M)16P-L6X, ZDRE10, (Z)DBE6		 X	0 ...20mA	
DRE6, ZDRE6		 X	4 ...20mA	

[1] Up to component series L5X
[2] Clock frequency can be set by switches S23 to S25

Meaning of potentiometers "Zw" and "Gw":

▶ Adjustment of biasing current by means of potentiometer "Zw"
- Turning clockwise → increase in biasing current
- Turning counter-clockwise → reduction of biasing current

▶ Adjustment of the max. command value by means of potentiometer "Gw"
- Turning clockwise → increase in command value
- Turning counter-clockwise → reduction of command value

Meaning of the DIL switches

Note (X): Before commissioning the amplifiers, make sure that the DIL switches on the printed-circuit board are set according to the relevant application.

Switch positions with reference to the current valve types or previous amplifier cards

	Valve types / amplifier cards			
DIL Switch	DBE(M)T，DBE(M)30 DRE(M)30，3DRE(M)10 3DRE(M)16 DBEP6A，DBEP6B 3DREP6A，3DREP6B pumps	DRE(M)10-L5X DRE(M)20-L5X	DBE(M)10-L5X DBE(M)20-L5X ZDRE10 (Z)DBE6 3DRE(M)10P-L6X 3DRE(M)16P-L6X	DRE, ZDRE6
	VT 2000			
	Characteristic curves			
	Basic characteristic curve	Characteristic curve 1	Characteristic curve 1	Characteristic curve 2
S15	OFF	ON	ON	OFF
S16	OFF	OFF	OFF	ON
	Command value filters			
		f_{-3dB} = 4Hz	f_{-3dB} = 4Hz	f_{-3dB} = 2.5Hz
S21	OFF	ON	ON	OFF
S22	OFF	OFF	OFF	ON
	Max. output current [1)]			
	I_{max}=800mA	I_{max}=800mA	I_{max}=1.6A	I_{max}=1.6A
S26	ON	ON	OFF	OFF
	Clock frequency			
	f=200Hz	f=200Hz	f=300Hz	f=370Hz
S23	OFF	OFF	OFF	OFF
S24	ON	ON	OFF	OFF
S25	ON	ON	ON	OFF
	Basic biasing current setting			
"Zw"	100mA	50mA	100mA	100mA

[1)] Doubling of the maximum output current doubles the adjustment range and the set biasing current.

Adjustment range of biasing current using potentiometer "Zw"

I_{max} = 800mA → I_v = 0 to 300mA I_{max} = 1600mA → I_v = 0 to 600mA

Adjustment options inedependent of the valve type (command value 2 and ramp time)

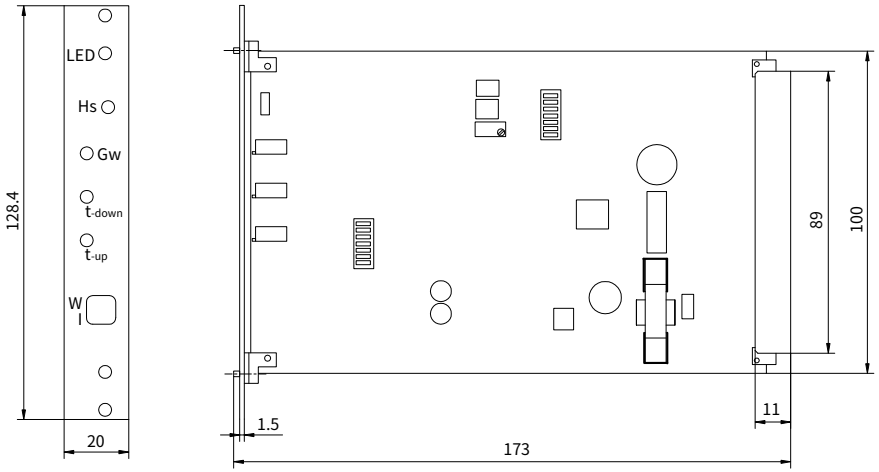
	Configuration of differential input		
	Command value 2: +10V	Command value 2: 0 to 20mA	Command value 2: 4 to 20mA
S11	OFF	ON	ON
S12	OFF	ON	ON
S13	OFF	OFF	ON
	Max. ramp time		
S14	OFF ≙ 1S		ON ≙ 5S

Note: Factory setting (corresponds to the configuration lf a VT 2000 amplifier).

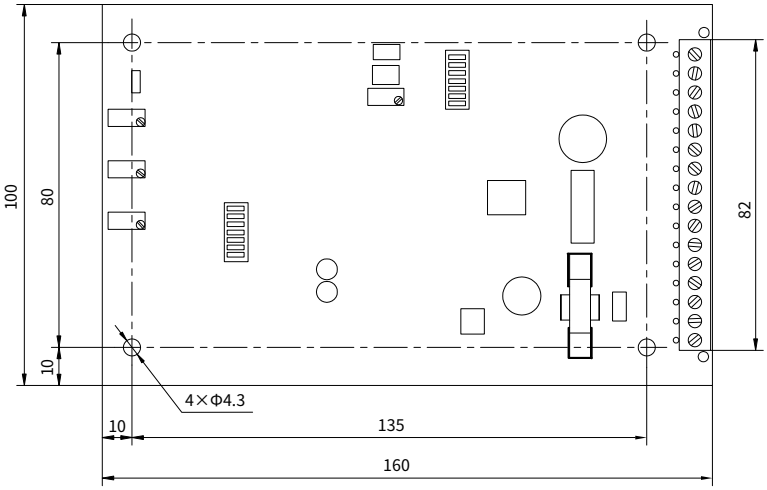
Unit dimensions

(Dimensions in mm)

· VT-VSPA1-1



· VT-VSPA1K-1



Hengli hydraulic Co.,Ltd.

ADD: No.99 Longqian Road, Wujin District,
Changzhou 213167, China
TEL: +86 400 101 8889 FAX: +86 519 8615 9988
E-mail: hengli@henglihydraulic.com

Hengli America

ADD: 580 Crossroads Parkway, Bolingbrook, Illinois 60440
TEL: +01 630 995 3674
E-mail: sales@hengliamerica.com

Hengli Germany

ADD: Sperenberger Straβe 13D-12277 Berlin, Germany
TEL: +49 172 3683463 FAX: +49 (30) 72088-44
E-mail: jacky.ding@henglihydraulic.com

Hengli Japan

ADD: 7F Kyoei Building, 2-1-19 Shibadaimon, Minato-Ku,
Tokyo 105-0012, Japan
TEL: +81 03 6809 1696 FAX: +81 03 6809 1698
E-mail: hl_zhaozhen@163.com

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