6.12

Pilot operated proportional directional valves

Type 4WRZ(E) and 4WRH

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

Contents

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.

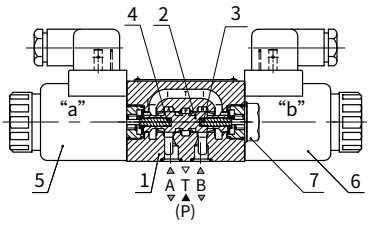
06

Notes:

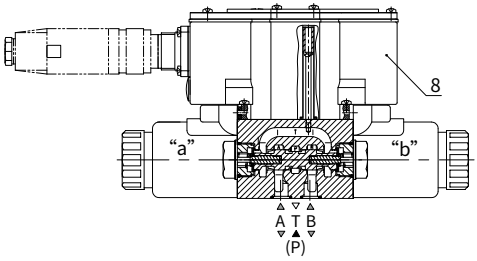
Type 3DREP 6: Draining of the tank line must be prevented. In the case of a corresponding installation situation, a pre-load valve is to be installed (pre-load pressure approx. 2 bar).

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:

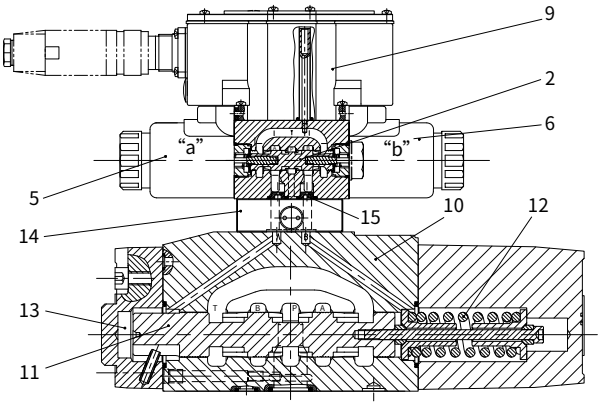
The valves basically consist of:
– A pilot valve (9) with proportional solenoids (5 and 6), control spool (2) and orifice plugs (15)
– A main valve (10) with main spool (11) and centering spring (12)

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

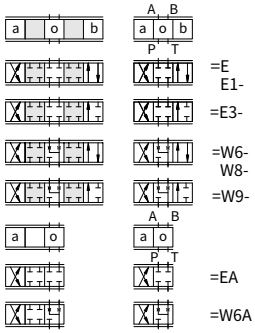
4WR_ | | | | -L7X/ | 6E | G24 | | | / | | V | *

Hydraulic operation =H
Electro-hydraulic =Z

For WRZ only:
For external electronics= No code
With integrated electronics =E

Nominal size 10 =10
Nominal size 16 =16
Nominal size 25 =25
Nominal size 32 =32

Spool symbols



Transitional symbols

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

25=	50=	85= for size10
100=	150=	for size16
220=	325=	for size25
360=	520=	for size32

L7X= Series L70~L79
(L70 to L79, unchanged installation and connection dimensions)

6E [1)] = Proportional solenoid with removable coil

G24 [1)] = Electronic contral supply voltage
Power supply voltage 24VDC

N9 [1)] = With protected hand override

No code= Pilot oil supply external
Pilot oil drain external
Pilot oil supply and drain
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
(for type 4WRH only possible with No code)

4WRZ: Z4= With plug-in connector
K4= Without plug-in connector
4WRZE: K31= Without plug-in connector
Z31= With plug-in connector

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

No code= Without pressure reducing valve
D3=With pressure reducing valve:
ZDR6DP0-L4X/40YM(fixed setting)

V = FKM
No code = NBR

Further information in plain text

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

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

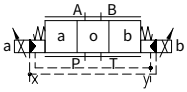
With spools W6-, W8-, W9- and W6A in the neutral position, there is a connection from A to T and B to T with approx. 2% of the relevant nominal cross-section.

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

Symbols(simplified)

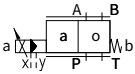
With electrohydraulic operation and for external electronics

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

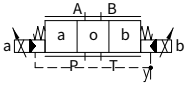


X=external
Y=external

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

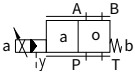


Type 4WRZ...-L7X/...E...

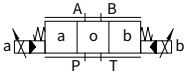


X=external
Y=external

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

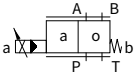


Type 4WRZ...-L7X/...ET...

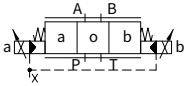


X=external
Y=external

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

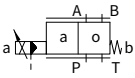


Type 4WRZ...-L7X/...T...



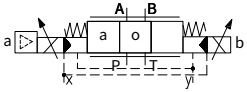
X=external
Y=external

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



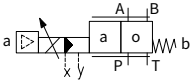
With electrohydraulic operation and for external electronics

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

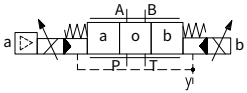


X=external
Y=external

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

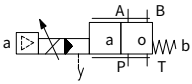


Type 4WRZE...-L7X/...E..

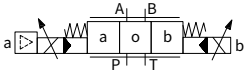


X=external
Y=external

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

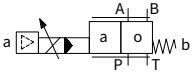


Type 4WRZE...-L7X/...ET

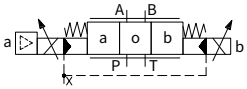


X=external
Y=external

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

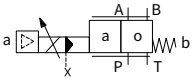


Type 4WRZE...-L7X/...T...



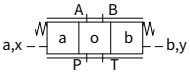
X=external
Y=external

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

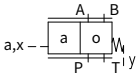


With hydraulic operation

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



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



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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

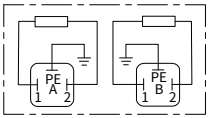
Electrical connections, plug-in connectors

nominal dimensions in mm

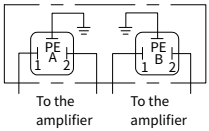
·For type 4WRZ...L7X (without integrated electronics)

Connections on the component plug

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



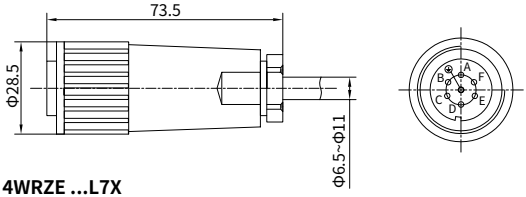
Connections on the plug-in connector



·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

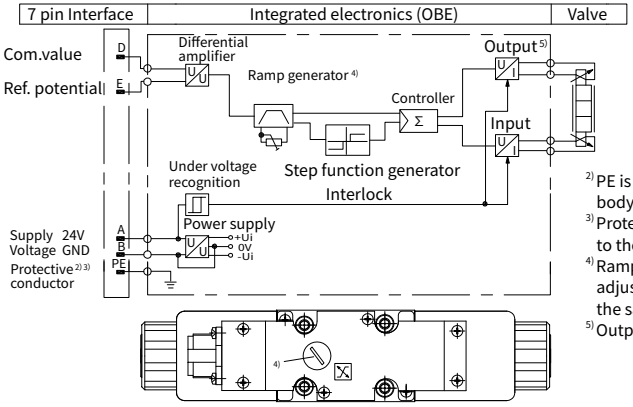
	Contact	Interface A1 signal	Interface F1 signal
Supply voltage	A	24 VDC(U(t)=19V to 35V)	
	B	GND	
	C	n.c. [1]	
Differential amplifier input	D	±10V, Re>50KΩ	4 to 20mA, Re>100Ω
	E	reference potentional command value	
	F	n.c. [1]	

[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

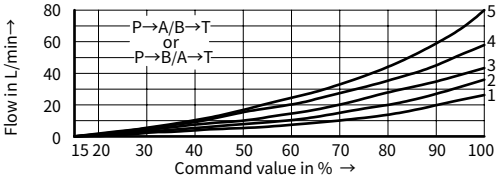


[2] PE is connected to the cooling body and the valve housing!
[3] Protective conductor screwed to the valve housing and cover.
[4] Ramp can be externally adjusted from 0 to 2.5s, the same applies for T_{up} and T_{down}.
[5] Output stages current regulated.

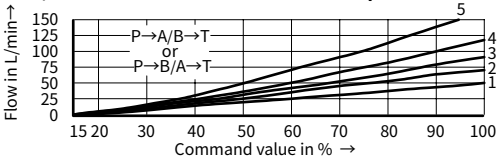
Characteristic curves (measured with spools "E, W6-, EA, W6A" and HLP46, ϑ_{oil}=40°C ±5°C , P=100bar)

NG 10

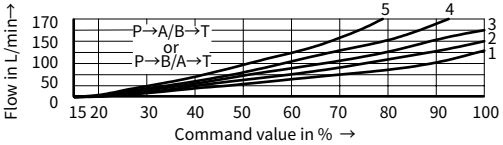
25L/min nominal flow at a 10 bar valve pressure differential



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



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

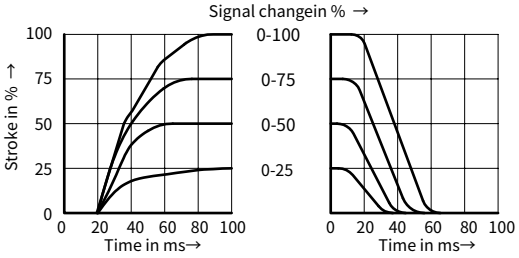


1 Δp=10bar constant
2 Δp=20bar constant
3 Δp=30bar constant
4 Δp=50bar constant
5 Δp=100bar constant

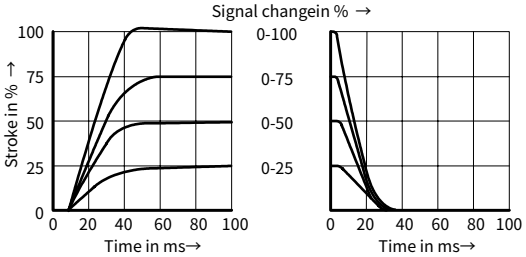
Δp=Valve pressure differential (inlet pressure p_p minus load pressure p_L minus return pressure p_T)

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

Type 4WRZ



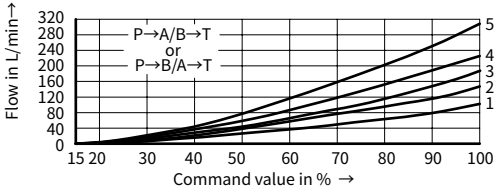
Type 4WRZE



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

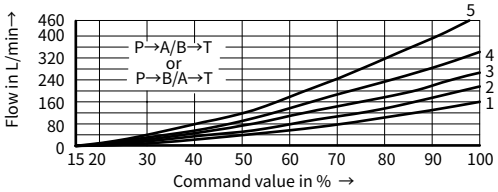
NG 16

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

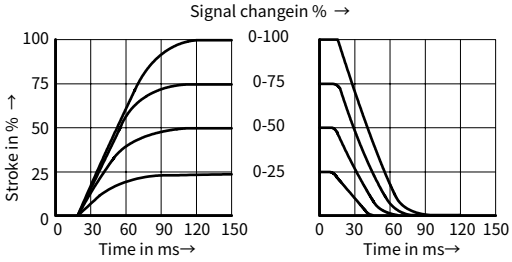
150L/min nominal flow at a 10 bar valve pressure differential



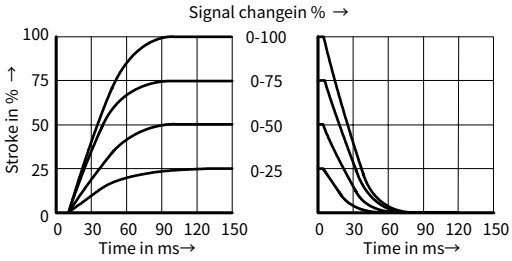
Δp=Valve pressure differential (inlet pressure p_P minus load pressure p_L minus return pressure p_T)

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

Type 4WRZ



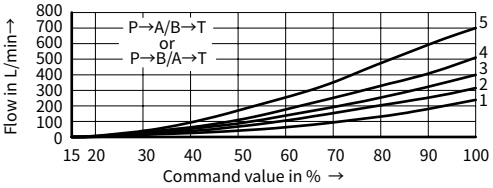
Type 4WRZE



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

NG 25

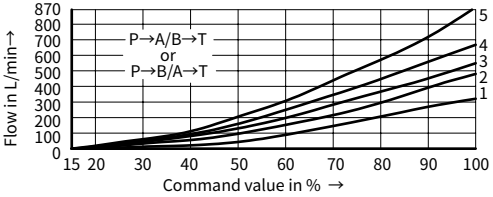
220L/min nominal flow at a 10 bar valve pressure differential



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

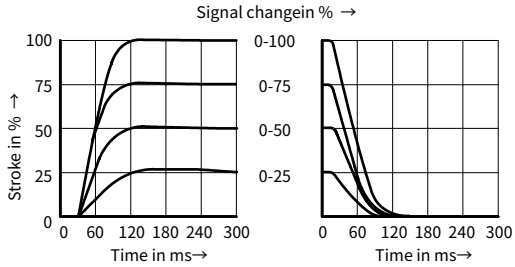
Δp=Valve pressure differential (inlet pressure p_p minus load pressure p_L minus return pressure p_T)

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

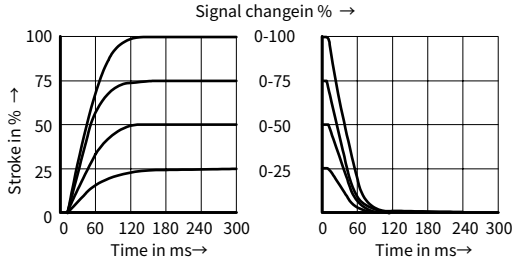


Transient function with a stepped form of electrical input signal P_{st}= 50bar

Type 4WRZ



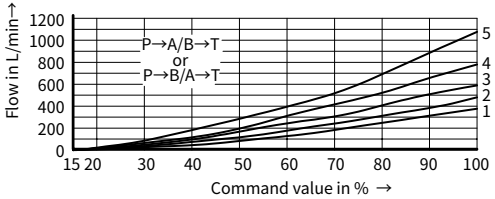
Type 4WRZE



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

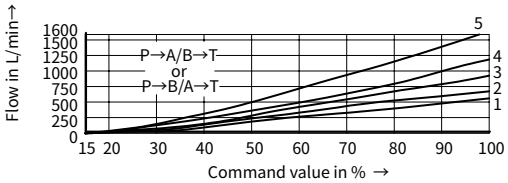
NG 32

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

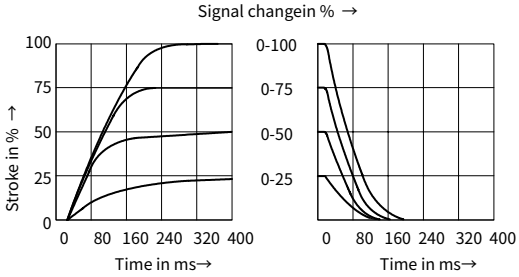
520L/min nominal flow at a 10 bar valve pressure differential



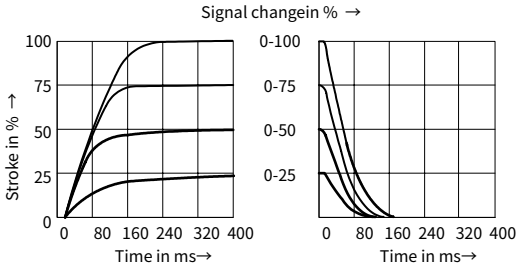
Δp=Valve pressure differential (inlet pressure p_p minus load pressure p_L minus return pressure p_T)

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

Type 4WRZ



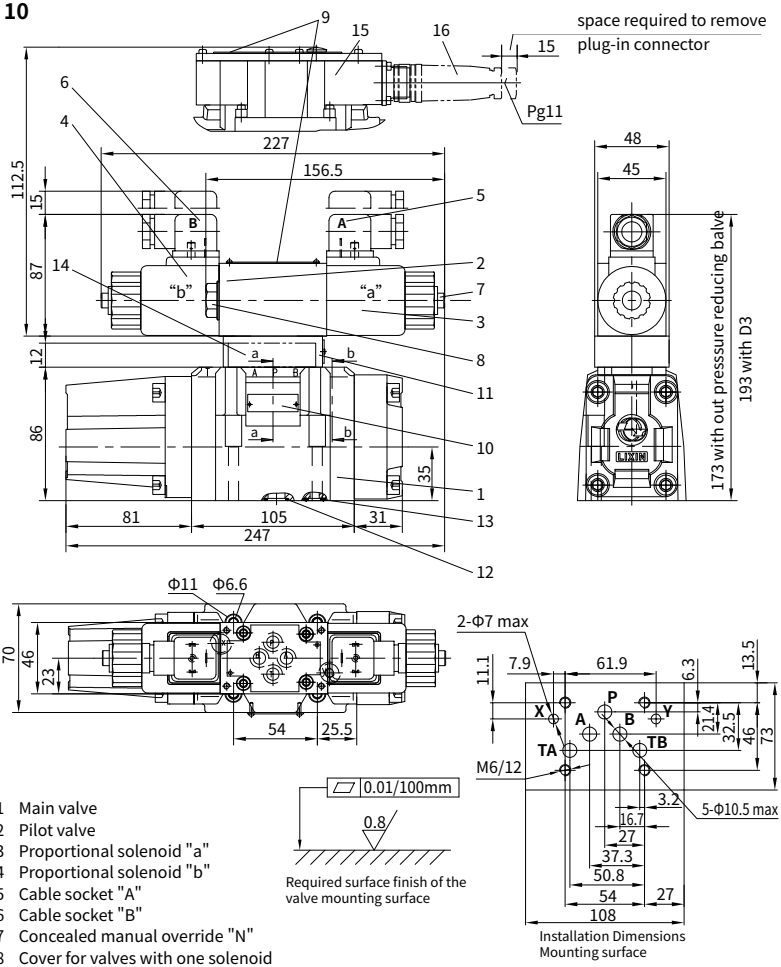
Type 4WRZE



Unit dimensions

(Dimensions in mm)

NG 10



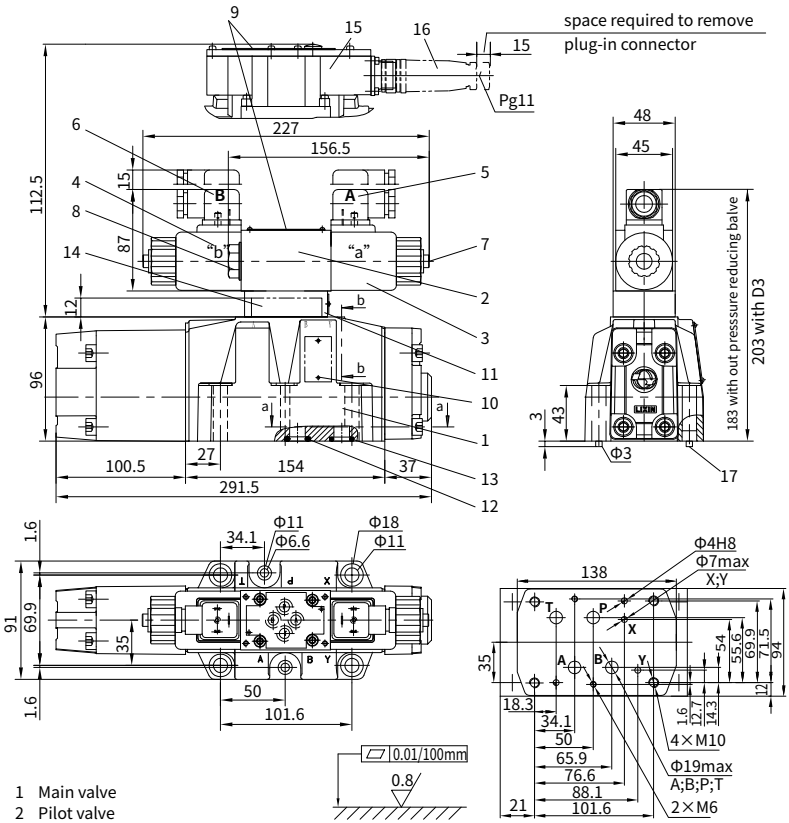
1 Main valve
2 Pilot valve
3 Proportional solenoid "a"
4 Proportional solenoid "b"
5 Cable socket "A"
6 Cable socket "B"
7 Concealed manual override "N"
8 Cover for valves with one solenoid
9 Nameplate for pilot valve
10 Name plate for main valve
11 Pressure reducing valve "D3"
12 Identical seal rings 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



Required surface finish of the valve mounting surface

Installation Dimensions Mounting surface

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

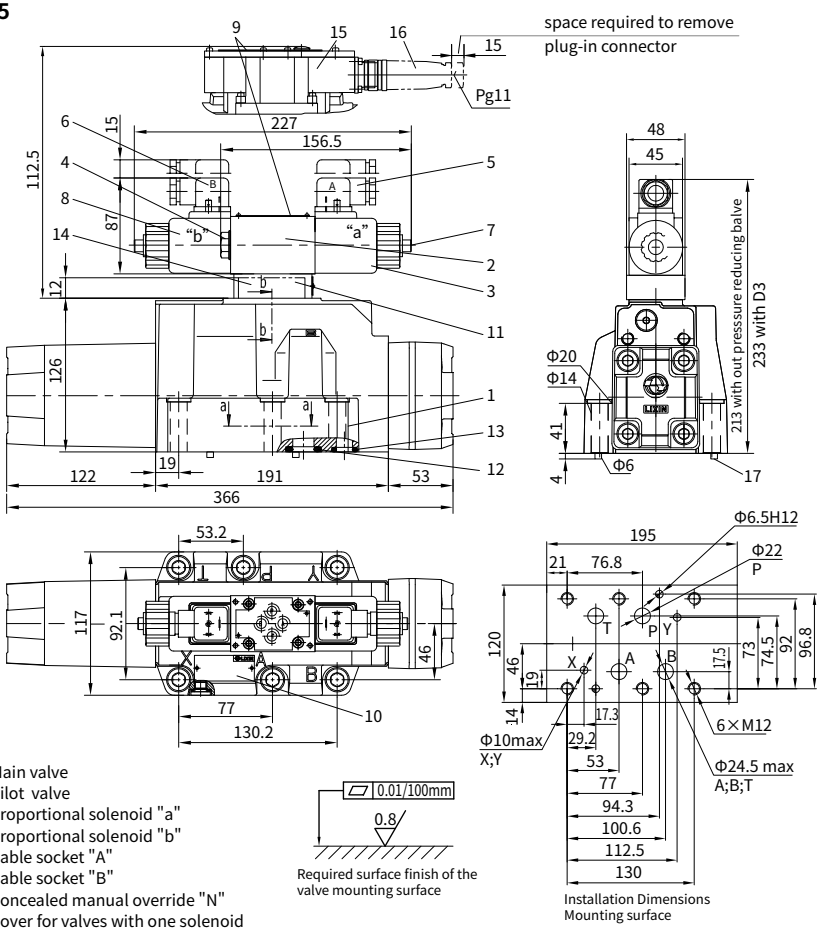
The following valve fixing screws are recommended:

- 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



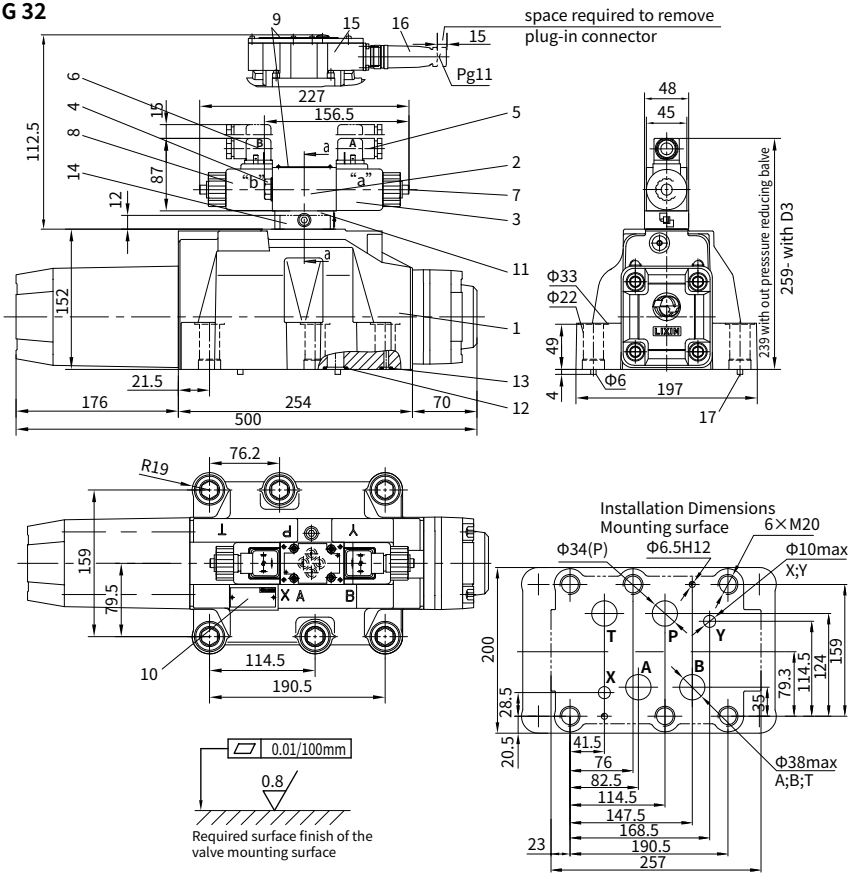
1 Main valve
2 Pilot valve
3 Proportional solenoid "a"
4 Proportional solenoid "b"
5 Cable socket "A"
6 Cable socket "B"
7 Concealed manual override "N"
8 Cover for valves with one solenoid
9 Nameplate for pilot valve
10 Nameplate for main valve
11 Pressure reducing valve "D3"
12 Identical seal rings 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%