

4WRA(E)

4/2- and 4/3-way proportional directional valves, direct actuated, without electrical position feedback

Nominal sizes 6 and 10

Series 2X

Maximum operating pressure 315 bar

Maximum flow 42 L/min (NS 6)

Maximum flow 75 L/min (NS10)



4WRA(E)

Overview of contents

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Features

- 1 - Direct actuated proportional valve for controlling the direction and volume of a flow
- 1 - Actuation by means of proportional solenoids with central thread and removable coil
- 2 - Spring centred control
- 3 - For subplate mounting: Porting pattern to ISO 4401-03-02-0-05/ISO 4401-05-04-0-05
- 5 - Integrated control electronics, interface A1 or F1 for type 4WRAE
- 9 - Control electronics for type WRA: Electrical amplifier RT-PSDM2 or RT-MSPD2-30 in modular format (separate order)

Ordering details

4WRA	E	6	E	07	-	2X	/	G24	N9		K31	/	F1	V	/	*
01	02	03	04	05		06		07	08	09	10		11	12		13

01 **4WRA** Four-port direct-actuated proportional direction control valve without electrical position feedback

02 **No code** Without integrated control electronics
E With integrated control electronics

03 **6** Nominal size 6
10 Nominal size 10

Symbols

04 **E** E, E1-, W, W1-, EA, WA; See hydraulic symbol table for details

Nominal flow at a valve pressure differential $\Delta p = 10$ bar

05	07	7 L/min	NS 6
	15	15 L/min	
	30	26 L/min	
	30	30 L/min	NS 10
	60	60 L/min	

06 **2X** Series 20 to 29 (20 to 29: unchanged installation and connection dimensions)

07 **G24** Supply voltage 24 VDC

08 **No code** Without manual emergency
N9 With manual emergency

4WRA	E	6	E	07	-	2X	/	G24	N9		K31	/	F1	V	/	*
01	02	03	04	05		06		07	08	09	10		11	12		13

09	No code	Without special protection
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Electrical connections

10	K4	Sockets conforming to DIN EN 175301-803 (plugs need to be ordered separately), see page 5	4WRA
	K31	7 pin sockets conforming to DIN EN 175201-804 (plugs need to be ordered separately), see page 5	4WRAE

Command value of amplifier

11	No code	ReboTech RT-PSDM2 or RT-MSPD2 modular amplifier is recommended (to be purchased separately)	4WRA
	A1	Command value input ± 10 V	4WRAE
	F1	Command value input 4 to 20 mA	

Sealing material

12	M	NBR seals
	V	FKM seals

13	12	Rated voltage 12V coils ¹⁾
	*	Further details in clear text

Symbols

4WRA...	4WRAE...	4WRA...EA...; 4WRA...WA...	4WRAE...EA...; 4WRAE...WA...
E	E1-	EA	EA
W	W1-	WA	WA

E1- and W1- spools:

P → A q_{Vnom} B → T: $q_{Vnom} / 2$

P → B: $q_{Vnom} / 2$ A → T: q_{Vnom}

Note:

With spools W and WA in the neutral position there is a connection from A to T and B to T with approx. 3 % of the relevant nominal cross-section.

1) 12V coils support only 6-size 4WRA6 proportional valves

Function, section

The 4/2- and 4/3-way proportional directional valves are designed as direct actuated 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 WRA) or by integrated control electronics (type WRAE).

Design:

The valves basically consist of:

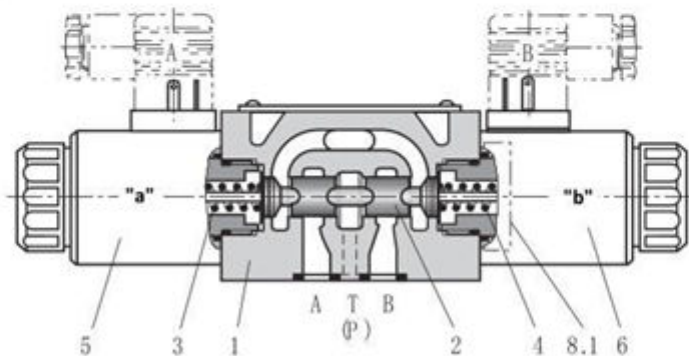
- Housing (1) with mounting surface
- Control spool (2) with compression springs (3 and 4)
- Solenoids (5 and 6) with central thread
- Optional integrated valve electronics (7)

Functional description:

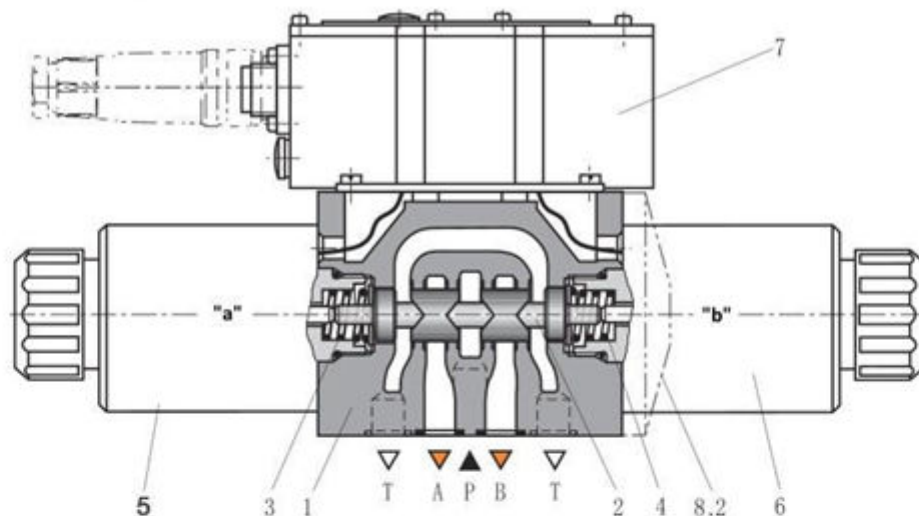
- With the solenoids (5 and 6) de-energised, the control spool (2) is held in the central position by compression springs (3 and 4)

- Direct actuation of the control spool (2) by energising a proportional solenoid
E.g. controlling of solenoid "b" (6)
→ The control spool (2) is moved to the left in proportion to the electrical input signal
→ Connection from P to A and B to T via orifice-like cross sections with progressive flow characteristics
- De-energisation of the solenoid (6)
→ The control spool (2) is returned to the central position by compression spring (3)

4WRA6...-2X/...



4WRAE10...-2X/...



Valve with 2 spool positions (Type 4WRA...A...):

In principle, the function of this valve version corresponds to that of the valve with 3 spool positions. However, the valves with 2 spool positions are only fitted with solenoid "a". Instead of the 2nd proportional solenoid a plug (8.1) is fitted for NS 6 or for NS 10 a cover (8.2).

Note:

The internal leakage of the hydraulic valve is inevitable, and the leakage will increase with the use of the hydraulic valve.

Note:

Draining of the tank line is to be avoided. With the appropriate installation conditions, a back pressure valve is to be installed (back pressure approx. 2 bar).

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

4WRA(E)

General

Normal size		6	10
Installation		optional, preferably horizontal	
Storage temperature range		-20 to +80	
Ambient temperature range	4WRA	-20 to +70	
	4WRAE	-20 to +50	
Weight	4WRA	Kg	2.0
	4WRAE	Kg	2.2

Hydraulic (measured at $p = 100$ bar, with HLP46 at $40 \text{ }^{\circ}\text{C} \pm 5 \text{ }^{\circ}\text{C}$)

Maximum operating pressure	Ports A, B, P	bar	315
	Port T	bar	210
Nominal flow v_{nom} at $\Delta p = 10 \text{ bar}^{1)}$	L/min	7	30
		15	60
		26	
Max. permissible flow	L/min	42	75
Pressure fluid temperature range	$^{\circ}\text{C}$	-20 to +80 (preferably +40 to +50)	
Viscosity range	mm^2/s	20 to 380 (preferably 30 to 46)	
Degree of contamination		ISO4406: 1999 20/18/15	
Hysteresis	%	≤ 5	
Reversal error	%	≤ 1	
Response sensitivity	%	≤ 0.5	

Electrical, solenoid

Voltage type		DC
Command value	Voltage controlled A1	V
	Current controlled F1	mA
For 4WRAE		4 to 20
Max. current per solenoid	A	2.5
Solenoid coil resistance	Cold value at $20 \text{ }^{\circ}\text{C}$	Ω
	Max. warm value	Ω
Electrical connection	4WRA	Sockets conforming to DIN EN 175301-803
	4WRAE	7 pin socket conforming to DIN EN 175201-804
Duty	%	100
Max. coil temperature	$^{\circ}\text{C}$	150
Valve protection to EN 60529		IP65

Electrical, control electronics

4WRA6	Digital	RT-PSDM2 or RT-MSPD2(Need to order separately)
4WRA10	Digital	RT-PSDM2 or RT-MSPD2(Need to order separately)
4WRAE6	Digital	RT-4WRAE6-2X-40//A1(F1)
4WRAE10	Digital	RT-4WRAE10-2X-40//A1(F1)
Supply voltage	Nominal voltage	VDC
	Lower limiting value	V
	Upper limiting value	V
Power consumption of the amplifier	Max. power current	A
	Max. power impulse current	A

¹⁾ Flow under other ΔP_x : $q_x = q_{vnom} \cdot \sqrt{\frac{\Delta P_x}{5}}$

Electrical connection, plug-in connectors

For type 4WRA((without integrated control electronics): connector conforming to DIN EN 175301-803
(Need to order separately)

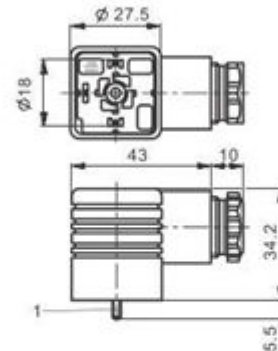
Solenoid a, colour grey

Separate order under material no. HP18110742

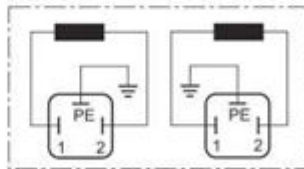
Solenoid b, colour black

Separate order under material no. HP18110741

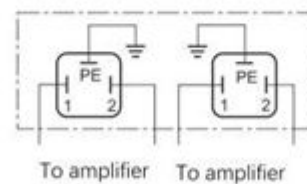
Fixing screw: M3, torque 0.5 Nm



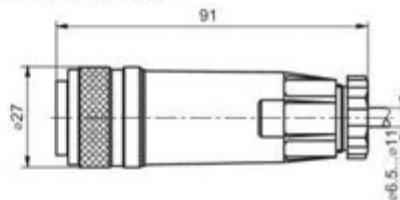
Connection on component plug



Connection on plug-in connector



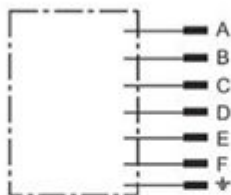
For type 4WRAE((with integrated control electronics): connector conforming to DIN EN 175201-804
(Need to order separately)



Plastic nut structure, order number: HP19050092

Metal nut structure, order number: HP19050091

Pin allocation of the component plug



Function	Slot	Signal
Supply voltage	A	24VDC (19.4 to 35VDC)
	B	GND
	C	N.C.
Differential amplifier input	D	com. value (± 10 V / 4 to 20 mA)
	E	ref. potential
	F	N.C.

Com. value:

- A positive command value (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 (or 4 to 12 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 (or 4 to 20 mA) at D and the reference potential at E results in a flow from P to B and A to T.

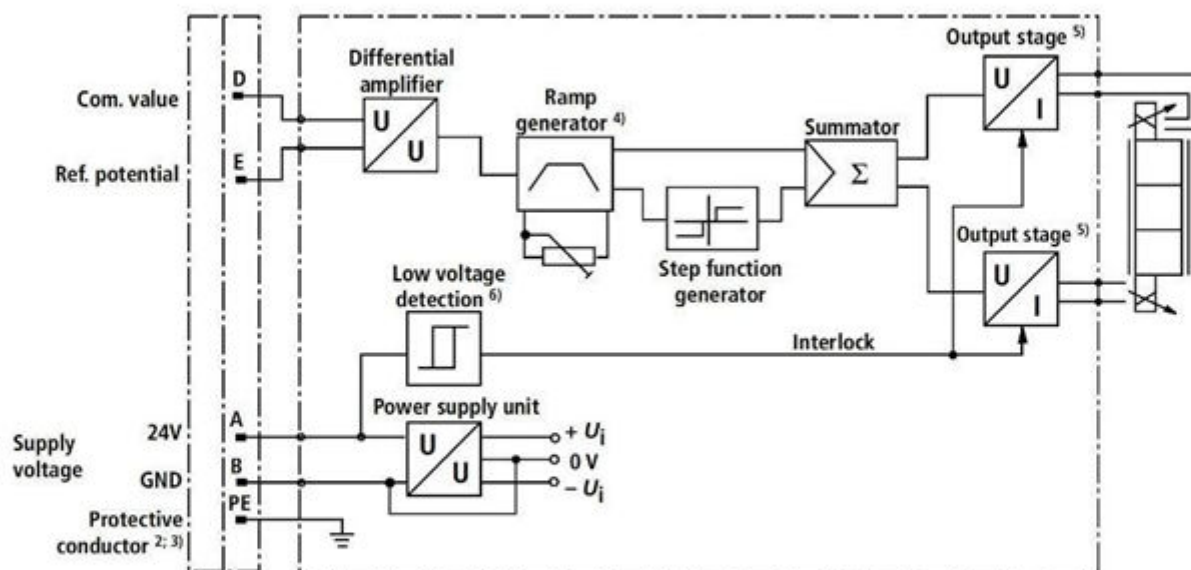
Connection cable:

- Connection cable: Recommendation: – up to 25 m cable length type LiYCY 5 x 0.75 mm²;
– up to 50 m cable length type LiYCY 5 x 1.0 mm²
- External diameter 6.5 to 11 mm
- Connect screen to PE only on the supply side.

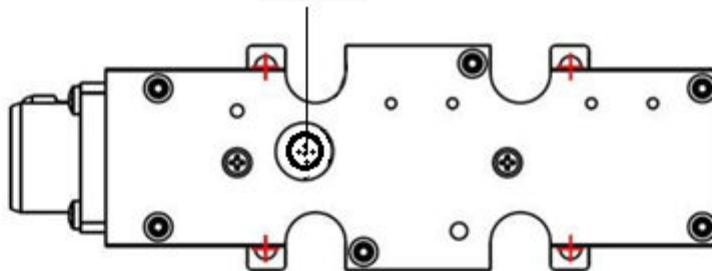
Note: Slots C and F must not be connected!

Block circuit diagram/terminal allocation of the integrated control electronics (4WRAE)

Interface	Integrated control electronics	Valve
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Adjust via Android app,
requires Bluetooth device. Ref.
200000098

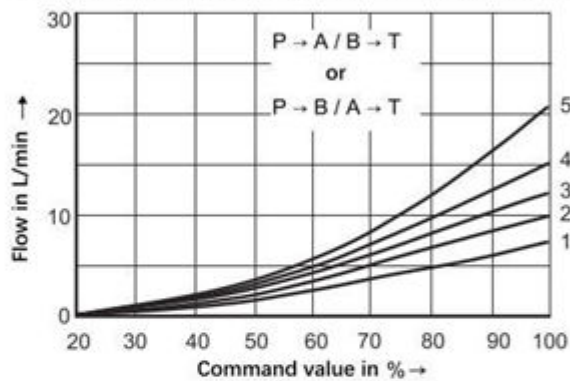


- 2) PE is connected to the cooling body and the valve housing
- 3) Protective conductor screwed to the valve housing and cover
- 4) Ramp can be externally adjusted from 0 to 5 s; the same applies for T_{up} and T_{down}
- 5) Output stages current regulated
- 6) Low voltage detection is not carried out for component type 4WRAE 10-2X.

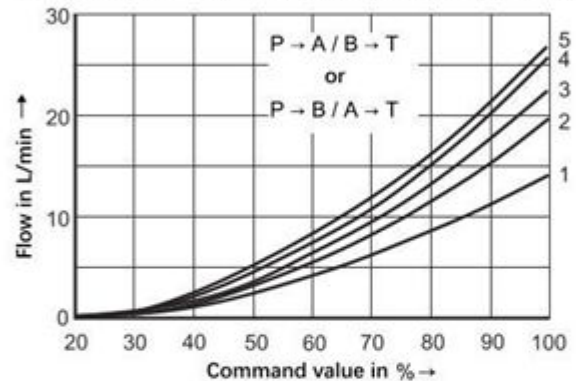
Characteristic curves NS6 (HLP46 at 40 °C ± 5 °C)

Flow characteristic curve, $P_p=100\text{bar}$

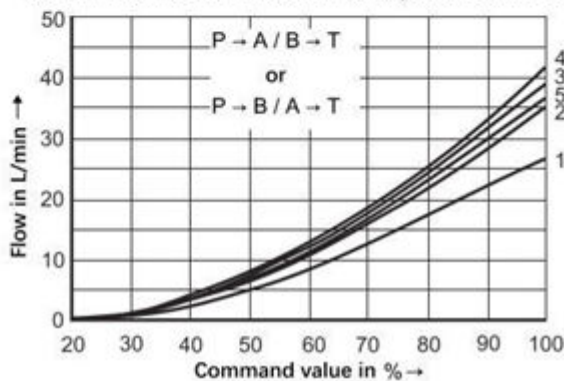
7 L/min nominal flow at 10 bar valve pressure differential



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



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



- 1 $\Delta p = 10$ bar constant
- 2 $\Delta p = 20$ bar constant
- 3 $\Delta p = 30$ bar constant
- 4 $\Delta p = 50$ bar constant
- 5 $\Delta p = 100$ bar constant

$$\Delta p = P_p - P_L - P_T$$

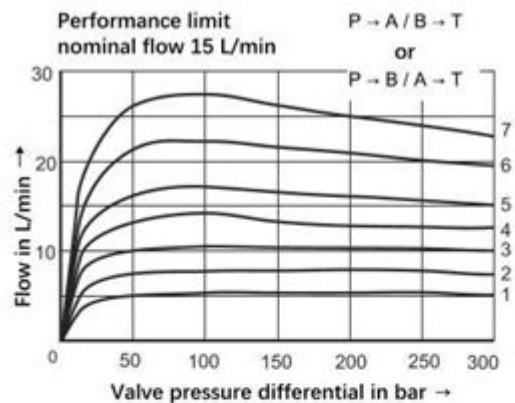
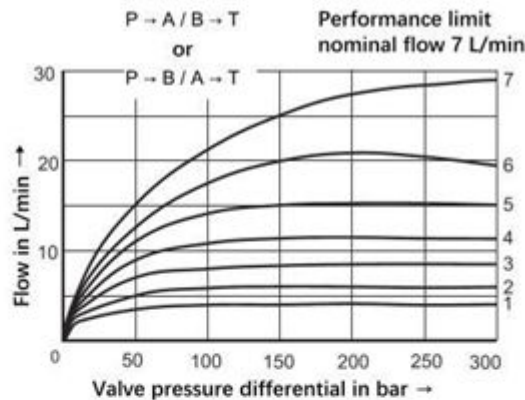
Δp : valve pressure differential

P_p : inlet pressure

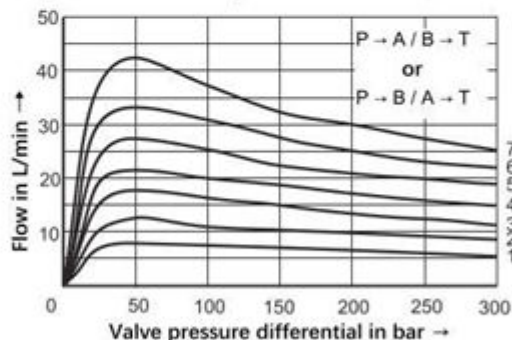
P_L : load pressure

P_T : return pressure

Performance limit



Performance limit, nominal flow 30 L/min



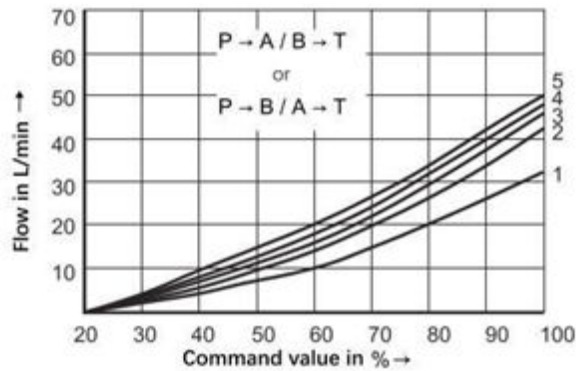
- 1 Command value = 40 %
- 2 Command value = 50 %
- 3 Command value = 60 %
- 4 Command value = 70 %
- 5 Command value = 80 %
- 6 Command value = 90 %
- 7 Command value = 100 %

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

Characteristic curves NS10 (HLP46 at 40 °C ± 5 °C)

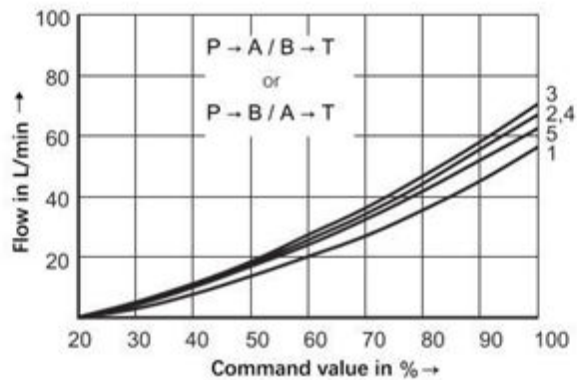
Flow characteristic curve, $\sigma=100\text{bar}$

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



- 1 $\Delta p = 10$ bar constant
- 2 $\Delta p = 20$ bar constant
- 3 $\Delta p = 30$ bar constant
- 4 $\Delta p = 50$ bar constant
- 5 $\Delta p = 100$ bar constant

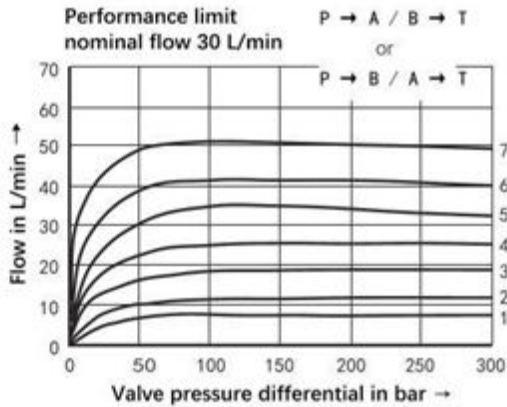
60 L/min nominal flow at 10 bar valve pressure differential



$\Delta p = p_p - p_L$
 Δp : valve pressure differential
 p_p : inlet pressure
 p_L : load pressure
 p_r : return pressure

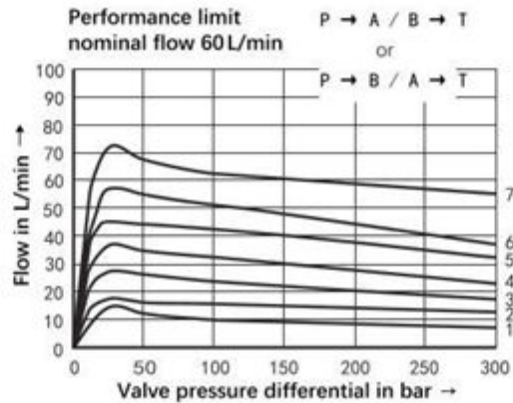
Performance limit

Performance limit
nominal flow 30 L/min



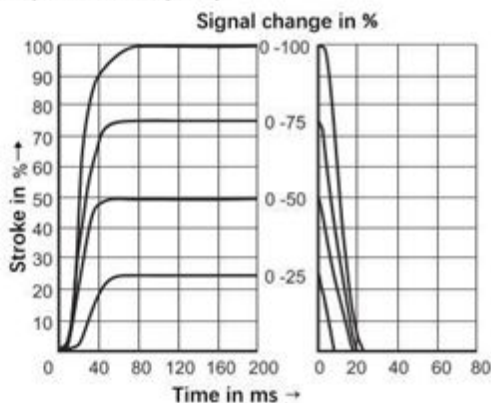
- 1 Command value = 40 %
- 2 Command value = 50 %
- 3 Command value = 60 %
- 4 Command value = 70 %
- 5 Command value = 80 %
- 6 Command value = 90 %
- 7 Command value = 100 %

Performance limit
nominal flow 60 L/min

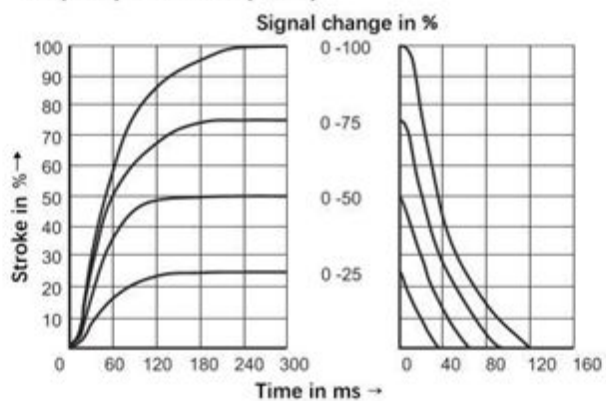


If the performance limits are exceeded then flow forces occur which lead to uncontrolled spool movements.

Step response curve(NS6)



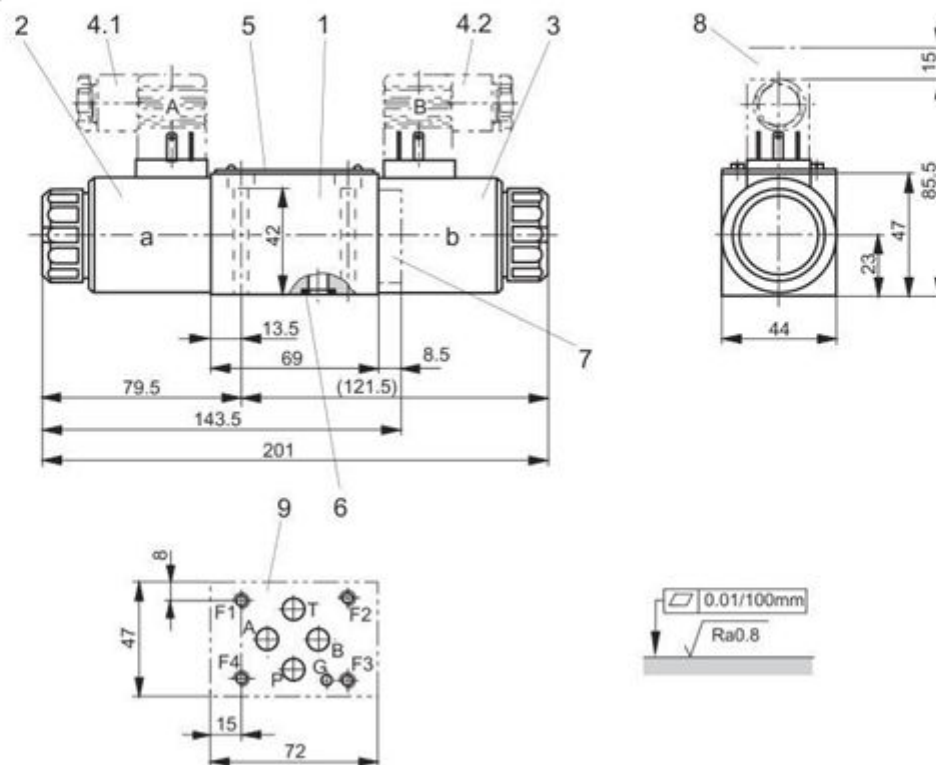
Step response curve(NS10)



Unit dimensions

4WRA6

Dimensions in mm



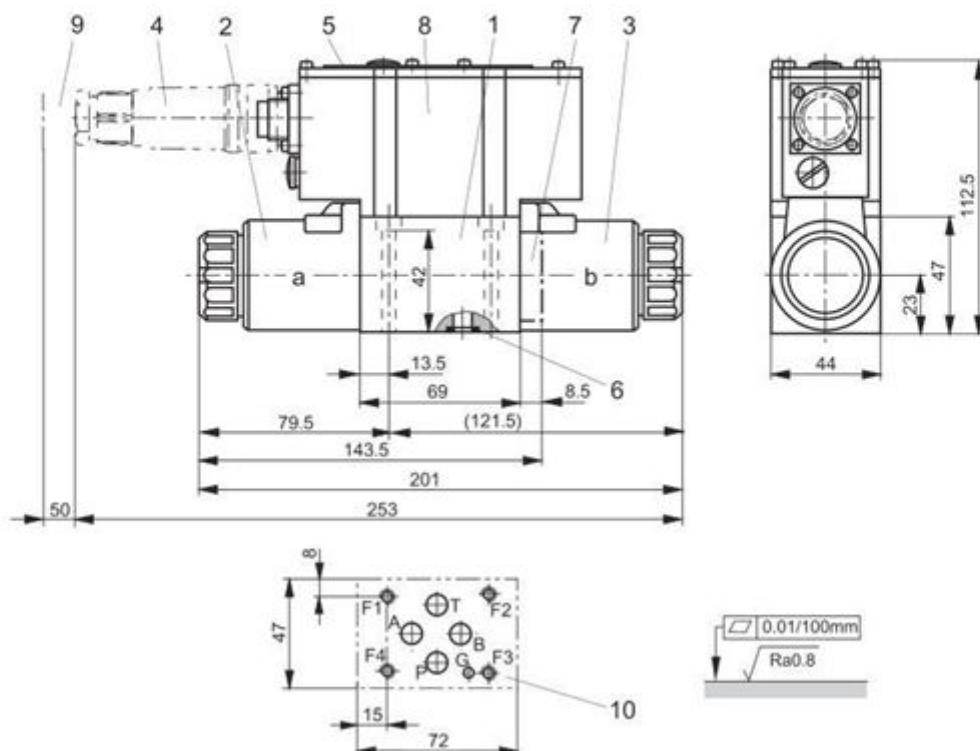
Dimensions in mm	P	A	T	B	F1	F2	F3	F4	G
Diameter/thread	ø7.5 max	ø7.5 max	ø7.5 max	ø7.5 max	M5	M5	M5	M5	ø4
x	21.5	12.7	21.5	30.2	0	40.5	40.5	0	33
y	25.9	15.5	5.1	15.5	0	-0.75	31.75	31	31.75

- 1 Valve housing
- 2 Proportional solenoid "a"
- 3 Proportional solenoid "b"
- 4.1 Plug-in connector "A", colour grey
- 4.2 Plug-in connector "B", colour black
- 5 Name plate
- 6 R-ring 9.81 x 1.5 x 1.78 (ports A, B, P, T)
- 7 Plug for valves with one solenoid
(2 switched positions, versions EA or WA)
- 8 Space required to remove the plug-in connector
- 9 Mounting surface, in accordance with ISO4401-03-02-0-05 oil port connection position and standard tolerances
- 10 Diameters of the ports P, A, B and T are 7.5 mm
- 11 Fixing screws: 4 GB/T 70.1 - M5 x 50 10.9
- 12 Torque: 8.9 Nm ± 10 %

Unit dimensions

4WRAE6

Dimensions in mm



Dimensions in mm	P	A	T	B	F1	F2	F3	F4	G
Diameter/thread	ø7.5 max	ø7.5 max	ø7.5 max	ø7.5 max	M5	M5	M5	M5	ø4
x	21.5	12.7	21.5	30.2	0	40.5	40.5	0	33
y	25.9	15.5	5.1	15.5	0	-0.75	31.75	31	31.75

- 1 Valve housing
- 2 Proportional solenoid "a"
- 3 Proportional solenoid "b"
- 4 Plug-in connector to DIN EN 175201-804(separate order)
- 5 Name plate
- 6 R-ring 9.81 x 1.5 x 1.78 (ports A, B, P, T)
- 7 Plug for valves with one solenoid
(2 switched positions, versions **EA** or **WA**)
- 8 Integrated control electronics

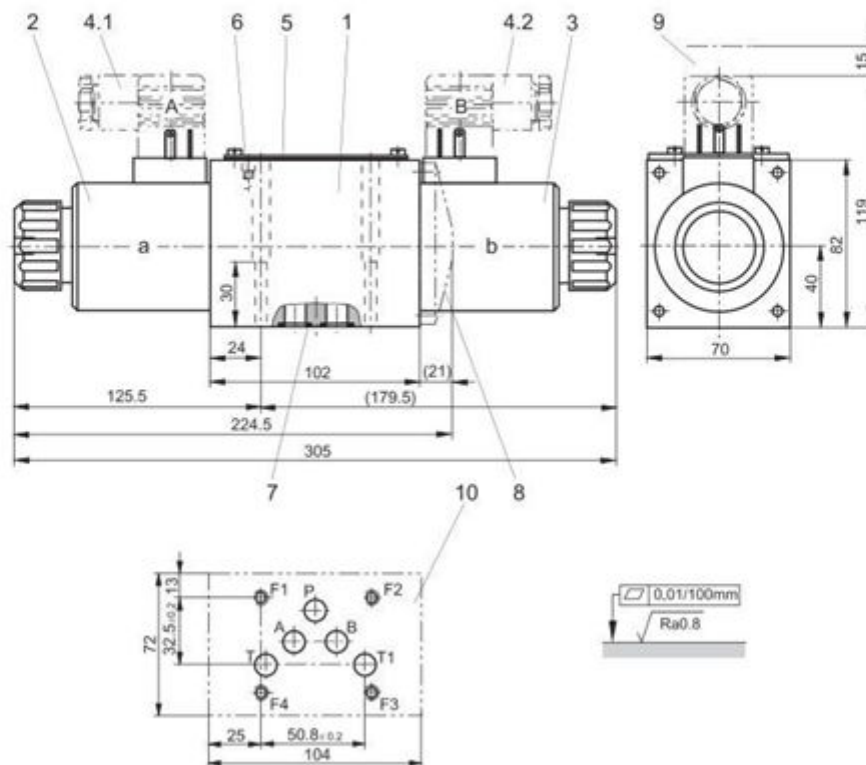
- 9 Space required to remove the plug-in connector
- 10 Mounting surface, in accordance with ISO4401-03-02-0-05 oil port connection position and standard tolerances

Diameters of the ports P, A, B and T are 7.5 mm
Fixing screws: 4 GB/T 70.1 - M5 x 50 10.9
Torque: 8.9 Nm $\pm$ 10 %

Unit dimensions

4WRA10

Dimensions in mm



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

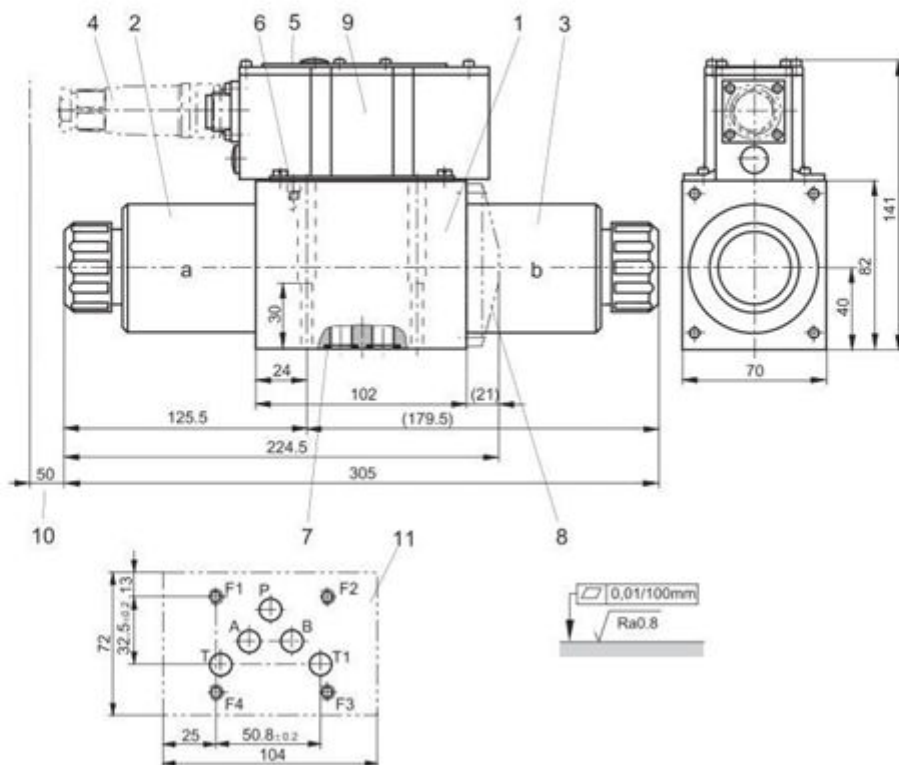
- 1 Valve housing
- 2 Proportional solenoid "a"
- 3 Proportional solenoid "b"
- 4.1 Plug-in connector "A", colour grey
- 4.2 Plug-in connector "B", colour black
- 5 Name plate
- 7 R-ring 13.0 x 1.6 x 2.0 (ports A, B, P, T)
- 8 Plug for valves with one solenoid
(2 switched positions, versions EA or WA)
- 9 Space required to remove the plug-in connector

- 10 Mounting surface, in accordance with ISO4401-05-04-0-05 oil port connection position and standard tolerances

Diameters of the ports P, A, B and T are 11.2 mm
Fixing screws: 4 GB/T 70.1 - M6 x 40 10.9
Torque: 15.5 Nm ± 10 %

4WRAE10

Dimensions in mm



Dimensions in mm	P	A	T	(T1)	B	F1	F2	F3	F4
Diameter/thread	⌀11.2 max	⌀11.2 max	⌀11.2 max	⌀11.2 max	⌀11.2 max	M6	M6	M6	M6
x	27	16.7	3.2	50.8	37.3	0	54	54	0
y	6.3	21.4	32.5	32.5	21.4	0	0	46	46

- | | | | |
|----|---|----|--|
| 1 | Valve housing | 11 | Mounting surface, in accordance with ISO4401-05-04-0-05 oil port connection position and standard tolerances |
| 2 | Proportional solenoid "a" | | |
| 3 | Proportional solenoid "b" | | |
| 4 | Plug-in connector to DIN EN 175201-804(separate order) | | Diameters of the ports P, A, B and T are 11.2 mm |
| 5 | Name plate | | Fixing screws: 4 GB/T 70.1 - M6 x 40 10.9 |
| 7 | R-ring 13.0 x 1.6 x 2.0 (ports A, B, P, T) | | Torque: 15.5 Nm $\pm$ 10 % |
| 8 | Plug for valves with one solenoid
(2 switched positions, versions EA or WA) | | |
| 9 | Plug-in connector to DIN EN 175201-804(separate order) | | |
| 10 | Space required to remove the plug-in connector | | |

Diameters of the ports P, A, B and T are 11.2 mm
Fixing screws: 4 GB/T 70.1 - M6 x 40 10.9
Torque: 15.5 Nm $\pm$ 10 %