4/3 proportional directional valve with integrated digital position controller and field bus interface (IAC-P)

Type STW 0240-1X/4WREA

RE 29018
Version: 2013-02
Replaces: 12.12

- Sizes 6 and 10
- Component series 2X
- Maximum operating pressure 315 bar
- Maximum flow: 80 l/min (size 6)
- Maximum flow: 180 l/min (size 10)

Features

- Direct operated proportional directional valve with integrated digital control electronics (Integrated Axis Controller IAC-P) for
  – flow control
  – position control
- Completely adjusted unit consisting of valve, digital control electronics and field bus connection
- Valve spool position-controlled
- Analog interfaces for command and actual values
- Analog position sensor (0 to 10 V or 4 to 20 mA)
- Design for CAN bus with CANopen protocol DS 408 or Profibus-DP V0/V1
- Quick commissioning via PC and commissioning software WIN-PED 6

Contents

Ordering code

01	02	03	04	05	06		07		08	09	10	11	12
STW 0240-1X/4WRE	**A**				**2X**	**/**	**V**	**–**	**24**				*****

01	Proportional directional valve	**STW 0240-1X/4WRE**
02	With integrated digital electronics and axis controller	**A**
03	Size 6	**6**
	Size 10	**10**
04	Symbols e.g. E, E1, V; possible design see page 3	

Rated flow size 6 [1)]

05	8 l/min	**08**
	16 l/min	**16**
	32 l/min	**32**

Rated flow size 10 [1)]

05	25 l/min	**25**
	50 l/min	**50**
	75 l/min	**75**
06	Component series 20 ... 29 (20 ... 29: Unchanged installation and connection dimensions)	**2X**
07	FKM seals	**V**
08	Supply voltage 24 V	**24**

Bus interface

09	CANBus DS 408	**C**
	Profibus DP V0/V1	**P**

Electrical interface

10	±10 VDC for command value Q or 0 to 10 V for position	**A6**
	4 to 20 mA	**F6**

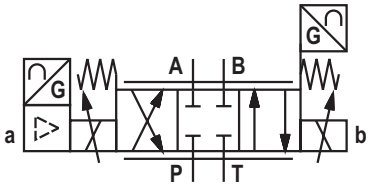
Sensor interface for external analog sensor

11	4 to 20 mA (only in connection with "F6")	**2**
	0 to 10 V (only in connection with "A6")	**3**
12	Further details in the plain text	

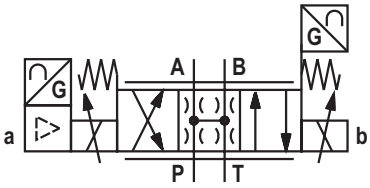
[1)] Also refer to the flow characteristic curves on pages 12 and 15

Symbols

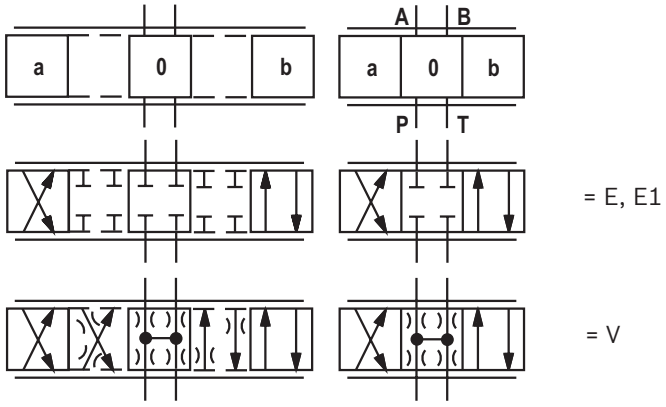
Type STW0240-1X/4WREA...E...



Type STW0240-1X/4WREA...V...



Control spool symbols



= E, E1

= V

With symbol E1:

P → A: q_{vmax} B → T: $q_v/2$

P → B: $q_v/2$ A → T: q_{vmax}

Function, section

Set-up

The valve basically consists of:

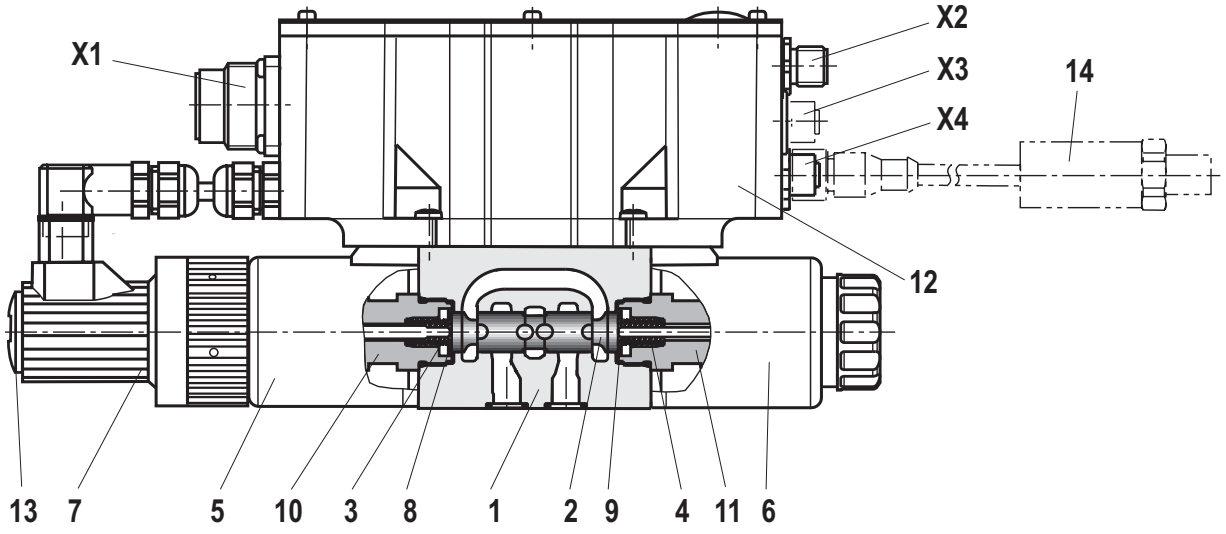
- Housing (1) with connection surface
- Control spool (2) with compression springs (3 and 4) and spring plates (8 and 9)
- Coils (5 and 6) and pole tubes (10 and 11) with central thread
- Position transducer (7)
- Integrated digital control electronics IAC-P (12)
- Port (X4) for an external, analog position sensor (14)

Functional description

With de-energized solenoids (5 and 6), the control spool (2) is brought into the central position by compression springs (3 and 4) between the spring plates (8 and 9) (with V control spool without spring plate). With V control spools, the mechanical zero position does not correspond to the hydraulic one.

Functions:

- Flow control
- Position control
- The command value can alternatively be specified via an analog interface (X1) or via the field bus interface (X2, X3)
- The actual value signals are provided via an analog interface (X1) and can additionally be read out via the field bus (X2, X3)
- The controller parameters are set via the field bus
- Separate supply voltage for bus/controller and power section (output stage) for safety reasons



☞ **Notice!** The PG fitting (13) must not be opened. Mechanical adjustment of the adjustment nut located below is prohibited and damages the valve!

☞ **Notice!** Due to the design principle, internal leakage is inherent to the valves, which may increase over the service life.
The tank line must not be allowed to run empty. With corresponding installation conditions, a preload valve is to be installed.

Function, section

The digital integrated control electronics enables the following fault detection:

- Cable break sensor (only with current interface)
- Undervoltage
- Cable break position transducer (7)
- Communication error
- Watchdog
- Cable break command value input (only with current interface)

The following additional functions are available:

- Ramp generator
- Internal command value profile
- Enable function via hardware or bus
- Error output 24 V
- Analog position sensor connection

PC program WIN-PED 6

To implement the project planning task and to parameterize the IAC-P valves, the user may use the commissioning software WIN-PED 6.

- Parameterization
- Diagnosis
- Comfortable data management on a PC

System requirements

- IBM PC or compatible system
- Windows 2000 or Windows XP
- RAM (recommendation: 256 MB)
- 150 MB of available hard disk capacity

Notice

The "WIN-PED 6" PC program is not included in the delivery. It can be downloaded on the Internet free of charge! (see page 19)

Technical data

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

general		**Size 6**	**Size 10**
Installation position		Any, preferably horizontal	
Storage temperature range	°C	–20 ... +80	
Ambient temperature range	°C	–20 ... +50	
Weight without sandwich plate	kg	2.4	6.5
Climate		Environmental audit according to EN 60068-2	

hydraulic (measured with HLP46, ϑ_{oil} = 40 °C ±5 °C)				
Operating pressure	– Port A, B and P	bar	Up to 315	
	– Port T	bar	Up to 210	
Rated flow q_{Vnom} with Δp = 10 bar (also refer to the flow characteristic curves pages 12 and 15)		l/min	8	25
			16	50
			32	75
Maximum admissible flow		l/min	80	180
Hydraulic fluid			See table page 6	
Hydraulic fluid temperature range		°C	–20 ... +70; preferably +40 ... +50	
Viscosity range		mm^2/s	20 to 380, preferably 30 to 46	
Maximum admissible degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c)			Class 20/18/15 [1]	
Hysteresis (position control - valve control spool)		%	≤ 0.1	
Range of inversion (position control - valve control spool)		%	≤ 0.05	
Response sensitivity (position control - valve control spool)		%	≤ 0.05	
Zero shift valve control spool upon change of hydraulic fluid temperature and operating pressure		%/10 K	< 0.15	
		%/100 bar	< 0.1	

[1] The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the life cycle of the components. For the selection of the filters see www.boschrexroth.com/filter.

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

Hydraulic fluid	Classification	Suitable sealing materials	Standards
Mineral oils and related hydrocarbons	HL, HLP	NBR, FKM	DIN 51524

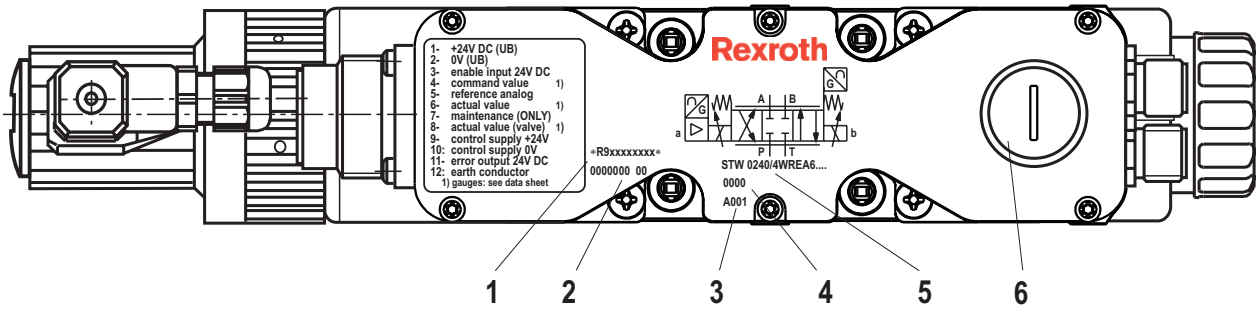
☞ **Important information on hydraulic fluids!**
- For more information and data on the use of other hydraulic fluids refer to data sheet 90220 or contact us!
- There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.)!
- The flash point of the hydraulic fluid used must be 40 K higher than the maximum solenoid surface temperature.

electric			
Duty cycle [1]		%	100
Supply voltage	– Nominal voltage	VDC	24
	– Lower limit value	VDC	19.4
	– Upper limit value	VDC	35
	– Maximum admissible residual ripple	Vpp	2
Total current consumption	– I_{max}	A	2
	– Impulse current	A	3
Command and actual value signals	– Voltage "A6", parameterizable	V	±10 for command value flow control 0 to 10 for command value position control (cylinder)
	– Current "F6"	mA	4 to 20
Converter resolution (command/actual value signals)		Bit	10
Maximum coil temperature [2]		°C	Up to 150
Protection class of the valve according to EN 60529			IP 65 with mounted and locked plug-in connectors
EMC (electromagnetic compatibility)			Interference resistance EN 61000-6-2:2001 Interference emission EN 61000-6-3:2001 Interference emission EN 61000-6-4:2001

1) Connect the valve to the supply voltage only when this is required for the functional processes of the machine.

2) Due to the temperatures occurring at the surfaces of the solenoid coils, the European standards ISO 13732-1 and EN ISO 4413 must be adhered to.

Control electronics (IAC-P), marking and adjustment elements



1 Material number
2 Production order number
3 Date of production
4 Serial number
5 Type designation
6 Under the cover: DIL switch for address and baud rate setting (position B0 right), see page 9

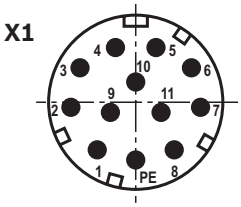
Control electronics (IAC-P), electrical connections and allocation

Connector allocation X1, 11-pole + PE according to EN 175201-804

Pin	Core marking [1]	Interface A6 allocation	Interface F6 allocation
1	1	24 VDC ($\boldsymbol{u}(\boldsymbol{t})$ = 19.4 to 35 V); $\boldsymbol{I}_{max}$ = 1.7 A (for output stage)	
2	2	0 V ≙ load zero, reference for pins 1 and 9	
3	white	Enable input 9 to 35 V = Enable on	
4	qellow	0 to 10 V position command value / ±10 V valve control spool command value, $\boldsymbol{R}_e$ > 50 kΩ	4 to 20 mA command value, $\boldsymbol{R}_e$ = 100 Ω
5	green	Reference for command values	
6	purple	0 to 10 V actual position value (limit load 5 mA)	4 to 20 mA actual position value, (load resistance maximum 300 Ω)
7	pink	Must not be used	
8	red	±10 V actual valve control spool value (limit load 5 mA)	4 to 20 mA actual valve control spool value (load resistance maximum 300 Ω)
9	brown	Control voltage, level as pin 1, $\boldsymbol{I}_{max}$ = 0.3 A (for signal part and bus)	
10	black	Control voltage 0 V, reference potential for pin 3, 6, 8 and 11 (in the valve connected to pin 2)	
11	blue	Error output 24 V (19.4 to 35 V), 300 mA maximum load	
PE	green-yellow	Protective earthing conductor (directly connected to cooling element and valve housing)	

Connect shield on PE only on the supply side!

[1] Core marking of the connection lines for mating connector with cable set (see accessories)



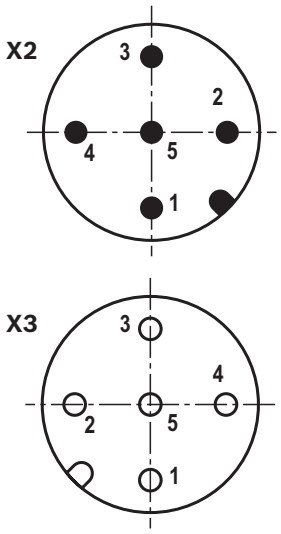
Control electronics (IAC-P), electrical connections and allocation

Connector allocation for CAN bus "X2"/"X3" (coding A), M12, 5-pole, pins/socket

Pin	Allocation
1	n. c.
2	n. c.
3	CAN_GND
4	CAN_H
5	CAN_L

Transmission rate kbit/s	20 to 1000
Bus address	1 to 127

CAN-specific settings:
Baud rate and identifier can be set via the bus system and/or the DIL switches.

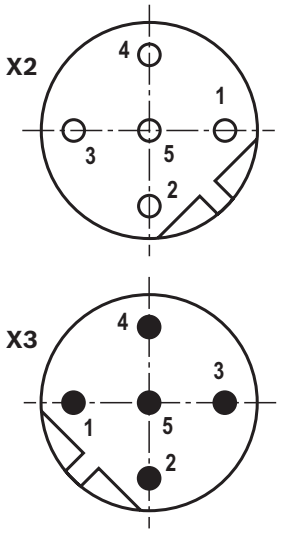


Connector allocation for Profibus DP "X2"/"X3" (coding B), M12, 5-pole, socket/pins

Pin	Allocation
1	+5 V
2	RxD/TxD-N (A line)
3	D GND
4	RxD/TxD-P (B line)
5	Shield

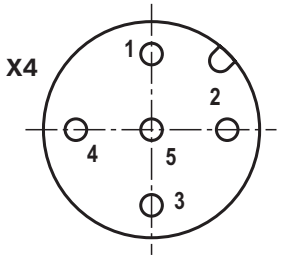
Transmission rate kbit/s	up to 12 MBaud
Bus address	1 to 126
Setting via DIL switch	

The +5 V voltage of the IAC-P is available for an external terminating resistor.



External position sensor "X4" (coding A), M12, 5-pin, socket

Pin	Allocation of voltage interface	Allocation of current interface
1	Supply 24 VDC	Supply 24 VDC
2	Signal (0 to +10 V)	Signal (4 to 20 mA)
3	Zero 0 V (GND)	Zero 0 V (GND)
4	n. c.	n. c.
5	n. c.	n. c.



☞ **Notice!** We recommend connecting the shields on both sides via the metal housings of the plug-in connectors. Using connector pins will affect the effectiveness of the screen! Internal screens are not required.

Control electronics (IAC-P), settings for CANopen and Profibus DP

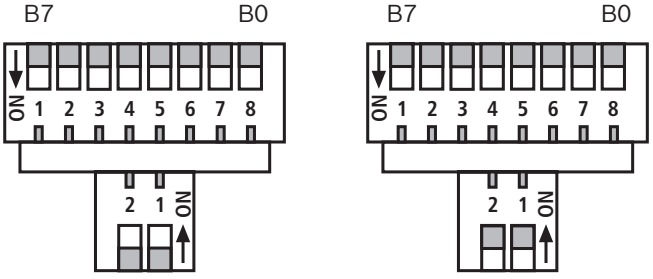
CANopen

B7	B6	B5	B4	B3	B2	B1	B0	HEX	Baud rate: B7, B6	Address range: B5 to B0
0	0	0	0	0	0	0	0	00 [1]	Standard 20 kBaud or re-programmed	1 = Standard or re-programmed
0	0	0	0	0	0	0	1	01	20 kBaud	1 to 63
					to			to		
0	0	1	1	1	1	1	1	3F		
0	1	0	0	0	0	0	0	40	125 kBaud	1 = Standard or re-programmed
0	1	0	0	0	0	0	1	41	125 kBaud	1 to 63
					to			to		
0	1	1	1	1	1	1	1	7F		
1	0	0	0	0	0	0	0	80	250 kBaud	1 = Standard or re-programmed
1	0	0	0	0	0	0	1	81	250 kBaud	1 to 63
					to			to		
1	0	1	1	1	1	1	1	BF		
1	1	0	0	0	0	0	0	C0	500 kBaud	1 = Standard or re-programmed
1	1	0	0	0	0	0	1	C1	500 kBaud	1 to 62
					to			to		
1	1	1	1	1	1	1	0	FE		
1	1	1	1	1	1	1	1	FF	250 kBaud	Monitor mode/programming mode 1 = fixed

Profibus DP

B7	B6	B5	B4	B3	B2	B1	B0	HEX	Address range
0	0	0	0	0	0	0	0	00 [1]	125 = Standard or re-programmed
0	0	0	0	0	0	0	1	01	1 to 126 with parameter channel
					to			to	
0	1	1	1	1	1	1	0	7E	
1	0	0	0	0	0	0	0	80	1 to 126 with parameter channel
					to			to	
1	1	1	1	1	1	1	0	FE	
1	1	1	1	1	1	1	1	FF	Monitor operation address 125

[1] Factory setting

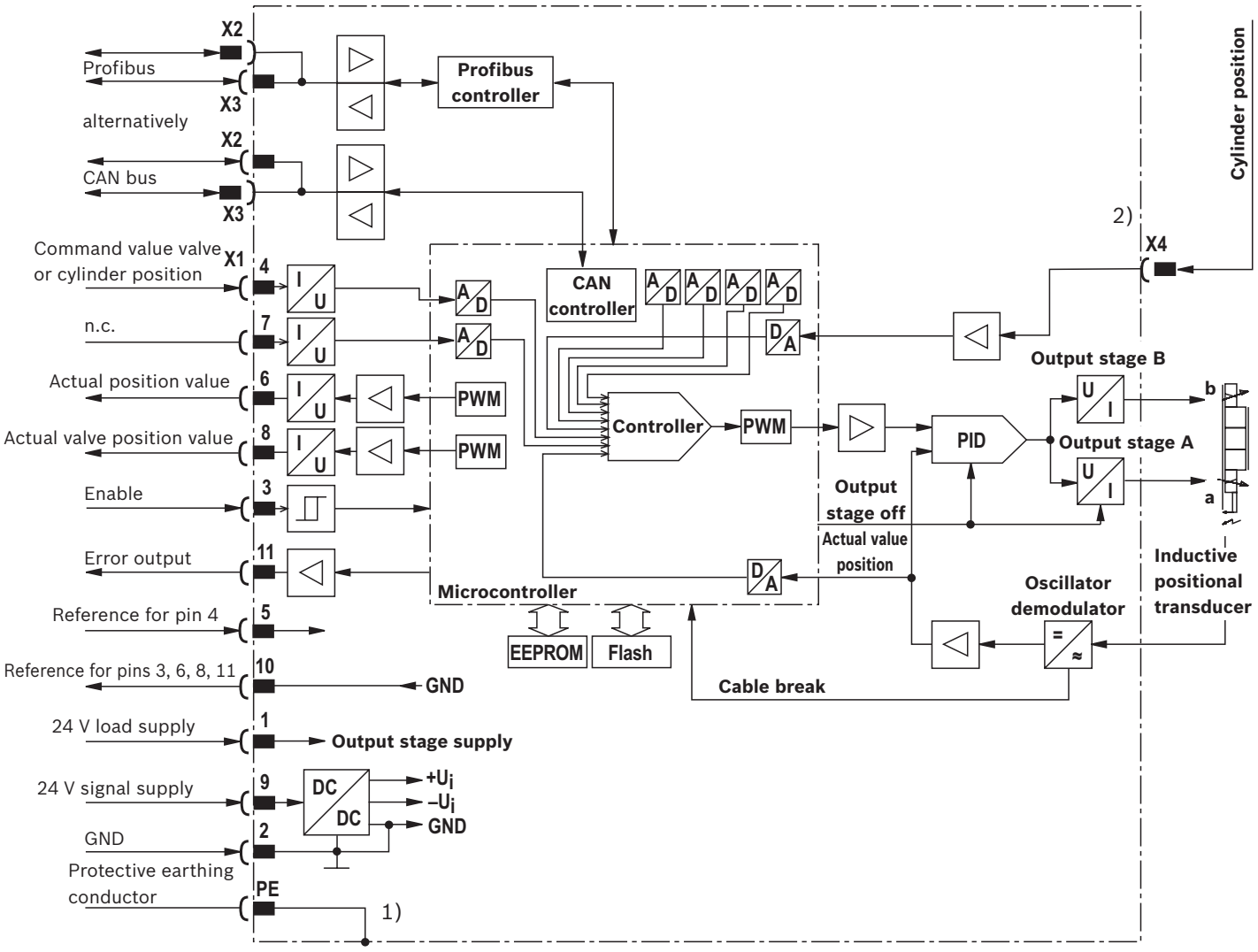


Connection of the bus terminator with the two lower switches (only with Profibus):

Left figure: Bus terminator not connected

Right figure: Bus terminator connected (both switches to "ON")

Control electronics (IAC-P), block diagram



1) The protective earthing conductor (PE) is connected to cooling element and valve housing.

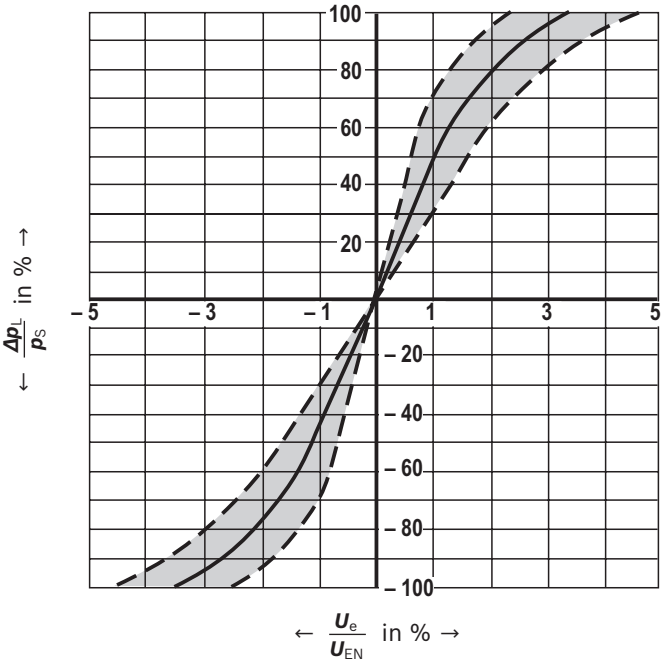
2) Connection for position sensor 0 to 10 V or 4 to 20 mA.

Command value Valve position	Positive command value 0 to +10 V (or 12 to 20 mA) at pin 4 and reference potential at pin 5 result in flow from P → A and B → T. Negative command value 0 to **–**10 V (or 12 to 4 mA) at pin 4 and reference potential at pin 5 result in flow from P → B und A → T.
Actual value Valve position	Positive actual value 0 to +10 V (or 12 to 20 mA) at pin 8 and reference potential at pin 10 result in flow from P → A and B → T. Negative actual value 0 to **–**10 V (or 12 to 4 mA) at pin 8 and reference potential at pin 10 result in flow from P → B und A → T.
Connection line	Recommendation: Up to 25 m line length for pins 1, 2 and PE: 0.75 mm²; otherwise 0.25 mm² Up to 50 m line length for pins 1, 2 and PE: 1.00 mm² External diameter see sketch of mating connector

Characteristic curves size 6

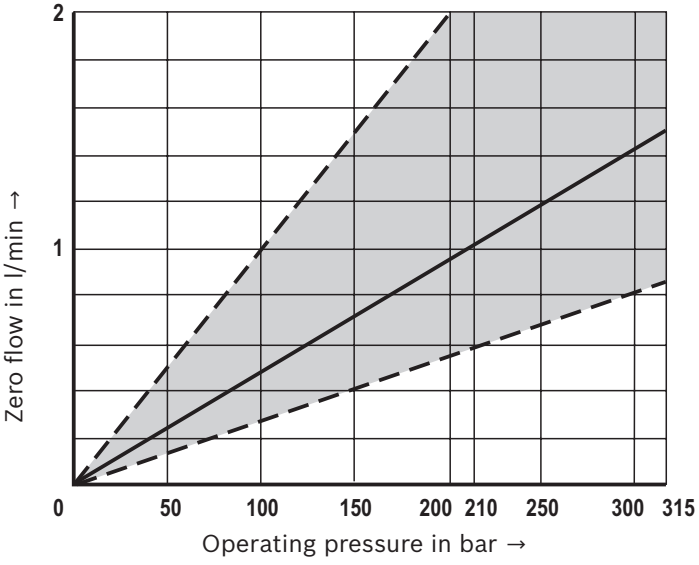
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Pressure/signal characteristic curve (V control spool), p_s = 100 bar



Zero flow (with central control spool position)

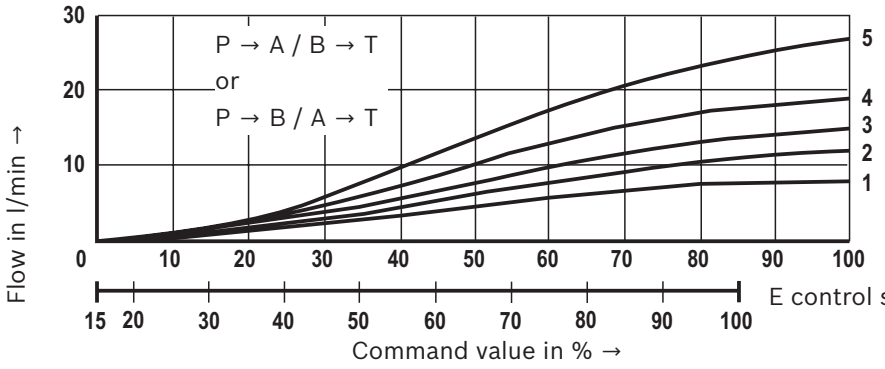
Type 4WREA 6 V32



Characteristic curve size 6

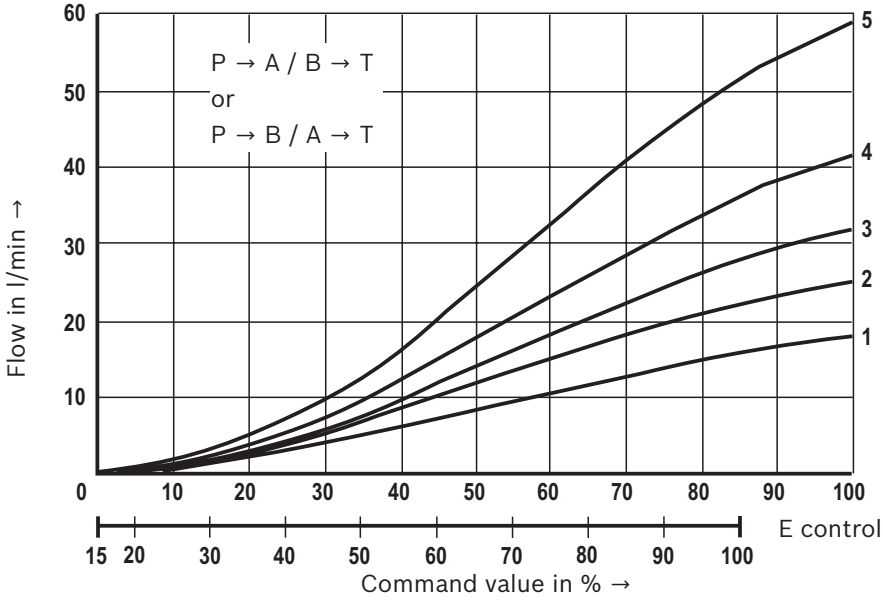
(measured with HLP46, ϑ_{oil} = 40 ±5 °C and p = 100 bar)

8 l/min rated flow



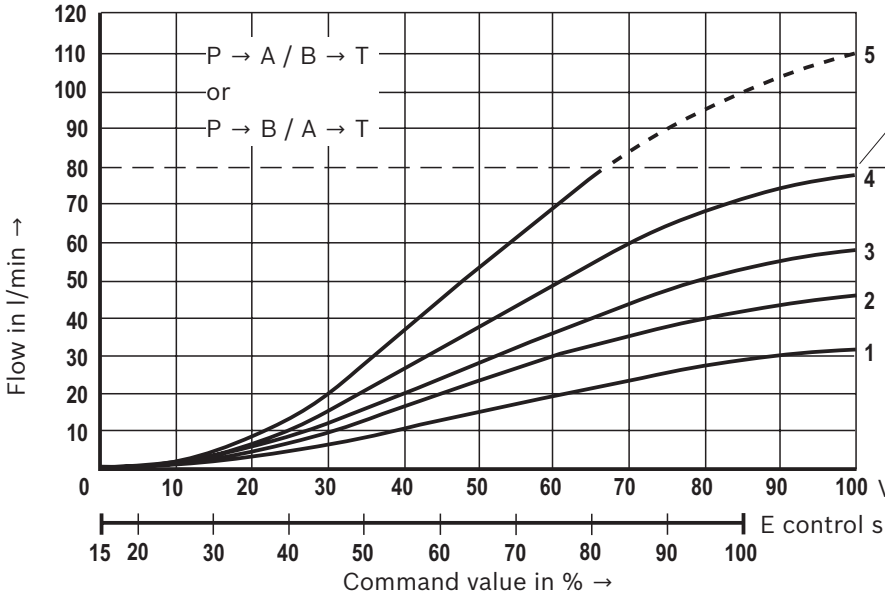
1 Δp = 10 bar constant
2 Δp = 20 bar constant
3 Δp = 30 bar constant
4 Δp = 50 bar constant
5 Δp = 100 bar constant

16 l/min rated flow



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

32 l/min rated flow



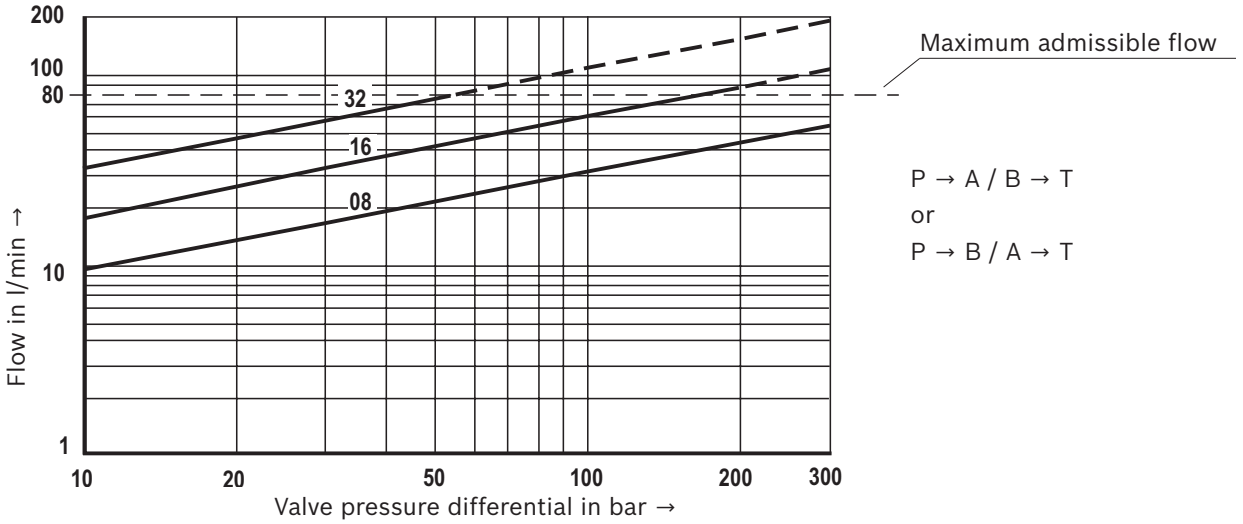
Maximum admissible flow
Notice:
Observe the flow/load function on page 13!

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

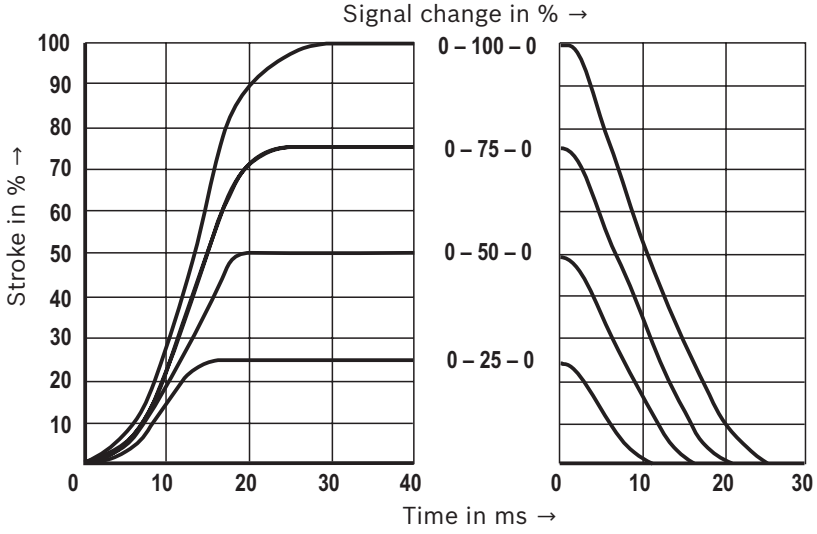
Characteristic curves size 6

(measured with HLP46, ϑ_{oil} = 40 ±5 °C) and p_s = 10 bar

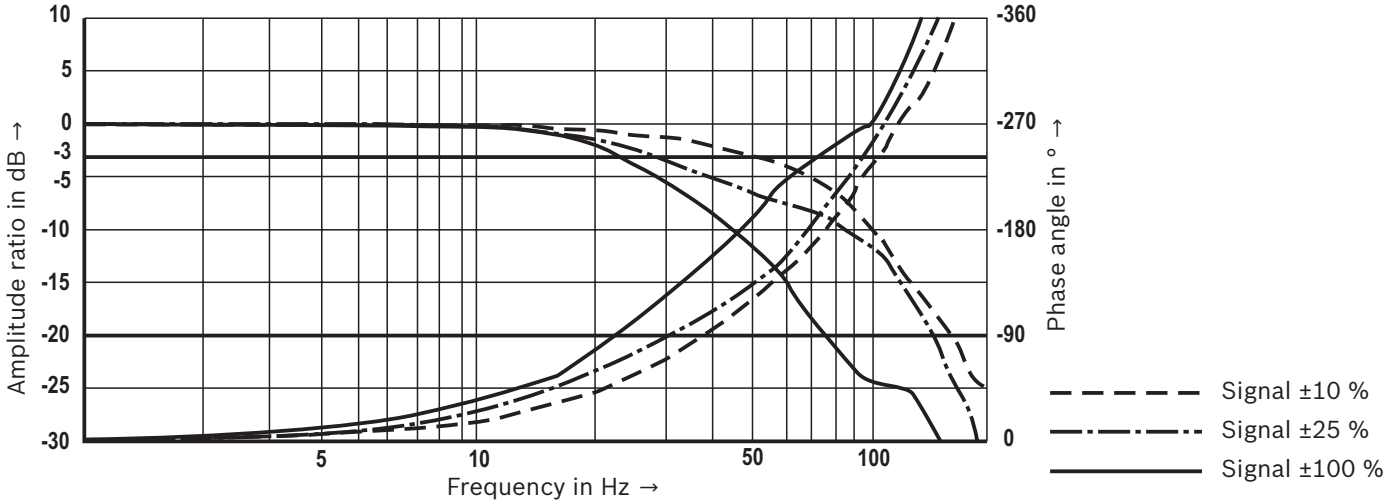
Flow/load function with maximum valve opening (with V control spool)



Transition function with stepped electrical input signals (with V control spool)

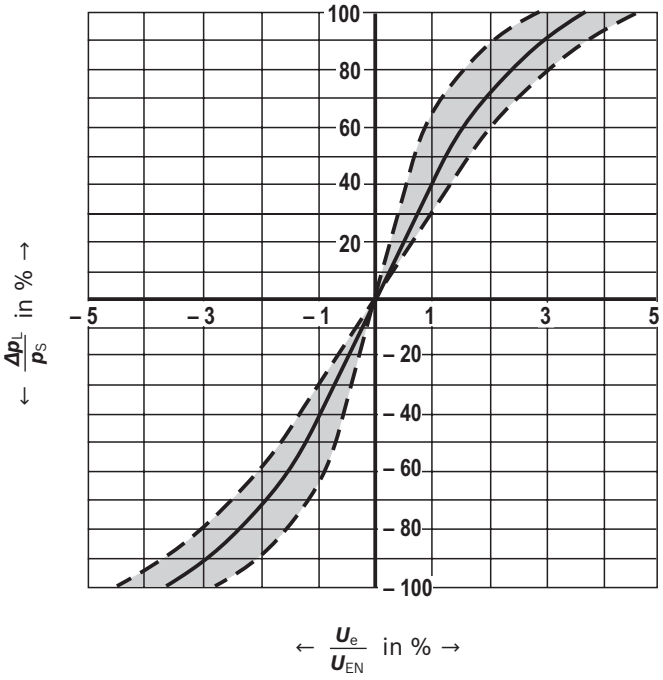


Frequency response (with V control spool)



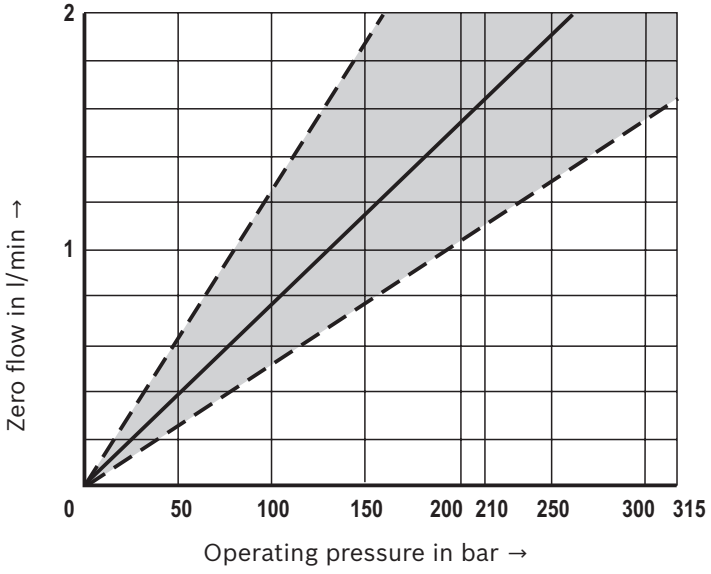
Characteristic curves size 10
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Pressure/signal characteristic curve (V control spool), p_s = 100 bar



Zero flow (with central control spool position)

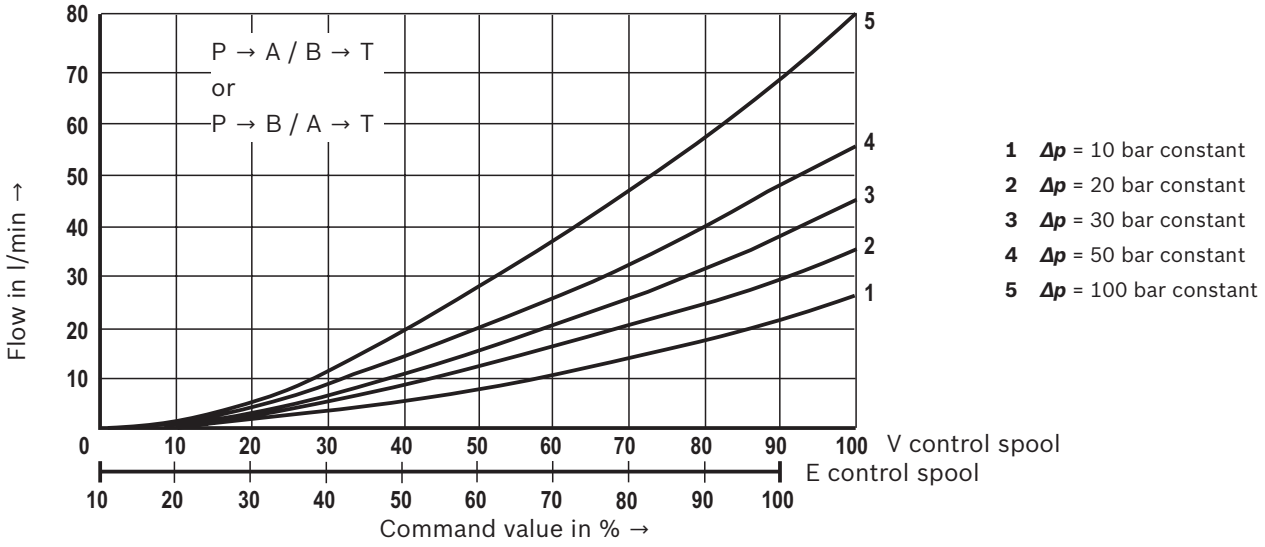
Type 4WREA 10 V75



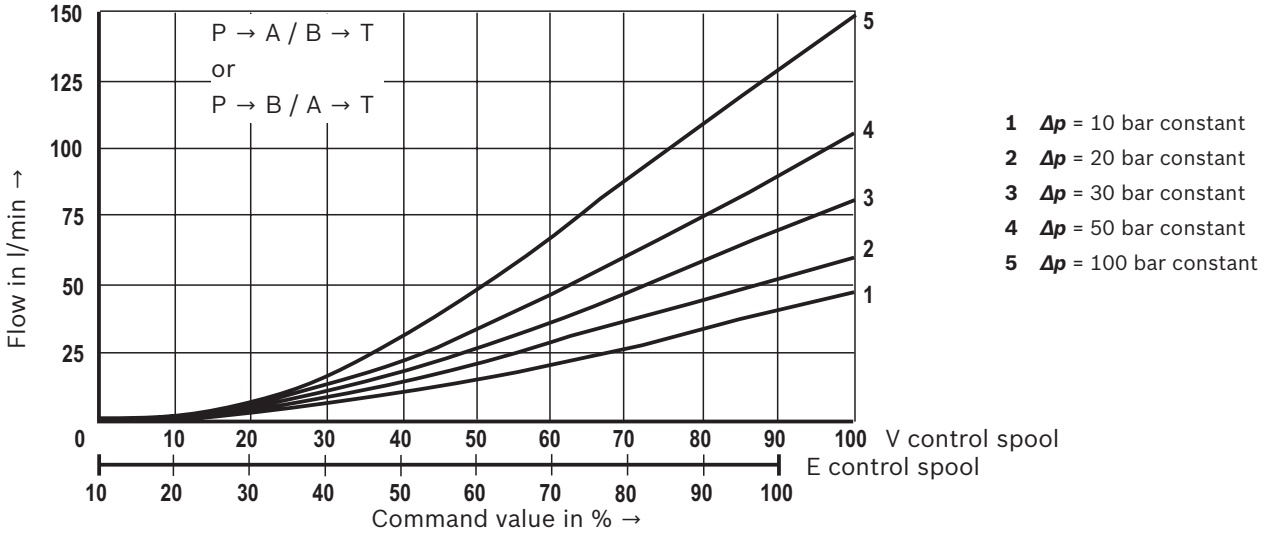
Characteristic curve size 10

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

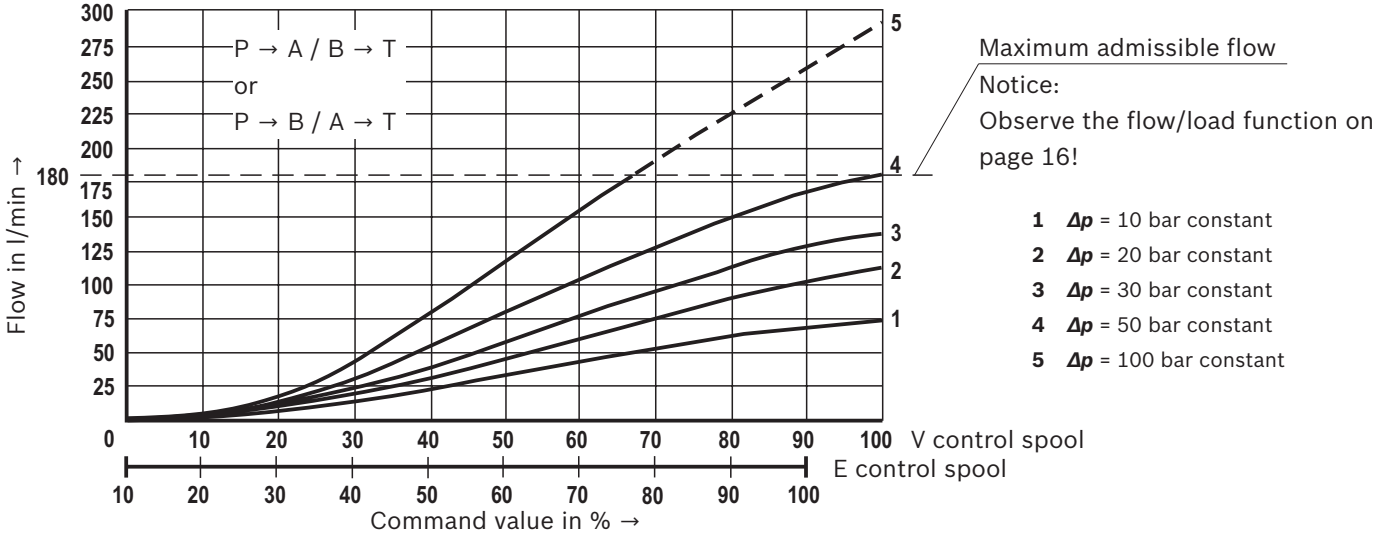
25 l/min rated flow



50 l/min rated flow



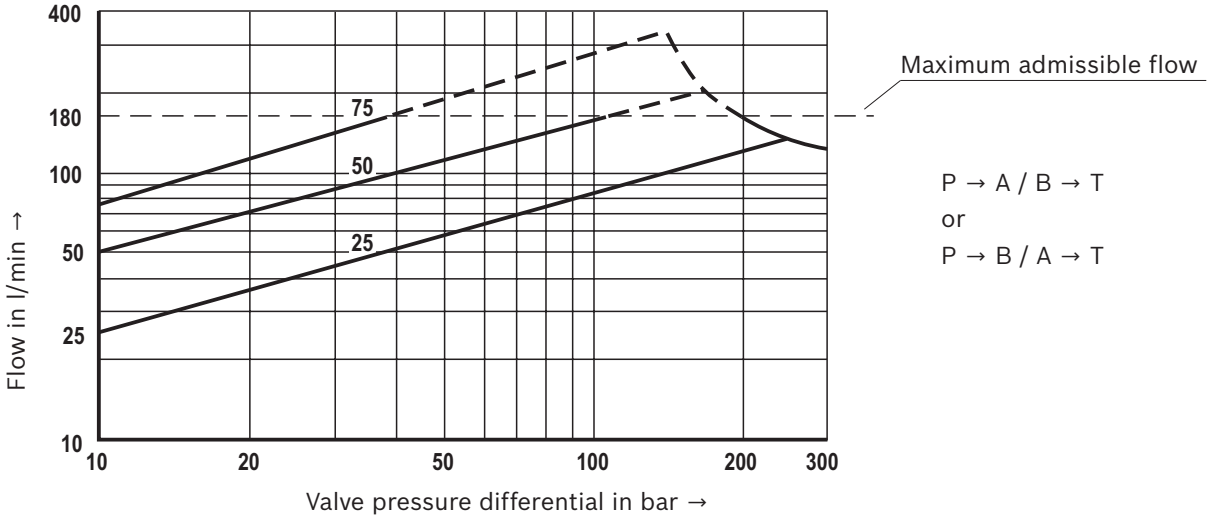
75 l/min rated flow



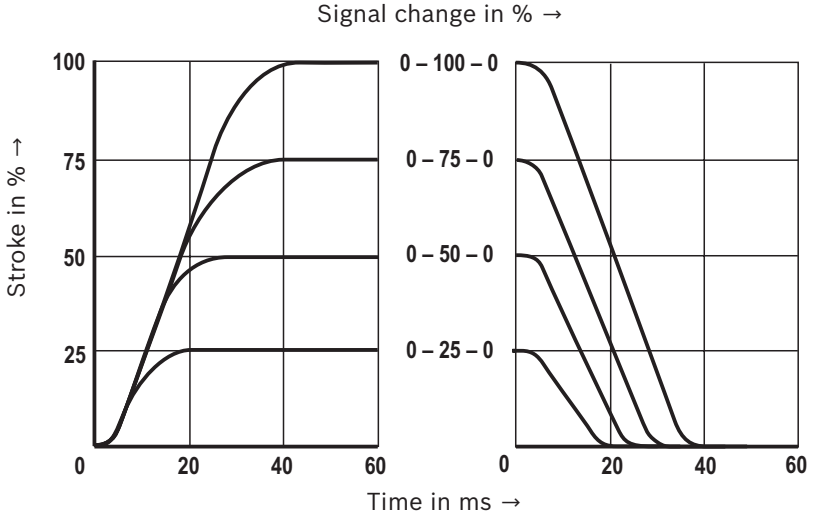
Characteristic curves size 10

(measured with HLP46, ϑ_{oil} = 40 ±5 °C) and p_s = 10 bar

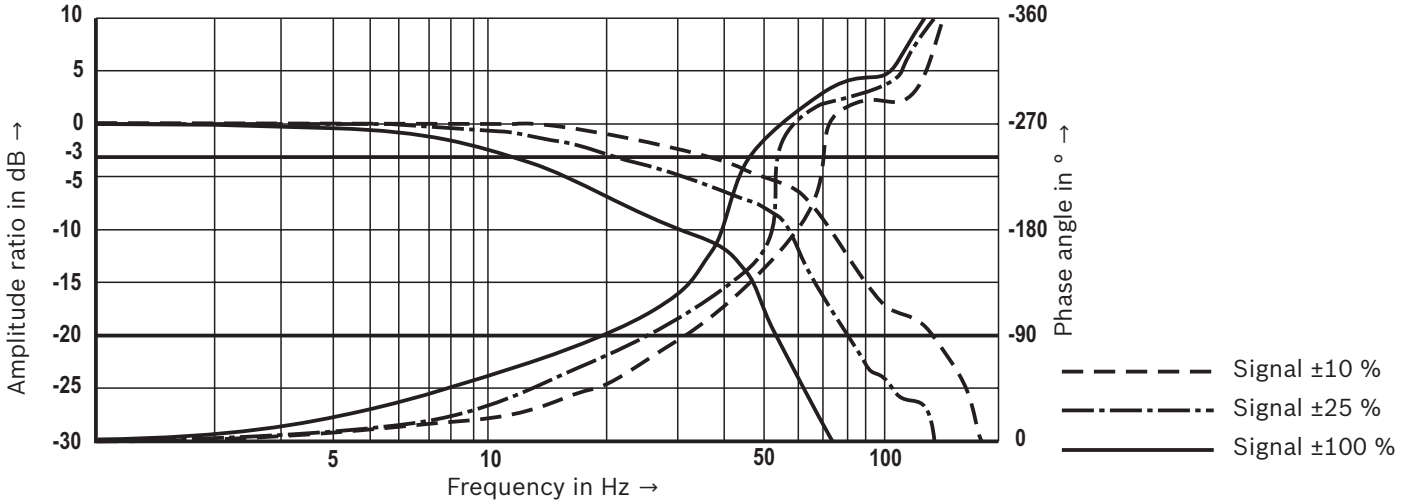
Flow/load function with maximum valve opening (with V control spool)



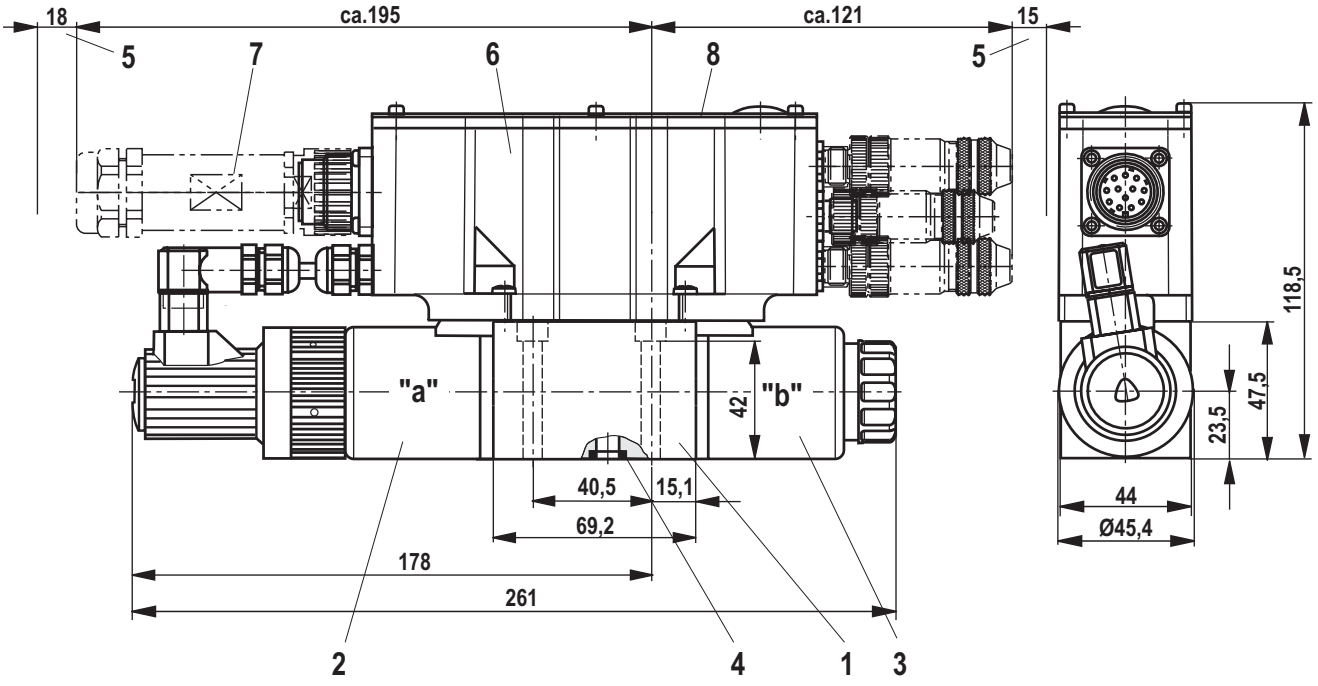
Transition function with stepped electrical input signals (with V control spool)

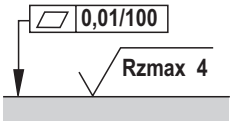


Frequency response (with V control spool)

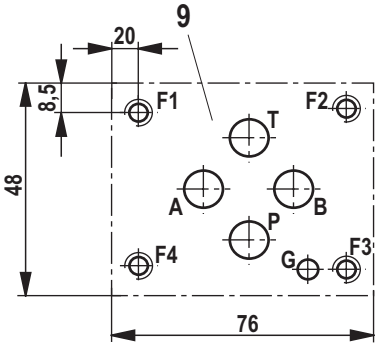


Dimensions size 6:
(dimensions in mm)





Required surface quality of
the valve connection surface

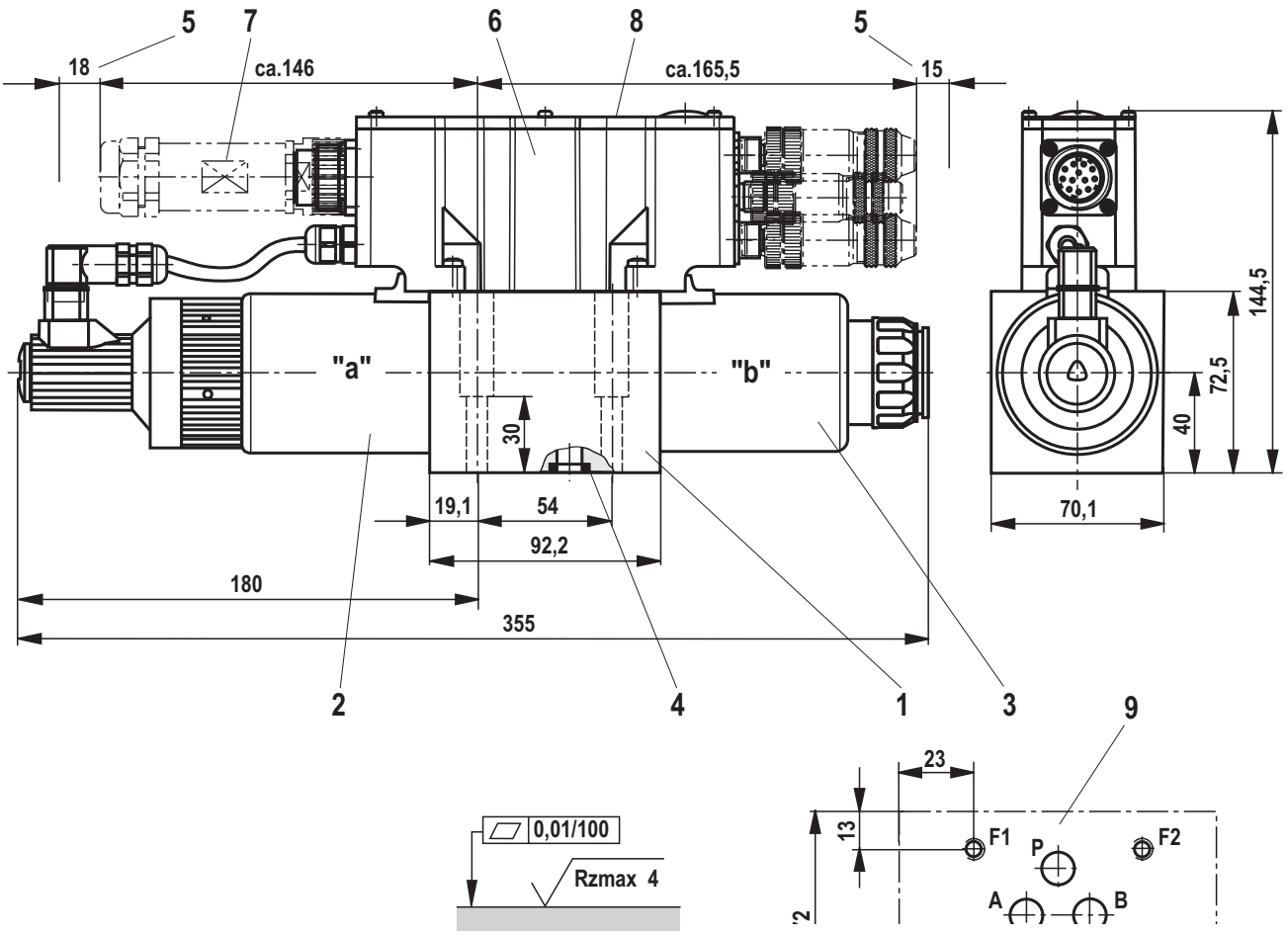


1 Valve housing
2 Proportional solenoid "a" with inductive position transducer
3 Proportional solenoid "b"
4 R-ring 9.81 x 1.5 x 1.78 for ports P, T, A and B
5 Space required to remove the mating connectors
6 Integrated digital control electronics
7 Mating connector according to DIN EN 175201-804; separate order, see page 20
8 Name plate
9 Machined valve contact surface,
porting pattern according to ISO 4401-03-02-0-05
Deviating from the standard:
Ports P, A, B, T Ø8 mm
Bore G may not be required since there is no pin in the valve.

Notice!
The dimensions are nominal dimensions which are subject to tolerances.

Valve mounting screws and **subplates** see page 19.

Dimensions size 10:
(dimensions in mm)



Required surface quality of
the valve connection surface

1 Valve housing
2 Proportional solenoid "a" with inductive position transducer
3 Proportional solenoid "b"
4 R-ring 13.0 x1.6 x 2.0 for ports P, T, T1, A and B
5 Space required to remove the mating connectors
6 Integrated digital control electronics
7 Mating connector according to DIN EN 175201-804; separate order, see page 20
8 Name plate
9 Machined valve contact surface, porting pattern according to ISO 4401-05-04-0-05

Notice!
The dimensions are nominal dimensions which are subject to tolerances.

Valve mounting screws and **subplates** see page 19.

Dimensions

Hexagon socket head cap screws		**Material number**
Size 6	4x ISO 4762 - M5 x 50 - 10.9-flZn-240h-L Tightening torque M_A = 7 Nm ±10 % or 4x ISO 4762 - M5 x 50 - 10.9 Tightening torque M_A = 8.9 Nm ±10 %	R913000064
Size 10	4x ISO 4762 - M6 x 40 - 10.9-flZn-240h-L Tightening torque M_A = 12.5 Nm ±10 % or 4x ISO 4762 - M6x 40 - 10.9 Tightening torque M_A = 15.5 Nm ±10 %	R913000058

Notice: The tightening torque of the hexagon socket head cap screws refers to the maximum operating pressure!

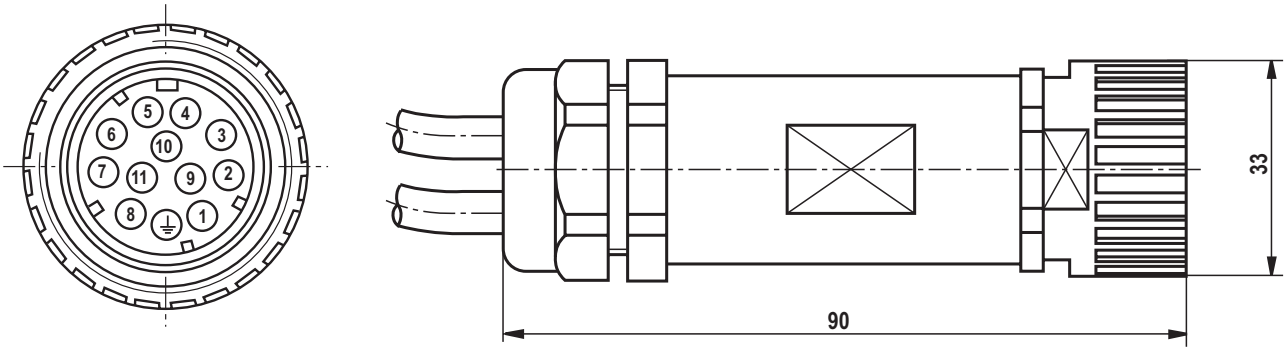
Subplates	**Data sheet**	**Material number**
Size 6	45052	
Size 10	45054	

Accessories (not included in the scope of delivery)

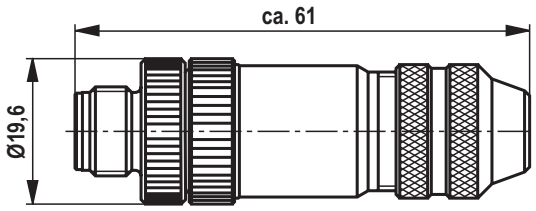
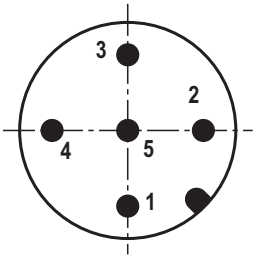
	The following is required for the parameterization with PC:	**CANopen**	**Profibus DP**
1	Interface converter (USB)	VT-ZKO-USB/CA-1-1X/V0/0 Mat. no. R901071963	VT-ZKO-USB/P-1-1X/V0/0 Mat. no. R901071962
2	Commissioning software	WIN-PED 6 Download from www.boschrexroth.de/IAC	
3	Connection cable, 3 m	D-Sub / M12, coding A Mat. no. R900751271	D-Sub / M12, coding B Mat. no. R901078053

Accessories, port X1 (not included in the scope of delivery)

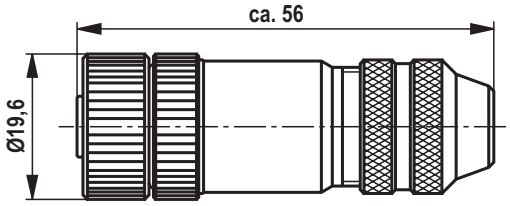
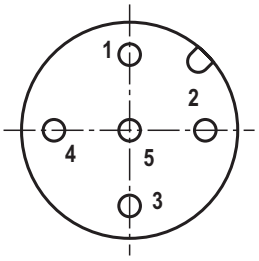
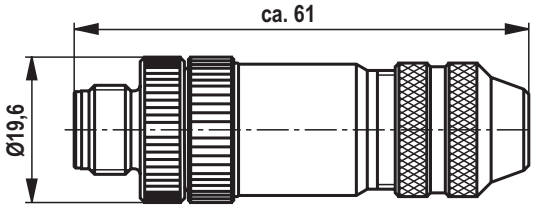
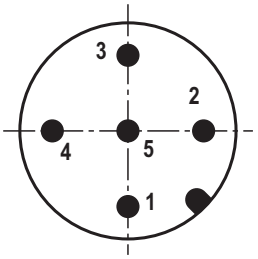
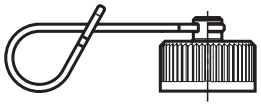
Mating connector for X1	**Version**	**Material number**
Mating connector according to DIN EN 175201-804 (12-pole)	Mating connector without cable (assembly kit)	R900884671
	Mating connector with cable set 2 x 5 m 12-pole	R900032356
	Mating connector with cable set 2 x 20 m 12-pole	R900860399



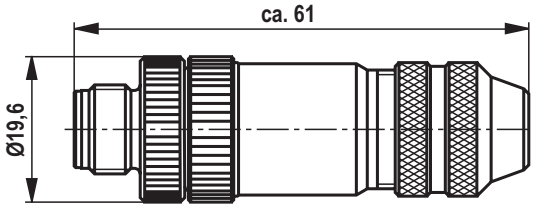
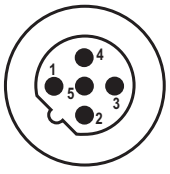
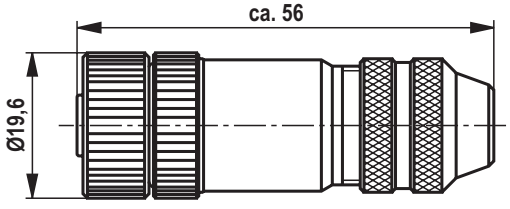
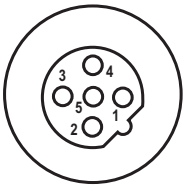
Accessories, sensor connection (not included in the scope of delivery)

Description	**View, dimensions**	**Pole pattern, order details**
X4 (analog sensor) Round connector, 5-pole, M12, can be assembled, A coding, straight line connector in metal design		 Mat. no. R901075542 (cable diameter 4 to 6 mm)

Accessories, CAN bus (A coding) (not included in the scope of delivery)

Description	View, dimensions	Pole pattern, order details
X2 Round connector, 5-pole, M12, can be assembled Straight mating connector in metal design		 Mat. no. R901076910 (cable diameter 6 to 8 mm)
X3 Round connector, 5-pole, M12, can be assembled Straight line connector in metal design		 Mat. no. R901076906 (cable diameter 6 to 8 mm)
M12 cap Dust protection (only for pins)		Mat. no. R901075564

Accessories, Profibus (B coding) (not included in the scope of delivery)

Description	View, dimensions	Pole pattern, order details
X2 Round connector, 5-pole, M12, can be assembled Straight line connector in metal design		 Mat. no. R901075545 (cable diameter 6 to 8 mm)
X3 Round connector, 5-pole, M12, can be assembled Straight mating connector in metal design		 Mat. no. R901075550 (cable diameter 6 to 8 mm)
M12 protective cap (only for socket)		Mat. no. R901075563

Project planning / maintenance instructions / additional information

Product documentation for IAC-P

- Data sheet 29018 (this data sheet)
- Operating manual 29015-B
- CAN bus protocol description data sheet 29015-01-Z
- Profibus protocol description data sheet 29015-02-Z
- General information on the maintenance and commissioning of hydraulic components 07800/07900
- General operating instructions: Hydraulic valves for industrial applications 07600-B

Commissioning software and documentation on the Internet: www.boschrexroth.com/IAC

Maintenance instructions:

- The devices have been tested in the plant and are supplied with default settings.
- Only complete units can be repaired. Repaired devices are returned with default settings. User-specific settings are not accepted. The machine end-user will have to retransfer the corresponding user parameters.

Notices:

- Connect the valve to the supply voltage only when this is required for the functional processes of the machine.
- Do not use electrical signals led out of control electronics (e.g. "No error" signal) for switching safety-relevant machine functions (See also EN ISO 13849 "Safety of machinery – Safety-related parts of control systems").
- If electro-magnetic interference is to be anticipated, suitable measures must be taken to ensure the function (depending on the application, e.g. shielding, filtration)!
- For more information refer to the operating instructions and the WIN-PED online help.

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