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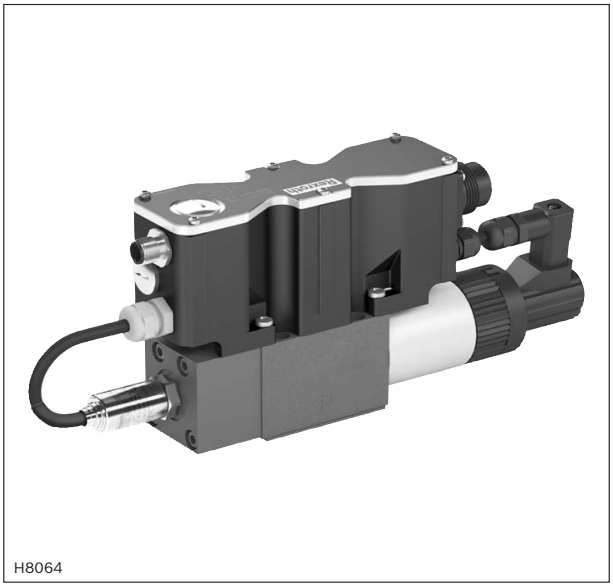
The Drive & Control Company

Rexroth
Bosch Group

Proportional directional valve, direct operated, with *pQ* functionality

Type STW 0195 and STW 0196

RE 29014
Edition: 2015-05
Replaces: 2013-03



- Sizes: 6 and 10
- Component series 1X, 2X

Features

- 3-way proportional directional valve with integrated IAC-P digital control electronics
- Completely adjusted unit consisting of position-controlled valve, pressure sensor and field bus connection
- Operation via a proportional solenoid with central thread and detachable coil
- Valve spool, position-controlled
- Integrated pressure sensor plate (optional)
- ISO 4401 porting pattern
- Analog interfaces for command and actual values
- Design for CAN bus with DS 408 CANopen protocol or DP Profibus
- Quick commissioning via PC and WINPED commissioning software

Contents

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Ordering codes

01	02		03		04	05	06		07	08	09		10
STW		**–**		**/**		**V**		**–**	**24**			**–**	*****

01	3-way proportional directional valve with integrated IAC-P digital control electronics	**STW**
02	Size 6	**0195**
	Size 10	**0196**
03	Component series 10 ... 19 (10 ... 19: unchanged installation and connection dimensions) - size 10	**1X**
	Component series 20 ... 29 (20 ... 29: unchanged installation and connection dimensions) - size 6	**2X**

Rated flow

04	**– Size 6** (model “0195”)	
	P → A: 10 l/min, A → T: 20 l/min	**1**
	P → A: 20 l/min, A → T: 20 l/min	**2**
	– Size 10 (model “0196”)	
	P → A: 65 l/min, A → T: 60 l/min, B → T: 60 l/min	**1**

Seal material

05	FKM seals	**V**
	Observe compatibility of seals with hydraulic fluid used! (Other seals upon request)	

Pressure rating of the integrated pressure sensor

06	Nominal pressure: 50 bar	**3**
	Nominal pressure: 160 bar	**5**
	Nominal pressure: 250 bar	**8**

Supply voltage

07	Direct voltage 24 V	**24**

Bus interface

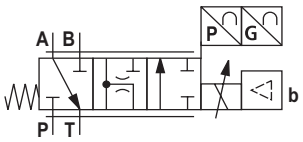
08	CANBus DS - 408	**C**
	Profibus DP V0/V1	**P**

Interface

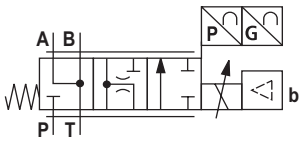
09	± 10 VDC	**A6**
	4 ... 20 mA	**F6**
10	Further details in the plain text	*****

Symbols

Version “0195”



Version “0196”



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Set-up, function, section

Set-up

- The IAC-P valve basically consists of:
- Housing (1) with connection surface
- Control spool (2) with compression spring (3)
- Solenoid and pole tube (4) with central thread
- Position transducer (5)
- Pressure sensor (6)
- Integrated IAC-P digital control electronics (7) with bus connection (X2) and central connector (X1).

Functional description

- If solenoids (4) are not operated, spool position A → T (with type STW 0196-1X/1 additionally B → T)
- Functions:
  - Flow control (***Q***)
  - Pressure control (***p***)
  - Override control ***p/Q***
- The command value can be defined either 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 may be read additionally via the field bus (X2, X3).
- The controller parameters are set via the field bus (X2, X3).
- Separate supply voltage for bus/controller and power part (output stage) for safety reasons

The digital integrated control electronics enables the following fault detection (diagnostics):

- Cable break of pressure sensor supply line (6)
- Undervoltage
- Cable break position transducer (5)
- Communication error
- Watchdog
- Cable break of command value inputs

The following additional functions are available:

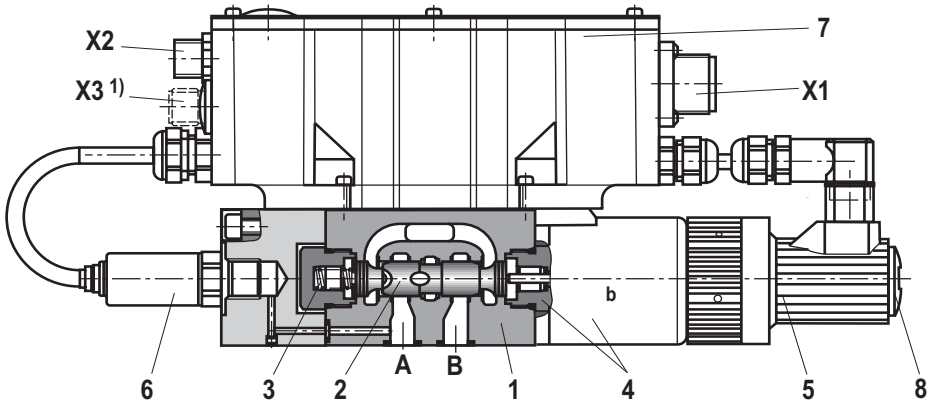
- Pressure ramp
- Internal command value profile
- Release function analog/digital
- Error output 24 V.

WINPED PC program

To implement the project planning task and to parameterize the IAC-P valves, the user may use the WINPED commissioning software (see accessories).

- Parameterization
- Diagnostics
- Comfortable data administration on a PC
- PC operating systems: Windows 2000 or Windows XP

$Q_{command}$	***Q*** control	***p*** closed-loop control
< 12 mA	A → T	inactive
> 12 mA	Override closed-loop control: (A → T or P → A) ***Q*** control ($Q_{command}$) with pressure limitation ($p_{command}$) if pressure limitation is active, the following applies: $Q_{actual} \leq Q_{command}$	



Type STW0195-2X/...

1) Only available with Profibus

Notice:
Due to the design principle, internal leakage is inherent to the valves, which may increase over the life cycle.
The tank line must not be allowed to run empty. If required by the installation conditions, use a suitable preload valve.

Notice:
The PG fitting (8) must not be opened. Mechanical adjustment of the adjustment nut located below is prohibited and damages the valve!

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Technical data

(For applications outside these parameters please consult us!)

General					
Size			S	6 (“0195”)	10 (“0196”)
Weight			kg	2.4	6.5
Installation position				any, preferably horizontal	
Ambient temperature range			°C	-20 ... +50	
Storage temperature range			°C	-20 ... +80	

Hydraulic [1]					
Operating pressure [2]	▶ Ports P, A, B (with sensor)	“3”	bar	50	
		“5”	bar	160	
		“8”	bar	250	
	▶ Port T (with sensor)	“3”	bar	50	
		“5”	bar	160	
		“8”	bar	210	
Rated flow $q_{V\ nom}$ (with Δp = 5 bar; see also characteristic curves starting on page 7)	▶ P → A	“1”	l/min	10	65
		“2”	l/min	20	–
	▶ A → T	“1”	l/min	20	–
		“2”	l/min	20	–
	▶ A → T, B → T	“1”	l/min	–	60
Max. flow			l/min	See performance limit starting on page 9	
Hydraulic fluid				See table below	
Hydraulic fluid temperature range (at the valve operating ports)			°C	-20 ... +80; preferably +40 ... +50	
Viscosity range			mm²/s	20 ... 380; preferably 30 ... 46	
Maximum admissible degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c)				Class 20/18/15 [3]	
Hysteresis			%	≤ 0.1	
Range of inversion			%	≤ 0.05	
Response sensitivity			%	≤ 0.05	
Zero shift			%10 K	≤ 0.15	
			%100 bar	≤ 0.1	

Hydraulic fluid		**Classification**	**Suitable sealing materials**	**Standards**	**Data sheet**
Mineral oils		HL, HLP, HLPD, HVLP, HVLPD	NBR, FKM	DIN 51524	90220
Bio-degradable	▶ Insoluble in water	HETG	NBR, FKM	ISO 15380	90221
		HEES	FKM		
	▶ Soluble in water	HEPG	FKM	ISO 15380	
Flame-resistant	▶ Water-free	HFDU, HFDR	FKM	ISO 12922	90222
	▶ Containing water	HFC (Fuchs Hydrotherm 46M, Petrofer Ultra Safe 620)	NBR	ISO 12922	90223

☞ **Important information on hydraulic fluids:**

- For more information and data about the use of other hydraulic fluids, refer to data sheets above 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.
- **Flame-resistant – containing water**:
  - Maximum pressure differential per control edge 50 bar
  - Pressure pre-loading at the tank port > 20% of the pressure differential, otherwise increased cavitation
  - Life cycle as compared to operation with mineral oil HL, HLP 50 to 100%
- **Bio-degradable and flame-resistant:** When using these hydraulic fluids that are simultaneously zinc-solving, zinc may accumulate (700 mg zinc per pole tube).

[1] Measured using HLP 46; ϑ_{Oil} = 40 °C ± 5 °C and p = 100 bar

[2] Operating pressure, dependent on valve and sensor

[3] 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.

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electrical			
Supply voltage	▶ Nominal voltage	VDC	24
	▶ Lower limit value	VDC	19.4
	▶ Upper limit value	VDC	35
Maximum admissible residual ripple		Vpp	2
Current consumption	▶ I_{max}	A	2
	▶ Impulse current	A	3
Command value signals		mA	4 ... 20 (or via CAN bus)
Duty cycle [1]		%	100
Maximum coil temperature [2]		°C	150
Protection class according to DIN EN 60529			IP 65 with mating connector correctly mounted and locked

Sensor technology					
Measurement range	▶ p_N	bar	50	160	250
Overload protection	▶ p_{max}	bar	110	320	500
Bursting pressure	▶ p	bar	200	640	1000
Temperature coefficient for zero point and range within the nominal temperature range [3]			< 0.1% / 10 K		
Characteristic curve deviation			< 0.2%		
Hysteresis			< 0.1%		
Repetition accuracy			< 0.05%		
Setting time (10 ... 90%)		t	< 1 ms		
Long-term drift (1 year) under reference conditions			< 0.1%		
Conformity			CE according EMC directive EN 61000-6-2 / EN 61326-2-3 and EN 61000-6-3 / EN 61326-2-3		

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

2) Due to the surface temperatures of the solenoid coils, the standards ISO 13732-1 and ISO 4413 need to be adhered to!

3) related to the complete measurement range, including non-linearity, hysteresis, zero point and end value deviation (corresponds to the measuring deviation according to IEC 61298-2)

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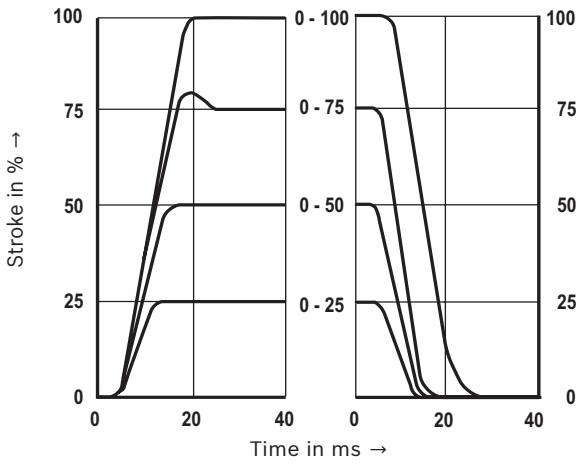
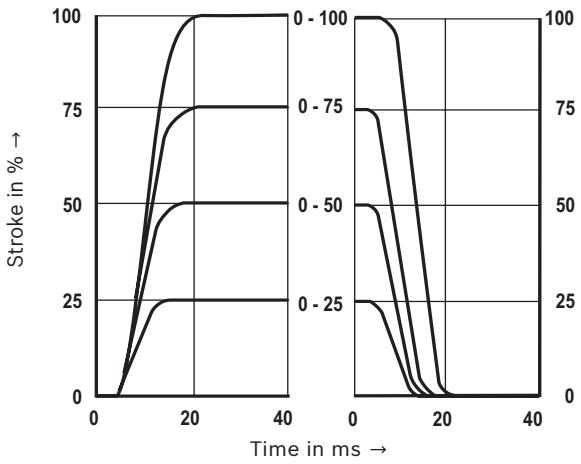
Characteristic curves: Size 6 (“0195...1”)
(measured with HLP46, ϑ_{Oil} = 40 ± 5 °C)

Transition function (A → T)

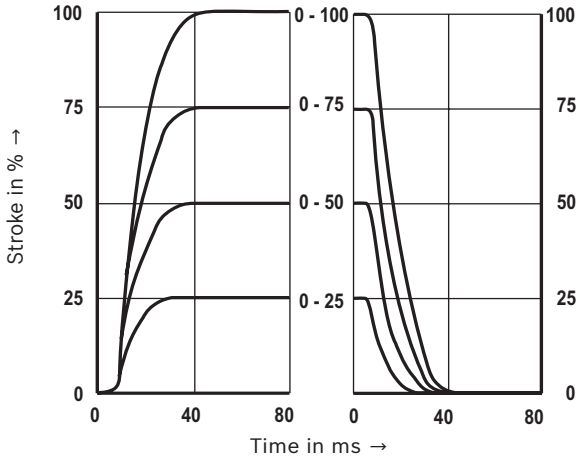


Transition function (P → A)

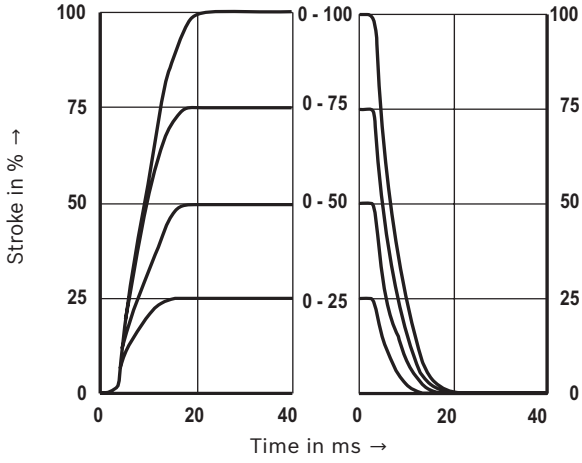


Characteristic curves: Size 10 (“0196...1”)
(measured with HLP46, ϑ_{Oil} = 40 ± 5 °C)

Transition function (A → T and B → T)



Transition function (P → A)



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Characteristic curves

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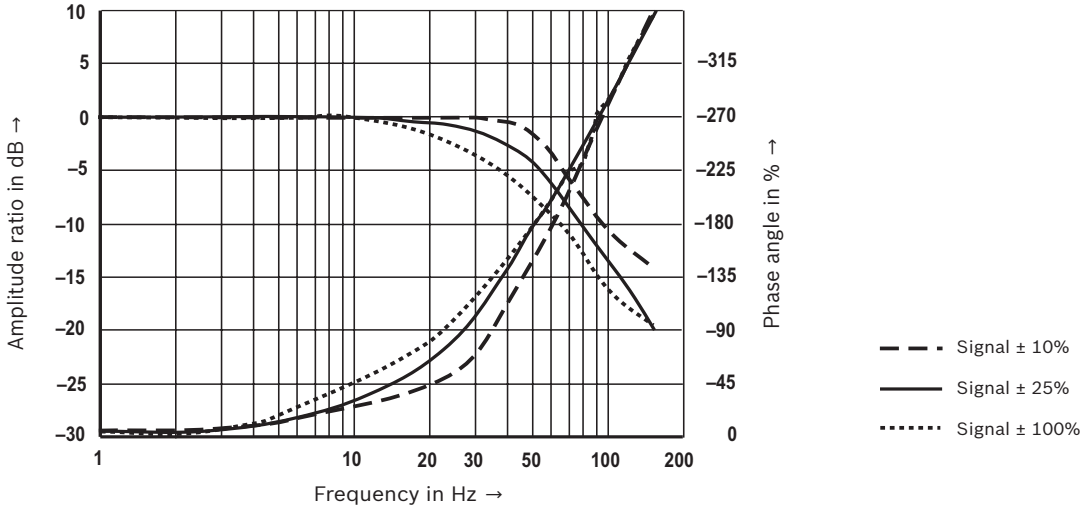
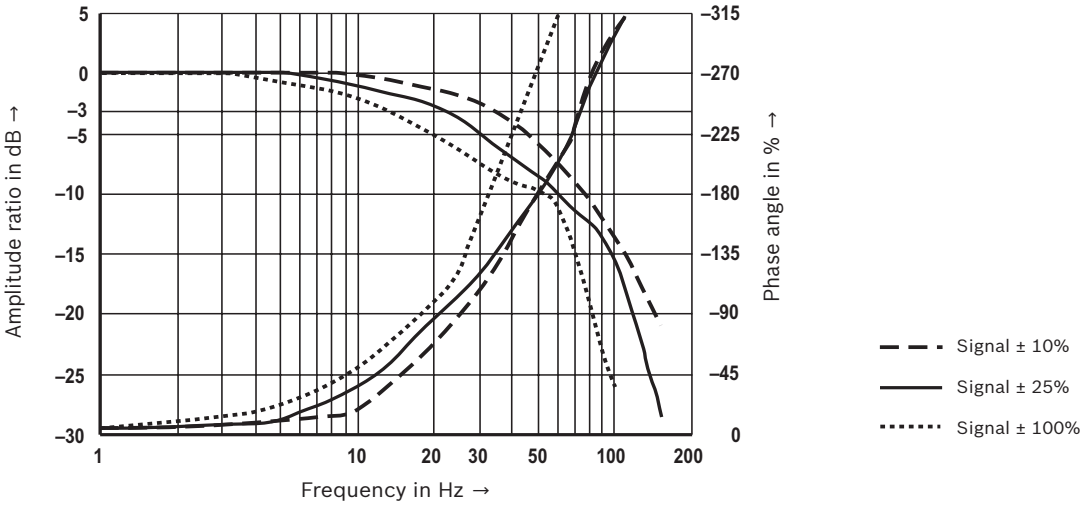
Frequency response, Size 6 (“0195...1”)



Frequency response, Size 10 (“0196...1”)



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Characteristic curves: Size 6 (“0195...”)
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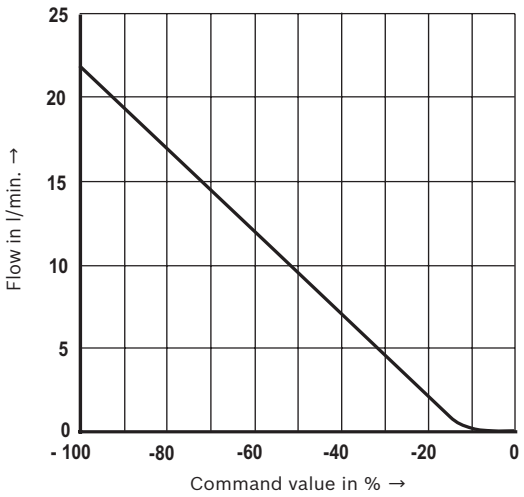
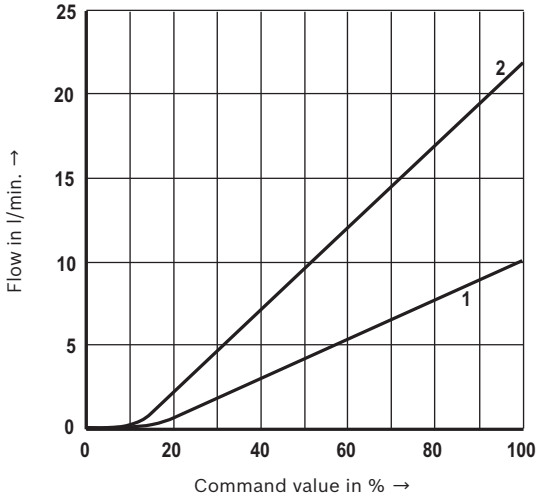
Flow characteristic curve (A → T, ***Δp*** = 5 bar)



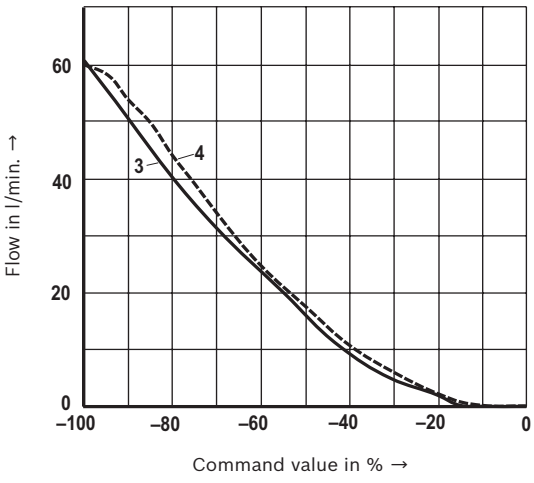
Flow characteristic curve (P → A, ***Δp*** = 5 bar)



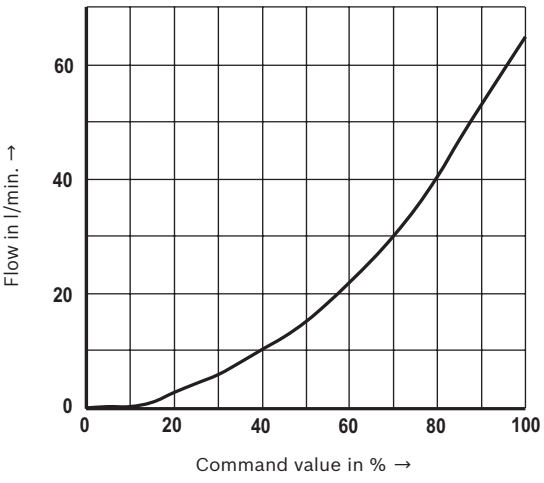
1 Version “0195...1”)
2 Version “0195...2”)

Characteristic curves: Size 10 (“0196”)
(measured with HLP46, ϑ_{Oil} = 40 ± 5 °C)

Flow characteristic curve (A/B → T, ***Δp*** = 5 bar)



Flow characteristic curve (P → A, ***Δp*** = 5 bar)



3 A → T
4 B → T

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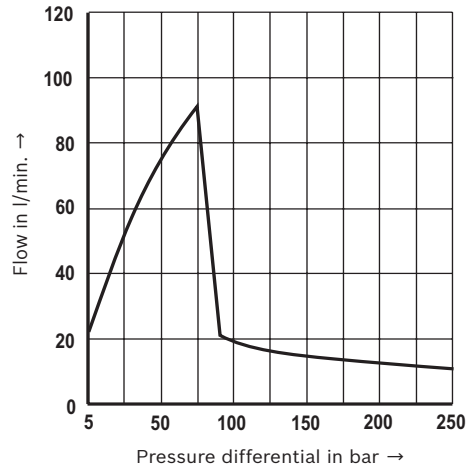
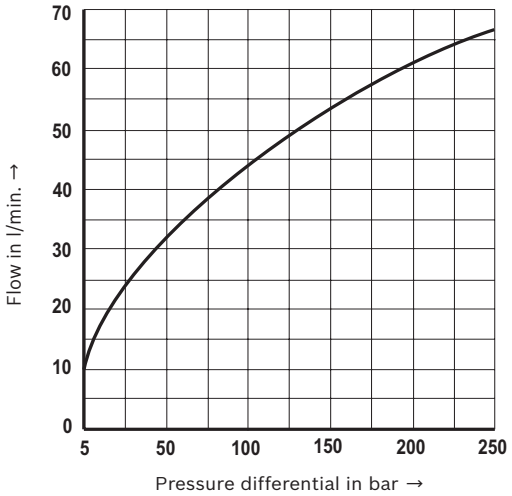
Performance limits: Size 6 (“0195...”)
(measured with HLP46, ϑ_{Oil} = 40 ± 5 °C)

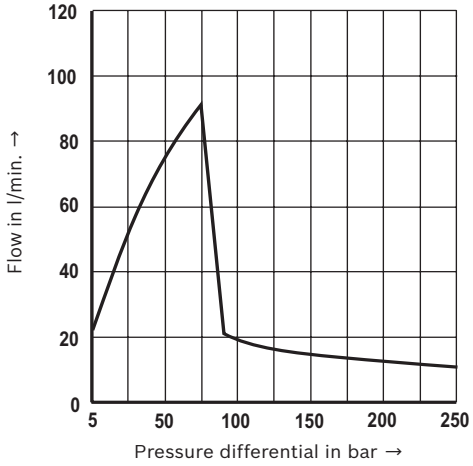
Position-controlled
(P → A: 10 l/min, A → T: 20 l/min – **A** → **T**)



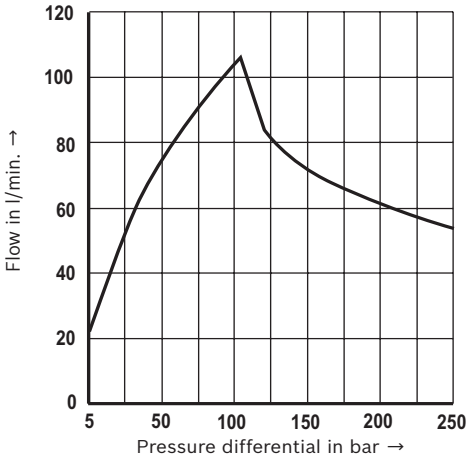
Position-controlled
(P → A: 10 l/min, A → T: 20 l/min – **P** → **A**)



Position-controlled
(P → A: 20 l/min, A → T: 20 l/min – **A** → **T**)



Position-controlled
(P → A: 20 l/min, A → T: 20 l/min – **P** → **A**)



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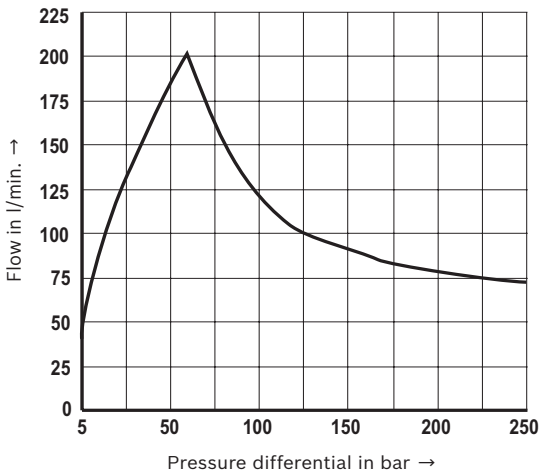
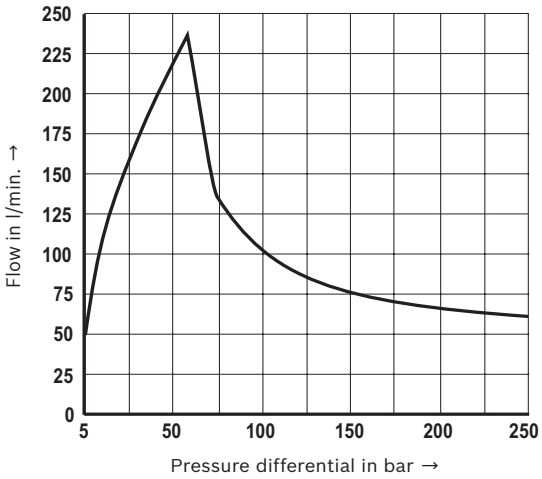
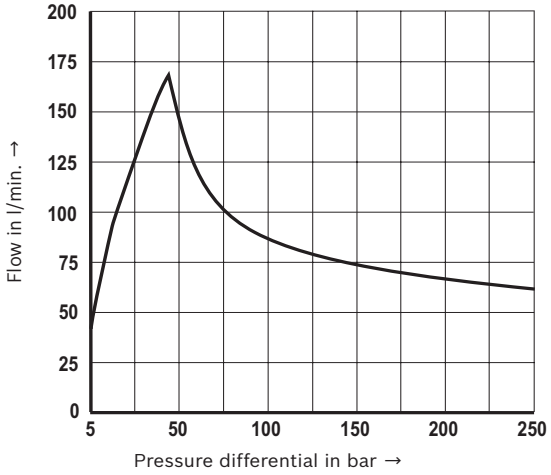
Position-controlled (A → T)



Position-controlled (P → A)



Position-controlled (B → T)



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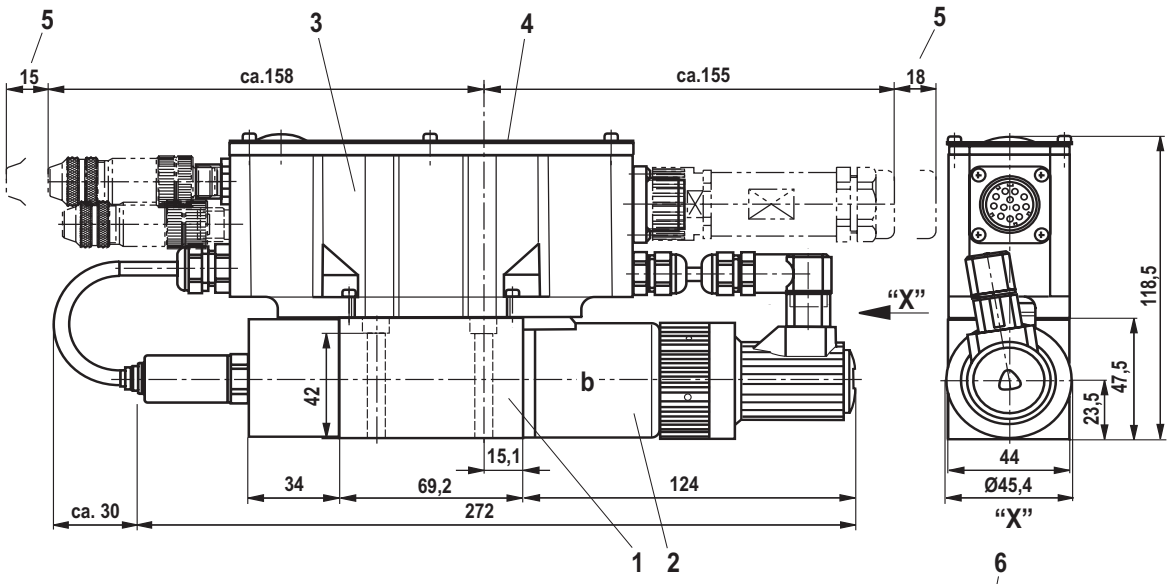
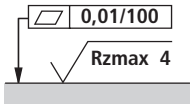
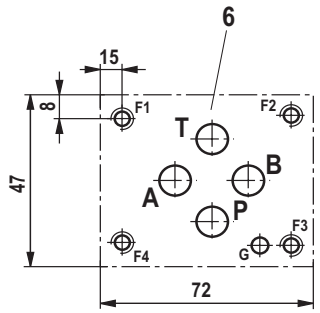
Dimensions: Size 6 (“0195”)
(dimensions in mm)





Required surface quality
of the valve contact surface



1 Valve housing
2 Proportional solenoid “b” with inductive position transducer
3 Integrated digital control electronics
4 Name plate
5 Space required to remove the connector
6 Machined valve contact surface
porting pattern according to ISO 4401-03-02-0-05
Deviating from the standard:
▶ Ports P, A, B and T with Ø 8 mm
▶ Locating pin not available

Note:
The dimensions are nominal dimensions which are subject to tolerances.

Subplates and valve mounting screws see page 13.

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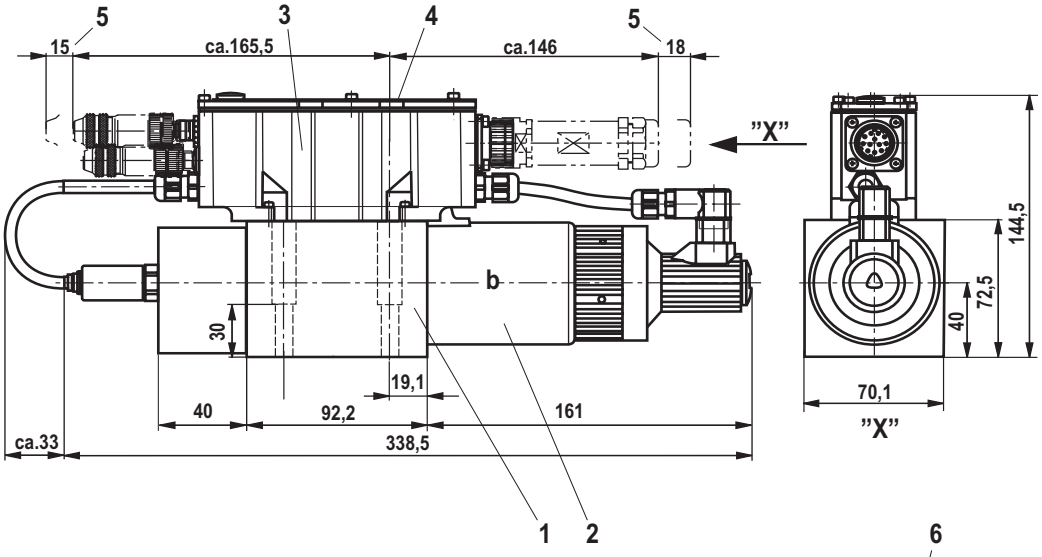
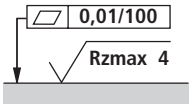
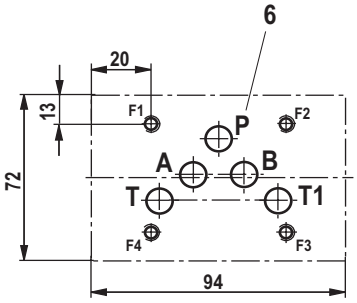
Dimensions: Size 10 (“0196”)
(dimensions in mm)





Required surface quality of the valve contact surface



1 Valve housing
2 Proportional solenoid “b” with inductive position transducer
3 Integrated digital control electronics
4 Name plate
5 Space required to remove the connector
6 Machined valve contact surface
Porting pattern in accordance with ISO 4401-05-04-0-05
Deviating from the standard:
Port T1 exists additionally

Note:
The dimensions are nominal dimensions which are subject to tolerances.

Subplates and valve mounting screws see page 13.

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Dimensions

Valve mounting screws (separate order)

Size	Hexagon socket head cap screws	Material number
6 (“0195”)	**4 hexagon socket head cap screws ISO 4762 - M5 x 50 - 10.9-flZn-240h-L** tightening torque M_A = 7 Nm ± 10%	**R913000064**
	4 hexagon socket head cap screws ISO 4762 - M5 x 50 Tightening torque M_A = 8.9 Nm ± 10%	Not in the Rexroth delivery range
10 (“0196”)	**4 hexagon socket head cap screws ISO 4762 - M6 x 40 - 10.9-flZn-240h-L** tightening torque M_A = 12.5 Nm ± 10%	**R913000058**
	4 hexagon socket head cap screws ISO 4762 - M6 x 40 - 10.9 tightening torque M_A = 15.5 Nm ± 10%	Not in the Rexroth delivery range

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

Subplates (separate order)

Size	Data sheet	Material number
6 (“0195”)	45052	–
10 (“0196”)	45054	–

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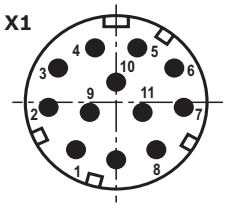
Electrical connections, assignment

Connector pin assignment X1, 11-pole + PE according to DIN EN 175201-804

Pin	Core marking [1]	Interface A6 allocation	Allocation Interface F6
1	1	24 VDC (u(t) = 19.4 V ... 35 V), 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 ... 35 V ≙ enable on	
4	yellow	± 10 V command value ***Q***, R_e > 50 kΩ	4 ... 20 mA command value ***Q***, R_e = 100 Ω
5	green	Reference for command values ***Q*** and ***p***	
6	purple	± 10 V actual value ***Q***	4 ... 20 mA actual value ***Q*** (load resistance max. 300 Ω)
7	pink	0 ... 10 V command value ***p***, R_e > 50 kΩ	4 ... 20 mA command value ***p***, R_e = 100 kΩ
8	red	0 ... 10 V actual value ***p***	4 ... 20 mA actual value ***p*** (load resistance max. 300 Ω)
9	brown	Control voltage, level as pin 1, I_{max} = 0.3 A (for signal part and bus)	
10	black	0 V reference potential for pins 3, 6, 8 and 11 (connected with pin 2 in valve)	
11	blue	Error output 24 V (19.4 V ... 35 V), 200 mA max. load	
PE	green-yellow	Connected to cooling element and valve housing	

Notice:
Connect shield to PE only on the supply side.

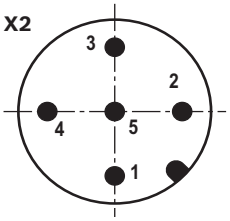
[1] Litz wire colors of the connection line for mating connector with cable set (see accessories page 17)



Connector pin assignment X2, CAN bus, (coding A), M12 x 1, 5-pole, pins

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

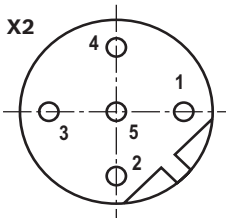
Transmission rate 20 ... 1000 kBit/s
Bus address 1 ... 127
CAN-specific settings:
Baud rate and identifier must be set via the bus system.



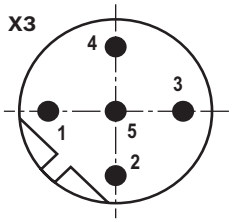
Connector pin assignment for Profibus DP, “X2” / “X3” (coding B), M12 x 1, 5-pole, socket / pins

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

Transmission rate up to 12 MBaud
Bus address 1 ... 126
Setting via DIL switch



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



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

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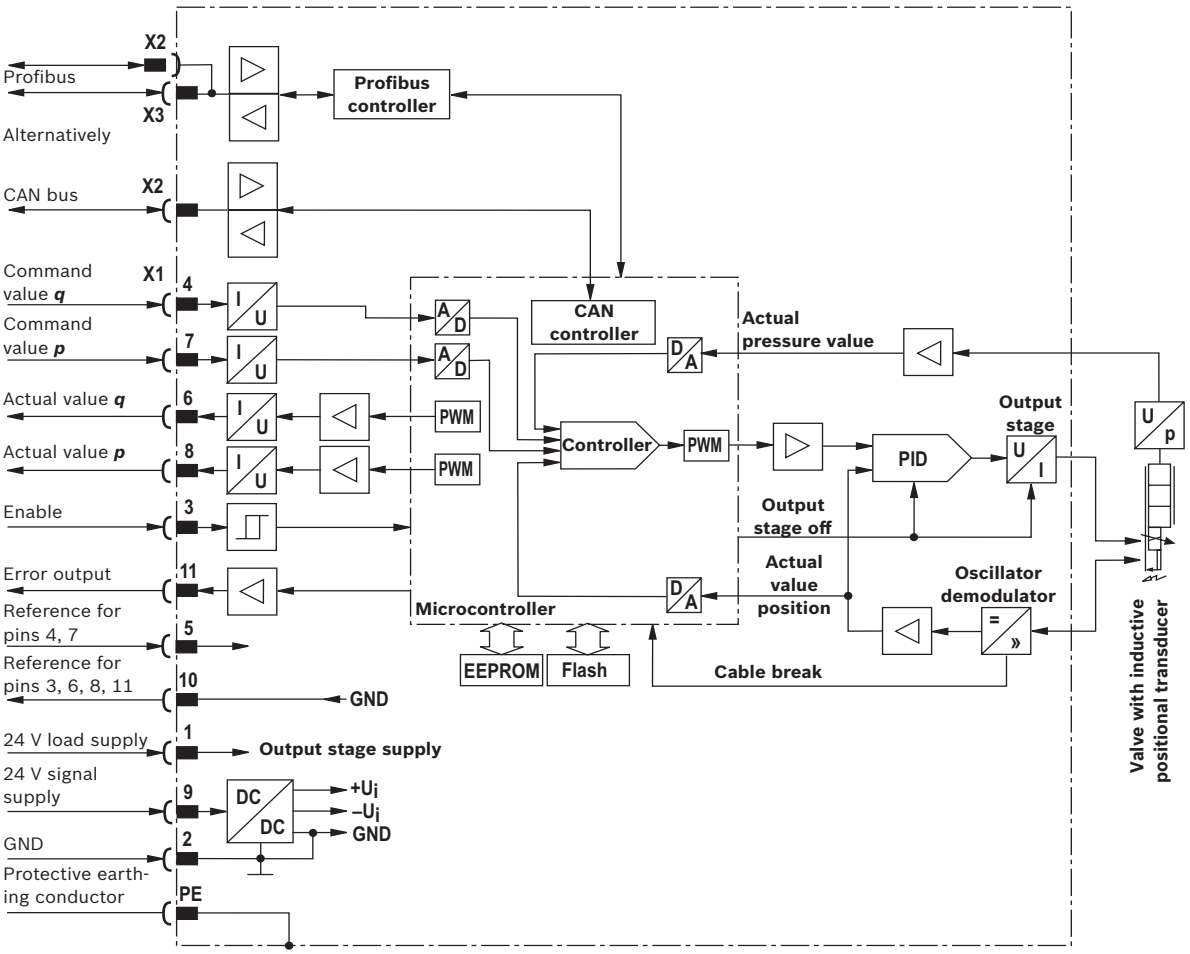
Electrical connections, assignment

Block diagram, integrated control electronics



Command value	Command value 12 to 20 mA at pin 4 and reference potential at pin 5 result in flow from P → A.
	Command value 4 to 12 mA at pin 4 and reference potential at pin 5 result in flow from A → T.
Actual value	Actual value 12 to 20 mA at pin 6 and reference potential at pin 10 result in flow from P → A.
	Actual value 4 to 12 mA at pin 6 and reference potential at pin 10 result in flow from A → T.
Connection line (recommended)**:**	▶ up to 25 m line length for pins 1, 2 and PE: 0.75 mm^2, otherwise 0.25 mm^2 ▶ up to 50 m line length for pins 1, 2 and PE: 1.00 mm^2 External diameter see sketch of mating connector

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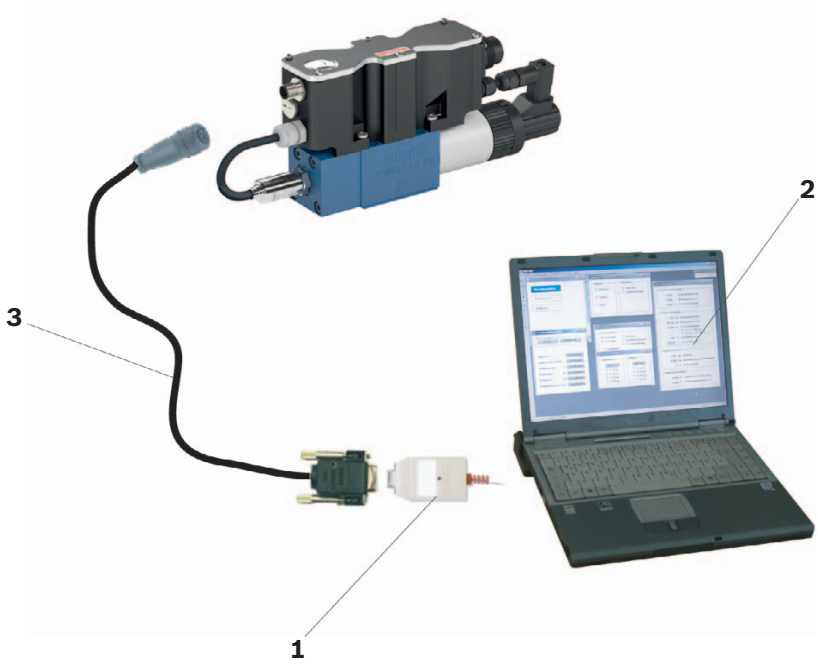
Accessories (separate order)

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



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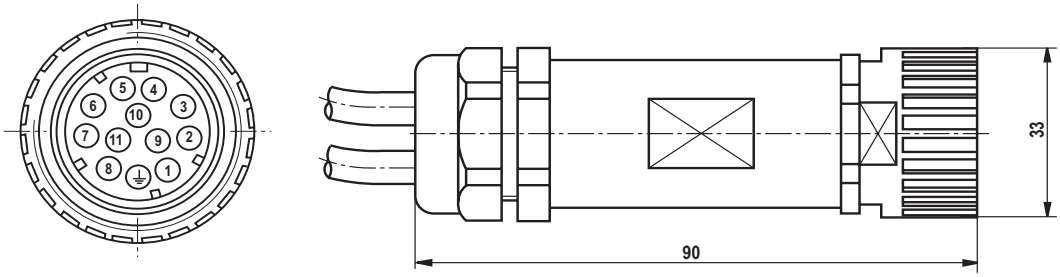
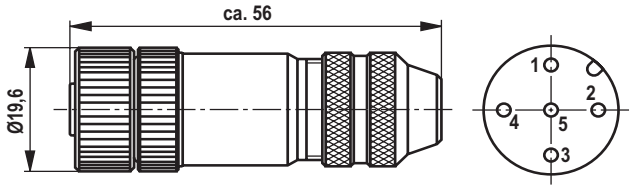
Accessories (separate order)

Port X1

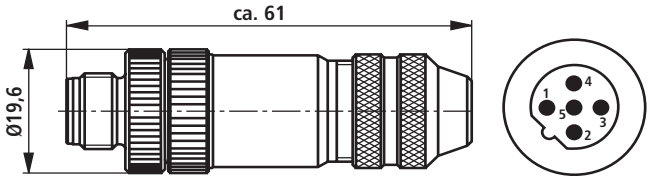
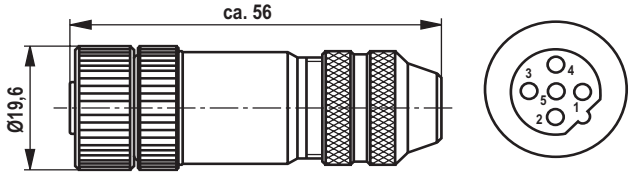
Mating connector for X1	Dimensions	Material number
Mating connector according to DIN EN 17520-804 (11-pole + PE), plastic variant	Without cable (assembly kit)	**R900884671**
	With cable set 2 x 5 m 12-pole	**R900032356**
	With cable set 2 x 20 m 12-pole	**R900860399**



CAN bus (A coding)

Plug-in connector for X2	View, dimensions	Material number
Round connector, processable, 5-pole, M12 x 1 Straight mating connector in metal design	 (line diameter 6 ... 8 mm)	**R901076910**

Profibus (B coding)

Plug-in connector for X2 and X3	View, dimensions	Material number
X2 Round connector, processable, 5-pole, M12 x 1 Straight mating connector in metal design	 (line diameter 6 ... 8 mm)	**R901075545**
X3 Round connector, processable, 5-pole, M12 x 1 Straight mating connector in metal design	 (line diameter 6 ... 8 mm)	**R901075550**

Protective cap

Protective cap M12	Version	Material number
		**R901075563**

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Project planning and maintenance instructions

- Connect the valve to the supply voltage only when this is required for the functional processes of the machine.
- Do not use electrical signals provided via 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 must be expected, take appropriate measures to ensure the function (depending on the application, e.g. shielding, filtration).
- 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 maintained. The machine end-user will have to retransfer the corresponding user parameters.

Further information

▶ Subplates	Data sheets 45052, 45054
▶ Hydraulic fluids on mineral oil basis	Data sheet 90220
▶ Environmentally compatible hydraulic fluids	Data sheet 90221
▶ Flame-resistant, water-free hydraulic fluids	Data sheet 90222
▶ Hydraulic valves for industrial applications	Data sheet 07600-B
▶ Assembly, commissioning and maintenance of hydraulic systems	Data sheet 07900
▶ CANopen protocol for IFB-P and IAC-P valves, protocol description	Data sheet 29015-01-Z Data sheet 29015-02-Z Data sheet 29015-B
▶ Profibus protocol for IFB and IAC-P valves, protocol description	
▶ Proportional directional valves with field bus interface, with and without integrated axis controller (IAC-P and IFB-P), operating instructions	
▶ Commissioning software and documentation on the Internet	
▶ Selection of the filters	

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