

# Directional control valve, direct operated, with integrated digital axis controller (IAC Multi Ethernet)

## Type 4WRPDH

**RE 29391**

Edition: 2016-02

Replaces: 2015-07



- ▶ Sizes 6 and 10
- ▶ Component series 2X
- ▶ Maximum operating pressure 350 bar
- ▶ Maximum flow 100 l/min ( $\Delta p = 70$  bar)



### Features

- ▶ Open
  - Integrated digital axis control functionality (IAC Multi Ethernet)
  - Bus connection/service interface (sercos, EtherCAT, EtherNet/IP, PROFINET RT, POWERLINK, VARAN)
- ▶ Scalable
  - 2 configurable analog sensor inputs
  - 1 input for linear position measurement system (SSI, 1Vpp or EnDat 2.2)
- ▶ Safe
  - Internal safety function (can be used up to category 4/PL e according to EN 13849-1)
  - CE conformity according to EMC Directive 2004/108/EC
- ▶ Precise
  - Best-in-class hydraulic controller
  - High response sensitivity and little hysteresis

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## Ordering codes

01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	
<b>4</b>	<b>WRP</b>	<b>D</b>	<b>H</b>			<b>B</b>			<b>-</b>	<b>2X</b>	<b>/</b>		<b>/</b>	<b>24</b>	<b>D6</b>	

01	4 main ports	<b>4</b>
02	Directional control valve	<b>WRP</b>
03	With integrated digital axis controller	<b>D</b>
04	Control spool/sleeve	<b>H</b>
05	Size 6	<b>6</b>
	Size 10	<b>10</b>
06	Symbols e.g. C, C1 etc.; for possible design, see page 3	
07	Installation side of the inductive position transducer	<b>B</b>

## Rated flow at 70 bar valve pressure differential (35 bar/control edge)

08		Flow characteristic			
		<b>"L"</b>	<b>"P"</b> (inflection 40 %)	<b>"P"</b> (inflection 60 %)	
	<b>- Size 6</b>				
	2 l/min	✓	-	-	<b>02</b>
	4 l/min	✓	✓	-	<b>04</b>
	12 l/min	✓	-	-	<b>12</b>
	15 l/min	-	-	✓	<b>15</b>
	24 l/min	✓	-	-	<b>24</b>
	25 l/min	-	-	✓	<b>25</b>
	40 l/min	✓	✓	-	<b>40</b>
	<b>- Size 10</b>				
	50 l/min	✓	✓	-	<b>50</b>
	100 l/min	✓	✓	-	<b>100</b>

## Flow characteristic

09	Linear	<b>L</b>
	Inflected characteristic curve (inflection 60% for size 6 with rated flows <b>"15"</b> and <b>"25"</b> , otherwise inflection 40%)	<b>P</b>
10	Component series 20 ... 29 (20 ... 29: unchanged installation and connection dimensions)	<b>2X</b>

## Seal material

11	NBR seals	<b>M</b>
	FKM seals	<b>V</b>
	Observe compatibility of seals with hydraulic fluid used! (Other seals upon request)	
12	Supply voltage 24 V	<b>24</b>

## Ethernet interface

13	EtherNET/IP	<b>E</b>
	PROFINET RT	<b>N</b>
	Sercos	<b>S</b>
	EtherCAT (CANopen profile)	<b>T</b>
	POWERLINK (CANopen profile)	<b>W</b>
	VARAN	<b>V</b>

## Electrical interface

14	±10 VDC or 4 ... 20 mA	<b>D6</b>
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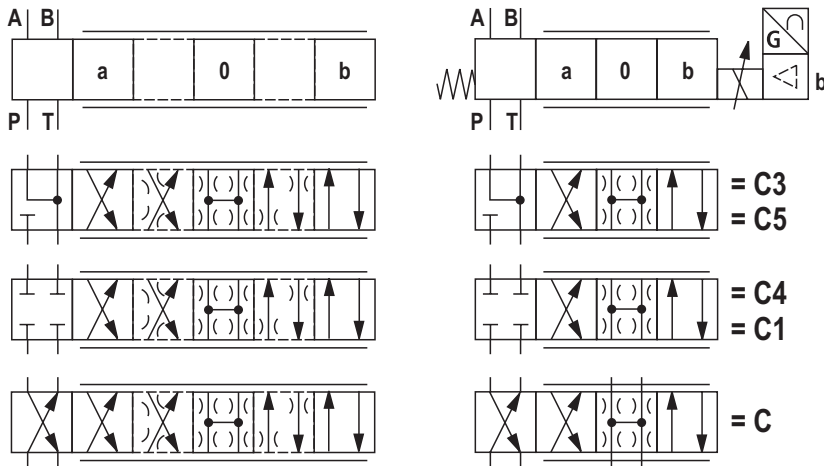
## Sensor interfaces

### Ordering codes

01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
<b>4</b>	<b>WRP</b>	<b>D</b>	<b>H</b>			<b>B</b>			<b>- 2X</b>	<b>/</b>		<b>/</b>	<b>24</b>	<b>D6</b>	

15	0 ... 10 V/4 ... 20 mA/EnDat 2.2	<b>S</b>
	0 ... 10 V/4 ... 20 mA/SSI	<b>T</b>
	0 ... 10 V/4 ... 20 mA/1Vpp	<b>U</b>
16	Further details in the plain text	<b>*</b>

### Symbols



**With symbols C5 and C1:** 1)

P → A:  $q_{V \text{ nom}}$     B → T:  $q_{V \text{ nom}}/2$

P → B:  $q_{V \text{ nom}}/2$     A → T:  $q_{V \text{ nom}}$

1) Standard = 1:1,  $q_{V \text{ nom}}$  2:1 from rated flow = 40 l/min (model "40")

**Notice:**

Representation according to DIN ISO 1219-1. Hydraulic interim positions are shown by dashes.

### Flow characteristic

Symbol	Linear characteristic curve (model "L")	Inflected characteristic curve (model "P")	
		Inflection 60 % ( $q_{V \text{ nom}} = 15, 25 \text{ l/min}$ )	Inflection 40 % ( $q_{V \text{ nom}} = 4, 40 \text{ l/min - size 6}$ ) ( $q_{V \text{ nom}} = 50, 100 \text{ l/min - size 10}$ )
C3, C5			
C4, C1			
C		-	-

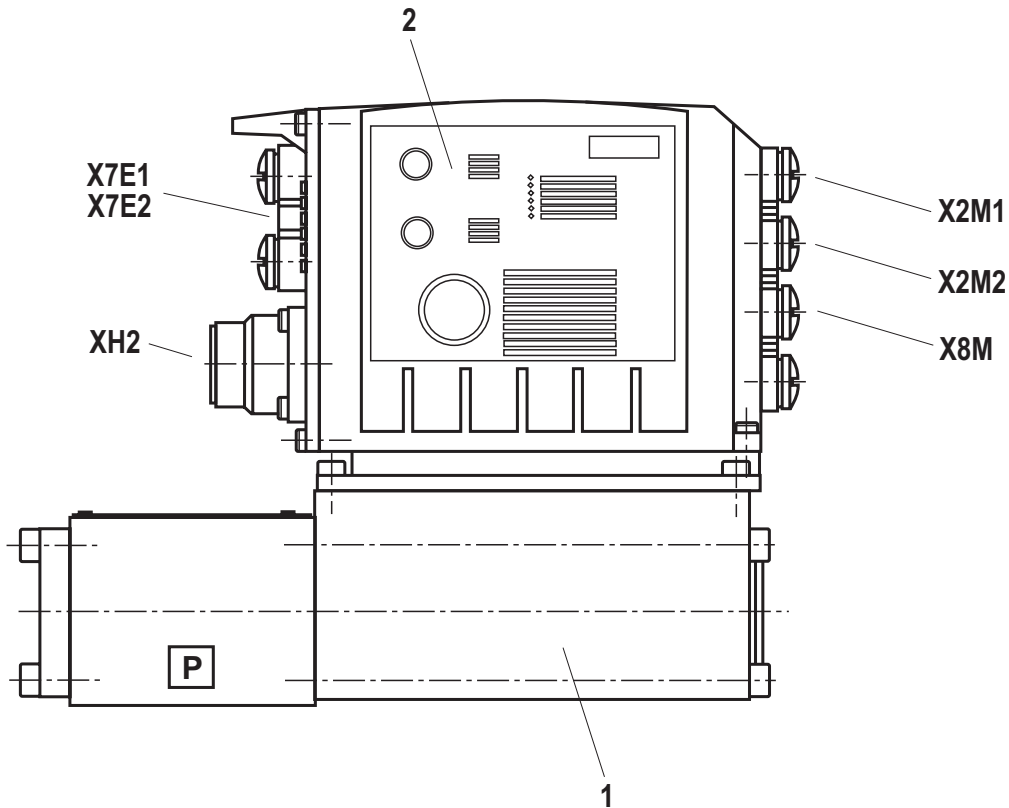
## Function, section

### Set-up

The directional control valve with IAC Multi Ethernet electronics mainly consists of:

- ▶ Direct operated directional control valve (1) with control spool and sleeve in servo quality
- ▶ Integrated digital axis controller (2) with:
  - analog/digital interface (XH2)
  - Ethernet interfaces (X7E1, X7E2)
  - analog sensor interfaces (X2M1, X2M2)
  - digital sensor interface (X8M)

**Directional control valve with integrated axis controller, analog interfaces (X2M1, X2M2), digital interfaces (XH2, X8M) and Ethernet interfaces (X7E1, X7E2)**



## Function, section

### Functional description

The **IAC Multi Ethernet** valve (Integrated Axis Controller based on directional control valves) is a digital directional control valve with integrated axis controller and the following functionalities:

- ▶ Position control
- ▶ Pressure/force control
- ▶ Closed-loop speed control
- ▶ Substitutional closed-loop control (position - pressure/force)
- ▶ Substitutional control (flow - pressure/force)
- ▶ pQ function (flow-controlled)

This enables, amongst others, the following operating modes:

- ▶ Valve direct control
- ▶ Drive-controlled position control
- ▶ Drive-controlled positioning
- ▶ Positioning block operation
  
- ▶ The command values are preset via the Ethernet interface (X7E1 or X7E2) or, alternatively, via the analog/digital interface (XH2)
- ▶ The feedback information of the actual value signals to the superior control system is provided optionally either via the Ethernet interface (X7E1 or X7E2) or the analog/digital interface (XH2)

### Safety function

The integrated control electronics of the valve enables the additional shut-off of a channel according to EN 13849-1 in the direction P to A (depending on the application, the fail-safe position must be adhered to). For this purpose, a suitable control system must be provided to perform the plausibility check between the direction-dependent valve signals "enable input" and "enable acknowledgement" (signal fed back by the valve).

It is not possible to switch off direction P to B in a safety-relevant manner according to EN 13849-1 (depending on valve type).

- ▶ The controller parameters are set via the Ethernet interface (X7E1 or X7E2)

### Monitoring

The digital control electronics enables comprehensive monitoring functions/error detection including:

- ▶ Undervoltage
- ▶ Communication error
- ▶ Cable break for analog sensor inputs and digital position measurement system
- ▶ Short-circuit monitoring for analog/digital outputs
- ▶ Monitoring of the microcontroller (watchdog)
- ▶ Temperature of the integrated electronics

### IndraWorks DS PC program

To implement the project planning task and to parameterize the IAC Multi Ethernet valves, the user may use the IndraWorks DS engineering tool (see accessories):

- ▶ Project planning
- ▶ Parameterization
- ▶ Commissioning
- ▶ Diagnosis
- ▶ Comfortable management of all data on a PC
- ▶ PC operating systems: Windows XP (SP3), Windows 7

**Technical data**

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

general			
Size	Size	6	10
Design		Directional spool valve, direct operated, with steel sleeve	
Actuation		Proportional solenoid with position control, OBE	
Type of connection		Plate connection, porting pattern according to ISO 4401	
Installation position		Any	
Ambient temperature range	°C	-20 ... +60	
Storage temperature range	°C	+5 ... +40	
Sine test according to DIN EN 60068-2-6		10 ... 2000 Hz / maximum of 10 g / 10 cycles / 3 axes	
Noise test according to DIN EN 60068-2-64		20 ... 2000 Hz / 10 g <sub>RMS</sub> / 30 g peak / 30 min / 3 axes	
Transport shock according to DIN EN 60068-2-27		15g / 11 ms / 3 axes	
Weight	kg	3.2	7.2
Maximum relative humidity (no condensation)	%	95	
Maximum surface temperature	°C	150	
MTTFd value according to EN ISO 13849	Years	150 (for further details, see operating instructions 29391-B)	

hydraulic										
Maximum operating pressure	▶ Port A, B, P	bar	350 (size 6); 315 (size 10)							
	▶ Port T	bar	250							
Rated flow ( $\Delta p = 35$ bar per edge <sup>1)</sup> )		l/min	2	4	12	15	24/25	40	50	100
Limitation of use (transition in fail safe position)	▶ Symbol C3, C5	bar	350	350	350	350	350	160	315	160
	▶ Symbol C4, C1	bar	350	350	350	280	250	100	250	100
Leakage flow (at 100 bar)	▶ Linear characteristic curve "L"	cm <sup>3</sup> /min	< 150	< 180	< 300	–	< 500	< 900	< 1200	< 1500
	▶ Inflected characteristic curve "P"	cm <sup>3</sup> /min	–	–	–	< 180	< 300	< 450	< 600 (1:1) < 500 (2:1)	< 600
Hydraulic fluid			See table page 7							
Viscosity range	▶ Recommended	mm <sup>2</sup> /s	20 ... 100							
	▶ Maximum admissible	mm <sup>2</sup> /s	10 ... 800							
Hydraulic fluid temperature range (flown-through)		°C	-20 ... +60							
Maximum admissible degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c)			Class 18/16/13 <sup>2)</sup>							

1) Flow for deviating  $\Delta p$ :

$$q_x = q_{V \text{ nom}} \times \sqrt{\frac{\Delta p_x}{35}}$$

2) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and simultaneously increases the life cycle of the components.

Available filters can be found at [www.boschrexroth.com/filter](http://www.boschrexroth.com/filter).

static / dynamic			
Hysteresis	%	≤ 0.2	
Manufacturing tolerance $q_{V \text{ max}}$	%	≤ 10	
Temperature drift	%/10 K	Zero shift < 0.25	
Pressure drift	%/100 bar	Zero shift < 0.15	
Zero compensation		Ex plant ±1 %	

## Technical data

(For applications outside these values, please consult us!)

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	ISO 15380	90221
		HEES		
	▶ Soluble in water	HEPG	ISO 15380	
Flame-resistant	▶ Water-free	HFDU, HFDR	ISO 12922	90222
	▶ Containing water	HFC (Fuchs Hydrotherm 46M, Petrofer Ultra Safe 620)	ISO 12922	90223



### Important information on hydraulic fluids:

- ▶ For more information and data on the use of other hydraulic fluids, please refer to the 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 ... 100 %

electrical, integrated electronics (OBE)			
Relative duty cycle		%	100 (continuous operation)
Protection class according to EN 60529			IP 65 with mounted and locked plug-in connectors
Supply voltage <sup>3; 4)</sup>	▶ Nominal voltage	VDC	24
	▶ Lower limit value	VDC	18
	▶ Upper limit value	VDC	36
	▶ Maximum admissible residual ripple	Vpp	2.5 (Comply with absolute supply voltage limit value)
Current consumption	▶ Maximum <sup>5)</sup>	A	2.5
	▶ Impulse current	A	4
Maximum power consumption	▶ Size 6	W	40
	▶ Size 10	W	60
AD/DA resolution	▶ Analog inputs		12 bit
	▶ Analog output		10 bit
Protective earthing conductor and screening			See connector pin assignment (CE-compliant installation) page 11 and 12
Required fuse protection, external		A	4, time-lag
Adjustment			Calibrated in the factory, see characteristic curves page 14 ... 17
Conformity			CE according to EMC Directive 2004/108/EC tested according to EN 61000-6-2 and EN 61000-6-3
Parameterization interface			Ethernet
Scan time pressure and force controller (minimum)		msec	0.5
Scan time position controller (minimum)		msec	1
Booting time		sec	< 15

<sup>3)</sup> Supply voltage is used directly for sensor connections X2M1, X2M2 and X8M (no internal voltage limitation)

<sup>4)</sup> Voltage limit values must be observed directly at the connector of the valve (observe line length and cable cross-section!)

<sup>5)</sup> The maximum current consumption will increase when using the sensor inputs or the switching output according to the external load

**Technical data**

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

<b>electrical, integrated electronics (OBE)</b>		
Digital inputs XH2	▶ Quantity	Optionally up to 2, configurable (analog inputs are omitted)
	▶ Low level	V -3 ... 5
	▶ High level	V 15 ... $U_B$
	▶ Current consumption at high level	mA < 1
	▶ Reference potential	Pin 5
Digital outputs XH2	▶ Quantity	1
	▶ Low level	V 0 ... 3
	▶ High level	V 15 ... $U_B$
	▶ Current carrying capacity	A 1.5 (short-circuit-proof)
	▶ Signal delay time	msec < 2 (depending on set scan time)
	▶ Reference potential	GND
Analog inputs XH2	▶ Number (current and voltage input parameterizable)	Optionally up to 2, configurable (digital inputs are omitted)
	▶ AD resolution	bit 12
	▶ Voltage inputs (differential inputs)	
	– Measurement range	V -10 ... +10
	– Input resistance	k $\Omega$ 80 +10 %
	– Temperature drift	< 14 mV / 10 K
	▶ Current inputs (reference to AGND)	
	– Input current	4 ... 20 (0 ... 20 physically)
	– Input resistance	$\Omega$ 200, measuring resistance plus FET
– Temperature drift	< 25 $\mu$ A / 10 K	
Analog outputs XH2	▶ Number (current and voltage input parameterizable)	1
	▶ DA resolution	bit 14
	▶ Voltage outputs	
	– Output range	V -10 ... +10 (0 ... 10 by software)
	– Minimum load impedance	k $\Omega$ 10
	– Temperature drift	< 5 mV / 10 K
	▶ Current outputs	
	– Output range	mA 0 ... 20 (4 ... 20 by software)
– Maximum load	$\Omega$ 200	
Analog sensors X2M1, X2M2	▶ Number (current and voltage input configurable)	1 per connector
	▶ Supply voltage	V 24 (corresponding to supply voltage applied to XH2)
	▶ Maximum supply current	mA 350 (sum X2M1, X2M2 and X8M)
	▶ AD resolution	bit 12
	▶ Voltage inputs	
	– Measurement range	V 0 ... 10
	– Input resistance	k $\Omega$ 80 +10 %
	– Temperature drift	< 15 mV / 10 K
	▶ Current inputs (reference to AGND)	
	– Input current	4...20 (0...20 physically)
– Input resistance	$\Omega$ 200, measuring resistance plus PTC	
– Temperature drift	< 10 $\mu$ A / 10 K	
<b>electrical, integrated electronics (OBE)</b>		

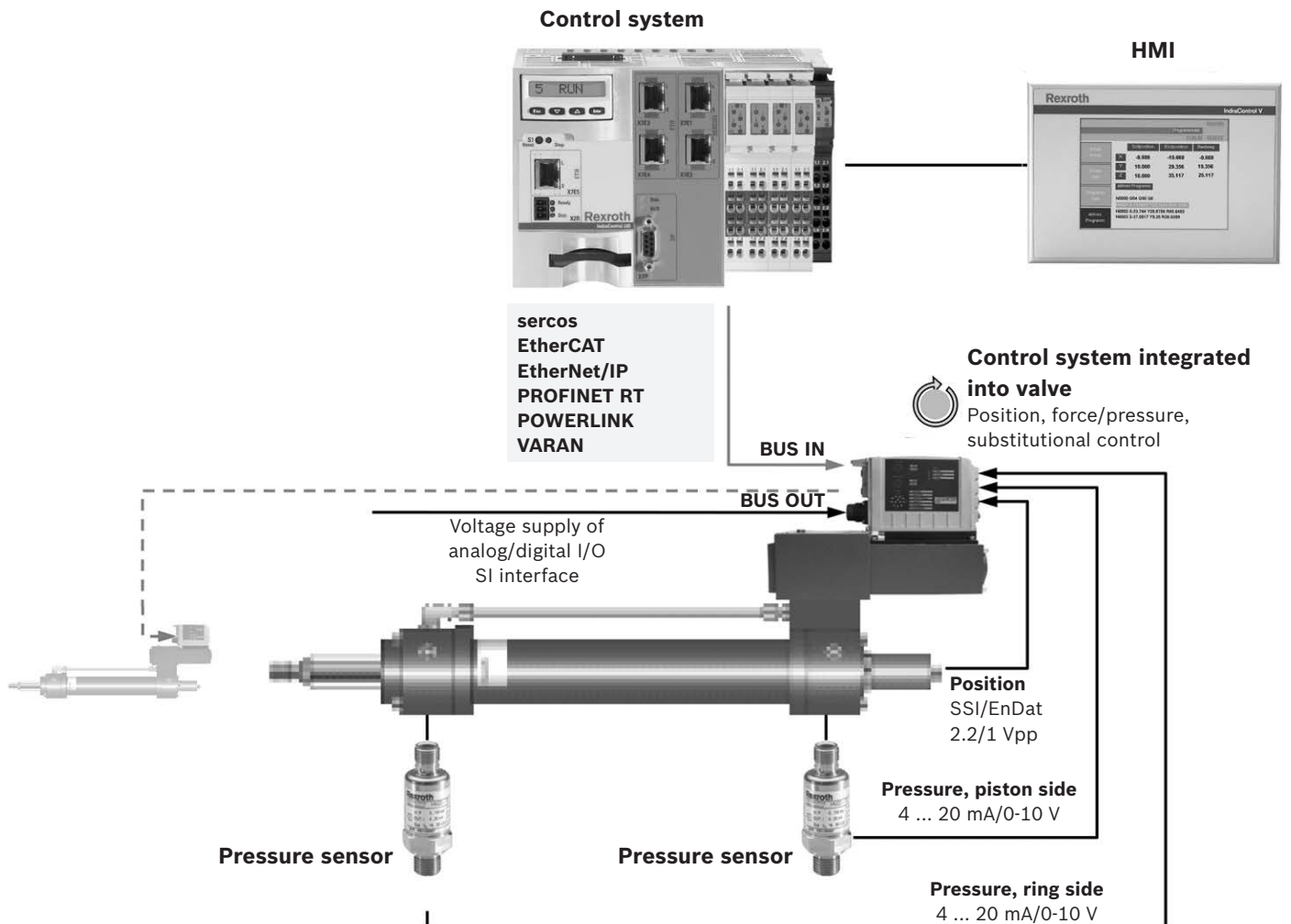


**Technical data**

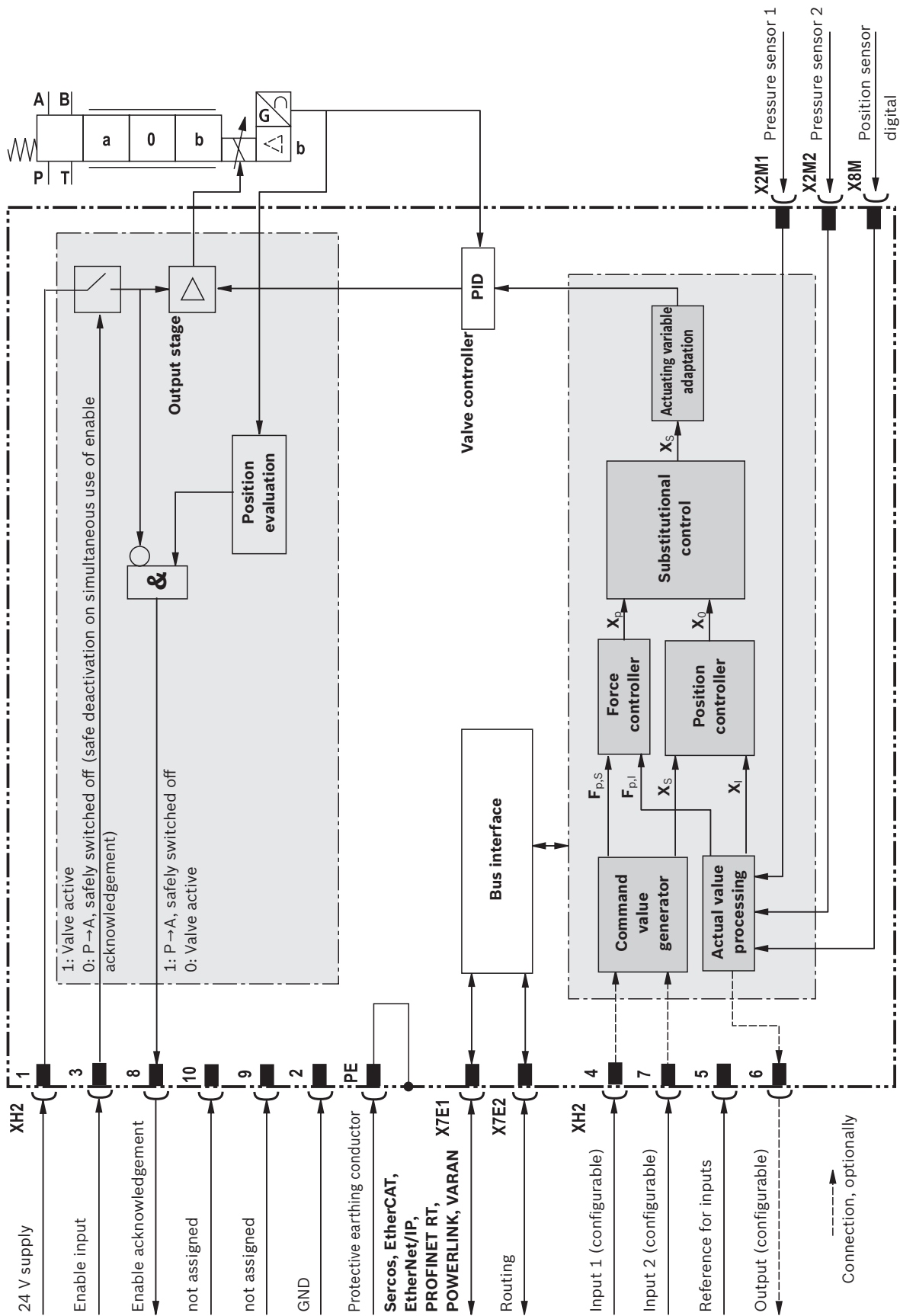
(For applications outside these parameters, please consult us!)

Digital sensor X8M	▶ Supply voltage	24 V or 5 V		
	▶ Maximum supply current	- 24 V	mA	350 (sum X2M1, X2M2 and X8M)
		- 5 V	mA	250
	▶ SSI transducer			
	- Coding	Gray		
	- Data width	12 ... 28 Bit		
	- Transfer frequency	80 kHz ... 1 MHz		
	- Line receiver / driver	RS485		
	▶ Endat encoder	2.2		
	- Line receiver / driver	RS485		
	- Resolution	minimum 10 nm and multiple		
	▶ 1Vpp-encoder			
	- Transfer frequency	kHz	250	

**Representation of the axis controller in the system network**



### Block diagram/controller function block



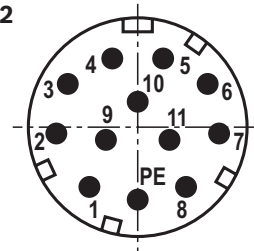
**Detailed description of the safety function:**  
 After the signal at the enable input has been removed, the output stage, and thus the solenoid of the valve, are internally separated from the available supply voltage. The enable acknowledgement will only be activated after the safe valve spool position has been achieved. For a detailed description of the safety function, refer to the operating instructions 29391-B.

## Electrical connections, assignment

### Connector pin assignment XH2, 11-pole + PE according to EN 175201-804

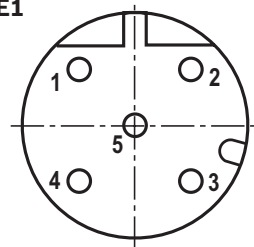
Pin	Core marking		Interface D6 assignment
	Cable, one-part <sup>1)</sup>	Cable, split <sup>2)</sup>	
1	1	1	24 V DC supply voltage
2	2	2	GND
3	3	White	Enable input 24 V DC (high $\geq 15$ V; low $< 2$ V)
4	4	Yellow	Command values 1 (4 ... 20 mA/ $\pm 10$ V) <sup>3)</sup>
5	5	Green	Reference for command values
6	6	Violet	Actual value/4 ... 20 mA/ $\pm 10$ V) <sup>3); 4)</sup>
7	7	Pink	Command value 2 (4 ... 20 mA/ $\pm 10$ V) <sup>3)</sup>
8	8	Red	Enable acknowledgement 24 V DC ( $I_{\max}$ 50 mA) <sup>5)</sup>
9	9	Brown	not assigned
10	10	Black	not assigned
11	11	Blue	Switching output 24 V, configurable (fault-free operation (24 V)/error (0 V) or power circuit signal), maximum 1.5 A <sup>3); 5)</sup>
PE	Green-yellow	Green-yellow	Functional earth (connected directly to metal housing)

- 1) Core marking of the connection lines for mating connector with cable set (see accessories, page 21, material numbers R901268000, R901272854, R901272852)
- 2) Core marking of the connection lines for mating connector with cable set (see accessories, page 21), material numbers R900884671, R900032356, R900860399)
- 3) Selection via commissioning software
- 4) For diagnostic purposes, precise actual value response via Ethernet interface
- 5) A load increases the current consumption on pin 1

**XH2**


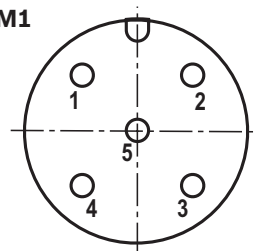
### Connector pin assignment for Ethernet interface "X7E1" and "X7E2" (coding D), M12, 4-pole, socket

Pin	Assignment
1	TxD +
2	RxD +
3	TxD -
4	RxD -
5	not assigned

**X7E1**


### Analog configurable sensor interfaces, connections "X2M1", "X2M2" (coding A), M12, 5-pole, socket

Pin	Assignment
1	+24 V voltage output (sensor supply) <sup>1); 2)</sup>
2	Sensor signal input current (4 ... 20 mA) <sup>3)</sup>
3	GND
4	Sensor signal input voltage (0 ... 10 V) <sup>3)</sup>
5	Negative differential amplifier input to pin 4 (optional)

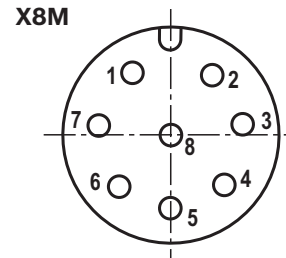
**X2M1**


- 1) Voltage output same as voltage supply connected to input XH2! (Maximum load capacity see page 12)
- 2) A load increases the current consumption of the valve (pin 1 on the connector XH2)
- 3) Only one signal input per interface, configurable

## Electrical connections, assignment

### Digital sensor interface SSI, EnDat 2.2 or 1Vpp measurement system "X8M", M12, 8-pole, socket

Pin	SSI pin assignment <sup>1)</sup>	EnDat 2.2 pin assignment <sup>1; 2)</sup>	1Vpp pin assignment
1	GND	GND	GND
2	+24 V <sup>3)</sup>	+5 V <sup>3)</sup>	+5 V <sup>3)</sup>
3	Data +	Data +	A +
4	Data -	Data -	A -
5	GND	GND	B +
6	Clock -	Clock -	B -
7	Clock +	Clock +	R +
8	+24 V <sup>3)</sup>	+5 V <sup>3)</sup>	R -



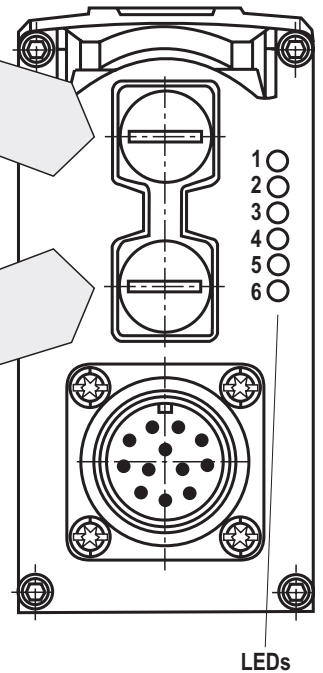
- 1) Pins 2, 8 and 1, 5 have the same assignment each
- 2) Supported resolution  $\geq 10$  nm
- 3) A load increases the current consumption of the valve (pin 1 on the connector XH2)

#### Notices:

- ▶ Reference potential for all signals: GND
- ▶ 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.

## LED displays

LED	Interface	Sercos	EtherNET/IP	EtherCAT	PROFINET RT	POWERLINK	VARAN
1	X7E1	Activity	Activity	Not used	Activity	Not used	Active
2		Link	Link	Link/activity	Link	Link/data activity	Link
3	Electronics module	S	Network status	Network status	Network status	Status/error	Network status
4		Module status	Module status	Module status	Module status	Module status	Module status
5	X7E2	Activity	Activity	Not used	Activity	Not used	Not used
6		Link	Link	Link/activity	Link	Link/data activity	Not used



### Displays of the Status LEDs

Module status LED (LED 4)	Display status
Off	No voltage supply
Green-red, flashing	Initialization
Green, flashing	Drive ready for operation
Green	Drive active
Orange, flashing	Warning
Red, flashing	Error

Network status LED (LED 3)	Display status
Off	No voltage supply
Green	Operation

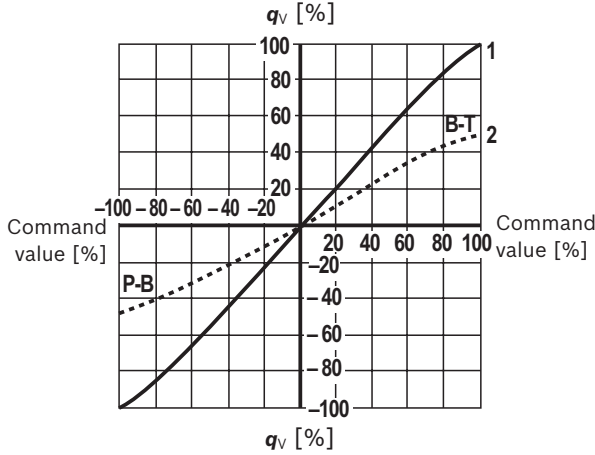
#### Notices:

- ▶ LEDs 1, 2, 5 and 6 relate to interfaces "X7E1" and "X7E2"
  - Link: Cable plugged in, connection established (permanently lit)
  - Activity: Data sent/received (flashing)
- ▶ Module status LEDs 3 and 4 relate to the electronics module
- ▶ For a detailed description of the diagnosis LEDs, please refer to the functional description Rexroth HydraulicDrive HDx.

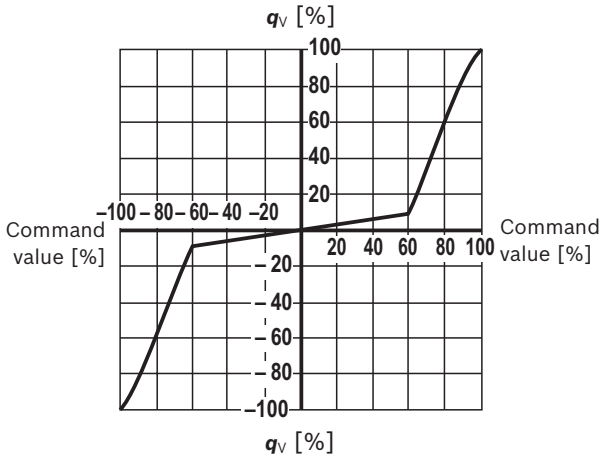
**Characteristic curves:** Size 6 – flow characteristic  
(measured with HLP46,  $\vartheta_{oil} = 40 \pm 5 \text{ }^\circ\text{C}$ )

**Flow/signal function**

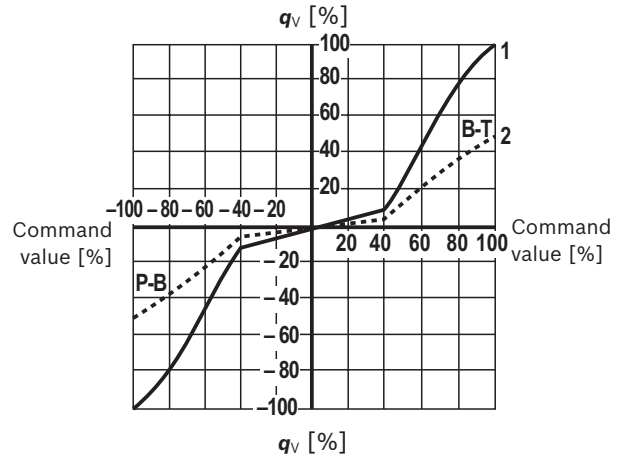
**Linear characteristic curve "L"**



**Inflected characteristic curve "P", inflection at 60 %**



**Inflected characteristic curve "P", inflection at 40 %**

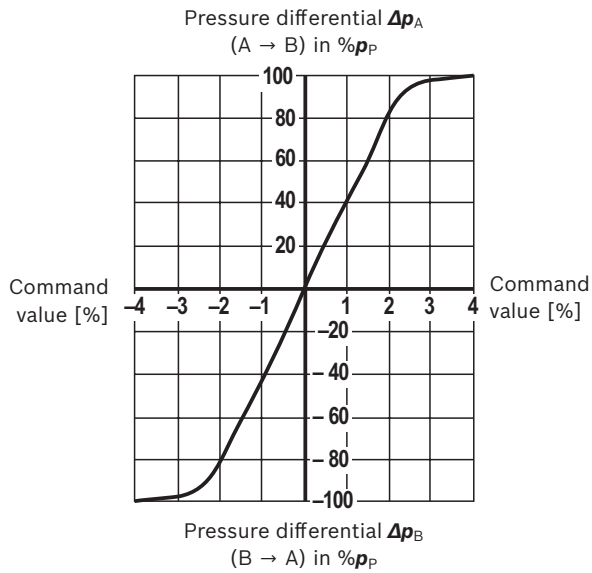


- 1  $q_{VA} : q_{VB} = 1:1$
- 2  $q_{VA} : q_{VB} = 2:1$

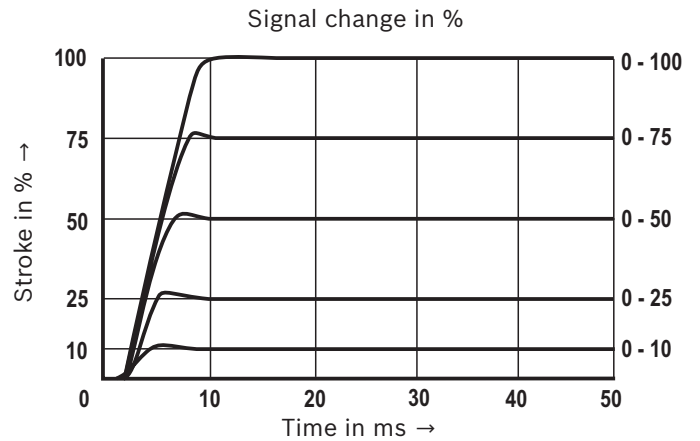
Fail-safe position			
	Leakage flow at 100 bar	P→A P→B	50 cm <sup>3</sup> /min 70 cm <sup>3</sup> /min
	Flow at $\Delta p = 35$ bar	A→T B→T	10 ... 20 l/min 7 ... 20 l/min
	Leakage flow at 100 bar	P→A P→B	50 cm <sup>3</sup> /min 70 cm <sup>3</sup> /min
		A→T B→T	70 cm <sup>3</sup> /min 50 cm <sup>3</sup> /min
Fail-safe	$p = 0 \text{ bar} \rightarrow 7 \text{ ms}$	Enable "off" or internal shut-off if an error has occurred	
	$p = 100 \text{ bar} \rightarrow 10 \text{ ms}$	$U_B \leq 18 \text{ V}$ or $I \leq 2 \text{ mA}$ (with 4 ... 20 mA signal, cable break detection: current threshold configurable)	

**Characteristic curves: Size 6**  
 (measured with HLP46,  $\vartheta_{oil} = 40 \pm 5 \text{ }^\circ\text{C}$ )

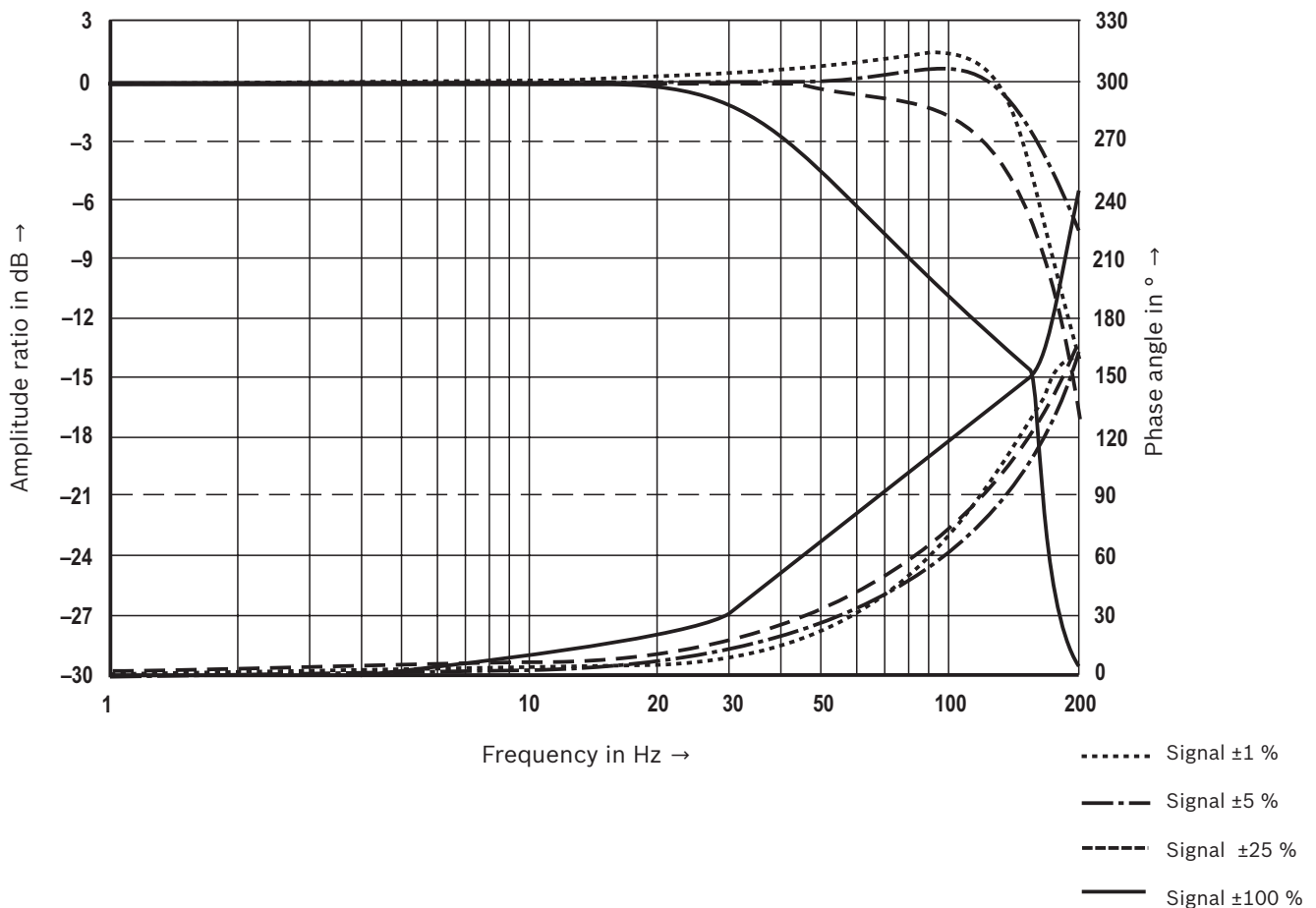
**Pressure/signal characteristic curve**



**Transition function with stepped electric input signals**



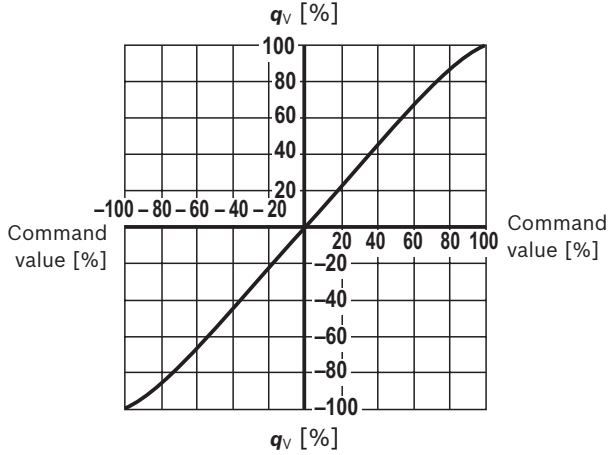
**Frequency response characteristic curves**



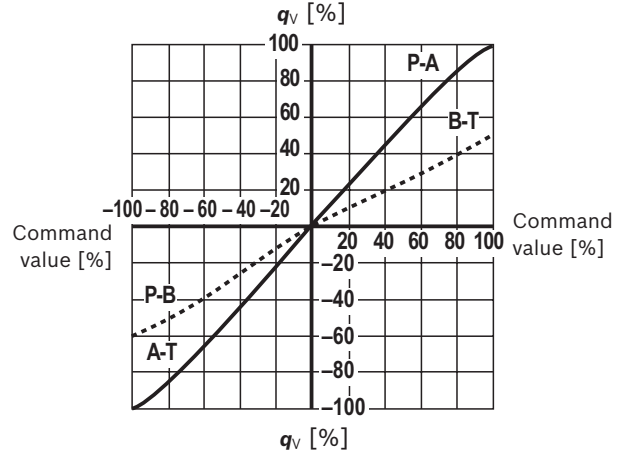
**Characteristic curves:** Size 10 – flow characteristic (measured with HLP46,  $\vartheta_{oil} = 40 \pm 5 \text{ }^\circ\text{C}$ )

**Flow/signal function**

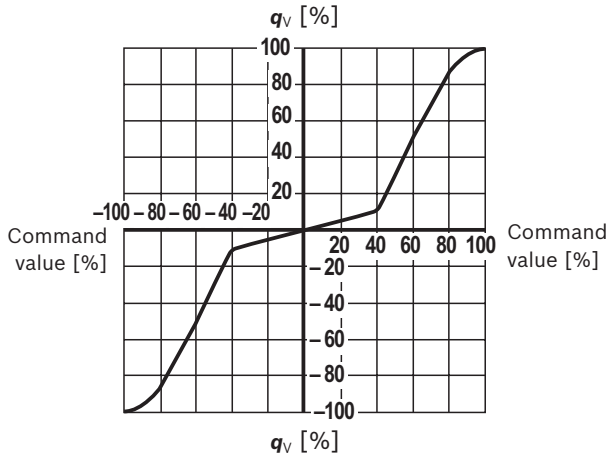
**Linear characteristic curve "L" (1:1)**



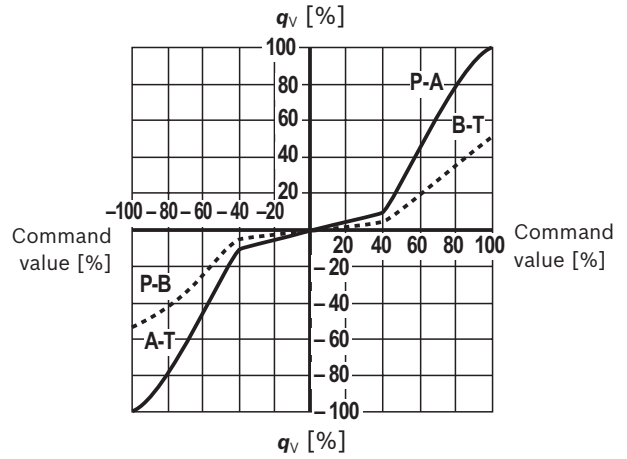
**Linear characteristic curve "L" (2:1)**



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



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

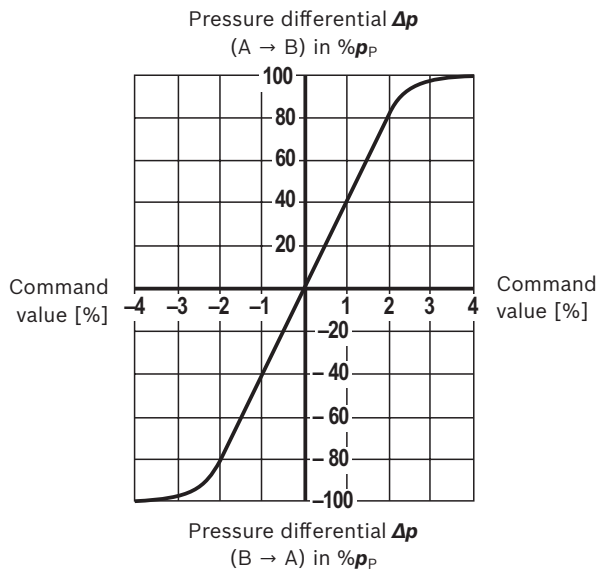


		Fail-safe position		
	Leakage flow at 100 bar	P→A	50 cm <sup>3</sup> /min	
		P→B	70 cm <sup>3</sup> /min	
	Flow at $\Delta p = 35$ bar	A→T	100 ... 110 l/min	
		B→T	10 ... 25 l/min	
	Leakage flow at 100 bar	P→A	50 cm <sup>3</sup> /min	
		P→B	70 cm <sup>3</sup> /min	
		A→T	70 cm <sup>3</sup> /min	
		B→T	50 cm <sup>3</sup> /min	
Fail-safe	$p = 0$ bar → 12 ms	Enable "off" or internal shut-off if an error has occurred		
	$p = 100$ bar → 16 ms	$U_B \leq 18$ V or $I \leq 2$ mA (with 4 ... 20 mA signal, cable break detection: current threshold configurable)		

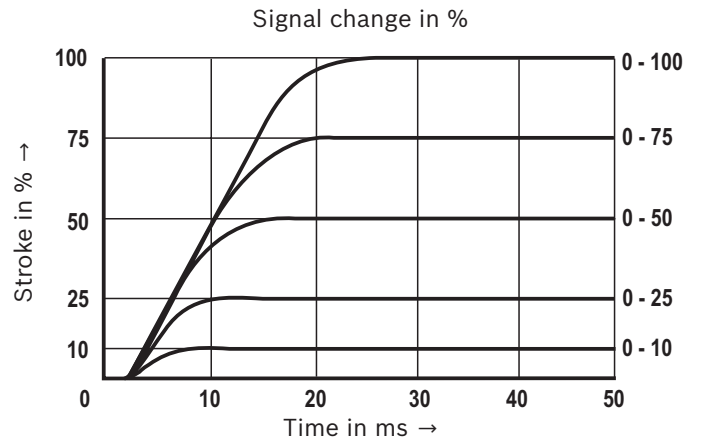


**Characteristic curves: Size 10**  
 (measured with HLP46,  $\vartheta_{oil} = 40 \pm 5 \text{ }^\circ\text{C}$ )

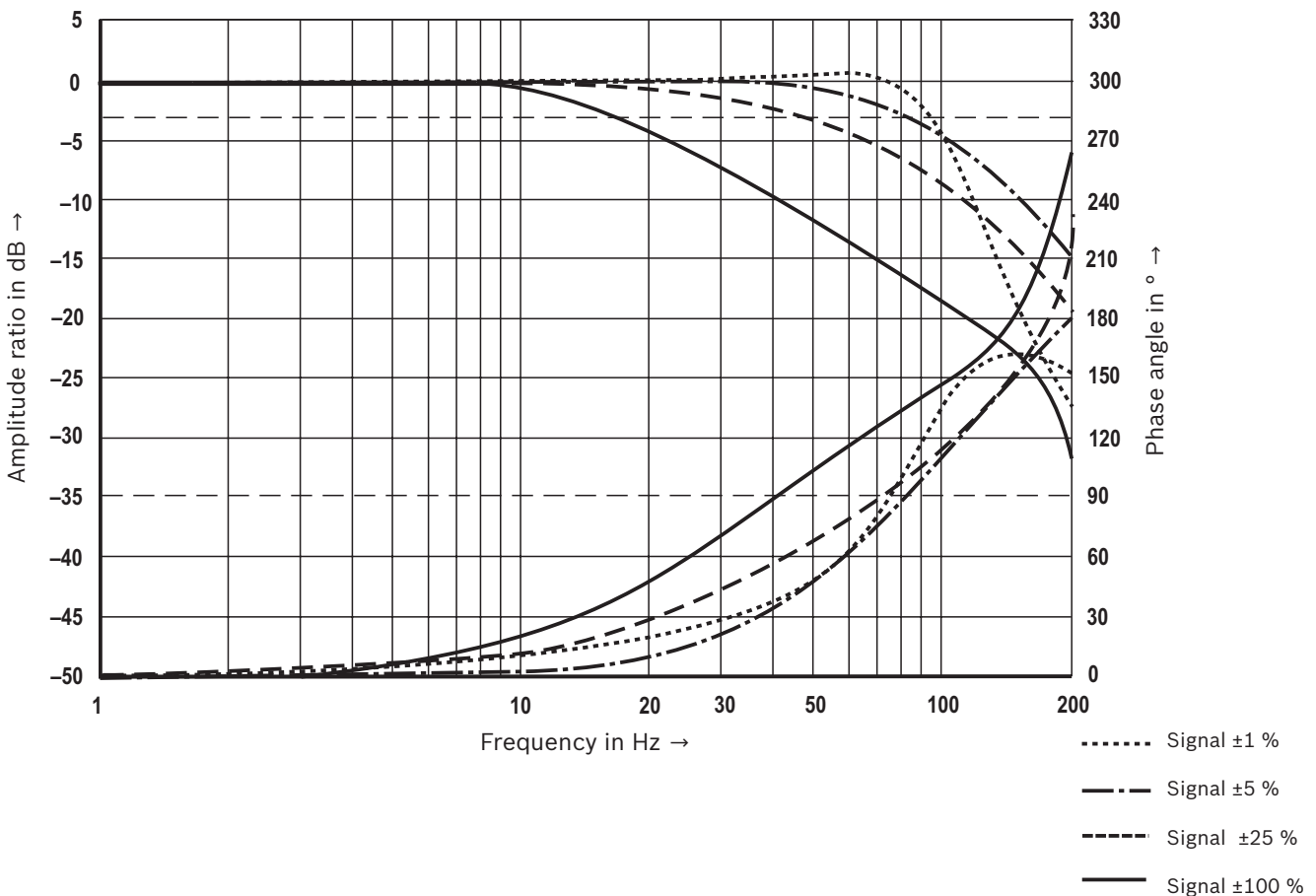
**Pressure/signal characteristic curve**



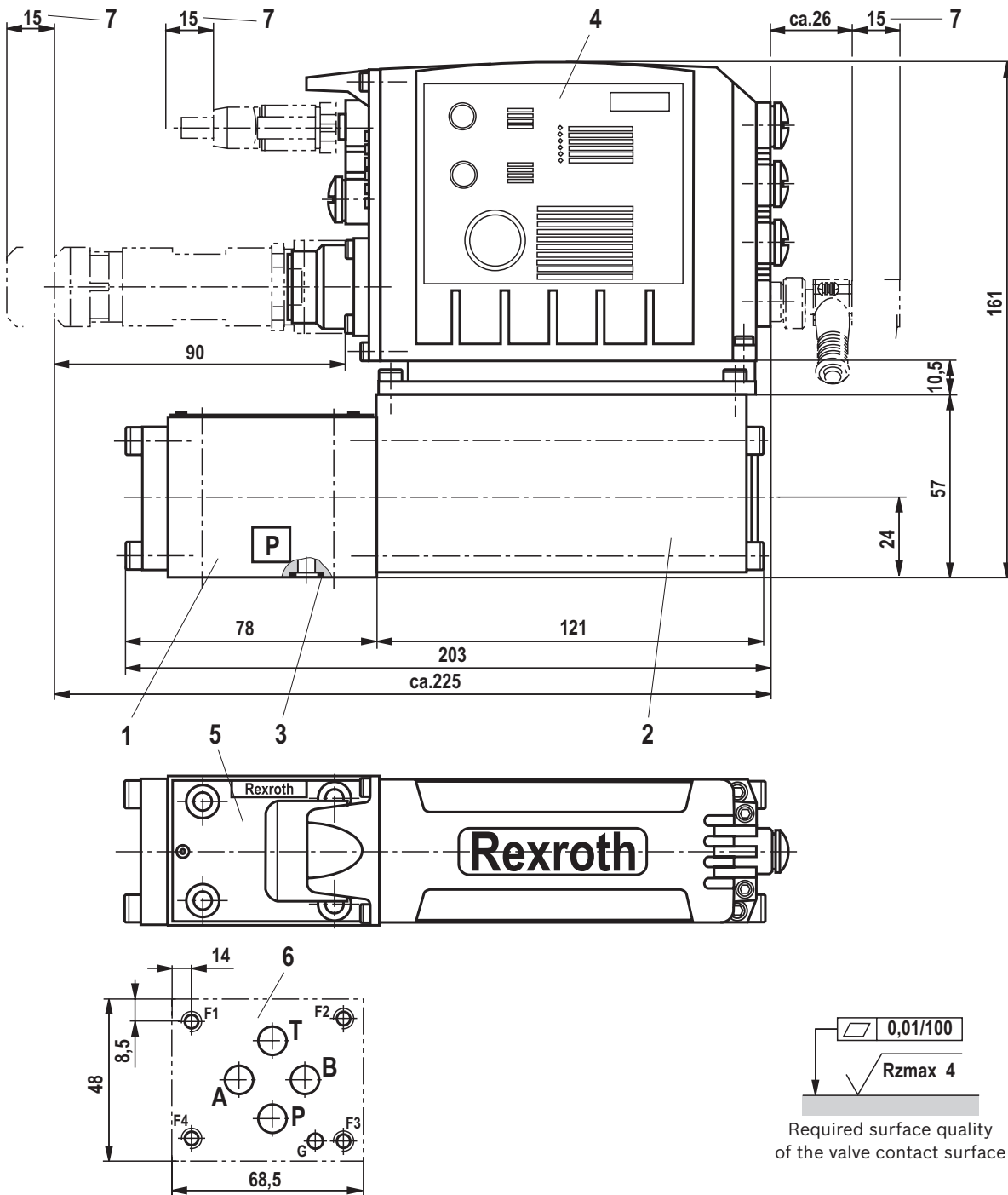
**Transition function with stepped electric input signals**



**Frequency response characteristic curves**



**Dimensions:** Size 6  
(dimensions in mm)



- 1 Valve housing
- 2 Control solenoid with position transducer
- 3 Identical seal rings for ports A, B, P, T
- 4 Integrated digital control electronics
- 5 Name plate
- 6 Machined valve contact surface, porting pattern according to ISO 4401-03-02-0-05
- 7 Space required for removing the mating connectors

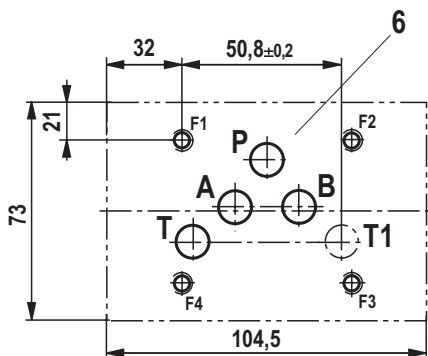
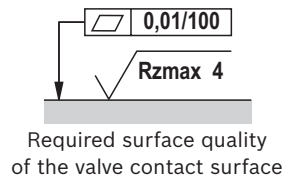
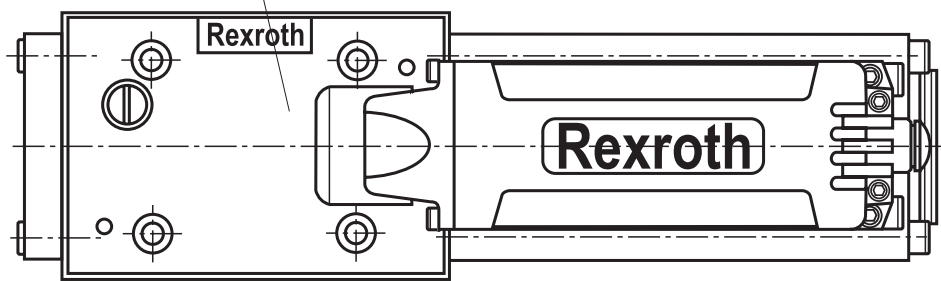
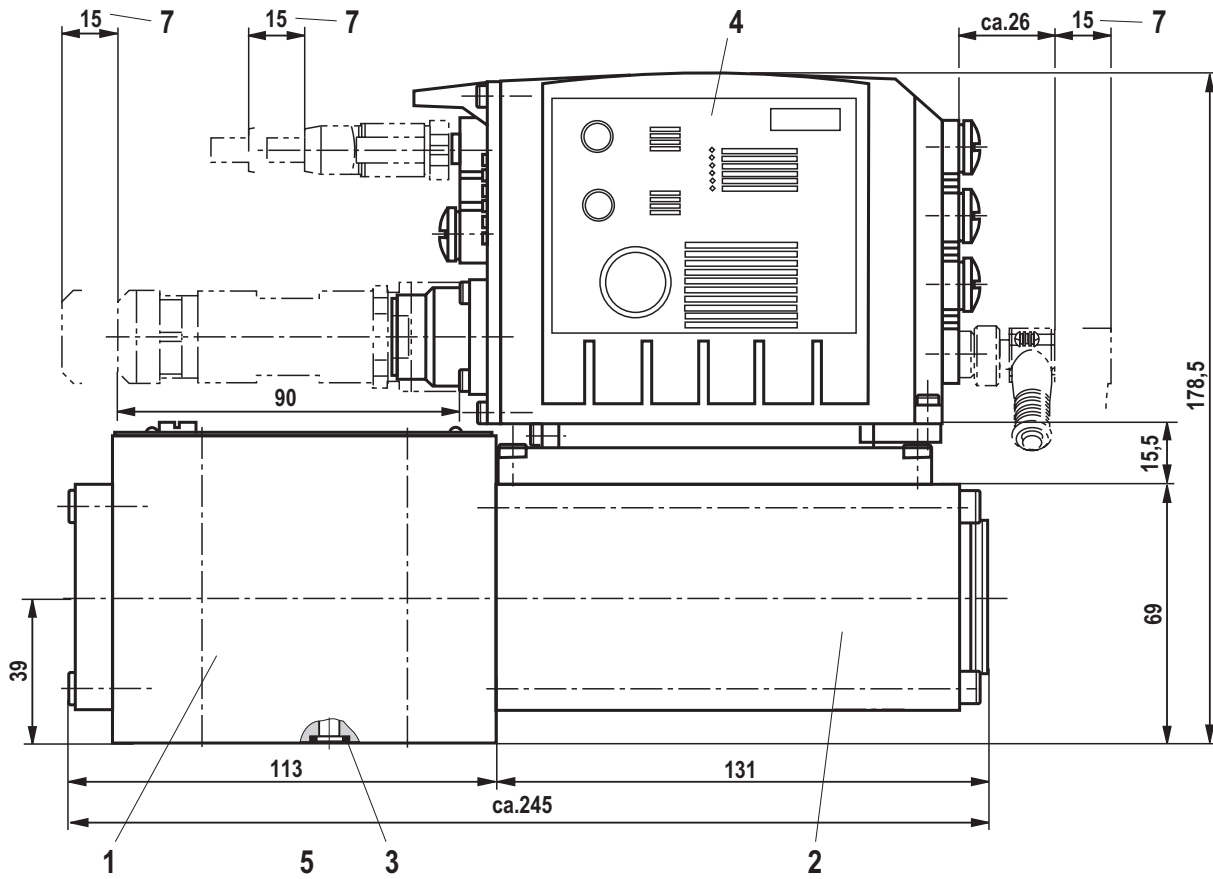


**Notices:**

The dimensions are nominal dimensions which are subject to tolerances.

**Valve mounting screws** see page 20.

**Dimensions:** Size 10  
(dimensions in mm)



- 1 Valve housing
- 2 Control solenoid with position transducer
- 3 Identical seal rings for ports A, B, P, T, T1
- 4 Integrated digital control electronics
- 5 Name plate
- 6 Machined valve contact surface, porting pattern according to ISO 4401-05-04-0-05  
Deviating from the standard:  
Port T1 exists additionally
- 7 Space required for removing the mating connectors

**Notices:**

The dimensions are nominal dimensions which are subject to tolerances.

**Valve mounting screws** see page 20.

## Dimensions

### Valve mounting screws (separate order)

Size	Hexagon socket head cap screws	Material number
6	4 hexagon socket head cap screws ISO 4762 - M5 x 30 - 10.9-N67F 821 70 (galvanized according to Bosch standard N67F821 70) Tightening torque $M_A = 6^{+2}$ Nm	2910151166
10	4 hexagon socket head cap screws ISO 4762 - M6 x 40 - 10.9-N67F 821 70 (galvanized according to Bosch standard N67F821 70) (Tightening torque $M_A = 11^{+3}$ Nm	2910151209



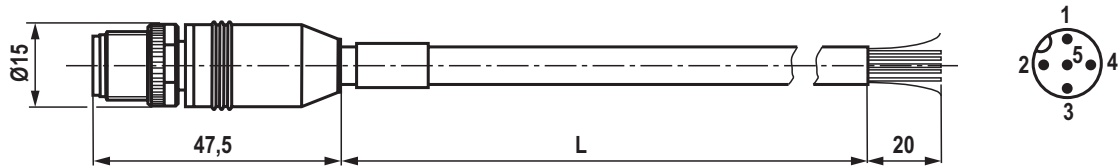
#### Notice:

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

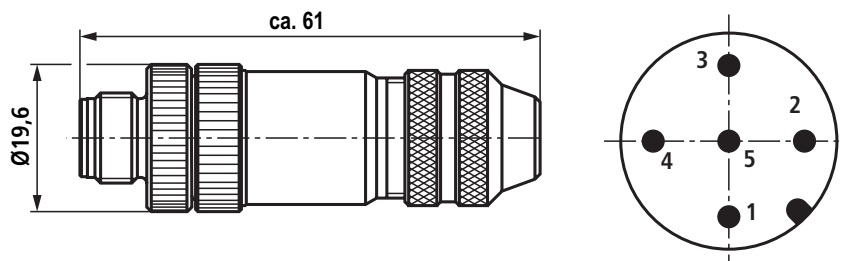
## Accessories (separate order)

### Sensor connections X2M1 and X2M2

Cable set (Analog sensors)	Length in m	Material number
Cable set for connection of the Rexroth pressure sensors type HM20, Shielded, 5-pole, A coding, PUR/PVC, straight connector M12, on straight socket M12, line cross-section 0.34 mm <sup>2</sup>	0.6	R901111709
	1.0	R901111712
	2.0	R901111713
Shielded, 5-pole, A coding, straight connector M12, on free line end, line cross-section 0.34 mm <sup>2</sup>	1.5	R901111752
	3.0	R901111754
	5.0	R901111756
	10.0	R913005147



Plug-in connector (Analog sensors)	View, dimensions	Material number
Plug-in connector, 5-pole, M12x1, pins, A coding, metal design (cable diameter 4 ... 6 mm) (due to the diameter, two plug-in connectors of this type cannot be simultaneously applied at X2M1 and X2M2)	see below	R901075542



### Sensor connection X8M

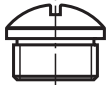
Cable set (SSI, 1Vpp only) <sup>1)</sup>	Length in m	Material number
Shielded, 8-pole, A coding, straight connector M12, on free line end, line cross-section 0.25 mm <sup>2</sup>	10.0	R913002641

<sup>1)</sup> **Recommendation:** If an EnDat 2.2 sensor is used, please refer to the sensor manufacturer Heidenhain with respect to a cable set.

**Accessories (separate order)**
**Ethernet connections X7E1 and X7E2**

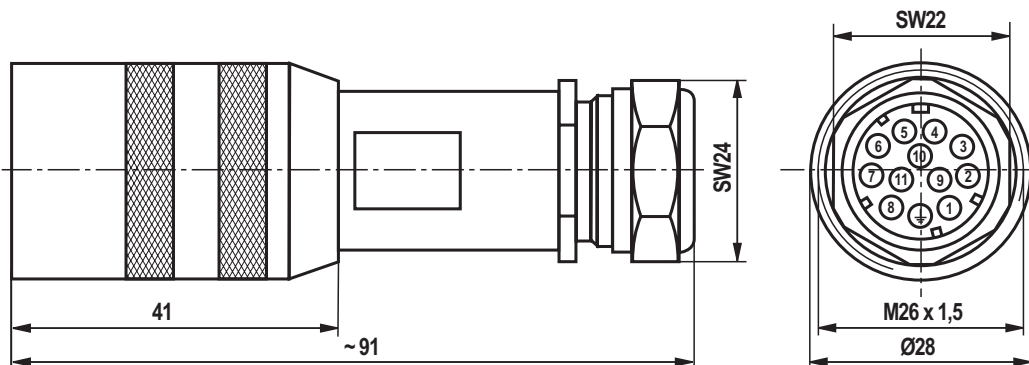
Cable set (Ethernet interface)	Length in m	Material number
Cable set, shielded, 4-pole, D coding, straight connector M12, on straight connector M12, line cross-section 0.25 mm <sup>2</sup> , CAT 5e	Freely selectable (= xx.x)	<b>R911172111</b> (additionally indication of type designation RKB0040/xx.x)
Cable set, shielded, 4-pole, straight connector M12, on straight connector RJ45, line cross-section 0.25 mm <sup>2</sup> , CAT 5e	Freely selectable (= xx.x)	<b>R911172135</b> (additionally indication of type designation RKB0044/xx.x)

**Protective cap**

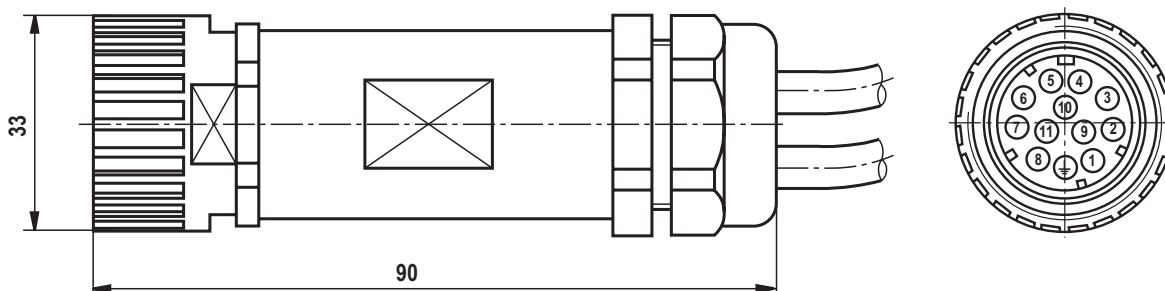
Protective cap M12	Design	Material number
		<b>R901075563</b>

**Port XH2**

Mating connector	Design	Material number
Mating connector according to DIN EN 175201-804 (12-pole, metal design)	Mating connector (assembly kit) for a cable diameter of 12 ... 15 mm	<b>R901268000</b>
	Mating connector with 5 m cable, 12 x 0.75 mm <sup>2</sup> with cable shield, assembled	<b>R901272854</b>
	Mating connector with 20 m cable, 12 x 0.75 mm <sup>2</sup> with cable shield, assembled	<b>R901272852</b>



Mating connector according to DIN EN 175201-804 (12-pole, plastic variant)	Mating connector (assembly kit)	<b>R900884671</b>
	Mating connector with 2 x 5 m cable, supply line (3 x 1.0 mm <sup>2</sup> ) and signal line (10 x 0.14 mm <sup>2</sup> ) separated, with cable shield, assembled	<b>R900032356</b>
	Mating connector with 2 x 20 m cable, supply line (3 x 1.0 mm <sup>2</sup> ) and signal line (10 x 0.14 mm <sup>2</sup> ) separated, with cable shield, assembled	<b>R900860399</b>



## Accessories (separate order)

### Parameterization

The following is required for the parameterization with PC		Material number/Download
1 Commissioning software	IndraWorks, Indraworks D, Indraworks DS	<a href="http://www.boschrexroth.com/IAC">www.boschrexroth.com/IAC</a>
2 Connection cable, 3 m	Shielded, M12 on RJ45, length can be freely selected (= xx.x)	<b>R911172135</b> (additionally indication of type designation RKB0044/xx.x)



## Project planning and maintenance instructions

- ▶ The supply voltage must be permanently connected, as otherwise bus communication is not possible.
- ▶ 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)!
- ▶ The devices have been tested in the plant and are supplied with default settings.
- ▶ Only complete devices can be repaired. Repaired devices are returned with default settings. User-specific settings will not be applied. The machine end-user will have to retransfer the corresponding user parameters.

## Additional information

- |  |  |
|--|--|
| ▶ Directional control valves, direct operated, with electrical position feedback and integrated electronics (OBE)                      | Data sheet 29035 and 29037   |
| ▶ Directional control valve with integrated digital axis controller (IAC-R) and field bus interface                                    | Data sheet 29191   |
| ▶ Directional control valve with integrated digital axis controller (IAC-R) and clock-synchronized PROFIBUS DP/V2 (PROFIdrive profile) | Data sheet 29291   |
| ▶ Directional control valve with integrated digital axis controller  | Operating instructions 29391-B   |
| ▶ CE Declaration of Conformity   | Upon request   |
| ▶ Subplates  | Data sheet 45100   |
| ▶ 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   | Operating instructions 07600-B   |
| ▶ General product information on hydraulic products  | Data sheet 07008   |
| ▶ Installation, commissioning and maintenance of servo valves and high-response valves   | Data sheet 07700   |
| ▶ Assembly, commissioning and maintenance of hydraulic systems   | Data sheet 07900   |
| ▶ Operation IAC Multi Ethernet electronics (xx = software version):  |  |
| – Functional description Rexroth HydraulicDrive HDx-xx   |  |
| – Parameter description Rexroth HydraulicDrive HDx-xx  |  |
| – Description of diagnosis Rexroth HydraulicDrive HDx-xx   |  |
| ▶ Commissioning software and documentation on the Internet   | <a href="http://www.boschrexroth.com/IAC">www.boschrexroth.com/IAC</a>       |
| ▶ Selection of filters   | <a href="http://www.boschrexroth.com/filter">www.boschrexroth.com/filter</a> |
| ▶ Information on available spare parts   | <a href="http://www.boschrexroth.com/spc">www.boschrexroth.com/spc</a>       |

## Notes

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