

Self-contained actuator

Type CytroMotion



- ▶ Component series 1X
- ▶ Maximum force generated by pressure up to 275 kN
- ▶ Maximum travel velocity 740 mm/s
- ▶ Maximum stroke length 1000 mm
- ▶ Closed system

Features

- ▶ Ready to install, easy installation (purely electrical connection)
- ▶ For applications with a closed control loop
- ▶ Compact design
- ▶ Installation independent of position
- ▶ Flexible set-up
- ▶ Maintenance-free
- ▶ Robust in use
- ▶ Optionally connectable reduced-force rapid traverse (regenerative mode)
- ▶ Operation with standard converter technology

Contents

Features	1
Ordering codes	2, 3
Function	4, 5
Hydraulic circuit diagram	5
CytroMotion operation	6
Technical data	7, 8
Performance range	9, 10
Dimensions	11, 12
Electrical connections	13, 14
Accessories	15
Further information	16

Ordering codes

01	02	03	04	05	06	07	08	09	10	11	12	13	14				
CYTROMOTION	-	1X	/	H		/		/		/	P	B		/			X

01	CytroMotion	CYTROMOTION
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02	Component series 10 ... 19 (10 ... 19: unchanged installation and connection dimensions)	1X
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Cylinder design

03	Mill type	H
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Cylinder function

04	Differential cylinder	D
	Differential cylinder with position measurement system	S

Cylinder mounting types

05	Round flange at head	F
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Piston Ø (ØAL) ¹⁾

06	40 mm	040
	50 mm	050
	63 mm	063
	80 mm	080
	100 mm	100
	125 mm	125

Piston rod Ø (ØMM) ¹⁾

07	28 mm	028
	36 mm	036
	45 mm	045
	56 mm	056
	70 mm	070
	90 mm	090

08	Stroke length 0050 ... 1000 in mm ²⁾	
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09	Parallel orientation	P
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10	Frame size 2	B
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Geometric displacement volume pump Vg

11	3.6 cm ³	C
	5.2 cm ³	E
	7.3 cm ³	G
	9.3 cm ³	I
	10.4 cm ³	J
	11.4 cm ³	K

¹⁾ For possible combinations, see table on page 9²⁾ Preferably in 100 mm steps. For version 040/028, the maximum stroke length is limited to 970 mm.

Ordering codes

01	02	03	04	05	06	07	08	09	10	11	12	13	14
CYTROMOTION	-	1X	/	H		/	/	/	P	B		/	X

Rated power

12	3.5 kW	C
	4.8 kW	D
	6.2 kW	F

Hydraulic circuit

13	Standard	S
	Reduced-force rapid traverse (regenerative mode)	R

Cover

14	Standard	S
	Without	X

Function

The CytroMotion is a compact, energy-efficient self-sustaining actuator that converts electrical energy into a precise, controllable movement of a hydraulic cylinder. The pre-tested overall system can be installed easily and independently of position, the integration is purely electric.

Forces up to 275 kN can be realized. Optionally, a rapid traverse with reduced force can be switched on in order to increase the speed of the cylinder during extension up to 740 mm/s (regenerative mode, version "R").

The CytroMotion basically consists of a synchronous motor with a rotary encoder (1), a 4Q-capable and low-noise internal gear pump (2), a cylinder unit (3), a compensator for the compensation of differential volume (4), a valve block (5) and an optional position measurement system (6).

Motor-pump group

The motor-pump group provides hydraulic power as required.

Cylinder unit / actuator

The cylinder unit of the compact axis converts flow and pressure into a linear movement with force.

Compensator (low-pressure accumulator)

The servo-hydraulic actuator is a hydraulically closed system. The compensator is used to receive differential volume of the retracting and extending piston rod and also temperature variations.

Valve block

By switching the 2/2 directional seat valves (VA, VB, VE and VR) used, various functions such as retraction and extension of the cylinder and holding the cylinder are implemented, and the rapid traverse is optionally switched on (see CytroMotion operation on page 6).

The pressure transducers SA, SB and SK used monitor the working pressures and the compensator pressure. In addition, the pressures are limited by the pressure relief valves used.

Position measurement system

(optional, cylinder version "S")

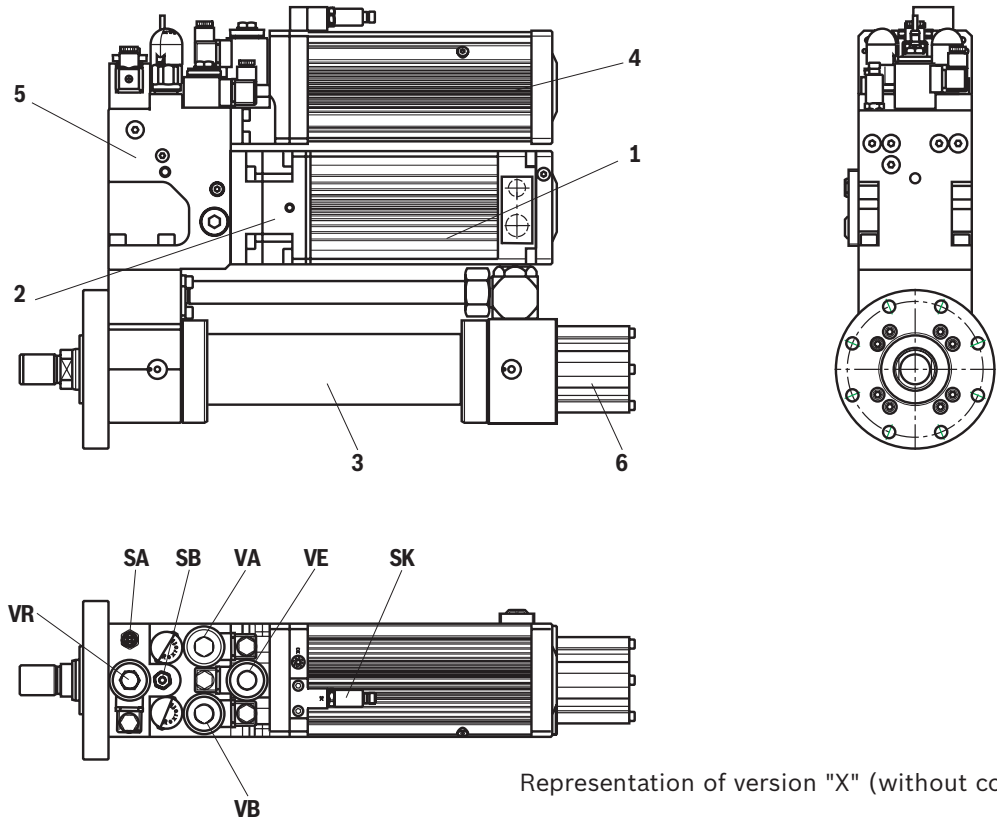
The piston position is detected by an installed absolute position measurement system.



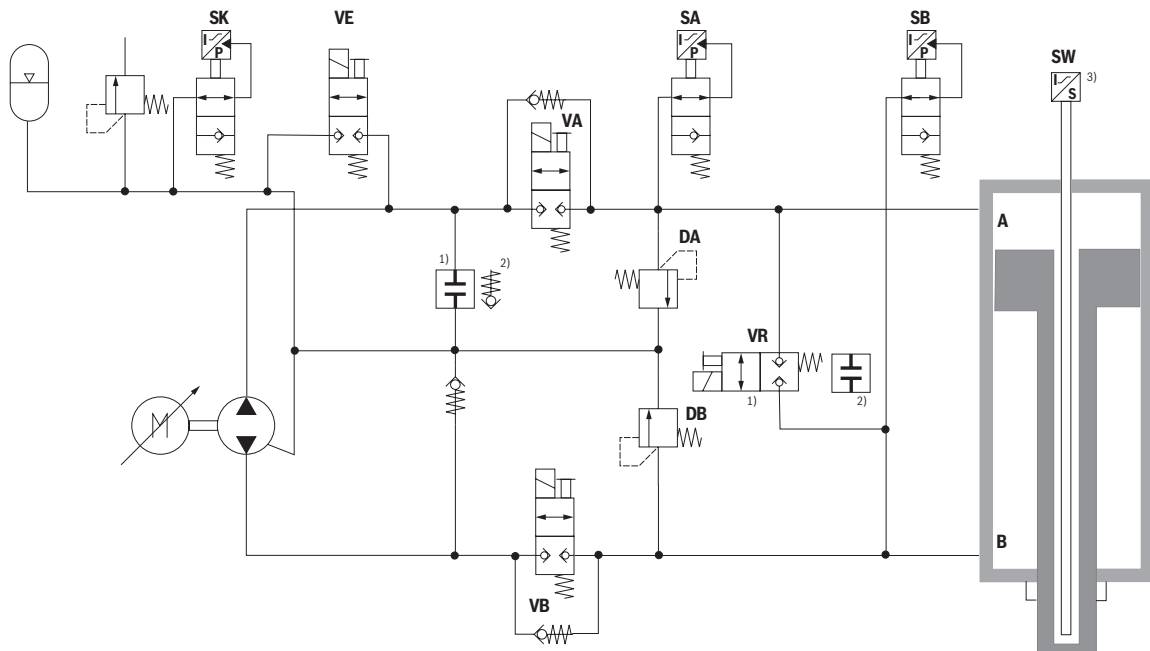
Notice:

- **Generator operation:**
External force effect on the cylinder may drive the motor/pump group.
Consequently, the motor acts as a generator and generates electrical energy.
This energy must be dissipated or stored by suitable measures such as a braking resistor or a DC link.
- **Retraction under load:**
If the retraction of the self-contained actuator is to take place during the process under load in the direction of movement, please contact Bosch Rexroth.

Function



Function: Hydraulic circuit diagram



- 1) Fitting with version "R" (reduced-force rapid traverse – regenerative mode).
- 2) Fitting with version "S" (standard)
- 3) Only for cylinder version "S" (with position measurement system)

Valve	VA	VB	VE	VR	Motor rotation direction ³⁾
Basic position	– ¹⁾	–	–	–	–
Force traverse, extending	+ ²⁾	+	–	–	right (clockwise)
Extending reduced-force rapid traverse (regenerative mode)	+	–	–	+	right (clockwise)
Retraction	+	+	+	–	left (anti-clockwise)
Hold force generated by pressure	– ⁴⁾	+	–	–	–
Hold traction force	+	– ⁴⁾	–	–	–

1) – → 2/2 directional seat valve, without current

2) + → 2/2 directional seat valve, with current

3) Looking onto the drive shaft (piston rod of the CytoMotion)

4) If required, the pressure can be adjusted via the by-pass check valve even when the VA seat valve is closed.



Note:

Activating the motor while the seat valve (VA) is closed can cause the cylinder to extend!

Pressure builds up in the piston chamber via the by-pass check valves. As soon as the pressure exceeds the protected pressure on the rod side (pressure intensification with a single-rod cylinder), the pressure relief valve opens and the cylinder extends.

CytoMotion operation

Basic position:

The motor is off / de-energized and all valves are without current. The pressure medium in the cylinder chambers A and B is blocked by the 2/2 directional seat valves.

Force traverse, extending:

Motor direction of rotation clockwise, the motor speed according to the speed requirement on the cylinder. The 2/2 directional seat valves VA and VB are switched/energized. The pressure medium is conveyed from the rod side of the cylinder B via the 2/2 directional seat valves VB and VA into the piston sides of the cylinder A. The additional differential volume is "sucked" out of the compensator via a check valve. The cylinder extends.

Reduced-force rapid traverse extension

(regenerative mode):

Only possible with version "R".

Motor direction of rotation clockwise, the motor speed according to the speed requirement on the cylinder. The 2/2 directional seat valves VA and VR are switched/energized. The pressure medium is conveyed by the pump via the 2/2 directional seat valve VA into the piston side A of the cylinder. The displacement additionally conveys the pressure medium from the rod side B via the 2/2 directional seat valve VR into the piston side A. The additional differential volume is "sucked" out of the compensator via a check valve. Thus, the extension speed can be nearly doubled compared to the "extension of the force traverse". As a result of the area ratios of the differential cylinder, the force generated by pressure is reduced by about half. (For the gear ratio, see page 9)
The cylinder extends in a reduced-force rapid traverse.

Retraction:

Motor direction of rotation counterclockwise, the motor speed according to the speed requirement on the cylinder. The 2/2 directional seat valves VA, VB and VE are switched/energized. The pressure medium is conveyed from the piston side of the cylinder A via the 2/2 directional seat valves VA and VB into the rod sides of the cylinder B. The differential volume from the piston side A is conveyed via the valve VE into the compensator. The cylinder retracts.

Hold force generated by pressure:

The motor is off / de-energized.

The 2/2 directional seat valve VB is switched/energized in order to relieve the rod side of the cylinder B.

The pressure in the piston side of the cylinder A is blocked by the closed 2/2 directional seat valve VA.

The force generated by pressure is held.

If required, the pressure can be adjusted via the by-pass check valve even when the seat valve VA is closed.

Hold traction force:

The motor is off / de-energized.

The 2/2 directional seat valve VA is switched/energized in order to relieve the piston side of the cylinder A.

The pressure in the rod side of the cylinder B is blocked by the closed 2/2 directional seat valve VB.

The traction force is held.

If required, the pressure can be adjusted via the by-pass check valve even when the seat valve VB is closed.

Technical data

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

General							
Design		Closed system					
Actuation		Electric					
Type of connection		Round flange at head					
Installation position		Any					
Ambient temperature range operation	°C	5 ... +40					
Weight	kg	60 ... 130 (configuration dependent)					
Condensation		Not admissible					
Maintenance interval		>10m load cycles					
Protection class according to EN 60529		IP50					
Performance level according to EN ISO 13489-1		Only on request, since configuration-specific					
Hydraulic							
Nominal pressure	bar	225					
Admissible pressure peaks	bar	250					
Compensator pressure	bar	2.5 ... 4.5					
Maximum compensator pressure	bar	13					
Oil volume	l	2 ... 10 (configuration dependent)					
Hydraulic fluid		HLP 46 (Data Sheet 90220)					
Hydraulic fluid temperature range (flown-through)	°C	5 ... +75					
Internal gear pump							
Pump version		C	E	G	I	J	K
Geometric displacement pump per rotation	cm³	3.6	5.2	7.3	9.3	10.4	11.4
Speed	1/min	0 ... 2400					
Maximum permissible motor current in dependence on the pump	A	11.7	16.8	23.6	26.4	29.5	32.3
Synchronous motor							
Motor version		C		D		F	
Nominal power	kW	3.5		4.8		6.2	
Mains voltage (input voltage for converter)	V	400 ... 480					
Maximum link voltage	V DC	560 ... 680					
Voltage tolerance (nominal voltage)	%	+/- 10					
Rated current	A	7.6		10.5		13.8	
Maximum admissible current	A	Depending on the internal gear pump used. See table “Technical data of internal gear pump“					
Rated speed	1/min	2400					
Nominal frequency	Hz	200					
Rated torque	Nm	13.8		19.3		24.8	
Resistance at 20°C	Ω	2.66		1.8		1.4	
Number of poles		10					
D - impedance PH - PH	mH	18		12		10	
Q - impedance PH - PH	mH	28		20		16	
Back EMF	V ms/rpm	137 / 1000					

Technical data

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

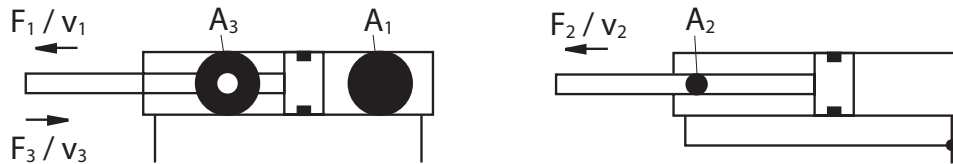
2/2-way screw-in seat valves				
Voltage type			Direct voltage	
Nominal voltage		V	24	
Rated current		A	1.36	
Nominal power		W	32.7	
Duty cycle (ED)		%	100	
Switching time according to ISO 6403	► ON	ms	50 ... 60	
	► OFF	ms	50 ... 60	
Position measurement system				
Electrical connection	► Type of connection	ms	1 x M16 connector (7-pole)	
	► Power consumption	W	1.2 typical	
SSI	► Interface		SSI 24 bit (RS-485/RS-422)	
	► Resolution	µm	0.5	
	► Direction of measurement		Synchronous forward	
	► Data format		Gray	
Pressure transducer				
Supply voltage	► Nominal voltage	VDC	24	
	► Lower limit value (U _S)	VDC	18	
	► Upper limit value (U _S)	VDC	36 ³⁾	
	► Maximum admissible residual ripple	V _{SS}	2.5 (40 ... 400 Hz)	
Current consumption		I _{max}	≤ 12 mA (with voltage output)	
Protection class			III	
Isolation resistance		MΩ	> 100 (500 VDC)	
Measurement range		bar	10	250
Overload protection		bar	20	500
Bursting pressure		bar	200	1000
Output				
Output signal and admissible load R_A	► Current (I _{Sig})	mA	4 ... 20; R_A = (U _S – 8.5 V) / 0.0215 A with R_A in Ω and U_S in V	
Setting time (10 to 90 %)		ms	< 1	
Characteristic curve deviation (corresponds to the measuring deviation according to DIN EN 61298-2)		%	< 0.5 (related to the complete measurement range, including non-linearity, hysteresis, zero point and end value deviation)	
Temperature coefficient (TC) for zero point and range	► Within nominal temperature range	% / 10 K	< 0.1	
	► Outside nominal temperature range	% / 10 K	< 0.2	
Non-repeatability		%	±0.05 ⁴⁾	
Long-term drift (1 year) under reference conditions		%	±0.1	

³⁾ With cCULus max. 30 VDC

⁴⁾ Related to the nominal temperature range

Performance range

Effective cylinder area, force generated by pressure and travel velocity with reduced rapid traverse (version "R")



Area ratio and cylinder force									
Piston	Piston rod	Power class	Area ratio	Areas			Force at 225 bar ³⁾		
				Piston	Rod	Ring	Pressure	Diff.	Pulling
ØAL mm	ØMM mm	kN	ϕ A_1/A_3	A_1 cm ²	A_2 cm ²	A_3 cm ²	F_1 kN	F_2 kN	F_3 kN
40	28	25 (~2.5 t)	1.96	12.56	6.16	6.40	28.26	13.86	14.4
50	36	45 (~2.5 t)	2.08	19.63	10.18	9.45	44.19	22.86	21.29
63	45	70 (~2.5 t)	2.04	31.17	15.90	15.27	70.11	35.78	34.34
80	56	110 (~2.5 t)	1.96	50.26	24.63	25.63	113.09	55.4	57.69
100	70	175 (~2.5 t)	1.96	78.54	38.48	40.06	176.72	86.58	90.14
125	90	275 (~2.5 t)	2.08	122.72	63.62	59.10	276.08	143.15	132.93

³⁾ Theoretical static cylinder force (without consideration of the efficiency and admissible load for attachment parts such as swivel heads, plates, or valves, etc.)

The specified force are maximum forces that are reached briefly during a process cycle at a permissible 2-fold overload of the servo-motor.

This time is determined by the selected maximum speed (displacement of the pump), the application cycle and the ambient temperature. A demanding combination may require the selection of a higher motor efficiency class or higher motor power at the engineering stage.

Thermal load

at maximum force (working pressure 225 bar) and high cyclic load

Thermal load			
Geometric displacement volume [cm ³]	Rated power [kW]		
	3.5	4.8	6.2
3.6	o	–	
5.2	+	o	o
7.3		+	+
9.3		++	+
10.4			++
11.4			++

- Low thermal load
- o Mean thermal load
- +
- ++ Very high thermal load

The thermal load increases with increasing force (with increasing working pressure). The combination of synchronous motor and internal gear pump also influences the thermal load (see table "Thermal load").

High loads over a certain cycle time can lead to an unacceptably high temperature rise and thus lead to shut-off. For system designs with high cycle load, please contact Bosch Rexroth.

Performance range

Nominal maximum velocity [mm/sec]

at 2400 rpm

Extending force traverse v_1							
Geometric displacement volume [cm3]	Pump type	Cylinder size					
		040/028	050/036	063/045	080/056	100/070	125/090
3.6	C	115	73	46	29	18	12
5.2	E	166	106	67	41	26	17
7.3	G	232	149	94	58	37	24
9.3	I	296	190	119	74	47	30
10.4	J	331	212	133	83	53	34
11.4	K	363	232	146	91	58	37

Extending reduced force rapid traverse v_2 (regenerative mode)							
Geometric displacement volume [cm3]	Pump type	Cylinder size					
		040/028	050/036	063/045	080/056	100/070	125/090
3.6	C	225	152	94	56	36	24
5.2	E	325	220	136	81	52	35
7.3	G	456	309	191	114	73	49
9.3	I	581	394	244	145	93	63
10.4	J	650	440	272	162	104	70
11.4	K	713	483	299	178	114	77

Retracting v_3							
Geometric displacement volume [cm3]	Pump type	Cylinder size					
		040/028	050/036	063/045	080/056	100/070	125/090
3.6	C	234	141	91	58	37	23
5.2	E	338	204	131	84	54	33
7.3	G	474	287	184	119	76	46
9.3	I	604	365	234	151	97	58
10.4	J	675	409	262	169	108	65
11.4	K	740	448	287	185	119	72



Notice:

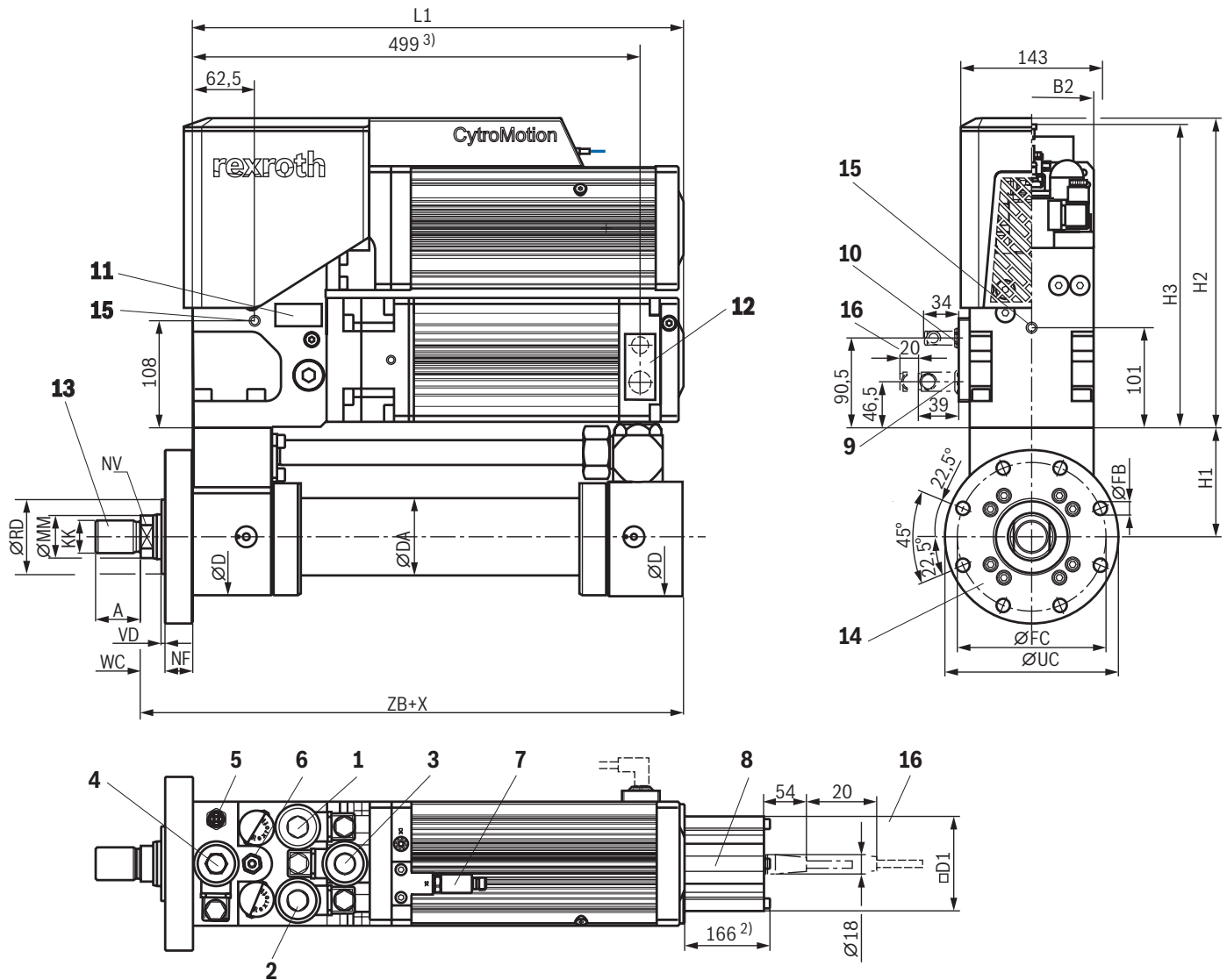
As the pressure increases, the delivery volume and thus the maximum velocity are reduced.

Usually, high travel velocities with simultaneous high pressure are not encountered.

Dimensions:

(Dimensions in mm)

Representation version "D" differential cylinder without position measurement system and "S" with cover



Representation of the "S" version of the differential cylinder with position measurement system, reduced-force rapid traverse "R" and without cover "X"

For **item explanations** and **mounting screws** and see 12.



Notice:

The dimensions are nominal dimensions which are subject to tolerances.

Dimensions:

(Dimensions in mm)

ØAL	ØMM	KK	A	NV	ØD	ØDA	X +2	D1 max	ØRD	WC ±2	VD	NF js13	ZB max	ØFB H13	ØFC js13	ØUC -1	L1 ³⁾
40 ¹⁾	28	M20x1.5	28	22	88	52	Stroke	80	52	22	4	25	239	11	115	138	580
50	36	M27x2	36	27/30	102	62	Stroke	96	63	22	4	25	254	13.5	132	155	619
63	45	M33x2	45	32/30	120	78	Stroke	96	75	25	4	28	299	13.5	150	175	779
80	56	M42x2	56	41/46	145	95	Stroke	96	90	28	4	32	332.5	17.5	180	210	779
100	70	M48x2	63	50/60	170	125	Stroke	96	110	32	5	36	340	22	212	250	779
125	90	M64x3	85	65/75	206	150	Stroke	96	132	36	5	40	396	22	250	290	779

ØAL	B2 ³⁾	H1	H2 ³⁾	H3 ³⁾
40 ¹⁾	125	86.5	312.5	290
50	180	93.5	351.5	345
63	180	113	351.5	345
80	180	127	351.5	345
100	180	138	351.5	345
125	180	155	351.5	345

¹⁾ Piston diameter not standardized²⁾ Only for version "S" (with position measurement system)³⁾ Maximum dimension (largest components with max. stroke 800 mm) For configuration-based dimensions, see Configurator CytroMotion**Item explanations**

- | | |
|---|--|
| <p>1 2/2 directional seat valves VA</p> <p>2 2/2 directional seat valves VB</p> <p>3 2/2 directional seat valves VE</p> <p>4 2/2 directional seat valves VR (only for version "R")</p> <p>5 Pressure transducer SA</p> <p>6 Pressure transducer SB</p> <p>7 Pressure transducer SK</p> <p>8 Position measurement system SW</p> <p>9 Motor connection</p> | <p>10 Resolver connection and motor temperature</p> <p>11 Name plate</p> <p>12 Motor name plate</p> <p>13 Piston rod end: Thread for the CGKD swivel head according to data sheet 17042</p> <p>14 Connection flange, cylinder "MF3" (installation at the head side)</p> <p>15 M10 thread for attachment device 3 x R900003438, RING BOLT DIN580-M10-C15E (included in scope of delivery)</p> <p>16 Space required to remove the connector</p> |
|---|--|

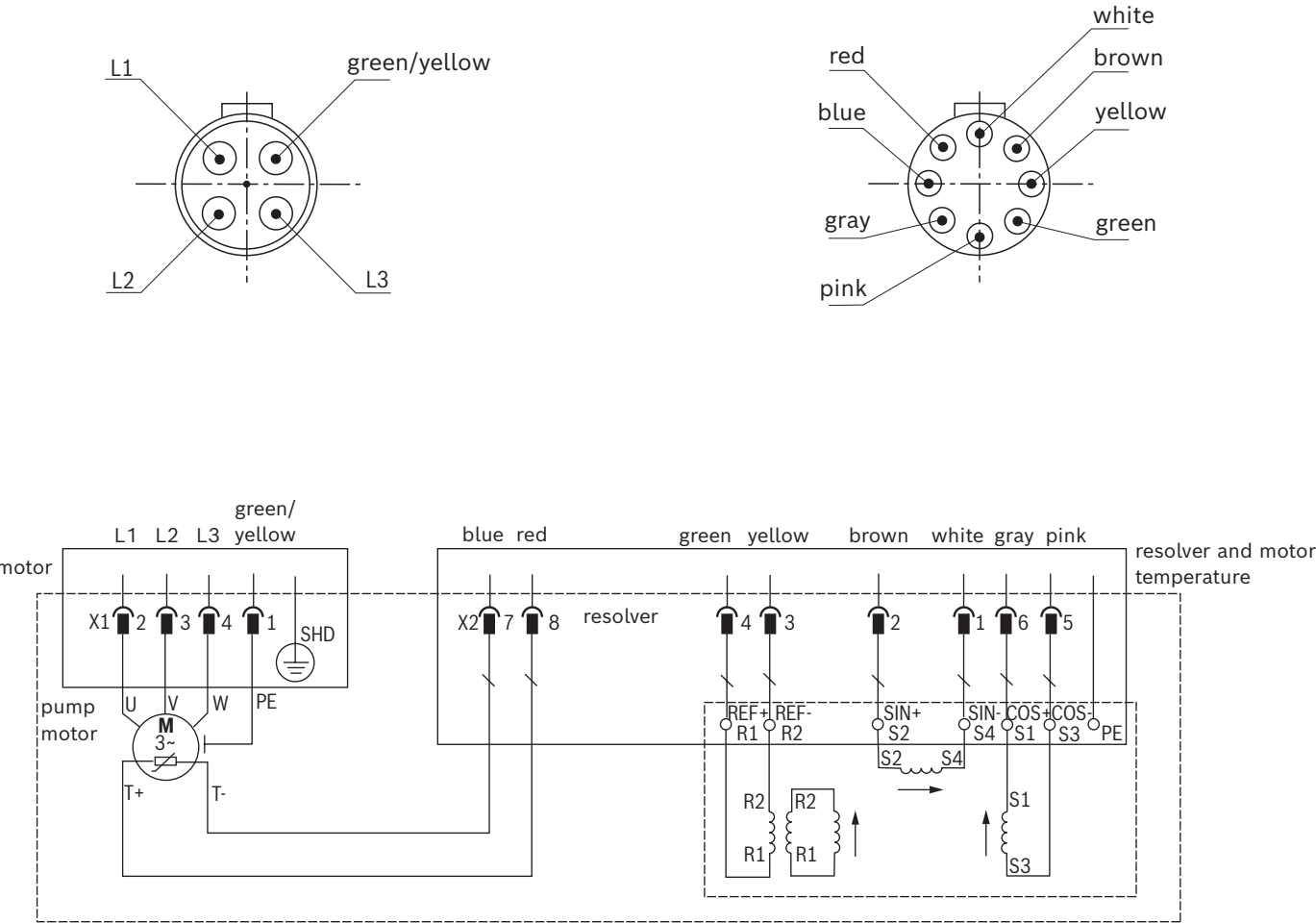
Mounting (see accessories, page 15)

Version	Clamping length	Quantity	Hexagon socket head cap screws ²⁾ (screw length for minimum screw-in depth 1.2 x d)		Torque +/- 5 % ¹⁾
040/028	25	6	HEXAGON SOCKET HEAD CAP SCREW	ISO4762-M10X40-10.9-&	57.5 Nm
	105	2	HEXAGON SOCKET HEAD CAP SCREW	ISO4762-M10X120-10.9&	
050/036	25	6	HEXAGON SOCKET HEAD CAP SCREW	ISO4762-M12X40-10.9-&	100 Nm
	105	2	HEXAGON SOCKET HEAD CAP SCREW	ISO4762-M12X120-10.9&	
063/045	28	6	HEXAGON SOCKET HEAD CAP SCREW	ISO4762-M12X45-10.9-&	100 Nm
	108	2	HEXAGON SOCKET HEAD CAP SCREW	ISO4762-M12X125-10.9&	
080/056	32	6	HEXAGON SOCKET HEAD CAP SCREW	ISO4762-M16X55-10.9-&	245 Nm
	112	2	HEXAGON SOCKET HEAD CAP SCREW	ISO4762-M16X135-10.9&	
100/070	36	6	HEXAGON SOCKET HEAD CAP SCREW	ISO4762-M20X60-10.9-&	480 Nm
	116	2	HEXAGON SOCKET HEAD CAP SCREW	ISO4762-M20X140-10.9&	
125/090	40	6	HEXAGON SOCKET HEAD CAP SCREW	ISO4762-M20X65-10.9-&	480 Nm
	120	2	HEXAGON SOCKET HEAD CAP SCREW	ISO4762-M20X150-10.9&	

¹⁾ Maximum admissible torque of the specified hexagon socket head cap screws²⁾ For the depth of the receiving hole, observe the screw and clamping length!

Electrical connections, assignment – individual connection

Device connector for motor, motor temperature and resolver

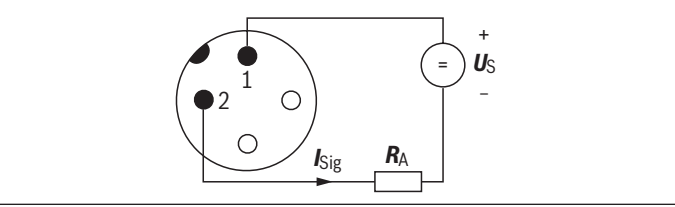


Device connector for 2/2 directional seat valves

Ordering code for connector	Top view	Circuit diagram	Pin	Connections, assignment
Connector 3-pole (2 + PE) according to DIN EN 175301-803			1 2 ⊕	Solenoid coil, polarity-independent Grounding

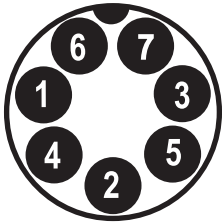
Electrical connections, assignment – individual connection

Device connector for pressure transducer, 4-pole, M12 x 1



Device connector for position measurement system

(View to pin side)



Pin	Cable	Function
1	gray	Data (-)
2	pink	Data (+)
3	yellow	Clock (+)
4	green	Clock (-)
5	brown	+12 ... 30 VDC ±20% (9.6 ... 36 VDC)
6	white	DC ground (0 V)
7	-	Not assigned

Accessories (separate order)

Designation		Version	Material number	Data sheet/standard
Cable set, motor				
ASSEMBLY	CBL-1X/MOT-10W4X02.5	4-pole, angled, 10 m	R901559242	See dimensions on page 11
Resolver cable set and motor temperature				
ASSEMBLY	CBL-1X/CRT-10W8XSPEZ	8-pole, angled, 10 m	R901559243	See dimensions on page 11
Mating connectors for on/off valves				
Mating connector; for valves with device connector, 2-pole + PE, design A		Without circuitry, M16 x 1.5, 12 ... 240 V, "b"	R901017011	08006
		With indicator light, M16 x 1.5, 12 ... 240 V	R901017022	
Mating connectors and cable sets for pressure transducers				
Cable sets		M12 x 1, 4-pole, straight, 2.0 m	R900773031	08006
		M12 x 1, 4-pole, straight, 5.0 m	R900779498	
Mating connectors		M12 x 1, 4-pole, straight, PG 7	R900773042	
Mating connector for position measurement system				
MATING CONNECTOR	7P STC09131D07	M16, 7-pole, straight	R900079551	See dimensions on page 11
Mounting kit ¹⁾ (screw lengths for minimum screw-in depth 1.2 x d)				
ASSEMBLY	MKT-1X/040M10/10.9ZN	Version "040/028" 6x HEXAGON SOCKET HEAD CAP SCREW ISO4762-M10X40-10.9& 2x HEXAGON SOCKET HEAD CAP SCREW ISO4762-M10X120-10.9&	R901564086	ISO 4762
ASSEMBLY	MKT-1X/050M12/10.9ZN	Version "050/036" 6x HEXAGON SOCKET HEAD CAP SCREW ISO4762-M12X40-10.9-& 2x HEXAGON SOCKET HEAD CAP SCREW ISO4762-M12X120-10.9&	R901564085	ISO 4762
ASSEMBLY	MKT-1X/063M12/10.9ZN	Version "063/045" 6x HEXAGON SOCKET HEAD CAP SCREW ISO4762-M12X45-10.9-& 2x HEXAGON SOCKET HEAD CAP SCREW ISO4762-M12X125-10.9&	R901564084	ISO 4762
ASSEMBLY	MKT-1X/080M16/10.9ZN	Version "080/056" 6x HEXAGON SOCKET HEAD CAP SCREW ISO4762-M16X55-10.9-& 2x HEXAGON SOCKET HEAD CAP SCREW ISO4762-M16X135-10.9&	R901564083	ISO 4762
ASSEMBLY	MKT-1X/100M20/10.9ZN	Version "100/070" 6x HEXAGON SOCKET HEAD CAP SCREW ISO4762-M20X60-10.9-& 2x HEXAGON SOCKET HEAD CAP SCREW ISO4762-M20X140-10.9&	R901576969	ISO 4762
ASSEMBLY	MKT-1X/125M20/10.9ZN	Version "125/090" 6x HEXAGON SOCKET HEAD CAP SCREW ISO4762-M20X65-10.9-& 2x HEXAGON SOCKET HEAD CAP SCREW ISO4762-M20X150-10.9&	R901576977	ISO 4762

¹⁾ For the depth of the receiving hole, observe the screw and clamping length!

Further information

CytroMotion

- ▶ Operating instructions

Instructions 62290-B

Electrics

- ▶ Pressure transducer for hydraulic applications
- ▶ Cable sets and valve plugs

Data sheet 30272

Data sheet 08006

Cylinder

- ▶ Mounting elements for hydraulic cylinders

Data sheet 17042