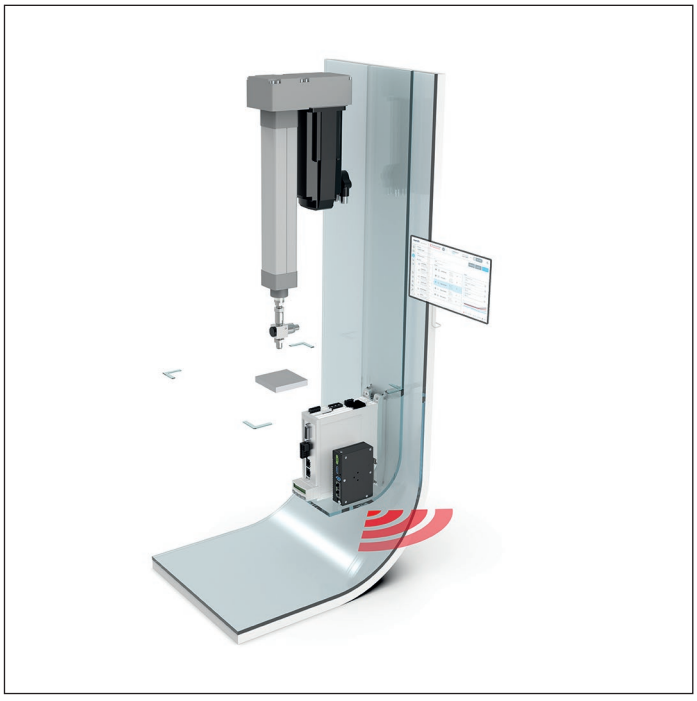
rexroth
A Bosch Company

Smart Function Kit

R999SFTDEN/2020-08



- System consisting of cylinder mechanics, regulator, control system and software to set up automatic program sequences for pressing and joining processes
- Web-based software allows you to set up sequence programs (on the PR21) by way of drag-and-drop movement profile building blocks
- Function of the system: Controlling the position of the piston rod while monitoring the force
- The recording of the force/route allows its evaluation (good/bad) through envelope graphs
- The recording data is available after the program sequence
- Easy start-up using the automatic drive parameterization

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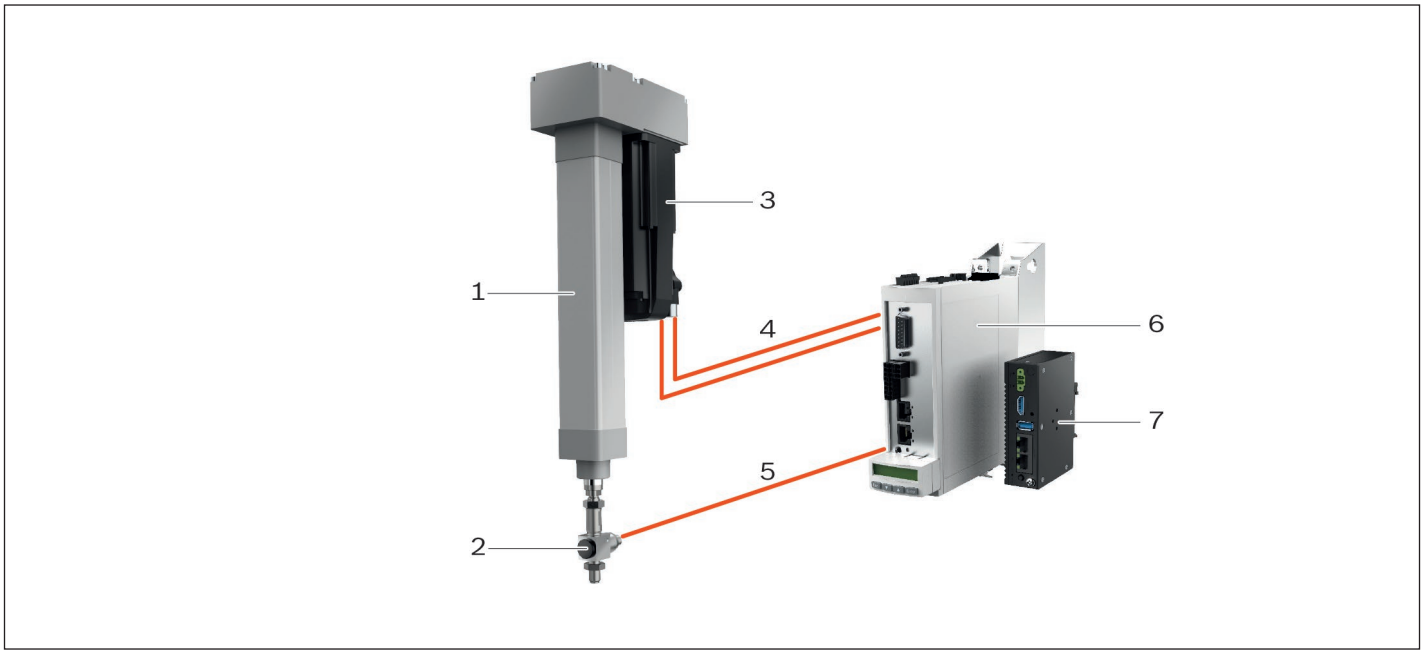
Product description

The Smart Function Kit mechatronic system is suitable for numerous pressing and joining applications.
Preselected mechanical and electrical components and software are combined in various kits for forces from 2 to 30 kN as an ideal basis for system integrators and end users.
The Smart Function Kit can be used as stand-alone solution or incorporated in superior systems via field bus.

Hardware



1) **Electromechanical cylinder EMC** with freely configurable travel up to 400 mm. Parallel or axial motor attachment
2) **Force sensor:** DMS technology for cost-effective and robust force measurement
3) **MS2N Servo Motor:** Latest generation of motors with absolute encoder and brake
4) **Motor cable**
5) **Sensor cable**
6) **IndraDrive HCS01 Drive Controller** with integrated PLC IndraMotion MLD and STO safety function
7) **Industrial PC PR21** with integrated web server

Advantages

- Only communication with the overarching control system requires detailed knowledge of the controls (definition of data transfer and bus interfaces and digital inputs and outputs)
- Total price of the automation components (cost-performance ratio)
- HMI: Visualization via web browser does not require software installation and allows you to display on many devices

Notes

- Currently no force control possible
- No monitoring of forces (tool weight ok)
- Process data can be displayed live via HMI – but are only available for processing after the program sequence in .json format

Software

Thanks to the modern, intuitive web HMIs with modular drag-and-drop process configuration, the software is ready for immediate use, with no previous knowledge required. The straightforward process for the visual generation of all required assessment and analysis elements is practically self-explanatory.

Start-up with auto configuration (Plug & Produce)

- Preinstalled software
- Wizard for easy, fast commissioning
- Automatic loading of the hardware configuration
- Auto parameterization of the drive controller
- Support for commissioning with reference run and jog mode

Simple programming and operation

- Modular process configuration with drag-and-drop
- Logic check of input data
- Simple visual definition of evaluation and analysis elements
- Visualization of process and status information in the dashboard

Analysis and diagnosis via dashboard

- Analysis of force-displacement curves
- Visualization of the process result (OK/NOK)
- Storing of process data for quality assurance in internal database
- Process history with filter and export function
- Diagnostic functions: System parameters as well as status reports and statistics
- Log book with plain text error messages integrated in the software
- Data access via ReST programming interface

Technical data

Smart Function Kit size		002	004	007	012	019	030
EMC size		EMC-040-NN-2	EMC-050-NN-2	EMC-063-NN-2	EMC-080-NN-2	EMC-100-NN-2	EMC-100-XC-2
Travel		35 ... 400 mm	40 ... 400 mm	65 ... 400 mm	80 ... 400 mm	70 ... 400 mm	90 ... 400 mm
Nominal force	**kN**	2	4	7	12	19	30
Maximum force	**kN**	3	6	10	15	20	40
Max. travel speed	**m/s**	0.38	0.32	0.55	0.5	0.37	0.5
Repeatability	**mm**	± 0.01					
Max. piston rod backlash (as new)	**°**	0.32	0.27	0.22	0.16	0.13	

Servo motor

Smart Function Kit size		002	004	007	012	019	030
Size	**Axial motor attachment**	MS2N04-B0BTN	MS2N04-C0BTN	MS2N05-D0BRN	MS2N06-E0BRN	MS2N07-D0BRN	MS2N10-D0BNN
	Motor attachment Parallel	MS2N04-B0BTN	MS2N04-C0BTN	MS2N05-D0BRN	MS2N06-D0BRN	MS2N06-E0BRN	MS2N07-E1BNN
Encoder type		Absolute value encoder					
Brake		With holding brake					

Drive controller (with integrated control system)

Smart Function Kit size				002 / 004		007	012	019	030
Size	**Axial motor attachment**			HCS01.1E-W0008	HCS01.1E-W0013	HCS01.1E-W0028		HCS01.1E-W0054	
	Parallel motor attachment					HCS01.1E-W0028			HCS01.1E-W0054
Mains connection voltage	**1 x AC**			-	110 ... 230 V	-			
	3 x AC			200 ... 500 V	110 ... 230 V	200 ... 500 V			
Maximum current (output-side)	**Axial motor attachment**		**A**	8	13	28		54	
	Parallel motor attachment		**A**			28			54
Continuous input mains current I_{LN} at U_{LN_rated} and P_{DC_cont}	**single-phase, without mains choke**		**A**	-	8.3 [1]	-			
	three-phase, without mains choke	**Motor attachment Axial**	**A**	2.5 A [1]	4,5 [1]	8 [1]		25 [1]	
		Motor attachment Parallel	**A**			8 [1]		25 [1]	
Safety function	**according to EN 61800-5-2**			Safe Torque Off (STO) [2]					
Field bus interface				Profinet, Ethernet/IP, EtherCAT, Sercos III					

[1] The actual phase current on the supply side highly depends on the application (cycle, load case etc.) and must be calculated.
[2] Category 4, Performance Level e according to EN 13849-1 and SIL 3 acc. to EN 62061

Software functions

Smart Function Kit size	002	004	007	012	019	030
Max. number of programs	99					
Number of program steps per program	500					
Number of digital inputs/outputs	6 inputs + 1 output or 7 inputs					
Force measurement	Unlimited recording, without reduction in resolution					
Evaluation elements	Windows, envelope graphs, limit values					
Number of assessment elements	50					
Points per envelope graph	100					
Output of evaluation resultsvia	Digital IOs, field bus, WebHMI, data interface					
Data export via	WebHMI in .json format					
Data interface	ReST API, OPC-UA					

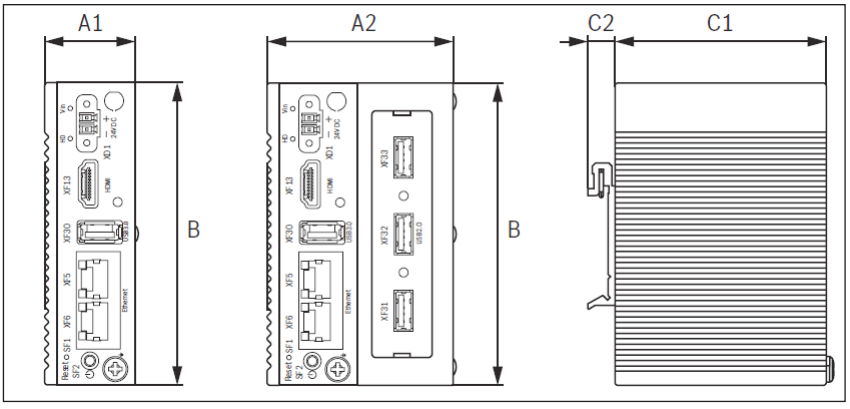
Ambient conditions

Smart Function Kit size		002	004	007	012	019	030
Operation ambient temperature [1]		0 °C ... 50 °C					
IP protection class		Mechanics: Standard IP54 (up to IP65 possible) Control cabinet hardware: IP20					
Duty cycle	%	100					

[1] Output losses from 40°C

Box PC PR21

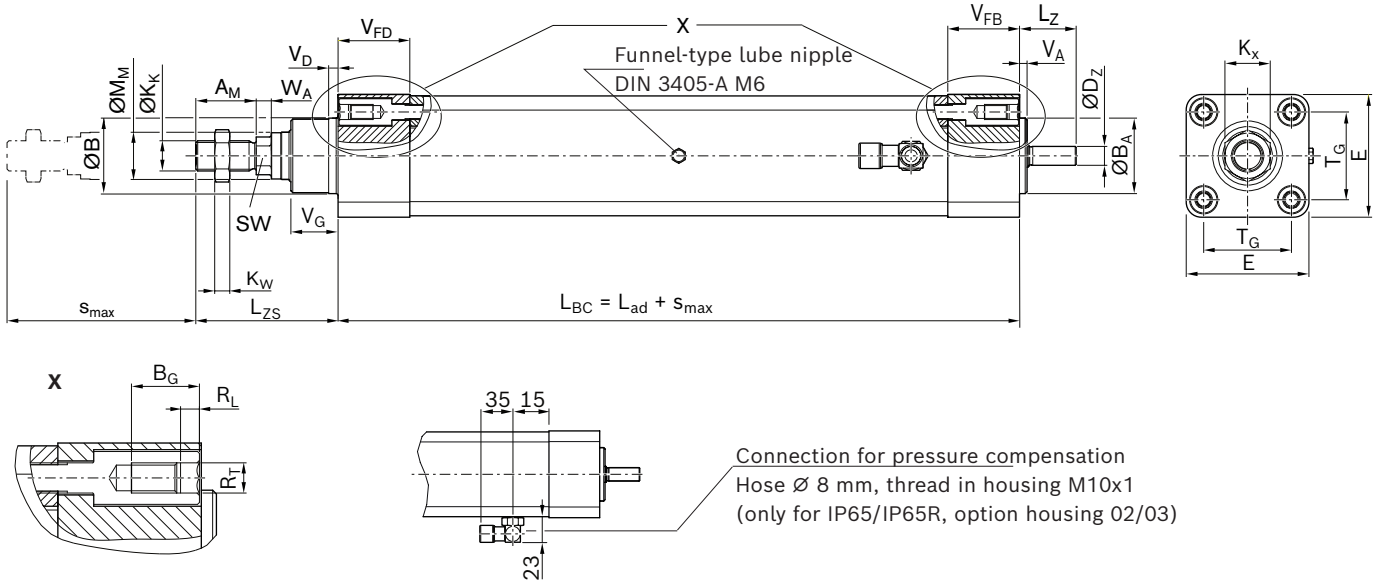
Dimensions		
Type		PR21
A1	mm	30
A2	mm	60
B	mm	100
C1	mm	70
C2	mm	6,5
Mass	kg	0.4



Performance data
-CPU Intel Atom E3815; 1.46 GHz
-GB 4 RAM
-Operating system Linux Ubuntu Core

Electrical specifications
-Power supply voltage V DC 24
-Max. power consumption W 20
-EMC class A
-Buffering RTC internal battery

OF01

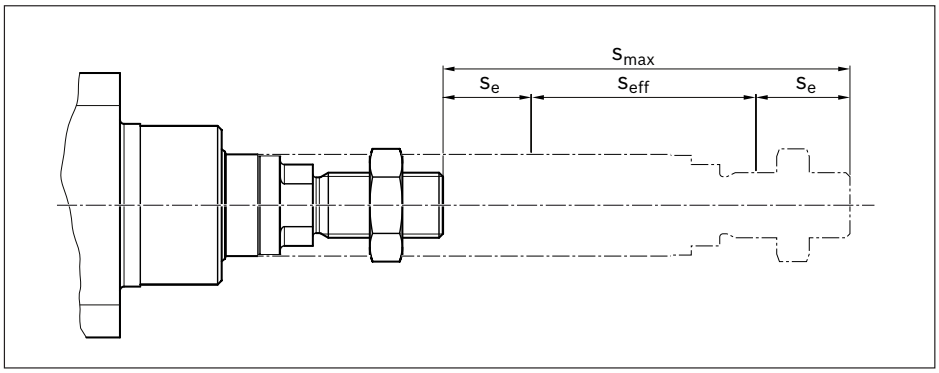


Connection for pressure compensation
Hose Ø 8 mm, thread in housing M10x1
(only for IP65/IP65R, option housing 02/03)

EMC / SPK	Rexroth ball screw assembly	Dimensions (mm)							
	d_0 x P	A_M -0.1	B d11 / B_A h7	$D^{Z\ h7}$	E ±0.1	K_K	K_W	K_X	L_{ZS}
	16 x 5								
40 / 002	16 x 10	24	35	8	53	M12 x 1.25	7	19	61.50
	16 x 16								
	20 x 5								
50 / 004	20 x 10	32	40	10	65	M16x1.5	8	24	76.75
	20 x 20								
	25 x 5								
63 / 007	25 x 10	32	45	15	75	M16x1.5	8	24	76.50
	25 x 25								
	32 x 5								
80 / 012	32 x 10	40	55	18	95	M20x1.5	10	30	94.50
	32 x 20								
	32 x 32								
	40 x 5								
100 / 019	40 x 10	40	65	25	115	M20x1.5	10	30	99.25
	40 x 20								
	40 x 40								
100XC / 030	50 x 10	72	75	32	115	M36 x 2	18	55	144.00
	50 x 20								

Effective stroke

Excess travel must be greater than braking distance. The acceleration travel can be taken as a guideline value for braking distance.



$$s_{eff} = s_{max} - 2 \cdot s_e$$

s_e	=	Excess travel	(mm)
s_{eff}	=	Effective stroke	(mm)
s_{max}	=	Maximum travel	(mm)

Length calculation:

Total length of EMC for motor attachment with flange and coupling = $L_{zs} + s_{max} + L_{ad} + L_f + L_m$

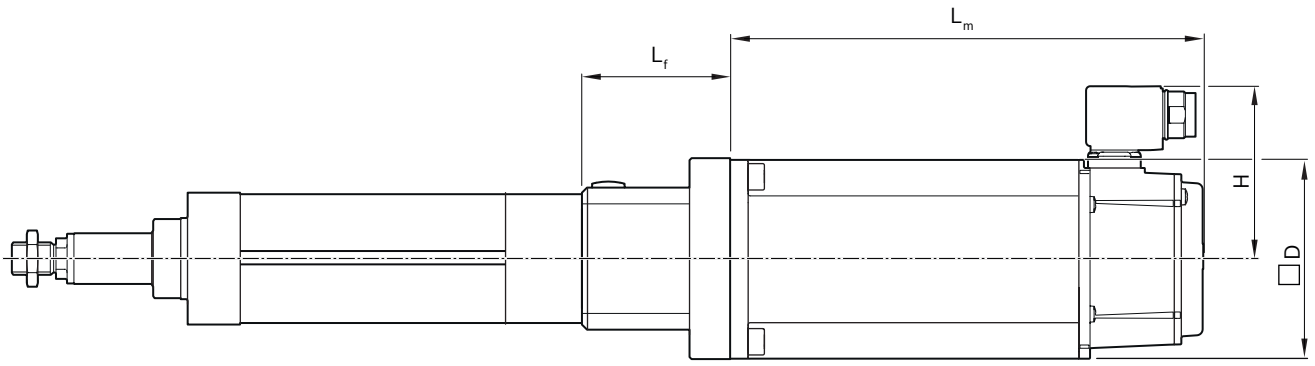
Total length of EMC for motor attachment with belt side drive = $L_{zs} + s_{max} + L_{ad} + G$

(for L_f, L_m and G, see following page)

L_{ad}	L_Z	$M_{M\ f8}$	R_T	B_G	R_L	SW	T_G	V_A ±0.1	V_D	V_{FB}	V_{FD}	V_G ±0.1	W_A
134	25	20	M6	18	4	13	38.0	4	5	33	30	20	6
143													
159													
142	30	25	M8		5	17	46.5			38	38	25	8
161													
180													
148	35	30	M8		5	17	56.5			40			
167													
199													
163	46	38	M10	22	6	22	72.0			44	45	33	10
187													
195													
230													
171	57	50	M10		6	22	89.0			54		38	10
185													
203													
258													
316	62	60	M12	28	7	36	89.0			121	62	38	18
338													

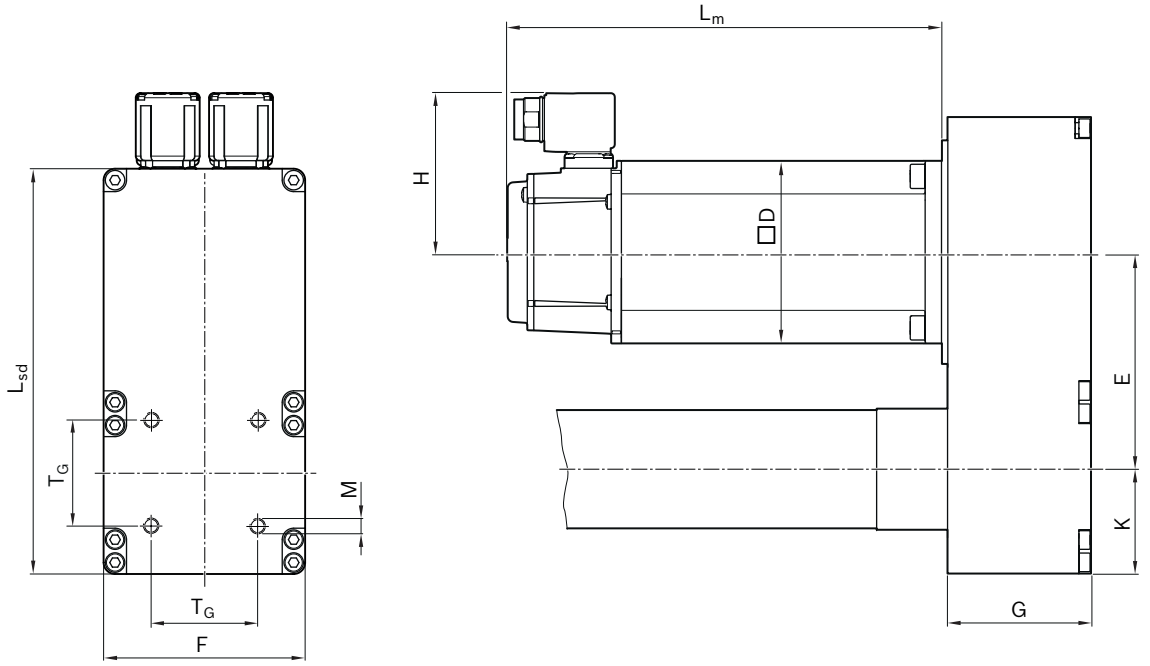
Flange and coupling

MF01



Belt side drive

RV01, RV02, RV03



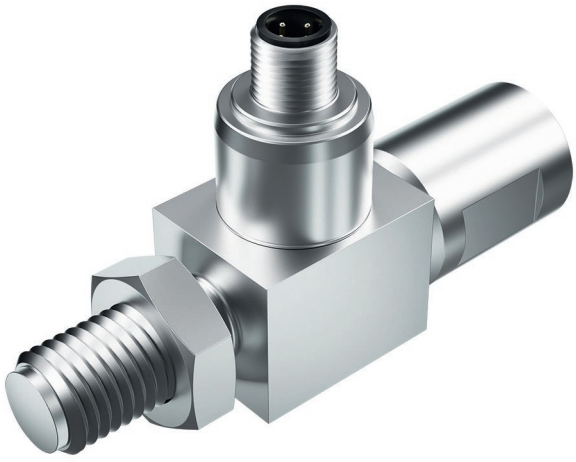
EMC SPK	for motor	i	Dimensions (mm)												
			E	K	G	□D	H	L_m without brake	L_m with brake	L_{sd}	L_f	F	T_G	M	Max. permissible screw-in depth[1]
40 002	MSM031C	1	62.8	33.0	45.5	60	42.0	98.5	135.0	138	61	64.5	38.0	M6	16.0
		1.5	65.3												
	MS2N03B	1	62.8			54	71.5	188.0	213.0						
		1.5	65.3												
	MS2N04	1	82.2	44.0	55.5	82	83.5	185.5	215.5	177		88.0			
		1.5	81.5												
50 004	MSM031C	1	82.2	44.0	55.5	60	43.0	99.0	135.0	177	73	88.0	46.5	M8	16.0
		1.5	81.5												
	MSM041B	1	82.2			80	53.0	112.0	149.0						
		1.5	81.5												
	MS2N04	1	82.2			82	83.5	185.5	215.5						
		1.5	81.5												
	MS2N05	1	117.2	56.0	77.0	96	85.5	203.0	233.0	245		116.0			
63 004	MSM041B	1	117.2	56.0	77.0	80	53.0	112.0	149.0	245	95	116.0	56.5	M8	16.0
		2	116.2												
	MS2N03	1	117.2			82	83.5	185.5	215.5		88				
		2	116.2												
	MS2N05	1	117.2			98	85.5	203.0	233.0		95				
		2	116.2												
	MS2N06	1	117.2			116	98.5	226.0	259.0						
80 012	MS2N05	1	116.2	56.0	77.0	98	85.5	203.0	233.0	245	100	116.0	72.0	M10	16.0
		2	117.2												
	MS2N06	1	149.7	77.0	102.0	116	98.5	226.0	259.0	324		160.0			
		2	151.4												
	MS2N07	1	149.7			140	110.0	292.5	292.5		110				
100 019	MS2N06	1	149.7	77.0	102.0	116	98.5	226.0	259.0	324	119	160.0	89.0	M10	16.0
		2	151.4												
	MS2N07	1	149.7			140	110.0	292.5	292.5						
		2	151.4												
100XC 030	MS2N07	1	174.7	89.0	113.5	140	132.0	352.0	387.0	375	143	197.0	89,0/ 140.0	M12/ M16	24.0
		1.5	175.6												
	MS2N10	1	174.7			192	166.0	410.0	410.0		145				
		1.5	175.6												

[1] Do not exceed max. permissible screw-in depth for "M" threads

Force sensor for Smart Function Kit

Features

- Corrosion-resistant stainless steel version
- High reproducibility
- Easy mounting directly at the EMC piston rod



Technical data

Metrological specifications

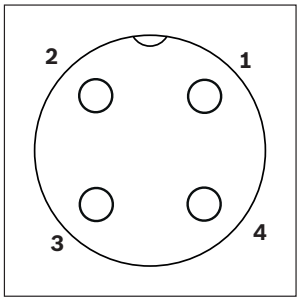
Smart Function Kit Size		002	004	007	012	019	030
Measurement technology		Strain gauge (DMS)					
Compressive force measuring range	kN	3	6	10	15	20	40
Traction force measuring range	kN	0.3	0.6	1			
Protection type		IP67					
Operating load (of measuring range)	%	150					
Breaking load (of measuring range)	%	300					
non-linearity (of measuring range)	%	± 0.3					
Relative creeping (of measuring range)	%	0.1					
Hysteresis (of measuring range)	%	0.1					
Temperature drift zero point (of the measuring range per Kelvin)	%	0.02					
Temperature drift above measuring range (of measuring range per Kelvin)	%	0.02					
Compensated temperature (min ... max)		-20 °C ... +80 °C					
Working temperature (min ... max)		-30 °C ... +80 °C					

Electrical specifications

Smart Function Kit size		002	004	007	012	019	030
Output signal (0kN)		0.909 V ± 0.01			0.625 V ± 0.01	0.476 V ± 0.01	0.244 V ± 0.01
Output signal (measuring range)		0 ... +10 V					
Nominal rating	N/V	330	660	1100	1600	2100	4100
Power supply voltage		14 ... 30 V					
Current consumption		8 mA (24V)					
Bandwidth		1 kHz ± 0.2					
Connector		Plug M12 x 1 4-pin					

Electrical connection

Connection diagram for force measuring bolt



Force sensor

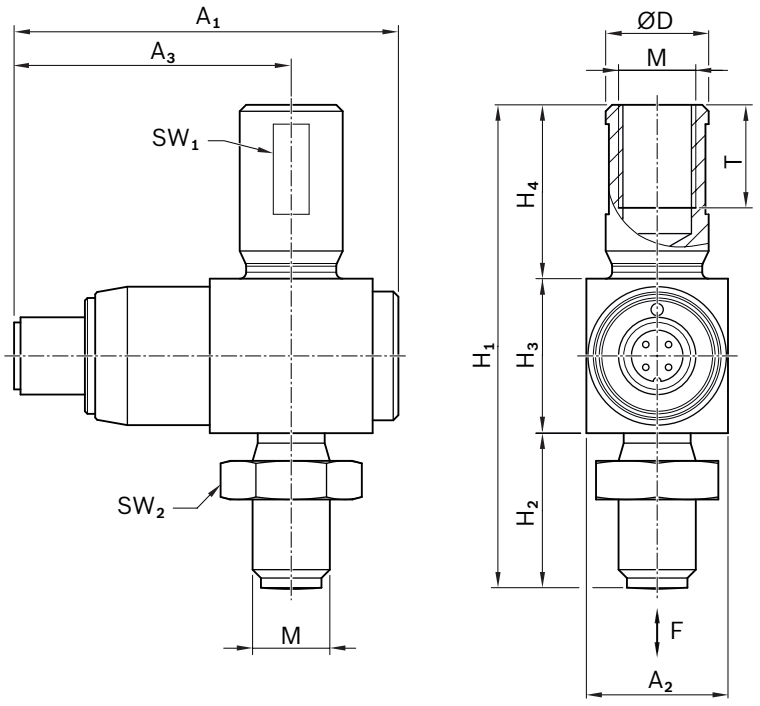
1 supply (+)
2 -
3 GND
4 output

Connection cable

1 brn
2 -
3 blu
4 blk

Connection cable length 15 m;
with M12 plug with free cable ends

Dimensions



Dimensions

Smart Function Kit size		002	004	007	012	019	030
A_1	mm	60					68
A_2	mm	22		26		35	
A_3	mm	43					
ØD	mm	18	24.5		30		50
H_1	mm	75	100		134		185
H_2	mm	24	32		40		57
H_3	mm	24	33		50		
H_4	mm	27	35		44		78
M		M12 x 1.25	M16 x 1.5		M20 x 1.5		M36x2
T	mm	16	23		29		49
SW_1	mm	16	22		26		46
SW_2	mm	19	24		30		55
Tightening torque Nut	Nm	69	166		356		570

Ordering data

Smart Function Kit size	Force sensor material number
002	R156623001
004	R156633001
007	R156643001
012	R156653001
019	R156663001
030	R156673001

Required and supplementary documentation

	Title	Document number	Document type	Included in delivery
	Electromechanical cylinders EMC	R999000473	Catalog	
	Instructions for electromechanical cylinders EMC	R320103102	Instructions	✔
	IndraDrive HCS01 drive control units power units	R911339011	Instructions	
	IndraControl PR21	R911389663	Instructions	
	SMC	R911343864	Manual	
	Smart Function Kit	R320103194	Instructions	
	Smart Function Kit software	R320103208	Instructions	
	Smart Function Kit - Field bus	R320103209	Instructions	
	Smart Function Kit - OPC-UA + REST-API	R320103210	Instructions	

The Rexroth documentation is available for download at www.boschrexroth.com/medienverzeichnis.

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