

Data Sheet | Torque Transducer Series M

Nominal Torque
2 N·m - 10 kN·m



Applications | Key Facts

- ? For static and dynamic torques
- ? Extremely robust and durable
- ? Nominal torque: 2 N·m to 10 kN·m
- ? Accuracy class: 0.05
- ? Fatigue strength: > 100 million load cycles
- ? Non-rotating version
- ? Standard variants or configurable variants for maximum flexibility

Options | Accessories

- ? Optional: second measuring circuit for redundancy from 20 N·m
- ? Fixed cable connection possible in various lengths
- ? Extensive electrical connection options
- ? Tension Torsion combination with Series K force transducer
- ? Special versions also in small quantities (on request)

Technical Data | 2 N·m - 500 N·m

Metrological Data	Rated Torque	M_{nom}	N·m	2	5	10	20	50	100	200	500
	Accuracy class			0.05							
	Torque measurement range		%	1 - 100							
	Linearity error	d_{lin}	%	0.05							
	Interpolation error	f_c	%	0.4							
	Hysteresis	h	%	0.05							
	Reversibility error	v	%	0.2							
	Repeatability (f.s.)		%	0.003							
	Creep		%	0.025							
	Temperature effect on characteristic value per 10 K	TK_C	%/10 K	0.04							
	Temperature effect on zero signal per 10 K	TK_0	%/10 K	0.025							
	Bending moment effect		%/N·m	1·10 ⁻²	4·10 ⁻³	2·10 ⁻³	1·10 ⁻³	4·10 ⁻⁴	2·10 ⁻⁴	1·10 ⁻⁴	4·10 ⁻⁵
	Lateral force effect		%/kN	0.9	0.5	0.3	0.15	0.1	0.05	0.03	0.02
	Axial force effect		%/kN	0.6	0.3	0.2	0.1	0.06	0.04	0.02	0.01
	Characteristic value difference, anticlockwise/clockwise	d_{RL}	%	0.2							
	Electrical Data	Rated characteristic value	C_{nom}	mV/V	1.8	1.6	2				
Characteristic value tolerance		d_c	%	1)		0.2					
Zero signal deviation		$d_{S,0}$	%	0.5							
Input resistance		R_e	Ω	1100 - 1500							
Output resistance		R_a	Ω	800 - 1200							
Insulation resistance		R_{is}	Ω	> 10 ⁹							
Operating range of excitation voltage		$B_{U,G}$	V	5 - 15							
Protection (DIN EN 60529)				IP 54							

1) The individual nominal value is specified on the type plate.

Technical Data | 2 N·m - 500 N·m

Mechanical Data	Rated torsion angle	j_{nom}	rad	0.01			0.018	0.013	0.011	0.009	0.007
	Torsional rigidity	c_T	N·m/rad	200	500	1000	1111	3846	9090	22220	71428
	Mass	m	kg	0.3			0.5		0.6	1.6	
	Fundamental resonant frequency	f_G	kHz	30				40	50	30	40
	Permissible oscillation stress		%	80							
Limits	Torque limit		%	150							
	Breaking torque		%	>300							
	Lateral force limit		kN	2	5	15	25	40	65	100	
	Bending moment limit	M_{bzul}	%	100							
	Axial force limit	F_{azul}	kN	5	10	20	40	60	100	160	
	Rated temperature range	$B_{T,nom}$	°C	10 - 60							
	Operating temperature range	$B_{T,G}$	°C	-40 - +120							

Technical Data | 1 kN·m - 10 kN·m

	Rated Torque	M_{nom}	N·m	1000	1500	2000	2500	3000	4000	5000
Metrological Data	Accuracy class			0.05						
	Torque measurement range		%	1 - 100						
	Linearity error	d_{lin}	%	0.05						
	Interpolation error	f_c	%	0.4						
	Hysteresis	h	%	0.05						
	Reversibility error	v	%	0.2						
	Repeatability (f.s.)		%	0.003						
	Creep		%	0.025						
	Temperature effect on characteristic value per 10 K	TK_C	%/10 K	0.04						
	Temperature effect on zero signal per 10 K	TK_0	%/10 K	0.025						
	Bending moment effect		%/N·m	2·10 ⁻⁵	1·10 ⁻⁵			1·10 ⁻⁵	5·10 ⁻⁶	4·10 ⁻⁶
	Lateral force effect		%/kN	0.01	0.009	0.007		0.006	0.005	0.004
Axial force effect		%/kN	0.01	0.006	0.005		0.004	0.003	0.003	
Characteristic value difference, anticlockwise/clockwise	d_{RL}	%	0.2							
Electrical Data	Rated characteristic value	C_{nom}	mV/V	2						
	Characteristic value tolerance	d_c	%	0.2						
	Zero signal deviation	$d_{S,0}$	%	0.5						
	Input resistance	R_e	Ω	1100 - 1500						
	Output resistance	R_a	Ω	800 - 1200						
	Insulation resistance	R_{is}	Ω	> 10 ⁹						
	Operating range of excitation voltage	$B_{U, G}$	V	5 - 15						
	Protection (DIN EN 60529)			IP 54						

Technical Data | 1 kN·m - 10 kN·m

Mechanical Data	Rated Torque	M_{nom}	N·m	1000	1500	2000	2500	3000	4000	5000
	Rated torsion angle	j_{nom}	rad	0.006	0.0055	0.005		0.004		
	Torsional rigidity	c_T	N·m/rad	1.7·10 ⁵	2.7·10 ⁵	4·10 ⁵		7.5·10 ⁵	1·10 ⁶	1.25·10 ⁶
	Mass	m	kg	4.8				7.6	7.7	7.8
	Fundamental resonant frequency	f_G	kHz	1.5	1.9	2.3		1.5	1.7	1.9
	Permissible oscillation stress		%	80						
Limits	Torque limit		%	150						
	Breaking torque		%	300						
	Lateral force limit		kN	180	200	300		400	500	650
	Bending moment limit	M_{bzul}	%	100						
	Axial force limit	F_{azul}	kN	250	300	400		600	700	850
	Rated temperature range	$B_{T,nom}$	°C	10 - 60						
	Operating temperature range	$B_{T,G}$	°C	-40 - +120						

*) Data on request

Cable Connection



Configurable variants		All standard variants	
Fixed cable connection with open cable ends		Pluggable cable connection ¹⁾²⁾³⁾	
SMC (from 20 N·m): grey Ø 6.5 mm twisted in pairs 3 x 2 x 0.25 mm ² -35 °C to +90 °C FMC (up to 10 N·m): black Ø 2.7 mm 6 x 0.014 mm ² -20 °C to +80 °C		7-pin LEMO Series 0 Female: - Male:	
Connection		Wire colour	Contact
Supply voltage (+)	U _{in+}	Measuring cable type SMC and FMC: blue	3
Supply voltage (-)	U _{in-}	Measuring cable type SMC and FMC: black	2
Measurement signal (+)	U _{out+}	Measuring cable type SMC and FMC: white	1
Measurement signal (-)	U _{out-}	Measuring cable type SMC and FMC: red	4
Sense (+)	Sense+	Measuring cable type SMC and FMC: green	5
Sense (-)	Sense-	Measuring cable type SMC and FMC: grey	6
Shielding		Measuring cable type SMC and FMC: yellow	Housing

1) View on solder side

2) Female LEMO S.A. Typ: EGG.1B.307.CLL; Male: FGG.1B.307.CLA.D72

3) Up to size 10 N·m, the connection socket is routed to the outside with a black measuring cable type FMC | 50 cm | Ø 2.7.

► Pluggable cable connection

All M series transducers series can be equipped with a pluggable LEMO socket (on all measuring circuits selected). Suitable measuring cables S-CAB / C- CAB are available as accessories.



► Plug-in cable connection with shielded measuring cable type SMC (S-CAB-SMC-L-5M-F)

► Fixed measuring cable

All M series transducers can be equipped with permanently mounted measuring cables, e.g. with 5 / 10 m shielded measuring cable type SMC (Ø 6.5 mm, from 20 N·m). Up to 10 N·m, measuring cables of type FMC (Ø 2.7 mm) are used. The cable ends can optionally be with open ends or fitted with various plugs for strain gauge amplifier connections.



► Fixed cable connection with shielded measuring cable type SMC and open cable ends | from 20 N·m

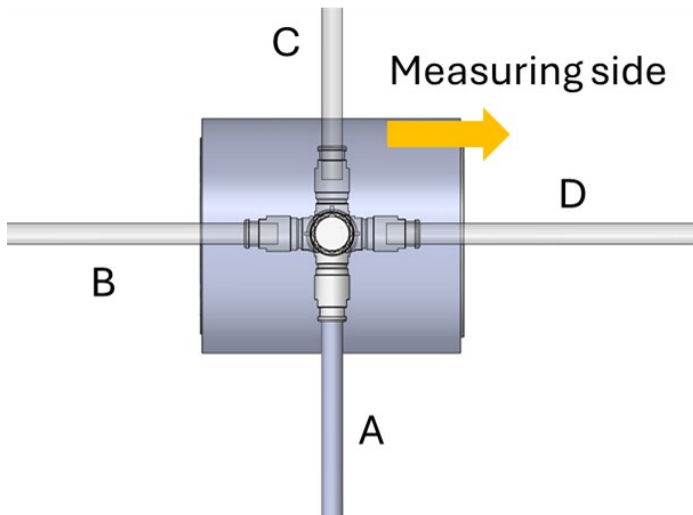


► Outward-facing connection socket up to size 10 N·m



► Fixed cable connection with shielded measuring cable type FMC and open cable ends | up to 10 N·m

Cable Connection



- Note: When using angled 90° plugs, the alignment in the application must be observed. The alignment of the connected 90° angled plug is determined by the C-CAB measuring cable. When using test leads / plugs from other manufacturers, we recommend checking the alignment in advance.

Alignment downwards | alignment A: C-CAB-XXX-LE7A-XXX-XXX

Alignment to the left | alignment B: C-CAB-XXX-LE7B-XXX-XXX

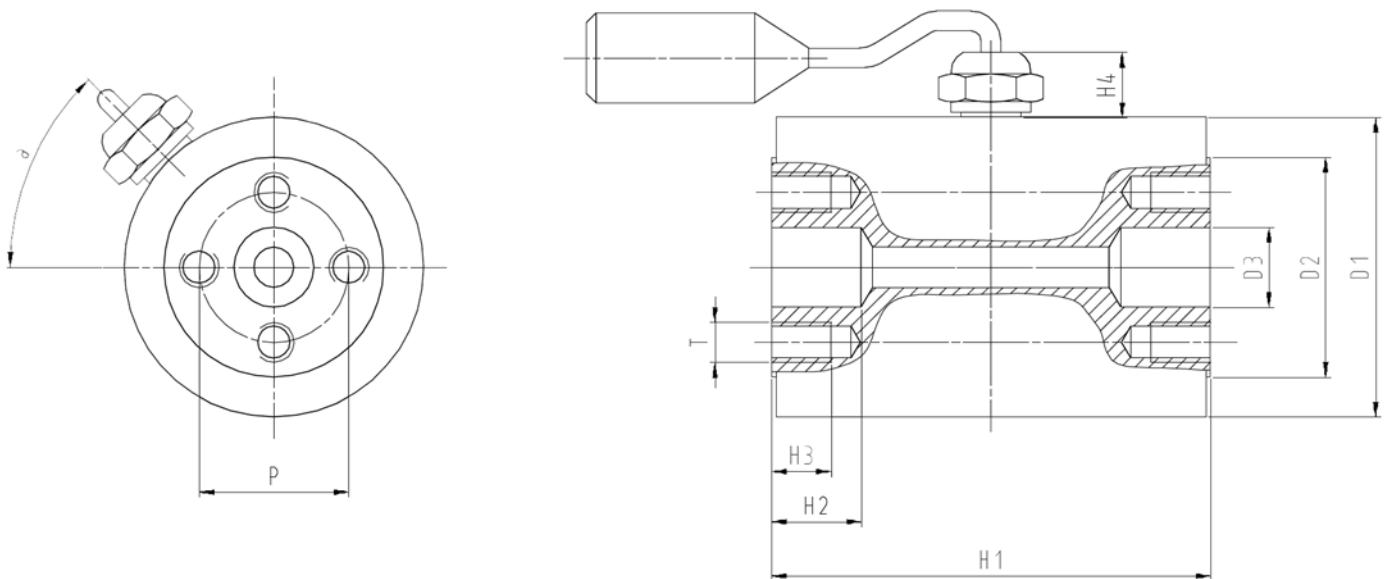
Alignment upwards | alignment A: C-CAB-XXX-LE7C-XXX-XXX

Alignment to the right | alignment B: C-CAB-XXX-LE7D-XXX-XXX

Double Bridge | from 20 N·m

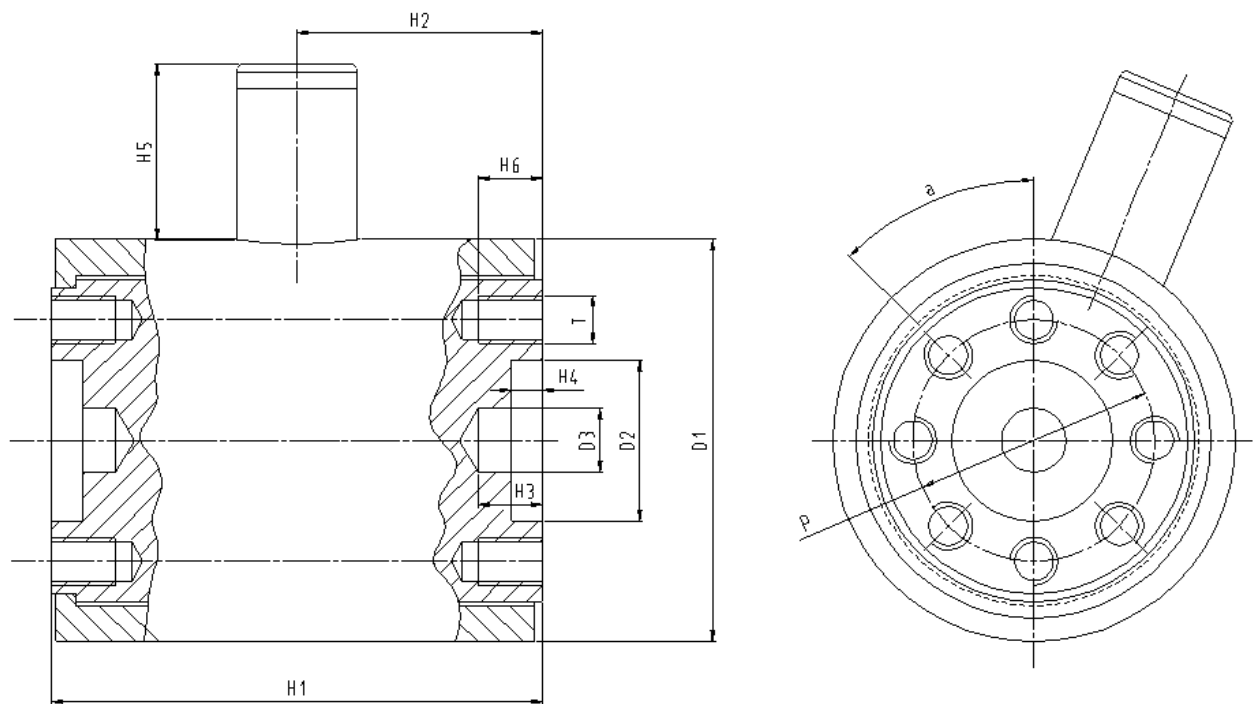
- In the version with double measuring bridge, the technical data apply equally to both measuring circuits.

Dimensions | 2 N·m - 10 N·m



Rated Torque	M_{nom}	N·m	2 ; 5 ; 10
Diameter	$\varnothing D_1$	mm	30
Diameter	$\varnothing D_2$	mm	22
Diameter	$\varnothing D_3$	mm	8 _{H7}
Pitch circle diameter	$\varnothing P$	mm	15
Thread	T_1		M4
Height	H_1	mm	44
Height	H_2	mm	9
Height	H_3	mm	6
Height	H_4	mm	ca. 7
Angle	α		45°

Dimensions | 20 N·m - 10 kN·m



Rated Torque	M_{nom}	N·m	20 50 100	200 500	1000 1500 2000 2500	3000 4000 5000 6000	10000
Diameter	$\varnothing D_1$	mm	50	73	107	141	205
Diameter	$\varnothing D_2$	mm	20 _{H7}	30 _{H7}	45 _{H7}	60 _{H7}	120 _{H7}
Diameter	$\varnothing D_3$	mm	8 _{H8}	10 _{H8}			
Pitch circle diameter	$\varnothing P$	mm	30 ± 0.1	45 ± 0.1	71 ± 0.1	95 ± 0.1	155 ± 0.1
Thread	T_1		M6	M10	M16	M20	M24
Height	H_1	mm	61 -0.1	82 -0.1	107 -0.1	130	170
Height	H_2	mm	30.5	41	54	65	85
Height	H_3	mm	8				12
Height	H_4	mm	4				8
Height	H_5	mm	22				
Height	H_6	mm	8	15	22	25	35
Angle	a		45°				

Order Numbers | Standard Variants

► Torque transducer series M | standard variants

Nominal		Description	Figure (similiar)	Order number
Torque	Signal			
Torque transfer standard series M				
5 N·m	1.6 mV/V	Torque transfer standard series M 5 N·m		S-M-K005
10 N·m	2 mV/V	Torque transfer standard series M 10 N·m		S-M-K010
20 N·m	2 mV/V	Torque transfer standard series M 20 N·m		S-M-K020
50 N·m	2 mV/V	Torque transfer standard series M 50 N·m		S-M-K050
100 N·m	2 mV/V	Torque transfer standard series M 100 N·m		S-M-K100

Note: all standard variants always (1) plug-in version with a connection socket type LEMO 7-pin push-pull | no measuring cables included (2) for nominal torques up to 10 N·m, the LEMO socket is led out with a 0.5 m measuring cable type FMC ø 2.7 mm

Order Numbers | Configurable Variants

► Torque transducer series M | configurable variants

Item	Code	Description
Torque Transducer Series M	C-DR	Configurable Torque Transducer Series M
Nominal Torque	K002	2 N·m
	K005	5 N·m
	K010	10 N·m
	K020	20 N·m
	K050	50 N·m
	K100	100 N·m
	K200	200 N·m
	K500	500 N·m
	1K00	1.000 N·m
	1K50	1.500 N·m
	2K00	2.000 N·m
	2K50	2500 N·m
	4K00	4.000 N·m
	6K00	6.000 N·m
	10K0	10.000 N·m
Single or double measuring bridge	SB	Single bridge
	DB	Double bridge
Bending moment measuring circuits Mx, My	NO	No bending moment measuring circuits Mx, My
Temperature range	S	Standard temperature range +10°C – +60°C
Electrical transducer connection (for all selected measuring circuits)	P	LEMO female plug(s) selected 7-pole push-pull straight
	A	5 m straight fixed standard measuring cable type SMC (from 20 N·m) type FMC up to 10 N·m on all measuring circuits
	B	10 m straight fixed standard measuring cable type SMC (from 20 N·m) type FMC up to 10 N·m on all measuring circuits
Cable connection type (for all selected measuring circuits)	P	LEMO female plug(s) no permanently mounted measuring cable(s)
	F	Free cable ends on all measuring circuits
	A	D-Sub 9-pole plug on all measuring circuits
	B	D-Sub 15-pole plug on all measuring circuits
	C	MS 7-pole plug on all measuring circuits
	D	HD-Sub 15-Pol plug on all measuring circuits

Order-Example

C	M	- K100	- SB	- NO	- S	- P	- P
		100 N·m	single bridge	No bending moment circuits Mx, My	standard temperature range	LEMO socket(s)	LEMO socket(s)

Order Numbers | Configurable Variants | Glossary

Item	Description
Single or double measuring bridge	For redundancy reasons, it is necessary in safety-relevant applications, for example, to check the safety-relevant integrity of the measurement signal using a second measurement bridge (functional redundancy in the same torque transducer). Two torque transducer output signals are processed and analysed independently of each other via two separate measuring amplifier channels. This makes it possible to connect two measuring amplifiers with different characteristics (DC / TF). The second redundant measuring circuit is characterised by no crosstalk between the channels with different carrier frequencies. Notes: 1. The selection of a double measuring bridge has an effect on the number of connection sockets and measuring cables (if selected). 2. The double measuring bridge can be selected from 20 N·m
Bending moment measuring circuits Mx, My	The M series torque transducer can be equipped with bending moment measuring circuits on request. The additional bending moment measuring circuits can be measured to check the horizontal bending moments Mx and My and made available as separate channels. Notes: 1. The selection of bending moment measuring circuits has an effect on the number of connection sockets.
Temperature range	S = Standard temperature range -10°C – +60°C
Electrical transducer connection	The M series torque transducer can be configured with fixed push-pull connection sockets or fixed measuring cables in different lengths. P = LEMO connection socket(s) 7-pin push-pull A = 5 m straight fixed standard measuring cable type SMC (from 20 N·m) type FMC up to 10 N·m on all measuring circuits B = 10 m straight fixed standard measuring cable type SMC (from 20 N·m) type FMC up to 10 N·m on all measuring circuits Notes: 1. The number of connection sockets or measuring cables depends on the number of measuring bridges selected. 2. Connection socket 2.1 Up to 10 N·m, the connection socket is routed to the outside with a black measuring cable type FMC 50 cm Ø 2.7 mm. 3. Fixed measuring cable: 3.1 Up to 10 N·m, a measuring cable type FMC is used. 3.2 From 20 N·m, a measuring cable type SMC is used. 4. When using 90° angle plugs, the orientation of the plugs is determined via the C-CAB. 4.1 Alignment downwards Alignment A: C-CAB-XXX-LE7A-XXX-XXX 4.2 Alignment to the left Alignment B: C-CAB-XXX-LE7B-XXX-XXX 4.3 Alignment upwards Orientation A: C-CAB-XXX-LE7C-XXX-XXX 4.4 Alignment to the right Alignment B: C-CAB-XXX-LE7D-XXX-XXX
Cable connection type	If the M series torque transducer is configured with fixed measuring cables, different connector types for strain gauge measuring amplifiers can be selected in addition to open cable ends. The selected connectors are assembled by GTM. The torque transducer can be connected directly to a measuring amplifier. P = LEMO push-pull connection socket(s) no fixed measuring cable(s) F = Free cable ends on all configured measuring circuits A = D-Sub 9-pin on all configured measuring circuits B = D-Sub 15-pin on all configured measuring circuits C = MS 7-pin on all configured measuring circuits D = HD-Sub 15-pin connector on all configured measuring circuits M = M12 8-pin on all configured measuring circuits Notes: 1. Up to 10 N·m, the connection socket is routed to the outside with a black measuring cable type FMC 50 cm Ø 2.7 mm.

Order Numbers | Accessories

Description	Order number
Measuring cable	
Standard measuring cable grey 5 m shielded and twisted in pairs cable sheath Ø 6.5 mm 6-wire technology transducer connection: straight plug (male) type LEMO 7-pole push-pull cable end amplifier: open	S-CAB-SMC-L-5M-F
Standard measuring cable grey 10 m shielded and twisted in pairs cable sheath Ø 6.5 mm 6-wire technology transducer connection: straight plug (male) type LEMO 7-pole push-pull cable end amplifier: open	S-CAB-SMC-L-10M-F
Standard measuring cable grey 15 m shielded and twisted in pairs cable sheath Ø 6.5 mm 6-wire technology transducer connection: straight plug (male) type LEMO 7-pole push-pull cable end amplifier: open	S-CAB-SMC-L-15M-F
Standard measuring cable grey 5 m double shielded and twisted in pairs cable sheath Ø 2.7 mm 6-wire technology transducer connection: straight plug (male) type LEMO 7-pole push-pull (male) cable end amplifier: open	S-CAB-SMC-LE7A-5M-F
Double-shielded measuring cable yellow 5 m double shielded and twisted in pairs cable sheath Ø 6.5 mm 6-wire technology transducer connection: straight plug (male) type LEMO 7-pole push-pull (male) cable end amplifier: open	S-CAB-DMC-L-5M-F
Temperature-resistant measuring cable red 5 m shielded and twisted in pairs cable sheath Ø 7.2 mm 6-wire technology transducer connection: straight plug (male) type LEMO 7-pole push-pull (male) cable end amplifier: open	S-CAB-TMC-L-5M-F
Double-shielded measuring cable yellow 5 m double shielded and twisted in pairs cable sheath Ø 6.5 mm 6-wire technology transducer connection: straight plug (male) type LEMO 7-pole push-pull (male) cable end amplifier: D-Sub 9 pol assembled	S-CAB-DMC-L-5M-DS09
Standard measuring cable grey 5 m shielded and twisted in pairs cable sheath Ø 6.5 mm 6-wire technology transducer connection: straight plug (male) type LEMO 7-pole push-pull cable end amplifier: D-Sub 15 pol 2-row assembled	S-CAB-SMC-L-5M-DS15
Standard measuring cable grey 10 m shielded and twisted in pairs cable sheath Ø 6.5 mm 6-wire technology transducer connection: straight plug (male) type LEMO 7-pole push-pull cable end amplifier: D-Sub 15 pol 2-row assembled	S-CAB-SMC-L-10M-DS15
Configurable measuring cable type SMC, DMC, TMC, FMC in different lengths with different connectors. Note: when using 90° angle plugs, the orientation of the plugs is determined by the C-CAB. 1. Alignment downwards alignment A: C-CAB-XXX-LE7A-XXX-XXX 2. Alignment to the left alignment B: C-CAB-XXX-LE7B-XXX-XXX 3. Alignment upwards alignment A: C-CAB-XXX-LE7C-XXX-XXX 4. Alignment to the right alignment B: C-CAB-XXX-LE7D-XXX-XXX	C-CAB-...