

Data Sheet | Force Transducer Series RF

Nominal Force
25 kN – 10 MN



Key Facts

- ▶ Applications: materials testing | component and structural testing | industrial quality and process control
- ▶ Compressive and tensile forces, static and dynamic
- ▶ Very good overforce tolerance | especially resistant to any traverse forces and bending moments | simple assembly, diverse adaption options
- ▶ Accuracy class: 0.05
- ▶ Force introduction via flange
- ▶ Fatigue and long-term stability | cycles: > 100 million cycles^{*note amplitude}
- ▶ Standard or configurable variants for maximum flexibility

Options | Accessories

- ▶ Optional inner through hole
- ▶ Optional plug protection
- ▶ Nominal characteristic values depending on requirement and nominal force 2 / 1 / 1.6 mV/V
- ▶ Optional second axial measuring circuit for redundancy
- ▶ Optional bending measuring circuits Mx, My
- ▶ Optional extended temperature range from -40° to 180 °C
- ▶ Comprehensive electrical connection options
- ▶ Special variants also in small quantities

Technical Data | 25 – 630 kN

Nominal force compression/tension		$\pm F_{nom}$	kN	25	50	63	100	200	250	300	400	500	630		
Metrological Data	Accuracy class			0.05											
	Force measurement range		%	1 - 100											
	Linearity error	d_{lin}	%	0.05											
	Interpolation error	f_c	%	0.4											
	Hysteresis	h	%	0.1											
	Reversibility error	v	%	0.5											
	Repeatability (f.s.)		%	0.005											
	Creep		%	0.025											
	Temperature effect on characteristic value per 10 K	TK_C	%/10 K	0.05											
	Temperature effect on zero signal per 10 K	TK_0	%/10 K	0.05											
	Eccentricity effect		%/mm	0.02											
	Lateral force effect		%/(0,1·F _{nom})	0.2											
	Torque effect		%/(mm·F _{nom})	0.005											
	Characteristic value difference, tension/compression force	d_{ZD}	%	1											
	Electrical Data	Rated characteristic value	C_{nom}	mV/V	1				2 ³⁾						
Characteristic value tolerance		d_c	%	0.4				0.2							
Zero signal deviation		$d_{S,0}$	%	1				0.5							
Input resistance		R_e	Ω	ca. 750											
Output resistance		R_a	Ω	ca. 500					ca. 750						
Insulation resistance		R_{is}	Ω	>10 ⁹											
Operating range of excitation voltage		$B_{U,G}$	V	5 - 12											
Protection (DIN EN 60529)				IP 68 ²⁾					IP 50 ¹⁾ ; IP 68 ²⁾						

Technical Data | 25 – 630 kN

Mechanical Data	Nominal force compression/tension	$\pm F_{nom}$	kN	25	50	63	100	200	250	300	400	500	630
	Rated Displacement	s_{nom}	mm	0.07			0.1			0.2			
	Spring rigidity	c_{ax}	kN/mm	350	700	900	1000	2000	2500	1500	2000	2500	3000
	Mass	m	kg	0.5			3			7.1	7.5	8	8.5
	Proportionate moving mass	m_{mess}	kg	0.25			1.5			4.5			
	Fundamental resonant frequency	f_G	kHz	>9			>5			>4			
	Permissible oscillation stress ³⁾		%	± 80									
Limits	Force limit		%	150									
	Breaking force		%	300									
	Lateral force limit		%	80									
	Permissible eccentricity	e_G	mm	30			40			50			
	Bending moment limit	M_{bzul}	kN·m	1	2	4	6	11	14	24	33	40	49
	Rated temperature range	$B_{T,nom}$	°C	10 - 60									
	Operating temperature range	$B_{T,G}$	°C	-10 – +80									

1) Plug -in connection

2) Permanent connection

3) Rated characteristic value 16mV/V with permissible oscillation stress ± 100% available on request.

Technical Data | 1 - 10 MN

Nominal force compression/tension		$\pm F_{nom}$	MN	1	1.2	1.5	2	2.5	3	4	5	6	7	8	10
Metrological Data	Accuracy class			0.05											
	Force measurement range		%	1 - 100											
	Linearity error	d_{lin}	%	0.05											
	Interpolation error	f_c	%	0.4						0.5					
	Hysteresis	h	%	0.1											
	Reversibility error	v	%	0.5											
	Repeatability (f.s.)		%	0.005											
	Creep		%	0.025											
	Temperature effect on characteristic value per 10 K	TK_C	%/10 K	0.05											
	Temperature effect on zero signal per 10 K	TK_0	%/10 K	0.05											
	Eccentricity effect		%/mm	0.02											
	Lateral force effect		%/(0,1·F _{nom})	0.2											
	Torque effect		%/(mm·F _{nom})	0.005											
	Characteristic value difference, tension/compression force	d_{ZD}	%	1											
	Electrical Data	Rated characteristic value ³⁾	C_{nom}	mV/V	2										
Characteristic value tolerance		d_c	%	0.2						0.4					
Zero signal deviation		$d_{S,0}$	%	0.5						1					
Input resistance		R_e	Ω	app. 750											
Output resistance		R_a	Ω	appr. 750											
Insulation resistance		R_{is}	Ω	>10 ⁹											
Operating range of excitation voltage		$B_{U,G}$	V	5 - 12											
Protection (DIN EN 60529)				IP 50 ¹⁾ ; IP 68 ²⁾											

Technical Data | 1 - 10 MN

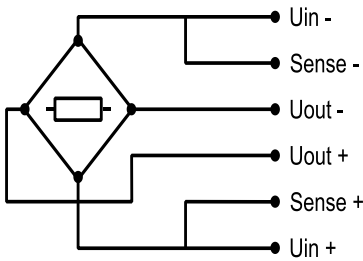
		Nominal force compression/tension	$\pm F_{nom}$	MN	1	1.2	1.5	2	2.5	3	4	5	6	7	8	10	
Mechanical Data	Rated Displacement	s_{nom}	mm	0.2		0.3			0.4		0.6		0.7	0.8	0.7		
	Spring rigidity	c_{ax}	MN/mm	5	6	5	6.7	8	7.5	10	8.3	10	10	10	10	14	
	Mass	m	kg	19		46			81	207	285	295	291	298	490		
	Proportionate moving mass	m_{mess}	kg	9.5		23			41	104	143	148	145	149	245		
	Fundamental resonant frequency	f_G	kHz	>3		>2			>1		~1						
	Permissible oscillation stress ³⁾		%	±80													
	Force limit		%	150													
Breaking force		%	300														
Lateral force limit		%	100														
Permissible eccentricity	e_G	mm	50						75	100							
Bending moment limit	$M_{b,zul}$	kN·m	92	112	140	200	240	520	1000	1250	1500	1500	1500	1500	3000		
Rated temperature range	$B_{T,nom}$	°C	+10 - +60														
Operating temperature range	$B_{T,G}$	°C	-10 - +80														

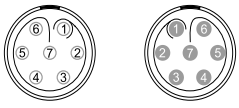
1) Plug-in connection

2) Permanent connection

3) Rated characteristic value 16 mV/V with permissible oscillation stress ±100% available on request.

Cable Connection



configurable variants	all standard variants
Permanent connection end not connected	Connection pluggable ¹⁾²⁾³⁾
SMC: grey Ø 6.5 mm twisted in pairs 3 x 2 x 0.25 mm ² -35 °C to +90 °C	7-pin LEMO Series 1 Female: - Male:
TMC (≥ 100 kN): red Ø 7,2 mm twisted in pairs 3 x 2 x 0.25 mm ² -50 °C to +180 °C	
TMC (25 - 63 kN)⁴⁾: white Ø 2 mm -196 °C to +200 °C	

Connection		Wire colour	Pin
Supply voltage (+)	U_{in+}	SMC: blue TMC (red): white TMC (white): blue	3
Supply voltage (-)	U_{in-}	SMC: black TMC (red): brown TMC (white): black	2
Measurement signal (+)	U_{out+}	SMC: white TMC (red): grey TMC (white): white	1
Measurement signal (-)	U_{out-}	SMC: red TMC (red): pink TMC (white): red	4
Sense (+)	$Sense+$	SMC: green TMC (red): green TMC (white): green	5
Sense (-)	$Sense-$	SMC: grey TMC (red): yellow TMC (white): grey	6
Shielding		SMC: yellow TMC (red): black TMC (white): yellow	Housing

1) View too weldingside

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

3) In the nominal force 25 - 63 kN, the connection sockets are led to the outside with a black measuring cable type FMC | 30 cm | Ø 2.9. let outwards. □

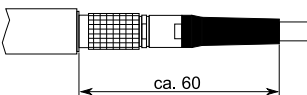
4) In the nominal force 25 - 63 kN, fixed high/low temperature measuring cables TMC = white cable with a temperature range: -196 °C to +200 °C.

► Pluggable cable connection

All standard variants of the series RF are equipped with a pluggable LEMO socket. Suitable measuring cables S-CAB / C-CAB are available as accessories.

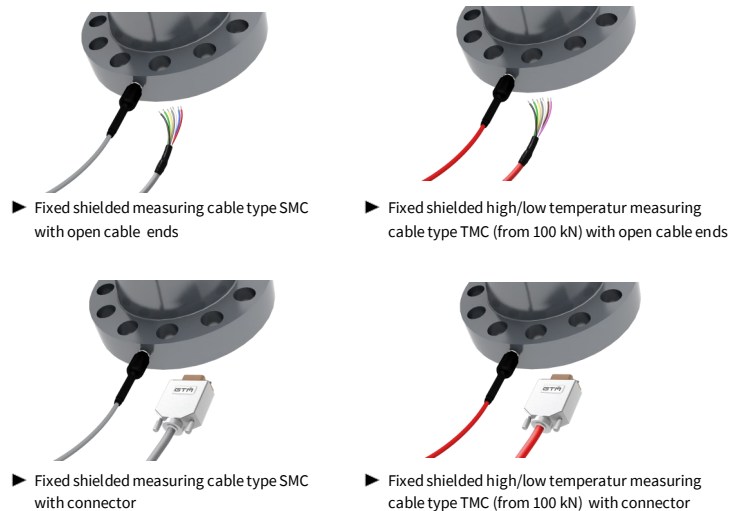


► Plug-in cable connection with shielded measuring cable type SMC (S-CAB-SMC-L-5M-F)



► Fixed measuring cable

All configurable variants of the series RF are optionally available with fixed measuring cables, e.g. with 5 / 10 / 15 m shielded standard measuring cable type SMC or 5 / 10 m high / low temperature measuring cables TMC and open cable ends or various connectors for strain gauge measuring amplifier connections.



Double Bridge | 2nd Measuring Circuit

► For the double measuring bridge (alternatively: two or three measuring circuits), the technical data apply equally to both measuring circuits.



Standard force transducer series RF
Single bridge | 1 x LEMO push-pull connection sockets female).



Configurable force transducer series RF
Double bridge | 1 x LEMO push-pull connection sockets female).

Bending Moment Measuring Circuits

► The bending moment measuring circuits Mx and My can be used advantageously with the use of a multi-channel measuring amplifier to control the force application. Combination bending moments and double bridge on request.



► **Configurable force transducer series RF**
Single bridge | bending moment measuring circuits Mx, My | 3 x LEMO push-pull connection sockets (female).

Nominal Force	F_{nom}	kN	25 - 63 (1 mV/V)	100 - 500 (2 mV/V)
Rated bending moment	Mb_{nom}	N·m	$F_{nom} \cdot 10 \text{ mm}$	
Reproducibility		%	0.01	
Temperature effect on characteristic value per 10 K	TK_C	%/10 K	0.2	
Temperature effect on zero signal per 10 K	TK_0	%/10 K	0.2	
Rated characteristic value	C_{nom}	mV/V	1)	
Input resistance	R_e	Ω	400	
Operating range of excitation voltage	$B_{U,G}$	V	12	

1) Specification shown on the label

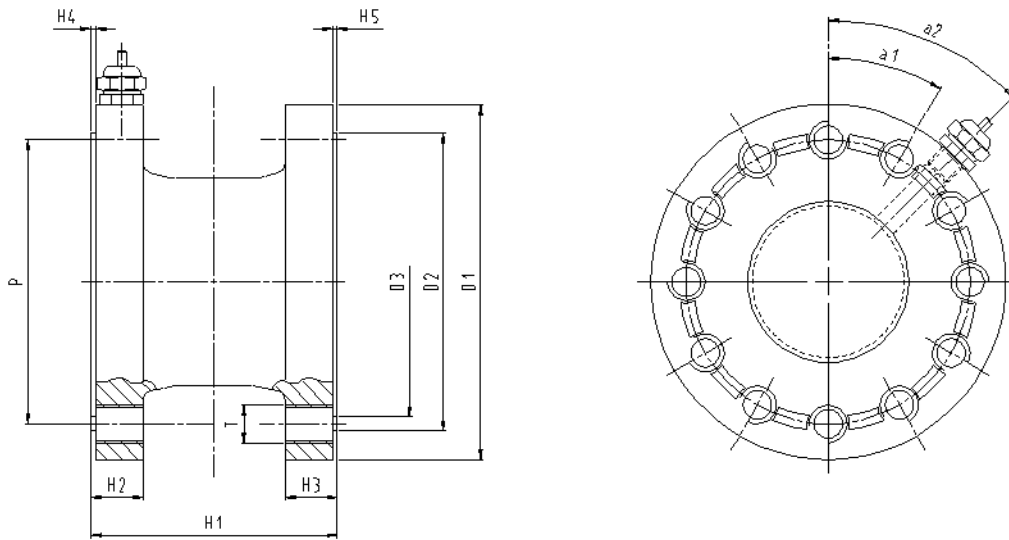
Inner Through Hole | from 100 kN

- ▶ In special cases, it may be necessary that design conditions require an inner through hole through the force transducer series RF. From the nominal force of 100 kN, the RF force transducers can optionally be equipped with an inner through hole.



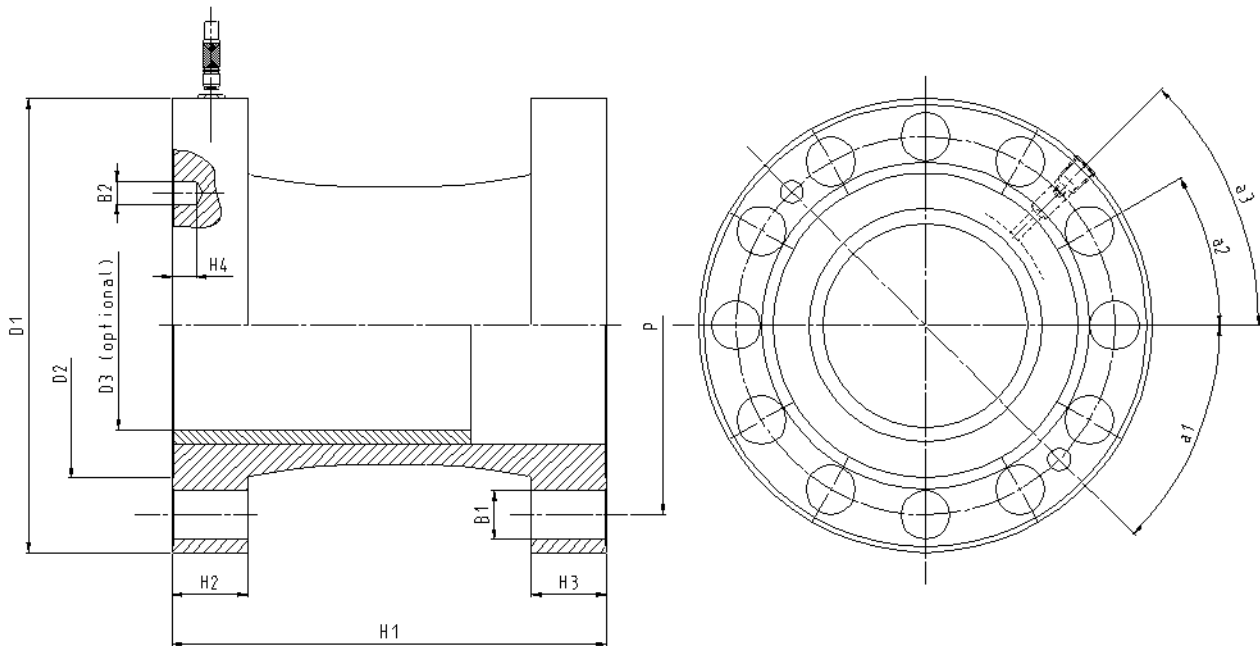
- ▶ **Configurable force transducer series RF**
with through hole option

Mating Dimensions | 25 – 63 kN



Nominal force compression/tension	$\pm F_{nom}$	kN	25 50 63
Diameter	$\varnothing D_1$	mm	75
Diameter	$\varnothing D_2$	mm	63-0.05
Diameter	$\varnothing D_3$	mm	57+0.01
Pitch circle diameter	$\varnothing P$	mm	60±0.1
Thread	T		M8
Height	H_1	mm	52
Height	H_2	mm	11
Height	H_3	mm	11
Height	H_4	mm	2+0.1
Height	H_5	mm	2+0.1
Angle	a_1		30°
Angle	a_2		45°

Mating Dimensions | 100 kN – 10 MN



Nominal force compression/tension	$\pm F_{nom}$	kN	100	300	1000	1500	3000	4000	5000	7000	10000
			200	400		2000					
			250	500	1200	2500					
Bore	$\varnothing B_1$	mm	11	22	26	33			39	45	45
Bore	$\varnothing B_2$	mm	8H7	12H7			---			---	
Diameter	$\varnothing D_1$	mm	130	197	240	305	415	536	570	600	750
Diameter	$\varnothing D_2$	mm	91	128	161	192	301	380	385	386	535
Diameter	$\varnothing D_3$	mm	60	88	110	119.7	236	250	---		
Pitch circle diameter	$\varnothing P$	mm	112±0.1	160±0.1	200±0.1	250±0.1	360±0.2	480±0.2	512±0.2	512±0.2	675±0.2
Height	H ₁	mm	112	160	230	326	358	400	580	580	650
Height	H ₂	mm	22	25	40	57.5	69	80	130	130	140
Height	H ₃	mm	22	25	40	57.5	69	80	130	130	140
Height	H ₄	mm	14	13			15	20	---		
Angle	a ₁		45°			50°	7.5°	---			
Angle	a ₂		30°			20°	15°	15°	15°	15°	11.25°
Angle	a ₃		45°			50°	7.5°	7.5°	7.5°	5.63°	

Order Numbers | Standard Variants

► Force transducer Series RF | standard variants

Nominal force	Description	Order number
25 kN	Standard force transducer series RF 25 kN 1 mV/V	S-RF-025K
50 kN	Standard force transducer series RF 50 kN 1 mV/V	S-RF-050K
63 kN	Standard force transducer series RF 63 kN 1 mV/V	S-RF-063K
2.5 kN	Standard force transducer series RF 100 kN 2 mV/V	S-RF-100K
200 kN	Standard force transducer series RF 200 kN 2 mV/V	S-RF-200K
250 kN	Standard force transducer series RF 250 kN 2 mV/V	S-RF-250K
400 kN	Standard force transducer series RF 400 kN 2 mV/V	S-RF-400K
500 kN	Standard force transducer series RF 500 kN 2 mV/V	S-RF-500K
630 kN	Standard force transducer series RF 630 kN 2 mV/V	S-RF-630K
1 MN	Standard force transducer series RF 1 MN 2 mV/V	S-RF-1M00
1,2 MN	Standard force transducer series RF 1.2 MN 2 mV/V	S-RF-1M20
1,5 MN	Standard force transducer series RF 1.5 MN 2 mV/V	S-RF-1M50
2 MN	Standard force transducer series RF 2 MN 2 mV/V	S-RF-2M00
2,5 MN	Standard force transducer series RF 2.5 MN 2 mV/V	S-RF-2M50
4 MN	Standard force transducer series RF 4 MN 2 mV/V	S-RF-4M00

Note: all standard versions always (1) without inner trough hole (2) no plug protection (3) single measuring bridge (5) standard temperature range (6) 1x LEM O connection socket 7-pin push-pull | no measuring cables included □

Order Numbers | Configurable Variants

► Force transducer Series RF | configurable variants

Item	Code	Description
Force Transducer Series RF	C-RF	Configurable force transducer series RF
Nominal Force	025K	25 kN
	050K	50 kN
	063K	63 kN
	100K	100 kN
	200K	200 kN
	250K	250 kN
	300K	300 kN
	400K	400 kN
	500K	500 kN
	630K	630 kN
	1M00	1 MN
	1M20	1.2 MN
	1M50	1.5 MN
	2M00	2 MN
	2M50	2.5 MN
	3M00	3 MN
	4M00	4 MN
5M00	5 MN	
6M00	6 MN	
7M00	7 MN	
8M00	8 MN	
10M0	10 MN	
Inner through hole	NO	without inner through hole
	TH	with inner through hole
Plug protection	N	No plug protection
	Y	With plug protection
Nominal sensitivity	2.0	2 mV/V
	1.0	1 mV/V
	1.6	1.6 mV/V
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
	BM	Bending moment measuring circuits Mx, My
Temperature range	S	Standard temp. range +10°C - +60°C
	E	Extended temp. range +10°C - ≤+120°C temperature adjustment
	L	Low and extended temp. range -40°C - ≤+120°C temp. adjustment low temp. protective measures
	H	High temp. range +10°C - +180°C temp. adjustment high temp. protective measures
Electrical transducer connection (for all selected measuring circuits)	B	High and low temp. range -40°C - +180°C temp. adjustment high and low temp. protective measures
	P	LEMO connection sockets(s) 7-pole push-pull on all measuring circuits
	A	5 m fixed standard measuring cable type SMC on all measuring circuits
	B	10 m fixed standard measuring cable type SMC on all measuring circuits
	C	15 m fixed standard measuring cable type SMC on all measuring circuits
Cable connection type (for all selected measuring circuits)	S	5 m fixed high/low temperature measuring cable type TMC* on all measuring circuits
	T	10 m fixed high/low temperature measuring cable type TMC* on all measuring circuits
	P	LEMO connection sockets(s) selected no fixed 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
	M	M12 8-pole plug on all measuring circuits

Note: not all variants can be freely combined. Please use the product configurator or get in contact with our team.

Order-Example

C	-	RF	-	1M00	-	TH	-	N	-	1.6	-	DB	-	NO	-	S	-	B	-	F
				1MN		without inner through hole		no plug protection		1.6 mV/V		double bridge		no bending moment Mx, My		standard temperatur		10 m fixed cable type SMC on all measuring circuits		free ends on all measuring circuits

Order Numbers | Configurable Variants

Item	Description
Inner through hole from 100 kN	In special cases, it may be necessary that design conditions require an inner through hole through the force transducer series RF. From the nominal force of 100 kN, the RF force transducers can optionally be equipped with an inner through hole.
Plug protection	In special cases it may be necessary to additionally equip the electrical connections on the force transducer series RF with a protective profile around the plug connection. Dimensions depending on nominal force.
Nominal sensitivity	The series RF force transducer is specified for a permissible oscillation stress of $\pm 80\%$ (25 kN - 63 kN @ 1mV/V ; from 100 kN @ 2 mV/V). 1 mV/V = 25 kN - 63 kN 2 mV/V = from 100 kN 1.6 mV/V = from 1 MN Note: For the nominal forces from 1MN, the option nominal characteristic value 1.6 mV/V can be selected. This allows a permissible oscillation stress of +100% (@1.6 mV/V) to be achieved for these nominal force ranges
Single or double measuring bridge	For redundancy reasons, it is necessary, for example in safety-relevant applications, to check the safety-relevant integrity of the measuring signal by means of a second measuring bridge (functional redundancy in the same force transducer). Via two separate measuring amplifier channels, two output signals are processed and evaluated independently of each other. This makes it possible to connect two measuring amplifiers with different characteristics (DC / CF). The second redundant measuring circuit is characterised by no crosstalk between the channels at different carrier frequencies. The selection of a double measuring bridge affects the number of connection sockets and measuring cables (if selected).
Bending moment measuring circuits Mx, My	The series RF force transducer can be optionally equipped with bending moment measuring circuits. The additional bending moment measuring circuits can be measured to control the horizontal bending moments Mx and My and can be provided as separate channels. The selection of bending moment measuring circuits affects the number of connection sockets and measuring cables (if selected). Note: Bending moment measuring circuits cannot be combined with double measuring bridge. Special variant on request.
Temperature range	The selection of the temperature range has an effect on the feature "electrical transducer connection" and the design of the series RF force transducer. S = For the standard temperature range +10°C - +60°C shielded measuring cables type SMC are used. E = For the extended temperature range +10°C - \leq +120°C shielded high/low temperature measuring cables type TMC are used additional temperature compensation L = For the low and extended temperature range -40°C - \leq +120°C shielded high/low temperature measuring cables type TMC* are used additional temperature compensation additional protective measures for use in the low temperature range H = For the high temperature range +10° - +180°C shielded high/low temperature measuring cables type TMC* are used additional temperature compensation additional protective measures for use in the high temperature range B = For the high and low temperature range -40° - +180°C shielded high/low temperature measuring cables type TMC* are used additional temperature compensation additional protective measures for use in the high and low temperature range Notes: *In nominal force 25 - 63 kN, fixed high/low temperature measuring cables TMC selection uses white, 6-core shielded test leads, \varnothing 2 mm, PFA sheath, temperature range: -196 to +200°C. - The additional temperature compensation ensures that the series RF force transducer fulfills the metrological characteristics over the selected temperature range
Electrical transducer connection	The series RF force transducer can be configured with fixed push-pull connection plugs (female) or fixed cables (type SMC or TMC) in different lengths. P = LEMO connection socket(s) 7-pole push-pull A = 5 m fixed standard measuring cable type SMC B = 10 m fixed standard measuring cable type SMC C = 15 m fixed standard measuring cable type SMC S = 5 m fixed high/low temperature measuring cable type TMC T = 10 m fixed high/low temperature measuring cable type TMC Notes: - In the nominal forces 25 - 63 kN, the push-pull connection plugs are led with a black measuring cable type FMC 30 cm to the outside. - In nominal force 25 - 63 kN, fixed high/low temperature measuring cables TMC selection uses white, 6-core shielded test leads, \varnothing 2 mm, PFA sheath, temperature range: -196 to +200°C. - The number of connection plugs or measuring cables results from the number of selected measuring bridges. The type of measuring cable depends on the selected temperature range.

Order Numbers | Configurable Variants

Item	Description
Cable connection type	<p>If the series RF force 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 assembly of the selected connectors is carried out by GTM. The force transducer can be connected directly to a measuring amplifier.</p> <p>P = LEMO push-pull connection socket(s) no fixed measuring cables</p> <p>F = free cable ends on all configured measuring circuits</p> <p>A = D-Sub 9-pin on all configured measuring circuits</p> <p>B = D-Sub 15-pin on all configured measuring circuits</p> <p>C = MS 7-pole on all configured measuring circuits</p> <p>M = M12 8-pole on all configured measuring circuits</p>

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
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
High flexible measuring cable black 5 m double shielded and twisted in pairs cable sheath Ø 2.9 mm 6-wire technology transducer connection: straight plug (male) type LEMO 7-pole push-pull (male) cable end amplifier: open	S-CAB-FMC-L-5M-F
Configurable measuring cable type SMC, DMC, TMC, FMC in different lengths with different connectors e.g. 90° angled	C-CAB-...

Subject to change without notice. All information describes our products in general terms. They do not represent agreed quality in the sense of § 434 Para. 1 of the BGB (German Civil Code). Illustrations may differ from originals.



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