

CMC

Piezoelectric force measurement chain

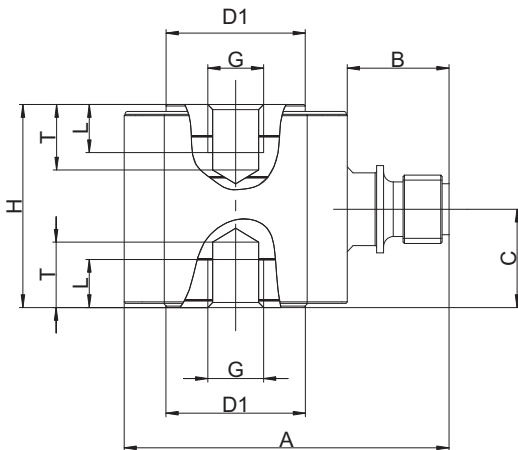
Special features

- Charge amplifier, cable and force transducer can be combined in any way
- Calibrated as a measurement chain (from N in V)
- Zoom function: Second measurement range with 5-fold amplification available
- 5 kN; 20 kN and 25 kN sensors: Piezo crystals made of gallium phosphate with a higher level of sensitivity
- Rust-proof components, minimal drift, IP65 degree of protection

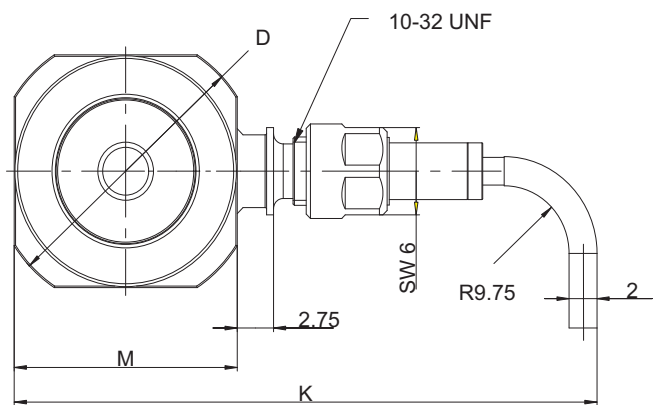
Data sheet



Dimensions of CFT force transducer



Nominal (rated) force 5, 20 kN

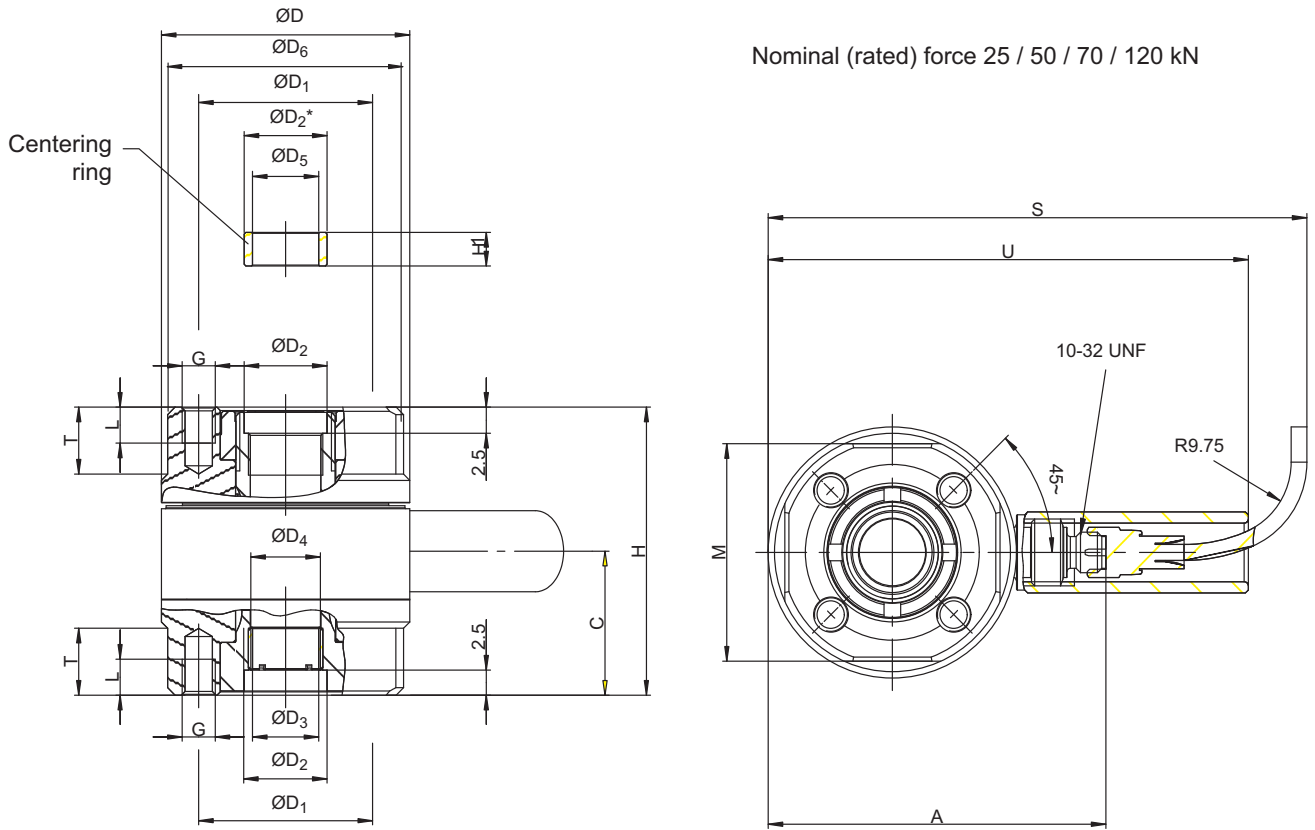


Dimensions in mm

Type	D	D ₁	M	H	B	G	T	L	K	A	C
CFT/5KN	13	5	11	10	7.45	M2.5	3.15	2.25	approx. 36	18.45	5.05
CFT/20KN	19	10	16	14	7.45	M4	4.05	3	approx. 41	23.45	7.13

Dimensions of CFT+ force transducer

Nominal (rated) force 25 / 50 / 70 / 120 kN

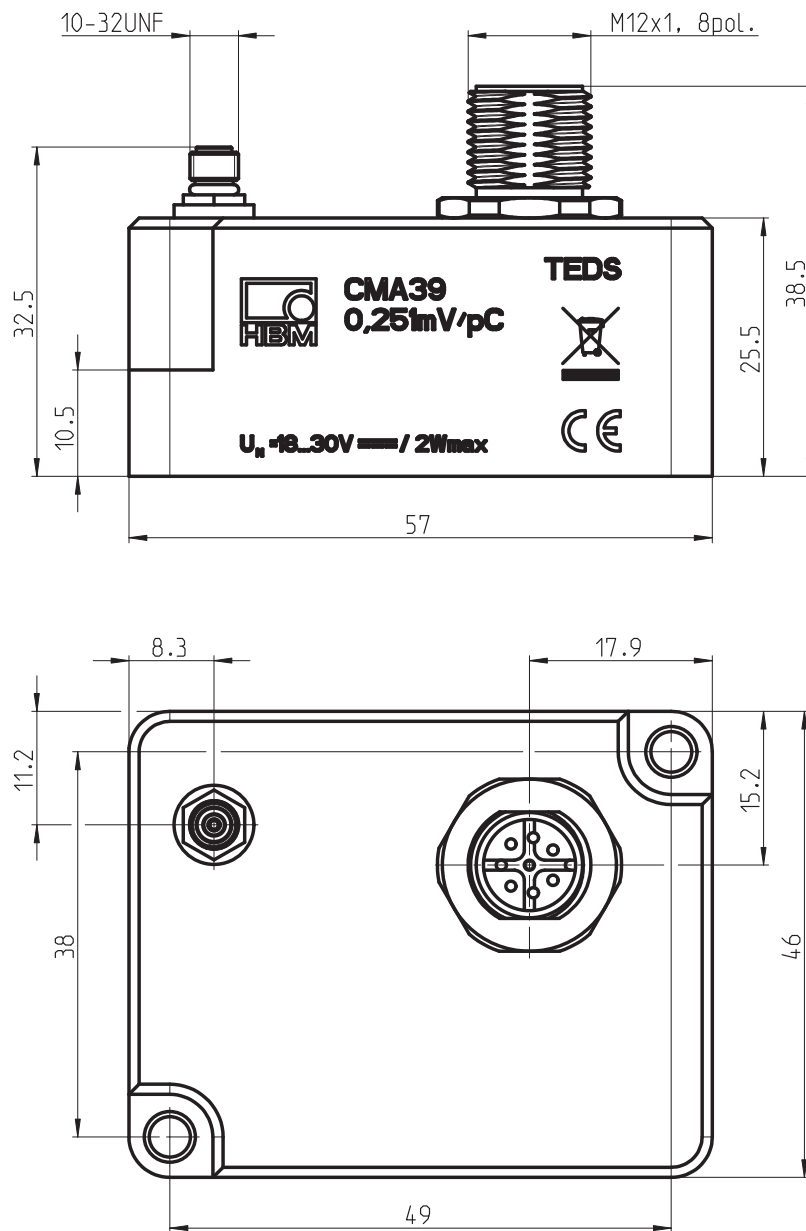


Dimensions in mm

Type	D	D ₁	D ₂	D ₂ *	D ₃	D ₄	D ₅	D ₆
CFT+/25KN	20±0.1	14	6 ^{H8}	6 ^{f7}	4	4	4. ^{+0.02}	19.2
CFT+/50KN	30±0.1	21	10 ^{H8}	10 ^{f7}	8	8.5	8. ^{+0.02}	28.5
CFT+/70KN	36±0.1	26	14 ^{H8}	14 ^{f7}	11	12	11. ^{+0.02}	34.5
CFT+/120KN	54±0.1	40	21 ^{H8}	21 ^{f7}	17	18.5	17. ^{+0.02}	53

Type	M	H	H ₁	B	G	T	L	A	C	S	P	U
CFT+/25KN	17	26±0.1	4.5	10	M3	6	3	30.50	13	55	38	28
CFT+/50KN	26	34±0.1	4	10.05	M4	8	4	40.05	16.5	56.33	41.35	35.4
CFT+/70KN	32	42±0.1	4	10.05	M5	9	5	46.15	21.5	62.35	44.35	38.4
CFT+/120KN	48	60±0.1	4	10.05	M8	13	8	64.15	32	80.35	53.35	47.4

Dimensions of CMA charge amplifier



Dimensions in mm

Specifications

Type			CMC					
Nominal (rated) force	F_{nom}	kN	5	20	25	50	70	120
Accuracy of the measurement chain								
Accuracy class			0.5					
Relative reproducibility and repeatability errors with unchanging mounting position	b'	%	0.1			0.05		
Rel. reversibility error	$v_{0.5}$	%	0.5					
Linearity deviation	d_{lin}	%	0.5					
Effect of lateral forces	d_q	N/N	0.06	0.05	0.06	0.032	0.045	0.08
Effect of the bending moment	d_{mb}	N/N·m	0.8	0.6	0.6	0.3	0.3	0.25
Effect of the temperature on the sensitivity of the sensor	TC_S	%/10K	0.5					
Effect of the temperature on the amplification	TK_V	%/10K	0.5					
Drift at 20°C		pC/s	< 0.1					
Characteristic electrical values (sensor)								
Sensor sensitivity	C	pC/N	-7.7	-7.4	-4.1		-4.0	
Sensitivity tolerance	d_c		5					
Insulation resistance (sensor)	R_{is}	Ω	> 10^{13}					
Sensor connection			Coaxial connector 10-32 UNF (Microdot)					
Characteristic electrical values (charge amplifier)								
Supply voltage (reference)		V	24					
Supply voltage range		V	18...30					
Output voltage		V	± 10					
Activation time for safe output signal		ms	4					
Time for measuring range change		μs	250					
Power consumption		W	< 1.2					
Output resistance		Ω	< 10					
Allowed load resistance		k Ω	> 5					
Sensor connection			10-32 UNF (Microdot)					
Control inputs								
Reset/measure step		pC	< ± 2					
Reset/measure switch time		μs	< 100					
Total time for reset process		ms	75					
Measure measurement mode		V	0...+5					
Reset measurement mode		V	12...30					
Range 1 measuring range		V	0...+5					
Range 2 measuring range		V	12...30					
Cut-off frequency (-3 db)		kHz	10					
Cut-off frequency (-1 db)		kHz	5					
Buffer condenser for power supply		μF	22					
Galvanic isolation			Galvanic isolation of the signal inputs (charge input) for the power supply; the CMA housing does not need to be grounded					
Device connections			10-32UNF socket, tightening torque ≤ 1.5 nm M12x1. 8-pin, for signal output, supply, digital input (shielded cable recommended)					
EMC conformity as per EN 61326-1:2013, EN 61326-2-3:2013			in an industrial environment					

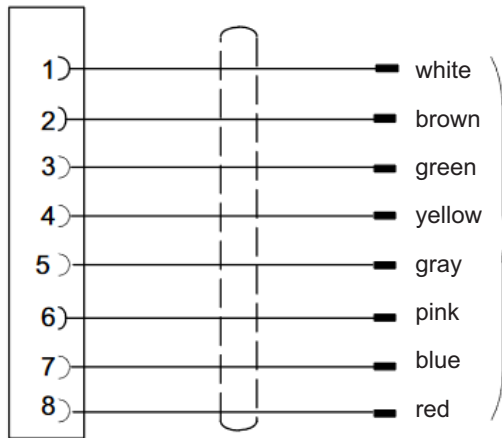
Nominal (rated) force	F_{nom}	kN	5	20	25	50	70	120
Temperature (sensor)								
Nominal (rated) temperature range	$B_{T,nom}$	°C	-40...+120					
Operating temperature range	$B_{T,G}$		-40...+120					
Storage temperature range	$B_{T,S}$		-40...+120					
Temperature (charge amplifier)								
Nominal (rated) temperature range		°C	0...+70					
Operating temperature range			0...+70					
Storage temperature range			0...+70					
Characteristic mechanical values (sensor)								
Maximum operating force	F_G	% of F_{nom}	110		120			
Force limit	F_L		110		120			
Breaking force	F_B		200	150	120	300		420
Lateral limit force ¹⁾	F_Q		80	160	300	1,000	1,800	5,800
Torque limit ¹⁾	M_D	Nm	0.3	1	1.9	12	20	130
Bending moment limit with $F_z=0N$	$M_{b perm, 0\%}$		2	4	25	75	150	650
Bending moment limit at $F_z=F_{nom}$	$M_{b perm, 100\%}$		0.5	2	1	20	20	250
Nominal (rated) displacement $\pm 15\%$	S_{nom}	μm	11	18	19	30	30	31
Stiffness	c	kN/ μm	4545	11111	16158	16667	23333	38710
Fundamental frequency	f_G	kHz	40	36	67	54	46	31
Tightening torque for the threaded connector	M	Nm	0.5	1	1.3	2	4	21
Maximum tensile force ²⁾	F_{perm}	kN	0.5	2	2.5	10	14	24
Permissible oscillation stress	F_{rb}	% of F_{nom}	100		70	100		
Characteristic mechanical values (charge amplifier)								
Vibration resistance 20...2000 [^] Hz, duration 16 min, cycle 2 min.		m/s^2	100					
Impact (duration 1 ms)		m/s^2	2,000					
Housing material			Aluminum					
General information								
Degree of protection in accordance with DIN 60529			IP65, with cable 1-KAB145 IP67					
Measuring element material			Gallium phosphate			Quartz		
Sensor ground	m	g	8	22	48	137	240	720
Charge amplifier ground	m	g	130					

1) When loaded in the tensile direction, the sensor must only be loaded with 10% of the specified lateral force/torque limit

2) Sensor is not calibrated in the tensile direction

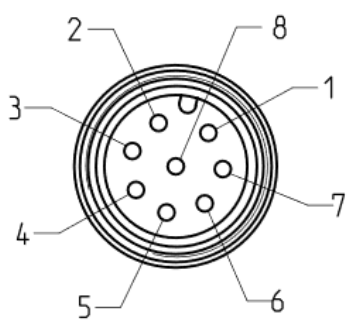
Interconnection

- Supply voltage 0 V (GND)
- RANGE 1/RANGE 2
- MEASURE/RESET
- Do not assign!
- Output signal -10 ... +10 V
- Ground for output signal
- Do not assign!
- Supply voltage 10...30 V_{DC}¹⁾



KAB168 connection cable wire assignment

M12 x 1. 8-pin



¹⁾ Operation in a SELV (safety extra low voltage) circuit

CMC versions and ordering numbers

Code	Nominal (rated) force	Sensor
05k0	5 kN	CFT/5KN
20k0	20 kN	CFT/20KN
25k0	25 kN	CFT+/25KN
50k0	50 kN	CFT+/50KN
70k0	70 kN	CFT+/70KN
120k	120 kN	CFT+/120KN

Combination notes

CFT/5KN cannot be combined with the 158,000 pC, 210,000 pC, 287,000 pC and 482,000 pC measuring ranges

CFT/20KN cannot be combined with the 210,000 pC, 287,000 pC and 482,000 pC measuring ranges

CFT+/20KN and CFT+/50KN cannot be combined with the 287,000 pC and 482,000 pC measuring ranges

CFT+/70KN cannot be combined with the 482,000 pC measuring range

Cable length	Measuring range of the charge amplifier
1 m 1m0	1,000 pC 001N0
2 m 2m0	2,000 pC 002N0
3 m 3m0	5,000 pC 005N0
7 m 7m0	20,000 pC 020N0
10 m 10m	39,500 pC 039N5
	158,000 pC 158N0
	210,000 pC 210N0
	287,000 pC 287N0
	482,000 pC 482N0

K-CMC-	25k0-	10m-	039N5
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The order example illustrated here is a measurement chain with a CFT+/25KN, a 10 m cable and a charge amplifier with a 39,500 pC input range.

Nominal (rated) force of the sensor

Select the sensor based on the maximum expected force and the parasitic loads (lateral forces, bending moments) that occur in your application.

The maximum force is the sum of the possible initial load (e.g. caused by the mass of load applications or assembled tools or pre-stresses caused by the installation conditions) and the force to be measured.

Select a larger sensor if you are uncertain.

Cable length

All of the cables are of the same quality. Select the length based on your requirements.

Measuring range of the charge amplifier

The measuring range of the amplifier is only based on the force that you have to measure. Pre-stresses and load applications from tools should not be taken into consideration to obtain a good resolution. Example: You would like to measure a force exerted by the press of 10 kN, the sensor is assembled in such a way that a weight force of 5000 N is applied to the sensor. The total force is thus 15,000 N, of which you must measure 10,000 N. In this case, you can configure the amplifier to 10,000 N, the tara load does not need to be taken into consideration.

The required input range is calculated as follows:

- For the CFT/5KN, CFT/20KN and CFT+/15KN force transducers:
Input range in pC: Force F to be measured in N * 8 pc/N
- For the CFT+/50KN, CFT+/70KN and CFT+/120KN force transducers:
Input range in pC: Force F to be measured in N * 4 pc/N

Example:

A force of 15,000 N is to be measured – select force transducer CFT+/25KN.

$$15,000 \text{ N} * 8 \text{ pC/N} = 120,000 \text{ pC.}$$

Select the module with an input range of 158,000 pC.

Information on new ordering number structure

If you are using a CMC measurement chain and would like the same product again, the new ordering numbers compared to the previous ordering numbers are detailed in the following. In this configuration, the charge amplifier is fully controlled at the nominal (rated) force of the relevant sensor.

Previous ordering number	New ordering number of identical measurement chain
1-CMC/5KN	K-CMC-05k0-3m0-039N5
1-CMC/20KN	K-CMC-20k0-3m0-158N0
1-CMC/50KN	K-CMC-50k0-3m0-210N0
1-CMC/70KN	K-CMC-70k0-3m0-287N0
1-CMC/120KN	K-CMC-120k-3m0-482N0

Subject to modifications.
All product descriptions are for general information only. They are not to be understood as a guarantee of quality or durability.

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