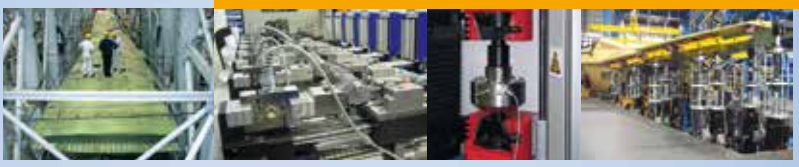


Reliable force measurements

HBM force transducers for industry and research

HBM

HBM force transducers
Versatile in use, proven

HBM – always the right solution

We provide ...

... the full range of force measurement technology:

___ Force transducers for use in production

___ Force transducers for tests and experimentation

___ Highly precise reference force transducers for calibration

... concentrated competence:

___ In-house, high-end strain gauge manufacturing

___ In-house mechanical manufacturing

___ Calibrations from 5 N to 5 MN

... the extensive range of services offered by the leading global measurement technology expert:

___ HBM expert knowledge on site anywhere in the world

___ Individually customized advice, installation and start-up

___ Training and seminars

___ Calibration services

___ Strain gauge installation

... in experiments and tests

Reliable measured value thanks to HBM's decades of experience in diverse industrial sectors including aerospace, automotive, test stand construction and many more ...

HBM force transducers ...

... provide the input signal to control actuators

... reliably measure the forces applied

... are used in function tests with high accuracy

... handle peak loads easily

worldwide ...

... in production monitoring

Automation ensures uniformly high quality, fast cycle times and reliable processes.

HBM force transducers ...

... utilize custom-made digital electronics to monitor:

- Press-fit processes
- Force trends in function tests
- Forming processes
- Web tension and much, much more

... provide the input signal for the controller

... reliably measure forces applied in the production environment

... can be used in function tests

... in test benches and in material testing

International quality guidelines require that material and product properties are safety checked.

HBM force transducers ...

... test and check the required specifications in various types of testing equipment and test benches

... measure torques on brakes and engine test benches via lever arms

... in calibration

Measurement accuracy is guaranteed with traceability to national standards.

HBM reference force transducers with calibration certificate ...

... verify production and measurement tools

... calibrate material testing machines and other force sensors reliably and precisely

... measure force with high precision to international standards

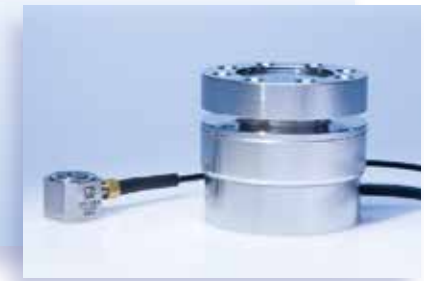
Everything about force measurement technology can be found at:
www.hbm.com/force

HBM technology in detail
... benefit from its unique fe

Robust and compact

Force transducers have an important role to play in industrial process control. Force responses or peak forces are monitored inline for fitting or compression processes and provide instant information about quality.

- Robust force transducers that are stable under lateral force
- Compact designs
- Easy mounting
- TEDS transducer identification
- Force transducers based on strain gauge technology and the piezoelectric effect



High endurance and precision

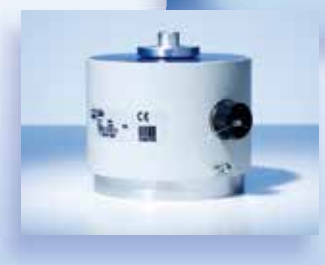
Reducing material consumption while ensuring component durability needs careful assessment for optimization. HBM's force measurement technology meets the requirements for these applications:

- Endurance strength
- Vast safety reserves
- High oscillation width (tensile and compressive loading)
- Good reproducibility and reliable high accuracy
- Redundant measuring bridges

Maximum precision from HBM

Extreme accuracy is required for force measurement in national institutes and accredited calibration laboratories. HBM's precision transducers for calibration easily meet these high standards thanks to years of varied experience and customer feedback:

- Technical specification exceeds the requirements of the ISO 376 standard for the top Class 00 by a factor of 10
- Outstanding long-term stability
- Perfect interaction with HBM's DMP41 and ML38B high-precision amplifiers



atures

Plug and Measure ...

... HBM's transducer identification, TEDS, gives immediate readiness for measurements

Plug and Measure is to measurement technology what Plug and Play is to computers: technology that simplifies the workload. Important characteristics of the transducer are stored internally in the form of an electronic data sheet. The measuring amplifier is able to load this data and convert it automatically into the correct settings. This allows the user to start measuring immediately with the right settings for the unit without having to make any adjustments.

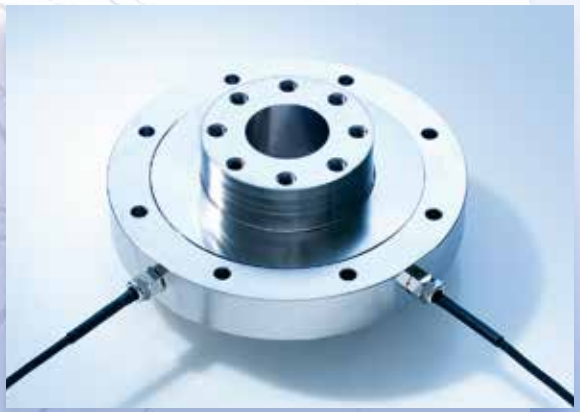
The advantages are:

- Very easy operation
- Minimal time required for measurement preparation
- Increased safety, as errors from manually setting up the amplifier are avoided

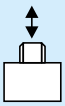
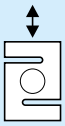
Individual: customized sensors

We develop and manufacture customized transducers for your order and to your specifications. Custom-made for you, with the experience and competence of the market leader.

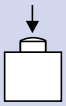
- Design flexibility and quantity required, small or large orders, with or without an integrated amplifier – it's your choice
- Fast development and production – rapid engineering and rapid prototyping provide quick results
- Reliable calibration, ISO9001 certification, two-year warranty and competent HBM After Sales Service



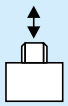
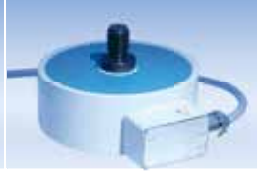
Force transducers...
... for industrial applications
... based on the strain gauge principle

Force direction		Tensile and compressive					
Design							
Linearity error (%)		0.1	0.2	0.5	0.03 - 0.06	0.03 - 0.06	0.02
Nominal (rated) force, max.	10	10 N					10 N
	20	20 N					20 N
N	50	50 N		50 N			50 N
	100			100 N			100 N
	200			200 N			200 N
	500		500 N	500 N			500 N
	1		1 kN	1 kN	1.25 kN	1.25 kN	1 kN
	2		2 kN	2 kN	2.5 kN	2.5 kN	
	5		5 kN	5 kN	5 kN	5 kN	
kN	10		10 kN	10 kN	12.5 kN	12.5 kN	
	20		20 kN	20 kN	25 kN	25 kN	
	50		50 kN	50 kN	50 kN	50 kN	
	100		100 kN		125 kN	125 kN	
	200		200 kN		250 kN	225 kN	
	500				500 kN	450 kN	
	1						
MN	2						
	5						
Force transducers		**U1A**	**U2B**	**U9B**	**U10M**	**U10S**	**S2M**
							
Special features		· Small force transducer for small tensile and compressive forces · Overload protection	· Versatile in use · Application focuses on: test benches and material testing machines	· Miniature force transducer for tensile and compressive forces · Hermetically encapsulated	· High dynamic oscillation width · Highly precise · Double bridge design and many other options available · TEDS	· High dynamic oscillation width · Highly precise · Double bridge design · TEDS · Threaded connector to UNF standard	· Overload protection for tensile and compressive forces · Highly precise · Highly flexible cable, suitable for drag chains · High protection class (IP67)

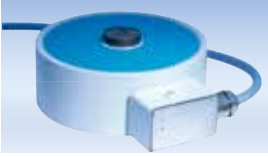
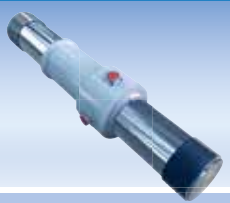
HBM force transducers reliably measure static and dynamic forces for tensile and compressive loading. This page shows you the easy-to-mount, compact and robust multi-purpose industrial versions for your special application.

				Compressive			
							
0.02	0.2	0.2	0.5	0.2	0.5	0.5	1
500 N 1 kN 2 kN 5 kN 10 kN 20 kN 50 kN	500 N 1 kN 2 kN 5 kN 10 kN 20 kN 50 kN 100 kN	100 kN 200 kN 500 kN	1 kN 2 kN 5 kN 10 kN 20 kN 50 kN	500 N 1 kN 2 kN 5 kN 10 kN 20 kN 50 kN 100 kN 200 kN	50 N 100 N 200 N 500 N 1 kN 2 kN 5 kN 10 kN 20 kN 50 kN	200 kN 500 kN 1 MN 2 MN 5 MN	20 kN 40 kN 60 kN 100 kN 200 kN 300 kN 400 kN
S9M	**U3**	**U5**	**U93**	**C2**	**C9B**	**C6A**	**KMR**
							
· Highly precise · Hermetically encapsulated (IP68) · Low profile design	· Insensitive to lateral forces · Extremely robust · Easy-to-mount flange connection	· Robust · Easy-to-mount flange connection	· Highly compact · Robust · TEDS · Miniature force transducer · High lateral force stability · Easy-to-mount flange connection	· Hermetically encapsulated · Low construction height	· Miniature force transducer · Hermetically encapsulated	· High nominal (rated) forces with small dimensions · Continuous internal bore	· Measuring washer based on strain gauge technology · Hermetically encapsulated

Reference force transducers ...
... for calibration tasks

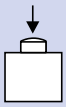
Force direction		Tensile and compressive			
Design					
Class to ISO 376		0.5	Better than 00	00	00
Nominal (rated) force, max.	10				
	20				
N	50			50 N	
	100		100 N	100 N	
	200		200 N	200 N	
	500		500 N	500 N	
	1		1 kN	1 kN	
	2	2.5 kN	2 kN	2 kN	
	5	5 kN	5 kN	5 kN	
	10	10 kN	10 kN	10 kN	
kN	20	25 kN	20 kN		20 kN
	50	50 kN	50 kN		50 kN
	100	100 kN	100 kN		100 kN
	200	250 kN	200 kN		200 kN
	500	500 kN	500 kN		500 kN
	1	1 MN			
MN	2				
	5				
Reference force transducers		**U15**	**Top Transfer**	**Z30A**	**Z4A**
					
Special features		· Precision force transducer · For a wide range of calibration tasks in industry and research · TEDS · Numerous options available	· Transfer standards with maximum precision · Greatly exceeds the requirements of class 00 · Suitable for international comparisons	· Precise measurement of small forces · For use as a calibration standard · TEDS	· Precise measurement of forces up to 500 kN · Force measurements with high precision · For use as a calibration standard

HBM reference force transducers are the reliable basis for traceability to national standards and for measurements with precision comparable to international standards.

Compressive				Tensile
0.5	0.5	0.5	0.5	0.5
20 kN 50 kN 100 kN 200 kN 500 kN	10 kN 20 kN 50 kN 100 kN 200 kN 300 kN 500 kN 1 MN 2 MN 3 MN 5 MN	1 MN 2 MN 3 MN 5 MN	2 MN	600 kN 1 MN
C4	**C18**	**KD**	**KDB**	**STZ**
				
· Force measurements with maximum precision · For use as a test standard	· Compact, low design · Ideal for calibration tasks	· Special force transducer for verifying material testing machines · Also measures bending moment	· Special force transducer for verifying material testing machines · Also measures bending moment	· Special force transducer for verifying material testing machines · Also measures bending moment

Force transducers...
... for industrial applications
... based on the piezoelectric principle

The highly compact HBM force transducers measure quasi-static and dynamic forces based on the piezoelectric principle.

Force direction		Compressive			
Design					
Linearity error (%)		1	1	1	1
Nominal (rated) force, max.	10				
	20				
N	50				
	100				
	200				
	500				
	1				
	2				
	5	5 kN	5 kN		7 kN
	10	20 kN	20 kN		
kN	20	50 kN	50 kN	20 kN 50 kN 70 kN 120 kN 140 kN 190 kN 330 kN 700 kN	26 kN
	50	70 kN	70 kN		62 kN
	100	120 kN	120 kN		
	200				
	500				
	1				
MN	2				
	5				
Reference force transducers		CFT	CMC	CFW	CLP
					
Special features		· Calibrated piezoelectric force transducers · High rigidity · Easy-to-mount flange connections	· Measuring chain calibrated in two ranges · Charge amplifier is included in the calibration · High bandwidth	· Compact force washers · High rigidity · Welded construction	· Extremely flat force transducer · With integrated cable · Welded construction

For perfect interaction ... HBM amplifier systems

HBM sensors and amplifiers are perfectly matched. The ideal system solution for easy, fast and reliable measurement results.

Find the right amplifier system for your specific measurement task:

Applications	Product		Interface	Special features
Amplifier systems for force measurements in research, development and test bench construction	QuantumX		Ethernet, EtherCAT, CAN, ± 10 V	Measuring amplifier system for universal measurement data acquisition
	espresso DAQ		USB	Compact, mobile measurement data acquisition with USB
	MGCplus		Ethernet, USB, Profibus, Canbus, ± 10 V	Universal and scalable measuring amplifier system for laboratory and test bench
	SOMAT		Ethernet, CAN, RS232	Rugged, mobile data acquisition systems
	Genesis		Ethernet, ± 10 V	Data logger with high sampling rate
	DMP41		Ethernet, USB	Precision digital measuring device – used around the world by nearly all national testing facilities
Amplifier systems for force measurements in production, monitoring, quality assurance, machine monitoring and control	PMX		Ethernet, Profinet, EtherCAT, ± 10 V	The modular measuring amplifier system for production and industrial test benches
	PME		Profibus, CAN, Interbus S, ± 10 V, 0/4 ... 20 mA	Industrial measurement electronics with fieldbus connection
	MP85		Ethernet, Profibus, CAN	The multi-talented performer for fitting, testing and press fitting processes
	DigiClip		Profibus, CAN, DeviceNet	Modular measuring amplifier system with fieldbus connection for industrial environments
	AED		RS485, Profibus, CAN, DeviceNet	Digital transducer electronics with field housing
	Clip		± 10 V, 0/4 ... 20 mA	Electronics for industrial measurement tasks
	CMD		Ethernet, ± 10 V	Digital charge amplifier for piezoelectric sensors
	CMA		± 10 V	Analog charge amplifier for piezoelectric sensors

Force calibration options at HBM:

Force								
Measuring range	Accredited calibration				Working standard calibration			
	↓	↑	↕	possible steps 4 6 8 10 A	↓	↑	↕	possible steps 6 10 B
5 N					X	X	X	■■
10 N	X	X	X	■□□□	X	X	X	■■
20 N	X	X	X	■■■□	X	X	X	■■
50 N	X	X	X	■■■■	X	X	X	■■
100 N	X	X	X	■■■■	X	X	X	■■
200 N	X	X	x	■■■■	X	X	X	■■
500 N	X	X	X	■■■■	X	X	X	■■
1 kN	X	X	X	■■■■	X	X	X	■■
2 kN	X	X	X	■■■■	X	X	X	■■
5 kN	X	X	X	■■■■	X	X	X	■■
10 kN	X	X	X	■■■■	X	X	X	■■
20 kN	X	X	X	■■■■	X	X	X	■■
50 kN	X	X	X	■■■■	X	X	X	■■
100 kN	X	X	X	■■■■	X	X	X	■■
200 kN	X	X	X	■■■■	X	X	X	■■
500 kN	X	X	X	■■■■	X	X	X	■■
1 MN	X	X	X	■■■■	X	X	X	■■
2 MN	X	X	X	■■■■	X	X	X	■■
5 MN	X	X	X	■■■■	X	X	X	■■
	Best possible uncertainty: >0.005 %							

■ Standard offer
□ Not available

8 10 acc. to ISO 376

A 4+2 increasing/decreasing series
B 1+1 increasing/decreasing series

All the calibration quantities and options of the HBM calibration laboratory can be found at:

www.hbm.com/calibration

HBM Test and Measurement

Tel. +49 6151 803-0
info@hbm.com
www.hbm.com

US Contact

HBM, Inc.
Tel. +1 (800) 578 4260
info@usa.hbm.com

measure and predict with confidence

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