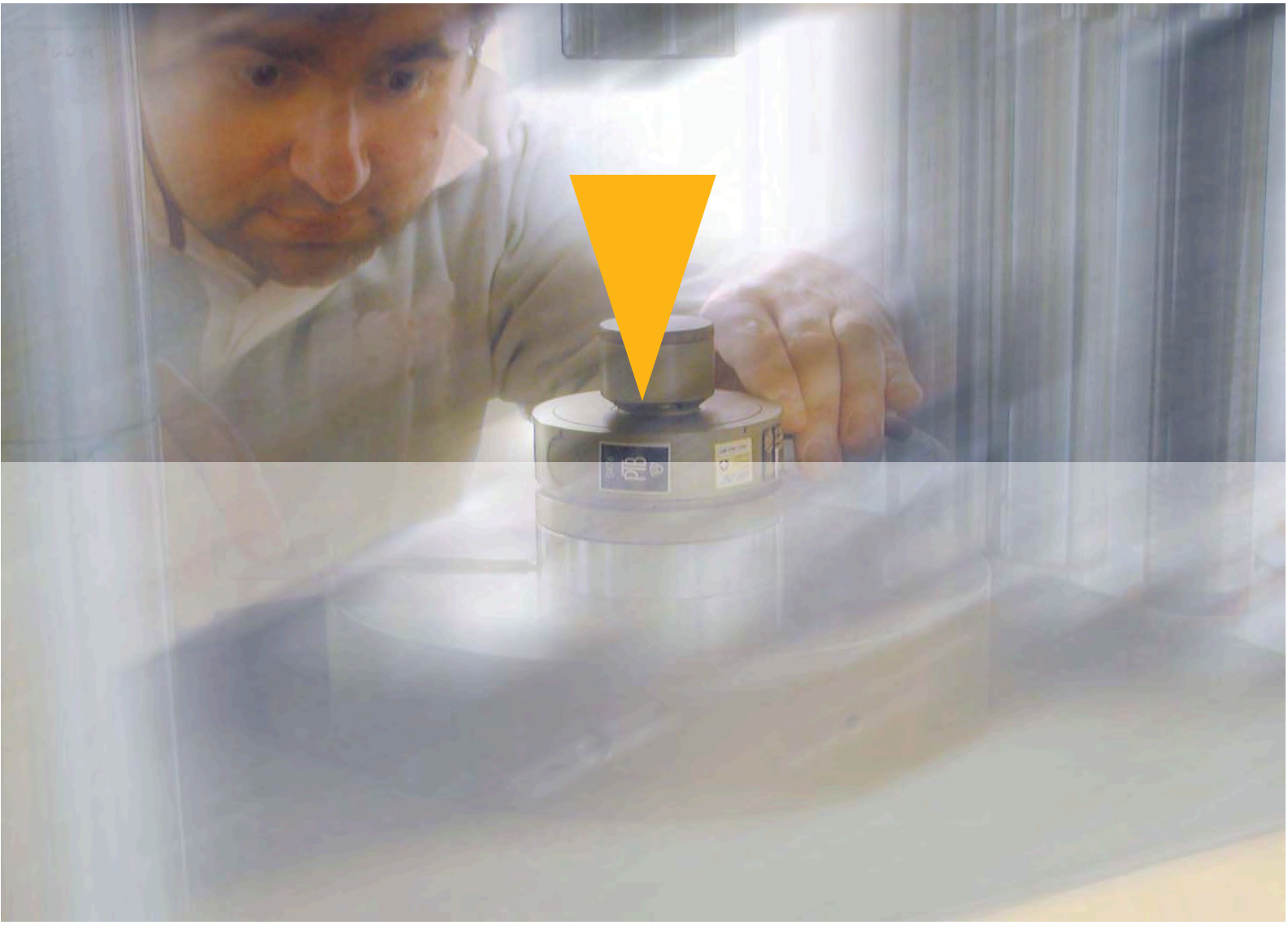
Be a Measure of

Forces and Moments

GTM
GASSMANN TESTING AND METROLOGY GMBH



Limits

Exhausting potentials and surmounting limits are the essential goals we set. If you want to be the first you have to extend the limits consistently. This is the only way for potentials to match increasing requirements and to be converted into performance. We see ourselves as a highly motivated team which consistently redefines limits – in the company, the team and above all in our specialist field – our market. We exceed limits, because beyond traditional ideas we work on new solutions.

Capabilities

The capacities of our team are pre-determined by the constantly developing goals defined by the market. As a world-wide trend-setting company for the measurement of forces and moments we have employees who think and act in ways that are both constructive in concept and critical in communication. Knowledge belongs to everyone. Everyone bears responsibility and everyone is qualified to lead projects. Three authorities govern project work: cooperation, learning ability (learning aptitude) and problem solving.

Milestones

1988 1989 1990 1991 1992 1993 1994 1995 1996

Development of load cells 0.12 to 60 t, force laboratory Siemens

2 patents 4 patents 5 patents 9 patents 12 patents 13 patents 14 patents

First supplier of the German Industry of testing machines

5 customers 110 customers 450 customers 780 customers

First force measuring machine with strain controlled elastic hinges First supplier world-wide for force standard machin

In 2 countries Primary standard of force

Intense

The GTM team of competent experts in design, evaluation, measurement and control techniques offers solutions for special, high and specific requirements. We replace established thought patterns as well as obsolete structures and approach problems creatively without any inhibitions. Thus standard products, standardised methods and individual projects are created in our company. Each of our solutions sets new standards, and even if we offer standards, their level clearly goes beyond the average.

Your individual tasks, conditions and requirements are no limitation for us but rather inspiration and incentive to perform. If you are looking for the ideal partner for precise and reliable measurement of forces and moments come to the leading address in this sector – not just to the next best – ask us.

Status

With our all-round mechatronic competence in all areas of the measurement of mechanical sizes, we – as the world-wide market leaders – set the standard for the measurement of forces and moments. In multi-component measuring techniques we are considered as the pioneer and the precursor. We are the leading supplier of calibration services for force, moment and multi-component sensors in Europe.

Chronicle

Our leading position is the result of an evolutionary process. We have always conformed to the high aspiration of being pathfinders by means of developments and patents, which have dramatically changed the world of force measurement.

Mission

Working on measuring forces and moments in terms of what they actually are – vectors - we continue to increase our competitive edge. We will be continually extending the limits of the measuring range and accuracy. And we are expanding GTM's world-wide presence with products, consultancy, training and engineering services.

97 1999 2001 2003 2005 200

Scales for hydrodynamic testfield PTB 30,000 kg weight to exactly 1 kg Leading supplier for force measuring technique for automotives

16 patents 17 patents 18 patents 19 patents 22 patents 23 patents 25 patents 27 patents 29 patents

Beam waveguide measured data acquisition for any number of measuring stations Biggest torque measuring machine in the world

1210 customers 1710 customers 2140 customers 3250 customers

1998 2000 2002 2004 2006

nes 6 component platforms for precise multi-component measurements

In more than 40 countries Primary standard of force

» *From the project planning stage, the design to manufacturing, assembly and commissioning of our projects Force Standard Machines 1 MN·m torque and 2 MN force the GTM engineers were reliable, creative and stimulating partners who have performed the agreed services in a technically correct manner and on schedule.*

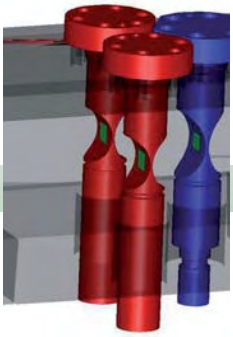
Dr. Ing. Diedert Peschel (Federal Physical Technical Institute, Brunswick)

Primarily global

Less than 1/10th of the width of a hair on one meter – this is the level of accuracy to which we define forces and moments. And because we can do this so precisely, we have orders from all over the world. From the pyramids of Giza to Sugarloaf Mountain in Rio. In more than 40 countries on five continents GTM primary standards are determining the scales for forces and moments.

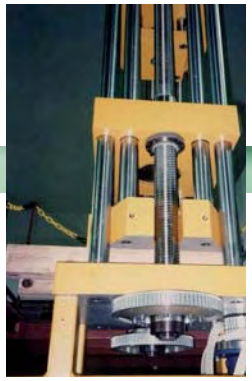
But limits are there to be surmounted, and borders to be crossed.

Largest of the world: 1,1 MN·m TSM



The breakthrough:
Strain controlled elastic hinges (DKG)

Build-up 9 · 600 kN = 5.400 kN



Modern force multiplication:
Lever 1:10 with DKG

Forces and Moments

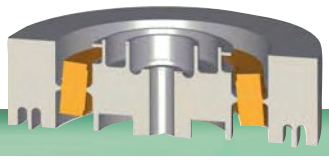
Mechanical interface: Central screw thread or hole circle, any diameters, pitches and drillings – the UBV product line allows you to have the mechanical interface always under control. The capturing and processing of measured data is facilitated due to measuring amplifier cards of the highest accuracy of up to 10 ppm and software for measurement and rapid control.

Overqualified?

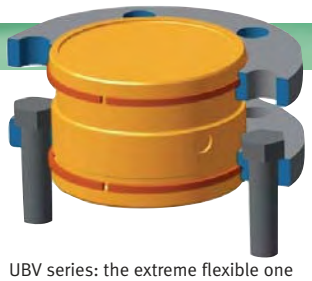
K-series sensors are in fact over-qualified with their measurement accuracy of 0.02% related to the final value. But this is no problem for us and, above all, our customers. Another quite significant feature results from this: the large measuring range of 500 : 1, measuring the respective force to accurately 1% is even up to 0.002% of the final value: Thus the K-series is the unchallenged leader.

» *Due to the GTM product range from 0.2 to 10,000 kN and an outstandingly good measurement performance together with reliable just-in-time deliveries GTM is the premium supplier.*

Zwick GmbH



K-series: the extreme precise one



UBV series: the extreme flexible one

Torque high precision

Torque robust

Multi-Components

The GTM multi-component analyzer (MCA) combines the whole world of multi-component measuring in one unified piece of software, i.e. the transformation of measured forces and moments into hexapods or screws, into vectors or Cartesian components, coordinate movements or rotations. All to single click. Finally, an optimal relationship should be the controlling factor between the six components of a force and moment system.

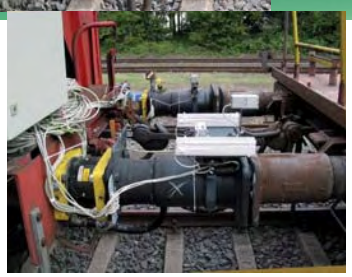
For example, the German Federal Railways became one of our customers due to our excellent know-how in this sector. The aim of this project was the determination of the forces to which the buffers of wagons are subjected. GTM constructed a three-component sensor for axial forces up to 2,000 kN and transverse forces up to 150 kN for the Railway's Experimental Institute. The strains on the wagon buffers could thus be determined and these findings enabled the railway engineers to optimise the buffers and their working life.

» *GTM has brought our test rig up to state-of-the art in measurement techniques with its wheel load sensors.*

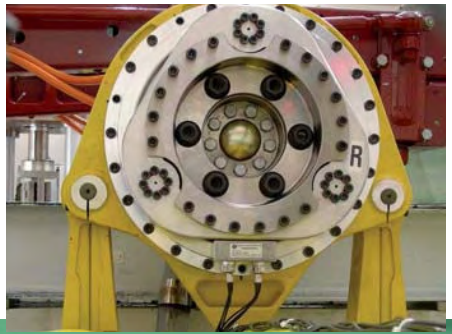
Roland Bösl, ZF Passau

Measure vectors:

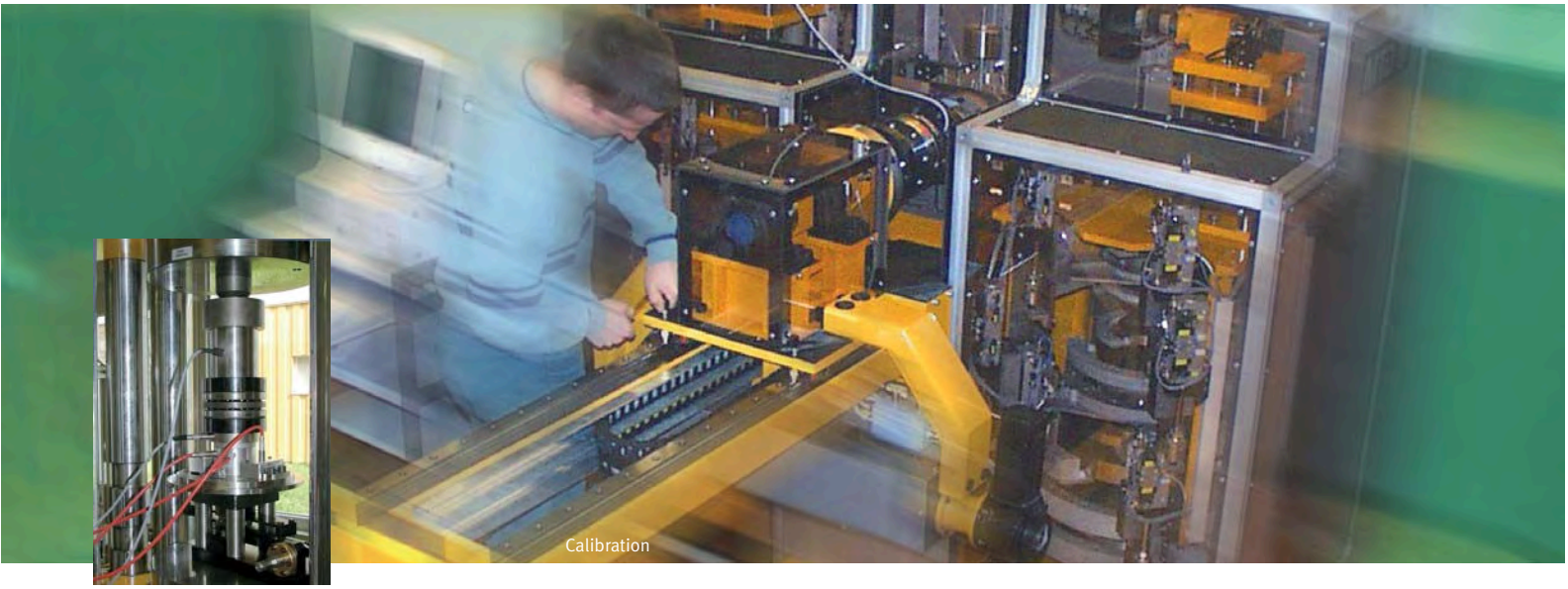
Trailor coupling



Wagon buffer



Chassis



Calibration

Force – Torque

“Can Do” Attitude

Calibration is better than studying – we offer calibration services with forces between 0.05 and 2,000 kN and moments from 0.02 up to 5,000 Nm. We can also analyse force and moment measuring systems on-site in all directions and values up to 10 MN or 400,000 Nm.

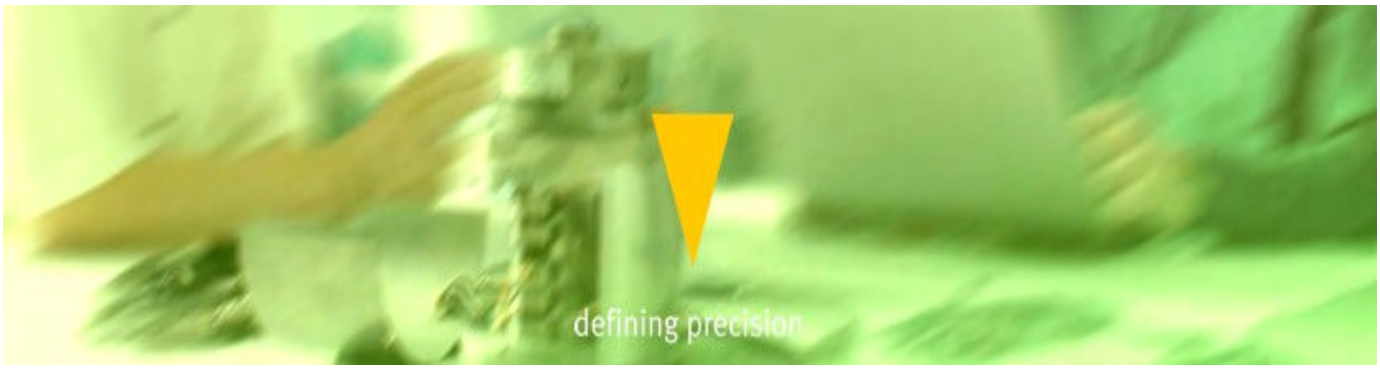
You can expect creativity and enthusiasm of the GTM team both in the technical range as well as regarding other problems and challenges which concern the professional execution of an order. We deliver on a turnkey basis even under difficult transporting and assembly conditions.

Based on this philosophy we have successfully constructed machines according to specific requirements and restrictions, which have arisen from transport routes and mounting places. Once the delivery route was only usable until a few meters before reaching the destination – so our project leader quickly decided to hire the services of a local farmer to take the machine to its destination with his tractor. Necessity is the mother of invention – as the saying goes!

The only limits in the technical field for us are the physical basic principles. If you should have quite specialised measurment requirements, the GTM engineers will create a sensor precisely to your requirements.

» *We are happy to use GTM’s DKD (German Calibration Service) accredited calibration laboratory with its well-trained staff, as we can rely on a short turn-round and reliable calibration service, in which deadlines are respected.*

Continental AG



GTM an Introduction! Image

05/2007

Force Transducers

	**K** **Precision Force Transducer** **Tension/Compression** **Nominal load 0.2 – 500 kN** Brochure K Data sheet K 0.2 - 2.5 kN Data sheet K 5 kN Data sheet K 10 - 160 kN Data sheet K 200 - 500 kN Load Diagram	• Accuracy class 0,2 • Integrating measuring principle • High suppression of disturbing components • Tolerant with respect to mounting surfaces • Low profile, small mass • Fatigue proof
	**RF** **Precision Force Transducer** **Tension/Compression** **Nominal Load 400 kN – 10 MN** Brochure RF	• Accuracy class 0,05 • Insensitive to eccentric load application and lateral forces • Compact design, simple mounting, small mass • Fatigue proof
	**UB** **Universal Force Transducer** **Tension/Compression** **Nominal Load 20 – 500 kN** Brochure UB	• Accuracy class 0,1 • Extremely low weight • Small, robust universal transducer • simple mounting, high reliability • Convincing price-performance ratio

UBV

Universal Force Transducer
Tension/Compression
static dynamic
Nominal Load 20 – 5000 kN

Brochure UBV
Drawing 20-100 kN

- Accuracy class 0,1
- Fatigue proof up to ± 100% nominal load
- Permissible eccentricity up to 10 mm
- Multiple adaptations via exchangeable flanges
- Small mass

UM

Universal Force Transducer
Tension/Compression
Nominal Load 0.25 – 10 kN

Brochure UM

- Accuracy class 0,05
- Insensitive to eccentric and lateral loads
- Exceptionally small and light transducer
- Simple integration in existing designs
- Convincing price-performance ratio

Force Transfer Standards

KTN

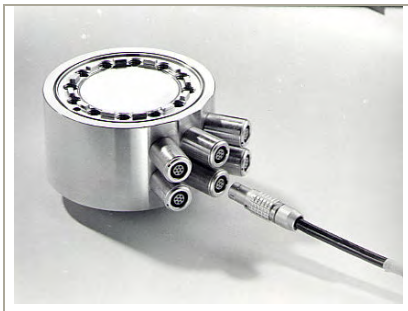
Force Transfer Standard
Nominal Load 10 N – 2000 kN
G1 G05 G00 GVN

Brochure KTN

Data sheet KTN compression
Data sheet KTN tens./compr. 5 - 50 kN
Data sheet KTN tens./compr.100 - 2000 kN
Data sheet KTN DZY
Data sheet KTN ZST

- Highest reproducibility, even with different FSM: ≤ 50 ppm
- High long-term stability
- Small rotation error
- Hermetically sealed
- Small effects of eccentric loading, side forces or moments

Multi-Component Systems

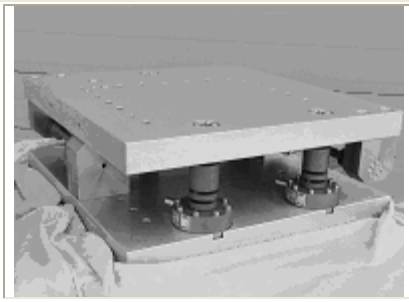
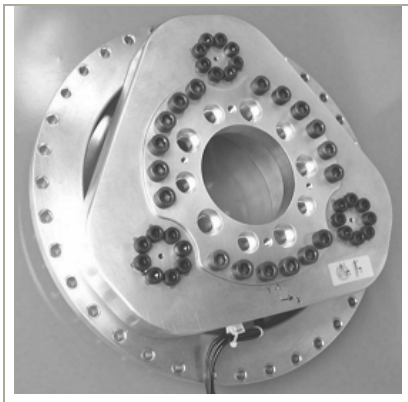
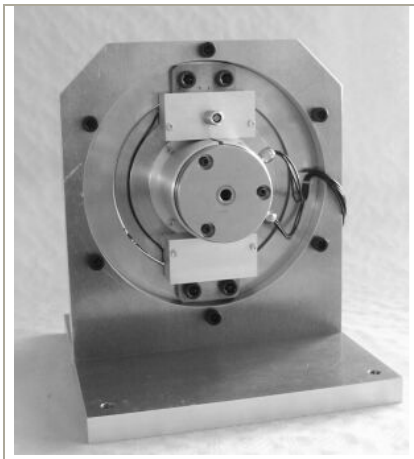


MKA

Multi Component Transducer
6 Components
Nominal Load 2.5 – 250 kN
Nominal Torque 120 – 12500 Nm

Brochure MKA

- Multitude of possible combinations of forces and moments
- Compact construction
- Fatigue rated
- Small cross talk

	**MPF** **Measuring platform** Brochure MPF	• Multitude of possible combinations of forces and moments • Precise measurement of complex loading conditions • Adaptable to almost any task
	**MKP** **Compact Measuring Platforms** Brochure MKP	• Multitude of possible combinations of forces and moments • Available as 3, 4, 6 component transducer • Fatigue proof until ± 80% nominal capacity • Low mass
	**RLS** **Wheel Load Measuring System** **6 Components** **Nominal Load Fz 25 kN, 50 kN** Brochure RLS	• High fatigue strength (dynamic integrity) due to simple construction • Suitable for long-term fatigue rig testing • Small mass and high stiffness due to FEA optimized design • Simple mounting conditions and adaptation to wheel spigots • Fx, Fy, Fz, Mx, My, Mz acquired from 3 multi-component transducers and measuring electronics
	**RMK** **Bolt Friction Measuring Head** Brochure RMK	• Precise measurement of tightening-, thread- and head friction torque as well as bolt tension of a bolt joint with a single sensor • From M4 to M27 with a single senor • Calibration of measurement head by the GTM DKD-Calibration lab • Special measuring amplifier MCM

Torque Transducers

M
Precision Torque Transducer
Nominal Torque
2 N·m – 10000 N·m

Brochure M
Data sheet Tension Torsion M

- Compact design
- High torsional stiffness
- Can be combined with Force Transducer Type K as TT (Tension Torsion)

MF
Universal Torque Transducer
Nominal Torque
500 N·m – 64000 N·m

Brochure MF

- Compact shape
- High stiffness
- Fatigue proof until ± 100% nominal capacity
- Variable mounting by flanges

Torque Transfer Standards

DTN
Torque Transfer Transducer
Nominal Torque
1 N·m – 10000 N·m

Brochure DTN

- Highest possible repeatability
- High stability of the measuring signal

DTS
Torque-Transfer Wrench
Nominal Torque
2 N·m – 1000 N·m

Brochure DTS

- Specification according DKD-R-37
- Protected against moisture
- Integrated temperature sensor PT100
- Low mass

Amplifier Systems

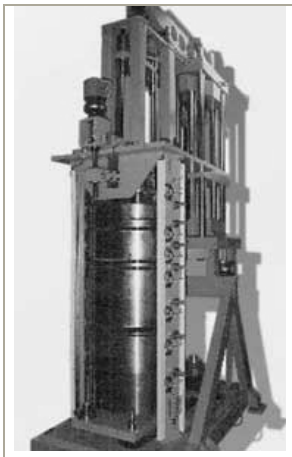
VN-Digitizer
High-Resolution Precision Measuring Instrument for DMS Transducers
Accuracy class ± 25 ppm of range

Brochure VN-Digitizer

- Resolution ± 200000 Digits
- Configurable surface
- Automatic calibration
- Transducer linearization
- Data acquisition and storage
- Max. 12 strain gauge inputs (with 6 slots)

	**LT-Digitizer** Brochure LT-Digitizer	• Portable amplifier with 2, 4 or 6 channels • Connection via USB interface • High precision • User friendly operator software • Customer specific desktop
	**MCA** **Measuring System** **6 Component Analyzer** Brochure MCA	• Simple operation • Transformation into defined 3-D force and moment vectors • Analogue output of the transformed quantities • Numeric and graphic online display
	**MCM** **Multi-Component Amplifier** Brochure MCM	• 12 strain gauge input signals • Resolutions 200000 Digits • Analogue output of the measured quantities • Cross-talk compensation and transducer linearization • Max. 12 strain gauge inputs (with 6 slots)

Machines

	**Machines** Brochure Machines	• Primary and secondary standard machines for force and torque for national metrological institutes and in industry • Calibration machines for transducer production • Various designs • Measuring uncertainties from 20ppm to 1000ppm • Forces: 10N to 10MN • Torque: 1 N·m to 25000 N·m

Services

Information GTM Calibration service	Calibration service	

General

General terms and conditions	AGB	

Force Transducer Series K

Precision Force Transducers for Tension and Compression Forces

Static and Dynamic

Capacity range 1 kN ... 500 kN
Accuracy class 0.02

Applications:

High-precision measurements of all static and dynamic applications in industrial testing, experimental mechanics and assembly testing.

Options:

- Fixed cable or plug connection
- Redundancy: Dual bridge for axial force measurement
- Additional bridges for the bending moments M_x and M_y (to verify central, purely axial force introduction)
- Tension-Torsion combination (with Series M torque transducer)

Accessories:

- Stretch bolts
- Base plate
- Thread adapter
- Tension adapter
- Tension rods
- Load button

Force Transducer Series K

Characteristics

- Rotational-symmetric design of the FE-optimised sensor element
- Integrating measuring principle: High suppression of disturbing components (bending moments, torque, lateral forces)
- Force introduction through central thread or flange mounting, depending on capacity
- Compatible with servo-hydraulic actuators of the GTM Novatest© series
- Tolerant with respect to mounting surfaces: No adapter plates required
- Low-profile, robust construction
- Low mass, high natural frequency
- Fatigue proof
- Long term stability
- Cable connection permanently fixed or plug-and-socket type
- Laser-welded, hermetically sealed sensor body made from stainless steel and filled with inert gas

Error limits

- The accuracy class normally refers to the linearity error and is relative to the capacity

- Important is the usable measuring range and the errors therein relative to the actually applied load (total error)

  Hence the accuracy class alone is not a criterion to judge the measuring quality of a force transducer.

  GTM Specification:

- Total error (relative to the applied load)

  - 0.4% in the range from 1% to 100%
  - 0.8% in the range from 0.4% to 1%

- Accuracy class 0.02

The GTM specification warrants highly precise measurements from the lowest utilisation right up to full capacity.

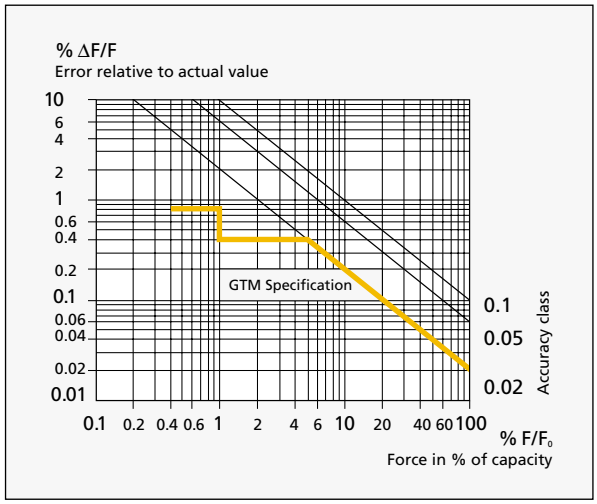


Fig. 1: Error limits according to GTM specification

Fatigue rating

- Fatigue proof up to +/- 80 % F_{nom} (1.6 F_{nom})

  - For capacities < 100 kN and nominal sensitivity 2 mV/V

  - For capacities ≥ 100 kN up to 500 kN and nominal sensitivity 1 mV/V

For all capacities GTM provides load diagrams. They allow to determine the permissible load limits even for complex loading situations.

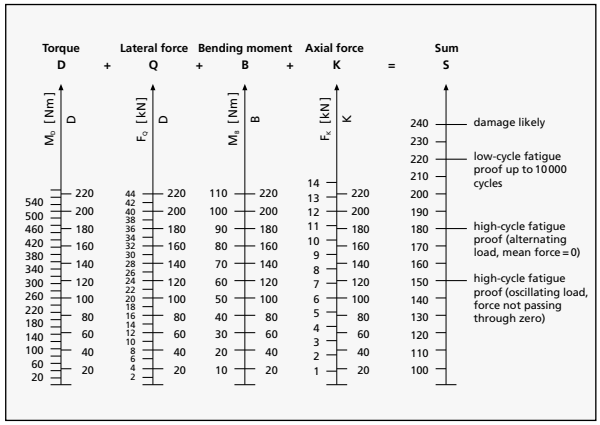


Fig. 2: Load diagram, extract

Technical data

General data (relative to full scale output)

Nominal capacity tension/compression	+/- F_{nom}	kN	1; 2.5	5	10; 20; 25	50; 63	100; 160	200; 250	400; 500
Accuracy class						0.02			0.03
Reproducibility error	f_{rep}	+/- %				0.003			
Linearity error	d_{lin}	+/- %	0.02	0.015	0.015	0.015	0.015	0.02	0.03
Hysteresis	u	+/- %	0.02	0.02	0.02	0.02	0.02	0.03	0.05
Temperature influence on zero	TK_0	+/- % pro K				0.001			
Temperature influence on span	TK_C	+/- % pro K				0.004			
Maximum load	F_L	+/- %				150			
Weight		kg	0.6	0.7	1	1.2	3.7	10.4	20
Nominal displacement		mm	0.05	0.06	0.07	0.07	0.09	0.19	0.29
Natural frequency		kHz	8	6	4,5	6.8	5	3.7	4

Electrical data

Nominal sensitivity	C_{nom}	mV/V	2	2	2	2	2; 1	2; 1	2; 1
Bridge impedance nominal	R_e	Ω	700			1000			
Maximum excitation	$U_{e,max}$	V	12			20			
Cable connection	5 m cable (6 wire), 6.5 mm diameter								
Environmental protection	IP 67 with fixed cable (EN 60529) IP 50 with plug connection								

Additional data (relative to actual value)

Total error in the range from 1% to 100 % F_{nom} 0.4 % to 1% F_{nom}	 f_{ges} f_{ges}	 +/- % +/- %	 0.4 0.8
Rel. creep (t_B = 30 min)	$d_{cr,F,E}$	+/- %	0.025
Nominal temperature range	$B_{t,nom}$	°C	+10 to +60
Influence of lateral forces	d_Q	+/- % per 0,1 F_{nom}	0.02
Influence of torque	d_M	+/- % per mm F_{nom}	0.005
Eccentricity influence	d_E	+/- % per mm	0.015
Maximum lateral load (static)	F_Q	+/- %	100

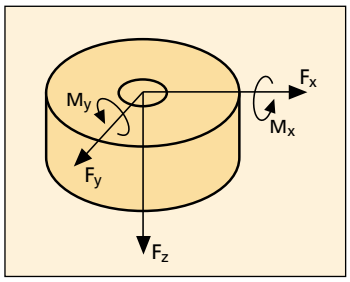
Options

Dual bridge (axial force), 2MK

The Series K transducers are optionally available with a second instrumentation for the axial load signal. The metrology data of both bridges are identical. Cable connection is possible as fixed cable or plug-and-socket type.

Bending moment instrumentation, 3MK

Option to check the axial force introduction F_z. In addition to F_z, the horizontal bending moments M_x and M_y are measured and fed out as separate channels. Cable connection is possible as fixed cable or plug-and-socket type.



Metrology data of the bending moment bridges 3MK (relative to full scale output)

Axial capacity	F_{nom}	kN	1 to 500 2 mV/V	100 to 500 1 mV/V
Nominal bending moment	M_{nom}	Nm	F_{nom} · 8 mm	F_{nom} · 12 mm
Nominal sensitivity	$C_{M,nom}$	mV/V	ca. 0.5	
Reproducibility error	f_{rep}	+/- %	0.01	
Temperature influence on zero	TK_0	+/- % per K	0.08	
Temperature influence on span	TK_C	+/- % per K	0.05	
Bridge impedance nominal	R_B	Ω	350	
Maximum excitation	$U_{e,max}$	V	12	

Tension-Torsion (TT)

The torque transducers Series M (non-rotating) are compatible with the force transducers Series K, so that a combined torque-axial load transducer is achieved in a simple way. Nominal torque capacities from 10 Nm up to 6000 Nm.

The tension-torsion system covers all applications of material and component testing which demand combined measurement of torque and force. Cable connection is possible as fixed cable or plug-and-socket type.

For technical data of the torque transducers please refer to the data sheet of Series M.

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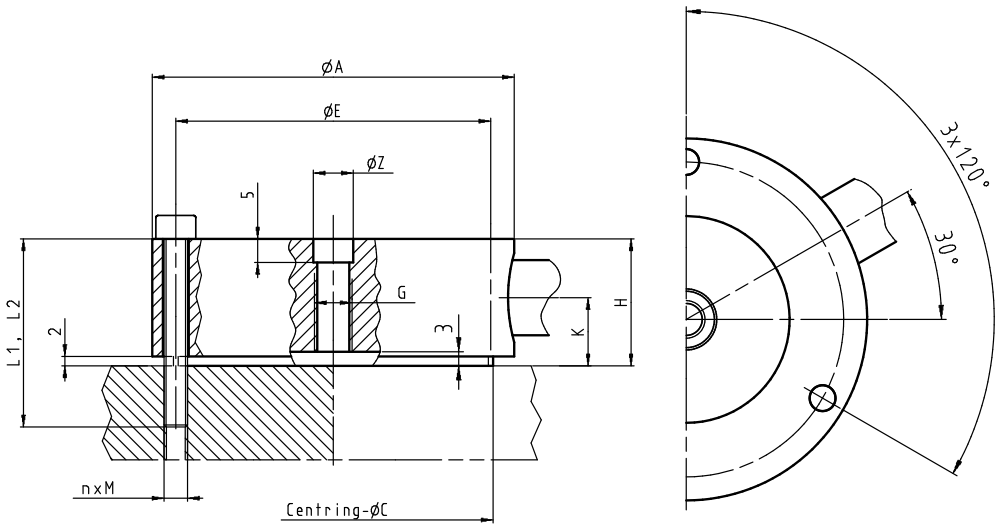
defining precision

Force Transducer K

Dimensions Nominal Capacity 200 N - 2.5 kN

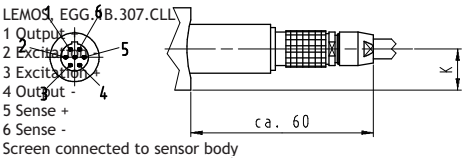


Nominal capacity	F_{nom}	± kN	0.2, 0.5, 1, 2.5
Outer diameter	ø A	mm	77
Flange diameter	ø B	mm	-
Outer centring diameter	ø C	mm	68 - 0.1
Outer pitch circle diameter	ø E	mm	67 ± 0.1
Centring pin diameter	ø Z	mm	8.5 + 0.1
Overall height	H	mm	23 - 0.1
	K	mm	12.5
n × thread			3 × M5
Inner pitch circle diameter	ø F	mm	-
Thread adapter internal thread	øG(M..)	mm	8
recomm. stretch bolt quality			8.8
static load	L_2	mm	35
dynamic load	L_1	mm	35
max. bolt torque (oiled, μ = 0.12)		N·m	on request
Permissible dynamic load range [1]	2 · F_a		1.6 · F_{nom}
electr. connection	Cable connected to transducer (5 m, PUR 6 wire, screened, ø 6.5 mm, open ended)		

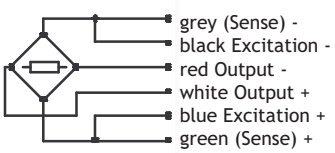
1) with alternating load acc. to DIN 50100, not exceeding ± F_{nom}

Plug connection (LEMO)

View from pin side



Screen connected to sensor body
Corresponding plug:
FGG.1B.307.CLA.D72



Specifications subject to change without notice
all details describe our products in general form
they are not to be understood as expressed warranty and do not constitute any liability whatsoever

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GASSMANN TESTING AND METROLOGY GMBH

Gassmann Testing and Metrology GmbH

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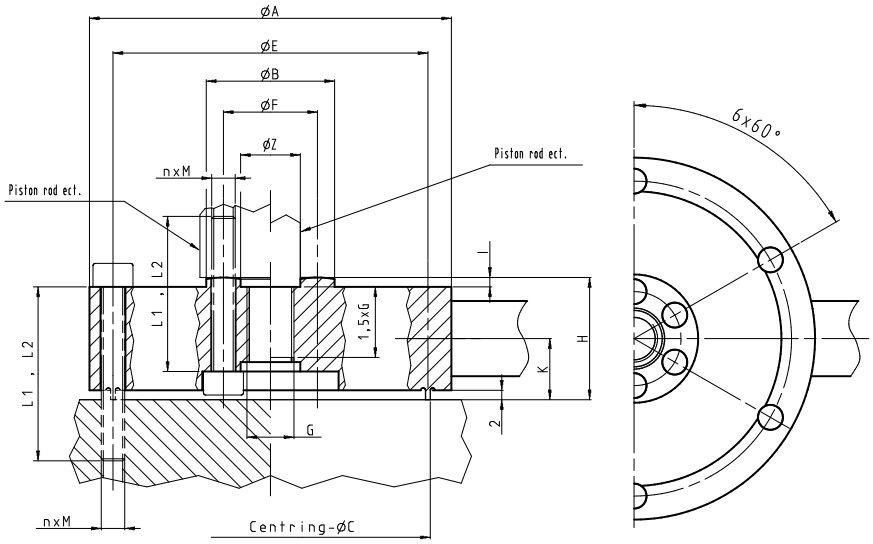
contact@gtm-gmbh.com

Force Transducer K

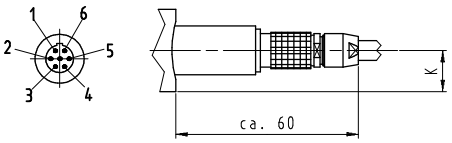
Dimensions Nominal Capacity 5 kN



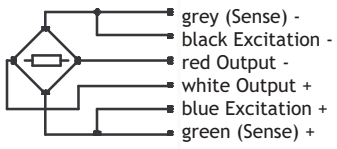
Nominal capacity	F_{nom}	± kN	5
Outer diameter	ø A	mm	77
Flange diameter	ø B	mm	27.3
Outer centring diameter	ø C	mm	68 - 0.1
Outer pitch circle diameter	ø E	mm	67 ± 0.1
Centring pin diameter	ø Z	mm	12.7 + 0.05
Overall height	H	mm	26 - 0.1
	I	mm	2
	K	mm	13
n × thread			6 × M5
Inner pitch circle diameter	ø F	mm	20 ± 0.1
Thread adapter internal thread	øG(M..)	mm	10 × 1
Stretch bolt quality			8.8
static load	L_2	mm	35
dynamic load	L_1	mm	35
Bolt torque (stretch bolts) (oiled, μ = 0.12)		N·m	3
Permissible dynamic load range [1]	$2 \cdot F_a$		$1.6 \cdot F_{nom}$
electr. connection	Cable connected to transducer (5 m, PUR, 6 wire, screened. ø 6.5 mm, open ended)		

Plug connection (LEMO)

View from pin side



LEMOS, EGG.1B.307.CLL
1 Output +
2 Excitation -
3 Excitation +
4 Output -
5 Sense +
6 Sense -
Screen connected to sensor body
Corresponding plug:
FGG.1B.307.CLA.D72



1) bei Wechselbeanspruchung nach DIN 50100, jedoch nicht größer als ± F_{nom}

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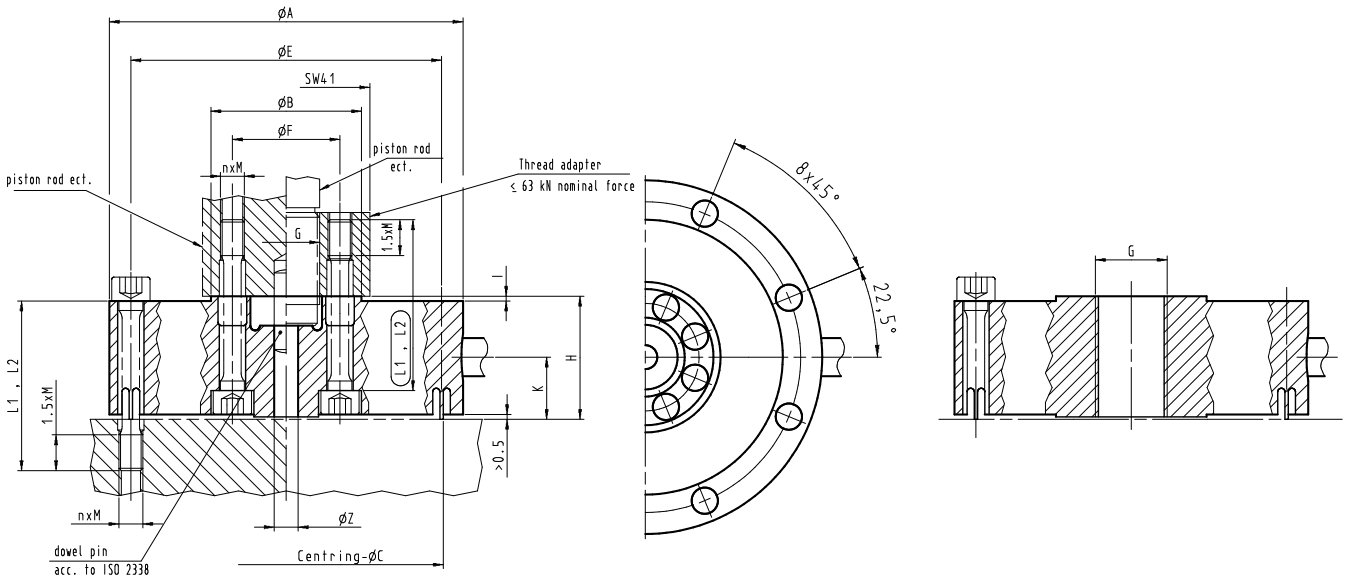
Force Transducer K

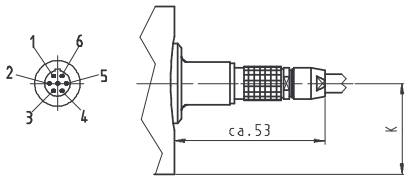
Dimensions Nominal Capacity 10 kN - 160 kN



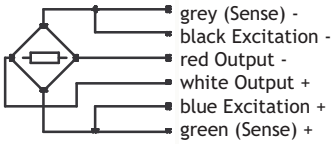
Nominal capacity	F_{nom}	± kN	10, 20, 25	50, 63	100, 150, 160
Outer diameter	ø A	mm	95	101	148
Flange diameter	ø B	mm	40	38.6	63
Outer centring diameter	ø C	mm	81 - 0.1	87.5 - 0.1	131.4 - 0.1
Outer pitch circle diameter	ø E	mm	80 ± 0.1	86 ± 0.1	130 ± 0.1
Centring pin diameter	ø Z	mm	8 + 0.1		10 + 0.1
Overall height	H	mm	31 - 0.1		49 - 0.1
	I	mm	1	1.5	0.5
	K	mm	18		25
n × thread			8 × M6		8 × M10
Inner pitch circle diameter	ø F	mm	30 ± 0.1		45 ± 0.1
Thread adapter internal thread	øG(M..)	mm	20 × 1.5 (except 25 kN)	-	
Stretch bolt quality			10.9		
static load	L_2	mm	45		70
dynamic load	L_1	mm	55		100
Bolt torque (stretch bolts) (oiled, μ = 0.12)		N·m	12		65
Permissible dynamic load range [1]	2 · F_a		1.6 · F_{nom}		[2]
electr. connection	Cable connected to transducer (5 m, PUR, 6 wire, screened, ø 6.5 mm, open ended)				

Plug connection (LEMO)

View from pin side



LEMOS, EGG.1B.307.CLL
1 Output +
2 Excitation -
3 Excitation +
4 Output -
5 Sense +
6 Sense -
Screen connected to sensor body
Corresponding plug:
FGG.1B.307.CLA.D72



1) with alternating load acc. to DIN 50100, not exceeding ± F_{nom}
2) 1.6 · F_{nom} (Version 1 mV/V), 1.0 · F_{nom} (Version 2 mV/V)

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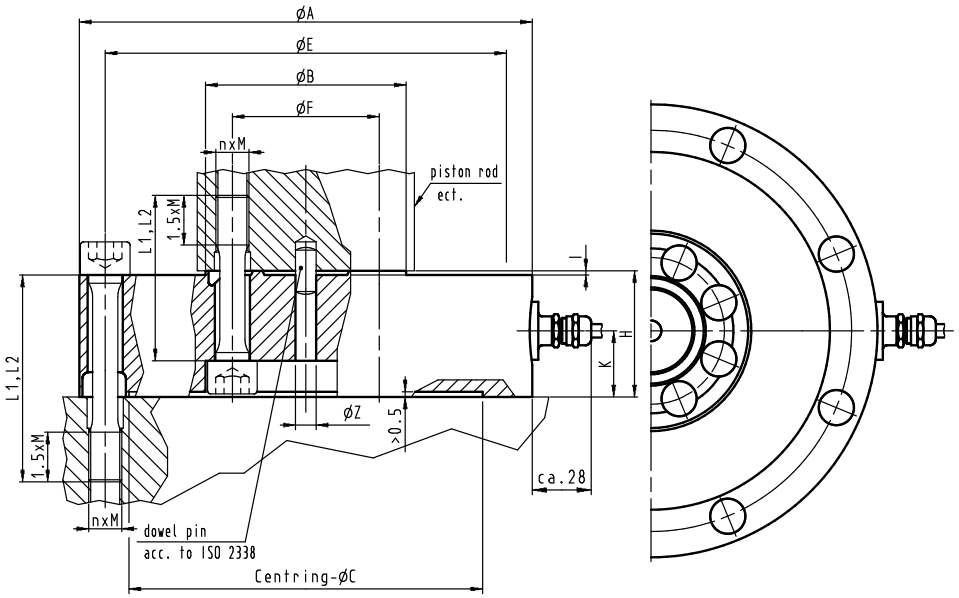
Force Transducer K

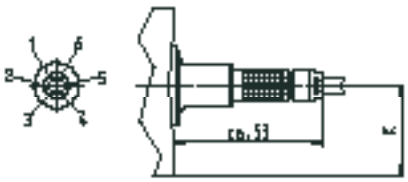
Dimensions Nominal Capacity 200 kN - 500 kN



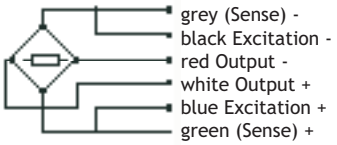
Nominal capacity	F_{nom}	± kN	200, 250	400, 500
Outer diameter	ø A	mm	219	270
Flange diameter	ø B	mm	97	129
Outer centring diameter	ø C	mm	171 ± 0.1	203 ± 0.1
Outer pitch circle diameter	ø E	mm	194 ± 0.1	235 ± 0.1
Centring pin diameter	ø Z	mm	10 + 0.1	
Overall height	H	mm	60 - 0.1	80 - 0.1
	I	mm	1	
	K	mm	32	40
n × thread			8 × M16	8 × M20
Inner pitch circle diameter	ø F	mm	71 ± 0.1	95 ± 0.1
Thread adapter internal thread	øG(M..)	mm	-	
Stretch bolt quality			10.9	
static load	L_2	mm	80	110
dynamic load	L_1	mm	160	200
Bolt torque (stretch bolts) (oiled, μ = 0.12)		N·m	230 - 280	450 - 560
Permissible dynamic load range [1]	$2 \cdot F_a$		$1.6 \cdot F_{nom}$ (Version 1 mV/V) $1.0 \cdot F_{nom}$ (Version 2 mV/V)	
electr. connection	Cable connected to transducer (5 m, PUR, 6 wire, screened, ø 6.5 mm, open ended)			

Plug connection (LEMO)

View from pin side



LEMOS, EGG.1B.307.CLL
1 Output +
2 Excitation -
3 Excitation +
4 Output -
5 Sense +
6 Sense -
Screen connected to sensor body
Corresponding plug:
FGG.1B.307.CLA.D72



1) with alternating load acc. to DIN 50100, not exceeding ± F_{nom}

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Force Transducer RF

Precision force transducer for tension and compression static and dynamic

- Nominal loads from 400 kN up to 10 MN
- Accuracy class 0,05
- Low profile, small mass
- Insensitive to eccentric load application and lateral forces
- Simple mounting
- Fatigue proof

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RF_p_e 04/2007

Force Transducer RF

Technical Description

The Series RF is fatigue proof (at alternating load tension/compression) with good support against bending moments and eccentric load.

The transducer can easily be mounted at crossheads and crossbars. It may be screwn in from only one side, through holes in the crossbar are not necessary.

The optimal adaptation of the strain gauges and the transducer geometry provide an excellent isolation from disturbing influences and a low creep error, even during sudden unloading. The brilliant sealing secures high long-term stability.

Applications

The Series RF is especially developed for material testing in the upper load range (400 kN to 10 MN).

Options

- Dual bridge
  The transducers are optionally available with two measuring bridges, which are identical in all their metrology specifications
- Bending moment instrumentation
  Option to check the quality of load introduction. Additionally to the axial force F_z, the horizontal bending moments M_x and M_y are measured separately and given out as individual channels

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Force Transducer RF

Technical Data

General Data (relative to full scale output)

Nominal capacity tension/compression	F_{nom}	± kN	400	500	630	1,000	2,000	2,500	3,000	4,000	5,000	10,000
Accuracy class			0.05									
Reproducibility error	f_{rep}	± %	0.005									
Linearity error	d_{lin}	± %	0.025									
Hysteresis	u	± %	0.2									
Temperature influence on zero	TK_0	± %/K	0.0025									
Temperature influence on span	TK_C	± %/K	0.004									
Maximum force	F_L	± %	150									
Maximum lateral force	F_Q	± %	100									
Breaking force	F_B	± %	> 300									
Weight		kg	9			19	46		81	122	on request	
Nominal displacement		mm	0.16			0.2	0.29		0.32	0.34	on request	
Natural frequency		kHz	3									

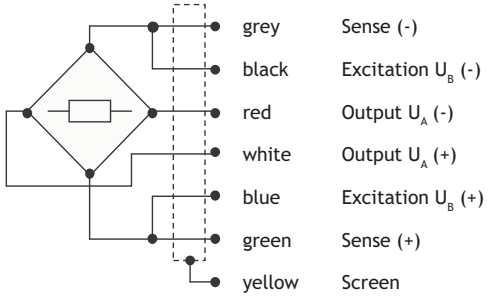
Electrical Data

Nominal sensitivity	C_{nom}	mV/V	2
Bridge impedance nominal	R_e	Ω	ca. 750
Maximum excitation	$U_{e, max}$	V	15
Cable connection			5 m long, 6-wire, ø 6.5 mm
Environmental protection			IP 54 with fixed Connection (EN60529)

Additional Data (relative to actual value)

Total error (incl. hysteresis, linearity and temperature error) in the range from 1% to 100% F_{nom}	ΔF/F	± %	0.5
Rel. creep (t_B = 30 min)	$d_{cr, F, E}$	± %	0.025
Nominal temperature range	$B_{t, nom}$	°C	+10 to +60
Lateral force influence	d_Q	± %/0,1 F_{nom}	0.2
Torque influence	d_M	± %/mm F_{nom}	< 0.005
Eccentricity influence	d_E	± %/mm	0.02

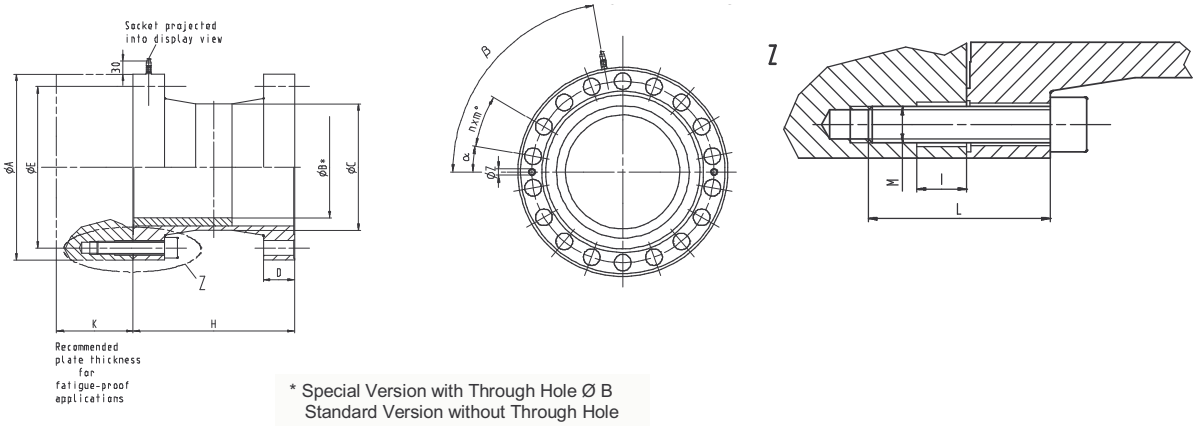
Electrical connection



fixed connection at transducer
(5 m, 6-wire, screened,
open ended)

Force Transducer RF

Dimensions



* Special Version with Through Hole Ø B
Standard Version without Through Hole

Nominal capacity tension/compression	F_{nom}	± kN	400, 500 630	1,000	2,000 2,500	3,000	4,000
Outer diameter	ø A	mm	197	240	305	415	536
Through hole	ø B	mm	87	110	119	236	on request
Diameter at waist	ø C	mm	114.5	146.5	171.4	282.4	on request
Flange height	D	mm	25	40	57	69	80
Pitch circle diameter	ø E	mm	160	200	250	360	480
Overall height	H	mm	160	230	326	358	400
Chamfering	I	mm	30	25	45	35	25
Plate thickness	K	mm	70	100	140	175	200
Minimum bolt length	L	mm	80	100	150		
Bolt thread	M		M20	M24	M30		M30×2
Pitch	n×m		12×30			18×20	24×15
Dowel pin (2)	ø Z	mm	12^{H8}				
Angular position of dowel pin	α	°	15			10	on request
Angular position of cable entry	ß	°	90	60	0	100	on request
Bolt quality			12.9				
Bolt torque (oiled, μ = 0.2)	H	N·m	400	1.000	2.000		
Permissible dynamic load range [1)2)]	$2 \cdot F_a$		$1.6 \cdot F_{nom}$				
electr. connection [2)]			Cable connected to transducer (5 m, PUR, 6-wire, screened, ø 6.5 mm, open ended				

1) With alternating load acc. DIN 50100 not exceeding ± F_{nom}
2) For 2,500 kN however not exceeding $1.28 \cdot F_{nom}$

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Force Transducer UB

Universal force transducer for tension and compression forces Static and dynamic

- Capacity range from 20 kN up to 500 kN
- Accuracy class 0,1
- Small, robust universal transducer
- Simple mounting, high reliability
- Convincing price-performance ratio
- Numerous adaptations possible

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UB_p_e 04/2007

Force Transducer UB

Technical Description

With the Series UB, designed as rotation-symmetric column type, GTM offers a transducer with extremely small diameter, low weight and high natural frequency. Of particular importance are the good dynamic properties of the Series UB, caused by nut mounting and long stretch sections. The robust FEM-optimised construction warrants high reliability.
By virtue of the flexible adaptability of the mounting components the load cell Series UB is particularly easy to apply as a universal load cell. The central inner thread enables the robust and fatigue-proof adaptation with a threaded bolt or with swivel joints. Machined spanner flats make the mounting simple and safe, allowing sufficient tightening in the test set-up.

Applications

Universal load cell for all static and dynamic applications in the areas of industrial testing, experimental mechanics and assembly testing

Options

Adaptations to a great variety of applications with GTM mounting components:

- Swivel joints
- Threaded bolts
- Load buttons

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Force Transducer UB

Technical Data

General Data (relative to full scale output)

Nominal capacity tension/compression	F_{nom}	± kN	20	50	100	200	500
Accuracy class					0.2		
Reproducibility error	f_{rep}	± %			0.002		
Linearity error	d_{lin}	± %			0.2		
Hysteresis	u	± %			0.05		
Temperature influence on zero	TK_0	± %/K			0.05		
Temperature influence on span	TK_C	± %/K			0.1		
Maximum force	F_L	± %			150		
Maximum lateral force	F_Q	± %			80		
Breaking force	F_B	± %			> 300		
Weight		kg	0.5		1.6	2.5	12
Nominal displacement		mm	0.04	0.07	0.09	0.12	0.21

Electrical Data

Nominal sensitivity	C_{nom}	mV/V	2
Bridge impedance nominal	R_e	Ω	ca. 380
Maximum excitation	$U_{e, max}$	V	12
Cable connection			5 m long (6-wire); ø 6.5 mm
Environmental protection			IP 67 with fixed connection (EN60529)

Additional Data (relative to actual value)

Rel. creep (t_B = 30 min)	$d_{cr, F, E}$	± %	< 0.005
Nominal temperature range	$B_{t, nom}$	°C	-10 to +70
Lateral force influence	d_Q	± %/0.1 F_{nom}	0.1
Eccentricity influence	d_E	± %/mm	0.05

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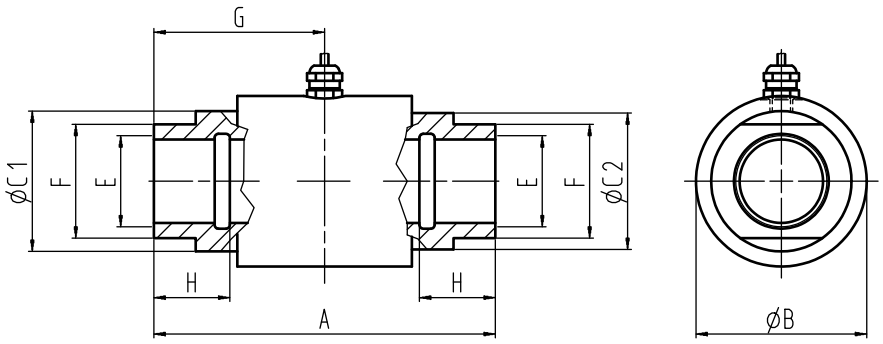
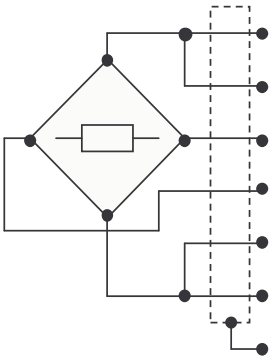
Force Transducer UB

Dimensions



Nominal capacity tension/compression	F_{nom}	± kN	20	50	100	200	500
Overall height	A	mm	71		95	115	180
Outer diameter	ø B	mm	38		55	65	120
Connection thread	E	mm	M20 × 1,5		M24 ×2	M30 ×2	M56 ×4
Diameter A/F-side	ø C_1	mm	30		45	55	110
Diameter other side	ø C_2	mm	29		44	54	109
Width across flats	F	mm	24		36	46	85
Cable entry position	G	mm	35.5		47.5	57.5	90
max. engagement length	H	mm	19		24	27	55
Tightning torque (oiled, μ = 0,12)		N·m	75	250	750	1800	6800
Recommended bolt length for fatigue application		mm	55		100		150

Electrical connection



grey	Sense (-)
black	Excitation U_B (-)
red	Output U_A (-)
white	Output U_A (+)
blue	Excitation U_B (+)
green	Sense (+)
yellow	Screen

fixed connection
(5 m, 6-wire, screened, open ended)

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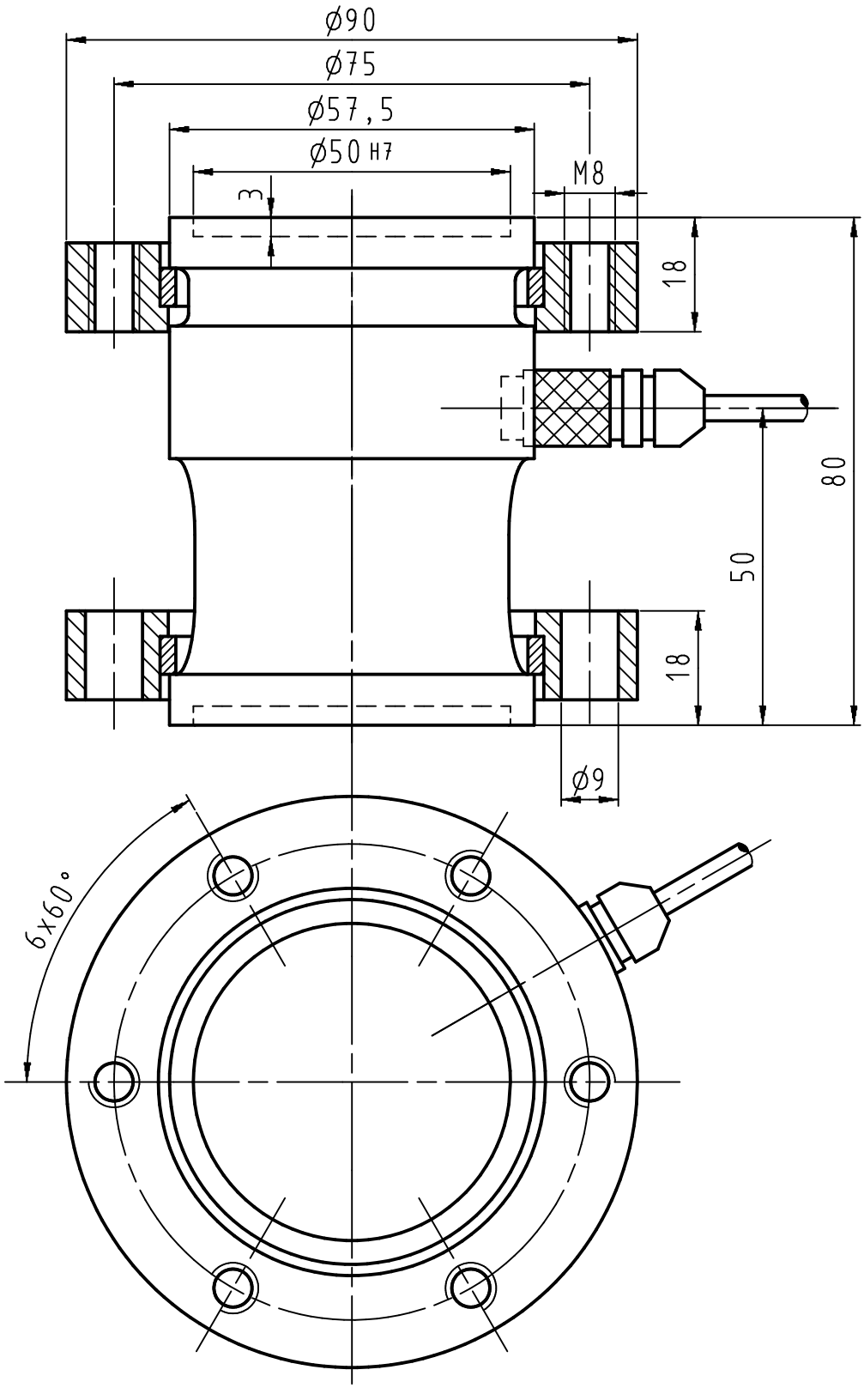

a	Maß 18 war 15	28.11.06	Unger
Zust.	Änderung	Datum	Name

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Gassmann Theiss
Messtechnik GmbH

Oberflächen ISO 1302	9210	Datum	Name
	gezeichnet	21.06.05	Raabe
Maßstab 1:1	geprüft		
	genehmigt		

Freimaßtoleranzen DIN 7168 "mittel"

Gegenstand **Messfeder**

UBV 20-100 kN

(Kundenzeichnung)

Werkstoff ---

Zeichn.-Nr. 20.4.4635 a

Ersatz für

Force Transducer UBV

Universal force transducer for tension and compression force static and dynamic

- Nominal capacity from 20 kN to 5,000 kN
- Accuracy class 0,1
- Tolerable eccentricity up to 10 mm
- Fatigue proof up to ± 100% nominal force
- Variable mounting flanges
- Low mass

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UBV_p_e 04/2007

Force Transducer UBV

Technical Description

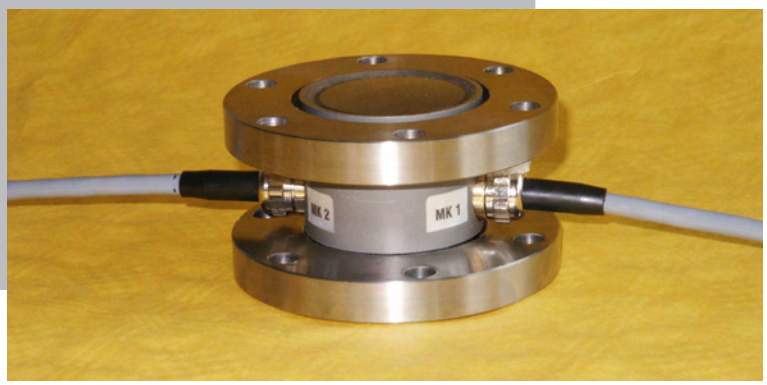
The transducer Series UBV is a rotational-symmetric design of FEM optimized sensor elements. Removable flanges enable the universal assembly for the most applications. The compact design and low mass is the base for the high natural frequency. It is possible to have an eccentric force up to 10 mm. The FEM optimized sensor is built for static and dynamic test, and for fatigue strength with more than 10^8 cycles.

Applications

Universally usable for all static and dynamic applications in industrial testing and instrumentation

Options

- Plug and socket connection
- Alternated flanges
- Second measuring circle



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Force Transducer UBV

Technical Data

General Data (relative to full scale output)

Nominal capacity tension/compression	F_{nom}	± kN	20; 50 63; 100	200; 250; 350 400; 500; 630	1,000 1,500	2,000 2,500	3,000; 4,000 5,000
Accuracy class			0.1				
Reproducibility error	f_{rep}	± %	0.005				
Linearity error	d_{lin}	± %	0.1				
Hysteresis	u	± %	0.1				
Temperature influence on zero	TK_0	± %/K	0.005				
Temperature influence on span	TK_C	± %/K	0.01				
Maximum force	F_L	± %	150				
Maximum lateral force	F_Q	± %	50				
Breaking force	F_B	± %	> 300				
Weight		kg	2	11	55		on request
Nominal displacement		mm	0.06	0.16	0.2	0.3	on request
Natural frequency		kHz	1				

Electrical Data

Nominal sensitivity	C_{nom}	mV/V	2.1 ± 0.1
Bridge impedance nominal	R_e	Ω	ca. 700
Maximum excitation	$U_{e, max}$	V	12
Cable connection			5 m long (6-wire); ø 6.5 mm
Environmental protection			IP 54 with fixed connection (EN60529)

Additional Data (relative to actual value)

Total error (incl. hysteresis, linearity and temperature error) in the range from 1% to 100% F_{nom}	ΔF/F	± %	0.5
Rel. creep (t_B = 30 min)	$d_{cr, F, E}$	± %	0.03
Nominal temperature range	$B_{t, nom}$	°C	+10 to +60
Lateral force influence	d_Q	± %/0.1 F_{nom}	0.1
Torque influence	d_M	± %/mm F_{nom}	0.1
Eccentricity influence	d_E	± %/mm	0.1

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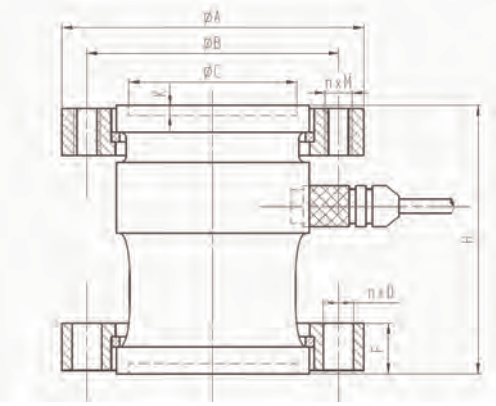
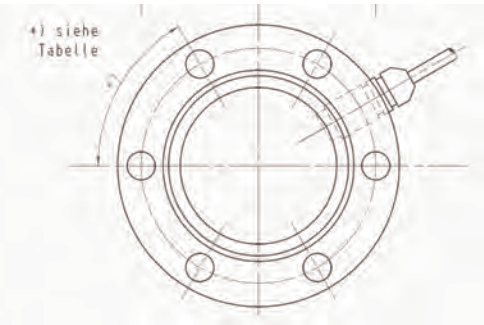
Force Transducer UBV

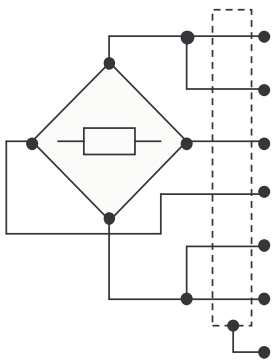
Dimensions Standard Flanges





Nominal capacity tension/compression	F_{nom}	± kN	20, 50 63, 100	200, 250, 350 400, 500, 630	1000, 1500 2000, 2500	3000, 4000 5000
Height	H	mm	80	160	300	
Flange diameter	ø A	mm	90	185	295	
Pitch circle diameter	ø B	mm	75	155	250	
Flange height	F	mm	18	39	70	
Thread	n × M		6 × M8	6 × M20	12 × M30	
Pitch	n × D	mm	6 × ø 9	6 × ø 22	12 × ø 33	on request
Pretension force $F_v = V \times F_{nom}$	V			1,1		
Centring diameter K = 3 mm	ø C	mm	50 H7	95 H7	132 H11	
Weight	M	kg	2	11	55	
Adaptation evenness				0.05		
Adaptation material	p_{max}	MPa		450		

Electrical Connection



grey	Sense (-)
black	Excitation U_B (-)
red	Output U_A (-)
white	Output U_A (+)
blue	Excitation U_B (+)
green	Sense (+)
yellow	Screen

fixed connection to transducer (0.8 m, 6-wire, screened, ø 5 mm)

GTM
GASSMANN TESTING AND METROLOGY GMBH

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contact@gtm-gmbh.com

Force Transducer UM

Universal force transducer for tension and compression forces static and dynamic

- Capacity range from 250 N to 10 kN
- Accuracy class 0,05
- Insensitive to eccentric and lateral loads
- Exceptionally small and light transducer
- Simple integration in existing designs
- Convincing price-performance ratio

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UM_p_e 04/2007

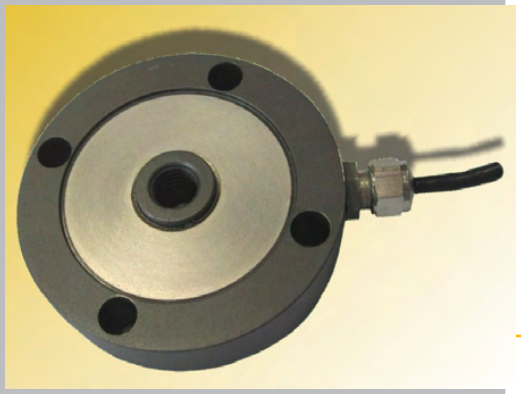
Force Transducer UM

Technical Description

With the Series UM, designed as rotation-symmetric diaphragm type, GTM offers a transducer with extremely small dimensions, low weight and high natural frequency. By virtue of the flexible adaptability of the mounting components the load cell Series UM is particularly easy to apply as a universal load cell.

Mounting Options

Series UM transducers may be fitted to machine cross-heads via a PCD which is compatible to other commercially available load cells. This also allows integration into existing constructions using adapter plates. The central thread enables additional possibilities: Swivel joints, load buttons, threaded rods. Exchangeability of all these mounting parts renders the flexibility of integration of these transducers very high.



Optionen

Adaptations to a great variety with GTM mounting components:

- Swivel joints
- Threaded bolts
- Load buttons
- Base plates

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Force Transducer UM

Technische Daten

General Data (relative to full scale output)

Nominal capacity tension/compression	F_{nom}	± kN	0.25	0.5	1	2.5	5	10
Accuracy class			0.05					
Reproducibility error	f_{rep}	± %	0.005					
Linearity error	d_{lin}	± %	0.05					
Hysteresis	u	± %	0.05					
Temperature influence on zero	TK_0	± %/K	0.005					
Temperature influence on span	TK_C	± %/K	0.01					
Maximum force	F_L	± %	150					
Maximum lateral force	F_Q	± %	100					
Breaking force	F_B	± %	> 300					
Weight		kg	0.2					
Nominal displacement		mm	< 0.04					
Natural frequency		kHz	ca. 4					

Electrical Data

Nominal sensitivity	C_{nom}	mV/V	2
Bridge impedance nominal	R_e	Ω	350
Maximum excitation	$U_{e, max}$	V	10
Cable connection			0.8 m cable (6-wire); ø 4.0 mm
Environmental protection			IP 67 with fixed connection (EN60529)

Additional Data (relative to actual value)

Total error (incl. hysteresis, linearity and temperature error) in the range from 1% to 100% F_{nom}	ΔF/F	± %	0.5
Rel. creep (t_B = 30 min)	$d_{cr, F, E}$	± %	0.025
Nominal temperature range	$B_{t, nom}$	°C	+10 to +60
Lateral force influence	d_Q	± %/0.1 F_{nom}	0.05
Torque influence	d_M	± %/mm F_{nom}	0.01
Eccentricity influence	d_E	± %/mm	0.1

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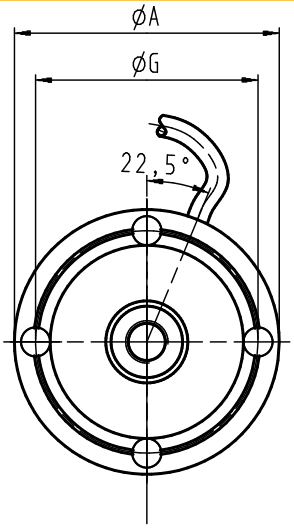
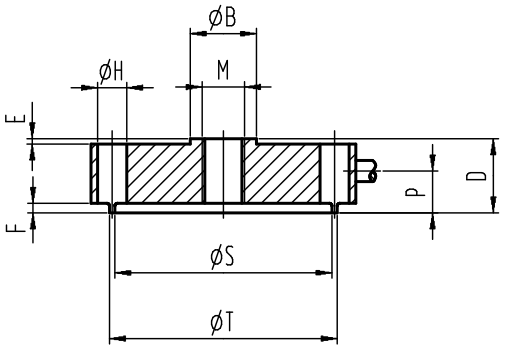
Force Transducer UM

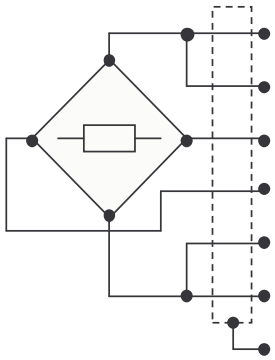
Dimensions





Nominal capacity tension/compression	F_{nom}	± kN	0.25	0.5	1	2.5	5	10
Outer diameter	ø A	mm	50 - 0.2					
Collar outer diameter	ø B	mm	12 + 0.1					
Pitch circle diameter	ø G	mm	42 ± 0.1					
Central thread	M		M8					
Tightening torque	M_{Amax}	N·m	10 N·m				20 N·m	
Fixing bolts	ø H	mm	5.5					
Cable entry position	P	mm	7.5					
Overall height	D	mm	14					
Diameter/length-ø (1mm)	ø S	mm	41 + 0.1					
Diameter/length-ø (1mm)	ø T	mm	43 - 0.1					

Electrical connection



yellow	Sense (-)
black	Excitation U_B (-)
red	Output U_A (-)
white	Output U_A (+)
blue	Excitation U_B (+)
green	Sense (+)
grey	Screen

fixed connection
(0,8 m, 6-wire, screened)

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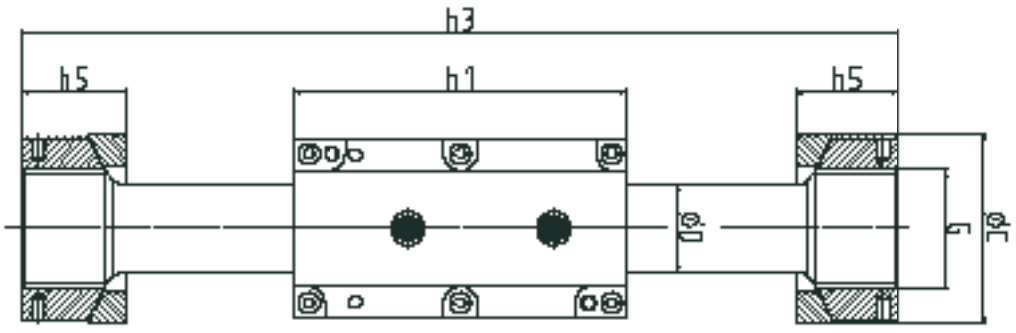
Force Transfer Standard ZST

Dimensions (nominal load 100 kN - 10 MN)



Nominal load tension	kN	100	200	500	1,000	2,000	5,000	10,000
h1	mm	120			160		170	
h3	mm	500		600	650	900	1,200	
h5	mm	31	32	52	72	104	171	200
Ø C	mm	50	64	90	120	165	270	345
Ø D	mm	26	25	40	56,5	80	126	178
G		M24×2	M30×2	M56×4	M64×4	M90×4	M160×6	M200×6
Weight	kg	2	2.8	7.8	15	36	118	285

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Defining Precision – GTM Calibration Equipment

defining precision

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Force Transfer Standards

GTM Force Transfer Standards – Precision Force Transducers …
… according to ISO 376 (supersedes DIN EN 10002-3), in the accuracy classes 00; 05; 1, as well as GTM Class VN for use as reference transducers for traceable calibrations.

- For tension and compression forces
- Capacities from 10 N up to 10 MN (special designs >10 MN)

Applications:
- Comparison measurements (especially Class VN) of Force Standard Machines (FSM)
- Reference transducers for the calibration of force calibration machines and systems
- Reference transducers for the use in mechanical and hydraulic test systems
- Reference transducers for all traceable force calibrations

Characteristics:
- Highest reproducibility, naturally with different FSM: ≤ 50 ppm, typically 20 ppm under comparable test conditions
- High long-term stability
- Small rotation error
- Hermetically sealed
- Small effects of eccentric loading, side forces or moments

Options:
- Mounting components according to ISO 376
- Robust cases or boxes: Safe storage and transportation
- Pt 100 temperature sensor
- 2 independent measuring circuits
- Additional bending moment measuring circuits

Metrological Data

Figures in % of reading, in the range of 20% – 100% • F_{nom}

* Definitions according to VDI/VDE 2638 respectively ISO 376
** better than G00 according to ISO 376

			GTM Class VN**	Class 00*	Class 0.5*	Class 1*
Rel. zero return	$d_{s,o}$	%	0.008	0.010	0.020	0.035
Rel. repeatability in unchanged mounting position	b_{rg}	%	0.002	0.023	0.045	0.08
Rel. repeatability in changed mounting position	b_{rv}	%	0.005	0.045	0.09	0.15
Rel. interpolation error	f_r	%	0.002	0.02	0.04	0.08
Rel. hysteresis	u	%	0.06	0.06	0.14	0.25
Temperature coefficient on zero per K	Tk_0	%/K	0.001	0.001	0.002	0.0025
Temperature coefficient on span per K	Tk_C	%/K	0.001	0.001	0.002	0.003
Rel. creep error 0.5 – 15 min. ≤ 100 kN 1 – 15 min. ≥ 200 kN	d_{cr}	%	0.008	0.01	0.02	0.025
Reference temperature	t_{ref}	°C	21	21	21	21
Nominal temperature range	$B_{t,nom}$	°C	21±5 K	10…30	10…30	10…30
Influence of 1 mm eccentricity	f_m	%	0.005	0.005	0.01	0.01

Types

KTN-Z/D-SP
Tension/compression Force Transfer Standard for small forces.
- Capacities from 10 N to 2.5 kN
- Compact size
- Accuracy classes G00; G05; G1

KTN-Z/D
The patented design guarantees small disturbing effects.
- Capacities from 5 kN to 500 kN
- GTM bending ring transducer with GTM spiral strain gauges
- Accuracy classes G00; G05; G1

KTN-D
Active calibration capability, i.e. the metrology performance is independent from the characteristics of the calibration machine and the mounting situation.
- Capacities from 5 kN to 10 MN
- Optimised dimensions, low weight
- Accuracy classes VN; G00; G05; G1

KTN-ZST
Due to their low weight, these transducers have big advantages in handling.
- Capacities from 100 kN to 10 MN
- Option: Additional bending moment bridges (alignment check)
- Accuracy classes G05; G1

KTN-DZY
Specially for the calibration of high compression forces.
- Capacities from 1 MN to 10 MN
- With three or four measuring bridges
- Accuracy class G1

Load Column KTN-DZYB For The Testing Of Building Materials
Specially for the calibration of concrete cube testing machines.
- Capacity 2000 kN
- According to DIN EN 51302-2
- With four measuring bridges
- Accuracy class G1

Torque Transfer Standards

Torque Transfer Standard
1–200 Nm

GTM Torque Transfer Standards
For comparison measurements of Torque Standard Machines and for the calibration of torque calibration systems.
Available in the classes 0.05; 0.1; 0.2 according to DIN 51309, and GTM Type VN (exceeds class 0.05).

Capacities
- From 1 Nm to 2000 Nm

Characteristics
- Hermetically sealed up to 200 Nm capacity
- Exceptionally high reproducibility

Applications
- Calibration of your test systems
- Verification of your transducers

Torque Transfer Standard
500–2000 Nm

Options:
- PT100 temperature sensor
- Bending moment measurement (from DTN 500 onwards)
- DKD calibration
- Robust transportation boxes

Metrological Data

Figures in % of reading, in the range of 20% – 100% • M_{nom} (Class 0.2), 40%–100%, • M_{nom} (Classses 0.1; 0.05; VN)			* Definitions according to DIN 51309 ** better than Class 0.05 according to DIN 51309			
			GTM Class VN**	Class 0.05*	Class 0.1*	Class 0.2*
Rel. repeatability	b	%	0.010	0.050	0.10	0.20
Rel. repeatability	b'	%	0.005	0.025	0.05	0.10
Rel. zero deviation	f_0	%	0.006	0.0125	0.025	0.050
Rel. hysteresis	h	%	0.063	0.063	0.125	0.250
Rel. indication/ interpolation error	f_q, f_a	%	±0.025	±0.025	±0.05	±0.10
Temperature coefficient on zero per K	Tk_0	%/K	0.0008	0.0008	0.001	0.002
Temperature coefficient on span per K	Tk_c	%/K	0.001	0.001	0.001	0.002
Rel. creep error 1 – 15 min.	d_{cr}	%	0.004	0.008	0.01	0.02
Reference temperature	t_{ref}	°C	21	21	21	21
Nominal temperature range	$B_{t,nom}$	°C	21±5 K	10…30	10…30	10…30

Reference Torque Wrenches

Reference Torque Wrench
Capacity: 20 Nm

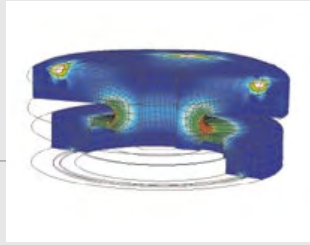
GTM Reference Torque Wrenches
Comparison measurements of torque wrench calibration systems and calibration of torque testing devices.

Capacities
- From 20 Nm up to 1000 Nm (5 Nm, 10 Nm upon request)

Characteristics
- Comply with recommendation DKD-R 3-7
- Exceptionally low weight

Applications:
- Comparison measurements of torque wrench calibration systems
- Calibration of torque testing devices

Options:
- Pt 100 temperature sensor
- Calibrated according to DKD-R 3-7
- Different sizes of square drives
- Delivery in special cases (durable plastic)



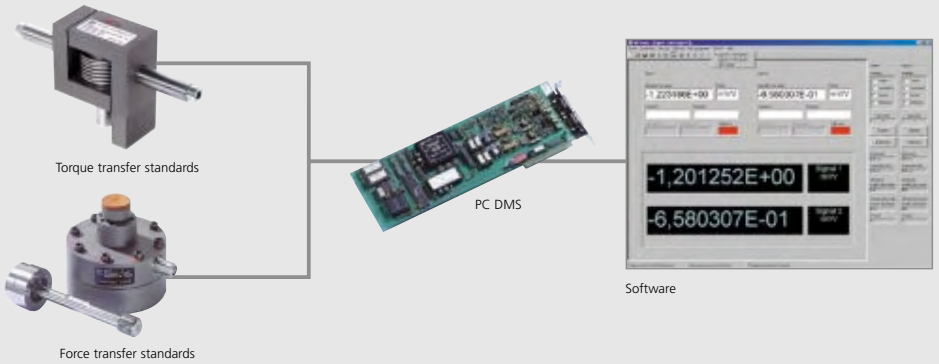
The sensor of this product has also been optimized with FEA

Metrological Data

Error limits of the reference torque wrenches in % of reading, in the range of 20% - 100% • M_E			*Definitions according to DIN 51309			
			Class 0.2*	Class 0.5*	Class 1*	Class 2*
Rel. repeatability	b, b_l	%	0.20	0.50	1.00	2.00
Rel. repeatability	b'	%	0.10	0.25		
Rel. zero deviation	f_0	%	0.050	0.125	0.25	0.50
Rel. hysteresis	h	%	0.250	0.63	1.25	2.50
Rel. indication/ interpolation error	f_q, f_a	%	±0.10	±0.25	±0.50	±1.0
Start of measuring range	M_A	%	≥1000r	≥400r	≥200r	≥100r
Rel. uncertainty of calibration torque		%	0.040	0.10	0.20	0.40

We supply the complete measuring chain

According to the calibration standard ISO 376 the measuring chain is defined as follows: The measuring chain consists of the sensor, its mounting accessories, cables and the electronic system used.



GTM Measuring Amplifier – the VN Digitizer

Characteristics

- Data acquisition, processing and evaluation of the measurement results integrated in one device
- VN Digitzer allows the acquisition and archiving of measurement sequences
- The portable PC is a handy tool for the daily on-site calibration tasks
- No compromises in terms of measuring uncertainty or resolution
- Available with two or four channels

Please ask for our demo CD/disk

Technical data VN Digitizer	
Accuracy class:	0.0025 % FSO
Resolution:	± 200,000 digits
Non-linearity:	± 0.001 % FSO
Excitation:	10 V or 20 V DC
Integration times:	selectable up to 500 ms
Averaging:	freely selectable

Calibrator

Characteristics

- Highly repeatable calibration standard for strain gauge amplifiers
- Steps: 0; 0.5; 1; 1.5 and 2 mV/V
- Measuring uncertainty 0.005 % of reading
- Long-term stability 0.005 % p.a.

GTM Calibration Service – Competent, Reliable, Flexible

Why calibrate?

Regular calibrations of your instruments help to assure the quality of your products and services, guarantee accurate measures to your customers and build up trust into your goods and services.

Increasing globalisation demands in particular to guarantee comparable measures across borders. Increasingly, the documented traceability of measuring instruments takes on a more and more important role. The trust into these instruments is assured by their regular verification at an accredited calibration laboratory, stating the measurement uncertainty.

The DKD Laboratory

GTM is accredited by the "Deutscher Kalibierdienst DKD" (equivalent to UKAS or A2LA) for the measuring quantity force. Regular audits by the Physikalisch Technische Bundesanstalt PTB (Braunschweig) ensure the high quality of our measuring systems and methods. GTM is exceptionally flexible in the turnaround of calibrations:

- 24 hour service
- Calibration of proprietary makes
- Using customer-specific amplifiers and software

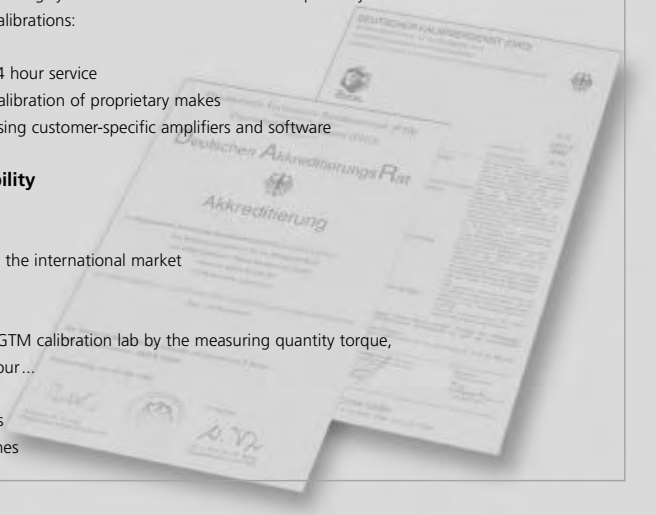
Importance of Traceability

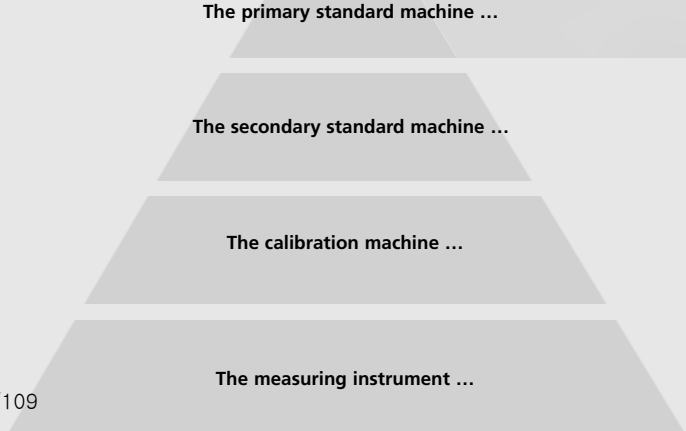
- Production safety
- Customer trust
- Comparable products on the international market

Torque Calibration

With the extension of the GTM calibration lab by the measuring quantity torque, we can offer to calibrate your…

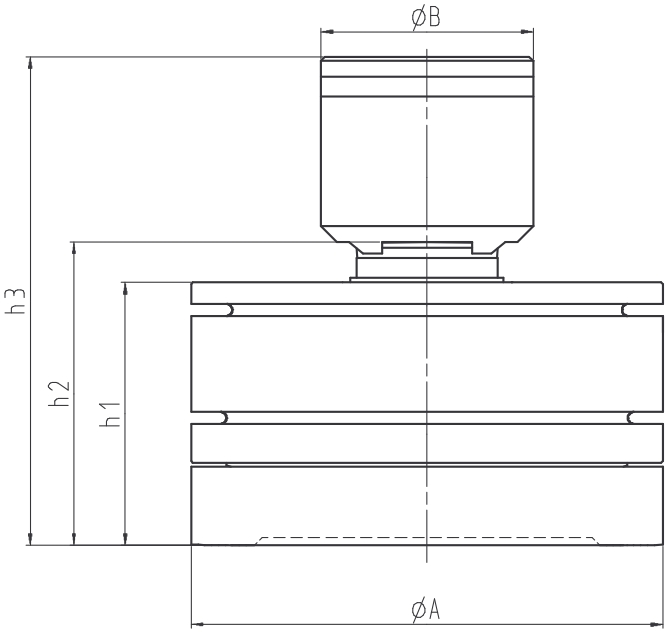
- Torque transducers
- Torque transfer standards
- Reference Torque wrenches





Force Transfer Standard D

Dimensions (nominal load 5 kN - 10 MN)



Nominal load compression	kN	5	10	20	50	100	200	500	1,000	2,000	5,000	10,000
h1	mm	41.5	60				66	90	113	140	187	240
h2	mm	48	70				77	93	125	153	203	260
h3	mm	71	93		107		124	149	195	267	360	460
Ø A	mm	87	82		92		120	140	200	270	375	480
Ø B	mm	30			42		54	80	110	160	200	285
Weight Transducer	kg	1.8	2		3		6	10	26	66	160	390
Weight Thrust Piece	kg	0.2				0.4		0.9	2.4	5,3	18	40

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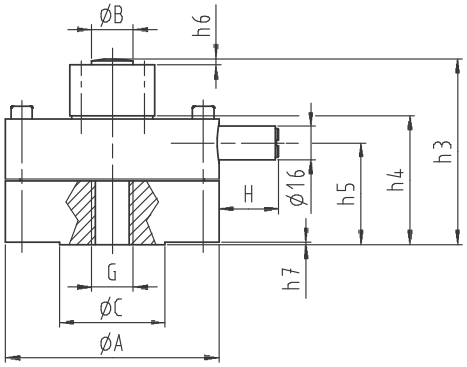
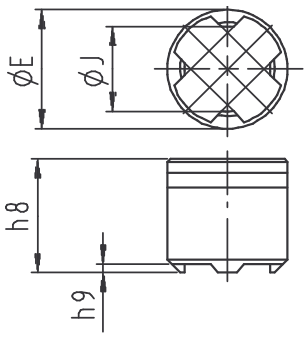
Force Transfer Standard Z/D

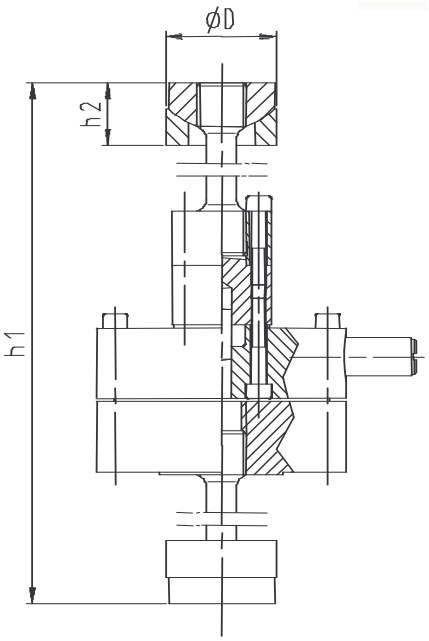
Dimensions (nominal load 5 kN - 50 kN)



Force Transfer Standard Z/D



Load Application Compression



Load Application Tension

Force Transfer Standard Z/D					
Nominal load	kN	5	10	20	50
Ø A	mm	77	95		101
Ø B	mm	12	20		
Ø C	mm	20	40		50
G		M10×1	M20×1.5		
H	mm	28			
h3	mm	69	88		
h4	mm	46	61		
h5	mm	33	48		
h6	mm	3			
h7	mm	1			
Weight	kg	1.3	3.1		3.5

Load Application Tension					
Nominal load	kN	5	10	20	50
Ø D	mm	35			45
h1	mm	ca. 354	ca. 371		
h2	mm	25			46
Gewicht	kg	0.07	0.11		

Load Application Compression					
Nominal load	kN	5	10	20	50
Ø E	mm	25	30		
Ø J	mm	12	20		
h8	mm	22	25		
h9	mm	2			3
Weight	kg	0.07	0.11		

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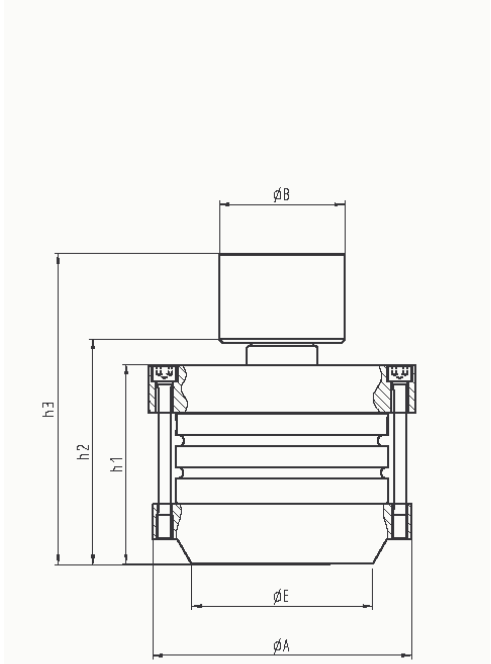
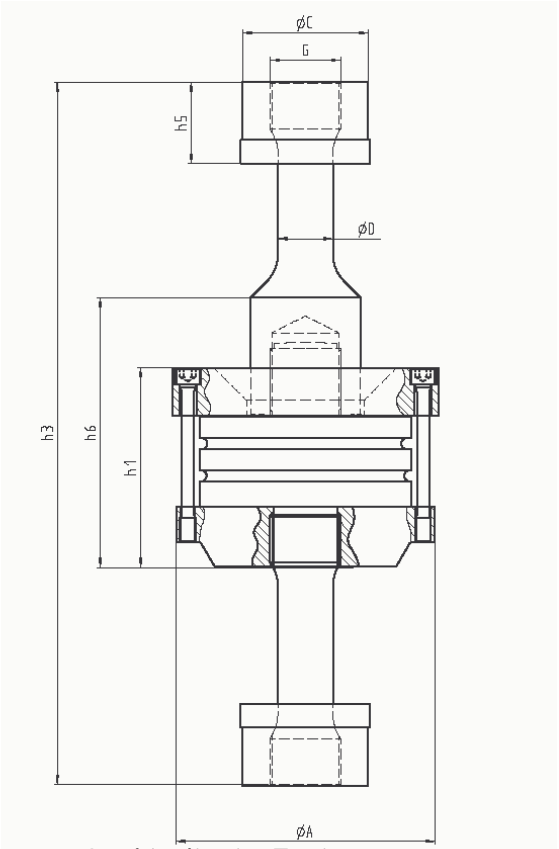
Force Transfer Standard Z/D

Dimensions (nominal load 100 kN - 2,000 kN)



Load Application Compression



Load Application Tension

Load Application Compression							
Nominal load	kN	100	200	250	500	1,000	2,000
Ø A	mm	124	157		190	252	330
Ø B	mm	42	54		80	110	160
Ø E	mm	54	67		100	196	230
h1	mm	98	101		151	181.5	253
h2	mm	107	112		162	210	286
h3	mm	144	159		214	280	396
Weight	kg	5.6	10.2		20	50	138

Load Application Tension							
Nominal load	kN	100	200	250	500	1,000	2,000
Ø A	mm	124	157		190	252	330
Ø C	mm	50	64		90	120	165
Ø D	mm	15	22		38	50	70
G		M24×2	M30×2		M56×4	M64×4	M90×4
h1	mm	98	101		151	182	253
h3	mm	500	496		650	926	895
h5	mm	30	32		48	72	104
h6	mm	118	134		197	258	343
Weight	kg	6.8	12.6		25	70	180

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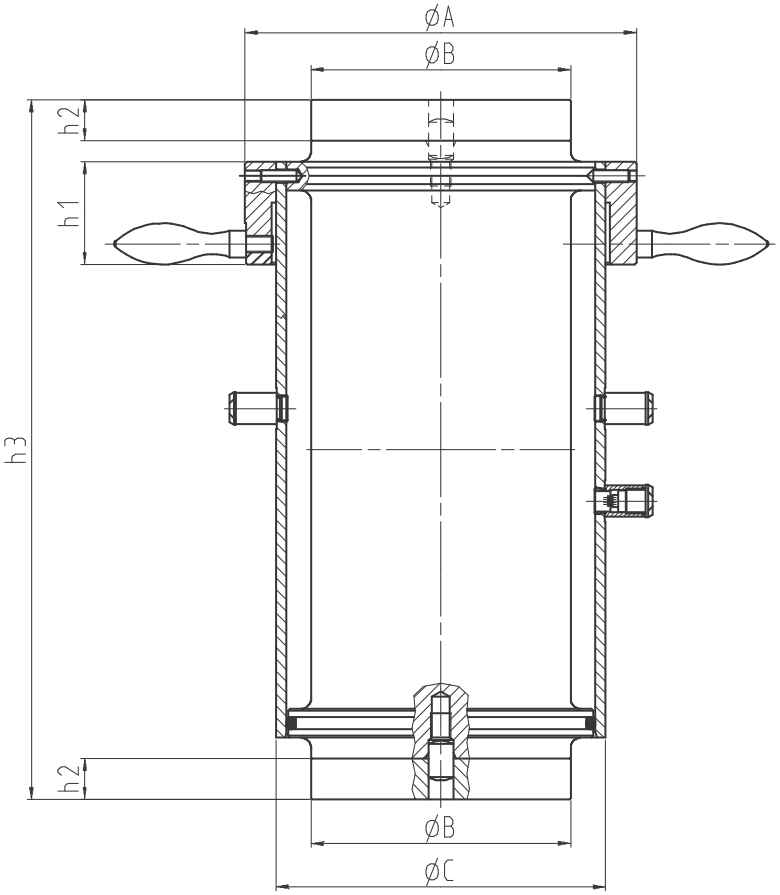
Force Transfer Standard DZY

Dimensions (nominal load 1 MN - 10 MN)



Nominal load	MN	1	3	4	5	10
h1	mm	50				52
h2	mm	25		15	20	30
h3	mm	210		250	340	550
Ø A	mm	165		190		316
Ø B	mm	90	140	113	126	252
Ø C	mm	135		160		276
Weight	kg	20		35	45	200

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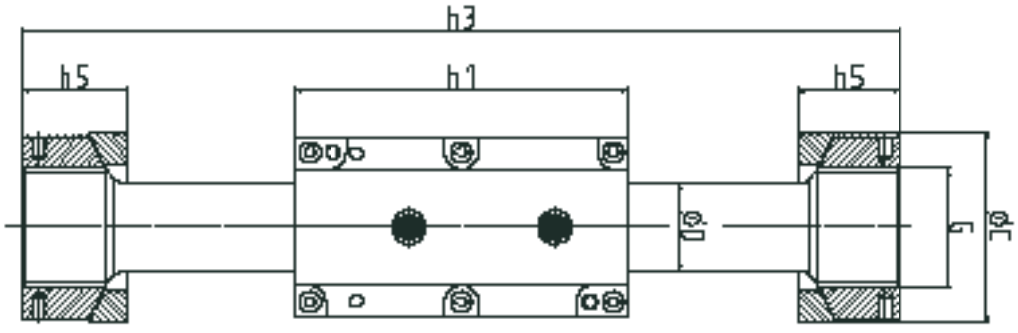
Force Transfer Standard ZST

Dimensions (nominal load 100 kN - 10 MN)



Nominal load tension	kN	100	200	500	1,000	2,000	5,000	10,000
h1	mm	120		160			170	
h3	mm	500		600	650	900	1,200	
h5	mm	31	32	52	72	104	171	200
Ø C	mm	50	64	90	120	165	270	345
Ø D	mm	26	25	40	56,5	80	126	178
G		M24×2	M30×2	M56×4	M64×4	M90×4	M160×6	M200×6
Weight	kg	2	2.8	7.8	15	36	118	285

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Multi-Component Transducer MKA

Multi-component transducer
for static und dynamic forces and moments

- Nominal force range
  from 2.5 kN to 250 kN
- Nominal torque range
  from 120 N·m to 12,500 N·m
- Accuracy class 0,2
- Fatigue proof up to
  ± 80 % nominal load
- Low mass
- Multitude of possible
  combinations of
  forces and moments

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Multi-Component Transducer MKA

Technical Description

The transducer MKA is a rotational-symmetric design of FEM optimized sensor elements. The flanges enable the universal assembly for the most static and dynamic applications. The transducers are fatigue rated for the load combinations as long as alternating loads do not exceed $0.8 \cdot F_{nom}$ or $0.8 \cdot M_{nom}$ respectively. For oscillating loads, the stated capacities must not be exceeded. The multitude of possible combinations of forces and moments are given and available

Applications

Universally usable for all static and dynamic applications in industrial testing and instrumentation

Options

- Design as 3-, 4- or 6-component transducer

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Multi-Component Transducer MKA

Technical Data

General Data (realtive to full scale output)

Accuracy class			0.2
Reproducibility error	f_{rep}	± %	0.01
Linearity error	d_{lin}	± %	0.2
Hysteresis	u	± %	0.05
Temperature influence on zero	TK_0	± %/K	0.0025
Temperature influence on span	TK_C	± %/K	0.004
rel. crosstalk (typical) rel. to FSO of the disturbed component at full load of the disturbing component	$f_{ü}$	± %	1.5
Permissible dynamic load range			1.6 · F_{nom} or 1.6 · M_{nom} respectively all components simultaneously

Electrical Data

Component			F_x	F_y	F_z	M_x	M_y	M_z
Bridge impedance nominal	R_e	Ω	ca. 400		ca. 800	ca. 400		
Output impedance	R_a	Ω	ca. 350		ca. 700	ca. 350		
Maximum excitation	$U_{e, max}$	V	12					

Additional Data (relative to actual value)

Total error (incl. hysteresis, linearity and temperature error) in the range 10% - 100% F_{nom} or M_{nom}	ΔF/F or ΔM/M	± %	0.5
Rel. creep (t_B = 30 min)	$d_{cr, F, E}$	± %	0.05
Nominal temperature range	$B_{t, nom}$	°C	+10 to +60

Configuration of measuring ranges (examples for optimum measuring range combinations)

MKA Size	± F_{nom} / ± M_{nom} F_x, F_y, F_z / M_x, M_y, M_z	Sensitivity C_{Fx}, C_{Fy}	Sensitivity C_{Fz}	Sensitivity C_{Mx}, C_{My}	Sensitivity C_{Mz}
	kN/N·m	mV/V			
I	2.5/120	1.7	0.3	1.6	1.6
	5/250	2.0	0.4	2.0	2.0
	10/500				
	20/1,000				
II	50/2,500	2.5	0.5		1.3
III	100/5,000	2.9	0.6	1.6	1.0

Due to the multitude of possible combinations of forces and moments, only the optimum combination at the maximum loads is given here. Other combinations are available on request. These load to different sensitivities, which are also available on request

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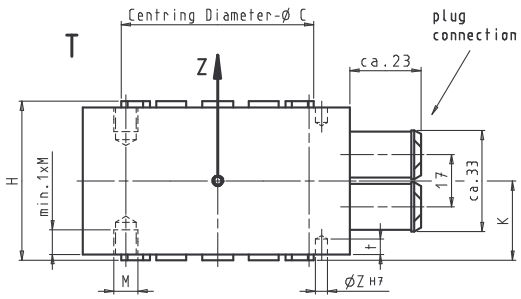
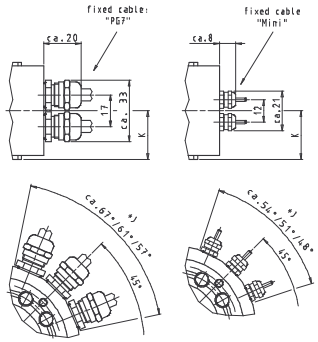
Multi-Component Transducer MKA

Dimensions

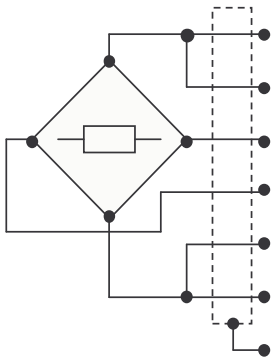




*) required space
value 1: size I
value 2: size II
value 3: size III

MKA size			I	II	III
Outside diameter	ø A	mm	88	124	169
Overall height	H	mm	52	60	82
Pitch circle diameter (top and bottom)	ø E	mm	60	90	130
Index hole	ø Z	mm		4	
PCD index hole	ø W	mm	68	103	145
Centring diameter	ø C	mm	63	95	136
Centring ring height	G	mm	2	1.5	2
Thread	n × M		12 × M8	12 × M12	12 × M16
max. deapth of thread M	T	mm	8	10	16
Pretension force $F_v = V \cdot F_{nom}$	V			1.1	
Position of cable entry	K	mm	26	30	41
Weight		kg	ca. 1	ca. 2	ca. 4
Adaptation evenness				0.05	
Adaptation material	σ_{max}	MPa		450	

Electrical Connection



grey	Sense (-)
black	Excitation U_B (-)
red	Output U_A (-)
white	Output U_A (+)
blue	Excitation U_B (+)
green	Sense (+)
yellow	Screen

Connection at transducer
(0.75 m, 6-wire, screened, ø 5 mm)

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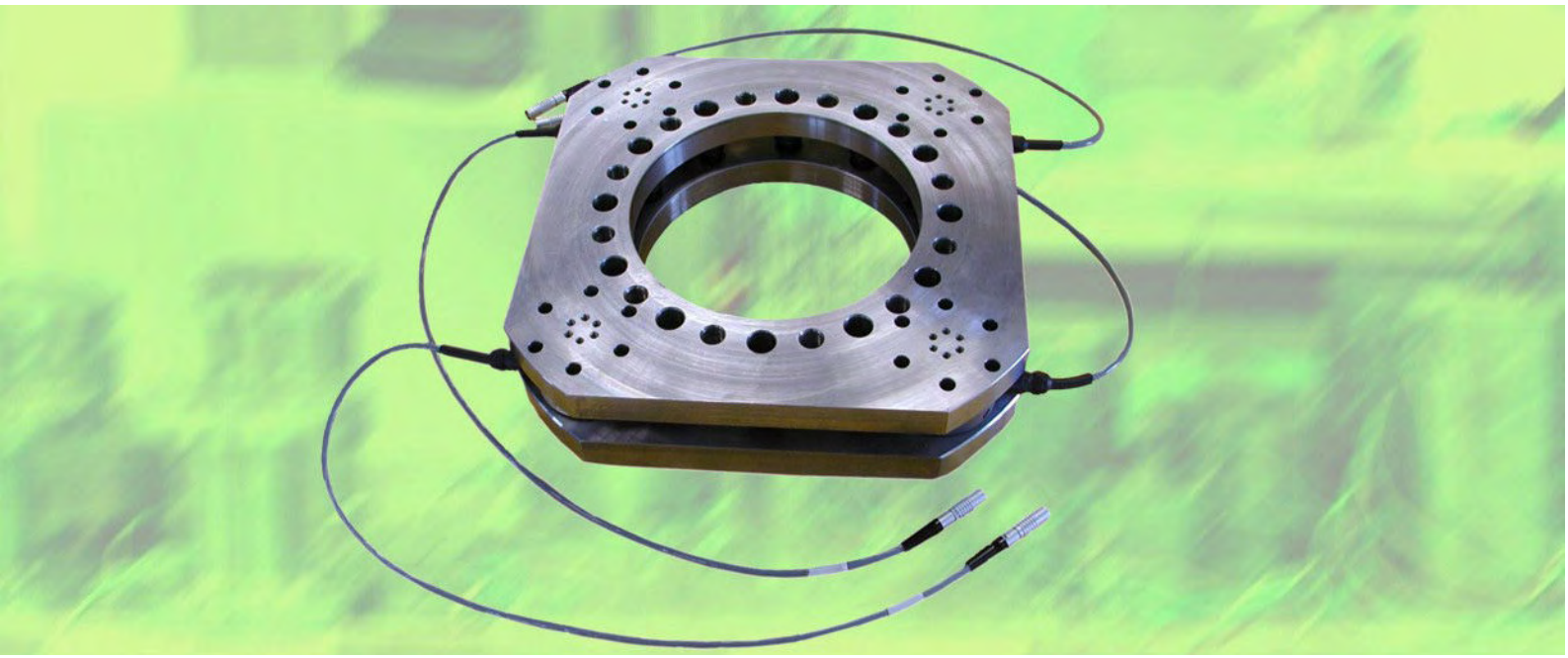
Measuring Platforms MPF



Multi-component system
for static and dynamic forces and moments

- Precise measurement of complex loading conditions
- Large measuring ranges
- Including signal condition
- Adaptable to almost any task

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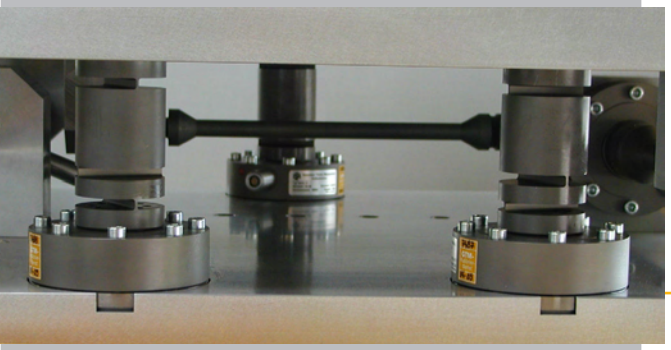
Measuring Platforms MPF

Technical Description

GTM Measuring Platforms consist of several individual force transducers, which are coupled to form a multi-component sensor by means of load introduction plates.
Depending on the construction, it is possible to measure up to 3 forces and 3 moments relative to a given co-ordinate system.
The advantages of measuring platforms over monolithic multi-component transducers are: Better adaptation of the platform capacities to the user´s desired load ranges and usually a reduced measuring uncertainty.
Due to the dimensions and capacities of the used individual force transducers, the minimum platform dimensions and capacities are given.



Options

GTM measuring platforms are designed according to the requirements of the application. For this, our engineers dispose of a set of calculation tools and suitable force transducers. This allows the fast and efficient reaction also to special requirements. You as a user specify the input quantities such as forces, moments and error limits as well as maximum dimensions and we will suggest the solution that fits.

Applications

- Materials and components
  Determination of component stiffness and strength (multi-axial)
  Measurement of the real loading situations of components
- Medicine
  Research and development (ergonomics of sports devices)
  Diagnostic (reaction forces of human movements)
- Manufacturing technology
  Cutting force measurements of machine tools

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Measuring Platforms MPF

Technical Data

General Data (relative to full scale output)

Reproducibility error (incl. cross talk)	f_{rep}	± %	0.01
Linearity deviation	d_{lin}	± %	0.2
Hysteresis	u	± %	0.05
Temperature influence on zero	TK_0	± %/K	0.025
Temperature influence on span	TK_C	± %/K	0.004
rel. crosstalk (typical) relative to capacity of the disturbed component with disturbing component at full capacity	$f_{ü}$	± %	1.5
Zulässige Schwingbreite			$1.6 \cdot F_{nom}$ or $1.6 \cdot M_{nom}$ respectively all components simultaneously
Gesamtmessunsicherheit vom Istwert im Bereich 1% bis 100% F_{nom} bzw. M_{nom}	$\Delta F/F$ or $\Delta M/M$	± %	0.5

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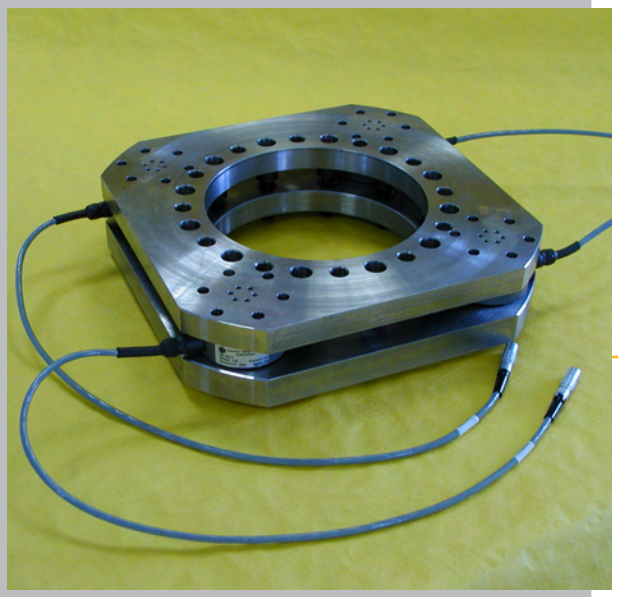
Measuring Platforms MPF



Signal Processing

All platform types can be operated together with the GTM measuring amplifier MCM. This makes the required signal processing particularly easy for the user.

The MCM allows online co-ordinate transformation and cross talk correction. The maximum sampling rate is 330 Hz. It generates output signals of the calibrated and corrected component signals for F_x, F_y, F_z and M_x, M_y, M_z, both analogue and digital in real time.

The measuring amplifier MCM is designed as a stand-alone device. This means: After a one-off configuration through an operating PC with the installed software MCC, the MCM works without additional periphery as self-sufficient, intelligent measuring amplifier. Measurement data can be accessed via TCP/IP or RS232 as well as a ± 10 V analogue signal for further data processing.

Measuring Quality

The application of precision force transducers in strain gauge technology renders the signals of the platform outstandingly stable and usable across a very large measuring range.

Due to its hermetically sealed design, the force transducers are well protected against environmental influences like temperature and humidity.

Calibration

The calibration of a measuring platform is carried out in GTM´s own DKD-accredited calibration lab. Here, calibration machines for all loading conditions are available.

Recalibrations are possible with short turn-around times.

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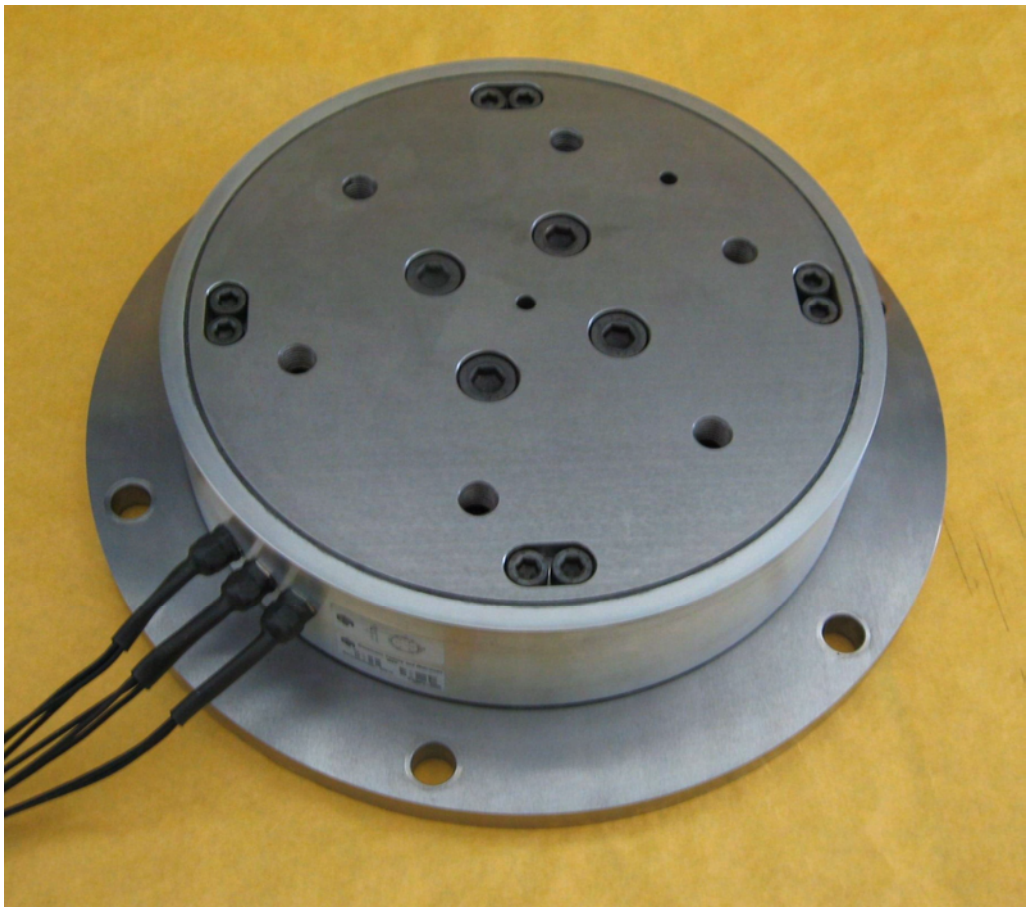
Mehrkomponenten Kompakt Plattform MKP

Mehrkomponentenaufnehmer für statische und dynamische Kräfte und Momente



Merkmale

- Nennkraftbereich 10kN - 100kN
- Nenndrehmomentbereich 100Nm - 10000Nm
- vielfältigen Kombinationsmöglichkeiten von Kräften und Momenten
- Ausführung als 3,4,6 Komponenten Aufnehmer (Fx,Fy,Fz,Mx,My,Mz)
- Dauerfest bei +- 80% Nennlast, Nenndrehmoment
- Genauigkeitsklasse 0,2
- Geringes Gewicht
- Hohe Steifigkeit

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Technische Kurzbeschreibung

Die Mehrkomponenten Kompakt Plattform MKP, aufgebaut mit einzelnen axialen und tangential wirkenden Aufnehmern. Durch geeigneten Aufbau bietet GTM einen leichten Aufnehmer mit kompakten Abmessungen und hoher Eigenfrequenz. Hervorzuheben ist die Robustheit der Aufnehmers. Der FEM optimierte Messkörper gewährleistet eine hohe Dauerfestigkeit. Die Ausführung sind in weiten Bereichen skalierbar. mit vielfältigen Kombinationen von Kräften und Momenten.

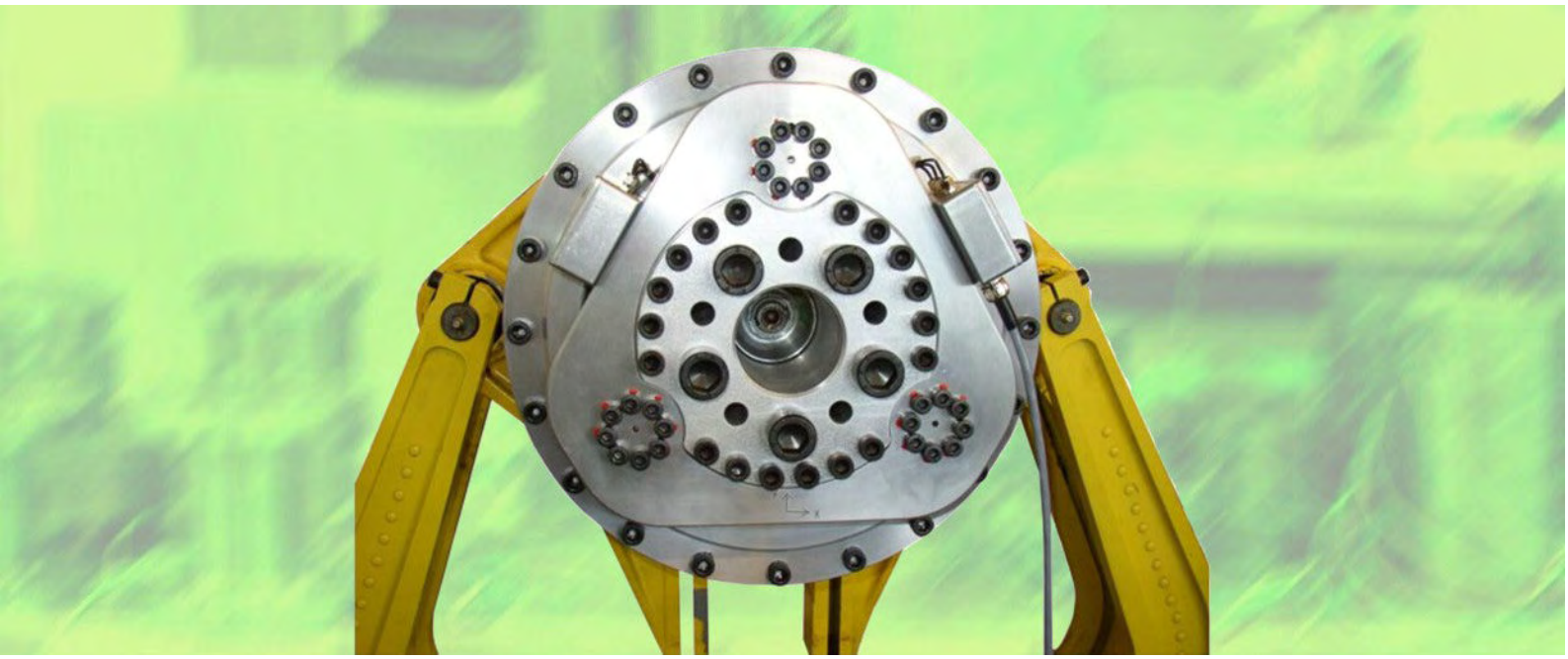
Technische Daten

Übergeordnete Angaben (bezogen auf den Endwert)

Genauigkeitsklasse			0,2
Reproduzierbarkeitsfehler	f_{rep}		0,01
Linearitätsabweichung	d_{Lin}		0,2
Umkehrspanne	u	%	0,05
Temperatureinfluss pro 1 K auf: Nullpunkt Kennwert	 TK_0 TK_C	 % %	 0,0025 0,004
rel. Übersprechen (typisch): bez. auf den Endwert der gestörten Komponente bei Nennlast der störenden Komponente (Mit Elektronik Faktor 10 besser)	fü	±%	1,5
Zulässige Schwingbreite			1,6 F_{nom} bei allen Komponeten gleichzeitig

Änderungen vorbehalten. Alle Angaben beschreiben unsere Produkte in allgemeiner Form. Sie stellen keine Eigenschaftszusicherung im Sinne des § 459, Abs. 2 BGB dar und begründen keine Haftung.

Wheel Load System RLS



Measurement of forces and moments

- High fatigue strength
- Low mass, high stiffness
- Analogue output ± 10 V or synchrony serial interface SSI
- Flexible adaptation to the test rig
- 6 components F_x, F_y, F_z, M_x, M_y, M_z
- Suitable for long-term testing

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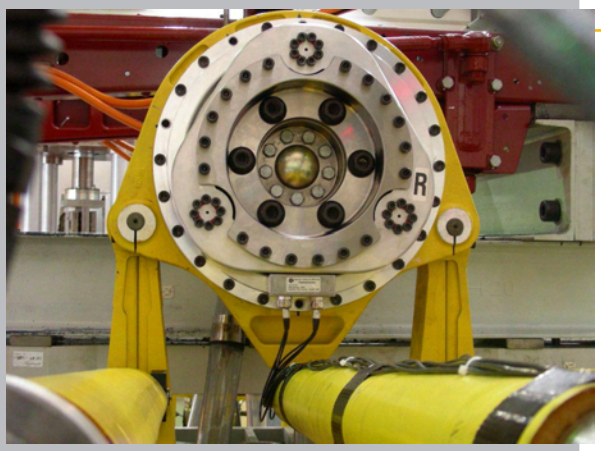
Wheel Load System RLS



Description

The GTM Wheel Load System RLS is a non-rotating measuring tool for the data acquisition of the forces and moments introduced at the contact point during rig testing. The multi-component measuring system can be set up to match the particular requirements of the customer and uses three multi-component force transducers each. Their signals are processed by the stand-alone amplifier and data-acquisition system MCM. The system is fixed to the spigot like a normal wheel and interfaces with the loading systems of the test rig at its outer circumference.

The six strain-gauge based signals are combined in the MCM to generate the 3 forces F_x, F_y, F_z and the 3 moments M_x, M_y, M_z.
For the calibration and testing, GTM use their own facilities.

Calibration

GTM´s own DKD-laboratory for the quantity of force offers the complete calibration service for the initial and all further re-calibrations. The turnaround time for re-calibrated wheel load systems is only a few working days. Quick delivery of spare parts (sensors and computer components) is achieved by entirely compatible component design.

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Wheel Load System RLS

Technical Data

	Unit	RLS 25	RLS 50	RLS 120/200
max. loads (vehicle coordinate system)				
F_x (driving direction)	kN	± 25		± 120
F_y (lateral)	kN	± 25	± 30	± 100
F_z (vertical)	kN	25	50	± 120 + 80 static
M_x (around longitudinal axis)	N·m	± 7,000	± 14,000	± 30,000
M_y (around lateral axis)	N·m	± 7,000	± 10,000	± 50,000
M_z (around vertical axis)	N·m	± 7,000		± 30,000
Life expectancy, 10,000,000 km load with Standard CARLOS vertical	kN	25	50	120
Weight				
Wheel fixed parts	ca. kg	3.5	5	7
Test rig fixed parts	ca. kg	7.5	11	15
Metrology data (with amplifier MCM, f.s.)				
Total error	± %	0.7		
Linearity error	± %	0.5		0.7
Hysteresis	± %	0.5		0.7
Cross talk with correction matrix (MCM)	± %	2 (0.5)		
Dimensions				
Overall diameter	ca. mm	350	400	650
Overall width	ca. mm	90	95	110
Fixing		customer adaptable		
Centring diameter		customer adaptable		
Environmental conditions				
Operational temperature range	° C	+10 to +70		
Temperature influence on zero (f.s.)	± %	0.0025		
Temperature influence on span (a.v.)	± %	0.005		
Protection rating (EN60529)		IP64		
Material		Aluminium / Steel		

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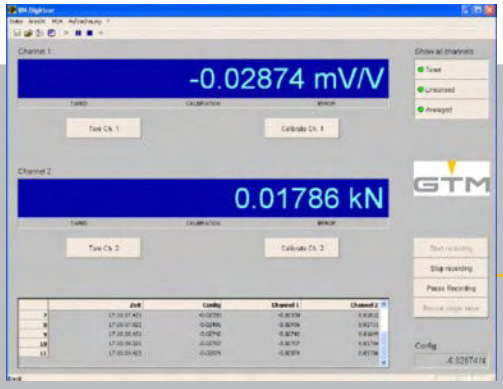

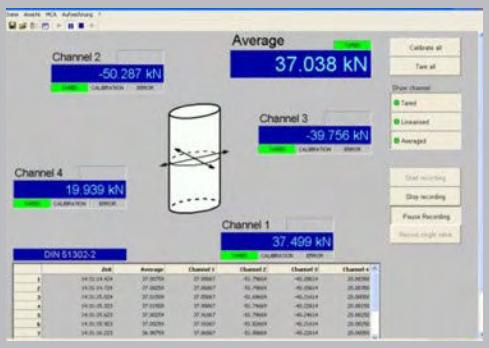

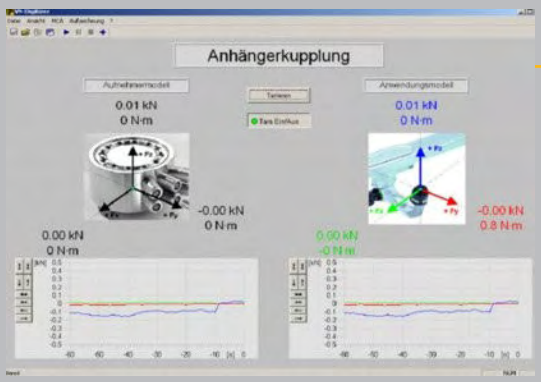

Wheel Load System RLS

Amplifier MCM

The measuring amplifier MCM is used for the data processing of the signals produced by the wheel load sensor RLS. Each of the 3 dual force signals is connected to its own measuring amplifier channel. Using the calculation specification, which is individual to each wheel load sensor and which contains the system-relevant and sensor-specific data, the 3 forces and 3 moments are calculated by the 6 input force signals.
These computations are carried out by the MCM system synchronously for all channels, so that the 6 force and moment quantities are available as analogue and digital output. The 14 bit analogue outputs can be configured to give ± 10 Volt output, even with partial utilisation of the transducer capacity. In conjunction with the high resolution of the input amplifiers this allows high accuracy measurements although for small loads.

Feature of the amplifier MCM

- Quotienten acquirement with 24 Bit A/Dconversion
- Oversampling 40 kHz
- Synchrony acquisition and calculation delay time < 1 ms
- 19“rack 4 units
- Up to 16 DMS-channels
- Analogue scaleable ± 10 Volt
- Digital output synchrony serial interface SSI
- Service and parameter setting direct or over TCP/IP network

For further informationen see the product overview of the MCM.

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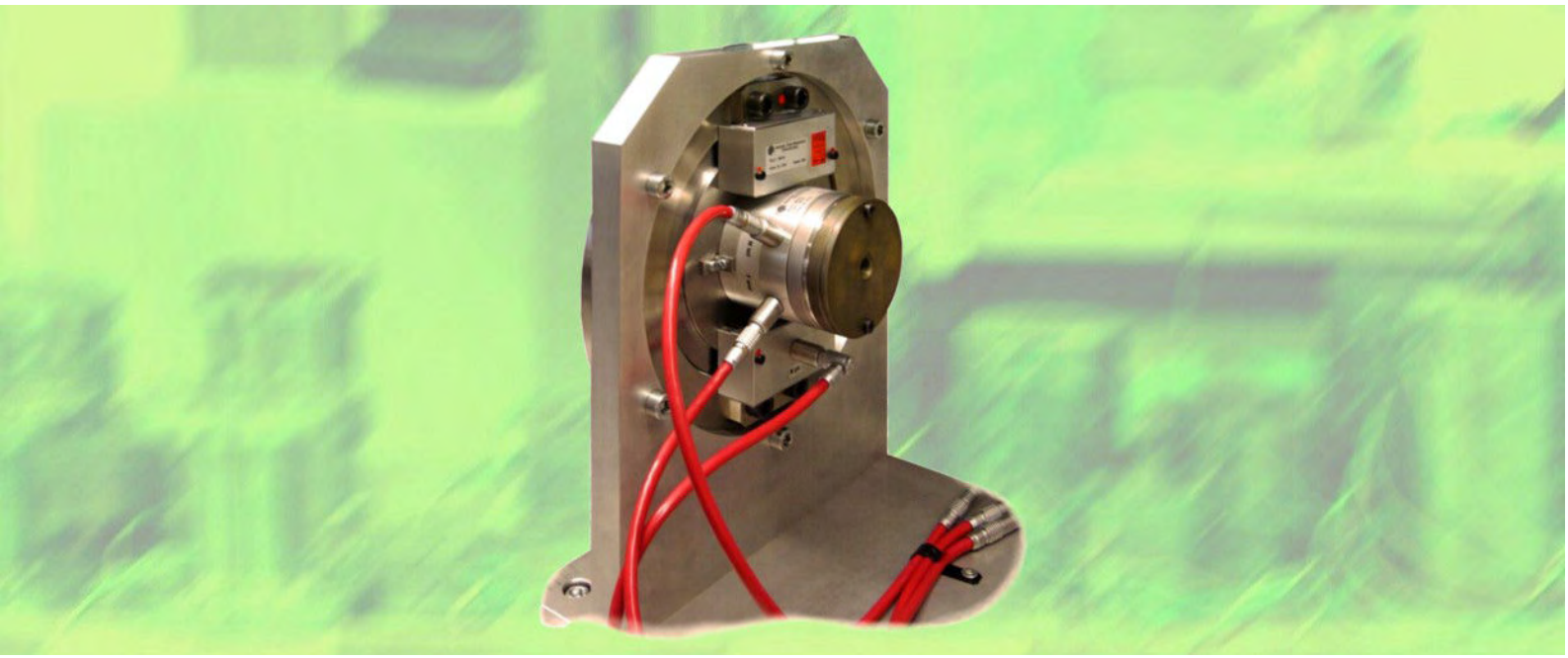
Bolt Friction Sensor RMK



Measurement of bolt force, bolt torque and the torque at screw head or screw thread

- Nominal force range from 3 kN to 300 kN
- Total torque range from 6 N·m to 600 N·m
- Partial torque range from 3 N·m to 300 N·m
- Total error < 1% of actual value
- Low height
- Large inner diameter

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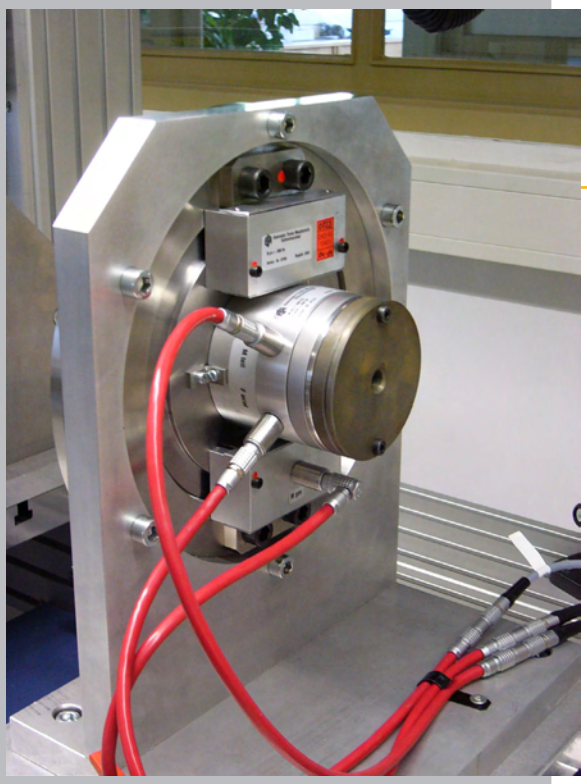
Bolt Friction Sensor RMK



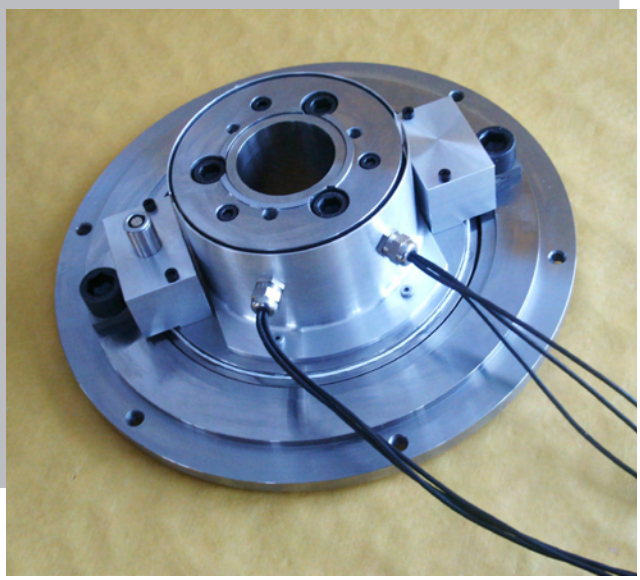
Technical Description

The GTM Bolt Friction Sensor offers the possibility to measure the bolt torque, the axial clamping force of the bolt connection and the friction torque at screw head or thread simlutaneously. Thereby a good measurement uncertainty is achieved, as due to the optimized shape of the sensor the three signals are excellently isolated from each other. In combination with the large nominal sensitivities of the three channels this results in very interference proof signals.

The low height and the large inner diameter of the bolt friction sensor allow a simple adaptation of the tested object.

By use of the measuring amplifier MCM_RMK3K for the bolt friction sensor the further mentioned measurement accuracies can be achieved. The amplifier contains three synchronously measured channels and a software for the intelligent processing of the measuring values. Measurement and taring can be triggered by an external signal. The measured values are stored locally by the amplifier and may be requested via TCP/IP.

For further information on the amplifier please see the product overview of the MCM.



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Bolt Friction Sensor RMK

Technical Data

Nominal force	F_{nom}	kN	300
Nominal torque, total	$M_{nom, ges}$	N·m	600
Nominal torque, partial	$M_{nom, teil}$	N·m	300
Nominal sensitivity of F_{nom}	$C_{nom, F}$	mV/V	3
Nominal sensitivity of $M_{nom, ges}$	$C_{nom, Mg}$	mV/V	4
Nominal sensitivity of $M_{nom, teil}$	$C_{nom, Mt}$	mV/V	4
Measuring range (F_{nom} / M_{nom})		%	1 to 100
Total error (relative to actual value)		%	1
Cross talk	$f_{ü}$	± %	< 1

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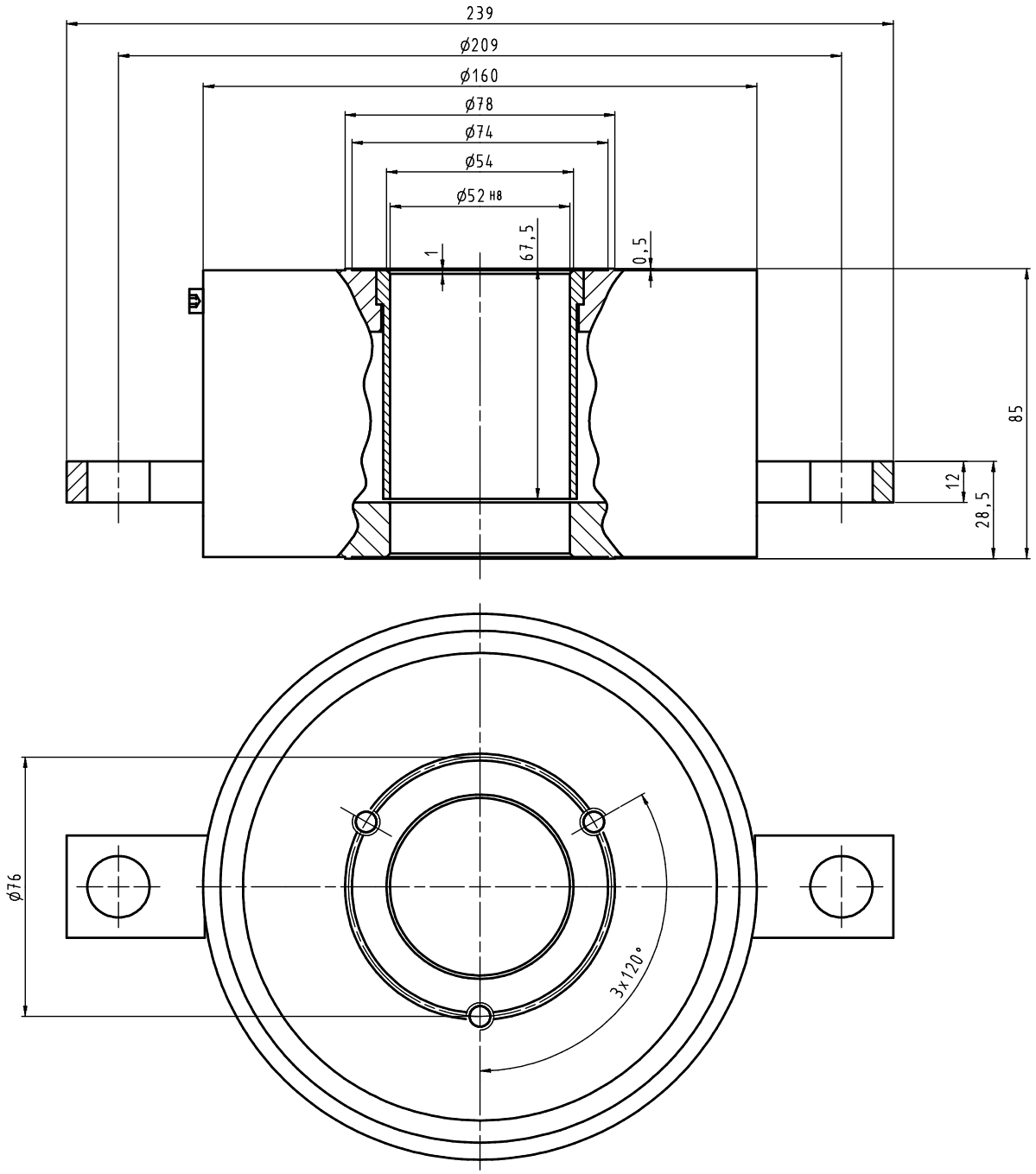
Bolt Friction Sensor RMK

Dimensions



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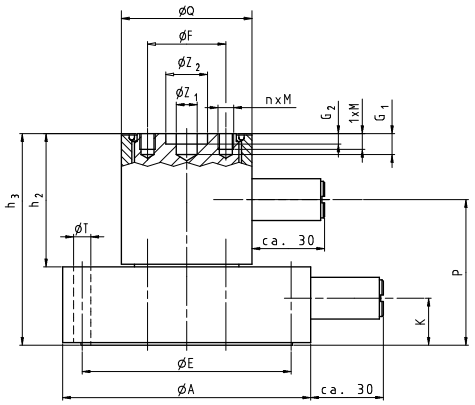
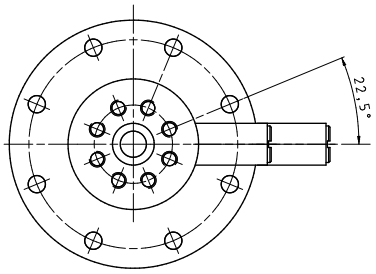
Torque Transducer M

Dimensions Tension Torsion Combination





Nominal torque	M_{nom}	± N·m	20	50	100	200 500	1,000 1,500 2,000	4,000 6,000
Nominal force	F_{nom}	± kN	10	20	50	100	250	500
Overall diameter	ø A	mm	95		101	148	219	270
Outer PCD	ø E	mm	80 ± 0.1		86 ± 0.1	130 ± 0.1	194 ± 0.1	235 ± 0.1
Outside diameter	ø Q	mm	50			73	107	141
Through hole diameter	ø T	mm	6.6			11	17	22
Inner PCD	ø F	mm	30 ± 0.1			45 ± 0.1	71 ± 0.1	95 ± 0.1
Centring PCD	ø Z	mm	8				10	
Depth of centring hole	G	mm	8			11	13	12
Height of cable entries	h_2	mm	60			82	107	130
Overall height	h_3	mm	93			131	167	210
Height of cable entries	P	mm	61.5			90	113.5	115
	K	mm	18			25	32	40
Thread	n × M		8 × M6			8 × M10	8 × M16	8 × M20
Bolt quality			10.9					
Bolt torque (oiled, μ = 0.12)		N·m	14			68	285	560
Total weight		kg	1.8		2.1	8.6		
Nominal angular deflection		°	< 1					
Permissible dynamic torque			on request					
electr. connection			Socket connection on the transducer (5 m, PUR, 6 wire, screened, ø 6.5 mm, open ended)					

(for metrology data of the force transducer please see the product overview of Series K)

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Torque Transducer M

Precision torque transducer (non-rotary) for static and dynamic applications

- Capacity range from 2 N·m to 10,000 N·m
- Accuracy class 0,02
- No influence of axial forces on the measuring value
- Compact design
- Compatible with force transducer Series K
- High torsional stiffness

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M_p_e 04/2007

Torque Transducer M

Technical description

The special design of the Series M makes the transducers compact, gives them a high torsional stiffness and allows easy application to many metrology tasks. Furthermore, they are compatible with the force transducer Series K, so that in a very simple way combined tension torsion transducers can be assembled.

Series M sensors are designed according to the principle of a strain gauged solid shaft. This advantageous design exhibits both high sensitivity to torque loading and great force-bearing capacity in the axial direction. The instrumentation is based on a Wheatstone full bridge sensing torsional strain. A strong tube is laser-welded around the sensor, thereby protecting the whole strain gauge application and wiring. A further advantage is the plug-and-socket cable connection, designed with minimum space requirements.

Applications

The transducers of the Series M are particularly suitable for all metrology tasks for which the reaction torque of machines, motors and similar components has to be measured, whereas the transducer itself may remain stationary.
Furthermore, it covers all applications of material and component testing, where either only torque instrumentation is required, or which need measurement of both axial load and torque, such as tension-torsion tests.

The available mounting components and adapters enable easy integration in existing or newly designed rigs.

Options

- Tension torsion combination with force transducer Series K
- Fixed or plug-and-socket cable connection

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Torque Transducer M

Technical Data

General data (relative to full scale output)

Nominal capacity	M_{nom}	± N·m	2	5	10	20	50	100	200	500	1,000	1,500	2,000	4,000	6,000	10,000
Accuracy class			0.05													
Reproducibility error	f_{rep}	± %	0.005													
Linearity error	d_{lin}	± %	0.05													
Hysteresis	u	± %	0.2													
Temperature influence on zero	TK_0	± %/K	0.0025													
Temperature influence on span	TK_C	± %/K	0.004													
Maximum torque	M_L	± %	150													
Maximum lateral torque	M_Q	± %	100													
Breaking torque	M_B	± %	> 300													
Weight		kg	0.3			0.5		0.6	1.6		4.8			7.7	7.9	o.r.
Nominal angular deflection	W	°	< 1													
Natural frequency		kHz	2													

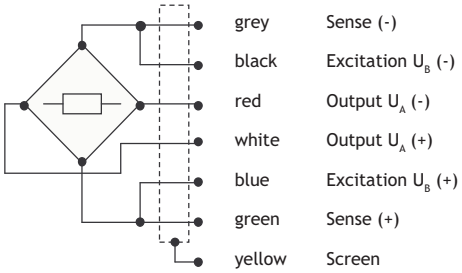
Electrical Data

Nominal sensitivity	C_{nom}	mV/V	2
Bridge impedance nominal	R_e	Ω	1,000
Maximum excitation	$U_{e, max}$	V	15
Cable connection			5 m long (6-wire); ø 6.5 mm
Environmental protection			IP 54 with plug-in connection (EN60529)

Additional Data (relative to actual value)

Total error (incl. hysteresis, linearity and temperature error) in the range from 1% to 100% F_{nom}	ΔM/M	± %	0.8
Rel. creep (t_B = 30 min)	$d_{cr, F, E}$	± %	0.025
Nominal temperature range	$B_{t, nom}$	°C	+10 to +60

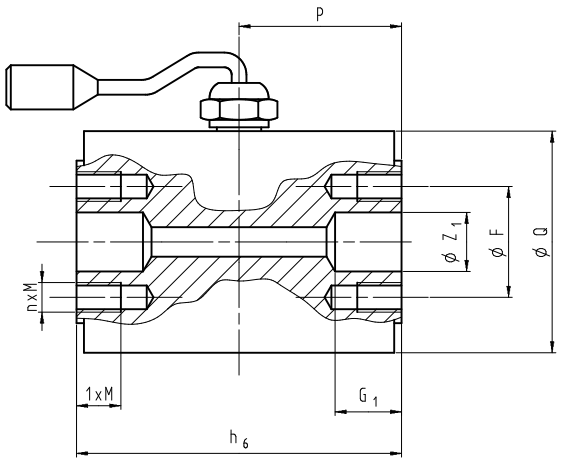
Electrical connection



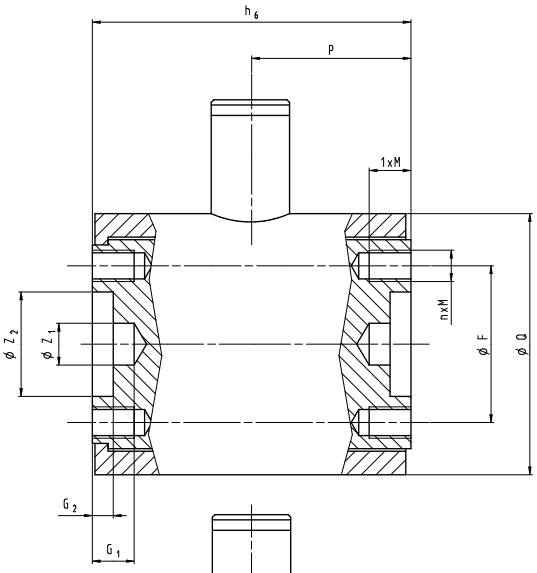
fixed connection on transducer
(5 m, 6-wire, screened, open ended)

Torque Transducer M

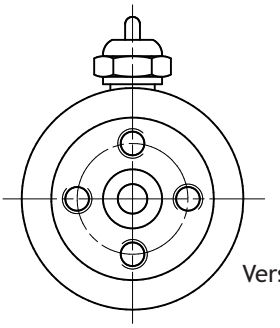
Dimensions

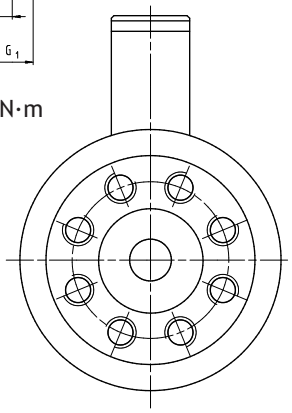


Version 2 N·m to 10 N·m



Version 20 N·m to 10,000 N·m





Nominal capacity	M_{nom}	± N·m	2, 5 10	20, 50 100	200 500	1,000, 1,500 2,000	4,000 6,000	10,000
Outside diameter	ø Q	mm	30	50	73	107	141	160
Inner PCD	ø F	mm	15 ± 0.1	30 ± 0.1	45 ± 0.1	71 ± 0.1	95 ± 0.1	110 ± 0.1
Centring pin diameter	ø Z_1	mm	8 H7	8 H8	10 H8			
Centring pin diameter	ø Z_2	mm	-	20 H7	30 H7	45 H7	60 H7	-
Depth centring hole	G_1	mm	9	8				
Depth centring hole	G_2	mm	-	4				-
Overall height	h_6	mm	44	61	82	107	130	150
Height of cable entry	P	mm	22	30.5	41	53.5	65	75
Thread	n × M		4 × M4	8 × M6	8 × M10	8 × M16	8 × M20	8 × M24
Bolt quality			10.9					
Bolt torque (oiled, μ = 0.12)		N·m	4	14	68	285	560	950
electr. connection			Socket connection on the transducer (5 m, PUR, 6-wire, screened, ø 6.5 mm, open ended)					

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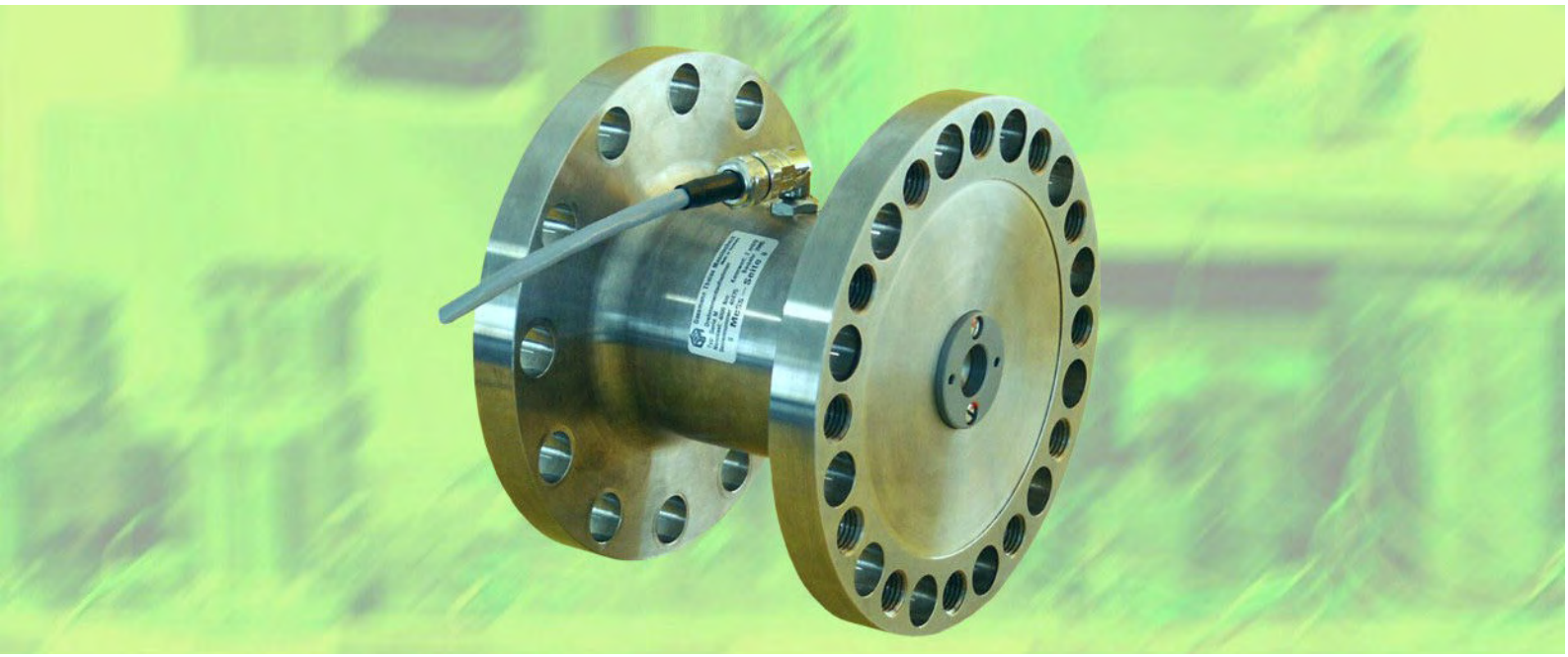
Torque Transducer MF



Universal torque transducer for static und dynamic applications

- Nominal capacity from 500 N·m to 64,000 N·m
- Accuracy class 0,2
- High torsional stiffness
- Fatigue proof up to ± 100% nominal capacity
- Compact design
- Variable mounting

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MF_p_e 04/2007

Torque Transducer MF

Technical Description

The torque transducer Series MF is a rotation-symmetric tube type with flanges. The hermetically sealed frame is made fatigue proof for alternating torques.

Anwendungen

The Series MF is a non-rotary torque transducer for industrial testing. With its large capacity range from 500 N·m up to 64,000 N·m it covers wide areas of testing and instrumentation.

Optionen

- Base plates

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Torque Transducer MF

Technial Data

General Data (relative to full scale output)

Nominal capacity	M_{nom}	± N·m	500	1,000	2,000	4,000	8,000	16,000	32,000	64,000
Accuracy class			0.05							
Reproducibility error	f_{rep}	± %	0.005							
Linearity error	d_{lin}	± %	0.05							
Hysteresis	u	± %	0.2							
Temperature influence on zero	TK_0	± %/K	0.0025							
Temperature influence on span	TK_C	± %/K	0.001							
Maximum torque	M_L	± %	150							
Maximum lateral torque	M_Q	± %	100							
Breaking torque	M_B	± %	> 300							
Weight		kg	5		7	10	15	25	40	65
Nominal angular deflection	W	°	< 0.1							
Natural frequency		kHz	2							

Electrical Data

Nominal sensitivity	C_{nom}	mV/V	1.6
Bridge impedance nominal	R_e	Ω	500
Maximum excitation	$U_{e, max}$	V	15
Cable connection			5 m long (6-wire); ø 6.5 mm
Environmental protection			IP 65 with fixed connection (EN60529)

Additional Data (relative to actual value)

Total error (incl. hysteresis, linearity and temperature error) in the range from 1% to 100% F_{nom}	ΔM/M	± %	0.8
Rel. creep (t_B = 30 min)	$d_{cr, F, E}$	± %	0.025
Nominal temperature range	$B_{t, nom}$	°C	+10 to +60

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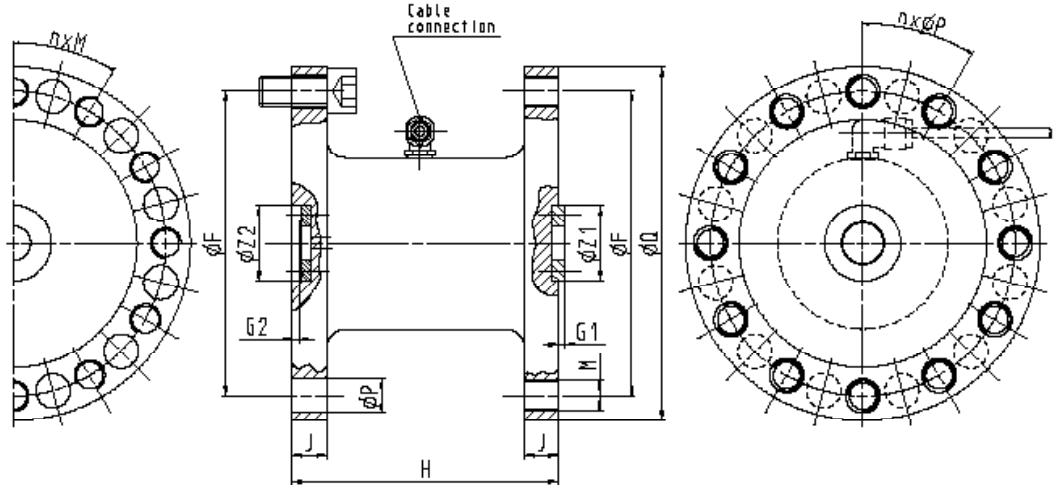
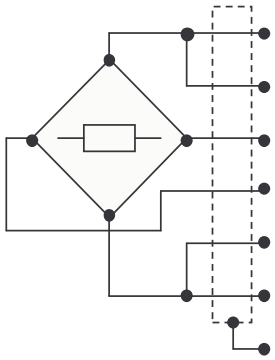
Torque Transducer MF

Dimensions



Nominal capacity	M_{nom}	± N·m	500 1,000	2,000	4,000	8,000	16,000	32,000	64,000
Outer diameter	ø Q	mm	118	146	186	235	286	360	460
Inner PCD	ø F	mm	100	125	160	200	250	315	400
Centring pin diameter	ø Z1	mm		40_{h6}			70_{h6}		
Centring pin diameter	ø Z2	mm		40_{H7}			70_{H7}		
	G1/G2	mm				3			
Through hole	n × øP		12 × ø11	12 × ø14	12 × ø18	12 × ø22	16 × ø22	16 × ø26	16 × ø33
Fastening screw thread	n × M		12 × M10	12 × M12	12 × M16	12 × M20	16 × M20	16 × M24	16 × M30
Overall height	H	mm	116	126	140	170	200	240	290

Electrical connection



grey	Sense (-)
black	Excitation U_B (-)
red	Output U_A (-)
white	Output U_A (+)
blue	Excitation U_B (+)
green	Sense (+)
yellow	Screen

fixed connection
(5 m, 6-wire, screened, open ended)

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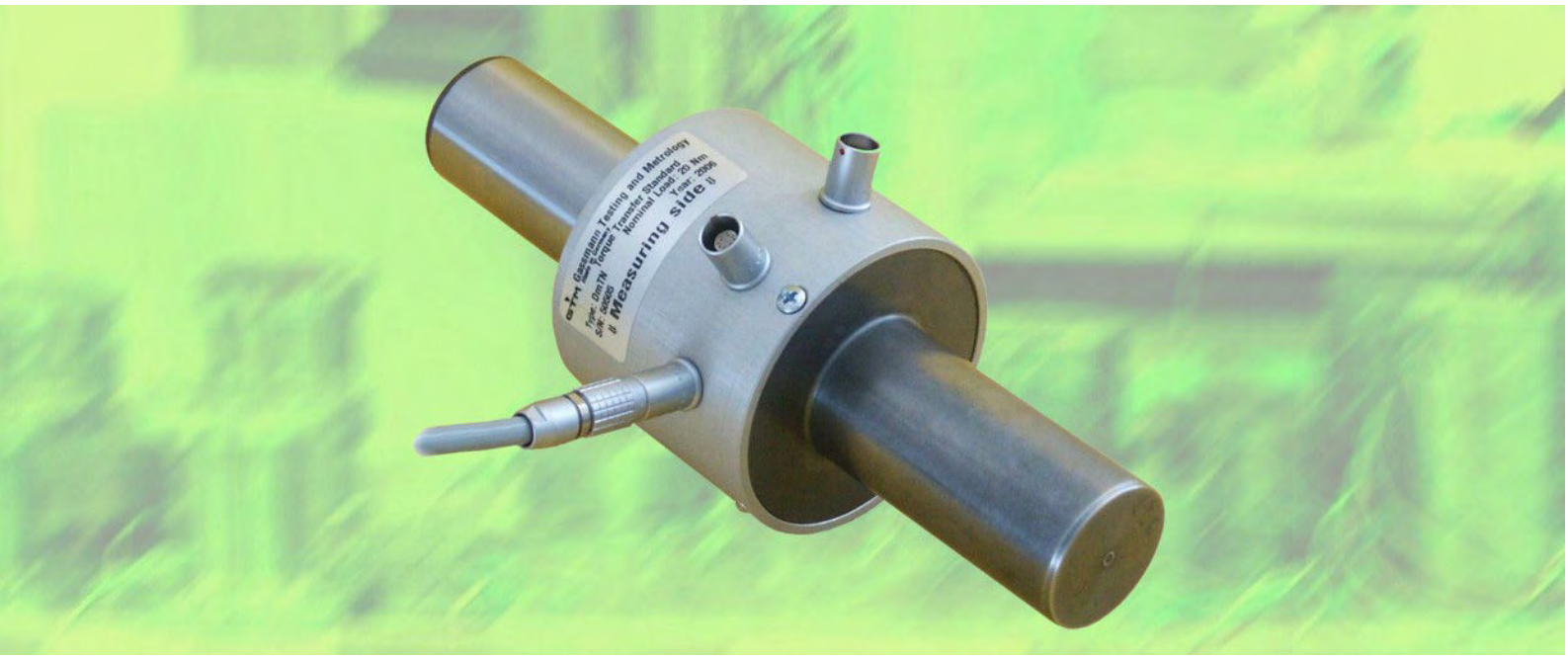
Torque Transfer Standards DTN



Transfer standards for comparison measurements of torque standard machines and for use as reference standards for the calibration of torque testing machines

- Nominal capacity from 1 N·m to 20,000 N·m
- Simple Adaptation via solid shaft
- Hermetically sealed
- Accuracy class 0.2 up to VN (better than 0.05)
- Design according to DIN 51309

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DTN_p_e 04/2007

Torque Transfer Standards DTN

Technical Description

During the manufacture of these transducers, particularly high standards of quality are being adhered to. All tests and methods of compensation are aimed at achieving the highest possible repeatability stability of the measuring signal. The transducers will be delivered with cable connection of 5 m and the end of it can be configured as the customers require. The torque transfer standards will be delivered in a rugged aluminium case.

Options

- Bending moment instrumentation
  To check the axial torque introduction M_z, it is possible to implement two moment measuring circuits. In addition to M_z, the horizontal bending moments M_x and M_y are measured and lead out as separate channels.
- Measuring of temperature
  If a temperature measuring is desired, a PT100 sensor can be integrated.
- Cable connection
  The connection at the transducer may a fixed or a plug-in connection.

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Torque Transfer Standards DTN

Technical Data (relative to actual value)

In the range 20 % - 100 % M_{nom} (class 0,2) 40 % - 100 % M_{nom} (classes 0,1; 0,05; VN)			GTM Type VN	Class 0,05	Class 0,1	Class 0,2
Relative variance (repeatability)	b	± %	0.010	0.050	0.10	0.20
Relative variance (reproducibility)	b‘	± %	0.005	0.025	0.05	0.10
Relative zero deviation	f_0	± %	0.006	0.0125	0.025	0.050
Relative hysteresis	h	± %	0.063		0.125	0.250
Relative interpolation error	f_q bzw. f_a	± %	0.025		0.05	0.10
Temperature coefficient on zero	TK_0	± %/K	0.0008		0.001	0.002
Temperature coefficient on span	TK_C	± %/K	0.001			0.002
Relative creep error 1 - 15 min	f_{cr}	± %	0.004	0.008	0.01	0.02
Reference temperature	t_{ref}	° C	21			
Nominal temperature range	$B_{t, nom}$	° C	10 - 30			

Definitions acc. DIN 51309

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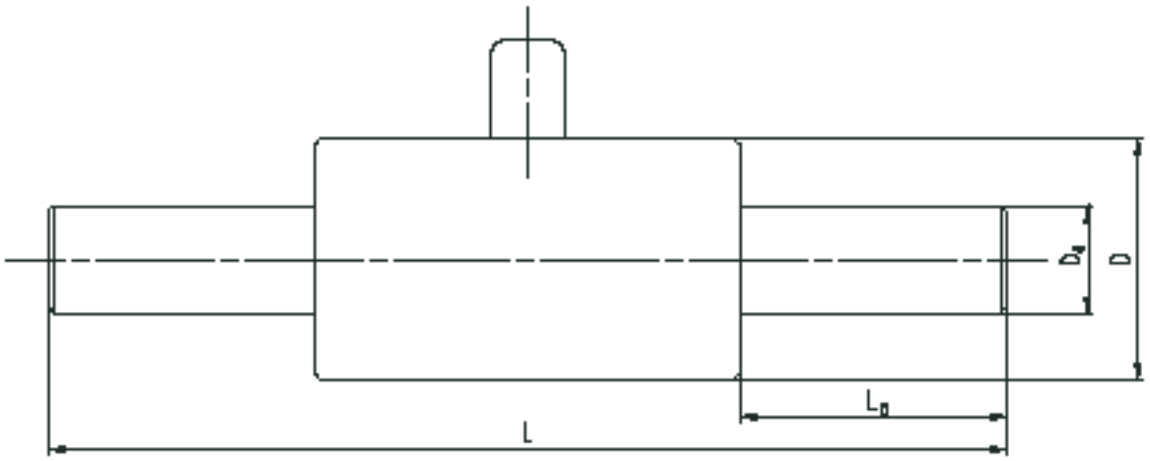
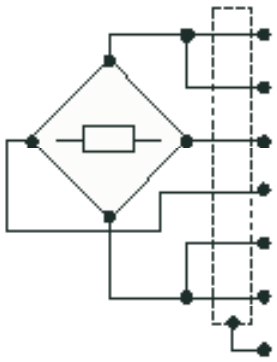
Torque Transfer Standards DTN

Dimensions



Nominal torque	Shaft diameter	Shaft length	Overall diameter	Overall length	Weight
	D_a	L_a	D	L	
N·m	mm	mm	mm	mm	ca. kg
1; 2; 5; 10	15_{h7}	25	48	108	0.3
20; 50	20_{h7}	45	46	140	0.4
100; 200	30_{h7}	60	64	182	1.2
500; 1,000	50_{h7}	80	110	244	4.6
2,000; 5,000	70_{h7}	115	180	346	15.8
10,000	110_{h7}	115	260	358	38.6
20,000	110_{h7}	115	270	358	39.4

Electrical Connection



grey	Sense (-)
black	Excitation U_B (-)
red	Output U_A (-)
white	Output U_A (+)
blue	Excitation U_B (+)
green	Sense (+)
yellow	Screen

Connection at transducer
(0.75 m, 6-wire, screened, ø 5 mm)

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Torque Transfer Wrench DTS

Comparison measurements of torque wrench calibrators and calibration of torque testing rigs

- Torque capacity from 5 N·m to 1.000 N·m
- Low mass
- Hermetically sealed
- Accuracy classes 2 to 0,2
- Design according to DKD-R 3-7

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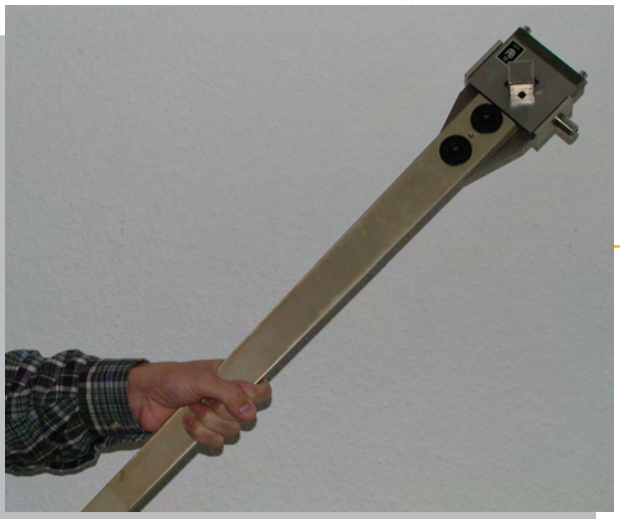
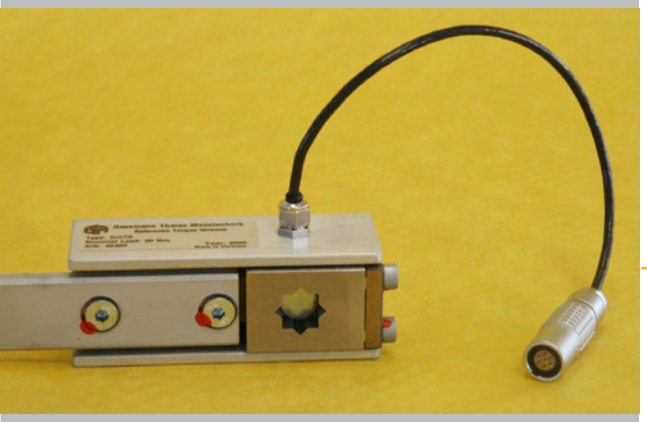
DTS_p_e 04/2007



Torque Transfer Wrench DTS

Description

For the adaptation to the device under test, a removable square drive (male) is used, which can be rotated in steps of 45°. It is held magnetically inside the wrench.
All torque transfer wrenches are protected against moisture; the torque transducer is hermetically sealed by a laser-welded metal bellows. An integrated temperature sensor (PT 100) allows to monitor the temperature of the transducer.
The lever arm is made from an aluminium profile, a groove of which serves as a cable channel - this avoids influences caused by varying cable lengths.
GTM torque transfer wrenches have a comparatively low mass, they are the feather-weights of the transfer wrench designs.



Options

In order to increase the possibilities of adaptation, square drives of different sizes are available for our torque transfer wrenches.
On request, we deliver the instruments in a plastic case (Peli-Case brand), which fulfils the US military standard MIL-STD 4150-H in terms of stackability, shock and moisture protection.

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Torque Transfer Wrench DTS

Metrology Specification

Nominal torque	M_{nom}	N·m	2	5	10	20	50	100	200	500	1,000
Nominal sensitivity	C_{Nenn}	mV/V	1			2					
Classification characteristics according to DKD-R 3-7			see below								
Temperature influence on zero	TK_0	± %/K	0.005								
Temperature influence on span	TK_C	± %/K	0.005								
Nominal input impedance	R_e	Ω	380								
Nominal output impedance	R_a	Ω	350								
Insulation impedance	R_{is}	Ω	> $2 \cdot 10^9$								
Reference excitation	U_{ref}	V	10								
Maximum excitation	$U_{e, max}$	V	12								
Nominal temperature range	$B_{t,nom}$	°C	-10 to +70								
Reference temperature	t_{ref}	°C	22 ± 1								
Operating temperature range	B_{tG}	°C	-20 to +85								
Cable connection			LEMO								
Protection rating			IP 60								

Excerpt from DKD-R 3-7

relative permissible errors of the torque transfer wrench (20 % - 100 % M_E)			class 0,2	class 0,5	class 1	class 2
relative reproducibility	b	± %	0.20	0.50	1.00	2.00
relative repeatability	b‘	± %	0.10	0.25	*)	
relative zero deviation	f_0	± %	0.050	0.125	0.25	0.50
relative hysteresis	h	± %	0.250	0.63	1.25	2.50
relative indication / interpolation error	f_q / f_a	± %	0.10	0.25	0.5	1.0
minimum starting torque	M_A		≥ 1,000 r	≥ 400 r	≥ 200 r	≥ 100 r
relative measuring uncertainty		± %	0.040	0.10	0.20	0.40

*) not stated in DKD-R 3-7

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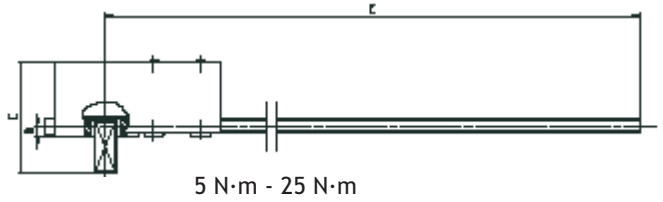
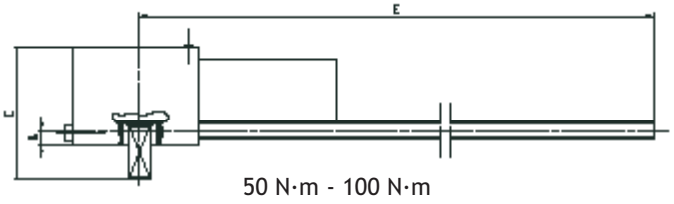
Torque Transfer Wrench DTS

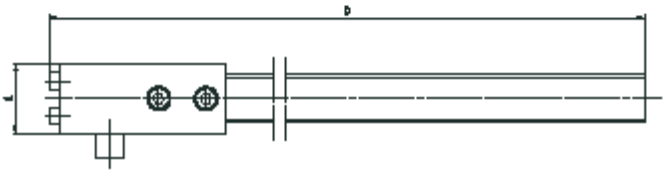
Dimensions

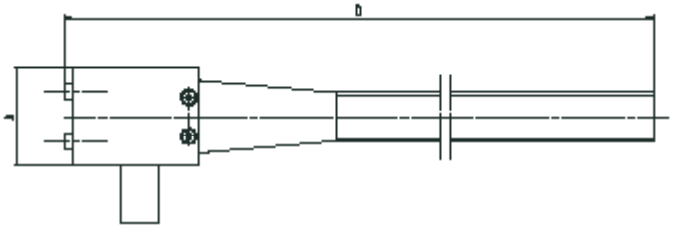


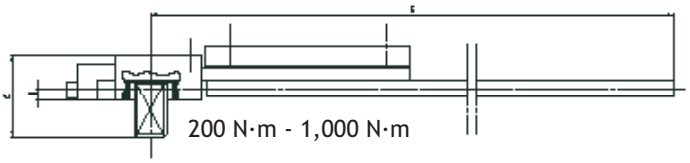
5 N·m - 25 N·m



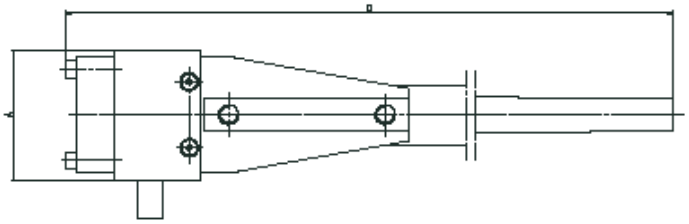
50 N·m - 100 N·m







200 N·m - 1,000 N·m



Nominal torque	M_{nom}	N·m	5	10	20	25	50	100	200	500	1,000
Head width	A	mm	30				40		60	80	100
Force axis offset	B	mm	4.3				5.8	4.0	6.8		7.0
Overall height	C	mm	47				54	63	49	50	56
Overall length	D	mm	276				481	581	792	1,089	
Lever length	E	mm	250				450	550	750	1,050	
A/F standard	SW	inch	3/8				1/2		1/2	3/4	1/1
A/F optional	SW	inch	1/4				3/8		3/8	1/2	3/4
Mass		kg	0.3				0.9		1.5	2.5	3.2

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GASSMANN TESTING AND METROLOGY GMBH

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VN-Digitizer

High resolution precision measuring system for up to 8 strain gauge transducers

- Portable amplifier with up to 8 channels
- Comfortable measuring, processing and storing
- High precision
- User friendly operator software
- Easy data exchange
- Customer specific desktop

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VND_p_e 04/2007

VN-Digitizer

Description

The VN-Digitizer is a direct voltage measuring amplifier with integrated software to amplify and display measurement data.

This precision system may optionally be equipped with two, four, six or eight channels. The transducers are connected via a programmable direct voltage of 5, 10 or 20 V in 6 wire full bridge circuit. Thus a drop of voltage on the wire is without influence on the measured value.

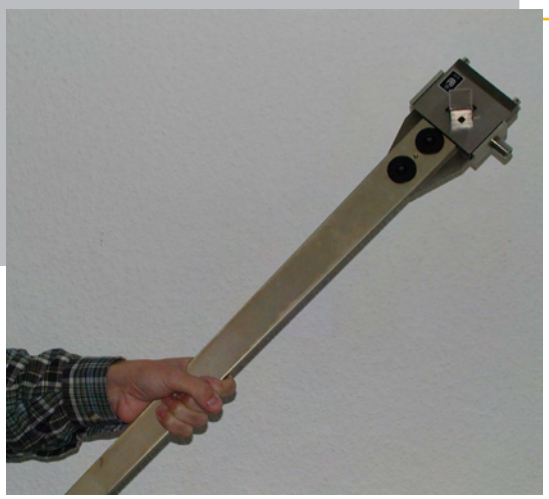
Functions

The measuring of the channels occurs absolutely synchronously, optionally triggered automatically or manually.

Filters, supply voltage and measuring cycles as well as limit value control and average calculation are configured via the operating software. The display of the measured data can be configured separately for each channel. Actual as well as stored data can be displayed simultaneously.

Besides the software offers many other functions to work on the data, print it and transfer it to other programs for further processing.

Options



The VN-Digitizer is available in two designs:

- in a portable, compact computer with integrated keyboard and screenr
- in a 19“-slot-PC plus screen, keyboard and mouse

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VN-Digitizer

Technical Data

Accuracy class	0.001
Non-linearity	± 5 ppm
Reproducibility (within 4 h)	± 5 ppm
Drift (after 2 h operating time) without autocalibration with autocalibration with manual calibration	 --- --- < ± 5 ppm
Long-term drift (per year)	< ± 25 ppm
Noise (3σ -value)	± 4 ppm at 5 s integration time
Temperature influence on zero on sensitivity	 ± 1 ppm /K ± 2.5 ppm a.v./K

Number of channels	2, 4, 6 or 8
Adaptable transducers	DMS full bridge circuit
Connection technique	6 wire
Supply voltage	5V DC, 10V DC or 20V DC
Measuring ranges	8 mV/V at 5V DC 4 mV/V at 10V DC 2 mV/V at 20V DC
Bridge impedance	150 Ω - 5 kΩ at 5V DC 300 Ω - 5 kΩ at 10V DC 1 kΩ - 5 kΩ at 20V DC
Input signal range	Max. ± 40 mV
Resolution	± $2 \cdot 10^6$ at 2 mV/V
Integration time (Oversampling)	1, 2, 5, 10, 16.6, 20, 33.3, 40, 50, 60, 100, 120, 200, 300 and 500 ms, 1, 2 and 5 s
Input sampling rate	80 kHz
Resolution A/D converter	24 Bit

Nominal temperature range	0...50°C
Operating temperature range	0...40°C
Storage temperature	-10...60°C

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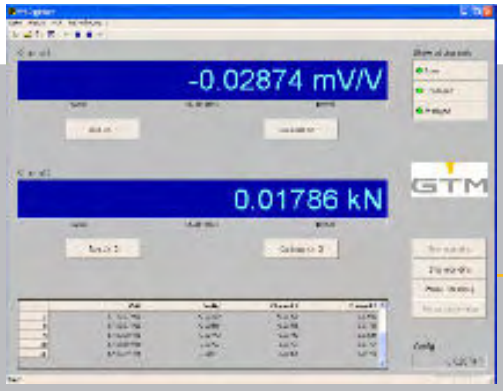

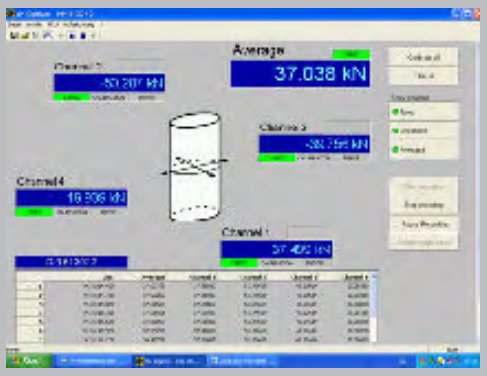

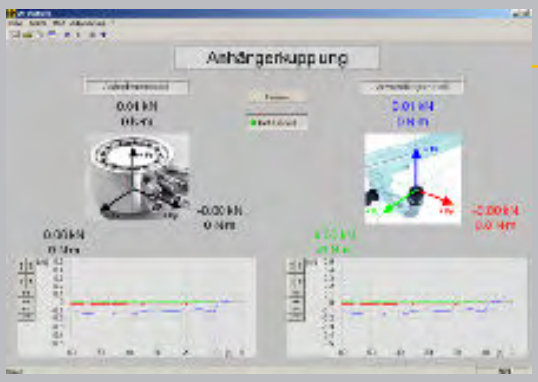

VN-Digitizer

Software

The software of the VN-Digitizer is a measure and visualization software, which records data within up to six channels.
The operator friendly program provides

- Comfortable measuring, recording and storing of data
- Manual or fully automatic triggering for the record of the measuring values
- Parameterising of filter, excitation voltage and measuring cycles
- Extensive functions to tare, calculate and examine as well as parameterisable monitoring of standstill
- Limit value monitoring and average determination
- Easy storage and data exchange of the extract measuring data
- Linearization of the transducer hysteresis via cubic polynomial

The program can be configured in a way, that the hardware for the data logging can be described, the properties of the data acquisition (physical channel) and of the display (logical channel) can be stated as well as the applied functional module and the views (display presentation) can be specified.

Display

The general desktop is, as shown in the figure above, a two channel presentation. Nevertheless, an individual desktop is also possible, as shown in the further figures. Numerical series of measurements as well as curve representations are also displayable.

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LT-Digitizer

Precision measuring system with user software for recording and visualisation of measuring data on existing PC or laptop. Workable with up to 6 channels for connection with DMS transducers

- Portable amplifier with 2, 4 or 6 channels
- Connection via USB interface
- High precision
- User friendly operator software
- Customer specific desktop

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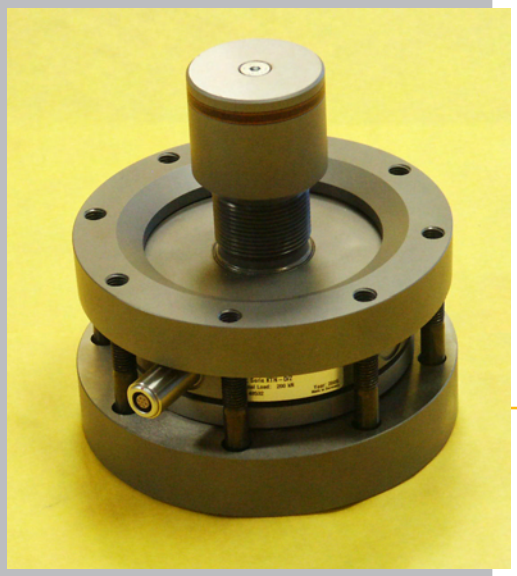
LTD_p_e 04/2007

LT-Digitizer

Application

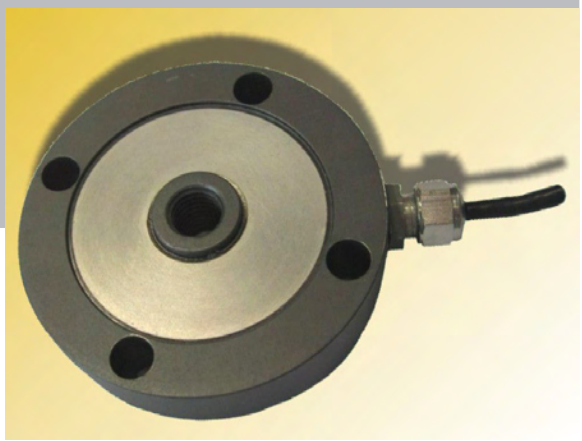
Force or torque transducers are often used in mobile constructions and systems. Because of that it is essential to use a flexible application measuring amplifier. It is also regularly required to have a mobile evaluating unit for the calibration of measuring equipment, test stand as well as load column and reference torque wrenches. Therefore it is necessary to work with a lightweight and portable measuring amplifier.



This mobility offers our high-precision LT-Digitizer. The amplifier is connectable via the USB interface of a PC or laptop to record and visualize measuring data and place ready for further use via the measuring and evaluating software, which is part of the scope of delivery. Depending on its high precision our LT-Digitizer is also predestinated to carry out traceable measurings according to the standards ISO 376 (force) and DIN 51309 (torque).

Description

Our LT-Digitizer is a mobile and handy unit, on which strain gauge transducers are connectable in full bridge circuit.



This precision measuring system can be equipped with 2, 4 or 6 channels, whereas the programmable DC connection (5, 10 or 20 V) of the transducer occurs in full Wheatstone bridge 6 wire. Thus a voltage drop on the line has no effect on the measuring value.

The desired high resolution is calculated by the signal processor under assistance of the digital signal processing. Thus disturbances of the supply frequency will be attenuated.

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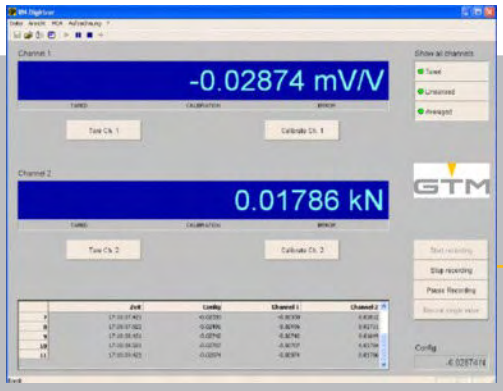
LT-Digitizer

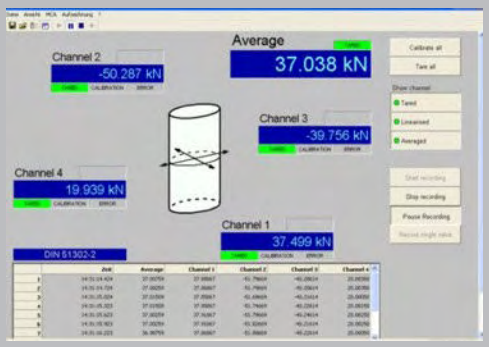
Technical Data

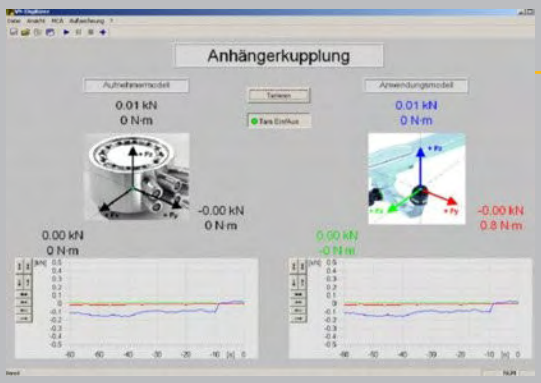
Accuracy class	0.0025
Non-linearity	± 5 ppm
Reproducibility (within 4 h)	± 5 ppm
Drift (after 2 h operating time) without autocalibration with autocalibration with manual calibration	 --- < ± 20 ppm < ± 5 ppm
Long-term drift (per year)	< ± 25 ppm
Noise (3σ -value)	± 10 ppm at 500 ms integration time
Temperature influence on zero on sensitivity	 ± 1 ppm /K ± 2.5 ppm a.v./K

Number of channels	2, 4 or 6
Adaptable transducers	DMS full bridge circuit
Connection technique	6 wire
Supply voltage	5V DC, 10V DC or 20V DC
Measuring ranges	8 mV/V at 5V DC 4 mV/V at 10V DC 2 mV/V at 20V DC
Bridge impedance	150 Ω - 5 kΩ at 5V DC 300 Ω - 5 kΩ at 10V DC 1 kΩ - 5 kΩ at 20V DC
Input signal range	Max. ± 40 mV
Resolution	± 200,000 at 2 mV/V
Integration time (Oversampling)	50, 100, 120, 200, 300 and 500 ms, 1, 2 and 5 s adjustable with software VN-Digitizer 3.0
Input sampling rate	80 kHz
Resolution A/D converter	24 Bit

Operating voltage	230V/50 Hz via plug-in power supply
Bus connection	USB 2
Nominal temperature range	0...50°C
Operating temperature range	0...40°C
Storage temperature	-10...60°C
Dimensions	ca. 170 x 55 x 220 mm (WxHxD)
Weight	ca. 1200g







LT-Digitizer

Software

The software VN-Digitizer for the LT-Digitizer is a measure and visualization software, which records data within up to six channels.
The operator friendly program provides

- Comfortable measuring, recording and storing of data
- Manual or fully automatic triggering for the record of the measuring values
- Parameterising of filter, excitation voltage and measuring cycles
- Extensive functions to tare, calculate and examine as well as parameterisable monitoring of standstill
- Limit value monitoring and average determination
- Easy storage and data exchange of the extract measuring data
- Linearization of the transducer hysteresis via cubic polynomial

The program can be configured in a way, that the hardware for the data logging can be described, the properties of the data acquisition (physical channel) and of the display (logical channel) can be stated as well as the applied functional module and the views (display presentation) can be specified.

Display

The general desktop is, as shown in the figure above, a two channel presentation. Nevertheless, an individual desktop is also possible, as shown in the further figures. Numerical series of measurements as well as curve representations are also displayable.

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Multi Component Analyzer MCA

Acquisition and transformation of all forces and moments on complex stressed components in the testing technology

- Easy and fast analysis of all forces and moments
- Synchronic data processing in real-time
- Analogue and digital interface
- Linearization of the transducer and crosstalk compensation
- Graphical and numerical visualisation
- Data acquisition and storing

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MCA_p_e 04/2007

Multi Component Analyzer MCA

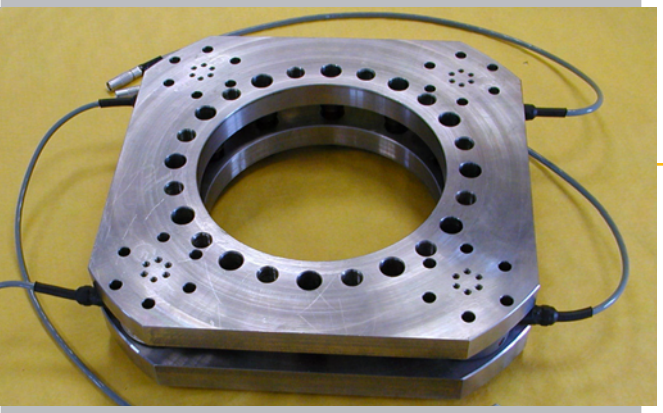
Description

The Multi Component Analyzer is a measuring tool for the quantification of all 6 force and moment components of parts under complex stress.

In many applications main components will be affected or falsified by additional parasitic forces and moments. With the aid of the multi-axis analysis of the load, the actual loading conditions can be evaluated and therefore be modified via constructive procedure; alternatively, the test results can be corrected by calculations.

Functions

The results of the 6 dimension multi-component measurement can be transformed into equivalent force and moment vectors with special properties, using the spatial equilibrium conditions. A free defina-ble description of the transducer position provides the basis for the translation of the forces and moments in the user coordinate system. Thus the load situation can be described through norm, coordinates of the point of application, angle of rotation and angle of height.



Options

The VN-Digitizer is available in two designs:

- in a portable, compact computer with integrated keyboard and screenr
- in a 19“-slot-PC plus screen, keyboard and mouse

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Multi Component Analyzer MCA

Technical Data

Accuracy class	0.0025
Non-linearity	± 5 ppm
Reproducibility (within 4 h)	± 5 ppm
Drift (after 2 h operating time) without autocalibration with autocalibration with manual calibration	 --- < ± 20 ppm < ± 5 ppm
Long-term drift (per year)	< ± 25 ppm
Noise (3σ -value)	± 4 ppm at 5 s integration time
Temperature influence on zero on sensitivity	 ± 1 ppm /K ± 2.5 ppm v.I./K

Number of channels	2, 4, 6 or 8 possible
Adaptable transducers	DMS full bridge circuit
Connection technique	6 wire
Supply voltage	5V DC, 10V DC or 20V DC
Measuring ranges	8 mV/V at 5V DC 4 mV/V at 10V DC 2 mV/V at 20V DC
Bridge impedance	150 Ω - 5 kΩ at 5V DC 300 Ω - 5 kΩ at 10V DC 1 kΩ - 5 kΩ at 20V DC
Input signal range	Max. ± 40 mV
Resolution	± $2 \cdot 10^6$ at 2 mV/V
Integration time (Oversampling)	1, 2, 5, 10, 16.6, 20, 33.3, 40, 50, 60, 100, 120, 200, 300 and 500 ms, 1, 2 and 5 s
Input sampling rate	80 kHz
Resolution A/D converter	24 Bit

Nominal temperature range	0...50°C
Operating temperature range	0...40°C
Storage temperature	-10...60°C

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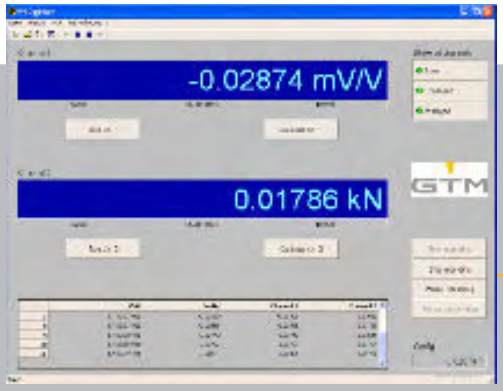

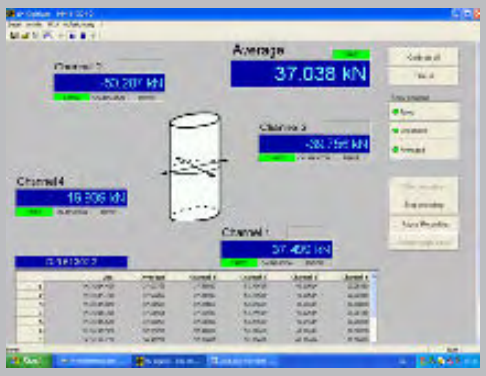

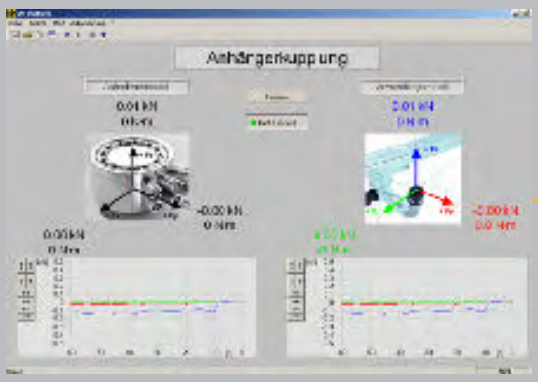

Multi Component Analyzer MCA

Software

The software of the MCA is a measure and visualization software, which record data within up to eight channels. The operator friendly program provides

- Comfortable measuring, recording and storing of data
- Manual or fully automatic triggering for the record of the measuring values
- Parameterising of filter, tension of supply and measuring cycles
- Extensive functions to tare, calculate and examine as well as parameterisable monitoring of standstill
- Grenzwertüberwachung und Mittelwertbildung
- Linearization of the transducer hysteresis via cubic polynomial
- Easy storage and data exchange of the extract measuring data
- Crosstalk correction by linear, quadratic und cubic polynomials
- Calculation of the stress situation at any given point
- Coordinate transformation

The program can be configured in a way that the hardware for the data logging can be described, the properties of the data acquisition (physical channel) and of the display (logical channel) can be stated as well as the applied functional module and the views (display presentation) can be specified.

Anzeige

The user can define freely the display presentation. Beside the primary force and moment results of the transducers, all results of the transformation can be displayed, stored and exported as well as digital further processing.

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MultiComponent-Measuring Amplifier MCM

Multi-component measuring amplifier for collecting and visualising data of up to 12 strain gauge transducers

- Measurement amplifier for 3, 6 or 12 channels
- Connection via RS232 or TCP/IP
- High precision
- User friendly operating software
- 19“-slot-PC
- Customer specific desktop

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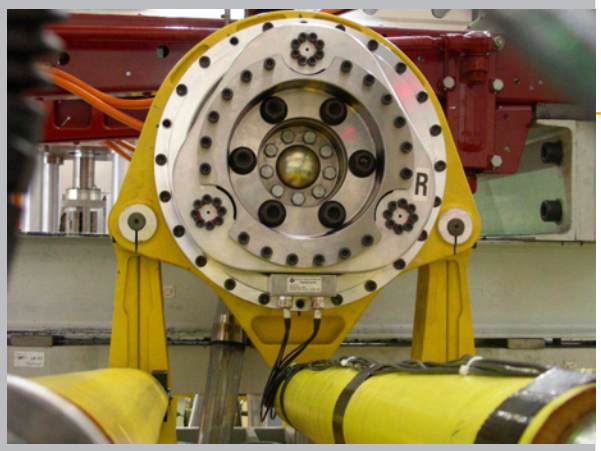

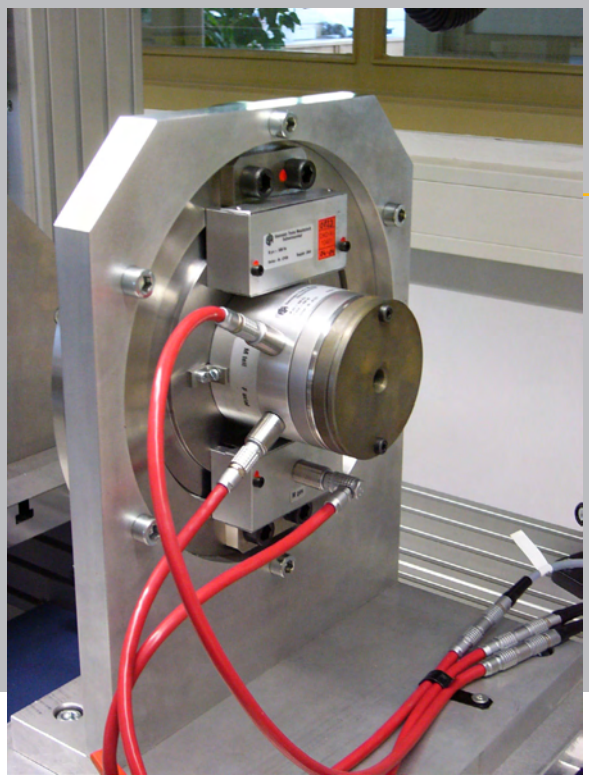

MultiComponent Measuring Amplifier MCM

Description

The Multi Component Measuring Amplifier MCM is a measuring tool for the processing of up to 12 strain gauge signals.

It uses a PC architecture to numerically process the digital signal outputs of on-board DC measuring amplifiers and further I/O-cards to provide a range of functions and application-defined output signals.

All channels are digitised synchronously and the whole numerical calculations are carried out in real time. In conjunction with the high precision digital amplifiers this allows measurements with high speed (up to 500 Hz) and high resolution (up to 200,000 digits).

Typically the output channels are in a 0-10 V format for online control. Simultaneous digital output is via RS232 or TCP/IP.

For the measurement of the up to 12 channels, 3 - 6 dual-channel amplifier cards PC-DMS are fitted to the system unit. They supply the connected transducers with DC voltage, amplify and digitise the measuring signals and pass them on for further processing in the CPU.

Application

The MCM system is ideally suited for linking it with existing control systems such as servo controllers and programmable logic controllers (PLC).

For a variety of applications, fully configured MCM systems are available to which the corresponding sensors need to be merely connected, upon which the correct output signals are avilable without the need for further user input:

- GTM Wheel Load Sensor RLS
- GTM Measuring Platforms MPF
- GTM Bolt Friction Measuring Sensor RMK

After plug-in and turning on the measuring amplifier will output its signals to subsequent instrumentation. No screen nor keyboard needs to be connected.

Other pre-configured installations are available on request.

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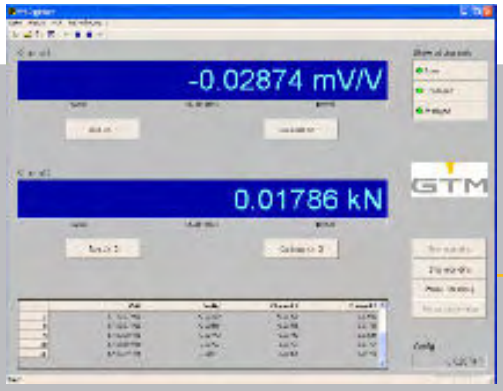
MultiComponent Measuring Amplifier MCM

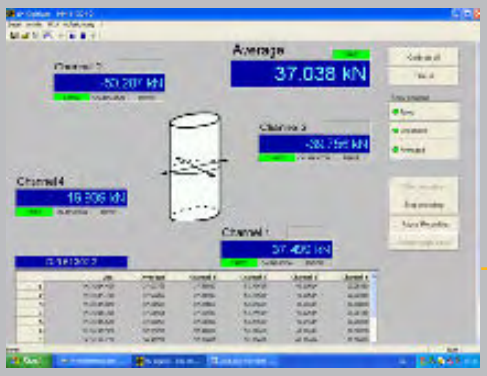
Technical Data

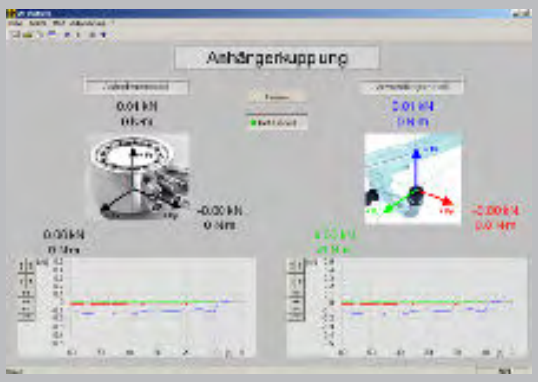
Accuracy class	0,01
Non-linearity	± 50 ppm
Reproducibility (within 4 h)	± 50 ppm
Drift (after 2 h operating time) without autocalibration with autocalibration with manual calibration	 < ± 100 ppm --- ---
Long-term drift (per year)	< ± 25 ppm
Noise (3σ -value)	± 40 ppm at 1 ms integration time
Temperature influence on zero on sensitivity	 ± 10 ppm /K ± 25 ppm a.v./K

Number of channels	3	6 or 12
Adaptable transducers	DMS-Vollbrücke	
Connection technique	6-Leitertechnik	
Supply voltage	5V DC, 10V DC oder 20V DC	
Measuring ranges	8 mV/V at 5V DC 4 mV/V at 10V DC 2 mV/V at 20V DC	
Bridge impedance	150 Ω - 5 kΩ at 5V DC 300 Ω - 5 kΩ at 10V DC 1 kΩ - 5 kΩ at 20V DC	
Input signal range	Max. ± 40 mV	
Resolution	± 200,000 bei 2 mV/V	
Integration time (Oversampling)	1 ms	100 µs
Input sampling rate	80 kHz	
Resolution A/D converter	24 Bit	

Operating voltage	230V/50 Hz
Nominal temperature range	0...50°C
Operating temperature range	0...40°C
Storage temperature	-10...60°C
Dimensions	19“-Slot-PC







MultiComponent-Measuring Amplifier MCM

Software

The MCM software offers these possibilities:

- Synchronous acquisition of all transducer signals selectable, max. 3,2 µs phase shift
- Selection of nominal capacities of all transducer channels
- Correktion matrix and mathematical cross talk correction of multi-component transducers: linear, suqare and cubic terms
- Transducer capacities can be read from disk, no manual input required
- Unit conversion
- Tare function (can be deactivated)
- Manual re-calibration of the PC-DMS

Display

The measuring amplifier is first parameterised from the MCC user software. This is done on a PC or laptop via the RS232 or TCP/IP interface included in the MCM.
The ouput options can be selected: Analogue, via the analogue module of the measuring amplifier, and/or digital via the RS232 or TCP/IP interface.
It is possible to display these quantities online (in order to visualise and avoid critical conditions etc.) and offline for post-processing of dynamic actions, e.g. using zoom functions etc. A PC or laptop must be connected for this. The stored values can also be imported into Excel.

Furthermore there are different options:

- Selectable X-axis, determined by scaling
- Interpolation (smoothing) between individual points when X-axis is not time-based
- Clear-screen function
- The acquired measurements can be stored and re-formatted for further processing e.g. with Excel
- Stored results can be re-loaded and re-played
- All input rules are stored; no data loss, when PC is switched off

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Calibration machines for force and torque

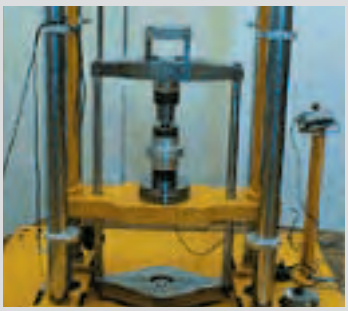
Gassmann Theiss Messtechnik GmbH

Calibration machines with direct mass action (deadweight) - Type DW

For the most precise definition of the physical quantity of force, since mass as the base quantity can be determined with a precision better than 1×10^{-6}. Therefore, this type is most suitable for primary standards in national metrology institutes (NMI's) and for secondary standards in accredited calibration labs, if Class 00 is required.

The design follows the 3-column steel base frame, carrying a four-column loading frame on top. The force generation is by steel mass disks (dead-weights). Additional flexibility in their use can be achieved by application of a binary exchange mass stack instead of the simple sequential stack. In this case, an electromechanical substitute load system is activated during load changes. The test spaces are in accordance with international standards.

Mass stack



Test space

100 kN force standard machine at PTB, Germany

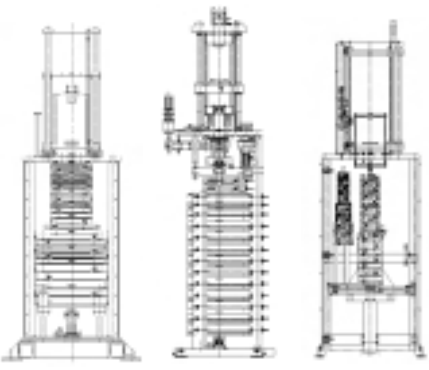
Features

- Standard type series from 200 N up to 500 kN capacity
- Secure load application with patented GTM coupling system
- Electromechanical substitute loading device
- Measuring uncertainty 2×10^{-5}, traceable to leading NMI's
- Internal verification of the machine by self-check routine

Model	Dimensions H x W x D (mm)	Test space Tension H x W (mm)	Test space Compr. H x W (mm)	Weight (kg)
200 N	2280 x 550 x 550	50-600 x 260	10-200 x 190	140
500 N	2540 x 550 x 550	50-600 x 260	10-200 x 190	220
1000 N	2700 x 630 x 630	50-600 x 300	10-240 x 250	400
2 kN	2850 x 710 x 710	50-600 x 300	10-240 x 250	680
5 kN	3380 x 820 x 800	50-600 x 400	10-260 x 300	1000
10 kN	3670 x 1000 x 1000	50-600 x 400	10-260 x 300	2500
20 kN	4040 x 1200 x 1200	50-600 x 400	10-600 x 300	4500
50 kN	4400 x 1350 x 1350	50-600 x 400	10-600 x 300	7000
100 kN	5300 x 1900 x 2100	150-750 x 500	10-600 x 470	13000
200 kN	6800 x 2400 x 2200	150-800 x 630	10-800 x 500	42000
500 kN	8800 x 2825 x 2000	150-1200 x 800	10-1200 x 600	75000

Design examples

Deadweight machine with …



… sequential stack … exchange stack … twin sequential stacks

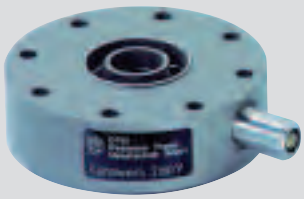
The Hierarchy of Metrology

The primary standard machine ...
... defines the Newton or the Newtonmeter, respectively. In both cases the quantities are compared with combinations of base units: mass, length and time. Preferably, deadweight and lever machines are used for the definition of force. For torque, lever-mass systems are usually applied.

The secondary standard machines ...
... serve for the calibration of sensors which are used in industrial quality laboratories as working standards. All GTM types are suitable for this purpose – even hydraulic systems offer sufficient measuring uncertainties.

The calibration machine ...
... is used for the calibration of measuring instruments which are used for production testing. GTM offers cost-effective devices with measuring uncertainties that are optimised for the specific task.

The measuring instrument ...
... verifies the physical parameters as specified for a process. With GTM force and torque transducers as your standard instrument you achieve the level of metrological certainty required for your process control.



The link between the levels of this hierarchy is accomplished by **GTM force and torque transfer standards.** They allow comparisons of all the various standards and enable traceability of measuring instruments to national standards. GTM transfer standards are characterised by their exceedingly high reproducibility.

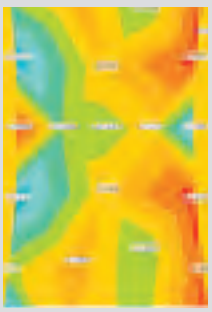
Calibration machines with lever amplification - Type LA

For larger forces, above 500 kN or so, the installation of direct-loading deadweight machines tends to be financially uneconomic or even impossible for reasons of limited available space. The application of a highly precise lever amplification system even for very high nominal forces enables cost effective calibration machines with measuring uncertainties of 100 ppm.

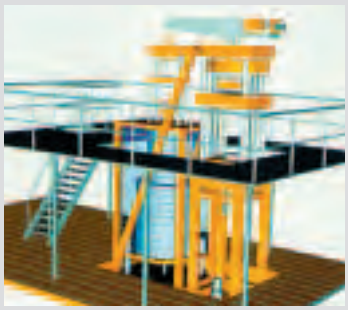
Also, the force range of existing deadweight machines can be increased by adding such a lever system.

In the lower force range, such a machine operates with direct mass action (deadweight). A highly precise lever transmission generates the higher forces. The lever support is designed as strain-controlled elastic hinges, which in contrast to the older types (using knife edge bearings) operate completely wear-free and enable accurate amplification. This strain-controlled bearing also serves for the lever control and position monitoring and thereby increases the reliability.

An additional advantage is the large combined measuring range of such lever-deadweight machines of up to 2000 : 1. This makes them attractive for capacities as small as 50 kN.



FEM Simulation: Lever



3-D Design of an operating platform

Lever-amplified force standard machine at EIM, Greece

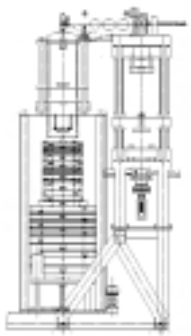
Features

- Standard type series from 50 kN to 2 MN
- Lever amplification with strain controlled elastic hinges (GTM patent)
- Electromechanical substitute loading device
- Measuring uncertainty 2×10^{-5} / 1×10^{-4}, traceable to leading NMI's

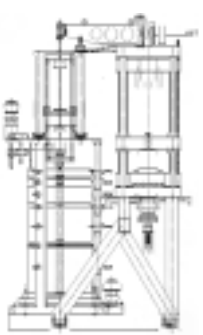
Model	Dimensions H x W x D (mm)	Test space Tension H x W (mm)	Test space Compr. H x W (mm)	Weight (kg)
50 kN	2100x1500x1010	50-600 x 450	0-600 x 450	1600
100 kN	2580x1700x1050	50-600 x 500	0-600 x 500	2500
200 kN	2800x2000x1200	50-800 x 580	0-800 x 580	6800
500 kN	3300x2360x1480	50-800 x 580	0-800 x 580	13000
1000 kN	4100x2820x1850	50-1000 x 660	0-1000 x 660	20000
2000 kN	5800x3100x2230	50-1000 x 750	0-1000 x 750	33200

Design examples

Lever-deadweight machines with ...



... sequential stack



... exchange stack

Calibration machines with jockey weight and lever - Type JW

The design principle of the strain controlled elastic hinges is used here once more, together with a travelling weight. The lever (symmetric with regards to its fulcrum point) generates tension and compression forces with only one weight in a single test space.

This for the first time enables calibrations with alternating loads (when using GTM coupling rods) and continuous calibrations. With up to three separate jockey weights measuring ranges of up to 625:1 are possible. Since there is no expensive mass stack required, this type of lever machine offers a particularly cost-effective solution amongst calibration machines. A fact that makes it an ideal choice for the production testing of force transducers and load cells.

Jockey weight machine, GTM DKD Force Calibration Laboratory


Test space

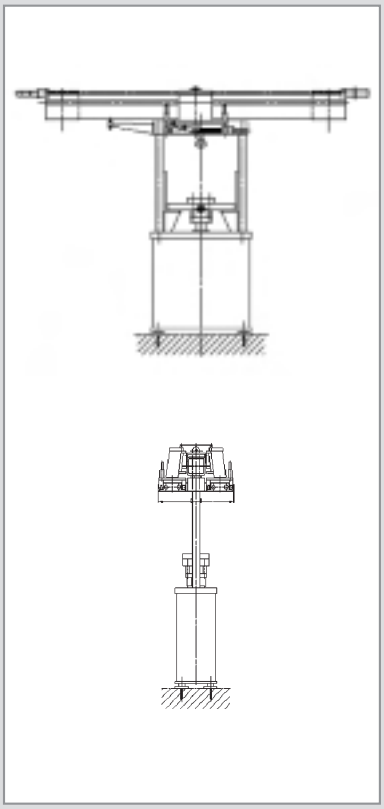

Lever bearing

Features

- Load ranges from 100 N to 100 kN
- Lever amplification with strain controlled elastic hinges (GTM patent)
- Continuous loading possible
- Through-zero calibration of force transducers in one test space
- Measuring uncertainty 1×10^{-4}, traceable to leading NMI's

Model	Dimensions H x W x D (mm)	Test space Tension H x W (mm)	Weight (kg)
100 N	1100x370x1810	20-140x130	150
200 N	1100x370x1810	20-140x130	150
500 N	1100x370x1810	20-140x130	150
1000 N	2100x2400x560	20-220x460	580
2000 N	2100x2400x560	20-220x460	580
5000 N	2100x2400x560	20-220x460	580
10 kN	2200x2400x620	80-380x520	950
20 kN	2200x2400x620	80-380x520	950
50 kN	2200x2400x620	80-380x520	950
100 kN	2400x2400x740	320-520x520	1700

Design examples



Calibration machines with hydraulic force generation and transfer standard - Type HT

Ideally suited as secondary force standard for day-to day calibrations in industrial quality control labs. High forces can be realised by such compact and low-cost machines.

Hydraulic force standard machines differ in many essential areas from material test machines of otherwise similar appearance: much lower hydraulic power due to short and slow piston travel, highly precise controllers, and the use of transfer standards optimised to the highest possible reproducibility.

Force calibration with reference transducer

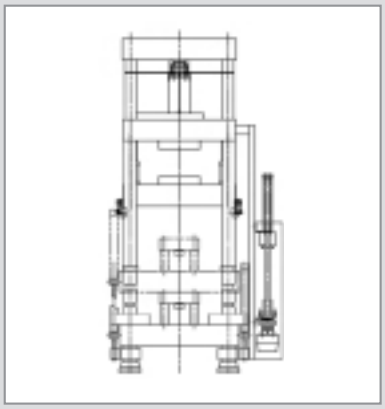
Secondary force standard machine at LBF, Frauenhofer Institut für Betriebsfestigkeit

Features

- Force ranges from 50 kN to 10 MN
- Continuous loading possible
- Measuring uncertainty 2×10^{-4}, traceable to leading NMI's

Load range	Dimensions H x W x D (mm)	Test space tension H x W (mm)	Test space Compr. H x W (mm)	Weight (kg)
50 kN	2200x720x400	50-600x350	10-600x320	600
100 kN	2500x800x500	200-600x460	10-600x400	1100
200 kN	2500x800x500	200-800x460	10-600x400	1200
500 kN	3150x910x670	270-950x520	60-740x520	3400
1000 kN	3150x910x670	270-950x520	60-740x520	3500
2000 kN	4000x1220x800	400-1200x600	100-800x600	8800
5000 kN	5200x1515x1200	800-1800x800	200-1200x680	15000
10000 kN	6500x1800x1400	800-1800x1000	200-1200x800	21000

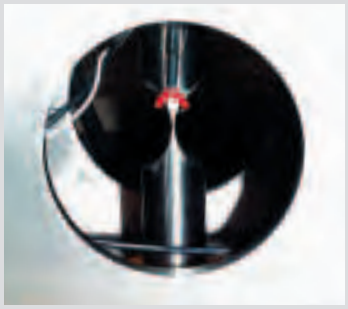
Design examples



Torque calibration machines

Definition of torque directly traceable to the base units of mass and length by weight action of calibrated mass disks onto a frictionless supported lever.

A welded steel base frame designed for floor mounting carries the lever for torque generation, using strain controlled elastic hinges arranged at right angles at both sides of the lever. Binary mass stacks are coupled at both lever ends via strain-controlled joints. During torque changeovers, a substitute loading device is active to maintain stable torque.



Mass coupling

Lever support

Primary torque standard machine, EAM Switzerland

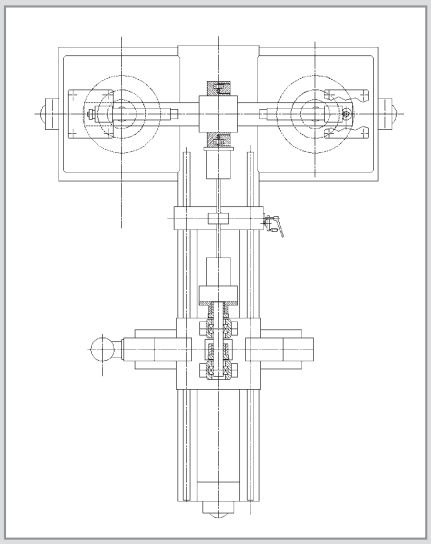
Features

- Nominal torque ranges from 20 Nm to 5000 Nm
- Measuring uncertainty over a range from 0.1 % - 100 %: < 50 ppm
- Large measuring range up to 1000 : 1, cw and ccw direction
- Lever support in elastic hinges arranged at 90°
- Continuous loading possible
- Clockwise and counter-clockwise operation in a single test space
- Measuring uncertainty 5×10^{-5}, traceable to leading NMI's

Nominal torque range	Dimensions H x W x D (mm)	Test space (mm) Length/Ø	Weight (kg)
20 Nm	1600 x 1700 x 2300	700/400	1050
50 Nm	1600 x 1700 x 2300	700/400	1250
100 Nm	1600 x 1700 x 2300	700/400	1500
200 Nm	1700 x 1900 x 2600	900/500	1500
500 Nm	1700 x 1900 x 2600	900/500	1600
1000 Nm	1700 x 1900 x 2600	900/500	1800
2000 Nm	1800 x 3000 x 3200	1200/600	2500
5000 Nm	2000 x 3600 x 4000	1200/600	3800

Design examples

Primary torque standard with direct mass action ...



Top view

GTM torque standard machines – a modular system

Primary torque standard machine
- with one or two mass stacks and double-sided lever for torque generation
- highly flexible (fine torque spacing) by binary mass stacks
- fully automatic operation, with measuring uncertainties < 50 ppm
- measuring uncertainty < 50 ppm

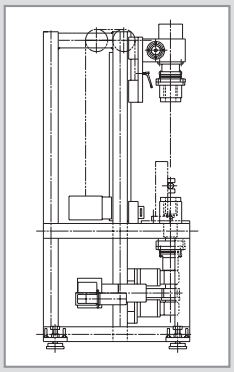
Secondary torque standard machine
- jockey weights on a double sided lever for torque generation
- short calibration times with continuous torque loading
- through-zero testing without gaps and delays
- measuring uncertainty 100 ppm

Torque calibration machine
- calibration against reference transducers of the highest precision
- quickest possible calibration with continuous torque loading
- measuring uncertainty 400 ppm
- vertical axis design possible

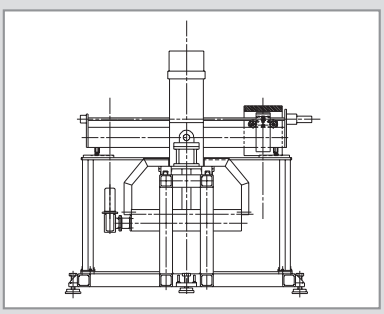
All GTM torque calibration machines can be upgraded on a modular basis if the demands on measuring uncertainty and ease of operation grow. Thus you remain flexible and can achieve low uncertainties from the beginning on a small budget.

Design examples

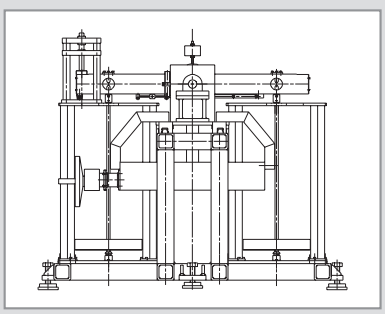
Torque calibration machine with ...



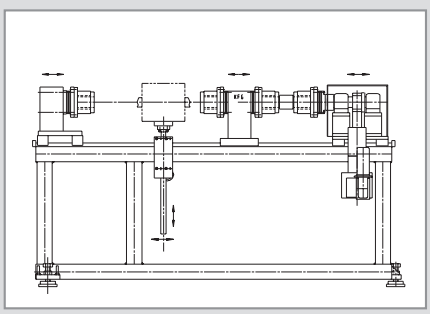
... vertical transducer axis



... jockey weight



... manual loading



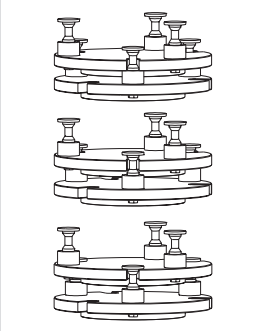
... reference transducer

Technical advance

Load application

Quick and exact increase and decrease of forces is essential for economic and reliable operation of a calibration machine. The patented coupling system developed by GTM is unique in this respect:

- exact centring of the masses during loading and unloading
- no stick effects due to statically determined location guides
- quick coupling of the masses by guided movements
- metrologic monitoring of force shunts in the mass stack



Strain controlled elastic hinges

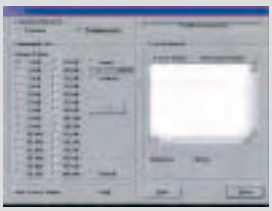
Are used instead of knife edge lever bearings and eliminate disadvantages like increasing transmission error caused by wear and correspondingly intensive maintenance. In principle, the strain controlled hinges are similar to a bending spring which is mounted between the lever and the machine frame. Strain gauges on both its sides measure bending stresses during the load increases and decreases, which are proportional to the bending moment. Modern servoelectric drives use this input and together with a closed-loop controller adjust the loading crosshead such that the resulting moment is zero. This "controlled" amplification for the first time fulfils a long-demanded requirement, i. e. to monitor the complete amplification mechanism in metrology terms, thereby keeping the measuring uncertainty over long periods in guaranteed small limits.

Strain controlled elastic hinges at right angles

Are based on the principle of strain controlled elastic joints and enable the wear-free and frictionless bearing of the lever in GTM torque calibration machines.

Control and data processing

With the GTM Force and Torque Manager GTM has created machine-specific control software which due to being PC-based enables simple and easy operation of the calibration machines. Microsoft Windows was chosen as operating software. The whole operation of the machine is activated by mouse and keyboard. Simple clicking on the corresponding buttons and options enters all commands for a measuring series. User data, such as transducer capacity, type etc. are entered via the keyboard.



The flexibility of testing is further enhanced by a module which allows the pre-programming of arbitrary test routines. This enables product-specific tests and quick reaction to changing test standards or customer demand.
The evaluation of test results is displayed in tables and diagrams. Data exchange through a network or another software tool is possible.

Options

Temperature chambers

For testing of transducers at temperatures different to room temperature. The special chamber geometry achieves an even temperature distribution. No condensation on the sensors due to integrated drying device. Temperature ranges from - 20° C to + 40° C.

Magazines

For optimum utilisation of your calibration machine. Magazine capacities up to 40 transducers, linear and round designs available, high flexibility due to exchangeable spacer masks.

GTM – Calibration Service – Competent, Reliable, Flexible

Why calibrate?

Regular calibrations of your instruments help to assure the quality of your products and services, guarantee accurate measures to your customers and build up trust into your goods and services.

Increasing globalisation demands in particular to guarantee comparable measures across borders. Increasingly, the documented tractability of measuring instruments takes on a more and more important role. The trust into these instruments is assured by their regular verification at an accredited calibration laboratory, stating the measurement uncertainty.

The DKD Laboratory

GTM is accredited by the “Deutscher Kalibrierdienst DKD” (equivalent to UKAS or A2LA) for the measuring quantity force. Regular audits by the Physikalisch Technische Bundesanstalt (PTB) Braunschweig ensure the high quality of our measuring systems and methods. GTM is exceptionally flexible in the turnaround of calibrations:

- 24 hour service
- Calibration of proprietary makes
- Using customer-specific amplifiers and software

Importance of Tractability

- Production safety
- Customer trust
- Comparable products on the international market

Torque Calibration

With the extension of the GTM calibration lab by the measuring quantity torque, we can offer to calibrate your …

- Torque transducer
- Torque transfer standards
- Torque-transfer wrenches

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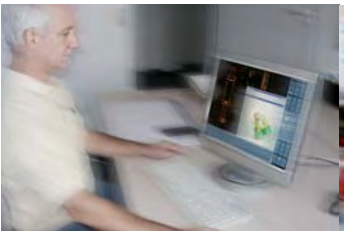
01/2006

DEFINING PRECISION

Outlook

As the pioneers in the field of measurement of forces and moments, we will also in future continue to make the most advanced technology in a timely and smooth manner available to our customers all over the world.




GTM
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