

Operating manual

Torque Transducer Series M

2 N·m - 10.000 N·m





GTM Testing and Metrology GmbH

Philipp-Reis-Straße 4-6

64404 Bickenbach

Deutschland

Tel: +49 6257 9720-0

Fax: +49 6257 9720-77

contact@gtm-gmbh.com

www.gtm-gmbh.com

© GTM Testing and Metrology GmbH

All rights reserved. This document may not be photocopied, duplicated in any other form or translated into another language either in whole or in part without the prior written consent of GTM.

The content of these manual is intended solely for information purposes and can be changed at any time without prior notification.

With regard to the warranty and liability, we refer expressly to our 'General commercial terms and conditions' (www.gtm-gmbh.com) and the instructions and regulations contained in these installation and operating instructions.

Table of contents

1. Product description	4
1.1 Designated use.....	4
1.2 Exempted use.....	4
2. Safety instructions.....	5
3. Storage and transport instructions	9
4. Cable connection	10
4.1 Cable connection pluggable	10
4.2 Cable connection permanent	11
5. Double Bridge from 20 N·m.....	12
6. Temperature Measurement.....	12
7. Application instructions	13
7.1 Assembly instruction	13
8. Mating dimensions	15
8.1 Construction size 2 - 10 N·m	15
8.2 Construction size 20 N·m - 10 kN·m	16
9. Technical Data.....	17
9.1 Construction size 2 - 500 N·m	17
9.2 Construction size 1.000 - 10.000 N·m	19
10. Technical support	21
11. Declaration of incorporation.....	22
12. Notes	23

1. Product description

1.1 Designated use

The torque transducer of the M series is suitable for measuring static and non-rotating dynamic pure torques.

Any other use is not intended and is therefore prohibited. No claims may be made for damage resulting from inappropriate use.

The limit values for the total load and all other limits must be complied with.

1.2 Exempted use

The torque transducer is not suitable for rotating operation. The torque transducer is not a safety component. You must not use it in a complete system in which its failure may lead to the life and well being of people being endangered.

The transducer is not suitable or approved for use in potentially explosive areas.

2. Safety instructions

Markings used

The following designations and symbols are used in the operating manual to identify hazards:



DANGER!

Denotes a possibly hazardous situation that can lead to physical injuries or death.



DANGER!

Denotes a hazardous situation due to electrical voltage that can lead to physical injuries or death.



NOTE!

Denotes usage tips, general information and other useful notes.



DANGER OF BURSTING!

Denotes a potentially hazardous situation that can cause physical injuries or death if ignored.

▶ Denotes handling instructions

● Denotes lists

Additional regulations

This operating manual contains the most important notes for safe operation of the transducer. Consideration must also be given to the legal and safety regulations applicable at the operating location, the accident prevention regulations applicable at the operating location and the technical data in connection with the safety regulations listed here.

Residual hazards

The transducer of series M is state-of-the-art technology and safe to operate. Residual hazards can arise during operation if the devices are used and operated improperly by unqualified personnel.

The scope of delivery for the transducer only covers a partial area of mechatronic metrology. The safety-related criteria for using the transducer within a complete system must be taken into account by the system design engineer, the equipment manufacturer and/or the operator so that residual hazards are minimised. Reference must be made to the remaining residual hazards in the complete system.



DANGER!

In the case of a complete system, the safety-related criteria must be taken into account so that any failure of the transducer does not present a hazard to anyone.

Transducer condition and modifications

You may only operate the transducer in a perfect condition while complying with the instructions given in the operating manual.

The transducer must not be modified either in its design or safety-related features, without our express, written permission.

Overloading

All transducers of this series have already been subjected to an overload test at the manufacturer's. No additional overloads are permissible; always comply with the nominal loads of the transducer.



DANGER OF BURSTING!

Do not overload the transducer!

The attached parts must also be designed to bear the maximum load. Only use attached parts in an appropriate condition.

In case of new, untested designs, you must provide additional protective measures against bursting parts.

Personnel qualifications

The transducer and additional components must only be operated and assembled by qualified personnel. Qualified personnel are those persons who are acquainted with the assembly, commissioning and operation of the transducer and who have the appropriate qualifications for their job.



NOTE

GTM offers training courses to qualify personnel.

Ambient conditions

The transducer is intended for use in enclosed rooms while complying with the ambient conditions detailed in the technical specifications.

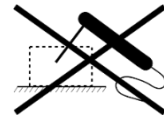
The transducer is not permitted for use in potentially explosive areas.



Protect the transducer against the influences of weather, such as rain and snow. Take appropriate measures on-site against power surges, e.g. from lightning strike.



No welding circuits may be introduced through the body of the transducer. If in doubt, you must dismantle the transducer.



DANGER!

The transducer is not suitable for:

- Potentially explosive areas
- Power surges
- Welding circuits

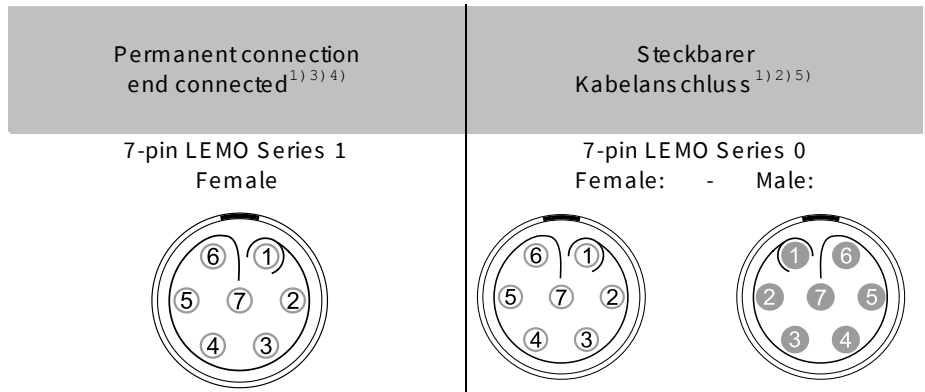
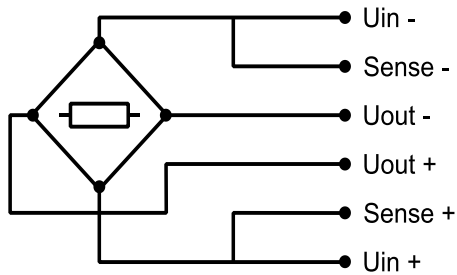
3. Storage and transport instructions

The transducer series M is a precision measuring device and must be handled with appropriate caution.

- ▶ If the transducer is dropped or jolted it can become damaged prohibiting any further use.
- ▶ During storage, secure rotationally symmetrical transducers and attachment parts from rolling away.
- ▶ Only use the original transport packaging and other appropriate cut-to-size packaging for storage and transport.

4. Cable connection

4.1 Cable connection| pluggable



Connection		Pin
Supply voltage (+)	U _{in+}	3
Supply voltage (-)	U _{in-}	2
Measurementsignal (+)	U _{out+}	1
Measurementsignal (-)	U _{out-}	4
Sense (+)	Sense ⁺	5
Sense (-)	Sense ⁻	6
Shielding		Housing

- 1) View too w weldingside
- 3) Up to size 10 N·m.
- 5) Available from size 20 N·m.

- 2) Female LEMO S.A. Typ: EGG.1B.307.CLL; Male: FGG.1B.307.CLA.D72
- 4) Cable lenght 0,5 m.

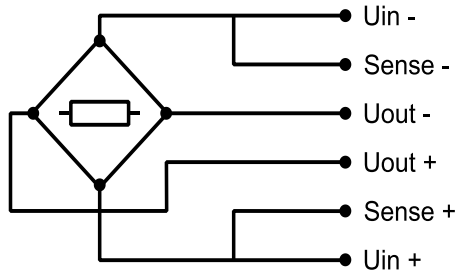


▶ permanent cable connection,
end connected (up to size 10 N·m)



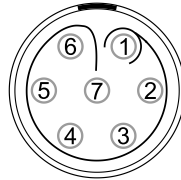
▶ pluggable cable connection

4.2 Cable connection| permanent



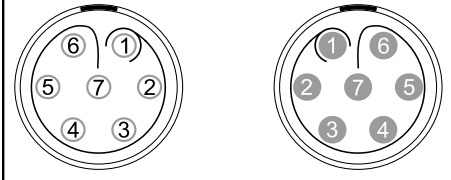
Permanent connection
end connected^{1) 3) 4)}

7-pin LEMO Series 1
Female



Steckbarer
Kabelanschluss^{1) 2) 5)}

7-pin LEMO Series 0
Female: - Male:



Connection		Pin
Supply voltage (+)	U_{in+}	3
Supply voltage (-)	U_{in-}	2
Measurement signal (+)	U_{out+}	1
Measurement signal (-)	U_{out-}	4
Sense (+)	Sense+	5
Sense (-)	Sense-	6
Shielding		Housing

1) View too weldingside

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

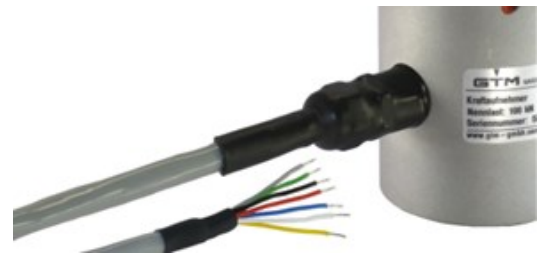
3) Up to size 10 N·m.

4) Cable length 0,5 m.

5) Available from size 20 N·m.



▶ permanent cable connection,
end not connected (Ø 2.9 mm)



▶ pluggable cable connection (Ø 6.5 mm)

5. Double Bridge | from 20 N·m

- ▶ For transducers with a double measuring bridge the second signal is measured by means of an additional plug. The respective electrical connections can be found in the chapter Technical Data.

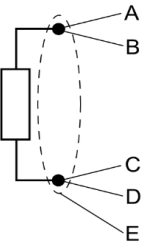
6. Temperature measurement

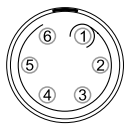
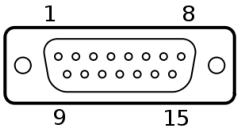
- ▶ For Type PT100 transducers with an integrated temperature sensor, observe the basic values of the resistors of the platinum measuring coils with a nominal resistance of 100 Ohms at 0°C.

These values and the permissible deviations correspond to DIN EN 60751.

Temperature range: see nominal temperature range in Technical Data

Connection type: 4 Conductor technology



		Permanent connection end not connected	Permanent connection ¹⁾	
		Black cable 4-pin Ø 2,2 mm vibration-proof, 4 x 0,04 mm ² Temperature range: -50 °C to +105 °C	6-pin LEMO Series 0 female: - male:	D-Sub 15-pin
Connection		Color		
U (+)	A	white	1	5
Sense (+)	B	red	3	12
U (-)	C	black	4	6
Sense (-)	D	green	6	13
Shielding	E	housing		

1) View to weldingside

7. Application instructions

7.1 Assembly instruction

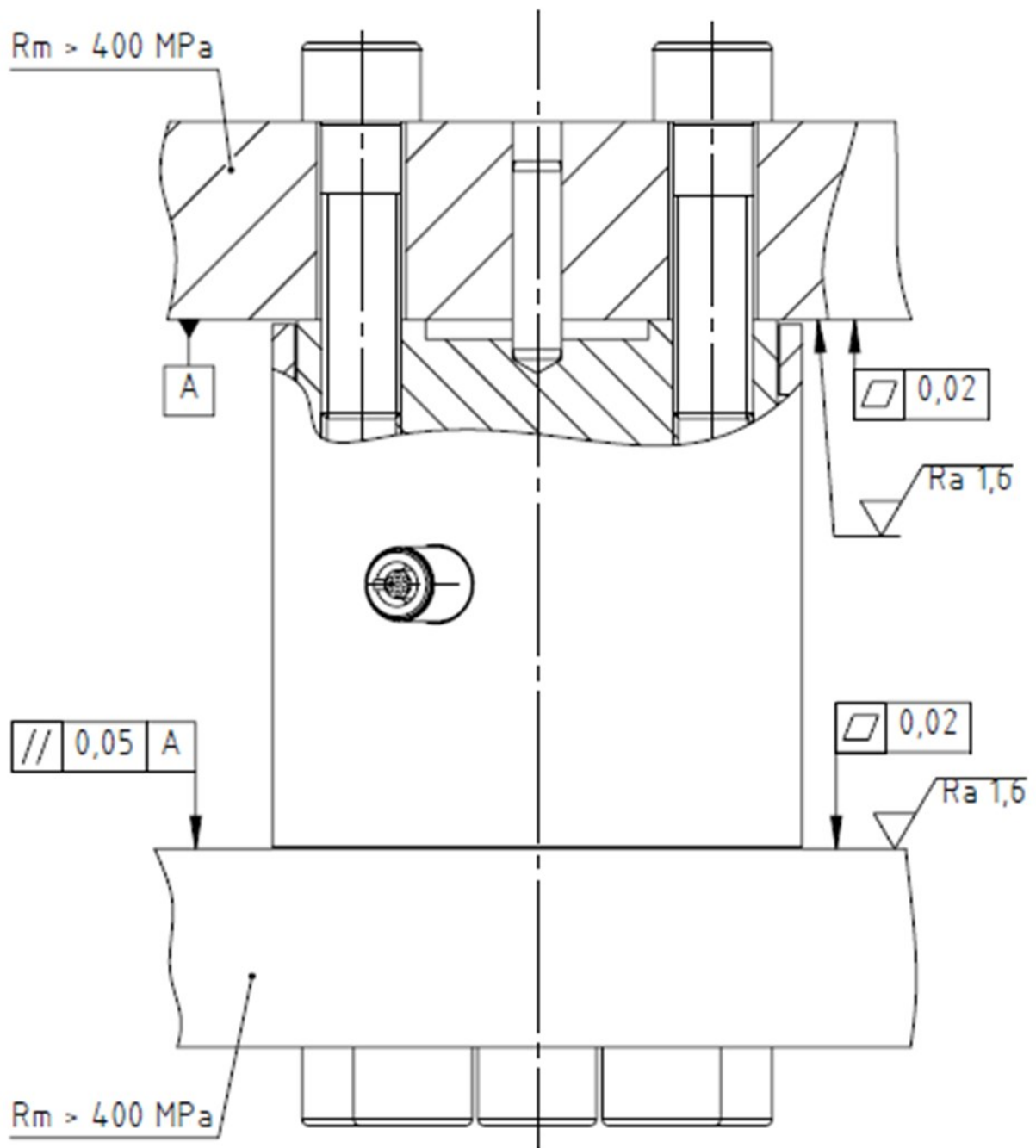
- ▶ Tighten the screws evenly and crosswise.
- ▶ Avoid mechanical strain on the cable and the connector.
- ▶ Avoid a deformation of the assembly surfaces. This could affect the measurement.
- ▶ Pay attention to the cleanliness of the mounting surfaces and connections. They should be cleaned from dust and dirt before mounting and measuring, otherwise the measuring would be influenced.

Nominal force	Screw size	Screw quality	Fastening torque	Surface pressure ¹⁾
Nm	-	-	N·m	N/mm ²
2 ²⁾ ; 5; 10	M4	10.9	4.1	90
20; 50; 100	M6	10.9	14	160
200; 500	M10	10.9	68	340
1000; 1500; 2000	M16	10.9	280	160
4000; 6000	M20	10.9	560	140
10000	M24	10.9	960	145

1) Surface pressure on the contact area as a result of the max. Fastening torque

2) The fastening torque should not be initiated through the force transducer

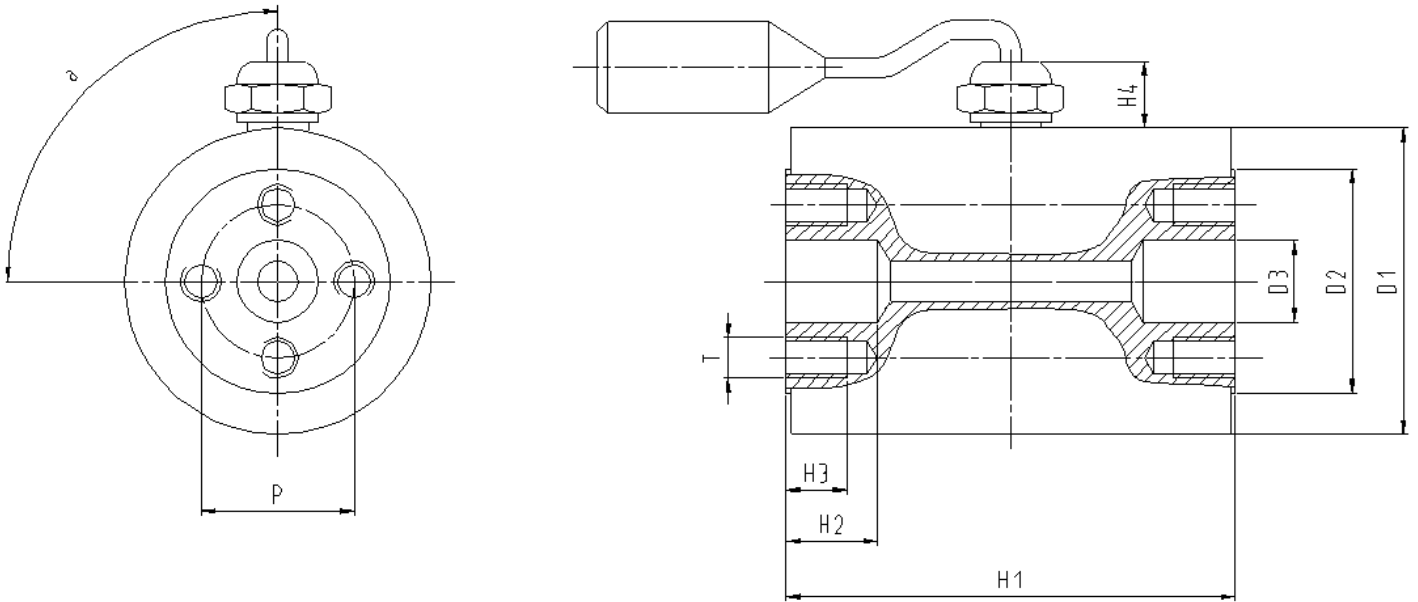
- ▶ **Fastening torque for the screws**



► Assembly surfaces

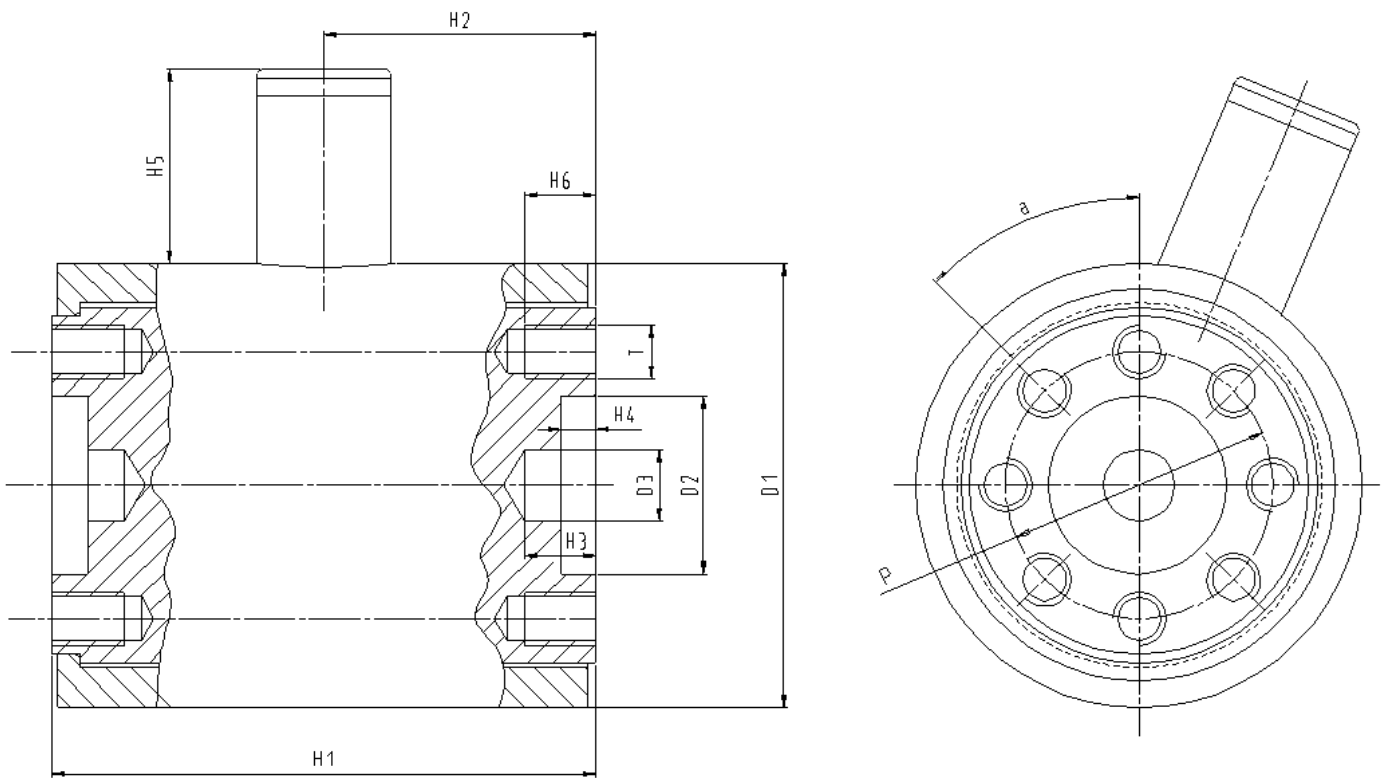
8. Mating dimensions

8.1 Construction size | 2 - 10 N·m



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

8.2 Construction size | 20 N·m - 10 kN·m



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

9. Technical Data

9.1 Construction size | 2 - 500 N·m

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

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

1) The individual nominal value is specified on the nameplate.

9.2 Construction size | 1.000 - 10.000 N·m

Rated Torque		M_{nom}	N·m	1000	1500	2000	3000	4000	5000	6000	10000
Accuracy class				0.05							
Torque measurement range			%	1 - 100							
Linearity error		d_{lin}	%	0.05							
Interpolation error		f_c	%	0.4							
Hysteresis		h	%	0.05							
Reversibility error		v	%	0.2							
Repeatability (f.s.)			%	0.003							
Creep			%	0.025							
Temperature effect on characteristic value per 10 K		TK_C	%/10 K	0.04							
Temperature effect on zero signal per 10 K		TK_0	%/10 K	0.025							
Metrological Data	Bending moment effect		%/N·m	$2 \cdot 10^{-5}$	$1 \cdot 10^{-5}$		$1 \cdot 10^{-5}$	$5 \cdot 10^{-6}$	$4 \cdot 10^{-6}$	$3 \cdot 10^{-6}$	$2 \cdot 10^{-6}$
	Lateral force effect		%/kN	0.01	0.009	0.007	0.006	0.005	0.004	0.003	0.002
	Axial force effect		%/kN	0.01	0.006	0.005	0.004	0.003	0.003	0.002	
	Characteristic value difference, anticlockwise/clockwise	d_{RL}	%	0.2							
Rated characteristic value		C_{nom}	mV/V	2							
Characteristic value tolerance		d_c	%	0.2							
Zero signal deviation		$d_{s,0}$	%	0.5							
Input resistance		R_e	Ω	1100 - 1500							
Output resistance		R_a	Ω	800 - 1200							
Insulation resistance		R_{is}	Ω	$> 10^9$							
Operating range of excitation voltage		$B_{U,G}$	V	5 - 15							
Protection (DIN EN 60529)				IP 54							
Electrical Data											

Mechanical Data	Rated Torque	M_{nom}	N·m	1000	1500	2000	3000	4000	5000	6000	10000	
	Rated torsion angle	j_{nom}	rad	0.006	0.0055	0.005	0.004				0.006	
	Torsional rigidity	c_T	N·m/rad	$1.7 \cdot 10^5$	$2.7 \cdot 10^5$	$4 \cdot 10^5$	$7.5 \cdot 10^5$	$1 \cdot 10^6$	$1.25 \cdot 10^6$	$1.5 \cdot 10^6$	$1.8 \cdot 10^6$	
	Mass	m	kg	4.8			7.6	7.7	7.8	7.9	28	
	Fundamental resonant frequency	f_G	kHz	1.5	1.9	2.3	1.5	1.7	1.9	2.2	1.6	
	Permissible oscillation stress		%	80								
Limits	Torque limit		%	150								
	Breaking torque		%	300								
	Lateral force limit		kN	180	200	300	400	500	650	800	1000	
	Bending moment limit	M_{bzul}	%	100								
	Axial force limit	F_{azul}	kN	250	300	400	600	700	850	1000	1500	
	Rated temperature range	$B_{T,nom}$	°C	10 - 60								
	Operating temperature range	$B_{T,G}$	°C	-40 - +120								

*) Data on request

10. Technical support

If problems arise while working with the product the following GTM services can be used:

E-mail support

contact@gtm-gmbh.com

Worldwide contact

GTM Testing and Metrology GmbH

Philipp-Reis-Straße 4-6

64404 Bickenbach

Tel. +49 6257 9720-0

Fax +49 6257 9720-77

www.gtm-gmbh.com

Local contact in Czech Republic

GTM Praha s.r.o.

Prosecká 811/76 a

19000 Praha 9

Czech Republic

Tel. +420 286 891 392

info@gtm.cz

www.gtm.cz

11. Declaration of incorporation

In accordance with EC Machinery Directive 2006/42/EC from May 17, 2006,
Appendix II B

We,

**GTM Testing and Metrology GmbH
Philipp-Reis-Straße 4-6
64404 Bickenbach
Deutschland**

hereby declare that the product

Force Transfer Standard Series M

complies with the following basic requirement:

- ▶ 2006/42/EG, Appendix II B EC Machinery Directive
- ▶ 2004/108/EC EMC Directive

The special technical documents were created in accordance with Appendix VII, Part B of the EC Machinery Directive 2006/42/EC. Upon reasoned request we shall undertake to submit them to the market supervision authority in electronic form within an appropriate period.

The product delivered by us may only be put into operation if it has been determined that the machine into which the product is to be incorporated likewise complies with the provisions of the Machinery Directive.



Daniel Schwind, Technical Manager

Bickenbach, 30.06.2022

12. Notes



#precision wins

GTM Testing and Metrology GmbH

Tel: +49 6257 9720-0

Fax: +49 6257 9720-77

contact@gtm-gmbh.com

www.gtm-gmbh.com

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

Illustrations may differ from originals.

