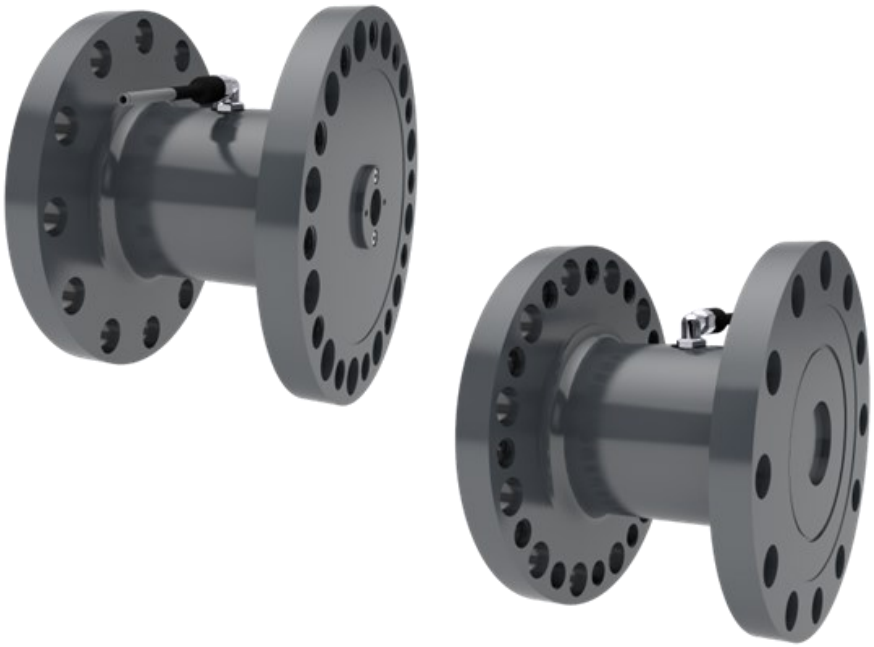
GTM
DEFINING PRECISION

Operating manual

Torque Transducer
Series MF

100 N · m - 150.000 N · m



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1. Product description

1.1 Designated use

The torque transducer of the MF series is 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 MF 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.

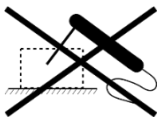
Ambient conditions

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

The tranducer 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.



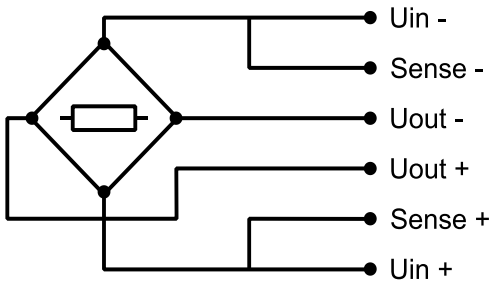
DANGER!
The transducer is not suitable for:
- Potentially explosive areas
- Power surges
- Welding circuits

3. Storage and transport instructions

The transducer series MF 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

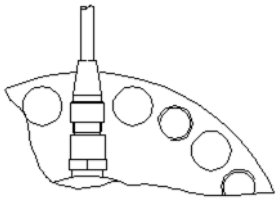


Permanent connection end not connected

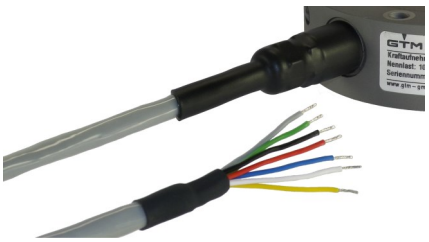
Grey cable
Ø 6,5 mm
3 x 2 x 0,25 mm²
Temperature range: -35 °C to +90 °C

Connection		Color
Supply voltage (+)	U_{in+}	blue
Supply voltage (-)	U_{in-}	black
Measurement signal (+)	U_{out+}	white
Measurement signal (-)	U_{out-}	red
Sense (+)	Sense+	green
Sense (-)	Sense-	grey
Shielding		yellow

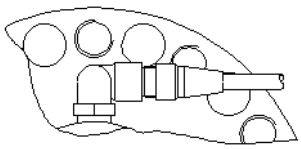
1) View too weldingside
2) Female LEMO S.A. Typ: EGG.1B.307.CLL; Male: FGG.1B.307.CLA.D72



cable connection straight



permanent connection; end not connected



cable connection 90° angled

5. Double Bridge

▶ 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.

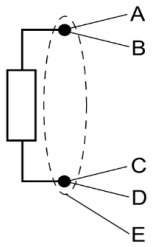
6. Temperature measurement

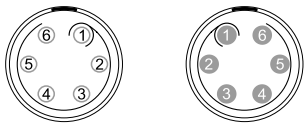
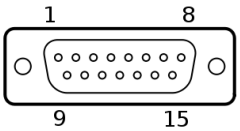
▶ For Type PT100 transducers with an integrated temperature sensor, observe the basic values of the resistors of the platinum measuring coils with a nominal resistance of 100 Ohms at 0°C.

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 mm² 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

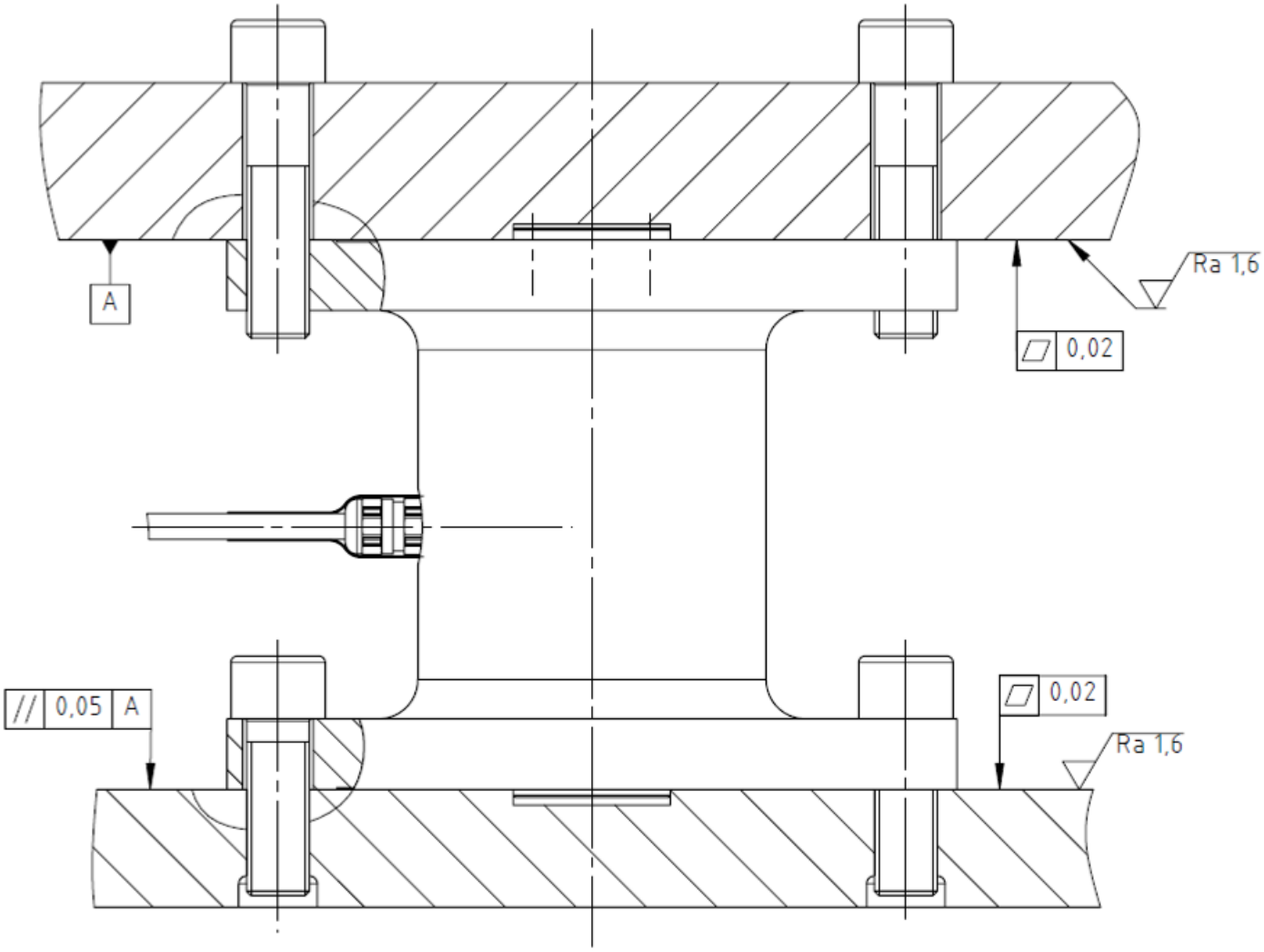
7.1 Assembly instruction

- The measuring side is the side where the flange does not have screw holes.
- Optionally the screw holes or the through-holes can be used for fixing.
- 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.

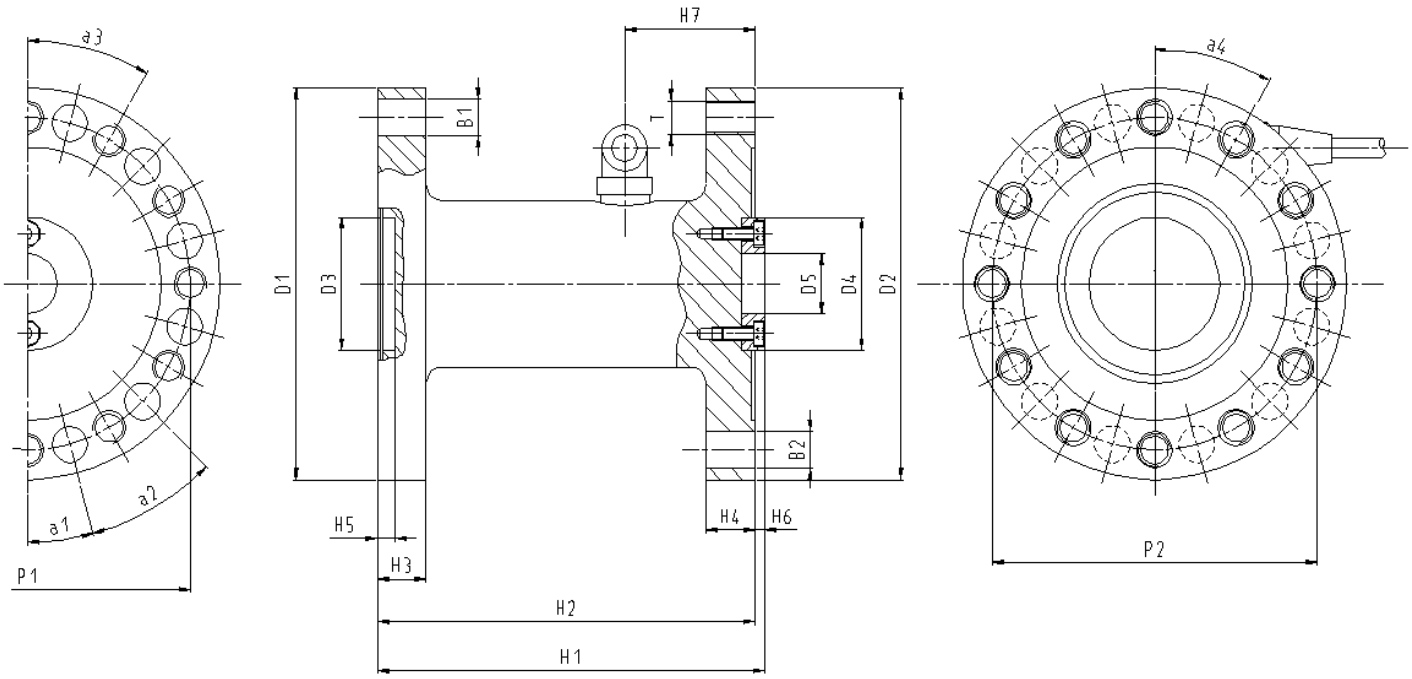
Nominal force	Screw size	Screw quality	Fastening torque	entire Preload-Force	Surface pressure [1)]
Nm	-	-	N·m	kN	N/mm²
100	M10	10.9	68	506	142
200	M10	10.9	68	506	142
500	M10	10.9	68	506	142
1000	M10	10.9	68	506	142
2000	M12	10.9	117	738	146
4000	M16	10.9	280	1388	165
5000	M16	10.9	280	1388	165
8000	M20	10.9	560	2172	159
10000	M20	10.9	560	2172	159
16000	M20	10.9	560	2896	169
32000	M24	10.9	960	3120	62
50000	M30	10.9	2010	5760	62
64000	M30	10.9	2010	5760	60
10000	M36	10.9	3490	12672	124
150000	M36	10.9	3490	12672	124

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

- **Fastening torque for the mounting screws**


A
Ra 1,6
0,02
// 0,05 A
0,02
Ra 1,6

8. Mating dimensions



Rated Torque	M_{nom}	N·m	100 200	500 1000	2000	4000 5000	8000 10000	16000 20000	25000 32000	50000 64000	100000 150000
Bore	$ØB_1$	mm	11		14	18	22		26	33	39
Bore	$ØB_2$	mm	11		14	18	22		26	33	39
Diameter	$ØD_1$	mm	118		146	186	235	286	360	460	600
Diameter	$ØD_2$	mm	118		146	186	235	286	360	460	600
Diameter	$ØD_3$	mm	40_{H7}				70_{H7}				
Diameter	$ØD_4$	mm	40_{H6}				70_{H6}				
Diameter	$ØD_5$	mm	18								
Pitch circle diameter	$ØP_1$	mm	$100_{\pm 0.1}$		$125_{\pm 0.1}$	$160_{\pm 0.1}$	$200_{\pm 0.1}$	$250_{\pm 0.1}$	$315_{\pm 0.1}$	$400_{\pm 0.1}$	$510_{\pm 0.2}$
Pitch circle diameter	$ØP_2$	mm	$100_{\pm 0.1}$		$125_{\pm 0.1}$	$160_{\pm 0.1}$	$200_{\pm 0.1}$	$250_{\pm 0.1}$	$315_{\pm 0.1}$	$400_{\pm 0.1}$	$510_{\pm 0.2}$
Thread	T		M10		M12	M16	M20		M24	M30	---
Height	H_1	mm	119		129	143	173	203	243	290	390
Height	H_2	mm	116		126	140	170	200	240	293	
Height	H_3	mm	15		14	18					36
Height	H_4	mm	15		14	18					36
Height	H_5	mm	5.5			4.5	7.5				
Height	H_6	mm	3								
Height	H_7	mm	40		61	73	58	74	108	98	150
Angle	α_1		15°				11.25°				---
Angle	α_2		30°				22.5°				---
Angle	α_3		30°				22.5°				15°
Angle	α_4		30°				22.5°				0°

9. Technical Data

9.1 Construction size | 100 - 5000 N·m

	Rated Torque	M_{nom}	N·m	100 200	500	1000	2000	4000	5000
Metrological Data	Accuracy class			0.05					
	Torque measurement range		%	1 - 100					
	Linearity error	d_{lin}	%	0.05					
	Interpolation error	f_c	%	0.5					
	Hysteresis	h	%	0.05					
	Reversibility error	v	%	0.2					
	Repeatability (f.s.)		%	0.005					
	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					
	Bending moment effect		%/N·m	$2 \cdot 10^{-4}$	$4 \cdot 10^{-5}$	$2 \cdot 10^{-5}$	$1 \cdot 10^{-5}$	$5 \cdot 10^{-6}$	$4 \cdot 10^{-6}$
	Lateral force effect		%/kN	$5 \cdot 10^{-2}$	$2 \cdot 10^{-2}$	$1 \cdot 10^{-2}$	$7 \cdot 10^{-3}$	$5 \cdot 10^{-3}$	$4 \cdot 10^{-3}$
Electrical Data	Rated characteristic value	C_{nom}	mV/V	1.6					
	Characteristic value tolerance	d_c	%	0.2					
	Zero signal deviation	$d_{S,0}$	%	0.5					
	Input resistance	R_e	Ω	560 - 650					
	Output resistance	R_a	Ω	400 - 500					
	Insulation resistance	R_{is}	Ω	$>10^9$					
	Operating range of excitation voltage	$B_{U,G}$	V	5 - 12					
	Protection (DIN EN 60529)			IP 64					

Mechanical Data	Rated Torque	M_{nom}	N·m	100 200	500	1000	2000	4000	5000
	Rated torsion angle	j_{nom}	rad	0.0047	0.0046	0.0052	0.0028	0.0022	
	Torsional rigidity	c_T	N·m/rad	200000	110000	200000	720000	1800000	
	Mass	m	kg	3			5	10	
	Proportionate moving mass	m_{mess}	kg	1			1.7	3	
	Permissible oscillation stress		%	100					
Limits	Torque limit		%	150					
	Breaking torque		%	>300					
	Rated temperature range	$B_{T,\,nom}$	°C	10 - 60					
	Operating temperature range	$B_{T,\,G}$	°C	-40 - 120					

9.2 Construction size | 8.000 - 150.000 N·m

	Rated Torque	M_{nom}	N·m	8000	10000	16000 20000	25000 32000	50000	64000	100000 150000
Metrological Data	Accuracy class			0.05						
	Torque measurement range		%	1 - 100						
	Linearity error	d_{lin}	%	0.05						
	Interpolation error	f_c	%	0.5						
	Hysteresis	h	%	0.05						
	Reversibility error	v	%	0.2						
	Repeatability (f.s.)		%	0.05						
	Creep		%	0.25						
	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						
	Bending moment effect		%/N·m	$2.5 \cdot 10^{-6}$	$2 \cdot 10^{-6}$	$1.25 \cdot 10^{-6}$	$6.25 \cdot 10^{-7}$	$4 \cdot 10^{-7}$	$3.125 \cdot 10^{-7}$	
	Lateral force effect		%/kN	$3 \cdot 10^{-3}$	$2.5 \cdot 10^{-3}$	$2 \cdot 10^{-3}$	$1 \cdot 10^{-3}$	$8 \cdot 10^{-4}$	$7 \cdot 10^{-4}$	
Electrical Data	Rated characteristic value	C_{nom}	mV/V	1.6						
	Characteristic value tolerance	d_c	%	0.2						
	Zero signal deviation	$d_{S,0}$	%	0.5						
	Input resistance	R_e	Ω	560 - 650						
	Output resistance	R_a	Ω	400 - 500						
	Insulation resistance	R_{is}	Ω	$>10^9$						
	Operating range of excitation voltage	$B_{U,G}$	V	5 - 12						
	Protection (DIN EN 60529)			IP 64						

Mechanical Data	Rated Torque	M_{nom}	N·m	8000	10000	16000 20000	25000 32000	50000	64000	100000 150000
	Rated torsion angle	j_{nom}	rad	0.0025		0.0036		0.0045		0.0029
	Torsional rigidity	c_T	N·m/rad	3,1E+06		4,5E+06	8,8E+06	1,4E+07		3,4E+07
	Mass	m	kg	15		25	40	65		148 213
	Proportionate moving mass	m_{mess}	kg	4		6	10	16		40 58
	Permissible oscillation stress		%	100						
Limits	Torque limit		%	150						
	Breaking torque		%	>300						
	Rated temperature range	$B_{T,\,nom}$	°C	10 - 60						
	Operating temperature range	$B_{T,\,G}$	°C	-40 - 120						

1) 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
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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 MF

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

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