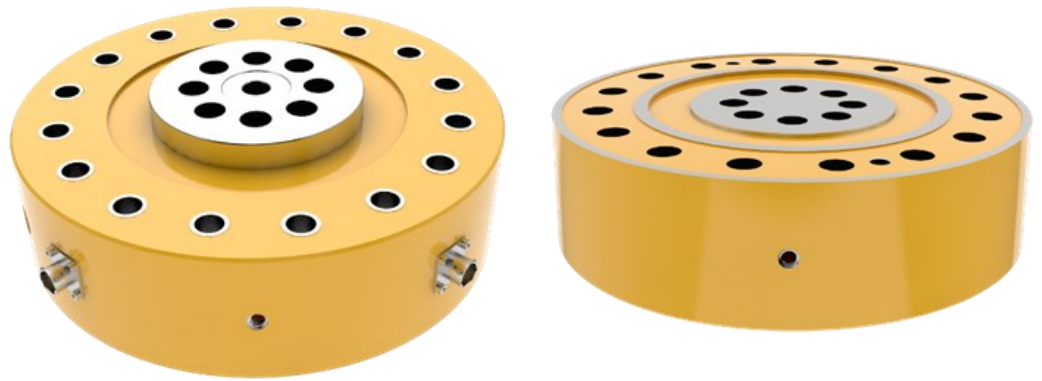


Operating manual

Force Transducer Series DR-Flange

Nominal Force
50 kN - 2500 kN





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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.

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1. Product description

1.1 Designated use

The force transducer of the DR-F series is to be used for measuring static and dynamic tensile forces and compressive forces.

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 force 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 DR-F 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



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.

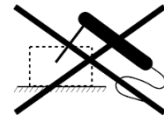
The transducer is not permitted for use in potentially explosive areas.



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:

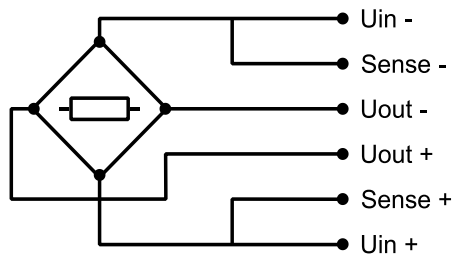
- Potentially explosive areas
- Power surges
- Welding circuits

3. Storage and transport instructions

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

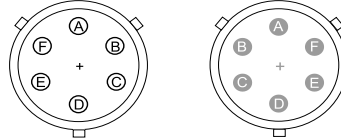
- ▶ If the transducer is dropped or jolted it can become damaged prohibiting any further use.
- ▶ During storage, secure rotationally symmetrical transducers and attachment parts from rolling away.
- ▶ Only use the original transport packaging and other appropriate cut-to-size packaging for storage and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

4. Cable connection | measuring bridge



Connection pluggable¹⁾²⁾

6-pin Amphenol cable connector: - appliance inlet:



Connection		Wire color	Pin
Supply voltage (+)	U _{in+}	blue	A
Supply voltage (-)	U _{in-}	black	D
Measurement signal (+)	U _{out+}	white	B
Measurement signal (-)	U _{out-}	red	C
Sense (+)	Sense+	green	F
Sense (-)	Sense-	grey	E
Shielding			Housing

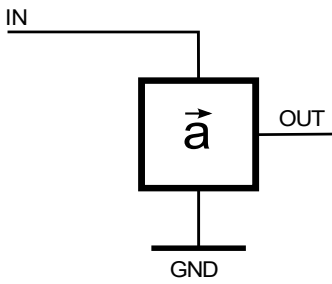
1) View too weldingside

2) Female Amphenol typ: MIL-C-26482 series 1 ; bayonet catch



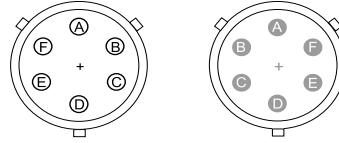
▶ pluggable cable connection

5. Cable connection | acceleration measuring



Connection pluggable¹⁾²⁾

6-pin Amphenol
cable connector: - appliance inlet:



Connection		wire color	Pin (Type 0)	Pin (Type I)
Supply voltage 5 V	IN	blue	A	
Output voltage	OUT	white	B	
Ground	GND	grey	E	
Supply voltage 5 V	IN	green		F
Output voltage	OUT	red		C
Ground	GND	black		D

1) View too weldingside

2) Female Amphenol typ: MIL-C-26482 series 1; bayonet catch



▶ pluggable cable connection

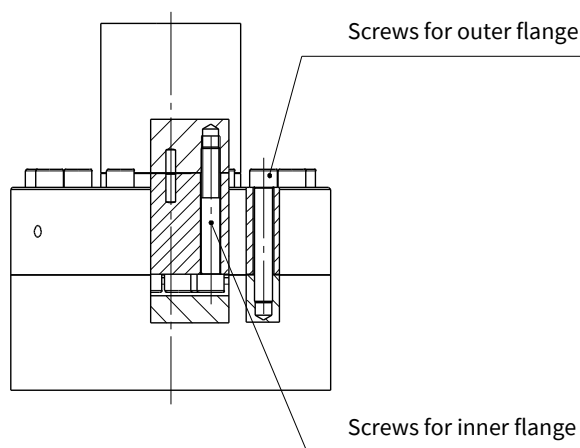
6. Double Bridge

- ▶ For the double measuring bridge (available as configurable variant), a second, metrologically equivalent signal is fed out via an additional plug. The technical data apply equally to both measuring circuits.

7. Application instructions

7.1 Assembly instruction

- ▶ Tighten the screws evenly and crosswise. For higher tightening torques, tighten the screws in stages.
- ▶ 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.
- ▶ We recommend a tightening-controlled tightening procedure for the mounting of the screws. The following table values apply to $\mu = 0.12$. Note that different clamping forces can result from different friction ratios. If the force transducers are to be mounted / disassembled several times, the screws must be replaced no later than the 20th time.



- ▶ Assembly instruction with base plate

Nominal force	Screw size	Screw quality	Tightening torque
kN	-	-	N·m
50	M10	10.9	71
125	M10	10.9	71
250	M16	10.9	302
500	M16	10.9	302
1000	M24	10.9	1017
2000	M30	10.9	2033
2500	M30	10.9	2033

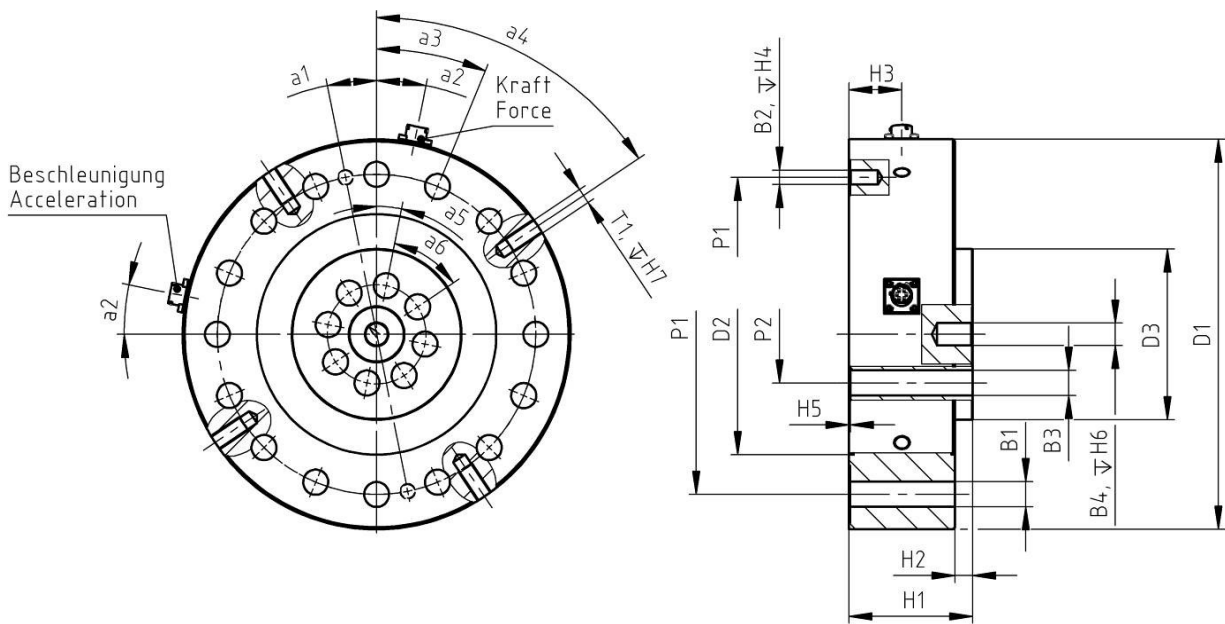
▶ **Fastening torque for the mounting screws; inner flange (stretch limits controlled tighten)**

Nominal force	Screw size	Screw quality	Tightening torque
kN	-	-	N·m
50	M10	10.9	71
125	M10	10.9	71
250	M12	10.9	123
500	M16	10.9	302
1000	M20	10.9	592
2000	M30	10.9	2033
2500	M27	10.9	1496

Please observe the measures for extending durability in accordance with VDI 2230 pages 1 and 2

▶ **Fastening torque for the mounting screws; outer flange (stretch limits controlled tighten)**

8. Mating dimensions



Nominal force compression/tension	$\pm F_{norm}$	kN	50	125	250	500	1000	1500	2000	2500
Bore	$\varnothing B_1$	mm	10.5	13	17.5	22	26	33	30	
Bore	$\varnothing B_2$	mm	10 _{H7}							
Bore	$\varnothing B_3$	mm	10.5	17	17.5	26		33		
Bore	$\varnothing B_4$	mm	10 _{H7}			16 _{H7}				
Diameter	$\varnothing D_1$	mm	153.9	203.2	279	304.8	393.7	480	520.7	
Diameter	$\varnothing D_2$	mm	108 _{H8}	138.9 _{H8}	172.1 _{H8}	195 _{H8}	254.4 _{H8}	310 _{H8}	340 _{H8}	
Diameter	$\varnothing D_3$	mm	61.2 _{h9}	95.5 _{h9}	122.2 _{h9}	144.3 _{h9}	196.9 _{h9}	232 _{h9}	267.9 _{h9}	
Pitch circle diameter	$\varnothing P_1$	mm	130.3 \pm 0.1	165.1 \pm 0.1	229 \pm 0.1	241.3 \pm 0.1	322.1 \pm 0.1	385 \pm 0.2	419.1 \pm 0.2	
Pitch circle diameter	$\varnothing P_2$	mm	45 \pm 0.1	71 \pm 0.1		105 \pm 0.1	150 \pm 0.1	180 \pm 0.2	215 \pm 0.2	
Thread	T_1		-				M12			
Height	H_1	mm	44.5-0.1	63.5-0.1	88.9-0.1	114.3-0.1	139.7-0.1	155-0.1	158.8-0.1	
Height	H_2	mm	3.1	6.3	12.7	6.3	12.7	6.3		
Height	H_3	mm	20.5	28.6	37.9	54	63.5	74.5		
Height	H_4	mm	17							
Height	H_5	mm	0.5			1				
Height	H_6	mm	10	20						
Height	H_7	mm	-				24			

Mating dimensions

Nominal force compression/tension	$\pm F_{\text{norm}}$	kN	50		125		250		500		1000		1500		2000		2500	
Angle	a_1		15°		11.25°		9°		7.5°		6.43°							
Angle	a_2		15°		11.25°		9°		7.5°		6.43°							
Angle	a_3		12x30°		16x22.5°		20x18°		24x15°		28x12.86°							
Angle	a_4				-		56.25°		63°		52.5°		57.8°					
Angle	a_5		15°		11.25°		9°		7.5°		6.43°							
Angle	a_6				8x45°				12x30°		14x25.71°							

9. Technical Data

Nominal force/compression/tension		$\pm F_{nom}$	kN	50	125	250	500	1000	1500	2000	2500
Metrological Data	Accuracy class			0.04			0.05	0.06		0.08	
	Linearity error	d_{lin}	%	0.04			0.05	0.06		0.08	
	Hysteresis	h	%	0.04			0.05	0.06		0.08	
	Repeatability (f.s.)		%	0.025							
	Zero error	f_0	%	0.01							
	Creep		%	0.025							
	Temperature effect on characteristic value per 10 K	TK_C	%/10 K	0.015							
	Temperature effect on zero signal per 10 K	TK_0	%/10 K	0.015							
	Eccentricity effect		%/mm	<0.01							
	Bending moment effect		%/N·m	<0.01							
Electrical Data	Rated characteristic value	C_{nom}	mV/V	2							
	Characteristic value tolerance	d_c	%	0.25							
	Zero signal deviation	$d_{S,0}$	%	1							
	Input resistance	R_e	Ω	375							
	Output resistance	R_a	Ω	280 - 360							
	Insulation resistance	R_{is}	Ω	>10 ⁹							
	Operating range of excitation voltage	$B_{U,G}$	V	0.5 - 12							
	Protection (DIN EN 60529)			67							

Mechanical Data	Nominal forcecompression/tension	$\pm F_{nom}$	kN	50	125	250	500	1000	1500	2000	2500	
	Rated Displacement	s_{nom}	mm	0.03	0.04	0.06	0.07	0.08	0.09	0.11	0.12	
	Spring rigidity	c_{ax}	kN/mm	1650	3125	4200	7150	12500	16650	18250	21000	
	Mass	m	kg	4.3	4.3	10.3	29.1	44.9	93	155.7	192.9	
	Proportionate moving mass	m_{mess}	kg	1.1	1.1	3	7.9	12.7	40	47.1	64.5	
	Fundamental resonant frequency	f_G	kHz	6.2	8.5	6	4.8	5	3.3	3.2	2.8	
	Permissible oscillation stress for the transducer ¹⁾		%	±100								
Limits	Force limit		%	230								
	Breaking force		%	400				300				
	Lateral force limit		%	100								
	Permissible eccentricity	e_G	mm	25			20					
	Bending moment limit	M_{bzul}	N·m	1.75	4.5	7.5	15	30	45	60	75	
	Rated temperature range	$B_{T,nom}$	°C	-10 - +45								
	Operating temperature range	$B_{T,G}$	°C	-30 - +85								

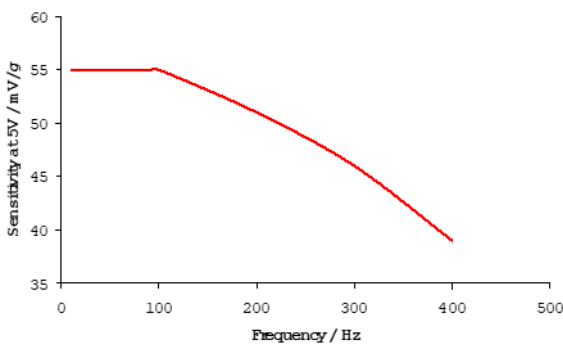
1) Recommendation: Please observe the measures of VDI 2230 Pages 1 and 2 regarding to durability of flange connection.

10. Acceleration Measurement (MEMS)

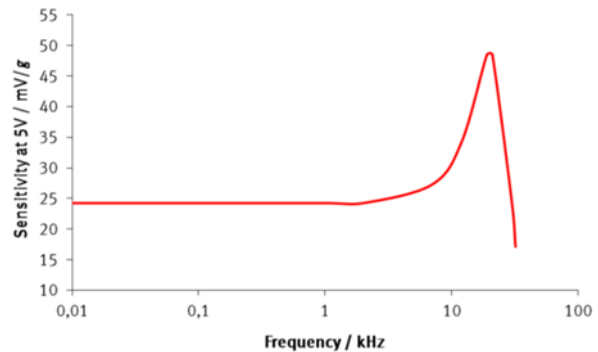
10.1 Acceleration sensor (19g/50g)

► Fitted as standard from Q4/2022 onwards

Typ		I	II
Rated acceleration	g	19	50
Rated sensitivity at 5 V	mV/g	57 ± 10	40 ± 2 (ratiometric)
Static output voltage at 0 g	V _{DC}	1.5 ± 0.25	2.5 ± 0.25
Typical bandwidth	kHz	1.6	11
Excitation voltage	V _{DC}	(5 ± 0.25)	
Linearity error	%	0.3	0.1
Resonant frequency	kHz	5.5	21



► Typ I (19 g)



► Typ II (50 g)

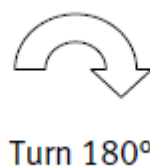
► In order to determine the individual sensitivity of the acceleration sensors, we recommend to measure the static output signal at +/- 1g.

The sensitivity results from the span of the two measured values divided by the span of the acceleration due to gravity (2g).

Signal A at + 1g

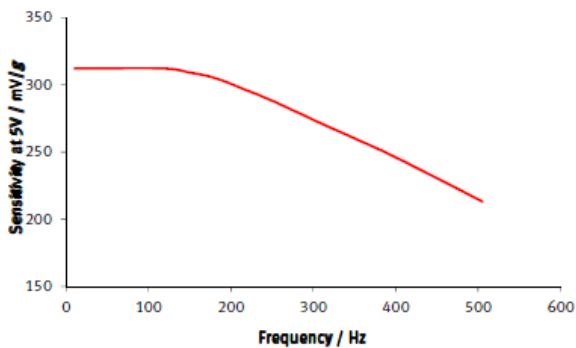


Signal B at - 1g

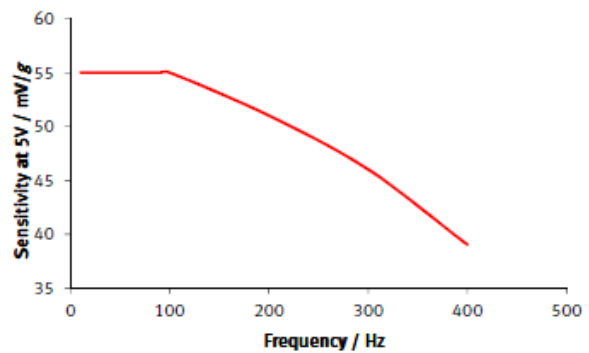


10.2 Acceleration sensor (6g/37g)

Typ		0	I
Rated acceleration	<i>g</i>	6	37
Rated sensitivity at 5V (ratiometric)	<i>mV/g</i>	312	55
Static output voltage at 0 g	V_{DC}	2.5 ± 0.2	2.5 ± 0.5
Typical bandwidth	<i>kHz</i>	0.4	0.4
Excitation voltage	V_{DC}	5 ± 0.25	
Linearity error	%	2	
Resonant frequency	<i>kHz</i>	5.5	22



▶ Typ 0 (6 g)



▶ Typ I (37 g)

11. 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

minimised. Reference must be made to the remaining residual hazards in the

12. 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 Transducer Series DR-F

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

13. Notes



#precision wins

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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.

