



KTR Kupplungstechnik
GmbH
D-48407 Rheine

DATAFLEX® 22/... Torque Measuring Shaft Assembly-/Operating Instructions

KTR-N 49011 E
sheet: 1
edition: 1

DATAFLEX® is a maintenance free torque measurement shaft with integrated speed measurement. In connection with the **RADEX®-NC** steel disc coupling it is a torsionally stiff double cardanic coupling with integrated measuring shaft.

General Hints

Read these instructions thoroughly before operating the measurement shaft.

Please pay special attention to the safety instructions!

The assembly instructions are a part of this product. Please store them carefully close to the measuring shaft. The copyright for these assembly instructions belongs to **KTR** Kupplungstechnik GmbH.

Safety and Advise Hints



DANGER !

Danger of injury to persons.



CAUTION !

Damages on the machine possible.



ATTENTION !

Pointing to important items.

General Hints to Danger



DANGER !

With the assembly, operation, and maintenance of the measuring shaft it is important that the entire drive train has been secured against unintentional engagement. Please read through and observe the following safety instructions.

- All work with and to the measuring shaft must be carried out with the idea of "Safety First".
- Secure the measuring shaft and the disengaged drive before work is carried out.
- Secure the drive system against unintentional engagement, for example place warning signs at the switch or remove the fuse.
- Do not touch the measuring shaft when it is in operation.
- Protect the measuring shaft from unintentional contact. Use an appropriate cover or shield.

Proper Use

You are only allowed to assemble, operate, and maintain the measurement shaft if you

- have carefully read and understood the assembly instructions
- you are authorized and have the proper training

The coupling can only be used in accordance with the technical data (see sheet 11). Unauthorized alterations to the measuring shaft are not allowed. We do not take any responsibility for any resulting damage. In the interest of further technical development of the product we reserve the right for modifications.

The **DATAFLEX®-measuring shaft** described corresponds to the technical status at the time of printing these assembly instructions.

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Assembly-/Operating Instructions

KTR-N 49011 E
sheet: 2
edition: 1

The measuring shaft and the couplings are supplied as single preassembled structural components. Before the assembly please make sure that all parts are complete.
The position of the **DATAFLEX®** is variable. The measurement system can be mounted horizontally as well as vertically.

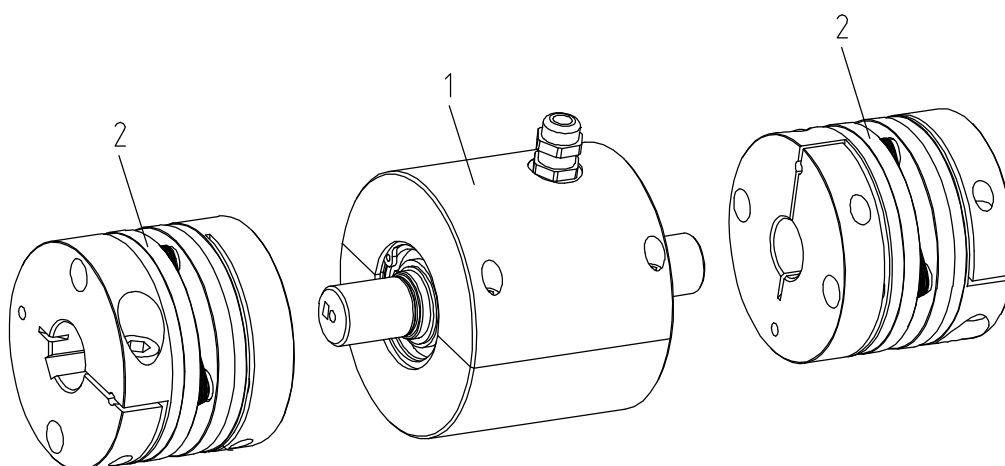
Components of DATAFLEX®-Torque Measuring Shaft

**Components of
DATAFLEX®-torque measuring shaft**

Component	Quantity	Designation
1	1	DATAFLEX®-torque measuring shaft

Components of RADEX®-NC coupling

Component	Quantity	Designation
2	2	RADEX®-NC design EK



picture 1: DATAFLEX® torque measuring shaft with RADEX®-NC

Displacements

The misalignment values given in table 1 provide security in order to compensate for outside influences for example thermal expansion or foundation shifting.

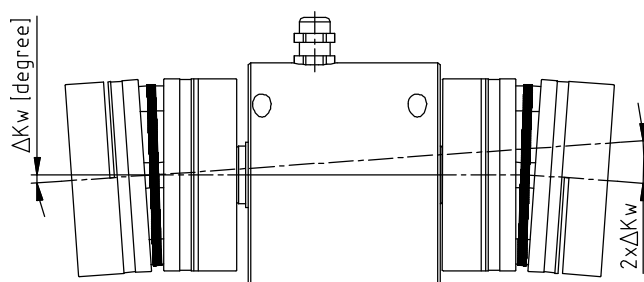


CAUTION !

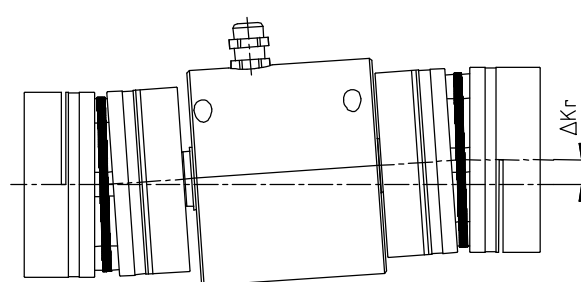
In order to ensure a long life of the measuring shaft the shaft ends must be precisely aligned. The misalignment values given must be observed (see table 1). If these values are exceeded the coupling will be damaged.

Please note:

- The misalignment values given in table 1 are maximum values. They cannot occur at the same time. When radial-, axial- and angular misalignment occur simultaneously, these values must be reduced (see picture 4).
- Please check using dial indicator, ruler or feeler gauges whether the permissible misalignment values in table 1 are being observed.



angular displacements

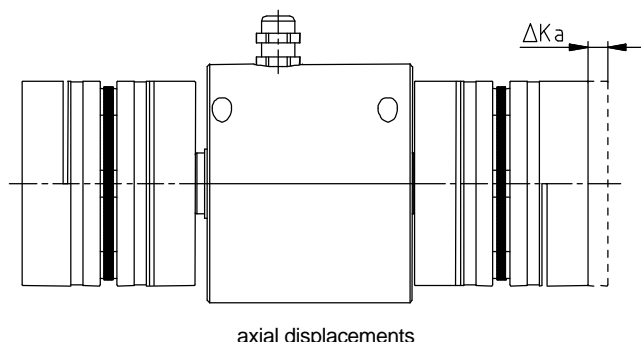


radial displacements

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	Geprüft: 17.07.02 Sha	Ersetzt durch:	W	K	V	VA		M KC



Displacements



axial displacements

picture 2: displacements

Table 1:

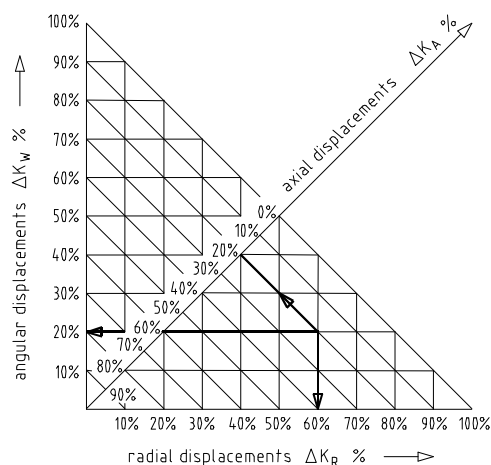
DATAFLEX® size	RADEX®-NC size	max. axial displacement ΔK_A [mm]	max. radial displacement ΔK_R [mm]	max. angular displacement ΔK_W [degree]
22/20	25	1,6	2,8	1,0
22/50	35	2,0	2,9	1,0
22/100				

Example for the misalignment combinations given in picture 3:

Example:

$\Delta K_R = 60\%$
 $\Delta K_W = 20\%$
 $\Delta K_A = 20\%$

picture 3: combination of displacements



$$\Delta K_{\text{total}} = \Delta K_A + \Delta K_R + \Delta K_W \leq 100\%$$

Assembly of the RADEX®-NC coupling

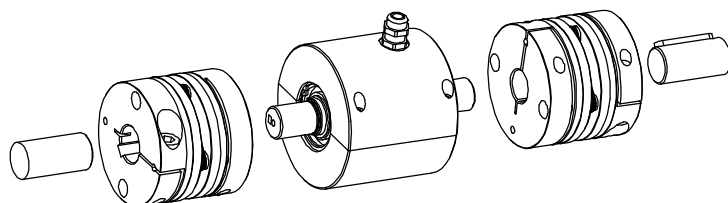
The torque transmission of the RADEX®-NC is effected frictionally engaged by clamping hubs.

During assembly please pay attention to the following procedures:

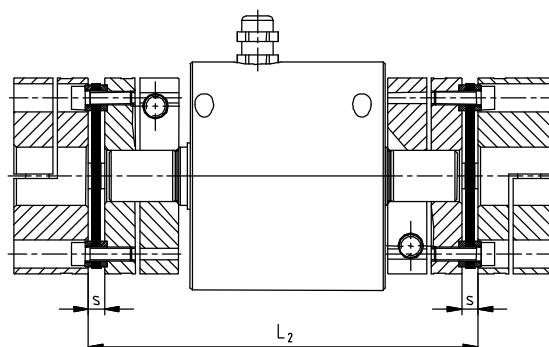
- Clean and degrease the hub bores and the shaft ends.
- Slightly detach the clamping screws.
- Insert the shaft ends of the measuring shaft and the drive and driven end into the hubs of the RADEX®-NC coupling (see picture 4).
- Displace the drive and driven machine in axial direction until reaching the s and L2 dimension. If the aggregates have already been fixed, adjust the s and L2 dimension (see picture 5) by axially displacing the hubs on the shafts.



Assembly of the RADEX®-NC coupling



picture 4: assembly of the clamping ring hubs



picture 5: adjusting to the dimension s and L₂



CAUTION !

During the assembly please make sure that the s and L₂ dimension (see table 3 and 11) is observed, so that the coupling is assembled in axial direction without tension. If this is not observed, the coupling can be damaged.

- Tighten the clamping hubs with the tightening torque T_A indicated in table 2.



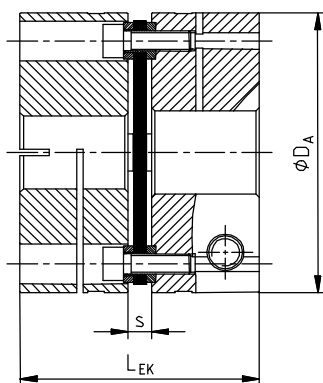
CAUTION !

The torques of the coupling clamping hubs transmittable with frictional engagement are dependent on the bore diameter.

Table 2:

size DATAFLEX®	22/20	22/50	22/100	size DATAFLEX®	22/20	22/50	22/100
size RADEX®-NC	25	35		size RADEX®-NC	25	35	
clamping screw M ₁	M8	M10		clamping screw M ₁	M8	M10	
tightening torque T _A [Nm]	25	49		tightening torque T _A [Nm]	25	49	
bore and transmittable torques of the clamping hubs [Nm]				bore and transmittable torques of the clamping hubs [Nm]			
Ø15	81,7			Ø28	97,8	172,9	
Ø16	82,9			Ø29	99,0	174,9	
Ø17	84,2			Ø30	100,2	176,9	
Ø18	85,4	153,3		Ø31	101,5	178,8	
Ø19	86,6	155,2		Ø32	102,7	180,8	
Ø20	87,9	157,2		Ø33	104,0	182,7	
Ø21	89,1	159,2		Ø34	105,2	184,7	
Ø22	90,3	161,1		Ø35	106,4	186,7	
Ø23	91,6	163,1		Ø36		188,6	
Ø24	92,8	165,1		Ø37		190,6	
Ø25	94,1	167,0		Ø38		192,6	
Ø26	95,3	169,0		Ø39		194,5	
Ø27	96,5	171,0		Ø40		196,5	

Assembly Hints



picture 6: assembly of the coupling

Table 3:

size DATAFLEX®	22/20	22/50	22/100
size RADEX®-NC	25	35	
Assembly dimensions			
dimension s	5	7	
dimension D _A	70	84	
dimension L _{EK}	63	71	
Screws of the laminae package			
screw size	M6	M6	
tightening torque T _A	14	14	



Assembly Hints

• Fix the Housing



CAUTION !

The housing must be secured against rotation. For this there is a thread size M4 at the bottom side.

• Insulation

All DATAFLEX® measuring shafts of type 22 correspond to the Protection IP50 according to DIN EN 60529.

• Maintenance

The DATAFLEX®-measuring shaft is maintenance free.



CAUTION !

Opening the housing is not required and can lead to damage of the measurement shaft.

Technical Description

1. General Description

All of the electronics are located in the fixed housing so that no additional equipment is needed to send the signal. The measuring shaft can be wired by the connection housing DF1 available as accessory or manually by the 15-pole High Density Sub-D coupling (for connection diagram see table 4). The measurement system contains three measurement outputs, from these the analog output values for torque and speed are readable. Over two digital outputs the actual operating condition is shown and two digital inputs can be used during calibration.



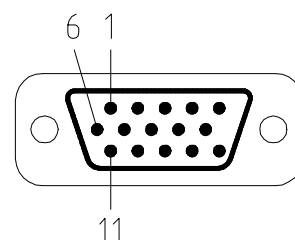
ATTENTION !

The measuring shaft should initially be turned on when all of the connections have been properly connected. After it has been turned on for the first time the measuring shaft will take around 5 minutes until this warm up phase is finished and the measurement device will have its standard accuracy.

2. Pin assignment of the measuring shaft

Table 4: Pin assignment of the D-Sub connection

Connection		Sub-D-Pin	Characteristic
Input Voltage			
Supply Voltage +	24V _{IN}	14	24 V DC ± 4 V / 100 mA
Supply Voltage -	GND	15	
Torque Output			
Output Voltage +	U _{OUT}	11	0 ... 10 V (R _A = 1 kΩ)
Output Voltage -	GND	6	
Output Current +	I _{OUT}	1	4 ... 20 mA (R _A ≤ 500 Ω)
Output Current -	L _{OUT}	2	
Speed Output			
Output Speed +	DRZ	12	24 V / 60 impulse/revolution / 5 mA
Output Speed -	GND	13	
LED Output			
Program-LED	U _{LED1+}	10	5 V / 5 mA prepared for LED
	U _{LED1-}	9	
Fault Signal	U _{LED2+}	5	24 V / 3mA prepared for LED
	GND	15	
Calibration Input			
Auto-Offset	T1	8	activ on connection with GND (Pin 15)
Program	T2	3	



picture 10: plug connection
DATAFLEX®



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DATAFLEX® 22/... Torque Measuring Shaft Assembly-/Operating Instructions

KTR-N 49011 E
sheet: 6
edition: 1

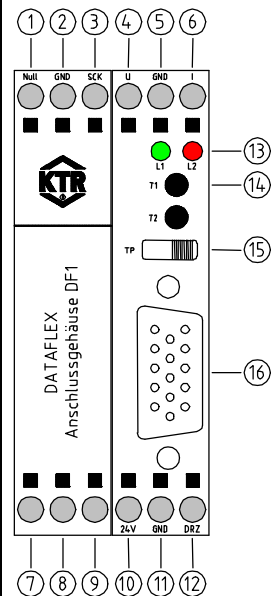
Technical Description

3. Connection housing DF1

The connection housing DF1 has 12 screw clips where the connections of the measuring shaft can be connected (see table 5).

Table 5: Pin assignment of the connection housing DF1

No.	Designation	Function	Characteristic
Input Voltage			
10	24V	Supply Voltage +	24 V DC \pm 4 V / 100 mA
11	GND	Supply Voltage -	
Torque Output			
4	U	Output Voltage +	0 ... 10 V ($R_A = 1 \text{ k}\Omega$)
5	GND	Ground torque output	
6	I	Output Current +	4 ... 20 mA ($R_A \leq 500 \Omega$)
Speed Output			
12	DRZ	Speed Output +	24 V / 60 impulse/revolution/ 5 mA
11	GND	Ground Speed Output	
Digital Connections			
1	NULL	Auto-Offset - Input	Zero Offset Alignment
2	GND	Ground Digital Connections	
3	SCK	Output Error Signal	in case of error: 24V / 50 mA
Operational Control / Indicators			
13	L1	Program - LED	State Indicator
	L2	Error LED	Error Indicator
14	T1	Button Auto Offset	Autom. Zero Alignment
	T2	Button for Programming	New Calibration
15	TP	Low-Pass Button	Filter on / off
16	-	Connection Measuring Shaft	1:1 Connecting Cable



picture 8:
connection housings DF1

4. Analogous outputs

a) Supply Voltage 24V

The supply voltage is 24V DC with a maximum current consumption of 100 mA.

b) Torque Output U, I

To control the torque there are a voltage and a current output available. Both outputs can be used at the same time.

Table 6: Relationship between Torque - Output Values

DATAFLEX® size	$\Delta U / \Delta M$	$\Delta I / \Delta M$
22 / 20	2,5 V / 10 Nm	4 mA / 10 Nm
22 / 50	1 V / 10 Nm	1,6 mA / 10 Nm
22 / 100	0,5 V / 10 Nm	0,8 mA / 10 Nm

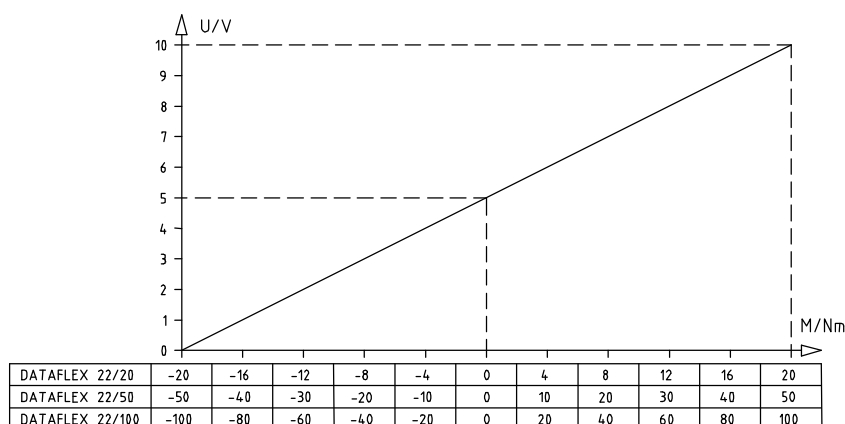
The characteristic curves of the output are shown in pictures 9.1 and 9.2.

Urheberrecht gemäß DIN 34	Gezeichnet: 15.07.02 Sha/Koe	Ersatz für:	Verteiler					
	Geprüft: 17.07.02 Sha	Ersetzt durch:	W	K	V	VA		M KC

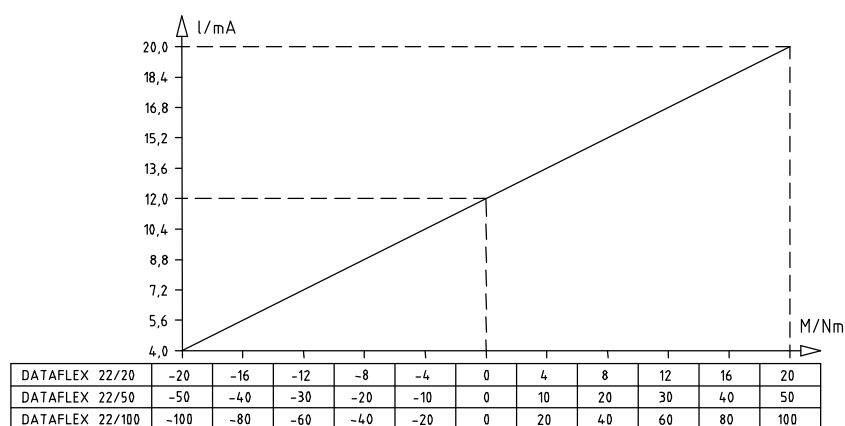


Technical Description

The characteristic curves of the output values (see pictures 9.1 and 9.2)



picture 9.1: voltage to torque relationship



picture 9.2: current to torque relationship

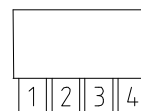
- Filter voltage output**

If the connection housing DF1 is used, the signal of the voltage output can be filtered.

Table 7: Low-Pass Button

Button adjustment TP	left	right
	Low-Pass on	Low-Pass off

The limit frequency of the filter can be changed by varying the DIP switches (see picture 10) inside the connection housing:



picture 10: DIP switch (top view)

Table 8: Adjustment of the requested filter frequency

Limit frequency [Hz]	button 1	button 2	button 3	button 4
15000	OFF	OFF	OFF	OFF
1	OFF	OFF	OFF	ON
10	OFF	OFF	ON	OFF
100	OFF	ON	OFF	OFF
1000	ON	OFF	OFF	OFF

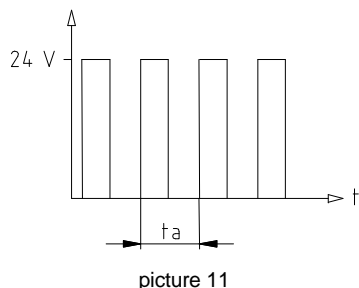
A filter frequency of 1,000 Hz is preset.



Technical Description

c) Output Speed U_N

For determining the speed a square wave with a frequency of 60 impulses per revolution is available. The height of the square wave voltage is 24 Volts.

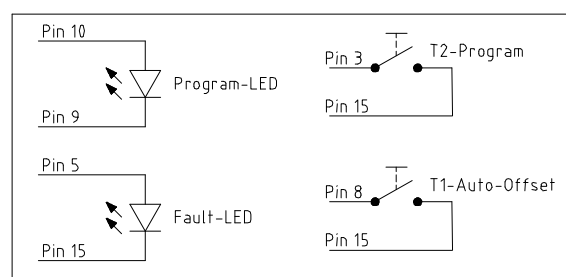


$$\text{speed (1/min)} = 1 / t_a(\text{s})$$

$$\text{speed (1/min)} = f \text{ (1/s)}$$

5. Digital Input and Output

The general parameters for calibration of the measuring shaft are stored electronically and can be changed by operating the external calibration input T1 and T2. As done in the connection box DF1 accessory the connections for the LED output and the calibration input are wired as shown in picture 12 (see Table 4).



picture 12

a) LED 1 (Program)

For calibration of the measuring shaft the factors for amplification and offset can be set in steps. According to the description of the procedure in chapter 4 (calibration) the PROGRAM-LED shows a change in the mode of operation.

b) LED 2 (Error) / Error Signal

The perfect function of the measuring system is permanently controlled.

An electronic defect is shown by a error signal. If an error is shown permanently, the measuring system is defect and must be returned to KTR.

For an easy connection in control systems the error signal is accessible in the connection housing DF1 (connection pin ERROR).

Table 9:

Condition	LED 2	Fault Signal
Normal Operation	OFF	0V
Error	ON	24V

c) Automatic Offset - Correction

If in torqueless state an incorrect value is indicated ($\neq 5,0 \text{ V}$), an automatic offset alignment can be effected by pressing the button T1-Auto-Offset for 2 seconds.

For this the torque is reduced to 0 and the button T1-AUTO-OFFSET must be pressed for 2 seconds. After successful alignment the saving of the new values is confirmed by 6-fold blinking of the programme - LED and the normal measuring operation is continued automatically.

For an easy connection in control systems the Auto-Offset-Connection is accessible in the connection housing DF1 (connection clip NULL).



Technical Description

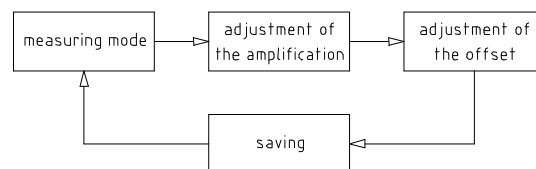
6. Calibration (Manual adjustment of amplification and offset.)



ATTENTION !

The measurement shaft is delivered calibrated.
We recommended checking the calibration every half year.

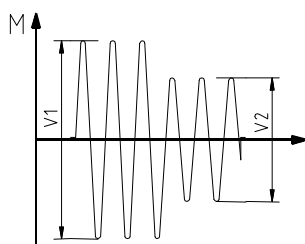
The amplification determines the correct relationship between the torque and the output voltage as well as the output current. It influences the steepness of the curves shown in picture 9.1 and 9.2. The displacement of the curves in vertical direction depends on the offset alignment. Both parameters can be set and saved one after the other (see picture 13).



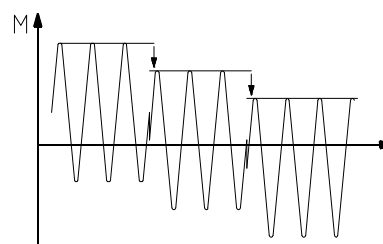
picture 13: flow of the manual setting

Instructions for a new calibration:

1. Press the T2-Program key for 2 seconds. The PROGRAM-LED will blink two times. An adjustment of the amplification factor is now possible.
2. The measurement shaft should now be alternately loaded and unloaded by a defined weight. The difference between the output values should be compared to the actual difference between the load and unload.
3. Through a quick press of the T1-AUTO-OFFSET key the amplification factor can be roughly varied. While a fine variation of the amplification factor can be made using a quick press of the T2-PROGRAM key. One after the other all of the types of amplification factors can be adjusted (see picture 14.1).
4. If the difference of the displayed measurement values of the loading and unloading corresponds with the outside determined torque difference, then the adjustment of the amplification is finished.
5. Press the T2-PROGRAM key for 2 seconds. The PROGRAM-LED will blink 4 times. The manual setting of the offset can now begin.
6. As described under point 3 the keys can be pressed quickly to set all of the values (see picture 14.2). When no torque is present the measurement shaft should be adjusted to an output voltage of 5,0 V or rather an output current of 12,0 mA.
7. When the offset adjustment is finished, pressing the T2-PROGRAM key for two seconds will save all of the new parameters. The PROGRAM-LED will blink one time. The measuring shaft will once again be in its normal operating mode.



picture 14.1



picture 14.2



CAUTION !

With saving all of the old data will be overwritten.



ATTENTION !

- The calibration can be interrupted if the measurement device is turned off for a short time and then turned back on. The previously saved parameters will then be reproduced.
- The safe measurement operation can be carried out after saving the new parameters (point 7) or after interrupting the power supply.
- After saving the new parameters (point 7) the parameters will stay the same even if the power supply is interrupted.

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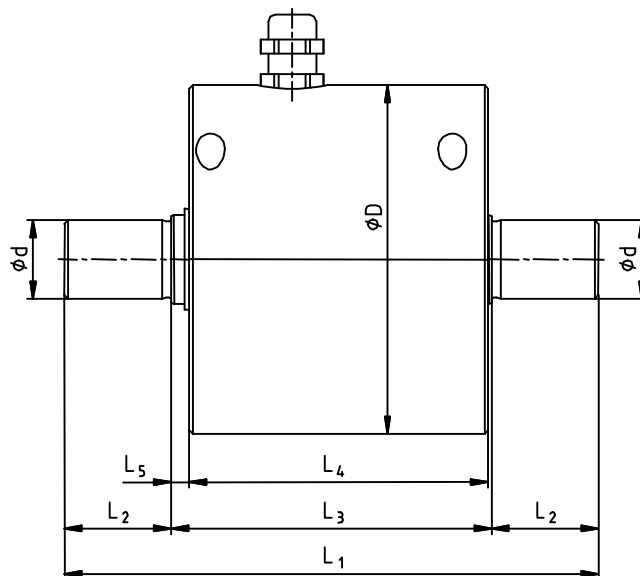


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D-48407 Rheine

DATAFLEX® 22/... Torque Measuring Shaft Assembly-/Operating Instructions

KTR-N 49011 E
sheet: 10
edition: 1

DATAFLEX® Torque Measuring Shaft



picture 15

Table 10: dimension and technical data

coupling size DATAFLEX®	22/20	22/50	22/100
Dimensions [mm]			
dimension d	22		
dimension D	98		
dimension L ₁	150		
dimension L ₂	30		
dimension L ₃	90		
dimension L ₄	84		
dimension L ₅	5		
Electrical Data			
nominal torque T _{KN} [Nm]	-20 .. +20 Nm	-50 .. +50 Nm	-100 .. +100 Nm
limit frequency torque signal [kHz]	16		
measuring inaccuracy [%] ¹⁾	1		
temperature influence [%/°K]	0,05		
nominal temperature range [°C]	0 - 55		
supply voltage [V] DC	24 ± 4		
max. current consumption [mA]	100		
Torque Output			
output voltage torque [V]	0 ... 10		
output current torque [mA]	4 ... 20		
Speed Output			
number of impulses / revolution	60		
output signal [V]	24		
Mechanical Data			
static load limit T _{Kmax.} ¹⁾ [%]	150		
breaking load T _{K break} ¹⁾ [%]	300		
max. bending torque [Nm]	5	10	18
max. radial force [N]	42	84	150
max. axial force [kN]	3	5	7,5
weight [kg]	1,5	1,5	1,5
torsion spring stiffness CT [Nm/rad]	2865	7163	14325
torsion angle at T _{KN} [degrees]	0,4		
mass moment of inertia [kgm ²]	0,000131	0,000132	0,000134
permanent speed [1/min] ²⁾	9000		
peak speed [1/min] ²⁾	12000		

1) referred to T_{KN}

2) after shrinkage of the bearings

Urheberschutz gemäß DIN 34	Gezeichnet: 15.07.02 Sha/Koe	Ersatz für:	Verteiler					
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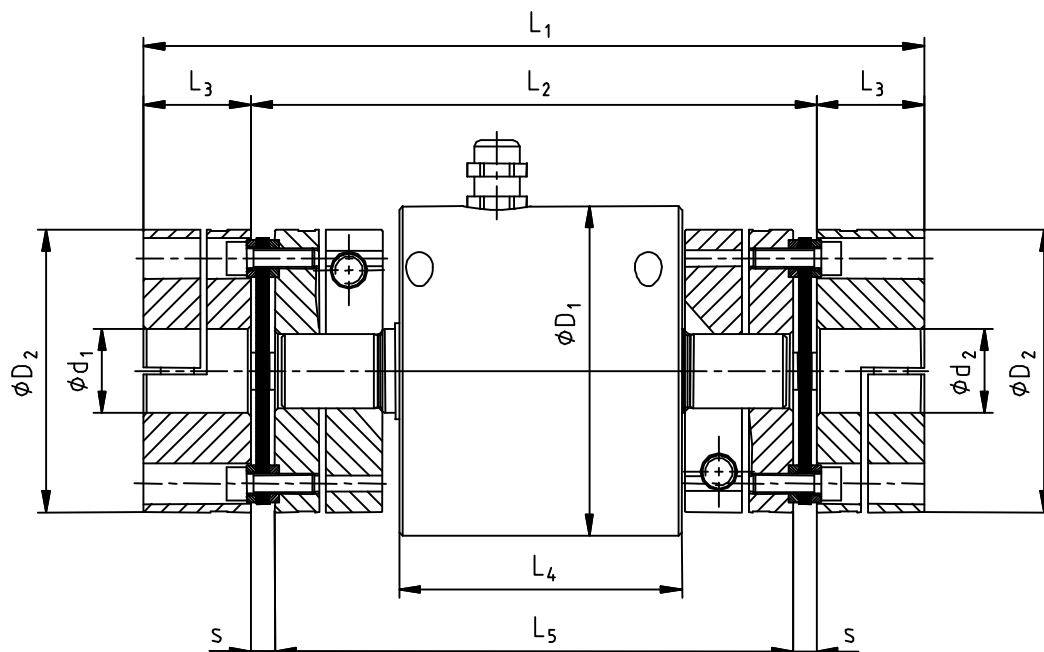


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DATAFLEX® 22/... Torque Measuring Shaft Assembly-/Operating Instructions

KTR-N 49011 E
sheet: 11
edition: 1

DATAFLEX® Torque Measuring Shaft in Combination with RADEX®-NC



picture 16: dimensions DATAFLEX® with RADEX®-NC

Table 11: dimension and technical data

coupling size DATAFLEX®	22/20	22/50	22/100
coupling size RADEX®-NC	25	35	
Dimensions [mm]			
dimension d ₁ / d ₂ max.	35	40	
dimension D ₁	98	98	
dimension D ₂	70	84	
dimension L ₁	216	232	
dimension L ₂	158	168	
dimension L ₃	29	32	
dimension L ₄	84	84	
dimension L ₅	148	154	
dimension s	5	7	
Clamping Screw [mm]			
dimension G	M8	M10	
tightening torque T _A [Nm]	25	49	
Torque of the Coupling			
T _{KN} [Nm]	60	100	
T _{Kmax.} [Nm]	120	200	
Mechanical Data of the Combination (DATAFLEX® with RADEX®-NC)			
mass moment of inertia [kgm ²]	0,00059	0,00122	0,00122
torsion spring stiffness [Nm/rad]	2521	6363	11448
weight [kg]	2,56	3,15	3,16
max. speed [1/min] ¹⁾	10000	9000	9000

1) higher speeds on request

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