DATAFLEX® is a maintenance-free torque measuring 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 measuring 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

D A N G E R ! **Danger of injury to persons.**

C A U T I O N ! **Damages on the machine possible.**

A T T E N T I O N ! **Pointing to important items.**

General Hints to Danger

D A N G E R !
With the assembly, operation, and maintenance of the measuring shaft it is important to secure the entire drive train against unintentional engagement. Please read through and observe the following safety instructions.

- All operations with and to the measuring shaft must be carried out based on the idea of “Safety First”.
- Secure the measuring shaft and the disengaged drive before the operations are 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 may only assemble, operate and maintain the measurement shaft if you

- carefully read through the mounting instructions and understood them
- had technical training
- are authorized to do so by your company

The coupling can only be used in accordance with the technical data (see sheet 12). 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® torque measuring shaft** described corresponds to the technical status at the time of printing these assembly instructions.

The measuring shaft and the couplings are supplied as single pre-assembled structural components. Before assembly the measuring shaft should be checked for completeness.
The position of the **DATAFLEX®** is variable. The measurement system can be mounted horizontally as well as vertically.

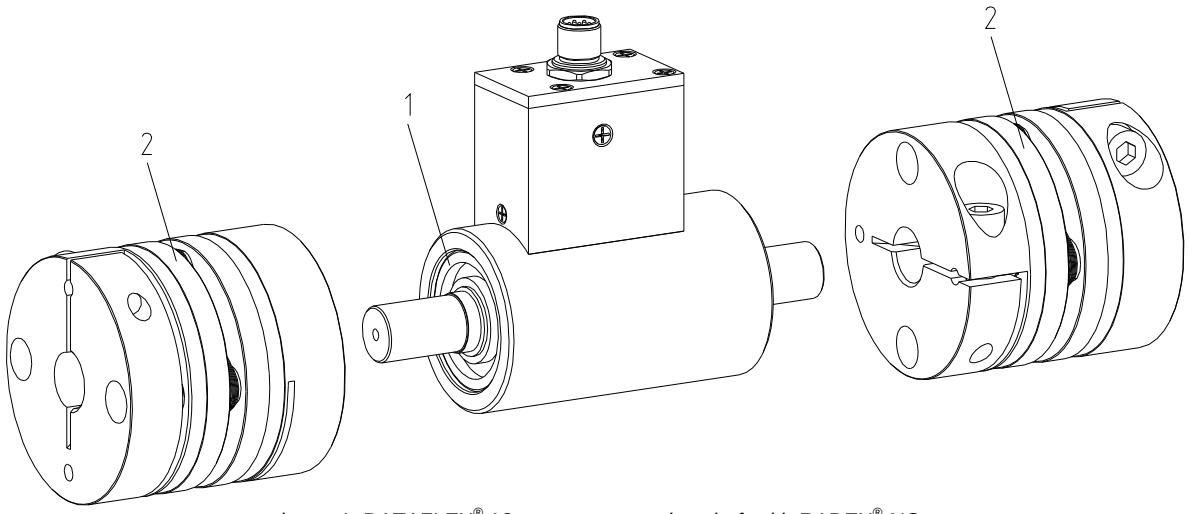
Components of DATAFLEX® Torque Measuring Shaft

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® 16 - torque measuring shaft with RADEX®-NC

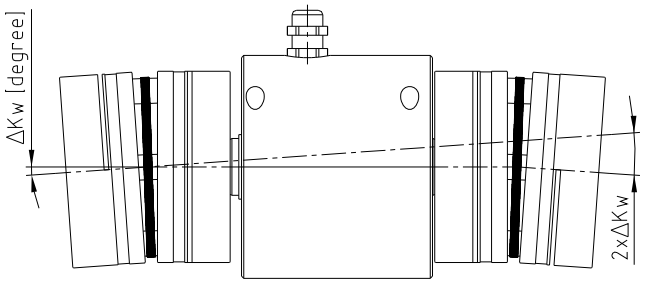
Displacements

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

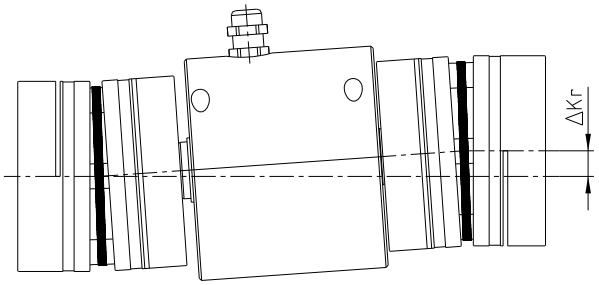
C A U T I O N !
In order to ensure a long life of the measuring shaft the shaft ends must be precisely aligned. The misalignment values given must be observed (see table 1). If these values are exceeded the coupling will be damaged.

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 occurs simultaneously, these values must be reduced (see picture 3).
- Please check using dial indicator, ruler or feeler gauges whether the permissible misalignment values in table 1 are being observed.

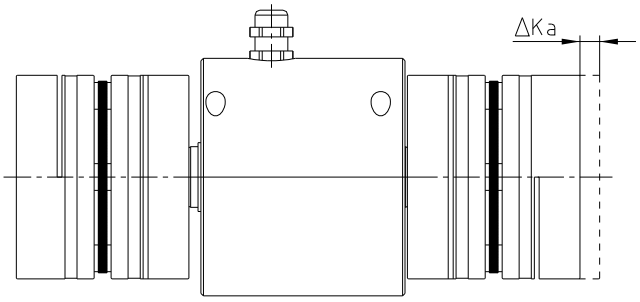


angular displacements



radial displacements

Displacements



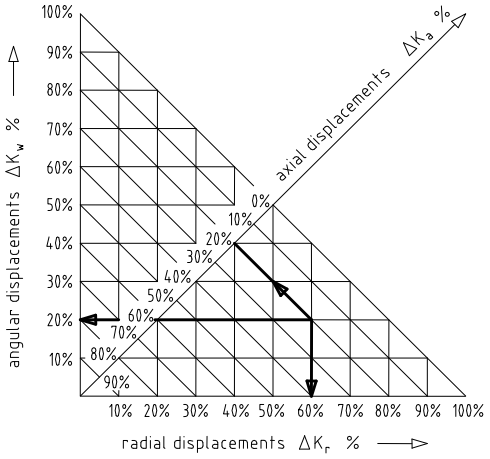
axial displacements

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]
16/10	20	1,2	2,4	1,0
16/30	25	1,6	2,7	
16/50				

picture 3: combination of displacements



Example for the misalignment combinations given in picture 3:

Example:
$\Delta K_r = 60\%$
$\Delta K_w = 20\%$
$\Delta K_a = 20\%$

$$\Delta K_{total} = \Delta K_a + \Delta K_r + \Delta K_w \leq 100\%$$

Assembly of the RADEX®-NC coupling

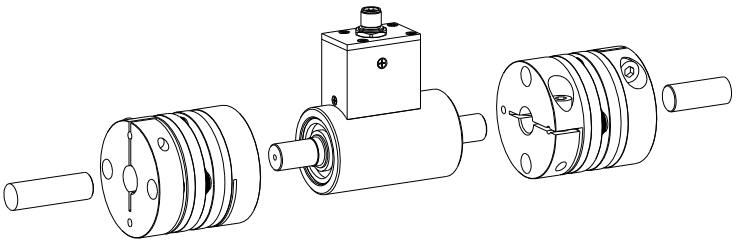
The torque transmission of the RADEX®-NC is effected frictionally engaged by clamping hubs.

During assembly please pay attention to the following procedures:

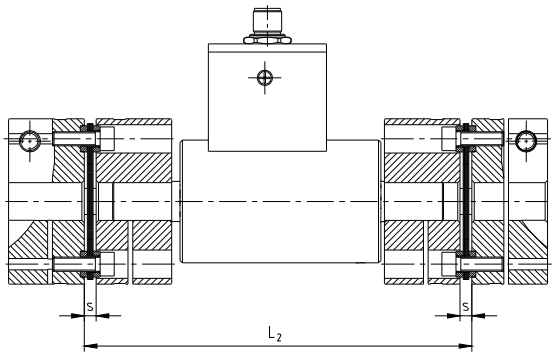
- Clean and degrease the hub bores and the shaft ends.
- Slightly detach the clamping screws.
- Insert the shaft ends of the measuring shaft and the drive and driven end into the hubs of the RADEX®-NC coupling (see picture 4).
- Displace the driving and driven machine in axial direction until reaching the s and L_2 dimension. If the power packs have already been fixed, adjust the s and L_2 dimension (see picture 5) by axially displacing the hubs on the shafts.

C A U T I O N !
When tightening the clamping screws please make sure that the torque measuring shaft is not loaded and the danger of bending or overload by torque can be excluded.

Assembly of the RADEX®-NC coupling



picture 4: assembly of the clamping ring hubs



picture 5: adjusting to the dimension s and L_2

C A U T I O N !
During the assembly please make sure that the s and L_2 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.

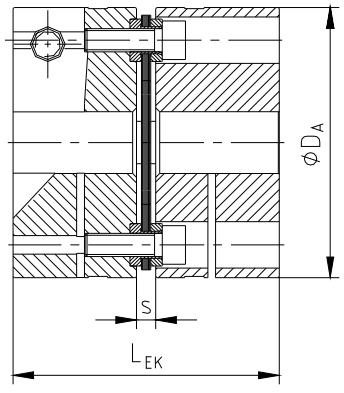
- Tighten the clamping hubs at the tightening torque T_A indicated in table 2.

C A U T I O N !
The transmittable torques of the coupling clamping hubs with frictional engagement are dependent on the bore diameter.

Table 2:

Size DATAFLEX®	16/10	16/30	16/50	Size DATAFLEX®	16/10	16/30	16/50
Size RADEX®-NC	20	25		Size RADEX®-NC	20	25	
Clamping screw M_1	M6	M8		Clamping screw M_1	M6	M8	
Tightening torque T_A [Nm]	10	25		Tightening torque T_A [Nm]	10	25	
Bore and transmittable torques of the clamping hubs [Nm]				Bore and transmittable torques of the clamping hubs [Nm]			
Ø12	35,8			Ø24	43,9	92,8	
Ø13	36,5			Ø25	44,6	94,1	
Ø14	37,1			Ø26		95,3	
Ø15	37,8	81,7		Ø27		96,5	
Ø16	**38,5**	**82,9**		Ø28		97,8	
Ø17	39,2	84,2		Ø29		99,0	
Ø18	39,8	85,4		Ø30		100,2	
Ø19	40,5	86,6		Ø31		101,5	
Ø20	41,2	87,9		Ø32		102,7	
Ø21	41,9	89,1		Ø33		104,0	
Ø22	42,5	90,3		Ø34		105,2	
Ø23	43,2	91,6		Ø35		106,4	

Assembly Hints



picture 6: assembly of the coupling

Table 3:

Size DATAFLEX®	16/10	16/30	16/50
Size RADEX®-NC	20	25	
Assembly dimensions			
Dimension s	4	5	
Dimension D_A	59	70	
Dimension L_{EK}	52	69	
Screws of the lamina package			
Screw size	M6	M6	
Tightening torque T_A [Nm]	10	14	

Assembly Hints

- **Fix the Housing**

C A U T I O N !
The housing must be secured against rotation. For this purpose there is a thread size M4 at the bottom side. Please make absolutely sure to avoid a rigid fixing of the housing!

C A U T I O N !
Opening the housing is not required and can lead to damage of the measurement shaft.

- **Insulation**
  All DATAFLEX® measuring shafts of type 16 correspond to the Protection IP51 according to DIN EN 60529.

- **Maintenance**
  The DATAFLEX® measuring shaft is maintenance-free. Lubrication or cleaning is not necessary.

- **Calibration**
  The transmitter is supplied with calibration. We recommend an annual inspection of the calibration.

Technical Description

1. General Description

The measuring shafts type DATAFLEX® 16 are provided with wire strain gauges (DMS) the signals of which are transmitted contactless.
In addition, a two-channel shaft encoder provides two speed sensor pulses offset by 90 degrees with a resolution of 360 periods per revolution. The measuring shaft is connected to the connection housing DF2 via the connection cable which is available as an accessory.

A T T E N T I O N !
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. Connection housing DF2

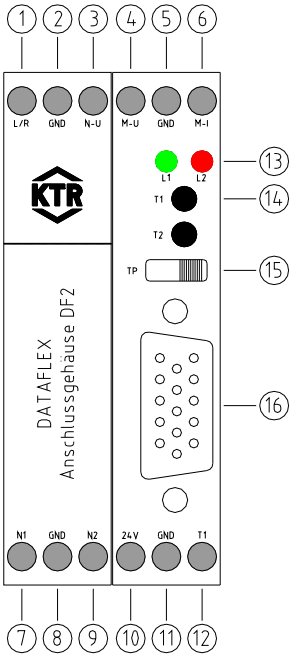
The connection housing DF2 has12-off terminal screws which power supply, display equipment and switches can be connected to.
The torque signal is displayed as proportional direct voltage -10 … 10 V.
For the speed display two square wave signals, one scalable voltage signal and one direction signal are available (for pin configuration see table 4).
The bush button T1 serves for programming and can be overbridged externally by connecting terminal screw 12 (T1) to ground (11).

Technical Description

Table 4: Pin assignment of the connection housing DF2

No.	Designation	Function	Characteristic
		Input Voltage	
10	24V	Supply Voltage +	24 V DC ± 4 V / 100 mA
11	GND	Supply Voltage -	
		Torque Output	
4	M-U	Output Voltage +	-10 V ... 10 V (R_A = 1 kΩ)
5	GND	Ground torque output	
6	M-I	Without function	
		Speed output pulse signal	
7	N1	Speed output channel 1	HTL* (24V, 360 pulses /rev.)
8	GND	Ground for pulse speed output	
9	N2	Speed output channel 2	HTL* (24V, 360 pulses /rev.)
		Speed output DC-voltage	
1	R/L	Direction of rotation	HTL* (24V, clockwise = 1)
2	GND	Ground for DC speed output	
3	N-U	Speed output DC-voltage	0 V ... 10 V (scalable)
		Other connections / operating device	
12	T1	Push button T1	External connection T1
13	L1, L2	Signal LED's	
14	T1, T2	Push button T1, T2	Push button for programming
15	TP	Switch low pass filter	On/off switch low-pass
16	-	Connection Measuring Shaft	1:1 Connection Cable

* TTL level on request



picture 7: connection housing DF2

3. Description of connections

a) Supply voltage 24 V (No. 10 and 11)

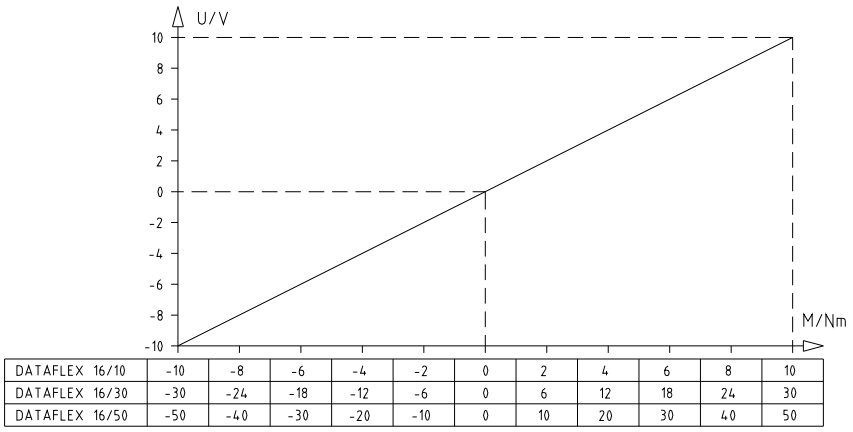
The supply voltage is 24 V ± 4 V direct current voltage (DC). The current consumption is 100 mA at the maximum.

b) Torque signal M-U (No. 4 and 5)

The output voltage is proportional to the torque with an output of values between -10 V and 10 V. Table 5 shows the relation between torque and output voltage.

Table 5: Relation between torque - output values

DATAFLEX® Size	ΔM / V
16/10	1 Nm / V
16/30	3 Nm / V
16/50	5 Nm / V



picture 8: relation between torque and output voltage

Technical Description

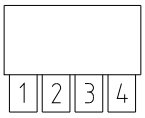
c) Low pass filter (No. 15)

The torque signal may be filtered by activating a low-pass so that high-frequency shares of the signal are eliminated.

Table 6: Low pass switch (No. 15)

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 9) inside the connection housing:



picture 9: DIP switch (top view)

Table 7: Adjustment of the requested filter frequency

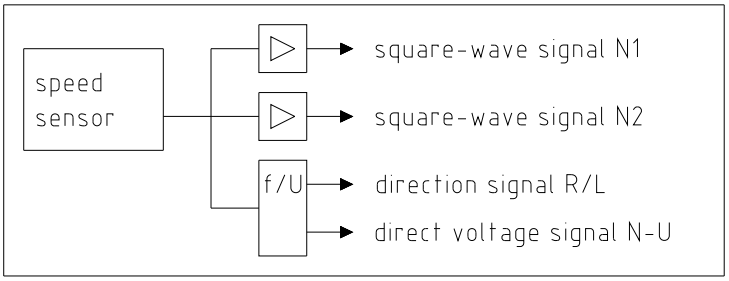
Limit frequency [Hz]	Switch 1	Switch 2	Switch 3	Switch 4
2000	**OFF**	**OFF**	**OFF**	**OFF**
1000	OFF	OFF	OFF	**ON**
100	OFF	OFF	**ON**	OFF
10	OFF	**ON**	OFF	OFF
1	**ON**	OFF	OFF	OFF

A filter frequency of 1000 Hz is preset.

d) Speed signals N1, N2, N-U, R/L (No. 1, 3, 7, 9)

The connection housing DF2 contains 4 connections for speed output:

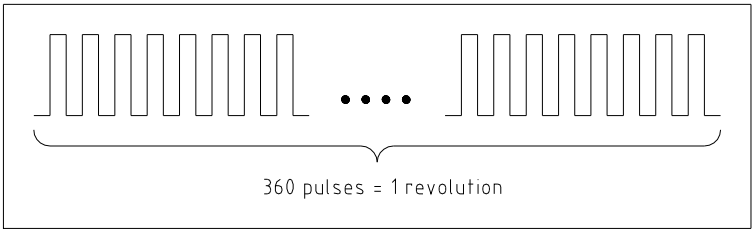
- Two square-wave signals offset by 90 degrees (N1, N2)
- A scalable voltage output (N-U) with direction signal (R/L)



picture 10

<u>Outputs N1 and N2</u>

Each of the speed outputs N1 and N2 provide a square-wave signal with a resolution of 360 periods per revolution (picture 11).

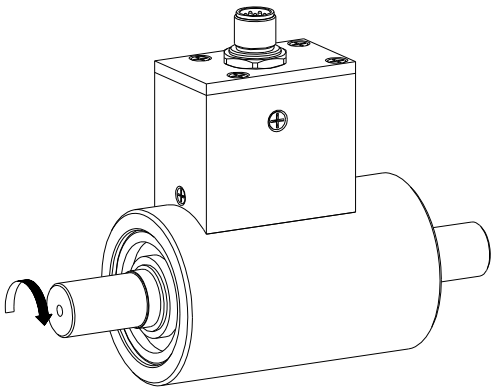


picture 11

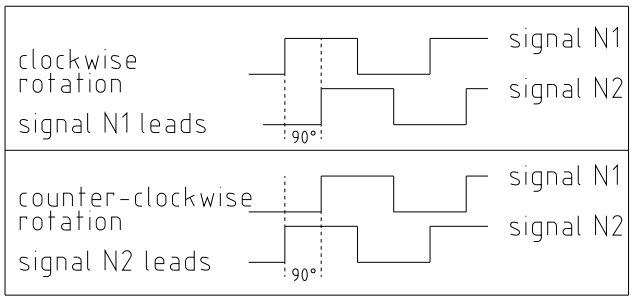
The speed is calculated as follows: **N [1/min] = f [Hz] / 6**

Technical Description

The speed channel signals N1 and N2 have a phase shift of 90 degrees to each other. Depending on the rotational direction one of the two signals leads 90° in phase (picture 12).



clockwise

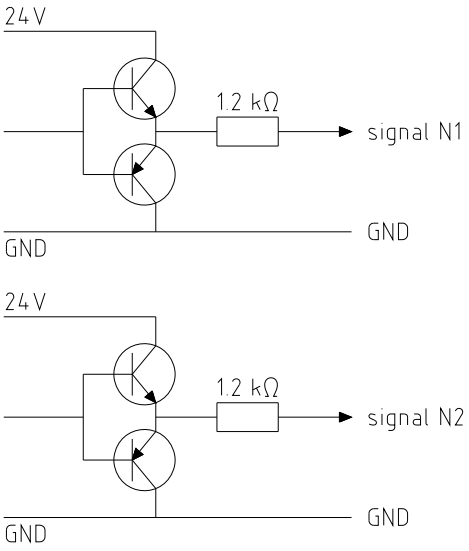


picture 12

Output circuit (connection N1 and N2)

The speed outputs N1 and N2 have short-circuit proof push-pull outputs providing a square-wave voltage with an amplitude of 24V and a maximum switching current of 20 mA. If necessary the output can be readjusted to 5V TTL level

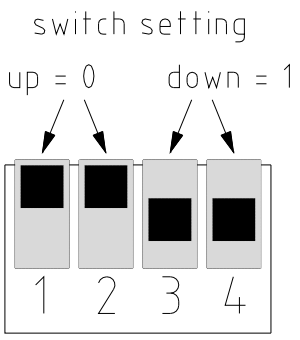
The output terminals must not be charged with an external voltage.



picture 13: output circuit of speed outputs

Outputs N-U and R/L

The KTR connection housing DF02 contains an integrated f/U converter. It converts the impulses of the encoder to a linear DC-voltage output (terminal N-U) and produces an additional signal for the rotational direction (terminal R/L). By means of the quadruple miniature switch at the bottom side of the connection housing DF02 the scale for the output signal can be adapted (picture 14).
Table 8 explains the relation between the coding of the switch and the corresponding scale.
The output voltage from 0 - 10 Volt is proportional to the speed range set from 0 - max. speed (see table 8).

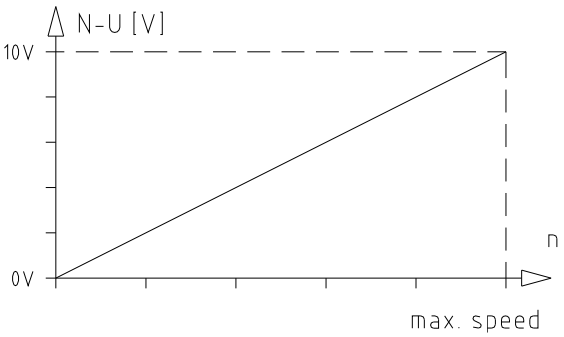


picture 14: switch positions

Technical Description

Table 8: Switch position S1-S4 and the corresponding scale of the speed output N-U

Max. speed	Scale	S1	S2	S3	S4
10	1 rpm / V	0	0	0	0
20	2 rpm / V	0	0	0	1
40	4 rpm / V	0	0	1	0
60	6 rpm / V	0	0	1	1
80	8 rpm / V	0	1	0	0
100	10 rpm / V	0	1	0	1
200	20 rpm / V	0	1	1	0
400	40 rpm / V	0	1	1	1
600	60 rpm / V	1	0	0	0
800	80 rpm / V	1	0	0	1
1000	100 rpm / V	1	0	1	0
2000	200 rpm / V	1	0	1	1
4000	400 rpm / V	1	1	0	0
6000	600 rpm / V	1	1	0	1
8000	800 rpm / V	1	1	1	0
10000	1000 rpm / V	1	1	1	1



picture 15

Table 9:

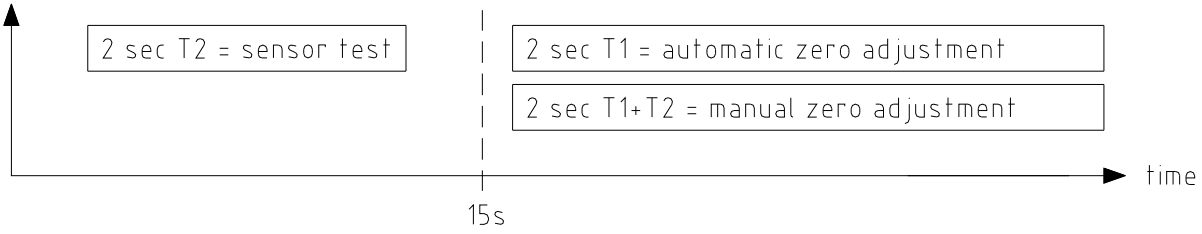
Output voltage R/L	Rotational direction
24V	clockwise
0	counter-clockwise

* If requested, the output can be adapted to 5V level.

The signal of the speed direction output R/L shows the rotational direction (see table 9).

e) Control buttons and LEDs (No. 12 to 14 and picture 16)

The connection housing DF02 contains control switches and LEDs for offset adjustment and sensor test. For reasons of safety the sensor test can only be performed during the first 15 seconds after switching on. The zero balance can be performed after a turn-on period of 15 seconds (picture 17). The termination of the 15 seconds period is signalized by a short blinking of the LEDs of the connection housing.



picture 16

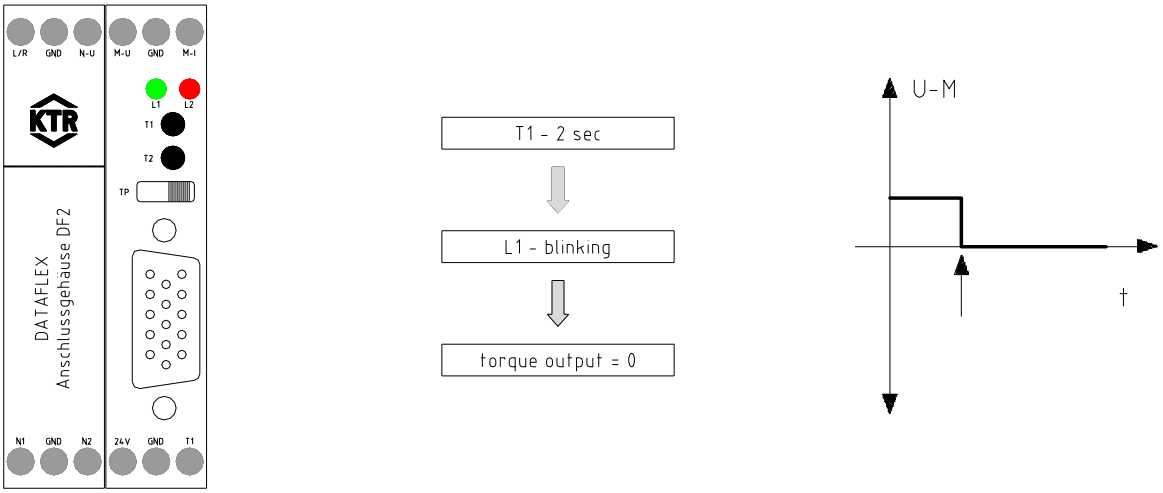
Automatic offset adjustment (picture 17)

If the „push button“ T1 is activated for a period of 2 seconds, the output of the torque signal is automatically set to 0 Volt. The setting is effected independent of the amount of the actual torque.
The termination of the adjustment is confirmed by fast blinking of the LED L1. The new zero point has been stored and the device is in measuring mode again.

Technical Description

A T T E N T I O N !

- **The automatic zero adjustment can only be performed if the measuring shaft is switched on for more than 15 seconds.**
- **If necessary, the automatic zero adjustment can be performed by an external control, too. If the potential of the terminal clamp T1 is connected with GND for 2 seconds, an automatic zero balance is performed.**



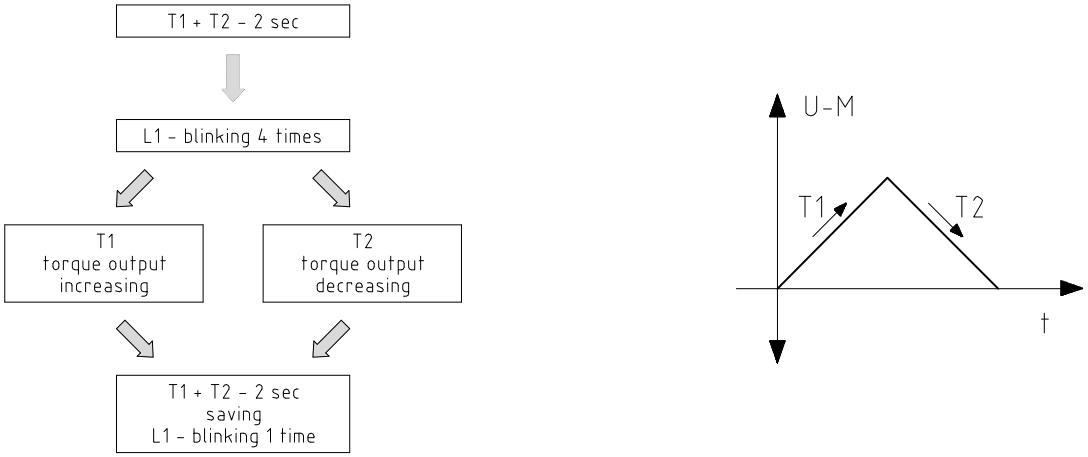
picture 17: automatic zero adjustment

Manual zero adjustment

The zero point of the torque output can be adjusted manually. For this purpose both push buttons T1 and T2 are activated simultaneously for 2 seconds. The LED L1 is blinking four times.
Pressing the push button T1 increases the voltage, pressing the push button T2 decreases the voltage. The modifications are accelerated if the corresponding push button is pressed permanently. Each amendment is confirmed by a short blinking of the LED L2.
Having performed the setting the new values are stored lastingly by pressing both push buttons again for 2 seconds. The LED L1 is illuminated once and signalizes the return to the measuring mode.

A T T E N T I O N !

- **The manual zero adjustment can only be performed if the measuring shaft is switched on for more than 15 seconds and the signal has levelled off.**



picture 18: manual zero adjustment

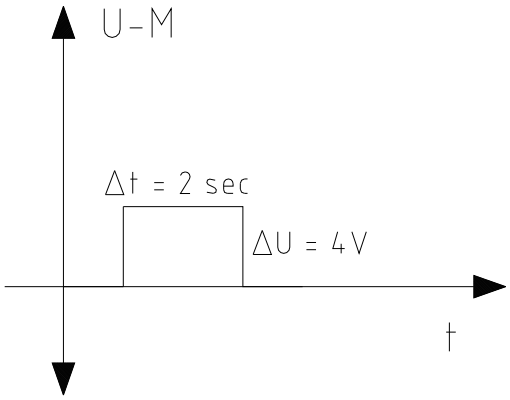
Technical Description

Sensor test

During the first 15 seconds after powering up the torque sensor can be inspected for operativeness.
If the push button T2 is pressed for 2 seconds the torque voltage output will be increased by approx. 4 Volt for the period of 2 seconds.

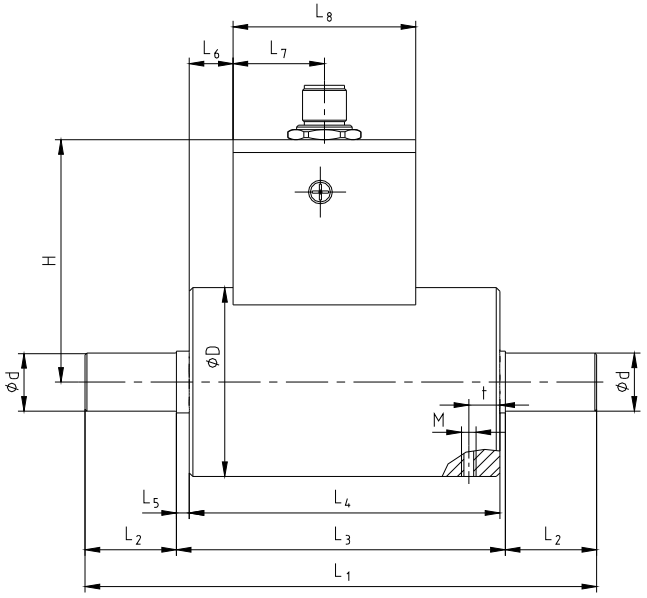
☞ **A T T E N T I O N !**

- **The sensor test can only be performed during the first 15 seconds after switching on.**



picture 19: sensor test

DATAFLEX® Torque Measuring Shaft



picture 20

Table 10: Dimension

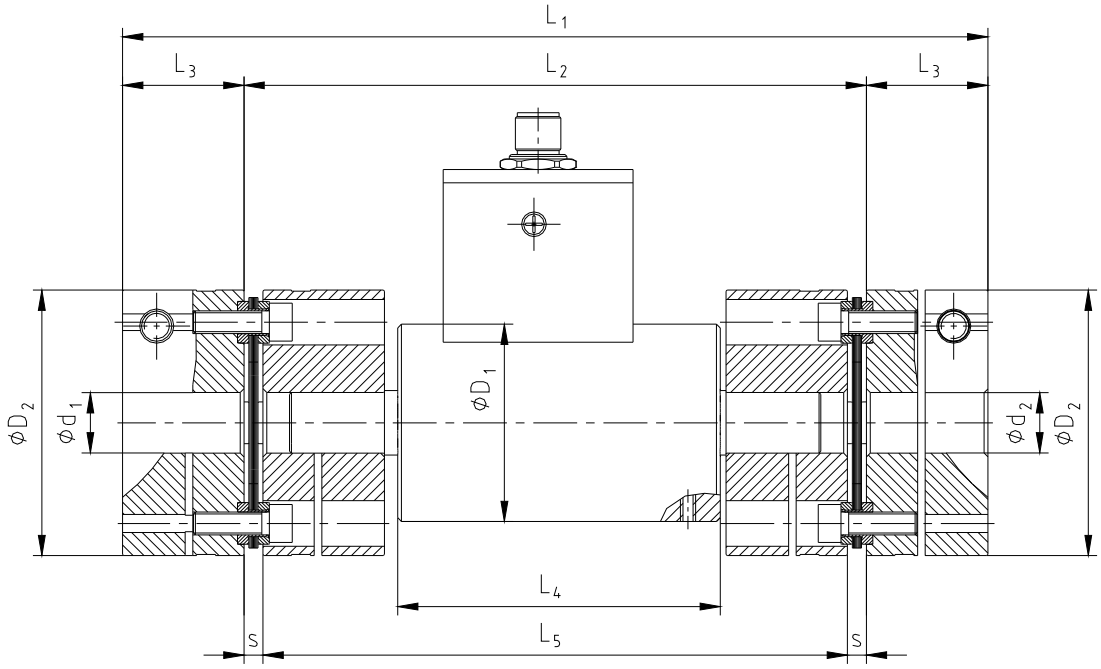
Size	Dimensions [mm]												
	d	D	L_1	L_2	L_3	L_4	L_5	L_6	L_7	L_8	H	M	t
16/10 16/30 16/50	16	52	140	25	90	85	3,5	12	25	50	67	M4	8,5

Table 11: Technical data

Coupling size DATAFLEX®	16/10	16/30	16/50
Electrical Data			
Nominal torque T_{KN} [Nm]	-10 .. +10 Nm	-30 .. +30 Nm	-50 .. +50 Nm
Band width of torque signal [kHz] (-3dB)	2		
Error in linearity incl. hysteresis [%] 1)	< 0,1		
Temperature influence [%/°10K]	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]	-10 .. +10		
Speed Output			
Number of impulses / revolution	360		
Amplitude [V] 2)	24		
DC speed output [V]	0 - 10		
Scale of direct voltage output	16 times over micro switch		
Direction signal [V] 2)	24 V = clockwise, 0V = counter-clockwise		
Mechanical Data			
Static load limit $T_{Kmax.}$ 1) [%]	150		
Breaking load $T_{K\ break}$ 1) [%]	300		
Max. bending torque [Nm]	1,07	3,2	5,3
Max. radial force [N]	12	37	61
Max. axial force [kN]	1,1	2,3	3,1
Weight [kg]	0,69		
Torsion spring stiffness C_T [Nm/rad]	910	2840	4100
Torsion angle at T_{KN} [degrees]	0,63	0,61	0,7
Mass moment of inertia [kgm²]	$22,6 \times 10^{-6}$		
Max. speed [rpm]	10000		

1) referred to T_{KN}
2) can be converted to 5V TTL level by the plant

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



picture 21: dimensions DATAFLEX® with RADEX®-NC

Table 12: Dimension and technical data

Coupling size DATAFLEX®	16/10	16/30	16/50
Coupling size RADEX®-NC	**20**	**25**	
Dimensions [mm]			
Dimension d_1 / d_2 max.	25	35	
Dimension D_1	52	52	
Dimension D_2	59	70	
Dimension L_1	194	228	
Dimension L_2	146	164	
Dimension L_3	24	32	
Dimension L_4	85	85	
Dimension L_5	138	154	
Dimension s	4	5	
Clamping Screw [mm]			
Dimension G	M6	M8	
Tightening torque T_A [Nm]	10	25	
Torque of the Coupling			
T_{KN} [Nm]	30	60	
$T_{Kmax.}$ [Nm]	60	120	
Mechanical Data of the Combination (DATAFLEX® with RADEX®-NC)			
Mass moment of inertia [kgm²]	177×10^{-6}	416×10^{-6}	
Torsion spring stiffness [Nm/rad]	860	2600	3600
Weight [kg]	1,30	1,75	1,75
Max. speed [rpm] [1]	6000		

1) higher speeds on request

EC Certificate of Conformity

The manufacturer - KTR Kupplungstechnik GmbH, D-48432 Rheine - herewith certifies that the

Torque measuring shaft DATAFLEX®

described in the present operating instructions is in accordance with the following standard:

89/336/EEC council directive of 3 May 1989 on the approximation of the laws of the member states relating to electromagnetic compatibility (89/336/EEC), changed by 91/263/EEC, 92/31/EEC and 93/68/EEC

Used standards:

DIN EN 61000-6-2:	immunity for industrial environments
DIN EN 61000-4-2:	electrostatic discharge immunity test (ESD)
DIN EN 61000-4-3:	radiated, radio-frequency, electromagnetic field immunity test
DIN EN 61000-4-4:	electrical fast transient/burst immunity test
DIN EN 61000-4-6:	immunity to conducted disturbances, induced by radio-frequency fields
DIN EN 61000-6-4:	emission for industrial environments
DIN EN 55011:	radio disturbance characteristics (intensity of radio interference area class B)

Rheine,	28.02.11	i. V.	i. A.
City	Date	Reinhard Wibbeling Engineering Manager	Jürgen Kösters Product Manager