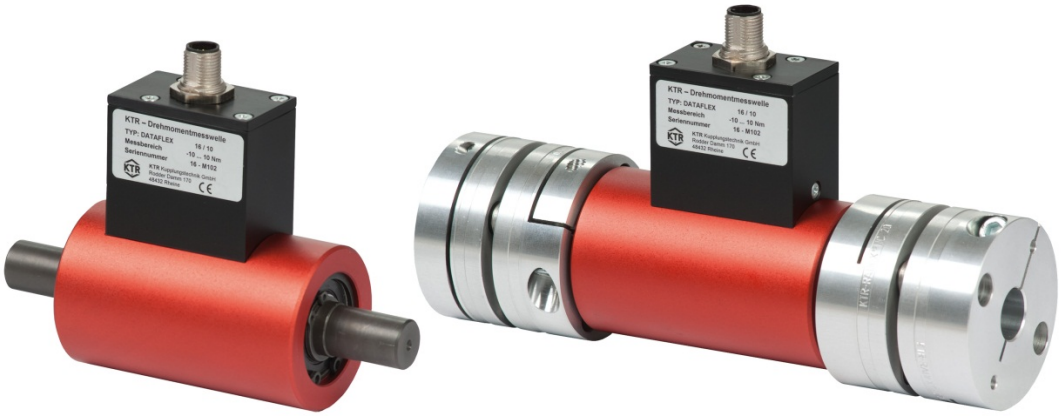
DATAFLEX®

Torque measuring shaft type 16/…



DATAFLEX® is a maintenance-free torque measuring shaft with integrated speed measurement. Combined with the steel lamina coupling **RADEX®-NC** the complete system forms a torsionally stiff, double-cardanic coupling with integrated measuring shaft.

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1 Technical data

DATAFLEX® torque measuring shaft

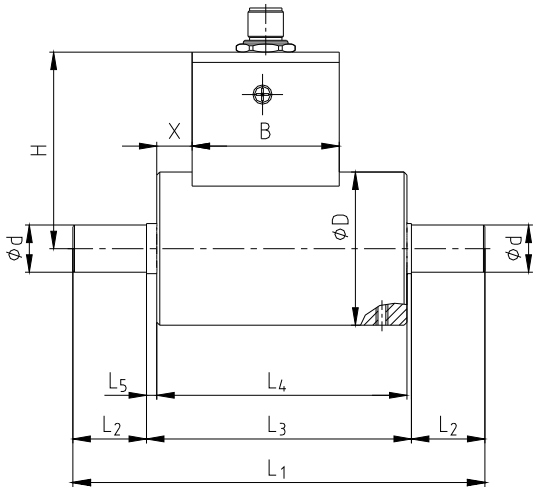


Illustration 1: DATAFLEX® torque measuring shaft

Table 1: Dimensions

DATAFLEX® type	Dimensions [mm]									
	d	D	L_1	L_2	L_3	L_4	L_5	H	B	X
16/10	16	52	140	25	90	85	3,5	67	50	12
16/30										
16/50										

Table 2: 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		
Influence of temperature [%/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 2)			
Number of impulses / revolution	360		
Amplitude [V]	24/5V		
DC speed output [V]	0 - 10		
Scale of direct voltage output	16 settings via micro switch		
Inaccuracy of DC output [%] 3)	± 0,2		
Direction signal [V]	24/5V		
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]	0,7		
Torsion spring stiffness C_T [Nm/rad]	910	2840	4100
Torsion angle with T_{KN} [degrees]	0,63	0,61	0,7
Mass moment of inertia [kgmm²]	22,6		
Max. speed [rpm]	10000		

1) Referring to rated torque T_{KN}
2) With connection housing DF2
3) Referring to measuring range value

1 Technical data

DATAFLEX® torque measuring shaft in combination with RADEX®-NC

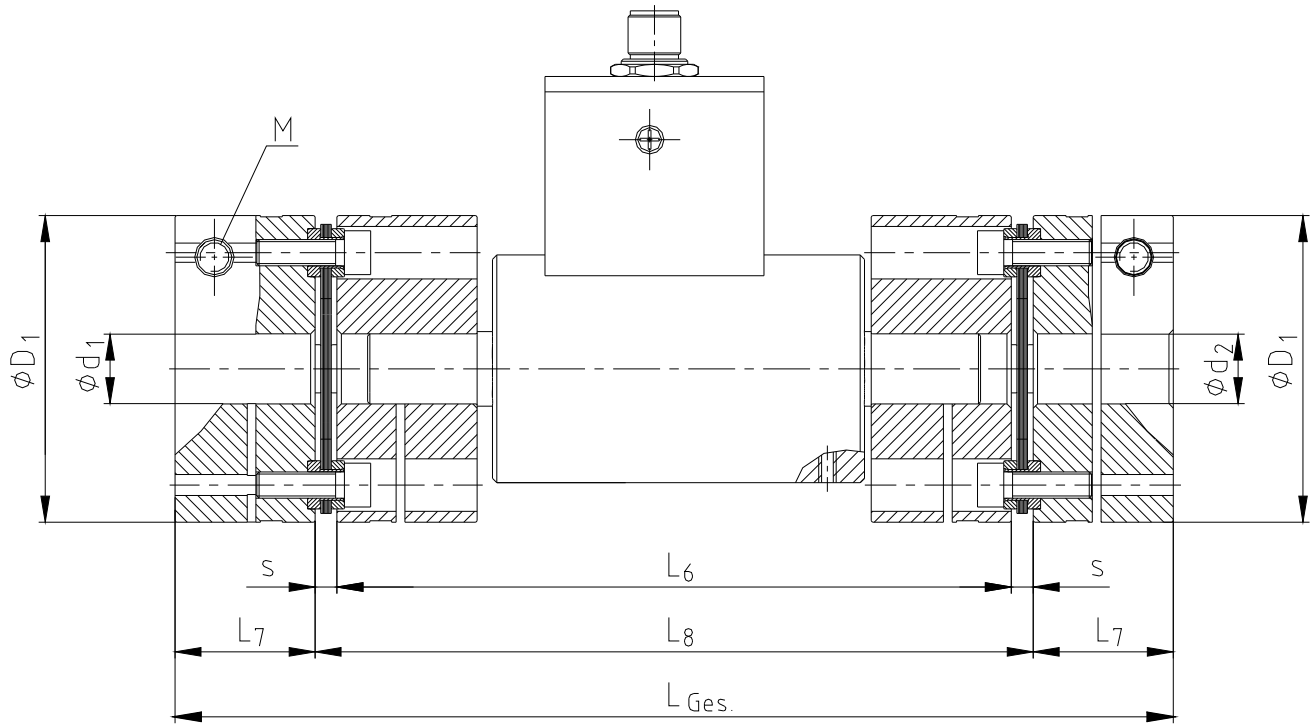


Illustration 2: DATAFLEX® with RADEX®-NC

Table 3: Dimensions 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	59	70	
Dimension L_6	138	154	
Dimension L_7	24	32	
Dimension L_8	146	164	
Dimension L_{Ges}	194	228	
Dimension s	4	5	
Clamping screw [mm]			
Dimension M	M6	M8	
Tightening torque T_A [Nm]	10	25	
Mechanical data of the combination (DATAFLEX® with RADEX®-NC)			
Mass moment of inertia [kgmm²]	177	416	
Torsion spring stiffness [Nm/rad]	860	2600	3600
Weight [kg]	1,30	1,75	1,75
Max. speed [rpm] 1)	7500		

1) Higher speeds on request; with high speeds please use coupling hubs balanced.

2 Advice

2.1 General advice

Please read through these assembly/operating instructions carefully before you start up the measuring shaft.
Please pay special attention to the safety instructions!
The mounting instructions are part of your product. Please keep them carefully and close to the measuring shaft.
The copyright for these mounting instructions remains with **KTR** Kupplungstechnik GmbH.

2.2 Safety and advice symbols

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.**

2.3 General hazard warnings

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 accidental switch-on. Please read through and observe the following safety instructions.

- All operations with and on the measuring shaft must be performed based on the idea of “Safety First”.
- Secure the measuring shaft and the disengaged drive before the operations are performed.
- Secure the drive system against accidental switch-on, 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 accidental contact. Use an appropriate cover or shield.

2.4 Intended use

You may only assemble, operate and maintain the measuring shaft if you

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

The measuring shaft can only be used in accordance with the technical data (see table 1 to 3). Unauthorized alterations to the measuring shaft are not allowed. We will not assume liability for any damage that may arise. In the interest of further development we reserve the right for technical modifications.
The **DATAFLEX® torque measuring shaft** described corresponds to the technical status at the time of printing these assembly instructions.

3 Storage

The **RADEX®-NC** couplings are supplied in preserved condition. Both **DATAFLEX®** and **RADEX®-NC** can be stored at a dry and covered place for 6 - 9 months.

C A U T I O N !
Humid storage rooms are not suitable.
Please make sure that condensation is not generated. The best relative air humidity is less than 65%.

4 Assembly

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.

4.1 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

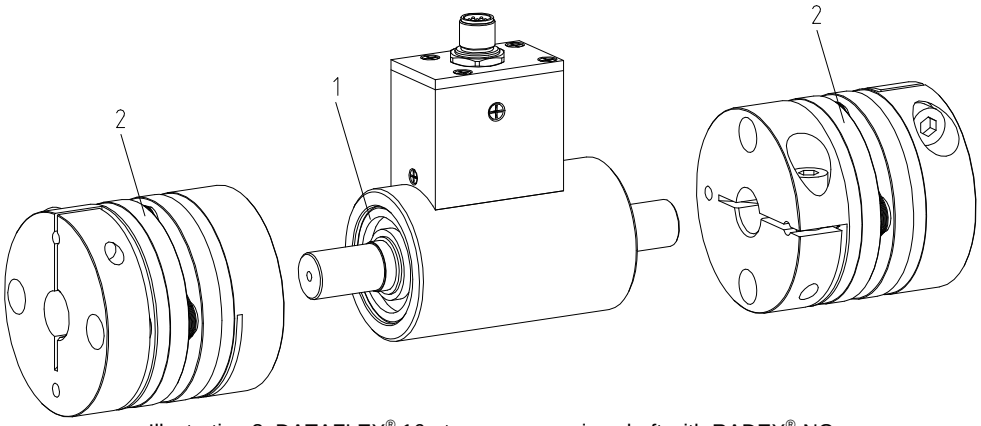


Illustration 3: DATAFLEX® 16 - torque measuring shaft with RADEX®-NC

4.2 Advice regarding finish bore

D A N G E R !
The maximum permissible bore diameters d_{1max} and d_{2max} (see RADEX®-NC catalogue) must not be exceeded. If these figures are disregarded, the coupling may tear. Rotating particles may cause danger to life.

- Clamping hub bores machined by the customer have to observe concentricity or axial runout, respectively (see illustration 4).
- Please make absolutely sure to observe the figures for Ø d_{1max} and Ø d_{2max}.
- Carefully align the clamping hubs when the finish bores are drilled.

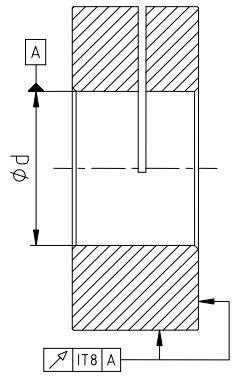


Illustration 4: concentricity and axial run-out

4 Assembly

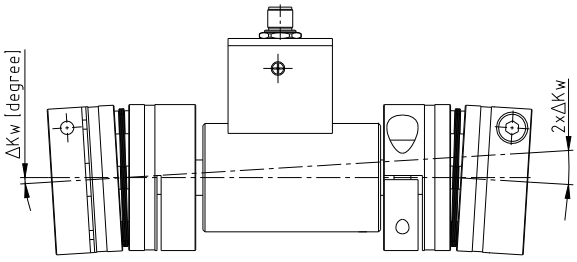
4.3 Displacements - alignment of the torque measuring shaft

The displacement figures shown in table 4 provide for sufficient safety to compensate for external influences like, for example, heat expansion or foundation settling.

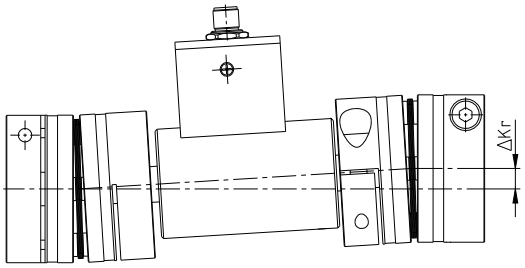
C A U T I O N !
I In order to ensure a long service life of the measuring shaft the shaft ends must be accurately aligned. The misalignment values given must be observed (see table 4). If these values are exceeded the measuring shaft with coupling will be damaged.

Please note:

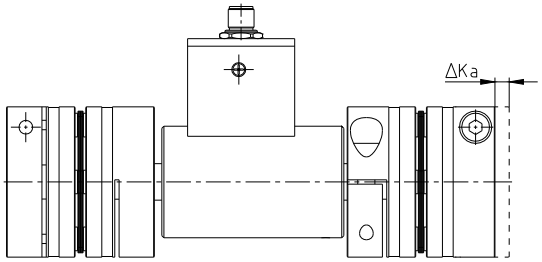
- The displacement figures given in table 4 are maximum values. They cannot occur at the same time. When radial, axial and angular displacement occurs simultaneously, these values must be reduced (see illustration 6).
- Please inspect with a dial gauge, ruler or feeler whether the permissible displacement figures of table 4 can be observed.



angular displacements



radial displacements



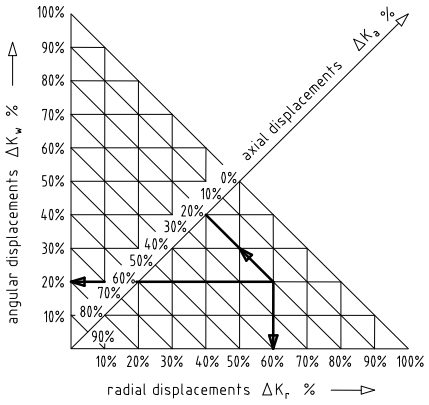
axial displacements

Illustration 5: displacements

Table 4: Displacement figures

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				

Illustration 6: combination of displacements



Examples for the displacement combinations given in illustration 6:

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

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

4 Assembly

4.4 Assembly of the hubs

A T T E N T I O N !
We recommend to inspect bores, shaft, keyway and feather key for dimensional accuracy before assembly.

4.5 Assembly of the RADEX®-NC on the DATAFLEX® torque measuring shaft

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

During assembly please pay attention to the following procedures:

- Please clean and degrease the contact surfaces of the hub bores and the shafts before assembly.

C A U T I O N !
Oil and grease with Molybdenum Disulfide or other hydrocarbons as well as grease paste should not be used.

- 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 illustration 7).
- Displace the drive and driven machine in axial direction until reaching the s and L_8 dimension. If the aggregates have already been fixed, adjust the s and L_8 dimension (see illustration 8) 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.

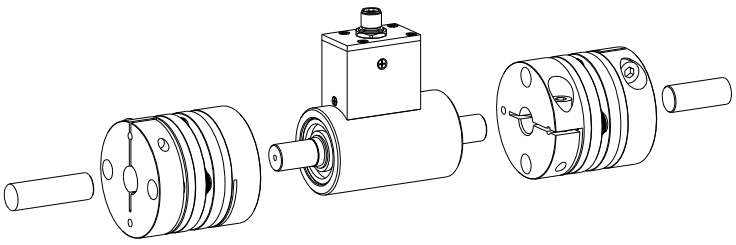


Illustration 7: assembly of the clamping hubs

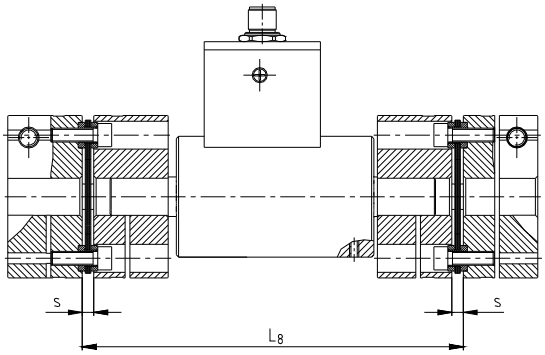


Illustration 8: adjusting to the dimension s and L_8

C A U T I O N !
During the assembly please make sure that the s and L_8 dimension (see table 3 and 6) 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 5.

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

4 Assembly

4.5 Assembly of the RADEX®-NC on the DATAFLEX® torque measuring shaft

Table 5:

Size DATAFLEX®	16/10	16/30	16/50
Size RADEX®-NC	20	25	
Clamping screw M	M6	M8	
Tightening torque T_A [Nm]	10	25	
Bore and transmittable torques of the clamping hubs [Nm]			
Ø12	35,8		
Ø13	36,5		
Ø14	37,1		
Ø15	37,8	81,7	
Ø16	**38,5**	**82,9**	
Ø17	39,2	84,2	
Ø18	39,8	85,4	
Ø19	40,5	86,6	
Ø20	41,2	87,9	
Ø21	41,9	89,1	
Ø22	42,5	90,3	
Ø23	43,2	91,6	

Size DATAFLEX®	16/10	16/30	16/50
Size RADEX®-NC	20	25	
Clamping screw M	M6	M8	
Tightening torque T_A [Nm]	10	25	
Bore and transmittable torques of the clamping hubs [Nm]			
Ø24	43,9	92,8	
Ø25	44,6	94,1	
Ø26		95,3	
Ø27		96,5	
Ø28		97,8	
Ø29		99,0	
Ø30		100,2	
Ø31		101,5	
Ø32		102,7	
Ø33		104,0	
Ø34		105,2	
Ø35		106,4	

4.6 Advice for assembly of the RADEX®-NC coupling

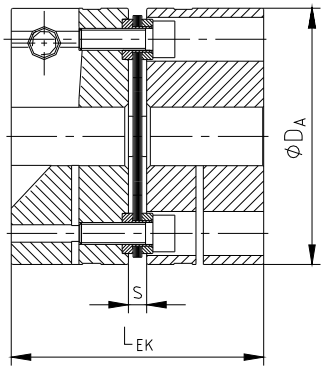


Illustration 9: assembly of the coupling

Table 6:

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 laminae package			
Screw size	M6	M6	
Tightening torque T_A [Nm]	10	14	

4.7 Advice for assembly of the DATAFLEX® torque measuring shaft

- **Fix the housing**

C A U T I O N !
The housing must be protected from 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 unit is supplied with a calibration sheet. We recommend an annual inspection of the calibration.

4 Assembly

4.8 Technical description

1. General description

The measuring shafts type DATAFLEX® 16 are provided with wire strain gauges (DMS). The torque signals are transmitted contactless internally.
In addition, a two-channel shaft encoder provides two speed signals shifted by 90 degrees. Each signal has 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 switched on when all of the connections have been properly connected. After it has been switched 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 has 12 screwed connections for power supply, display equipment and switches.
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 7).
The switch T1 serves for programming and can be bridged externally from GND via the terminal 12 (T1).

Table 7: 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.) TTL (5V, 360 pulses /rev.)
8	GND	Ground for pulse speed output	
9	N2	Speed output channel 2	HTL (24V, 360 pulses /rev.) TTL (5V, 360 pulses /rev.)
		Speed output DC-voltage	
1	R/L	Direction of rotation	HTL (24V, clockwise = 0) TTL (5V, clockwise = 0)
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
17	-	Switch for speed scaling	see table 11

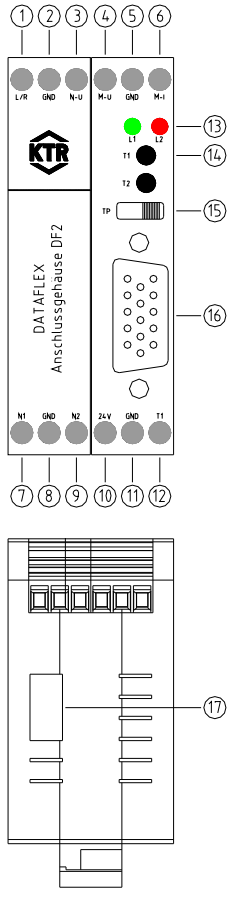


Illustration 10:
connection housing DF2

4 Assembly

4.8 Technical description

3. Description of connections

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

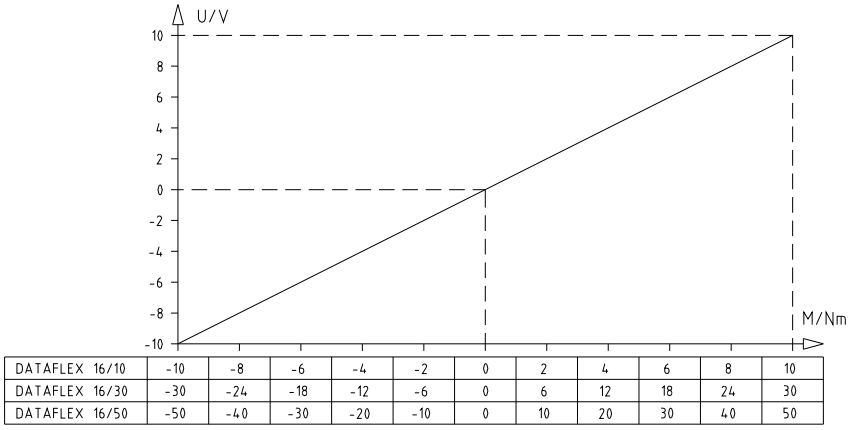
The supply voltage is 24 V ± 4 V direct current voltage (DC). The current consumption is 100 mA at the maximum.

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 8 shows the relation between torque and output voltage.

Table 8: Relation between torque - output values

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



DATAFLEX 16/10	-10	-8	-6	-4	-2	0	2	4	6	8	10
DATAFLEX 16/30	-30	-24	-18	-12	-6	0	6	12	18	24	30
DATAFLEX 16/50	-50	-40	-30	-20	-10	0	10	20	30	40	50

Illustration 11: relation between torque and output voltage

c) Low pass filter (No. 15)

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

Table 9: 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 illustration 12) inside the connection housing:

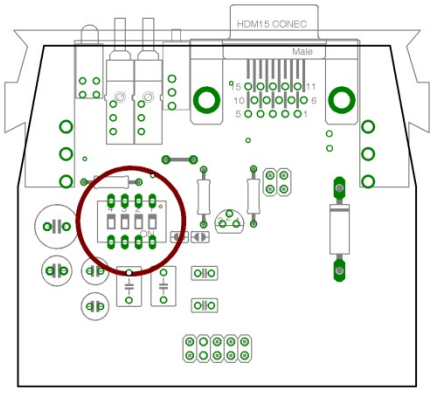


Illustration 12: position of DIP switch

4 Assembly

4.8 Technical description

Table 10: Adjustment of the requested filter frequency

Limit frequency [Hz]	Switch 4	Switch 3	Switch 2	Switch 1
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 pre-set.

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 shifted by 90 degrees (N1, N2)
- A scalable voltage output (N-U) with direction signal (R/L)

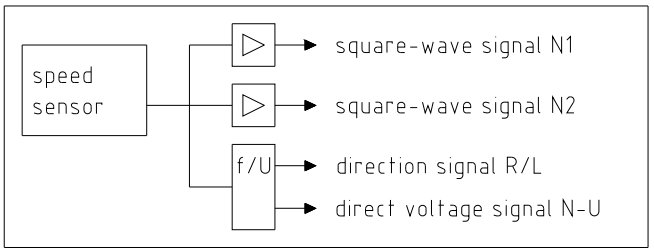


Illustration 13

Outputs N1 and N2

Each of the speed outputs N1 and N2 provide a square-wave signal with a resolution of 360 periods per revolution (illustration 14).

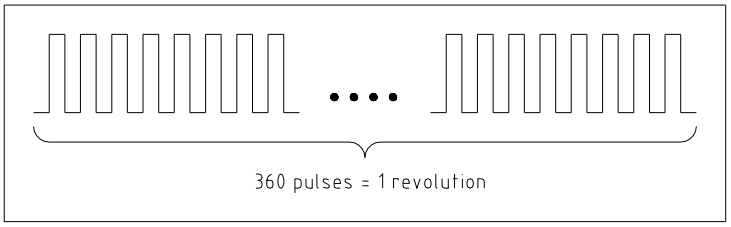
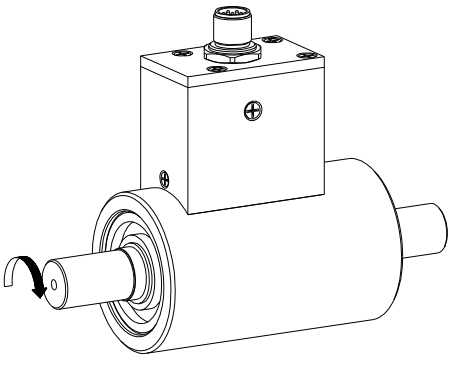


Illustration 14

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

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 (illustration 15).



clockwise

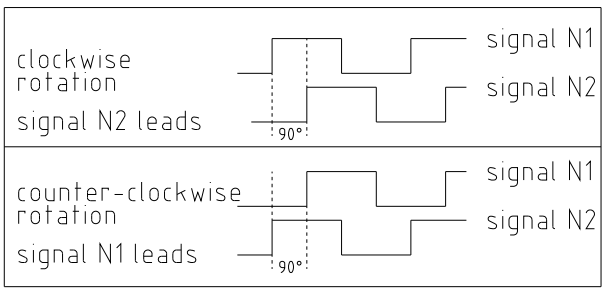


Illustration 15

4 Assembly

4.8 Technical description

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 30 mA. The output terminals must not be charged with an external voltage (see illustration 16).

The output voltage of speed lines and torsional direction line can be varied by modifying the jumper position in the connection housing to 5V level (see illustration 17).

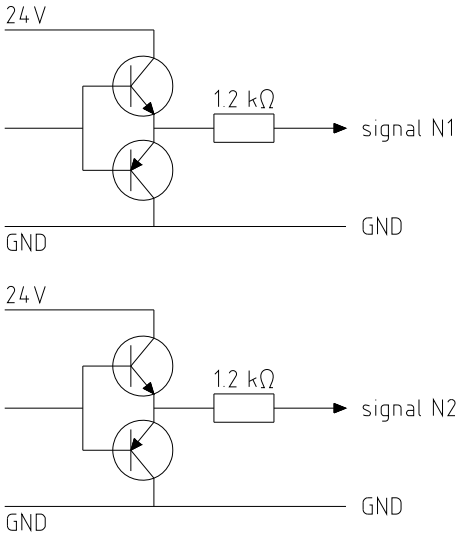
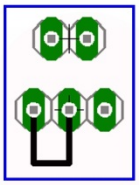
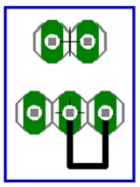


Illustration 16: output circuit of speed outputs

Outputs N1, N2, R/L = 24Vss:



Outputs N1, N2, R/L = 5Vss:



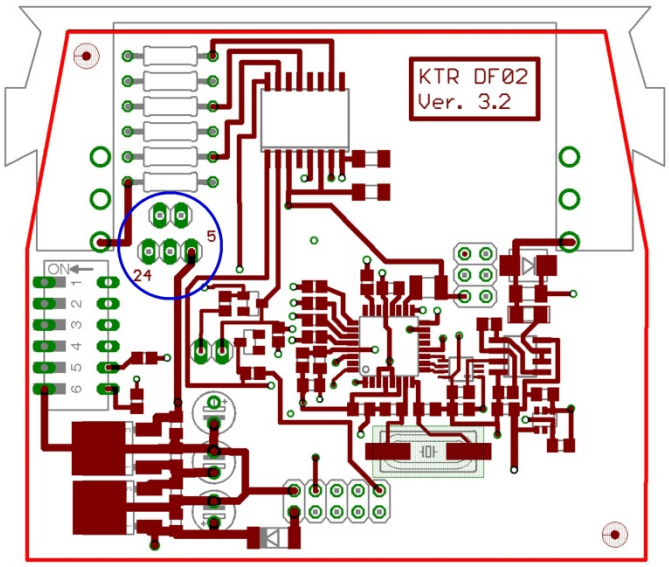


Illustration 17: modification of voltage level for the speed signal/direction signal

4 Assembly

4.8 Technical description

Outputs N-U and R/L

The KTR connection housing DF02 contains an integrated f/U converter. It converts the pulses of the encoder to a linear DC-voltage output (terminal N-U) and produces an additional signal for the rotational direction (terminal R/L).
On the bottom side of the connection housing DF02 there is a sixfold multiple switch allowing to adapt the scaling of the speed signal to the type of measuring shaft and the speed range (see illustration 10 and 18).

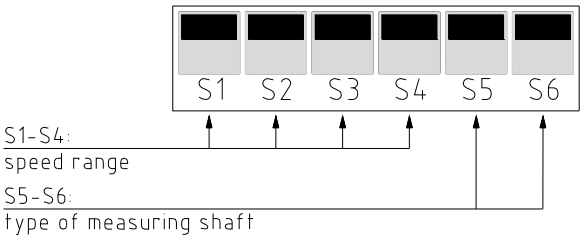


Illustration 18: switch positions

Scaling of the speed direct voltage output

Table 11: Switch position S1-S4 and the corresponding scale of the speed output N-U

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

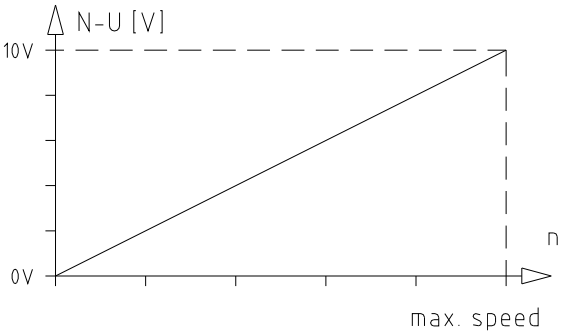


Illustration 19

Table 12: Selection of DATAFLEX® series

DATAFLEX® type	S5	S6
DATAFLEX® 22, 42, 85, 140	0	0
DATAFLEX® 16	1	1
DATAFLEX® 32	0	1

Table 13: Direction signal

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

The signal of the speed direction output R/L shows the rotational direction (see table 13).

* Switching between 5V 24V possible (see illustration 17 *Amendment of voltage level for the speed signal/direction signal)*

4 Assembly

4.8 Technical description

e) Control buttons and LEDs (No. 12 to 14 and illustration 20)

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 (illustration 21). The termination of the 15 seconds period is signalized by a short blinking of the LEDs of the connection housing.

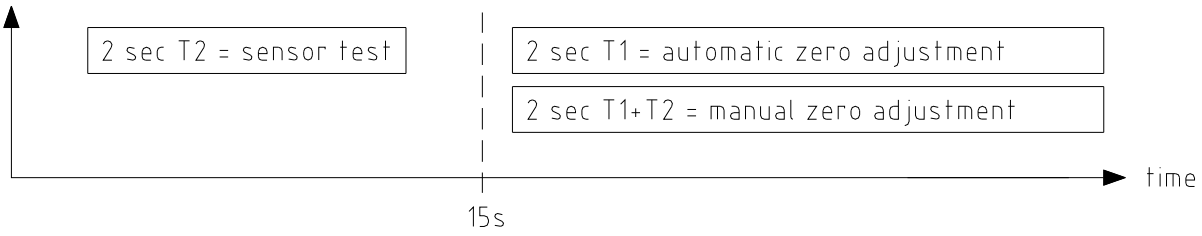


Illustration 20

Automatic offset adjustment (illustration 21)

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.

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.**

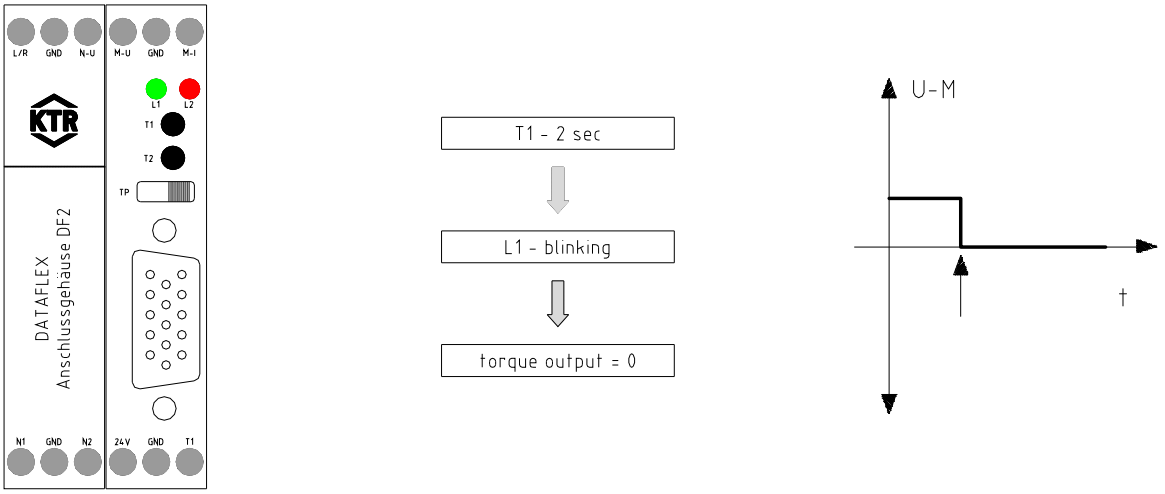


Illustration 21: automatic zero adjustment

4 Assembly

4.8 Technical description

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.**

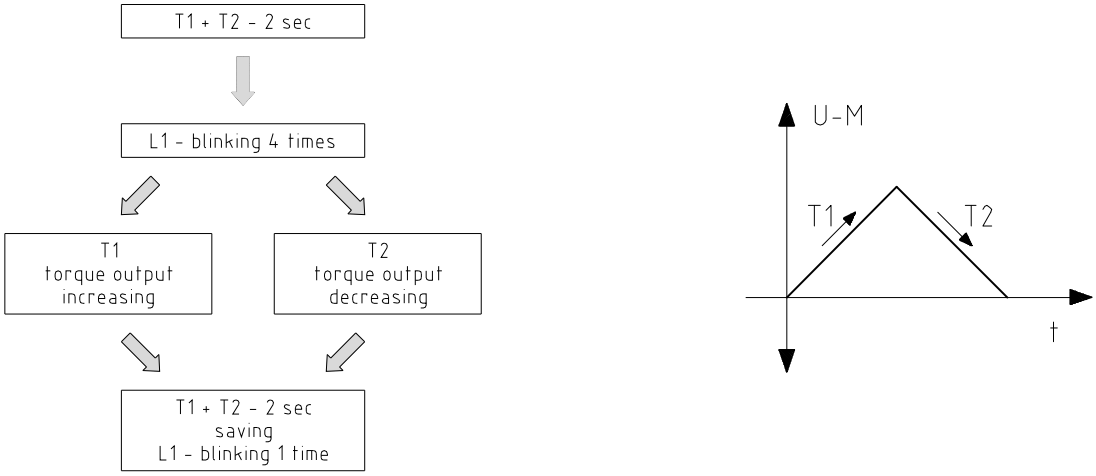


Illustration 22: manual zero adjustment

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.**

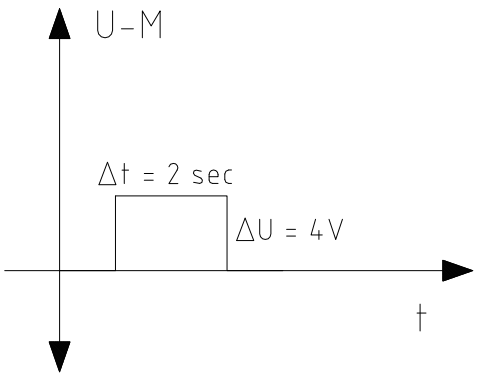


Illustration 23: sensor test

4 Assembly

4.9 Services, customer service addresses

If requested we are pleased to perform the calibration of your torque measuring shaft and other services.

Contact addresses of the KTR partners for spare parts and orders can be obtained from the KTR homepage at www.ktr.com.

A T T E N T I O N !
KTR does not assume any liability or warranty for the use of spare parts and accessories which are not provided by KTR and for the damages which may incur as a result.

5 EC certificate of conformity

EC Certificate of Conformity

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

torque measuring shaft DATAFLEX®

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

2004/108/EG council directive of 15 December 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility and repealing directive 89/336/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, City — 16.05.2012 Date

i. V. Reinhard Wibbeling, Engineering Manager

i. A. Jürgen Kösters, Product Manager