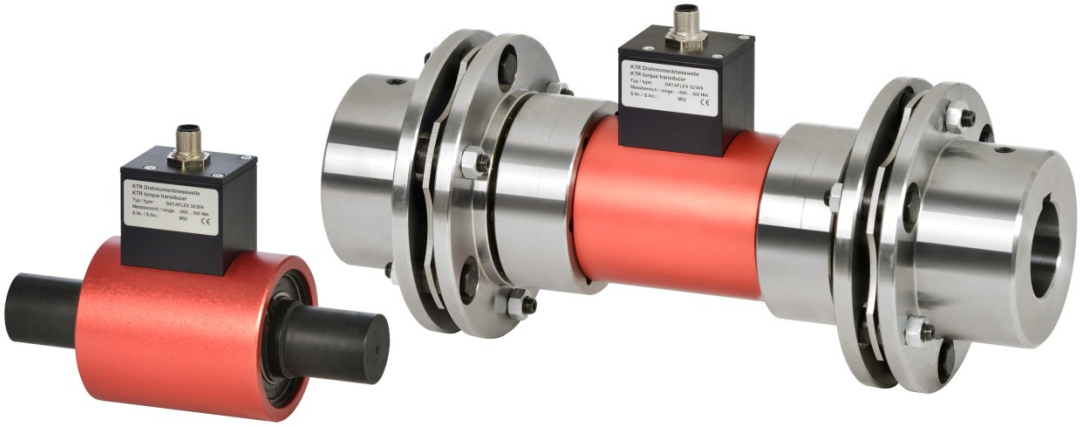
DATAFLEX®

Torque measuring shaft type 32/…



DATAFLEX® is a maintenance-free torque measuring shaft with integrated speed measurement. Combined with the steel lamina coupling **RADEX®-N** 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

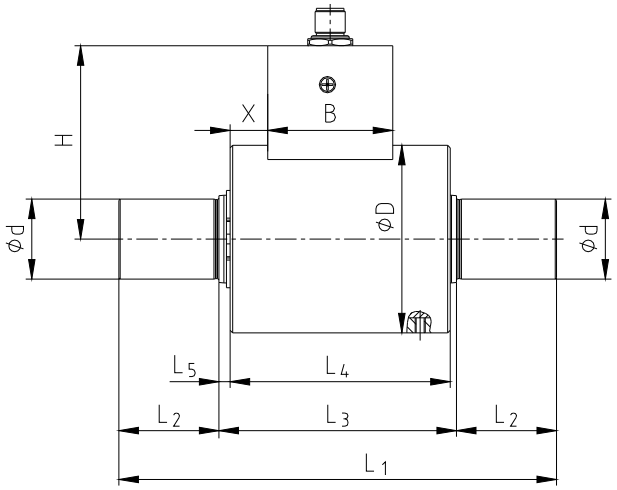


Illustration 1: DATAFLEX® torque measuring shaft

Table 1: Dimensions

DATAFLEX® type	Dimensions [mm]									
	d	D	L_1	L_2	L_3	L_4	L_5	H	B	X
32/100 32/300 32/500	32	75	175	40	95	88	4,5	77,3	50	15

Table 2: Technical data

Coupling size DATAFLEX®	32/100	32/300	32/500
Electrical data			
Nominal torque T_{KN} [Nm]	-100 .. +100 Nm	-300 .. +300 Nm	-500 .. +500 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	2x 720		
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]	11,0	32,0	53,0
Max. radial force [N]	110	320	530
Max. axial force [kN]	5,0	10,4	14,6
Weight [kg]	1,903	1,929	1,945
Torsion spring stiffness C_T [Nm/rad]	18000	46000	60000
Torsion angle with T_{KN} [degrees]	0,32	0,37	0,48
Mass moment of inertia [kgmm²]	219	221	224
Max. speed [rpm]	7500		

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®-N

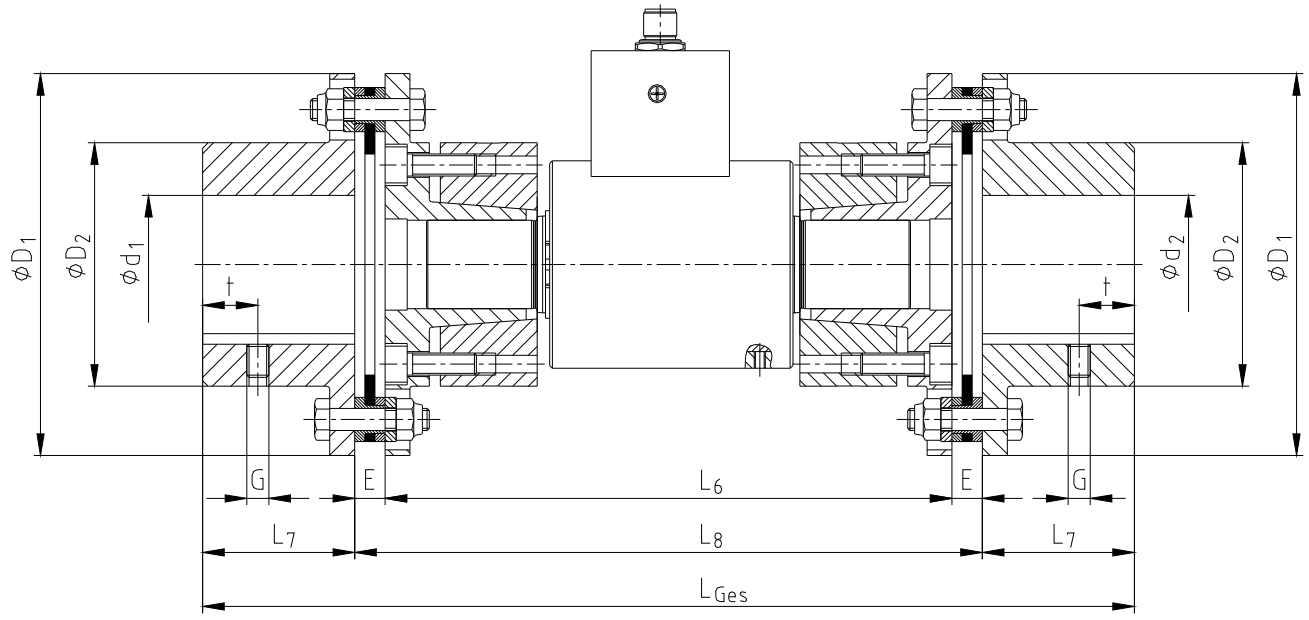


Illustration 2: DATAFLEX® with RADEX®-N

Table 3: Dimensions and technical data

Coupling size DATAFLEX®	32/100	32/300	32/500
Coupling size RADEX®-N	42	60	
Dimensions [mm]			
Dimension d_1 / d_2 max.	42	60	
Dimension D_1	104	138	
Dimension D_2	68	88	
Dimension L_6	185	205	
Dimension L_7	45	55	
Dimension L_8	205	227	
Dimension L_{Ges}	295	337	
Dimension E	10	11	
Setscrew [mm]			
Dimension G	M8		
Dimension t	20		
Tightening torque T_A [Nm]	10		
Mechanical data of the combination (DATAFLEX® with RADEX®-N)			
Mass moment of inertia [kgmm²]	5900	17900	
Torsion spring stiffness [Nm/rad]	16000	40000	49000
Weight [kg]	6,95	11,65	11,70
Max. speed [rpm] 1)	7500	6700	

1) higher speeds on request

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.

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 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 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®-N** couplings are supplied in preserved condition. Both **DATAFLEX®** and **RADEX®-N** 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®-N coupling

Component	Quantity	Designation
2	2	Flange hub
3	2	Lamina set
4	2	Clamping ring hub with clamping ring
5	2	Setscrew DIN EN ISO 4029

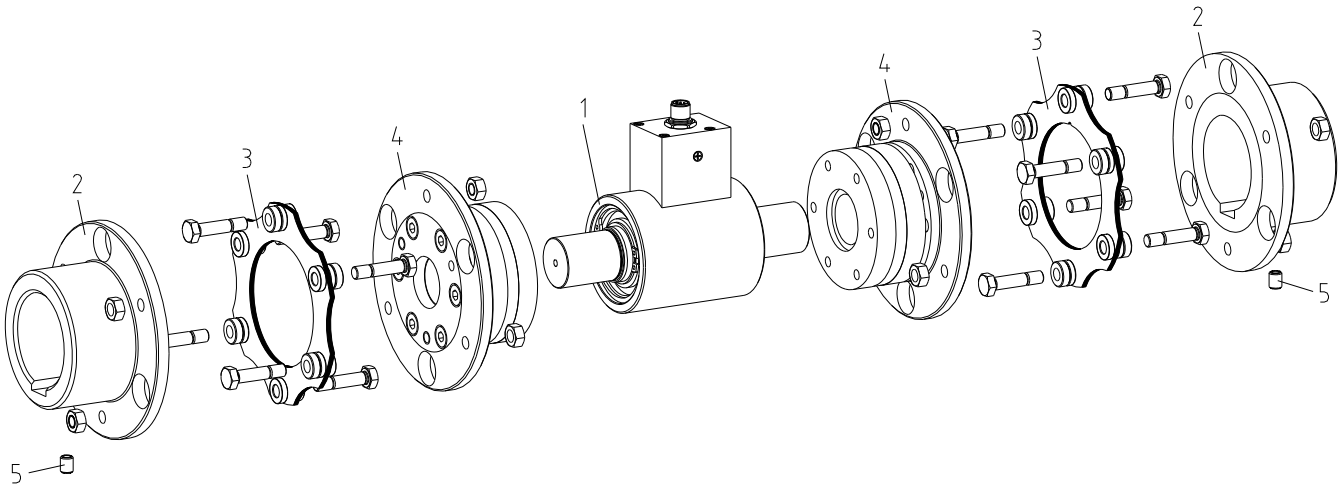


Illustration 3: DATAFLEX® 32 - torque measuring shaft with RADEX®-N

4 Assembly

4.2 Advice regarding finish bore

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

- 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 hubs when the finish bores are drilled.
- Please provide for a setscrew according to DIN EN ISO 4029 with cup point or an end plate for the axial fastening of the hubs.

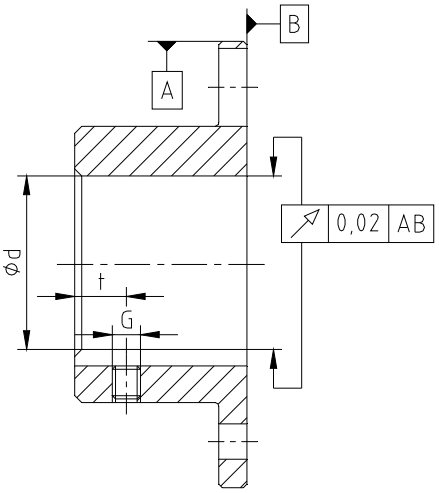


Illustration 4: concentricity and axial run-out

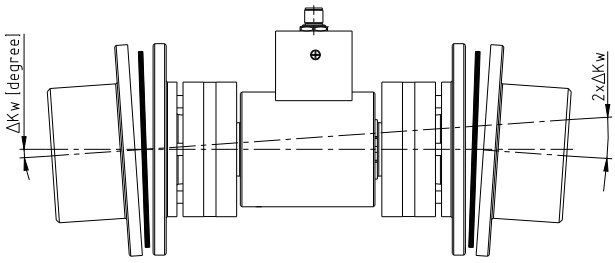
4.3 Displacements - alignment of the torque measuring shaft

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

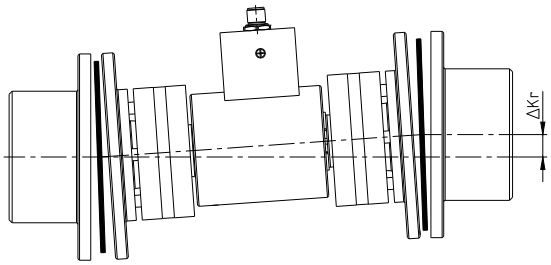
C A U T I O N !
In order to ensure a long service life of the measuring shaft the shaft ends must be accurately aligned. Please absolutely observe the displacement figures indicated (see table 4). If the figures are exceeded, the measuring shaft with coupling will be damaged.

Please note:

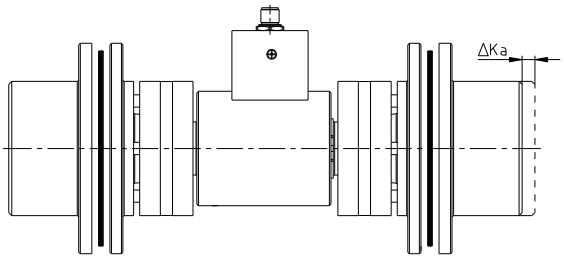
- The displacement figures given in table 4 are maximum values. They cannot occur at the same time. When radial, axial and angular displacement occurs simultaneously, these values must be reduced (see illustration 6).
- Please inspect with a dial gauge, ruler or feeler whether the permissible displacement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



angular displacements



radial displacements



axial displacements

Illustration 5: displacements

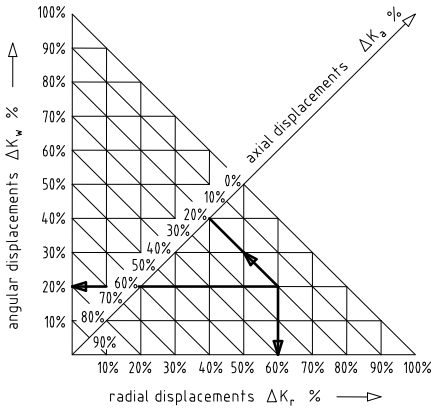
4 Assembly

4.3 Displacements - alignment of the torque measuring shaft

Table 4: Displacement figures

DATAFLEX® size	RADEX®-N size	Max. axial displacement ΔK_a [mm]	Max. radial displacement ΔK_r [mm]	Max. angular displacement ΔK_w [degree]
32/100	42	2,8	3,4	1,0 (each laminae package)
32/300	60	2,0	3,7	
32/500				

Illustration 6: combination of displacements



Examples for the displacement combinations given in illustration 6:

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

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

4.4 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®-N clamping ring hubs on the DATAFLEX® torque measuring shaft

The force is transmitted through a frictional connection. The fit for the shaft and clamping ring hub is H7/h6.

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.

- The clamping screws must be lightly unscrewed, the clamping ring hub should be placed on the shaft and adjusted to the L_6 dimension.
- The clamping screws must be tightened evenly crosswise. The tightening torques should be increased gradually. This procedure should be repeated until the tightening torque of all of the clamping screws corresponds to the value given in table 5.

4 Assembly

4.5 Assembly of the RADEX®-N clamping ring hubs on the DATAFLEX® torque measuring shaft

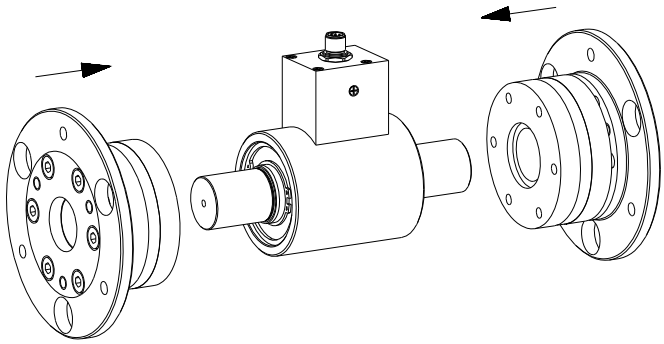


Illustration 7: assembly of the clamping ring hubs

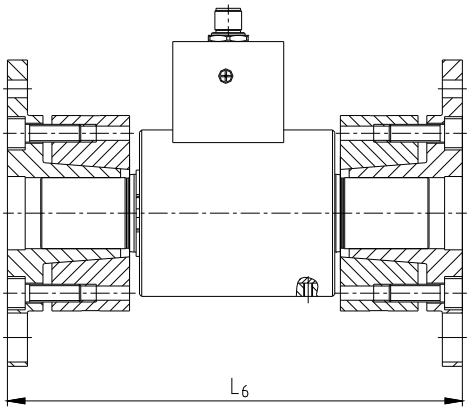


Illustration 8: adjusting to the L_6 dimension

Table 5: Tightening torque of the clamping screws

Coupling size DATAFLEX®	32/100	32/300	32/500
Coupling size RADEX®-N	42	60	
Screw size	M6	M8	
Tightening torque T_A [Nm]	14	35	
Transmittable torque [Nm] 1) (frictional torque)	394	598	

1) H7/h6 shaft/hub fit

4.6 Assembly of the hubs on driving and driven side

- Assemble the hubs on the shafts of the driven and driving side (illustration 9). The ends of the shafts must not protrude through the hubs.
- Move the units in axial direction until the dimension L_8 is achieved.
- If the unit is fixed move the hubs on the shaft to achieve the L_8 dimension.

A T T E N T I O N !
On request the hubs can be machined for a set screw to secure the hubs in axial direction. Please mention this request in your order.

C A U T I O N !
During assembly please make sure the correct L_8 is observed (table 3). If this is not done the measuring shaft (coupling) can be damaged.

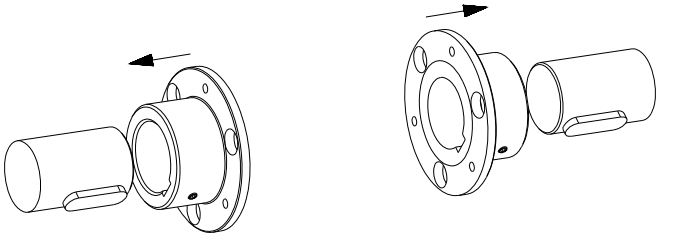


Illustration 9: assembly of the driven and driving side hubs

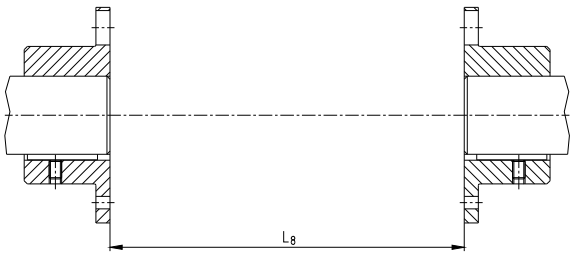


Illustration 10: adjusting to the L_8 dimension

4 Assembly

4.7 Assembly of the lamina sets

C A U T I O N !
During assembly it is important that the lamina sets are assembled free from distortion in axial direction. If this is not done the coupling can be damaged.

- Insert the lamina sets and the DATAFLEX® measuring shaft.
- Screw the components hand-tight for the time being, while the fitting screws have to be mounted offset from left to right (see illustration 11).
- Tighten the fitting screws to the tightening torques mentioned in table 6 by means of a torque key.

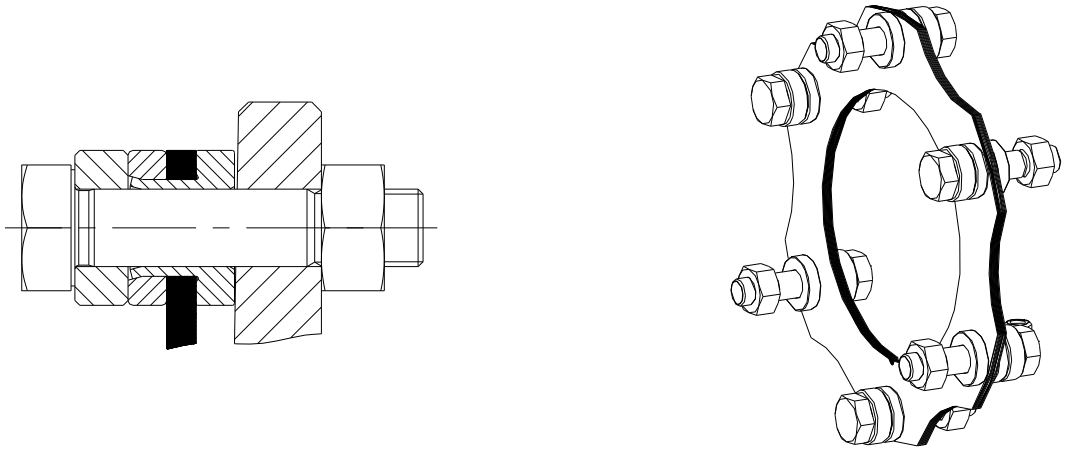


Illustration 11: assembly of the lamina sets

4.8 Tightening torque of the fitting screws

The fitting screws have to be tightened to the tightening torques T_A mentioned in table 6.

Table 6: Tightening torque of the fitting screws

Coupling size DATAFLEX®	32/100	32/300	32/500
Coupling size RADEX®-N	42	60	
Screw size	M8	M8	
Tightening torque T_A [Nm]	35	33	

C A U T I O N !
After the coupling has been put into operation the tightening torque of the fitting screws should be checked during normal maintenance intervals.

4 Assembly

4.9 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 32 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.

4.10 Technical description

1. General description

The measuring shafts type DATAFLEX® 32 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 720 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.

4 Assembly

4.10 Technical description

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, 720 pulses /rev.) TTL (5V, 720 pulses /rev.)
8	GND	Ground for pulse speed output	
9	N2	Speed output channel 2	HTL (24V, 720 pulses /rev.) TTL (5V, 720 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

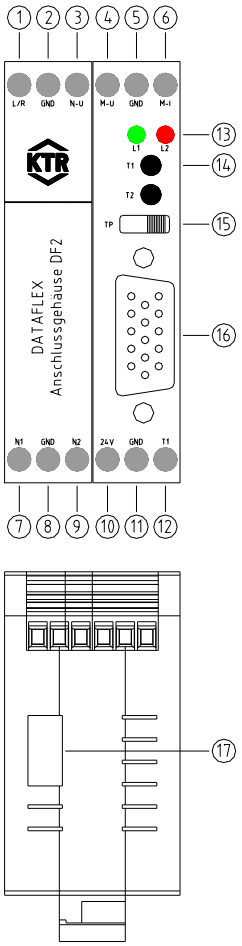


Illustration 12:
connection housing DF2

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.

4 Assembly

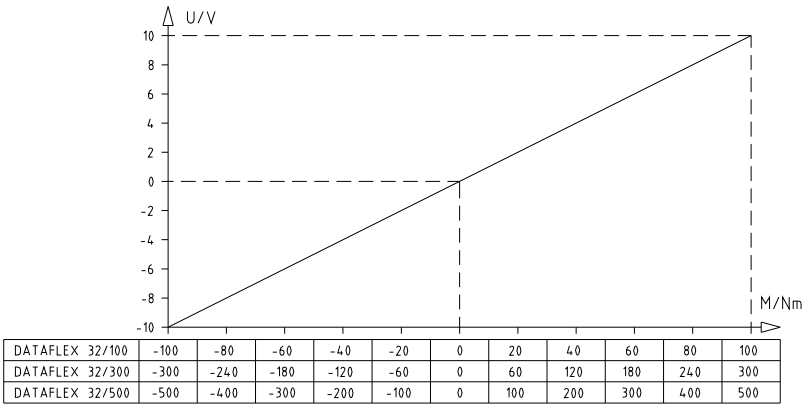
4.10 Technical description

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
32/100	10 Nm / V
32/300	30 Nm / V
32/500	50 Nm / V



DATAFLEX 32/100	-100	-80	-60	-40	-20	0	20	40	60	80	100
DATAFLEX 32/300	-300	-240	-180	-120	-60	0	60	120	180	240	300
DATAFLEX 32/500	-500	-400	-300	-200	-100	0	100	200	300	400	500

Illustration 13: 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 14) inside the connection housing:

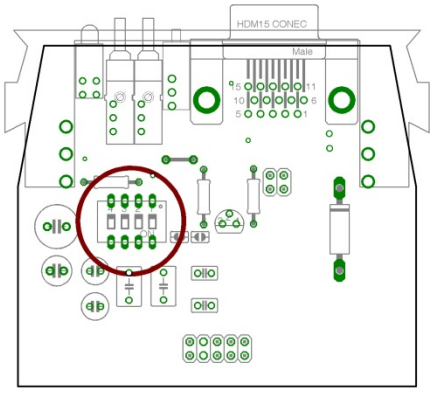


Illustration 14: position of DIP switch

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.

4 Assembly

4.10 Technical description

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)

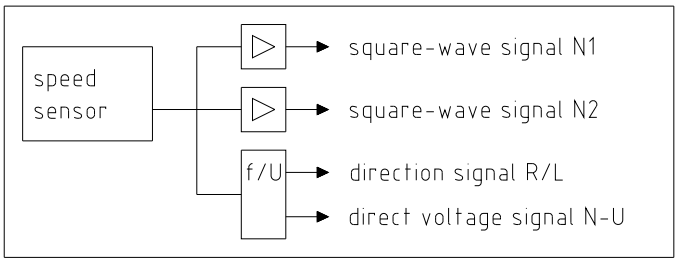


Illustration 15

Outputs N1 and N2

Each of the speed outputs N1 and N2 provide a square-wave signal with a resolution of 720 periods per revolution (illustration 16).

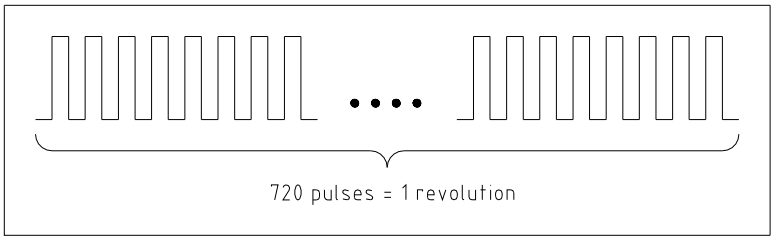
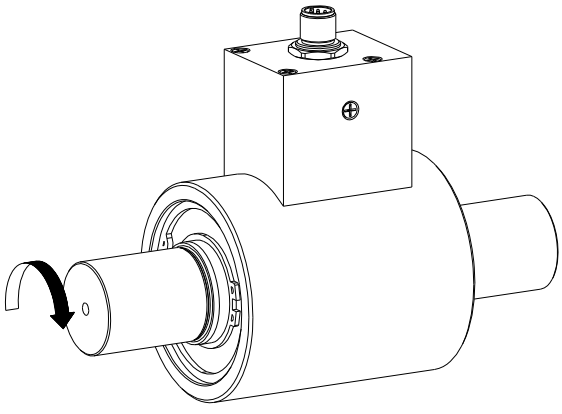


Illustration 16

The speed is calculated as follows: **N [1/min] = f [Hz] / 12**

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 17).



clockwise

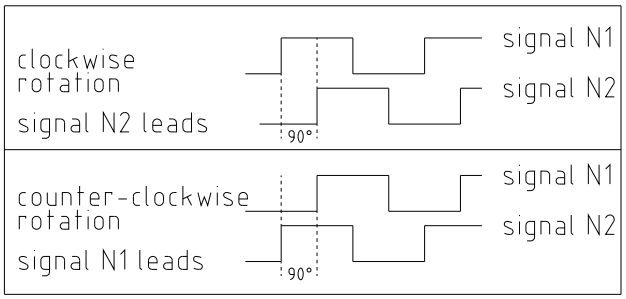


Illustration 17

4 Assembly

4.10 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 18).

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 19).

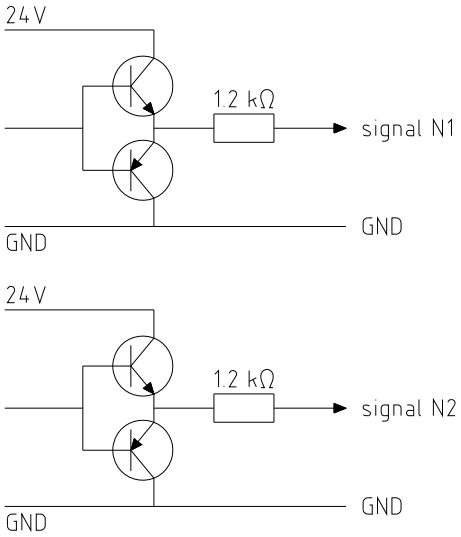
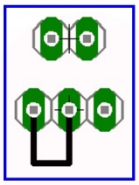
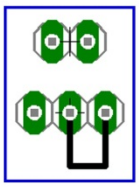


Illustration 18: output circuit of speed outputs

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



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



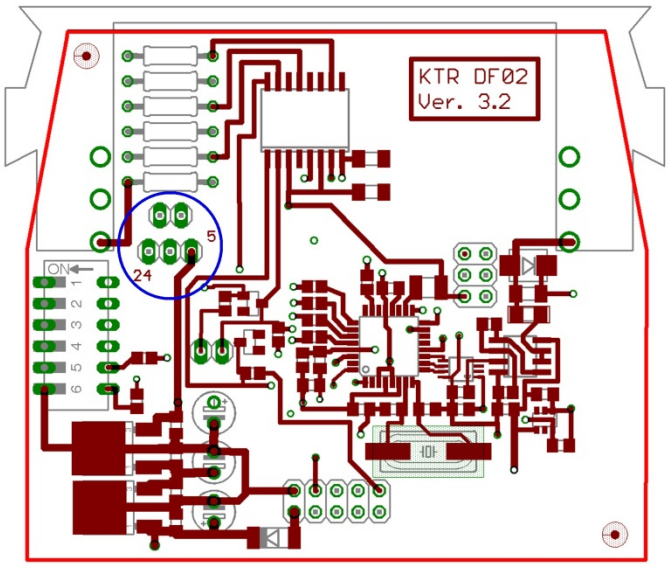


Illustration 19: modification of voltage level for the speed signal/direction signal

4 Assembly

4.10 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 12 and 20).

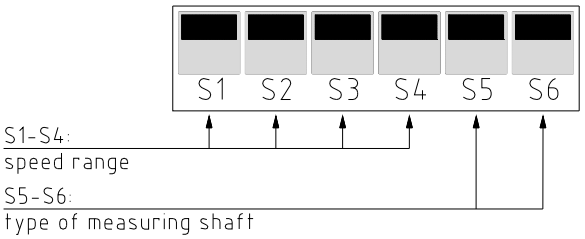


Illustration 20: switch positions

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

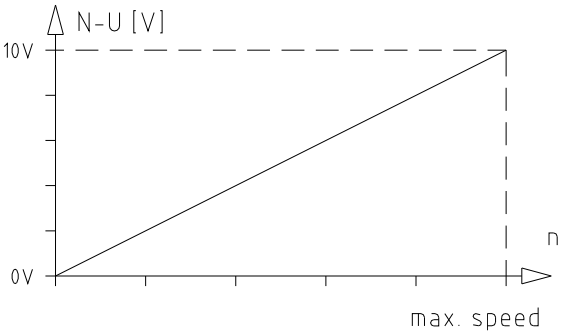


Illustration 21

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 19 *Amendment of voltage level for the speed signal/direction signal)*

4 Assembly

4.10 Technical description

e) Control buttons and LEDs (No. 12 to 14 and illustration 22)

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

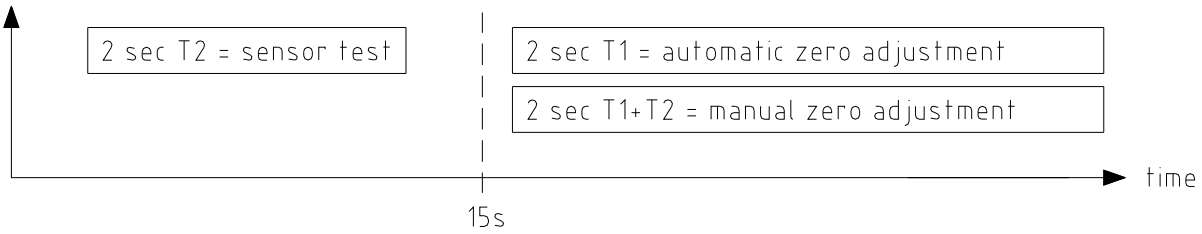


Illustration 22

Automatic offset adjustment (illustration 23)

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.**

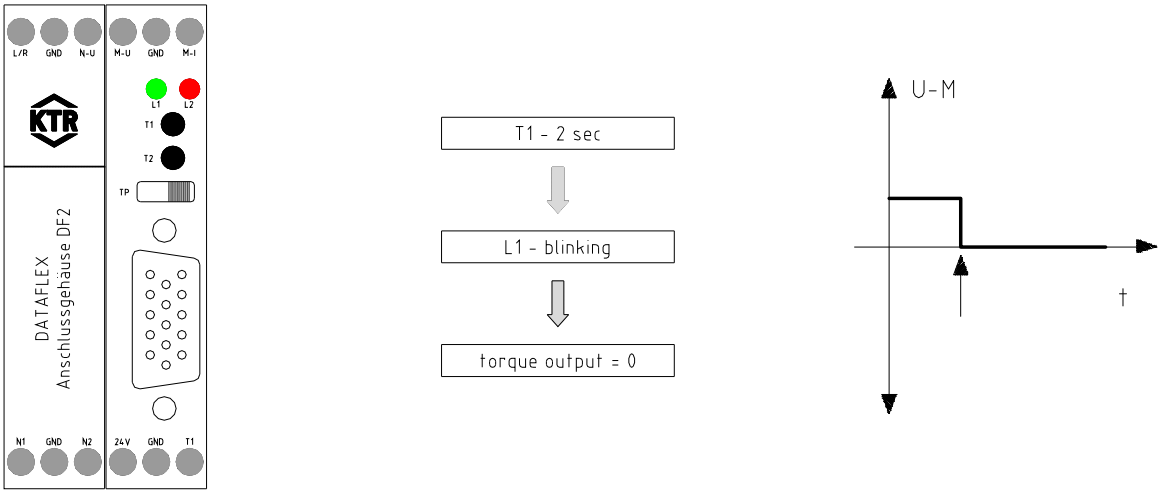


Illustration 23: automatic zero adjustment

4 Assembly

4.10 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.**

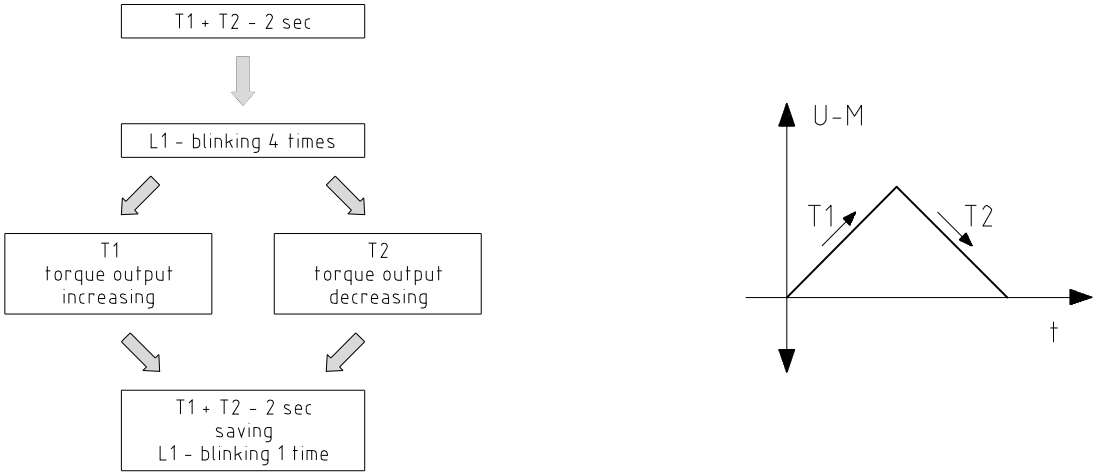


Illustration 24: manual zero adjustment

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.**

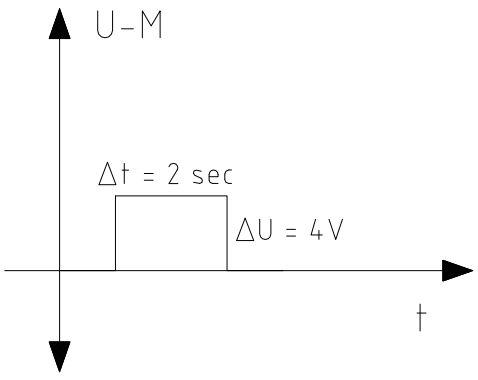


Illustration 25: sensor test

4 Assembly

4.11 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 — 07.02.2013 Date

i. V. Reinhard Wibbeling, Engineering Manager

i. A. Jürgen Kösters, Product Manager