DATAFLEX®

Torque measuring shaft type 110/…
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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DATAFLEX® torque measuring shaft

Table 1: Dimensions

<table>
<thead>
<tr>
<th>DATAFLEX® type</th>
<th>d [mm]</th>
<th>D [mm]</th>
<th>L₁ [mm]</th>
<th>L₂ [mm]</th>
<th>L₃ [mm]</th>
<th>L₄ [mm]</th>
<th>L₅ [mm]</th>
<th>H [mm]</th>
<th>B [mm]</th>
<th>X [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>110/10000</td>
<td>110</td>
<td>196</td>
<td>393</td>
<td>120</td>
<td>153</td>
<td>138</td>
<td>7.5</td>
<td>141.4</td>
<td>50</td>
<td>34</td>
</tr>
<tr>
<td>110/20000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Technical data

<table>
<thead>
<tr>
<th>Coupling size of DATAFLEX®</th>
<th>110/10000</th>
<th>110/20000</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Electrical data</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated torque $T_{KN}$ [Nm]</td>
<td>-10000 .. +10000 Nm</td>
<td>-20000 .. +20000 Nm</td>
</tr>
<tr>
<td>Band width of torque signal [KHz] (-3dB)</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Error in linearity incl. hysteresis [%]</td>
<td>&lt; 0.1</td>
<td></td>
</tr>
<tr>
<td>Influence of temperature [%/10K]</td>
<td>0.05</td>
<td></td>
</tr>
<tr>
<td>Nominal temperature range [°C]</td>
<td>0 - 55</td>
<td></td>
</tr>
<tr>
<td>Supply voltage [V] DC</td>
<td>24 ± 4</td>
<td></td>
</tr>
<tr>
<td>Max. current consumption [mA]</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

**Torque output**

Output voltage torque [V] | -10 .. +10 |

**Speed output**

Number of pulses / revolutions | 2 x 720 |
Amplitude [V] | 5/24 |
DC voltage output [V] | 0 - 10 |
Scale of DC voltage output | 16fold via micro switch |
Inaccuracy of DC voltage output [%] | ± 0.2 |
Direction signal [V] | 5/24 |

**Mechanical data**

Static load limit $T_{Kmax}$/ [%] | 150 |
Breaking load $T_{Kbreak}$/ [%] | 300 |
Max. bending torque [Nm] | 1033 | 2037 |
Max. radial force [N] | 4700 | 9300 |
Max. axial force [kN] | 106 | 166 |
Weight [kg] | 35.72 | 36.20 |
Torsion spring stiffness $C_T$/ [Nm/rad] | 2270000 | 3550000 |
Torsion angle with $T_{Kn}$ [degrees] | 0.25 | 0.32 |
Mass moment of inertia [kgmm²] | 0.0562 | 0.0569 |
Max. speed [rpm] | 3000 |

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

Please observe protection note ISO 16016.
DATAFLEX® torque measuring shaft in combination with RADEX®-N

Table 3: Dimensions and technical data

<table>
<thead>
<tr>
<th>Coupling size of DATAFLEX®</th>
<th>110/10000</th>
<th>110/20000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coupling size of RADEX®-N</td>
<td>135</td>
<td>156</td>
</tr>
<tr>
<td>Dimensions [mm]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dimension d₁ / d₂ max.</td>
<td>135</td>
<td>150</td>
</tr>
<tr>
<td>Dimension D₁</td>
<td>305</td>
<td>325</td>
</tr>
<tr>
<td>Dimension D₂</td>
<td>184</td>
<td>195</td>
</tr>
<tr>
<td>Dimension L₆</td>
<td>423</td>
<td></td>
</tr>
<tr>
<td>Dimension L₇</td>
<td>135</td>
<td>150</td>
</tr>
<tr>
<td>Dimension L₈</td>
<td>477</td>
<td></td>
</tr>
<tr>
<td>Dimension L₉</td>
<td>747</td>
<td></td>
</tr>
<tr>
<td>Dimension E</td>
<td>27</td>
<td>27</td>
</tr>
<tr>
<td>Setscrew [mm]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dimension G</td>
<td>M20</td>
<td>2 x M12</td>
</tr>
<tr>
<td>Dimension t</td>
<td>40</td>
<td>30 / 70</td>
</tr>
<tr>
<td>Tightening torque Tₐ [Nm]</td>
<td>140</td>
<td>40</td>
</tr>
<tr>
<td>Mass moment of inertia [kgmm²]</td>
<td>1.04</td>
<td>1.39</td>
</tr>
<tr>
<td>Torsion spring stiffness [Nm/rad]</td>
<td>1.28 x 10⁶</td>
<td>2.22 x 10⁶</td>
</tr>
<tr>
<td>Weight [kg]</td>
<td>134.2</td>
<td>158.4</td>
</tr>
<tr>
<td>Max. speed [rpm]</td>
<td>3000</td>
<td>3000</td>
</tr>
</tbody>
</table>

1) Higher speeds on request.
Advice

2.1 General advice

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

2.2 Safety and advice symbols

**Warning of potentially explosive atmospheres**
This symbol indicates notes which may contribute to preventing bodily injuries or serious bodily injuries that may result in death caused by explosion.

**Warning of personal injury**
This symbol indicates notes which may contribute to preventing bodily injuries or serious bodily injuries that may result in death.

**Warning of product damages**
This symbol indicates notes which may contribute to preventing material or machine damage.

**General advice**
This symbol indicates notes which may contribute to preventing adverse results or conditions.

2.3 General hazard warnings

With assembly, operation and maintenance of the measuring shaft it has to be made sure that the entire drive train is secured against accidental switch-on. You may be seriously hurt by rotating parts. Please make absolutely sure to read through and observe the following safety indications.

- All operations on and with the measuring shaft have to be performed taking into account "safety first".
- Please make sure to switch off the power pack before you perform your work on the measuring shaft.
- Secure the power pack against accidental switch-on, e. g. by providing warning signs at the place of switch-on or removing the fuse for current supply.
- Do not reach into the operation area of the measuring shaft as long as it is in operation.
- Secure the rotating components of the measuring shaft against accidental contact. Please provide for the necessary protection devices and covers.
2 Advice

2.4 Intended use

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

- have carefully read through the operating/assembly instructions and understood them
- had technical training
- are authorized by your company

The measuring shaft may only be used in accordance with the technical data (see chapter 1). Unauthorized modifications on the measuring shaft are not admissible. 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 in here corresponds to the technical status at the time of printing of these operating/assembly instructions.

3 Storage, transport and packaging

3.1 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.

Humid storage rooms are not suitable.
Please make sure that condensation is not generated. The best relative air humidity is less than 65 %.

3.2 Transport and packaging

In order to avoid any injuries and any kind of damage please always make use of proper transport and lifting equipment.

The couplings are packed differently each depending on size, number and kind of transport. Unless otherwise contractually agreed, packaging will follow the in-house packaging specifications of KTR.
The measuring shaft and the couplings are supplied as single pre-assembled component assemblies. Before assembly the measuring shaft has to be inspected for completeness. The mounting position of DATAFLEX® is variable. The measurement system can be mounted both horizontally and vertically.

### Components of DATAFLEX® torque measuring shaft

<table>
<thead>
<tr>
<th>Component</th>
<th>Quantity</th>
<th>Component assembly</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>DATAFLEX® torque measuring shaft</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Component</th>
<th>Quantity</th>
<th>Component assembly</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>2</td>
<td>Flange hub</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>Lamina set</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>Clamping ring hub with</td>
</tr>
<tr>
<td></td>
<td></td>
<td>clamping ring</td>
</tr>
<tr>
<td>5</td>
<td>2</td>
<td>Setscrew DIN EN ISO 4029</td>
</tr>
</tbody>
</table>

Illustration 3: DATAFLEX® 110 torque measuring shaft with RADEX®-N

Please consider our operating/assembly instructions KTR-N 47110 additionally when using the RADEX®-N coupling.
4 Assembly

4.2 Advice for finish bore

The maximum permissible bore diameters \( d_{1\text{max}} \) and \( d_{2\text{max}} \) (see RADEX\textsuperscript{®}-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 \( \Theta d_{1\text{max}} \) and \( \Theta d_{2\text{max}} \).
- Carefully align the hubs when the finish bores are drilled.
- Please provide for a setscrew according to DIN EN ISO 4029 with a cup point or an end plate to fasten the hubs axially.

4.3 Displacements - alignment of the torque measuring shaft

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

\[ \text{!} \]

In order to ensure a long service life of the measuring shaft, the shaft ends have to be accurately aligned. Please absolutely observe the displacement figures specified (see table 4). If the figures are exceeded, the measuring shaft with coupling will be damaged.

Please note:

- The displacement figures specified in table 4 are maximum figures which must not arise in parallel. If radial, axial and angular displacement arises at the same time, these values must be reduced (see illustration 6).
- Please inspect with a dial gauge, ruler or feeler gauge whether the permissible displacement figures specified in table 4 can be observed.
4 Assembly

4.3 Displacements - alignment of the torque measuring shaft

Table 4: Displacement figures

<table>
<thead>
<tr>
<th>DATAFLEX® size</th>
<th>RADEX®-N size</th>
<th>Max. axial displacement $\Delta K_a$ [mm]</th>
<th>Max. radial displacement $\Delta K_r$ [mm]</th>
<th>Max. angular displacement $\Delta K_w$ [degree]</th>
</tr>
</thead>
<tbody>
<tr>
<td>110/10000</td>
<td>135</td>
<td>3.5</td>
<td>7.8</td>
<td>1.0</td>
</tr>
<tr>
<td>110/20000</td>
<td>156</td>
<td>4.2</td>
<td>5.8</td>
<td>0.7</td>
</tr>
</tbody>
</table>

1) each lamina set

Examples of the displacement combinations specified in illustration 6:

Example:

$\Delta K_w = 60\%$

$\Delta K_a = 20\%$

$\Delta K_r = 20\%$

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

4.4 Assembly of the hubs

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 power transmission is frictionally engaged. Fit pair of shaft-clamping ring hub is specified with H7/h6.

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

Applying for RADEX®-N 135 only:

Oils and greases containing molybdenum disulfide or other high-pressure additives as well as internal lubricants must not be used.

Applying for RADEX®-N 156 only:

Do not lubricate taper surfaces of the clamping ring hubs with initial assembly, since the components are coated with lubricant when being supplied. For re-lubrication, for example after disassembly, please use the multi-purpose fat Molykote G Rapid plus. Only use thin-fluid oil for the threads of the clamping screws.

- Lightly unscrew the clamping screws, shift the clamping ring hub onto the shaft of the measuring shaft and align to dimension $L_6$.
- Tighten the clamping screws evenly crosswise. Increase the tightening torque stepwise. Repeat this process until the tightening torque specified in table 5 has been achieved with all clamping screws.

Applying for RADEX®-N 156 only:

No gap allowed between hub and clamping ring after tightening of all clamping screws (see illustration 8).
4.5 Assembly of the RADEX®-N clamping ring hubs on the DATAFLEX® torque measuring shaft

Illustration 7: Assembly of clamping ring hubs

Illustration 8: Adjusting to dimension L₈

Table 5: Tightening torques of clamping screws

<table>
<thead>
<tr>
<th>Coupling size of DATAFLEX®</th>
<th>110/10000</th>
<th>110/20000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coupling size of RADEX®-N</td>
<td>135</td>
<td>156</td>
</tr>
<tr>
<td>Screw size</td>
<td>M16</td>
<td>M16</td>
</tr>
<tr>
<td>Tightening torque Tₐ [Nm]</td>
<td>295</td>
<td>295</td>
</tr>
<tr>
<td>Transmittable torque [Nm]</td>
<td>24800</td>
<td>30000</td>
</tr>
</tbody>
</table>

1) H7/h6 shaft/hub fit

4.6 Assembly of hubs on the driving and driven side

- Mount the hubs on the shaft of driving and driven side (see illustration 9). The ends of the shafts must not protrude through the hubs.
- Shift the power packs in axial direction until the dimension L₈ is achieved.
- If the power packs are already firmly assembled, shifting the hubs axially on the shafts allows for adjusting the distance dimension L₈.

On request the hubs can be provided with a bore for setscrews for axial fastening. Please specify in your order.

With the assembly please make sure that the distance dimension L₈ (see table 3) is observed. Disregarding this advice may cause damage to the measuring shaft (coupling).
4 Assembly

4.7 Assembly of the lamina sets, RADEX®-N size 135

With the assembly please make sure that the lamina sets are installed free from distortion in axial direction. Disregarding this advice may cause damage to the coupling.

- Insert the lamina sets and the DATAFLEX® measuring shaft.
- Hand-tighten the components for the time being, with the fit bolts being assembled displaced from left to right (see illustration 11).
- Tighten the fit bolts to the tightening torques mentioned in table 6 by means of a suitable torque key.

4.8 Assembly of the lamina sets, RADEX®-N size 156

With the assembly please make sure that the lamina sets are installed free from distortion in axial direction. Disregarding this advice may cause damage to the coupling.

- Insert the lamina sets and the DATAFLEX® measuring shaft.
- Hand-tighten the components for the time being, with the fit bolts being assembled displaced from left to right (see illustration 12). With size 156 use a washer under the screw head.
- The pressure screws in the clamping nut must not protrude on the pressure side (see illustration 13).

All components must be superimposed without any gap.

- Afterwards turn back the clamping nut until there is a gap of 1 - 2 mm (see illustration 13).
- Hand-tighten the pressure screws marked in illustration 15.
- Tighten these screws (see illustration 15) at half the tightening torque according to table 6 and afterwards at the full tightening torque according to table 6.
- Now tighten all pressure screws one after another and with several revolutions until all screws have achieved the full tightening torque (illustration 16).

The pressure screws must not bear on the heads after assembly (see illustration 14).

- All clamping nuts have to be mounted as per the aforementioned process.
4 Assembly

4.8 Assembly of the lamina sets, RADEX®-N size 156

Illustration 12: Assembly of lamina sets, RADEX®-N size 156

Illustration 13

Illustration 14

Illustration 15: Tightening of pressure screws

Illustration 16: Tightening of pressure screws (one after another)

4.9 Tightening torques of screw connections on the lamina set

The fit bolts have to be tightened to the tightening torques $T_A$ specified in table 6.

Table 6: Tightening torques of the fit bolts

<table>
<thead>
<tr>
<th>Coupling size of DATAFLEX® 110/10000</th>
<th>110/20000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coupling size of RADEX®-N 135</td>
<td>156</td>
</tr>
<tr>
<td>Screw size $G_1$ M24</td>
<td></td>
</tr>
<tr>
<td>Screw size $G_2$ M27</td>
<td></td>
</tr>
<tr>
<td>Tightening torque $T_A$ [Nm] 900</td>
<td>9 x M8</td>
</tr>
<tr>
<td>Pressure screw $G_2$</td>
<td></td>
</tr>
<tr>
<td>Tightening torque $T_A$ [Nm]</td>
<td>30</td>
</tr>
</tbody>
</table>

Having started up the coupling, the tightening torque of the fit bolts has to be inspected at regular maintenance intervals.
4 Assembly

4.10 Advice for assembly of the DATAFLEX® torque measuring shaft

- **Fixing the housing**

  The housing must be protected from rotation. For that purpose there is a thread size M5 at the bottom side. Please make absolutely sure to avoid a rigid fixing of the housing!

  !

  Opening the housing is not required and may cause damage to the measuring shaft.

  !

- **Degree of protection**

  All DATAFLEX® measuring shafts type 110 correspond to protection class IP51 according to DIN EN 60529.

- **Maintenance**

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

- **Calibration**

  The transducer is calibrated when being supplied. We recommend an annual inspection of the calibration.

4.11 Technical description

1. **General description**

   The measuring shafts type DATAFLEX® 110 are provided with wire strain gauges (DMS) the signals of which are transmitted contactless.

   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.

   The measuring shaft should not be switched on before all connections have been properly connected. After initial switch-on the measuring shaft needs about 5 minutes until the warm-up period is finished and the measurement device has its standard accuracy.
2. Connection housing DF2

The connection housing DF2 has 12 screw terminals to connect power supply, display equipment and switches. The torque signal is displayed as proportional direct voltage from -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 button 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

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Function</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>24V</td>
<td>Input operating voltage</td>
<td>Supply voltage + 24V DC ± 4V / 100 mA</td>
</tr>
<tr>
<td>11</td>
<td>GND</td>
<td>Supply voltage - 24V DC ± 4V / 100 mA</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>M-U</td>
<td>Torque output</td>
<td>Output voltage + -10V ... 10V (R_A = 1 kΩ)</td>
</tr>
<tr>
<td>5</td>
<td>GND</td>
<td>Ground torque output</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>M-I</td>
<td>Without function</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>N1</td>
<td>Speed output pulse signal</td>
<td>Speed output channel 1 HTL (24V, 720 pulses/rev.)</td>
</tr>
<tr>
<td>8</td>
<td>GND</td>
<td>Ground for pulse speed output</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>N2</td>
<td>Speed output channel 2 HTL (24V, 720 pulses/rev.)</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>R/L</td>
<td>Speed output DC-voltage</td>
<td>Direction signal speed HTL (24V, clockwise = 0)</td>
</tr>
<tr>
<td>2</td>
<td>GND</td>
<td>Ground for DC speed output</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>N-U</td>
<td>Speed of DC voltage output 0 V ... 10 V (scalable)</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>T1</td>
<td>Other connections / operating devices</td>
<td>Push button T1 External push button connection T1</td>
</tr>
<tr>
<td>13</td>
<td>L1, L2</td>
<td>Signal LEDs</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>T1, T2</td>
<td>Push button T1, T2 Push button for programming</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>TP</td>
<td>Switch low pass filter On/off switch low-pass</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>-</td>
<td>Connection of measuring shaft 1:1 Connection cable</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>-</td>
<td>Switch for speed scaling see table 11</td>
<td></td>
</tr>
</tbody>
</table>

3. Description of connections

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

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

4.11 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 -10V and 10V. Table 8 shows the relation between torque and output voltage.

Table 8: Assignment of torque - output values

<table>
<thead>
<tr>
<th>DATAFLEX® size</th>
<th>ΔM / V</th>
</tr>
</thead>
<tbody>
<tr>
<td>110/10000</td>
<td>1000 Nm / V</td>
</tr>
<tr>
<td>110/20000</td>
<td>2000 Nm / V</td>
</tr>
</tbody>
</table>

Illustration 18: Assignment of torque - output values

Table 9: Low pass button (No. 15)

<table>
<thead>
<tr>
<th>Switch position TP</th>
<th>Left</th>
<th>Right</th>
</tr>
</thead>
<tbody>
<tr>
<td>TP</td>
<td>Low pass on</td>
<td>Low pass off</td>
</tr>
</tbody>
</table>

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 button (No. 15)

<table>
<thead>
<tr>
<th>Limit frequency [Hz]</th>
<th>Switch 1</th>
<th>Switch 2</th>
<th>Switch 3</th>
<th>Switch 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>1000</td>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>100</td>
<td>OFF</td>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>10</td>
<td>OFF</td>
<td>OFF</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>1</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>ON</td>
</tr>
</tbody>
</table>

A filter frequency of 1000 Hz is preset.

Illustration 19: Location of DIP switch
4 Assembly

4.11 Technical description

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

The connection housing DF2 has 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)

Outputs N1 and N2

Each of the speed outputs N1 and N2 provide a square-wave signal with a resolution of 2x720 periods per revolution (illustration 21).

The speed is calculated as follows: \( N \text{ [rpm]} = \frac{f \text{ [Hz]}}{7.5} \)

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 22).
4 Assembly

4.11 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 23).

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 24).

Illustration 23: Output circuit of speed outputs

Illustration 24: Modification of voltage level for the speed signal/direction signal
4 Assembly

4.11 Technical description

Outputs N-U and R/L

The KTR connection housing DF02 has an integrated f/U converter which converts the square wave signals of the encoder into a linear DC voltage output (terminal N-U) and generates 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 17 and 25).

Scaling of the speed direct voltage output

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

<table>
<thead>
<tr>
<th>Max. speed</th>
<th>Scaling</th>
<th>S1</th>
<th>S2</th>
<th>S3</th>
<th>S4</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>1 rpm / V</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>20</td>
<td>2 rpm / V</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>40</td>
<td>4 rpm / V</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>60</td>
<td>6 rpm / V</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>80</td>
<td>8 rpm / V</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>100</td>
<td>10 rpm / V</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>200</td>
<td>20 rpm / V</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>400</td>
<td>40 rpm / V</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>600</td>
<td>60 rpm / V</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>800</td>
<td>80 rpm / V</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1000</td>
<td>100 rpm / V</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2000</td>
<td>200 rpm / V</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>4000</td>
<td>400 rpm / V</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6000</td>
<td>600 rpm / V</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>8000</td>
<td>800 rpm / V</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>10000</td>
<td>1000 rpm / V</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 12: Selection of DATAFLEX® series

<table>
<thead>
<tr>
<th>DATAFLEX® type</th>
<th>S5</th>
<th>S6</th>
</tr>
</thead>
<tbody>
<tr>
<td>DATAFLEX® 22, 42, 85, 140</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>DATAFLEX® 16</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>DATAFLEX® 32, 42 (red), 110</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>DATAFLEX® 70</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 13: Direction signal

<table>
<thead>
<tr>
<th>Output voltage R/L</th>
<th>Torsional direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Clockwise</td>
</tr>
<tr>
<td>24V</td>
<td>Counter-clockwise</td>
</tr>
</tbody>
</table>

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

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

Please observe protection note ISO 16016.
e) Control buttons and LEDs (No. 12 to 14 and illustration 27)

The connection housing DF02 has 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 adjustment can be performed after a turn-on period of 15 seconds (illustration 27). The termination of the 15 seconds period is signalized by a short blinking of the LEDs of the connection housing.

Illustration 27

Automatic zero adjustment (illustration 28)

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 adjusting is effected irrespective 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 saved and the device is in the measuring mode again.

- 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 adjustment is performed.

Illustration 28: Automatic zero adjustment
4 Assembly

4.11 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 short blinking of the LED L2.

Having performed the adjusting the new values are stored lastingly by pressing both push buttons again for 2 seconds. The LED L1 is illuminated once and signals the return to the measuring mode.

- 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.

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.

- The sensor test can only be performed during the first 15 seconds after switching on.
In respect of environmental protection we would ask you to dispose of the packaging or products on termination of their service life in accordance with the legal regulations and standards that apply, respectively.

**6 Maintenance and service**

DATAFLEX® is a low-maintenance torque measuring shaft. We recommend to perform a visual inspection on the torque measuring shaft at least once a year. Please pay special attention to the condition, alignment and screw connection of the torque measuring shaft and the condition of the lamina sets of the RADEX®-N coupling.

⚠️ Having started up the torque measuring shaft the tightening torques of the screws have to be inspected during the usual inspection intervals.

⚠️ Please consider our operating/assembly instructions KTR-N 47110 additionally when using the RADEX®-N coupling.

**7 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.

⚠️ 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.
EC Certificate of conformity

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

DATAFLEX® torque measuring shaft
described in the present operating/assembly instructions is in accordance with the following directive:


Standards applied:

DIN EN 61000-6-2: Interference 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: Intensity of radio interference area (class B)

Rheine, 2017-08-02
Place Date

i. V. Reinhard Wibbeling
Engineering/R&D

i. A. Jürgen Kösters
Product Manager