

# Incremental Shaft Encoders with Full Length Hollow Shaft Type RI 76TD

Item No. 2 533 095, Edition: 3050798hu

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## Introduction

These installation instructions are provided for the connection and starting procedure of your shaft encoder.

There are two mounting versions for the shaft encoder with full length hollow shaft available:

- Front clamped connection to the actuating shaft (version D)
  - Rear clamped connection to the actuating shaft (version H).
- Concerning this, please refer to the reverse side of these installation instructions.



This sign marks paragraphs particularly to be observed to assure proper use and to avoid risks.

## Safety and Operating Instructions

- The incremental shaft encoders of the type RI 76TD model series are quality products manufactured in accordance with established electrical engineering standards. The units have been delivered from the factory in perfect conformance to safety regulations. To maintain this condition and to ensure trouble-free operation, please observe the technical specifications of this document.
- Installation and mounting may only be performed by an electrotechnical expert!
- The units may only be operated within the limits specified by the technical data.
- Maximum operating voltages must not be exceeded! The units are designed complying with DIN EN 61010 part 1, protection class III. To prevent dangerous structure-borne currents, the equipment has to be run on safety extra-low voltage (SELV) and must be in an area of equipotential bonding. Use an external fuse for protection (see Electrical data).
- Fields of application: industrial processes and controls. Overvoltage at the connecting terminals must be limited to overvoltage-class-II values.
- The high-quality EMC-specifications are only valid together with standard-type cables and plugs. When using screened cables, the screen must broadly be connected with ground on both ends. Likewise, the voltage-supply cables should entirely be screened. If this is not possible you will have to take appropriate filtering measures.
- Installation environment and wiring are influential on the encoder's EMC. Thus the installer must secure EMC of the whole facility (device).
- Transient peaks on the power supply leads are to be limited by the pre-connected power unit to a maximum of 1000 V.
- In electrostatically threatened areas please take care for neat ESD-protection of plug and connecting cable during installation work.

## Connection diagram TPE-cable

| Colour (TPE)                 | Output circuit        |                       |                      |                           |
|------------------------------|-----------------------|-----------------------|----------------------|---------------------------|
|                              | RS 422 (T)<br>+ Sense | RS 422 (R)<br>+ Alarm | Push-pull (K)        | Push-pull<br>complem. (I) |
| brown                        | Channel A             | Channel A             | Channel A            | Channel A                 |
| green                        | Channel $\bar{A}$     | Channel $\bar{A}$     | Channel $\bar{A}$    | Channel $\bar{A}$         |
| grey                         | Channel B             | Channel B             | Channel B            | Channel B                 |
| pink                         | Channel $\bar{B}$     | Channel $\bar{B}$     | Channel $\bar{B}$    | Channel $\bar{B}$         |
| red                          | Channel N             | Channel N             | Channel N            | Channel N                 |
| black                        | Channel $\bar{N}$     | Channel $\bar{N}$     | Channel $\bar{N}$    | Channel $\bar{N}$         |
| violet (white) <sup>1)</sup> | Sense GND             | Alarm                 | Alarm                | Alarm                     |
| blue                         | Sense V <sub>CC</sub> | Sense V <sub>CC</sub> |                      | Sense V <sub>CC</sub>     |
| brown/green                  | 5VDC                  | 5/10...30VDC          | 5/10...30VDC         | 10...30VDC                |
| white/green                  | GND                   | GND                   | GND                  | GND                       |
| Screen <sup>1)</sup>         | Screen <sup>1)</sup>  | Screen <sup>1)</sup>  | Screen <sup>1)</sup> | Screen <sup>1)</sup>      |

<sup>1)</sup> connected to encoder housing<sup>2)</sup> white for Sense (T)

## Mechanical data

|                                       |                                                                                         |
|---------------------------------------|-----------------------------------------------------------------------------------------|
| Shaft fixation                        | clamping ring, front or rear                                                            |
| Coupling                              | stator coupling (spring plate)                                                          |
| Hollow shaft-Ø                        | 15 ... 42 mm (tolerance: 0.005 ... 0.040)<br>(required tolerance of mounting shaft: g8) |
| Minimum length of mounting shaft      |                                                                                         |
| Front clamping ring                   | 32 mm with Ø 15 ... 30, 35 mm with Ø >30 ... 42                                         |
| Rear clamping ring                    | corresponding to total length of encoder                                                |
| Max. parallel shaft misalignment      |                                                                                         |
| with spring plate A (flexible)        | ± 2.0 mm axial, ± 0.15 mm radial                                                        |
| with 1x spring plate N (rigid)        | ± 0.5 mm axial, ± 0.3 mm radial                                                         |
| with 2x spring plate N (rigid)        | ± 0.3 mm axial, ± 0.2 mm radial                                                         |
| Maximum speed                         |                                                                                         |
| at 70 °C and IP65:                    | 3,600 RPM for Ø 15...25 mm<br>1,800 RPM for Ø >25...42 mm                               |
| at 70 °C and IP50:                    | 6,000 RPM for Ø 15...42 mm                                                              |
| at 100 °C always:                     | 1,800 RPM for Ø 15...42 mm                                                              |
| Torque                                | 3 ... 10 Ncm (depending on version)                                                     |
| Moment of inertia                     | 140 ... 420 gcm <sup>2</sup> (depending on version)                                     |
| Protection class housing/ball bearing | IP 50/40, IP 65/64 <sup>1)</sup>                                                        |
| Operating temperature                 | -25 ... +100 °C                                                                         |
| Storage temperature                   | -25 ... +100 °C                                                                         |
| Vibration performance (IEC 68-2-6)    | 10 g = 100 m/s <sup>2</sup> (10 ... 2000 Hz)                                            |
| Shock resistance (IEC 68-2-27)        | 100 g = 1000 m/s <sup>2</sup> (6 ms)                                                    |
| Connection                            | Cable radial                                                                            |
| Housing                               | Aluminium                                                                               |
| Weight                                | 320 ... 580 g (depending on version)                                                    |

<sup>1)</sup> no standing water allowed at the shaft entrance or at the ball bearing

## Electrical data

|                                   |                                                                                                                    |                                                                                                                      |           |           |                   |       |
|-----------------------------------|--------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|-----------|-----------|-------------------|-------|
| General design                    | as per DIN EN 61010 part 1, protection class III, contamination level 2, overvoltage class II connected to housing |                                                                                                                      |           |           |                   |       |
| Screening                         | as per EN 50081-2 (edition 1993)                                                                                   |                                                                                                                      |           |           |                   |       |
| Noise emission                    | as per EN 50082-2 (edition 1995)                                                                                   |                                                                                                                      |           |           |                   |       |
| Noise immunity                    | as per EN 50082-2 (edition 1995)                                                                                   |                                                                                                                      |           |           |                   |       |
| Supply voltage U <sub>s</sub>     | 5 V DC (SELV) ±10%                                                                                                 | 10 ... 30 V DC (SELV)                                                                                                |           |           |                   |       |
| Power self-consumption max.       | 60 mA                                                                                                              | 60 mA (10 V), 30 mA (24 V)                                                                                           |           |           |                   |       |
| Total power consumption           | max. 100 mA                                                                                                        | max. 150 mA                                                                                                          |           |           |                   |       |
| Recommended external fuse         | T 0,125 A                                                                                                          | T 0,2 A                                                                                                              |           |           |                   |       |
| Output circuit <sup>1)</sup>      | PP                                                                                                                 | PP                                                                                                                   | RS422     | PP        | PP compl.         | RS422 |
| Code letter                       | K                                                                                                                  | D                                                                                                                    | R, T      | K         | I                 | R     |
| Output load (mA)                  | ±10                                                                                                                | ±30                                                                                                                  | ±30       | ±30       | ±30               | ±30   |
| Output level (V)                  | High                                                                                                               | ≥2.5                                                                                                                 | ≥2.5      | ≥2.5      | U <sub>s</sub> /3 | ≥2.5  |
|                                   | Low                                                                                                                | ≤0.5                                                                                                                 | ≤0.5      | ≤0.5      | ≤2                | ≤0.5  |
| Pulse rise time (ns)              |                                                                                                                    | 250                                                                                                                  | 100       | 100       | 2000              | 2000  |
| Max. pulse frequency (kHz)        |                                                                                                                    | 300                                                                                                                  | 300       | 300       | 200               | 200   |
| Pole protection of U <sub>s</sub> |                                                                                                                    | yes                                                                                                                  | no        | no        | yes               | yes   |
| Short circuit proof               |                                                                                                                    | yes                                                                                                                  | 1 channel | 1 channel | yes               | yes   |
| Pulse duty factor                 |                                                                                                                    | 1 : 1                                                                                                                |           |           |                   |       |
| Pulse width error                 |                                                                                                                    | ± 25% electrical                                                                                                     |           |           |                   |       |
| Phase shift                       |                                                                                                                    | 90° (distance from Channel A to B is at least 0.45 µs, at 300 kHz)                                                   |           |           |                   |       |
| Pulse shape                       |                                                                                                                    | rectangular                                                                                                          |           |           |                   |       |
| Alarm output                      |                                                                                                                    | Open Collector, NPN (5 mA, 24 V max. with U <sub>s</sub> = 5 VDC; 5 mA, 32 V max. with U <sub>s</sub> = 10...30 VDC) |           |           |                   |       |

<sup>1)</sup> PP=Push-pull; PP compl.=Push-pull complementary; RS422=Line driver

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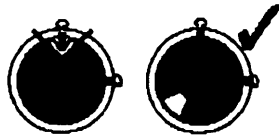
## Mechanical installation of versions D and H

### General information

### Safety instructions

- All installation work must be carried out according to applicable safety instructions!
- During installation work all appliances worked on must be disconnected from electric current!  
Ensure that these appliances cannot be powered up during the installation work!
- Only tighten clamping ring screws when encoder is placed on a shaft. Otherwise the hollow shaft might be damaged.

The screws of the clamping ring must not be positioned over a slot or flattening of the mounting shaft!



- Take care that your mounting shaft has the required tolerance g8. This is important for a tight connection between mounting and hollow shaft.
- In order to compensate for axial and radial shaft eccentricity as well as any angle offset, the encoder flange may not be rigidly mounted. Please mount the flange with a flexible stator coupling (e.g. spring plate) as torque support:
  - A flexible spring plate (A) for higher levels of play and lower requirements for accuracy.
  - A rigid spring plate (N) for reduced play and rigid connection with reduced swing angle. This is suitable in the case of higher accuracy and dynamics requirements.
- Take care of the maximum permissible misalignment and the minimum length of mounting shaft (see "Mechanical Data").

## Installation

### Mounting the torque support

- Mount the spring plates to the flange on the encoder's front, using M3-screws.  
This side will point to the actuator.

### Checking the clamping device

The clamping device of the versions D and H is comprised of a clamping ring with two hexagon-socket screws.  
The clamping ring of version D is located on the front side at the flange; this one of version H is in the rear of the housing.

Check first whether the clamping ring is loosened:

- Hold the encoder in such a position that you can see the clamping ring from the side. The hexagon-socket screws are inserted into the side of the clamping ring.
- Check whether the clamping device of the sleeve shaft is loosened by inserting the actuating shaft into the sleeve shaft.  
The shaft must slide into the sleeve shaft smoothly!  
Do not use force and do not try to drive the shaft into the sleeve with hammer blows!  
This would damage the shaft encoder!
- If the shaft cannot be inserted: check the shaft diameter and/or release the clamping device.

### Releasing the clamping device

- Loosen the clamping ring:  
Use a hex key (size 2);  
turn the hexagon-socket screws to the left (counter-clockwise).

### Mounting the encoder to the actuating shaft

- Slide the encoder onto the actuating shaft
- Tighten the screws of the clamping ring with 100 Ncm:  
Use a hex key (size 2);  
turn the hexagon-socket screws to the right (clockwise).
- Mount the torque support to the actuator housing.

The encoder is now ready for connection.

Ensure that no external forces act on the shaft encoder during installation and operation!

## Ordering code (see identification plate)

