



## Incremental Encoders

Incremental encoders are sensors capable of **generating signals** in response to rotary movement. In conjunction with mechanical conversion devices, such as rack-and-pinions, measuring wheels or spindles, incremental shaft encoders can also be used to measure **linear movement**. The shaft encoder generates a signal for each incremental change in position.

With the **optical transformation**, a line-coded disc made of metal, plastic or glass and positioned on a rotary bearing interrupts the infra red light ray emitted by gallium arsenid sender diode. The number of lines determines the resolution, i.e. the measuring points within a revolution. The interruptions of the light ray are sensed by the receptor element and electronically processed. The information is then made available as a rectangular signal at the encoder output.

### Examples for typical applications of incremental encoders:

- |                                           |                            |
|-------------------------------------------|----------------------------|
| ■ Franking machines                       | ■ Tampon printing machines |
| ■ Door closing devices for trains         | ■ Ultrasonic welding       |
| ■ Desktop robots                          | ■ Screwing machines        |
| ■ Lens grinding machines                  | ■ Labelling machines       |
| ■ Plotters                                | ■ x/y indication           |
| ■ Testing machines for optical waveguides | ■ Analysis devices         |
| ■ Scattering machines                     | ■ Drilling machines        |
|                                           | ■ Mixing machines          |

## Incremental Encoders



| Type                                  | RI 30                                                                                                                                                                                                                                                                                                                                                                                                              | RI 36                                                                                                                                                                                                                                                   |
|---------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Special features</b>               | <ul style="list-style-type: none"> <li>■ small encoder for industrial applications</li> <li>■ low power consumption</li> <li>■ high immunity to interference</li> <li>■ cable lengths up to 100 m</li> <li>■ suitable for high pulse frequencies</li> <li>■ high level of protection</li> <li>■ applications, e.g. CNC machine centers, handling systems, motors, medical technology, textile machinery</li> </ul> | <ul style="list-style-type: none"> <li>■ small industrial encoder for high numbers of pulses</li> <li>■ high operating safety</li> <li>■ applications, e.g. CNC axles, machine tools, robots, special machinery, high-speed winding machines</li> </ul> |
| <b>Number of pulses</b>               | 5 ... 1,500                                                                                                                                                                                                                                                                                                                                                                                                        | 5 ... 3,600                                                                                                                                                                                                                                             |
| <b>Technical Data – mechanical</b>    |                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                         |
| Flange                                | S = synchro flange, R = round flange                                                                                                                                                                                                                                                                                                                                                                               | S = synchro flange, R = round flange                                                                                                                                                                                                                    |
| Shaft diameter                        | 5 mm                                                                                                                                                                                                                                                                                                                                                                                                               | 6 mm/6,35 mm                                                                                                                                                                                                                                            |
| Absolute max. shaft load radial/axial | 30 N/15 N (6.5/3.3 lbs)                                                                                                                                                                                                                                                                                                                                                                                            | 30 N/15 N (6.5/3.3 lbs)                                                                                                                                                                                                                                 |
| Absolute max. speed                   | 10,000 RPM                                                                                                                                                                                                                                                                                                                                                                                                         | 10,000 RPM                                                                                                                                                                                                                                              |
| Torque                                | ≤ 0.2 Ncm                                                                                                                                                                                                                                                                                                                                                                                                          | ≤ 0.3 Ncm                                                                                                                                                                                                                                               |
| Protection class Housing/Bearing      | IP 64/64                                                                                                                                                                                                                                                                                                                                                                                                           | IP 64/64                                                                                                                                                                                                                                                |
| General design                        | as per DIN VDE 0160, protection class III                                                                                                                                                                                                                                                                                                                                                                          | as per DIN VDE 0160, protection class III                                                                                                                                                                                                               |
| Operating temperature                 | -10...+70 °C                                                                                                                                                                                                                                                                                                                                                                                                       | -10...+70 °C                                                                                                                                                                                                                                            |
| Connection                            | Cable axial/radial                                                                                                                                                                                                                                                                                                                                                                                                 | Cable or connector axial/radial                                                                                                                                                                                                                         |
| Size                                  | Ø 30 mm                                                                                                                                                                                                                                                                                                                                                                                                            | Ø 36 mm                                                                                                                                                                                                                                                 |
| Weight                                | 60 g approx.                                                                                                                                                                                                                                                                                                                                                                                                       | 80 g approx.                                                                                                                                                                                                                                            |
| <b>Technical data – electrical</b>    |                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                         |
| Output                                | RS 422/push-pull                                                                                                                                                                                                                                                                                                                                                                                                   | RS 422/push-pull                                                                                                                                                                                                                                        |
| Supply voltage (SELV)                 | 5 VDC/10...30 VDC                                                                                                                                                                                                                                                                                                                                                                                                  | 5 VDC/10...30 VDC                                                                                                                                                                                                                                       |
| Max. intrinsic power consumption      | 40 mA (5 VDC), 30 mA (24 VDC), 60 mA (10 VDC)                                                                                                                                                                                                                                                                                                                                                                      | 40 mA (5 VDC), 30 mA (24 VDC), 60 mA (10 VDC)                                                                                                                                                                                                           |
| Max. pulse frequency                  | 300 kHz (RS 422)<br>200 kHz (push-pull)                                                                                                                                                                                                                                                                                                                                                                            | 300 kHz (RS 422)<br>200 kHz (push-pull)                                                                                                                                                                                                                 |
| Output load                           | RS 422: ± 30 mA<br>push-pull with short circuit protection:<br>30 mA (10...30 VDC)                                                                                                                                                                                                                                                                                                                                 | RS 422: ± 30 mA<br>push-pull with short circuit protection:<br>30 mA (10...30 VDC)                                                                                                                                                                      |
| Alarm output                          | NPN-O.C. 5 mA                                                                                                                                                                                                                                                                                                                                                                                                      | NPN-O.C. 5 mA                                                                                                                                                                                                                                           |
| Pulse shape                           |                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                    |
| Pulse duty factor                     | 1 : 1                                                                                                                                                                                                                                                                                                                                                                                                              | 1 : 1                                                                                                                                                                                                                                                   |
| Pulse width error                     | ± max. 25° electrical                                                                                                                                                                                                                                                                                                                                                                                              | ± max. 25° electrical                                                                                                                                                                                                                                   |
| Page                                  | 61                                                                                                                                                                                                                                                                                                                                                                                                                 | 65                                                                                                                                                                                                                                                      |

## Incremental Encoders



| RI 58                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | RI 59                                                                                                                                                                                                                                                                                             | RX 70-TI                                                                                                                                                                                                                                                                   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>■ universal industrial encoder</li> <li>■ up to 40,000 steps with 10,000 pulses</li> <li>■ high signal accuracy</li> <li>■ protection class up to IP 67</li> <li>■ operating temperature up to 100°C</li> <li>■ flexible due to many flange and connector variants</li> <li>■ suitable for high shock loads</li> <li>■ applications e.g. machine tools, CNC axes, packaging machinery, motors, drives, injection moulding machines, sawing machines, textile machinery</li> </ul> | <ul style="list-style-type: none"> <li>■ stainless steel encoder with high degree of protection</li> <li>■ high corrosion resistance</li> <li>■ suitable for use in food production</li> <li>■ applications e.g. packaging machinery, filling plants, washing systems, mixing machines</li> </ul> | <ul style="list-style-type: none"> <li>■ explosion-proof according to class II of EEX d IIC T6/T4</li> <li>■ highest operating safety</li> <li>■ applications e.g. lacquering lines, surface processing machines, filling plants, mixing machines, silo systems</li> </ul> |
| 1 ... 10,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 1 ... 10,000                                                                                                                                                                                                                                                                                      | 1 ... 10,000                                                                                                                                                                                                                                                               |
| S = synchro flange, K = clamping flange, G, Q = square flange, M = synchro clamping flange                                                                                                                                                                                                                                                                                                                                                                                                                               | Q = square flange                                                                                                                                                                                                                                                                                 | K = clamping flange                                                                                                                                                                                                                                                        |
| 6 mm/6.35 mm/7 mm/10 mm/9.52 mm/12 mm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 9.52 mm/10 mm                                                                                                                                                                                                                                                                                     | 10 mm                                                                                                                                                                                                                                                                      |
| Ø 12 mm - 180/140 N (39/30 lbs)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 160/107 N (35/24 lbs)                                                                                                                                                                                                                                                                             | 160/107 N (35/24 lbs)                                                                                                                                                                                                                                                      |
| Ø 7 ... 10 mm - 160/107 N (35/24 lbs)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                            |
| Ø 6 mm/6.35 mm - 110/60 N (24/13 lbs)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                            |
| 10,000 RPM                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 10,000 RPM                                                                                                                                                                                                                                                                                        | 6,000 RPM (T6), 10,000 RPM (T4)                                                                                                                                                                                                                                            |
| ≤ 0.5 Ncm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | ≤ 0.5 Ncm                                                                                                                                                                                                                                                                                         | ≤ 0.5 Ncm                                                                                                                                                                                                                                                                  |
| 65/64, 67/67                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | IP 67/67                                                                                                                                                                                                                                                                                          | IP 65/64                                                                                                                                                                                                                                                                   |
| as per DIN VDE 0160, protection class III                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | as per DIN VDE 0160, protection class III                                                                                                                                                                                                                                                         | as per DIN VDE 0160, protection class III                                                                                                                                                                                                                                  |
| RI 58-O: -10...+70 °C/RI 58-T: -25...+100 °C                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | -10...+ 70 °C                                                                                                                                                                                                                                                                                     | -10...+ 40 °C (T6), -20...+60 °C (T4)                                                                                                                                                                                                                                      |
| Cable or connector axial/radial                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Cable radial                                                                                                                                                                                                                                                                                      | Cable axial                                                                                                                                                                                                                                                                |
| Ø 58 mm, square flange = 63.5 mm / 80 mm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Ø 58 mm, square flange = 63.5 mm                                                                                                                                                                                                                                                                  | Ø 70 mm                                                                                                                                                                                                                                                                    |
| 300 g approx.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 620 g approx.                                                                                                                                                                                                                                                                                     | 1,400 g approx.                                                                                                                                                                                                                                                            |
| RS 422/push-pull/push-pull complementary 5 VDC/10...30 VDC                                                                                                                                                                                                                                                                                                                                                                                                                                                               | RS 422/push-pull/push-pull complementary 5 VDC/10...30 VDC                                                                                                                                                                                                                                        | RS 422/push-pull/push-pull complementary 5 VDC/10...30 VDC                                                                                                                                                                                                                 |
| 40 mA (5 VDC), 30 mA (24 VDC), 60 mA (10 VDC)                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 40 mA (5 VDC), 30 mA (24 VDC), 60 mA (10 VDC)                                                                                                                                                                                                                                                     | 40 mA (5 VDC), 30 mA (24 VDC), 60 mA (10 VDC)                                                                                                                                                                                                                              |
| 300 kHz (RS 422)<br>200 kHz (push-pull)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 300 kHz (RS 422)<br>200 kHz (push-pull)                                                                                                                                                                                                                                                           | 300 kHz (RS 422)<br>200 kHz (push-pull)                                                                                                                                                                                                                                    |
| RS 422: ± 30 mA<br>push-pull with short circuit protection: 30 mA (10...30 VDC)                                                                                                                                                                                                                                                                                                                                                                                                                                          | RS 422: ± 30 mA<br>push-pull with short circuit protection: 30 mA (10...30 VDC)                                                                                                                                                                                                                   | RS 422: ± 30 mA<br>push-pull with short circuit protection: 30 mA (10...30 VDC)                                                                                                                                                                                            |
| NPN-O.C. 5 mA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | NPN-O.C. 5 mA                                                                                                                                                                                                                                                                                     | NPN-O.C. 5 mA                                                                                                                                                                                                                                                              |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                            |
| 1 : 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1 : 1                                                                                                                                                                                                                                                                                             | 1 : 1                                                                                                                                                                                                                                                                      |
| ± max. 25° electrical                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | ± max. 25° electrical                                                                                                                                                                                                                                                                             | ± max. 25° electrical                                                                                                                                                                                                                                                      |
| 68                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 76                                                                                                                                                                                                                                                                                                | 79                                                                                                                                                                                                                                                                         |

## Incremental Encoders – with hollow shaft



| Type                                                           | RI 36-H                                                                                                                                                                                                                                                                       | RI 58-H                                                                                                                                                                                                                       |
|----------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Special features</b>                                        | <ul style="list-style-type: none"> <li>miniature industry encoder for high numbers of pulses</li> <li>short mounting depth</li> <li>easy mounting procedure</li> <li>applications, e.g. motors, machine tools, packaging machines, robots, automated SMD equipment</li> </ul> | <ul style="list-style-type: none"> <li>through hollow shaft</li> <li>high accuracy due to integrated coupling</li> <li>secure shaft mounting</li> <li>applications e.g. textile machinery, motors, drives, copiers</li> </ul> |
| <b>Number of pulses</b>                                        | 5 ... 3,600                                                                                                                                                                                                                                                                   | 1 ... 5,000                                                                                                                                                                                                                   |
| <b>Technical Data – mechanical</b><br>Flange or shaft fixation |                                                                                                                                                                                                                                                                               | S = synchro flange                                                                                                                                                                                                            |
| Shaft diameter                                                 | hollow shaft 4 mm/6 mm/8 mm/10 mm                                                                                                                                                                                                                                             | Hollow shaft 10 mm/12 mm                                                                                                                                                                                                      |
| Absolute max. shaft load radial/axial                          | misalignment radial $\pm 0.15$ mm,<br>misalignment axial $\pm 0.5$ mm                                                                                                                                                                                                         | misalignment axial $\pm 0.4$ mm<br>misalignment parallel 0.4 mm<br>misalignment angular $1^\circ$                                                                                                                             |
| Absolute max. speed                                            | 10,000 RPM                                                                                                                                                                                                                                                                    | 3,000 RPM                                                                                                                                                                                                                     |
| Torque                                                         | $\leq 0.3$ Ncm                                                                                                                                                                                                                                                                | $\leq 2$ Ncm                                                                                                                                                                                                                  |
| Protection class Housing/Bearing                               | IP 64/64                                                                                                                                                                                                                                                                      | IP 64/64                                                                                                                                                                                                                      |
| General design                                                 | as per DIN VDE 0160, protection class III                                                                                                                                                                                                                                     | as per DIN VDE 0160, protection class III                                                                                                                                                                                     |
| Operating temperature                                          | $-10...+70$ °C                                                                                                                                                                                                                                                                | $-10...+70$ °C                                                                                                                                                                                                                |
| Connection                                                     | 1.5 m cable* axial/radial                                                                                                                                                                                                                                                     | cable radial                                                                                                                                                                                                                  |
| Size                                                           | $\varnothing$ 36 mm                                                                                                                                                                                                                                                           | $\varnothing$ 58 mm                                                                                                                                                                                                           |
| Weight                                                         | ca. 80 g                                                                                                                                                                                                                                                                      | 210 g approx.                                                                                                                                                                                                                 |
| <b>Technical data – electrical</b>                             |                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                               |
| Output                                                         | RS 422/push-pull/push-pull complementary                                                                                                                                                                                                                                      | RS 422/push-pull/push-pull complementary                                                                                                                                                                                      |
| Supply voltage (SELV)                                          | 5 VDC/10...30 VDC                                                                                                                                                                                                                                                             | 5 VDC/10...30 VDC                                                                                                                                                                                                             |
| Max. intrinsic power consumption                               | 40 mA (5 VDC), 30 mA (24 VDC),<br>60 mA (10 VDC)                                                                                                                                                                                                                              | 40 mA (5 VDC), 30 mA (24 VDC),<br>60 mA (10 VDC)                                                                                                                                                                              |
| Max. pulse frequency                                           | 300 kHz (RS 422)<br>200 kHz (push-pull)                                                                                                                                                                                                                                       | 300 kHz (RS 422)<br>200 kHz (push-pull)                                                                                                                                                                                       |
| Output load                                                    | RS 422: $\pm 30$ mA<br>push-pull with short circuit protection:<br>30 mA (10...30 VDC)                                                                                                                                                                                        | RS 422: $\pm 30$ mA<br>push-pull with short circuit protection:<br>30 mA (10...30 VDC)                                                                                                                                        |
| Alarm output                                                   | NPN-O.C. 5 mA                                                                                                                                                                                                                                                                 | NPN-O.C. 5 mA                                                                                                                                                                                                                 |
| Pulse shape                                                    |                                                                                                                                                                                            |                                                                                                                                          |
| Pulse duty factor                                              | 1 : 1                                                                                                                                                                                                                                                                         | 1 : 1                                                                                                                                                                                                                         |
| Pulse width error                                              | $\pm$ max. $25^\circ$ electrical                                                                                                                                                                                                                                              | $\pm$ max. $25^\circ$ electrical                                                                                                                                                                                              |
| Page                                                           | 82                                                                                                                                                                                                                                                                            | 84                                                                                                                                                                                                                            |

## Incremental Encoders – with hollow shaft



| Type                               | RI 58-D                                                                                                                                                                                                                                                                                                                                                                                                                                                               | RI 76 TD                                                                                                                                                                                                                                                                                                                                |
|------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Special features</b>            | <ul style="list-style-type: none"> <li>■ direct mounting without coupling</li> <li>■ flexible hollow shaft concept up to 14 mm</li> <li>■ through hollow shaft or as end shaft (blind shaft)</li> <li>■ simple installation with clamping ring or fixing screws</li> <li>■ short mounting depth of only 33 mm</li> <li>■ operating temperature up to 100 °C (RI 58 TD)</li> <li>■ applications, e.g. positioning drives, length measuring machines, motors</li> </ul> | <ul style="list-style-type: none"> <li>■ through hollow shaft</li> <li>■ shaft diameters 15 to 42 mm</li> <li>■ external diameter only 76 mm</li> <li>■ simple installation with clamping ring front or rear</li> <li>■ operating temperature up to 100 °C</li> <li>■ applications e.g. motors, printing machines, elevators</li> </ul> |
| <b>Number of pulses</b>            | 1 ... 5,000                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1...10,000                                                                                                                                                                                                                                                                                                                              |
| <b>Technical Data – mechanical</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                         |
| Flange or shaft fixation           | E= synchro flange with blind shaft<br>F, D, H = Synchro flange with clamping shaft                                                                                                                                                                                                                                                                                                                                                                                    | D = clamping ring front (flange side)<br>H = clamping ring rear (cover side)                                                                                                                                                                                                                                                            |
| Shaft diameter                     | Hollow shaft 10 mm/12 mm/14 mm                                                                                                                                                                                                                                                                                                                                                                                                                                        | Hollow shaft 15...42 mm                                                                                                                                                                                                                                                                                                                 |
| Absolute max. speed                | 6,000 RPM                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 6,000 RPM (depends on version)                                                                                                                                                                                                                                                                                                          |
| Torque                             | ≤ 1.7 Ncm                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 3...10 Ncm (depends on version)                                                                                                                                                                                                                                                                                                         |
| Protection class Housing/Bearing   | IP 65/64                                                                                                                                                                                                                                                                                                                                                                                                                                                              | IP 50/40, Option: IP 65/64                                                                                                                                                                                                                                                                                                              |
| General design                     | as per DIN VDE 0160, protection class III                                                                                                                                                                                                                                                                                                                                                                                                                             | as per DIN EN 61010, protection class III                                                                                                                                                                                                                                                                                               |
| Operating temperature              | -10...+70 °C (Option: -25...+100 °C)                                                                                                                                                                                                                                                                                                                                                                                                                                  | -25...+100 °C                                                                                                                                                                                                                                                                                                                           |
| Connection                         | Cable or connector radial                                                                                                                                                                                                                                                                                                                                                                                                                                             | Cable radial                                                                                                                                                                                                                                                                                                                            |
| Size                               | Ø 58 mm                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Ø 76 mm                                                                                                                                                                                                                                                                                                                                 |
| Weight                             | 170 g approx.                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 320...580 g approx. (depends on version)                                                                                                                                                                                                                                                                                                |
| <b>Technical data – electrical</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                         |
| Output                             | RS 422/push-pull/push-pull complementary                                                                                                                                                                                                                                                                                                                                                                                                                              | RS 422/push-pull/push-pull complementary                                                                                                                                                                                                                                                                                                |
| Supply voltage (SELV)              | 5 VDC/10...30 VDC                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 5 VDC/10...30 VDC                                                                                                                                                                                                                                                                                                                       |
| Max. intrinsic power consumption   | 40 mA (5 VDC), 30 mA (24 VDC), 60 mA (10 VDC)                                                                                                                                                                                                                                                                                                                                                                                                                         | 40 mA (5 VDC), 30 mA (24 VDC), 60 mA (10 VDC)                                                                                                                                                                                                                                                                                           |
| Max. pulse frequency               | 300 kHz (RS 422)<br>200 kHz (push-pull)                                                                                                                                                                                                                                                                                                                                                                                                                               | 300 kHz (RS 422)<br>200 kHz (push-pull)                                                                                                                                                                                                                                                                                                 |
| Output load                        | RS 422: ± 30 mA<br>push-pull with short circuit protection: 30 mA (10...30 VDC)                                                                                                                                                                                                                                                                                                                                                                                       | RS 422: ± 30 mA<br>push-pull with short circuit protection: 30 mA (10...30 VDC)                                                                                                                                                                                                                                                         |
| Alarm output                       | NPN-O.C. 5 mA                                                                                                                                                                                                                                                                                                                                                                                                                                                         | NPN-O.C. 5 mA                                                                                                                                                                                                                                                                                                                           |
| Pulse shape                        |                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                    |
| Pulse duty factor                  | 1 : 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1 : 1                                                                                                                                                                                                                                                                                                                                   |
| Pulse width error                  | ± max. 25° electrical                                                                                                                                                                                                                                                                                                                                                                                                                                                 | ± max. 25° electrical                                                                                                                                                                                                                                                                                                                   |
| Page                               | 87                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 93                                                                                                                                                                                                                                                                                                                                      |

## Incremental Encoders – Economy Types

Replacement  
for RI 5 and  
RI 31



Replacement  
for RI 39



| Type                                  | RI 32                                                                                                                                                                                                                                                                                        | RI 38                                                                                                                                                                                                                                                                                                |
|---------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Special features</b>               | <ul style="list-style-type: none"> <li>■ economy encoder for small devices</li> <li>■ long life due to ball bearings</li> <li>■ low torque</li> <li>■ application e.g. laboratory devices, fitness machines, crimping machines, tampon printing machines, small grinding machines</li> </ul> | <ul style="list-style-type: none"> <li>■ encoder for universal mounting due to front or rear fixing</li> <li>■ long life due to ball bearings</li> <li>■ low torque</li> <li>■ applications e.g. small motors, laboratory devices, labelling devices, plotters, length measuring machines</li> </ul> |
| <b>Number of pulses</b>               | 5 ... 1,500                                                                                                                                                                                                                                                                                  | 5 ... 1,024                                                                                                                                                                                                                                                                                          |
| <b>Technical Data – mechanical</b>    |                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                      |
| Flange or shaft fixation              | R = round flange                                                                                                                                                                                                                                                                             | Q = square flange                                                                                                                                                                                                                                                                                    |
| Shaft diameter                        | 5 mm/6 mm                                                                                                                                                                                                                                                                                    | 6 mm                                                                                                                                                                                                                                                                                                 |
| Absolute max. shaft load radial/axial | 30 N/15 N (6.5/3.3 lbs)                                                                                                                                                                                                                                                                      | 30 N/15 N (6.5/3.3 lbs)                                                                                                                                                                                                                                                                              |
| Absolute max. speed                   | 6,000 RPM                                                                                                                                                                                                                                                                                    | 10,000 RPM                                                                                                                                                                                                                                                                                           |
| Torque                                | ≤ 0.05 Ncm                                                                                                                                                                                                                                                                                   | ≤ 0.2 Ncm                                                                                                                                                                                                                                                                                            |
| Protection class Housing/Bearing      | IP 50/40                                                                                                                                                                                                                                                                                     | IP 50/40                                                                                                                                                                                                                                                                                             |
| General design                        | as per DIN VDE 0160, protection class III                                                                                                                                                                                                                                                    | as per DIN VDE 0160, protection class III                                                                                                                                                                                                                                                            |
| Operating temperature                 | -10°...+60 °C                                                                                                                                                                                                                                                                                | -10°...+60 °C                                                                                                                                                                                                                                                                                        |
| Connection                            | cable, radial/axial                                                                                                                                                                                                                                                                          | cable radial                                                                                                                                                                                                                                                                                         |
| Size                                  | Ø 30 mm                                                                                                                                                                                                                                                                                      | 39 x 39 mm                                                                                                                                                                                                                                                                                           |
| Weight                                | 50 g approx.                                                                                                                                                                                                                                                                                 | 60 g approx.                                                                                                                                                                                                                                                                                         |
| <b>Technical data – electrical</b>    |                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                      |
| Output                                | push-pull                                                                                                                                                                                                                                                                                    | push-pull                                                                                                                                                                                                                                                                                            |
| Supply voltage (SELV)                 | 5 VDC or 10...30 VDC                                                                                                                                                                                                                                                                         | 5 VDC or 10...30 VDC                                                                                                                                                                                                                                                                                 |
| Max. intrinsic power consumption      | 40 mA (5 VDC), 30 mA (24 VDC)                                                                                                                                                                                                                                                                | 40 mA (5 VDC), 30 mA (24 VDC),                                                                                                                                                                                                                                                                       |
| Max. pulse frequency                  | 300 kHz (5 VDC)<br>200 kHz (10 ... 30 VDC)                                                                                                                                                                                                                                                   | 300 kHz (5 V)<br>200 kHz (10 ... 30 V)                                                                                                                                                                                                                                                               |
| Output load                           | push-pull with short circuit protection:<br>10 mA (5 VDC),<br>30 mA (10...30 VDC)                                                                                                                                                                                                            | push-pull with short circuit protection:<br>10 mA (5 VDC),<br>30 mA (10...30 VDC)                                                                                                                                                                                                                    |
| Alarm output                          | NPN-O.C. 5 mA                                                                                                                                                                                                                                                                                | NPN-O.C. 5 mA                                                                                                                                                                                                                                                                                        |
| Pulse shape                           |                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                      |
| Pulse duty factor                     | 1 : 1                                                                                                                                                                                                                                                                                        | 1 : 1                                                                                                                                                                                                                                                                                                |
| Pulse width error                     | ± max. 25° electrical                                                                                                                                                                                                                                                                        | ± max. 25° electrical                                                                                                                                                                                                                                                                                |
| <b>Page</b>                           | 96                                                                                                                                                                                                                                                                                           | 98                                                                                                                                                                                                                                                                                                   |

## Incremental Encoders – Economy Types



| Type                                  | RI 41                                                                                                                                                                                            | RI 42                                                                                                                                                                         |
|---------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Special features</b>               | <ul style="list-style-type: none"> <li>economy encoder</li> <li>high mechanical life</li> <li>applications e.g. small motors, graphic machines, desktop robots, wood working machines</li> </ul> | <ul style="list-style-type: none"> <li>economy encoder</li> <li>high protection IP 65</li> <li>push-pull or NPN-O.C.</li> <li>applications, e.g. textile machinery</li> </ul> |
| <b>Number of pulses</b>               | 5 ... 3,600                                                                                                                                                                                      | 5 ... 1,024                                                                                                                                                                   |
| <b>Technical Data – mechanical</b>    |                                                                                                                                                                                                  |                                                                                                                                                                               |
| Flange or shaft fixation              | R = round flange                                                                                                                                                                                 | R = round flange                                                                                                                                                              |
| Shaft diameter                        | 6 mm                                                                                                                                                                                             | 6 mm                                                                                                                                                                          |
| Absolute max. shaft load radial/axial | 30 N/15 N (6.5/3.3 lbs)                                                                                                                                                                          | 30 N/15 N (6.5/3.3 lbs)                                                                                                                                                       |
| Absolute max. speed                   | 10,000 RPM                                                                                                                                                                                       | 10,000 RPM                                                                                                                                                                    |
| Torque                                | ≤ 0.2 Ncm                                                                                                                                                                                        | ≤ 1 Ncm                                                                                                                                                                       |
| Protection class Housing/Bearing      | IP 50/40                                                                                                                                                                                         | IP 65/64                                                                                                                                                                      |
| General design                        | as per DIN VDE 0160, protection class III                                                                                                                                                        | as per DIN VDE 0160, protection class III                                                                                                                                     |
| Operating temperature                 | -10°...+70 °C                                                                                                                                                                                    | 0°...+60 °C                                                                                                                                                                   |
| Connection                            | cable radial                                                                                                                                                                                     | cable axial                                                                                                                                                                   |
| Size                                  | Ø 40 mm                                                                                                                                                                                          | Ø 40 mm                                                                                                                                                                       |
| Weight                                | 60 g approx.                                                                                                                                                                                     | approx. 75 g                                                                                                                                                                  |
| <b>Technical data – electrical</b>    |                                                                                                                                                                                                  |                                                                                                                                                                               |
| Output                                | push-pull                                                                                                                                                                                        | push-pull/push-pull complementary/<br>NPN-O.C                                                                                                                                 |
| Supply voltage (SELV)                 | 5 VDC or 10...30 VDC                                                                                                                                                                             | 5 VDC/10...30 VDC/10...24 VDC                                                                                                                                                 |
| Max. intrinsic power consumption      | 40 mA (5 VDC), 30 mA (24 VDC),                                                                                                                                                                   | 40 mA (5 VDC), 30 mA (24 VDC),                                                                                                                                                |
| Max. pulse frequency                  | 300 kHz (5 VDC)<br>200 kHz (10 ... 30 VDC)                                                                                                                                                       | 300 kHz (5 V)<br>200 kHz (10 ... 30 V)<br>50 kHz (10...24 VDC)                                                                                                                |
| Output load                           | push-pull with short circuit protection:<br>10 mA (5 VDC),<br>30 mA (10...30 VDC)                                                                                                                | NPN-O.C.:30 mA (10...24 VDC)<br>push-pull with short circuit protection<br>10 mA (5 VDC),<br>30 mA (10...30 VDC)                                                              |
| Alarm output                          | NPN-O.C. 5 mA                                                                                                                                                                                    | NPN-O.C. 5 mA                                                                                                                                                                 |
| Pulse shape                           |                                                                                                                                                                                                  |                                                                                                                                                                               |
| Pulse duty factor                     | 1 : 1                                                                                                                                                                                            | 1 : 1                                                                                                                                                                         |
| Pulse width error                     | ± max. 25° electrical                                                                                                                                                                            | ± max. 25° electrical                                                                                                                                                         |
| Page                                  | 100                                                                                                                                                                                              | 102                                                                                                                                                                           |

# Measuring Signals

## SINGLE-CHANNEL SHAFT ENCODERS

Single-channel shaft encoders have only one output channel (A). They are used wherever it is not necessary to detect the direction of

rotation, such as in adding or subtracting counters or tachometers.

## TWO-CHANNEL SHAFT ENCODERS

These shaft encoders use two scanning systems, and output the signal pulses generated on two output channels (A and B). The output pulses from the two channels are 90° out of phase. A downstream logic circuit can derive the encoder's direction of rotation

from this phase shift. Two-channel shaft encoders are used wherever it is necessary to detect the direction of rotation, such as in up/down counters or positioning devices.

## THREE-CHANNEL SHAFT ENCODERS

In principle, these are two-channel shaft encoders which supply one pulse per revolution of the encoder on a third channel (N). This pulse is needed for precise determination of a reference position, for example. It is

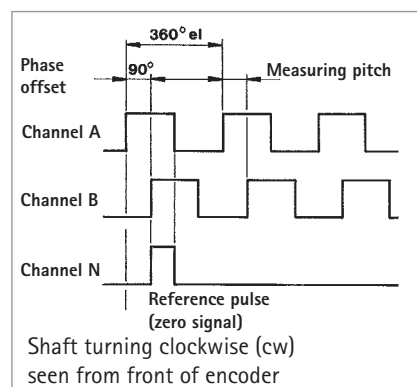
called the zero signal or reference signal. Shaft encoders with a zero signal are used very often in positioning systems.

## HENGSTLER SHAFT ENCODERS

All incremental HENGSTLER shaft encoders of the new generation with OPTOASIC are three-channel shaft encoders.

When applied as single- or two-channel shaft encoders the dispensable output signals can be omitted.

## OUTPUT SIGNALS



The shaft encoders supply two squarewave pulses offset by 90° A and B, and a reference pulse N (zero signal) as well.

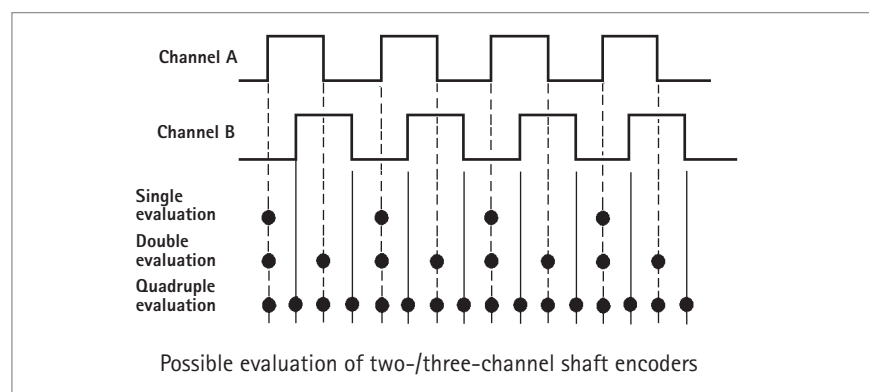
In order to suppress spurious pulses, certain output circuits (RS 422 and push-pull) generate inverted signals ( $\bar{A}$ ,  $\bar{B}$ ,  $\bar{N}$ ), such as in models RI 30, RI 36, RI 58, RI 58-H, RI 76-TD and RI 58-D.

The measuring pitch is defined as the value of the distance between two pulse edges of A and B.

## EVALUATION

The resolution of a two-channel shaft encoder can be doubled or quadrupled in the subsequent circuitry. This enables the resolution of a two-channel encoder with

2,500 lines per rev. to be increased electronically to 5,000 or 10,000 pulses per revolution (see diagram below).





# Maximum Speed, Protection Class

## SPEED

The maximum permissible speed of a shaft encoder is derived from:

- the **mechanically permissible** r.p.m,
- the minimum permissible **pulse-edge** spacing of the square-wave output signals of the shaft encoder for the subsequent circuitry, which depends on the tolerance of the phase offset,
- the **functional speed**, which is limited by the pulse frequency.

The **mechanically permissible r.p.m.** is specified for each shaft encoder among the mechanical characteristics.

In general, the control circuitry does not permit less than a certain **minimum edge spacing** between the square-wave output signal pulses. The minimum pulse-edge spacing is specified for each model of shaft encoder among the electrical characteristics.

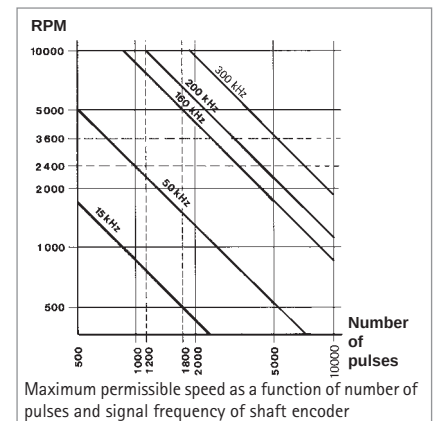
The **functional speed** of an encoder is obtained by the equation:

$$n_{\max} = f_{\max} \cdot 10^3 \cdot 60 / Z$$

$n_{\max}$  = maximum functional speed [r.p.m.]

$f_{\max}$  = maximum pulse frequency of shaft encoder, or input frequency of downstream circuitry [kHz]

$Z$  = number of pulses of shaft encoder



## PROTECTION CLASS

All encoders of the industrial types RI 30, RI 36, RI 58, RI 58-H, RI 58-D, RX 70-I as well as the absolute encoders RA 58, comply with protection class IP 65 according to EN 60529 and IEC 529, unless otherwise stated.

These specifications are valid for the housing and the cable output and also for plugged in socket connectors.

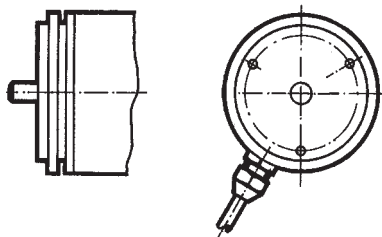
The shaft input complies with protection class IP 64. If however the encoder is mounted vertically, there must be no standing water present at the shaft input and the ball bearings.

In case the standard protection class IP 64 is not sufficient for the shaft input, e.g. with vertical mounting of the encoder, the encoders must be protected by additional labyrinth or pot-type seals. On request our encoders are also available with protection class IP 67 for the shaft input and for the housing.

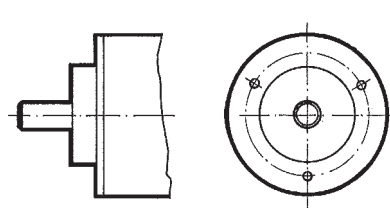
## Examples of Flange Mounting

### FLANGE TYPE OVERVIEW

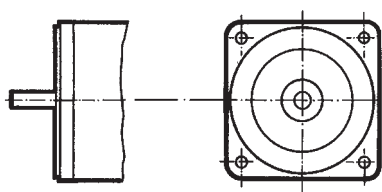
S = Synchro flange



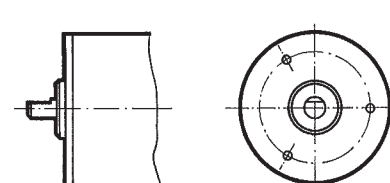
K = Clamping flange



Q = Square flange



R = Round flange

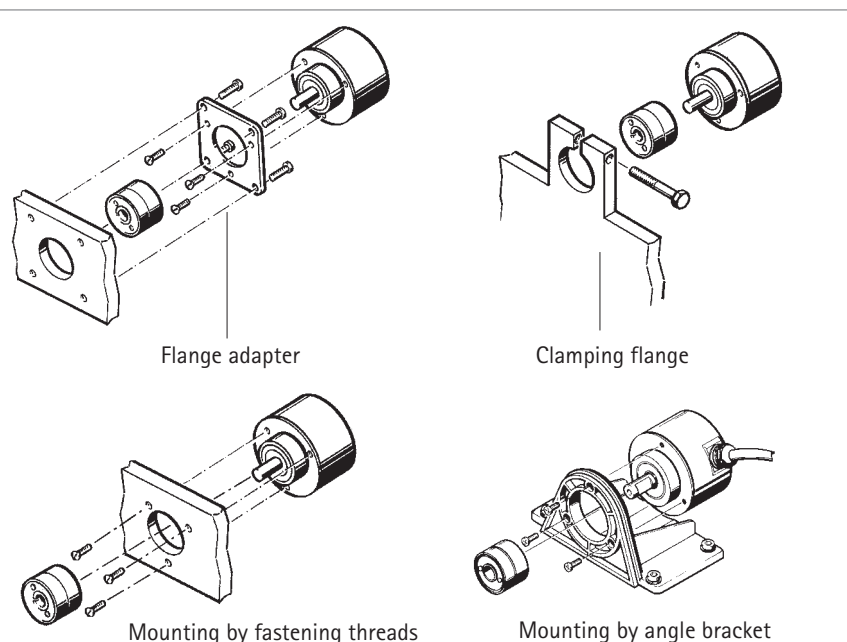


### SHAFT ENCODERS WITH CLAMPING FLANGE

The shaft encoders with a clamping flange can be installed in following ways:

- by means of various flange adapters (see "Accessories"),
- by means of the clamping flange itself,
- by means of the fastening threads provided on the face,
- by means of an angle bracket (see "Accessories").

The encoder housing is centered by means of the clamping flange.



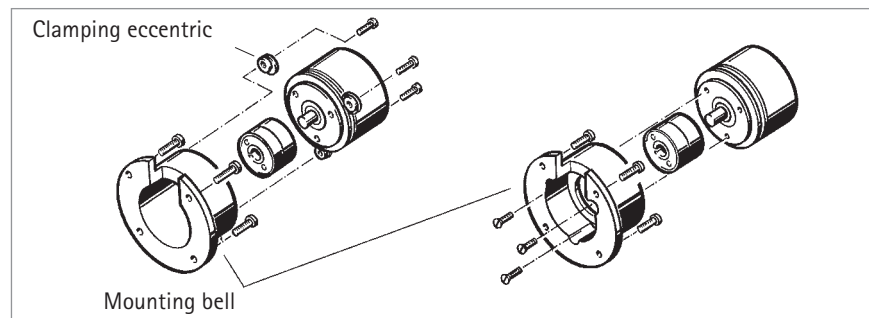
## Examples of Flange Mounting

### SHAFT ENCODERS WITH SYNCHRO FLANGE

The shaft encoders with synchro flange can be installed in two ways:

- by means of the synchro flange and three clamping eccentrics (see "Accessories"),
- by means of the fastening threads provided on the face.

The encoder is centered by means of the centering collar on the flange.

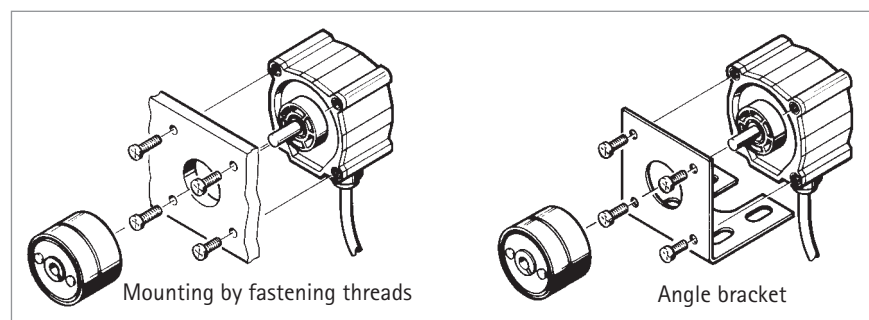


### SHAFT ENCODERS WITH SQUARE FLANGE

The shaft encoders with square flange can be installed in two ways:

- by means of the fastening threads provided on the face,
- by means of an angle bracket.

The encoder is centered by means of the centering collar on the flange.

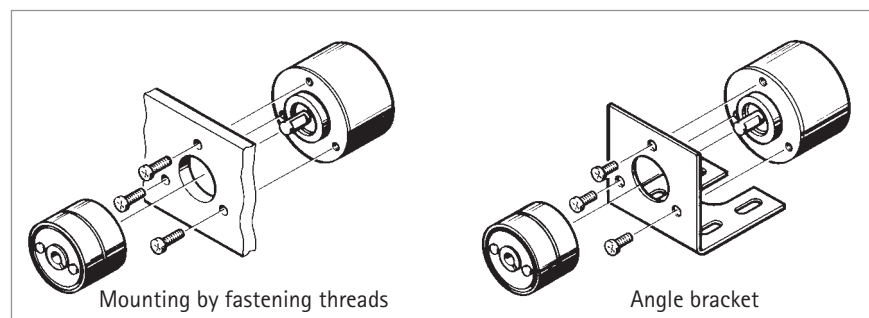


### SHAFT ENCODERS WITH ROUND FLANGE

The shaft encoders with round flange can be installed in two ways:

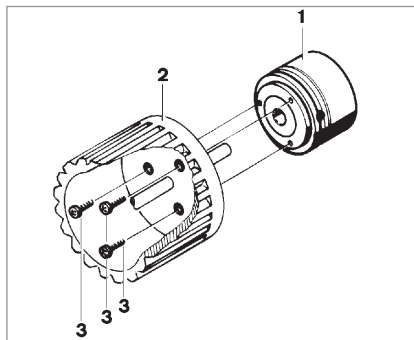
- by means of the fastening threads provided on the face,
- by means of an angle bracket.

The encoder is centered by means of the centering collar on the flange.

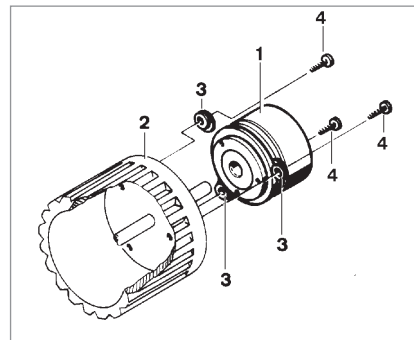


## Examples of Flange Mounting

### SHAFT ENCODERS WITH HOLLOW SHAFT (RI 58-H)

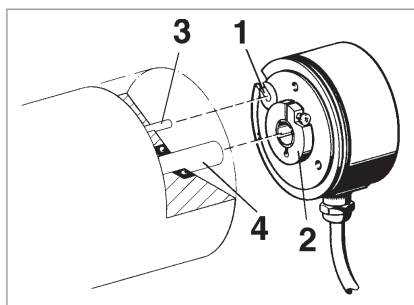


a) Mounting by screws  
1 Hollow-shaft encoder  
2 "B"-side of drive shaft  
3 Fastening screws (M4)



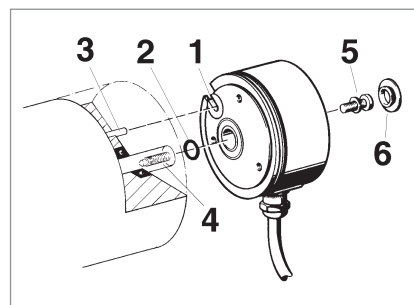
b) Mounting by clamping eccentrics  
1 Hollow-shaft encoder  
2 "B"-side of drive shaft  
3 Clamping eccentrics  
4 Fastening screws

### SHAFT ENCODERS WITH HOLLOW SHAFT (RI 58-D/G)



Mounting of version F, D (Clamping shaft)

- 1 Torque spring
- 2 Clamping ring with cross-recess screw
- 3 Straight pin
- 4 Actuating shaft



Mounting of version E (Blind shaft)

- 1 Torque spring
- 2 O-ring
- 3 Straight pin
- 4 Actuating shaft with threaded bore
- 5 M4-screw with spring washer
- 6 Cap

### SHAFT ENCODERS WITH SOLID SHAFT

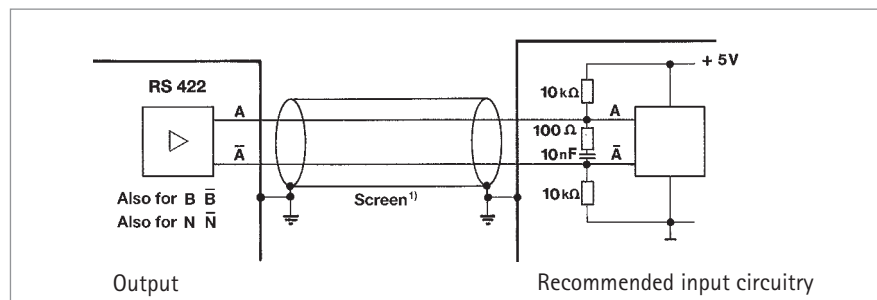
Connection of solid-shaft encoders to the shaft is by means of a coupling. The coupling compensates for axial movements and lack of alignment between the shaft encoder and the drive shaft, thus preventing excessive bearing loads on the encoder shaft. For further details please refer to heading "Accessories".

## OUTPUT CIRCUIT

## TECHNICAL DATA

## CABLE LENGTH

# Output RS 422



<sup>1)</sup> Cable screen:

- not existing for RI 32, 38, 42
- connected to encoders housing for RI 30, 36, 58, 59, 76 and RX 70

|                                                                        |                                                                                                                                                                                   |
|------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Code Letter                                                            | R = RS 422 + Alarm <sup>3)</sup> (with $U_B = 5/10...30$ VDC)<br>T = RS 422 + Sense <sup>4)</sup> (only with $U_B = 5$ VDC)                                                       |
| Output signals shaft turning clockwise (cw) seen from front of encoder | <p>Square wave pulses (TTL) for channels A, B, N and their inverted signals <math>\bar{A}</math>, <math>\bar{B}</math>, <math>\bar{N}</math></p>                                  |
| Delay times at 1.5 m cable                                             | <p><math>\leq 100</math> ns <math>\leq 100</math> ns</p>                                                                                                                          |
| Pulse shape                                                            |                                                                                                                                                                                   |
| Pulse duty factor                                                      | 1:1                                                                                                                                                                               |
| Pulse width error <sup>1)</sup>                                        | $\pm 25^\circ$ electrical                                                                                                                                                         |
| Max. pulse frequency                                                   | 300 kHz                                                                                                                                                                           |
| Output voltage                                                         | 0... + 5 VDC <sup>2)</sup>                                                                                                                                                        |
| Output level                                                           | H $\geq 2.5$ VDC/L $\leq 0.5$ VDC (TTL-level)                                                                                                                                     |
| Output load max.                                                       | $\pm 30$ mA                                                                                                                                                                       |
| Short circuit protection                                               | with $U_B = 5$ VDC: only 1 channel at a time for max. 1 s (standard RS 422-driver)<br>with $U_B = 10...30$ VDC: short circuit proof for all channels due to integrated controller |
| Pole protection of $U_B$                                               | with $U_B = 5$ VDC: no<br>with $U_B = 10...30$ VDC: yes                                                                                                                           |

<sup>1)</sup> distance from A to B is at least  $0.45 \mu s$  (at 300 kHz)

<sup>2)</sup> also for  $U_B = 10...30$  VDC

<sup>3)</sup> Description – see Outputs-Alarm

<sup>4)</sup> Description – see Outputs-Sense

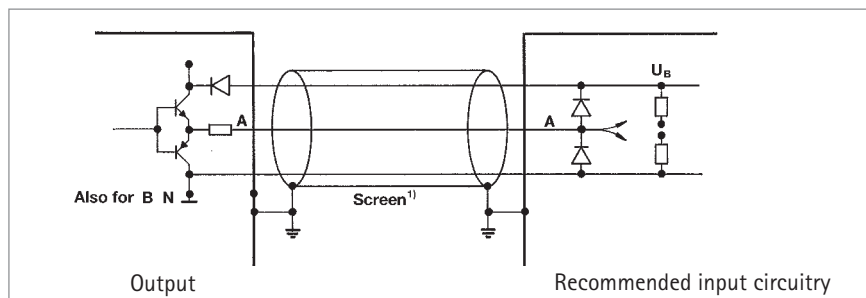
depending on voltage and frequency (at  $25^\circ C$ ) <sup>1)</sup>:

|        |                |
|--------|----------------|
| length | RS 422         |
| 10 m   | 5 VDC, 300 kHz |
| 50 m   | 5 VDC, 300 kHz |
| 100 m  | 5 VDC, 300 kHz |

<sup>1)</sup> with respect to Hengstler own cables

# Output Push-pull

## OUTPUT CIRCUIT



<sup>1)</sup> Cable screen:

- not existing for RI 32, 38, 42
- RI 41, not connected to encoder housing
- connected to encoders housing for RI 30, 36, 58, 59, 76 and RX 70

## TECHNICAL DATA

|                                                                        |                                                                                                                                    |                 |                         |
|------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|-----------------|-------------------------|
| Code Letter                                                            | K = push-pull, 10 mA with $U_B = 5$ VDC<br>or push-pull, 30 mA with $U_B = 10...30$ VDC<br>D = push-pull, 30 mA with $U_B = 5$ VDC |                 |                         |
| Output signals shaft turning clockwise (cw) seen from front of encoder |                                                                                                                                    |                 |                         |
| Delay times with 1.5 m Cable                                           | $\leq 250$ ns $\leq 250$ ns                                                                                                        |                 |                         |
| Pulse shape                                                            |                                                                                                                                    |                 |                         |
| Pulse duty factor                                                      | 1:1                                                                                                                                |                 |                         |
| Pulse width error <sup>1)</sup>                                        | $\pm 25^\circ$ electrical                                                                                                          |                 |                         |
| Max. pulse frequency                                                   | 300 kHz (see cable length)                                                                                                         |                 |                         |
| Output voltage                                                         | 0... + $U_B$                                                                                                                       |                 |                         |
| Output level                                                           | K                                                                                                                                  | K               | D                       |
|                                                                        | push-pull (10...30 V)                                                                                                              | push-pull (5 V) | push-pull (5 V)         |
|                                                                        | $H \geq U_B - 3V$                                                                                                                  | $H \geq 2,5$ V  | $H \geq 2,5$ V          |
|                                                                        | $L \leq 2$ V                                                                                                                       | $L \leq 0,5$ V  | $L \leq 0,5$ V          |
| Output load max.                                                       | $\pm 30$ mA                                                                                                                        | $\pm 10$ mA     | $\pm 30$ mA             |
| Short circuit protection                                               | all channels                                                                                                                       | all channels    | 1 channel <sup>2)</sup> |
| Pole protection of $U_B$                                               | with $U_B = 5$ VDC: output K yes, output D no<br>with $U_B = 10...30$ VDC: yes                                                     |                 |                         |

<sup>1)</sup> Distance A to B min. 0.45  $\mu$ s (at 300 kHz)

<sup>2)</sup> only 1 channel at a time for max. 1 s

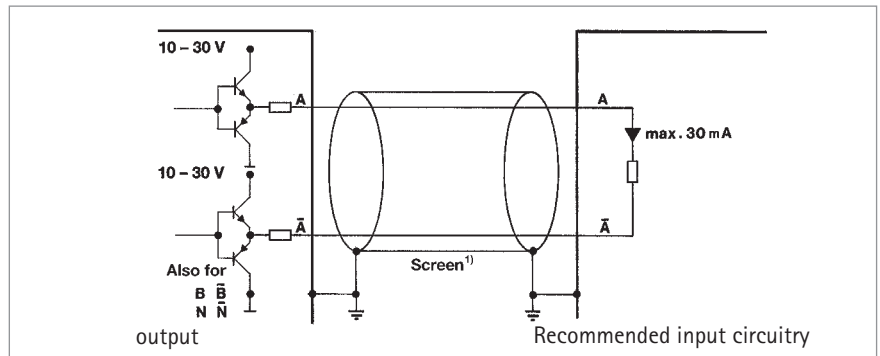
## CABLE LENGTH

|                                                              |               |               |                                                       |
|--------------------------------------------------------------|---------------|---------------|-------------------------------------------------------|
| depending on voltage and frequency (at 25°C) <sup>1)</sup> : |               |               |                                                       |
| length                                                       | push-pull (K) | push-pull (D) | push-pull (K)                                         |
|                                                              | 5 VDC, 10 mA  | 5 VDC, 30 mA  | 10...30 VDC, 30 mA                                    |
| 10 m                                                         | 300 kHz       | 300 kHz       | 12 VDC, 200 kHz<br>24 VDC, 200 kHz<br>30 VDC, 200 kHz |
| 50 m                                                         |               | 300 kHz       | 12 VDC, 200 kHz<br>24 VDC, 200 kHz<br>30 VDC, 100 kHz |
| 100 m                                                        |               | 300 kHz       | 12 VDC, 200 kHz<br>24 VDC, 100 kHz<br>30 VDC, 50 kHz  |

<sup>1)</sup> with respect to Hengstler own cables

# Output

## Push-pull complementary



<sup>1)</sup> Cable screen connected with encoder housing

### TECHNICAL DATA

| Code Letter                                                            | I = push-pull complementary (with $U_B = 10...30\text{ V}$ )                                                                                     |
|------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| Output signals shaft turning clockwise (cw) seen from front of encoder | <p>Square wave pulses (HTL) for channels A, B, N and their inverted signals <math>\bar{A}</math>, <math>\bar{B}</math>, <math>\bar{N}</math></p> |
| Delay times at 1.5 m cable                                             | <p><math>\leq 250\text{ ns} \leq 250\text{ ns}</math></p>                                                                                        |
| Pulse shape                                                            |                                                                                                                                                  |
| Pulse duty factor                                                      | 1:1                                                                                                                                              |
| Pulse width error <sup>1)</sup>                                        | $\pm 25^\circ$ electrical                                                                                                                        |
| Max. pulse frequency                                                   | 200 kHz (see cable length)                                                                                                                       |
| Output voltage                                                         | $0... + U_B$                                                                                                                                     |
| Output level                                                           | $H \geq U_B - 3\text{ V/L} \leq 2\text{ V}$                                                                                                      |
| Output load max.                                                       | $\pm 30\text{ mA}$                                                                                                                               |
| Short circuit protection                                               | short circuit proof for all channels due to integrated controller                                                                                |
| Pole protection of $U_B$ :                                             | yes                                                                                                                                              |

<sup>1)</sup> distance from A to B is at least  $0.7\text{ }\mu\text{s}$  (at 200 kHz)

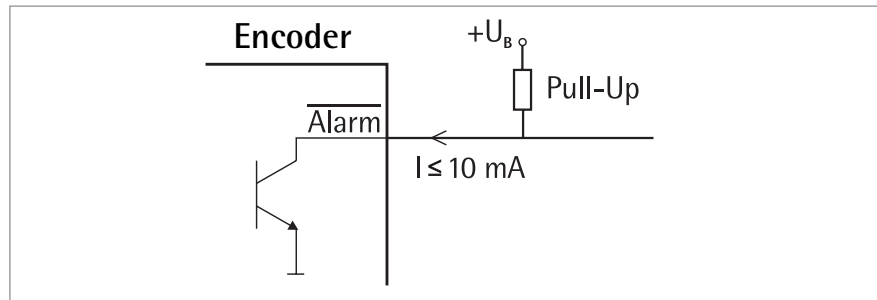
### CABLE LENGTH

| depending on voltage and frequency (at $25^\circ\text{C}$ ) <sup>1)</sup> : |                         |
|-----------------------------------------------------------------------------|-------------------------|
| length                                                                      | push-pull complementary |
| 10 m                                                                        | 12 VDC, 200 kHz         |
|                                                                             | 24 VDC, 200 kHz         |
|                                                                             | 30 VDC, 200 kHz         |
| 50 m                                                                        | 12 VDC, 200 kHz         |
|                                                                             | 24 VDC, 50 kHz          |
|                                                                             | 30 VDC, 25 kHz          |
| 100 m                                                                       | 12 VDC, 150 kHz         |
|                                                                             | 24 VDC, 25 kHz          |
|                                                                             | 30 VDC, 12 kHz          |

<sup>1)</sup> with respect to Hengstler own cables

# Output Alarm

## OUTPUT CIRCUIT



## TECHNICAL DATA

|                             |                                                                                                                                                       |
|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| Output                      | NPN - open collector                                                                                                                                  |
| Output load max.            | 5 mA/24 V at $U_B = 5 \text{ VDC}$<br>5mA/32 V at $U_B = 10...30 \text{ VDC}$                                                                         |
| Output Level                | Output active (failure condition): $L \leq 0.7 \text{ VDC}$<br>Output inactive: highohmic (if necessary: get H-level by an external pull-up resistor) |
| Malfunction indication time | $\geq 20 \text{ ms}$                                                                                                                                  |

## FUNCTION

The rotary encoders are equipped with an electronic monitoring system which reports malfunctions via a separate alarm output.

The alarm output can be used for selecting an optical display (LED; for circuit, see above) or the control system (SPC or similar).

Moreover, the alarm outputs of several encoders can be interconnected to a common "systems alarm" by means of a parallel connection. The following malfunctions are indicated:

| Category I      | Category II                                | Category III                                           |
|-----------------|--------------------------------------------|--------------------------------------------------------|
| - damaged disks | - overtemperature                          | - voltage range<br>$1 \text{ VDC} < U < 4 \text{ VDC}$ |
| - defective LED | - overload (e. g.<br>due to short circuit) | - voltage drop on the<br>supply lines                  |
| - contamination |                                            |                                                        |

Category I malfunctions cannot be corrected; the encoder must be replaced.

Category II malfunctions are detected by means of a thermal monitoring unit in the electronic system. The alarm message is cleared after the cause of temperature increase has been removed.

Category III malfunctions indicate insufficient supply voltage. Also included in this category are transients in the supply voltage, e.g. due to electrostatic discharge, which may distort the output signals.

This is corrected by

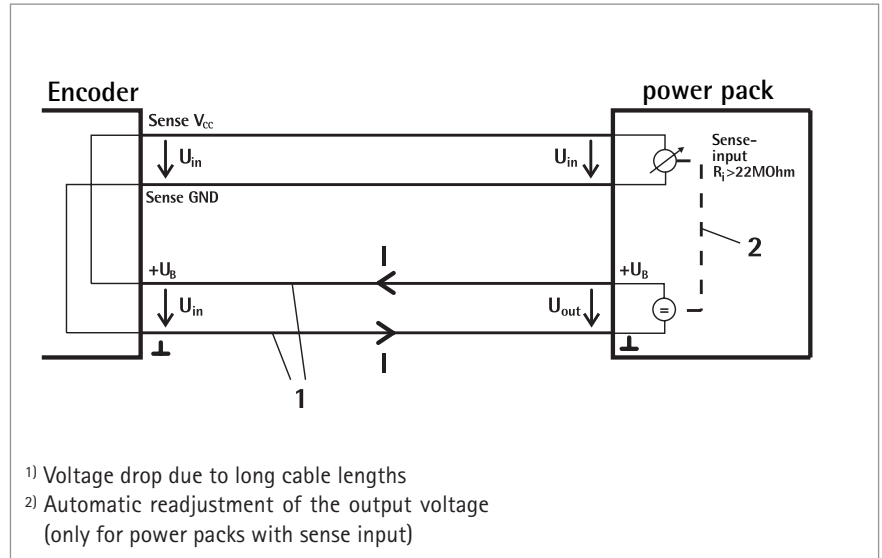
- readjustment to the correct voltage
- eliminating the cause of disturbance, i.e. by careful arrangement of the cables.



## Output

### Sense at RS 422 (T)

#### OUTPUT CIRCUIT



#### FUNCTION

The sense cables enable the measuring of the actual sensor voltage (no corruption due to voltage drop resulting from supply current and cable resistance).

Due to the voltage drop in the cables and the voltage supply, the encoder input voltage  $U_{in}$  is less than the power pack output voltage  $U_{out}$ .

The present input voltage  $U_{in}$  is now output to the Sense  $V_{cc}$  and Sense GND cables and returns as data to the power pack.

The input resistance  $R_i$  on the power pack should amount to at least 22 MOhm so that no voltage drop occurs on these cables.

In case of power packs with sense input, it is now possible to readjust the output voltage  $U_{out}$  automatically.

# Code Table

## for Incremental Shaft Encoders

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<sup>1)</sup> CONIN, BINDER, MIL and KPT indicate the connectors with pins on the encoder housing

<sup>2)</sup> only for connection of TPE cable (E, F)

<sup>3)</sup> only with connection cable (A, B, E, F) and differing from standard (1.5 m resp. 1.0 m + plug) special lengths for larger quantities on request.

<sup>4)</sup> e.g. RI 76 see section RI 76

|                        |  |                                       |
|------------------------|--|---------------------------------------|
| <b>Example:</b>        |  | <b>RI 58-H/5000ES.37KB-DO</b>         |
| Type:                  |  | RI 58-H                               |
| Number of pulses:      |  | 5,000                                 |
| E: Supply voltage:     |  | 10...30 VDC=                          |
| S: Type of flange:     |  | Synchro flange                        |
| 3: Protection class:   |  | IP 64                                 |
| 7: Shaft diameter:     |  | 12 mm                                 |
| K: Output circuit:     |  | push-pull short circuit proof + Alarm |
| B: Type of connection: |  | PVC cable, radial                     |
| DO: Cable length:      |  | 3.0 m                                 |

# Incremental Shaft Encoders Type RI 30

## Industrial types



### NUMBER OF PULSES

- Miniature encoder for industrial use
- Low current consumption
- High noise interference immunity
- Cable lengths of up to 100 m
- Suitable for high pulse frequencies
- High protection class
- Application e.g.:  
CNC machines, manipulators, motors,  
medical technology, textile machines

5 / 10 / 20 / 25 / 30 / 50 / 60 / 100 / 120 / 128 / 200 / 250 / 256 / 288 / 300 / 360 / 400 / 500  
/ 512 / 600 / 720 / 900 / 1,000 / 1,024 / 1,250 / 1,500  
Other numbers of pulses available on request

### TECHNICAL DATA mechanical

|                             |                                                                                                                                                                                                                                                                                              |
|-----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Shaft diameter              | 5 mm                                                                                                                                                                                                                                                                                         |
| Absolute max. shaft load    | radial 30 N / axial 15 N (6.5/3.3 lbs)                                                                                                                                                                                                                                                       |
| Absolute maximum speed      | max. 10,000 RPM                                                                                                                                                                                                                                                                              |
| Torque                      | ≤ 0.2 Ncm                                                                                                                                                                                                                                                                                    |
| Moment of inertia           | ca. 0.8 gcm <sup>2</sup>                                                                                                                                                                                                                                                                     |
| Protection class (EN 60529) | Housing IP 64, bearings IP 64                                                                                                                                                                                                                                                                |
| Operating temperature       | -10 ... +70 °C                                                                                                                                                                                                                                                                               |
| Storage temperature         | -25 ... +85 °C                                                                                                                                                                                                                                                                               |
| Vibration performance       | 100 m/s <sup>2</sup> (10 ... 2000 Hz)                                                                                                                                                                                                                                                        |
| Shock resistance            | 1,000 m/s <sup>2</sup> (6 ms)                                                                                                                                                                                                                                                                |
| Type of connection          | 1.5 m cable radial/axial <sup>1)</sup> , connector axial                                                                                                                                                                                                                                     |
| Housing                     | aluminium                                                                                                                                                                                                                                                                                    |
| Flange                      | S = synchro flange, R = round flange                                                                                                                                                                                                                                                         |
| Weight                      | 60 g approx.                                                                                                                                                                                                                                                                                 |
| Bearing life                | 1 x 10 <sup>10</sup> revolutions (typ.) at 35 % of full rated shaft load<br>1 x 10 <sup>9</sup> revolutions (typ.) at 75 % of full rated shaft load<br>1 x 10 <sup>8</sup> revolutions (typ.) at 100 % of full rated shaft load<br>For example 30,000 h at 6,000 RPM with a 2 lb radial load |

<sup>1)</sup> Other cable length on request

### TECHNICAL DATA electrical

|                               |                                                                                           |                                                                                |
|-------------------------------|-------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|
| General design                | as per DIN VDE 0160, protection class III,<br>contamination level 2, overvoltage class II |                                                                                |
| Supply voltage<br>(SELV)      | with RS 422 (R, T):                                                                       | 5 VDC ± 10 %                                                                   |
|                               | with push-pull (K):                                                                       | 10 ... 30 VDC <sup>1)</sup>                                                    |
| Power consumption             | 40 mA (5 VDC), 60 mA (10 VDC), 30 mA (24 VDC)                                             |                                                                                |
| Standard-                     | RS 422 (R)                                                                                | A, B, N, $\overline{A}$ , $\overline{B}$ , $\overline{N}$ , $\overline{Alarm}$ |
| Output versions <sup>2)</sup> | RS 422 (T)                                                                                | A, B, N, $\overline{A}$ , $\overline{B}$ , $\overline{N}$ , Sense              |
|                               | push-pull (K)                                                                             | A, B, N, $\overline{Alarm}$                                                    |

<sup>1)</sup> Pole protection

<sup>2)</sup> Output description and technical data see section „Output“.

# Incremental Shaft Encoders

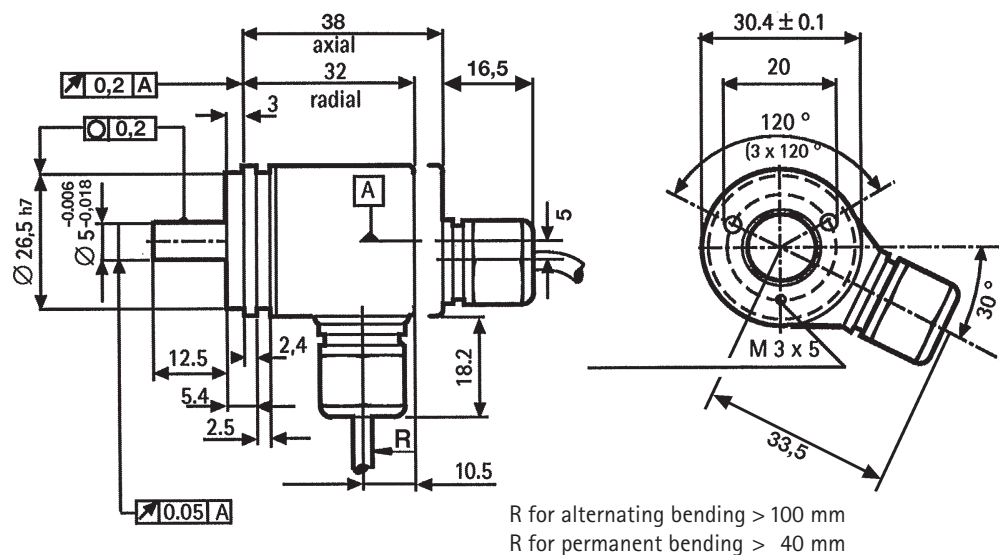
## Industrial types

Type RI 30

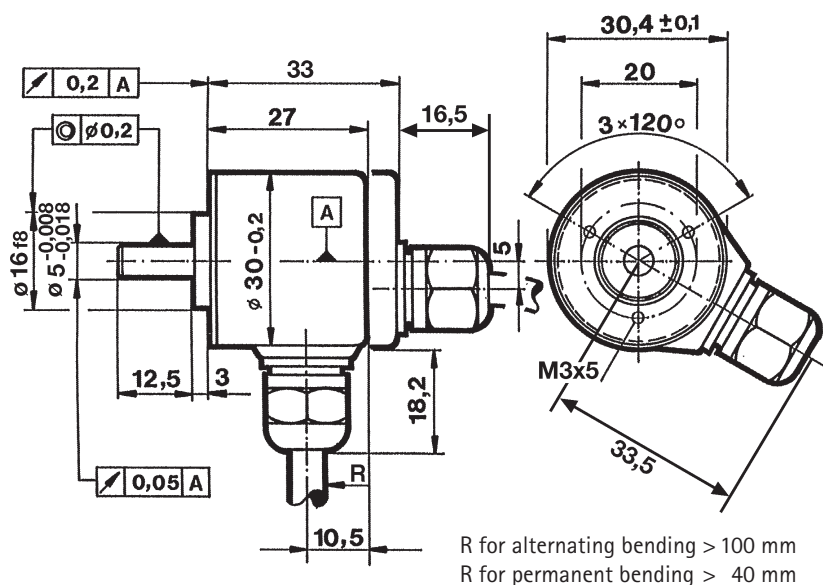
### DIMENSIONED DRAWINGS

(Dimensions in mm)

Synchro flange, cable



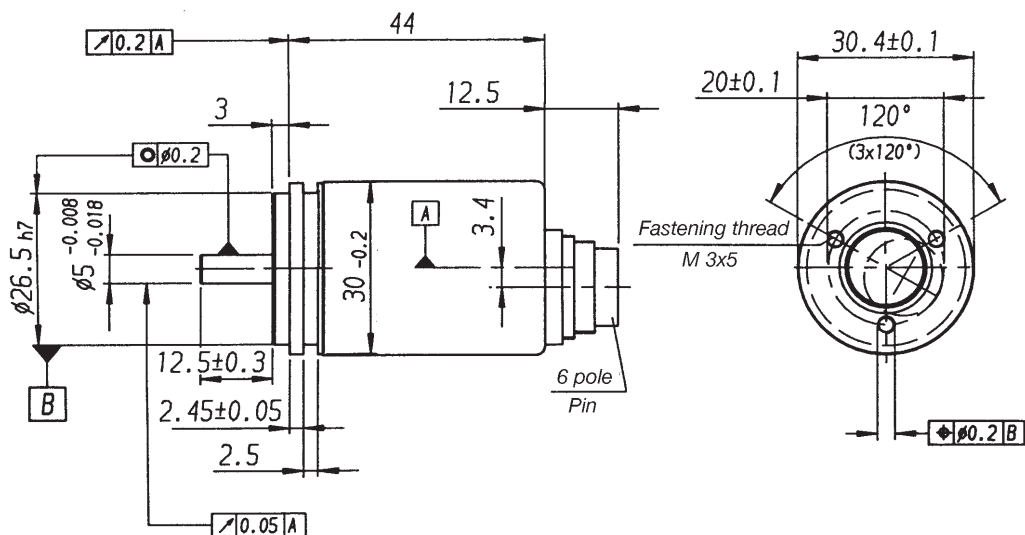
Round flange, cable



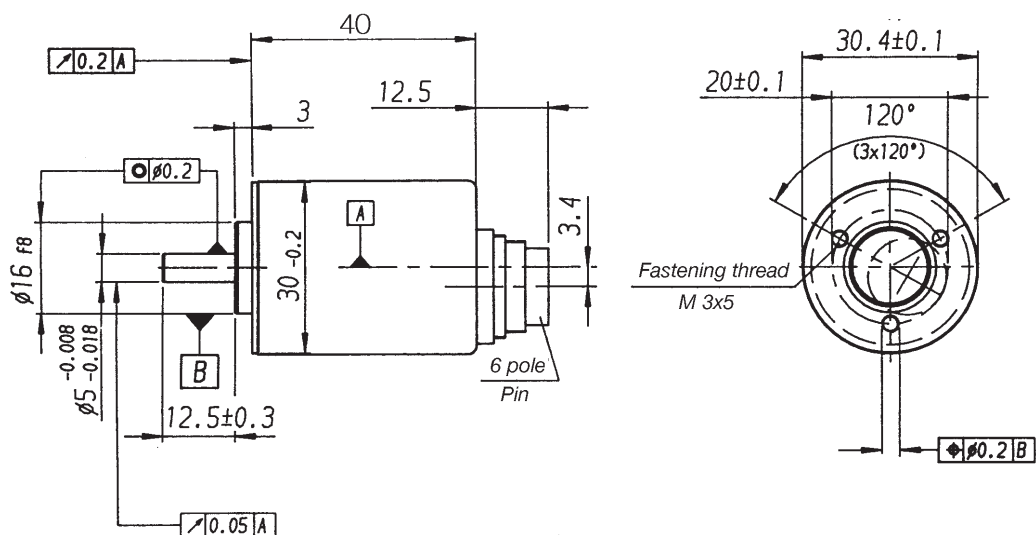
# Incremental Shaft Encoders Type RI 30

## Industrial types

Synchro flange, BINDER



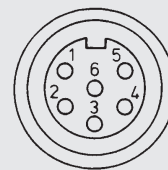
Round flange, BINDER



## Industrial types

## CONNECTOR 6 POLE (BINDER)

| Description (push-pull) | Pin |
|-------------------------|-----|
| 10 ... 30 VDC           | 1   |
| Channel A               | 2   |
| Channel N               | 3   |
| Channel B               | 4   |
| Alarm                   | 5   |
| GND                     | 6   |

CONNECTION DIAGRAM  
cable

| Description (push-pull) | Description (RS 422)          | Lead Ø mm <sup>2</sup> | Colour               |
|-------------------------|-------------------------------|------------------------|----------------------|
| 10 ... 30 VDC           | 5 VDC                         | 0.5                    | red                  |
|                         | Sense V <sub>CC</sub>         | 0.14                   | yellow/red           |
| Channel A               | Channel A                     | 0.14                   | white                |
|                         | Channel $\bar{A}$             | 0.14                   | white/brown          |
| Channel B               | Channel B                     | 0.14                   | green                |
|                         | Channel $\bar{B}$             | 0.14                   | green/brown          |
| Channel N               | Channel N                     | 0.14                   | yellow               |
|                         | Channel $\bar{N}$             | 0.14                   | yellow/brown         |
| GND                     | GND                           | 0.5                    | black                |
| Alarm                   | Alarm/Sense GND <sup>1)</sup> | 0.14                   | yellow/black         |
| screen <sup>2)</sup>    | screen <sup>2)</sup>          |                        | screen <sup>2)</sup> |

<sup>1)</sup> depending on ordering code

<sup>2)</sup> connected to housing

## ORDERING DATA

|                                        |                                                                                  |                                                                                                           |                                                                                                                                           |
|----------------------------------------|----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| <b>0</b> standard                      | Supply voltage<br><b>A</b> 5 VDC<br><b>E</b> 10 ... 30 VDC (only with push-pull) | Type of flange<br><b>S</b> synchro flange<br><b>R</b> round flange                                        | Shaft diameter<br><b>4</b> 5 mm                                                                                                           |
| <b>R I 3 0</b>                         | <b>- 0</b>                                                                       | <b>/</b>                                                                                                  | <b>3</b>                                                                                                                                  |
| Number of pulses<br><b>5 ... 1,500</b> | Protection class<br><b>3</b> IP 64                                               | Output<br><b>T</b> RS 422 + Sense<br><b>K</b> push-pull<br>short circuit proof<br><b>R</b> RS 422 + Alarm | Type of connection<br><b>A</b> cable axial<br><b>B</b> cable radial<br><b>N</b> BINDER <sup>1)</sup><br>6 pole, axial<br>(only push-pull) |
|                                        |                                                                                  |                                                                                                           | <b>4</b>                                                                                                                                  |

<sup>1)</sup> encoder connector with pins

# Incremental Shaft Encoders Type RI 36

## Industrial types



### NUMBER OF PULSES

- Miniature industry standard encoder for high numbers of pulses
- High reliability
- Application e.g.:
  - CNC axles
  - Machine tools
  - Robots
  - Special purpose machines
  - High-speed winding machines

5 / 10 / 20 / 25 / 28 / 32 / 50 / 60 / 72 / 100 / 128 / 144 / 200 / 250 / 256 / 288 / 300 / 360 / 400 / 500 / 512 / 600 / 720 / 900 / 1,000 / 1,024 / 1,250 / 1,500 / 2,000 / 2,048 / 2,500 / 3,000 / 3,600

Other numbers of pulses available on request

### TECHNICAL DATA mechanical

|                             |                                                                                                                                                                                                                                                                                              |
|-----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Shaft diameter              | 6 mm / 6,35 mm                                                                                                                                                                                                                                                                               |
| Absolute max. shaft load    | radial 30 N / axial 15 N (6.5/3.3 lbs)                                                                                                                                                                                                                                                       |
| Absolute maximum speed      | max. 10,000 RPM                                                                                                                                                                                                                                                                              |
| Torque                      | ≤ 0.3 Ncm                                                                                                                                                                                                                                                                                    |
| Moment of inertia           | ca. 2.8 gcm <sup>2</sup>                                                                                                                                                                                                                                                                     |
| Protection class (EN 60529) | Housing IP 64, bearings IP 64                                                                                                                                                                                                                                                                |
| Operating temperature       | -10 ... +70 °C                                                                                                                                                                                                                                                                               |
| Storage temperature         | -25 ... +85 °C                                                                                                                                                                                                                                                                               |
| Vibration performance       | 100 m/s <sup>2</sup> (10 ... 2,000 Hz)                                                                                                                                                                                                                                                       |
| Shock resistance            | 1,000 m/s <sup>2</sup> (6 ms)                                                                                                                                                                                                                                                                |
| Type of connection          | 1.5 m cable or connector, axial or radial <sup>1)</sup>                                                                                                                                                                                                                                      |
| Housing                     | aluminium                                                                                                                                                                                                                                                                                    |
| Flange                      | S = synchro flange, R = round flange                                                                                                                                                                                                                                                         |
| Wight                       | 80 g approx.                                                                                                                                                                                                                                                                                 |
| Bearing life                | 1 x 10 <sup>10</sup> revolutions (typ.) at 35 % of full rated shaft load<br>1 x 10 <sup>9</sup> revolutions (typ.) at 75 % of full rated shaft load<br>1 x 10 <sup>8</sup> revolutions (typ.) at 100 % of full rated shaft load<br>For example 30,000 h at 6,000 RPM with a 2 lb radial load |

<sup>1)</sup> Other cable length on request

### TECHNICAL DATA electrical

|                               |                                                                                        |                                                    |
|-------------------------------|----------------------------------------------------------------------------------------|----------------------------------------------------|
| General design                | as per DIN VDE 0160, protection class III, contamination level 2, overvoltage class II |                                                    |
| Supply voltage (SELV)         | with RS 422 (R, T):                                                                    | 5 VDC ± 10 %                                       |
|                               | with push-pull (K, I):                                                                 | 10 ... 30 VDC <sup>1)</sup>                        |
| Power consumption             | 40 mA (5 VDC), 60 mA (10 VDC), 30 mA (24 VDC)                                          |                                                    |
| Standard-                     | RS 422 (R):                                                                            | A, B, N, $\bar{A}$ , $\bar{B}$ , $\bar{N}$ , Alarm |
| Output versions <sup>2)</sup> | RS 422 (T):                                                                            | A, B, N, $\bar{A}$ , $\bar{B}$ , $\bar{N}$ , Sense |
|                               | push-pull (K):                                                                         | A, B, N, $\bar{A}$ , $\bar{B}$ , $\bar{N}$ , Alarm |
|                               | push-pull complementary (I):                                                           | A, B, N, $\bar{A}$ , $\bar{B}$ , $\bar{N}$ , Alarm |

<sup>1)</sup> Pole protection

<sup>2)</sup> Output description and technical data see section „output“.





# Incremental Shaft Encoders Type RI 36

## Industrial types

### CONNECTION DIAGRAM

| Cable PVC (A, B)     | Lead Ø          | Output RS 422 (R, T)          | push-pull (K)        | push-pull complementary (I) |
|----------------------|-----------------|-------------------------------|----------------------|-----------------------------|
| Colour               | mm <sup>2</sup> |                               |                      |                             |
| red                  | 0.5             | 5 VDC=                        | 10...30 VDC=         | 10...30 VDC=                |
| yellow/red           | 0.14            | Sense V <sub>CC</sub>         |                      | Sense V <sub>CC</sub>       |
| white                | 0.14            | Channel A                     | Channel A            | Channel $\bar{A}$           |
| white/brown          | 0.14            | Channel $\bar{A}$             |                      | Channel A                   |
| green                | 0.14            | Channel B                     | Channel B            | Channel $\bar{B}$           |
| green/brown          | 0.14            | Channel $\bar{B}$             |                      | Channel B                   |
| yellow               | 0.14            | Channel N                     | Channel N            | Channel N                   |
| yellow/brown         | 0.14            | Channel $\bar{N}$             |                      | Channel $\bar{N}$           |
| black                | 0.5             | GND                           | GND                  | GND                         |
| yellow/black         | 0.14            | Alarm/Sense GND <sup>1)</sup> | Alarm                | Alarm                       |
| Screen <sup>2)</sup> |                 | Screen <sup>2)</sup>          | Screen <sup>2)</sup> | Screen <sup>2)</sup>        |

<sup>1)</sup> depending on ordering code

<sup>2)</sup> connected to housing

### ORDERING DATA

|                                        |                                                                             |                                                                                                                                            |                                                                                                                                                                                            |
|----------------------------------------|-----------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>0</b> standard                      | Supply voltage<br><b>A</b> 5 VDC<br><b>E</b> 10 ... 30 VDC (only push-pull) | Type of flange<br><b>S</b> synchro flange<br><b>R</b> round flange                                                                         | Shaft diameter<br><b>1</b> 6 mm<br><b>5</b> 6.35 mm                                                                                                                                        |
| <b>RI 36 - 0 /</b>                     |                                                                             |                                                                                                                                            |                                                                                                                                                                                            |
| Number of pulses<br><b>5 ... 3,600</b> | Protection class<br><b>3 IP 64</b>                                          | Output<br><b>T</b> RS 422 + Sense<br><b>K</b> push-pull short circuit proof<br><b>R</b> RS 422 + Alarm<br><b>I</b> push-pull complementary | Type of connection<br><b>A</b> cable axial<br><b>B</b> cable radial<br><b>N</b> BINDER <sup>1)</sup> , 6 pole, axial (only push-pull)<br><b>J</b> BINDER*, 6 pole, radial (only push-pull) |

<sup>1)</sup> encoder connector with pins

## Industrial types



- Universal industry standard encoder
- Up to 40,000 steps with 10,000 pulses
- High signal accuracy
- Protection class up to IP 67
- Operating temperature up to 100 °C (RI 58-T)
- Flexible due to many flange and configuration variants
- Suitable for high shock ratings
- Application e.g.: Machine tools, CNC axes, packing machines, motors/drives, injection moulding machines, sawing machines, textile machines
- For EX version, see RX 70-I

## NUMBER OF PULSES

RI 58-O

1 / 2 / 3 / 4 / 5 / 10 / 15 / 20 / 25 / 29 / 30 / 35 / 40 / 50 / 60 / 64 / 70 / 72 / 80 / 100 / 117 / 120 / 125 / 127 / 128 / 136 / 144 / 150 / 180 / 200 / 226 / 230 / 250 / 256 / 280 / 300 / 314 / 350 / 356 / 360 / 375 / 400 / 460 / 480 / 500 / 512 / 600 / 625 / 635 / 720 / 750 / 889 / 900 / 942 / 1,000 / 1,024 / 1,125 / 1,200 / 1,250 / 1,270 / 1,500 / 1,600 / 1,800 / 1,885 / 1,979 / 2,000 / 2,048 / 2,400 / 2,500 / 3,000 / 3,400 / 3,480 / 3,600 / 3,750 / 3,925 / 3,958 / 3,968 / 4,000 / 4,096 / 4,445 / 4,800 / 5,000 / 5,400 / 6,000 / 6,875 / 7,200 / 7,680 / 7,854 / 8,000 / 8,192 / 9,000 / 10,000

other numbers of pulses available on request.

RI 58-T

(high temperature): as above, but only for the range from 4 ... 2,500 pulses  
other numbers of pulses available on request.

TECHNICAL DATA  
mechanical

|                                            |                                                                          |                       |
|--------------------------------------------|--------------------------------------------------------------------------|-----------------------|
| Shaft diameter                             | 6 mm/6.35 mm/7 mm/12 mm/10 mm/9.52 mm                                    |                       |
| Absolute max. shaft load<br>radial / axial | Ø 12 mm                                                                  | 180/140 N (39/30 lbs) |
|                                            | Ø 7...10 mm                                                              | 160/107 N (35/24 lbs) |
|                                            | Ø 6 mm/6.35 mm                                                           | 110/60 N (24/13 lbs)  |
| Absolute maximum speed                     | 10,000 RPM                                                               |                       |
| Torque                                     | ≤ 0.5 Ncm (IP 65), ≤ 1 Ncm (IP 67)                                       |                       |
| Moment of inertia                          | synchro flange 14 gcm <sup>2</sup> approx.                               |                       |
|                                            | clamping flange 20 gcm <sup>2</sup> approx.                              |                       |
| Protection class (EN 60529)                | Housing IP 65, bearings IP 64                                            |                       |
|                                            | Housing IP 67, bearings IP 67                                            |                       |
| Operating temperature                      | RI 58-O: -10 ... +70 °C; RI 58-T: -25 ... +100 °C                        |                       |
| Storage temperature                        | RI 58-O: -25 ... +85 °C; RI 58-T: -25 ... +100 °C                        |                       |
| Vibration proof (IEC 68-2-6)               | 100 m/s <sup>2</sup> (10 ... 2000 Hz)                                    |                       |
| Shock resistance (IEC 68-2-27)             | 1,000 m/s <sup>2</sup> (6 ms)                                            |                       |
| Type of connection                         | 1.5 m cable <sup>1)</sup> or connector, axial or radial                  |                       |
| Housing                                    | aluminium Ø 58 mm                                                        |                       |
| Flange                                     | S = synchro flange, K = clamping flange,                                 |                       |
|                                            | G, Q = square flange, M = synchro clamping flange                        |                       |
| Weight                                     | 360 g approx.                                                            |                       |
| Bearing life                               | 1 x 10 <sup>10</sup> revolutions (typ.) at 35 % of full rated shaft load |                       |
|                                            | 1 x 10 <sup>9</sup> revolutions (typ.) at 75 % of full rated shaft load  |                       |
|                                            | 1 x 10 <sup>8</sup> revolutions (typ.) at 100 % of full rated shaft load |                       |
|                                            | For example 30,000 h at 6,000 RPM with                                   |                       |
|                                            | a 13 lb radial load (10 mm or 9.52 mm shaft)                             |                       |

<sup>1)</sup> Other cable lengths on request

## Industrial types

### TECHNICAL DATA electrical

|                                        |                                                                                        |                                                                                |  |
|----------------------------------------|----------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|--|
| General design                         | as per DIN VDE 0160, protection class III, contamination level 2, overvoltage class II |                                                                                |  |
| Supply voltage (SELV)                  | with RS 422 + Sense (T):                                                               | 5 VDC ± 10 %                                                                   |  |
|                                        | with RS 422 + Alarm (R):                                                               | 5 VDC ± 10 % oder 10 ... 30 VDC <sup>1)</sup>                                  |  |
|                                        | with push-pull (K, I):                                                                 | 10 ... 30VDC <sup>1)</sup>                                                     |  |
| Power consumption                      | 40 mA (5 VDC), 60 mA (10 VDC), 30 mA (24 VDC)                                          |                                                                                |  |
| Standard-Output versions <sup>2)</sup> | RS 422 (R):                                                                            | A, B, N, $\overline{A}$ , $\overline{B}$ , $\overline{N}$ , $\overline{Alarm}$ |  |
|                                        | RS 422 (T):                                                                            | A, B, N, $\overline{A}$ , $\overline{B}$ , $\overline{N}$ , Sense              |  |
|                                        | push-pull (K):                                                                         | A, B, N, $\overline{Alarm}$                                                    |  |
|                                        | push-pull complementary (I):                                                           | A, B, N, $\overline{A}$ , $\overline{B}$ , $\overline{N}$ , $\overline{Alarm}$ |  |

<sup>1)</sup> Pole protection with supply voltage 10...30 VDC

<sup>2)</sup> Output description and technical data see section „output“.

### CONNECTION DIAGRAM CABLE PVC

| cable PVC (A, B)     | Output RS 422 (R, T)          | push-pull (K)        | push-pull complementary (I) |
|----------------------|-------------------------------|----------------------|-----------------------------|
| red                  | 5/10...30 VDC=                | 10...30 VDC=         | 10...30 VDC=                |
| yellow/red           | Sense V <sub>CC</sub>         |                      | Sense V <sub>CC</sub>       |
| white                | Channel A                     | Channel A            | Channel A                   |
| white/brown          | Channel $\overline{A}$        |                      | Channel $\overline{A}$      |
| green                | Channel B                     | Channel B            | Channel B                   |
| green/brown          | Channel $\overline{B}$        |                      | Channel $\overline{B}$      |
| yellow               | Channel N                     | Channel N            | Channel N                   |
| yellow/brown         | Channel $\overline{N}$        |                      | Channel $\overline{N}$      |
| black                | GND                           | GND                  | GND                         |
| yellow/black         | Alarm/Sense GND <sup>1)</sup> | Alarm                | Alarm                       |
| Screen <sup>2)</sup> | Screen <sup>2)</sup>          | Screen <sup>2)</sup> | Screen <sup>2)</sup>        |

<sup>1)</sup> depending on ordering code

<sup>2)</sup> connected to housing

### CONNECTION DIAGRAM CABLE TPE

| cable TPE (E, F)             | Output RS 422 (R, T)          | push-pull (K)        | push-pull complementary (I) |
|------------------------------|-------------------------------|----------------------|-----------------------------|
| brown/green                  | 5/10...30 VDC=                | 10...30 VDC=         | 10...30 VDC=                |
| blue                         | Sense V <sub>CC</sub>         |                      | Sense V <sub>CC</sub>       |
| brown                        | Channel A                     | Channel A            | Channel A                   |
| green                        | Channel $\overline{A}$        |                      | Channel $\overline{A}$      |
| grey                         | Channel B                     | Channel B            | Channel B                   |
| pink                         | Channel $\overline{B}$        |                      | Channel $\overline{B}$      |
| red                          | Channel N                     | Channel N            | Channel N                   |
| black                        | Channel $\overline{N}$        |                      | Channel $\overline{N}$      |
| white/green                  | GND                           | GND                  | GND                         |
| violet (white) <sup>1)</sup> | Alarm/Sense GND <sup>2)</sup> | Alarm                | Alarm                       |
| Screen <sup>3)</sup>         | Screen <sup>3)</sup>          | Screen <sup>3)</sup> | Screen <sup>3)</sup>        |

<sup>1)</sup> white for RS 422 + Sense (T)

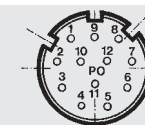
<sup>2)</sup> depending on ordering code

<sup>3)</sup> connected to housing

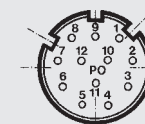
## Industrial types

## CONNECTOR 12 POLE (CONIN)

| Pin | RS 422 + Sense (T) | RS 422 + Alarm (R) | push-pull (K)      | push-pull complementary |
|-----|--------------------|--------------------|--------------------|-------------------------|
| 1   | Channel $\bar{B}$  | Channel $\bar{B}$  | N.C.               | Channel $\bar{B}$       |
| 2   | Sense $V_{CC}$     | Sense $V_{CC}$     | N.C.               | Sense $V_{CC}$          |
| 3   | Channel N          | Channel N          | Channel N          | Channel N               |
| 4   | Channel $\bar{N}$  | Channel $\bar{N}$  | N.C.               | Channel $\bar{N}$       |
| 5   | Channel A          | Channel A          | Channel A          | Channel A               |
| 6   | Channel $\bar{A}$  | Channel $\bar{A}$  | N.C.               | Channel $\bar{A}$       |
| 7   | N.C.               | Alarm              | Alarm              | Alarm                   |
| 8   | Channel B          | Channel B          | Channel B          | Channel B               |
| 9   | N.C. <sup>1)</sup> | N.C. <sup>1)</sup> | N.C. <sup>1)</sup> | N.C. <sup>1)</sup>      |
| 10  | GND                | GND                | GND                | GND                     |
| 11  | Sense GND          | N.C.               | N.C.               | N.C.                    |
| 12  | 5 VDC =            | 5/10...30 VDC =    | 10...30 VDC =      | 10...30 VDC =           |



Pin-assignment  
connector counter  
clockwise (ccw)



connector  
clockwise (cw)

<sup>1)</sup> Screen for cable with CONIN connector

## CONNECTOR 10 POLE (MIL)

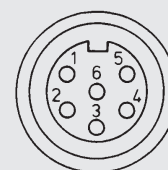
| Pin  | RS 422/Push-pull complementary Euro-pinout (connection codes O and K) | Push-pull (O and K) | RS 422/Push-pull complementary US-pinout (R and T) |
|------|-----------------------------------------------------------------------|---------------------|----------------------------------------------------|
| 1/A  | Channel A                                                             | Channel A           | Channel A                                          |
| 2/B  | Channel B                                                             | Channel B           | Channel B                                          |
| 3/C  | Channel N                                                             | Channel N           | Channel N                                          |
| 4/D  | 5/10...30 VDC =                                                       | 10...30 VDC =       | 5/10...30 VDC =                                    |
| 5/E  | Alarm                                                                 | Alarm               | Alarm                                              |
| 6/F  | GND                                                                   | GND                 | GND                                                |
| 7/G  | Channel $\bar{A}$                                                     | Screen              | Screen                                             |
| 8/H  | Channel $\bar{B}$                                                     | N.C.                | Channel $\bar{A}$                                  |
| 9/I  | Channel $\bar{N}$                                                     | N.C.                | Channel $\bar{B}$                                  |
| 10/J | Screen                                                                | Screen              | Channel $\bar{N}$                                  |

## CONNECTOR 6/7 POLE (MIL)

| Pin | MIL 6 pole Push-pull | MIL 7 pole Push-pull |
|-----|----------------------|----------------------|
| 1/A | 10...30 VDC          | Channel A            |
| 2/B | Channel A            | Channel B            |
| 3/C | Channel B            | Channel N            |
| 4/D | Channel N            | 10...30 VDC =        |
| 5/E | GND                  | Alarm                |
| 6/F | Screen               | GND                  |
| 7/G | -                    | Screen               |

## CONNECTOR 6 POLE (BINDER)

| Description (push-pull) | Pin |
|-------------------------|-----|
| 10 ... 30 VDC           | 1   |
| Channel A               | 2   |
| Channel N               | 3   |
| Channel B               | 4   |
| Alarm                   | 5   |
| GND                     | 6   |

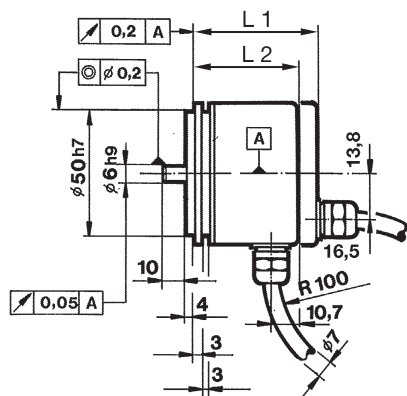


# Incremental Shaft Encoders Type RI 58

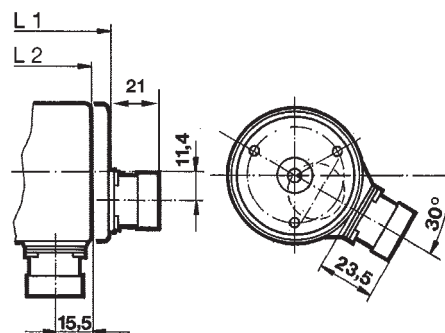
## Industrial types

### DIMENSIONED DRAWINGS

Synchro flange, 58 mm  
Connecting cable axial/radial



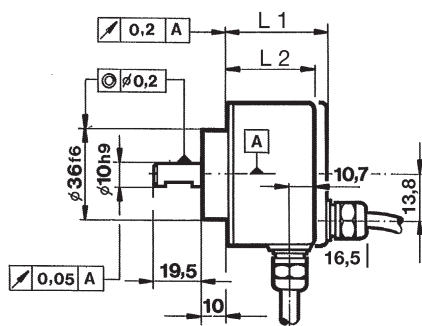
Connector 12 pole, axial/radial



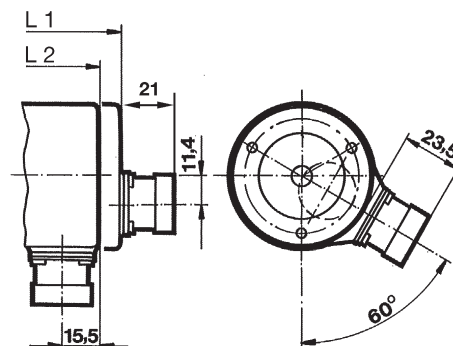
Dimensions in mm

R for alternating bending > 100 mm  
R for permanent bending > 40 mm

Clamping flange, 58 mm  
Connecting cable axial/radial



Connector 12 pole, axial, radial



Dimensions in mm

R for alternating bending > 100 mm  
R for permanent bending > 40 mm

### DIMENSIONS

| Type                   | Connection | Output <sup>1)</sup>                   | axial L <sub>1</sub> | radial L <sub>2</sub> |
|------------------------|------------|----------------------------------------|----------------------|-----------------------|
| Synchro flange, 58 mm  | cable      | R (with U <sub>B</sub> = 5 V), T, K, I | 51.5                 | 41.5                  |
|                        |            | R (with U <sub>B</sub> = 10...30 V)    | 56                   | 56                    |
|                        | connector  | R (with U <sub>B</sub> = 5 V), T, K, I | 57.5                 | 51.5                  |
|                        |            | R (with U <sub>B</sub> = 10...30 V)    | 57.5                 | 56                    |
| Clamping flange, 58 mm | cable      | R (with U <sub>B</sub> = 5 V), T, K, I | 45.5                 | 35.5                  |
|                        |            | R (with U <sub>B</sub> = 10...30 V)    | 50                   | 50                    |
|                        | connector  | R (with U <sub>B</sub> = 5 V), T, K, I | 51.5                 | 45.5                  |
|                        |            | R (with U <sub>B</sub> = 10...30 V)    | 51.5                 | 50                    |

<sup>1)</sup> R = RS 422 + Alarm, T = RS 422 + Sense, K = push-pull, I = push-pull complementary

## Type RI 58

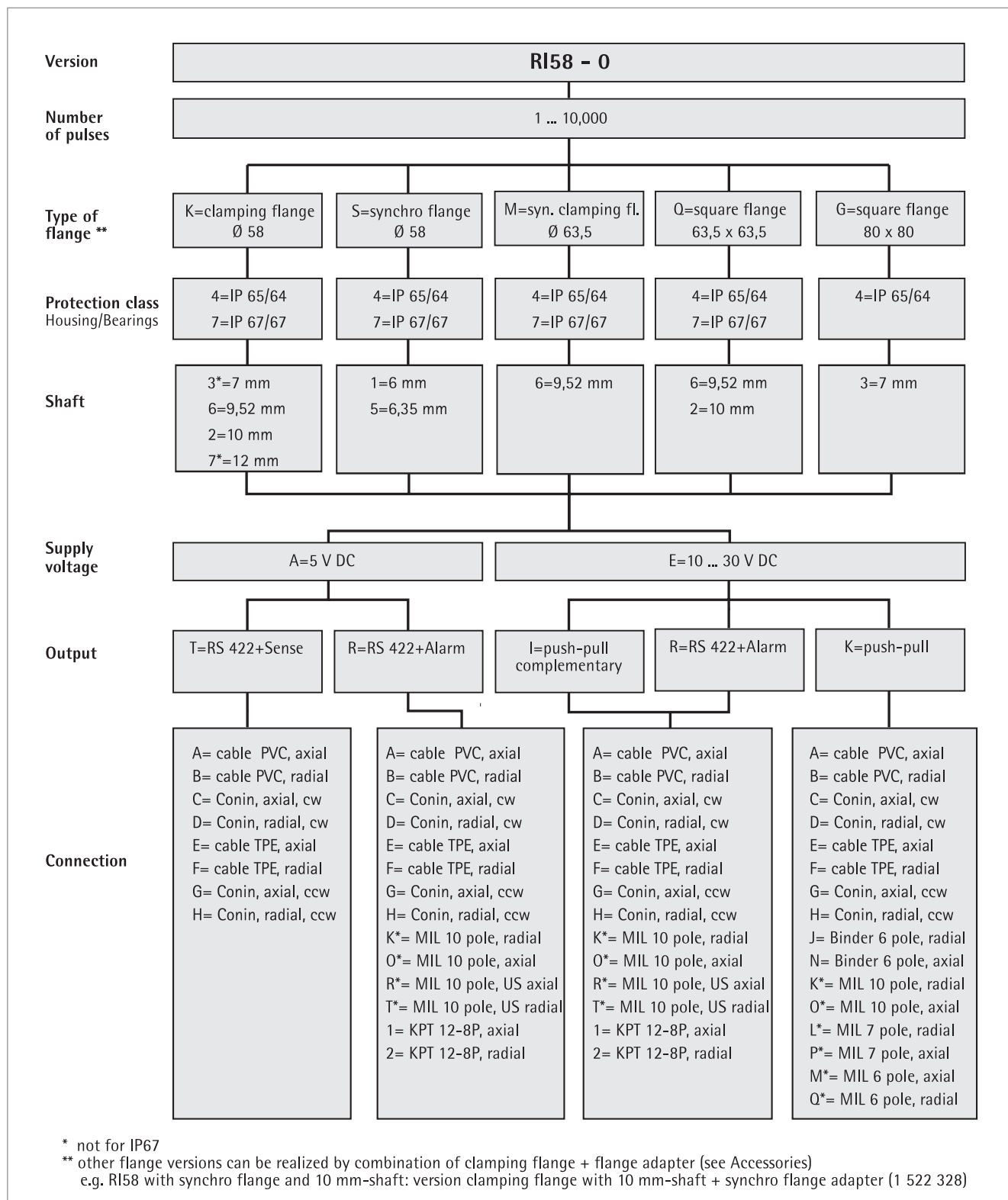
# Incremental Shaft Encoders

## Industrial types

Type RI 58

### STANDARD VERSIONS

Guide for selection of RI 58-O

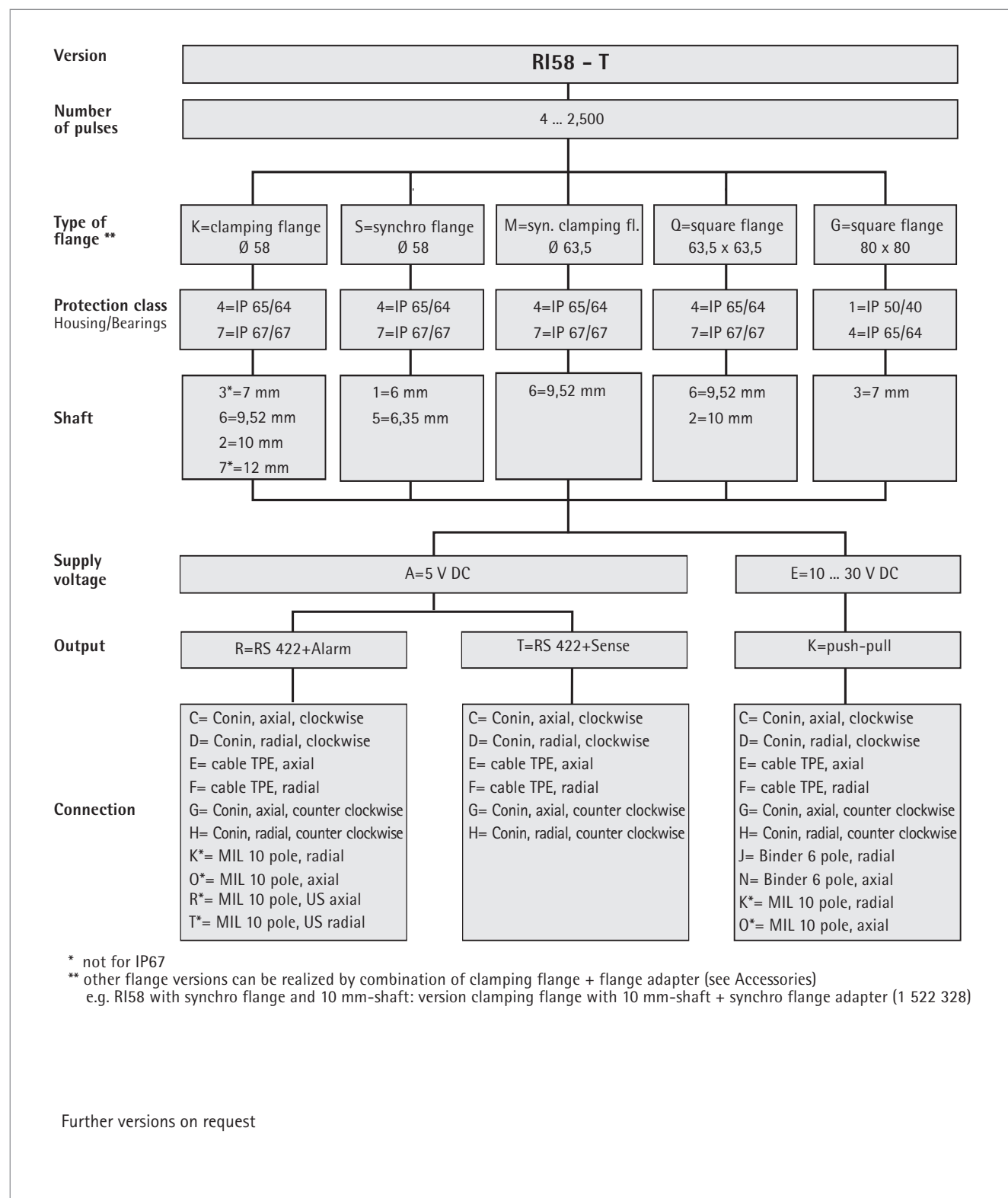


# Incremental Shaft Encoders

## Industrial types

Type RI 58

STANDARD VERSIONS  
Guide for selection of RI 58-T





# Incremental Shaft Encoders Type RI 58

## Industrial types

**ORDERING DATA**  
Please check „selection guide“  
on previous pages as not all  
combinations are possible!

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                            |                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                           |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| <b>O</b> standard<br><b>T</b> high temperature                                                                                                                                                                                                                                                                                                                                                                                                                              | Supply voltage<br><b>A</b> 5 VDC<br><b>E</b> 10 ... 30 VDC | Type of flange<br><b>S</b> synchro flange<br><b>K</b> clamping flange<br><b>G</b> square flange 80 x 80<br><b>Q</b> square flange 63.5 x 63.5<br><b>M</b> synchro clamping flange                                                                                                                                                                                                                        | Shaft diameter<br><b>1</b> 6 mm<br><b>2</b> 10 mm<br><b>3</b> 7 mm<br><b>5</b> 6.35 mm<br><b>6</b> 9.52 mm<br><b>7</b> 12 mm              |
| <div> <div>RI 58 -</div> <div></div> <div>/</div> <div></div> <div></div> <div></div> <div>.</div> <div></div> <div></div> <div></div> </div>                                                                                                                                                                                                                                                                                                                               |                                                            |                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                           |
| Number of pulses<br>RI58-O: 1 ... 10,000<br>RI58-T: 4 ... 2,500                                                                                                                                                                                                                                                                                                                                                                                                             |                                                            | Protection class<br><b>4</b> IP 64<br><b>7</b> IP 67                                                                                                                                                                                                                                                                                                                                                     | Output<br><b>T</b> RS 422 + Sense<br><b>K</b> push-pull, short circuit proof<br><b>I</b> push-pull complementary<br><b>R</b> RS 422+Alarm |
| Type of connection<br><b>A</b> PVC-cable axial <sup>2)</sup><br><b>B</b> PVC-cable radial<br><b>C</b> CONIN <sup>1)</sup> , axial clockwise<br><b>D</b> CONIN <sup>1)</sup> , radial clockwise<br><b>E</b> TPE-cable axial<br><b>F</b> TPE-cable radial<br><b>G</b> CONIN <sup>1)</sup> , axial counter clockwise<br><b>H</b> CONIN <sup>1)</sup> , radial counter clockwise<br><b>J</b> BINDER <sup>1)</sup> 6 pole, radial<br><b>N</b> BINDER <sup>1)</sup> 6 pole, axial |                                                            | <b>O</b> MIL MS <sup>1)</sup> , 10 pole, axial<br><b>K</b> MIL MS <sup>1)</sup> , 10 pole, radial<br><b>L</b> MIL <sup>1)</sup> 7 pole, radial<br><b>P</b> MIL 7 pole, axial<br><b>MM</b> 6 pole, axial<br><b>Q</b> MIL 6 pole, radial<br><b>R</b> MIL 10 pole, U.S. axial <sup>3)</sup><br><b>T</b> MIL 10 pole, U.S. radial <sup>3)</sup><br><b>1</b> KPT 12-8 P, axial<br><b>2</b> KPT 12-8 P, radial |                                                                                                                                           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                            | <sup>1)</sup> encoder connector with pins <sup>3)</sup> U.S. pinout<br><sup>2)</sup> European pinout                                                                                                                                                                                                                                                                                                     |                                                                                                                                           |

## ACCESSORIES

Clamping eccentric  
(set of three)

Ordering code **0 070 655**

Spring washer coupling  
hole 6/6 mm

Ordering code **3 520 081**

hole 10/10 mm

Ordering code **3 520 088**

Cable plug connector  
for connector (CONIN), clockwise  
(type of connection C, D)

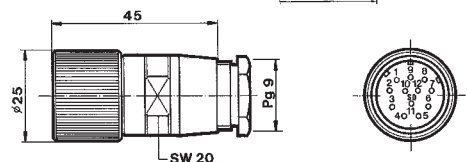
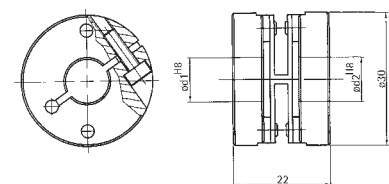
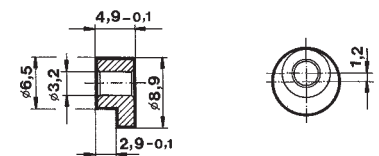
Ordering code **3 539 202**

for connector (CONIN), counter  
clockwise (type of connection G, H)

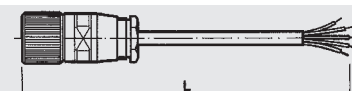
Ordering code **3 539 229**

Mounting spanner  
for CONIN connectors

Ordering code **3 539 343**



Extension cables  
(TPE)



12-pin plug (socket) on one end

clockwise (C, D)

counter clockwise (G, H)

Ordering code

Ordering code

L = 3 m

**1 522 348**

**1 522 394**

L = 5 m

**1 522 349**

**1 522 395**

L = 10 m

**1 522 350**

**1 522 396**

TPE-cable (not made up with connectors) **3 280 112** + state required length

For more detailed specifications and other accessories see "Accessories"

# Incremental Shaft Encoders

## Industrial types

# Type RI 59

## Stainless Steel



### NUMBER OF PULSES

- Stainless steel encoder with high protection class
- High corrosion resistance
- Use in the area of food production or if sea-water proof is required
- Application e.g.:
  - packing machines
  - bottling machines
  - washing plants
  - mixers
  - cranes
  - hoists
  - marine outfitters

1 / 2 / 3 / 4 / 5 / 10 / 15 / 20 / 25 / 29 / 30 / 35 / 40 / 50 / 60 / 64 / 70 / 72 / 80 / 100 / 117 / 120 / 125 / 127 / 128 / 136 / 144 / 150 / 180 / 200 / 226 / 230 / 250 / 256 / 280 / 300 / 314 / 350 / 356 / 360 / 375 / 400 / 460 / 480 / 500 / 512 / 600 / 625 / 635 / 720 / 750 / 889 / 900 / 942 / 1,000 / 1,024 / 1,125 / 1,200 / 1,250 / 1,270 / 1,500 / 1,600 / 1,800 / 1,885 / 1,979 / 2,000 / 2,048 / 2,400 / 2,500 / 3,000 / 3,400 / 3,480 / 3,600 / 3,750 / 3,925 / 3,958 / 3,968 / 4,000 / 4,096 / 4,445 / 4,800 / 5,000 / 5,400 / 6,000 / 6,875 / 7,200 / 7,680 / 7,854 / 8,000 / 8,192 / 9,000 / 10,000

Other numbers of pulses available on request.

### TECHNICAL DATA

#### mechanical

|                                |                                                                                                                                                                                                                                                                                                  |
|--------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Shaft diameter                 | 9.52 mm/10 mm                                                                                                                                                                                                                                                                                    |
| Absolute max. shaft load       | radial 160 N / axial 107 N (35/24 lbs)                                                                                                                                                                                                                                                           |
| Absolute maximum speed         | 10,000 RPM                                                                                                                                                                                                                                                                                       |
| Torque                         | ≤ 1 Ncm                                                                                                                                                                                                                                                                                          |
| Moment of inertia              | ca. 20 gcm <sup>2</sup>                                                                                                                                                                                                                                                                          |
| Protection class (EN 60529)    | Housing IP 67, bearings IP 67                                                                                                                                                                                                                                                                    |
| Operating temperature          | -10 ... +70 °C                                                                                                                                                                                                                                                                                   |
| Storage temperature            | -25 ... +85 °C                                                                                                                                                                                                                                                                                   |
| Vibration proof (IEC 68-2-6)   | 100 m/s <sup>2</sup> (10 ... 2000 Hz)                                                                                                                                                                                                                                                            |
| Shock resistance (IEC 68-2-27) | 1,000 m/s <sup>2</sup> (6 ms)                                                                                                                                                                                                                                                                    |
| Type of connection             | 1.5 m cable <sup>1)</sup> radial or axial                                                                                                                                                                                                                                                        |
| Housing                        | stainless steel Ø 58 mm                                                                                                                                                                                                                                                                          |
| Flange                         | Q= square flange 63.5 x 63.5 mm                                                                                                                                                                                                                                                                  |
| Weight                         | approx. 620 g                                                                                                                                                                                                                                                                                    |
| Bearing life                   | 1 x 10 <sup>10</sup> revolutions (typ.) at 35 % of full rated shaft load<br>1 x 10 <sup>9</sup> revolutions (typ.) at 75 % of full rated shaft load<br>1 x 10 <sup>8</sup> revolutions (typ.) at 100 % of full rated shaft load<br>For example 30,000 h at 6,000 RPM with<br>a 13 lb radial load |

<sup>1)</sup> Other cable length on request

# Incremental Shaft Encoders Type RI 59

## Industrial types

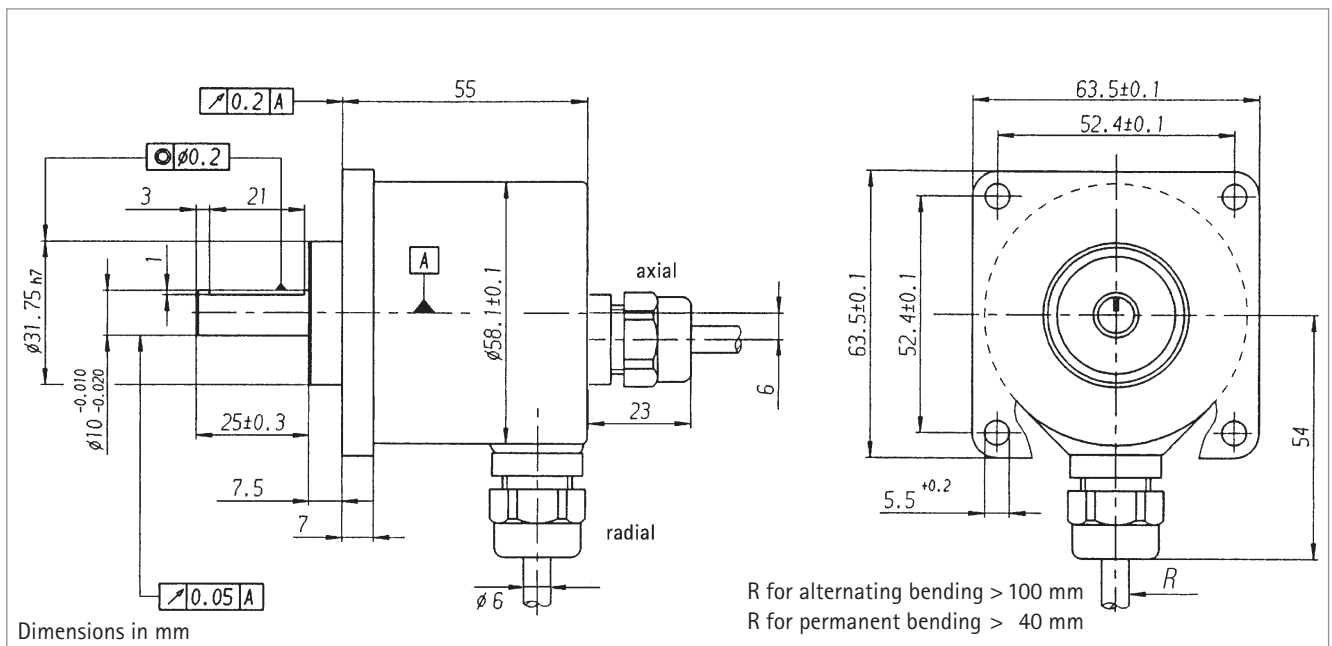
### TECHNICAL DATA electrical

|                                            |                                                                                        |                                                                                |
|--------------------------------------------|----------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|
| General design                             | as per DIN VDE 0160, protection class III, contamination level 2, overvoltage class II |                                                                                |
| Supply voltage (SELV)                      | with RS 422 + Sense (T):                                                               | 5 VDC $\pm$ 10 %                                                               |
|                                            | with RS 422 + Alarm (R):                                                               | 5 VDC $\pm$ 10 % or 10 ... 30 VDC <sup>1)</sup>                                |
|                                            | with push-pull (K, I):                                                                 | 10 ... 30 VDC <sup>1)</sup>                                                    |
| Power consumption                          | 40 mA (5 VDC), 60 mA (10 VDC), 30 mA (24 VDC)                                          |                                                                                |
| Standard-<br>Output versions <sup>2)</sup> | RS 422 (R):                                                                            | A, B, N, $\overline{A}$ , $\overline{B}$ , $\overline{N}$ , Alarm              |
|                                            | RS 422 (T):                                                                            | A, B, N, $\overline{A}$ , $\overline{B}$ , $\overline{N}$ , Sense              |
|                                            | push-pull (K):                                                                         | A, B, N, $\overline{Alarm}$                                                    |
|                                            | push-pull complementary (I):                                                           | A, B, N, $\overline{A}$ , $\overline{B}$ , $\overline{N}$ , $\overline{Alarm}$ |

<sup>1)</sup> Pole protection with supply voltage 10 ... 30 VDC

<sup>2)</sup> Output description and technical data see section „output“

### DIMENSIONED DRAWING



## Industrial types

## CONNECTION DIAGRAM

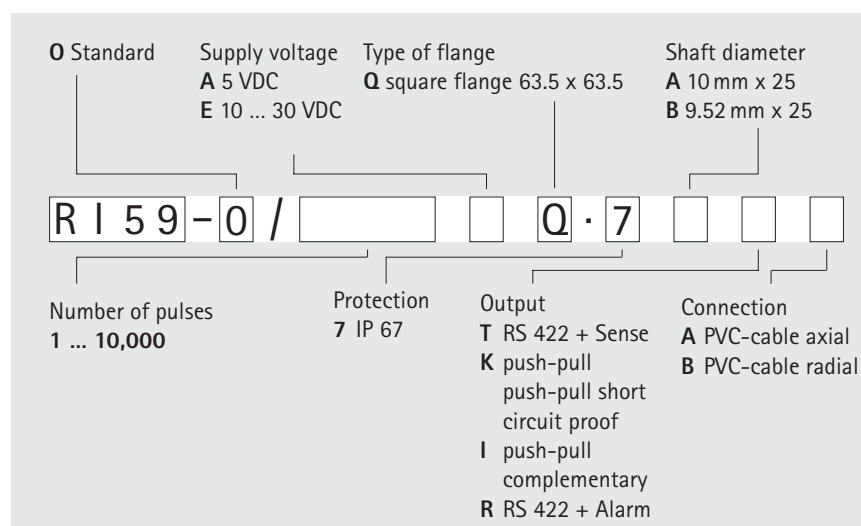
| Connection cable     |                        | Output                                       |                                 |
|----------------------|------------------------|----------------------------------------------|---------------------------------|
| Colour               | Lead Ø mm <sup>2</sup> | RS 422                                       | push-pull                       |
|                      |                        | T and R                                      | K and I                         |
| red                  | 0.5 mm <sup>2</sup>    | 5/10...30 VDC                                | 10 ... 30 VDC                   |
| red/yellow           | 0.14 mm <sup>2</sup>   | Sense V <sub>CC</sub>                        | Sense V <sub>CC</sub>           |
| white                | 0.14 mm <sup>2</sup>   | Channel A                                    | Channel A                       |
| white/brown          | 0.14 mm <sup>2</sup>   | Channel $\bar{A}$                            | Channel $\bar{A}$ <sup>1)</sup> |
| green                | 0.14 mm <sup>2</sup>   | Channel B                                    | Channel B                       |
| green/brown          | 0.14 mm <sup>2</sup>   | Channel $\bar{B}$                            | Channel $\bar{B}$ <sup>1)</sup> |
| yellow               | 0.14 mm <sup>2</sup>   | Channel N                                    | Channel N                       |
| yellow/brown         | 0.14 mm <sup>2</sup>   | Channel $\bar{N}$                            | Channel $\bar{N}$ <sup>1)</sup> |
| black                | 0.5 mm <sup>2</sup>    | GND                                          | GND                             |
| black/yellow         | 0.14 mm <sup>2</sup>   | $\bar{\text{Alarm/Sense GND}}$ <sup>2)</sup> | $\bar{\text{Alarm}}$            |
| screen <sup>3)</sup> |                        | screen <sup>3)</sup>                         | screen <sup>3)</sup>            |

<sup>1)</sup> only push-pull complementary (I)

<sup>2)</sup> depending on ordering code

<sup>3)</sup> connected to housing

## ORDERING DATA



# Incremental Shaft Encoders Type RX 70 TI

## Industrial types

### EX



- Encoder for explosion-protection type II
- Top reliability
- Application e.g.:
  - enamelling production lines
  - finishing machines
  - bottling machines
  - mixers
  - silo works
- For absolute EX encoders, see  
"Absolute Encoders Type RX 70-TS, TM, TP"



#### NUMBER OF PULSES

1 / 2 / 3 / 4 / 5 / 10 / 15 / 20 / 25 / 29 / 30 / 35 / 40 / 50 / 60 / 64 / 70 / 72 / 80 / 100 / 117 / 120 / 125 / 127 / 128 / 136 / 144 / 150 / 180 / 200 / 226 / 230 / 250 / 256 / 280 / 300 / 314 / 350 / 356 / 360 / 375 / 400 / 460 / 480 / 500 / 512 / 600 / 625 / 635 / 720 / 750 / 889 / 900 / 942 / 1,000 / 1,024 / 1,125 / 1,200 / 1,250 / 1,270 / 1,500 / 1,600 / 1,800 / 1,885 / 1,979 / 2,000 / 2,048 / 2,400 / 2,500 / 3,000 / 3,400 / 3,480 / 3,600 / 3,750 / 3,925 / 3,958 / 3,968 / 4,000 / 4,096 / 4,445 / 4,800 / 5,000 / 5,400 / 6,000 / 6,875 / 7,200 / 7,680 / 7,854 / 8,000 / 8,192 / 9,000 / 10,000

Other numbers of pulses available on request.

#### EX-CLASSIFICATION

Hengstler EXPLOSION-PROOF shaft encoders are classified according to EEx d IIC T6/T4 (according to EN 50014 and EN 50018)  
Certificate of conformity: BVS 95.D.2027

|                                                                      | EEx | d IIC | T6/T4 |
|----------------------------------------------------------------------|-----|-------|-------|
| Symbol designating equipment built in compliance with European Norms |     |       |       |
| Flange protection                                                    |     |       |       |
| Explosion group II (all areas except for fire-damp mining areas)     |     |       |       |
| Temperature class                                                    |     |       |       |
| T6 = Highest permissible surface temperature: 85° C <sup>1)</sup>    |     |       |       |
| T4 = Highest permissible surface temperature: 130° C <sup>2)</sup>   |     |       |       |

<sup>1)</sup> EEx d IIC T6: max. speed = 6,000 RPM

<sup>2)</sup> EEx d IIC T4: max. speed = 10,000 RPM

# Incremental Shaft Encoders Type RX 70 TI

## Industrial types

EX

### TECHNICAL DATA mechanical

|                                |                                                                                                                                                                                                                                                                                                                           |
|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Shaft diameter                 | 10 mm                                                                                                                                                                                                                                                                                                                     |
| Absolute max. shaft load       | radial 160 N / axial 107 N (35/24 lbs)                                                                                                                                                                                                                                                                                    |
| Absolute maximum speed         | 10,000 RPM (EEx d IIC T4)<br>6,000 RPM (EEx d IIC T6)                                                                                                                                                                                                                                                                     |
| Torque                         | ≤ 1 Ncm                                                                                                                                                                                                                                                                                                                   |
| Moment of inertia              | ca. 20 gcm <sup>2</sup>                                                                                                                                                                                                                                                                                                   |
| Protection class (EN 60529)    | Housing IP 65, bearings IP 64                                                                                                                                                                                                                                                                                             |
| Operating temperature          | -20 ... +60 °C (EEx d IIC T4)<br>-10 ... +40 °C (EEx d IIC T6)                                                                                                                                                                                                                                                            |
| Storage temperature            | -25 ... +85 °C                                                                                                                                                                                                                                                                                                            |
| Vibration proof (IEC 68-2-6)   | 10 g = 100 m/s <sup>2</sup> (10...2,000 Hz)                                                                                                                                                                                                                                                                               |
| Shock resistance (IEC 68-2-27) | 100 g = 1,000 m/s <sup>2</sup> (6 ms)                                                                                                                                                                                                                                                                                     |
| Type of connection             | 5 m cable axial <sup>1)</sup> for fixed layout                                                                                                                                                                                                                                                                            |
| Size                           | Ø 70 mm                                                                                                                                                                                                                                                                                                                   |
| Flange                         | Clamping flange, holes 3 x M6                                                                                                                                                                                                                                                                                             |
| Weight                         | approx. 1,400 g                                                                                                                                                                                                                                                                                                           |
| Bearing life                   | 1 x 10 <sup>10</sup> revolutions (typ.) at 35 % of full rated shaft load<br>1 x 10 <sup>9</sup> revolutions (typ.) at 75 % of full rated shaft load<br>1 x 10 <sup>8</sup> revolutions (typ.) at 100 % of full rated shaft load<br>For example 30,000 h at 6,000 RPM with<br>a 13 lb radial load (10 mm or 9.52 mm shaft) |

<sup>1)</sup> Other cable lengths on request

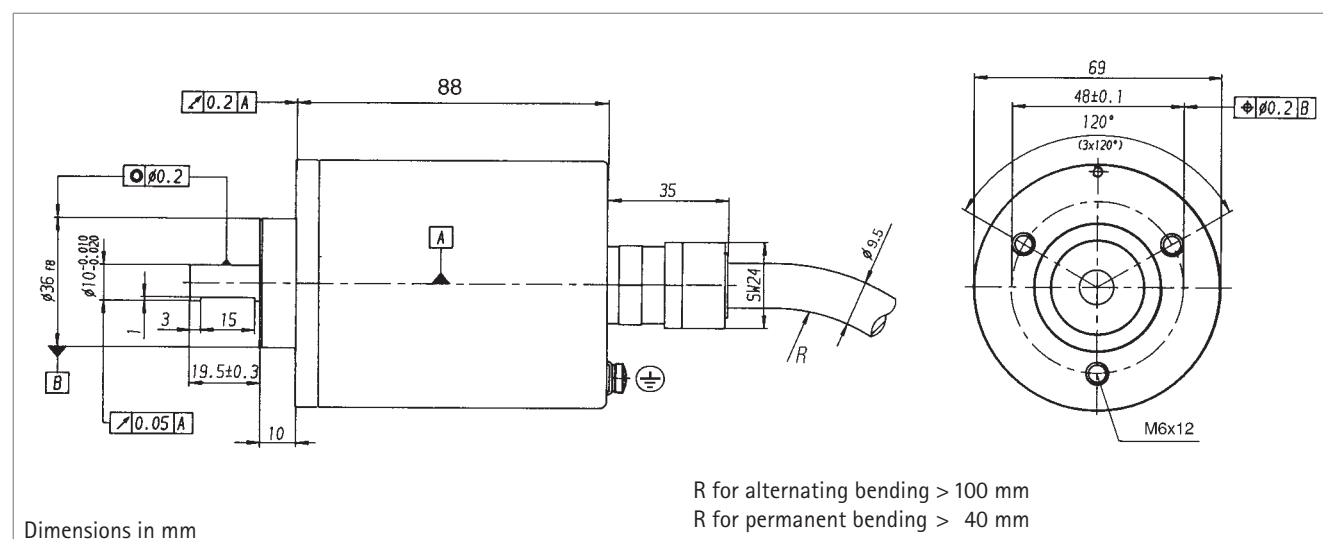
### TECHNICAL DATA electrical

|                                            |                                                                                                                                                                                                                                                                              |
|--------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| General design                             | as per DIN VDE 0160, protection class III,<br>contamination level 2, overvoltage class II                                                                                                                                                                                    |
| Supply voltage<br>(SELV)                   | with RS 422 + Sense (T): 5VDC ± 10 %<br>with RS 422 + Alarm (R): 5VDC ± 10 % oder 10 ... 30 VDC <sup>1)</sup><br>with push-pull (K, I): 10 ... 30VDC <sup>1)</sup>                                                                                                           |
| Power consumption                          | 40 mA (5 VDC), 60 mA (10 VDC), 30 mA (24 VDC)                                                                                                                                                                                                                                |
| Standard-<br>Output versions <sup>2)</sup> | RS 422 (R): A, B, N, $\bar{A}$ , $\bar{B}$ , $\bar{N}$ , $\bar{Alarm}$<br>RS 422 (T): A, B, N, $\bar{A}$ , $\bar{B}$ , $\bar{N}$ , Sense<br>push-pull (K): A, B, N, $\bar{Alarm}$<br>push-pull complementary (I): A, B, N, $\bar{A}$ , $\bar{B}$ , $\bar{N}$ , $\bar{Alarm}$ |

<sup>1)</sup> Pole protection with supply voltage 10 ... 30 VDC

<sup>2)</sup> Output description and technical data see section „output“.

### DIMENSIONED DRAWING



# Incremental Shaft Encoders Type RX 70 TI

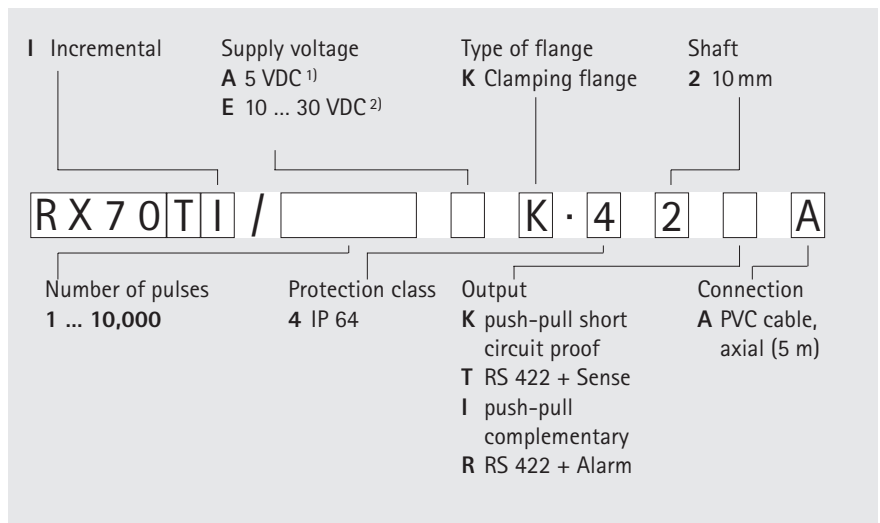
## Industrial types

### EX

#### CONNECTION DIAGRAM

| Cable          |                       | Output                                          |               |                             |
|----------------|-----------------------|-------------------------------------------------|---------------|-----------------------------|
| No.            | RS 422+ Sense (T)     | RS 422+ Alarm (R)                               | push-pull (K) | push-pull complementary (I) |
| 12             | 5 VDC                 | 5/10...30 VDC                                   | 10...30 VDC   | 10...30 VDC                 |
| 11             | GND                   | GND                                             | GND           | GND                         |
| 10             | Sense V <sub>CC</sub> |                                                 |               |                             |
| 9              | Sense GND             |                                                 |               |                             |
| 1              | Channel A             | Channel A                                       | Channel A     | Channel A                   |
| 2              | Channel $\bar{A}$     | Channel $\bar{A}$                               |               | Channel $\bar{A}$           |
| 3              | Channel B             | Channel B                                       | Channel B     | Channel B                   |
| 4              | Channel $\bar{B}$     | Channel $\bar{B}$                               |               | Channel $\bar{B}$           |
| 5              | Channel N             | Channel N                                       | Channel N     | Channel N                   |
| 6              | Channel $\bar{N}$     | Channel $\bar{N}$                               |               | Channel $\bar{N}$           |
| 7              |                       | Alarm                                           | Alarm         | Alarm                       |
| screen         |                       | Cable screen connected to housing               |               |                             |
| Screw terminal |                       | for additional connection of an earth conductor |               |                             |

#### ORDERING DATA



<sup>1)</sup> with output T, R

<sup>2)</sup> with output K, I, R

## Incremental Encoder with Hollow Shaft

Type RI 36-H



- miniature industry encoder for high number of pulses
- short mounting length
- easy mounting procedure
- Application e.g.:
  - Motors
  - Machine tools
  - Packaging Machines
  - Robots
  - Automated SMD equipment

### NUMBER OF PULSES

5 / 10 / 20 / 25 / 50 / 60 / 100 / 200 / 250 / 300 / 360 / 500 / 600 / 720 / 1000 / 1024 / 1250  
/ 1500 / 2000 / 2048 / 2500 / 3000 / 3600  
Other number of pulses available on request

### TECHNICAL DATA mechanical

|                                 |                                                         |
|---------------------------------|---------------------------------------------------------|
| Mounting                        | Clamping shaft (one side open) with front clamping ring |
| Coupling                        | spring plate                                            |
| Shaft diameter                  | 4, 6, 8, 10 mm hollow shaft                             |
| Angular shaft misalignment max. | ±0,15 mm radial, ±0,5 mm axial                          |
| Absolute max. speed             | max. 10.000 min <sup>-1</sup>                           |
| Torque                          | ≤ 1 Ncm                                                 |
| Moment of inertia               | ca. 3 gcm <sup>2</sup>                                  |
| Protection class (EN 60529)     | Housing IP 64, bearings IP 64                           |
| Operating temperature           | -10...+70 °C                                            |
| Storage temperature             | -25 ... +85 °C                                          |
| Vibration performance           | 100 m/s <sup>2</sup> (10...2000 Hz)                     |
| Shock resistance                | 1000 m/s <sup>2</sup> (6 ms)                            |
| Type of connection              | 1,5 m cable <sup>1)</sup> axial or radial               |
| Housing                         | aluminium                                               |
| Weight                          | ca. 80 g                                                |

<sup>1)</sup> other cable length on request

### TECHNICAL DATA electrical

|                              |                                                                                         |                                                                   |
|------------------------------|-----------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| General design               | as per DIN EN61010-1, protection class III, contamination level 2, overvoltage class II |                                                                   |
| Supply voltage (SELV)        | with RS 422 (R, T):                                                                     | 5 VDC 10 %                                                        |
|                              | with push-pull (K, I):                                                                  | 10 ... 30 VDC <sup>1)</sup>                                       |
| Power consumption            | 40 mA (5 VDC), 60 mA (10 VDC), 30 mA (24 VDC)                                           |                                                                   |
| Standard-                    | RS 422 (R):                                                                             | A, B, N, $\overline{A}$ , $\overline{B}$ , $\overline{N}$ , Alarm |
| Output version <sup>2)</sup> | RS 422 (T):                                                                             | A, B, N, $\overline{A}$ , $\overline{B}$ , $\overline{N}$ , Sense |
|                              | push-pull (K):                                                                          | A, B, N, Alarm                                                    |
|                              | push-pull complementary (I):                                                            | A, B, N, $\overline{A}$ , $\overline{B}$ , $\overline{N}$ , Alarm |

<sup>1)</sup> pole protection

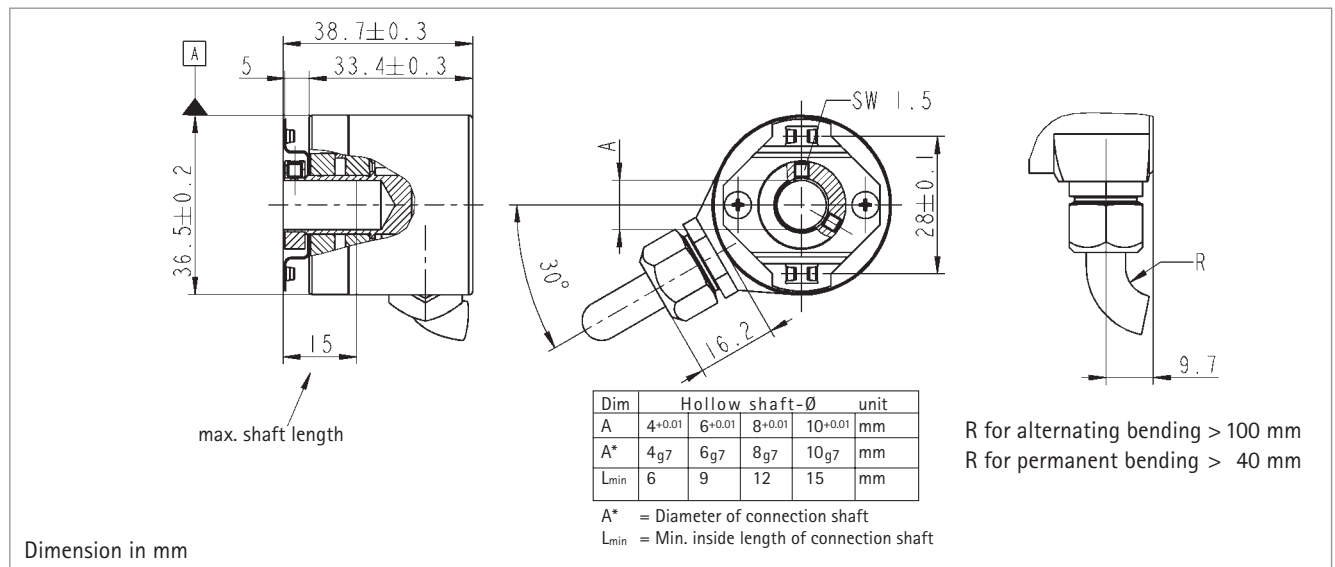
<sup>2)</sup> Output description and technical data see section "output"



# Incremental Encoder with Hollow Shaft

Type RI 36-H

## DIMENSIONED DRAWING



The spring plate as torque support must be fixed by a cylindrical pin (2.4 mm Ø) at the machine side

## CONNECTION DIAGRAM

| Cable PVC (A, B)     | Lead Ø | Output RS 422 (R, T)          | push-pull (K)         | push-pull complementary (I) |
|----------------------|--------|-------------------------------|-----------------------|-----------------------------|
| red                  | 0.5    | 5 VDC=                        | 10...30 VDC=          | 10...30 VDC=                |
| yellow/red           | 0.14   | Sense V <sub>CC</sub>         | Sense V <sub>CC</sub> |                             |
| white                | 0.14   | Channel A                     | Channel A             | Channel A                   |
| white/brown          | 0.14   | Channel $\bar{A}$             |                       | Channel $\bar{A}$           |
| green                | 0.14   | Channel B                     | Channel B             | Channel B                   |
| green/brown          | 0.14   | Channel $\bar{B}$             |                       | Channel $\bar{B}$           |
| yellow               | 0.14   | Channel N                     | Channel N             | Channel N                   |
| yellow/brown         | 0.14   | Channel $\bar{N}$             |                       | Channel $\bar{N}$           |
| black                | 0.5    | GND                           | GND                   | GND                         |
| yellow/black         | 0.14   | Alarm/Sense GND <sup>1)</sup> | Alarm                 | Alarm                       |
| Screen <sup>2)</sup> |        | Screen <sup>2)</sup>          | Screen <sup>2)</sup>  | Screen <sup>2)</sup>        |

<sup>1)</sup> depending on ordering code

<sup>2)</sup> connected to housing

## ORDERING DATA

|                                |                                                               |                                                                                            |                                                         |
|--------------------------------|---------------------------------------------------------------|--------------------------------------------------------------------------------------------|---------------------------------------------------------|
| H Hollow shaft                 | Supply voltage<br>A 5 VDC<br>E 10 ... 30 VDC (push-pull only) | Mounting<br>F clamping shaft                                                               | Shaft diameter<br>0 4 mm<br>1 6 mm<br>C 8 mm<br>2 10 mm |
| RI 36-H                        |                                                               | F · 3                                                                                      |                                                         |
| Number of pulses<br>5 ... 3600 | Protection class<br>3 IP 64                                   | Output<br>T RS 422 + Sense<br>K push-pull<br>R RS 422 + Alarm<br>I push-pull complementary | Type of connection<br>A Cable axial<br>B Cable radial   |

## Incremental Shaft Encoders Type RI 58-H with Hollow Shaft



- Through shaft
- High accuracy by means of integrated flexible coupling
- Safe shaft mounting
- Application e.g.:
  - textile machines
  - motors
  - drives
  - copiers

### NUMBER OF PULSES

1 / 2 / 3 / 4 / 5 / 10 / 15 / 20 / 25 / 29 / 30 / 35 / 50 / 60 / 70 / 72 / 80 / 100 / 117 / 120 / 125 / 128 / 136 / 144 / 150 / 180 / 200 / 226 / 230 / 250 / 256 / 280 / 300 / 314 / 350 / 360 / 375 / 400 / 460 / 480 / 500 / 512 / 600 / 720 / 900 / 1,000 / 1,024 / 1,250 / 1,270 / 1,500 / 1,600 / 1,800 / 1,885 / 2,000 / 2,048 / 2,400 / 2,500 / 3,000 / 3,400 / 3,480 / 3,600 / 3,925 / 4,000 / 4,096 / 5,000

Other numbers of pulses available on request

### TECHNICAL DATA mechanical

|                                |                                                                                                                                                                                   |          |
|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| Shaft diameter                 | 10 mm hollow shaft<br>12 mm hollow shaft<br>Required dimension of mounting shaft:<br>Ø 10 mm, tolerance g8 (-0.005 ... -0.027 mm)<br>Ø 12 mm, tolerance g8 (-0.006 ... -0.033 mm) |          |
| Balance tolerances             | Misalignment axial                                                                                                                                                                | ± 0.4 mm |
|                                | Misalignment parallel                                                                                                                                                             | 0.4 mm   |
|                                | Misalignment angular                                                                                                                                                              | 1°       |
| Absolute maximum speed         | max. 3,000 RPM                                                                                                                                                                    |          |
| Torque                         | ≤ 2 Ncm (IP 64)                                                                                                                                                                   |          |
| Moment of inertia              | approx. 65 gcm <sup>2</sup> (10 mm shaft)<br>approx. 95 gcm <sup>2</sup> (12 mm shaft)                                                                                            |          |
| Protection class (EN 60529)    | Housing IP 64, bearings IP 64                                                                                                                                                     |          |
| Operating temperature          | -10 ... +70 °C                                                                                                                                                                    |          |
| Storage temperature            | -25 ... +85 °C                                                                                                                                                                    |          |
| Vibration proof (IEC 68-2-6)   | 10 g = 100 m/s <sup>2</sup> (10 ... 2 kHz)                                                                                                                                        |          |
| Shock resistance (IEC 68-2-27) | 100 g = 1,000 m/s <sup>2</sup> (6 ms)                                                                                                                                             |          |
| Type of connection radial      | cable, 1.5 m <sup>1)</sup>                                                                                                                                                        |          |
| Housing                        | aluminium                                                                                                                                                                         |          |
| Flange                         | synchro flange                                                                                                                                                                    |          |
| Weight                         | 210 g approx.                                                                                                                                                                     |          |

<sup>1)</sup> Other cable length on request

## Incremental Shaft Encoders Type RI 58-H with Hollow Shaft

## TECHNICAL DATA

### electrical

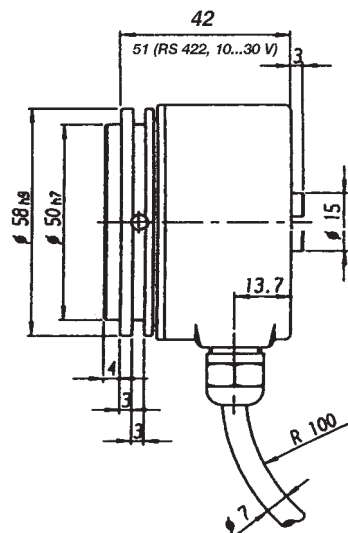
|                               |                                                                                        |                                                                                |
|-------------------------------|----------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|
| General design                | as per DIN VDE 0160, protection class III, contamination level 2, overvoltage class II |                                                                                |
| Supply voltage                | with RS 422 + Sense (T):                                                               | 5 VDC $\pm$ 10 %                                                               |
|                               | with RS 422 + Alarm (R):                                                               | 5 VDC $\pm$ 10 % oder 10 ... 30 VDC <sup>1)</sup>                              |
| (SELV)                        | with push-pull (K, I):                                                                 | 10 ... 30 VDC <sup>1)</sup>                                                    |
| Power consumption             | 40 mA (5 VDC), 60 mA (10 VDC), 30 mA (24 VDC)                                          |                                                                                |
| Standard-                     | RS 422 (R):                                                                            | A, B, N, $\overline{A}$ , $\overline{B}$ , $\overline{N}$ , $\overline{Alarm}$ |
| Output versions <sup>2)</sup> | RS 422 (T):                                                                            | A, B, N, $\overline{A}$ , $\overline{B}$ , $\overline{N}$ , Sense              |
|                               | push-pull (K):                                                                         | A, B, N, $\overline{Alarm}$                                                    |
|                               | push-pull complementary (I):                                                           | A, B, N, $\overline{A}$ , $\overline{B}$ , $\overline{N}$ , $\overline{Alarm}$ |

1) Pole protection with supply voltage 10...30 VDC

<sup>2)</sup> Output description and technical data see section "output".

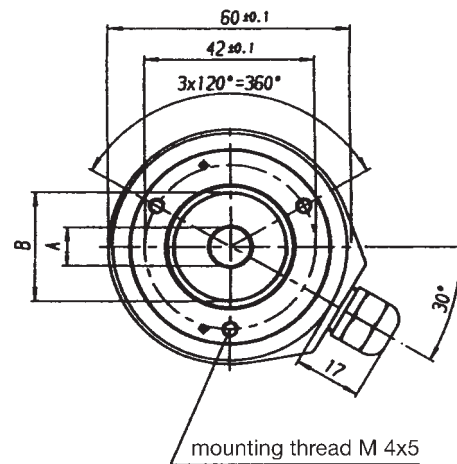
## DIMENSIONED DRAWING

### Synchro flange



R for alternating bending > 100 mm  
R for permanent bending > 40 mm

| ø Hollow shaft | Required dimension<br>of mounting shaft (g8) |
|----------------|----------------------------------------------|
| 10 mm          | - 0.005 ... - 0.027 mm                       |
| 12 mm          | - 0.006 ... - 0.033 mm                       |



| Dim. | $\emptyset$ |        |
|------|-------------|--------|
| A    | 10 mm*      | 12 mm* |
| B    | 28 mm       | 33 mm  |

\* Tolerance  
H7 = 0 ... + 0.018 mm

Dimensions in mm

# Incremental Shaft Encoders Type RI 58-H with Hollow Shaft

## CONNECTION DIAGRAM

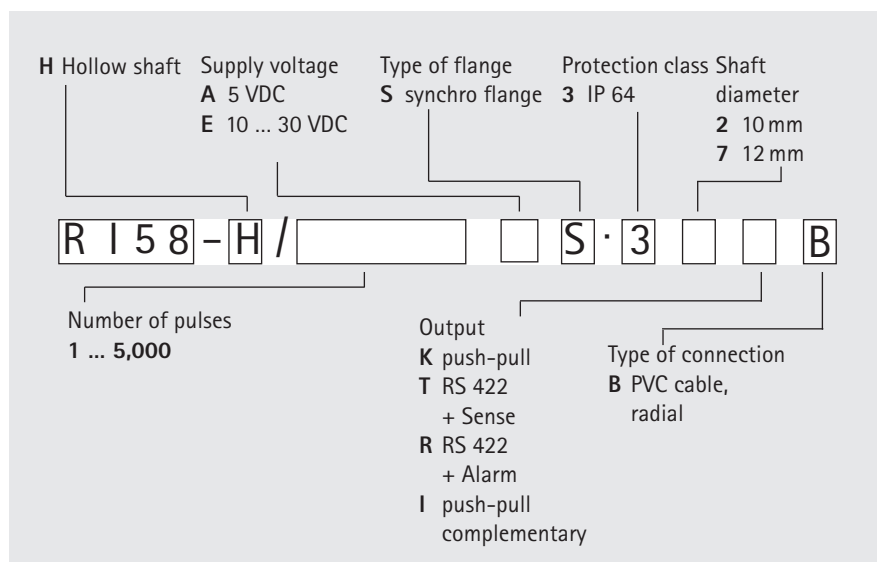
| Connection cable<br>Colour | Lead Ø mm <sup>2</sup> | Output                        |                                 |
|----------------------------|------------------------|-------------------------------|---------------------------------|
|                            |                        | RS 422<br>T and R             | push-pull<br>K and I            |
| red                        | 0.5 mm <sup>2</sup>    | 5/10...30 VDC                 | 10...30 VDC                     |
| red/yellow                 | 0.14 mm <sup>2</sup>   | Sense V <sub>cc</sub>         | Sense V <sub>cc</sub>           |
| white                      | 0.14 mm <sup>2</sup>   | Channel A                     | Channel A                       |
| white/brown                | 0.14 mm <sup>2</sup>   | Channel $\bar{A}$             | Channel $\bar{A}$ <sup>1)</sup> |
| green                      | 0.14 mm <sup>2</sup>   | Channel B                     | Channel B                       |
| green/brown                | 0.14 mm <sup>2</sup>   | Channel $\bar{B}$             | Channel $\bar{B}$ <sup>1)</sup> |
| yellow                     | 0.14 mm <sup>2</sup>   | Channel N                     | Channel N                       |
| yellow/brown               | 0.14 mm <sup>2</sup>   | Channel $\bar{N}$             | Channel $\bar{N}$ <sup>1)</sup> |
| black                      | 0.5 mm <sup>2</sup>    | GND                           | GND                             |
| black/yellow               | 0.14 mm <sup>2</sup>   | Alarm/Sense GND <sup>2)</sup> | Alarm                           |
| screen <sup>3)</sup>       |                        | screen <sup>3)</sup>          | screen <sup>3)</sup>            |

<sup>1)</sup> only push-pull complementary (I)

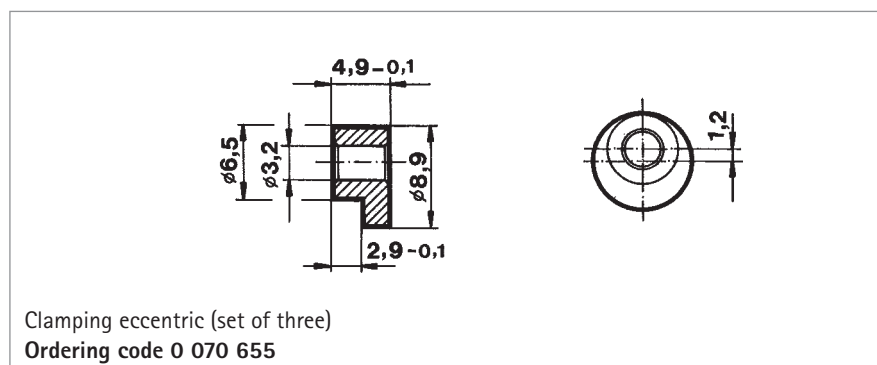
<sup>2)</sup> depending on ordering code

<sup>3)</sup> connected to housing

## ORDERING DATA



## ACCESSORIES



# Incremental Shaft Encoders Type RI 58-D with Hollow Shaft



- Flexible hollow shaft design up to diameter 14 mm
- Short overall length
- Easy installation by means of clamping shaft or blind shaft
- Application e.g.:
  - actuators
  - length measuring machines
  - motors
- Operating temperature up to 100 °C (RI 58 TD)

## NUMBER OF PULSES

RI 58-D

1 / 2 / 3 / 4 / 5 / 10 / 20 / 25 / 29 / 30 / 35 / 40 / 45 / 50 / 60 / 64 / 70 / 72 / 80 / 100 / 117 / 120 / 125 / 128 / 136 / 144 / 150 / 160 / 180 / 200 / 226 / 230 / 250 / 256 / 280 / 300 / 314 / 350 / 360 / 375 / 400 / 460 / 480 / 500 / 512 / 600 / 625 / 720 / 889 / 900 / 942 / 1000 / 1024 / 1250 / 1270 / 1500 / 1600 / 1800 / 1885 / 2000 / 2048 / 2400 / 2500 / 3000 / 3400 / 3480 / 3600 / 3925 / 4000 / 4096 / 5000

RI 58 TD

(high temperature); As above, but only within the range 4...2,500  
Other numbers of pulses available on request

## SHAFT VARIANTS

E = End shaft (non-through shaft)  
F = Clamping shaft (non-through shaft)  
D = Clamping shaft (through shaft)

## TECHNICAL DATA mechanical

|                                |                                                                                                                                                                                                                      |
|--------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Mounting                       | synchro flange with clamping shaft or blind shaft                                                                                                                                                                    |
| Shaft diameter                 | hollow shaft 10 mm<br>hollow shaft 12 mm<br>hollow shaft 14 mm (not through)<br>required dimension of mounting shaft:<br>Ø 10 mm, tolerance g8 (-0.005...-0.027 mm)<br>Ø 12/14 mm, tolerance g8 (-0.006...-0.033 mm) |
| Absolute maximum speed         | E, F: max. 6,000 RPM; D = max. 4000 min <sup>-1</sup>                                                                                                                                                                |
| Torque                         | ≤ 1 Ncm with non-through shaft (E, F)<br>≤ 2 Ncm with through shaft D                                                                                                                                                |
| Moment of inertia              | F: approx. 35 gcm <sup>2</sup> (clamping non-through shaft)<br>E: approx. 20 gcm <sup>2</sup> (end shaft)<br>D: approx 60 gcm <sup>2</sup> (clamping through shaft)                                                  |
| Protection class (EN 60529)    | E, F: housing IP 65, bearings IP 64<br>D: housing IP 64, bearings IP 64                                                                                                                                              |
| Operating temperature          | -10 ... +70 °C, Option: -25 ...+100°C                                                                                                                                                                                |
| Storage temperature            | -25 ... +85 °C                                                                                                                                                                                                       |
| Vibration proof (IEC 68-2-6)   | 10 g = 100 m/s <sup>2</sup> (10 ... 2,000 Hz)                                                                                                                                                                        |
| Shock resistance (IEC 68-2-27) | 100 g = 1,000 m/s <sup>2</sup> (6 ms)                                                                                                                                                                                |
| Type of connection radial      | 1.5 m cable <sup>1)</sup> or connector                                                                                                                                                                               |
| Housing                        | aluminium                                                                                                                                                                                                            |
| Weight                         | E, F: 170 g approx.; D: 190 g approx.                                                                                                                                                                                |

<sup>1)</sup> Other cable length on request

# Incremental Shaft Encoders Type RI 58-D with Hollow Shaft

## TECHNICAL DATA electrical

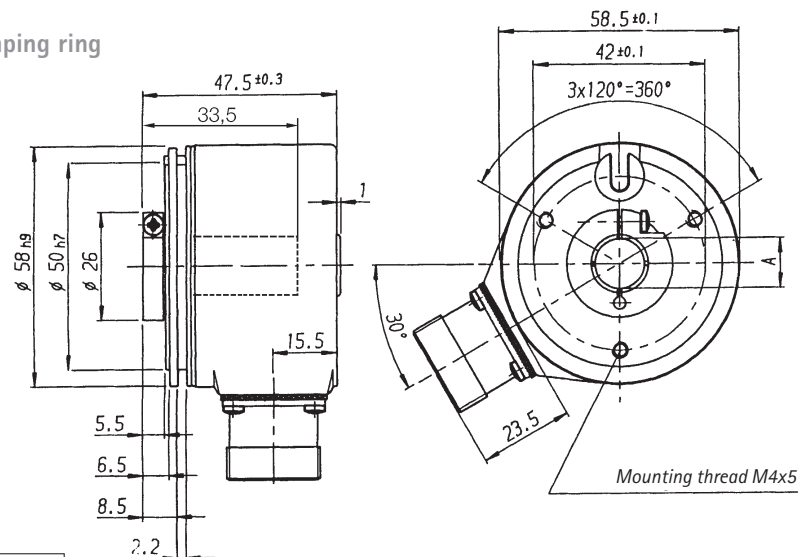
|                                            |                                                                                        |                                                                                       |
|--------------------------------------------|----------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| General design                             | as per DIN VDE 0160, protection class III, contamination level 2, overvoltage class II |                                                                                       |
| Supply voltage (SELV)                      | with RS 422 + Sense (T):                                                               | 5 VDC $\pm$ 10 %                                                                      |
|                                            | with RS 422 + Alarm (R):                                                               | 5 VDC $\pm$ 10 % oder 10 ... 30 VDC <sup>1)</sup>                                     |
|                                            | with push-pull (K, I):                                                                 | 10 ... 30 VDC <sup>1)</sup>                                                           |
| Power consumption                          | 40 mA (5 VDC), 60 mA (10 VDC), 30 mA (24 VDC)                                          |                                                                                       |
| Standard-<br>Output versions <sup>2)</sup> | RS 422 (R):                                                                            | A, B, N, $\overline{A}$ , $\overline{B}$ , $\overline{N}$ , $\overline{\text{Alarm}}$ |
|                                            | RS 422 (T):                                                                            | A, B, N, $\overline{A}$ , $\overline{B}$ , $\overline{N}$ , Sense                     |
|                                            | push-pull (K):                                                                         | A, B, N, $\overline{\text{Alarm}}$                                                    |
|                                            | push-pull complementary (I):                                                           | A, B, N, $\overline{A}$ , $\overline{B}$ , $\overline{N}$ , $\overline{\text{Alarm}}$ |

<sup>1)</sup> Pole protection with supply voltage 10...30 VDC

<sup>2)</sup> Output description and technical data see section „Output“.

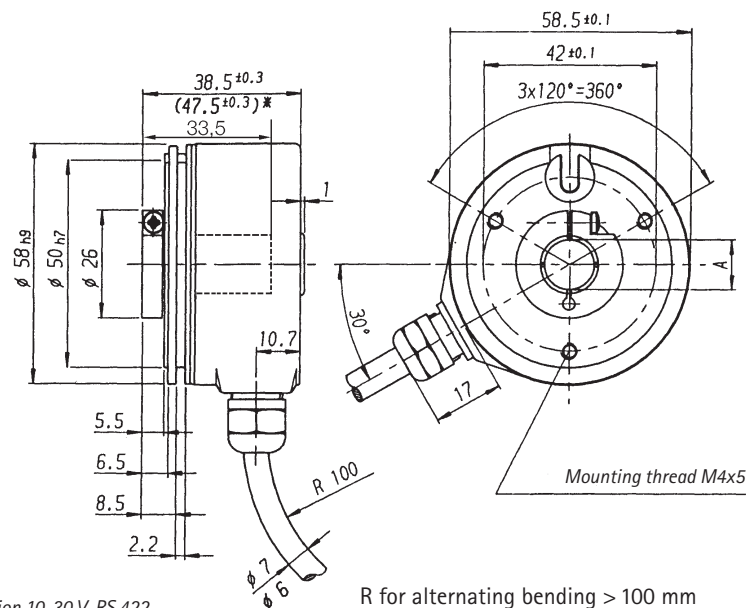
## DIMENSIONED DRAWING

Mounting = F:  
blind shaft with clamping ring



| Dim.: | Ø of hollow shaft                                  | Unit |
|-------|----------------------------------------------------|------|
| A     | 10 <sup>H7</sup> 12 <sup>H7</sup> 14 <sup>H7</sup> | mm   |
| A*    | 10 <sub>g8</sub> 12 <sub>g8</sub> 14 <sub>g8</sub> | mm   |

A\* = Diameter of connection shaft



Dimensions in mm

\*with Version 10-30 V RS 422

\*\*with mounting F: clamping shaft; not through-going

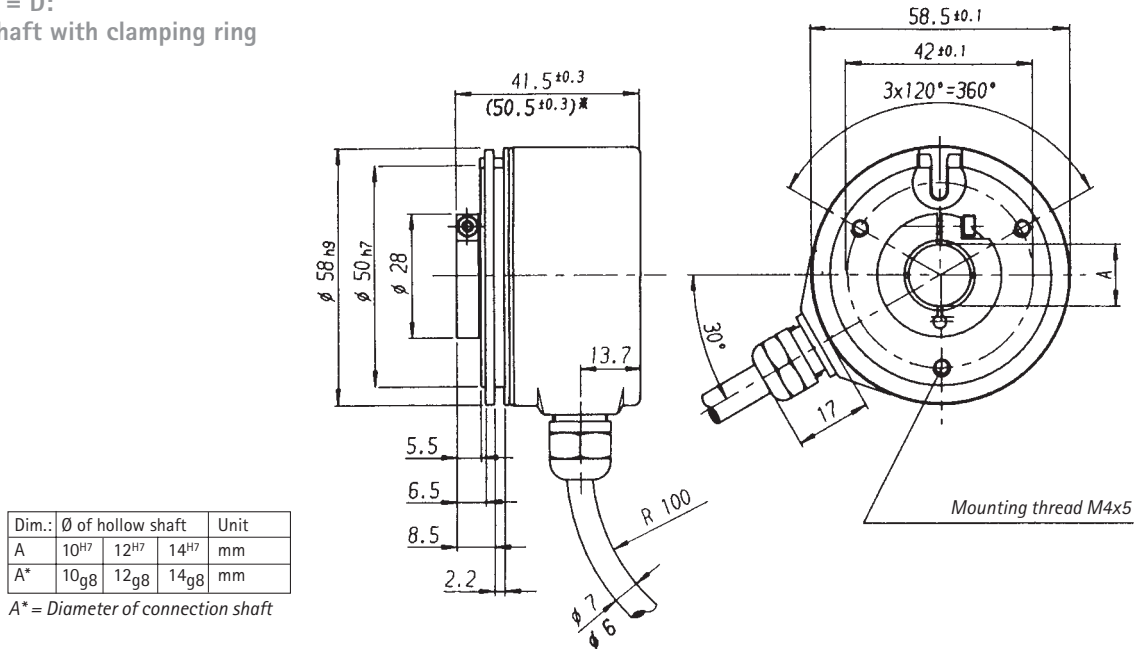
R for alternating bending > 100 mm

R for permanent bending > 40 mm

# Incremental Shaft Encoders Type RI 58-D with Hollow Shaft

## DIMENSIONED DRAWING

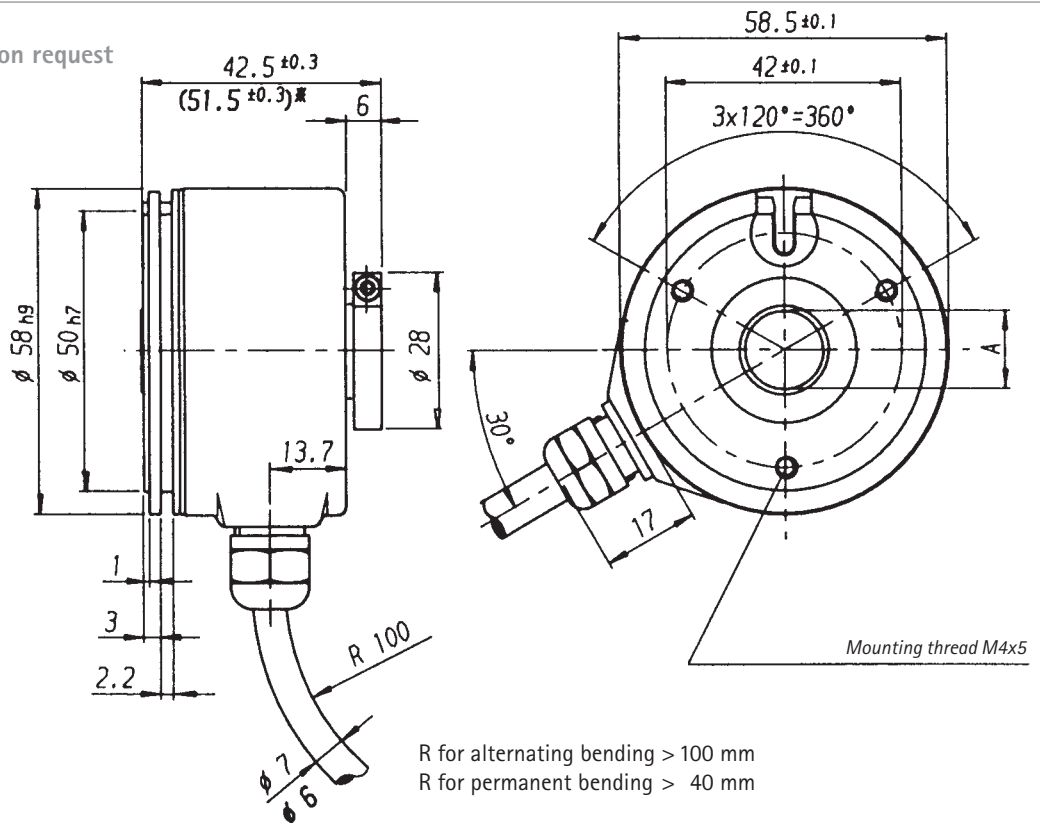
Mounting = D:  
through shaft with clamping ring



\* with Version 10-30 V RS 422

R for alternating bending > 100 mm  
R for permanent bending > 40 mm

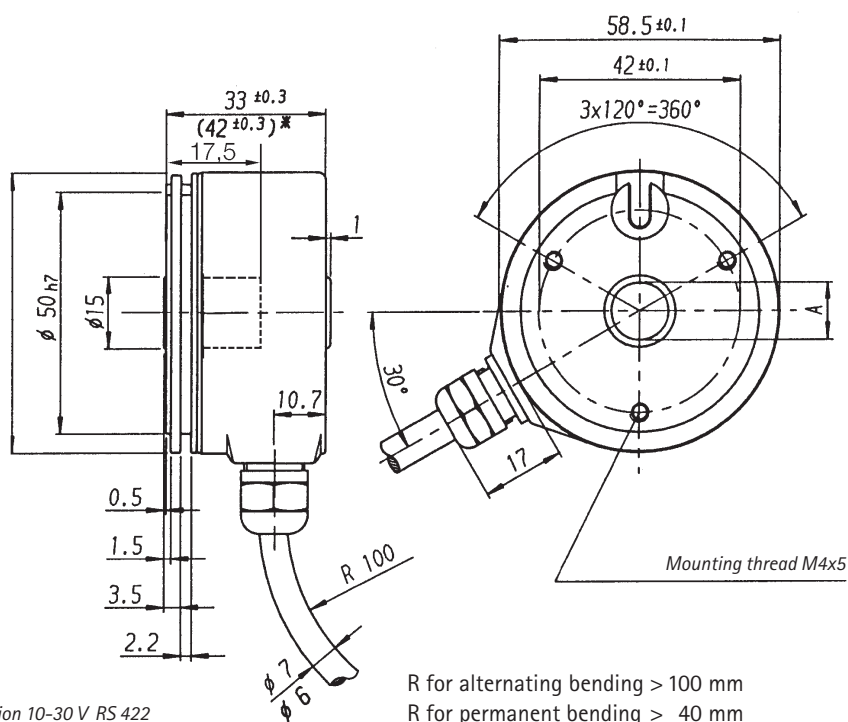
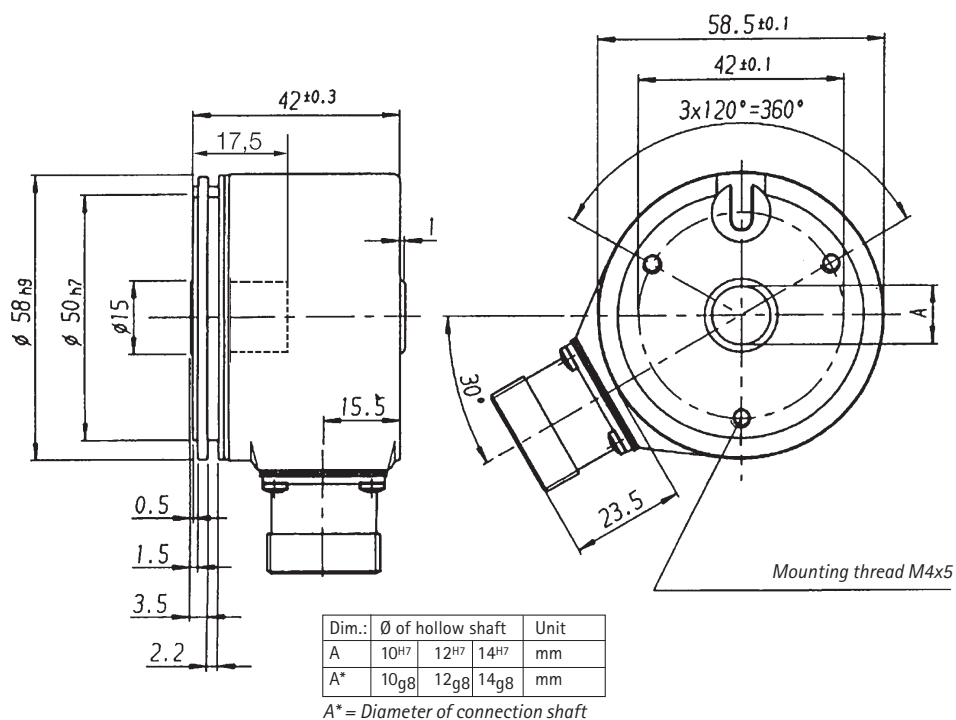
OPTION:  
Clamping ring at rear on request



# Incremental Shaft Encoders Type RI 58-D with Hollow Shaft

## DIMENSIONED DRAWING

Mounting of version E, blind shaft  
(no through shaft)



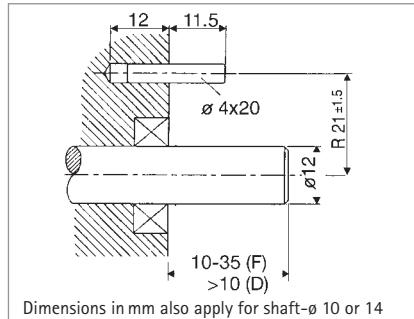
Dimensions in mm



# Incremental Shaft Encoders Type RI 58-D with Hollow Shaft

## MOUNTING NECESSITIES

In order to be able to compensate an axial and radial misalignment of the shaft, the encoder flange must not be fixed rigidly.  
Fix the flanges by means of a stator coupling (e.g. spring plate) as torque support (see "Accessories") or by means of a cylindrical pin:



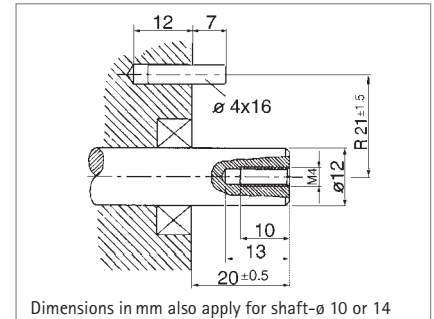
Mounting D, F (Clamping shaft)

### Preparation of the machine flange<sup>1)</sup> (all mounting versions):

In the machine flange a straight pin must be installed (diameter 4x16 resp. 4x20, DIN 6325).

This pin is required as a torque support.

<sup>1)</sup> Or as an option: stator coupling as torque support



Mounting E (Blind shaft)

### Preparation of the drive shaft (only in mounting = E):

The drive shaft must be provided with a threaded bore M 4 x 10:

This bore accepts the fastening screw of the shaft encoder.

## CONNECTION DIAGRAM CABLE PVC

| Cable PVC                  | RS 422                     | Output circuit             | push-pull (K)              | push-pull complementary (I) |
|----------------------------|----------------------------|----------------------------|----------------------------|-----------------------------|
| Colour                     | + Sense (T)                | + Alarm (R)                |                            |                             |
| white                      | Channel A                  | Channel A                  | Channel A                  | Channel A                   |
| white/brown                | Channel $\bar{A}$          | Channel $\bar{A}$          |                            | Channel $\bar{A}$           |
| green                      | Channel B                  | Channel B                  | Channel B                  | Channel B                   |
| green/brown                | Channel $\bar{B}$          | Channel $\bar{B}$          |                            | Channel $\bar{B}$           |
| yellow                     | Channel N                  | Channel N                  | Channel N                  | Channel N                   |
| yellow/brown               | Channel $\bar{N}$          | Channel $\bar{N}$          |                            | Channel $\bar{N}$           |
| yellow/black               | Sense GND                  | Alarm                      | Alarm                      | Alarm                       |
| yellow/red                 | Sense $V_{CC}$             | Sense $V_{CC}$             |                            | Sense $V_{CC}$              |
| red                        | 5 V DC=                    | 5/10...30 V DC=            | 10...30 V DC=              | 10...30 V DC=               |
| black                      | GND                        | GND                        | GND                        | GND                         |
| Cable screen <sup>1)</sup> | Cable screen <sup>1)</sup> | Cable screen <sup>1)</sup> | Cable screen <sup>1)</sup> | Cable screen <sup>1)</sup>  |

<sup>1)</sup> connected to housing

## CONNECTION DIAGRAM CABLE TPE

| Cable TPE                    | RS 422                     | Output circuit             | push-pull (K)              | push-pull complementary (I) |
|------------------------------|----------------------------|----------------------------|----------------------------|-----------------------------|
| Colour                       | + Sense (T)                | + Alarm (R)                |                            |                             |
| brown                        | Channel A                  | Channel A                  | Channel A                  | Channel A                   |
| green                        | 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 $\bar{B}$           |
| red                          | Channel N                  | Channel N                  | Channel N                  | Channel N                   |
| black                        | Channel $\bar{N}$          | Channel $\bar{N}$          |                            | Channel $\bar{N}$           |
| violet (white) <sup>2)</sup> | Sense GND                  | Alarm                      | Alarm                      | Alarm                       |
| blue                         | Sense $V_{CC}$             | Sense $V_{CC}$             |                            | Sense $V_{CC}$              |
| brown/green                  | 5 V DC=                    | 5/10...30 V DC=            | 10...30 V DC=              | 10...30 V DC=               |
| white/green                  | GND                        | GND                        | GND                        | GND                         |
| Cable screen <sup>1)</sup>   | Cable screen <sup>1)</sup> | Cable screen <sup>1)</sup> | Cable screen <sup>1)</sup> | Cable screen <sup>1)</sup>  |

<sup>1)</sup> connected to housing

<sup>2)</sup> white with Version Sense (T)

# Incremental Shaft Encoders Type RI 58-D with Hollow Shaft

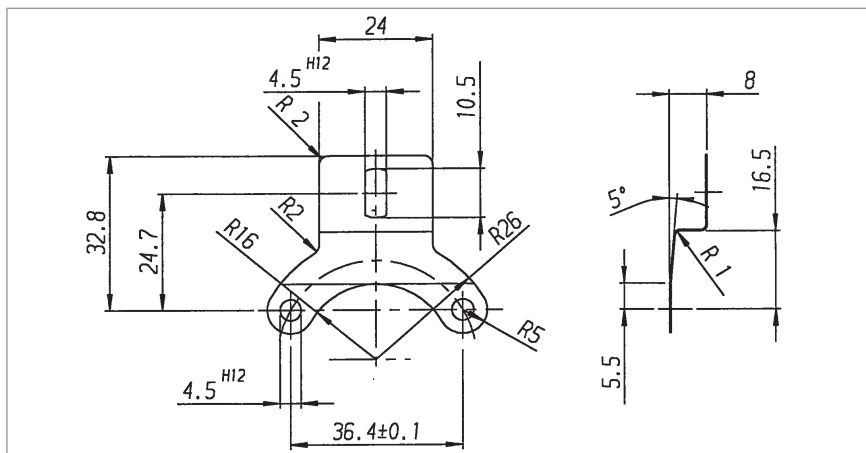
## CONNECTION DIAGRAM CONNECTOR (CONIN)

| Pin | RS 422 + Sense (T) | RS 422 + Alarm (R) | push-pull (K)      | push-pull complementary (I) |
|-----|--------------------|--------------------|--------------------|-----------------------------|
| 1   | Channel $\bar{B}$  | Channel $\bar{B}$  | N.C.               | Channel $\bar{B}$           |
| 2   | Sense $V_{cc}$     | Sense $V_{cc}$     | N.C.               | Sense $V_{cc}$              |
| 3   | Channel N          | Channel N          | Channel N          | Channel N                   |
| 4   | Channel $\bar{N}$  | Channel $\bar{N}$  | N.C.               | Channel $\bar{N}$           |
| 5   | Channel A          | Channel A          | Channel A          | Channel A                   |
| 6   | Channel $\bar{A}$  | Channel $\bar{A}$  | N.C.               | Channel $\bar{A}$           |
| 7   | N.C.               | Alarm              | Alarm              | Alarm                       |
| 8   | Channel B          | Channel B          | Channel B          | Channel B                   |
| 9   | N.C. <sup>1)</sup> | N.C. <sup>1)</sup> | N.C. <sup>1)</sup> | N.C. <sup>1)</sup>          |
| 10  | GND                | GND                | GND                | GND                         |
| 11  | Sense GND          | N.C.               | N.C.               | N.C.                        |
| 12  | 5 V DC=            | 5/10 ... 30 V DC=  | 10 ... 30 V DC=    | 10 ... 30 V DC=             |

<sup>1)</sup> screen with cable version with CONIN-connector

## ACCESSORIES

Spring plate as stator coupling: **Ordering code 1 531 162**



## ORDERING DATA

|                                           |                                              |                                                                                                                                    |                                                               |
|-------------------------------------------|----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|
| -D hollow shaft<br>TD hollow shaft 100° C | Supply voltage<br>A 5 VDC<br>E 10 ... 30 VDC | Mounting<br>synchro flange with<br>E blind shaft <sup>1)</sup><br>F clamping shaft <sup>1)</sup><br>D clamping shaft <sup>2)</sup> | Shaft diameter<br>2 10 mm<br>7 12 mm<br>9 14 mm <sup>1)</sup> |
|-------------------------------------------|----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|

|       |  |   |  |  |  |  |  |  |  |
|-------|--|---|--|--|--|--|--|--|--|
| RI 58 |  | / |  |  |  |  |  |  |  |
|-------|--|---|--|--|--|--|--|--|--|

|                                 |                                                                                            |                                                                                                                                                                                  |
|---------------------------------|--------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Number of pulses<br>1 ... 5,000 | Output<br>K push-pull<br>T RS 422 + Sense<br>R RS 422 + Alarm<br>I push-pull complementary | Type of connection<br>B PVC-cable radial<br>F TPE-cable radial<br>D CONIN-connector radial, clockwise <sup>3)</sup><br>H CONIN-connector radial, counter <sup>3)</sup> clockwise |
|---------------------------------|--------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                                            |
|--------------------------------------------|
| Protection class<br>3 IP 642)<br>4 IP 641) |
|--------------------------------------------|

<sup>1)</sup> Mounting E, F; no through shaft, protection class code 4

<sup>2)</sup> through shaft, protection class code 3, only cable connection

<sup>3)</sup> only with mounting E or F (not through going)

# Incremental Shaft Encoders Type RI 76 TD with Hollow Shaft



NUMBER OF PULSES

TECHNICAL DATA  
mechanical

- Through shaft with up to diameter 42 mm
- Short overall length with an outside diameter of only 76 mm
- Easy installation by means of clamping ring
- Operating temperature up to 100 °C
- Application e.g.:
  - motors
  - printing machines
  - lifts

50 / 100 / 250 / 300 / 500 / 600 / 900 / 1,000 / 1,024 / 1500 / 2,048 / 2,500 / 3,072 / 4096 / 5,000 / 9,000 / 10,000

Other numbers of pulses available on request

|                                                         |                                                                                                                                                                                                                                          |
|---------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Shaft fixation                                          | clamping ring, front or rear                                                                                                                                                                                                             |
| Coupling                                                | stator coupling (spring plate)                                                                                                                                                                                                           |
| Shaft diameter                                          | 15...42 mm (Available: 15, 16, 18, 20, 24, 25, 27, 28, 30, 32, 38, 40, 42 mm also $\frac{5}{8}$ ", $1\frac{5}{8}$ ", $\frac{3}{4}$ ")                                                                                                    |
| Minimum length of mounting shaft                        |                                                                                                                                                                                                                                          |
| Front clamping ring                                     | 32 mm with $\varnothing$ 15...30, 35 mm with $\varnothing$ > 30...42                                                                                                                                                                     |
| Rear clamping ring                                      | corresponding to total length of encoder                                                                                                                                                                                                 |
| Max. parallel shaft misalignment                        |                                                                                                                                                                                                                                          |
| With flexible stator coupling A (flexible)              | $\pm 2.0$ mm axial, $\pm 0.15$ mm radial                                                                                                                                                                                                 |
| With 1 x flexible stator coupling N (torsionally rigid) | $\pm 0.5$ mm axial, $\pm 0.3$ mm radial                                                                                                                                                                                                  |
| With 2 x flexible stator coupling N (torsionally rigid) | $\pm 0.3$ mm axial, $\pm 0.2$ mm radial                                                                                                                                                                                                  |
| Absolute maximum speed                                  | at 70° C and IP 64: 3,600 RPM for $\varnothing$ 15...25<br>at 70° C and IP 64: 1,800 RPM for $\varnothing$ > 25...42<br>at 70° C and IP 40: 6,000 RPM for $\varnothing$ 15...42<br>at 100° C always: 1,800 RPM for $\varnothing$ 15...42 |
| Torque                                                  | 3...10 Ncm (depending on version)                                                                                                                                                                                                        |
| Moment of inertia                                       | 140...420 gcm <sup>2</sup> (depending on version)                                                                                                                                                                                        |
| Protection class (EN 60529)                             | Housing IP 50, bearings IP 40                                                                                                                                                                                                            |
| Option:                                                 | Housing IP 65, bearings IP 64                                                                                                                                                                                                            |
| Operating temperature                                   | -25 ...+100 °C                                                                                                                                                                                                                           |
| Storage temperature                                     | -25...+100 °C                                                                                                                                                                                                                            |
| Vibration proof (IEC 68-2-6)                            | 10 g = 100 m/s <sup>2</sup> (10 ... 2,000 Hz)                                                                                                                                                                                            |
| Shock resistance (IEC 68-2-27)                          | 100 g = 1,000 m/s <sup>2</sup> (6 ms)                                                                                                                                                                                                    |
| Type of connection                                      | 1.5 m cable <sup>1)</sup> radial                                                                                                                                                                                                         |
| Housing                                                 | aluminium                                                                                                                                                                                                                                |
| Weight                                                  | 320 - 580 g (depending on version)                                                                                                                                                                                                       |

<sup>1)</sup> Other cable length on request

TECHNICAL DATA  
electrical

|                               |                                                                                         |
|-------------------------------|-----------------------------------------------------------------------------------------|
| General design                | as per DIN EN 61010, protection class III, contamination level 2, overvoltage class II  |
| Supply voltage                | with RS 422 (R, T): 5 VDC $\pm$ 10 %                                                    |
| (SELV)                        | with push-pull (K, I): 10 ... 30 VDC <sup>1)</sup>                                      |
| Power consumption             | 60 mA (5 VDC), 60 mA (10 VDC), 35 mA (24 VDC)                                           |
| Standard-                     | RS 422 (R): A, B, N, $\bar{A}$ , $\bar{B}$ , $\bar{N}$ , $\bar{Alarm}$                  |
| Output versions <sup>2)</sup> | RS 422 (T): A, B, N, $\bar{A}$ , $\bar{B}$ , $\bar{N}$ , Sense                          |
|                               | push-pull (K): A, B, N, $\bar{Alarm}$                                                   |
|                               | push-pull complementary (I): A, B, N, $\bar{A}$ , $\bar{B}$ , $\bar{N}$ , $\bar{Alarm}$ |

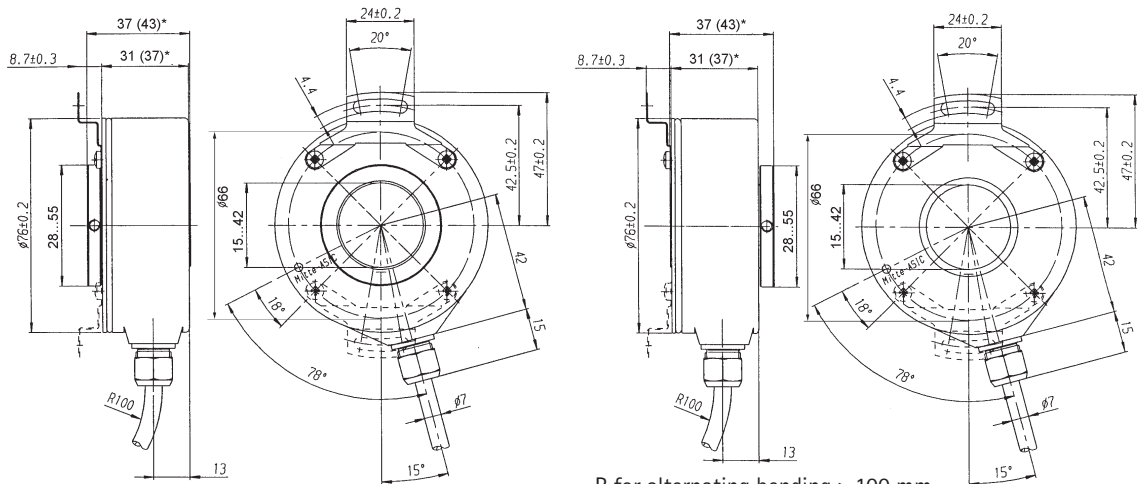
<sup>1)</sup> Pole protection with supply voltage 10 ... 30 VDC

<sup>2)</sup> Output description and technical data see section „output“.

# Incremental Shaft Encoders Type RI 76 TD with Hollow Shaft

## DIMENSIONED DRAWING

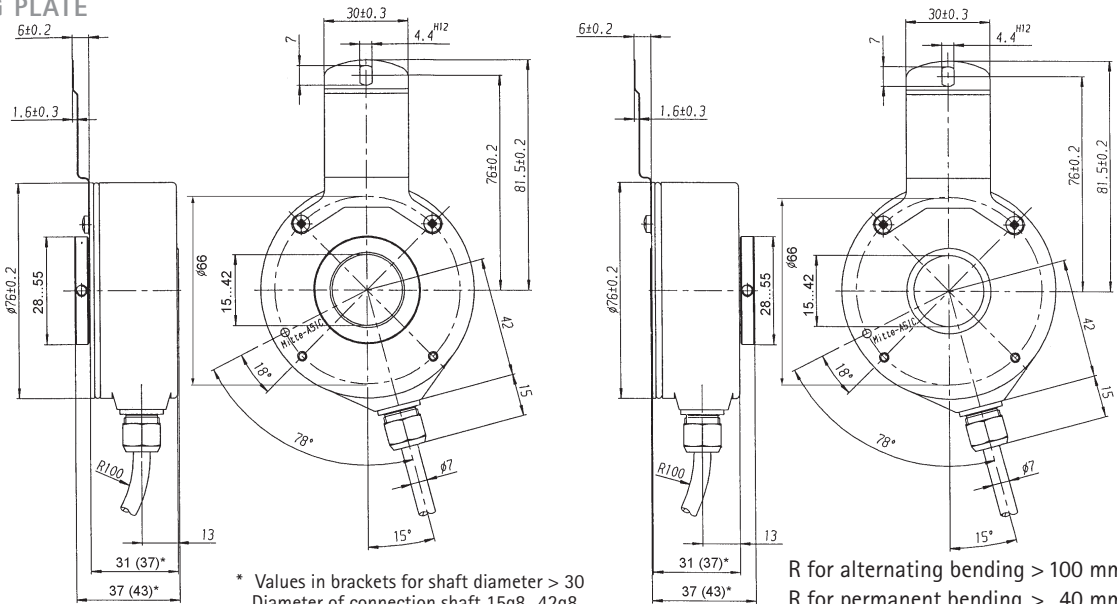
### WITH SPRING PLATE "RIGID"



\* Values in brackets for shaft diameter > 30  
Diameter of connection shaft 15g8...42g8

R for alternating bending > 100 mm  
R for permanent bending > 40 mm

### WITH SPRING PLATE "FLEXIBLE"



\* Values in brackets for shaft diameter > 30  
Diameter of connection shaft 15g8...42g8

R for alternating bending > 100 mm  
R for permanent bending > 40 mm

## SHAFT CONNECTION

Shaft fixing is done through a clamping ring either on the flange or cap side. As a rule, flange side clamping is better for smaller motors as the available shaft stub is correspondingly shorter. On the other hand, cap side clamping is easier when there is sufficient shaft length available.

## MOUNTING NECESSITIES

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. There are two flexible mounting plates:

- 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.

# Incremental Shaft Encoders Type RI 76 TD with Hollow Shaft

## CONNECTION DIAGRAM CABLE TPE

| Colour (TPE)                 | Output circuit        |                       |                      |                                |
|------------------------------|-----------------------|-----------------------|----------------------|--------------------------------|
|                              | RS 422<br>+ Sense (T) | RS 422<br>+ Alarm (R) | push-pull (K)        | push-pull<br>complementary (I) |
| brown                        | Channel A             | Channel A             | Channel A            | Channel A                      |
| green                        | 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 $\bar{B}$              |
| red                          | Channel N             | Channel N             | Channel N            | Channel N                      |
| black                        | Channel $\bar{N}$     | Channel $\bar{N}$     |                      | Channel $\bar{N}$              |
| violet (white) <sup>2)</sup> | Sense GND             | $\bar{\text{Alarm}}$  | $\bar{\text{Alarm}}$ | $\bar{\text{Alarm}}$           |
| blue                         | Sense V <sub>cc</sub> | Sense V <sub>cc</sub> |                      | Sense V <sub>cc</sub>          |
| brown/green                  | 5 VDC=                | 5/10 ... 30 VDC=      | 10 ... 30 VDC=       | 10 ... 30 VDC=                 |
| 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 housing

<sup>2)</sup> white for RS 422 + Sense (T)

## ACCESSORIES

|                        |                         |
|------------------------|-------------------------|
| Spring plate, flexible | Ordering code 1 533 079 |
| Spring plate, rigid    | Ordering code 1 533 078 |

## ORDERING DATA

|                                           |                                                                                                                                                          |                                                                                                 |                                                    |
|-------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|----------------------------------------------------|
| D Hollow shaft                            | Supply voltage<br>A 5 VDC <sup>2)</sup><br>E 10...30 VDC <sup>3)</sup>                                                                                   | Mounting<br>synchro flange with<br>D Front clamping ring<br>H Rear clamping ring                | Spring plate<br>O without<br>A flexible<br>N rigid |
| Temperature<br>T high<br>temperature      |                                                                                                                                                          |                                                                                                 |                                                    |
| RI76                                      | T                                                                                                                                                        | D                                                                                               | /                                                  |
| Number of<br>pulses<br>1...10000          | Shaft diameter <sup>1)</sup><br>15...42 metric in mm<br>50...99 coded by inches<br>50 = $\frac{5}{8}$ "<br>51 = $1\frac{5}{8}$ "<br>52 = $\frac{3}{4}$ " | Output<br>R RS 422 + Alarm<br>T RS 422 + Sense<br>K push-pull<br>I push-pull comple-<br>mentary | Type of connection<br>F TPE-cable radial           |
| Protection<br>class<br>1 IP 40<br>4 IP 64 |                                                                                                                                                          |                                                                                                 |                                                    |

<sup>1)</sup>Available with front clamping ring and IP 40: 15, **20**, **24**, 25, 27, 28, 30, 38, 40, 42, 50 ( $\frac{5}{8}$ "), 51 ( $1\frac{5}{8}$ ")  
Available with front clamping ring and IP 64: **15**, 16, 18, **20**, 24, **25**, 27, 28, 30, 32, **38**, **40**, **42**,  
50 ( $\frac{5}{8}$ "), 51 ( $1\frac{5}{8}$ "), 52 ( $\frac{3}{4}$ ")

Available with rear clamping ring and IP 40: 25, 28, 30, 32, 38, 40, 42

Available with rear clamping ring and IP 64: 20, **25**, 30, 32, 38, 40, **42**

Bold printed: preferred versions

Others: please request delivery time

<sup>2)</sup> only with output R, T, K

<sup>3)</sup> only with output R, K, I

## Economy Types



- Replacement for type RIS and RI 31
- The economical encoder for small appliances
- High efficiency by means of ball bearing
- Small torque
- Application e.g.
  - laboratory equipment
  - training equipment
  - crimping machines
  - tampon printing machines
  - miniature grinding machines

## NUMBER OF PULSES

5 / 10 / 20 / 25 / 30 / 50 / 60 / 100 / 120 / 128 / 200 / 250 / 256 / 288 / 300 / 360 / 400 / 500  
 / 512 / 600 / 720 / 900 / 1,000 / 1,024 / 1,250 / 1,500  
 Other numbers of pulses available on request

TECHNICAL DATA  
mechanical

|                                |                                                                                                                                                                                                                                                                                                   |
|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Shaft diameter                 | 5 mm / 6 mm                                                                                                                                                                                                                                                                                       |
| Absolute max. shaft load       | radial 30 N (6.5 lbs), axial 15 N (3.3 lbs)                                                                                                                                                                                                                                                       |
| Absolute maximum speed         | max. 6,000 RPM                                                                                                                                                                                                                                                                                    |
| Torque                         | ≤ 0.05 Ncm                                                                                                                                                                                                                                                                                        |
| Protection class (EN 60529)    | Housing IP 50, bearings IP 40                                                                                                                                                                                                                                                                     |
| Operating temperature          | -10 ... +60 °C                                                                                                                                                                                                                                                                                    |
| Storage temperature            | -25 ... +85 °C                                                                                                                                                                                                                                                                                    |
| Vibration proof (IEC 68-2-6)   | 100 m/s <sup>2</sup> (10 ... 2,000 Hz)                                                                                                                                                                                                                                                            |
| Shock resistance (IEC 68-2-27) | 1,000 m/s <sup>2</sup> (6 ms)                                                                                                                                                                                                                                                                     |
| Type of connection             | 1.5 m cable axial/radial <sup>1)</sup>                                                                                                                                                                                                                                                            |
| Material                       | Housing: plastic; Flange: aluminium                                                                                                                                                                                                                                                               |
| Flange                         | Round flange                                                                                                                                                                                                                                                                                      |
| Weight                         | ca. 50 g                                                                                                                                                                                                                                                                                          |
| Bearing life                   | 2.4 x 10 <sup>9</sup> revolutions (typ.) at 35 % of full rated shaft load<br>2.4 x 10 <sup>8</sup> revolutions (typ.) at 75 % of full rated shaft load<br>2.4 x 10 <sup>7</sup> revolutions (typ.) at 100 % of full rated shaft load<br>For example 10,000 h at 4,000 RPM with a 2 lb radial load |

<sup>1)</sup> Other cable length on request

TECHNICAL DATA  
electrical

|                                        |                                                                                                                     |
|----------------------------------------|---------------------------------------------------------------------------------------------------------------------|
| General design                         | as per DIN VDE 0160, protection class III, contamination level 2, overvoltage class II                              |
| Supply voltage (SELV)                  | with push-pull (D): 5 VDC ± 10 %<br>with push-pull (K): 5 VDC <sup>1)</sup> ± 10 % oder 10 ... 30 VDC <sup>1)</sup> |
| Power consumption                      | 40 mA (5 VDC), 60 mA (10 VDC), 30 mA (24 VDC)                                                                       |
| Standard-Output versions <sup>2)</sup> | push-pull (K, D): A, B, N, $\overline{A}$ alarm                                                                     |

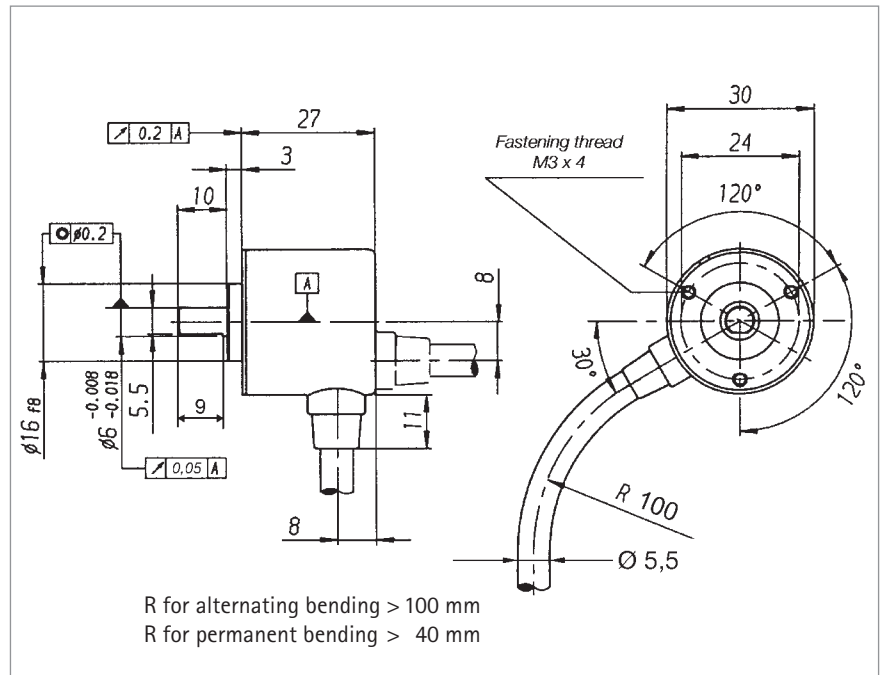
<sup>1)</sup> Pole protection

<sup>2)</sup> Output description and technical data see section „Output“.

# Incremental Shaft Encoders Economy Types

Type RI 32

## DIMENSIONED DRAWING



## CONNECTION DIAGRAM

| Description (push-pull) | Lead Ø mm <sup>2</sup> | Colour       |
|-------------------------|------------------------|--------------|
| 5 VDC/10-30 VDC         | 0,5                    | red          |
| Channel A               | 0,14                   | white        |
| Channel B               | 0,14                   | green        |
| Channel N               | 0,14                   | yellow       |
| GND                     | 0,5                    | black        |
| Alarm                   | 0,14                   | yellow/black |

## ORDERING DATA

| O Standard                     | Supply voltage<br>A 5 VDC<br>E 10 ... 30 VDC <sup>3)</sup> | Type of flange<br>R round flange                                                       | Shaft diameter<br>1 6 mm <sup>1)</sup><br>4 5 mm <sup>2)</sup> |
|--------------------------------|------------------------------------------------------------|----------------------------------------------------------------------------------------|----------------------------------------------------------------|
| RI 32                          | -0                                                         | /                                                                                      | R · 1                                                          |
| Number of pulses<br>5 ... 1500 | Protection class<br>1 IP 40                                | Output<br>K push-pull <sup>4)</sup><br>short circuit proof<br>D push-pull 5 V, ± 30 mA | Type of connection<br>A cable axial<br>B cable radial          |

<sup>1)</sup> flattened, see dimensioned drawing

<sup>2)</sup> not flattened

<sup>3)</sup> only with output K

<sup>4)</sup> ± 10 mA at 5 V, ± 30 mA at 10 ... 30 V

# Incremental Shaft Encoders Type RI 38

## Economy Types



- Encoder for universal installation by means of front/back panel mounting
- High efficiency by means of ball bearing
- Small torque
- Application e.g.:
  - FHP motors
  - laboratory equipment
  - labelling machines
  - plotters
  - length measuring machines

### NUMBER OF PULSES

5 / 10 / 20 / 25 / 28 / 32 / 50 / 60 / 72 / 100 / 128 / 144 / 200 / 250 / 256 / 288 / 300 / 360 / 400 / 500 / 512 / 600 / 720 / 900 / 1,000 / 1,024  
Other numbers of pulses available on request

### TECHNICAL DATA mechanical

|                             |                                                                                                                                                                                                                                                                                              |
|-----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Shaft diameter              | 6 mm                                                                                                                                                                                                                                                                                         |
| Absolute max. shaft load    | radial 30 N (6.5 lbs), axial 15 N (3.3 lbs)                                                                                                                                                                                                                                                  |
| Absolute maximum speed      | max. 10,000 RPM                                                                                                                                                                                                                                                                              |
| Torque                      | ≤ 0.2 Ncm                                                                                                                                                                                                                                                                                    |
| Protection class (EN 60529) | Housing IP 50, bearings IP 40                                                                                                                                                                                                                                                                |
| Operating temperature       | -10 ... +60 °C                                                                                                                                                                                                                                                                               |
| Storage temperature         | -25 ... +85 °C                                                                                                                                                                                                                                                                               |
| Vibration proof             | 100 m/s <sup>2</sup> (10 ... 2000 Hz)                                                                                                                                                                                                                                                        |
| Shock resistance            | 1000 m/s <sup>2</sup> (6 ms)                                                                                                                                                                                                                                                                 |
| Type of connection          | 1.5 m cable, radial <sup>1)</sup>                                                                                                                                                                                                                                                            |
| Housing                     | glassfibre reinforced plastic                                                                                                                                                                                                                                                                |
| Flange                      | Q = square flange                                                                                                                                                                                                                                                                            |
| Weight                      | 60 g approx.                                                                                                                                                                                                                                                                                 |
| Bearing life                | 1 x 10 <sup>10</sup> revolutions (typ.) at 35 % of full rated shaft load<br>1 x 10 <sup>9</sup> revolutions (typ.) at 75 % of full rated shaft load<br>1 x 10 <sup>8</sup> revolutions (typ.) at 100 % of full rated shaft load<br>For example 30,000 h at 6,000 RPM with a 2 lb radial load |

<sup>1)</sup> Other cable length on request

### TECHNICAL DATA electrical

|                                        |                                                                                                                     |
|----------------------------------------|---------------------------------------------------------------------------------------------------------------------|
| General design                         | as per DIN VDE 0160, protection class III, contamination level 2, overvoltage class II                              |
| Supply voltage (SELV)                  | with push-pull (D): 5 VDC ± 10 %<br>with push-pull (K): 5 VDC <sup>1)</sup> ± 10 % oder 10 ... 30 VDC <sup>1)</sup> |
| Power consumption                      | 40 mA (5 VDC), 60 mA (10 VDC), 30 mA (24 VDC)                                                                       |
| Standard-Output versions <sup>2)</sup> | push-pull (K, D): A, B, N, $\overline{A}$ alarm                                                                     |

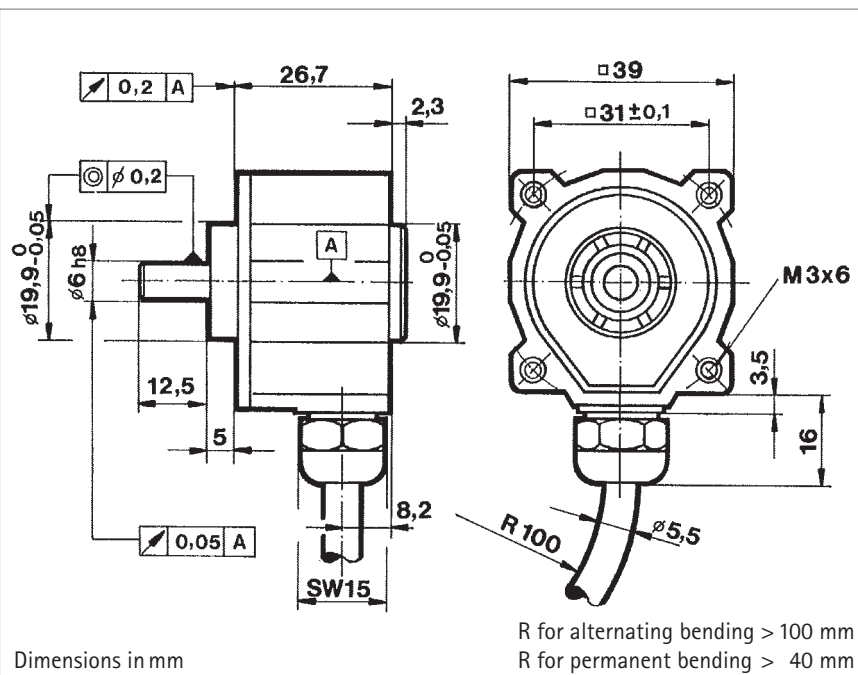
<sup>1)</sup> Pole protection

<sup>2)</sup> Output description and technical data see section "Output"



## Type RI 38

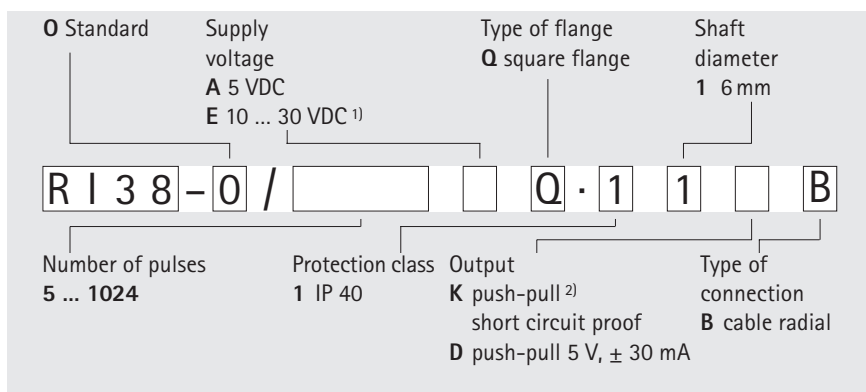
## DIMENSIONED DRAWING



## CONNECTION DIAGRAM

| Description (push-pull) | Lead Ø mm <sup>2</sup> | Colour       |
|-------------------------|------------------------|--------------|
| 5 VDC/10-30 VDC         | 0,5                    | red          |
| Channel A               | 0,14                   | white        |
| Channel B               | 0,14                   | green        |
| Channel N               | 0,14                   | yellow       |
| GND                     | 0,5                    | black        |
| Alarm                   | 0,14                   | yellow/black |

## ORDERING DATA



1) only with output K

2)  $\pm 10 \text{ mA}$  at  $5 \text{ V}$ ,  $\pm 30 \text{ mA}$  at  $10 \dots 30 \text{ V}$

## Economy Types



- Replacement for type RIM
- Economical miniature encoder
- Up to 14,400 steps with 3,600 pulses
- High mechanical efficiency
- Application e.g.
  - wood working machines
  - FHP motors
  - graphic machines
  - table robots

## NUMBER OF PULSES

5 / 10 / 20 / 25 / 28 / 32 / 50 / 60 / 72 / 100 / 128 / 144 / 200 / 250 / 256 / 288 / 300 / 360 / 400 / 500 / 512 / 600 / 720 / 900 / 1,000 / 1,024 / 1,250 / 1,500 / 2,000 / 2,048 / 2,500 / 3,000 / 3,600

Other numbers of pulses available on request

TECHNICAL DATA  
mechanical

|                                |                                                                                                                                                                                                                                                                                              |
|--------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Shaft diameter                 | 6 mm                                                                                                                                                                                                                                                                                         |
| Absolute max. shaft load       | radial 30 N (6.5 lbs), axial 15 N (3.3 lbs)                                                                                                                                                                                                                                                  |
| Absolute maximum speed         | max. 10,000 RPM                                                                                                                                                                                                                                                                              |
| Torque                         | ≤ 0.2 Ncm                                                                                                                                                                                                                                                                                    |
| Protection class (EN 60529)    | Housing IP 50, bearings IP 40                                                                                                                                                                                                                                                                |
| Operating temperature          | -10 ... +70 °C                                                                                                                                                                                                                                                                               |
| Storage temperature            | -25 ... +85 °C                                                                                                                                                                                                                                                                               |
| Vibration proof (IEC 68-2-6)   | 100 m/s <sup>2</sup> (10 ... 2,000 Hz)                                                                                                                                                                                                                                                       |
| Shock resistance (IEC 68-2-27) | 1000 m/s <sup>2</sup> (6 ms)                                                                                                                                                                                                                                                                 |
| Type of connection             | 1.5 m cable, radial <sup>1)</sup>                                                                                                                                                                                                                                                            |
| Housing                        | Aluminium                                                                                                                                                                                                                                                                                    |
| Flange                         | Round flange                                                                                                                                                                                                                                                                                 |
| Weight                         | ca. 60 g                                                                                                                                                                                                                                                                                     |
| Bearing life                   | 1 x 10 <sup>10</sup> revolutions (typ.) at 35 % of full rated shaft load<br>1 x 10 <sup>9</sup> revolutions (typ.) at 75 % of full rated shaft load<br>1 x 10 <sup>8</sup> revolutions (typ.) at 100 % of full rated shaft load<br>For example 30,000 h at 6,000 RPM with a 2 lb radial load |

<sup>1)</sup> Other cable length on request

TECHNICAL DATA  
electrical

|                                        |                                                                                                                     |
|----------------------------------------|---------------------------------------------------------------------------------------------------------------------|
| General design                         | as per DIN VDE 0160, protection class III, contamination level 2, overvoltage class II                              |
| Supply voltage (SELV)                  | with push-pull (D): 5 VDC ± 10 %<br>with push-pull (K): 5 VDC <sup>1)</sup> ± 10 % oder 10 ... 30 VDC <sup>1)</sup> |
| Power consumption                      | 40 mA (5 VDC), 60 mA (10 VDC), 30 mA (24 VDC)                                                                       |
| Standard-Output versions <sup>2)</sup> | push-pull (K, D): A, B, N, Alarm                                                                                    |

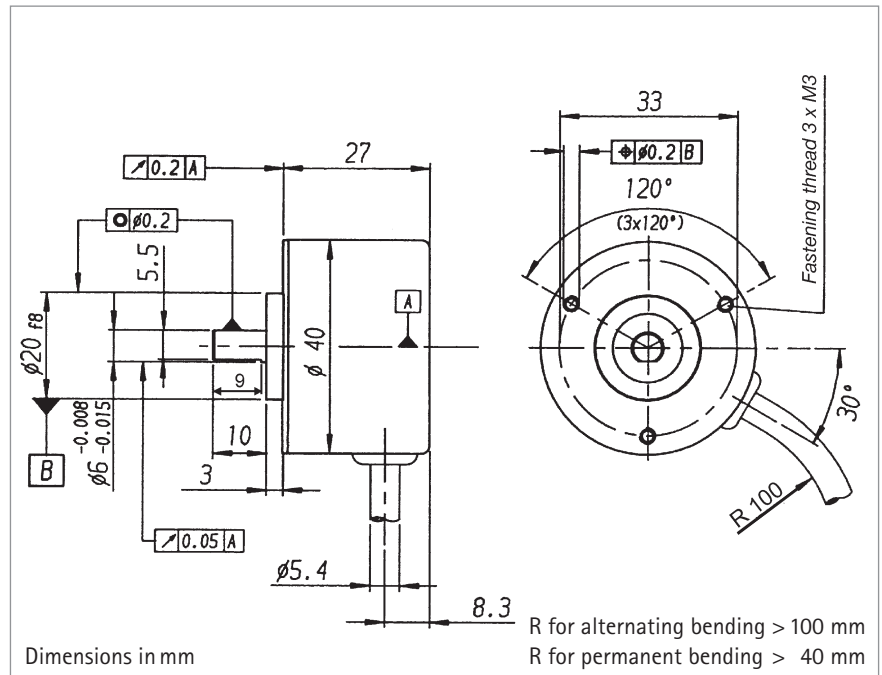
<sup>1)</sup> Pole protection

<sup>2)</sup> Output description and technical data see section "Output"

# Incremental Shaft Encoders Economy Types

Type RI 41

## DIMENSIONED DRAWING



## CONNECTION DIAGRAM

| Description (push-pull) | Lead Ø mm² | Colour               |
|-------------------------|------------|----------------------|
| 5 VDC / 10-30 VDC       | 0,5        | red                  |
| Channel A               | 0,14       | white                |
| Channel B               | 0,14       | green                |
| Channel N               | 0,14       | yellow               |
| GND                     | 0,5        | black                |
| Alarm                   | 0,14       | yellow/black         |
| screen <sup>1)</sup>    |            | screen <sup>1)</sup> |

<sup>1)</sup> Not connected to encoder housing

## ORDERING DATA

|                                |                                                            |                                                                                        |                                      |
|--------------------------------|------------------------------------------------------------|----------------------------------------------------------------------------------------|--------------------------------------|
| O Standard                     | Supply voltage<br>A 5 VDC<br>E 10 ... 30 VDC <sup>1)</sup> | Type of flange<br>R round flange                                                       | Shaft diameter<br>1 6 mm             |
| R I 4 1 - 0 /                  |                                                            | R · 1                                                                                  | 1 B                                  |
| Number of pulses<br>5 ... 3600 | Protection class<br>1 IP 40                                | Output<br>K push-pull <sup>2)</sup><br>short circuit proof<br>D push-pull 5 V, ± 30 mA | Type of connection<br>B cable radial |

<sup>1)</sup> Only with output K

<sup>2)</sup> ± 10 mA at 5 V, ± 30 mA at 10 ... 30 V

## Economy Types



- Economy encoder
- High protection IP 65
- Push-pull or NPN-O.C.
- Applications, e.g.
  - textile machinery

## NUMBER OF PULSES

5 / 10 / 20 / 25 / 28 / 32 / 50 / 60 / 72 / 100 / 128 / 144 / 200 / 250 / 256 / 288 / 300 / 360 / 400 / 500 / 512 / 600 / 720 / 900 / 1000 / 1024

Other numbers of pulses available on request

TECHNICAL DATA  
mechanical

|                                    |                                       |
|------------------------------------|---------------------------------------|
| Shaft diameter                     | 6 mm                                  |
| Balance tolerances                 | radial 10 N, axial 5 N                |
| Absolute max. speed                | 10,000 min <sup>-1</sup>              |
| Torque                             | ≤ 1 Ncm                               |
| Protection class (EN 60529)        | Housing IP 65, bearings IP 64         |
| Operating temperature              | 0 ... +60 °C                          |
| Storage temperature                | -25 ... +85 °C                        |
| Vibration performance (IEC 68-2-6) | 100 m/s <sup>2</sup> (10 ... 2000 Hz) |
| Shock resistance (IEC 68-2-27)     | 1000 m/s <sup>2</sup> (6 ms)          |
| Connection                         | 1.5 m cable axial <sup>1)</sup>       |
| Material                           | plastic, flange: aluminium            |
| Flange                             | round flange                          |
| Weight                             | approx. 75 g                          |

<sup>1)</sup> Other cable length on request

TECHNICAL DATA  
electrical

|                                        |                                                                                                                                                                                                                                |
|----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| General design                         | as per DIN VDE 0160, protection class III, contamination level 2, overvoltage class II                                                                                                                                         |
| Supply voltage (SELV)                  | with push-pull (D): 5 VDC ± 10 %<br>with push-pull (K): 5 VDC <sup>1)</sup> ± 10 % or 10...30 VDC <sup>1)</sup><br>with push-pull complementary (I): 10...30 VDC <sup>1)</sup><br>with NPN-O.C. (S): 10...24 VDC <sup>1)</sup> |
| Power consumption                      | 40 mA (5 VDC), 30 mA (24 VDC) with push-pull (K,I)<br>40 mA (24 VDC), bei NPN-O.C. (S)                                                                                                                                         |
| Standard-Output versions <sup>2)</sup> | push-pull <sup>2)</sup> / push-pull complementary <sup>2)</sup> / NPN-O.C. <sup>3)</sup>                                                                                                                                       |

<sup>1)</sup> Pole protection

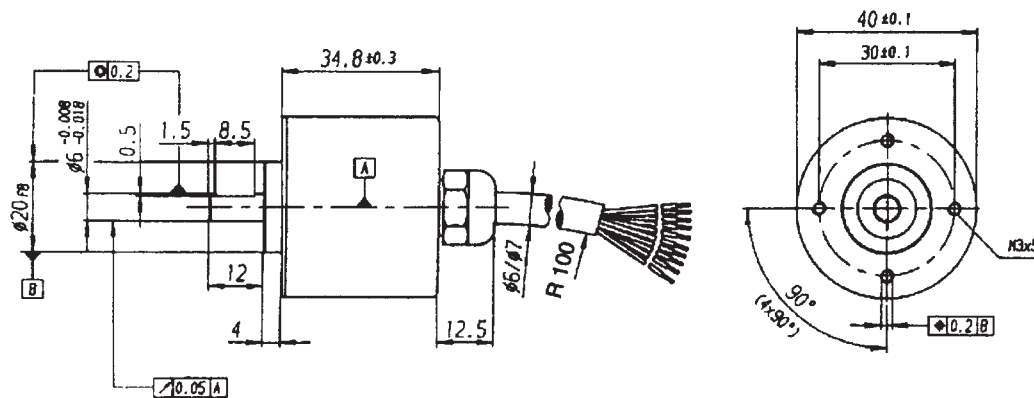
<sup>2)</sup> Output description and technical data see section "output"

<sup>3)</sup> NPN-O.C. with internal pull-up resistor = 10 KΩ, max. pulse frequency = 50 KHz, max. output lead = ± 30 mA, tolerance ≤ ± 30° electrical, delay time ≤ 4μs

# Incremental Shaft Encoders Economy Types

Type RI 42

## DIMENSIONED DRAWING



R for alternating bending > 100 mm  
R for permanent bending > 40 mm

Dimensions in mm

## CONNECTION DIAGRAM

| Colour (PVC) | Output Circuit<br>push-pull (K, D),<br>Open Collector (S) | push-pull<br>complementary (I) |
|--------------|-----------------------------------------------------------|--------------------------------|
| white        | Channel A                                                 | Channel A                      |
| white/brown  |                                                           | Channel $\bar{A}$              |
| green        | Channel B                                                 | Channel B                      |
| green/brown  |                                                           | Channel $\bar{B}$              |
| yellow       | Channel N                                                 | Channel N                      |
| yellow/brown |                                                           | Channel $\bar{N}$              |
| yellow/black | Alarm                                                     | Alarm                          |
| yellow/red   |                                                           | Sense $V_{CC}$                 |
| red          | 5/10...30/10...24 VDC                                     | 10...30 V DC                   |
| black        | GND                                                       | GND                            |

## ORDERING DATA

|                                       |                                                                                                                                |                                                                                                                                                                      |                                                    |
|---------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|
| <b>O</b> Standard                     | Supply voltage<br><b>A</b> 5 VDC <sup>1)</sup><br><b>E</b> 10 ... 30 VDC <sup>2)</sup><br><b>C</b> 10 ... 24 VDC <sup>3)</sup> | Type of flange<br><b>R</b> Round flange                                                                                                                              | Shaft diameter<br><b>1</b> 6 mm                    |
| <b>R I 4 2 - 0 /</b>                  |                                                                                                                                | <b>R · 4</b>                                                                                                                                                         | <b>1</b>                                           |
| Number of pulses<br><b>5 ... 1024</b> | Protection class<br><b>4</b> IP 64                                                                                             | Output<br><b>K</b> Push-pull short circuit proof <sup>4)</sup><br><b>D</b> Push-pull 5 V, ± 30 mA<br><b>S</b> Open Collector NPN<br><b>I</b> Push-pull complementary | Type of connection<br><b>A</b> Cable axial         |
| <sup>1)</sup> only with output K, D   | <sup>2)</sup> only with output K, I                                                                                            | <sup>3)</sup> only with output S                                                                                                                                     | <sup>4)</sup> ± 10 mA at 5 V, ± 30 mA at 10...30 V |