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# TURCK



## Sensors Catalog

### Linear, Angular, Rotary

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# Linear and Rotary Position

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|                              |                  |            |
|------------------------------|------------------|------------|
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##### Compact, Optical

|                  |            |            |
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|                    |              |            |
|--------------------|--------------|------------|
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#### Multiturn

##### Compact, Magnetic

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|             |         |             |
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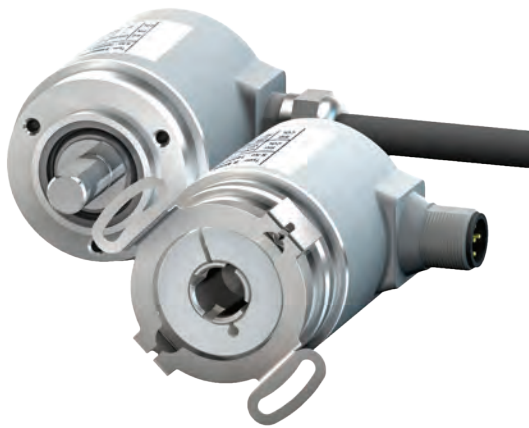
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# LINEAR AND ROTARY POSITION WHAT'S NEW?



## Rotary Sensor - Energy Harvesting Technology

RM-97/98    RM-115    RM-116  
RM-99/100    RM-117    RM-118  
RM-101/102    RM-109    RM-121

- Compact, magnetic sensor
- Absolute, multiturn
- Analog, SSI, CANopen outputs available



## Rotary Sensor – Battery Backed Technology

RM-103/104  
RM-105/106

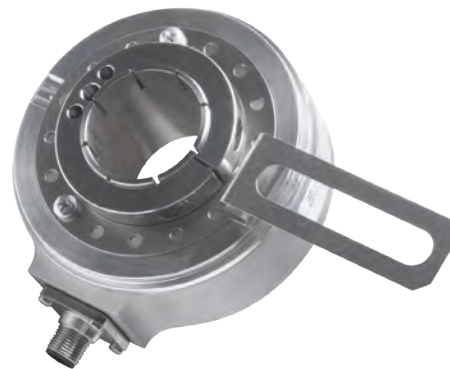
- 58 mm, optical sensor
- Absolute, multiturn
- SSI, CANopen, Modbus outputs available



## Incremental Encoders

RI-10/12

- Any Device, One Price!
- Rugged and compact for many applications
- Pulse rates available from 1 to 5000
- Shaft and Bore sizes 6 mm to 5/8"
- Numerous mounting accessories
- Single or double-ended signals
- Many electrical options
- M12, M23, Military and cable connections
- Can match wiring and waveforms from competitors



## Incremental Encoders

RI-43

- Any Device, One Price!
- Heavy duty for use with AC vector motors
- Pulse rates available from 50 to 5000
- Bore sizes 12 mm to 42 mm (including inch sizes)
- Available with or without isolation insert
- Numerous mounting accessories
- Many electrical options
- M12, M23, Military and cable connections
- Can match wiring and waveforms from competitors



# LINEAR POSITION TECHNOLOGY

| SERIES                                 | TYPE                | INTERFACE                | PAGE       |
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| <b>Q-track™</b>                        |                     |                          |            |
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| QR14 Miniature Series                  | Standard Resolution | Analog Output (U/I)      | <b>B4</b>  |
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| Q25 HE Series                          | Enhanced Resolution | SSI Interface            | <b>B10</b> |
| Q25 E Series                           | Enhanced Resolution | IO-Link Compatible       | <b>B12</b> |
| Q-track Accessories                    |                     |                          | <b>B14</b> |
| <b>EZ-track</b>                        |                     |                          |            |
| Analog Profile Series                  | Q21(R)/Q35(R)       |                          | <b>B17</b> |
| Quadrature Profile Series              | Q21-DQ/Q35-DQ       |                          | <b>B19</b> |
| Digital Profile Series                 | Q21D/Q35D           |                          | <b>B21</b> |
| Profile Series Accessories             |                     |                          | <b>B23</b> |
| Rod Series                             | R10                 |                          | <b>B25</b> |
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| <b>Linear Magnetic Position System</b> |                     |                          |            |
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| <b>Draw Wire Assemblies</b>            |                     |                          |            |
|  | DW70                | Analog or Encoder Output | <b>B38</b> |
|  | DW110               | Analog or Encoder Output | <b>B42</b> |
|  | DW155               | Analog or Encoder Output | <b>B47</b> |
|  | DW135               | Analog or Encoder Output | <b>B53</b> |
| Miniature Draw Wire                    | DW55                | Analog Output            | <b>B60</b> |
|  | DW55                | Incremental Output       | <b>B63</b> |
| Standard Draw Wire                     | DW125               | Encoder Output           | <b>B65</b> |
| Mini Measurement System                | WE-1                | Incremental Output       | <b>B68</b> |

## Q-track Linear Position Sensors – Breaking New Ground

### Principle of Operation

Turck's new Q-track linear position sensor operation is based on the RLC (Resistance Inductive Capacitance) principle, incorporating an advanced microprocessor, precisely positioned emitter, and receiver coils on a printed circuit board.

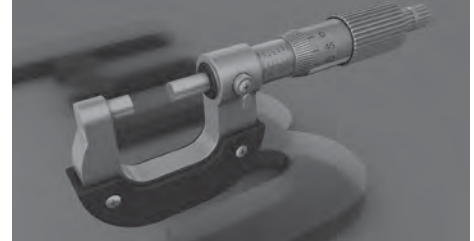
The emitter coils are excited with a high frequency AC field. The interaction between the moving position element and the receiver coils creates different voltages that are induced into the receiver coils, which determines the position of the target.



### Speed and Accuracy

To increase speed and accuracy, Turck designed the linear position sensor with two different coil systems. The first coil system is for coarse measurements, while the second coil system is used to determine the fine position. An advanced microprocessor circuit analyzes the resulting signals, producing a measuring system with high linearity and repeatability.

The Q-track linear position sensor is available in 100 mm increments from 100 to 1,000 mm in length. Depending upon the series selected, the sensor is available with 12, 16 or 20 bit accuracy.



### Short Blind Zones

Turck designed the microprocessor board and coil system to be compact. The sensor length is only 58 mm longer than the measuring span. The blind zones measure a mere 29 mm on each end of the sensor.

The layout of the coils is designed in such a way to minimize the effect of vertical (up to 4 mm) or lateral misalignment.



### Q-track Linear Position Sensors – Breaking New Ground

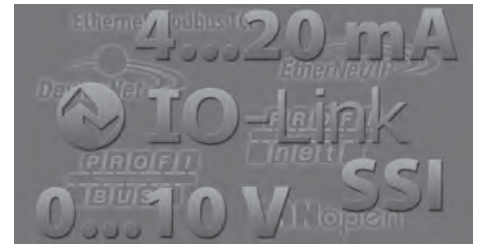
#### Analog or Digital Outputs

The standard resolution versions feature 0-10 V and 4-20 mA analog signals with 12 bit resolution, plus the flexibility of scaling or reversing the direction of operation.

The enhanced resolution versions are available in either 20 bit SSI (Synchronous Serial Interface),

16 bit IO-Link, or with configurable switching points.

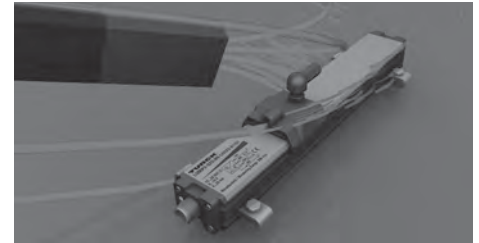
A dual multifunctional Green / Yellow LED facilitates simple set up and diagnostics.



#### High Noise Immunity

The RLC circuit used in the Q-track linear position sensor is highly immune to noise interference. All products meet IEC 60529 and EN 60529 standards for noise immunity.

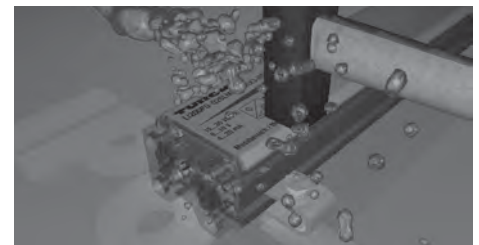
The Q-track linear position sensor is inherently weld field immune.



#### Robust Housing

The Q-track linear position sensor provides many advantages over existing linear measurement technologies, such as potentiometer and magnetostrictive devices. Potentiometer devices are larger in size relative to the measuring span and are subject to wear and contamination. Magnetostrictive transducers are also longer in length relative to the measuring span and require external magnets that are subject to environmental degradation.

M12 Eurofast® connectors provide an industry standard connection to the linear position sensor.



### Q-track Linear Position Sensors – Precise, Versatile and Rugged

Turck's Q-track linear position sensors do not use magnets. Instead, they use a tuned coil positioning element. The Q-track RLC technology provides absolute position feedback and is noise immune. As a result, the linear position sensor may be used in a wide variety of industries and applications that require linear feedback, such as:

- Cylinder position
- Stamping
- Pinch roll height
- Ride control
- Level control
- Flight simulators
- Pitch control
- Casting machines
- Weld nut height
- Metal cutting machinery
- Wood cutting machinery
- Plastic molding machines

**QR14 Miniature Series, Analog Output (U/I)**



**Measuring Range Specifications**

|                         |        |
|-------------------------|--------|
| Measuring span (A...B): | 25 mm  |
| Blind zone (a):         | 17 mm  |
| Blind zone (b):         | 7.5 mm |

**System**

|                      |  |
|----------------------|--|
| Resolution:          | 12 bit                                       |
| Repeatability:       | 0.006 mm                                     |
| Linearity deviation: | ≤ 0.5% of full scale                         |
| Temperature drift:   | ≤ ±0.01% / K                                 |
| Ambient temperature: | -25 to +70 °C<br>-40 to +70 °C (S97 version) |

**Electrical Data**

|  |                                    |
|--|------------------------------------|
| Operating voltage:                           | 15-30 VDC (LiU5)<br>8-30 VDC (LU4) |
| Residual ripple:                             | ≤ 10% U <sub>pp</sub>              |
| No-load current:                             | ≤ 50 mA                            |
| Rated insulation voltage:                    | ≤ 0.5 kV                           |
| Short-circuit protection:                    | yes                                |
| Wire breakage / reverse polarity protection: | yes/yes                            |
| Output function:                             | analog output                      |
| Voltage output:                              | 0-10 V (LiU5)<br>0.5-4.5 V (LU4)   |
| Current output:                              | 4-20 mA (LiU5)                     |
| Load resistance of voltage output:           | ≥ 4.7 kΩ                           |
| Load resistance of current output:           | ≤ 0.4 kΩ                           |
| Current consumption:                         | < 100 mA                           |
| Sampling rate:                               | 700 Hz                             |

**Housing Style**

|  |   |
|--|---|
| Housing style:                         | rectangular, QR14   |
| Dimensions:                            | 53.5 x 49 x 14 mm   |
| Housing material:                      | plastic, PBT-GF30-V0                                      |
| Cable quality:                         | 5.2 mm, LifYY, PVC (LiU5)<br>5.2 mm, Lif 32432, TPE (LU4) |
| Connection:                            | cable/cable with connector, M12 x 1                       |
| Vibration resistance:                  | 55 Hz (1 mm)  |
| Shock resistance:                      | 30 g (11 ms)  |
| Protection class (IEC 60529/EN 60529): | IP68/IP69K  |

**LEDs**

|                             |   |
|-----------------------------|---|
| Power on indication:        | green LED                                   |
| Measuring range indication: | green/green flashing (multifunctional LEDs) |

**Miscellaneous**

|                       |                 |
|-----------------------|-----------------|
| Included in delivery: | P1-Li-QR14/Q17L |
|-----------------------|-----------------|

**Product Features**

- 12 bit resolution
- Current and voltage output in one device
- M12 Eurofast connector (4-pin)
- Cable, open end
- Extreme short blind zones
- Watertight (IP68/IP69K) fully potted polycarbonate housing

**Measuring Range Indicated via LED**

- **Green:** The positioning element is in the measuring range.
- **Green flashing:** The positioning element is in the measuring range with a lower signal quality (e.g., the distance between sensor and element is too large).
- **Off:** The positioning element is outside the programmed range.

### QR14 Miniature Series, Analog Output (U/I)

#### Part Number Key: QR14 Series

|    |    |    |   |      |   |        |   |         |   |     |
|----|----|----|---|------|---|--------|---|---------|---|-----|
| A  | B  | C  |   | D    |   | E      |   | F       |   | G   |
| LI | 25 | P1 | - | QR14 | - | LIU5X2 | - | 0.3-RS4 | / | S97 |

| A  | Type             |
|----|------------------|
| LI | Linear Inductive |

| B  | Measuring Span |
|----|----------------|
| 25 | 25 mm          |

| C  | Positioning Element, Floating |
|----|-------------------------------|
| P1 | P1-Li-QR14/Q17L*              |

\*Operates at a distance of 0-4 mm from the sensor surface

| D    | Housing Style             |
|------|---------------------------|
| QR14 | Rectangular, 53.5 x 14 mm |

| E      | Operating Voltage and Output Type  |
|--------|------------------------------------|
| LU4X2  | 8-30 VDC, 0.5-4.5 V, 2 LEDs        |
| LIU5X2 | 15-30 VDC, 4-20 mA, 0-10 V, 2 LEDs |

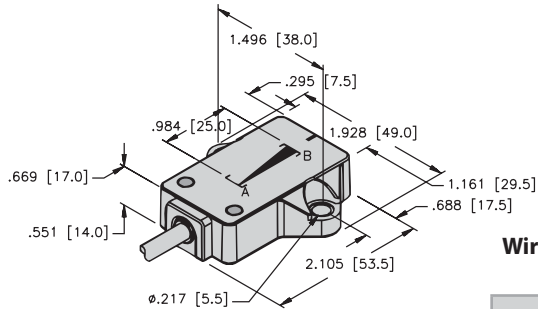
| F                  | Type of Connection*  |
|--------------------|--|
| 0.3-RS4<br>(Blank) | Cable (0.3 m PUR) w/ M12 Eurofast Connector<br>Cable (2 m PUR) |

\*TPE cable for output type 'LU4X2'.

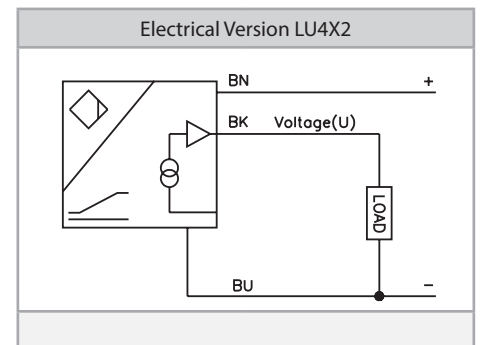
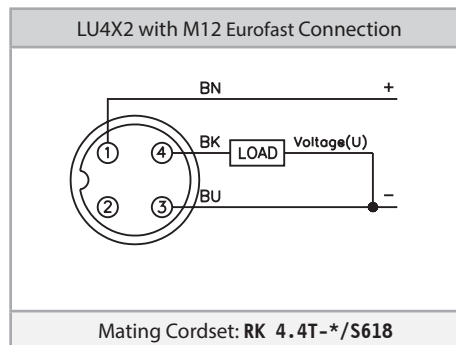
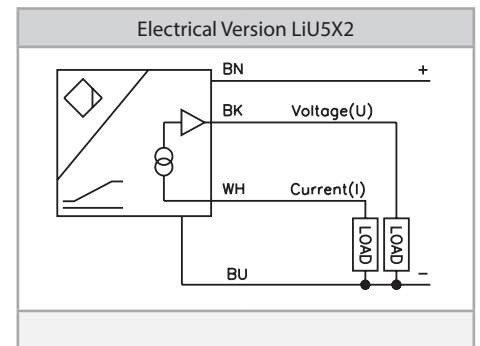
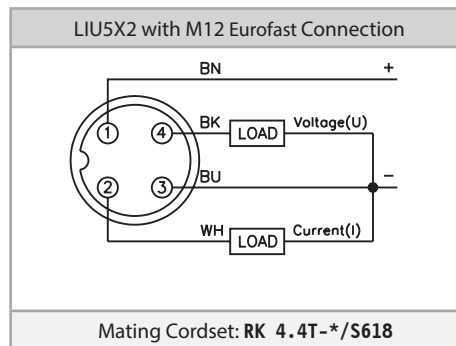
| G   | Specials (Optional)                                    |
|-----|--|
| S97 | -40 to +70 °C Extended Temperature Range <sup>1)</sup> |

<sup>1)</sup> Only available for output type 'LU4X2'.

#### Dimensions: QR14 Series



#### Wiring Diagram: QR14



See page H1, Connectivity, for cables and connectors.

## Q17L Compact Series, Analog Output (U/I)



### Measuring Range Specifications

|                      |                           |
|----------------------|---------------------------|
| Max. measuring span: | 50, 100, 150, 200, 300 mm |
| Blind zone (a):      | 22 mm                     |
| Blind zone (b):      | 10 mm (Li50 = 16 mm)      |

### System

|                      |  |
|----------------------|--|
| Resolution:          | 12 bit                                       |
| Repeatability:       | 0.025%                                       |
| Linearity deviation: | ≤ 0.5% of full scale                         |
| Temperature drift:   | ≤ ±0.01 % / K                                |
| Ambient temperature: | -25 to +70 °C<br>-40 to +70 °C (S97 version) |

### Electrical Data

|  |                                  |
|--|----------------------------------|
| Operating voltage:                           | 15-30 VDC (LIU5) 8-30 VDC (LU4)  |
| Residual ripple:                             | ≤ 10% $U_{pp}$                   |
| No-load current:                             | ≤ 50 mA                          |
| Rated insulation voltage:                    | ≤ 0.5 kV                         |
| Short-circuit protection:                    | yes                              |
| Wire breakage / reverse polarity protection: | yes/yes                          |
| Output function:                             | 4-wire, analog output            |
| Voltage output:                              | 0-10 V (LIU5)<br>0.5-4.5 V (LU4) |
| Current output:                              | 4-20 mA (LIU5)                   |
| Load resistance of voltage output:           | ≥ 4.7 kΩ                         |
| Load resistance of current output:           | ≤ 0.4 kΩ                         |
| Current consumption:                         | < 100 mA                         |
| Sampling rate:                               | 700 Hz                           |

### Housing Style

|  |  |
|--|--|
| Housing style:                         | rectangular, Q17L  |
| Dimensions:                            | 20 x 16.5 mm, length L = measuring length + 32 mm,<br>(Li50 + 38 mm) |
| Housing material:                      | plastic, PC-GF10   |
| Cable quality:                         | 5.2 mm, Li9YH-11YH, PUR (LIU5)<br>5.2 mm, Lif32Y32Y, TPE (LU4)       |
| Connection:                            | cable/cable with connector, M12 x 1                                  |
| Vibration resistance:                  | 55 Hz (1 mm)   |
| Shock resistance:                      | 30 g (11 ms)   |
| Protection class (IEC 60529/EN 60529): | IP67   |

### Miscellaneous

|                       |   |
|-----------------------|---|
| Included in delivery: | P1-Li-QR14/Q17L (position element),<br>M1.1-Q17L, M1.2-Q17L (mounting feet) |
|-----------------------|---|

### Product Features

- 12 bit resolution
- Current and voltage output in one device
- M12 Eurofast connector (5-pin)
- Cable, open end
- Extreme short blind zones
- Programmable measuring range
- Watertight (IP67) fully potted polycarbonate housing

### Measuring Range Indicated via LED

- **Green:** The positioning element is in the measuring range.
- **Green/flashing:** The positioning element is in the measuring range with a lower signal quality (e.g., the distance between sensor and element is too large).
- **Off:** The positioning element is outside the programmed range.

### Setting the Measuring Range

The initial and final value of the measuring range is set at the push of a button, either via a teach adapter or programming line (pin 5). Furthermore, the output curve can be inverted.

- Factory setting (0 V/4 mA at the connector end): Jumper pin 5 and pin 1 for 10 sec.
- Factory setting inverted: Jumper pin 5 and pin 3 for 10 sec.
- Setting the initial value: Move positioning element to desired position and jumper pin 5 and pin 3 for 2 sec.
- Setting the final value: Move positioning element to desired position and jumper pin 5 and pin 1 for 2 sec.

### Q17L Compact Series, Analog Output (U/I)

#### Part Number Key: Q17L Series

| A  | B  | C  | D | E    | F  | G | H     |   |          |   |     |
|----|----|----|---|------|----|---|-------|---|----------|---|-----|
| LI | 50 | P1 | - | Q17L | M1 | - | LU4X2 | - | 0.3M-RS5 | / | S97 |

| A  | Type             |
|----|------------------|
| LI | Linear Inductive |

| B   | Measuring Span |
|-----|----------------|
| 50  | 50 mm          |
| 100 | 100 mm         |
| 150 | 150 mm         |
| 200 | 200 mm         |
| 300 | 300 mm         |

| C  | Positioning Element, Floating |
|----|-------------------------------|
| P1 | P1-Li-QR14/Q17L*              |

\*Operates at a distance of 0-4 mm from the sensor surface

| D    | Housing Style             |
|------|---------------------------|
| Q17L | Rectangular, 16.5 x 20 mm |

| E  | Mounting Bracket        |
|----|-------------------------|
| M1 | M1.1-Q17L and M1.2-Q17L |

| F      | Operating Voltage and Output Type  |
|--------|------------------------------------|
| LU4X2  | 8-30 VDC, 0.5-4.5 V, 2 LEDs        |
| LIU5X2 | 15-30 VDC, 4-20 mA, 0-10 V, 2 LEDs |

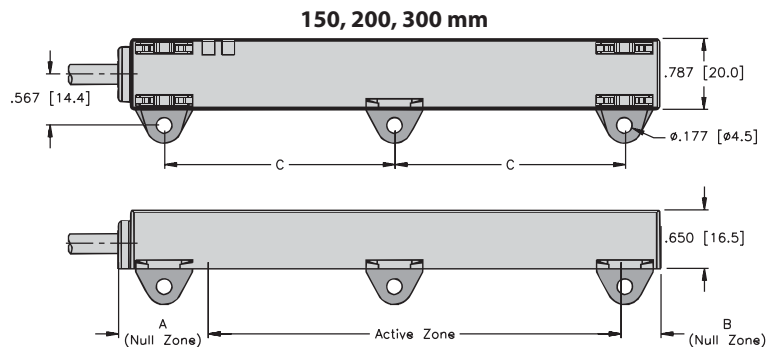
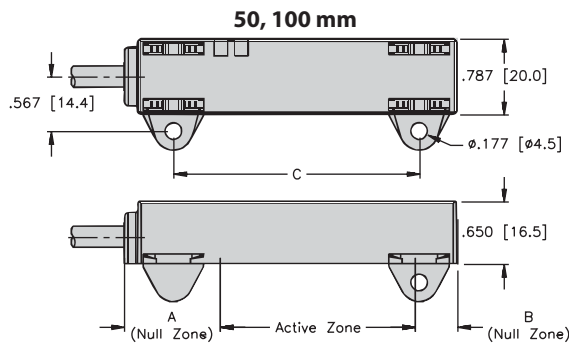
| G                | Type of Connection*  |
|------------------|--|
| 0.3M-RS5 (Blank) | Cable (0.3 m PUR) w/ M12 Eurofast Connector<br>Cable (2 m PUR) |

\*TPE cable for output type 'LU4'.

| H   | Specials (Optional)                                    |
|-----|--|
| S97 | -40 to +70 °C Extended Temperature Range <sup>1)</sup> |

<sup>1)</sup>Only available for output type 'LU4'.

#### Dimensions: Q17L Series



#### Wiring Diagram: Q17L

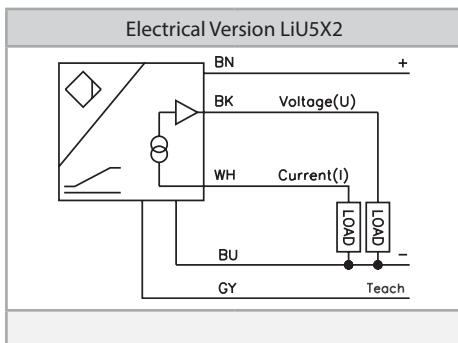
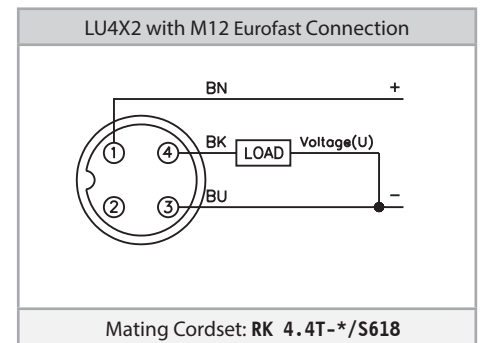
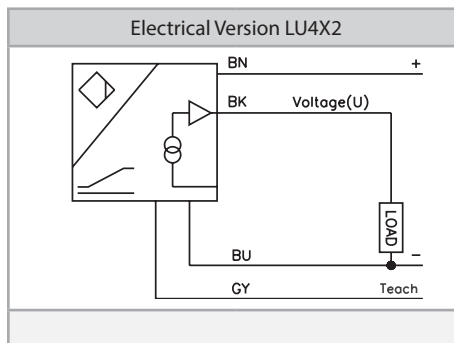
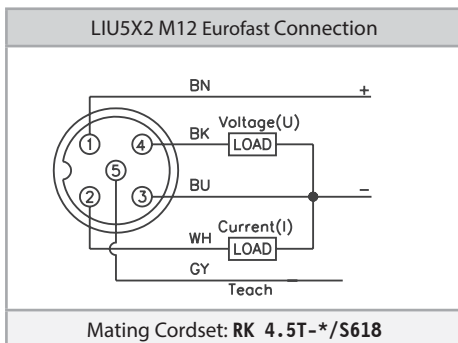


Table 1:

| Measuring Range | Mounting Hole Dimensions (C) |
|-----------------|------------------------------|
| 50 mm           | 65 mm                        |
| 100 mm          | 108 mm                       |
| 150 mm          | 79 mm                        |
| 200 mm          | 104 mm                       |
| 300 mm          | 154 mm                       |

See page H1, Connectivity, for cables and connectors.



\* Length in meters.

**S-Series with Standard Resolution, Analog Output (U/I)**



**Assembly part number:**  
Li200P1-Q25LM2-LiU5X3-H1151

**Measuring Range Specifications**

|                     |   |
|---------------------|---|
| Measuring span (L): | 100, 200, 300, 400, 500, 600, 700, 800, 900, 1,000 mm |
| Blind zone (a):     | 29 mm   |
| Blind zone (b):     | 29 mm   |

**System**

|                      |                                       |
|----------------------|---------------------------------------|
| Resolution:          | 12 bit (measuring range in mm / 4096) |
| Repeatability:       | 0.025% (0.025 mm per 100 mm)          |
| Linearity deviation: | ≤ 0.1% of full scale                  |
| Temperature drift:   | ≤ ±0.003 % / K                        |
| Ambient temperature: | -25 to +70 °C                         |

**Electrical Data**

|  |                       |
|--|-----------------------|
| Operating voltage:                           | 15-30 VDC             |
| Residual ripple:                             | ≤ 10% U <sub>pp</sub> |
| No-load current:                             | ≤ 50 mA               |
| Rated insulation voltage:                    | ≤ 0.5 kV              |
| Short-circuit protection:                    | yes                   |
| Wire breakage / reverse polarity protection: | yes/fully             |
| Output function:                             | 5-wire, analog output |
| Voltage output:                              | 0-10 V                |
| Current output:                              | 4-20 mA               |
| Load resistance of voltage output:           | ≥ 4.7 kΩ              |
| Load resistance of current output:           | ≤ 0.4 kΩ              |
| Current consumption:                         | < 100 mA              |
| Sample rate:                                 | 500 Hz                |

**Housing Style**

|  |   |
|--|---|
| Housing style:                         | rectangular, Q25L                               |
| Dimensions:                            | profile 35 x 25 mm, L = measuring range + 58 mm |
| Housing material:                      | aluminum  |
| Material active face:                  | plastic, PC-GF20                                |
| Connection:                            | connector, M12 x 1                              |
| Vibration resistance:                  | 55 Hz (1 mm)                                    |
| Shock resistance:                      | 30 g (11 ms)                                    |
| Protection class (IEC 60529/EN 60529): | IP67  |

**LEDs**

|                             |                                  |
|-----------------------------|----------------------------------|
| Power indication:           | green LED                        |
| Measuring range indication: | green/yellow multifunctional LED |

**Product Features**

- 12 bit resolution
- Current and voltage output in one device (5-wire, 15-30 VDC)
- M12 Eurofast connector (5-pin)
- 29 mm blind zones
- Programmable measuring range
- Captive and floating (0-4 mm from sensing face) position elements available
- Robust extruded aluminum housing
- Watertight (IP67) polycarbonate insert
- Multifunction LED

**Measuring Range Indicated via LED**

- **Green:** The positioning element is in the measuring range.
- **Green/yellow alternate flashing:** The positioning element is in the measuring range with a lower signal quality (e.g., the distance between sensor and element is too large).
- **Yellow flashing:** The positioning element is outside of the measuring range (max. range).
- **Off:** The positioning element is outside the programmed range but inside the total, non-programmed measuring length.

**Setting the Measuring Range**

The initial and final value of the measuring range is set at the push of a button, either via a teach adapter or programming line (pin 5). Furthermore, the output curve can be inverted.

- Factory setting (0 V/4 mA at the connector end): Jumper pin 5 and pin 1 for 10 sec.
- Factory setting inverted: Jumper pin 5 and pin 3 for 10 sec.
- Setting the initial value: Move positioning element to desired position and jumper pin 5 and pin 3 for 2 sec.
- Setting the final value: Move positioning element to desired position and jumper pin 5 and pin 1 for 2 sec.



### S-Series with Standard Resolution, Analog Output (U/I)

#### Part Number Key: S-Series

| A  | B   | C  |   | D    | E  |   | F      |   | G     |
|----|-----|----|---|------|----|---|--------|---|-------|
| LI | 100 | P0 | - | Q25L | M0 | - | LIU5X3 | - | H1151 |

| A  | Type             |
|----|------------------|
| LI | Linear Inductive |

| D    | Housing Style         |
|------|-----------------------|
| Q25L | Rectangle, 25 x 35 mm |

| B    | Measuring Span |
|------|----------------|
| 100  | 100 mm         |
| 200  | 200 mm         |
| 300  | 300 mm         |
| 400  | 400 mm         |
| 500  | 500 mm         |
| 600  | 600 mm         |
| 700  | 700 mm         |
| 800  | 800 mm         |
| 900  | 900 mm         |
| 1000 | 1000 mm        |

| E  | Mounting Bracket     |
|----|----------------------|
| M0 | No Mounting Brackets |
| M1 | M1-Q25L              |
| M2 | M2-Q25L              |
| M3 | M3-Q25L              |

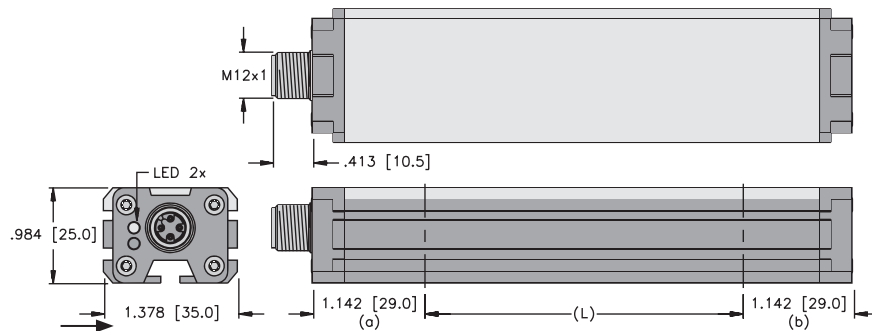
| F      | Operating Voltage and Output Type  |
|--------|------------------------------------|
| LIU5X3 | 15-30 VDC, 4-20 mA, 0-10 V, 3 LEDs |

| C  | Positioning Element                 |
|----|-------------------------------------|
| P0 | No Positioning Element              |
| P1 | P1-Li-Q25L (Captive)                |
| P2 | P2-Li-Q25L (Floating)*              |
| P3 | P3-Li-Q25L (Floating, Right Angle)* |

| G     | Type of Connection           |
|-------|------------------------------|
| H1151 | 5-pin M12 Eurofast Connector |

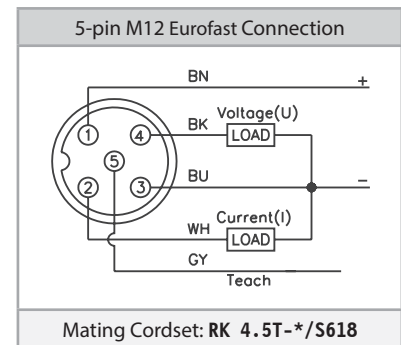
\*Operates at a distance of 0-4 mm from the sensor surface

#### Dimensions: S-Series



**Note:** Right angle cable direction

#### Wiring Diagram: S-Series



\* Length in meters.

#### Ordering Information

The Q-track linear position sensors are available in different lengths from 100 to 1,000 mm, in increments of 100 mm. The sensors, mounting accessories, and positioning elements are available individually or as a kit.

See page H1, Connectivity, for cables and connectors.

## HE-Series with Enhanced Resolution and SSI Interface



**Assembly part number:**

Li100P2-Q25LM1-HESG25X3-H1181

**Measuring Range Specifications**

|                     |   |
|---------------------|---|
| Measuring span (L): | 100, 200, 300, 400, 500, 600, 700, 800, 900, 1,000 mm |
| Blind zone (a):     | 29 mm   |
| Blind zone (b):     | 29 mm   |

**System**

|                      |                      |
|----------------------|----------------------|
| Resolution:          | 0.001 mm             |
| Repeatability:       | 10 µm (0.01 mm)      |
| Linearity deviation: | ≤ 0.1% of full scale |
| Temperature drift:   | ≤ ±0.0001 % / K      |
| Ambient temperature: | -25 to +70 °C        |

**Electrical Data**

|  |                               |
|--|-------------------------------|
| Operating voltage:                           | 15-30 VDC                     |
| Residual ripple:                             | ≤ 10% U <sub>pp</sub>         |
| No-load current:                             | ≤ 50 mA                       |
| Rated insulation voltage:                    | ≤ 0.5 kV                      |
| Short-circuit protection:                    | yes                           |
| Wire breakage / reverse polarity protection: | yes/yes (voltage supply)      |
| Output function:                             | 8-wire, SSI, 25 bit gray code |

|                    |                  |
|--------------------|------------------|
| Process data area: | bit 1.... bit 20 |
|--------------------|------------------|

|                  |  |
|------------------|--|
| Diagnostic bits: | bit 21: Positioning element left the measuring range and is outside the detectable area<br>bit 22: Positioning element is in the measuring range, lower signal quality (e.g., distance is too large)<br>bit 23: Positioning element is outside the measuring range |
|------------------|--|

|                      |          |
|----------------------|----------|
| Current consumption: | < 100 mA |
| Sample rate:         | 5 kHz    |

**Housing Style**

|  |   |
|--|---|
| Housing style:                         | rectangular, Q25L                               |
| Dimensions:                            | profile 35 x 25 mm, L = measuring range + 58 mm |
| Housing material:                      | aluminum  |
| Material active face:                  | plastic, PC-GF20                                |
| Connection:                            | connector, M12 x 1                              |
| Vibration resistance:                  | 55 Hz (1 mm)                                    |
| Shock resistance:                      | 30 g (11 ms)                                    |
| Protection class (IEC 60529/EN 60529): | IP67  |

**LEDs**

|                             |                                  |
|-----------------------------|----------------------------------|
| Power indication:           | green LED                        |
| Measuring range indication: | green/yellow multifunctional LED |

**Product Features**

- Enhanced resolution (up to 20 bit) depending on sensor length
- Enhanced sample rate of 5 kHz
- Excellent temperature stability and linearity through direct digital signal transmission
- SSI interface
- M12 Eurofast connector (8-pin)
- 29 mm blind zones
- Robust extruded aluminum housing
- Watertight (IP67) polycarbonate insert
- Multifunction LED

**Measuring Range Indicated via LED**

- **Green:** The positioning element is in the measuring range.
- **Green/yellow alternate flashing:** The positioning element is in the measuring range with a lower signal quality (e.g., the distance between sensor and element is too large).
- **Yellow flashing:** The positioning element is outside of the measuring range (max. range).
- **Off:** The positioning element is outside the programmed range but inside the total, non-programmed measuring length.

**High-Precision Digital SSI Output**

SSI (synchronous serial interface) is a 4-wire data communication standard commonly used in industry to transmit position data digitally. The conductors in the cable are shielded twisted pairs that enhance EMI/RFI protection. In addition to the clock and data wires, it also has separate power wiring.

**HE-Series with Enhanced Resolution and SSI Interface**

**Part Number Key: HE-Series / SSI**

|    |     |    |   |      |    |   |          |   |       |
|----|-----|----|---|------|----|---|----------|---|-------|
| A  | B   | C  |   | D    | E  |   | G        |   | H     |
| LI | 100 | P0 | - | Q25L | M0 | - | HESG25X3 | - | H1181 |

| A  | Type             |
|----|------------------|
| LI | Linear Inductive |

| D    | Housing Style           |
|------|-------------------------|
| Q25L | Rectangular, 25 x 35 mm |

| B    | Measuring Span |
|------|----------------|
| 100  | 100 mm         |
| 200  | 200 mm         |
| 300  | 300 mm         |
| 400  | 400 mm         |
| 500  | 500 mm         |
| 600  | 600 mm         |
| 700  | 700 mm         |
| 800  | 800 mm         |
| 900  | 900 mm         |
| 1000 | 1000 mm        |

| E  | Mounting Bracket     |
|----|----------------------|
| M0 | No Mounting Brackets |
| M1 | M1-Q25L              |
| M2 | M2-Q25L              |
| M3 | M3-Q25L              |

| G        | Operating Voltage and Output Type         |
|----------|---|
| HESG25X3 | 15-30 VDC, SSI, Gray Code, 25 bit, 3 LEDs |

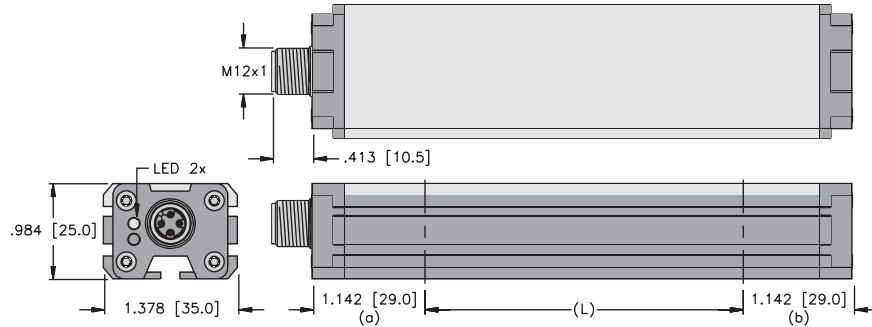
| C  | Positioning Element                 |
|----|-------------------------------------|
| P0 | No Positioning Element              |
| P1 | P1-Li-Q25L (Captive)                |
| P2 | P2-Li-Q25L (Floating)*              |
| P3 | P3-Li-Q25L (Floating, Right Angle)* |

\*Operates at a distance of 0-4 mm from the sensor surface

| H     | Type of Connection           |
|-------|------------------------------|
| H1181 | 8-pin M12 Eurofast Connector |

Linear Position Technology

**Dimensions: HE-Series / SSI**

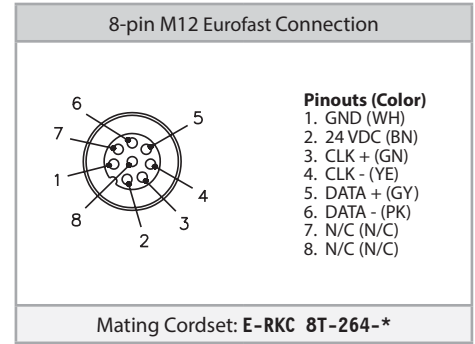


**Note:** Right angle cable direction

**Ordering Information**

The Q-track linear position sensors are available in different lengths from 100 to 1,000 mm, in increments of 100 mm. The sensors, mounting accessories, and positioning elements are available individually or as a kit.

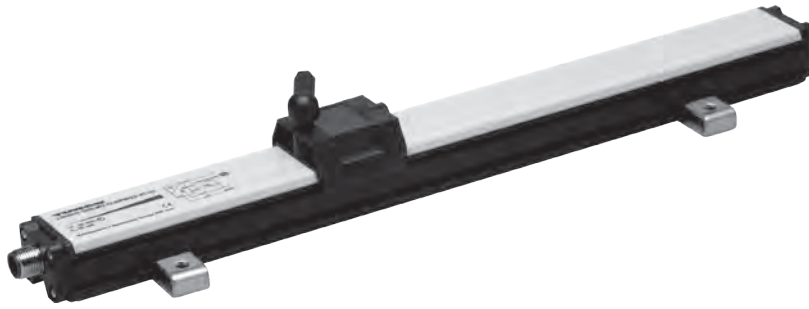
**Wiring Diagram: E-Series / SSI**



\* Length in meters.

See page H1, Connectivity, for cables and connectors.

**E-Series with Enhanced Resolution, IO-Link Compatible**



**Assembly part number:**  
Li300P1-Q25LM1-ELIUPN8X3-H1151

**Measuring Range Specifications**

|                     |   |
|---------------------|---|
| Measuring span (L): | 100, 200, 300, 400, 500, 600, 700, 800, 900, 1,000 mm |
| Blind zone (a):     | 29 mm   |
| Blind zone (b):     | 29 mm   |

**System**

|                      |  |
|----------------------|--|
| Resolution:          | 16 bit<br>(D/A converter and IO-Link) measuring range in mm / 65536) |
| Repeatability:       | 0.0015% (0.0015 mm per 100 mm)                                       |
| Linearity deviation: | ≤ 0.035% of full scale   |
| Temperature drift:   | ≤ ±0.003 % / K   |
| Ambient temperature: | -25 to +70 °C  |

**Electrical Data**

|  |   |
|--|---|
| Operating voltage:                           | 15-30 VDC   |
| Residual ripple:                             | ≤ 10% U <sub>pp</sub>   |
| No-load current:                             | ≤ 50 mA   |
| Rated insulation voltage:                    | ≤ 0.5 kV  |
| Short-circuit protection:                    | yes   |
| Wire breakage / reverse polarity protection: | yes/yes (voltage supply)  |
| Output function:                             | two programmable outputs (analog output current or voltage, switching outputs, PWM, ...) IO-Link compatible<br>Factory setting: 0-10 V on pin 2, PNP switching output on pin 4. Changes to settings via IO-Link only. |
| Load resistance of voltage output:           | ≥ 4.7 kΩ  |
| Load resistance of current output:           | ≤ 0.4 kΩ  |
| Current consumption:                         | < 100 mA  |
| Sample rate:                                 | 1000 Hz   |

**Housing Style**

|  |   |
|--|---|
| Housing style:                         | rectangular, Q25L                               |
| Dimensions:                            | profile 35 x 25 mm, L = measuring range + 58 mm |
| Housing material:                      | aluminum  |
| Material active face:                  | plastic, PC-GF20                                |
| Connection:                            | connector, M12 x 1                              |
| Vibration resistance:                  | 55 Hz (1 mm)                                    |
| Shock resistance:                      | 30 g (11 ms)                                    |
| Protection class (IEC 60529/EN 60529): | IP67  |

**LEDs**

|                             |                                  |
|-----------------------------|----------------------------------|
| Power indication:           | green LED                        |
| Measuring range indication: | green/yellow multifunctional LED |

**Product Features**

- Enhanced resolution of 16 bit
- Enhanced sample rate 1 kHz
- Improved linearity
- Two programmable outputs (analog output current or voltage, switching outputs, PWM) IO-Link compatible
- M12 Eurofast connector (5-pin)
- 29 mm blind zones
- Robust extruded aluminum housing
- Watertight (IP67) polycarbonate insert
- Multifunction LED

**Measuring Range Indicated via LED**

- **Green:** The positioning element is in the measuring range.
- **Green/yellow alternate flashing:** The positioning element is in the measuring range with a lower signal quality (e.g., the distance between sensor and element is too large).
- **Yellow flashing:** The positioning element is outside of the measuring range (max. range).
- **Off:** The positioning element is outside the programmed range but inside the total, non-programmed measuring length.

**Programming and IO-Link**

Output functions, measuring ranges and alarm outputs are set via a teach adapter or programming line (pin 5). Alternatively, the sensor can also be operated in IO-Link mode. For this purpose, connect the sensor to an IO-Link compatible module. The established connection is indicated by a green flashing LED. For more information, please see the corresponding instruction manual.

### E-Series with Enhanced Resolution, IO-Link Compatible

#### Part Number Key: E-Series / IO-Link

| A  | B   | C  |   | D    | E  |   | G         |   | H     |
|----|-----|----|---|------|----|---|-----------|---|-------|
| LI | 100 | P0 | - | Q25L | M0 | - | ELIUPN8X3 | - | H1151 |

| A  | Type             |
|----|------------------|
| LI | Linear Inductive |

| D    | Housing Style           |
|------|-------------------------|
| Q25L | Rectangular, 25 x 35 mm |

| B    | Measuring Span |
|------|----------------|
| 100  | 100 mm         |
| 200  | 200 mm         |
| 300  | 300 mm         |
| 400  | 400 mm         |
| 500  | 500 mm         |
| 600  | 600 mm         |
| 700  | 700 mm         |
| 800  | 800 mm         |
| 900  | 900 mm         |
| 1000 | 1000 mm        |

| E  | Mounting Bracket     |
|----|----------------------|
| M0 | No Mounting Brackets |
| M1 | M1-Q25L              |
| M2 | M2-Q25L              |
| M3 | M3-Q25L              |

| G         | Operating Voltage and Output Type       |
|-----------|---|
| ELIUPN8X3 | 15-30 VDC, IO-Link Configurable, 3 LEDs |

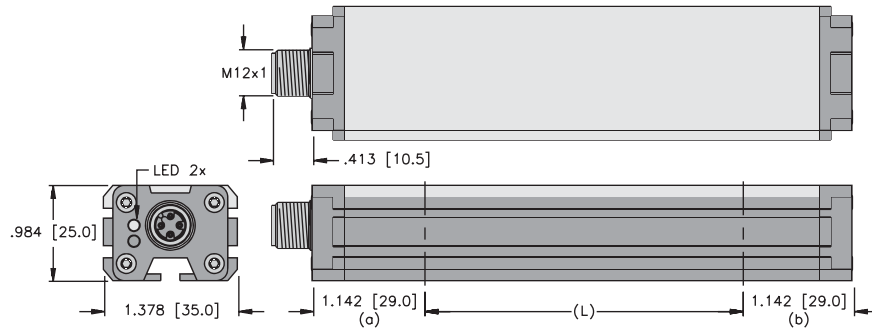
| C  | Positioning Element                 |
|----|-------------------------------------|
| P0 | No Positioning Element              |
| P1 | P1-Li-Q25L (Captive)                |
| P2 | P2-Li-Q25L (Floating)*              |
| P3 | P3-Li-Q25L (Floating, Right Angle)* |

\*Operates at a distance of 0-4 mm from the sensor surface

| H     | Type of Connection           |
|-------|------------------------------|
| H1151 | 5-pin M12 Eurofast Connector |

Linear Position Technology

#### Dimensions: E-Series / IO-Link



**Note:** Right angle cable direction

#### Ordering Information

The Q-track linear position sensors are available in different lengths from 100 to 1,000 mm, in increments of 100 mm. The sensors, mounting accessories, and positioning elements are available individually or as a kit.

#### Sample Networked Communication: IO-Link Master

The following components can be used to connect a linear position sensor through IO-Link to any Turck supported network protocol:

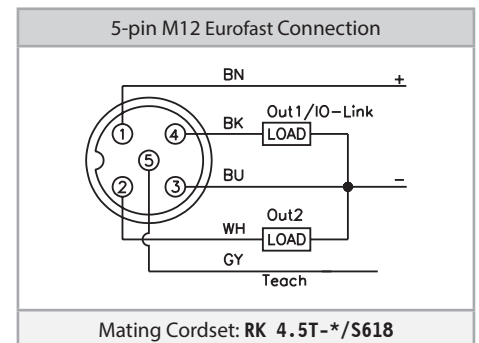
|                      | BL20        | BL67              | TBEN              | BLC               |
|----------------------|-------------|-------------------|-------------------|-------------------|
| 1 x IO-Link Master   | BL20-E-4IOL | BL67-4IOL         | TBEN-*.IOL        | BLCEN-*.4IOL-*    |
| 1 x BL67 Base        | N/A         | BL67-B-4M12       | N/A               | N/A               |
| 1 x Connection Cable | RK 4.4T-*   | RK 4.4T-*.RS 4.4T | RK 4.4T-*.RS 4.4T | RK 4.4T-*.RS 4.4T |

#### Sample Configuration: IO-Link Master

The following components can be used for parameterization of a linear sensor through IO-Link:

|                      |                   |
|----------------------|-------------------|
| 1 x IO-Link Master   | USB-2-IOL-0002    |
| 1 x Connection Cable | RK 4.5T-*.RS 4.5T |

#### Wiring Diagram: E-Series / IO-Link

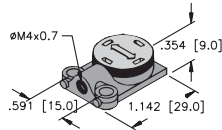


\* Length in meters.

See page H1, Connectivity, for cables and connectors.

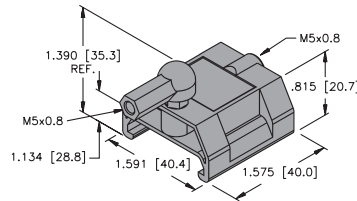


**Q-track Accessories – Position Elements**



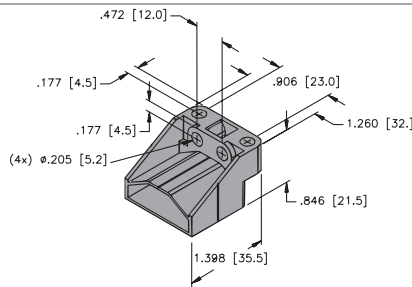
**P1-Li-QR14/Q17L**

Floating positioning element for miniature and compact series QR14 and Q17L. Operates at a distance of 0-4 mm to the sensor surface.



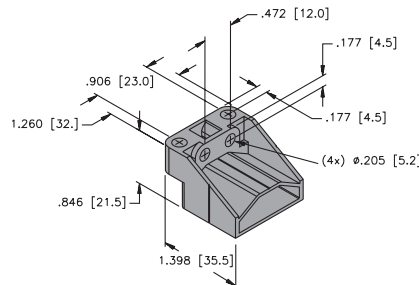
**P1-Li-Q25L**

Captive positioning element; laterally inserted in sensor groove; incl. rod-end bearing to mount M5 threaded rods.



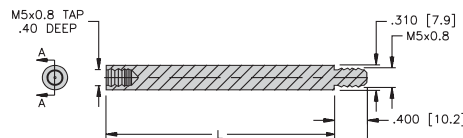
**P2-Li-Q25L**

Floating positioning element, operates at a distance of 0-4 mm to the sensor surface.



**P3-Li-Q25L**

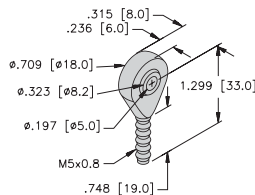
Floating positioning element; right angle orientation; operates at a distance of 0-4 mm to the sensor surface.



**CA\*E-Q21**

Control arm; Can be used with P1-Li-Q25L and RE-Q21 to connect the positioning element to an actuator.

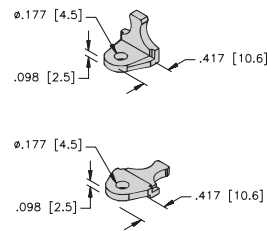
\* Length specified in inches. 3, 6 and 9 inches are standard lengths. Other lengths available, consult factory for part numbers and availability.



**RE-Q21**

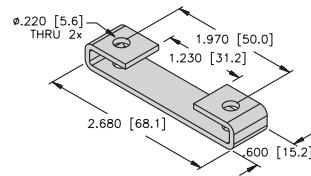
Rod End; Can be used with P1-Li-Q25L and CA\*E-Q21 to connect the positioning element to an actuator.

**Q-track Accessories – Mounting Accessories**



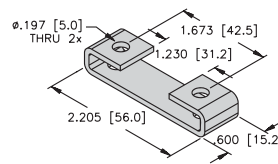
**M1.1-Q17L (right angle) (3 pcs per bag)**  
**M1.2-Q17L (straight) (3 pcs per bag)**

Mounting feet for inductive linear position sensor Q17L. Each sensor is delivered with a sufficient quantity of M1.1-Q17L and M1.2-Q17L for mounting.



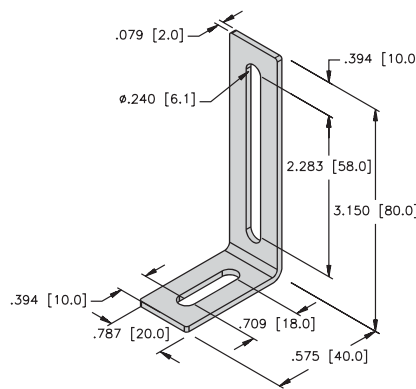
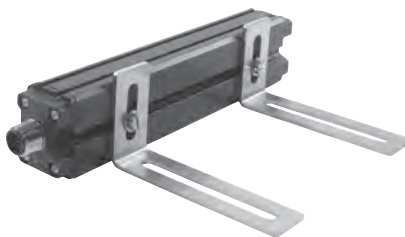
**M1-Q25L**

Mounting foot for Q-track linear position sensors; Two mounting feet should be used for devices with a measuring range of up to 1,000 mm; Material: stainless steel; 2 pcs. per bag.



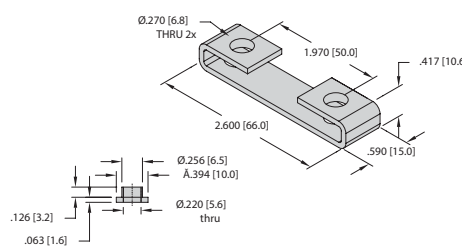
**M2-Q25L**

Mounting foot for Q-track linear position sensors; Two mounting feet should be used for devices with a measuring range of up to 1,000 mm; Material: stainless steel; 2 pcs. per bag.



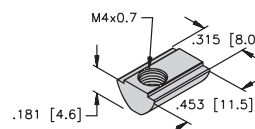
**M4-Q25L**

Mounting bracket for Q-track linear position sensors; Two mounting feet should be used for devices with a measuring range of up to 1,000 mm; Material: stainless steel; 2 pcs. per bag.



**M5-Q25L**

Mounting foot for Q-track linear position sensors; Two mounting feet should be used for devices with a measuring range of up to 1,000 mm; Includes isolation sleeves; Material: anodized aluminum, nylon; 2 sets per bag.

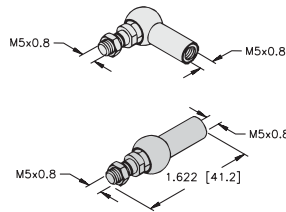


**MN-M4-Q25**

Sliding blocks with M4 thread for back side groove of Q-track linear position sensors; Material: Brass; 10 pcs. per bag.

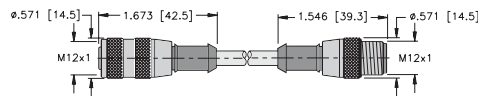
Only available separately, not as a kit with linear position sensors.

**Q-track Accessories**



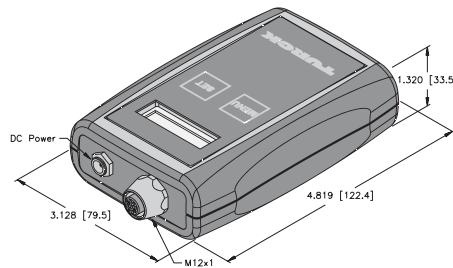
**RBVA-M5**  
Angle joint for M5 thread, stainless steel

**ABVA-M5**  
Axial joint for M5 thread, stainless steel

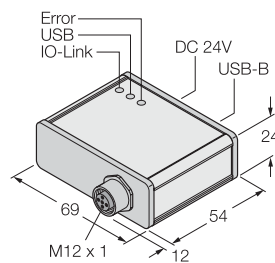
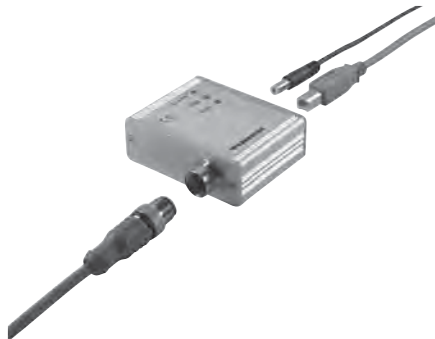


**RK 4.5T-\* -RS 4.4T/S3107 Cable**  
To convert existing wiring from EZ-track installation with current output to Q-track current output.

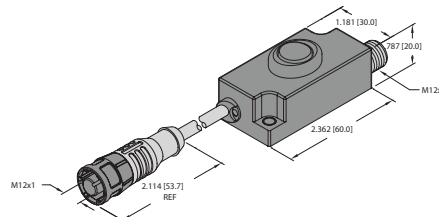
**RK 4.5T-\* -RS 4.4T/S3108 Cable**  
To convert existing wiring from EZ-track installation with voltage output to Q-track voltage output.



**TB4 V.2**  
Analog test box for sensors with analog or switching outputs, incl. batteries.



**USB-2-IOL-0002**  
IO-Link master with integrated USB interface for parameterization of IO-Link compliant linear position sensors via PC.



**TX1-Q20L60**  
Teach adapter to program measuring range of inductive position sensors.



### Analog Profile Series



EZ-track LDT's profile style probes use magnetostrictive technology by applying a mechanical strain pulse to a magnetostrictive waveguide that runs the length of the sensor. When the strain pulse encounters a magnetic field produced by the slide or floating magnet assembly, a current pulse is produced that is picked up by the electronic circuitry. A high

speed timer measures the time difference between the applied strain pulse and the return of the induced current pulse. This time, proportional to position is compared to the "zero" and "span" positions established during the calibration process to scale the output. Once the position has been scaled accordingly, it is converted to a signal in the form of an analog (voltage or current) output, quadrature pulse output, or digital (PWM or start/stop) outputs.

#### Enhanced Resolution Analog Profile Series (Q21R/Q35R) Specifications:

|                        |  |   |   |
|------------------------|--|---|---|
| Output:                | <u>Current:</u><br>20 to 4 mA<br>4 to 20 mA  | <u>Voltage:</u><br>0 to 10 V<br>10 to 0 V | <u>Differential:</u><br>0 to 10 V<br>4 to 20 mA |
| Load impedance:        | $\leq (\text{voltage in } -4) \div 0.02 \text{ A}$<br>(example: 10 VDC $\leq$ 300 $\Omega$ )   |   | $\geq 1000 \Omega$                              |
| Q21R span:             | 40 to 180 in   |   |   |
| Q35R span:             | 5 to 36 in   |   |   |
| Repeatability:         | +/-0.006% of full span or +/-0.002 in, whichever is greater  |   |   |
| Resolution:            | 0.001 in internal (For span lengths < 65 in); 16 bit (For lengths > 65 in)   |   |   |
| Non-linearity:         | +/-0.05% of stroke   |   |   |
| Operating temperature: | -4 to +158 °F (-20 to +70 °C)  |   |   |
| Null zone:             | 3.00 in  |   |   |
| Dead zone:             | 2.00 in  |   |   |
| Operating voltage:     | 13.5-30 VDC  |   |   |
| Current consumption:   | 120 mA at 15 VDC, 2.5 watts maximum  |   |   |
| Response time:         | $\leq 50$ in   | 1 ms                                      |   |
|                        | 51 to 100 in   | 2 ms                                      |   |
|                        | 101 to 150 in  | 3 ms                                      |   |
|                        | 151 to 180 in  | 4 ms                                      |   |
| LED:                   | Green = Power is applied and magnet is present in the programmed range<br>Red = Fault, magnet is in the Null Zone, Dead Zone or lost<br>Yellow = Magnet is out of the active programmed range, but still within the active stroke area |   |   |
| Protection rating:     | Electronics: IP67, IP68 optional<br>Rod housing: IP65  |   |   |
| Agency approval:       | CE   |   |   |

#### Standard Resolution Analog Profile Series (Q21/Q35) Specifications:

|                        |  |   |
|------------------------|--|---|
| Output:                | <u>Current:</u><br>20 to 4 mA<br>4 to 20 mA  | <u>Voltage:</u><br>+5 to -5 V<br>0 to +10 V<br>-5 to +5 V<br>+10 to 0 V<br>0 to +5 V<br>-10 to +10 V<br>+5 to 0 V<br>+10 to -10 V |
| Load impedance:        | $\leq (\text{voltage in } -4) \div 0.02 \text{ A}$<br>(example: 10 VDC $\leq$ 300 $\Omega$ )   |   |
| Q21 span:              | 40 to 180 in   |   |
| Q35 span:              | 5 to 36 in   |   |
| Repeatability:         | +/-0.01% of full span or +/-0.014 in, whichever is greater   |   |
| Resolution:            | 0.014 in for stroke lengths less than 60 in; For lengths over 60 in: 12 bits   |   |
| Non-linearity:         | +/-0.05% of stroke or +/-0.028 whichever is greater  |   |
| Accuracy:              | +/-0.1% of stroke or +/-0.050 whichever is greater   |   |
| Operating temperature: | -40 to +158 °F (-40 to +70 °C)   |   |
| Null zone:             | 3.00 in  |   |
| Dead zone:             | 1.50 in  |   |
| Operating voltage:     | 10-30 VDC  |   |
| Current consumption:   | 100 mA (maximum)   |   |
| Response time:         | 50 in or less: 1 ms updates with 5 ms settling time<br>50 in or greater: 2 ms updates with 4 ms settling time  |   |
| LED:                   | Green = power is applied and magnet is present in the programmed range<br>Red = fault, magnet is in the null zone, dead zone or lost<br>Yellow = magnet is out of the active programmed range, but still within the active stroke area |   |
| Protection rating:     | Electronics: IP67, IP68 optional<br>Rod housing: IP65  |   |
| Agency approval:       | CE, FM Class I, Div 2  |   |

#### Low Profile Extrusion Housing:

The Q21 series is housed in low profile, environmentally sealed, anodized aluminum housings. The electronics and the sensing element are incorporated into a housing that is less than 1 inch tall without the need for a can or head on the sensor to house the electronics

#### Diagnostic LED:

The EZ-track Series utilizes a diagnostic LED that enables the operator to understand the state of the sensor dependent upon the position of the target magnet.

The LED flashes to indicate it is in AGC mode (Q21 and Q35 series). This feature simplifies programming and troubleshooting, effectively reducing setup and maintenance time.

#### Various Analog Outputs

##### Available Profile Style:

The Q21 and Q35 series may be ordered in a variety of outputs.

Although sensors may be ordered with any of the above outputs, the units may easily be changed in the field to reverse the analog signal. Thus, one model can be used for two applications by programming the "zero" and "span" appropriately.

#### Automatic Gain Control:

The Automatic Gain Control (AGC) feature allows the EZ-track to sense a magnet other than the standard slide magnet and adjust to the magnetic field strength accordingly. With the ability to sense a standard floating magnet up to 3/8 inch away, the user has greater mounting flexibility for various applications.

#### FM Approved Installation

##### (Class I, Division 2):

The EZ-track Q21 unit can be ordered for use in a Class I, Division 2 environment. The unit utilizes a Lock-Euro-G.

### Analog Profile Series

#### Part Number Key: Analog Profile Series

|    |    |   |   |     |   |   |    |   |    |   |       |   |       |
|----|----|---|---|-----|---|---|----|---|----|---|-------|---|-------|
| A  | B  | C |   | D   | E |   | F  | G | H  |   | I     |   | J     |
| LT | 40 | E | - | Q21 | R | - | LI | 0 | X3 | - | H1151 | / | S1661 |

| A  | Type              |
|----|-------------------|
| LT | Linear Transducer |

| B | Measuring Span           |
|---|--------------------------|
| * | Length of Measuring Span |

| C | Housing |
|---|---------|
| E | Inches  |

| D   | Housing Height |
|-----|----------------|
| Q21 | 21 mm          |
| Q35 | 35 mm          |

| E       | Resolution          |
|---------|---------------------|
| (Blank) | Standard Resolution |
| R       | Enhanced Resolution |

| F  | Output Configuration       |
|----|----------------------------|
| LI | Current                    |
| LU | Voltage                    |
| LD | Differential <sup>1)</sup> |

<sup>1)</sup> Analog differential output is the difference between two magnets. Minimum distance = 2.5 inches

| G | Output Type |                           |                         |
|---|-------------|---------------------------|-------------------------|
|   | Current     | Voltage                   | Differential            |
| 0 | 4-20 mA     | 0 to 10 V                 | 0 to 10 V <sup>3)</sup> |
| 1 | 20-4 mA     | 10 to 0 V                 | 4 - 20 mA <sup>3)</sup> |
| 2 |             | -10 to 10 V <sup>2)</sup> |                         |
| 3 |             | 10 to -10 V <sup>2)</sup> |                         |
| 4 |             | 0 to 5 V <sup>2)</sup>    |                         |
| 5 |             | 5 to 0 V <sup>2)</sup>    |                         |
| 6 |             | -5 to 5 V <sup>2)</sup>   |                         |
| 7 |             | 5 to -5 V <sup>2)</sup>   |                         |

<sup>2)</sup> Only available with 'Q21'/'Q35'

<sup>3)</sup> Only available with 'Q21R'/'Q35R'

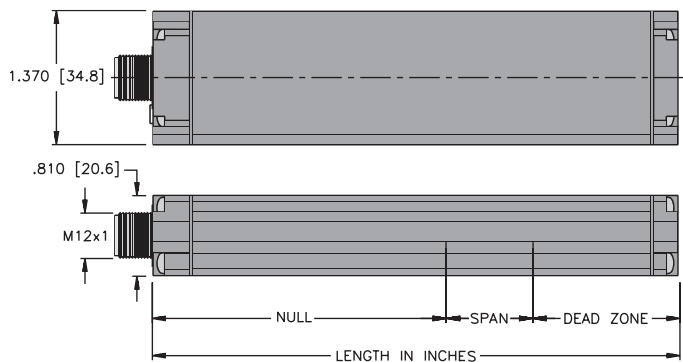
| H  | Number of LEDs    |
|----|-------------------|
| X3 | 3 Diagnostic LEDs |

| I     | Type of Connection                         |
|-------|--|
| H1141 | 4-pin M12 Eurofast Connector <sup>2)</sup> |
| H1151 | 5-pin M12 Eurofast Connector <sup>3)</sup> |

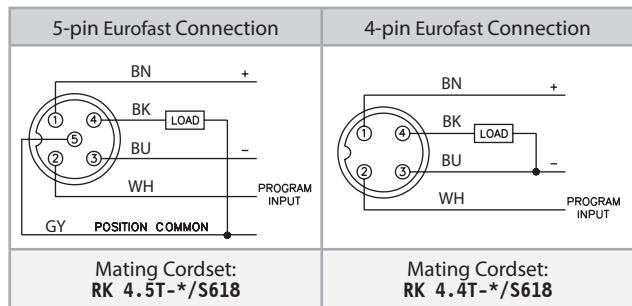
| J       | Specials |
|---------|----------|
| (Blank) | IP67     |
| S1661   | IP68     |

**Note:** In addition to the LDT, a typical system includes a magnet, mounting feet and cable (all sold separately).

#### Dimensions: Q21 Analog Profile Series

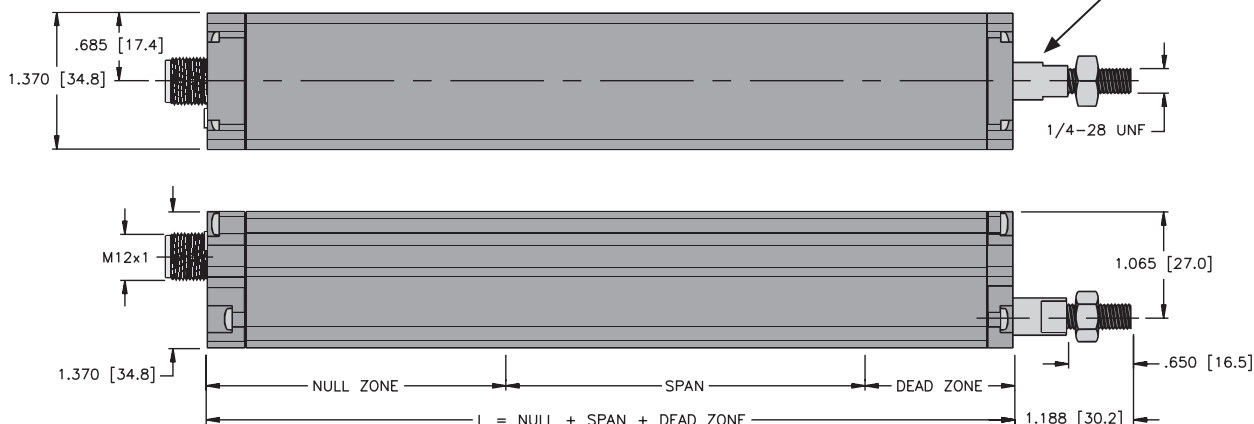


#### Wiring Diagrams: Q21R/Q35R



\* Length in meters.

#### Dimensions: Q35 Analog Profile Series



**Note:** Self contained piston with magnet permanently attached

**Quadrature Profile Series**



**Direct Quadrature Output:**

Directly interface to the PLC input card and reduce installation time, vendors and cost. The Q21-DQ provides A and B channel quadrature output signals that are proportional to the position of the magnet assembly along the length of the probe, and output directly from the transducer to the controller. The quadrature output makes it possible to directly interface to virtually any incremental encoder input or counter card, eliminating costly absolute encoder converters and special PLC interface modules.

An index channel (Z) is also provided and its position may be set by the user at any position along the active system. The A, B and Z channels are differential outputs: the connection for each output consists of two signal wires. These are typically described as the “+” and “-” signals. Differential signals are much less prone to interference caused by electrical noise or ground loops often found in single ended connections.

**Quadrature Profile Series (Q21-DQ/Q35-DQ) Specifications:**

|                        |  |                                  |
|------------------------|--|----------------------------------|
| Output:                | Quadrature, A, $\bar{A}$ , B, $\bar{B}$ , Z, $\bar{Z}$   |                                  |
| Span:                  | 5 to 180 in (Q35 maximum span is 36 in)  |                                  |
| Repeatability:         | +/-0.006% of full span   |                                  |
| Resolution:            | 0.001 in internal (1000 pulses per in)   |                                  |
| Operating temperature: | -4 to +158 °F (-20 to +70 °C)  |                                  |
| Null zone:             | 3.00 in  |                                  |
| Dead zone:             | 2.00 in  |                                  |
| Operating voltage:     | 13.5-30 VDC  |                                  |
| Current consumption:   | 3 watts maximum (1 watt typical)   |                                  |
| Response time:         | ≤ 40 in  | 1 ms                             |
|                        | ≤ 41 to 100 in   | 2 ms                             |
|                        | 101 to 150 in  | 3 ms                             |
|                        | 151 to 180 in  | 4 ms                             |
| Inputs:                | Option N   | NPN (used with sourcing outputs) |
|                        | Option P   | PNP (used with sinking outputs)  |
|                        | Option T   | TTL                              |
|                        | Option R   | 5 V differential                 |
|                        | Option L   | 10 to 30 VDC, Volt = Vin-1 Volt  |
| Output frequency:      | 10 kHz - 1 MHz   |                                  |
| Nonlinearity:          | +/-0.05% of full span  |                                  |
| LED:                   | Green = Power is applied and magnet is present in the programmed range<br>Red = Fault, magnet is in the Null Zone, Dead Zone or lost |                                  |
| Protection rating:     | Electronics: IP67, IP68 optional<br>Rod housing: IP65  |                                  |
| Agency approval:       | CE   |                                  |

**Incremental Output, Absolute Functionality:**

The Q21-DQ allows you to use an incremental output, while taking advantage of an absolute sensing technology. The Burst Input on the transducer triggers a data transfer of all incremental position data relative to the transducer’s zero position. This can be used to achieve absolute position updates when power is restored to the system or anytime an update is needed to re-zero or home the machine.

**Programmable Zero Point:**

The zero input allows you to set the probes reference position at any point along the active span. The probe will output an increasing or decreasing signal based on the direction the magnet is moving in relation to the established zero point. See Quadrature Part Number Key to select storage mode.

**Volatile Storage:**

The zero point will be kept until a new zero pulse is sent or until the probe loses power.

The zero point can be programmed an infinite number of times.

**Non-Volatile Storage:**

The probe will store the zero position even in the event of a power failure. The zero point can be set 100,000 times.

**Transducer Inputs:**

The burst and zero inputs are single ended connections: the connection for each input consists of only one wire. The Q21-DQ is available with either +24 VDC level signal or TTL level thresholds. Additionally, the 24 VDC may be specified as either sinking or sourcing relative to the probe’s input.

**Quadrature Output Resolution and Speed:**

The internal resolution of the Q21-DQ transducer is 0.001 inches. This would be represented to the encoder input device by specifying an output resolution of 1,000 cycles per inch (CPI).

**Replace Incremental Output Devices:**

The Q21-DQ may be used in certain applications to replace incremental rotary and linear encoders. The quadrature output may be used in applications requiring 0.001 inch resolution and repeatability.

**Velocity Feedback:**

The EZ-track quadrature produces pulses that are sent to the controller in packets at a fixed frequency. The period of the pulses does not change with magnet velocity. Therefore, velocity cannot be determined from the pulse packets unless the controller can interpolate velocity from position over time. If your application requires a velocity feedback, please consider the Linear Encoder on pages B32-B37 or consult factory.

**Frequency or Pulse Rate:**

For a typical incremental encoder output, the resolution of the encoder and the speed of travel govern the frequency and pulse width of the output pulses. The output pulse rate from the EZ-track transducer is fixed and controlled internally. This output frequency is user specified (10 kHz to 1 MHz) so that it does not exceed the maximum input rate of the counter card. If the controller’s maximum input frequency falls between two available frequencies, choose the lower frequency.

**Output Drivers:**

The Q21-DQ uses an OL7272 line driver and may be configured for either a TTL level output or a 10-30 VDC level output. Option R has a 5 VDC TTL level output regardless of input power. Option L has an output of 1 volt less than the probe’s input voltage and should be used when driving input cards that are not TTL compatible.

### Quadrature Profile Series

#### Part Number Key: Quadrature Profile Series

| A  | B  | C |   | D   |   | E  | F | G | H | I | J  |   | K      |
|----|----|---|---|-----|---|----|---|---|---|---|----|---|--------|
| LT | 40 | E | - | Q21 | - | DQ | R | A | N | N | X2 | - | H11121 |

| A  | Type              |
|----|-------------------|
| LT | Linear Transducer |

| B | Measuring Span           |
|---|--------------------------|
| * | Length of Measuring Span |

| C | Units of Measurement |
|---|----------------------|
| E | Inches               |

| D   | Housing Height |
|-----|----------------|
| Q21 | 21 mm          |
| Q35 | 35 mm          |

| E  | Resolution |
|----|------------|
| DQ | Quadrature |

| F | Output Configuration                              |
|---|---|
| L | 10-30 VDC, Line Driver                            |
| R | 13.5 - 30 VDC, RS422 Line Driver (TTL Compatible) |

| G | Quadrature Cycle Frequency |   |          |
|---|----------------------------|---|----------|
| A | 10 kHz                     | F | 150 kHz  |
| B | 25 kHz                     | G | 250 kHz  |
| C | 50 kHz                     | H | 500 kHz  |
| D | 75 kHz                     | I | 1000 kHz |
| E | 100 kHz                    |   |          |

| H | Zero Offset Storage                      |
|---|--|
| N | Nonvolatile (100,000 storage cycles max) |
| V | Volatile                                 |

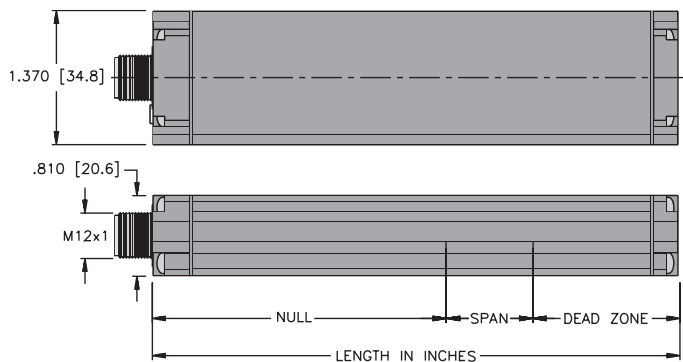
| I | Input Type                                     |
|---|--|
| N | Sinking (Typically used with Sourcing Outputs) |
| P | Sourcing (Typically used with Sinking Outputs) |
| T | TTL Level                                      |

| J  | Number of LED's   |
|----|-------------------|
| X2 | 2 Diagnostic LEDs |

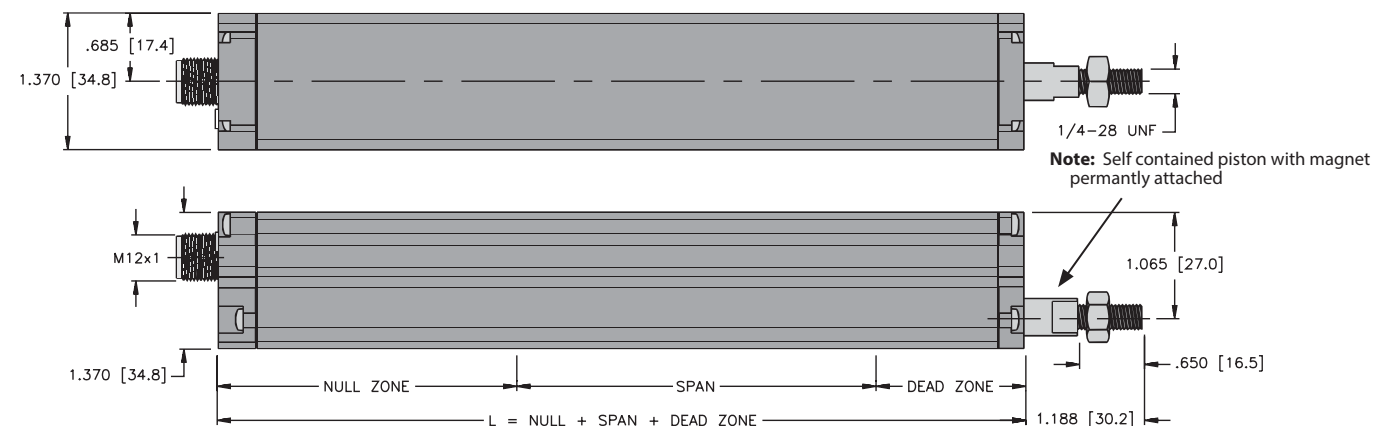
| K      | Type of Connection            |
|--------|-------------------------------|
| H11121 | 12-pin M12 Eurofast Connector |

**Note:** In addition to the LDT, a typical system includes a magnet, mounting feet and cable (all sold separately).

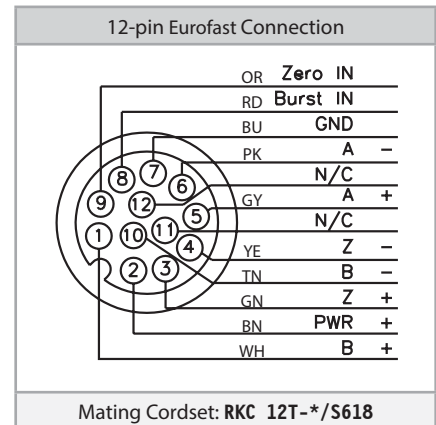
#### Dimensions: Q21-DQ Quadrature Profile Series



#### Dimensions: Q35-DQ Quadrature Profile Series



#### Wiring Diagram: Q21-DQ/ Q35-DQ



\* Length in meters.

**Digital Profile Series**



The Q21D is a non-contact LDT with a digital output. This transducer utilizes magnetostrictive technology to give absolute position that is repeatable to .006% of the active sensing distance. It also has the same auto-tuning capability that the other profile series transducers offer, so that it can adjust its signal strength to various magnets.

There is a diagnostic LED that is located at the connector end of the probe and provides visual status information regarding the operation of the Q21D. The indications are specified in the table below. The Q21D digital transducer provides either a Start/Stop or a Variable Pulse signal interface that is proportional to the position of the slide magnet assembly along the length of the probe.

**Digital Profile Series (Q21D/Q35D) Specifications:**

|                          |   |
|--------------------------|---|
| Output:                  | Start/Stop Pulse: External interrogation; Variable Pulse: Internal or External interrogation  |
| Number of recirculation: | Variable Pulse: 001 (standard) to 127   |
| Span:                    | 5 to 180 in (Q35 maximum span is 36 in)   |
| Repeatability:           | +/-0.006% of full span  |
| Hysteresis:              | +/-0.02% of full span   |
| Operating temperature:   | -4 to +158 °F (-20 to +70 °C)   |
| Null Zone:               | 3.00 in   |
| Dead Zone:               | 2.00 in   |
| Operating voltage:       | 13.5-30 VDC   |
| Current consumption:     | 120 mA at 15 VDC, 2.5 watts maximum   |
| Shock:                   | Tested to 40 g  |
| Vibration:               | MIL-STD810E, 10G rms random, 20 Hz - 2 kHz  |
| LED:                     | Green = power is applied and magnet is present<br>Red = fault, magnet is in the null zone, dead zone or lost<br>Yellow = no interrogation signal detected |
| Protection rating:       | Electronics: IP67, IP68 optional<br>Rod housing: IP65   |
| Agency approval:         | CE  |

**Start/Stop (RS):**

The Start/Stop signal interface of the Q21D digital output series is a differential RS-422 output. To initiate a start pulse, an external device must be used, and should be a minimum of 1 ms in duration. A stop pulse of 1 ms in duration will follow. The time delay from the leading edge of the start pulse to the leading edge of the stop pulse is proportional to the distance from the Null Zone to the Magnet.

**Variable Pulse (VP):**

The Variable Pulse signal interface digital output is a pulse width modulated signal (RS-422). The Q21D LDT can be ordered with either an external (VPE) or internal (VPI) interrogation.

External interrogation occurs when an external device connected to the Q21D-VPE generates a start pulse. This start pulse should be a minimum of 1 ms in duration. Within 50 nanoseconds after the leading edge of the start pulse has been received, the LDT will generate an output pulse. The duration of the output pulse is proportional to the distance from the Null Zone to the Magnet.

The Q21D-VPI generates an internal interrogation, and will continually output pulse width modulated signals. The duration of this output pulse is also proportional to the distance from the Null Zone to the Magnet.

### Digital Profile Series

#### Part Number Key: Digital Profile Series

| A  | B  | C | D | E    | F | G   | H | I   |   |    |   |       |   |       |
|----|----|---|---|------|---|-----|---|-----|---|----|---|-------|---|-------|
| LT | 40 | E | - | Q21D | - | VPI | - | 001 | - | X3 | - | H1161 | / | S1661 |

| A  | Type              |
|----|-------------------|
| LT | Linear Transducer |

| B | Measuring Span           |
|---|--------------------------|
| * | Length of Measuring Span |

| C | Units of Measurement |
|---|----------------------|
| E | Inches               |

| D    | Housing Height |
|------|----------------|
| Q21D | 21 mm          |
| Q35D | 35 mm          |

| E   | Output Mode                            |
|-----|--|
| CP  | RS422, Control Pulse                   |
| RS  | RS422, Start/Stop Pulse                |
| VPE | Variable Pulse External Interrogations |
| VPI | Variable Pulse Internal Interrogations |

| F   | Number of Recirculations <sup>1)</sup> |
|---|--|
| *   | 001 (Standard) to 127                  |
| <sup>1)</sup> Only Available with Output Mode 'VPI' or 'VPE'. Otherwise (Blank) |  |

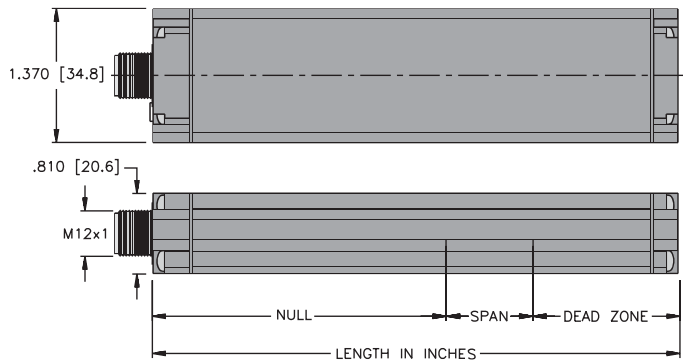
| G  | Number of LEDs     |
|----|--------------------|
| X3 | 3 Diagnostic LED's |

| H     | Type of Connection           |
|-------|------------------------------|
| H1161 | 6-pin M12 Eurofast Connector |

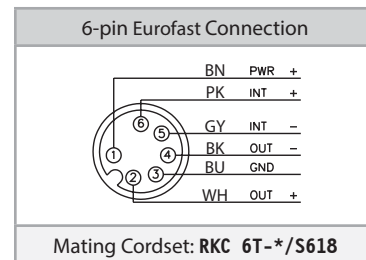
| I       | Specials |
|---------|----------|
| (Blank) | IP67     |
| S1661   | IP68     |

**Note:** In addition to the LDT, a typical system includes a magnet, mounting feet and cable (all sold separately).

#### Dimensions: Q21D Digital Profile Series

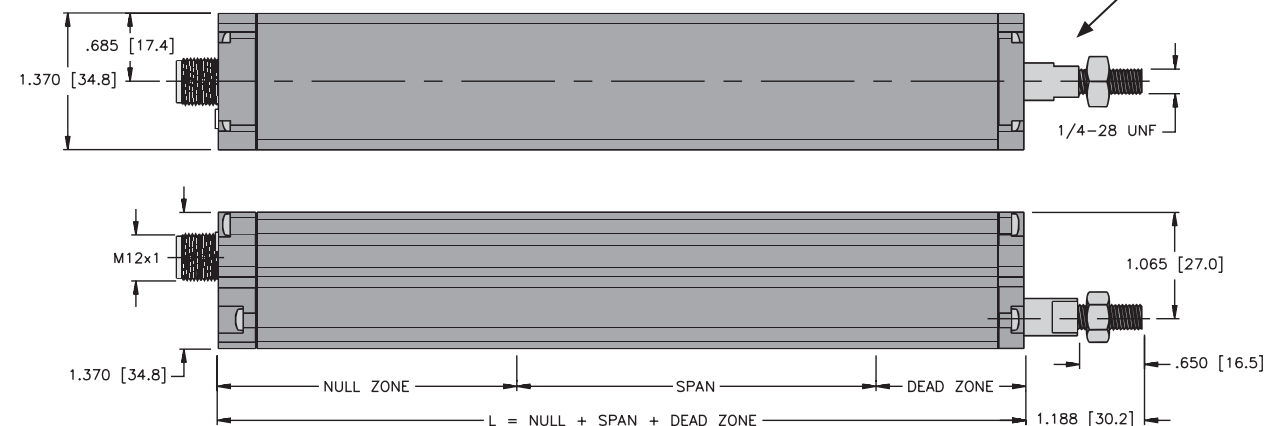


#### Wiring Diagram: Q21D/Q35D



\* Length in meters.

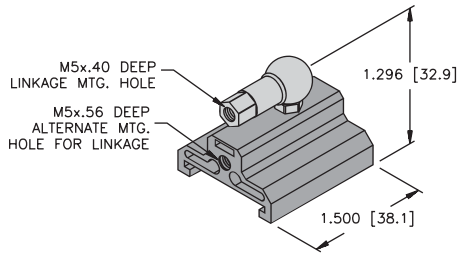
#### Dimensions: Q35D Digital Profile Series



### Profile Series Accessories

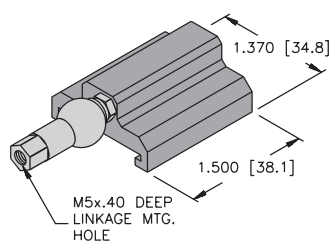
#### Slide Magnet

SM-Q21



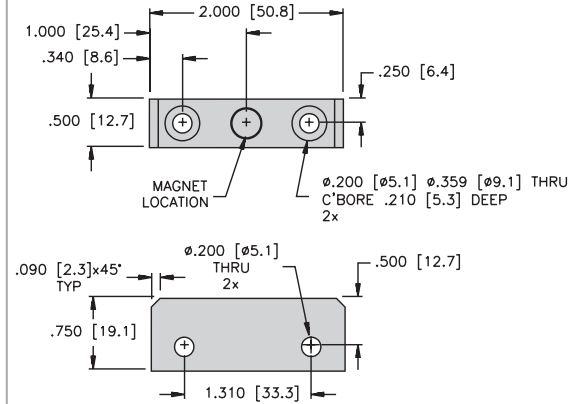
#### Slide Magnet with Side Adapter

SA-Q21



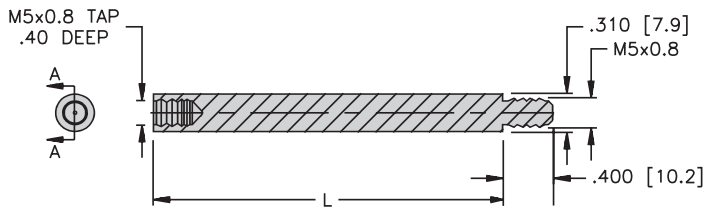
#### Floating Magnet

FM-Q21



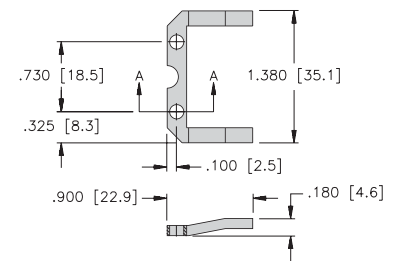
#### Control Arms

CA\*E-Q21



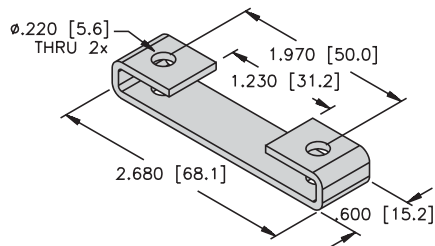
#### Q21 Upside Down Brackets

UB-Q21 (2/bag)



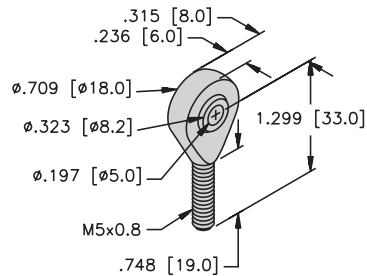
#### Q21 Mounting Brackets

MB-Q21



#### Rod Ends

RE-Q21



#### RBVA-M5

Angle Joint for M5 Thread, Stainless Steel



#### ABVA-M5

Angle Joint for M5 Thread, Stainless Steel

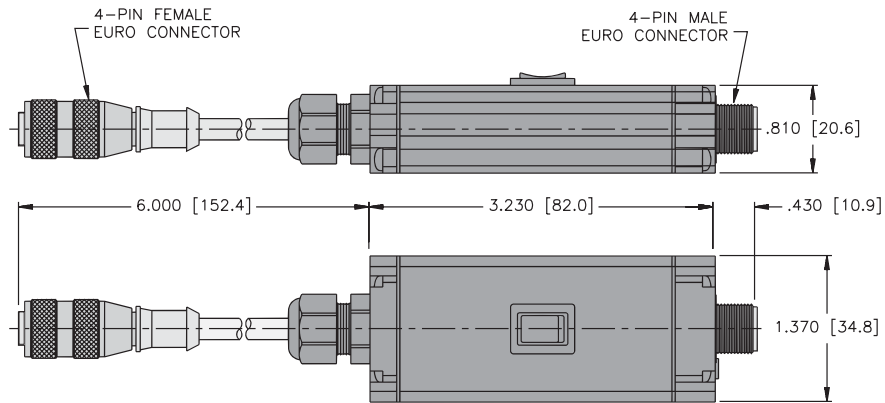


\* Length in inches.

**Profile Series Accessories**

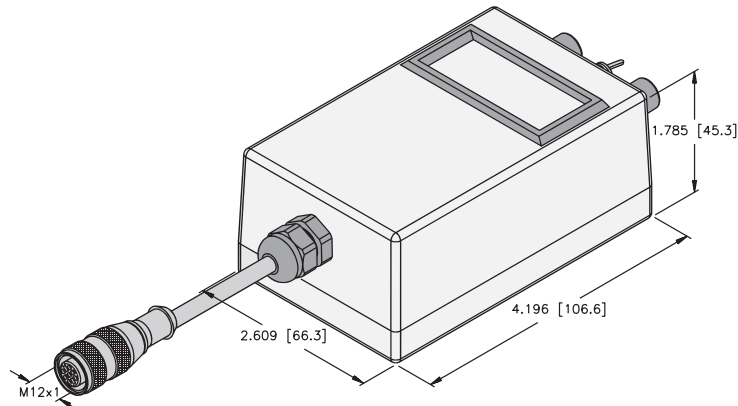
**Rocker Programmer**

**RP-Q21**



**Test and Programming Device**

**TB2-LDT (voltage)**  
**TB2-LDT-LI (current)**

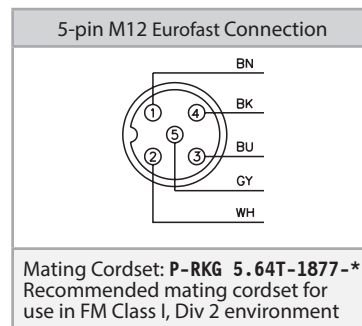


**Lock-Euro-G**

Required for use with a Q21 to maintain FM approval in a Class I, Div 2 environment



**Wiring Diagram**





**Rod Style Series**



**Rugged Rod Style Housings:**

Transducers designed to survive in harsh industrial environments to reduce downtime on the plant floor.

The R10 housing, sensing rod and components are designed and constructed to withstand heavy duty applications, such as those found in lumber mills, steel mills and stamping plants. They have been lab tested and field proven to withstand 2000 g of shock and 30 g of random vibration without false signals or mechanical damage.

In addition, the **R10's** electronics are enclosed in

an aluminum housing with O-ring seals for an IP67 environmental rating.

Although R10 sensors can be ordered with any of the outputs below, the units can easily be changed in the field to reverse the output signal. Thus, one model can be used for two applications by programming the “zero” and “span” appropriately. The differential feature allows the gap distance between two magnets to be measured. The magnets must remain within the active span at all times and cannot be any closer than 2.5 inches to each other.

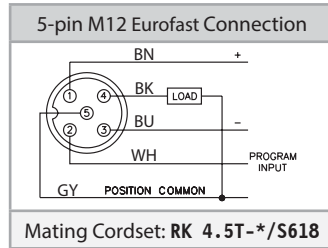
**Rod Style Series (R10) Specifications:**

|                         | <b>LT Analog</b>   | <b>LTX Analog</b>  | <b>LTX Digital</b>  | <b>LTX SSI</b>   |
|-------------------------|--|--|---|--|
| Output:                 | 4-20 mA, 20-4 mA, 0-10 VDC, 10-0 VDC   | 0-10 VDC, 10-0 VDC, -10 to 10 VDC, 10 to -10 VDC, 0-5 VDC, 5-0 VDC, -5 to 5 VDC, 5 to -5 VDC, 4-20 mA, 20-4 mA   | RS422 Start/Stop, Variable Pulse: Internal or External interrogation  | 24, 25 or 26 bit, Binary or Gray Code  |
| Span:                   | 2-168 in   | 1-300 in   | 1-300 in  | 1-300 in   |
| Repeatability:          | +/-0.006% of full span or +/-0.002 in, whichever is greater  | Equal to resolution  | Equal to resolution of controller   | Equal to output resolution   |
| Resolution:             | 0.001 in / 16 bit  | 0.00006 in / 16 bit  | Controller dependent  | English: 0.00005 in, 0.0001 in, 0.0005 in, 0.001 in<br>Metric: 1, 5, 10, 20 micron   |
| Operating temperature:  | Head (Electronics): -40 to +158 °F (-40 to +70 °C)<br>Guide Tube: -40 to +221 °F (-40 to +105 °C)                            | Head (Electronics): -40 to +185 °F (-40 to +85 °C)<br>Guide Tube: -40 to +221 °F (-40 to +105 °C)  | Head (Electronics): -40 to +185 °F (-40 to +85 °C)<br>Guide Tube: -40 to +221 °F (-40 to +105 °C)   | Head (Electronics): -40 to +185 °F (-40 to +85 °C)<br>Guide Tube: -40 to +221 °F (-40 to +105 °C)  |
| Storage temp.           | -40 to +185 °F (-40 to +85 °C)   | -40 to +221 °F (-40 to +105 °C)  | -40 to +221 °F (-40 to +105 °C)   | -40 to +221 °F (-40 to +105 °C)  |
| Null zone:              | 2.00 in  | 2.00 in  | 2.00 in   | 2.00 in  |
| Dead zone:              | 2.50 in  | 2.50 in  | 2.50 in   | 2.50 in  |
| Operating pressure:     | 5,000 PSI operating, 10,000 PSI spike  | 5,000 PSI operating, 10,000 PSI spike  | 5,000 PSI operating, 10,000 PSI spike   | 5,000 PSI operating, 10,000 PSI spike  |
| Operating voltage:      | 13.5-30 VDC  | 7-30 VDC   | 7-30 VDC  | 7-30 VDC   |
| Current consumption:    | 3 watts maximum, 200 mA at 15 VDC  | 1 watt at 1 ms interrogation time with no recirculations. Power consumption increases as interrogation times and recirculations increase. 40 mA at 24 VDC typical  | 1 watt at 1 ms interrogation time with no recirculations. Power consumption increases as interrogation times and recirculations increase. 40 mA at 24 VDC typical | 1.3 watt at 1 ms interrogation time. Power consumption increases as interrogation times increase. 40 mA at 24 VDC typical  |
| Response time:          | 1 ms (span length 1-50 in)<br>2 ms (span length 51-100 in)<br>3 ms (span length 101-150 in)<br>4 ms (span length 151-168 in) | 0.5 mms (L ≤ 2")<br>1 ms (2" < L ≤ 12")<br>2 ms (12" < L ≤ 30")<br>3 ms (30" < L ≤ 50")<br>4 ms (50" < L ≤ 100")<br>5 ms (100" < L ≤ 150")<br>6 ms (150" < L ≤ 180")<br>7 ms (180" < L ≤ 250")<br>8 ms (250" < L ≤ 300") | Controller Dependent  | 4.0 K measurements/sec. (span length 1-12 in)<br>2.4 K measurements/sec. (span length 13-30 in)<br>2.0 K measurements/sec. (span length 31-40 in)<br>1.1 K measurements/sec. (span length 41-80 in)<br>0.5 K measurements/sec. (span length 81-197 in) |
| Shock:                  | 2000 g   | 1000 g   | 1000 g  | 1000 g   |
| Vibration:              | 30 g   | 30 g   | 30 g  | 30 g   |
| Hysteresis:             | +/-0.02% of full span  | 0.001 in   | 0.001 in  | 0.001 in   |
| Non-linearity:          | +/-0.05% of full span  | < 0.01% or +/-0.005 in, whichever is greater   | < 0.01% or +/-0.005 in, whichever is greater  | < 0.01% or +/-0.005 in, whichever is greater   |
| Rod end / Mounting hex: | 316 stainless steel, 0.405 in (10.29 mm) outer dia.  | 316 stainless steel, 0.405 in (10.29 mm) outer dia.  | 316 stainless steel, 0.405 in (10.29 mm) outer dia.   | 316 stainless steel, 0.405 in (10.29 mm) outer dia.  |
| LED:                    | N/A  | Tri-color diagnostic   | Tri-color diagnostic  | Tri-color diagnostic   |
| Protection rating:      | IP67   | IP68   | IP68  | IP68   |
| Agency approval:        | CE   | CE   | CE  | CE   |

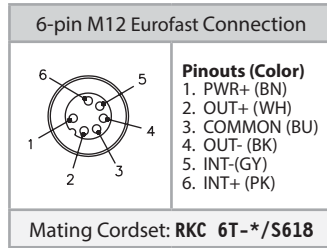
### Rod Style Series

#### Wiring Diagrams:

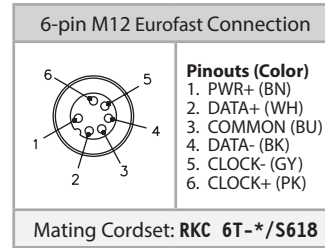
##### LT and LTX Analog



##### LTX Digital



##### LTX SSI



#### Part Number Key: Analog R10 Rod Style Series

| A  | B  | C |   | D   |   | E  | F |   | G     |
|----|----|---|---|-----|---|----|---|---|-------|
| LT | 12 | E | - | R10 | - | LI | 0 | - | H1151 |

| A  | Type              |
|----|-------------------|
| LT | Linear Transducer |

| B | Measuring Span           |
|---|--------------------------|
| * | Length of Measuring Span |

| C | Units of Measurement |
|---|----------------------|
| E | Inches               |

| D    | Housing Size, Material     |
|------|----------------------------|
| R10  | 10 mm Rod, Aluminum        |
| ER10 | 10 mm Rod, Stainless Steel |

| E  | Output Configuration |
|----|----------------------|
| LI | Current              |
| LU | Voltage              |
| LD | Differential         |

| F | Output Type |          |              |
|---|-------------|----------|--------------|
|   | Current     | Voltage  | Differential |
| 0 | 4-20 mA     | 0 to 10V | 0 to 10V     |
| 1 | 20-4 mA     | 10 to 0V | 4-20 mA      |
| 4 |             | 0 to 5V  |              |
| 5 |             | 5 to 0V  |              |

| G     | Type of Connection           |
|-------|------------------------------|
| H1151 | 5-pin M12 Eurofast Connector |

#### Part Number Key: LTX Analog R10 Rod Style Series

| A   | B  | C |   | D   |   | E  | F | G  |   | H     |
|-----|----|---|---|-----|---|----|---|----|---|-------|
| LTX | 12 | E | - | R10 | - | LI | 0 | X3 | - | H1151 |

| A   | Type              |
|-----|-------------------|
| LTX | Linear Transducer |

| B | Measuring Span           |
|---|--------------------------|
| * | Length of Measuring Span |

| C | Units of Measurement |
|---|----------------------|
| E | Inches               |
| M | Millimeters          |

| D    | Housing Size, Material     |
|------|----------------------------|
| R10  | 10 mm Rod, Aluminum        |
| ER10 | 10 mm Rod, Stainless Steel |

| E  | Output Configuration |
|----|----------------------|
| LI | Current              |
| LU | Voltage              |

| F | Output Type |            |
|---|-------------|------------|
|   | Current     | Voltage    |
| 0 | 4-20 mA     | 0 to 10V   |
| 1 | 20-4 mA     | 10 to 0V   |
| 2 |             | -10 to 10V |
| 3 |             | 10 to -10V |
| 4 |             | 0 to 5V    |
| 5 |             | 5 to 0V    |
| 6 |             | -5 to 5V   |
| 7 |             | 5 to -5V   |

| G  | Number of LEDs    |
|----|-------------------|
| X3 | 3 Diagnostic LEDs |

| H     | Type of Connection           |
|-------|------------------------------|
| H1151 | 5-pin M12 Eurofast Connector |

**Rod Style Series**

**Part Number Key: Digital R10 Rod Style Series**

| A   | B  | C |   | D   |   | E   |   | F   |   | G  |   | H     |
|-----|----|---|---|-----|---|-----|---|-----|---|----|---|-------|
| LTX | 12 | E | - | R10 | - | VPI | - | 001 | - | X3 | - | H1161 |

| A   | Type              |
|-----|-------------------|
| LTX | Linear Transducer |

| B | Measuring Span           |
|---|--------------------------|
| * | Length of Measuring Span |

| C | Units of Measurement |
|---|----------------------|
| E | Inches               |
| M | Millimeters          |

| D    | Housing Size, Material     |
|------|----------------------------|
| R10  | 10 mm Rod, Aluminum        |
| ER10 | 10 mm Rod, Stainless Steel |

| E   | Output Mode                            |
|-----|--|
| RS  | RS422, Start/Stop Pulse                |
| VPE | Variable Pulse External Interrogations |
| VPI | Variable Pulse Internal Interrogations |

| F | Number of Recirculations <sup>1)</sup> |
|---|--|
| * | 001 (Standard) to 225                  |

<sup>1)</sup> Only Available with Output Mode 'VPI' or 'VPE'. Otherwise (Blank)

| G  | Number of LEDs    |
|----|-------------------|
| X3 | 3 Diagnostic LEDs |

| H     | Type of Connection           |
|-------|------------------------------|
| H1161 | 6-pin M12 Eurofast Connector |

**Part Number Key: SSI R10 Rod Style Series**

| A   | B  | C |   | D   |   | E   |   | F |   | G | H | I | J |   | K  |   | L |   | M     |
|-----|----|---|---|-----|---|-----|---|---|---|---|---|---|---|---|----|---|---|---|-------|
| LTX | 12 | E | - | R10 | - | SSI | - | 1 | - | B | S | F | B | - | X3 | - | A | - | H1161 |

| A   | Type              |
|-----|-------------------|
| LTX | Linear Transducer |

| B | Measuring Span           |
|---|--------------------------|
| * | Length of Measuring Span |

| C | Units of Measurement |
|---|----------------------|
| E | Inches               |
| M | Millimeters          |

| D    | Housing Size, Material     |
|------|----------------------------|
| R10  | 10 mm Rod, Aluminum        |
| ER10 | 10 mm Rod, Stainless Steel |

| E   | Data Mode                    |
|-----|------------------------------|
| SSI | Synchronous Serial Interface |

| F | Data Length |
|---|-------------|
| 1 | 24 bit      |
| 2 | 25 bit      |
| 3 | 26 bit      |

| G | Data Format |
|---|-------------|
| B | Binary Code |
| G | Gray Code   |

| H | Data Type    |
|---|--------------|
| A | Asynchronous |
| S | Synchronous  |

| I | Direction |
|---|-----------|
| F | Forward   |
| R | Reverse   |
| V | Velocity  |

| J | Resolution |
|---|------------|
| 1 | 0.005 mm   |
| 2 | 0.01 mm    |
| 3 | 0.05 mm    |
| 4 | 0.1 mm     |
| 5 | 0.02 mm    |
| 6 | 0.002 mm   |
| 7 | 0.001 mm   |
| 8 | 0.00005"   |
| 9 | 0.0001"    |
| A | 0.0005"    |
| B | 0.001"     |

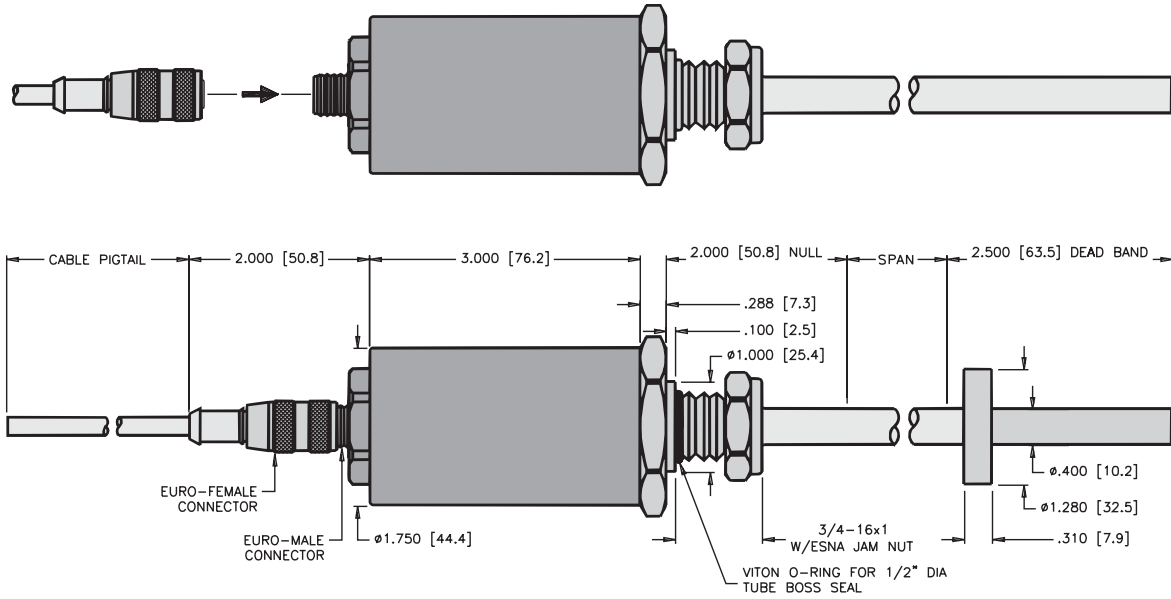
| K  | Number of LEDs    |
|----|-------------------|
| X3 | 3 Diagnostic LEDs |

| L       | Option |
|---------|--------|
| (Blank) | None   |
| A       | Alarm  |

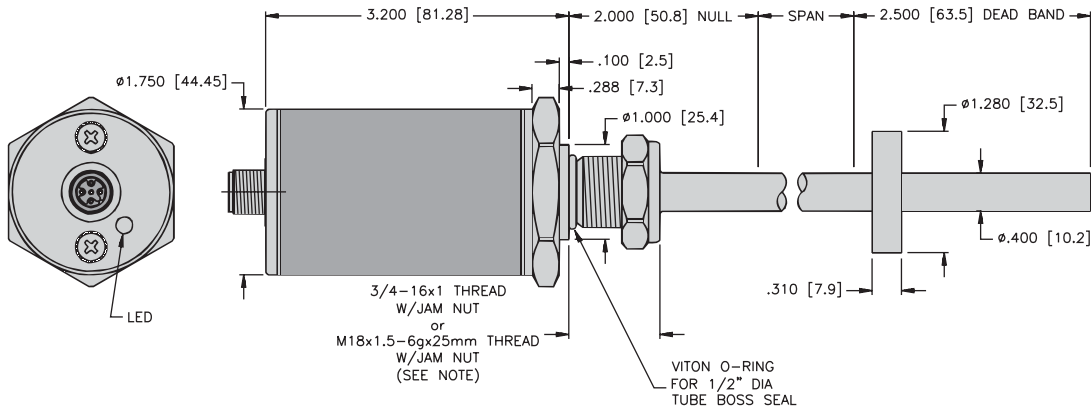
| M     | Type of Connection           |
|-------|------------------------------|
| H1161 | 6-pin M12 Eurofast Connector |

**Rod Style Series**

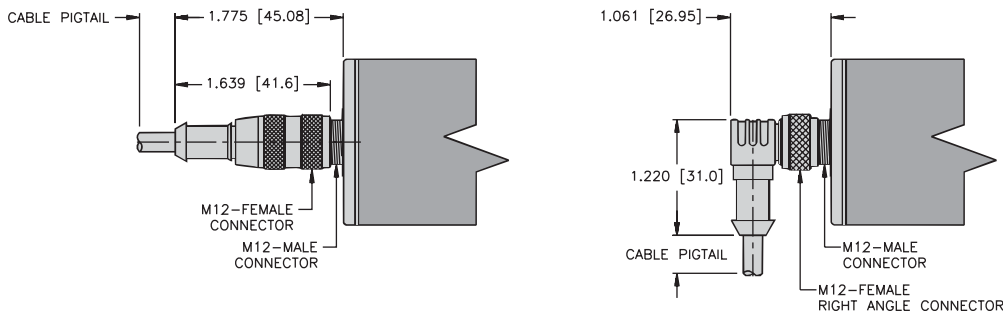
**Dimensions: Rod Style Series LT**



**Dimensions: Rod Style Series LTX**



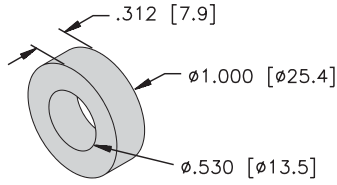
**NOTE:** UNLESS OTHERWISE SPECIFIED  
 FOR ENGLISH THREAD TYPE, RAISED FACE FEATURE COMPLIES WITH SAE J1926-1.



**Rod Style Series Accessories**

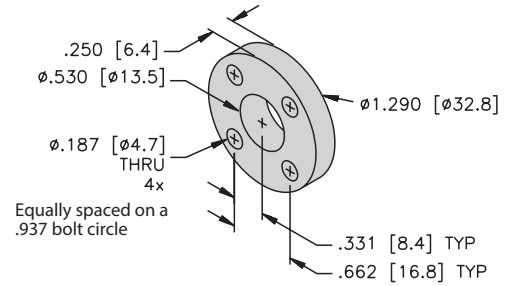
**1" Diameter Cylinder Magnet**

CM-R10



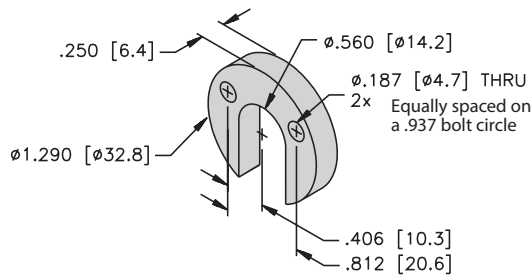
**Standard Magnet Spacer**

STS-R10



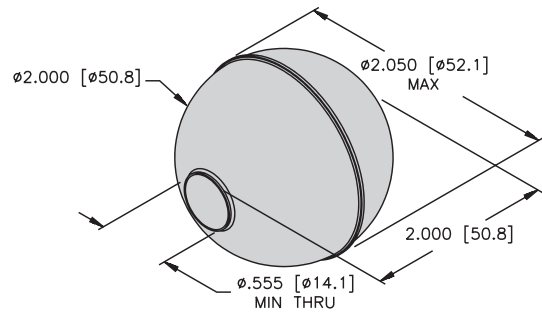
**Split Magnet Spacer**

SPS-R10



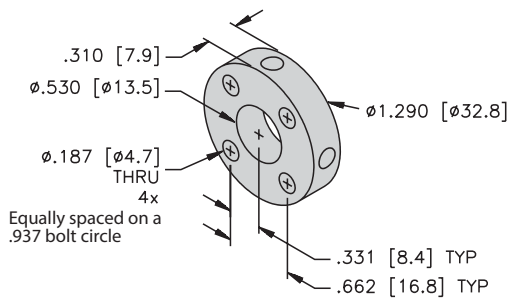
**Egg Shape Float**

EF-R10



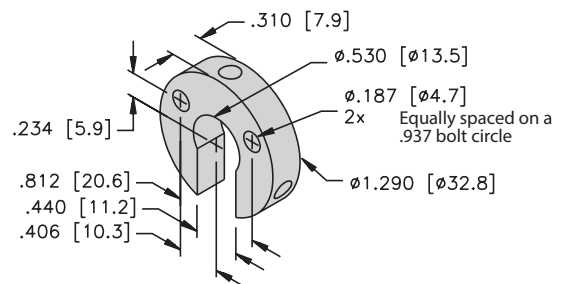
**Standard 4-Hole Magnet**

STM-AL-R10 (aluminum)  
STM-SS-R10 (stainless steel)



**Split Magnet**

SPM-AL-R10

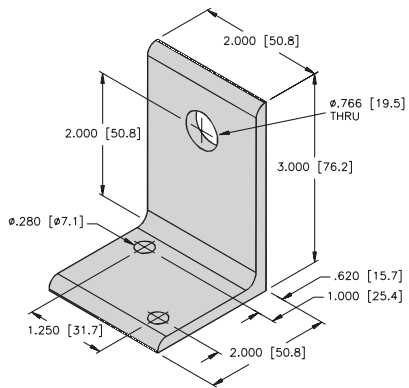


All dimensions shown as: inches [mm]

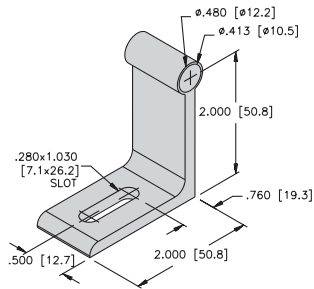
Linear Position Technology

**Rod Style Series Accessories**

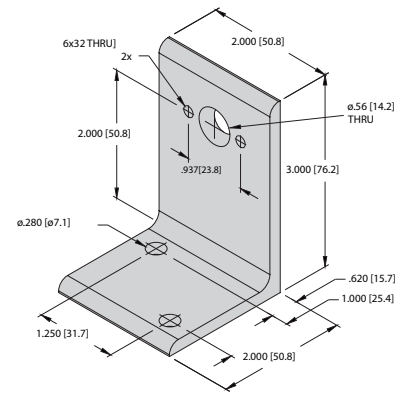
**Mounting Bracket**  
**LB-R10**



**Rod Support**  
**RB-R10**

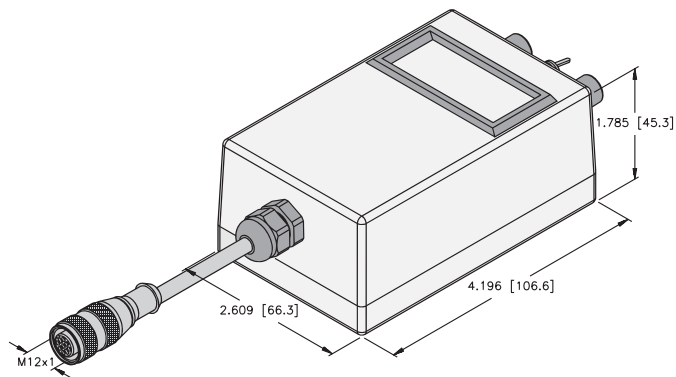


**Magnet Mounting Bracket**  
**MMB-R10**

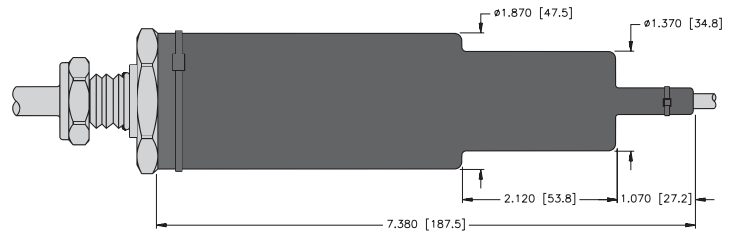


**MB-R10:** Part number includes mounting bracket **LB-R10** and rod support bracket **RB-R10**.

**Test and Programming Device**  
**TB2-LDT**  
**TB2-LDT-LI**



**Rubber Boot**  
**BT-R10**



All dimensions shown as: inches [mm]

## Glossary of Terms: Linear Position Sensors

**Absolute Sensing:** Position is accurately known at power ON without the need for a reference or home position.

**Magnetostrictive Technology:** A linear sensor technology based on a magnetic principal of operation used in all EZ-track LDTs.

**Repeatability:** The difference in the indicated position of a single point when that point is repeatedly approached from the same direction under the same ambient conditions.

**Accuracy:** The difference between the target point and the point actually indicated by the sensor with relation to a fixed reference.

**Non-Linearity:** The distance the indicated position of the positioning element along the span varies from the actual physical position.

**Resolution:** The smallest incremental change in position that can be detected and indicated as an output.

**Blind Zone:** Term used to describe the areas of the Q-track sensors where it no longer picks up the positioning element.

**Non-Volatile:** Position is held in memory and will not be lost on power down.

**Span:** The area of a linear sensor that reacts to the positioning element as it moves over it, producing an output signal.

**Dead Zone:** An area at the end of the EZ-track sensor that is opposite the connector where the magnet cannot be accurately sensed.

**Null Zone:** An area at the connector end of the sensor where the magnet cannot be accurately sensed.

**Span Point:** The end point of the analog measuring distance at which the output signal equals the greatest value of the analog scale.

**Hysteresis:** The difference of the measured value when approaching a defined point from opposite directions.

**Quadrature Cycle Output Frequency:** The fixed frequency at which the pulse rate is transmitted out of the probe.

**SSI:** Synchronous Serial Interface is a standard protocol for serial interface between sensors and controllers.

**Incremental Sensing:** A relative position feedback device whose signal is always referenced to the zero position. The sensor produces a digital square wave pulse train that is fed into an up/down counter chip or clock to derive position.

**RLC:** Stands for Resistance, Inductance and Capacitance. It is the principal of operation for all Turck Q-track sensors. The positioning element is a passive coil circuit that is excited by an emitter coil and the resulting inducted voltage is picked up by receiver coils.

**Volatile:** Position held in memory that is lost on power down.

**Zero Point:** The beginning point of the analog measuring distance at which the output signal equals the lowest value of the analog scale. The Zero Point is also used as the reference position for the incremental scale used in quadrature output probes.

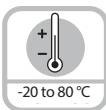
# Linear Position Technology

## Linear Magnetic Position System

### Linear Magnetic Measurement System LM-2/LMT-2



High IP



Temperature



Shock/vibration resistant



Reverse polarity protection

#### Robust

- **Fully potted diecast metal housing.**
- **Increased ability to withstand vibrations and rough installation:** Eliminates machine downtime and repairs. Non-contact technology results in high shock and vibration resistance.
- **Stays sealed even when subjected to harsh everyday use.** Die cast metal housing with up to IP68/IP69K protection.



#### Compact

- **Installation depth only 10 mm, width of magnetic band 10 mm.**
- **Installation height only 28 mm.** May be used even where space is very tight.

#### Versatile

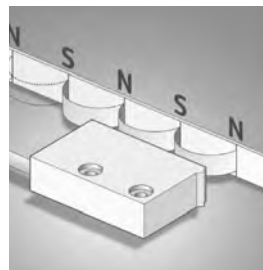
- **Fast start-up of the measuring system:** Easy attachment of the magnetic band and the sensor head.
- **Easy mounting with large tolerances possible:** Distance of sensor head to magnetic band from 0.1 to 1.0 mm; tolerates lateral misalignment + 1 mm; LED warning indicator when magnetic field is too weak.

#### Technical Data Magnetic Sensor LM-2:

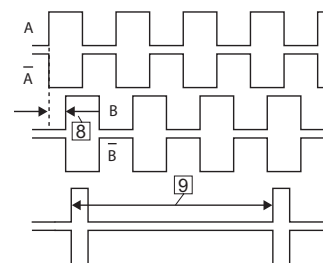
|                                      |   |                         |
|--------------------------------------|---|-------------------------|
| Output circuit [Key Code]:           | Push-Pull [2R]  | RS422 [4K]              |
| Supply voltage:                      | 4.8 to 30 VDC   | 4.8 to 26 VDC           |
| Load/channel, max cable length:      | ±20 mA, max. 30 m   | 120 Ohm, RS422 standard |
| Current consumption (without load):  | typ. 25 mA, max. 60 mA  |                         |
| Short circuit protected:             | yes   | yes <sup>1)</sup>       |
| Min. pulse interval:                 | 1 μs (edge interval) corresponds to 4 μs/cycle (see signal figures below)   |                         |
| Output signal:                       | A, $\bar{A}$ , B, $\bar{B}$ , I, $\bar{I}$  |                         |
| Reference signal:                    | Index periodical  |                         |
| System accuracy:                     | typ. 200 μm, max. ± (0.04 + 0.04 x L) mm, (L in [m], up to L = 50 m, at T = 20 °C)  |                         |
| Repeat accuracy:                     | ±1 increment  |                         |
| Resolution and speed <sup>2)</sup> : | 100 μm (post-quadrature), max. 25 m/s<br>25 μm (post-quadrature), max. 4 m/s<br>10 μm (post-quadrature), max. 6.5 m/s             |                         |
| Permissible alignment tolerance:     | see draft "Mounting tolerances"   |                         |
| Gap sensor / magnetic band:          | 0.1-1.0 mm (0.4 mm recommended)   |                         |
| Offset:                              | max. ±1 mm  |                         |
| Tilting:                             | max. 3°   |                         |
| Torsion:                             | max. 3°   |                         |
| Working temperature:                 | -4 to +176 °F (-20 to +80 °C)   |                         |
| Shock resistance:                    | 500 g / 1 ms  |                         |
| Vibration strength:                  | 30 g / 10-2,000 Hz  |                         |
| Protection class:                    | IP67 according to DIN 60529 (housing)   |                         |
| Humidity:                            | 100%, condensation possible   |                         |
| Housing:                             | Zinc die-cast   |                         |
| Cable:                               | 2 m, PUR 8 x 0.14 mm <sup>2</sup> , shielded, may be used in trailing cable installations   |                         |
| Status-LED:                          | Green: Pulse-index; Red: Error<br>Speed too high or magnetic fields too weak (for sensors LM-2*10-**020-*21 and LM-2-*10-**050-*) |                         |

RoHS compliant acc. to EU guideline 2011/65/EU

#### Function Principle:



#### Signal Figures



- <sup>9)</sup> Periodic index signal (every 2 mm)  
The logical assignment A, B and I-Signal can change
- <sup>8)</sup> Min. pulse interval: pay attention to the instructions in the technical data

<sup>1)</sup> A max. of one channel only may be short-circuited: (when +V = 5 V, a short circuit to another channel, 0 V, or +V is permissible.) (when +V = 5-30 V, a short circuit to another channel or to 0 V is permissible.)

<sup>2)</sup> At the listed rotational speed the min. pulse interval is 1 μs, this corresponds to 250 kHz. For the max. rotational speed range a counter with a count input frequency of not less than 250 kHz should be provided.



### Linear Magnetic Measurement System LM-2/LMT-2

#### Technical Data Magnetic Band LMT-2:

|                          |   |
|--------------------------|---|
| Pole gap:                | 2 mm from pole to pole  |
| Dimensions:              | Width: 10 mm, Thickness: 1.7 mm incl. masking tape  |
| Temperature coefficient: | (11±1)×10 <sup>-6</sup> /K  |
| Temperature ranges:      | working temperature: -4 to +176 °F (-20 to +80 °C)<br>storage temperature: -40 to +176 °F (-40 to +80 °C)                           |
| Mounting:                | adhesive joint  |
| Measuring:               | 0.1 m (to receive an optimal result of measurement, the magnetic band should be ca. 0.1 m longer than the desired measuring length) |
| Bending radius:          | ≥ 50 mm   |

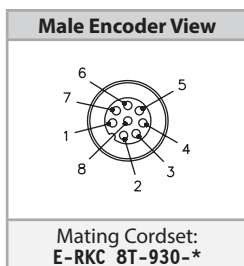


#### Standard Wiring:

| Pin | Signal    | Color |
|-----|-----------|-------|
| 1   | 0 V       | WH    |
| 2   | +V        | BN    |
| 3   | A         | GN    |
| 4   | $\bar{A}$ | YE    |
| 5   | B         | GY    |
| 6   | $\bar{B}$ | PK    |
| 7   | Z         | BU    |
| 8   | $\bar{Z}$ | RD    |

Shield is on the housing

#### Wiring Diagram:



\* Length in meters.

#### Part Number Key: Magnetic Sensor LM-2

| A    |   | B   |   | C  | D   |   | E |
|------|---|-----|---|----|-----|---|---|
| LM-2 | - | P10 | - | 2R | 005 | - | C |

| A    | Type            |
|------|-----------------|
| LM-2 | Linear Magnetic |

| B   | Housing           |
|-----|-------------------|
| P10 | 10 mm, IP68/IP69K |
| Q10 | 10 mm, IP67       |

| C  | Voltage Supply and Output Type |
|----|--------------------------------|
| 2R | 4.8-30 VDC, Push-Pull          |
| 4K | 4.8-26 VDC, RS422              |

| D   | Resolution* |
|-----|-------------|
| 005 | 100 μm      |
| 020 | 25 μm       |
| 050 | 10 μm       |

\* With quadruple evaluation

| E         | Type                               |
|-----------|------------------------------------|
| C         | Cable (2 m PUR)                    |
| C*M-RSS8T | Cable w/ *m M12 Eurofast Connector |

\* Not available > 2 m

#### Part Number Key: Magnetic Band LMT-2

| A     |   | B    |
|-------|---|------|
| LMT-2 | - | 0010 |

| A     | Type                                       |
|-------|--|
| LMT-2 | 10 mm, Linear Magnetic Tape, 2 mm Pole Gap |

| B    | Length* |
|------|---------|
| 0010 | 1 m     |
| 0050 | 5 m     |
| 0100 | 10 m    |

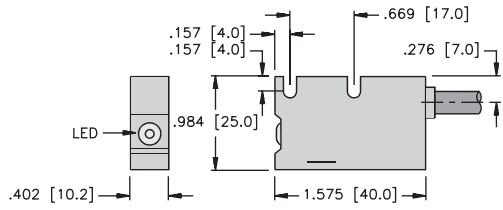
\*Other lengths < 50 m available on request

# Linear Position Technology

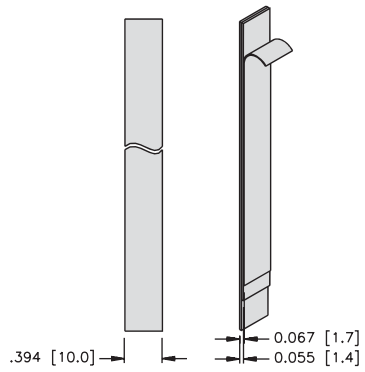
## Linear Magnetic Position System

### Linear Magnetic Measurement System LM-2/LMT-2

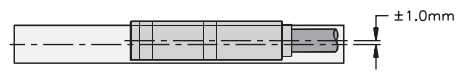
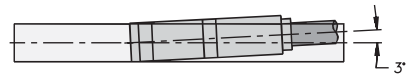
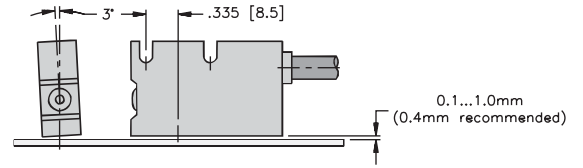
#### Dimensions: Magnetic Sensor LM-2-\*10



#### Dimensions: Magnetic Band LMT-2



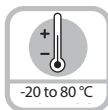
#### Permissible Mounting Tolerances:



### Linear Magnetic Measurement System LM-5/LMT-5



High IP



Temperature



Shock/vibration resistant



Reverse polarity protection

#### Robust

- **Fully potted diecast metal housing.**
- **Increased ability to withstand vibrations and rough installation:** Eliminates machine downtime and repairs. Non-contact technology results in high shock and vibration resistance.
- **Stays sealed even when subjected to harsh everyday use.** Die cast metal housing with up to IP68/IP69K protection.



#### Compact

- **Installation depth only 10 mm, width of magnetic band 10 mm.**
- **Installation height only 28 mm.** May be used even where space is very tight.

#### Simple Installation

- **Fast start-up of the measuring system:** Easy attachment of the magnetic band and the sensor head.
- **Easy mounting with large tolerances possible:** Distance of sensor head to magnetic band from 0.1 to 2.0 mm; tolerates lateral misalignment +1 mm; LED warning indicator when magnetic field is too weak.

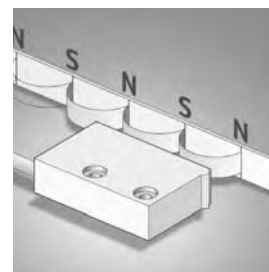
Linear Position Technology

#### Technical Data Magnetic Sensor LM-5:

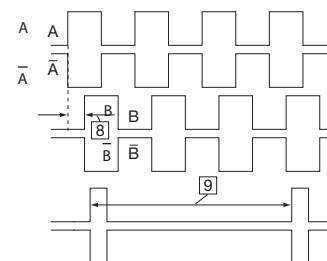
|                                      |  |                         |
|--------------------------------------|--|-------------------------|
| Output circuit [Key Code]:           | Push-Pull [2R]   | RS422 [4K]              |
| Supply voltage:                      | 4.8 to 30 VDC  | 4.8 to 26 VDC           |
| Load/channel, max cable length:      | ±20 mA, max. 30 m  | 120 Ohm, RS422 standard |
| Current consumption (without load):  | typ. 25 mA, max. 60 mA   |                         |
| Short circuit protected:             | yes  | yes <sup>1)</sup>       |
| Min. pulse interval:                 | 1 μs (edge interval) corresponds to 4 μs/cycle (see signal figures below)  |                         |
| Output signal:                       | A, $\bar{A}$ , B, $\bar{B}$ , I, $\bar{I}$   |                         |
| Reference signal:                    | Index periodical   |                         |
| System accuracy:                     | typ. 200 μm, max. ± (0.06 + 0.04 x L) mm, (L in [m], up to L = 50 m, at T = 20 °C)   |                         |
| Repeat accuracy:                     | ±1 increment   |                         |
| Resolution and speed <sup>2)</sup> : | 25 μm (post-quadrature), max. 16.25 m/s<br>5 μm (post-quadrature), max. 3.25 m/s   |                         |
| Permissible alignment tolerance:     | see draft "Mounting tolerances"  |                         |
| Gap sensor / magnetic band:          | 0.1-2.0 mm (1.0 mm recommended)  |                         |
| Offset:                              | max. ±1 mm   |                         |
| Tilting:                             | max. 3°  |                         |
| Torsion:                             | max. 3°  |                         |
| Working temperature:                 | -4 to +176 °F (-20 to +80 °C)  |                         |
| Shock resistance:                    | 500 g/1 ms   |                         |
| Vibration strength:                  | 30 g/10-2000 Hz  |                         |
| Protection class:                    | IP67 according to DIN 60529 (housing)<br>IP68/IP69K  |                         |
| Humidity:                            | 100%, condensation possible  |                         |
| Housing:                             | Zinc die-cast  |                         |
| Cable:                               | 2 m, PUR 8 x 0.14 mm <sup>2</sup> , shielded, may be used in trailing cable installations                                      |                         |
| Status-LED:                          | Green: Pulse-index; Red: Error<br>Speed too high or magnetic fields too weak (for sensors LM-5-*10-*050-* and LM-5-*10-*250-*) |                         |

RoHS compliant acc. to EU guideline 2011/65/EU

#### Function Principle:



#### Signal Figures:



- 9) Periodic index signal (every 5 mm)  
The logical assignment A, B and I-Signal can change
- 8) Min. pulse interval: pay attention to the instructions in the technical data

<sup>1)</sup> A max. of one channel only may be short-circuited: (when +V = 5 V, a short circuit to another channel, 0 V, or +V is permissible.) (when +V = 5-30 V, a short circuit to another channel or to 0 V is permissible.)

<sup>2)</sup> At the listed rotational speed the min. pulse interval is 1 μs, this corresponds to 250 kHz. For the max. rotational speed range, a counter with a count input frequency of not less than 250 kHz should be provided.

# Linear Position Technology

## Linear Magnetic Position System

### Linear Magnetic Measurement System LM-5/LMT-5

#### Technical Data Magnetic Band LMT-5:

|                          |  |
|--------------------------|--|
| Pole gap:                | 5 mm from pole to pole   |
| Dimensions:              | Width: 10 mm, Thickness: 1.7 mm incl. masking tape   |
| Temperature coefficient: | (11±1)×10 <sup>-6</sup> /K   |
| Temperature ranges:      | working temperature: -4 to +176 °F (-20 to +80 °C)<br>storage temperature: -40 to +176 °F (-40 to +80 °C)                            |
| Mounting:                | adhesive joint   |
| Measuring:               | 0.1 m (to receive an optimal result of measurement, the magnetic band should be ca. 0.1 m longer than the desired measuring length ) |
| Bending radius:          | ≥ 50 mm  |

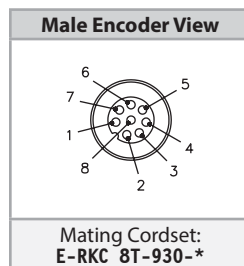


#### Standard Wiring:

| Pin | Signal    | Color |
|-----|-----------|-------|
| 1   | 0 V       | WH    |
| 2   | +V        | BN    |
| 3   | A         | GN    |
| 4   | $\bar{A}$ | YE    |
| 5   | B         | GY    |
| 6   | $\bar{B}$ | PK    |
| 7   | Z         | BU    |
| 8   | $\bar{Z}$ | RD    |

Shield is on the housing

#### Wiring Diagram:



\* Length in meters.

#### Part Number Key: Magnetic Sensor LM-5

| A    |   | B   |   | C  | D   |   | E |
|------|---|-----|---|----|-----|---|---|
| LM-5 | - | P10 | - | 2R | 050 | - | C |

| A    | Type            |
|------|-----------------|
| LM-5 | Linear Magnetic |

| B   | Housing           |
|-----|-------------------|
| P10 | 10 mm, IP68/IP69K |
| Q10 | 10 mm, IP67       |

| C  | Voltage Supply and Type |
|----|-------------------------|
| 2R | 4.8-30 VDC, Push-Pull   |
| 4K | 4.8-26 VDC, RS422       |

| D   | Resolution <sup>1)</sup> |
|-----|--------------------------|
| 050 | 25 μm                    |
| 250 | 5 μm                     |

<sup>1)</sup> with quadruple evaluation

| E         | Type of Connection                 |
|-----------|------------------------------------|
| C         | Cable (2 m PUR)                    |
| C*M-RSS8T | Cable w/ *m M12 Eurofast Connector |

\* Not available > 2 m

#### Part Number Key: Magnetic Band LMT-5

| A     |   | B    |
|-------|---|------|
| LMT-5 | - | 0010 |

| A     | Type                                       |
|-------|--|
| LMT-5 | 10 mm, Linear Magnetic Tape, 5 mm Pole Gap |

| B    | Length* |
|------|---------|
| 0010 | 1 m     |
| 0050 | 5 m     |
| 0100 | 10 m    |

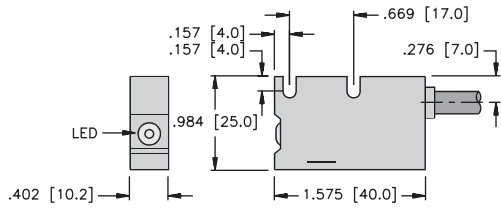
\*Other lengths < 50 m available on request

#### Accessories:

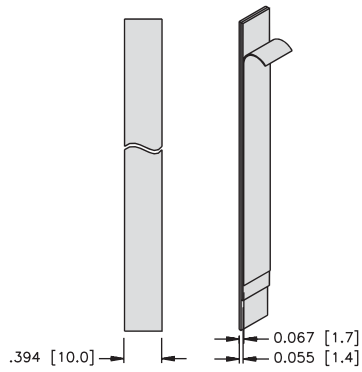
- See page H1, Connectivity, for cables and connectors

**Linear Magnetic Measurement System LM-5/LMT-5**

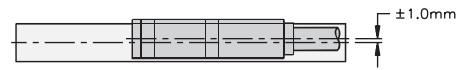
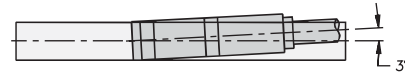
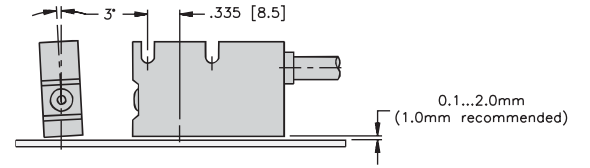
**Dimensions: Magnetic Sensor LM-5-\*10**



**Dimensions: Magnetic Band LMT-5**



**Permissible Mounting Tolerances:**



# Linear Position Technology

## Draw Wire Mechanics with Encoder or Analog Sensor

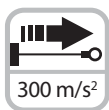
### Draw Wire Encoder DW70



Wide temperature range



Reverse polarity protection



Maximum acceleration  
300 m/s<sup>2</sup>

#### Robust

- **Corrosion resistant:** Titanium-anodized aluminium housing.
- **High-strength stainless steel draw wire.**
- **Low friction design or wire exit free from wear.** Diamond-polished ceramic guide.
- **Wide temperature range**



#### Versatile

- **Suitable for various sensors/encoders:** Incremental and analog.
- **Quick mounting:** Fastening by means of two screws.
- **Flexible connection options:** Cable, M12 connector, radial, axial.
- **Linearity up to 0.05%.**

#### Fast

- **High traverse speed.**
- **High acceleration:** Dynamic spring traction by means of a constant force spring.

#### Mechanical Characteristics (Draw Wire Mechanics):

|                                |  |                              |                              |
|--------------------------------|--|------------------------------|------------------------------|
| Measuring range:               | 250 mm   | 500 mm                       | 1250 mm                      |
| Extension force                | Fmin:  | (6.8 N) 1.53 lbs             | (3.4 N) 0.76 lbs             |
|                                | Fmax:  | (7.9 N) 1.78 lbs             | (4.0 N) 0.90 lbs             |
| Max. speed:                    | 26.2 ft/s (8 m/s)                                    | 26.2 ft/s (8 m/s)            | 32.8 ft/s (10 m/s)           |
| Max. acceleration:             | (200 m/s <sup>2</sup> ) 20 g                         | (200 m/s <sup>2</sup> ) 20 g | (300 m/s <sup>2</sup> ) 30 g |
| Linearity (of measuring range) | analog output:                                       | 0.15%                        | 0.15%                        |
|                                | encoder:   | 0.05%                        | 0.05%                        |
| Weight:                        | approx. 330 g (depending on the sensor/encoder used) |                              |                              |
| Materials:                     | housing: titanium-anodized aluminium                 |                              |                              |
|                                | wire: stainless steel Ø 0.5 mm                       |                              |                              |
| Protection (encoder only):     | IP65   |                              |                              |

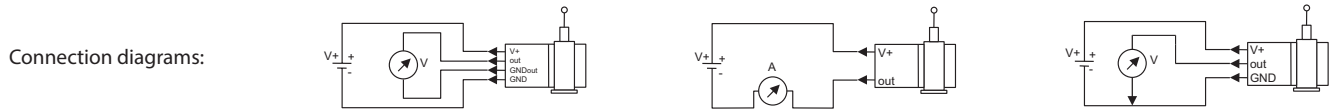
#### Electrical Characteristics (Digital Output):

The electrical characteristics of the draw wire encoder assembly may be found in the data sheets of the encoder selected.

### Draw Wire Encoder DW70

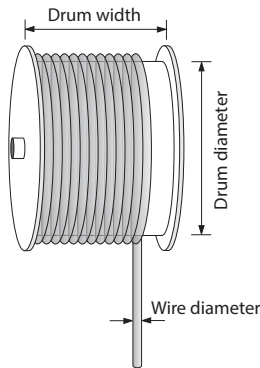
#### Electrical Characteristics (Analog Output):

|                              |   |                               |                               |
|------------------------------|---|-------------------------------|-------------------------------|
| Analog output [Key code]:    | 0-10 V [8C]                                   | 4-20 mA [7E]                  | Potentiometer [PA]            |
| Output:                      | 0-10 V galvanically isolated,<br>4 conductors | 4-20 mA,<br>2 conductors      | 1 kOhm                        |
| Supply voltage:              | 12-30 VDC                                     | 12-30 VDC                     | max. 30 VDC                   |
| Recommended slider current:  | -   | -                             | < 1 µA                        |
| Max. current consumption:    | 22.5 mA (no load)                             | 50 mA                         | -                             |
| Reverse polarity protection: | yes   | yes                           | -                             |
| Operating temperature:       | -4 to +140 °F (-20 to +60 °C)                 | -4 to +140 °F (-20 to +60 °C) | -4 to +185 °F (-20 to +85 °C) |



ROHS compliant according to: EU guideline 2011/65/EU

#### Operating Principle:



#### Construction:

The core of a draw wire device is a drum mounted on bearings, onto which a wire is wound. Winding takes place via a spring-loaded device.

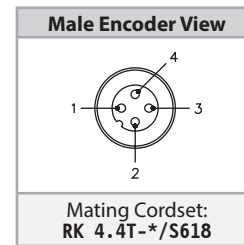
#### Note:

Exceeding the maximum extension length of the draw wire will lead to damage to the wire and the mechanics.

#### Wiring Diagram (Analog Output):

#### Standard Wiring (Analog Output):

| Pin | Color | 0-10 V   | 4-20 mA | 10 kOhm |
|-----|-------|----------|---------|---------|
| 1   | BN    | V+       | V+      | V+      |
| 2   | WH    | Signal   | N/C     | Slider  |
| 3   | BU    | GND      | Signal  | GND     |
| 4   | BK    | GND Sig. | N/C     | N/C     |



\* Length in meters.

#### Accessories:

- See page H1, Connectivity, for cables and connectors

# Linear Position Technology

## Draw Wire Mechanics with Encoder or Analog Sensor

### Draw Wire Encoder DW70

#### Part Number Key: DW70 with Encoder

| A  | B   |   | C  |   | D  |   | E  | F    |   | G     |   | H        |
|----|-----|---|----|---|----|---|----|------|---|-------|---|----------|
| DW | 250 | - | 70 | - | 04 | - | 2H | 1000 | - | H1181 | / | Specials |

| A  | Type      |
|----|-----------|
| DW | Draw Wire |

| B    | Measuring Range*   |
|------|--------------------|
| 250  | 250 mm Steel Wire  |
| 500  | 500 mm Steel Wire  |
| 1250 | 1250 mm Steel Wire |

\*Other measuring ranges available on request

| C  | Housing |
|----|---------|
| 70 | 50 mm   |

#### Available resolution, drum circumference: 125 mm

|                      |      |       |        |
|----------------------|------|-------|--------|
| Encoder PPR          | 125  | 1250  | 2500   |
| PQ* pulse/revolution | 500  | 5000  | 10000  |
| Pulses/mm            | 4    | 40    | 80     |
| Resolution [mm]      | 0.25 | 0.025 | 0.0125 |

\*PQ = Post Quadrature

#### Standard resolutions for draw wire with absolute encoder RM-46 or RM-47 CANopen, drum circumference 125 mm

| Absolute encoder  | RM-46       | RM-47 CANopen                        |
|-------------------|-------------|--------------------------------------|
| Pulses/resolution | 4096/12 bit | 4096, programmable via the bus/12bit |
| Pulses/mm         | 32.8        | 32.8                                 |
| Resolution (mm)   | ~ 0.03      | ~ 0.03                               |

| D  | Encoder Type       |
|----|--------------------|
| 04 | RI-04, Incremental |
| 46 | RM-46, SSI         |
| 47 | RM-47, CANopen     |

| E | Voltage Supply and Output Type              |
|---|---|
|   | Dependant on Encoder Selected <sup>1)</sup> |

| F | Pulse Rate/Resolution                       |
|---|---|
|   | Dependant on Encoder Selected <sup>1)</sup> |

| G | Type of Connection                          |
|---|---|
|   | Dependant on Encoder Selected <sup>1)</sup> |

<sup>1)</sup>Recommended encodes listed below

#### Recommended standard device:

DW\*\*\*-04-2H1250-C

Draw wire with mounted encoder typ RI-04 incremental RI-04Q6C-2H1250-C

- Push-pull with inverted signals
- Supply voltage 8-30 VDC
- Cable radial 2 M
- 1250 PPR

DW\*\*\*\*-46-3C12S12M-C

Draw wire with mounted encoder RM-46 RM-46T6S-3C12S12M-CT1M

- SSI interface
- Supply voltage 10-30 VDC
- SSI gray code
- Cable tangential 1 M
- Resolution 4096 PPR

DW\*\*\*-47-9D32B-CT1M

Draw wire with mounted encoder RM-47 RM-47T6S-9D32B-CT1M

- CANopen interface
- Supply voltage 10-30 VDC
- Cable tangential 1 M
- CANopen encoder profile V3.2

#### Part Number Key: DW70 with Analog Sensor

| A  | B   |   | C  |   | D  |   | E     |
|----|-----|---|----|---|----|---|-------|
| DW | 250 | - | 70 | - | 7E | - | H1441 |

| A  | Type      |
|----|-----------|
| DW | Draw Wire |

| B    | Measuring Range*   |
|------|--------------------|
| 250  | 250 mm Steel Wire  |
| 500  | 500 mm Steel Wire  |
| 1250 | 1250 mm Steel Wire |

\*Other measuring ranges available on request

| C  | Housing |
|----|---------|
| 70 | 50 mm   |

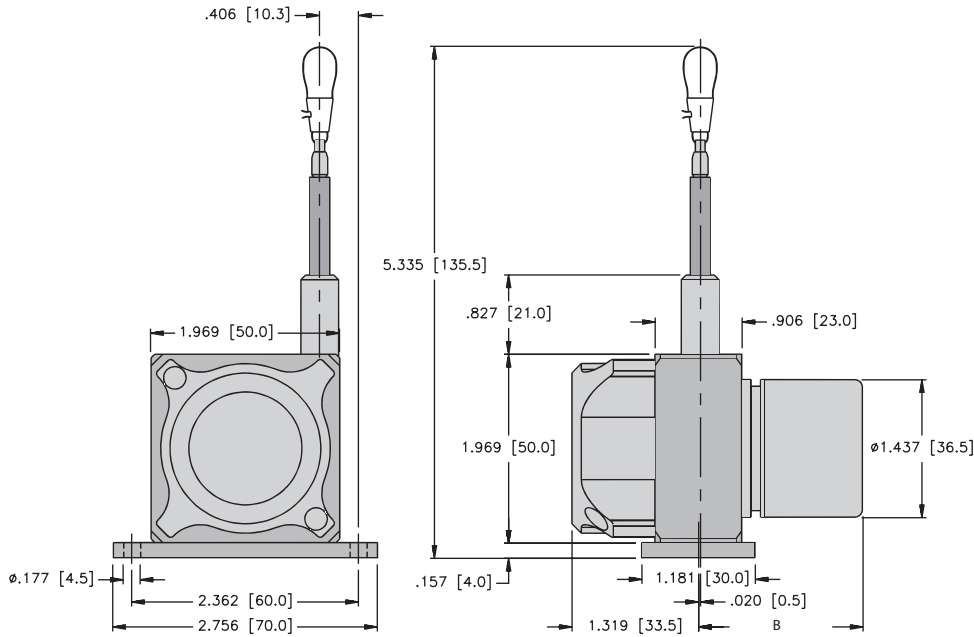
| D  | Voltage Supply and Output Type  |
|----|---------------------------------|
| 7E | 12-30 VDC, 4-20 mA              |
| 8C | 12-30 VDC, 0-10 V               |
| PA | 30 VDC max, 1 kΩ, Potentiometer |

| E     | Type of Connection                 |
|-------|------------------------------------|
| H1441 | Axial 4-pin M12 Eurofast Connector |
| CA    | Axial Cable (2 m PVC)              |



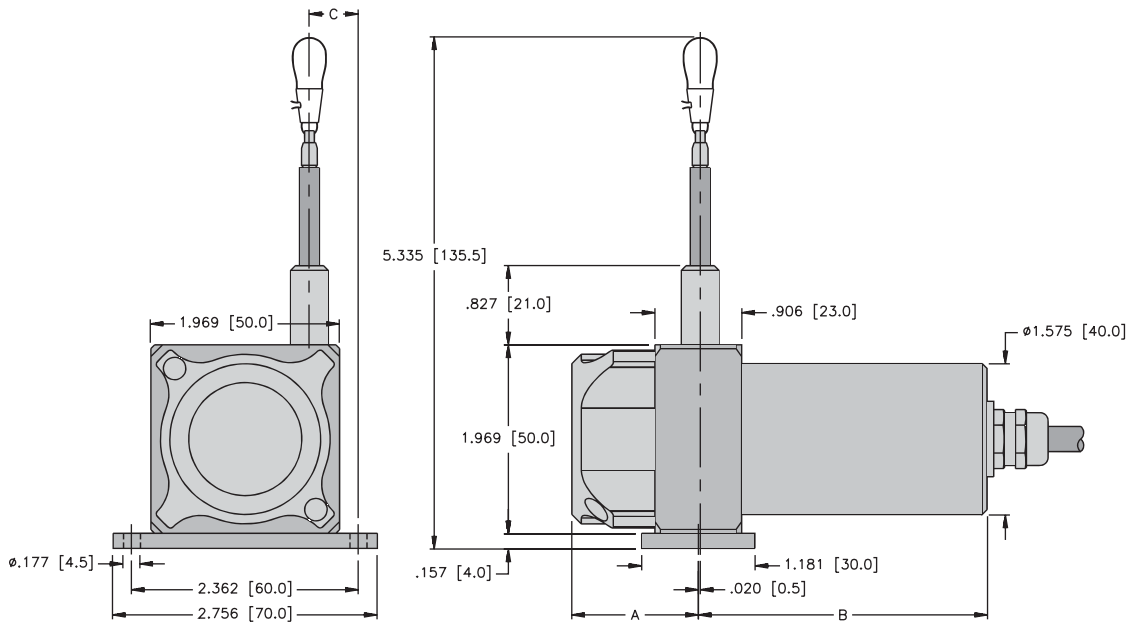
### Draw Wire Encoder DW70

#### Dimensions: DW70 with Encoder



| Encoder Type | Measuring Length | B in. [mm]   |
|--------------|------------------|--------------|
| Incremental  | 250-1250 mm      | 1.693 [43]   |
| Absolute     | 250-1250 mm      | 2.114 [53.7] |

#### Dimensions: DW70 with Analog Sensor



| Sensor Type       | Measuring Length | A in. [mm]   | B in. [mm]   | C in. [mm]   |
|-------------------|------------------|--------------|--------------|--------------|
| Potentiometer     | 250 mm           | 1.043 [26.5] | 2.559 [65]   | 0.840 [21.3] |
|                   | 500 mm           | 1.043 [26.5] | 2.559 [65]   | 0.840 [21.3] |
|                   | 1,250 mm         | 1.319 [33.5] | 2.559 [65]   | 0.406 [10.3] |
| 0-10 V<br>4-20 mA | 250 mm           | 1.043 [26.5] | 3.091 [78.5] | 0.840 [21.3] |
|                   | 500 mm           | 1.043 [26.5] | 3.091 [78.5] | 0.840 [21.3] |
|                   | 1,250 mm         | 1.319 [33.5] | 3.091 [78.5] | 0.406 [10.3] |

# Linear Position Technology

## Draw Wire Mechanics with Encoder or Analog Sensor

### Draw Wire Encoder DW110



Wide temperature range



Shock/vibration resistant



Reverse polarity protection



#### Robust

- **Corrosion resistant:** Titanium-anodized aluminium housing.
- **High-strength stainless steel draw wire.**
- **Low friction design or wire exit free from wear.** Diamond-polished ceramic guide.
- **Wide temperature range of** -40 to +194 °F (-40 to +90 °C).

#### Fast

- **High traverse speed.**
- **High acceleration:** Dynamic spring traction by means of a constant force spring.

#### Versatile

- **Suitable for various sensors/encoders:** Absolute, fieldbus, incremental and analog.
- **Quick mounting:** Fastening by means of two screws.
- **Flexible connection options:** Cable, connector, radial, axial.
- **Linearity up to 0.05%.**

#### Mechanical Characteristics (Draw Wire Mechanics):

| Measuring range:               | 1000 mm  | 2000 mm                      | 3000 mm                      |       |
|--------------------------------|--|------------------------------|------------------------------|-------|
| Extension force                | Fmin: (6.9 N) 1.55 lbs                               | (6.4 N) 1.44 lbs             | (6.9 N) 1.55 lbs             |       |
|                                | Fmax: (8.3 N) 1.87 lbs                               | (7.8 N) 1.75 lbs             | (9.8 N) 2.20 lbs             |       |
| Max. speed:                    | 32.8 ft/s (10 m/s)                                   | 32.8 ft/s (10 m/s)           | 32.8 ft/s (10 m/s)           |       |
| Max. acceleration:             | 14 g (140 m/s <sup>2</sup> )                         | 14 g (140 m/s <sup>2</sup> ) | 14 g (140 m/s <sup>2</sup> ) |       |
| Linearity (of measuring range) |  |                              |                              |       |
|                                | analog output:                                       | 0.15%                        | 0.1%                         | 0.1%  |
|                                | encoder:   | 0.05%                        | 0.05%                        | 0.05% |
| Weight:                        | approx. 750 g (depending on the sensor/encoder used) |                              |                              |       |
| Materials:                     | housing: titanium-anodized aluminium                 |                              |                              |       |
|                                | wire: stainless steel Ø 0.5 mm                       |                              |                              |       |
| Protection (encoder only):     | IP65   |                              |                              |       |

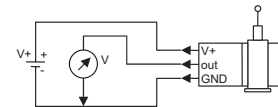
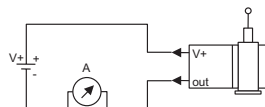
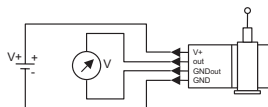
#### Electrical Characteristics (Digital Output):

The electrical characteristics of the draw wire encoder assembly may be found in the data sheets of the encoder selected.

#### Electrical Characteristics (Analog Output):

| Analog output [Key Code]:    | 0-10 V [8C]                                | 4-20 mA [7E]                  | Potentiometer [PA]            |
|------------------------------|--|-------------------------------|-------------------------------|
| Output:                      | 0-10 V galvanically isolated, 4 conductors | 4-20 mA, 2 conductors         | 1 kOhm                        |
| Supply voltage:              | 12-30 VDC                                  | 12-30 VDC                     | max. 30 VDC                   |
| Recommended slider current:  | -  | -                             | < 1 µA                        |
| Max. current consumption:    | 22.5 mA (no load)                          | 50 mA                         | -                             |
| Reverse polarity protection: | yes  | yes                           | -                             |
| Operating temperature:       | -4 to +140 °F (-20 to +60 °C)              | -4 to +140 °F (-20 to +60 °C) | -4 to +185 °F (-20 to +85 °C) |

Connection diagrams:



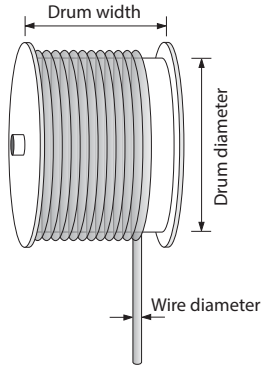
ROHS compliant according to: EU guideline 2011/65/EU

# Linear Position Technology

## Draw Wire Mechanics with Encoder or Analog Sensor

### Draw Wire Encoder DW110

**Operating Principle:**



**Construction:**

The core of a draw wire device is a drum mounted on bearings, onto which a wire is wound. Winding takes place via a spring-loaded device.

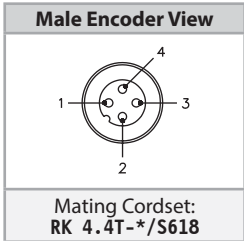
**Note:**

Exceeding the maximum extension length of the draw wire will lead to damage to the wire and the mechanics.

**Standard Wiring:**

| Pin | Color | 0-10 V   | 4-20 mA | 10 kOhm |
|-----|-------|----------|---------|---------|
| 1   | BN    | V+       | V+      | V+      |
| 2   | WH    | Signal   | N/C     | Slider  |
| 3   | BU    | GND      | Signal  | GND     |
| 4   | BK    | GND Sig. | N/C     | N/C     |

**Wiring Diagram:**



Mating Cordset:  
RK 4.4T-\*/S618

\* Length in meters.

Linear Position Technology

# Linear Position Technology

## Draw Wire Mechanics with Encoder or Analog Sensor

### Draw Wire Encoder DW110

#### Part Number Key: DW110 with Encoder

| A  | B    |   | C   |   | D  |   | E  | F    |   | G     |   | H        |
|----|------|---|-----|---|----|---|----|------|---|-------|---|----------|
| DW | 1000 | - | 110 | - | 10 | - | 2B | 1024 | - | H1181 | / | Specials |

| A  | Type      |
|----|-----------|
| DW | Draw Wire |

| B    | Measuring Range*   |
|------|--------------------|
| 1000 | 1000 mm Steel Wire |
| 2000 | 2000 mm Steel Wire |
| 3000 | 3000 mm Steel Wire |

\*Other Measuring Ranges Available on Request

| C   | Housing |
|-----|---------|
| 110 | 80 mm   |

| D  | Encoder Type                  |
|----|-------------------------------|
| 10 | RI-10, Incremental            |
| 28 | RM-28, SSI                    |
| 29 | RM-29, CANopen or PROFIBUS-DP |

| E | Voltage Supply and Output Type              |
|---|---|
|   | Dependant on Encoder Selected <sup>1)</sup> |

| F | Pulse Rate/Resolution                       |
|---|---|
|   | Dependant on Encoder Selected <sup>1)</sup> |

| G | Type of Connection                          |
|---|---|
|   | Dependant on Encoder Selected <sup>1)</sup> |

| H | Specials                                    |
|---|---|
|   | Dependant on Encoder Selected <sup>1)</sup> |

<sup>1)</sup> Recommended encodes listed below

#### Standard resolutions for draw wire with incremental encoder RI-10, drum circumference 200 mm

|                      |         |          |         |
|----------------------|---------|----------|---------|
| Encoder PPR          | 200     | 2000     | 5000    |
| PQ* pulse/revolution | 800     | 8000     | 20,000  |
| Pulses/mm            | 4       | 40       | 100     |
| Resolution           | 0.25 mm | 0.025 mm | 0.01 mm |

\*PQ = Post Quadrature

#### Standard resolutions for draw wire with absolute encoder RM-28 or RM-29, drum circumference 200 mm

|                   |              |  |
|-------------------|--------------|--|
| Absolute encoder  | RM-28        | RM-29                                  |
| Pulses/revolution | 2048/11 bits | 4096, programmable via the bus/12 bits |
| Pulses/mm         | 10.24        | 20.48                                  |
| Resolution        | ~0.1 mm      | ~0.05 mm                               |

#### Example part number key: Standard device with incremental encoder, RI-10

#### DW\*\*\*\*-110-10-2B2000-H1481

The standard device is supplied mounted. The mounted encoder is the incremental **RI-10** encoder, connector axial 8-pin M12 Eurofast, push-pull with inverted signals, supply voltage 10-30 VDC (RI-10T10C-2B2000-H1481)

#### Example part number key: Standard device with absolute encoder, RM-28 or RM-29

#### DW\*\*\*\*-110-28-3C23B-12M23

Absolute **RM-28** encoder with SSI interface (gray code), 2048 pulses/rev., set key, 10-30 VDC, radial 12-pin M23 Multifast connector (RM-28T10C-3C23B-12M23)

#### DW\*\*\*\*-110-29-9D28B-R2M12

Absolute **RM-29** encoder with CANopen interface, 4096 pulses/rev. programmable via the bus, set key, 10-30 VDC, M12 Eurofast connector (RM-29T10C-9D28B-R2M12)

#### DW\*\*\*\*-110-29-9A28B-R3M12

Absolute **RM-29** encoder with PROFIBUS connection, 4096 pulses/rev. programmable via the bus, set key, 10-30 VDC, M12 Eurofast connector (RM-29T10C-9A28B-R3M12)

#### Accessories:

- See page H1, Connectivity, for cables and connectors

### Draw Wire Encoder DW110

#### Part Number Key: DW110 with Analog Sensor

| A  | B    |   | C   |   | D  |   | E     |
|----|------|---|-----|---|----|---|-------|
| DW | 1000 | - | 110 | - | 7E | - | H1441 |

| A  | Type      |
|----|-----------|
| DW | Draw Wire |

| B    | Measuring Range*   |
|------|--------------------|
| 1000 | 1000 mm Steel Wire |
| 2000 | 2000 mm Steel Wire |
| 3000 | 3000 mm Steel Wire |

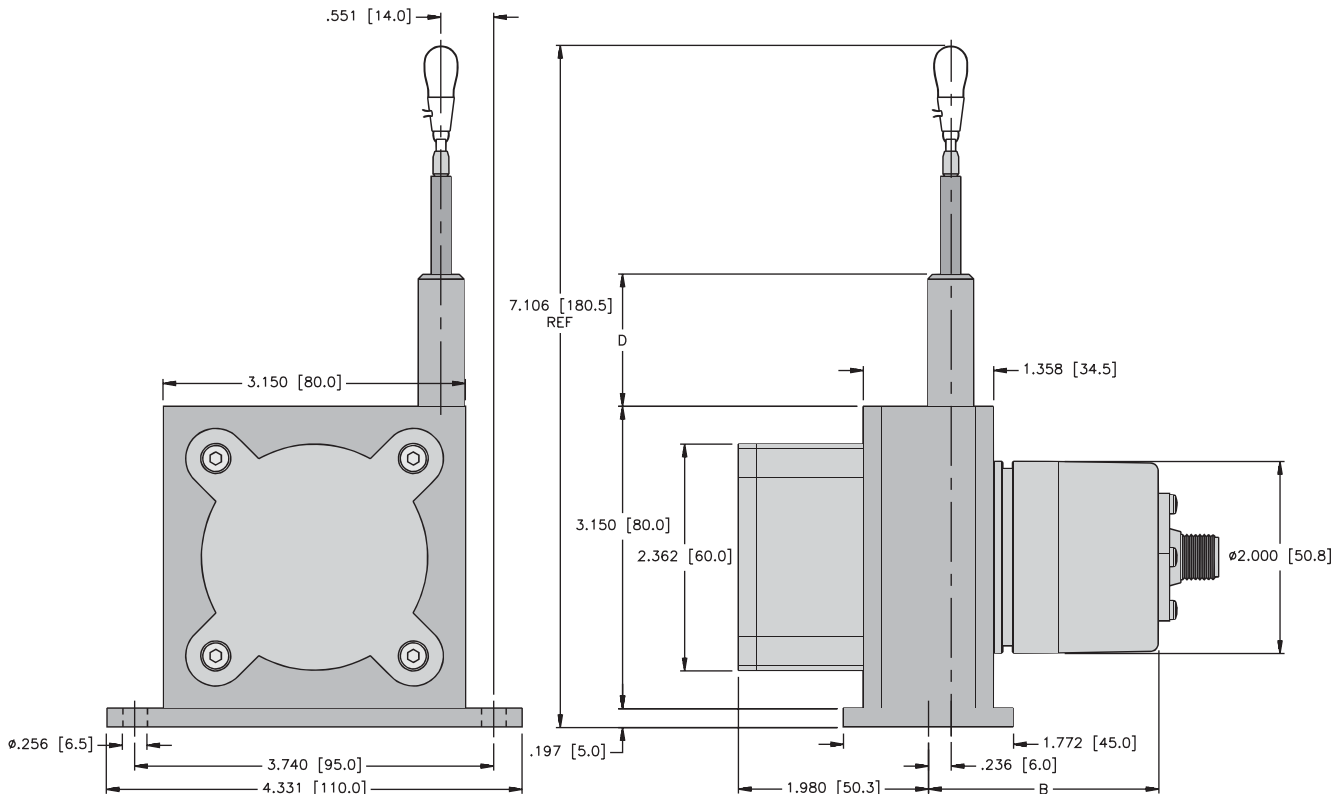
\*Other Measuring Ranges Available on Request

| C   | Housing |
|-----|---------|
| 110 | 80 mm   |

| D  | Voltage Supply and Output Type  |
|----|---------------------------------|
| 7E | 12-30 VDC, 4-20 mA              |
| 8C | 12-30 VDC, 0-10 V               |
| PA | 30 VDC max, 1 kΩ, Potentiometer |

| E     | Type of Connection                 |
|-------|------------------------------------|
| H1441 | Axial 4-pin M12 Eurofast Connector |
| CA    | Axial Cable (2 m PVC)              |

#### Dimensions: DW110 with Encoder



#### Dimension B depends on the encoder used

| Measuring Range | D in. [mm] |
|-----------------|------------|
| 1,000 mm        | 0.827 [21] |
| 2,000 mm        | 1.378 [35] |
| 3,000 mm        | 1.378 [35] |

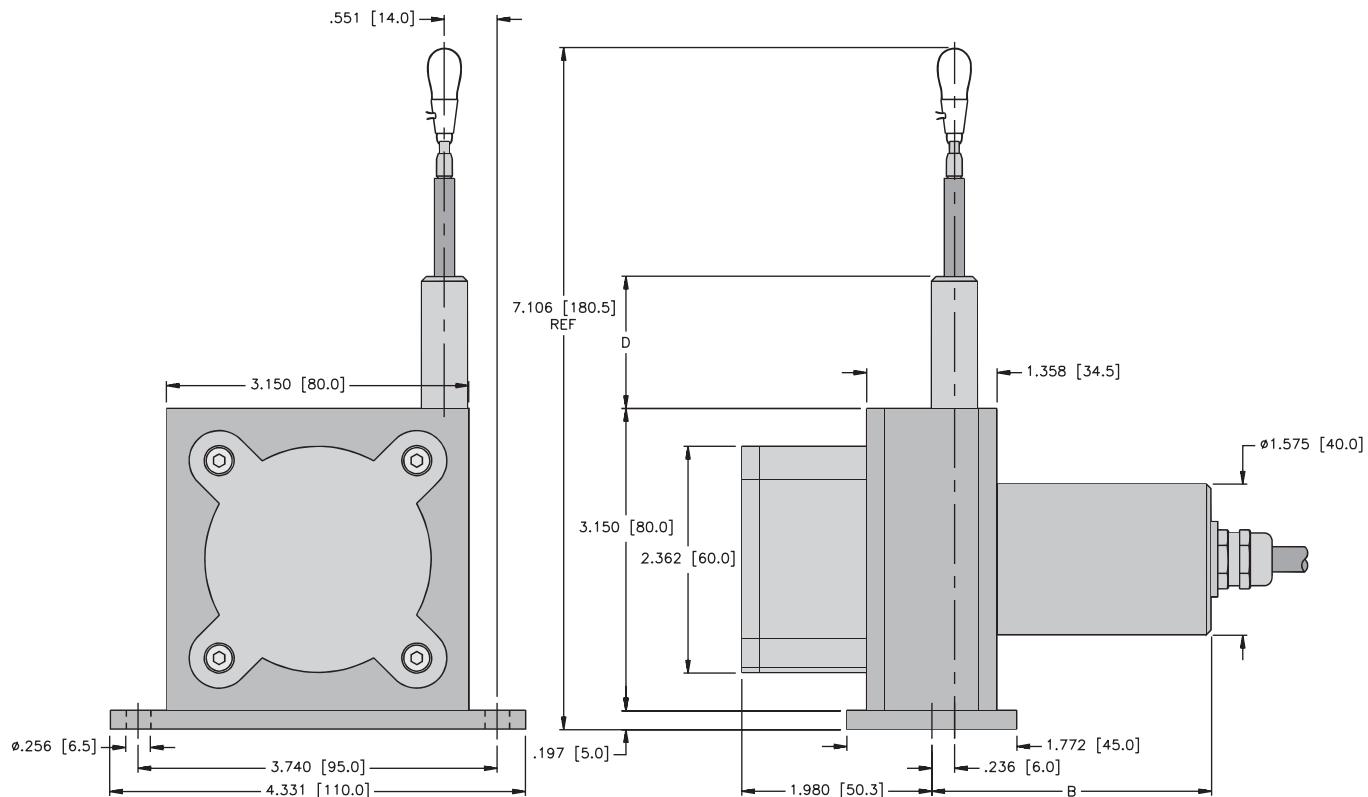
| Encoder  | B in. [mm]    |
|--|---------------|
| Incremental (RI-10)<br>DW***-110-10-*****_**** | 2.136 [54.25] |
| Absolute (RM-28)<br>DW***-110-28-*****_****    | 2.628 [66.75] |
| Absolute (RM-29)<br>DW***-110-29-*****_****    | 3.671 [93.25] |

# Linear Position Technology

## Draw Wire Mechanics with Encoder or Analog Sensor

### Draw Wire Encoder DW110

#### Dimensions: DW110 with Analog Sensor



| Sensor Type       | Measuring Length | B<br>in. [mm]  | C<br>in. [mm] |
|-------------------|------------------|----------------|---------------|
| Potentiometer     | 1,000 mm         | 2.913 [74]     | 0.827 [21]    |
|                   | 2,000 mm         | 2.913 [74]     | 0.827 [21]    |
|                   | 3,000 mm         | 4.026 [102.25] | 1.378 [35]    |
| 0-10 V<br>4-20 mA | 1,000 mm         | 3.445 [87.5]   | 0.827 [21]    |
|                   | 2,000 mm         | 3.445 [87.5]   | 0.827 [21]    |
|                   | 3,000 mm         | 4.026 [102.25] | 1.378 [35]    |

### Draw Wire Encoder Accessories

**Part Number:**  
RA-DW-SEC-2M

**Description:**  
2 m steel wire extension

**Part Number:**  
RA-DW-SEC-5M

**Description:**  
5 m steel wire extension

**Part Number:**  
RA-DW-PEC-2M

**Description:**  
2 m para wire extension

**Part Number:**  
RA-DW-SEC-10M

**Description:**  
10 m steel wire extension



**Part Number:**  
RDR-1

**Description:**  
Guide pulley



**Accessories:**

- See page H1, Connectivity, for cables and connectors

### Draw Wire Encoder DW155



Wide temperature range



Shock/vibration resistant



Reverse polarity protection



#### Robust

- **Corrosion resistant:** Titanium-anodized aluminium housing.
- **High-strength stainless steel draw wire.**
- **Low friction design or wire exit free from wear.** Diamond-polished ceramic guide.
- **Wide temperature range**

#### Fast

- **High traverse speed.**
- **High acceleration:** Dynamic spring traction by means of a constant force spring.

#### Versatile

- **Suitable for various sensors/encoders:** Absolute, fieldbus, incremental and analog.
- **Quick mounting:** Fastening by means of two screws.
- **Flexible connection options:** Cable, connector, radial, axial.
- **Linearity up to 0.05%.**

Linear Position Technology

#### Mechanical Characteristics (Draw Wire Mechanics):

|                            |  |                   |
|----------------------------|--|-------------------|
| Measuring range:           | 6,000 mm (6 meter)   |                   |
| Extension force            | Fmin:  | 1.98 (8.8 N)      |
|                            | Fmax:  | 2.77 lbs (12.3 N) |
| Max. speed:                | 32.8 ft/s (10 m/s)   |                   |
| Max. acceleration:         | 14 g (140 m/s <sup>2</sup> )                                     |                   |
| Linearity:                 | analog output: 0.1% (of the measuring range)                     |                   |
|                            | encoder: 0.05% (of the measuring range)                          |                   |
| Weight:                    | approx. 3.5 lbs (1,600 g) (depending on the sensor/encoder used) |                   |
| Materials:                 | housing: titanium-anodized aluminium                             |                   |
|                            | wire: stainless steel Ø 0.5 mm                                   |                   |
| Protection (encoder only): | IP65   |                   |

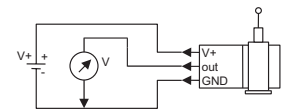
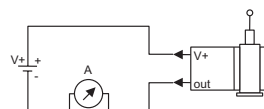
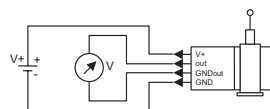
#### Electrical Characteristics (Digital Output):

The electrical characteristics of the draw wire encoder assembly may be found in the data sheets of the encoder selected.

#### Electrical Characteristics (Analog Output):

|                              |  |                               |                               |
|------------------------------|--|-------------------------------|-------------------------------|
| Analog output [Key Code]:    | 0-10 V [8C]                                | 4-20 mA [7E]                  | Potentiometer [PA]            |
| Output:                      | 0-10 V galvanically isolated, 4 conductors | 4-20 mA, 2 conductors         | 1 kOhm                        |
| Supply voltage:              | 12-30 VDC                                  | 12-30 VDC                     | max. 30 VDC                   |
| Recommended slider current:  | -  | -                             | < 1 µA                        |
| Max. current consumption:    | 22.5 mA (no load)                          | 50 mA                         | -                             |
| Reverse polarity protection: | yes  | yes                           | -                             |
| Operating temperature:       | -4 to +140 °F (-20 to +60 °C)              | -4 to +140 °F (-20 to +60 °C) | -4 to +185 °F (-20 to +85 °C) |

Connection diagrams:



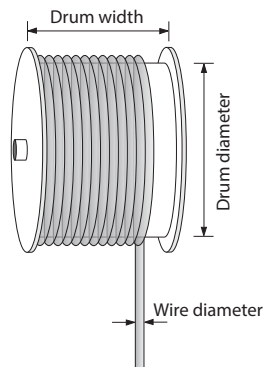
ROHS compliant according to: EU guideline 2011/65/EU

# Linear Position Technology

## Draw Wire Mechanics with Encoder or Analog Sensor

### Draw Wire Encoder DW155

#### Operating Principle:



#### Construction:

The core of a draw wire device is a drum mounted on bearings, onto which a wire is wound. Winding takes place via a spring-loaded device.

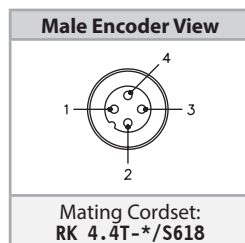
#### Note:

Exceeding the maximum extension length of the draw wire will lead to damage to the wire and the mechanics.

#### Standard Wiring:

| Pin | Color | 0-10 V   | 4-20 mA | 10 kOhm |
|-----|-------|----------|---------|---------|
| 1   | BN    | V+       | V+      | V+      |
| 2   | WH    | Signal   | N/C     | Slider  |
| 3   | BU    | GND      | Signal  | GND     |
| 4   | BK    | GND Sig. | N/C     | N/C     |

#### Wiring Diagram:



\* Length in meters.



### Draw Wire Encoder DW155

#### Part Number Key: DW155 with Encoder

| A  | B    |   | C   |   | D  |   | E  | F    |   | G     |   | H        |
|----|------|---|-----|---|----|---|----|------|---|-------|---|----------|
| DW | 6000 | - | 155 | - | 10 | - | 2B | 1024 | - | H1181 | / | Specials |

| A  | Type      |
|----|-----------|
| DW | Draw Wire |

| E | Voltage Supply and Output Type |
|---|--------------------------------|
|   | Dependant on Encoder Selected* |

| B    | Measuring Range    |
|------|--------------------|
| 6000 | 6000 mm Steel Wire |

| F | Pulse Rate/Resolution          |
|---|--------------------------------|
|   | Dependant on Encoder Selected* |

| C   | Housing |
|-----|---------|
| 155 | 120 mm  |

| G | Type of Connection             |
|---|--------------------------------|
|   | Dependant on Encoder Selected* |

| D  | Encoder Type                  |
|----|-------------------------------|
| 10 | RI-10, Incremental            |
| 28 | RM-28, SSI                    |
| 29 | RM-29, CANopen or PROFIBUS-DP |

| H | Specials                       |
|---|--------------------------------|
|   | Dependant on Encoder Selected* |

\*Recommended encodes listed below

#### Standard resolutions for draw wire with incremental encoder RI-10, drum circumference 317.68 mm

|                       |          |          |
|-----------------------|----------|----------|
| Encoder PPR           | 500      | 2000     |
| PQ* pulses/revolution | 2000     | 8000     |
| Pulses/mm             | 6.3      | 25.2     |
| Resolution            | ~0.16 mm | ~0.04 mm |

PQ\* = Post Quadrature

#### Standard resolutions for draw wire with absolute encoder RM-28 or RM-29, drum circumference 317.68 mm

|                   |              |   |
|-------------------|--------------|---|
| Absolute encoder  | RM-28        | RM-29                                   |
| Pulses/revolution | 2048/11 bits | 4096, programmable via the bus/ 12 bits |
| Pulses/mm         | 6.4          | 12.9                                    |
| Resolution        | ~0.16 mm     | ~0.08 mm                                |

#### Example part number key: Standard device with incremental encoder, RI-10

#### DW6000-155-10-2B2000-H1481

The standard device is supplied mounted. The mounted encoder is the incremental **RI-10** encoder, connector axial 8 pin M12, push-pull with inverted signals, supply voltage 10-30 VDC (RI-10T10C-2B2000-H1481)

#### Example part number key: Standard device with absolute encoder, RM-28 or RM-29

#### DW6000-155-28-3C23B-12M23

Absolute **RM-28** encoder with SSI interface (Gray code), 2048 pulses/rev., set key, 10-30 VDC, radial 12 pole M23 connector (RM-28T10C-3C23B-12M23)

#### DW6000-155-29-9D28B-R2M12

Absolute **RM-29** encoder with CANopen interface, 4096 pulses/rev. programmable via the bus, set key, 10-30 VDC, M12 connector (RM-29T10C-9D28B-R2M12)

#### DW6000-155-29-9A28B-R3M12

Absolute **RM-29** encoder with PROFIBUS connection, 4096 pulses/rev. programmable via the bus, set key, 10-30 VDC, M12 connector (RM-29T10C-9A28B-R3M12)

#### Accessories:

- See page H1, Connectivity, for cables and connectors

# Linear Position Technology

## Draw Wire Mechanics with Encoder or Analog Sensor

### Draw Wire Encoder DW155

Part Number Key: DW155 with Analog Sensor

| A  | B    |   | C   |   | D  |   | E     |
|----|------|---|-----|---|----|---|-------|
| DW | 6000 | - | 155 | - | 7E | - | H1441 |

| A  | Type      |
|----|-----------|
| DW | Draw Wire |

| B    | Measuring Range    |
|------|--------------------|
| 6000 | 6000 mm Steel Wire |

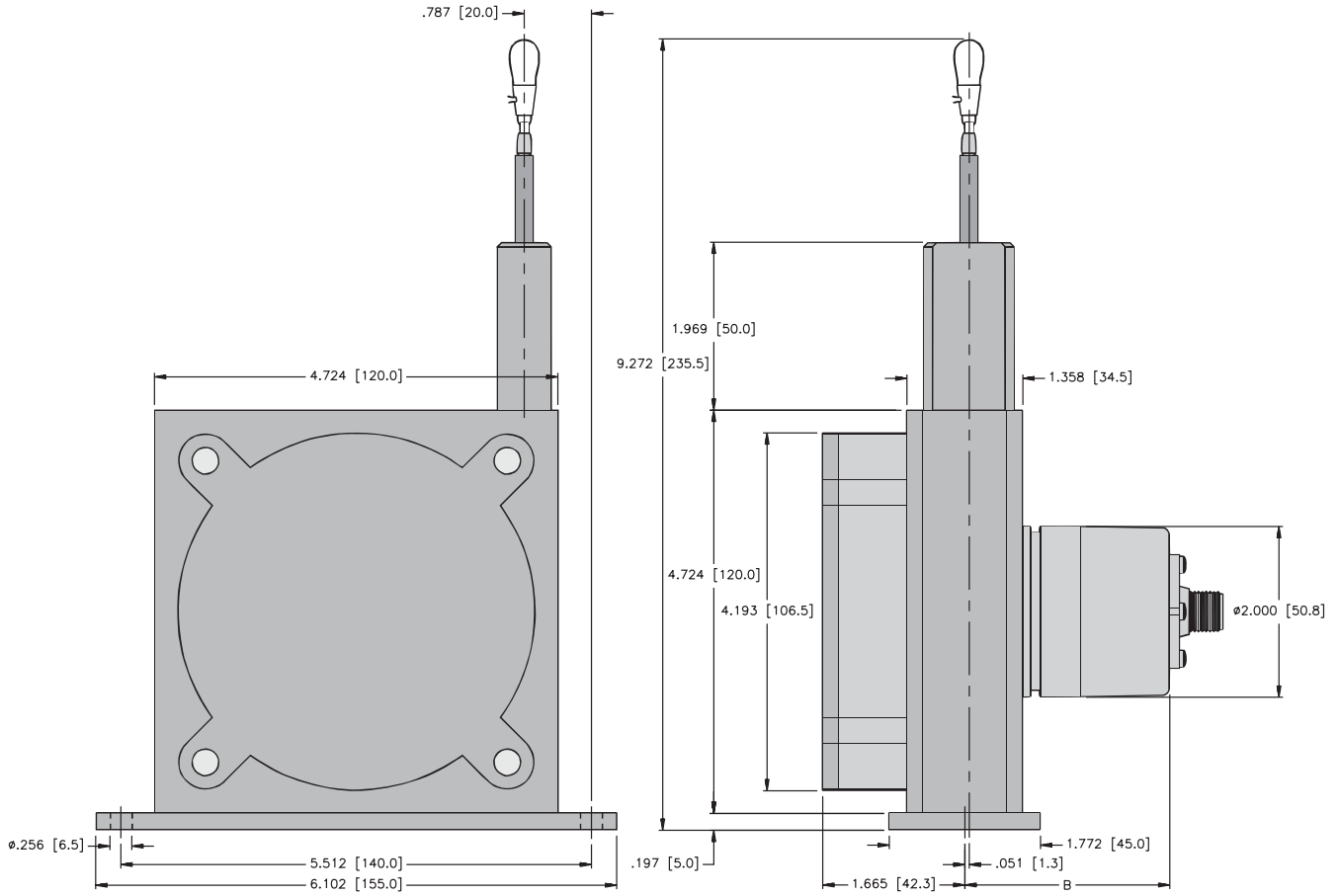
| C   | Housing |
|-----|---------|
| 155 | 120 mm  |

| D  | Voltage Supply and Output Type  |
|----|---------------------------------|
| 7E | 12-30 VDC, 4-20 mA              |
| 8C | 12-30 VDC, 0-10 V               |
| PA | 30 VDC max, 1 kΩ, Potentiometer |

| E     | Type of Connection                 |
|-------|------------------------------------|
| H1441 | Axial 4-pin M12 Eurofast Connector |
| CA    | Axial Cable (2 m PVC)              |

**Draw Wire Encoder DW155**

Dimensions: DW155 with Encoder



Dimension B depends on the encoder used

| Encoder  | B in. [mm]    |
|--|---------------|
| Incremental (RI-10)<br>DW****-155-10-*****_***** | 2.136 [54.25] |
| Absolute (RM-28)<br>DW****-155-28-*****_*****    | 2.628 [66.75] |
| Absolute (RM-29)<br>DW****-155-29-*****_*****    | 3.671 [93.25] |

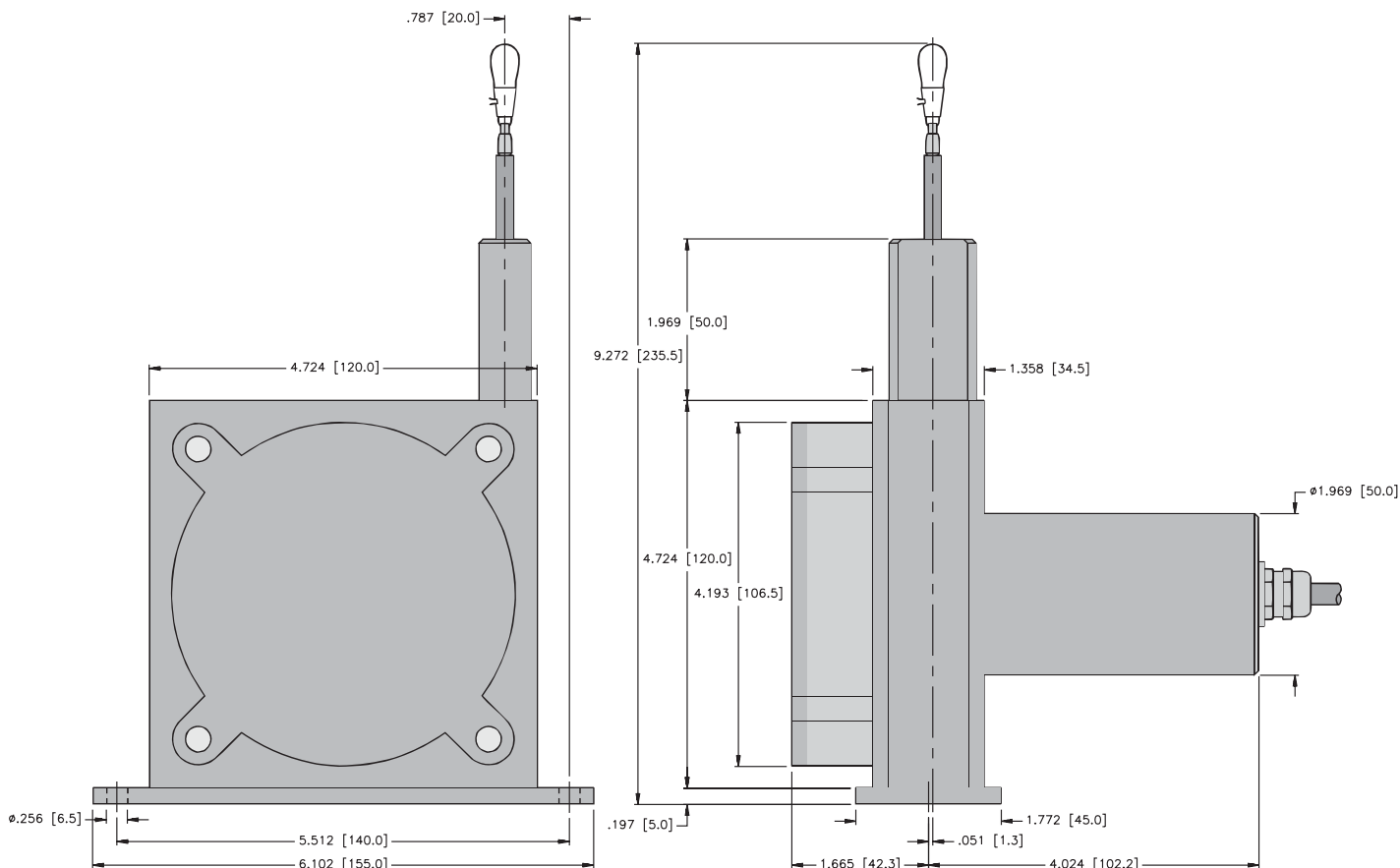
Linear Position Technology

# Linear Position Technology

## Draw Wire Mechanics with Encoder or Analog Sensor

### Draw Wire Encoder DW155

Dimensions: DW155 with Analog Sensor



### Draw Wire Encoder Accessories

**Part Number:**  
RA-DW-SEC-2M

**Description:**  
2 m steel wire extension

**Part Number:**  
RA-DW-SEC-5M

**Description:**  
5 m steel wire extension

**Part Number:**  
RA-DW-PEC-2M

**Description:**  
2 m para wire extension

**Part Number:**  
RA-DW-SEC-10M

**Description:**  
10 m steel wire extension



**Part Number:**  
RDR-1

**Description:**  
Guide pulley



**Accessories:**

- See page H1, Connectivity, for cables and connectors

### Draw Wire Encoder DW135



Wide temperature range



Shock/vibration resistant



Reverse polarity protection



#### Robust

- **Corrosion resistant:** Titanium-anodized aluminium housing.
- **High-strength stainless steel draw wire.**
- **Low friction design or wire exit free from wear:** Diamond-polished ceramic guide.
- **Wide temperature range.**

#### Dynamic

- **High traverse speed.**
- **High acceleration:** Dynamic spring traction by means of a constant force spring.

#### Versatile

- **Suitable for various sensors/encoders:** Absolute, fieldbus, incremental and analog.
- **Quick mounting:** Fastening by means of mounting feet.
- **Flexible connection options:** Cable, connector, radial, axial.
- **Linearity up to 0.05%.**

Linear Position Technology

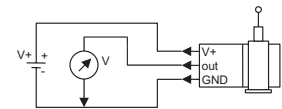
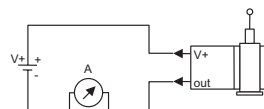
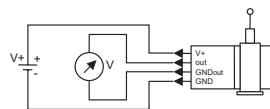
#### Mechanical Characteristics (Draw Wire Mechanics):

|                            |   |                            |                            |                            |                            |
|----------------------------|---|----------------------------|----------------------------|----------------------------|----------------------------|
| Measuring range:           | 8,000 mm  | 10,000/15,000 mm           | 20,000 mm                  | 25,000/30,000 mm           | 35,000/40,000 mm           |
| Extension force            | Fmin:   | 1.62 lbs (7.2 N)           | 1.96 lbs (8.7 N)           | 1.57 lbs (7.0 N)           | 1.64 lbs (7.3 N)           |
|                            | Fmax:   | 3.60 lbs (16.0 N)          | 3.80 lbs (16.9 N)          | 2.79 lbs (12.4 N)          | 3.53 lbs (15.7 N)          |
| Max. speed:                | 32.8 ft/s (10 m/s)  | 19.7 ft/s (6 m/s)          | 16.4 ft/s (5 m/s)          | 16.4 ft/s (5 m/s)          | 16.4 ft/s (5 m/s)          |
| Max. acceleration:         | 14 g (140 m/s <sup>2</sup> )  | 8 g (80 m/s <sup>2</sup> ) | 6 g (60 m/s <sup>2</sup> ) | 6 g (60 m/s <sup>2</sup> ) | 6 g (60 m/s <sup>2</sup> ) |
| Linearity:                 | analog output: 0.1% (of the measuring range)<br>encoder: 0.05% (of the measuring range) |                            |                            |                            |                            |
| Weight:                    | approx. 1.65 lbs (750 g) (depending on the sensor/encoder used)                         |                            |                            |                            |                            |
| Materials:                 | housing: titanium-anodized aluminium<br>wire: stainless steel Ø 0.5 mm                  |                            |                            |                            |                            |
| Protection (encoder only): | IP65  |                            |                            |                            |                            |

#### Electrical Characteristics (Analog Output):

|                              |  |                               |                               |
|------------------------------|--|-------------------------------|-------------------------------|
| Analog output [Key Code]:    | 0-10 V [8C]                                | 4-20 mA [7E]                  | Potentiometer [PA]            |
| Output:                      | 0-10 V galvanically isolated, 4 conductors | 4-20 mA, 2 conductors         | 1 kOhm                        |
| Supply voltage:              | 12-30 VDC                                  | 12-30 VDC                     | max. 30 VDC                   |
| Recommended slider current:  | -  | -                             | < 1 µA                        |
| Max. current consumption:    | 22.5 mA (no load)                          | 50 mA                         | -                             |
| Reverse polarity protection: | yes  | yes                           | -                             |
| Operating temperature:       | -4 to +140 °F (-20 to +60 °C)              | -4 to +140 °F (-20 to +60 °C) | -4 to +185 °F (-20 to +85 °C) |

Connection diagrams:



ROHS compliant according to: EU guideline 2011/65/EU

# Linear Position Technology

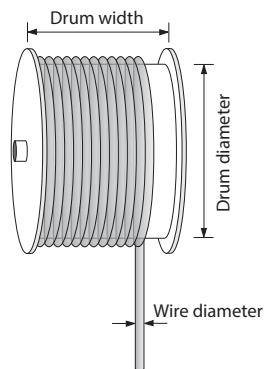
## Draw Wire Mechanics with Encoder or Analog Sensor

### Draw Wire Encoder DW135

#### Electrical Characteristics (Digital Output):

The electrical characteristics of the draw wire encoder assembly may be found in the data sheets of the encoder selected.

#### Operating Principle:



#### Construction:

The core of a draw wire device is a drum mounted on bearings, onto which a wire is wound. Winding takes place via a spring-loaded device.

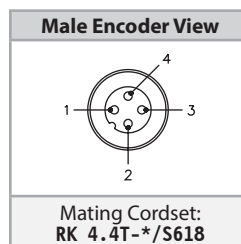
#### Note:

Exceeding the maximum extension length of the draw wire will lead to damage to the wire and the mechanics.

#### Standard Wiring:

| Pin | Color | 0-10 V   | 4-20 mA | 10 kOhm |
|-----|-------|----------|---------|---------|
| 1   | BN    | V+       | V+      | V+      |
| 2   | WH    | Signal   | N/C     | Slider  |
| 3   | BU    | GND      | Signal  | GND     |
| 4   | BK    | GND Sig. | N/C     | N/C     |

#### Wiring Diagram:



\* Length in meters.

### Draw Wire Encoder DW135

#### Part Number Key: DW135 with Encoder

| A  | B    |   | C   |   | D  |   | E  | F    |   | G     |   | H        |
|----|------|---|-----|---|----|---|----|------|---|-------|---|----------|
| DW | 8000 | - | 135 | - | 10 | - | 2B | 1024 | - | H1181 | / | Specials |

| A  | Type      |
|----|-----------|
| DW | Draw Wire |

| B     | Measuring Range*    |
|-------|---------------------|
| 8000  | 8000 mm Steel Wire  |
| 10000 | 10000 mm Steel Wire |
| 15000 | 15000 mm Steel Wire |
| 20000 | 20000 mm Steel Wire |
| 25000 | 25000 mm Steel Wire |
| 30000 | 30000 mm Steel Wire |
| 35000 | 35000 mm Steel Wire |
| 40000 | 40000 mm Steel Wire |

\*Other Measuring Ranges Available on Request

| C   | Housing |
|-----|---------|
| 135 | 135 mm  |

| D  | Encoder Type                  |
|----|-------------------------------|
| 10 | RI-10, Incremental            |
| 28 | RM-28, SSI                    |
| 29 | RM-29, CANopen or PROFIBUS-DP |

| E | Voltage Supply and Output Type              |
|---|---|
|   | Dependant on Encoder Selected <sup>1)</sup> |

| F | Pulse Rate/Resolution                       |
|---|---|
|   | Dependant on Encoder Selected <sup>1)</sup> |

| G | Type of Connection                          |
|---|---|
|   | Dependant on Encoder Selected <sup>1)</sup> |

| H | Specials                                    |
|---|---|
|   | Dependant on Encoder Selected <sup>1)</sup> |

<sup>1)</sup>Recommended encodes listed below

Linear Position Technology

#### Standard resolutions for draw wire with incremental encoder RI-10, drum circumference 333.33 mm (357.14 mm for the 8,000 mm measuring range)

|                       |                |                  |
|-----------------------|----------------|------------------|
| Encoder PPR           | 500            | 2000             |
| PQ* pulses/revolution | 2000           | 8000             |
| Pulses/mm             | 6 (5.6)        | 24 (22.4)        |
| Resolution            | 0.17 (0.18) mm | 0.042 (0.045) mm |

\*PQ = Post Quadrature

#### Standard resolutions for draw wire with absolute encoder RM-28 or RM-29, drum circumference 333.33 mm (357.14 mm for the 8,000 mm measuring range)

| Absolute encoder  | RM-28           | RM-29                                   |
|-------------------|-----------------|---|
| Pulses/revolution | 2048/11 bits    | 4096, programmable via the bus/ 12 bits |
| Pulses/mm         | 6.4 (5.73)      | 12.9 (11.47)                            |
| Resolution        | ~0.16 (0.17) mm | ~0.08 (0.09) mm                         |

#### Example part number key: Standard device with incremental encoder, RI-10

**DW\*\*\*\*\*-135-10-2B2000-H1481**

The standard device is supplied mounted. The mounted encoder is the incremental **RI-10** encoder, connector axial 8-pin M12 Eurofast, push-pull with inverted signals, supply voltage 10-30 VDC (RI-10T10C-2B2000-H1481)

#### Example part number key: Standard device with absolute encoder, RM-28 or RM-29

**DW\*\*\*\*\*-135-28-3C23B-12M23**

Absolute **RM-28** encoder with SSI interface (Gray code), 2048 pulses/rev., set key, 10-30 VDC, radial 12-pin M23 Multifast connector (RM-28T10C-3C23B-12M23)

**DW\*\*\*\*\*-135-29-9D28B-R2M12**

Absolute **RM-29** encoder with CANopen interface, 4096 pulses/rev. programmable via the bus, set key, 10-30 VDC, M12 Eurofast connector (RM-29T10C-9D28B-R2M12)

**DW\*\*\*\*\*-135-29-9A28B-R3M12**

Absolute **RM-29** encoder with PROFIBUS connection, 4096 pulses/rev. programmable via the bus, set key, 10-30 VDC, M12 Eurofast connector (RM-29T10C-9A28B-R3M12)

#### Accessories:

- See page H1, Connectivity, for cables and connectors

# Linear Position Technology

## Draw Wire Mechanics with Encoder or Analog Sensor

### Draw Wire Encoder DW135

#### Part Number Key: DW135 with Analog Sensor

| A  | B    |   | C   |   | D  |   | E     |
|----|------|---|-----|---|----|---|-------|
| DW | 8000 | - | 135 | - | 7E | - | H1441 |

| A  | Type      |
|----|-----------|
| DW | Draw Wire |

| C   | Housing |
|-----|---------|
| 135 | 135 mm  |

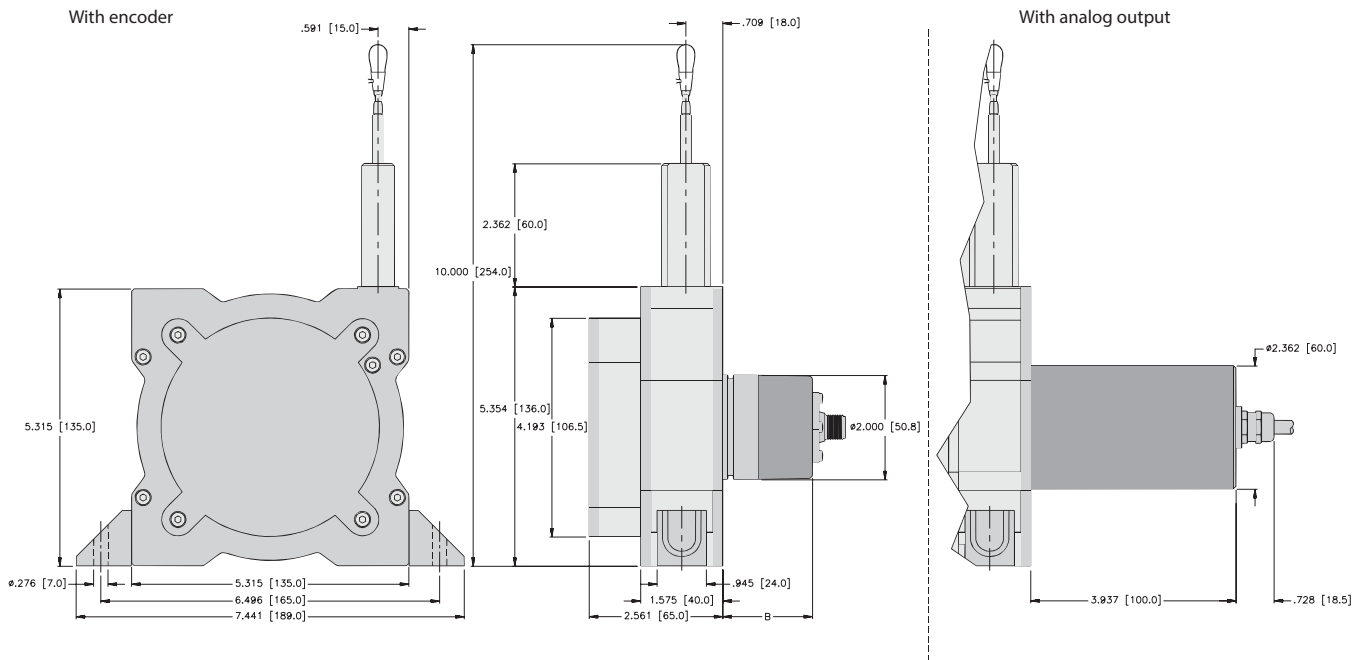
| B     | Measuring Range*    |
|-------|---------------------|
| 8000  | 8000 mm Steel Wire  |
| 10000 | 10000 mm Steel Wire |
| 15000 | 15000 mm Steel Wire |
| 20000 | 20000 mm Steel Wire |
| 25000 | 25000 mm Steel Wire |
| 30000 | 30000 mm Steel Wire |
| 35000 | 35000 mm Steel Wire |
| 40000 | 40000 mm Steel Wire |

| D  | Voltage Supply and Output Type  |
|----|---------------------------------|
| 7E | 12-30 VDC, 4-20 mA              |
| 8C | 12-30 VDC, 0-10 V               |
| PA | 30 VDC max, 1 kΩ, Potentiometer |

| E     | Type of Connection                 |
|-------|------------------------------------|
| H1441 | Axial 4-pin M12 Eurofast Connector |
| CA    | Axial Cable ( 2m PVC)              |

\*Other Measuring Ranges Available on Request

#### Dimensions: D135 with Encoder, Measuring Range 8,000 mm



#### Dimension B depends on the encoder used

| Encoder  | B in. [mm]   |
|--|--------------|
| Incremental (RI-10)<br>DW****-135-10-*****-***** | 1.457 [37.0] |
| Absolute (RM-28)<br>DW****-135-28-*****-*****    | 1.929 [49.0] |
| Absolute (RM-29)<br>DW****-135-29-*****-*****    | 2.992 [76.0] |

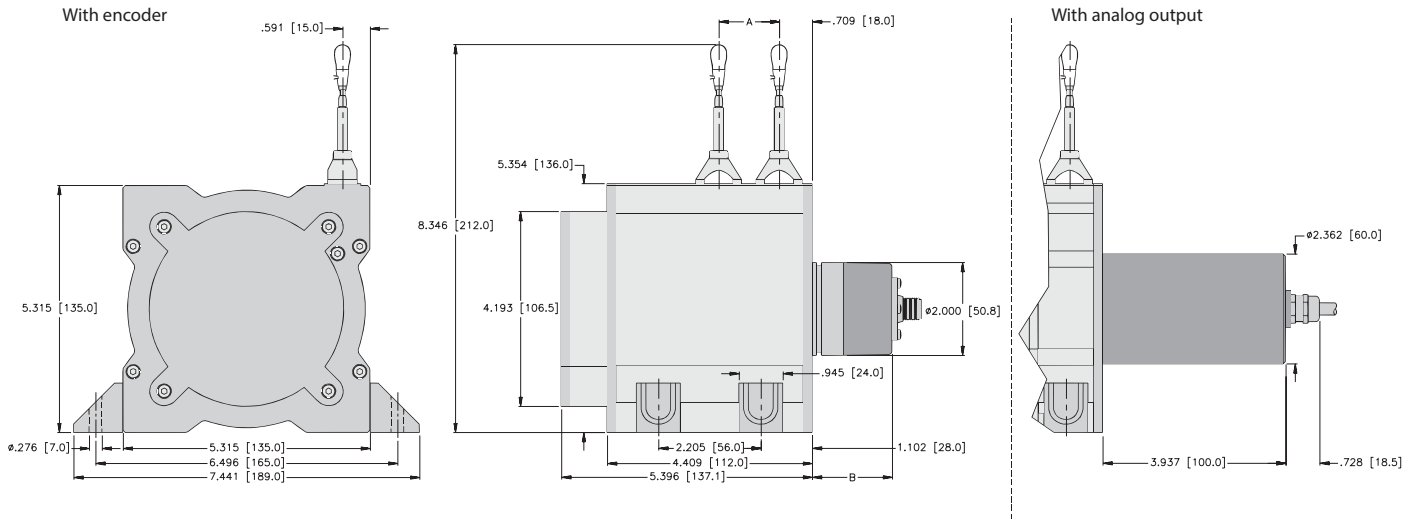


# Linear Position Technology

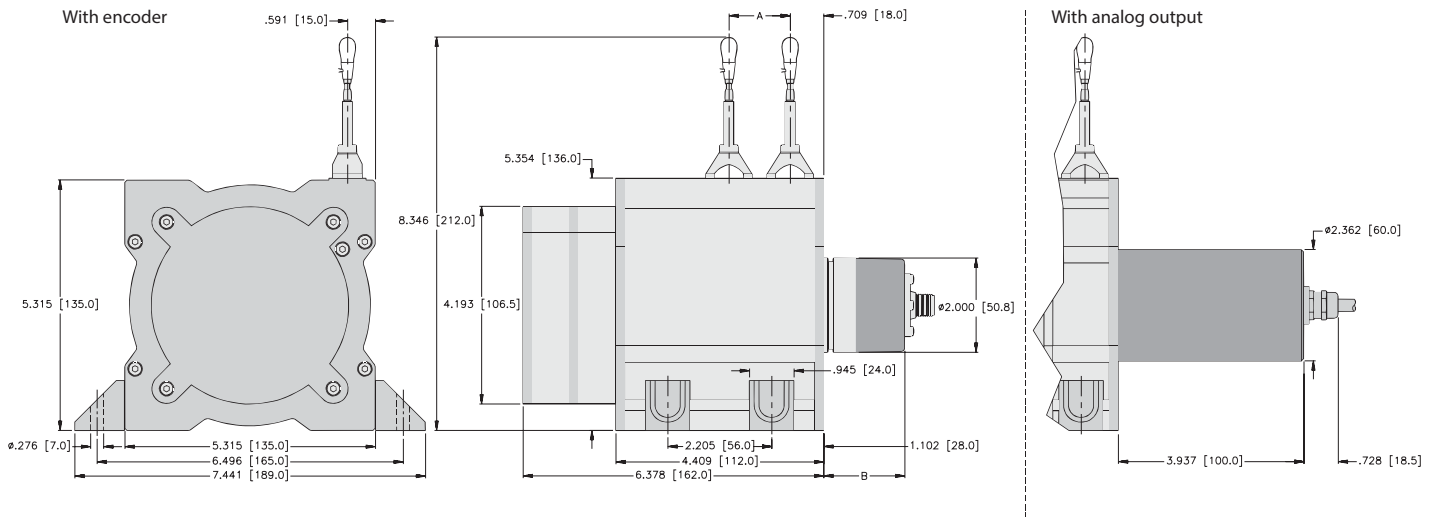
## Draw Wire Mechanics with Encoder or Analog Sensor

### Draw Wire Encoder DW135

#### Dimensions: DW135 with Encoder, Measuring Range 10,000 - 12,000 mm



#### Dimensions: DW135 with Encoder, Measuring Range 15,000 - 20,000 mm



Dimension B depends on the encoder used

| Encoder   | B in. [mm]   |
|---|--------------|
| Incremental (RI-10)<br>DW*****_135-10-*****_***** | 1.457 [37.0] |
| Absolute (RM-28)<br>DW*****_135-28-*****_*****    | 1.929 [49.0] |
| Absolute (RM-29)<br>DW*****_135-29-*****_*****    | 2.992 [76.0] |

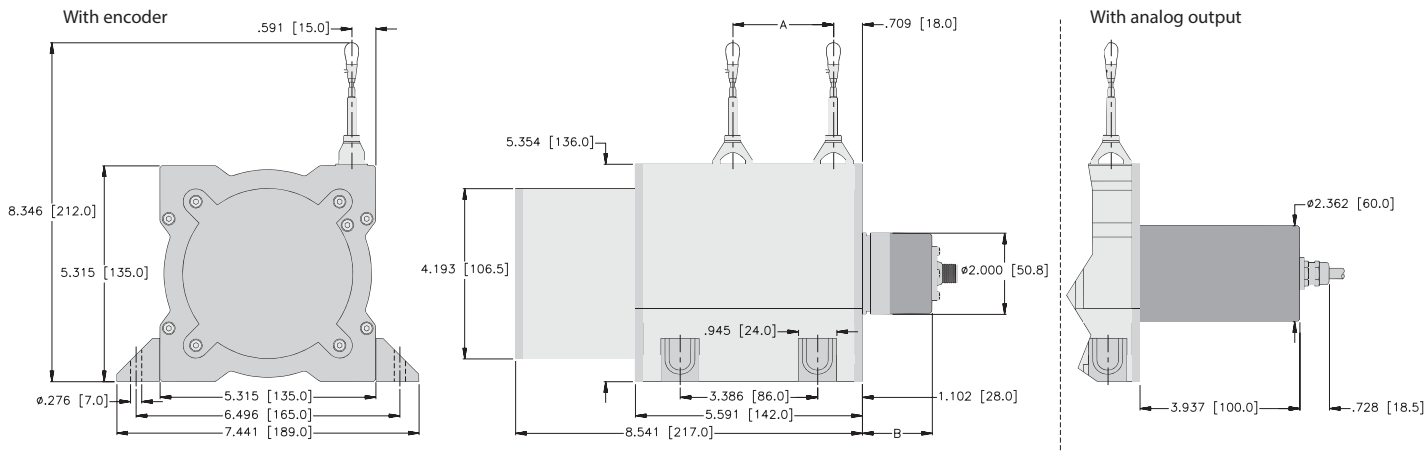
| Measuring Range | A     |
|-----------------|-------|
| 10M             | 33 mm |
| 12M             | 36 mm |
| 15M             | 41 mm |
| 20M             | 48 mm |

# Linear Position Technology

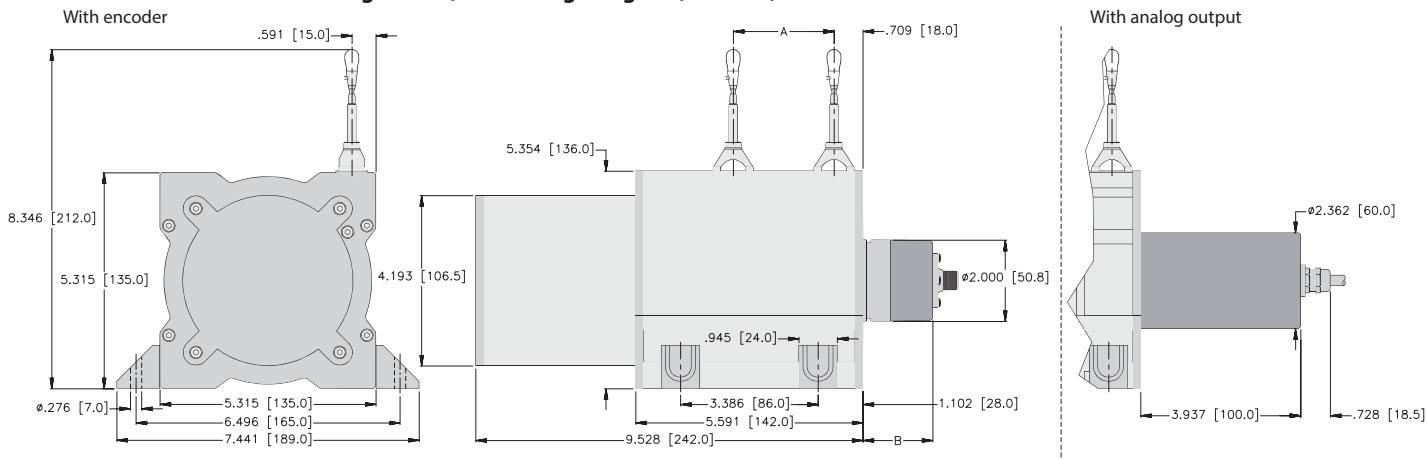
## Draw Wire Mechanics with Encoder or Analog Sensor

### Draw Wire Encoder DW135

Dimensions: DW135 with Analog Sensor, Measuring Range 25,000 - 30,000 mm



Dimensions: DW135 with Analog Sensor, Measuring Range 35,000 - 40,000 mm



Dimension B depends on the encoder used

| Encoder  | B in. [mm]   |
|--|--------------|
| Incremental (RI-10)<br>DW****-135-10_*****_***** | 1.457 [37.0] |
| Absolute (RM-28)<br>DW****-135-28_*****_*****    | 1.929 [49.0] |
| Absolute (RM-29)<br>DW****-135-29_*****_*****    | 2.992 [76.0] |

| Measuring Range | A     |
|-----------------|-------|
| 25 m            | 56 mm |
| 30 m            | 63 mm |
| 35 m            | 71 mm |
| 40 m            | 78 mm |

### Draw Wire Encoder Accessories

**Part Number:**  
RA-DW-SEC-2M

**Description:**  
2 m steel wire extension

**Part Number:**  
RA-DW-SEC-5M

**Description:**  
5 m steel wire extension

**Part Number:**  
RA-DW-PEC-2M

**Description:**  
2 m para wire extension

**Part Number:**  
RA-DW-SEC-10M

**Description:**  
10 m steel wire extension



**Part Number:**  
RDR-1

**Description:**  
Guide pulley



**Accessories:**

- See page H1, Connectivity, for cables and connectors

# Linear Position Technology

## Draw Wire

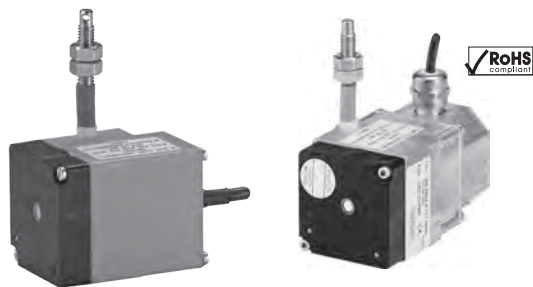
### Mini Draw Wire Encoder DW55, Analog Output



Magnetic field proof

#### Rugged

- Reinforced plastic housing (1 m wire).
- Stainless steel cable
- Zinc die cast housing (2 m wire).



#### Versatile

- Simple processing of analog signal by means of a digital panel meter.
- Voltage or current output.
- Radial or axial cable exit.
- Analog outputs 4-20 mA, 0-10 V or resistance.

#### Compact

- Measuring length up to 2,000 mm.
- 40 x 40 x 58 mm housing (1 m wire).
- 40 x 40 x 72.3 mm housing (2 m wire).

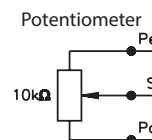
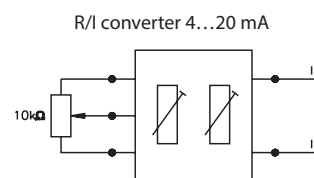
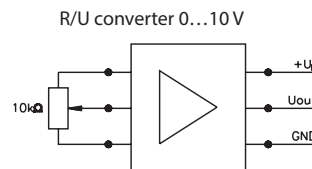
#### Mechanical Characteristics of the Draw-Wire Encoder:

|                      |  |               |  |
|----------------------|--|---------------|--|
| Measuring range:     | up to 2,000 mm   |               |  |
| Absolute accuracy:   | ±0.35% for the whole measuring range   |               |  |
| Repetition accuracy: | ±0.15 mm per direction of travel   |               |  |
| Resolution:          | analog output signal   |               |  |
|                      | 1 m ⇒ 0-10 V   | 2 m ⇒ 0-10 V  |  |
|                      | 1 m ⇒ 4-20 mA  | 2 m ⇒ 4-20 mA |  |
|                      | 1 m ⇒ 0-10 kΩ  | 2 m ⇒ 0-10 kΩ |  |
| Traversing speed:    | max. 2.62 ft/s (800 mm/s)  |               |  |
| Required force:      | approx. 2.25 lbs (10 N) (on wire)  |               |  |
| Material:            | Housing: reinforced plastic (1 m), Zinc die cast (2 m) Wire: stainless steel Ø 0.45 mm, plastic coated |               |  |
| Weight:              | approx. 0.463 lbs (0.210 kg) for 1 m wire; 0.705 lbs (0.320 kg) for 2 m wire                           |               |  |

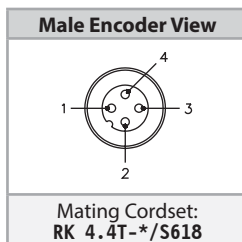
#### Electrical Characteristics:

|                           |                               |                               |                               |
|---------------------------|-------------------------------|-------------------------------|-------------------------------|
| Analog output [Key Code]: | 0-10 V [8C]                   | 4-20 mA [7E]                  | Potentiometer 10 kΩ [PB]      |
| Supply voltage:           | 15-28 VDC                     | 15-28 VDC                     | -                             |
| Temperature range:        | 32 to 122 °F<br>(0 to +50 °C) | 32 to 122 °F<br>(0 to +50 °C) | 32 to 122 °F<br>(0 to +50 °C) |
| Load:                     | max 500 Ω                     | max 500 Ω                     | -                             |

#### Electrical Connections:



#### Wiring Diagram:



\* Length in meters.

#### Standard Wiring:

| Color      | WH               | BN                 | GN               |
|------------|------------------|--------------------|------------------|
| Pin M12    | 2                | 1                  | 3/BU             |
| 4-20 mA    | *-I              | +I                 | N/C              |
| 0-10 VDC   | GND              | 15-28 V            | V <sub>out</sub> |
| Pot. 10 kΩ | Pe, end position | Po, start position | Wiper contact    |

\* Loop powered

**Mini Draw Wire Encoder DW55, Analog Output**

Part Number Key: DW55

| A  | B    |   | C  |   | D  |   | E  |
|----|------|---|----|---|----|---|----|
| DW | 1000 | - | 55 | - | 7F | - | CA |

| A  | Type      |
|----|-----------|
| DW | Draw Wire |

| B    | Measuring Range      |
|------|----------------------|
| 1000 | 1 m Steel Wire, IP50 |
| 2000 | 2 m Steel Wire, IP65 |

| C  | Housing |
|----|---------|
| 55 | 40 mm   |

| D  | Voltage Supply and Output Type   |
|----|----------------------------------|
| 7F | 15-28 VDC, 4-20 mA               |
| 8D | 15-28 VDC, 0-10 V                |
| PB | 40 VDC max, 10 kΩ, Potentiometer |

| E     | Type of Connection                                |
|-------|---|
| H1141 | Radial 4-pin M12 Eurofast Connector <sup>1)</sup> |
| C     | Radial Cable (2 m PVC) <sup>1)</sup>              |
| CA    | Axial Cable (2 m PVC) <sup>2)</sup>               |

<sup>1)</sup> Only available with measuring range '2000'  
<sup>2)</sup> Only available with measuring range '1000'

**Accessories:**

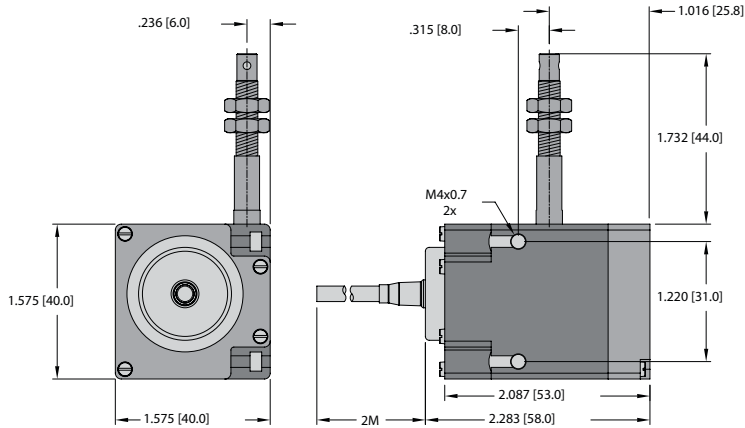
- See page H1, Connectivity, for cables and connectors

# Linear Position Technology

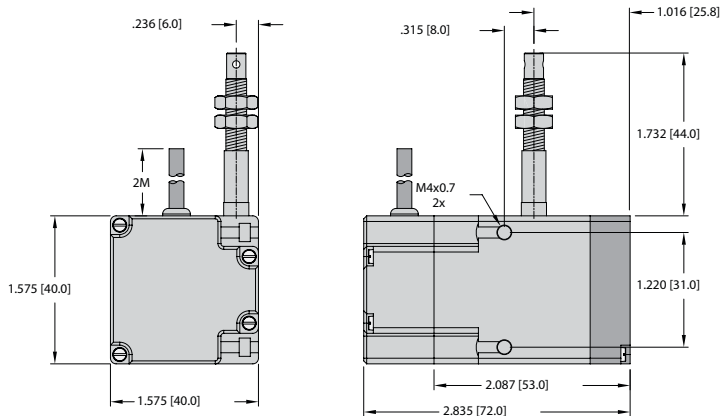
## Draw Wire

### Mini Draw Wire Encoder DW55, Analog Output

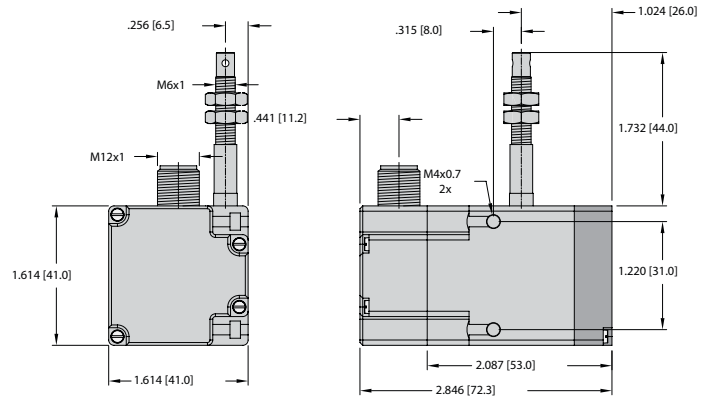
#### Dimensions: DW1000-55-\*\*-CA



#### Dimensions: DW2000-55-\*\*-C



#### Dimensions: DW2000-55-\*\*-H1141



### Draw Wire Encoder Accessories

**Part Number:**  
RA-DW-SEC-2M

**Description:**  
2 m steel wire extension

**Part Number:**  
RA-DW-SEC-5M

**Description:**  
5 m steel wire extension

**Part Number:**  
RA-DW-PEC-2M

**Description:**  
2 m para wire extension

**Part Number:**  
RA-DW-SEC-10M

**Description:**  
10 m steel wire extension

**Accessories:**

- See page H1, Connectivity, for cables and connectors

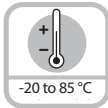


**Part Number:**  
RDR-1

**Description:**  
Guide pulley



### Mini Draw Wire Encoder DW55, Incremental Output



Temperature



Magnetic field proof



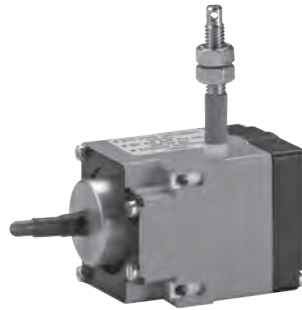
Short-circuit proof



Reverse polarity protection

#### Rugged

- Reinforced plastic housing.
- Stainless steel cable.



#### Compact

- Measuring length up to 2,000 mm.
- 40 x 40 x 58 mm housing.

#### Versatile

- Incremental outputs.

Linear Position Technology

#### Mechanical Characteristics of the Draw-Wire Encoder:

|                           |  |
|---------------------------|--|
| Measuring range:          | up to 2,000 mm   |
| Absolute accuracy:        | 0.1% for the whole measuring range   |
| Repetition accuracy:      | ±0.15% mm per direction of travel  |
| Resolution (incremental): | 0.1 mm (0.025 mm post-quadrature) [standard encoder with 1,000 ppr.]         |
| Traversing speed:         | max. 2.62 ft/s (800 mm/s)  |
| Required force:           | approx. 2.25 lbs (10 N) (on wire)  |
| Material:                 | Housing: reinforced plastic, Wire: stainless steel ø 0.45 mm, plastic coated |
| Weight:                   | approx. 0.463 lbs (0.210 kg)   |

#### Mechanical Characteristics:

|   |   |
|---|---|
| Protection acc. to EN 60529:                  | IP64 from housing side                    |
| Working temperature:                          | -4 to +185 °F (-20 to +85 °C)             |
| Shock resistance acc. to DIN-IEC 68-2-27:     | 100 g (1,000 m/s <sup>2</sup> ), 6 ms     |
| Vibration resistance acc. to DIN-IEC 68-2-27: | 10 g (100 m/s <sup>2</sup> ), 55-2,000 Hz |

#### Electrical Characteristics:

|                                     |                 |                |
|-------------------------------------|-----------------|----------------|
| Output circuits [Key Code]:         | Push-Pull [2D]  | Push-Pull [2A] |
| Supply voltage:                     | 5-24 VDC        | 8-30 VDC       |
| Current consumption (without load): | max. 50 mA      | max. 50 mA     |
| Permitted load per channel:         | max. 50 mA      | max. 50 mA     |
| Pulse rate:                         | max. 160 kHz    | max. 160 kHz   |
| Switching level high:               | min. +V – 2.5 V | min. +V – 3 V  |
| Switching level low:                | max. 0.5 V      | max. 2.5 V     |
| Rise time tr:                       | max. 1 µs       | max. 1 µs      |
| Fall time tf:                       | max. 1 µs       | max. 1 µs      |
| Short-circuit protected:            | yes             | yes            |

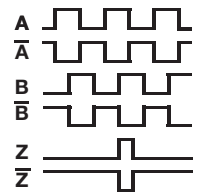
#### Description of the Incremental Encoder (Connected on Load Side)

- Compensation for temperature and aging
- Short-circuit protected outputs
- Reverse polarity protected power-supply input
- Push-pull output

| Part Number            | Description         |
|------------------------|---------------------|
| DW1000-55-01-2D1000-CA | 1 m range, 5-24 VDC |
| DW2000-55-01-2A1000-CA | 2 m range, 5-24 VDC |

#### Electrical Connections:

| Color: | Signal:   |
|--------|-----------|
| WH     | Common    |
| BN     | +V        |
| GN     | A         |
| YE     | $\bar{A}$ |
| GY     | B         |
| PK     | $\bar{B}$ |
| BU     | Z         |
| RD     | $\bar{Z}$ |



\* Index present every 100 mm every linear travel.

# Linear Position Technology

## Draw Wire

### Mini Draw Wire Encoder DW55, Incremental Output

#### Part Number Key: DW55 Incremental

| A  | B    | C | D  | E | F  | G  |
|----|------|---|----|---|----|----|
| DW | 1000 | - | 55 | - | 01 | 2A |

| A  | Type      |
|----|-----------|
| DW | Draw Wire |

| B    | Measuring Range |
|------|-----------------|
| 1000 | 1 m Steel Wire  |
| 2000 | 2 m Steel Wire  |

| C  | Housing |
|----|---------|
| 55 | 40 mm   |

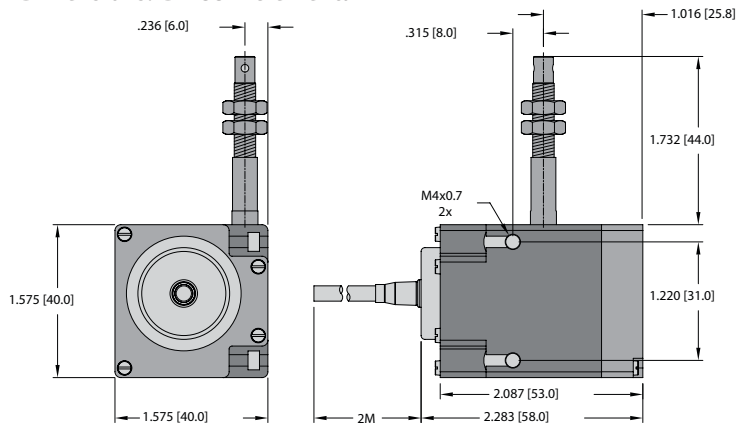
| D  | Encoder Type       |
|----|--------------------|
| 01 | RI-01, Incremental |

| E  | Voltage Supply and Output Type            |
|----|---|
| 2A | 8-30 VDC, Push-Pull (w/ Inverted Signals) |
| 2D | 5-24 VDC, Push-Pull (w/ Inverted Signals) |

| F | Pulse Rate |
|---|------------|
|   | 1000       |

| G  | Type of Connection    |
|----|-----------------------|
| CA | Axial Cable (2 m PVC) |

#### Dimensions: DW55 Incremental



### Draw Wire Encoder Accessories

**Part Number:**  
RA-DW-SEC-2M

**Description:**  
2 m steel wire extension

**Part Number:**  
RA-DW-SEC-5M

**Description:**  
5 m steel wire extension

**Part Number:**  
RA-DW-PEC-2M

**Description:**  
2 m para wire extension

**Part Number:**  
RA-DW-SEC-10M

**Description:**  
10 m steel wire extension



**Part Number:**  
RDR-1

**Description:**  
Guide pulley



**Accessories:**

- See page H1, Connectivity, for cables and connectors



### Standard Draw Wire Encoder DW125

#### Description

- Direct length measurement.
- High repeatability.



#### Compact

- Long measuring lengths up to 6,000 mm.

#### Versatile

- Easy assembly.
- No additional guidance system.
- Wire guidance possible using guide pulleys.
- Multiple encoder outputs available.

#### Mechanical Characteristics of the Draw-Wire Encoder:

|                          |   |
|--------------------------|---|
| Measuring range:         | up to 6,000 mm  |
| Repeatability:           | ±0.15 mm  |
| Resolution:              | 0.1 mm (standard encoder) with 2,000 ppr.               |
| Extension length 200 mm: | ~ 1 encoder revolution                                  |
| Travel speed:            | max. 9.84 ft/s (3,000 mm/s)                             |
| Required pull on spring: | min. 1.12 lbs (5 N) (on wire)                           |
| Wire diameter:           | para wire nylon 2.6 m: 1.05 mm, steel wire 6 m: 0.54 mm |
| Weight:                  | approx. 2.32 lbs (700 g)                                |

#### Note:

If the maximum extension length is exceeded, the wire and transducer will be damaged.

#### Accessories:

- See page H1, Connectivity, for cables and connectors

# Linear Position Technology

## Draw Wire

### Standard Draw Wire Encoder DW125

**Part Number Key: DW125**

| A  | B    |   | C   |   | D  |   | E  | F    |   | G     |   | H        |
|----|------|---|-----|---|----|---|----|------|---|-------|---|----------|
| DW | 6000 | - | 125 | - | 10 | - | 2B | 1024 | - | H1181 | / | Specials |

| A  | Type      |
|----|-----------|
| DW | Draw Wire |

| B    | Measuring Range         |
|------|-------------------------|
| 2800 | 2800 mm Para Nylon Wire |
| 6000 | 6000 mm Steel Wire      |

| C   | Housing |
|-----|---------|
| 125 | 105 mm  |

| D  | Encoder Type                  |
|----|-------------------------------|
| 10 | RI-10, Incremental            |
| 28 | RM-28, SSI                    |
| 29 | RM-29, CANopen or PROFIBUS-DP |

| E | Voltage Supply and Output Type |
|---|--------------------------------|
|   | Dependant on Encoder Selected  |

| F | Pulse Rate/Resolution         |
|---|-------------------------------|
|   | Dependant on Encoder Selected |

| G | Type of Connection            |
|---|-------------------------------|
|   | Dependant on Encoder Selected |

| H | Specials                      |
|---|-------------------------------|
|   | Dependant on Encoder Selected |

\*The type of encoder and the version are specified here. The first two numbers describe the type of encoder (e.g., 10 = RI-10).

Further characteristics of the encoder may be found in the description of the encoder and are identical to the encoder part number key.

**Order Example:**

Draw wire actuator with 2.8 m para wire. The encoder should be a RI-10 with RS422 (with inverting) and 5 V voltage supply. The connection should be 1 m axial cable (PVC). The pulse rate will be 2048.

**Part number key:**

**DW2800-125-10-4A2048-CA1M**

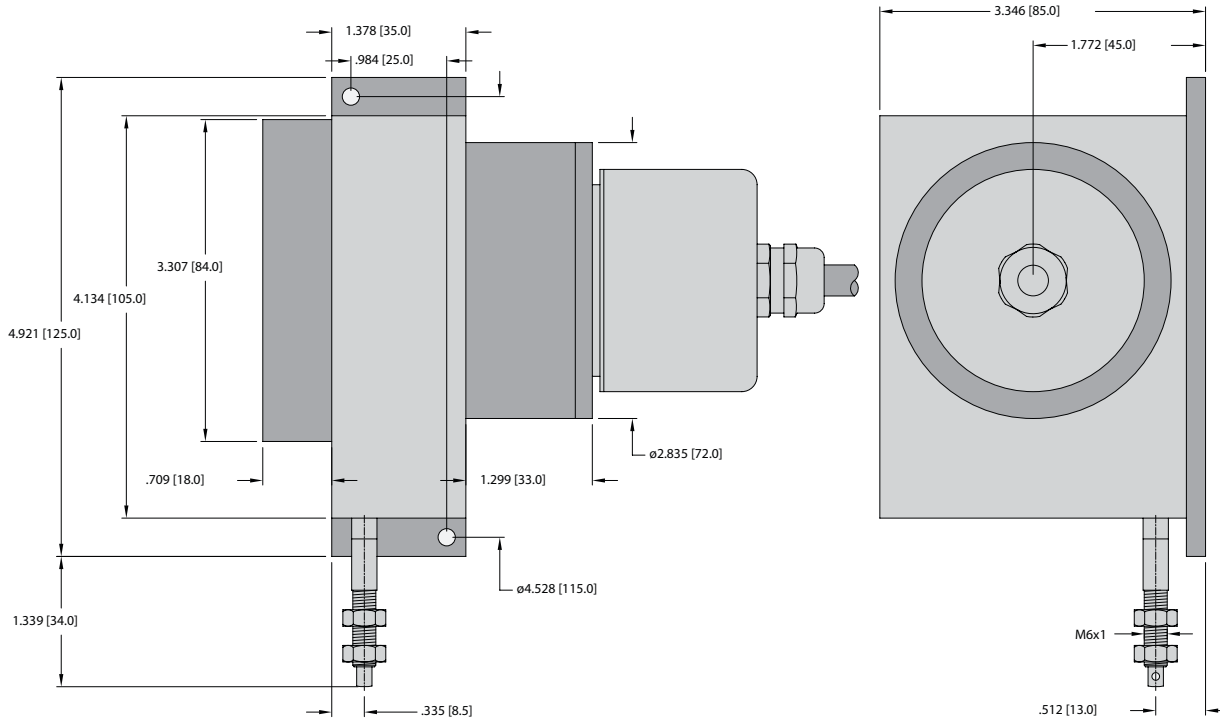
\* Uses RI-10T6Z2-4A2048-CA1M

**Accessories:**

- See page H1, Connectivity, for cables and connectors

Standard Draw Wire Encoder DW125

Dimensions: DW125



Linear Position Technology

# Linear Position Technology

## Mini Measurement System Type WE-1



High rotational speed



Magnetic field proof



Short-circuit proof



Reverse polarity protection

### Rugged

- Wide temperature range  
-4 to +185 °F  
(-20 to +85 °C)
- Robust strain relief on cable outlet thanks to multiple clamping.



### Versatile

- Low power consumption despite high scanning rate.
- Broad input voltage range (8-30 V).
- Fix, connect, ready to go.

### Compact

- 74 x 50 x 52 mm.
- Easy to install, one unit.

### Mechanical Characteristics:

|                                |               |
|--------------------------------|---------------|
| Measuring wheel circumference: | 100 mm        |
| Resolution:                    | Up to 0.1 mm  |
| Radial cable outlet:           | 2 m PVC cable |
| Speed max.:                    | 2000 RPM      |
| Protection:                    | IP64          |

### Electrical Characteristics:

|                              |                          |
|------------------------------|--------------------------|
| Output circuit [Key Code]:   | Push-pull [2A]<br>(7272) |
| Supply voltage:              | 8-30 VDC                 |
| Power consumption (no load): | ≤ 20 mA                  |
| Permissible load/channel:    | 20 mA                    |
| Pulse frequency:             | ≥ 100 kHz                |

### Standard Wiring:

| Connection Type | Case Ground  | Common (0 V) | +V | A  | Ā  | B  | B̄ | Z  | Z̄ |
|-----------------|--------------|--------------|----|----|----|----|----|----|----|
| Cable           | Shield/Drain | WH           | BN | GN | YE | GY | PK | BU | RD |

### Part Number Key: WE-1

| A  | B | C  | D | E   | F | G |   |    |     |   |   |
|----|---|----|---|-----|---|---|---|----|-----|---|---|
| WE | - | 01 | - | 100 | - | 1 | - | 2A | 100 | - | C |

| A  | Type                |
|----|---------------------|
| WE | Wheel Encoder, IP64 |

| B  | Measuring Range                  |
|----|----------------------------------|
| 01 | RI-01, w/ 50 mm x 68 mm Mounting |

| C   | Housing |
|-----|---------|
| 100 | 100 mm  |

| D | Encoder Type                 |
|---|------------------------------|
| 1 | Knurled Aluminum             |
| 2 | Rubber, Hardness: 60 Shure A |

| E  | Housing                                   |
|----|---|
| 2A | 8-30 VDC, Push-Pull (w/ Inverted Signals) |

| F | Pulse Rate/Resolution |
|---|-----------------------|
|   | 100, 200, 1000*       |

\*Resolution = 100 mm circumference wheel is divided by pulse rate to determine resolution in mm

| G | Housing                |
|---|------------------------|
| C | Radial Cable (2 m PUR) |

**Notes:**

# Linear Position Technology

**Notes:**

# ANGULAR POSITION TECHNOLOGY INCLINOMETERS

| <b>SERIES</b>        |                     | <b>PAGE</b> |
|----------------------|---------------------|-------------|
| <b>Inclinometers</b> | General Information | <b>C2</b>   |
|                      | Inclinometers       | <b>C4</b>   |
|                      | Accessories         | <b>C6</b>   |

# Angular Position Technology

## Inclinometers

### WHAT IS AN INCLINOMETER?

Inclinometers measure angular tilt in reference to gravity. Turck inclinometers contain a MEMS (Micro-Electro-Mechanical System) device that incorporates a microelectromechanical capacitive element into the sensor that utilizes two parallel plate electrodes, one stationary and one attached to a spring-mass system. The suspended electrode is free to move with the change in angle relative to earth's gravity. This results in a measurable change in the capacitance between the two plates that is proportional to the angle of deflection. These signals are conditioned to provide voltage outputs (0.1 to 4.9 VDC) or current outputs (4 to 20 mA).

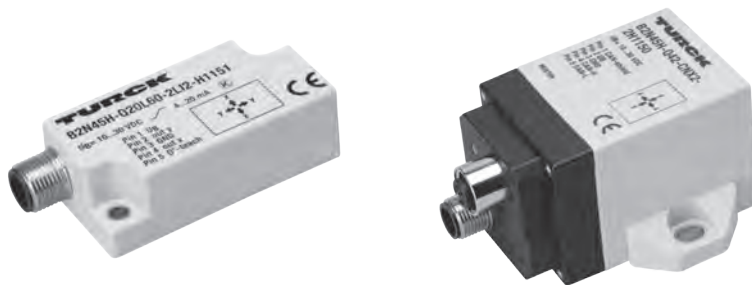
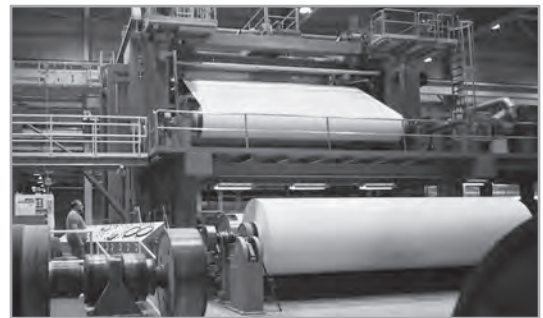
The microprocessor design and the MEMS technology allows for a compact, precise inclinometer in a very robust, industrialized package. The inclinometer carries an IP68 rating for ingress protection, and can operate in temperatures from -30 °C to +70 °C (-22 °F to +158 °F), with the option for -40 °C (-40 °F). These sensors can be mounted up to a maximum of ±85° angle for dual axis models and 360° for single axis models.

### WHERE CAN I USE AN INCLINOMETER?

Inclinometer sensors may be used in a wide variety of applications to solve unique feedback requirements where the customer needs to level platforms or control tilt angle.

The device's small size lends itself to a multitude of applications, such as:

- Commercial machines: diggers, cranes, rotary tables, bulldozers, road construction machinery
- Dancer arm position for web tension control
- Solar plants: mirror and cell positioning
- Machine control: levers, pedals, flaps, mixing machines, hydraulic jacks
- Vertical and horizontal drills used in tunnel and road construction and immersion equipment
- Offshore plants: platforms, cranes
- HVAC louvers, flood control gates, telescopes
- Conveyors, utility vehicles, agricultural and forestry machinery, cranes and hoisting technology – and more





## Inclinometers

### Why Choose Turck Inclinometers?

#### High Accuracy and Repeatability

- $\leq 0.1\%$  repeatable, after a warm-up time of 0.5 hours, ensures consistent outputs.
- Resolution as fine as  $\leq 0.04^\circ$  for Dual Axis analog family.
- Resolution as fine as  $< 0.01^\circ$  for CANopen Single Axis family.
- Temperature compensated down to  $-40^\circ\text{C}$  ( $-40^\circ\text{F}$ ) and up to  $+70^\circ\text{C}$  ( $+158^\circ\text{F}$ ) on select versions. Temperature coefficients as low as  $0.01^\circ/\text{K}$  for analog models or  $0.008^\circ/\text{K}$  for CANopen models.



#### Rugged, Reliable and Compact

- Rated to 55 Hz (1 mm) vibration and 30 g (11 ms) shock for a wide variety of applications.
- Q20L60 analog and set point versions measure 20 mm x 30 mm x 60 mm, making them the most compact IP68/IP69K rated inclinometer on the market.
- Q42 CANopen inclinometer housing measures 42 mm x 42.5 mm x 68 mm, and incorporates bus-in and bus-out M12 Eurofast® connectors for ease of use.
- IP68 rated according to Turck's stringent test protocol:
  - » 24 hours continuous storage at  $70^\circ\text{C}$  ( $158^\circ\text{F}$ )
  - » 24 hours continuous storage at  $-25^\circ\text{C}$  ( $-13^\circ\text{F}$ )
  - » 7 days submerged at a depth of 1 meter
  - » 10 thermal shock changes from  $-25$  to  $+70^\circ\text{C}$  ( $-13$  to  $+158^\circ\text{F}$ ), 1 hour dwell cycle



#### Expanded Line

- Dual axis with analog voltage or current outputs measuring up to  $-85$  to  $+85^\circ$ .
- Single axis with analog voltage or current outputs measuring from 1 to  $360^\circ$  of travel.
- $360^\circ$  Single axis with configurable dual PNP set points.
- CANopen interface now available in single axis or dual axis that can be used in a wide variety of industrial and mobile applications.
- Factory default measuring ranges.
- Non-standard measuring ranges available upon request. Contact factory for availability and specifications.
- Prewired connections potted in cable and value add connectivity is available on request. Contact factory for availability and specifications.



#### Easy to Use

- Zero point offset on the Dual Axis Analog inclinometers can be field adjusted by applying a signal to the teach input pin or by using an optional teach pendant.
- Span of the Single Axis Analog inclinometers can be easily scaled by using the teach input pin to set the span in the field.
- Discrete outputs of the Single Axis Digital inclinometer can be independently set by using the teach input pin or by using an optional teach pendant.
- CANopen inclinometers come with CiA DS-301, profile CiA DSP-410 for ease of configuration.



# Angular Position Technology

## Inclinometers

### Dual Axis with Analog Output

Turck's standard product is a low profile dual axis (X and Y) inclinometer with standard angular ranges of  $\pm 10^\circ$ ,  $\pm 45^\circ$ ,  $\pm 60^\circ$  and  $\pm 85^\circ$ , with additional ranges optional. Each axis has independent outputs. The 5 VDC version is a ratiometric design and the power is limited between 4.75 and 5.25 VDC. This means that the output is proportional to the supply voltage. The 10-30 VDC supply units are regulated and the output is fixed regardless.

- $\pm 10^\circ$ ,  $\pm 45^\circ$ ,  $\pm 60^\circ$ ,  $\pm 85^\circ$
- Current 4-20 mA, 10-30 VDC
- Voltage output 0.1-4.9 V, 10-30 VDC
- Voltage output 0.1-4.9 V @ 5 VDC
- Teachable zero point up to  $\pm 15\%$  with teach adapter VB2-SP4
- FM Class I, Div 2 approved when used with Guard-Q20L60 and approved cordset.



| Part Number   | ID Number | Angular Range  | Resolution     | Absolute Accuracy | Zero Point Calibration | Temperature Drift               | Temperature Coefficient | Load Resistance           | Dimensional Drawing | Wiring Diagram |
|---|-----------|----------------|----------------|-------------------|------------------------|---------------------------------|-------------------------|---------------------------|---------------------|----------------|
| <b>Dual Axis – Analog Output, 4-20 mA</b>                       |           |                |                |                   |                        |                                 |                         |                           |                     |                |
| B2N10H-Q20L60-2LI2-H1151  | 1534012   | $\pm 10^\circ$ | $< 0.04^\circ$ | $\pm 0.3^\circ$   | $\pm 5^\circ$          | $\leq \pm 0.05^\circ/\text{K}$  | 0.01 %/K                | $\leq 200 \Omega$         | 1                   | 1              |
| B2N45H-Q20L60-2LI2-H1151  | 1534013   | $\pm 45^\circ$ | $< 0.1^\circ$  | $\pm 0.5^\circ$   | $\pm 15^\circ$         | $\leq \pm 0.025^\circ/\text{K}$ | 0.03 %/K                | $\leq 200 \Omega$         | 1                   | 1              |
| B2N60H-Q20L60-2LI2-H1151  | 1534014   | $\pm 60^\circ$ | $< 0.14^\circ$ | $\pm 0.5^\circ$   | $\pm 15^\circ$         | $\leq \pm 0.025^\circ/\text{K}$ | 0.03 %/K                | $\leq 200 \Omega$         | 1                   | 1              |
| B2N60H-Q20L60-2LI2-H1151/S97                                    | 1534046   | $\pm 60^\circ$ | $< 0.14^\circ$ | $\pm 0.5^\circ$   | $\pm 15^\circ$         | $\leq \pm 0.025^\circ/\text{K}$ | 0.03 %/K                | $\leq 200 \Omega$         | 1                   | 1              |
| B2N85H-Q20L60-2LI2-H1151  | 1534032   | $\pm 85^\circ$ | $< 0.14^\circ$ | $\pm 0.5^\circ$   | $\pm 15^\circ$         | $\leq \pm 0.025^\circ/\text{K}$ | 0.03 %/K                | $\leq 200 \Omega$         | 1                   | 1              |
| <b>Dual Axis – Analog Output, 0.1–4.9 V</b>                     |           |                |                |                   |                        |                                 |                         |                           |                     |                |
| B2N10H-Q20L60-2LU3-H1151  | 1534006   | $\pm 10^\circ$ | $< 0.04^\circ$ | $\pm 0.3^\circ$   | $\pm 5^\circ$          | $\leq \pm 0.05^\circ/\text{K}$  | 0.01 %/K                | $\geq 40 \text{ k}\Omega$ | 1                   | 1              |
| B2N45H-Q20L60-2LU3-H1151  | 1534007   | $\pm 45^\circ$ | $< 0.1^\circ$  | $\pm 0.5^\circ$   | $\pm 15^\circ$         | $\leq \pm 0.025^\circ/\text{K}$ | 0.03 %/K                | $\geq 40 \text{ k}\Omega$ | 1                   | 1              |
| B2N45H-Q20L60-2LU3-H1151/S97                                    | 1534039   | $\pm 45^\circ$ | $< 0.1^\circ$  | $\pm 0.5^\circ$   | $\pm 15^\circ$         | $\leq \pm 0.025^\circ/\text{K}$ | 0.03 %/K                | $\geq 40 \text{ k}\Omega$ | 1                   | 1              |
| B2N60H-Q20L60-2LU3-H1151  | 1534008   | $\pm 60^\circ$ | $< 0.14^\circ$ | $\pm 0.5^\circ$   | $\pm 15^\circ$         | $\leq \pm 0.025^\circ/\text{K}$ | 0.03 %/K                | $\geq 40 \text{ k}\Omega$ | 1                   | 1              |
| B2N60H-Q20L60-2LU3/S97  | 1534060   | $\pm 60^\circ$ | $< 0.14^\circ$ | $\pm 0.5^\circ$   | $\pm 15^\circ$         | $\leq \pm 0.025^\circ/\text{K}$ | 0.03 %/K                | $\geq 40 \text{ k}\Omega$ | 1                   | 1              |
| B2N85H-Q20L60-2LU3-H1151  | 1534027   | $\pm 85^\circ$ | $< 0.14^\circ$ | $\pm 0.5^\circ$   | $\pm 15^\circ$         | $\leq \pm 0.025^\circ/\text{K}$ | 0.03 %/K                | $\geq 40 \text{ k}\Omega$ | 1                   | 1              |
| B2N85H-Q20L60-2LU3/S97  | 1534040   | $\pm 85^\circ$ | $< 0.14^\circ$ | $\pm 0.5^\circ$   | $\pm 15^\circ$         | $\leq \pm 0.025^\circ/\text{K}$ | 0.03 %/K                | $\geq 40 \text{ k}\Omega$ | 1                   | 1              |
| <b>Dual Axis – Analog Output, Ratiometric 0.1-4.9 V @ 5 VDC</b> |           |                |                |                   |                        |                                 |                         |                           |                     |                |
| B2N10H-Q20L60-2LU5-H1151  | 1534009   | $\pm 10^\circ$ | $< 0.04^\circ$ | $\pm 0.3^\circ$   | $\pm 5^\circ$          | $\leq \pm 0.05^\circ/\text{K}$  | 0.01 %/K                | $\geq 40 \text{ k}\Omega$ | 1                   | 1              |
| B2N45H-Q20L60-2LU5-H1151  | 1534010   | $\pm 45^\circ$ | $< 0.1^\circ$  | $\pm 0.5^\circ$   | $\pm 15^\circ$         | $\leq \pm 0.025^\circ/\text{K}$ | 0.03 %/K                | $\geq 40 \text{ k}\Omega$ | 1                   | 1              |
| B2N60H-Q20L60-2LU5-H1151  | 1534011   | $\pm 60^\circ$ | $< 0.14^\circ$ | $\pm 0.5^\circ$   | $\pm 15^\circ$         | $\leq \pm 0.025^\circ/\text{K}$ | 0.03 %/K                | $\geq 40 \text{ k}\Omega$ | 1                   | 1              |
| B2N85H-Q20L60-2LU5-H1151  | 1534042   | $\pm 85^\circ$ | $< 0.14^\circ$ | $\pm 0.5^\circ$   | $\pm 15^\circ$         | $\leq \pm 0.025^\circ/\text{K}$ | 0.03 %/K                | $\geq 40 \text{ k}\Omega$ | 1                   | 1              |

#### Technical Specifications – Q20L60:

|                        |   |
|------------------------|---|
| Voltage:               | 10-30 VDC / Ratiometric: 4.75-5.25 VDC  |
| Protection:            | IP68  |
| Operating temperature: | -30 to +70 °C (-22 to +158 °F)  |
| /S97 Option:           | -40 to +70 °C (-40 to +158 °F)  |
| Housing:               | Polycarbonate   |
| Shock resistance:      | 30 g (11 ms)  |
| Vibration:             | 55 Hz (1 mm)  |
| Repeatability:         | $\leq 0.2\%$ of measuring range [A-B]<br>$\leq 0.1\%$ after warm-up time of 0.5 h |

#### Technical Specifications – Q42:

|                        |   |
|------------------------|---|
| Voltage:               | 10-30 VDC   |
| Protection:            | IP68  |
| Operating temperature: | -40 to +70 °C (-40 to +158 °F)  |
| Housing:               | PA12  |
| Shock resistance:      | 30 g (11 ms)  |
| Vibration:             | 55 Hz (1 mm)  |
| Max. linear deviation: | $\pm 0.2^\circ$ ( $10^\circ$ or $360^\circ$ ) / $\pm 0.3^\circ$ ( $45^\circ$ ) / $\pm 0.4^\circ$ ( $60^\circ$ ) |
| Baud rate:             | 10 kBit/s to 1 MBit/s   |
| Interface:             | CANopen   |

## Inclinometers

### Single Axis 360° with Analog Output

When a larger range is required or only one axis is necessary, the single axis 360° inclinometer has an adjustable measuring range and allows for programming a specified span within the 360°. The teach function is simple and can be done in seconds. In addition, this version comes with two outputs in one device. The first output increases with clockwise rotation (CW). The second output increases with counter-clockwise rotation (CCW).

- Measuring range is adjustable via teach adapter VB2-SP4
- Current 4-20 mA output
- Voltage 0.1-4.9 V output
- Vertical mount only
- Factory default is 1° to 360°
- FM Class I, Div 2 approved when used with Guard-Q20L60 and approved cordset.



### Single Axis 360° with Two Discrete Switchpoints

This version has dual discrete outputs that are programmable as either normally open or normally closed with an adjustable span within the full angular range 0° to 360°.

- Two switchpoints (PNP, N.O. or N.C.), hysteresis, and span are all adjustable with teach adapter VB2-SP5
- Switch state indication by LEDs



### Single and Dual Axis with CANopen Interface

A standard CANopen interface according to CiA DS-301/CiA DSP-410. All measured values and parameters are accessible via the object directory (OD).

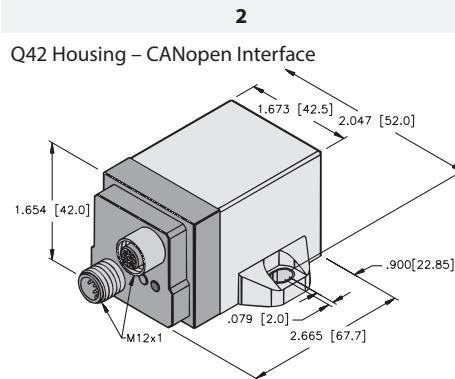
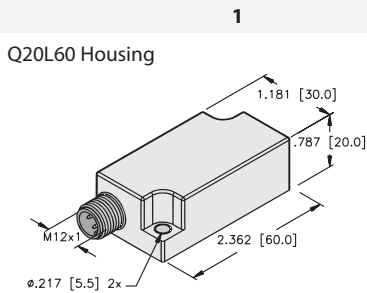
- Transmit data object (TPDO1) with four operating modes
- Service-data object (Standard-SDO)
- Error message via emergency object
- Monitoring functions Heartbeat as well as Nodeguarding/Lifeguarding
- Memory and recovery function of all parameters
- Indication of status and error via two-color LED
- Setting of node ID as well as baud rate via object dictionary
- Freely configurable limit frequency (digital filter)
- Configuration of the minimal change of angle for TPDO1 send event
- Optional monitoring of internal device temperature



| Part Number  | ID Number | Angular Range | Resolution | Absolute Accuracy | Zero Point Calibration | Temperature Drift | Temperature Coefficient | Load Resistance | Dimensional Drawing | Wiring Diagram |
|--|-----------|---------------|------------|-------------------|------------------------|-------------------|-------------------------|-----------------|---------------------|----------------|
| <b>Single Axis 360° – Analog Output, Adjustable Measuring Range 4–20 mA</b>                    |           |               |            |                   |                        |                   |                         |                 |                     |                |
| B1N360V-Q20L60-2L12-H1151  | 1534068   | 360°          | < 0.14°    | ±0.5°             | N/A                    | N/A               | 0.03 °/K                | ≤ 200 Ω         | 1                   | 2              |
| <b>Single Axis 360° – Analog Output, Adjustable Measuring Range 0.1–4.9 V</b>                  |           |               |            |                   |                        |                   |                         |                 |                     |                |
| B1N360V-Q20L60-2L13-H1151  | 1534069   | 360°          | < 0.14°    | ±0.5°             | N/A                    | N/A               | 0.03 °/K                | ≤ 40 kΩ         | 1                   | 2              |
| <b>Single Axis 360° – Digital Output, PNP, N.O./N.C. Programmable, Adjustable Switchpoints</b> |           |               |            |                   |                        |                   |                         |                 |                     |                |
| B1N360V-Q20L60-2UP6X3-H1151  | 1534051   | 360°          | < 0.14°    | ±0.5°             | N/A                    | ≤ ±0.03° K        | 0.03 °/K                | ≤ 500 mA        | 1                   | 3              |
| <b>Single Axis – CANopen Interface</b>   |           |               |            |                   |                        |                   |                         |                 |                     |                |
| B1N360V-Q42-CNX2-2H1150  | 1534065   | 360°          | < 0.01°    | ±0.1°             | N/A                    | N/A               | 0.008 °/K               | N/A             | 2                   | 4              |
| <b>Dual Axis – CANopen Interface</b>   |           |               |            |                   |                        |                   |                         |                 |                     |                |
| B2N10H-Q42-CNX2-2H1150   | 1534061   | ±10°          | ≤ 0.05°    | ±0.1°             | N/A                    | N/A               | 0.008 °/K               | N/A             | 2                   | 4              |
| B2N45H-Q42-CNX2-2H1150   | 1534062   | ±45°          | ≤ 0.1°     | ±0.1°             | N/A                    | N/A               | 0.008 °/K               | N/A             | 2                   | 4              |
| B2N60H-Q42-CNX2-2H1150   | 1534063   | ±60°          | ≤ 0.1°     | ±0.1°             | N/A                    | N/A               | 0.008 °/K               | N/A             | 2                   | 4              |

## Inclinometers

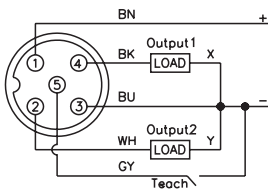
### Dimensional Drawings



### Wiring Diagrams

**Diagram 1**

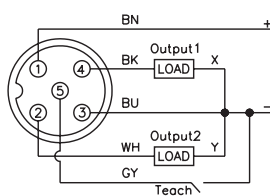
5-pin M12 Eurofast Connection



Mating Cordset: **RK 4.5T-\*/S618**  
Teaching Adapter: **VB2-SP4**

**Diagram 2**

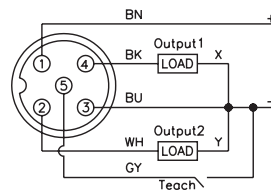
5-pin M12 Eurofast Connection



Mating Cordset: **RK 4.5T-\*/S618**  
Teaching Adapter: **VB2-SP4**

**Diagram 3**

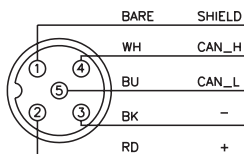
5-pin M12 Eurofast Connection



Mating Cordset: **RK 4.5T-\*/S618**  
Teaching Adapter: **VB2-SP5**

**Diagram 4**

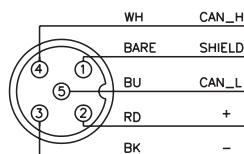
5-pin M12 Eurofast Connection



**Male**

Mating Cordset: **RKC 572-\*M**

5-pin M12 Eurofast Connection



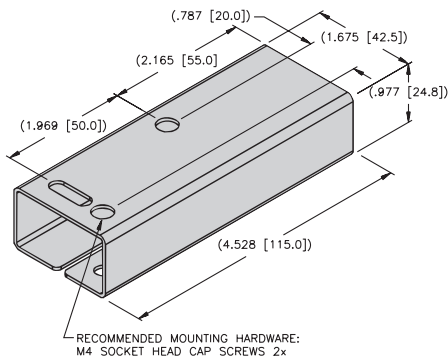
**Female**

Mating Cordset: **RSC 572-\*M**

\* Length in meters. Standard cable lengths are 2, 5, 10 and 15 m. Consult factory for other lengths.

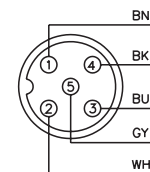
### Accessories

**Guard - Q20L60**, required for use with an inclinometer to maintain FM approval in a Class I, Div 2 environment



### Wiring Diagram

5-pin M12 Eurofast Connection



Mating Cordset: **P-RKG 5.64T-1877-\***  
Recommended mating cordset for use in FM Class I, Div 2 environment

# ROTARY POSITION TECHNOLOGY – INDUCTIVE

| <b>SERIES</b>       | <b>PAGE</b> |
|---------------------|-------------|
| General Information | <b>D2</b>   |
| QR14                | <b>D3</b>   |
| QR24                | <b>D5</b>   |
| Accessories         | <b>D11</b>  |

## Rotary Inductive Sensors

### What is a rotary inductive sensor?

Turck's rotary inductive analog sensor operation is based on the RLC (Resistance Inductive Capacitance) principle and incorporates an advanced microprocessor and precisely positioned emitter and receiver coils on a printed circuit board.

The emitter coils are excited with a high frequency AC field. The interaction between the moving position element and the receiver coils creates different voltages that are induced into the receiver coils which determines the position of the target.

The tuned positioning element can be mounted in a number of ways, but because it is contactless, there is no wear to the sensor or to the positioning element. Irregular rotating shafts can cause vibration and offset of the positioning element. Because of the contactless arrangement of the sensor and positioning element, there is a  $\leq 3\text{mm}$  compensation of lateral offset. The absence of a shaft and bearing enables easy adaptation to many applications.



### Where can I use a rotary inductive sensor?

The rotary inductive sensor can be used in a variety of applications and industries.

- Mobile equipment: Detection of the boom angle, platform rotation and ladder position.
- Solar panel tracking and wind turbine blade pitch.
- Commercial: Gate or door position on trains and buses.



### Why choose Turck rotary inductive sensors?

#### High noise immunity

As a result of the RLC circuit. All products meet IEC 60529 and EN 60529 standard for noise immunity. The sensor is also inherently weld field immune.

#### High linearity and precision

The new rotary inductive sensors provide high precision measurement and a repeatability of  $0.09^\circ$  with a measuring range of  $360^\circ$ . Bearing tolerances are eliminated through the contactless design as well as vibration caused by irregular rotating shafts, guaranteeing high linearity.

#### Robust housing

Made of high quality plastic. The IP67 rated sensor protects the sensor from most chemicals and oils. It is also shock and vibration resistant up to 30 g (11 ms) and 55 Hz (1 mm displacement).

#### Analog or digital outputs

The standard units feature analog outputs 0-10 V and 4-20 mA with operating voltage of 15-30 VDC or 0.5-4.5 V with operating voltage of 8-30 VDC. All standard units have 12 bit resolution. Operating temperatures available are  $-25$  to  $+70^\circ\text{C}$  or  $-40$  to  $+70^\circ\text{C}$ . Enhanced units feature SSI output with operating voltage of 15-30 VDC and 16 bit resolution. Versions with incremental outputs can be used in place of optical encoders in counting applications.



## Rotary Inductive Sensors, Analog Output, QR14

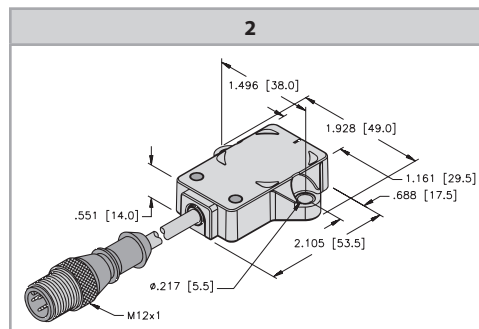
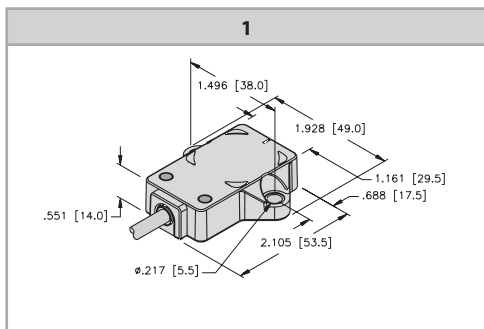
| Part Number                    | ID Number | Measuring Range | Resolution (12 bit) | Ambient Temperature               | Operating Voltage | Voltage Output | Current Output | Dimensional Drawing | Wiring Diagram |
|--------------------------------|-----------|-----------------|---------------------|-----------------------------------|-------------------|----------------|----------------|---------------------|----------------|
| Ri 360P2-QR14-ELiU5X2*         | 1590857   | 0-360°          | ≤ 0.09°             | -13 to +158 °F<br>(-25 to +70 °C) | 15-30 VDC         | 0-10 V         | 4-20 mA        | 1                   | 1              |
| Ri 360P2-QR14-ELU4X2/S97       | 1590858   | 0-360°          | ≤ 0.09°             | -40 to +158 °F<br>(-40 to +70 °C) | 8-30 VDC          | 0.5-4.5 V      | N/A            | 1                   | 2              |
| Ri 360P2-QR14-ELiU5X2-0.3-RS5* | 1590859   | 0-360°          | ≤ 0.09°             | -13 to +158 °F<br>(-25 to +70 °C) | 15-30 VDC         | 0-10 V         | 4-20 mA        | 2                   | 3              |

\*P2 of part number indicates position element P2-Ri-QR14 included in delivery

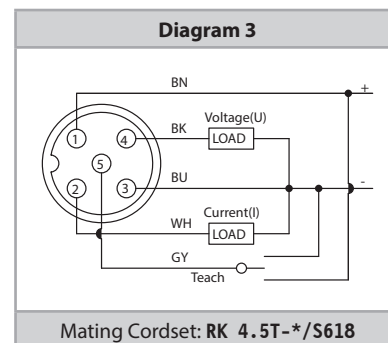
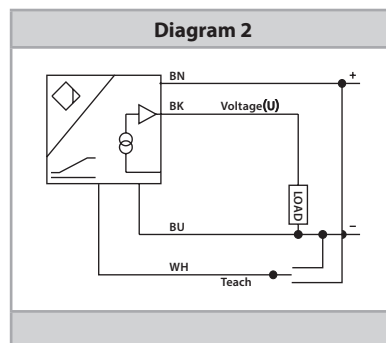
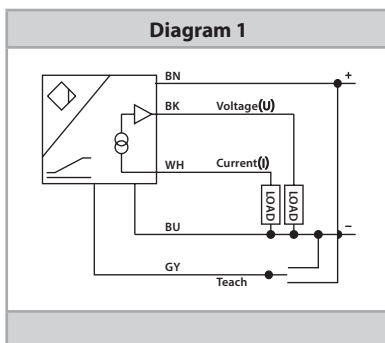
### Technical Specifications:

|                                  |              |                             |                          |
|----------------------------------|--------------|-----------------------------|--------------------------|
| Linearity deviation:             | ≤ 0.3% f.s.  | Housing:                    | rectangular, QR14        |
| Temperature drift:               | ≤ ±0.01% / K | Dimensions:                 | 53.5 x 49 x 14 mm        |
| Lateral offset:                  | ≤ 3 mm       | Housing material:           | plastic, PBT-GF30-V0     |
| Residual ripple:                 | ≤ 10% Upp    | Electrical connection:      | cable/connector          |
| Rated insulation voltage:        | ≤ 0.5 kV     | Vibration resistance:       | 55 Hz (1 mm)             |
| Short-circuit protection:        | yes          | Shock resistance:           | 40 g, 6 ms (continuous)  |
| Wire-break/Rev. pol. protection: | yes/fully    | Degree of protection:       | IP68/IP69K               |
| Load resistance voltage:         | ≥ 4.7 kΩ     | Power-on indication:        | LED, green               |
| Load resistance current output:  | ≤ 0.4 kΩ     | Measuring range indication: | multifunction LED, green |
| Sampling rate:                   | 800 Hz       |                             |                          |
| Current consumption:             | < 100 mA     |                             |                          |

### Dimensions:



### Wiring Diagrams:



Mating Cordset: RK 4.5T-\*/S618

\* Length in meters.

## Rotary Inductive Sensors, SSI Output, QR14

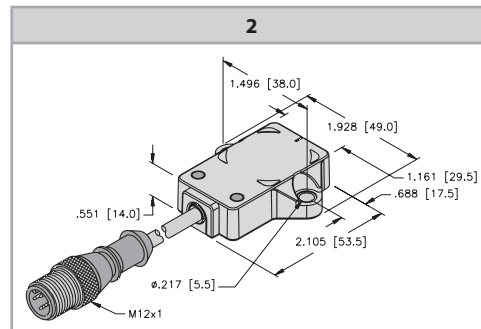
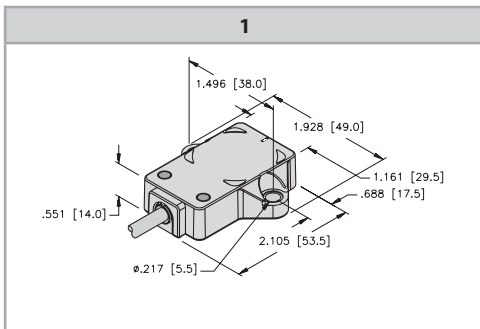
| Part Number                   | ID Number | Measuring Range | Resolution (16bit) | Ambient Temperature               | Operating Voltage | Function Output | Dimensional Drawing | Wiring Diagram |
|-------------------------------|-----------|-----------------|--------------------|-----------------------------------|-------------------|-----------------|---------------------|----------------|
| Ri360P2-QR14-ESG25X2*         | 1590827   | 0-360°          | ≤ 0.006°           | -13 to +158 °F<br>(-25 to +70 °C) | 15-30 VDC         | SSI             | 1                   | 1              |
| Ri360P2-QR14-ESG25X2-0.3-RS8* | 1590826   | 0-360°          | ≤ 0.006°           | -13 to +158 °F<br>(-25 to +70 °C) | 15-30 VDC         | SSI             | 2                   | 2              |

\*P2 of part number indicates position element P2-Ri-QR14 included in delivery

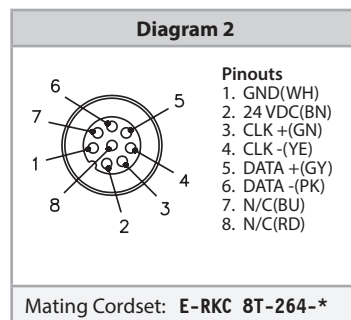
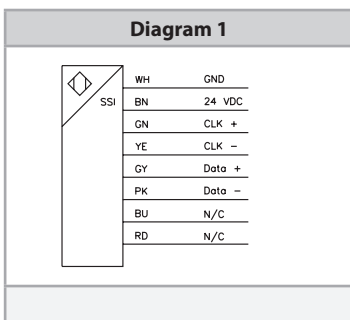
### Technical Specifications:

|                                  |  |                             |                           |
|----------------------------------|--|-----------------------------|---------------------------|
| Linearity deviation:             | ≤ 0.3% of full scale   | Sampling rate:              | 700 Hz                    |
| Temperature drift:               | ≤ ±0.0001% / K   | Power consumption:          | < 100 mA                  |
| Lateral offset:                  | ≤ 3 mm   | Housing:                    | rectangular, QR14         |
| Residual ripple:                 | ≤ 10% U <sub>ss</sub>  | Dimensions:                 | 53.5 x 49 x 14 mm         |
| Rated insulation voltage:        | ≤ 0.5 kV   | Housing material:           | plastic, PBT-GF30-V0      |
| Short-circuit protection:        | yes  | Electrical connection:      | cab/cable with connection |
| Wire-break/Rev. pol. protection: | yes/yes (supply voltage)   | Vibration resistance:       | 55 Hz (1 mm)              |
| Output function:                 | 8-wire, SSI, 25 bit, gray coded  | Shock resistance:           | 30 g (11 ms)              |
| Process data area:               | Bit 1 to Bit 16  | Degree of protection:       | IP68/IP69K                |
| Diagnostic bits:                 | Bit 22: Positioning element is in measuring range, lower signal quality (e.g., distance too large)<br>Bit 23: Positioning element is outside measuring range | Power-on indication:        | LED, green                |
|                                  |  | Measuring range indication: | multifunction LED, green  |

### Dimensions:



### Wiring Diagrams:





## Rotary Inductive Sensors, Incremental Output, QR24

| Part Number                   | ID Number | Measuring Range | Resolution  | Ambient Temperature               | Operating Voltage | Output        | Dimensional Drawing | Wiring Diagram |
|-------------------------------|-----------|-----------------|-------------|-----------------------------------|-------------------|---------------|---------------------|----------------|
| Ri 360P0-QR24M0-INCRX2-H1181  | 1590910   | 0-360°          | 1-5000* ppr | -13 to +185 °F<br>(-25 to +85 °C) | 10-30 VDC         | Push-Pull/HTL | 1                   | 1              |
| Ri 360P0-EQR24M0-INCRX2-H1181 | 1590912   | 0-360°          | 1-5000* ppr | -13 to +185 °F<br>(-25 to +85 °C) | 10-30 VDC         | Push-Pull/HTL | 1                   | 1              |

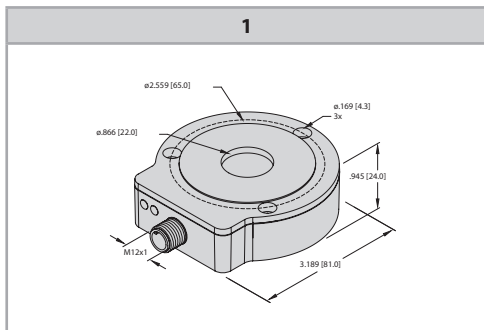
NOTE: Incremental output QR24 sensors not to be used for speed feedback.

\* Easyteach pulse rates available: 360, 512, 1000, 1024, 2048, 2500, 3600, 4096, 5000 ppr

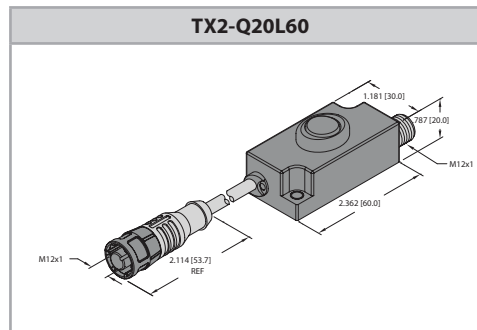
### Technical Specifications:

|                                  |                       |                             |  |
|----------------------------------|-----------------------|-----------------------------|--|
| Linearity deviation:             | ≤ 0.05% of full scale | Housing:                    | QR24   |
| Temperature drift:               | ≤ ±0.003% / K         | Dimensions:                 | 81 x 78 x 24 mm                                |
| Residual ripple:                 | ≤ 10% Uss             | Housing material (QR24):    | metal/plastic, ZnAlCu1/PBT-GF30-V0             |
| Rated insulation voltage:        | ≤ 0.5 kV              | Housing material (EQR24):   | stainless steel/plastic V4A (1.4404) PA12-GF30 |
| Short-circuit protection:        | yes                   | Shaft type:                 | hollow shaft                                   |
| Wire-break/Rev. pol. protection: | yes/yes               | Electrical connection:      | M12 x 1  |
| Pulse frequency max.:            | 200 kHz               | Vibration resistance:       | 55 Hz (1 mm)                                   |
| Signal level high:               | min. V+ - 2V          | Shock resistance:           | 40 g, 6 ms (continuous)                        |
| Signal level low:                | max. 2V               | Degree of protection:       | IP68/IP69K                                     |
| Sampling rate:                   | 1000 Hz               | Power-on indication:        | LED, green                                     |
| Current consumption:             | < 100 mA              | Measuring range indication: | LED, yellow, yellow flashing                   |

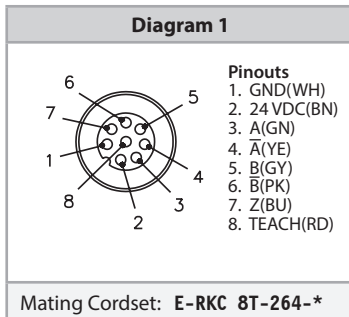
### Dimensions:



### Easyteach Programming Tool:



### Wiring Diagrams:



### Sample Configuration: IO-Link Master

The following components can be used for parameterization of the QR24 incremental sensor through IO-Link:

|                      |                            |
|----------------------|----------------------------|
| 1 x IO-Link Master   | USB-2-IOL-0002             |
| 1 x Connection Cable | RKC 8.302T-1.5-RSC4T/TX320 |



## Rotary Inductive Sensors, Analog Output, QR24

| Part Number                   | ID Number | Measuring Range | Resolution (16bit) | Ambient Temperature               | Operating Voltage | Voltage Output       | Current Output          | Dimensional Drawing | Wiring Diagram |
|-------------------------------|-----------|-----------------|--------------------|-----------------------------------|-------------------|----------------------|-------------------------|---------------------|----------------|
| Ri360P0-QR24M0-ELIU5X2-H1151  | 1590908   | 0-360°          | ≤ 0.006°           | -13 to +185 °F<br>(-25 to +85 °C) | 15-30 VDC         | 0-10 V <sup>1)</sup> | 4 - 20 mA <sup>2)</sup> | 1                   | 1              |
| Ri360P0-EQR24M0-ELIU5X2-H1151 | 1590977   | 0-360°          | ≤ 0.006°           | -13 to +185 °F<br>(-25 to +85 °C) | 15-30 VDC         | 0-10 V <sup>1)</sup> | 4 - 20 mA <sup>2)</sup> | 1                   | 1              |

<sup>1)</sup> Programmable to other outputs: 0-5 V or 0.5-4.5 V

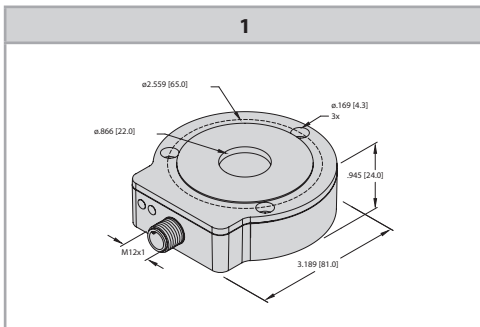
<sup>2)</sup> Programmable to 0-20 mA

### Technical Specifications:

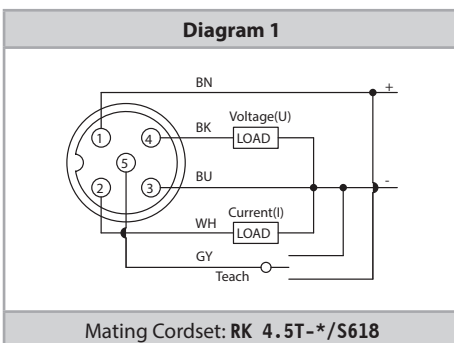
|                                  |                       |
|----------------------------------|-----------------------|
| Linearity deviation:             | ≤ 0.5% of full scale  |
| Temperature drift:               | ≤ ±0.004% / K         |
| Residual ripple:                 | ≤ 10% U <sub>ss</sub> |
| Rated insulation voltage:        | ≤ 0.5 kV              |
| Short-circuit protection:        | yes                   |
| Wire-break/Rev. pol. protection: | yes/yes               |
| Load resistance (voltage):       | ≥ 4.7 kΩ              |
| Load resistance (current):       | ≤ 0.4 kΩ              |
| Sampling rate:                   | 5000 Hz               |
| Current consumption:             | < 100 mA              |

|                             |  |
|-----------------------------|--|
| Housing:                    | QR24   |
| Dimensions:                 | 81 x 78 x 24 mm                                |
| Housing material (QR24):    | metal/plastic, ZnAlCu1/PBT-GF30-V0             |
| Housing material (EQR24):   | stainless steel/plastic V4A (1.4404) PA12-GF30 |
| Shaft type:                 | hollow shaft                                   |
| Electrical connection:      | M12 x 1  |
| Vibration resistance:       | 55 Hz (1 mm)                                   |
| Shock resistance:           | 40 g, 6 ms (continuous)                        |
| Degree of protection:       | IP68/IP69K                                     |
| Power-on indication:        | LED, green                                     |
| Measuring range indication: | LED, yellow, yellow flashing                   |

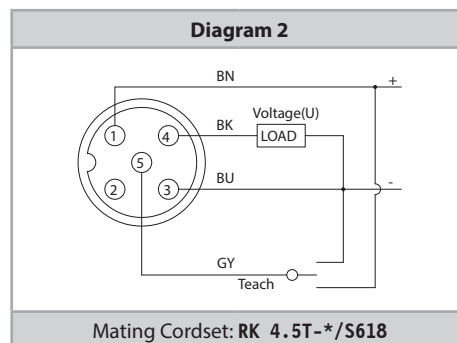
### Dimensions:



### Wiring Diagrams:



\* Length in meters.



\* Length in meters.

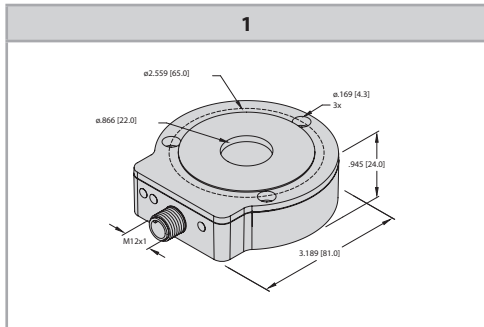
## Rotary Inductive Sensors, SSI Output, QR24

| Part Number                     | ID Number | Measuring Range | Resolution (16-bit) | Ambient Temperature               | Operating Voltage | Output Function | Dimensional Drawing | Wiring Diagram |
|---------------------------------|-----------|-----------------|---------------------|-----------------------------------|-------------------|-----------------|---------------------|----------------|
| Ri 360P0-QR24M0-HESG25X3-H1181  | 1590905   | 0-360°          | ≤ 0.006°            | -13 to +185 °F<br>(-25 to +85 °C) | 15-30 VDC         | SSI             | 1                   | 1              |
| Ri 360P0-EQR24M0-HESG25X3-H1181 | 1590911   | 0-360°          | ≤ 0.006°            | -13 to +185 °F<br>(-25 to +85 °C) | 15-30 VDC         | SSI             | 1                   | 1              |

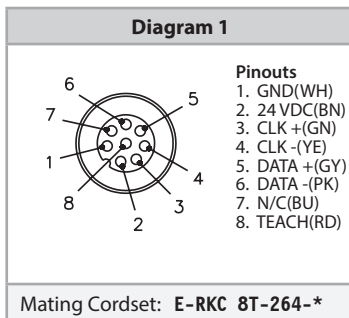
### Technical Specifications:

|                                  |   |                             |  |
|----------------------------------|---|-----------------------------|--|
| Linearity deviation:             | ≤ 0.05% of full scale   | Sampling rate:              | 5000 Hz  |
| Temperature drift:               | ≤ ±0.003% / K   | Current consumption:        | < 100 mA                                       |
| Residual ripple:                 | ≤ 10% U <sub>ss</sub>   | Housing:                    | QR24   |
| Rated insulation voltage:        | ≤ 0.5 kV  | Dimensions:                 | 81 x 78 x 24 mm                                |
| Short-circuit protection:        | yes   | Housing material (QR24):    | metal/plastic, ZnAlCu1/PBT-G30-V0              |
| Wire-break/Rev. pol. protection: | yes/yes (supply voltage)  | Housing material (EQR24):   | stainless steel/plastic V4A (1.4404) PA12-GF30 |
| Output function:                 | 8-wire, SSI, 25 bit, gray coded   | Shaft type:                 | hollow shaft                                   |
| Process data area:               | Configurable  | Electrical connection:      | M12 x 1  |
| Diagnostic bits:                 | Bit 22: Positioning was changed during power drop<br>Bit 23: Positioning element has reached the end of the measuring range. This is indicated by a lower signal quality<br>Bit 24: Positioning element is outside the measuring range.<br>Data messages parameterizable as multiturn and singleturn process data or error bits | Vibration resistance:       | 55 Hz (1 mm)                                   |
|                                  |   | Shock resistance:           | 40 g, 6 ms (continuous)                        |
|                                  |   | Degree of protection:       | IP68/IP69K                                     |
|                                  |   | Power-on indication:        | LED, green                                     |
|                                  |   | Measuring range indication: | LED, yellow, yellow flashing                   |
|                                  |   | Error indication:           | LED, red                                       |

### Dimensions:



### Wiring Diagrams:



### Sample Configuration: IO-Link Master

The following components can be used for parameterization of the QR24 SSI sensor through IO-Link:

|                      |                            |
|----------------------|----------------------------|
| 1 x IO-Link Master   | USB-2-IOL-0002             |
| 1 x Connection Cable | RKC 8.302T-1.5-RSC4T/TX320 |



## Rotary Inductive Sensors, IO-Link, QR24

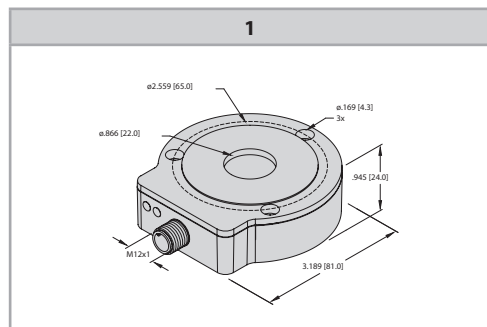
| Part Number                 | ID Number | Measuring Range | Resolution (16bit) | Ambient Temperature               | Operating Voltage | IO-Link Data Telegram | Dimensional Drawing | Wiring Diagram |
|-----------------------------|-----------|-----------------|--------------------|-----------------------------------|-------------------|-----------------------|---------------------|----------------|
| Ri360P0-QR24M0-IOLX2-H1141  | 1590975   | 0-360°          | ≤ 0.006°           | -13 to +185 °F<br>(-25 to +85 °C) | 15-30 VDC         | 32-bit                | 1                   | 1              |
| Ri360P0-EQR24M0-IOLX2-H1141 | 1590978   | 0-360°          | ≤ 0.006°           | -13 to +185 °F<br>(-25 to +85 °C) | 15-30 VDC         | 32-bit                | 1                   | 1              |

### Technical Specifications:

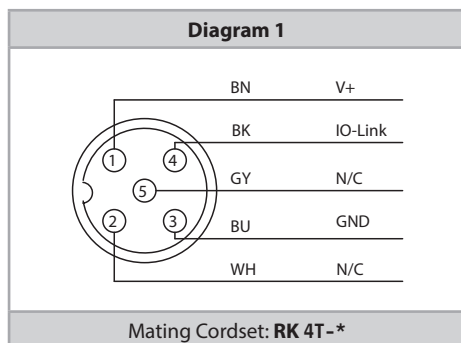
|                           |  |
|---------------------------|--|
| Linearity deviation:      | ≤ 0.05% of full scale                                |
| Repeat Accuracy           | ≤ 0.01% of full scale                                |
| Temperature drift:        | ≤ ±0.003%/K  |
| Residual ripple:          | ≤ 10% Uss  |
| Rated insulation voltage: | ≤ 0.5 kV   |
| IO-Link Specification:    | Version 1.1  |
| IO-Link Telegram          | 16-bit single-turn<br>13-bit multiturn, 3 error bits |
| Sampling rate:            | 1000 Hz  |
| Current consumption:      | <50 mA   |

|                             |  |
|-----------------------------|--|
| Housing:                    | QR24   |
| Dimensions:                 | 81 x 78 x 24 mm                                |
| Housing material (QR24):    | metal/plastic, ZnAlCu1/PBT-GF30-V0             |
| Housing material (EQR24):   | stainless steel/plastic V4A (1.4404) PA12-GF30 |
| Shaft type:                 | hollow shaft                                   |
| Electrical connection:      | M12 x 1  |
| Vibration resistance:       | 55 Hz (1 mm)                                   |
| Shock resistance:           | 40 g, 6 ms (continuous)                        |
| Degree of protection:       | IP68/IP69K                                     |
| Power-on indication:        | LED, green                                     |
| Measuring range indication: | LED, yellow, yellow flashing                   |

### Dimensions:



### Wiring Diagrams:



\* Length in meters.

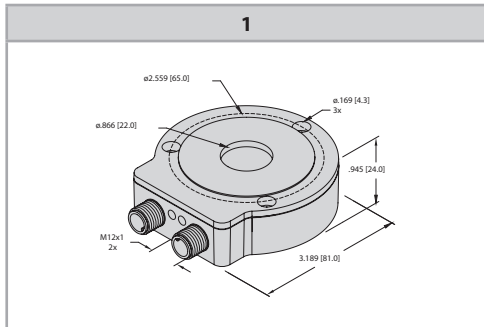
**Rotary Inductive Sensors, CANopen Output, QR24**

| Part Number                | ID Number | Measuring Range | Resolution (16-bit) | Ambient Temperature               | Operating Voltage | Output Function                      | Dimensional Drawing | Wiring Diagram |
|----------------------------|-----------|-----------------|---------------------|-----------------------------------|-------------------|--------------------------------------|---------------------|----------------|
| Ri360P0-QR24M0-CNX4-2H1150 | 1590914   | 0-360°          | ≤ 0.006°            | -13 to +185 °F<br>(-25 to +85 °C) | 10-30 VDC         | CANopen,<br>DS406 V3.2<br>LSS DS 305 | 1                   | 1              |

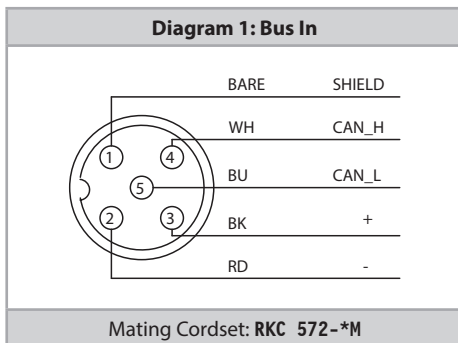
**Technical Specifications:**

|                           |   |                             |                                    |
|---------------------------|---|-----------------------------|------------------------------------|
| Linearity deviation:      | ≤ 0.05% of full scale   | Housing:                    | QR24                               |
| Temperature drift:        | ≤ ±0.003% / K   | Dimensions:                 | 81 x 78 x 24 mm                    |
| Residual ripple:          | ≤ 10% Uss   | Housing material:           | metal/plastic, ZnAlCu1/PBT-GF30-V0 |
| Rated insulation voltage: | ≤ 0.5 kV  | Shaft type:                 | hollow shaft                       |
| Node ID:                  | 1 - 127, factory default: 3   | Electrical connection:      | 2 x M12 x 1                        |
| Baud rate:                | 10, 20, 50, 125, 250, 500,<br>& 800 kbps<br>factory default: 125 kbps | Vibration resistance:       | 55 Hz (1 mm)                       |
| Sampling rate:            | 1000 Hz   | Shock resistance:           | 40 g, 6 ms (continuous)            |
| Current consumption:      | < 60 mA   | Degree of protection:       | IP68/IP69K                         |
|                           |   | Power-on indication:        | LED, green                         |
|                           |   | Measuring range indication: | LED, yellow, yellow flashing       |
|                           |   | Status CANopen:             | LED, green/red                     |

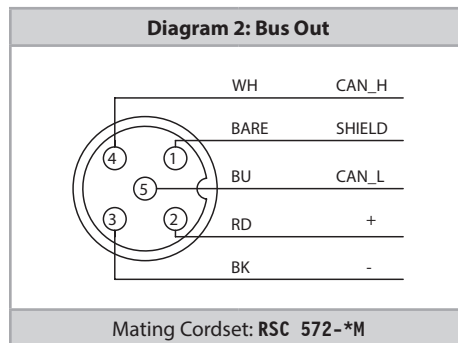
**Dimensions:**



**Wiring Diagrams:**



\* Length in meters.



\* Length in meters.

## Rotary Inductive Sensors, DSU35

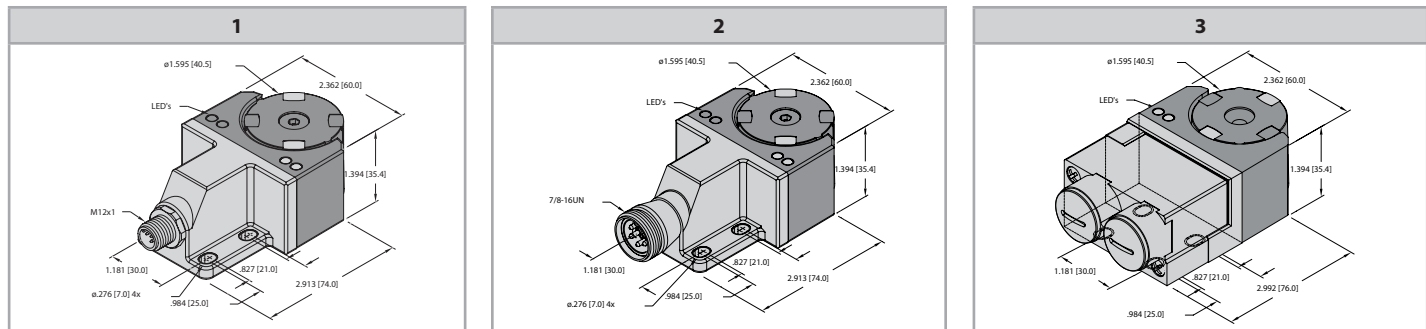
| Part Number                        | ID Number | Measuring Range | Resolution (12-bit) | Ambient Temperature               | Operating Voltage | Output Function              | Dimensional Drawing | Wiring Diagram |
|------------------------------------|-----------|-----------------|---------------------|-----------------------------------|-------------------|------------------------------|---------------------|----------------|
| Ri360P1-DSU35-ELIU5X2-H1151*       | 1590866   | 0-360°          | ≤ 0.09°             | -13 to +167 °F<br>(-25 to +75 °C) | 15-30 VDC         | Analog<br>0-10 V/<br>4-20 mA | 1                   | 1              |
| Ri360P1-DSU35-2UP6X4-H1151*        | 1590867   | 0-360°          | ≤ 0.09°             | -13 to +167 °F<br>(-25 to +75 °C) | 10-30 VDC         | 2 x NO/NC,<br>PNP            | 1                   | 2              |
| Ri360P1-DSU35-ELIU5X2-B1150/S1265* | 1593040   | 0-360°          | ≤ 0.09°             | -13 to +167 °F<br>(-25 to +75 °C) | 15-30 VDC         | Analog<br>0-10 V/<br>4-20 mA | 2                   | 3              |
| Ri360P1-DSU35TC-ELI-EXI*           | 1593015   | 0-360°          | ≤ 0.09°             | -13 to +158 °F<br>(-25 to +70 °C) | 14-30 VDC         | Analog<br>4-20 mA            | 3                   | 4              |

\*P1 of part number indicates P1-RI-DSU35 included in delivery

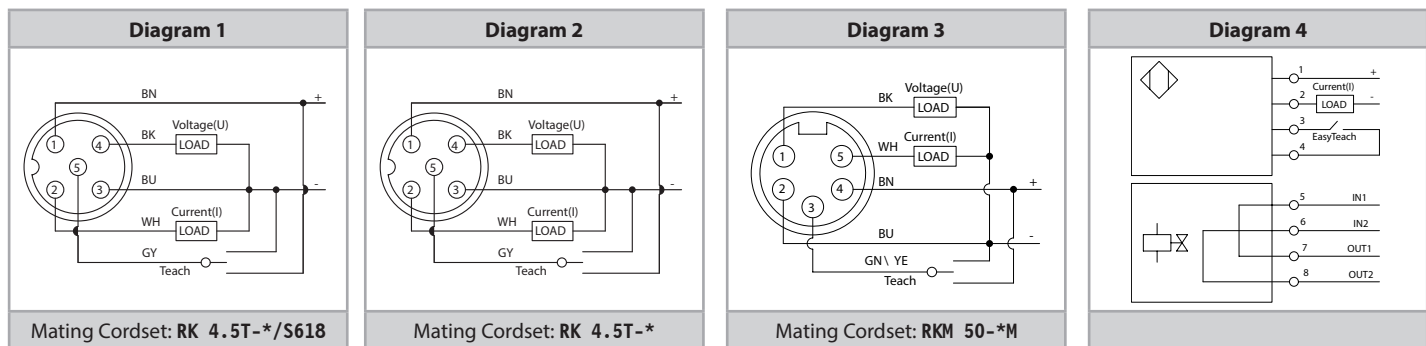
### Technical Specifications:

|                                  |                        |   |   |
|----------------------------------|------------------------|---|---|
| Repeatability:                   | ≤ 0.025% of full scale | Housing:                                | DSU35                                     |
| Temperature drift:               | ≤ ±0.02% / K           | Hazardous approvals (EXI version only): | ATEX (Zone 1 & 21), IECEx                 |
| Residual ripple:                 | ≤ 10% U <sub>ss</sub>  | Housing materials:                      | plastic                                   |
| Rated insulation voltage:        | ≤ 0.5 kV               | Electrical connection:                  | M12 x 1, 7/8" -20UNF,<br>terminal chamber |
| Short-circuit protection:        | yes                    | Vibration resistance:                   | 55 Hz (1 mm)                              |
| Wire-break/Rev. pol. protection: | yes/yes                | Shock resistance:                       | 30 g                                      |
| Load Resistance (voltage):       | ≥ 4.7 kΩ               | Degree of protection:                   | IP67                                      |
| Load Resistance (current):       | ≤ 0.7 kΩ               | Power-on indication:                    | LED, green                                |
| Sampling rate:                   | 500 Hz                 | Measuring range indication:             | LED, green, green flashing                |
| Current consumption:             | < 100 mA               | Error indication:                       | LED, yellow                               |

### Dimensions:



### Wiring Diagrams:



Mating Cordset: RK 4.5T-\*/S618

\* Length in meters.

Mating Cordset: RK 4.5T-\*

\* Length in meters.

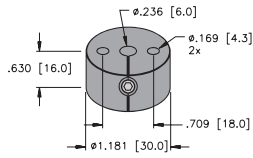
Mating Cordset: RKM 50-\*M

\* Length in meters.

Rotary Inductive Sensors – Accessories, QR14

Positioning Element

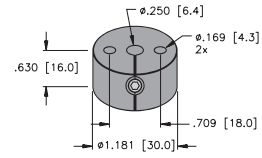
P1-Ri-QR14



Positioning element, operating at a distance of 0-6 mm to the sensor surface

Positioning Element

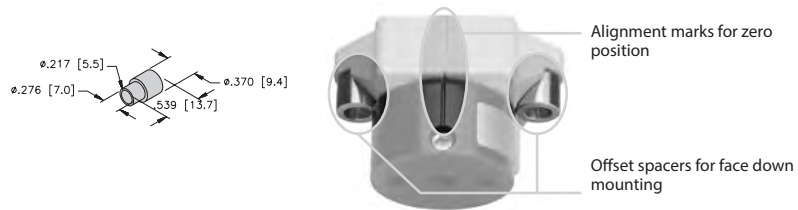
P2-Ri-QR14



Positioning element, operating at a distance of 0-6 mm to the sensor surface

Spacer Sleeve

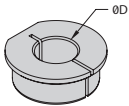
DS-Ri-QR14



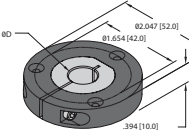
Spacer sleeve for overhead mounting

**Accessories, QR24**

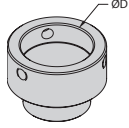
**Reducing Bushings and Shaft Adapters**

| Dimension Drawing   | Type                                | Description            |
|---|-------------------------------------|------------------------|
|  | RA1-QR24 <sup>1)</sup><br>(20 mm)   | Reducing bushing 20 mm |
|   | RA2-QR24<br>(14 mm)                 | Reducing bushing 14 mm |
|   | RA3-QR24 <sup>1)</sup><br>(12 mm)   | Reducing bushing 12 mm |
|   | RA4-QR24 <sup>1)</sup><br>(10 mm)   | Reducing bushing 10 mm |
|   | RA5-QR24<br>(6 mm)                  | Reducing bushing 6 mm  |
|   | RA6-QR24<br>(3/8 in)                | Reducing bushing 3/8"  |
|   | RA7-QR24<br>(1/4 in)                | Reducing bushing 1/4"  |
|   | RA8-QR24 <sup>1)</sup><br>(BP)      | Blanking plug          |
|   | RA9-QR24 <sup>1)</sup><br>(1/2 in)  | Reducing bushing 1/2"  |
|   | RA10-QR24 <sup>1)</sup><br>(5/8 in) | Reducing bushing 5/8"  |
|   | RA11-QR24 <sup>1)</sup><br>(3/4 in) | Reducing bushing 3/4"  |

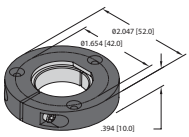
**Ready-to-Install Positioning Elements**

| Dimension Drawing  | Type                                  | Description                                 |
|--|---------------------------------------|---|
|  | P1-Ri-QR24 <sup>1)</sup><br>(20 mm)   | Positioning element with hollow shaft 20 mm |
|  | P2-Ri-QR24<br>(14 mm)                 | Positioning element with hollow shaft 14 mm |
|  | P3-Ri-QR24 <sup>1)</sup><br>(12 mm)   | Positioning element with hollow shaft 12 mm |
|  | P4-Ri-QR24 <sup>1)</sup><br>(10 mm)   | Positioning element with hollow shaft 10 mm |
|  | P5-Ri-QR24<br>(6 mm)                  | Positioning element with hollow shaft 6 mm  |
|  | P6-Ri-QR24<br>(3/8 in)                | Positioning element with hollow shaft 3/8"  |
|  | P7-Ri-QR24<br>(1/4 in)                | Positioning element with hollow shaft 1/4"  |
|  | P8-Ri-QR24 <sup>1)</sup><br>(BP)      | Positioning element with blanking plug      |
|  | P9-Ri-QR24 <sup>1)</sup><br>(1/2 in)  | Positioning element with hollow shaft 1/2"  |
|  | P10-Ri-QR24 <sup>1)</sup><br>(5/8 in) | Positioning element with hollow shaft 5/8"  |
|  | P11-Ri-QR24 <sup>1)</sup><br>(3/4 in) | Positioning element with hollow shaft 3/4"  |

<sup>1)</sup> Items offered with stainless steel components (EQR24). Contact factory for more options.

| Dimension Drawing   | Type                    | Description          |
|---|-------------------------|----------------------|
|  | RAA6-QR24<br>(1 in)     | Shaft Adapter 1"     |
|   | RAA7-QR24<br>(1 1/8 in) | Shaft Adapter 1 1/8" |
|   | RAA8-QR24<br>(1 1/4 in) | Shaft Adapter 1 1/4" |
|   | RAB1-QR24<br>(1 1/2 in) | Shaft Adapter 1 1/2" |

Other shaft adapter sizes available upon request

| Dimension Drawing  | Type                   | Description                       |
|--|------------------------|-----------------------------------|
|  | PE1-QR24 <sup>1)</sup> | Base unit for positioning element |



Accessories, QR24

Protection Ring and Shielding Plate

| Dimension Drawing | Type     | Description  | Dimension Drawing | Type                  | Description      |
|-------------------|----------|--|-------------------|-----------------------|------------------|
|                   | SP1-QR24 | Shield<br>Ø 74 mm,<br>aluminium                                    |                   | M1-QR24 <sup>2)</sup> | Aluminium ring   |
|                   | SP2-QR24 | Shield<br>Ø 74 mm with<br>bore for shaft<br>guidance,<br>aluminium |                   | M2-QR24               | M1-QR24+SP1-QR24 |
|                   | SP3-QR24 | Shield<br>Ø 52 mm,<br>aluminium                                    |                   | M3-QR24               | M1-QR24+SP2-QR24 |
|                   |          |  |                   | M4-QR24               | M1-QR24+SP3-QR24 |
|                   |          |  |                   |                       |                  |

<sup>2)</sup> Also offered in plastic (M5-QR24).

Spacing Tool

| Dimension Drawing | Type    | Description  |
|-------------------|---------|--|
|                   | MT-QR24 | Mounting aid, already included in the delivery scope of the sensor |

**Notes:**

# ROTARY POSITION TECHNOLOGY

## INCREMENTAL ENCODERS

| Series  | Type             | Interface | Page       |
|---|------------------|-----------|------------|
| <b>Miniature - Shaft/Hollow Shaft</b>                     |                  |           |            |
| Miniature   | Type RI-01/RI-02 |           | <b>E2</b>  |
| Miniature Compact   | Type RI-04/RI-05 |           | <b>E5</b>  |
| Miniature Economy   | Type RI-08/RI-09 |           | <b>E8</b>  |
| <b>Incremental Encoders - Standard Shaft/Hollow Shaft</b> |                  |           |            |
| Compact   | Type RI-10/RI-12 |           | <b>E11</b> |
| Stainless Steel   | Type RI-65/RI-96 |           | <b>E19</b> |
| High Resolution   | Type RI-16/RI-64 |           | <b>E23</b> |
| Large Bore  | Type RI-43       |           | <b>E28</b> |
| <b>Magnetic Ring Encoders</b>                             |                  |           |            |
|   | Type LM-2/RMT-2  |           | <b>E34</b> |
|   | Type LM-5/RMT-5  |           | <b>E37</b> |

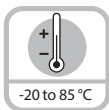
# Rotary Position Technology

## Incremental Encoders

### Miniature Type RI-01 (Shaft) / RI-02 (Blind Hollow Shaft)



High rotational speed



-20 to 85 °C

Temperature



Magnetic field proof



Short-circuit protected



Reverse polarity protection

#### Rugged

- Wide temperature range  
-4 to +185 °F  
(-20 to +85 °C)
- Robust strain relief on cable outlet
- Highly flexible cable withstands constant flexing from 32 to 158 °F (0 to 70 °C)
- Very high EMC standard  
Turck encoder type RI-01, RI-02 meet German Railways standard EN 50121



#### Versatile

- Low power consumption despite high scanning rate
- Short-circuit proof
- Temperature compensation
- Broad input voltage range (5-24 V or 8-30 V)
- Shaft and hollow shaft up to 1024 ppr

#### Compact

- **Can be used where space is tight**  
Overall diameter of only 24 mm  
Shaft diameter min. 4 mm

#### Mechanical Characteristics:

|  |  |
|--|--|
| Speed:                                     | max. 12,000 RPM  |
| Rotor moment of inertia:                   | approx. 5.5 x 10 <sup>-3</sup> oz-in <sup>2</sup> (0.1 x 10 <sup>-6</sup> kgm <sup>2</sup> ) |
| Starting torque:                           | < 1.4 oz-in (< 0.01 Nm)  |
| Radial load capacity of shaft:             | 2.25 lbs (10 N)  |
| Axial load capacity of shaft:              | 4.5 lbs (20 N)   |
| Weight:                                    | approx 0.14 lbs (0.06 kg)  |
| Protection acc. to EN 60529:               | IP65 housing side, IP50 shaft side (IP64 on request)   |
| Working temperature:                       | -4 to 185 °F (-20 to +85 °C)   |
| Materials:                                 | Shaft: stainless steel<br>Blind hollow shaft: brass  |
| Shock resistance acc. to EN 60068-2-27:    | 100 g (1,000 m/s <sup>2</sup> ), 6 ms  |
| Vibration resistance acc. to EN 60068-2-6: | 10 g (100 m/s <sup>2</sup> ), 55-2,000 Hz  |

#### Electrical Characteristics:

| Output circuit [Key Code]:              | Push-Pull [1D/2D]<br>(7272 compatible) <sup>3)</sup> | Push-Pull [1A/2A]<br>(7272 compatible) <sup>3)</sup> |
|---|--|--|
| Supply voltage:                         | 5-24 VDC <sup>5)</sup>                               | 8-30 VDC   |
| Power consumption (no load):            | max. 50 mA   | max. 50 mA   |
| Permissible load/channel:               | max. 50 mA   | max. 50 mA   |
| Pulse frequency:                        | max. 160 kHz   | max. 160 kHz   |
| Signal level high:                      | min. +V -2.5 V                                       | min. +V -3 V   |
| Signal level low:                       | max. 0.5 V   | max. 0.5 V   |
| Rise time t <sub>r</sub> :              | max. 1 μs  | max. 1 μs  |
| Fall time t <sub>f</sub> :              | max. 1 μs  | max. 1 μs  |
| Short-circuit protected <sup>1)</sup> : | yes <sup>2)4)</sup>                                  | yes <sup>2)4)</sup>                                  |

RoHS compliant acc. to EU guideline 2011/65/EU

<sup>1)</sup> If supply voltage correctly applied

<sup>2)</sup> Only one channel allowed to be shorted-out:  
(If +V=5 V, short-circuit to channel, 0 V, or +V is permitted.)  
(If +V=5-30 V, short-circuit to channel or 0 V is permitted.)

<sup>3)</sup> Max. recommended cable length 30 m

<sup>4)</sup> Approximately one minute

<sup>5)</sup> With 24 VDC there is no tolerance above 24 VDC.  
Please use output circuit 8-30 VDC.

### Miniature Type RI-01 (Shaft) / RI-02 (Blind Hollow Shaft)

#### Standard Wiring:

| Connection Type           | Case Ground  | Common (0 V) | +V | A  | $\bar{A}$ | B  | $\bar{B}$ | Z  | $\bar{Z}$ |
|---------------------------|--------------|--------------|----|----|-----------|----|-----------|----|-----------|
| Cable                     | Shield/Drain | WH           | BN | GN | -         | YE | -         | GY | -         |
| Cable w/ Inverted Signals | Shield/Drain | WH           | BN | GN | YE        | GY | PK        | BU | RD        |

#### Part Number Key: RI-01 Shaft Version

| A      | B | C  |   | D  | E    |   | F |
|--------|---|----|---|----|------|---|---|
| RI-01Q | 4 | F1 | - | 1A | 1024 | - | C |

| A      | Type                                    |
|--------|---|
| RI-01Q | Ø 24 mm, Shaft w/ Flat, IP50 Shaft Seal |
| RI-01T | Ø 24 mm, Shaft, IP50 Shaft Seal         |

| B  | Shaft (Ø x L)                |
|----|------------------------------|
| 4  | Ø 4 mm x 10 mm               |
| 5  | Ø 5 mm x 10 mm <sup>1)</sup> |
| 6  | Ø 6 mm x 10 mm               |
| A0 | Ø 1/4" x 10 mm <sup>1)</sup> |

<sup>1)</sup> Available only with Type RI-01Q.

| C  | Flange  |
|----|---------|
| F1 | Ø 24 mm |
| F2 | Ø 30 mm |
| F3 | Ø 28 mm |

| D  | Voltage Supply and Output Type            |
|----|---|
| 1A | 8-30 VDC, Push-Pull                       |
| 1D | 5-24 VDC, Push-Pull                       |
| 2A | 8-30 VDC, Push-Pull (w/ Inverted Signals) |
| 2D | 5-24 VDC, Push-Pull (w/ Inverted Signals) |

| E  | Pulse Rate               |
|--|--------------------------|
| 4, 6, 8, 10, 16, 20, 25, 36, 40, 50, 60, 80, 100, 120, 125, 180, 200, 250, 300, 360, 400, 500, 512, 1000, 1024 | (e.g. 360 pulses => 360) |
| Other Pulse Rates Available on Request   |                          |

| F  | Type of Connection     |
|----|------------------------|
| C  | Radial Cable (2 m PVC) |
| CA | Axial Cable (2 m PVC)  |

#### Part Number Key: RI-02 Blind Hollow Shaft Version

| A      | B | C  |   | D  | E    |   | F |
|--------|---|----|---|----|------|---|---|
| RI-02C | 4 | S3 | - | 1A | 1024 | - | C |

| A      | Type   |
|--------|--|
| RI-02C | Ø 24 mm, Blind Hollow Shaft, IP50 Shaft Seal |

| B  | Bore (14 mm Insertion Depth) |
|----|------------------------------|
| 4  | Ø 4 mm                       |
| 6  | Ø 6 mm                       |
| A0 | Ø 1/4"                       |

| C  | Flange                   |
|----|--------------------------|
| S3 | Flange w/ Spring Element |

| D  | Voltage Supply and Output Type            |
|----|---|
| 1A | 8-30 VDC, Push-Pull                       |
| 1D | 5-24 VDC, Push-Pull                       |
| 2A | 8-30 VDC, Push-Pull (w/ Inverted Signals) |
| 2D | 5-24 VDC, Push-Pull (w/ Inverted Signals) |

| E  | Pulse Rate               |
|--|--------------------------|
| 4, 6, 8, 10, 16, 20, 25, 36, 40, 50, 60, 80, 100, 120, 125, 180, 200, 250, 300, 360, 400, 500, 512, 1000, 1024 | (e.g. 360 pulses => 360) |
| Other Pulse Rates on Request   |                          |

| F  | Type of Connection     |
|----|------------------------|
| C  | Radial Cable (2 m PVC) |
| CA | Axial Cable (2 m PVC)  |

#### Accessories:

- See page H1, Connectivity, for cables and connectors
- See page G1, Accessories, for mounting attachments and couplings

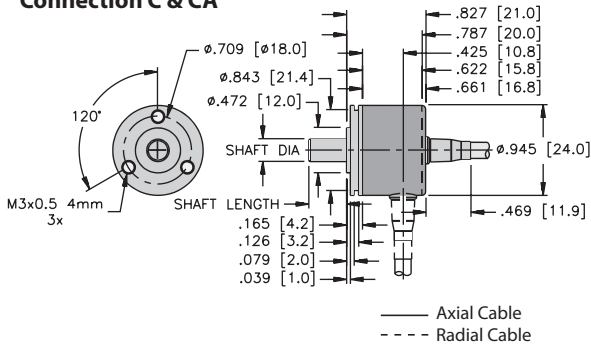
# Rotary Position Technology

## Incremental Encoders

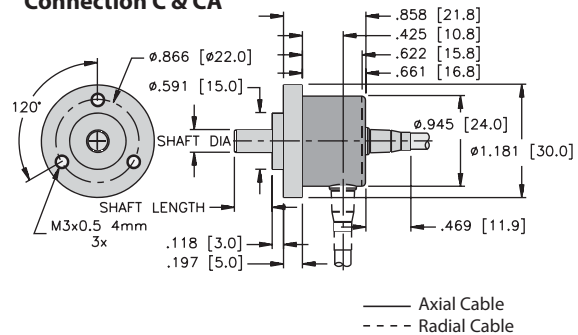
### Miniature Type RI-01 (Shaft) / RI-02 (Blind Hollow Shaft)

#### Dimensions: RI-01 Shaft Version

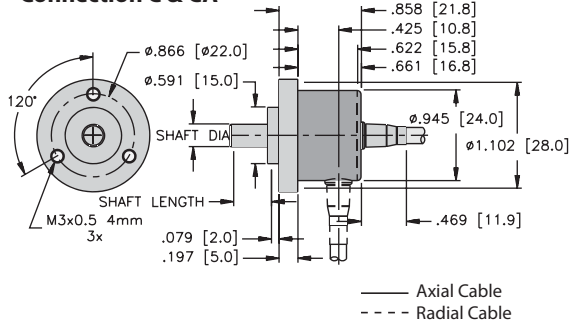
##### RI-01 Flange F1 Connection C & CA



##### RI-01 Flange F2 Connection C & CA



##### RI-01 Flange F3 Connection C & CA



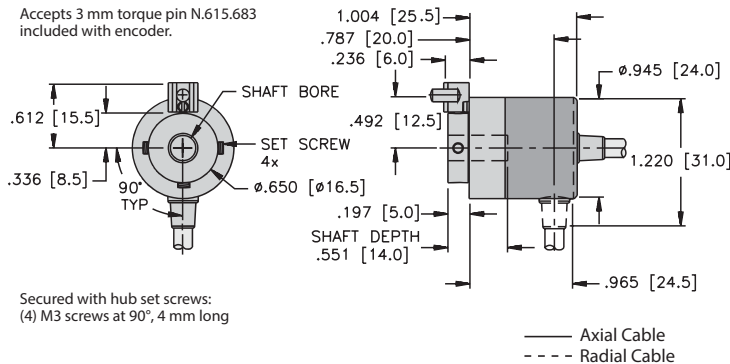
#### Mounting Advice:

The flanges and shafts of the encoder and drive should not be rigidly coupled together at the same time. We recommend the use of suitable couplings (see page G1, Accessories).

#### Dimensions: RI-02 Blind Hollow Shaft Version

##### RI-02 Flange S3 Connection C & CA

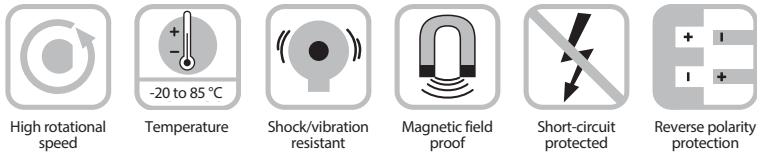
Accepts 3 mm torque pin N.615.683 included with encoder.



#### Mounting Advice:

The flanges and shafts of the encoder and drive should not both be rigidly coupled together at the same time. A cylindrical pin (RA-TP-3-S per ISO 2338-A-3m6 x 10), for use as a torque stop, is supplied.

## Compact Type RI-04 (Shaft) / RI-05 (Hollow Shaft)



### Rugged

- Chromated housing resistant to cooling lubricants and other environmental influences
- IP65 from housing side
- Robust strain relief on cable outlet.
- Highly flexible cable (withstands constant flexing at 32 to 158 °F (0 to 70 °C))
- Short-circuit proof
- Wide temperature range -4 to +185 °F (-20 to +85 °C)
- Temperature and aging compensation



### Versatile

- Hollow shaft version: Fits directly onto drive shaft - no couplings needed - saves up to 30% on cost and 60% on installation space and time
- Universal application in mechanical engineering, vehicles, conveyors and elevators
- Low current consumption despite high scanning rate
- Broad input voltage range (5-18 V or 8-30 V)

### Compact

- **Can be used where space is tight**  
Overall diameter of only 36.5 mm  
Shaft diameter min. 4 mm

### Mechanical Characteristics:

|                                    |   |  |   |
|------------------------------------|---|--|---|
| Speed:                             | Shaft version: max. 12,000 RPM<br>Hollow shaft version: max. 6,000 RPM                          | Working temperature:                       | -4 to +185 °F (-20 to +85 °C)   |
| Rotor moment of inertia:           | approx. 1.1 x 10 <sup>-2</sup> oz-in <sup>2</sup><br>(0.2 x 10 <sup>-6</sup> kgm <sup>2</sup> ) | Materials:                                 | Shaft: stainless steel; Hollow shaft: brass<br>Housing: chromated Aluminium<br>Cable: PVC |
| Starting torque:                   | < 7 oz-in (< 0.05 Nm)   | Shock resistance acc. to EN 60068-2-27:    | approx. 100 g (1,000 m/s <sup>2</sup> ), 6 ms   |
| Radial load capacity of the shaft: | 9 lbs (40 N)  | Vibration resistance acc. to EN 60068-2-6: | approx. 10 g (100 m/s <sup>2</sup> ), 55-2,000 Hz   |
| Axial load capacity of the shaft:  | 4.5 lbs (20 N)  |  |   |
| Weight:                            | approx. 0.175 lbs (0.08 kg)   |  |   |
| Protection acc. to EN 60 529:      | IP65, housing side,<br>IP50 shaft side (IP64 on request)  |  |   |

### Electrical Characteristics:

| Output circuit [Key Code]:                        | Push-Pull [2I]<br>(7272 compatible) <sup>2)</sup> | Push-Pull [1H/2H]<br>(7272 compatible) <sup>2)</sup> | RS422 [4A]     |
|---|---|--|----------------|
| Supply voltage:                                   | 5-18 VDC  | 8-30 VDC   | 5 VDC          |
| Power consumption (no load) with inverted signal: | < 40 mA   | < 40 mA  | < 40 mA        |
| Permissible load/channel:                         | max. ±50 mA                                       | max. ±50 mA  | max. ±50 mA    |
| Pulse frequency:                                  | max. 200 kHz                                      | max. 200 kHz   | max. 200 kHz   |
| Signal level high:                                | min. +V -2.5 V                                    | min. +V -3 V   | min. +V -2.5 V |
| Signal level low:                                 | max. 0.5 V  | max. 0.5 V   | max. 0.5 V     |
| Rise time t <sub>r</sub> :                        | max. 1 µs   | max. 1 µs  | max. 200 µs    |
| Fall time t <sub>f</sub> :                        | max. 1 µs   | max. 1 µs  | max. 200 µs    |
| Short-circuit protected <sup>1)</sup> :           | yes   | yes  | yes            |
| Reverse polarity protection:                      | yes   | yes  | yes            |

RoHS compliant acc. to EU guideline 2011/65/EU

<sup>1)</sup> If supply voltage correctly applied

<sup>2)</sup> Max. recommended cable length 30 m

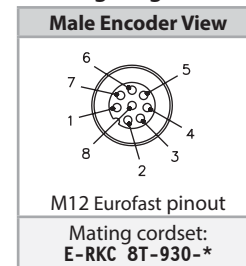
# Rotary Position Technology Incremental Encoders

## Compact Type RI-04 (Shaft) / RI-05 (Hollow Shaft)

### Standard Wiring:

| Connection Type            | Case Ground  | Common (0 V) | +V | A  | $\bar{A}$ | B  | $\bar{B}$ | Z  | $\bar{Z}$ |
|----------------------------|--------------|--------------|----|----|-----------|----|-----------|----|-----------|
| M12 Eurofast               | Coupling Nut | 1            | 2  | 3  | 4         | 5  | 6         | 7  | 8         |
| Cable w/ Inverted Signals  | Shield/Drain | WH           | BN | GN | YE        | GY | PK        | BU | RD        |
| Cable w/o Inverted Signals | Shield/Drain | WH           | BN | GN | -         | YE | -         | GY | -         |

### Wiring Diagram:



\* Length in meters.

### Part Number Key: RI-04 Shaft Version

| A      | B | C |   | D  | E  |   | F     |
|--------|---|---|---|----|----|---|-------|
| RI-04Q | 6 | C | - | 1H | 25 | - | H1181 |

| A      | Type                                    |
|--------|---|
| RI-04Q | Ø 36 mm, Shaft w/ Flat, IP50 Shaft Seal |
| RI-04T | Ø 36 mm, Shaft, IP50 Shaft Seal         |

| B  | Shaft (Ø x L)                  |
|----|--------------------------------|
| 4  | Ø 4 mm x 10 mm <sup>1)</sup>   |
| 5  | Ø 5 mm x 10 mm <sup>1)</sup>   |
| 6  | Ø 6 mm x 12.5 mm <sup>2)</sup> |
| A0 | Ø 1/4" x 12.5 mm <sup>2)</sup> |

<sup>1)</sup> Available only with Type RI-04T  
<sup>2)</sup> Available only with Type RI-04Q

| C | Flange          |
|---|-----------------|
| C | Clamping Flange |
| S | Servo Flange    |

| D  | Voltage Supply and Output Type            |
|----|---|
| 1H | 8-30 VDC, Push-Pull                       |
| 2H | 8-30 VDC, Push-Pull (w/ Inverted Signals) |
| 2I | 5-18 VDC, Push-Pull (w/ Inverted Signals) |
| 4A | 5 VDC, RS422 (w/ Inverted Signals)        |
| 4D | 8-30 VDC, RS422 (w/ Inverted Signals)     |

| E | Pulse Rate  |
|---|---|
|   | 25, 100, 200, 360, 500, 512, 600, 1000,<br>1024, 1500, 2000, 2048, 2500, 3600<br>(e.g. 500 Pulses => 500) |
|   | Other Pulse Rates Available on Request  |

| F     | Type of Connection                   |
|-------|--------------------------------------|
| H1181 | Radial 8-pin M12 Eurofast® Connector |
| H1481 | Axial 8-pin M12 Eurofast Connector   |
| C     | Radial Cable (2 m PVC)               |
| CA    | Axial Cable (2 m PVC)                |

### Part Number Key: RI-05 Hollow Shaft Version

| A      | B | C |   | D  | E  |   | F     |
|--------|---|---|---|----|----|---|-------|
| RI-05I | 6 | E | - | 1H | 25 | - | H1181 |

| A      | Type                                   |
|--------|--|
| RI-05I | Ø 36 mm, Hollow Shaft, IP50 Shaft Seal |

| B  | Shaft (Ø x L) |
|----|---------------|
| 6  | Ø 6 mm        |
| 8  | Ø 8 mm        |
| A0 | Ø 1/4"        |

| C  | Flange                               |
|----|--------------------------------------|
| E  | Ø 19 mm Flange w/ Slotted Flex Mount |
| T  | Ø 19 mm Flange w/ Long Torque Stop   |
| T1 | Ø 19 mm Flange w/ Short Torque Stop  |

| D  | Voltage Supply and Output Type            |
|----|---|
| 1H | 8-30 VDC, Push-Pull                       |
| 2H | 8-30 VDC, Push-Pull (w/ Inverted Signals) |
| 2I | 5-18 VDC, Push-Pull (w/ Inverted Signals) |
| 4A | 5 VDC, RS422 (w/ Inverted Signals)        |
| 4D | 8-30 VDC, RS422 (w/ Inverted Signals)     |

| E | Pulse Rate  |
|---|---|
|   | 25, 100, 200, 360, 500, 512, 600, 1000,<br>1024, 1500, 2000, 2048, 2500, 3600<br>(e.g. 500 Pulses => 500) |
|   | Other Pulse Rates Available on Request  |

| F     | Type of Connection                  |
|-------|-------------------------------------|
| H1181 | Radial 8-pin M12 Eurofast Connector |
| C     | Radial Cable (2 m PVC)              |

### Accessories:

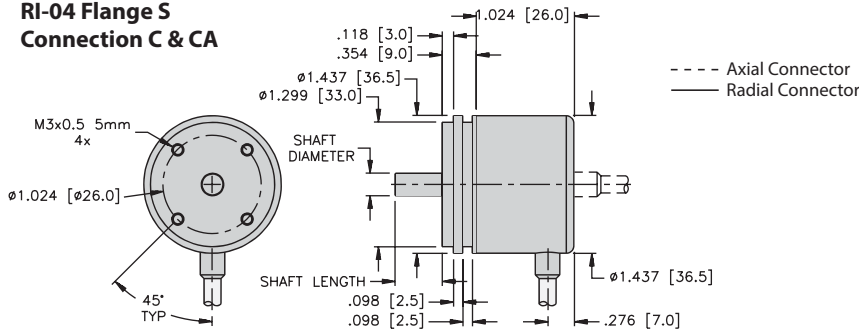
- See page H1, Connectivity, for cables and connectors
- See page G1, Accessories, for mounting attachments and couplings



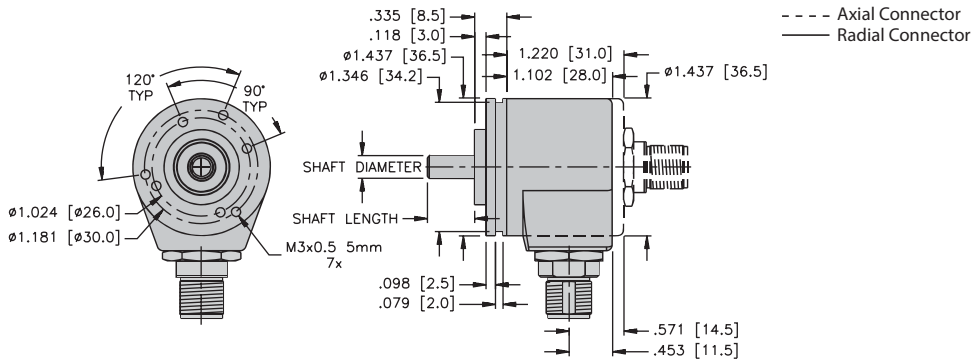
### Compact Type RI-04 (Shaft) / RI-05 (Hollow Shaft)

#### Dimensions: RI-04 Shaft Version

##### RI-04 Flange S Connection C & CA



##### RI-04 Flange C Connection H1181 & H1481

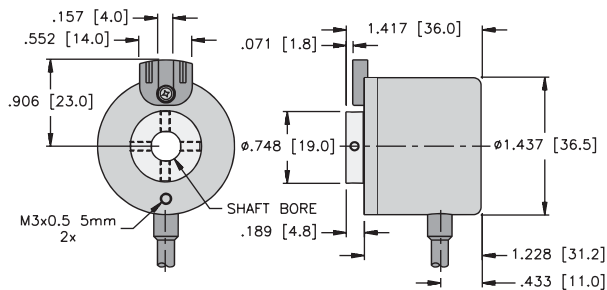


#### Mounting Advice:

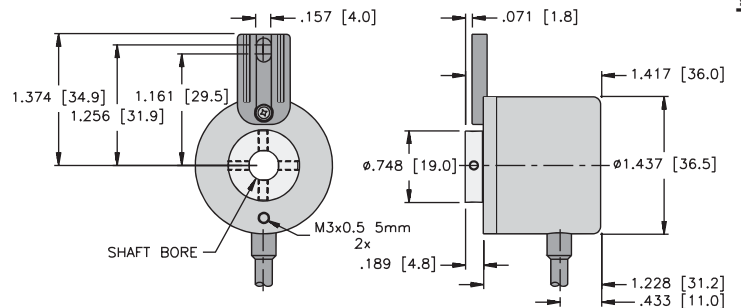
The flanges and shafts of the encoder and drive should not be rigidly coupled together at the same time. We recommend the use of suitable couplings (see page G1, Accessories).

#### Dimensions: RI-05 Hollow Shaft Version

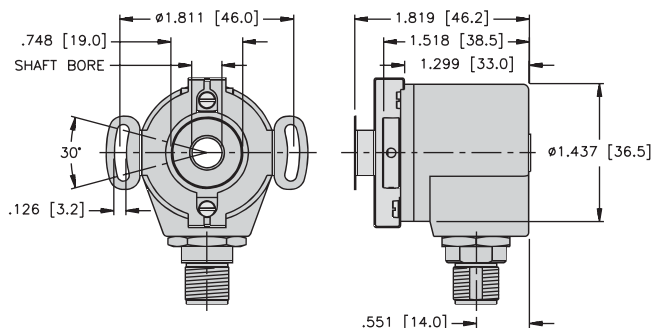
##### RI-05 Flange T1 Connection C



##### RI-05 Flange T Connection C



##### RI-05 Flange E Connection H1181

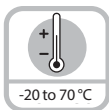


# Rotary Position Technology Incremental Encoders

## Economy Type RI-08 (Shaft) / RI-09 (Hollow Shaft)



High rotational speed



Temperature  
-20 to 70 °C



Shock/vibration resistant



Magnetic field proof



Short-circuit protected



Reverse polarity protection



Optical sensor

### Rugged

- Temperature and aging compensation
- Short-circuit protected outputs
- Flange and cover made from a new High-Tech-Material (composite material)
- High component integration leads to low profile design, high performance and economical pricing
- Cable outlet guarantees 10x higher strain relief than traditional cabling methods and ensures IP67 protection



### Versatile

- Hollow shaft version: Fits directly onto drive shaft - no couplings needed - saves up to 30% on cost and 60% on installation space and time
- 1 1/2" (37 mm) diameter housing suitable for replacing resolvers

### Compact

- Compact size only Ø 37 x 33 mm

### Mechanical Characteristics:

|                                    |   |
|------------------------------------|---|
| Speed:                             | max. 6,000 RPM  |
| Rotor moment of inertia:           | Shaft version: approx.<br>2.2 x 10 <sup>-2</sup> oz-in <sup>2</sup> (0.4 x 10 <sup>-6</sup> kgm <sup>2</sup> )        |
|                                    | Hollow shaft version: approx.<br>7.7 x 10 <sup>-2</sup> oz-in <sup>2</sup> (1.4 x 10 <sup>-6</sup> kgm <sup>2</sup> ) |
|                                    | Starting torque:  |
| Radial load capacity of the shaft: | 4.5 lbs (20 N)  |
| Axial load capacity of the shaft:  | 2.25 lbs (10 N)   |
| Weight:                            | approx. 0.22 lbs (0.1 kg)   |
| Protection acc. to EN 60 529:      | IP65 housing (IP67 on request)  |

|  |  |
|--|--|
| Working temperature:                       | -4 to 158 °F (-20 up to +70 °C) <sup>1)</sup>  |
| Materials:                                 | Shaft/hollow shaft: stainless steel; housing, flange: composite PPA, 40% CF (carbon fiber); cable: PVC |
| Shock resistance acc. to EN 60068-2-27:    | approx. 100 g (1,000 m/s <sup>2</sup> ), 6 ms  |
| Vibration resistance acc. to EN 60068-2-6: | approx. 10 g (100 m/s <sup>2</sup> ), 10-2,000 Hz  |

<sup>1)</sup> For versions with push-pull output and supply voltage >15 VDC: max. 131 °F (55 °C)

### Electrical Characteristics:

| Output circuit [Key Code]:                        | RS422 [4A]<br>(TTL compatible) | Push-Pull [2F]<br>(7272 compatible) <sup>3)</sup> | Push-Pull [2J]<br>(7272 compatible) <sup>3)</sup> |
|---|--------------------------------|---|---|
| Supply voltage:                                   | 5 V (±5%)                      | 5-30 VDC  | 10-30 VDC   |
| Power consumption (no load) with inverted signal: | typ. 40 mA /<br>max. 90 mA     | typ. 50 mA /<br>max. 100 mA                       | typ. 50 mA /<br>max. 50 mA                        |
| Permissible load/channel:                         | max. ±20 mA                    | max. ±20 mA                                       | max. ±20 mA                                       |
| Pulse frequency:                                  | max. 250 kHz                   | max. 250 kHz                                      | max. 250 kHz                                      |
| Signal level high:                                | min. 2.5 V                     | min. +V - 2.0 V                                   | min. +V - 2.0 V                                   |
| Signal level low:                                 | max. 0.5 V                     | max. 0.5 V  | max. 0.5 V  |
| Rise time t <sub>r</sub> :                        | max. 200 ns                    | max. 1 µs   | max. 1 µs   |
| Fall time t <sub>f</sub> :                        | max. 200 ns                    | max. 1 µs   | max. 1 µs   |
| Short-circuit protected <sup>1)</sup> :           | yes <sup>2)</sup>              | yes   | yes   |
| Reverse polarity protection:                      | no                             | no  | yes   |

RoHS compliant acc. to EU guideline 2011/65/EU

<sup>1)</sup> If supply voltage correctly applied

<sup>2)</sup> Only one channel allowed to be shorted-out:

(If +V=5V, short-circuit to channel, 0V, or +V is permitted.) (If +V=5-30V, short-circuit to channel or 0V is permitted.)

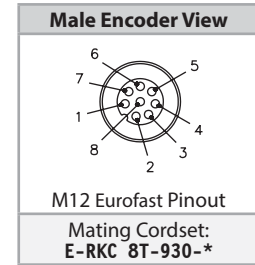
<sup>3)</sup> Max. recommended cable length 30 m

## Economy Type RI-08 (Shaft) / RI-09 (Hollow Shaft)

### Standard Wiring:

| Connection Type | Case Ground  | Common (0 V) | +V | A  | $\bar{A}$ | B  | $\bar{B}$ | Z  | $\bar{Z}$ |
|-----------------|--------------|--------------|----|----|-----------|----|-----------|----|-----------|
| M12 Eurofast    | Coupling Nut | 1            | 2  | 3  | 4         | 5  | 6         | 7  | 8         |
| Cable           | Shield/Drain | WH           | BN | GN | YE        | GY | PK        | BU | RD        |

### Wiring Diagram:



\* Length in meters.

### Part Number Key: RI-08 Shaft Version

| A      | B | C | D | E  | F  |
|--------|---|---|---|----|----|
| RI-08Q | 4 | S | - | 2F | 10 |

| A      | Type                                    |
|--------|---|
| RI-08Q | Ø 37 mm, Shaft w/ Flat, IP65 Shaft Seal |

| B  | Shaft (Ø x L)    |
|----|------------------|
| 4  | Ø 4 mm x 12.5 mm |
| 5  | Ø 5 mm x 12.5 mm |
| 6  | Ø 6 mm x 12.5 mm |
| 8  | Ø 8 mm x 12.5 mm |
| A0 | Ø 1/4" x 12.5 mm |

| C  | Flange                     |
|----|----------------------------|
| S  | Ø 20 mm Flange w/o Adapter |
| S1 | Ø 20 mm Flange w/ Adapter  |

| D  | Voltage Supply and Output Type             |
|----|--|
| 2F | 5-30 VDC, Push-Pull (w/ Inverted Signals)  |
| 2J | 10-30 VDC, Push-Pull (w/ Inverted Signals) |
| 4A | 5 VDC (±5%), RS422 (w/ Inverted Signals)   |

| E | Pulse Rate   |
|---|--|
|   | 10, 25, 50, 60, 100, 200, 250, 300,<br>360, 400, 500, 512, 600, 1000, 1024<br>(e.g. 250 Pulses => 250)<br>Other Pulse Rates Available on Request |

| F    | Type of Connection       |
|------|--------------------------|
| C    | Radial Cable (2 m PVC) * |
| C1M  | Radial Cable (1 m PVC) * |
| CA   | Axial Cable (2 m PVC) *  |
| CA1M | Axial Cable (1 m PVC) *  |

\* Other Cable Lengths Available on Request

### Part Number Key: RI-09 Hollow Shaft Version

| A      | B | C | D | E  | F  |
|--------|---|---|---|----|----|
| RI-09I | 4 | E | - | 2F | 10 |

| A      | Type                                   |
|--------|--|
| RI-09I | Ø 36 mm, Hollow Shaft, IP65 Shaft Seal |

| B  | Bore   |
|----|--------|
| 4  | Ø 4 mm |
| 5  | Ø 5 mm |
| 6  | Ø 6 mm |
| 8  | Ø 8 mm |
| A0 | Ø 1/4" |

| C  | Flange                               |
|----|--------------------------------------|
| E  | Ø 19 mm Flange w/ Slotted Flex Mount |
| T  | Ø 19 mm Flange w/ Long Torque Stop   |
| T1 | Ø 19 mm Flange w/ Short Torque Stop  |

| D  | Voltage Supply and Output Type             |
|----|--|
| 2F | 5-30 VDC, Push-Pull (w/ Inverted Signals)  |
| 2J | 10-30 VDC, Push-Pull (w/ Inverted Signals) |
| 4A | 5 VDC (±5%), RS422 (w/ Inverted Signals)   |

| E | Pulse Rate   |
|---|--|
|   | 10, 25, 50, 60, 100, 200, 250, 300,<br>360, 400, 500, 512, 600, 1000, 1024<br>(e.g. 250 Pulses => 250)<br>Other Pulse Rates Available on Request |

| F   | Type of Connection       |
|-----|--------------------------|
| C   | Radial Cable (2 m PVC) * |
| C1M | Radial Cable (1 m PVC) * |

\* Other Cable Lengths Available on Request

### Accessories:

- See page H1, Connectivity, for cables and connectors
- See page G1, Accessories, for mounting attachments and couplings

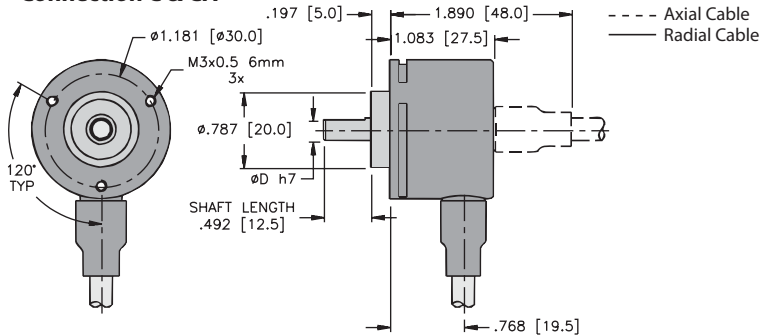
# Rotary Position Technology

## Incremental Encoders

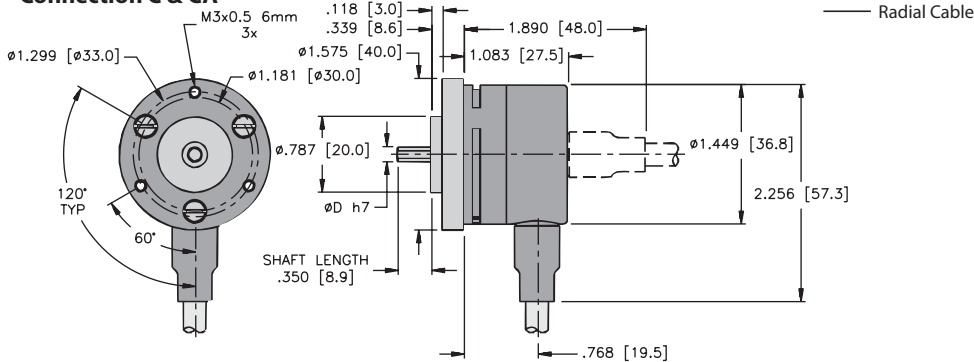
### Economy Type RI-08 (Shaft) / RI-09 (Hollow Shaft)

#### Dimensions: RI-08 Shaft Version

##### RI-08 Flange S Connection C & CA



##### RI-08 Flange S1 Connection C & CA

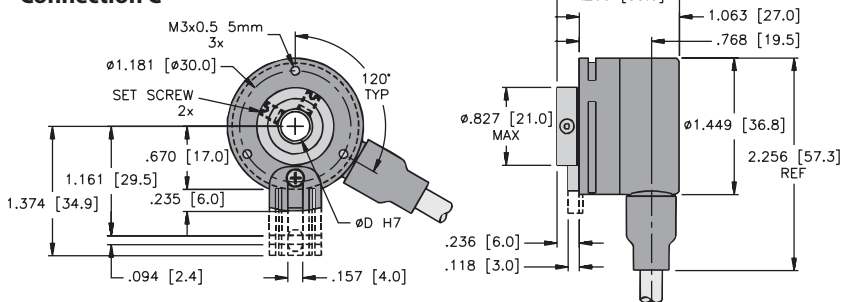


#### Mounting Advice:

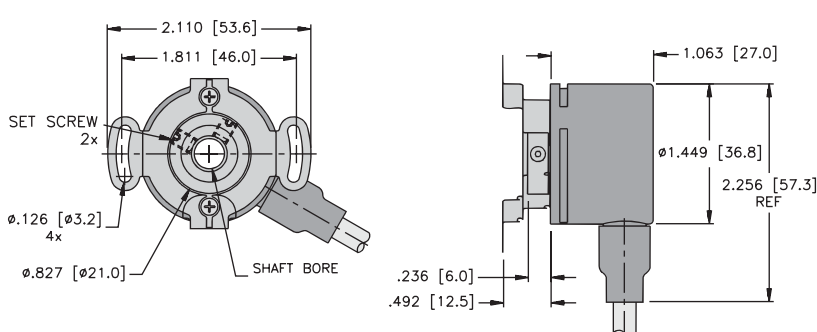
The flanges and shafts of the encoder and drive should not be rigidly coupled together at the same time. We recommend the use of suitable couplings (see page G1, Accessories).

#### Dimensions: RI-09 Hollow Shaft Version

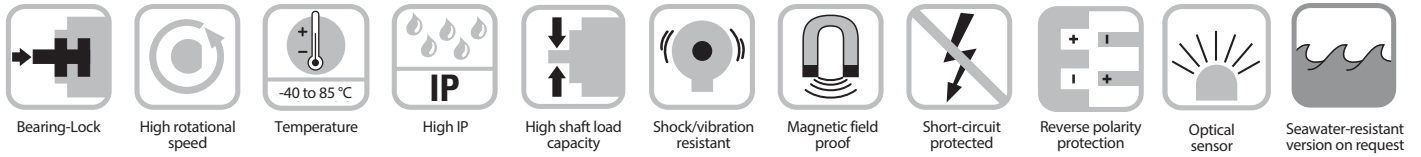
##### RI-09 Flange T & T1 Connection C



##### RI-09 Flange E Connection C



## Incremental Type RI-10 (Shaft) / RI-12 (Hollow Shaft)



### Versatile

- **The right connection for every application:** Cable, M12 connector, M23 connector, and Mil-Spec Connectors.
- **Wide variety of standard industrial mounting options:** Servo, square, clamping flanges.
- **Standardized designs for worldwide use:** Compatible with US and European standards; 5-30 V supplies; Various output options; Up to 5,000 ppr.



### Compact

- **Small footprint:**  
Outer diameter 2" x 2"  
Can utilize 2" or 2.5" flanges.

### Rugged and Tough

- **High tolerance to vibration, shock and alignment issues:**  
Sturdy double bearing lock design.
- **Environmentally protected design:**  
Die-cast housings; butyl rubber shaft seals and O-rings; robust stainless steel hubs, flanges, and disc tables. Ratings up to IP67.
- **Wide temperature range:**  
-40 to +185 °F (-40 to +85 °C)
- Also available in seawater resistant version, certified acc. to salt-spray test IEC 68-2-11 ≥ 672 hours

### Mechanical Characteristics:

|                                    |  |
|------------------------------------|--|
| Speed IP65 <sup>1)</sup> :         | max. 12,000 RPM  |
| Speed IP67 <sup>2)</sup> :         | max. 6,000 RPM   |
| Rotor moment of inertia:           | Shaft: approx. 0.098 oz-in <sup>2</sup><br>(1.8 x 10 <sup>-6</sup> kgm <sup>2</sup> )        |
|                                    | Hollow shaft: approx. 0.328 oz-in <sup>2</sup><br>(6.0 x 10 <sup>-6</sup> kgm <sup>2</sup> ) |
| Starting torque:                   | < 1.4 oz-in (< 0.01 Nm), IP65<br>< 7 oz-in (< 0.05 Nm), IP67                                 |
| Radial load capacity of the shaft: | 18 lbs (80 N)  |
| Axial load capacity of the shaft:  | 9 lbs (40 N)   |

|   |   |
|---|---|
| Weight:   | approx. 0.9 lbs (0.4 kg)                  |
| Protection acc. to EN 60 529 without shaft sealing: | IP65                                      |
| Protection acc. to EN 60 529 with shaft sealing:    | IP67                                      |
| Working temperature <sup>3)</sup> :                 | -40 to +185 °F<br>(-40 to +85 °C)         |
| Shaft:  | stainless steel                           |
| Shock resistance acc. to EN 60068-2-27:             | 250 g (2,500 m/s <sup>2</sup> ), 6 ms     |
| Vibration resistance to EN 60068-2-6:               | 10 g (100 m/s <sup>2</sup> ), 10-2,000 Hz |

<sup>1)</sup> For continuous operation 6000 RPM

<sup>2)</sup> For continuous operation max. 3000 RPM

<sup>3)</sup> With connector: -40 °F (-40 °C), cable fixed: -22 °F (-30 °C), cable moved: -4 °F (-20 °C)

### Electrical Characteristics:

| Output circuit [Key Code]:              | RS 422 [4B]<br>(TTL compatible) | RS 422 [4A]<br>(TTL compatible) | Push-Pull [2B]            | Push-Pull [2K]<br>(7272 compatible) <sup>3)</sup> | Open Collector [CA]<br>(7273) <sup>3)</sup> |
|---|---------------------------------|---------------------------------|---------------------------|---|---|
| Supply voltage:                         | 5-30 VDC                        | 5 V ±5%                         | 10-30 V DC                | 5-30 V DC   | 5-30 V DC                                   |
| Power consumption (no load):            | typ. 40 mA<br>max. 90 mA        | typ. 40 mA<br>max. 90 mA        | typ. 50 mA<br>max. 100 mA | typ. 50 mA<br>max. 100 mA                         | 100 mA                                      |
| Permissible load/channel:               | max. ±20 mA                     | max. ±20 mA                     | max. ±20 mA               | max. ±20 mA                                       | 20 mA sink@30 VDC                           |
| Pulse frequency:                        | max. 300 kHz                    | max. 300 kHz                    | max. 300 kHz              | max. 300 kHz                                      | max. 300 kHz                                |
| Signal level high:                      | min. 2.5 V                      | min. 2.5 V                      | min. +V -1.0 V            | min. +V -2.0 V                                    | n/a   |
| Signal level low:                       | max. 0.5 V                      | max. 0.5 V                      | max. 0.5 V                | max. 0.5 V  | n/a   |
| Rise time t <sub>r</sub> :              | max. 200 ns                     | max. 200 ns                     | max. 1 μs                 | max. 1 μs   |   |
| Fall time t <sub>f</sub> :              | max. 200 ns                     | max. 200 ns                     | max. 1 μs                 | max. 1 μs   |   |
| Short-circuit protected <sup>1)</sup> : | yes <sup>2)4)</sup>             | yes <sup>2)4)</sup>             | yes                       | yes <sup>2)4)</sup>                               | yes   |
| Reverse polarity protection:            | yes                             | no                              | yes                       | no  | no  |

RoHS compliant acc. to EU guideline 2011/65/EU

<sup>1)</sup> If supply voltage correctly applied

<sup>2)</sup> Only one channel allowed to be shorted-out: (If +V=5 V, short-circuit to channel, 0 V, or +V is permitted.) (If +V=5-30 V, short-circuit to channel or 0 V is permitted.)

<sup>3)</sup> Max. recommended cable length 30 m

<sup>4)</sup> Approximately one minute

# Rotary Position Technology

## Incremental Encoders

### Incremental Type RI-10 (Shaft) / RI-12 (Hollow Shaft)

#### Standard Wiring :

| Connection Type    | Case Ground  | Common (0V) | +V | A  | $\bar{A}$ | B  | $\bar{B}$ | Z  | $\bar{Z}$ | N/C | N/C | 0V <sup>1)</sup> Sens | +V <sup>2)</sup> Sens |
|--------------------|--------------|-------------|----|----|-----------|----|-----------|----|-----------|-----|-----|-----------------------|-----------------------|
| M23 Multifast      | Coupling Nut | 10          | 12 | 5  | 6         | 8  | 1         | 3  | 4         | -   | -   | 11                    | 2                     |
| MS 6-pin           | -            | A           | B  | E  | -         | D  | -         | C  | -         | -   | -   |                       |                       |
| MS 7-pin           | G            | F           | D  | A  | -         | B  | -         | C  | -         | -   | -   |                       | E                     |
| MS 10-pin          | J            | F           | D  | A  | G         | B  | H         | C  | I         | -   | -   |                       | E                     |
| M12 Eurofast 8-pin | Coupling Nut | 1           | 2  | 3  | 4         | 5  | 6         | 7  | 8         | -   | -   |                       |                       |
| M12 Eurofast 5-pin | Coupling Nut | 3           | 1  | 4  | -         | 2  | -         | 5  | -         | -   | -   |                       |                       |
| Cable              | Shield/Drain | WH          | BN | GN | YE        | GY | PK        | BU | RD        | BK  | VT  | GY/PK                 | RD/BU                 |

<sup>1)</sup> The sensor cables are connected to the supply voltage internally. If long feeder cables are involved they can be used to adjust or control the voltage at the encoder.

<sup>2)</sup> Isolate unused outputs before initial startup.

#### Special Pin Configuration:

| Wiring Code | Connection Type    | Case Ground  | Common (0V) | +V | A | $\bar{A}$ | B | $\bar{B}$ | Z | $\bar{Z}$ |
|-------------|--------------------|--------------|-------------|----|---|-----------|---|-----------|---|-----------|
| N41         | M12 Eurofast 8-pin | Coupling Nut | 7           | 2  | 1 | 3         | 4 | 5         | 6 | 8         |
| N35         | MS 6-pin           | -            | A, F        | B  | D | -         | E | -         | C | -         |
| N38         | MS 7-pin           | G            | F           | D  | A | C         | B | E         | - | -         |
| N40         | MS 10-pin          | G            | F           | D  | A | H         | B | I         | C | J         |
| N78         | M12 Eurofast 5-pin | Coupling Nut | 1           | 2  | 3 | -         | 4 | -         | 5 | -         |

#### Wiring Diagrams:

| Male Encoder View              |                                  |                                |                            |                              |                               |
|--------------------------------|----------------------------------|--------------------------------|----------------------------|------------------------------|-------------------------------|
|                                |                                  |                                |                            |                              |                               |
| M12 Eurofast Pinout            | M12 Eurofast Pinout              | M23 Multifast Pinout           | MS Pinout (6-pin)          | MS Pinout (7-pin)            | MS Pinout (10-pin)            |
| Mating Cordset: E-RKC 8T-930-* | Mating Cordset: E-RKC 4.5T-930-* | Mating Cordset: E-CKM 12-931-* | Mating Cordset: E-MK 6-0-* | Mating Cordset: E-MK 7-930-* | Mating Cordset: E-MK 10-931-* |

\* Length in meters.

### Incremental Type RI-10 (Shaft) / RI-12 (Hollow Shaft) Accessories - Inserts

#### Isolation/Adapter Inserts for Hollow Shaft Encoders



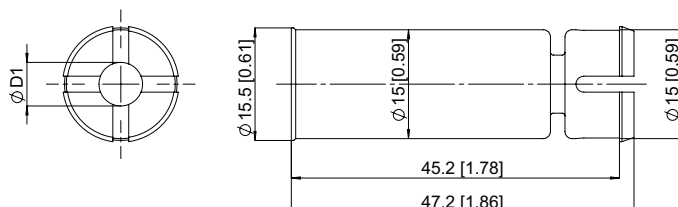
#### Thermal and Electrical Isolation of the Encoders:

Isolation inserts prevent currents from passing through the encoder bearings. These currents can occur when using inverter controlled three-phase or AC vector motors and considerably shorten the service life of the encoder bearings. In addition, the encoder is thermally isolated as the plastic does not transfer the heat to the encoder.

#### Tip:

By using these adapter inserts, you can achieve six different hollow shaft diameters, all on the basis of one 15 mm encoder.

#### Dimensions:



| Isolation Insert | D1 [mm] | D1 [in] |
|------------------|---------|---------|
| RSA-6-12         | 6       |         |
| RSA-A0-12        | 6.35    | (1/4)   |
| RSA-10-12        | 10      |         |
| RSA-A1-12        | 9.53    | (3/8)   |
| RSA-12-12        | 12      |         |
| RSA-A3-12        | 12.7    | (1/2)   |

Note: Use with 15 mm bore size hollow shaft RI-12 encoder.

### Incremental Type RI-10 (Shaft)

#### Part Number Key: RI-10 Shaft Version

| A      | B | C  |   | D  | E    |   | F     |   | G/H      |
|--------|---|----|---|----|------|---|-------|---|----------|
| RI-10S | 6 | Z2 | - | 2B | 1024 | - | H1181 | / | Specials |

| A      | Type                         |
|--------|------------------------------|
| RI-10S | Ø 2", Shaft, IP67 Shaft Seal |
| RI-10T | Ø 2", Shaft, IP65 Shaft Seal |

| B  | Shaft (Ø x L)        |
|----|----------------------|
| 6  | Ø 6 mm x 10 mm       |
| 8  | Ø 8 mm x 15 mm       |
| 10 | Ø 10 mm x 20 mm      |
| 12 | Ø 12 mm x 20 mm      |
| A0 | Ø 1/4" <sup>1)</sup> |
| A1 | Ø 3/8" <sup>2)</sup> |

<sup>1)</sup> 1/4" x 5/8" for Flange Z2, Z4, C & S. 1/4" x 7/8" for Flange R & S0.  
<sup>2)</sup> 3/8" x 5/8" for Flange Z2, Z4, C & S. 3/8" x 7/8" for Flange R & S0.

| C  | Flange                  |
|----|-------------------------|
| Z2 | Ø 2" Servo Flange       |
| Z4 | 2" Square Flange        |
| C  | Ø 58 mm Clamping Flange |
| S  | Ø 58 mm Servo Flange    |
| R  | 2.5" Square Flange      |
| S0 | Ø 2.5" Servo Flange     |

| D  | Voltage Supply and Output Type                        |
|----|---|
| 2B | 10-30 VDC, Push-Pull                                  |
| 2K | 5-30 VDC, Push-Pull (7272 comp. w/o bypass capacitor) |
| 4A | 5 VDC, RS422 (TTL compatible)                         |
| 4B | 5-30 VDC, RS422 (TTL compatible)                      |
| CA | 5-30 VDC, Open Collector                              |

| E | Pulse Rate  |
|---|---|
|   | 1, 2, 4, 5, 10, 12, 14, 20, 25, 28, 30, 32, 36, 50, 60, 64, 80, 100, 120, 125, 150, 180, 200, 240, 250, 256, 300, 342, 360, 375, 400, 500, 512, 600, 625, 720, 800, 900, 1000, 1024, 1200, 1250, 1500, 1800, 2000, 2048, 2500, 3000, 3600, 4000, 4096, 5000<br>(e.g. 250 Pulses => 250)<br>Other Pulse Rates Available on Request |

| F      | Type of Connection                     |
|--------|--|
| H1181  | Radial 8-pin M12 Eurofast Connector    |
| H1481  | Axial 8-pin M12 Eurofast Connector     |
| H1151  | Radial 5-pin M12 Eurofast Connector    |
| H1451  | Axial 5-pin M12 Eurofast Connector     |
| 12M23  | Radial 12-pin M23 Multifast® Connector |
| 12M23A | Axial 12-pin M23 Multifast Connector   |
| 6MIL   | Radial 6-pin MS Connector              |
| 7MIL   | Radial 7-pin MS Connector              |
| 10MIL  | Radial 10-pin MS Connector             |
| C1M    | Radial Cable (1 m PVC)                 |
| CA1M   | Axial Cable (1 m PVC)                  |

| G | Special Output Signal Formats |
|---|-------------------------------|
|   | N21 to N33 (See Page E40)     |

| H | Special Connector Pin Configuration |
|---|-------------------------------------|
|   | N35 to N41 (See Page E12)           |

#### Accessories:

- See page H1, Connectivity, for cables and connectors
- See page G1, Accessories, for mounting attachments and couplings

# Rotary Position Technology

## Incremental Encoders

### Incremental Type RI-12 (Hollow Shaft)

#### Part Number Key: RI-12 Hollow Shaft Version

| A      | B | C  |   | D  | E    |   | F     |   | G/H      |
|--------|---|----|---|----|------|---|-------|---|----------|
| RI-12H | 6 | S1 | - | 2B | 1024 | - | H1181 | / | Specials |

| A      | Type                               |
|--------|------------------------------------|
| RI-12H | Ø 2" Hollow Shaft, IP67 Shaft Seal |
| RI-12I | Ø 2" Hollow Shaft, IP65 Shaft Seal |

| B  | Bore    |
|----|---------|
| 6  | Ø 6 mm  |
| 8  | Ø 8 mm  |
| 10 | Ø 10 mm |
| 12 | Ø 12 mm |
| 14 | Ø 14 mm |
| 15 | Ø 15 mm |
| A0 | Ø 1/4"  |
| A1 | Ø 3/8"  |
| A3 | Ø 1/2"  |
| A4 | Ø 5/8"  |

| C  | Flange                        |
|----|-------------------------------|
| S1 | Flange w/ Long Tether Arm     |
| T  | Flange w/ Torque Stop*        |
| E2 | Ø 2.25" w/ Flex Mount         |
| E  | Ø 63 mm w/ Slotted Flex Mount |
| E1 | Ø 65 mm w/ Flex Mount         |

\* Requires 4 mm torque pin

| D  | Voltage Supply and Output Type                        |
|----|---|
| 2B | 10-30 VDC, Push-Pull                                  |
| 2K | 5-30 VDC, Push-Pull (7272 comp. w/o bypass capacitor) |
| 4A | 5 VDC, RS422 (TTL compatible)                         |
| 4B | 5-30 VDC, RS422 (TTL compatible)                      |
| CA | 5-30 VDC, Open Collector                              |

| E | Pulse Rate  |
|---|---|
|   | 1, 2, 4, 5, 10, 12, 14, 20, 25, 28, 30, 32, 36, 50, 60, 64, 80, 100, 120, 125, 150, 180, 200, 240, 250, 256, 300, 342, 360, 375, 400, 500, 512, 600, 625, 720, 800, 900, 1000, 1024, 1200, 1250, 1500, 1800, 2000, 2048, 2500, 3000, 3600, 4000, 4096, 5000<br>(e.g. 250 Pulses => 250)<br>Other Pulse Rates Available on Request |

| F            | Type of Connection                               |
|--------------|--|
| H1181        | Radial 8-pin M12 Eurofast Connector              |
| H1151        | Radial 5-pin M12 Eurofast Connector              |
| 12M23        | Radial 12-pin M23 Multifast Connector            |
| 10MIL        | Radial 10-pin MS Connector                       |
| C1M          | Radial Cable (1 m PVC)                           |
| CT1M         | Tangential Cable (1 m PVC)                       |
| CT0.3M-FSFD5 | Tangential Cable w/ 0.3 m M12 Eurofast Connector |

| G | Special Output Signal Formats |
|---|-------------------------------|
|   | N21 to N33 (See Page E40)     |

| H | Special Connector Pin Configuration |
|---|-------------------------------------|
|   | N36 - N41 (See Page E12)            |

#### Accessories:

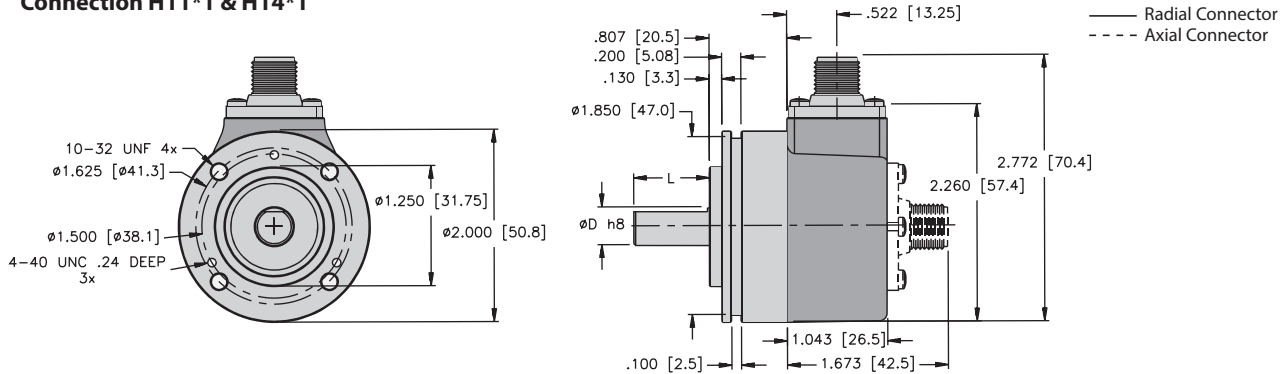
- See page H1, Connectivity, for cables and connectors
- See page G1, Accessories, for mounting attachments and couplings



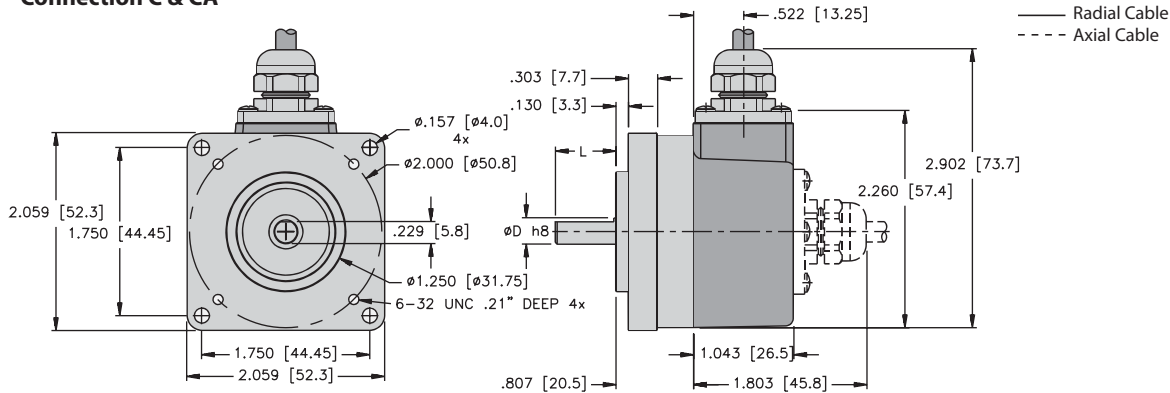
### Incremental Type RI-10 (Shaft) / RI-12 (Hollow Shaft)

#### Dimensions: RI-10 Shaft Version

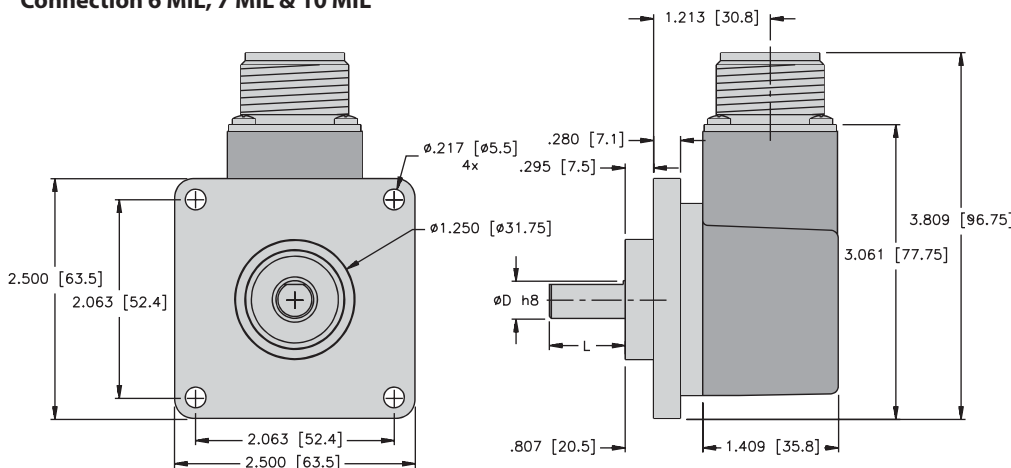
##### RI-10 Flange Z2 Connection H11\*1 & H14\*1



##### RI-10 Flange Z4 Connection C & CA



##### RI-10 Flange R Connection 6 MIL, 7 MIL & 10 MIL



#### Mounting advice:

The flanges and shafts of the encoder and drive should not be rigidly coupled together at the same time. We recommend the use of suitable couplings (see page G1, Accessories).

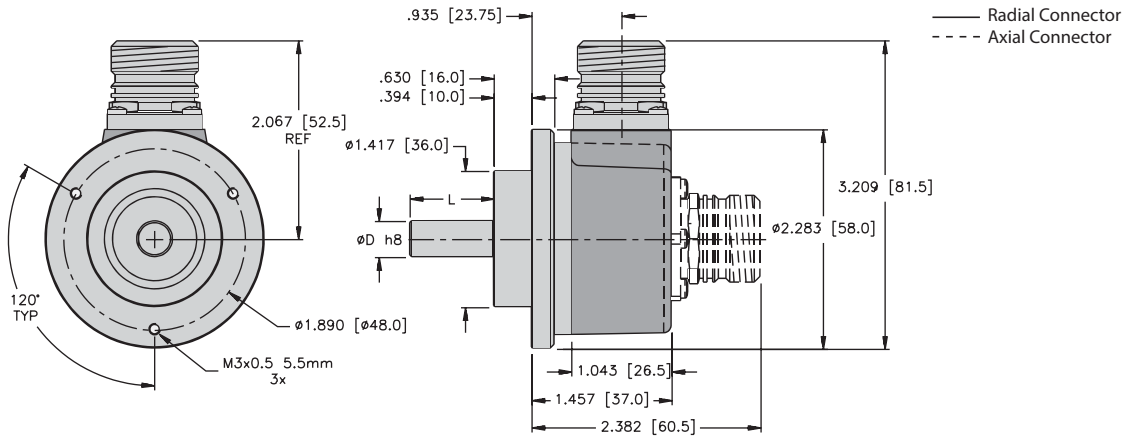
# Rotary Position Technology

## Incremental Encoders

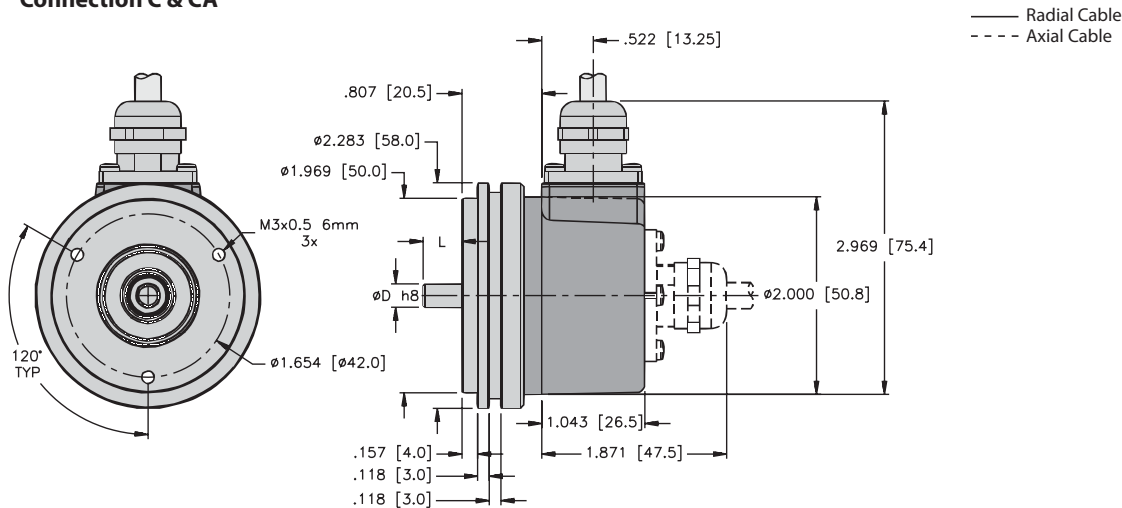
### Incremental Type RI-10 (Shaft) / RI-12 (Hollow Shaft)

#### Dimensions: RI-10 Shaft Version

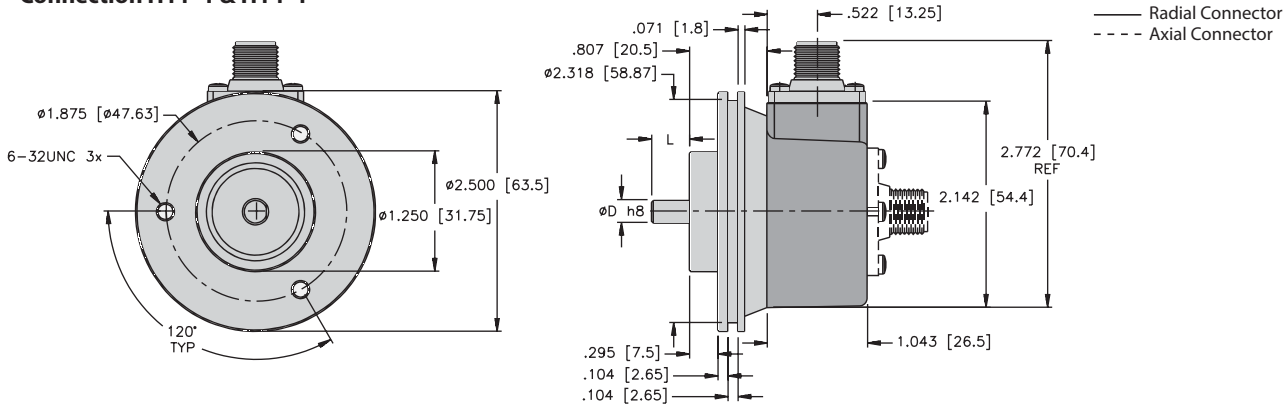
##### RI-10 Flange C Connection 12M23 & 12M23A



##### RI-10 Flange S Connection C & CA



##### RI-10 Flange S0 Connection H11\*1 & H14\*1



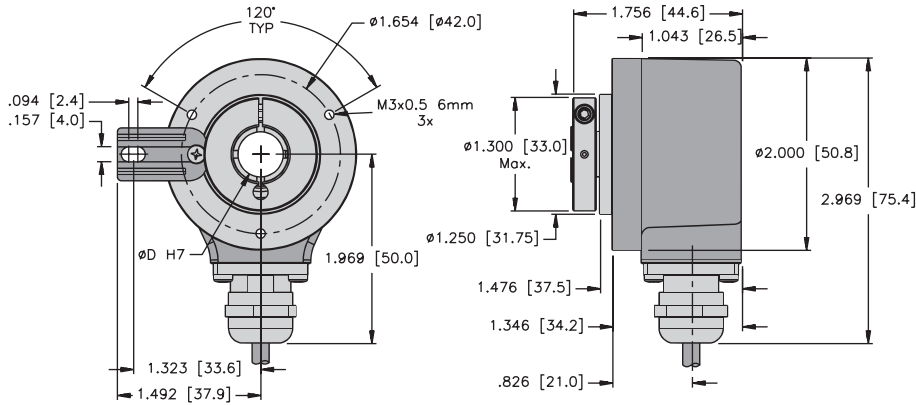
#### Mounting Advice:

The flanges and shafts of the encoder and drive should not be rigidly coupled together at the same time. We recommend the use of suitable couplings (see page G1, Accessories).

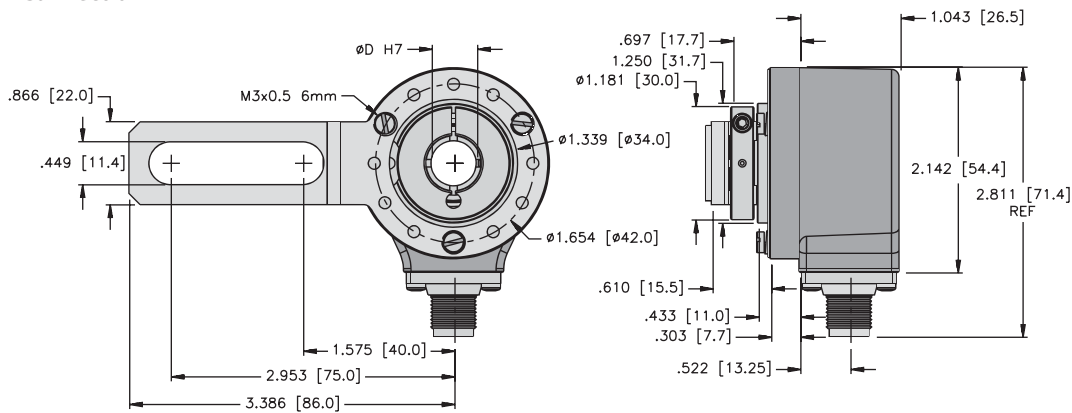
### Incremental Type RI-10 (Shaft) / RI-12 (Hollow Shaft)

#### Dimensions: RI-12 Hollow Shaft Version

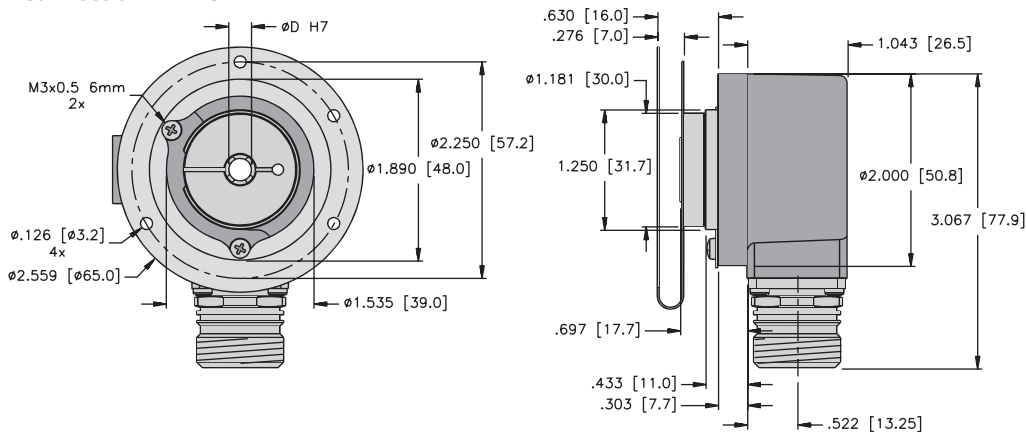
##### RI-12 Flange T Connection C



##### RI-12 Flange S1 Connection H11\*1



##### RI-12 Flange E2 Connection 12M23



Incremental Encoders

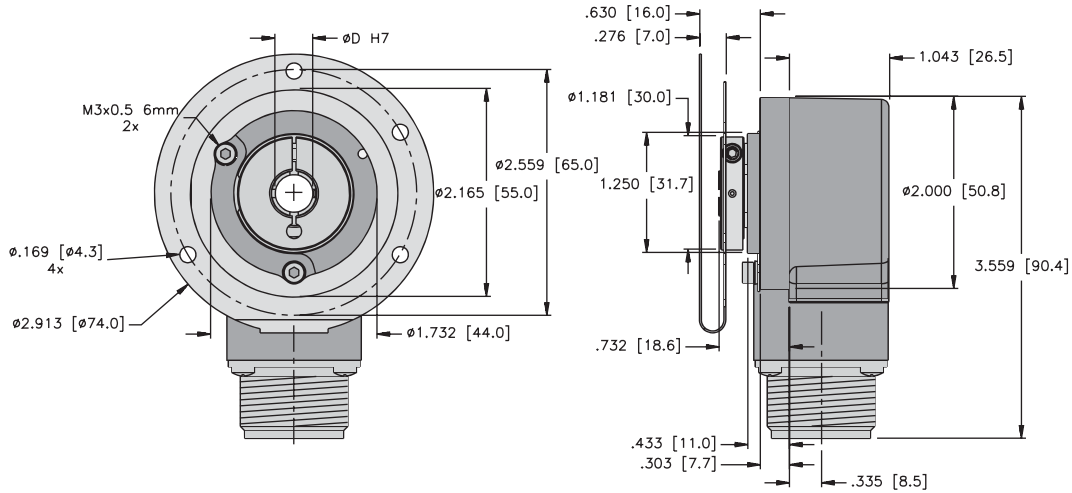
# Rotary Position Technology

## Incremental Encoders

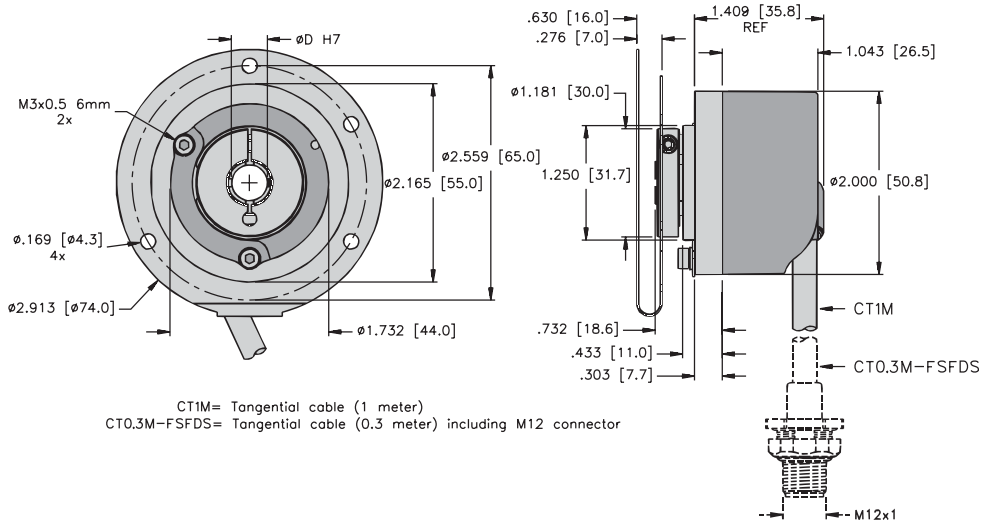
### Incremental Type RI-10 (Shaft) / RI-12 (Hollow Shaft)

Dimensions: RI-12 Hollow Shaft Version

RI-12 Flange E1  
Connection 10 MIL

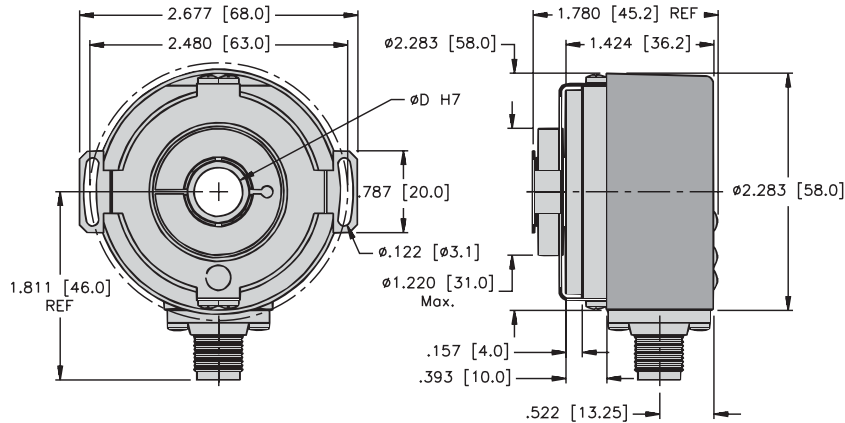


RI-12 Flange E1  
Connection CT

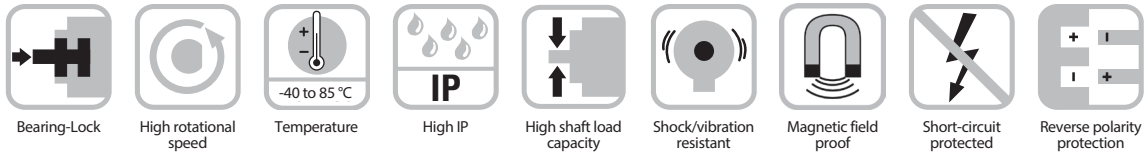


CT1M= Tangential cable (1 meter)  
CT0.3M-FSFDS= Tangential cable (0.3 meter) including M12 connector

RI-12 Flange E  
Connection H11\*1



### Incremental Type RI-65 (Shaft) / RI-96 (Hollow Shaft), Stainless Steel



#### Versatile

- **Reliable mounting in a wide variety of installation situations:** Comprehensive and proven mounting options.
- **Standard encoder for use worldwide:** compatible with II US and European standards, supply voltage 5-30 VDC, various interface options, max. 5000 ppr.



#### Compact

- **Can be used even where space is tight:** outer diameter 50 mm, installation depth max. 47 mm.

#### Rugged

- Stays sealed even when subjected to harsh everyday use:
  - IP67 Protection
  - Rugged stainless-steel housing
  - Viton seals
  - High security against failures in the field, ideal for use in outdoor applications
- **Can be used in a wide temperature range:** -40 to +185 °F (-40 to +85 °C)
- **Increased ability to withstand vibration and installation errors:** Eliminates machine downtime and repairs. Sturdy double bearing lock design.

#### Mechanical Characteristics:

|  |   |
|--|---|
| Speed <sup>1)</sup> :                            | max. 6,000 RPM  |
| Rotor moment of inertia:                         | approx. 0.098 oz-in <sup>2</sup> (1.8 x 10 <sup>-6</sup> kgm <sup>2</sup> ) |
| Starting torque:                                 | < 7 oz-in (< 0.05 Nm)   |
| Weight:  | approx. 0.9 lbs (0.4 kg)  |
| Radial load capacity of the shaft:               | 18 lbs (80 N)   |
| Axial load capacity of the shaft:                | 9 lbs (40 N)  |
| Protection acc. to EN 60 529 with shaft sealing: | IP66/IP67   |

<sup>1)</sup> For continuous operation 3,000 RPM

|   |  |
|---|--|
| Working temperature:                    | -40 to +185 °F (-40 to +85 °C)   |
| Materials:                              | Housing, flange, Shaft: 1.4305 (303) stainless steel<br>Connector: stainless steel<br>Seals: viton |
| Shock resistance acc. to EN 60068-2-27: | 250 g (2,500 m/s <sup>2</sup> ), 6 ms  |
| Vibration resistance to EN 60068-2-6:   | 10 g (100 m/s <sup>2</sup> ), 10-2,000 Hz  |

#### Electrical Characteristics:

| Output circuit [Key Code]:              | RS 422 [4A]<br>(TTL compatible) | Push-Pull [2B]            | Push-Pull [2F]<br>(7272 compatible) |
|---|---------------------------------|---------------------------|-------------------------------------|
| Supply voltage:                         | 5 V ±5%                         | 10-30 VDC                 | 5-30 VDC                            |
| Power consumption (no load):            | typ. 40 mA<br>max. 90 mA        | typ. 50 mA<br>max. 100 mA | typ. 50 mA<br>max. 100 mA           |
| Permissible load/channel:               | max. ±20 mA                     | max. ±20 mA               | max. ±20 mA                         |
| Pulse frequency:                        | max. 300 kHz                    | max. 300 kHz              | max. 300 kHz <sup>3)</sup>          |
| Signal level high:                      | min. 2.5 V                      | min. +V -1.0 V            | min. +V -2.0 V                      |
| Signal level low:                       | max. 0.5 V                      | max. 0.5 V                | max. 0.5 V                          |
| Rise time t <sub>r</sub> :              | max. 200 ns                     | max. 1 µs                 | max. 1 µs                           |
| Fall time t <sub>f</sub> :              | max. 200 ns                     | max. 1 µs                 | max. 1 µs                           |
| Short-circuit protected <sup>1)</sup> : | yes <sup>2)</sup>               | yes                       | yes <sup>2) 4)</sup>                |
| Reverse polarity protection:            | no                              | yes                       | no                                  |

RoHS compliant acc. to EU guideline 2011/65/EU

<sup>1)</sup> If supply voltage correctly applied

<sup>2)</sup> Only one channel allowed to be shorted-out:

(If +V=5 V, short-circuit to channel, 0 V, or +V is permitted.) (If +V=5-30 V, short-circuit to channel or 0 V is permitted.)

<sup>3)</sup> Max. recommended cable length 30 m

<sup>4)</sup> Approximately one minute

# Rotary Position Technology

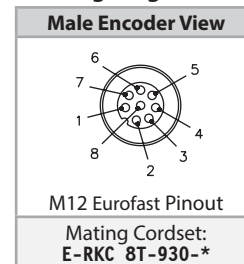
## Incremental Encoders

### Incremental Type RI-65 (Shaft) / RI-96 (Hollow Shaft), Stainless Steel

#### Standard Wiring:

| Connection Type | Case Ground  | Common (0V) | +V | A  | $\bar{A}$ | B  | $\bar{B}$ | Z  | $\bar{Z}$ |
|-----------------|--------------|-------------|----|----|-----------|----|-----------|----|-----------|
| M12 Eurofast    | Coupling Nut | 1           | 2  | 3  | 4         | 5  | 6         | 7  | 8         |
| Cable           | Shield/Drain | WH          | BN | GN | YE        | GY | PK        | BU | RD        |

#### Wiring Diagram:



\* Length in meters.

#### Part Number Key: RI-65 Shaft Version

| A      | B | C |   | D  | E   |   | F     |
|--------|---|---|---|----|-----|---|-------|
| RI-65S | 6 | C | - | 2B | 360 | - | H1181 |

| A      | Type                        |
|--------|-----------------------------|
| RI-65S | Ø 2" Shaft, IP67 Shaft Seal |

| B  | Shaft (Ø x L)   |
|----|-----------------|
| 6  | Ø 6 mm x 10 mm  |
| 10 | Ø 10 mm x 20 mm |
| A1 | Ø 3/8" x 7/8"   |

| C | Flange                  |
|---|-------------------------|
| C | Ø 58 mm Clamping Flange |
| S | Ø 58 mm Servo Flange    |
| R | 2.5" Square Flange      |

| D  | Voltage Supply and Output Type            |
|----|---|
| 2B | 10-30 VDC, Push-Pull (w/ Inverted Signal) |
| 2F | 5-30 VDC, Push-Pull (w/ Inverted Signal)  |
| 4A | 5 VDC, RS 422 (w/ Inverted Signal)        |

| E | Pulse Rate   |
|---|--|
|   | 1, 5, 10, 12, 36, 100, 200, 250, 256, 360, 400, 500, 512, 600, 800, 1000, 1024, 1200, 2000, 2048, 2500, 3600, 4096, 5000<br>(e.g. 250 Pulses => 250)<br>Other Pulse Rates Available on Request |

| F     | Type of Connection                  |
|-------|-------------------------------------|
| H1181 | Radial 8-pin M12 Eurofast Connector |

#### Part Number Key: RI-96 Hollow Shaft Version

| A      | B  | C |   | D  | E   |   | F     |
|--------|----|---|---|----|-----|---|-------|
| RI-96H | A0 | E | - | 2B | 360 | - | H1181 |

| A      | Type                               |
|--------|------------------------------------|
| RI-96H | Ø 2" Hollow Shaft, IP67 Shaft Seal |

| B  | Bore    |
|----|---------|
| 10 | Ø 10 mm |
| 12 | Ø 12 mm |
| 15 | Ø 15 mm |
| A0 | Ø 1/4"  |
| A1 | Ø 3/8"  |
| A3 | Ø 1/2"  |

| C | Flange                        |
|---|-------------------------------|
| E | Ø 63 mm w/ Slotted Flex Mount |
| T | Flange w/ Torque Stop         |

| D  | Voltage Supply and Output Type            |
|----|---|
| 2B | 10-30 VDC, Push-Pull (w/ Inverted Signal) |
| 2F | 5-30 VDC, Push-Pull (w/ Inverted Signal)  |
| 4A | 5 VDC, RS 422 (w/ Inverted Signal)        |

| E | Pulse Rate   |
|---|--|
|   | 1, 5, 10, 12, 36, 100, 200, 250, 256, 360, 400, 500, 512, 600, 800, 1000, 1024, 1200, 2000, 2048, 2500, 3600, 4096, 5000<br>(e.g. 250 Pulses => 250)<br>Other Pulse Rates Available on Request |

| F     | Type of Connection                  |
|-------|-------------------------------------|
| H1181 | Radial 8-pin M12 Eurofast Connector |

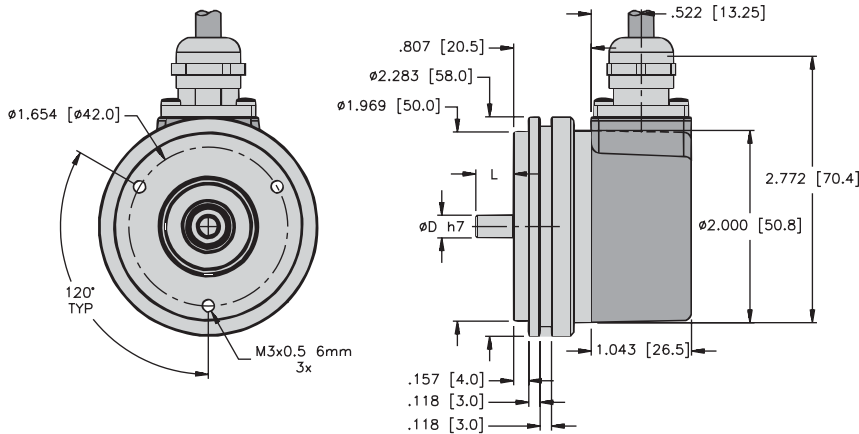
#### Accessories:

- See page H1, Connectivity, for cables and connectors
- See page G1, Accessories, for mounting attachments and couplings

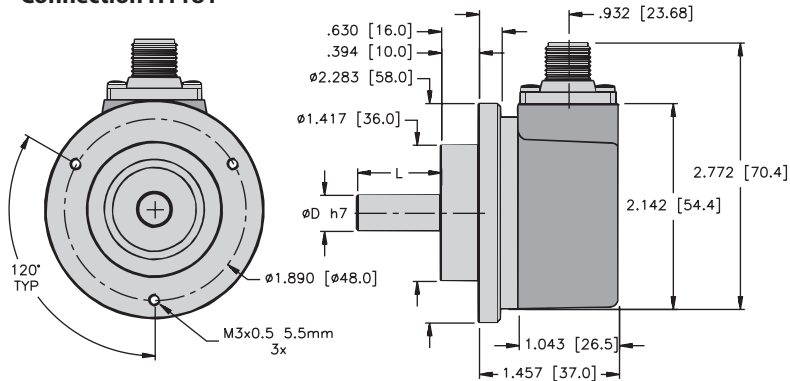
### Incremental Type RI-65 (Shaft) / RI-96 (Hollow Shaft), Stainless Steel

#### Dimensions: RI-65 Shaft Version

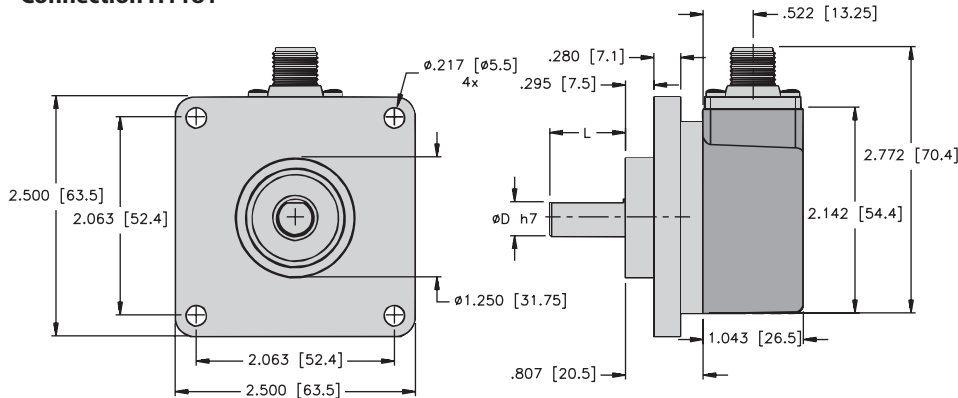
##### RI-65 Flange S Connection C



##### RI-65 Flange C Connection H1181



##### RI-65 Flange R Connection H1181



#### Mounting advice:

The flanges and shafts of the encoder and drive should not be rigidly coupled together at the same time. We recommend the use of suitable couplings (see page G1, Accessories).

Incremental Encoders

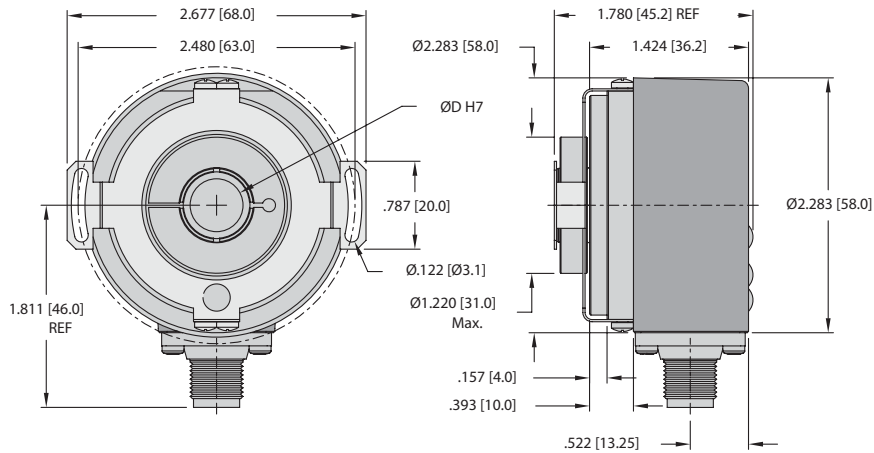
# Rotary Position Technology

## Incremental Encoders

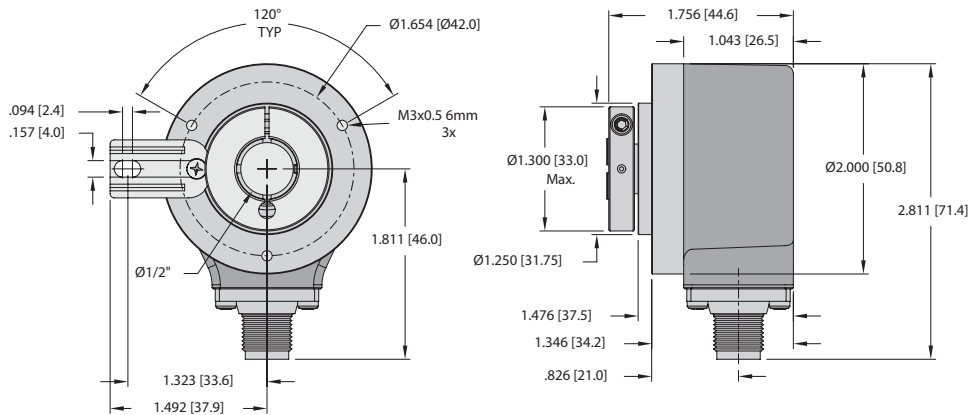
### Incremental Type RI-65 (Shaft) / RI-96 (Hollow Shaft), Stainless Steel

#### Dimensions: RI-96 Hollow Shaft Version

##### RI-96 Flange E Connection H1181



##### RI-96 Flange T Connection H1181





### Incremental Type RI-16 (Shaft) / RI-64 (Hollow Shaft)

|                       |         |                             |                          |                           |                      |                         |                |
|-----------------------|---------|-----------------------------|--------------------------|---------------------------|----------------------|-------------------------|----------------|
|                       |         |                             |                          |                           |                      |                         |                |
| High rotational speed | High IP | Temperature<br>-20 to 80 °C | High shaft load capacity | Shock/vibration resistant | Magnetic field proof | Short-circuit protected | Optical sensor |

#### High Performance

- High shaft loading capability
- Maximum speed up to 12000 revolutions per minute
- High IP protection up to max. IP66



#### Compact

- Ø 58 mm housing, industry standard

#### Many Variants

- With RS422 or push-pull interface
- With cable or connector

#### Mechanical Characteristics:

|   |  |  |
|---|--|--|
| Speed:                                      | Shaft IP65<br>Hollow Shaft IP40<br>Hollow Shaft IP66 <sup>1)</sup> | 12000 RPM<br>12000 RPM<br>6000 RPM   |
| Moment of inertia:                          | Shaft version<br>Hollow shaft version                              | approx. 0.098 oz-in <sup>2</sup> (1.8 x 10 <sup>-6</sup> kgm <sup>2</sup> )<br>approx. 0.328 oz-in <sup>2</sup> (6 x 10 <sup>-6</sup> kgm <sup>2</sup> ) |
| Starting torque at 68 °F (20 °C):           |  | <1.4oz-in (0.01 Nm), IP40/IP65<br><7oz-in (0.05 Nm), IP66  |
| Radial load capacity of the shaft:          |  | 18 lbs (80 N)  |
| Axial load capacity of the shaft:           |  | 9 lbs (40 N)   |
| Weight:                                     |  | approx. 0.9 lbs (0.4 kg)   |
| Protection acc. to EN 60529 :               |  | IP40, IP65, IP66   |
| Working temperature:                        |  | -4 to +221 °F (-20 to +105 °C), IP40/IP65<br>-4 to +194 °F (-20 to +90 °C), IP66   |
| Materials:                                  | Shaft/hollow shaft   | stainless steel  |
| Shock resistance acc. to EN 60068-2-27:     |  | approx. 100 g (1000 m/s <sup>2</sup> ), 6 ms   |
| Vibration resistance acc. to EN 60068-2-27: |  | approx. 10 g (100 m/s <sup>2</sup> ), 10-2000 Hz   |

<sup>1)</sup> For continuous operation max 3000 RPM, ventilated

# Rotary Position Technology

## Incremental Encoders

### Incremental Type RI-16 (Shaft) / RI-64 (Hollow Shaft)

#### Electrical Characteristics:

|                              |                                  |                           |
|------------------------------|----------------------------------|---------------------------|
| Output circuit [Key Code]:   | RS 422 [4A/4C] (TTL compatible)  | Push-Pull [2B]            |
| Supply voltage:              | 5 VDC ( $\pm 5\%$ ) or 10-30 VDC | 10-30 VDC                 |
| Power consumption (no load): | typ. 70 mA / max. 120 mA         | typ. 115 mA / max. 160 mA |
| Permissible load/channel:    | max. $\pm 20$ mA                 | max. $\pm 30$ mA          |
| Pulse frequency:             | max. 800 kHz                     | max. 600 kHz              |
| Signal level high:           | min. 2.5 V                       | min. +V -2.5 V            |
| Signal level low:            | max. 0.5 V                       | max. 2.0 V                |
| Rise time $t_r$ :            | max. 200 ns                      | max. 1 $\mu$ s            |
| Fall time $t_f$ :            | max. 200 ns                      | max. 1 $\mu$ s            |
| Short-circuit protected:     | yes <sup>1)</sup>                | yes                       |
| Reverse polarity protection: | 5 VDC: No, 10-30 VDC: yes        | yes                       |

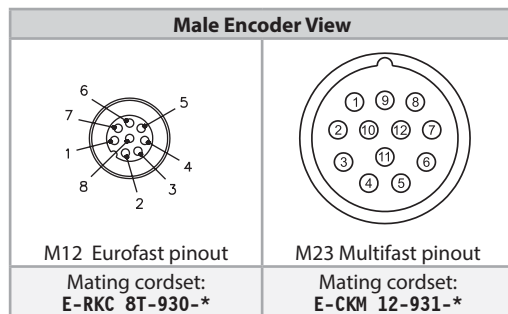
RoHS compliant acc. to EU guideline 2011/65/EU

<sup>1)</sup> Only one channel allowed to be shorted-out: (If +V = 5 V, short-circuit to channel, 0 V, or +V is permitted) (If +V = 10-30 V, short-circuit to channel or 0 V is permitted)

#### Standard Wiring:

| Connection Type | Case Ground  | Common (0 V) | +V | A  | $\bar{A}$ | B  | $\bar{B}$ | Z  | $\bar{Z}$ | -  | -  | Com / Sensor | +V Sensor |
|-----------------|--------------|--------------|----|----|-----------|----|-----------|----|-----------|----|----|--------------|-----------|
| M23 Multifast   | Coupling Nut | 10           | 12 | 5  | 6         | 8  | 1         | 3  | 4         | -  | -  | 11           | 2         |
| M12 Eurofast    | Coupling Nut | 1            | 2  | 3  | 4         | 5  | 6         | 7  | 8         | -  | -  | -            | -         |
| Cable           | Shield/Drain | WH           | BN | GN | YE        | GY | PK        | BU | RD        | BK | VT | GY/PK        | RD/BU     |

#### Wiring Diagrams:



\* Length in meters.

### Incremental Type RI-16 (Shaft) / RI-64 (Hollow Shaft)

#### Part Number Key: RI-16 Shaft Version

| A      | B | C |   | D  | E    |   | F     |
|--------|---|---|---|----|------|---|-------|
| RI-16T | 6 | C | - | 2B | 6000 | - | H1181 |

| A      | Type                                    |
|--------|---|
| RI-16T | Ø 58 mm, Shaft w/ Flat, IP65 Shaft Seal |

| B  | Shaft (Ø x L)   |
|----|-----------------|
| 6  | Ø 6 mm x 10 mm  |
| 10 | Ø 10 mm x 20 mm |

| C | Flange                  |
|---|-------------------------|
| C | Ø 58 mm Clamping Flange |
| S | Ø 58 mm Servo Flange    |

| D  | Voltage Supply and Output Type             |
|----|--|
| 2B | 10-30 VDC, Push-Pull (w/ Inverted Signals) |
| 4A | 5 VDC, RS422 (w/ Inverted Signals)         |
| 4C | 10-30 VDC, RS422 (w/ Inverted Signals)     |

| E | Pulse Rate  |
|---|---|
|   | 6000, 7200, 8000, 8192, 9000, 10000, 18000, 36000<br>Other Pulse Rates Available on Request |

| F      | Type of Connection                    |
|--------|---------------------------------------|
| H1181  | Radial 8-pin M12 Eurofast Connector   |
| H1481  | Axial 8-pin M12 Eurofast Connector    |
| 12M23  | Radial 12-pin M23 Multifast Connector |
| 12M23A | Axial 12-pin M23 Multifast Connector  |
| C1M    | Radial Cable (1 m PUR)                |
| CA1M   | Axial Cable (1 m PUR)                 |

#### Part Number Key: RI-64 Hollow Shaft Version

| A      | B | C |   | D  | E    |   | F     |
|--------|---|---|---|----|------|---|-------|
| RI-64B | 6 | T | - | 2B | 6000 | - | H1181 |

| A      | Type   |
|--------|--|
| RI-64B | Ø 58 mm, Blind Hollow Shaft, IP66 Shaft Seal |
| RI-64C | Ø 58 mm, Blind Hollow Shaft, IP40 Shaft Seal |
| RI-64H | Ø 58 mm, Hollow Shaft, IP66 Shaft Seal       |
| RI-64I | Ø 58 mm, Hollow Shaft, IP40 Shaft Seal       |

| B  | Bore (30 mm max insertion depth for blind hollow shaft) |
|----|---|
| 6  | Ø 6 mm  |
| 8  | Ø 8 mm  |
| 10 | Ø 10 mm   |
| 12 | Ø 12 mm   |

| C  | Flange                        |
|----|-------------------------------|
| T  | Ø 58 mm Flange w/ Torque Stop |
| E1 | Ø 65 mm Flange w/ Flex Mount  |

| D  | Voltage Supply and Output Type             |
|----|--|
| 2B | 10-30 VDC, Push-Pull (w/ Inverted Signals) |
| 4A | 5 VDC, RS422 (w/ Inverted Signals)         |
| 4C | 10-30 VDC, RS422 (w/ Inverted Signals)     |

| E | Pulse Rate  |
|---|---|
|   | 6000, 7200, 8000, 8192, 9000, 10000, 18000, 36000<br>Other Pulse Rates Available on Request |

| F     | Type of Connection                    |
|-------|---------------------------------------|
| H1181 | Radial 8-pin M12 Eurofast Connector   |
| 12M23 | Radial 12-pin M23 Multifast Connector |
| C1M   | Radial Cable (1 m PVC)                |

#### Accessories:

- See page H1, Connectivity, for cables and connectors
- See page G1, Accessories, for mounting attachments and couplings

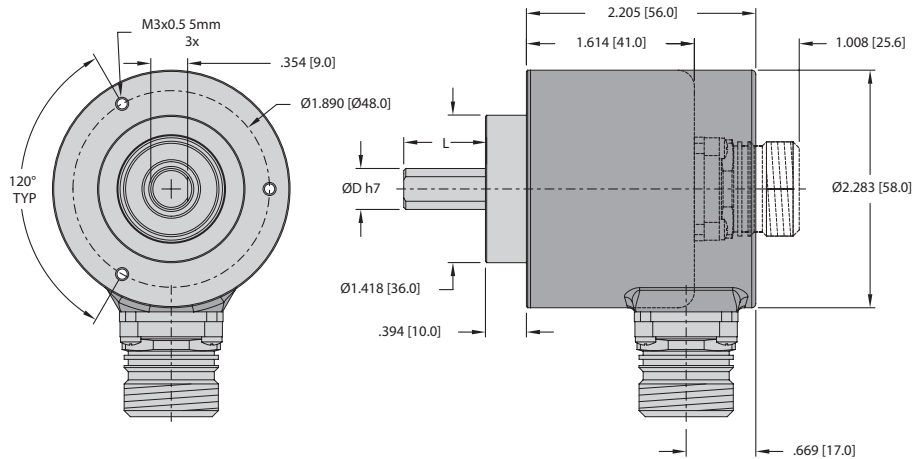
# Rotary Position Technology

## Incremental Encoders

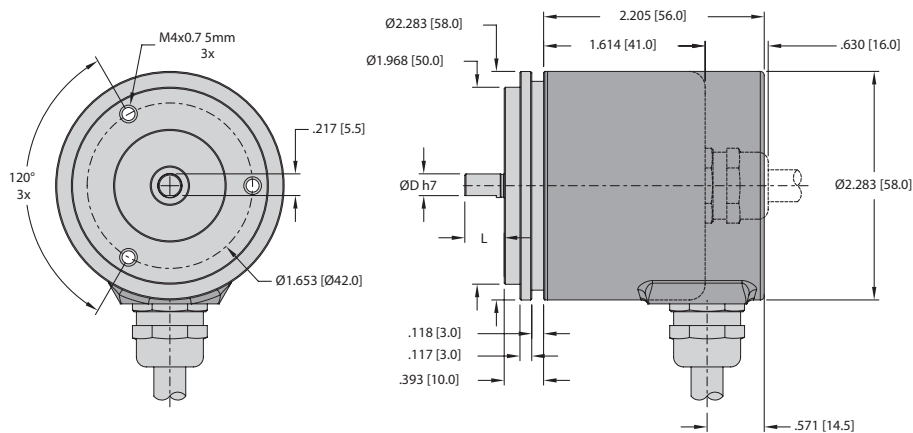
### Incremental Type RI-16 (Shaft) / RI-64 (Hollow Shaft)

#### Dimensions: RI-16 Shaft Version

##### RI-16 Flange C Connection 12M23 & 12M23A



##### RI-16 Flange S Connection C1M & CA1M



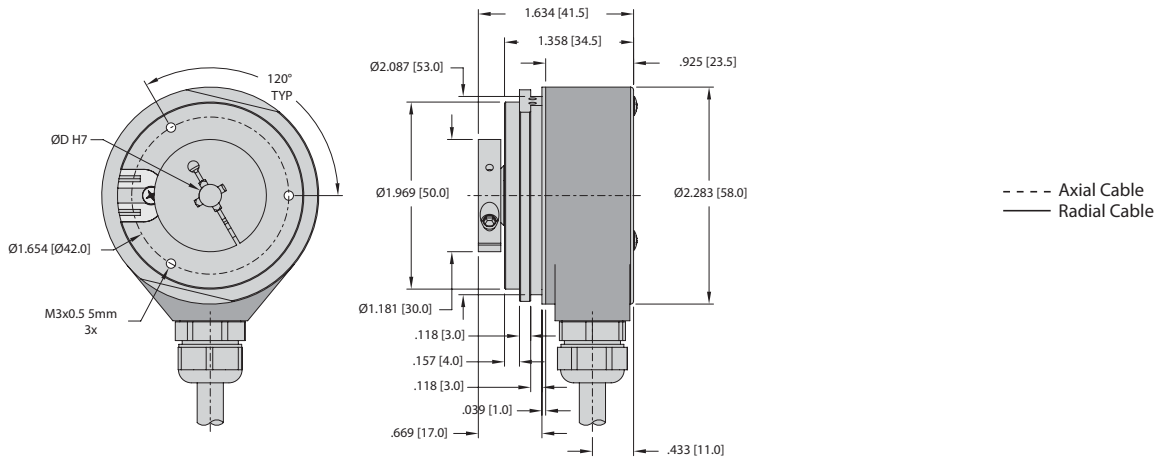
#### Mounting advice:

The flanges and shafts of the encoder and drive should not be rigidly coupled together at the same time. We recommend the use of suitable couplings (see page G1, Accessories).

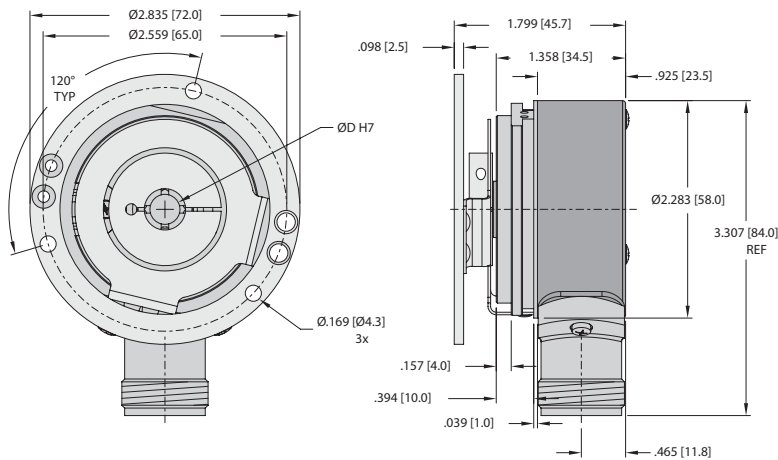
## Incremental Type RI-16 (Shaft) / RI-64 (Hollow Shaft)

### Dimensions: RI-64 Hollow Shaft Version

#### RI-64 Flange T Connection C



#### RI-64 Flange E1 Connection 12M23



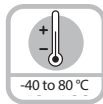
#### Mounting advice:

The flanges and shafts of the encoder and drive should not be rigidly coupled together at the same time. We recommend the use of suitable couplings (see page G1, Accessories).

# Rotary Position Technology

## Incremental Encoders

### Large Bore Type RI-43 (Hollow Shaft)



Temperature



Shock/vibration resistant



Short-circuit protected



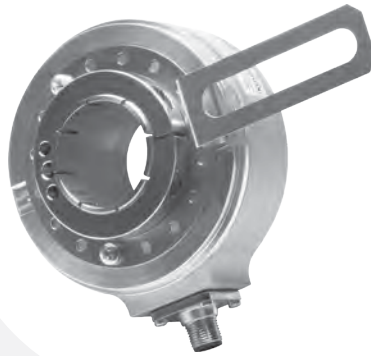
Reverse polarity protection



High rotational speed

#### Rugged

- Balanced, stainless-steel clamping rings, special bearing-shaft connection increases stability and vibration resistance.
- Optional plastic isolating inserts protect against damage from shaft currents.
- New type of mechanical construction, ideal for handling tough mechanical stresses and strains.



#### Economical

- Alternative to traditional heavy duty encoders that are often over-engineered and expensive.

#### Versatile

- Very compact. Optional isolating inserts protect against damage from shaft currents, e.g. with AC vector motors.
- Only 49 mm clearance needed.
- Hollow shaft diameter up to Ø 42 mm.
- RS422, push-pull or SIN/COS outputs.
- Extended speed range up to 6,000 RPM.
- High-quality construction, balanced, stainless steel ensures quiet vibration-free running.

#### Mechanical Characteristics:

|  |  |
|--|--|
| Speed:                                       | max. 6,000 RPM at 158 °F (70 °C) <sup>1)</sup><br>max. 3,500 RPM at 176 °F (80 °C) <sup>1)</sup> |
| Rotor moment of inertia:                     | < 12 oz-in <sup>2</sup> (< 220 x 10 <sup>-6</sup> kgm <sup>2</sup> ) <sup>2)</sup>               |
| Starting torque with sealing:                | < 28.3 oz-in (< 0.2 Nm)  |
| Weight:                                      | approx. 1.8 lbs (0.8 kg)   |
| Protection acc. to EN 60 529:                | IP65   |
| Working temperature:                         | -40 to +176 °F (-40 to +80 °C) <sup>3)</sup>   |
| Materials:                                   |  |
| Housing:                                     | die-cast aluminium   |
| Flange:                                      | aluminium  |
| Shaft:                                       | stainless steel  |
| Shock resistance acc. to DIN-IEC 68-2-27     | 200 g (2,000 m/s <sup>2</sup> ), 6 ms  |
| Vibration resistance acc. to DIN-IEC 68-2-6: | 10 g (100 m/s <sup>2</sup> ), 10-2,000 Hz  |

<sup>1)</sup> During the run-in-phase of approx. 2 hours, reduce the limits for working temperature max or speed max by 1/3

<sup>2)</sup> Dependent on the shaft diameter

<sup>3)</sup> With connectors, -40 °C, cable securely installed; -30 °C, cable flexibly installed; -20 °C

#### Electrical Characteristics Sine Wave Output:

| Output circuit [Key Code]:                          | SinCos [AB]<br>U = 1 V <sub>pp</sub> (±20%) | SinCos [AA]<br>U = 1 V <sub>pp</sub> (±20%) |
|---|---|---|
| Supply voltage:                                     | 5 VDC (±5%)                                 | 10-30 VDC                                   |
| Current consumption (no load) with inverted signal: | typ. 65 mA /<br>max. 110 mA                 | typ. 65 mA /<br>max. 110 mA                 |
| -3 dB frequency:                                    | < 180 kHz                                   | < 180 kHz                                   |
| Signal level channels A/B:                          | 1 V <sub>pp</sub> (±20%)                    | 1 V <sub>pp</sub> (±20%)                    |
| Signal level channel 0:                             | 0.1-1.2 V                                   | 0.1-1.2 V                                   |
| Short-circuit protected <sup>1)</sup>               | yes   | yes   |
| Reverse polarity protection:                        | no  | yes   |
| RoHS compliant acc. to EU guideline 2011/65/EU      |   |   |

<sup>1)</sup> If supply voltage correctly applied

## Large Bore Type RI-43 (Hollow Shaft)

### Electrical Characteristics RS422 or Push-Pull Output:

| Output circuit [Key Code]:                              | RS 422 [4A/4C]<br>(TTL compatible) | Push-Pull [2B]              | Push-Pull [2F]<br>(7272 compatible) <sup>3)</sup> |
|---|------------------------------------|-----------------------------|---|
| Supply voltage:   | 5 VDC (±5 %) or<br>10-30 VDC       | 10-30 VDC                   | 5-30 VDC  |
| Power consumption (no load)<br>without inverted signal: | -                                  | typ. 55 mA /<br>max. 125 mA | -   |
| Power consumption (no load)<br>with inverted signal:    | typ. 40 mA /<br>max. 90 mA         | typ. 80 mA /<br>max. 150 mA | typ. 50 mA /<br>max. 100 mA                       |
| Permissible load/channel:                               | max. ±20 mA                        | max. ±30 mA                 | max. ±20 mA                                       |
| Pulse frequency:  | max. 300 kHz                       | max. 300 kHz                | max. 300 kHz                                      |
| Signal level high:                                      | min. 2.5 V                         | min. +V -3 V                | min. +V -2.0 V                                    |
| Signal level low:                                       | max. 0.5 V                         | max. 2.5 V                  | max. 0.5 V  |
| Rise time t <sub>r</sub> :                              | max. 200 ns                        | max. 1 μs                   | max. 1 μs   |
| Fall time t <sub>f</sub> :                              | max. 200 ns                        | max. 1 μs                   | max. 1 μs   |
| Short-circuit protected <sup>1)</sup> :                 | yes                                | yes                         | yes   |
| Reverse polarity protection:                            | 5 VDC: no, 10-30 VDC: yes          | yes                         | no  |

<sup>1)</sup> If supply voltage correctly applied

<sup>2)</sup> Only one channel allowed to be shorted-out:

(If +V = 5 VDC, short-circuit to channel, 0 V, or +V is permitted) (If +V = 5-30 VDC, short-circuit to channel or 0 V is permitted)

<sup>3)</sup> Max. recommended cable length 30 m

### Standard Wiring:

| Connection Type | Case Ground  | Common (0 V) | +V | A  | $\bar{A}$ | B  | $\bar{B}$ | Z  | $\bar{Z}$ | -  | -  | OV Sensor | +V Sensor |
|-----------------|--------------|--------------|----|----|-----------|----|-----------|----|-----------|----|----|-----------|-----------|
| M23 Multifast   | Coupling Nut | 10           | 12 | 5  | 6         | 8  | 1         | 3  | 4         | -  | -  | 11        | 2         |
| MS 10-pin       | J            | F            | D  | A  | G         | B  | H         | C  | I         | -  | -  | -         | -         |
| M12 Eurofast    | Coupling Nut | 1            | 2  | 3  | 4         | 5  | 6         | 7  | 8         | -  | -  | -         | -         |
| Cable           | Shield/Drain | WH           | BN | GN | YE        | GY | PK        | BU | RD        | BK | VT | GY/PK     | RD/BU     |

Individually isolate unused outputs before initial start up.

### Special Pin Configuration:

| Output Code | Connection Type | Case Ground  | Common (0 V) | +V | A | $\bar{A}$ | B | $\bar{B}$ | Z | $\bar{Z}$ | - | - |
|-------------|-----------------|--------------|--------------|----|---|-----------|---|-----------|---|-----------|---|---|
| N41         | M12 Eurofast    | Coupling Nut | 7            | 2  | 1 | 3         | 4 | 5         | 6 | 8         | - | - |
| N40         | MS 10-pin       | G            | F            | D  | A | H         | B | I         | C | J         | - | - |

### Wiring Diagrams:

| Male Encoder View   |  |   |
|---|--|---|
|   |  |   |
| M12 Eurofast Pinout<br>Mating Cordset:<br><b>E-RKC 8T-930-*</b> | M23 Multifast Pinout<br>Mating Cordset:<br><b>E-CKM 12-931-*</b> | MS Pinout (10-pin)<br>Mating Cordset:<br><b>E-MK 10-931-*</b> |

\* Length in meters.

# Rotary Position Technology

## Incremental Encoders

### Large Bore Type RI-43 (Hollow Shaft)

#### Part Number Key: RI-43 Hollow Shaft Version

| A      | B  | C  |   | D  | E  |   | F     |   | G/H/I    |
|--------|----|----|---|----|----|---|-------|---|----------|
| RI-43H | 20 | E2 | - | 1B | 50 | - | H1181 | / | Specials |

| A      | Type                                    |
|--------|---|
| RI-43H | Ø 100 mm, Hollow Shaft, IP65 Shaft Seal |

| B  | Bore                   |
|----|------------------------|
| 20 | Ø 20 mm <sup>1)</sup>  |
| 25 | Ø 25 mm <sup>1)</sup>  |
| 28 | Ø 28 mm                |
| 30 | Ø 30 mm <sup>1)</sup>  |
| 32 | Ø 32 mm <sup>2)</sup>  |
| 38 | Ø 38 mm                |
| 40 | Ø 40 mm                |
| 42 | Ø 42 mm                |
| A3 | Ø 1/2" <sup>2)</sup>   |
| A4 | Ø 5/8" <sup>1)</sup>   |
| A5 | Ø 3/4" <sup>2)</sup>   |
| A6 | Ø 1" <sup>1)</sup>     |
| A7 | Ø 1-1/8" <sup>2)</sup> |
| A8 | Ø 1-1/4" <sup>1)</sup> |

<sup>1)</sup> Bores Available with Isolation Inserts.  
<sup>2)</sup> Only Available with an Isolation Insert.

| C  | Flange                     |
|----|----------------------------|
| E2 | 4 - 1/2" C-Face Tether     |
| S  | Face Mount                 |
| S4 | Long Anti-Rotation Spring  |
| S5 | Short Anti-Rotation Spring |
| S8 | Long Tether Arm            |

| D  | Voltage Supply and Output Type                                 |
|----|--|
| 1B | 10-30 VDC, Push-Pull   |
| 2B | 10-30 VDC, Push-Pull (w/ Inverted Signals)                     |
| 2E | 5-30 VDC, Push-Pull (w/ Inverted Signals)                      |
| 2F | 5-30 VDC, Push-Pull (7272 compatible w/ Inverted Signals)      |
| 4A | 5 VDC, RS422 (w/ Inverted Signals)                             |
| 4B | 5-30 VDC, TTL (w/ Inverted Signals)                            |
| 4C | 10-30 VDC, RS422 (w/ Inverted Signals)                         |
| AA | 10-30 VDC <sup>3)</sup> , SIN/COS, 1 Vpp (w/ Inverted Signals) |
| AB | 5 VDC <sup>3)</sup> , SIN/COS, 1 Vpp (w/ Inverted Signals)     |

<sup>3)</sup> N24 is the Only Valid Special Output Code for SIN/COS Outputs.

| E | Pulse Rate  |
|---|---|
|   | 50*, 360*, 512*, 600*, 1000*, 1024, 1500, 2000,<br>2048, 2500, 4096, 5000<br>(e.g. 360 Pulses => 360) |
|   | Other Pulse Rates Available on Request  |

\* SIN/COS Version not Available with Pulses < 1024

| F     | Type of Connection                    |
|-------|---------------------------------------|
| H1181 | Radial 8-pin M12 Eurofast Connector   |
| 12M23 | Radial 12-pin M23 Multifast Connector |
| 10MIL | Radial 10-pin MS Connector            |
| C1M   | Radial Cable (1 m PVC)                |

| G | Special Output Signal Formats |
|---|-------------------------------|
|   | See N21 thru N33 on Page E40  |

| H   | Special Insert Options                  |
|-----|---|
| N42 | Isolation Insert Included <sup>4)</sup> |

<sup>4)</sup> Includes Plastic Hollow Shaft Inserts for Electrical Isolation.

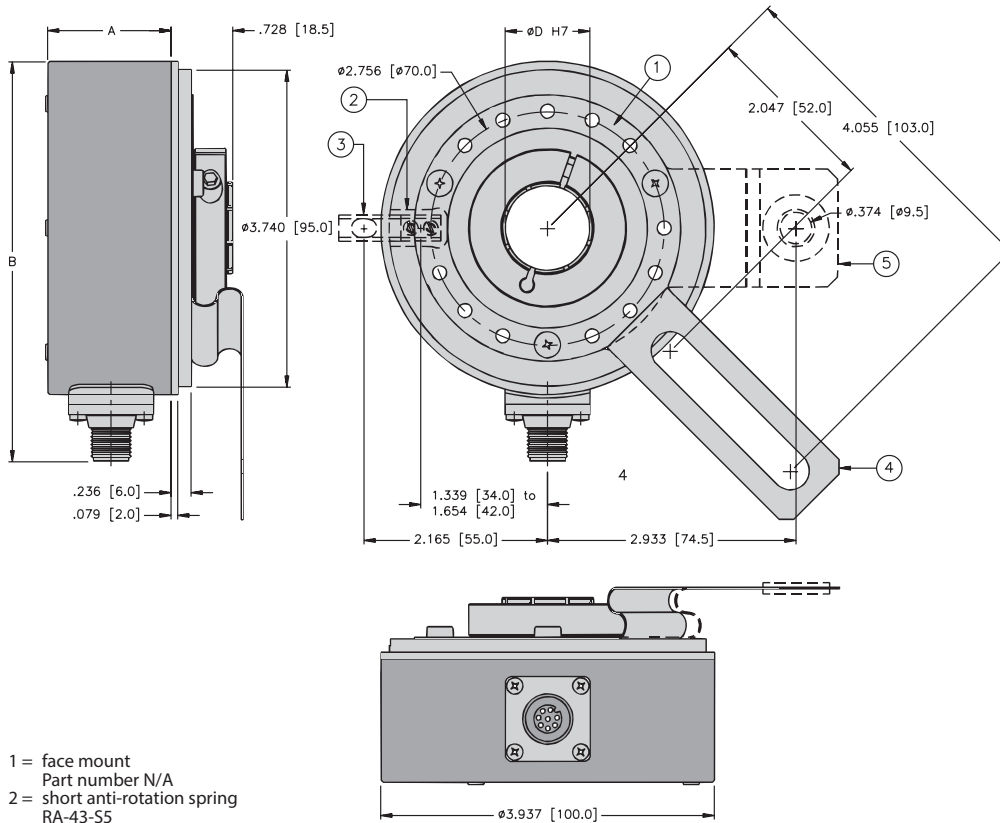
| I | Special Connector Pin Configuration |
|---|-------------------------------------|
|   | See N40 or N41 on Page E29          |



## Large Bore Type RI-43 (Hollow Shaft)

Dimensions: RI-43 Hollow Shaft Version

RI-43 Flange S8/E2  
Connection H1181



- 1 = face mount  
Part number N/A
- 2 = short anti-rotation spring  
RA-43-S5
- 3 = long anti-rotation spring  
RA-43-S4
- 4 = tether arm (long)  
RA-43-S8
- 5 = 4 1/2" C-face tether  
RA-43-E2

Incremental Encoders

### Dimensions for Radial Connector - in [mm]

| DIM | Connection Style |                  |                  |                  |
|-----|------------------|------------------|------------------|------------------|
|     | Cable            | M12              | M23              | MS<br>(10-pin)   |
| A   | 1.181<br>[30.0]  | 1.181<br>[30.0]  | 1.181<br>[30.0]  | 1.457<br>[37.0]  |
| B   | -                | 4.705<br>[119.5] | 4.961<br>[126.0] | 5.394<br>[137.0] |

# Rotary Position Technology

## Incremental Encoders

### Large Bore Type RI-43 (Hollow Shaft)

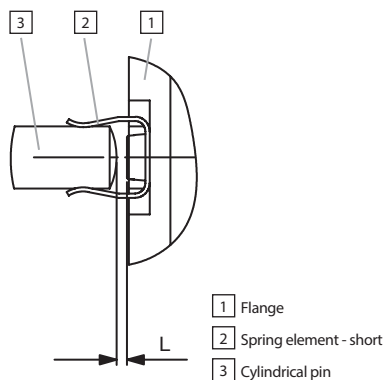
#### Mating Shaft Requirements:

| Type of Flange                    | Axial End Play    | Radial Runout     | Angular Offset     |
|-----------------------------------|-------------------|-------------------|--------------------|
| S5 (anti-rotational spring short) | max. $\pm 1$ mm   | max. $\pm 0.3$ mm | max. $\pm 2^\circ$ |
| S4 (anti-rotational spring long)  | max. $\pm 1$ mm   | max. $\pm 0.3$ mm | max. $\pm 2^\circ$ |
| S8 (tether arm long)              | max. $\pm 0.5$ mm | max. $\pm 0.3$ mm | max. $\pm 2^\circ$ |
| E2 (C-face tether)                | max. $\pm 0.5$ mm | max. $\pm 0.3$ mm | max. $\pm 2^\circ$ |

#### Mounting:

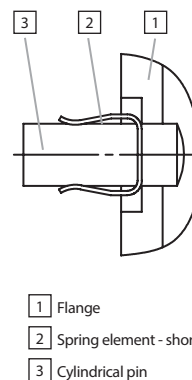
Mounting using the spring element - short:

When mounting the encoder, ensure that dimension **L** is larger than the maximum axial play of the drive in the direction of the arrow.



Mounting using the spring element - long:

Cylindrical pin fed through the bore of the spring.



### Large Bore Type RI-43 (Hollow Shaft) Accessories

#### Isolation Insert



The RI-43 encoder is used for AC vector motor and general industrial applications. For AC vector motor applications, the encoder should be electrically isolated from the motor chassis to minimize encoder bearing currents and ground noise. An isolation insert for the hollow shaft is provided with the encoder by specifying N42 in the "special insert option" decode. **When ordering isolation inserts separately, choose option 38 with a bore diameter of 38 mm.**

| Part Number: | Inner Dimensions  |
|--------------|-------------------|
| RSA - A3     | 12.7 mm (1/2")    |
| RSA - A4     | 15.875 mm (5/8")  |
| RSA - 12     | 12 mm             |
| RSA - 14     | 14 mm             |
| RSA - 15     | 15 mm             |
| RSA - 16     | 16 mm             |
| RSA - 18     | 18 mm             |
| RSA - A5     | 19.05 mm (3/4")   |
| RSA - 20     | 20 mm             |
| RSA - 25     | 25 mm             |
| RSA - A6     | 25.4 mm (1")      |
| RSA - A7     | 28.58 mm (1-1/8") |
| RSA - 30     | 30 mm             |
| RSA - A8     | 31.75 mm (1-1/4") |
| RSA - 32     | 32 mm             |

For general industrial applications, isolation is not required and the decode for "special insert options" can be left blank.

#### Isolation insert for hollow shaft $\varnothing 42$ mm:

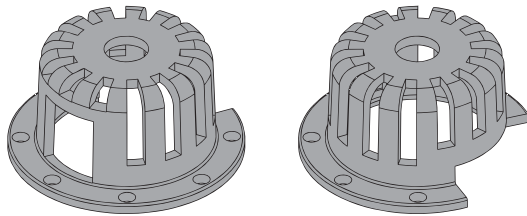
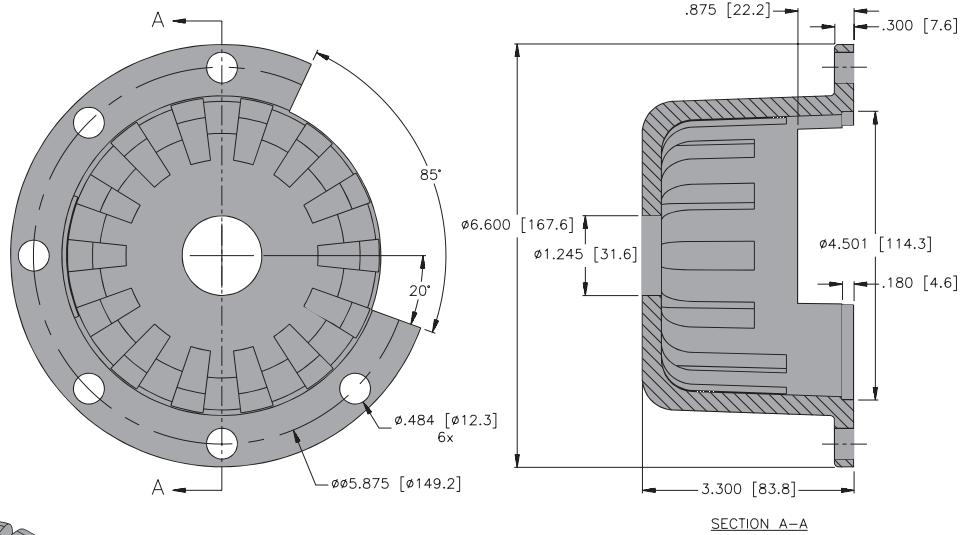
External diameter 42 mm  
Internal diameter 38 H7 in accordance with ISO 286-2  
Order Number: RSA-38

## Large Bore Type RI-43 (Hollow Shaft) Accessories

**Part Number:**  
ENCODER COVER KIT

**Description:**  
Cover kit for 4.5" C-face motors

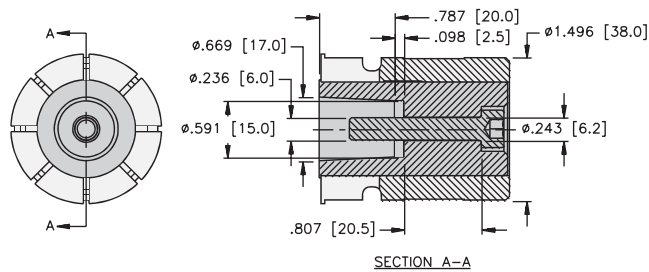
Included: (3) 3/8 x 16 x 3/4 bolts, (3) washers



**Part Number:**  
RSA-TAPER

**Description:**  
Mounting kit adapts the RI-43 hollow shaft encoder for mounting onto a tapered shaft. Tapered shafts are used for high-precision direct coupling to devices. An isolating insert is also included in the mounting kit; this reliably protects the encoder from shaft currents.

Included: Insert for cone blind hole, cone 1:10, 17 mm length, isolation insert, allen screw for tightening



## Magnetic Rings LM-2 / RMT-2



High rotational speed



High IP



Shock/vibration resistant



Reverse polarity protection

### Robust

- **Increased ability to withstand vibrations and rough installation:** Eliminates machine downtime and repairs. High shock and vibration resistance, thanks to non-contact technology.
- **Stays sealed even when subjected to harsh everyday use. Offers security against failures in the field:** Potted housing with up to IP67 protection.

### Compact

- Installation depth only 16 mm, width of magnetic ring 10 mm



### Compact (cont.)

- Large hollow shaft up to 30 mm. Can be used even where space is very tight.

### Compact (cont.)

- Large hollow shaft up to 30 mm. Can be used even where space is very tight.

### Simple Installation

- **Fast start-up of the measuring system:** Easy fixing of the magnetic ring and the sensor head
- **Easy mounting with large tolerances possible:** Distance of sensor head to magnetic ring from 0.1-1.0 mm
- Tolerates lateral misalignment +1 mm
- Warning signal when magnetic field is too weak (LED)

### Technical Data Magnetic Sensor LM-2:

|  |  |                         |
|--|--|-------------------------|
| <b>Output Circuit [Key Code]:</b>              | Push-Pull [2R]   | RS422 [4K]              |
| Supply voltage:                                | 4.8-30 VDC   | 4.8-26 VDC              |
| Load/channel, max. cable length:               | ±20 mA, max. 30 m  | 120 Ohm, RS422 standard |
| Current consumption (without load):            | typ. 25 mA, max. 60 mA   |                         |
| Short-circuit protection:                      | yes  | yes <sup>1)</sup>       |
| Min. pulse interval:                           | 1 µs (edge interval) corresp. to 4 µs/period (see signal figures at right)                             |                         |
| Output signal:                                 | A, $\bar{A}$ , B, $\bar{B}$ , I, $\bar{I}$   |                         |
| Reference signal:                              | Index periodical   |                         |
| <b>Accuracy:</b>                               |  |                         |
| System accuracy:                               | typ. ±0.3° with shaft tolerance g6   |                         |
| Repeat accuracy:                               | ±1 increment   |                         |
| <b>Admissible Alignment Tolerance:</b>         |  |                         |
| Gap sensor / magnetic ring:                    | 0.1-1.0 mm (recommended 0.4 mm)  |                         |
| Offset:  | max. ±1 mm   |                         |
| Tilting:                                       | max. 3°  |                         |
| Torsion:                                       | max. 3°  |                         |
| <b>Environmental Conditions:</b>               |  |                         |
| Working temperature:                           | -4 to +176 °F (-20 to +80 °C)  |                         |
| Vibration resistance:                          | 30 g (300 m/s <sup>2</sup> ), 10-2000 Hz   |                         |
| Shock resistance:                              | 500 g (5000 m/s <sup>2</sup> ), 1 ms   |                         |
| Protection class:                              | IP67, IP68/IP69K according to DIN 60529 (housing)  |                         |
| Humidity:                                      | 100%, condensation possible  |                         |
| Housing:                                       | Zinc die-cast  |                         |
| <b>General Data:</b>                           |  |                         |
| Cable:   | 2 m, PUR 8 x 0.14 mm <sup>2</sup> , shielded, may be used in flexing cable installations               |                         |
| Status-LED:                                    | Green: Pulse-index; Red: Error, revs too high or magnetic field too weak (for LM-2-*020 and LM-2-*050) |                         |
| RoHS compliant acc. to EU guideline 2011/65/EU |  |                         |

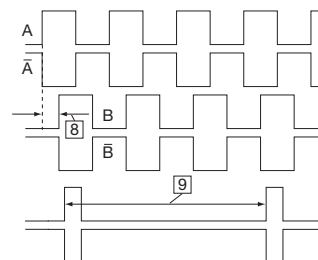
<sup>1)</sup> A max. of one channel only may be short-circuited: (when +V = 5 V, a short-circuit to another channel, 0 V, or +V is permissible.) (When +V = 5-30 V, a short-circuit to another channel or to 0 V is permissible.)

### Technical Data Magnetic Ring RMT-2:

|                     |  |
|---------------------|--|
| Pole gap:           | 2 mm from pole to pole   |
| Temperature ranges: | Working temperature: -4 to +185 °F (-20 to +80 °C)<br>Storage temperature: -4 to +185 °F (-20 to +80 °C)   |
| Mounting:           | Screwed on shaft<br>typ. +0.3° (at 77 °F, 25 °C)<br>Sensor/Magnetic ring distance 0.5 mm and drive shaft tolerance g6 in accordance with ISO 286-2 |
| System accuracy:    |  |

### Signal Figures:

With rotation of the magnetic ring in the CW-direction (see "permissible mounting tolerances")



8] Min. pulse interval: pay attention to the instructions in the technical data

9] Periodic index signal (every 2 mm) the logical assignment A, B and I-signal can change

## Magnetic Rings LM-2 / RMT-2

### Part Number Key: LM-2

| A    |   | B   |   | C  | D   |   | E |
|------|---|-----|---|----|-----|---|---|
| LM-2 | - | P10 | - | 2R | 005 | - | C |

| A    | Type            |
|------|-----------------|
| LM-2 | Linear Magnetic |

| B   | Housing           |
|-----|-------------------|
| P10 | 10 mm, IP68/IP69K |
| Q10 | 10 mm, IP67       |

| C  | Voltage Supply and Output Type |
|----|--------------------------------|
| 2R | 4.8-30 VDC, Push-Pull          |
| 4K | 4.8-26 VDC, RS422              |

| D   | Code <sup>1)</sup> |
|-----|--------------------|
| 005 |                    |
| 016 |                    |
| 020 |                    |
| 050 |                    |

<sup>1)</sup> See selection guide

| E         | Type of Connection                 |
|-----------|------------------------------------|
| C         | Cable (2 m PUR)                    |
| C*M-RSS8T | Cable w/ *m M12 Eurofast Connector |

\* Not available > 2 m

### Part Number Key: RMT-2

| A     |   | B   |  | C |
|-------|---|-----|--|---|
| RMT-2 | - | 031 |  | 8 |

| A     | Type                                      |
|-------|---|
| RMT-2 | 16 mm Rotary Magnetic Ring, 2 mm Pole Gap |

| B   | Ring Diameter |
|-----|---------------|
| 031 | ∅ 31 mm       |
| 041 | ∅ 41.2 mm     |
| 045 | ∅ 45 mm       |

| C  | Ring Bore |    |                     |
|----|-----------|----|---------------------|
| 8  | 8 mm      | 25 | 25 mm <sup>1)</sup> |
| 10 | 10 mm     | 30 | 30 mm <sup>1)</sup> |
| 12 | 12 mm     | A1 | 3/8 in.             |
| 15 | 15 mm     | A4 | 5/8"                |
| 18 | 18 mm     | A6 | 1" <sup>1)</sup>    |
| 20 | 20 mm     |    |                     |

<sup>1)</sup> Only available with ring diameter '045'

### Accessories:

- See page G1, Accessories, for mounting attachments and couplings

### Selection Guide: Magnetic Sensor LM-2/Magnetic Ring RMT-2

| Pulses/ppr | Part Number for Magnetic Sensor LM-2 | Part Number for Magnetic Ring RMT-2 <sup>1)</sup> | Max. rpm |
|------------|--------------------------------------|---|----------|
| 250        | LM-2-*10-*005-C                      | RMT-2-031-*                                       | 12,000   |
| 1000       | LM-2-*10-*020-C                      | RMT-2-031-*                                       | 2,400    |
| 2500       | LM-2-*10-*050-C                      | RMT-2-031-*                                       | 3,900    |
| 1024       | LM-2-*10-*016-C                      | RMT-2-041-*                                       | 7,000    |
| 360        | LM-2-*10-*005-C                      | RMT-2-045-*                                       | 12,000   |
| 3600       | LM-2-*10-*050-C                      | RMT-2-045-*                                       | 2,700    |

<sup>1)</sup>At the listed rotational speed, the min. pulse interval is 1 µs; This corresponds to 250 kHz. For the maximum rotational speed range, a counter with a count input frequency of no less than 250 kHz should be provided.

### Standard Wiring:

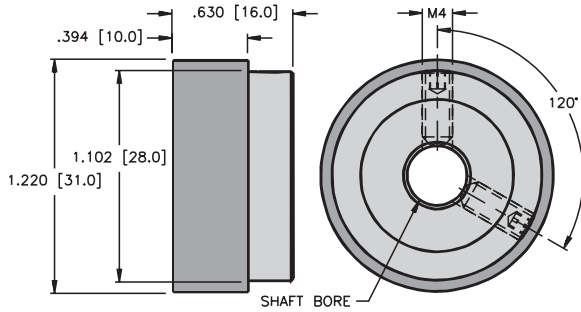
| Connect Type | 0 V, GND | +V | A  | $\bar{A}$ | B  | $\bar{B}$ | I  | $\bar{I}$ |
|--------------|----------|----|----|-----------|----|-----------|----|-----------|
| Cable        | WH       | BN | GN | YE        | GY | PK        | BU | RD        |

Shield is on the housing

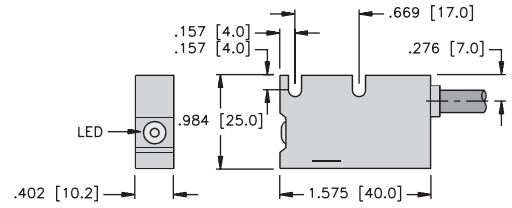
## Magnetic Rings RMT-2 / LM-2

### Dimensions: RMT-2 Magnetic Ring

RMT-2-031-\*, Ø 31 mm

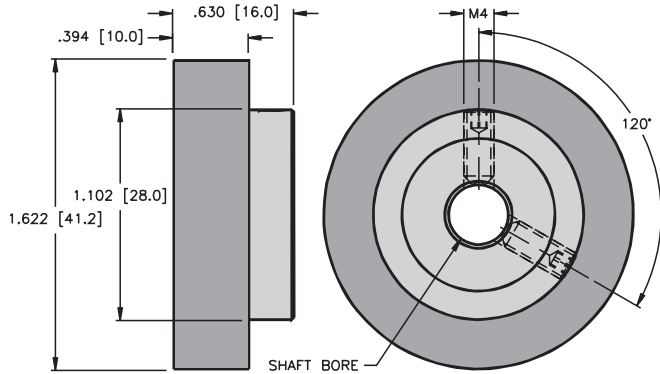


### Dimensions: Magnetic Sensor LM-2



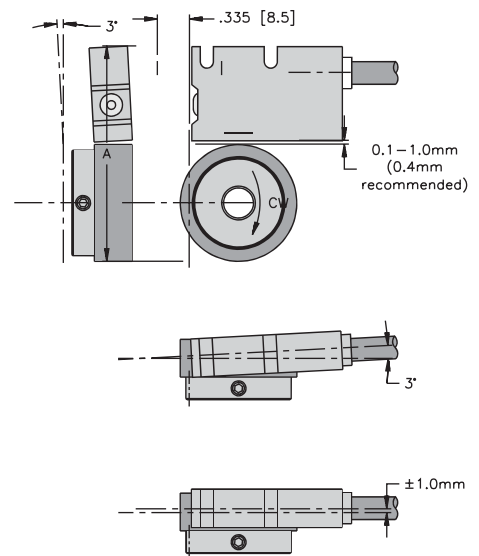
### Dimensions: RMT-2 Magnetic Ring

RMT-2-041-\*, Ø 41.2 mm

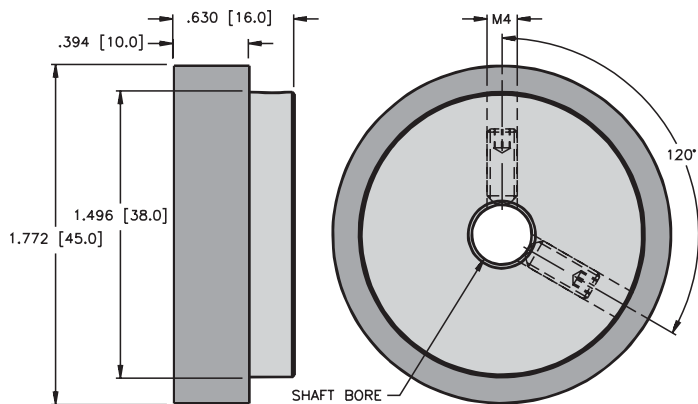


### Permissible Mounting Tolerances:

#### RMT-2 and Linear Read Head



RMT-2-045-\*, Ø 45 mm



| Part Number | Dimension A        |
|-------------|--------------------|
| RMT-2-031-* | 56.4 <sup>1)</sup> |
| RMT-2-041-* | 66.6 <sup>1)</sup> |
| RMT-2-045-* | 70.4 <sup>1)</sup> |

<sup>1)</sup> Distance calculated with 0.4 mm between the sensor and magnetic ring

Recommended tolerance of the drive shaft diameter: g6 in accordance with ISO 286-2

## Magnetic Rings LM-5 / RMT-5



High rotational speed



High IP



Shock/vibration resistant



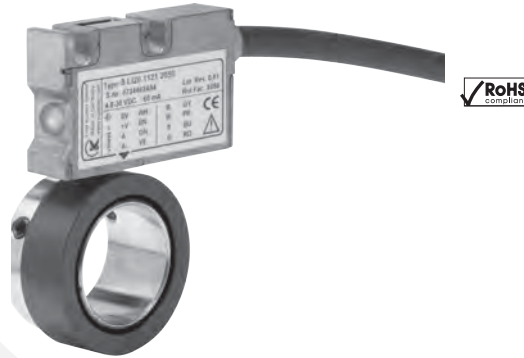
Reverse polarity protection

### Robust

- **Increased ability to withstand vibrations and rough installation.** Eliminates machine downtime and repairs. High shock and vibration resistance, thanks to non-contact technology.
- **Stays sealed even when subjected to harsh everyday use. Offers security against failures in the field.** Potted housing with up to IP67 protection.

### Compact

- Installation depth only 16 mm, width of magnetic ring 10 mm



- Large hollow shaft up to 30 mm  
Can be used even where space is very tight

### Simple Installation

- **Fast start-up of the measuring system**  
Easy fixing of the magnetic ring and the sensor head
- **Easy mounting with large tolerances possible**  
Distance of sensor head to magnetic ring from 0.1-1.5 mm
- Tolerates lateral misalignment  $\pm 0.5$  mm
- Warning signal when magnetic field is too weak (LED)

### Technical Data Magnetic Sensor LM-5:

|  |  |                         |
|--|--|-------------------------|
| <b>Output Circuit [Key Code]:</b>              | Push-Pull [2R]   | RS422 [4K]              |
| Supply voltage:                                | 4.8-30 VDC   | 4.8-26 VDC              |
| Load/channel, max. cable length:               | $\pm 20$ mA, max. 30 m   | 120 Ohm, RS422 standard |
| Current consumption (without load):            | typ. 25 mA, max. 60 mA   |                         |
| Short-circuit protection:                      | yes  | yes <sup>1)</sup>       |
| Min. pulse interval:                           | 1 $\mu$ s (edge interval) corresp. to 4 $\mu$ s/period (see signal figures at right)                         |                         |
| Output signal:                                 | A, $\bar{A}$ , B, $\bar{B}$ , I, $\bar{I}$   |                         |
| Reference signal:                              | Index periodical   |                         |
| <b>Accuracy:</b>                               |  |                         |
| System accuracy:                               | typ. $\pm 0.3^\circ$ with shaft tolerance g6   |                         |
| Repeat accuracy:                               | $\pm 1$ increment  |                         |
| <b>Admissible Alignment Tolerance:</b>         |  |                         |
| Gap sensor / magnetic ring:                    | 0.1-1.0 mm (recommended 0.4 mm)  |                         |
| Offset:  | max. $\pm 1$ mm  |                         |
| Tilting:                                       | max. $3^\circ$   |                         |
| Torsion:                                       | max. $3^\circ$   |                         |
| <b>Environmental Conditions:</b>               |  |                         |
| Working temperature:                           | -4 to +185 °F (-20 to +80 °C)  |                         |
| Vibration resistance:                          | 30 g (300 m/s <sup>2</sup> ), 10-2000 Hz   |                         |
| Shock resistance:                              | 500 g (5000 m/s <sup>2</sup> ), 1 ms   |                         |
| Protection class:                              | IP67, IP68/IP69K according to DIN 60529 (housing)  |                         |
| Humidity:                                      | 100%, condensation possible  |                         |
| Housing:                                       | Zinc die-cast  |                         |
| <b>General Data:</b>                           |  |                         |
| Cable:   | 2 m, PUR 8 x 0.14 mm <sup>2</sup> , shielded, may be used in flexing cable installations                     |                         |
| Status-LED:                                    | Green: Pulse-index; Red: Error, revs too high or magnetic field too weak (for LM-5-*.*.050 and LM-5-*.*.250) |                         |
| RoHS compliant acc. to EU guideline 2011/65/EU |  |                         |

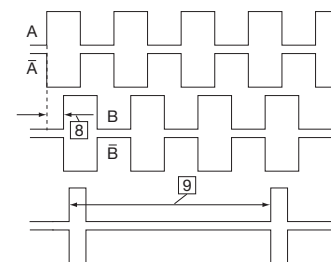
<sup>1)</sup> A max. of one channel only may be short-circuited: (when +V = 5V, a short-circuit to another channel, 0V, or +V is permissible.) (When +V = 5-30V, a short-circuit to another channel or to 0V is permissible.)

### Technical Data Magnetic Ring RMT-5:

|                     |  |
|---------------------|--|
| Pole gap:           | 5 mm from pole to pole   |
| Temperature ranges: | Working temperature: -4 to +185 °F (-20 to +80 °C)<br>Storage temperature: -4 to +185 °F (-20 to +80 °C)   |
| Mounting:           | Screwed on shaft<br>typ. +0.3° (at 77 °F, 25 °C)<br>Sensor/Magnetic ring distance 0.5 mm and drive shaft tolerance g6 in accordance with ISO 286-2 |
| System accuracy:    |  |

### Signal Figures:

With rotation of the magnetic ring in the CW-direction (see draft "Permissible Mounting tolerances").



8 Min. pulse interval: pay attention to the instructions in the technical data

9 Periodic index signal (every 5 mm) the logical assignment A, B and I-signal can change

# Rotary Position Technology

## Magnetic Rings RMT-5 / LM-5

### Part Number Key: LM-5

| A    |   | B   |   | C  | D   |   | E |
|------|---|-----|---|----|-----|---|---|
| LM-5 | - | P10 | - | 2R | 050 | - | C |

| A    | Type            |
|------|-----------------|
| LM-5 | Linear Magnetic |

| B   | Housing           |
|-----|-------------------|
| P10 | 10 mm, IP68/IP69K |
| Q10 | 10 mm, IP67       |

| C  | Voltage Supply and Type |
|----|-------------------------|
| 2R | 4.8-30 VDC, Push-Pull   |
| 4K | 4.8-26 VDC, RS422       |

| D   | Code <sup>1)</sup> |
|-----|--------------------|
| 032 |                    |
| 050 |                    |
| 064 |                    |
| 100 |                    |

<sup>1)</sup> See selection guide

| E         | Type of Connection                 |
|-----------|------------------------------------|
| C         | Cable (2 m PUR)                    |
| C*M-RSS8T | Cable w/ *m M12 Eurofast Connector |

\* Not available > 2 m

### Part Number Key: RMT-5

| A     |   | B   |  | C |
|-------|---|-----|--|---|
| RMT-5 | - | 031 |  | 6 |

| A     | Type                                      |
|-------|---|
| RMT-5 | 16 mm Rotary Magnetic Ring, 5 mm Pole Gap |

| B   | Ring Diameter |
|-----|---------------|
| 031 | Ø 31 mm       |
| 048 | Ø 48.3 mm     |
| 055 | Ø 54.7 mm     |

| C  | Ring Bore |    |                       |
|----|-----------|----|-----------------------|
| 6  | Ø 6 mm    | 25 | Ø 25 mm               |
| 8  | Ø 8 mm    | 30 | Ø 30 mm <sup>1)</sup> |
| 10 | Ø 10 mm   | 35 | Ø 35 mm <sup>2)</sup> |
| 12 | Ø 12 mm   | A4 | Ø 5/8"                |
| 15 | Ø 15 mm   | A6 | Ø 1" <sup>1)</sup>    |
| 20 | Ø 20 mm   |    |                       |

<sup>1)</sup> Only available with ring diameters '048' and '055'  
<sup>2)</sup> Only available with ring diameter '055'

### Selection Guide: Magnetic Sensor LM-5/Magnetic Ring RMT-5

| Pulses/<br>ppr <sup>1)</sup> | Part Number for<br>Magnetic Ring RMT-5 | Part Number for<br>Magnetic Sensor LM-5 | Max. rpm (electronic <sup>2)</sup> ) |                       |
|------------------------------|--|---|--------------------------------------|-----------------------|
|                              |  |   | without using<br>index signal        | using index<br>signal |
| 1000                         | RMT-5-031-*                            | LM-5-*10-*050-C                         | 9,000                                | 3,000                 |
| 2500                         | RMT-5-031-*                            | LM-5-*10-*100-C                         | 4,000                                | 3,000                 |
| 1024                         | RMT-5-048-*                            | LM-5-*10-*032-C                         | 9,000                                | 2,000                 |
| 2048                         | RMT-5-048-*                            | LM-5-*10-*064-C                         | 4,000                                | 2,000                 |
| 3600                         | RMT-5-055-*                            | LM-5-*10-*100-C                         | 2,500                                | 1,700                 |

<sup>1)</sup> The pulse rate (ppr) results from the combination of the magnetic sensor with the various outer diameters. Other pulse rates available on request

<sup>2)</sup> With an input frequency of the evaluation unit of 250 kHz

### Standard Wiring:

| Connection Type | 0 V, GND | +V | A  | Ā  | B  | B̄ | I  | Ī  |
|-----------------|----------|----|----|----|----|----|----|----|
| Cable           | WH       | BN | GN | YE | GY | PK | BU | RD |

Shield is on the housing

### Accessories:

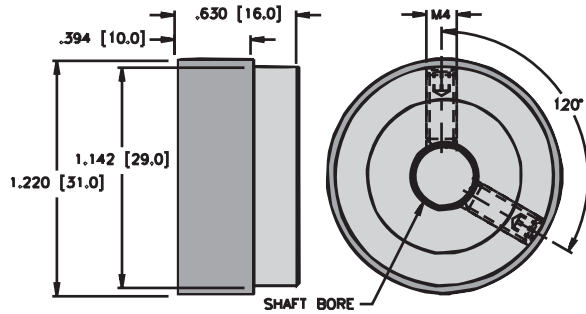
- See page H1, Connectivity, for cables and connectors
- See page G1, Accessories, for mounting attachments and couplings



## Magnetic Rings RMT-5 / LM-5

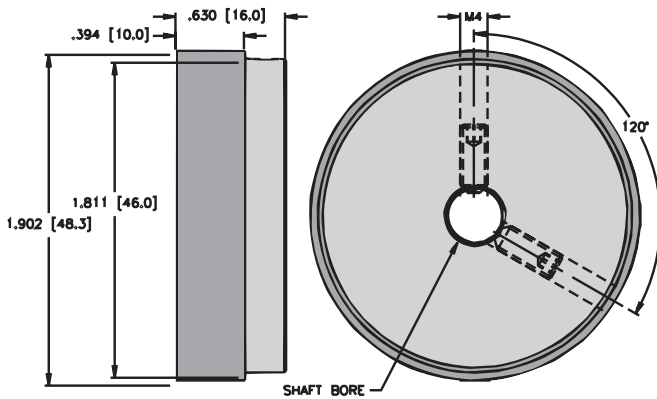
### Dimensions: RMT-5 Magnetic Ring

RMT-5-031-\*, Ø 31 mm

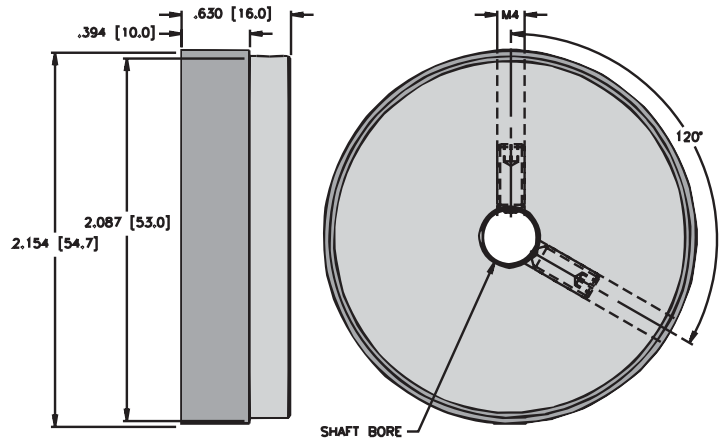


### Dimensions: RMT-5 Magnetic Ring

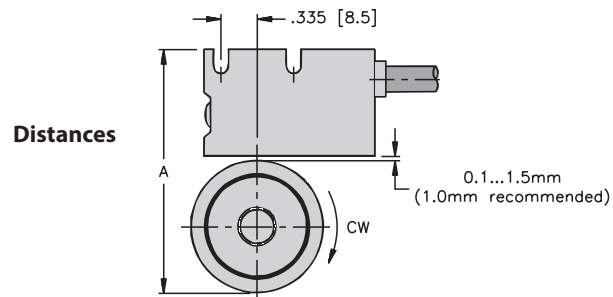
RMT-5-048-\*, Ø 48 mm



RMT-5-055-\*, Ø 55 mm

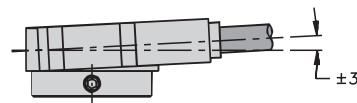


### Mounting Orientation and Permissible Mounting Tolerances

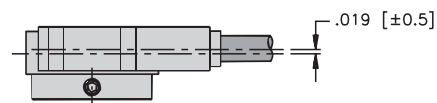


| Magnetic Ring | A distance calculated with 1 mm between sensor and magnetic ring |
|---------------|--|
| RMT-5-031-*   | 57.0   |
| RMT-5-048-*   | 74.3   |
| RMT-5-055-*   | 80.7   |

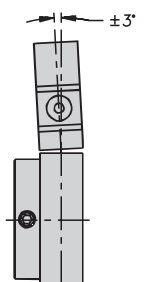
### Torsion



### Offset



### Tilting



Incremental Encoders

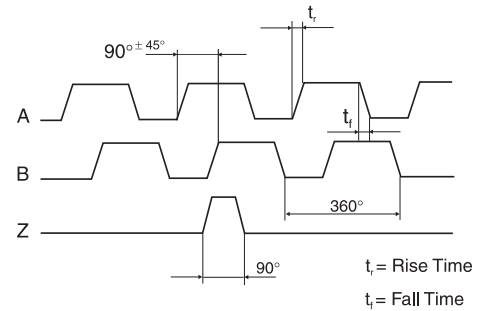
# Rotary Position Technology

## Wave Forms

### Outputs

All Turck encoders come standard with six channels, where A leads B in the clockwise direction and the standard index is gated with A & B. The tolerance of the wave form affects the control, and in some cases it may affect the smoothness of system operation.

### Wave Form Tolerances



|   |  |  |  |
|---|--|--|--|
| <p>A leads B when the shaft is turned in the clockwise direction viewing the shaft or collet end.</p> <p>This is Turck's standard. This format applies to the pin key codes listed below.</p> |  | <p>B leads A when the shaft is rotated in the clockwise direction viewing the shaft or collet end.</p> <p>This format applies to the pin key codes listed below.</p> |  |
| <p>A leads B, Z gated with A &amp; B. This is Turck's standard. Z is 90° wide.</p>  |  | <p><b>Code N24:</b><br/>B leads A, Z gated with A &amp; B. Z is 90° wide.</p>  |  |
| <p><b>Code N21:</b><br/>A leads B, Z gated with B. Z is 180° wide.</p>  |  | <p><b>Code N25:</b><br/>B leads A, Z gated with B. Z is 180° wide.</p>   |  |
| <p><b>Code N22:</b><br/>A leads B, Z gated with A. Z is 180° wide.</p>  |  | <p><b>Code N26:</b><br/>B leads A, Z gated with A. Z is 180° wide.</p>   |  |
| <p><b>Code N23:</b><br/>A leads B, Z ungated. Z is 330° to 360° wide.</p>   |  | <p><b>Code N27:</b><br/>B leads A, Z is ungated. Z is 330° to 360° wide.</p>   |  |
| <p><b>Code N28:</b><br/>A leads B, Z is 180° wide.</p>  |  | <p><b>Code N29*:</b><br/>B leads A, Z gated with B-bar. Z is 180° wide.</p>  |  |
| <p><b>Code N33*:</b><br/>A leads B, Z gated with B-bar. Z is 180° wide.</p>   |  | <p><b>Code N30:</b><br/>B leads A, Z is a negative marker gated with B. Z is 180° wide.</p>  |  |
| <p><b>Code N31:</b><br/>A leads B, Z is a minimum width of 270° (electrical degrees).</p>   |  | <p><b>Code N32:</b><br/>B leads A. Z has a minimum width of 270°.</p>  |  |

Note: \* For RI-10/12/65 encoders, Z is 160° Wide

**Notes:**

# Rotary Position Technology

**Notes:**

# ROTARY MEASUREMENT TECHNOLOGY

## ABSOLUTE ENCODERS

| SERIES                           | TYPE               | INTERFACE                 | PAGE        |
|----------------------------------|--------------------|---------------------------|-------------|
| <b>Singleturn</b>                |                    |                           |             |
| <b>Compact, Magnetic</b>         | Type RS-06/RS-07   | Analog                    | <b>F6</b>   |
|                                  | Type RS-52/RS-53   | CANopen                   | <b>F11</b>  |
|                                  | Type RS-52/RS-53   | SAE J1939                 | <b>F15</b>  |
| <b>Compact, Optical</b>          | Type RS-44/RS-48   | SSI/BiSS-C                | <b>F19</b>  |
|                                  | Type RS-45/RS-49   | CANopen                   | <b>F25</b>  |
| <b>Standard, Optical</b>         | Type RS-24/RS-31   | SSI/BiSS-C                | <b>F29</b>  |
|                                  | Type RS-25/RS-33   | CANopen                   | <b>F37</b>  |
|                                  | Type RS-25/RS-33   | EtherCAT                  | <b>F47</b>  |
|                                  | Type RS-25/RS-33   | PROFIBUS <sup>®</sup> -DP | <b>F52</b>  |
|                                  | Type RS-25/RS-33   | PROFINET IO               | <b>F57</b>  |
|                                  | Type RS-107/RS-108 | EtherNet/IP               | <b>F62</b>  |
|                                  |                    |                           |             |
| <b>Multiturn</b>                 |                    |                           |             |
| <b>Compact, Magnetic</b>         | Type RM-97/RM-98   | Analog                    | <b>F67</b>  |
|                                  | Type RM-99/RM-100  | SSI                       | <b>F72</b>  |
|                                  | Type RM-101/RM-102 | CANopen                   | <b>F76</b>  |
| <b>Compact, Magnetic, Robust</b> | Type RM-115        | Analog                    | <b>F80</b>  |
|                                  | Type RM-117        | SSI                       | <b>F85</b>  |
|                                  | Type RM-109        | CANopen                   | <b>F89</b>  |
| <b>Standard, Magnetic</b>        | Type RM-116        | Analog                    | <b>F93</b>  |
|                                  | Type RM-118        | SSI                       | <b>F98</b>  |
|                                  | Type RM-121        | CANopen                   | <b>F102</b> |
| <b>Compact, Optical/Battery</b>  | Type RM-46/RM-50   | SSI/BiSS-C                | <b>F106</b> |
|                                  | Type RM-47/RM-51   | CANopen                   | <b>F111</b> |
| <b>Standard, Optical/Geared</b>  | Type RM-28/RM-35   | SSI/BiSS-C                | <b>F114</b> |
|                                  | Type RM-29/RM-36   | CANopen/CANlift           | <b>F122</b> |
|                                  | Type RM-29/RM-36   | EtherCAT                  | <b>F132</b> |
|                                  | Type RM-29/RM-36   | PROFIBUS-DP               | <b>F137</b> |
|                                  | Type RM-29/RM-36   | PROFINET IO               | <b>F143</b> |
| <b>Standard, Optical/Battery</b> | Type RM-103/RM-104 | SSI/BiSS-C                | <b>F148</b> |
|                                  | Type RM-105/RM-106 | CANopen                   | <b>F155</b> |
|                                  | Type RM-105/RM-106 | EtherNet/IP               | <b>F160</b> |
|                                  | Type RM-105/RM-106 | Modbus                    | <b>F165</b> |

# Rotary Position Technology

## Absolute Encoders

### Absolute Singleturn Encoder Selection Guide

|                             |                                | Absolute      |               |               |               |               |               |               |               |
|-----------------------------|--------------------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
|                             |                                | RS-06         | RS-07         | RS-52         | RS-53         | RS-44         | RS-48         | RS-45         | RS-49         |
| Interface                   | SSI                            |               |               |               |               | X             | X             |               |               |
|                             | SSI and Incremental track      |               |               |               |               | X             | X             |               |               |
|                             | SSI and SIN/COS track          |               |               |               |               | X             | X             |               |               |
|                             | BiSS-C                         |               |               |               |               | X             | X             |               |               |
|                             | BiSS-C and Incremental track   |               |               |               |               | X             | X             |               |               |
|                             | BiSS-C and SIN/COS track       |               |               |               |               | X             | X             |               |               |
|                             | Parallel                       |               |               |               |               |               |               |               |               |
|                             | Analog output                  | X             | X             |               |               |               |               |               |               |
|                             | RS485                          |               |               |               |               |               |               |               |               |
|                             | PROFIBUS-DP                    |               |               |               |               |               |               |               |               |
|                             | PROFINET                       |               |               |               |               |               |               |               |               |
|                             | CANopen                        |               |               | X             | X             |               |               | X             | X             |
|                             | CANlift                        |               |               |               |               |               |               |               |               |
|                             | EtherCAT                       |               |               |               |               |               |               |               |               |
|                             | J1939                          |               |               | X             | X             |               |               |               |               |
| EtherNet/IP                 |                                |               |               |               |               |               |               |               |               |
| Modbus                      |                                |               |               |               |               |               |               |               |               |
| Mechanical Characteristics  | Shaft max. (mm)                | 8             | -             | 8             | -             | 10            | -             | 10            | -             |
|                             | Blind hollow shaft max. (mm)   | -             | 10            | -             | 10            | -             | 10            | -             | 10            |
|                             | Through hollow shaft max. (mm) | -             | -             | -             | -             | -             | 8             | -             | 8             |
| Performance Characteristics | Max. speed RPM (thousands)     | 6             | 6             | 6             | 6             | 12            | 12            | 12            | 12            |
|                             | Mechanical gears               |               |               |               |               |               |               |               |               |
|                             | Non-contact gears              |               |               |               |               |               |               |               |               |
|                             | Resolution max. (Bit)          | 12            | 12            | 14            | 14            | 17            | 17            | 17            | 17            |
|                             | Programmable                   |               |               | X             | X             |               |               | X             | X             |
|                             | Control outputs                |               |               |               |               |               |               |               |               |
|                             | Set key (optional)             |               |               |               |               |               |               |               |               |
|                             | Status LED (optional)          | X             | X             | X             | X             |               |               | X             | X             |
|                             | Bearing-lock                   | X             | X             | X             | X             | X             | X             | X             | X             |
|                             | Temperature min.               | -40°F (-40°C) | -40°F (-40°C) | -40°F (-40°C) | -40°F (-40°C) | -40°F (-40°C) | -40°F (-40°C) | -22°F (-30°C) | -22°F (-30°C) |
| Temperature max.            | 185°F (85°C)                   | 185°F (85°C)  | 185°F (85°C)  | 185°F (85°C)  | 194°F (90°C)  | 194°F (90°C)  | 185°F (85°C)  | 185°F (85°C)  |               |
| IP max.                     | IP69K                          | IP69K         | IP69K         | IP69K         | IP67          | IP67          | IP67          | IP67          |               |
| Catalog Page                | F6                             | F6            | F11           | F11           | F19           | F19           | F25           | F25           |               |

**Absolute Singleturn Encoder Selection Guide**

| Absolute |       |       |       |        |        |  |
|----------|-------|-------|-------|--------|--------|--|
| RS-24    | RS-31 | RS-25 | RS-33 | RS-107 | RS-108 |  |

| Interface   | SSI                          | X | X |   |   |   |  |
|-------------|------------------------------|---|---|---|---|---|--|
|             | SSI and Incremental track    | X | X |   |   |   |  |
|             | SSI and SIN/COS track        | X | X |   |   |   |  |
|             | BiSS-C                       | X | X |   |   |   |  |
|             | BiSS-C and Incremental track | X | X |   |   |   |  |
|             | BiSS-C and SIN/COS track     | X | X |   |   |   |  |
|             | Parallel                     |   |   |   |   |   |  |
|             | Analog output                |   |   |   |   |   |  |
|             | RS485                        |   |   |   |   |   |  |
|             | PROFIBUS-DP                  |   |   | X | X |   |  |
|             | PROFINET                     |   |   | X | X |   |  |
|             | CANopen                      |   |   | X | X |   |  |
|             | CANlift                      |   |   |   |   |   |  |
|             | EtherCAT                     |   |   | X | X |   |  |
|             | J1939                        |   |   |   |   |   |  |
| EtherNet/IP |                              |   |   |   | X | X |  |
| Modbus      |                              |   |   |   |   |   |  |

| Mechanical Characteristics | Shaft max. (mm)                | 10 | -  | 10 | -  | 10 |    |
|----------------------------|--------------------------------|----|----|----|----|----|----|
|                            | Blind hollow shaft max. (mm)   | -  | -  | -  | 15 |    | 15 |
|                            | Through hollow shaft max. (mm) | -  | 15 | -  | -  |    |    |

| Performance Characteristics | Max. speed RPM (thousands) | 12              | 9               | 9               | 9               | 8               | 6               |
|-----------------------------|----------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
|                             | Mechanical gears           |                 |                 |                 |                 |                 |                 |
|                             | Non-contact gears          |                 |                 |                 |                 |                 |                 |
|                             | Resolution max. (Bit)      | 21              | 21              | 16              | 16              | 32              | 32              |
|                             | Programmable               |                 |                 | X               | X               | X               | X               |
|                             | Control outputs            |                 |                 |                 |                 |                 |                 |
|                             | Set key (optional)         | X               | X               | X               | X               |                 |                 |
|                             | Status LED (optional)      | X               | X               | X               | X               | X               | X               |
|                             | Bearing-Lock               | X               | X               | X               | X               | X               | X               |
|                             | Temperature min.           | -40 °F (-40 °C) | -40 °F (-40 °C) | -40 °F (-40 °C) | -40 °F (-40 °C) | -40 °F (-40 °C) | -40 °F (-40 °C) |
|                             | Temperature max.           | 194 °F (90 °C)  | 194 °F (90 °C)  | 176 °F (80 °C)  | 176 °F (80 °C)  | 176 °F (80 °C)  | 176 °F (80 °C)  |
| IP max.                     | IP67                       | IP67            | IP67            | IP67            | IP65            | IP65            |                 |

| Catalog Page | <b>F29</b> | <b>F29</b> | <b>F37</b> | <b>F37</b> | <b>F62</b> | <b>F62</b> |
|--------------|------------|------------|------------|------------|------------|------------|
|--------------|------------|------------|------------|------------|------------|------------|

Absolute Encoders

# Rotary Position Technology

## Absolute Encoders

### Absolute Multiturn Encoder Selection Guide

| Absolute |       |       |        |        |        |        |        |        |        |        |        |  |
|----------|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--|
| RM-97    | RM-98 | RM-99 | RM-100 | RM-101 | RM-102 | RM-115 | RM-117 | RM-109 | RM-116 | RM-118 | RM-121 |  |

| Interface   | SSI                          |   |   | X | X |   |   |   | X |   |   | X |   |
|-------------|------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
|             | SSI and Incremental track    |   |   |   |   |   |   |   |   |   |   |   |   |
|             | SSI and SIN/COS track        |   |   |   |   |   |   |   |   |   |   |   |   |
|             | BiSS-C                       |   |   |   |   |   |   |   |   |   |   |   |   |
|             | BiSS-C and Incremental track |   |   |   |   |   |   |   |   |   |   |   |   |
|             | BiSS-C and SIN/COS track     |   |   |   |   |   |   |   |   |   |   |   |   |
|             | Parallel                     |   |   |   |   |   |   |   |   |   |   |   |   |
|             | Analog output                | X | X |   |   |   |   | X |   |   | X |   |   |
|             | RS485                        |   |   |   |   |   |   |   |   |   |   |   |   |
|             | PROFIBUS-DP                  |   |   |   |   |   |   |   |   |   |   |   |   |
|             | PROFINET                     |   |   |   |   |   |   |   |   |   |   |   |   |
|             | CANopen                      |   |   |   |   | X | X |   |   | X |   |   | X |
|             | CANlift                      |   |   |   |   |   |   |   |   |   |   |   |   |
|             | EtherCAT                     |   |   |   |   |   |   |   |   |   |   |   |   |
|             | J1939                        |   |   |   |   |   |   |   |   |   |   |   |   |
| EtherNet/IP |                              |   |   |   |   |   |   |   |   |   |   |   |   |
| Modbus      |                              |   |   |   |   |   |   |   |   |   |   |   |   |

| Mechanical Characteristics | Shaft max. (mm)                | 10 | -  | 10 | -  | 10 | -  | 10 | 10 | 10 | 10 | 10 | 10 |
|----------------------------|--------------------------------|----|----|----|----|----|----|----|----|----|----|----|----|
|                            | Blind hollow shaft max. (mm)   | -  | 10 | -  | 10 | -  | 10 | -  | -  | -  | -  | -  | -  |
|                            | Through hollow shaft max. (mm) | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  | -  |

| Performance Characteristics | Max. speed RPM (thousands) | 6               | 4               | 6               | 4               | 6               | 4               | 4               | 4               | 4               | 4               | 4               | 4               |
|-----------------------------|----------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
|                             | Mechanical gears           |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |
|                             | Non-contact gears          |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |
|                             | Resolution max. (Bit)      | 12              | 12              | 38              | 38              | 38              | 38              | 12              | 38              | 38              | 12              | 38              | 38              |
|                             | Programmable               | X               | X               |                 |                 | X               | X               | X               |                 | X               | X               |                 | X               |
|                             | Control output             |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |
|                             | Set key (optional)         |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |
|                             | Status LED (optional)      |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |
|                             | Bearing-Lock               | X               | X               | X               | X               | X               | X               | X               | X               | X               | X               | X               | X               |
|                             | Temperature min.           | -40 °F (-40 °C) | -40 °F (-40 °C) | -40 °F (-40 °C) | -40 °F (-40 °C) | -40 °F (-40 °C) | -40 °F (-40 °C) | -40 °F (-40 °C) | -40 °F (-40 °C) | -40 °F (-40 °C) | -40 °F (-40 °C) | -40 °F (-40 °C) | -40 °F (-40 °C) |
| Temperature max.            | 185 °F (85 °C)             | 185 °F (85 °C)  | 185 °F (85 °C)  | 185 °F (85 °C)  | 185 °F (85 °C)  | 185 °F (85 °C)  | 185 °F (85 °C)  | 185 °F (85 °C)  | 185 °F (85 °C)  | 185 °F (85 °C)  | 185 °F (85 °C)  | 185 °F (85 °C)  | 185 °F (85 °C)  |
| IP max.                     | IP67                       | IP67            | IP67            | IP67            | IP67            | IP67            | IP67            | IP69K           | IP69K           | IP69K           | IP65            | IP65            | IP65            |

| Catalog Page | F67 | F67 | F72 | F72 | F76 | F76 | F80 | F85 | F89 | F93 | F98 | F102 |
|--------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
|--------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|



**Absolute Multiturn Encoder Selection Guide**

| Absolute |       |       |       |       |       |       |       |        |        |        |        |
|----------|-------|-------|-------|-------|-------|-------|-------|--------|--------|--------|--------|
| RM-46    | RM-50 | RM-47 | RM-51 | RM-28 | RM-35 | RM-29 | RM-36 | RM-103 | RM-104 | RM-105 | RM-106 |

| Interface   | SSI                          | X | X |   |   | X | X |   |   | X | X |   |   |
|-------------|------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|
|             | SSI and Incremental track    | X | X |   |   | X | X |   |   | X | X |   |   |
|             | SSI and SIN/COS track        | X | X |   |   | X | X |   |   | X | X |   |   |
|             | BiSS-C                       | X | X |   |   | X | X |   |   | X | X |   |   |
|             | BiSS-C and Incremental track | X | X |   |   | X | X |   |   | X | X |   |   |
|             | BiSS-C and SIN/COS track     | X | X |   |   | X | X |   |   | X | X |   |   |
|             | Parallel                     |   |   |   |   |   |   |   |   |   |   |   |   |
|             | Analog output                |   |   |   |   |   |   |   |   |   |   |   |   |
|             | RS485                        |   |   |   |   |   |   |   |   |   |   |   |   |
|             | PROFIBUS-DP                  |   |   |   |   |   |   | X | X |   |   |   |   |
|             | PROFINET                     |   |   |   |   |   |   | X | X |   |   |   |   |
|             | CANopen                      |   |   | X | X |   |   | X | X |   |   | X | X |
|             | CANlift                      |   |   |   |   |   |   | X | X |   |   |   |   |
|             | EtherCAT                     |   |   |   |   |   |   | X | X |   |   |   |   |
| J1939       |                              |   |   |   |   |   |   |   |   |   |   |   |   |
| EtherNet/IP |                              |   |   |   |   |   |   |   |   |   | X | X |   |
| Modbus      |                              |   |   |   |   |   |   |   |   |   | X | X |   |

| Mechanical Characteristics | Shaft max. (mm)                | 10 | -  | 10 | -  | 10 | -  | 10 | -  | 10 | -  | 10 | -  |
|----------------------------|--------------------------------|----|----|----|----|----|----|----|----|----|----|----|----|
|                            | Blind hollow shaft max. (mm)   | -  | 10 | -  | 10 | -  | 15 | -  | 15 | -  | -  | -  | 15 |
|                            | Through hollow shaft max. (mm) | -  | 8  | -  | 8  | -  | 14 | -  | -  | -  | 15 | -  | -  |

| Performance Characteristics | Max. speed RPM (thousands) | 12              | 12              | 12              | 12              | 12              | 9               | 9               | 9               | 10              | 6               | 12              | 9               |
|-----------------------------|----------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
|                             | Mechanical gears           |                 |                 |                 |                 | X               | X               | X               | X               |                 |                 |                 |                 |
|                             | Non-contact gears          | X               | X               | X               | X               |                 |                 |                 |                 |                 |                 |                 |                 |
|                             | Resolution max. (Bit)      | 41              | 41              | 32              | 32              | 29              | 29              | 28              | 28              | 41              | 41              | 32              | 32              |
|                             | Programmable               |                 |                 |                 |                 |                 |                 | X               | X               |                 |                 | X               | X               |
|                             | Control output             |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |
|                             | Set key (optional)         |                 |                 |                 |                 | X               | X               | X               | X               | X               | X               |                 |                 |
|                             | Status LED (optional)      |                 |                 | X               | X               | X               | X               | X               | X               | X               | X               | X               | X               |
|                             | Bearing-Lock               | X               | X               | X               | X               | X               | X               | X               | X               | X               | X               | X               | X               |
|                             | Temperature min.           | -22 °F (-30 °C) | -22 °F (-30 °C) | -22 °F (-30 °C) | -22 °F (-30 °C) | -40 °F (-40 °C) | -40 °F (-40 °C) | -40 °F (-40 °C) | -40 °F (-40 °C) | -40 °F (-40 °C) | -40 °F (-40 °C) | -40 °F (-40 °C) | -40 °F (-40 °C) |
| Temperature max.            | 194 °F (90 °C)             | 194 °F (90 °C)  | 185 °F (85 °C)  | 185 °F (85 °C)  | 194 °F (90 °C)  | 194 °F (90 °C)  | 176 °F (80 °C)  | 176 °F (80 °C)  | 185 °F (85 °C)  | 185 °F (85 °C)  | 176 °F (80 °C)  | 176 °F (80 °C)  |                 |
| IP max.                     | IP67                       | IP67            | IP67            | IP67            | IP67            | IP67            | IP67            | IP67            | IP67            | IP67            | IP67            | IP67            |                 |

| Catalog Page | F106 | F106 | F111 | F111 | F114 | F114 | F122 | F122 | F148 | F148 | F155 | F155 |
|--------------|------|------|------|------|------|------|------|------|------|------|------|------|
|--------------|------|------|------|------|------|------|------|------|------|------|------|------|

# Rotary Position Technology

## Absolute Encoders, Singleturn

### Absolute, Singleturn Encoder Type RS-06 (Shaft) / RS-07 (Blind Hollow Shaft)

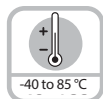
Analog



Bearing Lock



High rotational speed



Temperature



High IP



High shaft load capacity



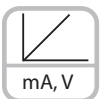
Shock/vibration resistant



Short-circuit protected



Reverse polarity protection



Output



Magnetic sensor



Seawater-resistant version on request

#### Rugged

- Non-contact measuring system: **Ensures long service life and the reliability of the application.**
- **Stays sealed even when subjected to harsh everyday use.** Solid die-cast housing with up to IP69K protection **offers security against failures in the field.**
- Wide temperature range of -40 to +185 °F (-40 to +85 °C).
- **Increased ability to withstand vibration and installation errors.** High shock (> 500 g) and vibration resistance (> 30 g) **eliminates machine downtime and repairs.**



#### Absolute



#### Compact

- **Can be used where space is tight:** Overall diameter of only 36 mm.
- **Shaft version can be mounted on a tight radius:** fixing holes on Ø 26 mm.
- **Hollow shaft version is ideal for large shafts:** blind hollow shaft up to 10 mm.

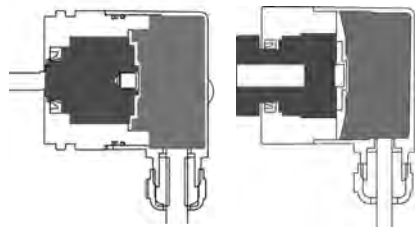
#### Versatile

- **Interface of 4-20 mA, 0-10 V:** One size available for different applications.
- **Measuring range of 45°, 90°, 180° and 360°.**
- **Easy diagnosis in case of fault condition:** Error indication via red LED (only current output).
- **Hollow shaft version may be fixed individually:** Torque stop and flex coupling available.
- **May be used in outdoor applications with large fluctuations in temperature:** Resistant against humidity and condensation.

#### Mechanical Characteristics:

|   |   |
|---|---|
| Max. speed:                                       | 6,000 RPM   |
| Starting torque:                                  | < 8.5 oz-in (< 0.06 Nm)   |
| Radial load capacity of shaft:                    | 9.0 lbs (40 N)  |
| Axial load capacity of shaft:                     | 4.5 lbs (20 N)  |
| Weight:   | approx. 0.44 lbs (0.2 kg)   |
| Protection acc. to EN 60 529 / DIN 40050-9:       | IP67 / IP69K  |
| Working temperature range:                        | -40 to +185 °F (-40 to +85 °C)  |
| Materials:  | Shaft: stainless steel, Flange: aluminium, Housing: die cast zinc, Cable: PUR |
| Shock resistance acc. to EN 60068-2-27:           | 500 g (5,000 m/s <sup>2</sup> ), 6 ms   |
| Vibration resistance acc. to EN 60068-2-6:        | 30 g (300 m/s <sup>2</sup> ), 10-2,000 Hz                                     |
| Permanent shock resistance acc. to EN 60068-2-29: | 100 g (1,000 m/s <sup>2</sup> ), 2 ms   |
| Vibration (broad-band random) to EN 60068-2-64:   | 5-2500 Hz, 10 g (100 m/s <sup>2</sup> ) - rms                                 |

#### All-round protection:



#### Bearing-Lock:

IP69K protection on the flange side, robust bearing assemblies with interlocking bearings, mechanically protected shaft seal.

#### Protected Sensor:

Fully encapsulated electronics, separate mechanical bearing assembly.

### Absolute, Singleturn Encoder Type RS-06 (Shaft) / RS-07 (Blind Hollow Shaft) Analog

#### Electrical Characteristics Current Interface 4-20 mA:

|   |  |
|---|--|
| <b>Sensor:</b>                                    |  |
| Supply voltage:                                   | 10-30 VDC  |
| Current consumption (without output load):        | max. 38 mA   |
| Reverse polarity protection at power supply (+V): | Yes  |
| Measuring range:                                  | 45°, 90°, 180° or 360°   |
| Resolution/Code:                                  | 12 bit   |
| Linearity 77 °F (25 °C):                          | < 1° (360° measurement range)  |
| Repeat accuracy 77 °F (25 °C):                    | < 0.1° (360° measurement range)  |
| Status LED:                                       | Red: sensor break detection, input too high<br>Green: reference point (CW: 0° to 1°)<br>(CCW: 0° to -1°) |

#### 4-20 mA Current Loop:

|   |  |
|---|--|
| Output load:  | max. 200 ohms at 10 VDC<br>max. 900 ohms at 24 VDC   |
| Setting time:   | 1 ms ( $R_{load} = 400 \text{ Ohm}$ , 77 °F (25 °C)) |
| Short-circuit protected outputs: when the supply voltage is correctly applied, then output to output is short-circuit protected, but not output to 0V or to +V. |  |
| Supply voltage and sensor output signal are not galvanically isolated.  |  |

#### Electrical Characteristics Voltage Interface

|   |                                       |
|---|---------------------------------------|
| <b>Sensor:</b>                                    |                                       |
| Supply voltage:                                   | 0-5 V, 10-30 VDC<br>0-10 V, 15-30 VDC |
| Current consumption (without output load):        | max. 35 mA                            |
| Reverse polarity protection at power supply (+V): | Yes                                   |
| Measuring range:                                  | 45°, 90°, 180° or 360°                |
| Resolution/Code:                                  | 12 bit                                |
| Linearity 77 °F (25 °C):                          | < 1° (360° measurement range)         |
| Repeat accuracy:                                  | < 0.1° (360° measurement range)       |

#### Voltage Output:

|   |  |
|---|--|
| Current output:   | max. 10 mA   |
| Setting time:   | < 1 ms ( $R_{load} \geq 1 \text{ KOhm}$ , 77 °F (25 °C))                                       |
| Supply voltage and sensor output signal are not galvanically isolated.  |  |
| Short-circuit protected outputs: when the supply voltage is correctly applied, then output to output is short-circuit protected, but not output to 0V or to +V. |  |
| Status LED  | Green: reference point display turns on at cw: between 0° and 1°<br>at ccw: between 0° and -1° |

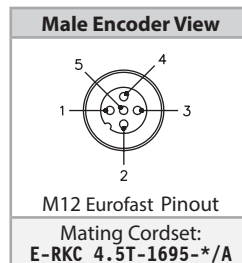
#### General Electrical Characteristics:

|                 |                                 |
|-----------------|---------------------------------|
| RoHS compliant: | acc. to EU guideline 2011/65/EU |
|-----------------|---------------------------------|

#### Standard Wiring:

| Connection Type: | Common (0 V) | +V | +I | -I |
|------------------|--------------|----|----|----|
| Cable:           | WH           | BN | GN | YE |
| M12 Eurofast:    | 3            | 2  | 4  | 5  |

#### Wiring Diagram:



\* Length in meters.

# Rotary Position Technology

## Absolute Encoders, Singleturn

### Absolute, Singleturn Encoder Type RS-06 (Shaft) / RS-07 (Blind Hollow Shaft)

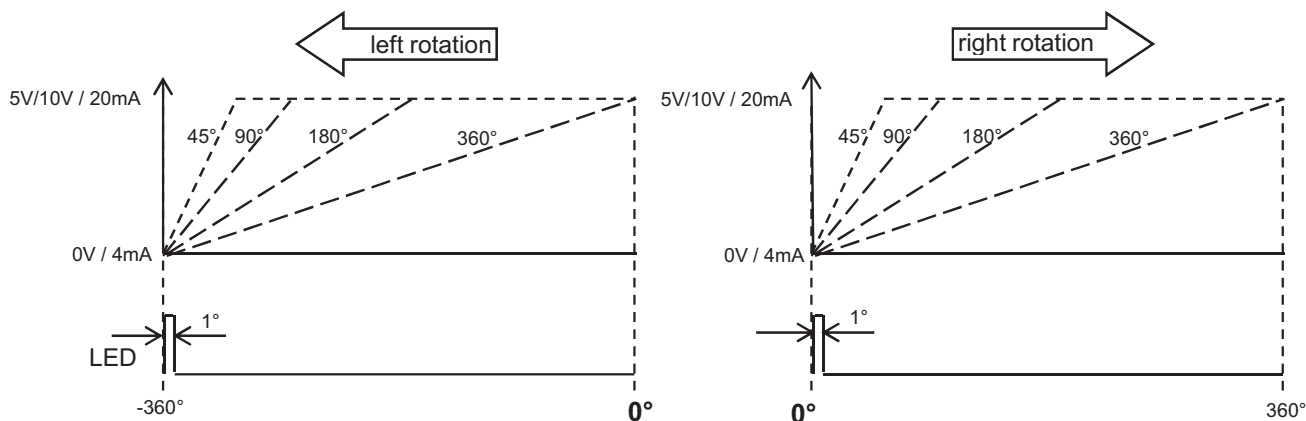
Analog

**Note:** Encoders must be ordered with a clockwise or counterclockwise profile. This determines whether the analog output increases or decreases in the given direction.

#### Example (Output Signal Profile):

Measuring range 45° / 90° / 180° / 360°

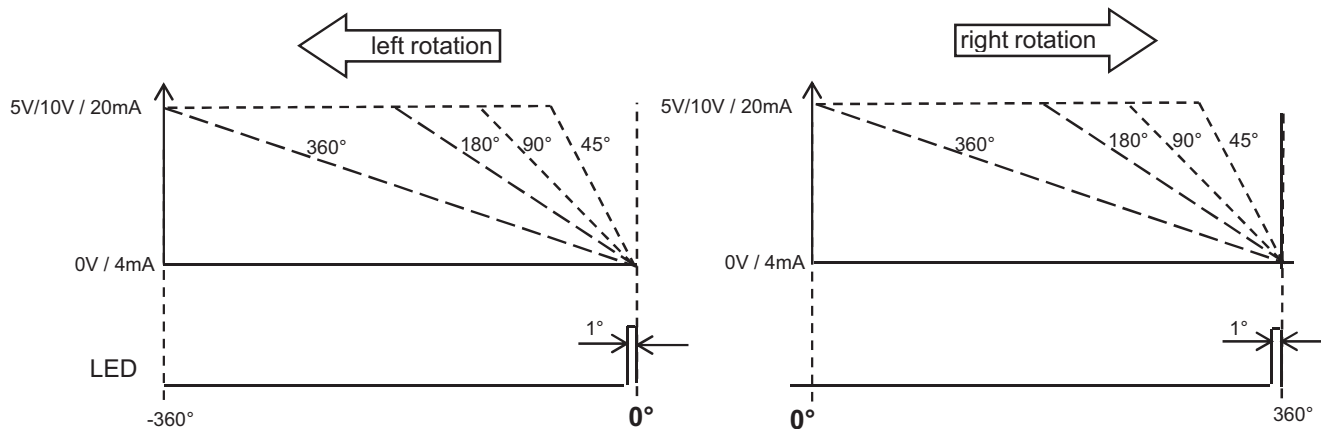
#### Clockwise (CW) Version



#### Example (Output Signal Profile):

Measuring range 45° / 90° / 180° / 360°

#### Counterclockwise (CCW) Version



### Absolute, Singleturn Encoder Type RS-06 (Shaft) / RS-07 (Blind Hollow Shaft) Analog

#### Part Number Key: RS-06 Shaft Version

| A      | B | C |   | D  | E  |   | F     |   | G  |
|--------|---|---|---|----|----|---|-------|---|----|
| RS-06P | 6 | S | - | 7A | AL | - | H1151 | / | N0 |

| A      | Type                             |
|--------|----------------------------------|
| RS-06P | Ø 36 mm, Shaft, IP69K Shaft Seal |
| RS-06S | Ø 36 mm, Shaft, IP67 Shaft Seal  |

| B  | Shaft (Ø x L)    |
|----|------------------|
| 6  | Ø 6 mm x 12.5 mm |
| 8  | Ø 8 mm x 12.5 mm |
| A0 | Ø 1/4" x 12.5 mm |

| C | Flange       |
|---|--------------|
| S | Servo Flange |

| D  | Voltage Supply and Output Type |
|----|--------------------------------|
| 7A | 10-30 VDC, 4-20 mA             |
| 8B | 15-30 VDC, 0-10 V              |
| BA | 10-30 VDC, 0-5 V               |

| E  | Direction            |
|----|----------------------|
| AL | Count Direction CCW* |
| AR | Count Direction CW*  |

| F     | Type of Connection                   |
|-------|--------------------------------------|
| H1151 | Radial 5-pin M12 Eurofast® Connector |
| H1451 | Axial 5-pin M12 Eurofast Connector   |
| C1M   | Radial Cable (1 m PUR)               |
| CA1M  | Axial Cable (1 m PUR)                |

| G  | Measurement Range |
|----|-------------------|
| N0 | 1 x 360°          |
| N4 | 1 x 180°          |
| N3 | 1 x 90°           |
| N1 | 1 x 45°           |

\*cw = increasing code values when shaft turning clockwise (cw).  
Top view on shaft.

#### Part Number Key: RS-07 Blind Hollow Shaft Version

| A      | B | C |   | D  | E  |   | F     |   | G  |
|--------|---|---|---|----|----|---|-------|---|----|
| RS-07B | 6 | E | - | 7A | AL | - | H1151 | / | N0 |

| A      | Type  |
|--------|---|
| RS-07B | Ø 36 mm, Blind Hollow Shaft, IP69K Shaft Seal |
| RS-07C | Ø 36 mm, Blind Hollow Shaft, IP67 Shaft Seal  |

| B  | Bore (18 mm Insertion Depth) |
|----|------------------------------|
| 6  | Ø 6 mm                       |
| 8  | Ø 8 mm                       |
| 10 | Ø 10 mm                      |
| A0 | Ø 1/4"                       |

| C | Flange                               |
|---|--------------------------------------|
| E | Ø 46 mm Flange w/ Slotted Flex Mount |
| T | Flange w/ Long Torque Stop           |

| D  | Voltage Supply and Output Type |
|----|--------------------------------|
| 7A | 10-30 VDC, 4-20 mA             |
| 8B | 15-30 VDC, 0-10 V              |
| BA | 10-30 VDC, 0-5 V               |

| E  | Direction            |
|----|----------------------|
| AL | Count Direction CCW* |
| AR | Count Direction CW*  |

| F     | Type of Connection                  |
|-------|-------------------------------------|
| H1151 | Radial 5-pin M12 Eurofast Connector |
| H1451 | Axial 5-pin M12 Eurofast Connector  |
| C1M   | Radial Cable (1 m PUR)              |
| CA1M  | Axial Cable (1 m PUR)               |

| G  | Measurement Range |
|----|-------------------|
| N0 | 1 x 360°          |
| N4 | 1 x 180°          |
| N3 | 1 x 90°           |
| N1 | 1 x 45°           |

\*cw = increasing code values when shaft turning clockwise (cw).  
Top view on shaft.

#### Accessories:

- See page H1, Connectivity, for cables and connectors
- See page G1, Accessories, for mounting attachments and couplings

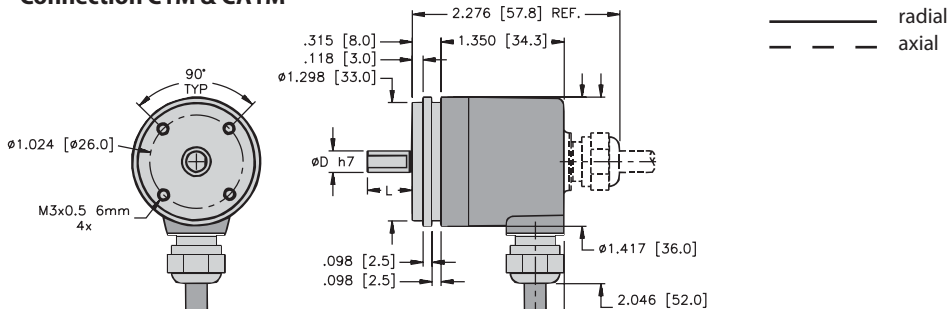
# Rotary Position Technology

## Absolute Encoders, Singleturn

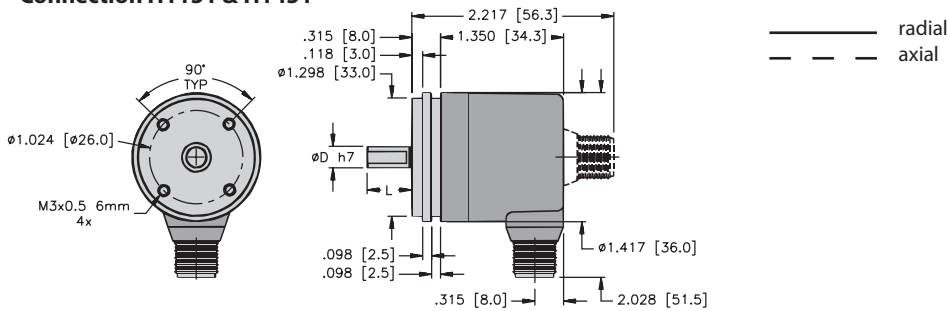
### Absolute, Singleturn Encoder Type RS-06 (Shaft) / RS-07 (Blind Hollow Shaft) Analog

#### Dimensions: RS-06 Shaft Version

##### RS-06 Flange S Connection C1M & CA1M



##### RS-06 Flange S Connection H1151 & H1451

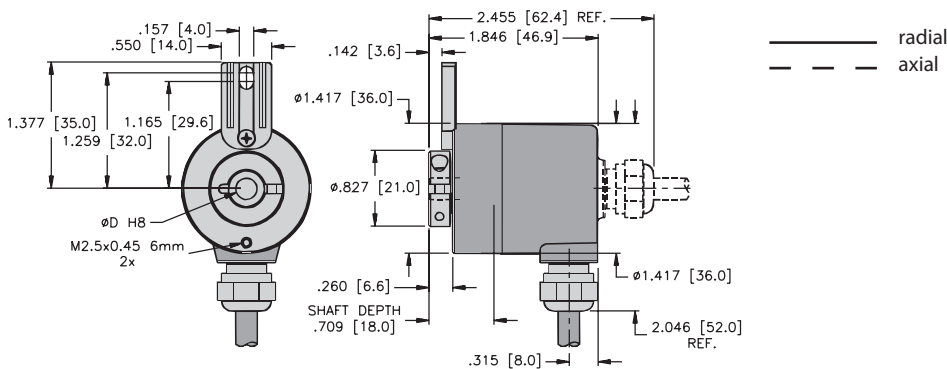


#### Mounting Advice:

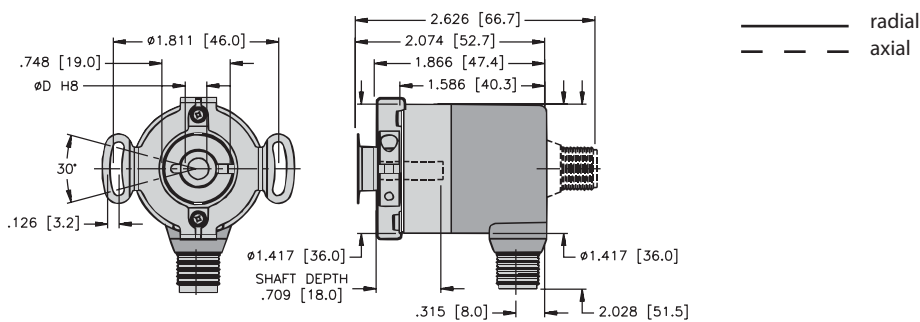
The flanges and shafts of the encoder and drive should not be rigidly coupled together at the same time. We recommend the use of suitable couplings (see page G1, Accessories).

#### Dimensions: RS-07 Blind Hollow Shaft Version

##### RS-07 Flange T Connection C1M & CA1M

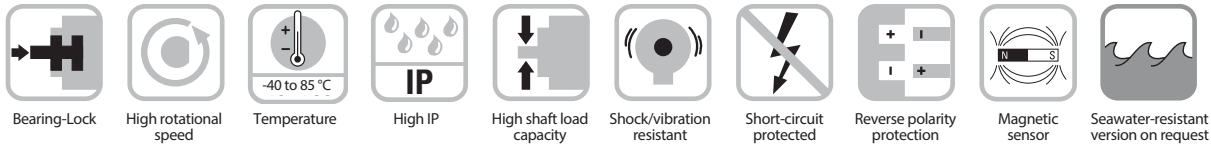


##### RS-07 Flange E Connection H1151 & H1451



### Absolute, Singleturn Encoder Type RS-52 (Shaft) / RS-53 (Blind Hollow Shaft)

CANopen



#### Rugged

- Non-contact measuring system: **Ensures long service life and the reliability of the application.**
- **Stays sealed even when subjected to harsh everyday use:** Solid die-cast housing with up to IP69K protection **offers security against failures in the field.**
- Wide temperature range of -40 to +185 °F (-40 to +85 °C).
- **Increased ability to withstand vibration and installation errors:** High shock (> 500 g) and vibration resistance (> 30 g) **eliminates machine downtime and repairs.**



#### Absolute



CANopen

#### Compact

- **Can be used where space is tight:** Overall diameter of only 36 mm.
- **Shaft version can be mounted on a tight radius:** Fixing holes on Ø 26 mm.
- **Hollow shaft version is ideal for large shafts:** Blind hollow shaft up to 10 mm.

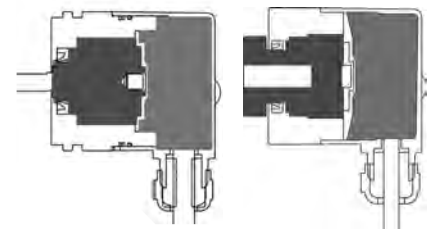
#### Versatile

- **CANopen fieldbus** with the latest profiles.
- **Connections for every application:** M12 connector or cable connection.
- **Real-time data: Position, speed or working area:** Variable PDO mapping in the memory.
- **Fast, error-free start-up, without setting any switches:** LSS services for configuration of the node address and baud rate via CIA DS 305 V2.0. Node address, baud rate and termination can be programmed via the bus.
- **Hollow shaft version may be fixed individually:** Torque stop and flex coupling available.
- **May be used in outdoor applications with large fluctuations in temperature:** Resistant against humidity and condensation.

#### Mechanical Characteristics:

|   |   |
|---|---|
| Max. speed:   | 6,000 RPM   |
| Starting torque:                                    | < 8.5 oz-in (< 0.06 Nm)   |
| Radial load capacity of shaft:                      | 9.0 lbs (40 N)  |
| Axial load capacity of shaft:                       | 4.5 lbs (20 N)  |
| Weight:   | approx. 0.44 lbs (0.2 kg)   |
| Protection acc. to EN 60 529 / DIN 40050-9:         | IP67 / IP69K  |
| Working temperature range:                          | -40 to +185 °F (-40 to +85 °C)  |
| Materials:  | Shaft: stainless steel, Flange: aluminium, Housing: die cast zinc, Cable: PUR |
| Shock resistance acc. to DIN-IEC 68-2-27:           | 500 g (5,000 m/s <sup>2</sup> ), 6 ms   |
| Vibration resistance acc. to DIN-IEC 68-2-6:        | 30 g (300 m/s <sup>2</sup> ), 10-2,000 Hz                                     |
| Permanent shock resistance acc. to DIN-IEC 68-2-29: | 100 g (1,000 m/s <sup>2</sup> ), 2 ms   |
| Vibration (broad-band random) to DIN-IEC 68-2-64:   | 5-2500 Hz, 10 g (100 m/s <sup>2</sup> ) - rms                                 |

#### All around protection:



#### Bearing-Lock:

IP69K protection on the flange side, robust bearing assemblies with interlocking bearings, mechanically protected shaft seal.

#### Protected Sensor:

Fully encapsulated electronics, separate mechanical bearing assembly.

# Rotary Position Technology

## Absolute Encoders, Singleturn

### Absolute, Singleturn Encoder Type RS-52 (Shaft) / RS-53 (Blind Hollow Shaft)

### CANopen

#### General Electrical Characteristics:

##### Sensor:

|   |            |
|---|------------|
| Supply voltage:                                   | 8-30 VDC   |
| Current consumption (without output load):        | Max. 25 mA |
| Reverse polarity protection at power supply (+V): | Yes        |
| Measuring range:                                  | 360°       |
| Linearity:  | < 1        |
| Repeat accuracy 77 °F (25 °C):                    | < 0.1      |
| Data refresh rate                                 | 400 µs     |
| RoHS compliant acc. to EU guideline 2011/65/EU    |            |

#### Interface Characteristics CANopen:

|                         |  |
|-------------------------|--|
| Resolution:             | 1-16384 (14 bit), (scalable: 1-16384)  |
| Default value:          | 16384 (14 bit)   |
| Code:                   | Binary   |
| Interface:              | CAN High-Speed according to ISO 11898, Basic and Full CANCAN Specification 2.0 B   |
| Protocol:               | CANopen profile DS 406 V3.2 with manufacturer-specific add-ons<br>LSS-Services DS305 V2.0  |
| Baud rate:              | 10-1000 kbit/s (software configurable)   |
| Node address:           | 1-127 (software configurable)  |
| Termination switchable: | Software configurable  |
| LSS Services:           | CIA LSS protocol DS305<br>Global command support for node address and baud rate.<br>Selective commands via attributes of the identity object |

#### Diagnostic LED (two-color, red/green):

|                           |                |
|---------------------------|----------------|
| LED ON or blinking red:   | Error display  |
| LED ON or blinking green: | Status display |

#### General Information about CANopen

The RS-52 and RS-53 series of encoders support the latest CANopen communication profile according to DS 301 V4.02. In addition, device-specific profiles like the encoder profile DS406 V3.2 are available.

The following operating modes may be selected: Polled Mode, Cyclic Mode, Sync Mode. Moreover, scale factors, preset values, limit switch values and many other additional parameters can be programmed via the CANopen fieldbus. When switching the device on, all parameters, which have been saved on a flash memory to protect them against power failure, are loaded again.

Position and status output values may be combined in a freely variable way as mapping.

The encoders are available with a connector or a cable connection. The device address and baud rate can be set or modified by means of the software. The two-color LED indicates the operating or fault status of the CANopen fieldbus, as well as the status of the internal diagnostics.



#### Standard Wiring:

| Connection Type: | +V | Common (0V) | CAN GND | CAN High | CAN Low |
|------------------|----|-------------|---------|----------|---------|
| Cable:           | BN | WH          | GY      | GN       | YE      |
| M12 Eurofast:    | 2  | 3           | 1       | 4        | 5       |

#### CANopen Communication Profile DS301 V4.02

The following Class C2 functionality is integrated:

- NMT Slave
- Heartbeat Protocol
- Identity Object
- Error Behavior Object
- Variable PDO Mapping self-start programmable (power on to operational), 3 Sending PDO's
- Node address, baud rate and CANopen
- Programmable termination

#### CANopen Encoder Profile DS406 V3.2

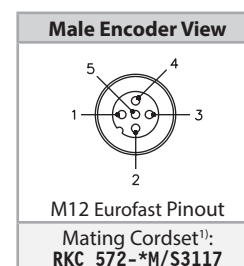
The following parameters may be programmed:

- Event mode
- One work area with upper and lower limit and the corresponding output states
- Variable PDO mapping for position, speed and work area status
- Extended failure management for position sensing with integrated temperature control
- User interface with visual display of bus and failure status – one LED, two colors
- Customer-specific memory – 16 Bytes
- Watchdog controlled device

#### LSS Layer Setting Services DS305 V2.0

- Global support of Node-ID and baud rate
- Selective protocol via identity object (1018h)

#### Wiring Diagram:



\* Length in meters.  
<sup>1)</sup> See Connectivity section H for corresponding cable color code.



**Absolute, Singleturn Encoder Type RS-52 (Shaft) / RS-53 (Blind Hollow Shaft) CANopen**

**Part Number Key: RS-52 Shaft Version**

| A      | B | C |   | D     |   | E     |
|--------|---|---|---|-------|---|-------|
| RS-52S | 6 | S | - | 9D14B | - | H1151 |

| A      | Type                             |
|--------|----------------------------------|
| RS-52S | Ø 36 mm, Shaft, IP69K Shaft Seal |
| RS-52T | Ø 36 mm, Shaft, IP67 Shaft Seal  |

| B  | Shaft (Ø x L)    |
|----|------------------|
| 6  | Ø 6 mm x 12.5 mm |
| 8  | Ø 8 mm x 12.5 mm |
| A0 | Ø 1/4" x 12.5 mm |

| C | Flange       |
|---|--------------|
| S | Servo Flange |

| D     | Voltage Supply and Output Type |
|-------|--------------------------------|
| 9D14B | 8-30 VDC, CANopen DS301 V4.02  |

| E     | Type of Connection                  |
|-------|-------------------------------------|
| H1151 | Radial 5-pin M12 Eurofast Connector |
| C1M   | Radial Cable (1 m PUR)              |

**Part Number Key: RS-53 Blind Hollow Shaft Version**

| A      | B | C |   | D     |   | E     |
|--------|---|---|---|-------|---|-------|
| RS-53B | 6 | E | - | 9D14B | - | H1151 |

| A      | Type  |
|--------|---|
| RS-53B | Ø 36 mm, Blind Hollow Shaft, IP69K Shaft Seal |
| RS-53C | Ø 36 mm, Blind Hollow Shaft, IP67 Shaft Seal  |

| B  | Bore (18mm Insertion Depth) |
|----|-----------------------------|
| 6  | Ø 6 mm                      |
| 8  | Ø 8 mm                      |
| 10 | Ø 10 mm                     |
| A0 | Ø 1/4"                      |

| C | Flange                       |
|---|------------------------------|
| E | Flange w/ Slotted Flex Mount |
| T | Flange w/ Long Torque Stop   |

| D     | Voltage Supply and Output Type |
|-------|--------------------------------|
| 9D14B | 8-30 VDC, CANopen DS301 V4.02  |

| E     | Type of Connection                  |
|-------|-------------------------------------|
| H1151 | Radial 5-pin M12 Eurofast Connector |
| C1M   | Radial Cable (1 m PUR)              |

**Accessories:**

- See page H1, Connectivity, for cables and connectors
- See page G1, Accessories, for mounting attachments and couplings

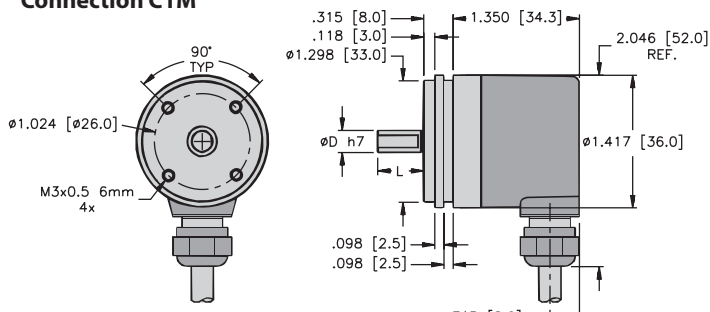
# Rotary Position Technology

## Absolute Encoders, Singleturn

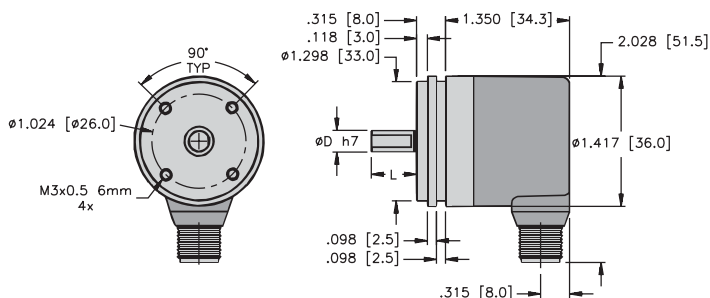
### Absolute, Singleturn Encoder Type RS-52 (Shaft) / RS-53 (Blind Hollow Shaft) CANopen

#### Dimensions: RS-52 Shaft Version

##### RS-52 Flange S Connection C1M



##### RS-52 Flange S Connection H1151

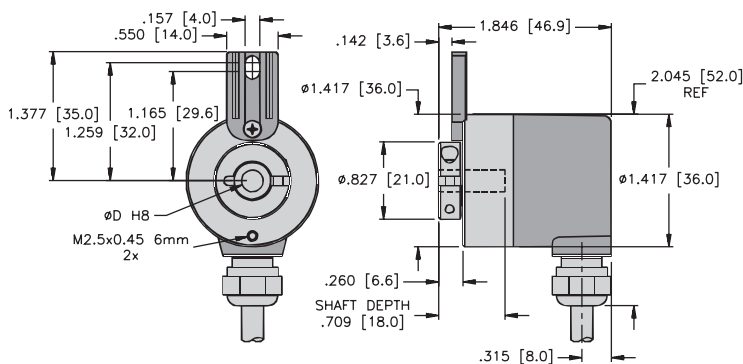


#### Mounting Advice:

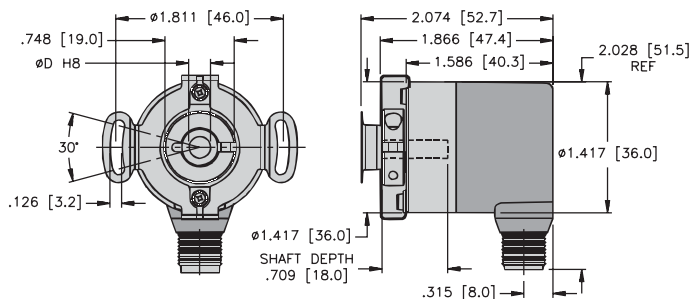
The flanges and shafts of the encoder and drive should not be rigidly coupled together at the same time. We recommend the use of suitable couplings (see page G1, Accessories).

#### Dimensions: RS-53 Blind Hollow Shaft Version

##### RS-53 Flange T Connection C1M

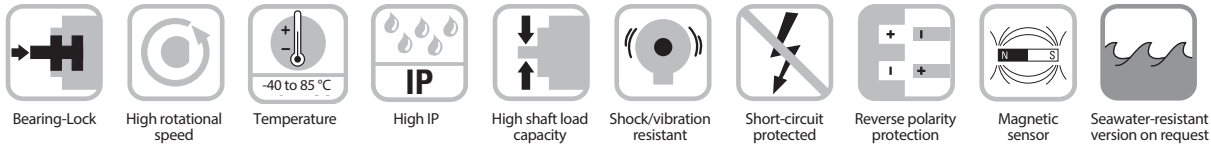


##### RS-53 Flange E Connection H1151



### Absolute, Singleturn Encoder Type RS-52 (Shaft) / RS-53 (Blind Hollow Shaft)

SAE J1939



#### Rugged

- Non-contact measuring system: **Ensures long service life and the reliability of the application.**
- **Stays sealed even when subjected to harsh everyday use:** Solid die-cast housing with up to IP69K protection **offers security against failures in the field.**
- Wide temperature range of -40 to +185 °F (-40 to +85 °C).
- **Increased ability to withstand vibration and installation errors:** High shock (> 500 g) and vibration resistance (> 30 g) **eliminates machine downtime and repairs.**



#### Absolute



SAE J1939

#### Compact

- **Can be used where space is tight:** Overall diameter of only 36 mm.
- **Shaft version can be mounted on a tight radius:** Fixing holes on Ø 26 mm.
- **Hollow shaft version is ideal for large shafts:** Blind hollow shaft up to 10 mm.

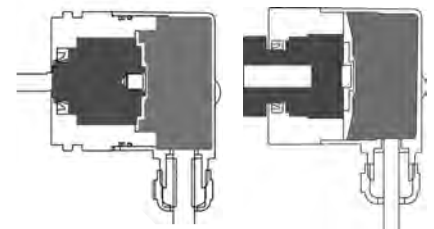
#### Versatile

- **Latest fieldbus performance:** SAE J1939 with CAN Highspeed according to ISO 11898.
- **Connections for every application:** M12 connector or cable connection.
- **Simple, fast recognition of the operating status:** Bicolored LED signalizes Bus-Status or potential errors.
- **Fast, error-free start-up, no need to set switches:** Automatic address allocation via Address Claiming (ACL).
- **May be used in outdoor applications with large fluctuations in temperature:** Resistant against humidity and condensation.

#### Mechanical Characteristics:

|   |   |
|---|---|
| Max. speed:   | 6,000 RPM   |
| Starting torque:                                    | < 8.5 oz-in (< 0.06 Nm)   |
| Radial load capacity of shaft:                      | 9.0 lbs (40 N)  |
| Axial load capacity of shaft:                       | 4.5 lbs (20 N)  |
| Weight:   | approx. 0.44 lbs (0.2 kg)   |
| Protection acc. to EN 60 529 / DIN 40050-9:         | IP67 / IP69K  |
| Working temperature range:                          | -40 to +185 °F (-40 to +85 °C)  |
| Materials:  | Shaft: stainless steel, Flange: aluminium, Housing: die cast zinc, Cable: PUR |
| Shock resistance acc. to DIN-IEC 68-2-27:           | 500 g (5,000 m/s <sup>2</sup> ), 6 ms   |
| Vibration resistance acc. to DIN-IEC 68-2-6:        | 30 g (300 m/s <sup>2</sup> ), 10-2,000 Hz                                     |
| Permanent shock resistance acc. to DIN-IEC 68-2-29: | 100 g (1,000 m/s <sup>2</sup> ), 2 ms   |
| Vibration (broad-band random) to DIN-IEC 68-2-64:   | 5-2500 Hz, 10 g (100 m/s <sup>2</sup> ) - rms                                 |

#### All-round protection:



#### Bearing-Lock:

IP69K protection on the flange side, robust bearing assemblies with interlocking bearings, mechanically protected shaft seal.

#### Protected Sensor:

Fully encapsulated electronics, separate mechanical bearing assembly.

# Rotary Position Technology

## Absolute Encoders, Singleturn

### Absolute, Singleturn Encoder Type RS-52 (Shaft) / RS-53 (Blind Hollow Shaft)

SAE J1939

#### General Electrical Characteristics:

|   |            |
|---|------------|
| Supply voltage:                                   | 8-30 VDC   |
| Current consumption (without output load):        | Max. 25 mA |
| Reverse polarity protection at power supply (+V): | Yes        |
| Measuring range:                                  | 360°       |
| Linearity:  | < 1°       |
| Repeat accuracy 77 °F (25 °C):                    | < 0.1°     |
| Data refresh:                                     | 400 µs     |
| RoHS compliant acc. to EU guideline 2002/95/EG    |            |

#### Interface Characteristics CANopen:

|                |  |
|----------------|--|
| Resolution:    | 1-16384 (14 bit), (scalable: 1-16384)  |
| Default value: | 16384 (14 bit)   |
| Code:          | Binary   |
| Interface:     | CAN High-Speed according to ISO 11898, Basic and Full CANCAN Specification 2.0 B |
| Protocol:      | J1939  |
| Baud rate:     | 250 kbit/s (software configurable)   |
| Node address:  | 1-255 (via address claiming)   |
| Termination:   | Software configurable  |

#### Diagnostic LED (two-color, red/green):

|                           |                |
|---------------------------|----------------|
| LED ON or blinking red:   | Error display  |
| LED ON or blinking green: | Status display |

#### General Information Concerning SAE J1939

The protocol J1939 originates from the international Society of Automotive Engineers (SAE) and operates on the physical layer with high speed CAN as per ISO11898. The application emphasis lies in the area of the power train and chassis of commercial vehicles. It serves to transfer diagnostic data (for example, motor speed, position, temperature) and control information. Series RS-52 and RS-53 encoders support the total functionality of J1939.

This protocol is a multimaster system with decentralized network management that does not involve channel-based communication. It supports up to 254 logic nodes and 30 physical control devices per segment. The information is described as Parameters (signals) and combined on four memory pages (Data Pages) into Parameter Groups (PGs). Each Parameter Group can be identified via a unique number, the Parameter Group Number (PGN). Independently of this, each signal is assigned a unique SPN (Suspect Parameter Number).

The major part of the communication occurs cyclically and can be received by all control devices without the explicit request for data (Broadcast). Furthermore, the parameter groups are optimized to a length of eight data bytes. This enables very efficient utilization of the CAN protocol.

If greater amounts of data need to be transferred, then transport protocols (TP) can be used: BAM (Broadcast Announce Message) and CMTD (Connection Mode Data Transfer). With BAM TP the transfer of data occurs as a broadcast.



#### Encoder Implementation SAE J1939

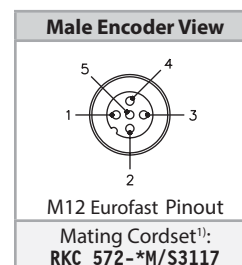
- PGNs that are adaptable to the customer's application
- Resolution of address conflicts -> Address Claiming (ACL)
- Continuous checking whether control addresses have been assigned twice within a network
- Change of control device addresses during run-time
- Unique identification of a control device with the help of a name that is unique worldwide. This name serves to identify the functionality of a control device in the network
- Predefined PGs for Position, Speed and Alarm
- 250 kbit/s, 29-bit Identifier
- Watchdog controlled device

A two-color LED, located on the rear of the encoder, signals the operating and fault status of the J1939 protocol, as well as the status of the internal sensor diagnostics.

#### Standard Wiring:

| Connection Type: | +V | 0 V | CAN GND | CAN High | CAN Low |
|------------------|----|-----|---------|----------|---------|
| M12 Eurofast:    | 2  | 3   | 1       | 4        | 5       |
| Cable:           | BN | WH  | GY      | GN       | YE      |

#### Wiring Diagram:



\* Length in meters.

<sup>1)</sup> See Connectivity section H for corresponding cable color code.

**Absolute, Singleturn Encoder Type RS-52 (Shaft) / RS-53 (Blind Hollow Shaft)**

**SAE J1939**

**Part Number Key: RS-52 Shaft Version**

| A      | B | C |   | D     |   | E     |
|--------|---|---|---|-------|---|-------|
| RS-52S | 6 | S | - | 9F14B | - | H1151 |

| A      | Type                             |
|--------|----------------------------------|
| RS-52S | Ø 36 mm, Shaft, IP69K Shaft Seal |
| RS-52T | Ø 36 mm, Shaft, IP67 Shaft Seal  |

| B  | Shaft (Ø x L)    |
|----|------------------|
| 6  | Ø 6 mm x 12.5 mm |
| 8  | Ø 8 mm x 12.5 mm |
| A0 | Ø 1/4" x 12.5 mm |

| C | Flange       |
|---|--------------|
| S | Servo Flange |

| D     | Voltage Supply and Output Type |
|-------|--------------------------------|
| 9F14B | 8-30 VDC, CAN Highspeed        |

| E     | Type of Connection                  |
|-------|-------------------------------------|
| H1151 | Radial 5-pin M12 Eurofast Connector |
| C1M   | Radial Cable (1 m PUR)              |

**Part Number Key: RS-53 Blind Hollow Shaft Version**

| A      | B | C |   | D     |   | E     |
|--------|---|---|---|-------|---|-------|
| RS-53B | 6 | E | - | 9F14B | - | H1151 |

| A      | Type  |
|--------|---|
| RS-53B | Ø 36 mm, Blind Hollow Shaft, IP69K Shaft Seal |
| RS-53C | Ø 36 mm, Blind Hollow Shaft, IP67 Shaft Seal  |

| B  | Bore (18mm Insertion Depth) |
|----|-----------------------------|
| 6  | Ø 6 mm                      |
| 8  | Ø 8 mm                      |
| 10 | Ø 10 mm                     |
| A0 | Ø 1/4"                      |

| C | Flange                       |
|---|------------------------------|
| E | Flange w/ Slotted Flex Mount |
| T | Flange w/ Long Torque Stop   |

| D     | Voltage Supply and Output Type |
|-------|--------------------------------|
| 9F14B | 8-30 VDC, CAN Highspeed        |

| E     | Type of Connection                  |
|-------|-------------------------------------|
| H1151 | Radial 5-pin M12 Eurofast Connector |
| C1M   | Radial Cable (1 m PUR)              |

**Accessories:**

- See page H1, Connectivity, for cables and connectors
- See page G1, Accessories, for mounting attachments and couplings

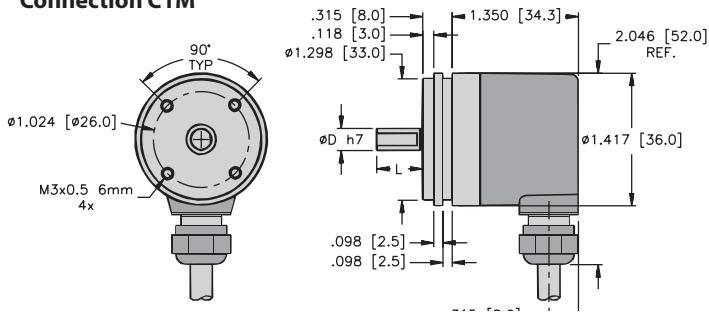
# Rotary Position Technology

## Absolute Encoders, Singleturn

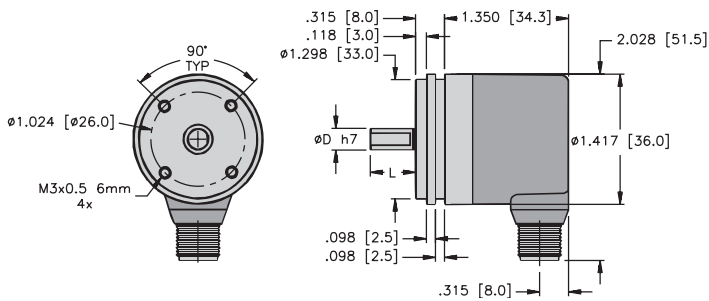
### Absolute, Singleturn Encoder Type RS-52 (Shaft) / RS-53 (Blind Hollow Shaft) SAE J1939

#### Dimensions: RS-52 Shaft Version

##### RS-52 Flange S Connection C1M



##### RS-52 Flange S Connection H1151

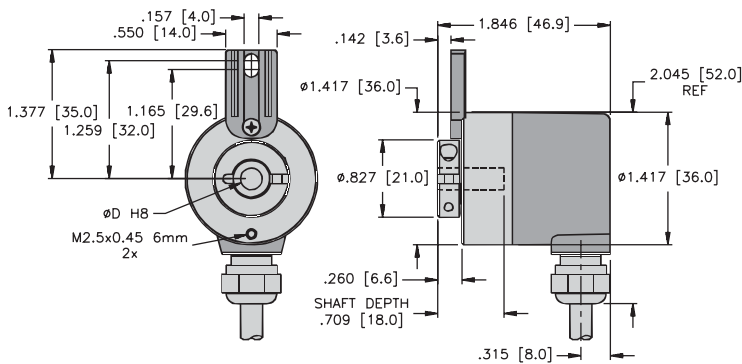


#### Mounting Advice:

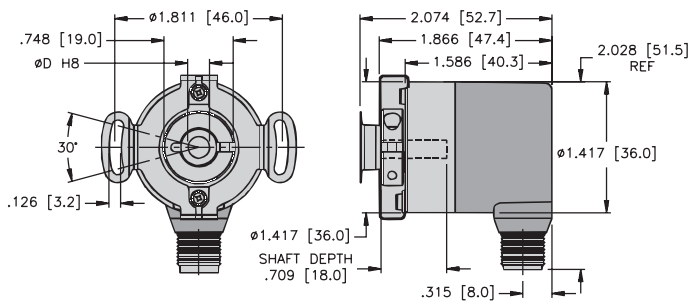
The flanges and shafts of the encoder and drive should not be rigidly coupled together at the same time. We recommend the use of suitable couplings (see page G1, Accessories).

#### Dimensions: RS-53 Blind Hollow Shaft Version

##### RS-53 Flange T Connection C1M

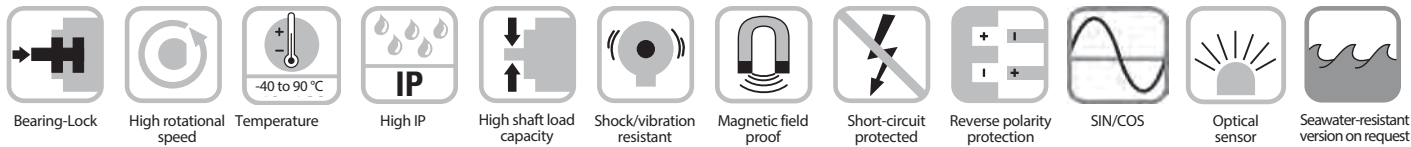


##### RS-53 Flange E Connection H1151



### Absolute, Singleturn Type RS-44 (Shaft) / RS-48 (Blind / Hollow Shaft)

SSI/BiSS-C



#### Reliable

- **Increased ability to withstand vibration and installation errors.** Sturdy Bearing-Lock Design bearing structure **eliminates machine downtime and repairs.**
- **Fewer components and connection points increase the operational reliability:** Turck OptoASIC technology with highest integration density (Chip-on-Board).
- Die cast housing and protection up to IP67: **Remains sealed even when subjected to harsh everyday use.**
- Wide temperature range of -40 to +194 °F (-40 to +90 °C).
- **Easy diagnosis in case of fault condition.** Status indication by means of LED, sensor, voltage and temperature monitoring.



#### Absolute



#### Fast

- **High accuracy:** Update rate of the whole position value above 100 kHz for a max. jitter of 1 µs (real-time).
- **High productivity due to very short regulation cycles:** Clock rate with SSI up to 2 MHz, with BiSS-C up to 10 MHz.
- **High-resolution feedback system achievable in real-time:** SinCos incremental outputs.

#### Versatile

- **Connections for every application:** Tangential cable or M12 connector.
- **Open interfaces ensure flexibility and independence:** SSI or BiSS-C with Sine-Cosine-Option incremental track RS422.
- Multiple mounting brackets for easy installation.
- **Compact design.**
- **Fast and easy start-up on site:** Preset and reversal of rotation direction by control inputs.
- **Direct mounting on standard diameter shafts up to 10 mm** through hollow shaft up to 8 mm.

#### Mechanical Characteristics:

|  |   |
|--|---|
| Max. speed:                                      |   |
| IP65 shaft or blind hollow shaft version:        | 12,000 RPM, continuous operation 10,000 RPM   |
| IP67 shaft version or IP65 hollow shaft version: | 10,000 RPM, continuous operation 8,000 RPM  |
| Starting torque without shaft sealing:           | < 1 oz-in (< 0.007 Nm)  |
| Starting torque with shaft sealing:              | < 1.4 oz-in (< 0.01 Nm)   |
| Radial load capacity of shaft:                   | 9 lbs (40 N)  |
| Axial load capacity of shaft:                    | 4.5 lbs (20 N)  |
| Weight:  | approx. 0.44 lbs (0.2 kg)   |
| Protection acc. to EN 60 529:                    | Housing: IP67, Shaft: IP65, opt. IP67   |
| Working temperature:                             | -40 to +194 °F (-40 to +90 °C)  |
| Materials:                                       | Shaft/Hollow shaft: stainless steel, Flange: aluminum, Housing: die cast zinc, Cable: PUR |
| Shock resistance acc. to DIN-IEC 68-2-27:        | > 250 g (> 2,500 m/s <sup>2</sup> ), 6 ms   |
| Vibration resistance acc. to DIN-IEC 68-2-6:     | > 10 g (>100 m/s <sup>2</sup> ), 55-2,000 Hz  |

# Rotary Position Technology

## Absolute Encoders, Singleturn

### Absolute, Singleturn Type RS-44 (Shaft) / RS-48 (Blind / Hollow Shaft)

### SSI/BiSS-C

#### General Electrical Characteristics:

|   |   |
|---|---|
| Supply voltage:                                     | 5 VDC $\pm$ 5% or 10-30 VDC                 |
| Current consumption (without output load):          | 5 VDC: max. 60 mA,<br>10-30 VDC: max. 30 mA |
| Reverse polarity protection at power supply (+V):   | yes   |
| RoHS compliant according to EU guideline 2011/65/EU |   |

#### General Interface Characteristics:

|   |                        |
|---|------------------------|
| Output driver:                          | RS485 transceiver type |
| Permissible load/channel:               | max. $\pm$ 30 mA       |
| Signal level high:                      | typ. 3.8 V             |
| Signal level low at $I_{load} = 20$ mA: | typ. 1.3 V             |
| Short-circuit protected outputs:        | yes <sup>1)</sup>      |

#### Interface Characteristics SSI:

|   |   |
|---|---|
| Singleturn resolution:                        | 10-17 bit   |
| Code:   | Binary or Gray  |
| SSI clock rate:                               | $\leq$ 14 bit: 50 kHz-2 MHz<br>$\geq$ 15 bit: 50 kHz-125 kHz  |
| Monoflop time:                                | $\leq$ 15 $\mu$ s   |
| Note:   | If clock starts cycling within monoflop time, a second data transfer starts with the same data. If clock starts cycling after monoflop time, the data transfer starts with updated values. Max. update rate is dependent on clock speed, data length and monoflop time. |
| Time jitter (data request to position latch): | $\leq$ 1 $\mu$ s up to 14 bits,<br>4 $\mu$ s up to 15-17 bits   |
| Status and Parity bit:                        | optional on request   |

#### Interface Characteristics BiSS-C:

|   |  |
|---|--|
| Singleturn resolution:                        | 10-17 bit  |
| Code:   | Binary   |
| Clock rate:                                   | up to 10 MHz   |
| Max. update rate:                             | $<$ 10 $\mu$ s, depending on clock speed and data length   |
| Time jitter (data request to position latch): | $\leq$ 1 $\mu$ s   |
| Note:   | • Bidirectional, programmable parameters are:<br>resolution, code, direction, alarms and warnings<br>• CRC data verification |

#### Incremental Output (A/B) 2048 ppr:

|                      |                    |                                     |
|----------------------|--------------------|-------------------------------------|
|                      | Sin/Cos            | RS 422 (TTL compatible)             |
| Max. -3dB frequency: | 400 kHz            | 400kHz                              |
| Signal level:        | 1 Vpp ( $\pm$ 20%) | high: min. 2.5 V<br>low: max. 0.5 V |
| Short-circuit proof: | yes <sup>1)</sup>  | yes <sup>1)</sup>                   |

<sup>1)</sup> Short-circuit to 0V or to output, one channel at a time, supply voltage correctly applied

#### SET Input:

|                                   |  |
|-----------------------------------|--|
| Input characteristics:            | active HIGH                              |
| Input type:                       | comparator                               |
| Signal level high:                | min. 60% of V+ (supply voltage), max: V+ |
| Signal level low:                 | max. 30% of V+ (supply voltage)          |
| Input current:                    | $<$ 0.5 mA                               |
| Min. pulse duration (SET):        | 10 ms                                    |
| Input delay:                      | 1 ms                                     |
| New position data readable after: | 1 ms                                     |
| Internal processing time:         | 200 ms                                   |

The encoder can be set to zero at any position by means of a HIGH signal on the SET input. Other preset values can be factory programmed. The SET input has a signal delay time of approximately 1 ms. Once the SET function has been triggered, the encoder requires an internal processing time of approximately 200 ms before the new position data can be read. During this time the supply voltage must not be switched off. The set function should only be carried out when the encoder is at rest.

#### DIR Input:

A HIGH signal switches the direction of rotation from the default CW to CCW. This inverted function can also be factory programmed. If DIR is changed when the device is already switched on, then this will be interpreted as an error. The LED will come ON and the status output will switch to LOW.

#### Status Output:

|                    |   |
|--------------------|---|
| Output driver:     | Open collector, internal pull up resistor 22 kOhm |
| Permissible load:  | max 20 mA   |
| Signal level high: | +V  |
| Signal level low:  | $<$ 1 V   |
| Active at:         | Low   |

The status output serves to display various alarm or error messages. In normal operation the status output is HIGH (open-collector with int. pull-up 22k).

An active status output (LOW) indicates:

- LED error (failure or aging)
- Over temperature
- Undervoltage

In the SSI mode, the fault indication can only be reset by switching off the power supply to the device.

#### Power-On Delay:

After Power-ON the device requires a time of approx. 150 ms before valid data can be read. Hot swapping of the encoder should be avoided.



### Absolute, Singleturn Type RS-44 (Shaft) / RS-48 (Blind / Hollow Shaft)

SSI/BiSS-C

#### Standard Wiring:

##### Output \*C & \*F (SSI or BiSS-C, SET, DIR, Status) (Connection CT\*M)

| Connection Type: | Common (0V) | +V | +Clock | -Clock | +Data | -Data | SET | DIR | Status | PE     |
|------------------|-------------|----|--------|--------|-------|-------|-----|-----|--------|--------|
| Cable:           | WH          | BN | GN     | YE     | GY    | PK    | BU  | RD  | VT     | Shield |

##### Output \*C & \*F (SSI or BiSS-C, SET, DIR) (Connection H1481)

| Connection Type: | GND | +V | +Clock | -Clock | +Data | -Data | SET | DIR | Shield/PE |
|------------------|-----|----|--------|--------|-------|-------|-----|-----|-----------|
| M12 Eurofast     | 1   | 2  | 3      | 4      | 5     | 6     | 7   | 8   | PH        |

##### Output \*E & \*G (SSI or BiSS-C, SET, DIR, 2048 Sin/Cos) (Connection CT\*M)

| Connection Type: | GND | +V | +Clock | -Clock | +Data | -Data | SET | DIR | A  | A inv | B     | B inv | PE     |
|------------------|-----|----|--------|--------|-------|-------|-----|-----|----|-------|-------|-------|--------|
| Cable:           | WH  | BN | GN     | YE     | GY    | PK    | BU  | RD  | BK | VT    | GY/PK | RD/BU | Shield |

##### Output \*H (SSI or BiSS-C, SET, DIR, Voltage Sense Outputs) (Connection CT\*M)

| Connection Type: | GND | +V | +Clock | -Clock | +Data | -Data | SET | DIR | 0 V sens | +V sens | PE     |
|------------------|-----|----|--------|--------|-------|-------|-----|-----|----------|---------|--------|
| Cable:           | WH  | BN | GN     | YE     | GY    | PK    | BU  | RD  | VT       | RD/BU   | Shield |

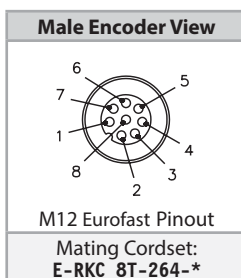
##### Output \*J (SSI or BiSS-C, SET, DIR, 2048 Sin/Cos, Voltage Sense Outputs) (Connection CT\*M)

| Connection Type: | GND | +V | +Clock | -Clock | +Data | -Data | 0 V sens | +V sens | A  | A inv | B     | B inv | PE     |
|------------------|-----|----|--------|--------|-------|-------|----------|---------|----|-------|-------|-------|--------|
| Cable:           | WH  | BN | GN     | YE     | GY    | PK    | BU       | RD      | BK | VT    | GY/PK | RD/BU | Shield |

##### Output \*K & \*L (SSI or BiSS-C, SET, DIR, 2048 inc. RS422) (Connection CT\*M)

| Connection Type: | GND | +V | +Clock | -Clock | +Data | -Data | A  | A inv | B     | B inv | PE     |
|------------------|-----|----|--------|--------|-------|-------|----|-------|-------|-------|--------|
| Cable:           | WH  | BN | GN     | YE     | GY    | PK    | BK | VT    | GY/PK | RD/BU | Shield |

#### Wiring Diagrams:



\* Length in meters.

# Rotary Position Technology

## Absolute Encoders, Singleturn

### Absolute, Singleturn Type RS-44 (Shaft) / RS-48 (Blind / Hollow Shaft)

SSI/BiSS-C

#### Part Number Key: RS-44 Shaft Version

| A      | B | C |   | D  | E   |   | F     |
|--------|---|---|---|----|-----|---|-------|
| RS-44S | 6 | C | - | 5F | 10B | - | H1481 |

| A      | Type                            |
|--------|---------------------------------|
| RS-44S | Ø 39 mm, Shaft, IP67 Shaft Seal |
| RS-44T | Ø 39 mm, Shaft, IP65 Shaft Seal |

| B  | Shaft (Ø x L)    |
|----|------------------|
| 6  | Ø 6 mm x 12.5 mm |
| 8  | Ø 8 mm x 15 mm   |
| 10 | Ø 10 mm x 20 mm  |
| A0 | Ø 1/4" x 12.5 mm |
| A1 | Ø 3/8" x 5/8"    |

| C | Flange                  |
|---|-------------------------|
| C | Ø 36 mm Clamping Flange |
| S | Ø 36 mm Servo Flange    |

| E   | Resolution |
|-----|------------|
| 10B | 10 bit ST  |
| 12B | 12 bit ST  |
| 13B | 13 bit ST  |
| 14B | 14 bit ST  |
| 17B | 17 bit ST  |

| F     | Type of Connection                  |
|-------|-------------------------------------|
| H1481 | Axial 8-pin M12 Eurofast Connector* |
| CT1M  | Tangential Cable (1 m PUR)          |
| CT5M  | Tangential Cable (5 m PUR)          |

\* Only Available with Output \*F' and \*C'

| D         | Voltage Supply and Output Type |         |        |  |
|-----------|--------------------------------|---------|--------|--|
|           | SSI (B)                        | SSI (G) | BiSS-C | Features   |
| 5 VDC     | 5F                             | 3F      | DF     | 2048 PPR SinCos<br>Voltage Monitoring<br>2048 PPR SinCos Plus Voltage Monitoring<br>2048 PPR Incr., RS422 (TTL Compatible) |
|           | 5E                             | 3E      | DE     |  |
|           | 5H                             | 3H      | DH     |  |
|           | 5J                             | 3J      | DJ     |  |
|           | 5K                             | 3K      | DK     |  |
| 10-30 VDC | 5C                             | 3C      | DC     | 2048 PPR SinCos<br>2048 PPR Incr., RS422   |
|           | 5G                             | 3G      | DG     |  |
|           | 5L                             | 3L      | DL     |  |

(B) = Binary, (G) = Gray

#### Accessories:

- See page H1, Connectivity, for cables and connectors
- See page G1, Accessories, for mounting attachments and couplings

### Absolute, Singleturn Type RS-44 (Shaft) / RS-48 (Blind / Hollow Shaft)

SSI/BiSS-C

**Part Number Key: RS-48 Blind / Hollow Shaft Version**

| A      | B | C |   | D  | E   |   | F     |
|--------|---|---|---|----|-----|---|-------|
| RS-48B | 6 | E | - | 5F | 10B | - | H1481 |

| A      | Type   |
|--------|--|
| RS-48B | Ø 39 mm, Blind Hollow Shaft, IP65 Shaft Seal |
| RS-48H | Ø 39 mm, Hollow Shaft, IP65 Shaft Seal       |

| B  | Bore                               |
|----|------------------------------------|
| 6  | Ø 6 mm                             |
| 8  | Ø 8 mm                             |
| 10 | Ø 10 mm* (14.5 mm Insertion Depth) |
| A0 | Ø 1/4"                             |

\* Only available with RS-48B

| C  | Flange                               |
|----|--------------------------------------|
| E  | Ø 36 mm Flange w/ Slotted Flex Mount |
| T  | Ø 36 mm Flange w/ Long Torque Stop   |
| T1 | Ø 36 mm Flange w/ Short Torque Stop  |

| E   | Resolution |
|-----|------------|
| 10B | 10 bit ST  |
| 12B | 12 bit ST  |
| 13B | 13 bit ST  |
| 14B | 14 bit ST  |
| 17B | 17 bit ST  |

| F     | Type of Connection                  |
|-------|-------------------------------------|
| H1481 | Axial 8-pin M12 Eurofast Connector* |
| CT1M  | Tangential Cable (1 m PUR)          |
| CT5M  | Tangential Cable (5 m PUR)          |

\* Only available with output "F" and "C"

| D         | Voltage Supply and Output Type |         |        |  |
|-----------|--------------------------------|---------|--------|--|
|           | SSI (B)                        | SSI (G) | BiSS-C | Features   |
| 5 VDC     | 5F                             | 3F      | DF     | 2048 PPR SinCos<br>Voltage Monitoring<br>2048 PPR SinCos Plus Voltage Monitoring<br>2048 PPR Incr., RS422 (TTL Compatible) |
|           | 5E                             | 3E      | DE     |  |
|           | 5H                             | 3H      | DH     |  |
|           | 5J                             | 3J      | DJ     |  |
|           | 5K                             | 3K      | DK     |  |
| 10-30 VDC | 5C                             | 3C      | DC     | 2048 PPR SinCos<br>2048 PPR Incr., RS422   |
|           | 5G                             | 3G      | DG     |  |
|           | 5L                             | 3L      | DL     |  |

(B) = Binary, (G) = Gray

**Accessories:**

- See page H1, Connectivity, for cables and connectors
- See page G1, Accessories, for mounting attachments and couplings

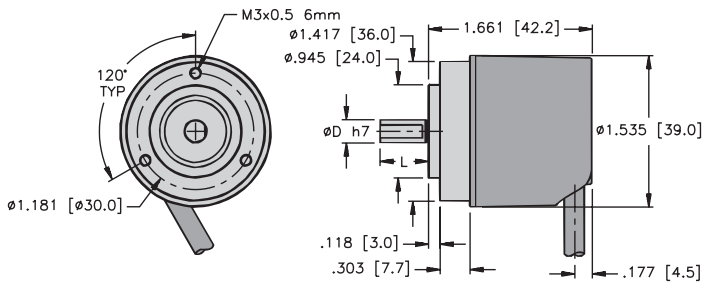
# Rotary Position Technology

## Absolute Encoders, Singleturn

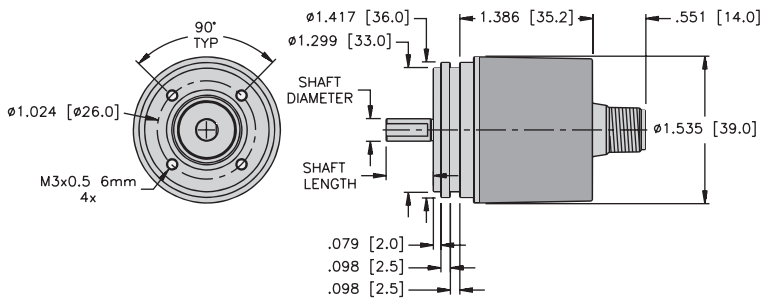
### Absolute, Singleturn Type RS-44 (Shaft) / RS-48 (Blind / Hollow Shaft) SSI/BiSS-C

#### Dimensions: RS-44 Shaft Version

##### RS-44 Flange C Connection CT\*M



##### RS-44 Flange S Connection H1481

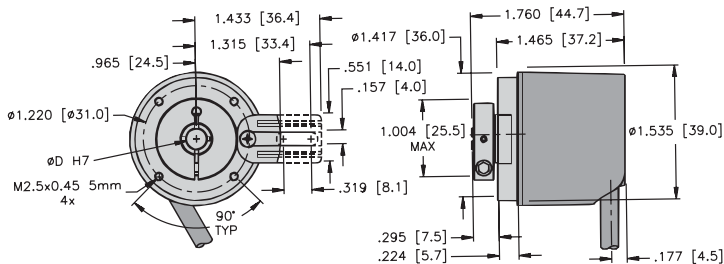


#### Mounting Advice:

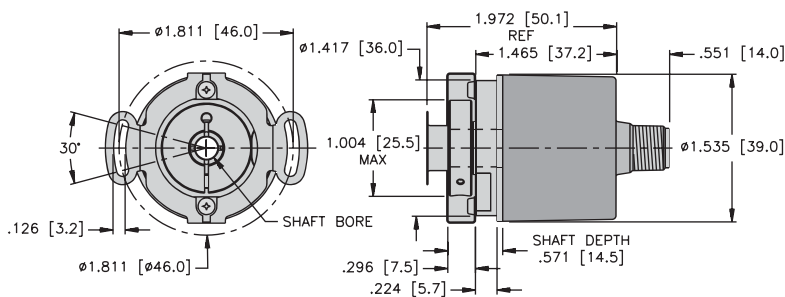
The flanges and shafts of the encoder and drive should not be rigidly coupled together at the same time. We recommend the use of suitable couplings (see page G1, Accessories).

#### Dimensions: RS-48 Hollow Shaft Version

##### RS-48 Flange T1 & T (dotted) Connection CT\*M



##### RS-48 Flange E (Blind Hollow Shaft) Connection H1481



### Absolute, Singleturn Type RS-45 (Shaft) / RS-49 (Blind Hollow Shaft)

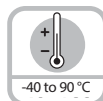
### CANopen



Bearing-Lock



High rotational speed



Temperature  
-40 to 90 °C



High IP



High shaft load capacity



Shock/vibration resistant



Magnetic field proof



Short-circuit protected



Reverse polarity protection

#### Rugged

- Sturdy bearing construction: Bearing-Lock design for resistance against vibration and installation errors.
- Ideal for use outdoors, thanks to IP67 protection.
- Wide temperature range: -40 to +185 °F (-40 to +85 °C).



#### Absolute



CANopen

#### Versatile

- CANopen with current encoder profile.
- LSS services for configuration of the node address and baud rate.
- Variable PDO mapping in the memory.
- High-precision optical sensor technology can achieve a resolution of up to 17 bits.

#### Compact

- Overall size of 36 x 42 mm:  
Hollow shaft of up to 8 mm,  
blind hollow shaft of up to 10 mm.

#### Mechanical Characteristics:

|  |   |
|--|---|
| Max. speed:<br>IP65 shaft or blind hollow shaft version: | 12,000 RPM, continuous operation 10,000 RPM   |
| IP67 shaft version or IP65 hollow shaft version:         | 10,000 RPM, continuous operation 8,000 RPM  |
| Starting torque without shaft sealing:                   | < 1 oz-in (< 0.007 Nm)  |
| Starting torque with shaft sealing:                      | < 1.4 oz-in (< 0.01 Nm)   |
| Radial load capacity of shaft:                           | 9.0 lbs (40 N)  |
| Axial load capacity of shaft:                            | 4.5 lbs (20 N)  |
| Weight:  | approx. 0.44 lbs (0.2 kg)   |
| Protection acc. to EN 60 529:                            | Housing: IP67<br>Shaft: IP65, opt. IP67   |
| Working temperature:                                     | -40 to +185 °F (-40 to +85 °C)  |
| Materials:   | Shaft/Hollow shaft: stainless steel,<br>Flange: aluminum,<br>Housing: die cast zinc, Cable: PUR |
| Shock resistance acc. to DIN-IEC 68-2-27:                | > 250g (> 2,500 m/s <sup>2</sup> ), 6 ms  |
| Vibration resistance acc. to DIN-IEC 68-2-6:             | > 10 g (>100 m/s <sup>2</sup> ), 55-2,000 Hz  |

#### Diagnostic LED (two-color, red/green):

|                    |   |
|--------------------|---|
| LED ON or blinking | red: error display<br>green: status display |
|--------------------|---|

#### General Electrical Characteristics:

|  |           |
|--|-----------|
| Supply voltage:                                | 10-30 VDC |
| Current consumption (no load):                 | 80 mA     |
| Reverse connection of the supply voltage (+V): | yes       |
| RoHS compliant acc. to EG-guideline 2002/95/EG |           |

#### Interface Characteristics CANopen:

|                           |   |
|---------------------------|---|
| Resolution Singleturn:    | 1-65536 (16 bit), scaleable: 1-65536  |
| Default value Singleturn: | 8192 (13 bit)   |
| Code:                     | Binary  |
| Interface:                | CAN High-Speed according to ISO 11898, Basic and Full-CAN, CAN Specification 2.0 B  |
| Protocol:                 | CANopen profile DS 406 V3.2 with manufacturer specific add-ons LSS-Service DS305 V2.0   |
| Baud rate:                | 10-1000 kbit/s (software configurable)  |
| Node address:             | 1-127 (software configurable)   |
| Termination switchable:   | Software configurable   |
| LSS Protocol              | CIA LSS protocol DS305<br>Global command support for node address and baud rate. Selective commands via attributes of the identity object |

#### General Information About CANopen

The CANopen encoder series support the latest CANopen communication profile according to DS 301 V4.02. In addition, device specific profiles, like the DS 406 V3.2, are available.

The following operating modes may be selected: Polled Mode, Cyclic Mode, Sync Mode. Moreover, scale factors, preset values, limit switch values and many other additional parameters can be programmed via the CANbus. When switching the device on, all parameters, which have been saved on a flash memory to protect them against power failure, are loaded again. Position, speed and status of the working area output values may be combined in a freely variable way as PDO mapping.

The encoders are available with a connector or a cable connection. The device address and baud rate may be set/modified by means of the software. A two-color LED indicates the operating or fault status of the CANbus, as well as the status of the internal diagnostics.

#### CANopen Communication Profile DS301 V4.02

The following functionality is integrated. Class C2 functionality:

- NMT Slave
- Heartbeat Protocol
- Identity Object
- Error Behavior Object
- Variable PDO Mapping self-start programmable (Power on to operational), 3 sending PDO's
- Node address, baud rate and CANbus/programmable termination

#### CANopen Encoder Profile DS406 V3.2

The following parameters may be programmed:

- Event mode
- One work area with upper and lower limit and the corresponding output states
- Variable PDO mapping for position, speed, work area status
- Extended failure management for position sensing
- User interface with visual display of bus and failure status: 1 LED, two-color
- Customer-specific memory - 16 bytes
- Customer-specific protocol
- "Watchdog controlled" device

#### LSS Layer Setting Services DS305 V2.0

- Global support of Node-ID and baud rate
- Selective protocol via identity object (1018h)

#### Standard Wiring:

| Connection Type: | +V | 0 V | CAN GND | CAN High | CAN Low |
|------------------|----|-----|---------|----------|---------|
| Cable:           | BN | WH  | GY      | GN       | YE      |

### Absolute, Singleturn Type RS-45 (Shaft) / RS-49 (Blind Hollow Shaft)

CANopen

#### Part Number Key: RS-45 Shaft Version

| A      | B | C |   | D     |   | E    |
|--------|---|---|---|-------|---|------|
| RS-45S | 6 | C | - | 9D16B | - | CT1M |

| A      | Type                            |
|--------|---------------------------------|
| RS-45S | Ø 39 mm, Shaft, IP67 Shaft Seal |
| RS-45T | Ø 39 mm, Shaft, IP65 Shaft Seal |

| D     | Voltage Supply and Output Type |
|-------|--------------------------------|
| 9D16B | 10-30 VDC, CANopen DS301 V4.02 |

| B  | Shaft (Ø x L)    |
|----|------------------|
| 6  | Ø 6 mm x 12.5 mm |
| 8  | Ø 8 mm x 15 mm   |
| 10 | Ø 10 mm x 20 mm  |
| A0 | Ø 1/4" x 12.5 mm |
| A1 | Ø 3/8" x 5/8"    |

| E    | Type of Connection         |
|------|----------------------------|
| CT1M | Tangential Cable (1 m PUR) |
| CT5M | Tangential Cable (5 m PUR) |

| C | Flange                  |
|---|-------------------------|
| C | Ø 36 mm Clamping Flange |
| S | Ø 36 mm Servo Flange    |

#### Part Number Key: RS-49 Blind Hollow Shaft Version

| A      | B | C |   | D     |   | E    |
|--------|---|---|---|-------|---|------|
| RS-49B | 6 | E | - | 9D16B | - | CT1M |

| A      | Type   |
|--------|--|
| RS-49B | Ø 39 mm, Blind Hollow Shaft, IP65 Shaft Seal |

| D     | Voltage Supply and Output Type |
|-------|--------------------------------|
| 9D16B | 10-30 VDC, CANopen DS301 V4.02 |

| B  | Bore (14.5 mm Insertion Depth) |
|----|--------------------------------|
| 6  | Ø 6 mm                         |
| 8  | Ø 8 mm                         |
| 10 | Ø 10 mm                        |
| A0 | Ø 1/4"                         |

| E    | Type of Connection         |
|------|----------------------------|
| CT1M | Tangential Cable (1 m PUR) |
| CT5M | Tangential Cable (5 m PUR) |

| C  | Flange                               |
|----|--------------------------------------|
| E  | Ø 36 mm Flange w/ Slotted Flex Mount |
| T  | Ø 36 mm Flange w/ Long Torque Stop   |
| T1 | Ø 36 mm Flange w/ Short Torque Stop  |

#### Accessories:

- See page H1, Connectivity, for cables and connectors
- See page G1, Accessories, for mounting attachments and couplings

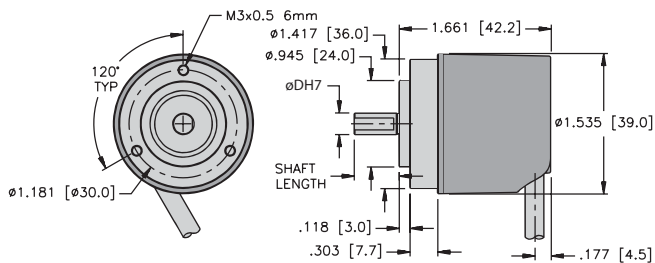
# Rotary Position Technology

## Absolute Encoders, Singleturn

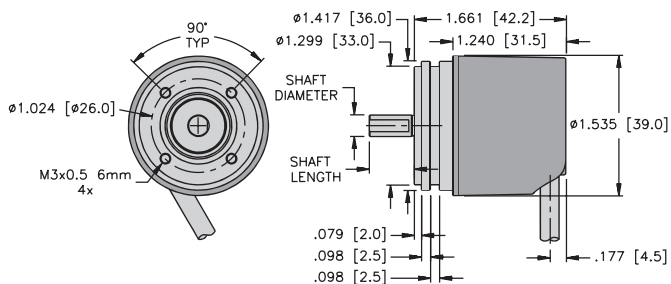
### Absolute, Singleturn Type RS-45 (Shaft) / RS-49 (Blind Hollow Shaft) CANopen

#### Dimensions: RS-45 Shaft Version

##### RS-45 Flanges C Connection CT\*M



##### RS-45 Flanges S Connection CT\*M

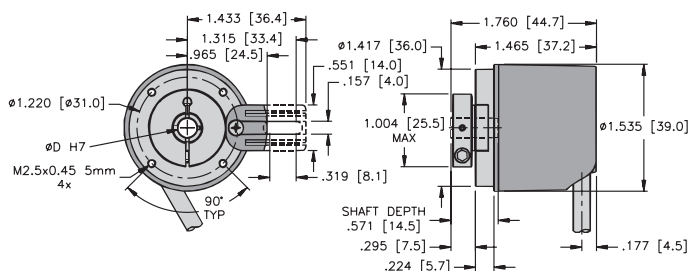


#### Mounting Advice:

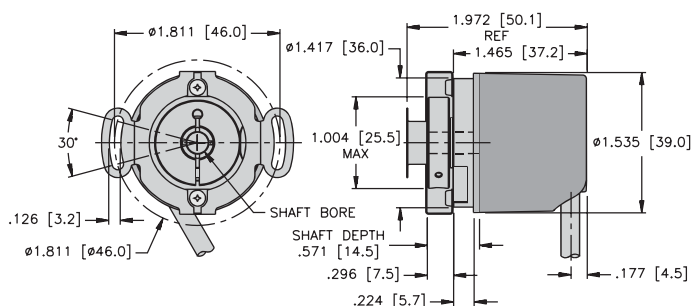
The flanges and shafts of the encoder and drive should not be rigidly coupled together at the same time. We recommend the use of suitable couplings (see page G1, Accessories).

#### Dimensions: RS-49 Blind Hollow Shaft Version

##### RS-49 Flange T1 and T (dotted) Connection CT\*M



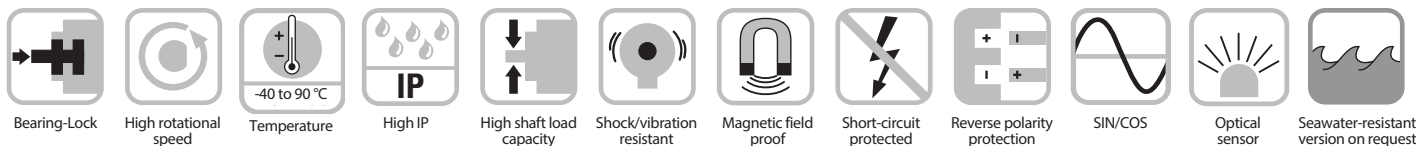
##### RS-49 Flanges E Connection CT\*M





### Absolute, Singleturn Type RS-24 (Shaft) / RS-31 (Hollow Shaft)

SSI/BiSS-C



#### Reliable

- **Increased ability to withstand vibration and installation errors.** Sturdy Bearing-Lock design structure eliminates machine downtime and repairs.
- **Fewer components and connection points increase the operational reliability.** Turck OptoASIC technology with highest integration density (Chip-on-Board).
- Die cast housing and protection up to IP67: **Remains sealed even when subjected to harsh everyday use.**
- Wide temperature range of -40 to +194 °F (-40 to +90 °C).
- **Easy diagnosis in case of fault condition.** Status indication by means of LED, sensor, voltage and temperature monitoring.



#### Absolute



#### Fast

- **High accuracy:** Update rate of the whole position value above 100 kHz for a max. jitter of 1 μs (real-time).
- **High productivity due to very short regulation cycles:** Clock rate with SSI up to 2 MHz, with BiSS-C up to 10 MHz.
- **High-resolution feedback system achievable in real-time:** SinCos incremental outputs.

#### Versatile

- **Connections for every application:** Cable, M12 connector or M12 connector.
- **Open interfaces ensure flexibility and independence:** SSI or BiSS-C with Sine-Cosine-Option.
- Multiple mounting brackets for easy installation.
- **Only the functionality really needed by the user is implemented:** Status LED and set key are optional.
- **Fast and easy start-up:** Set key or preset by means of a control input.
- **Direct mounting on large diameter shafts** through hollow shaft up to 15 mm.

#### Mechanical Characteristics:

##### Shaft Version:

Max. speed without shaft sealing (IP65) up to 158 °F (70 °C): 12,000 RPM, continuous 10,000 RPM  
 Max. speed without shaft sealing (IP65) up to Tmax: 8,000 RPM, continuous 5,000 RPM  
 Max. speed with shaft sealing (IP67) up to 158 °F (70 °C): 11,000 RPM, continuous, 9 000 RPM  
 Max. speed with shaft sealing (IP67) up to Tmax: 8,000 RPM, continuous 5,000 RPM

##### Hollow Shaft Version:

Max. speed without shaft sealing (IP65) up to 158 °F (70 °C): 9,000 RPM, continuous 6,000 RPM  
 Max. speed without shaft sealing (IP65) up to Tmax: 6,000 RPM, continuous 3,000 RPM  
 Max. speed with shaft sealing (IP67) up to 158 °F (70 °C): 8,000 RPM, continuous 4,000 RPM  
 Max. speed with shaft sealing (IP67) up to Tmax: 4,000 RPM, continuous 2,000 RPM

Starting torque without shaft sealing (IP65):

Shaft version: < 1.4 oz-in (< 0.01 Nm)  
 Hollow shaft version: < 4.25 oz-in (< 0.03 Nm)

Starting torque with shaft sealing (IP67):

< 7 oz-in (< 0.05 Nm)

Moment of inertia:

Shaft version: 0.16 oz-in<sup>2</sup> (3.0 x 10<sup>-6</sup> kgm<sup>2</sup>)  
 Hollow shaft version: 0.328 oz-in<sup>2</sup> (6.0 x 10<sup>-6</sup> kgm<sup>2</sup>)

Radial load capacity of shaft:

18 lbs (80 N)

Axial load capacity of shaft:

9 lbs (40 N)

Weight:

approx. 0.77 lbs (0.35 kg)

Protection acc. to EN 60 529:

Housing: IP67, Shaft: IP65, opt. IP67

Working temperature:

-40 to +194 °F (-40 to +90 °C) <sup>1)</sup>

Materials:

Shaft/hollow shaft: stainless steel, Flange: aluminum, Housing: die cast zinc, Cable: PVC

Shock resistance acc. to DIN-IEC 68-2-27:

> 250 g (> 2,500 m/s<sup>2</sup>), 6 ms

Vibration resistance acc. to DIN-IEC 68-2-6:

> 10 g (>100 m/s<sup>2</sup>), 55-2,000 Hz

<sup>1)</sup> Cable versions: -22 to +167 °F (-30 to +75 °C)



Encoder with tangential cable outlet

# Rotary Position Technology

## Absolute Encoders, Singleturn

### Absolute, Singleturn Type RS-24 (Shaft) / RS-31 (Hollow Shaft)

### SSI/BiSS-C

#### General Electrical Characteristics:

|   |  |
|---|--|
| Supply voltage:                                   | 5 VDC + 5% or 10-30 VDC                  |
| Current consumption (without output load):        | 5 VDC: max. 70 mA, 10-30 VDC: max. 45 mA |
| Reverse polarity protection at power supply (+V): | Yes (only 10-30 VDC)                     |
| RoHS compliant acc. to EU guideline 2011/65/EU    |  |

#### General Interface Characteristics:

|  |                        |
|--|------------------------|
| Output driver:                                   | RS485 Transceiver type |
| Permissible load/channel:                        | max. 20 mA             |
| Signal level high:                               | typ. 3.8 V             |
| Signal level low at $I_{load} = 20 \text{ mA}$ : | typ. 1.3 V             |
| Short-circuit protected:                         | Yes <sup>2)</sup>      |

#### Interface Characteristics SSI:

|                        |  |
|------------------------|--|
| Singleturn resolution: | 10-14 bits and 17 bits <sup>3)</sup>                                       |
| Code:                  | Binary or Gray   |
| SSI clock rate:        | $\leq 14 \text{ bit}$ 50 kHz-2 MHz<br>$\geq 15 \text{ bit}$ 50 kHz-125 kHz |
| Monoflop time:         | $\geq 15 \mu\text{s}$ <sup>3)</sup>  |

Note:  
If clock starts cycling within monoflop time, a second data transfer starts with the same data. If clock starts cycling after monoflop time, the data transfer starts with updated values. Maximum update rate is dependent on clock speed, data length and monoflop time.

|   |   |
|---|---|
| Time jitter (data request to position latch): | $< 1 \mu\text{s}$ up to 14 bits,<br>$4 \mu\text{s}$ at 15-17 bits |
| Status and Parity bit:                        | optional on request   |

#### Interface Characteristics BiSS-C:

|   |   |
|---|---|
| Singleturn resolution:                        | 10-14 bits and 17 bits customer programmable <sup>3)</sup>    |
| Code:   | Binary  |
| Interfaces:                                   | RS485   |
| Clock rate:                                   | up to 10 MHz  |
| Max. update rate:                             | $< 10 \mu\text{s}$ , depending on clock speed and data length |
| Time jitter (data request to position latch): | $\leq 1 \mu\text{s}$  |

Note:  
• Bidirectional, programmable parameters are: resolution, code, direction, alarms and warnings  
• Multicycle data output, e.g. for temperature  
• CRC data verification

<sup>2)</sup> Short-circuit to 0V or to output, one channel at a time, supply voltage correctly applied

<sup>3)</sup> Other options upon request

#### SET (zero or defined value) and DiRection (CW/CCW) Control Inputs:

|                            |  |
|----------------------------|--|
| Input characteristics:     | High active                              |
| Receiver type:             | Comparator                               |
| Signal level high:         | min. 60% of V+ (Supply voltage), max: V+ |
| Signal level low:          | max. 25% of V+ (Supply voltage)          |
| Input current:             | $< 0.5 \text{ mA}$                       |
| Min. pulse duration (SET): | 10 ms                                    |
| Timeout after SET input:   | 14 ms                                    |
| Reaction Time (DIR input): | 1 ms                                     |

The encoder can be set to zero at any position by means of a HIGH signal on the SET input or by pressing the optional SET key. Other preset values can be factory-programmed. The SET input has a signal delay time of approximately 1 ms. Once the SET function has been triggered, the encoder requires an internal processing time of approximately 15 ms before the new position data can be read. During this time, the LED is ON and the status output is at LOW.

#### Status Output and LED:

|                    |   |
|--------------------|---|
| Output driver:     | Open collector, internal pull up resistor 22 kOhm |
| Permissible load:  | Max. 20 mA  |
| Signal level high: | +V  |
| Signal level low:  | $< 1 \text{ V}$                                   |
| Active at:         | Low   |

The optional LED (red) and the status output serve to display various alarm or error messages. In normal operation the LED is OFF and the status output is HIGH (open-collector with int. pull-up 22k).

If the LED is ON (status output LOW) this indicates:

- Sensor error, singleturn or multiturn (soiling, glass breakage etc.)
- LED error, failure or aging
- Over or under-temperature

In the SSI mode, the fault indication can only be reset by switching off the power-supply to the device.

#### DIR Input:

A HIGH signal switches the direction of rotation from the default clockwise to counter-clockwise. This inverted function can also be factory-programmed. If DIR is changed when the device is already switched on, then this will be interpreted as an error. The LED will come ON and the status output will switch to LOW.

#### Option Incremental Output (A/B), 2048 ppr:

|                      | Sin/Cos                    | RS422 (TTL compatible)              |
|----------------------|----------------------------|-------------------------------------|
| -3dB frequency:      | 400 kHz                    | 400 kHz                             |
| Signal level:        | $1 V_{pp}$ ( $\pm 20 \%$ ) | high: min. 2.5 V<br>low: max. 0.5 V |
| Short-circuit proof: | Yes                        | Yes                                 |

#### Power-On Delay:

After Power-ON the device requires a time of approx. 150 ms before valid data can be read.

### Absolute, Singleturn Type RS-24 (Shaft) / RS-31 (Hollow Shaft)

SSI/BiSS-C

#### Standard Wiring:

##### Output Circuit \*C or \*F and (2 Control Inputs, 1 Status Output) (Connection C\*1M or 12M23\*)

| Connection Type: | Common (0 V) | +V | +Clock | -Clock | +Data | -Data | ST | DIR | Status | NC | NC | NC | PE     |
|------------------|--------------|----|--------|--------|-------|-------|----|-----|--------|----|----|----|--------|
| M23 Multifast:   | 1            | 2  | 3      | 4      | 5     | 6     | 7  | 8   | 9      | 10 | 11 | 12 | PH     |
| Cable:           | WH           | BN | GN     | YE     | GY    | PK    | BU | RD  | BK     | -  | -  | -  | Shield |

##### Output Circuit \*H and (2 Control Inputs, 1 Status Output, Voltage Monitor Outputs) (Connection C\*1M or 12M23\*)

| Connection Type: | Common (0 V) | +V | +Clock | -Clock | +Data | -Data | ST | DIR | Status | NC | 0 V Sens | +V Sens | PE     |
|------------------|--------------|----|--------|--------|-------|-------|----|-----|--------|----|----------|---------|--------|
| M23 Multifast:   | 1            | 2  | 3      | 4      | 5     | 6     | 7  | 8   | 9      | 10 | 11       | 12      | PH     |
| Cable:           | WH           | BN | GN     | YE     | GY    | PK    | BU | RD  | BK     | -  | GY/PK    | RD/BU   | Shield |

##### Output Circuit \*E, \*G, \*K or \*L, and (2 Control Inputs, Incremental Track or Sine/Cosine) (Connection C\*1M or 12M23\*)

| Connection Type: | Common (0 V) | +V | +Clock | -Clock | +Data | -Data | ST | DIR | Sin A | Sin inv A- | Cos B | Cos inv B- | PE     |
|------------------|--------------|----|--------|--------|-------|-------|----|-----|-------|------------|-------|------------|--------|
| M23 Multifast:   | 1            | 2  | 3      | 4      | 5     | 6     | 7  | 8   | 9     | 10         | 11    | 12         | PH     |
| Cable:           | WH           | BN | GN     | YE     | GY    | PK    | BU | RD  | BK    | VT         | GY/PK | RD/BU      | Shield |

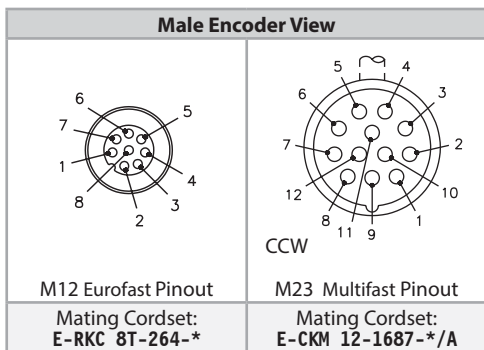
##### Output Circuit \*J or \*M, and (Sine/Cosine or Incremental Monitor, Voltage Outputs) (Connection C\*1M or 12M23\*)

| Connection Type: | Common (0 V) | +V | +Clock | -Clock | +Data | -Data | Sin A | Sin inv A- | Cos B | Cos inv B- | 0 V Sens | +V Sens | PE     |
|------------------|--------------|----|--------|--------|-------|-------|-------|------------|-------|------------|----------|---------|--------|
| M23 Multifast:   | 1            | 2  | 3      | 4      | 5     | 6     | 7     | 8          | 9     | 10         | 11       | 12      | PH     |
| Cable:           | WH           | BN | GN     | YE     | GY    | PK    | BU    | RD         | BK    | VT         | GY/PK    | RD/BU   | Shield |

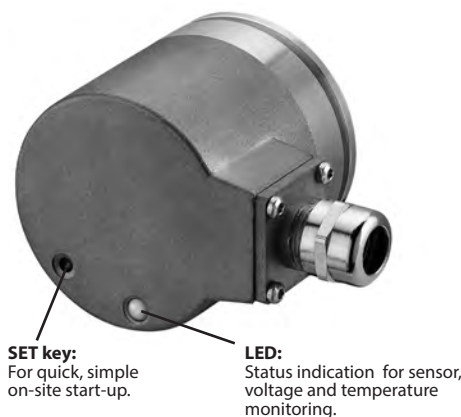
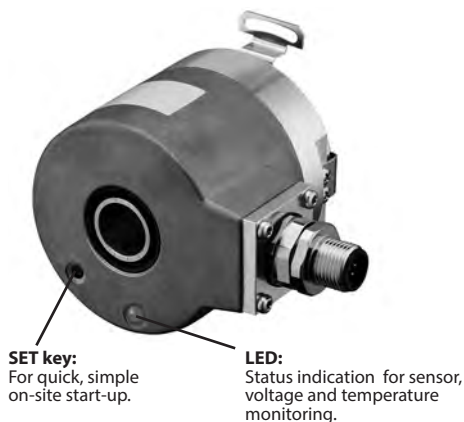
##### Output Circuit \*C or \*F, and (2 Control Inputs) (Connection H1\*81)

| Connection Type: | Common (0 V) | +V | +Clock | -Clock | +Data | -Data | SET | DIR | Shield/PE |
|------------------|--------------|----|--------|--------|-------|-------|-----|-----|-----------|
| M12 Eurofast:    | 1            | 2  | 3      | 4      | 5     | 6     | 7   | 8   | PH        |

#### Wiring Diagrams:



\* Length in meters.



# Rotary Position Technology

## Absolute Encoders, Singleturn

### Absolute, Singleturn Type RS-24 (Shaft) / RS-31 (Hollow Shaft)

SSI/BiSS-C

#### Part Number Key: RS-24 Shaft Version

| A      | B | C |   | D  | E   |   | F     |   | G   |
|--------|---|---|---|----|-----|---|-------|---|-----|
| RS-24S | 6 | C | - | 5F | 10B | - | H1181 | / | N16 |

| A      | Type                            |
|--------|---------------------------------|
| RS-24S | Ø 58 mm, Shaft, IP67 Shaft Seal |
| RS-24T | Ø 58 mm, Shaft, IP65 Shaft Seal |

| B  | Shaft (Ø x L)   |
|----|-----------------|
| 6  | Ø 6 mm x 10 mm  |
| 10 | Ø 10 mm x 20 mm |
| A0 | Ø 1/4" x 7/8"   |
| A1 | Ø 3/8" x 7/8"   |

| C | Flange                  |
|---|-------------------------|
| C | Ø 58 mm Clamping Flange |
| S | Ø 58 mm Servo Flange    |
| R | 2.5" Square Flange      |

| E   | Resolution             |
|-----|------------------------|
| 10B | 10 bit ST              |
| 11B | 11 bit ST              |
| 12B | 12 bit ST              |
| 13B | 13 bit ST              |
| 14B | 14 bit ST              |
| 17B | 17 bit ST              |
| 21B | 21 bit ST <sup>1</sup> |

<sup>1</sup> Only available with output 'DF' and 'DC'

| F      | Type of Connection                               |
|--------|--|
| H1181  | Radial 8-pin M12 Eurofast Connector <sup>2</sup> |
| H1481  | Axial 8-pin M12 Eurofast Connector <sup>2</sup>  |
| 12M23  | Radial 12-pin M23 Multifast Connector            |
| 12M23A | Axial 12-pin M23 Multifast Connector             |
| C1M    | Radial Cable (1 m PVC)                           |
| CA1M   | Axial Cable (1 m PVC)                            |

<sup>2</sup> Only available with output '\*F' and '\*C'

| G       | Options                              |
|---------|--------------------------------------|
| (BLANK) | SET Button and Status LED (Standard) |
| N16     | No Options                           |
| N43     | Status LED                           |

| D        | Voltage Supply and Output Type |         |        | Features   |
|----------|--------------------------------|---------|--------|--|
|          | SSI (B)                        | SSI (G) | BiSS-C |  |
| 5VDC     | 5F                             | 3F      | DF     |  |
|          | 5E                             | 3E      | DE     | 2048 PPR SinCos  |
|          | 5H                             | 3H      | DH     | Voltage Monitoring   |
|          | 5J                             | 3J      | DJ     | 2048 PPR SinCos Plus Voltage Monitoring                        |
|          | 5K                             | 3K      | DK     | 2048 PPR Incr., RS422 (TTL-Compatible)                         |
| 10-30VDC | 5M                             | 3M      | DM     | 2048 PPR Incr., RS422 (TTL-compatible) Plus Voltage Monitoring |
|          | 5C                             | 3C      | DC     |  |
|          | 5G                             | 3G      | DG     | 2048 PPR SinCos  |
|          | 5L                             | 3L      | DL     | 2048 PPR Incr., RS422  |

(B) = Binary, (G) = Gray

**Absolute, Singleturn Type RS-24 (Shaft) / RS-31 (Hollow Shaft) SSI/BiSS-C**

**Part Number Key: RS-31 Hollow Shaft Version**

| A      | B  | C |   | D  | E   |   | F     |   | G   |
|--------|----|---|---|----|-----|---|-------|---|-----|
| RS-31H | 10 | E | - | 5F | 10B | - | H1181 | / | N16 |

| A      | Type                                   |
|--------|--|
| RS-31H | Ø 58 mm, Hollow Shaft, IP67 Shaft Seal |
| RS-31I | Ø 58 mm, Hollow Shaft, IP65 Shaft Seal |

| B  | Bore    |
|----|---------|
| 10 | Ø 10 mm |
| 12 | Ø 12 mm |
| 14 | Ø 14 mm |
| 15 | Ø 15 mm |
| A1 | Ø 3/8"  |
| A3 | Ø 1/2"  |

| C  | Flange                               |
|----|--------------------------------------|
| E  | Flange w/ Ø 63 mm Slotted Flex Mount |
| E1 | Flange w/ Ø 65 mm Flex Mount         |
| T  | Flange w/ Torque Stop                |

| E   | Resolution             |
|-----|------------------------|
| 10B | 10 bit ST              |
| 11B | 11 bit ST              |
| 12B | 12 bit ST              |
| 13B | 13 bit ST              |
| 14B | 14 bit ST              |
| 17B | 17 bit ST              |
| 21B | 21 bit ST <sup>1</sup> |

<sup>1</sup> Only available with output 'DF' and 'DC'

| F     | Type of Connection                                 |
|-------|--|
| H1181 | Radial 8-pin M12 Eurofast Connector <sup>2</sup>   |
| 12M23 | Radial 12-pin M23 Multifast Connector <sup>2</sup> |
| C1M   | Radial Cable (1 m PVC)                             |
| CT1M  | Tangential Cable (1 m PVC)                         |

<sup>2</sup> Only available with output 'F' and 'C'

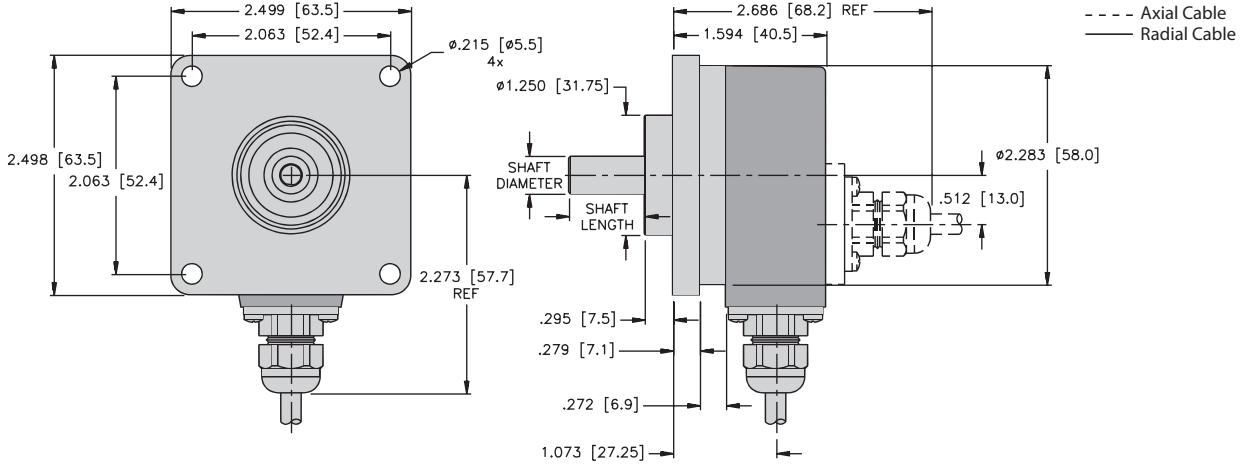
| G       | Options                              |
|---------|--------------------------------------|
| (BLANK) | SET Button and Status LED (Standard) |
| N16     | No Option                            |
| N43     | Status LED                           |

| D        | Voltage Supply and Output Type |         |        |  |
|----------|--------------------------------|---------|--------|--|
|          | SSI (B)                        | SSI (G) | BiSS-C | Features   |
| 5VDC     | 5F                             | 3F      | DF     | 2048 PPR SinCos<br>Voltage Monitoring<br>2048 PPR SinCos Plus Voltage Monitoring<br>2048 PPR Incr., RS422 (TTL-Compatible)<br>2048 PPR Incr., RS422 (TTL-compatible) Plus Voltage Monitoring |
|          | 5E                             | 3E      | DE     |  |
|          | 5H                             | 3H      | DH     |  |
|          | 5J                             | 3J      | DJ     |  |
|          | 5K                             | 3K      | DK     |  |
|          | 5M                             | 3M      | DM     |  |
| 10-30VDC | 5C                             | 3C      | DC     | 2048 PPR SinCos<br>2048 PPR Incr., RS422   |
|          | 5G                             | 3G      | DG     |  |
|          | 5L                             | 3L      | DL     |  |

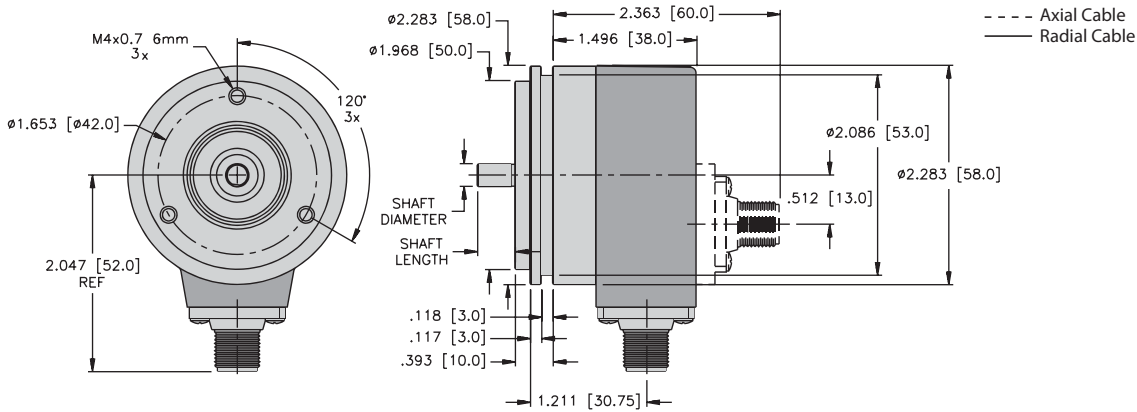
(B) = Binary, (G) = Gray

**Dimensions: RS-24 Shaft Version**

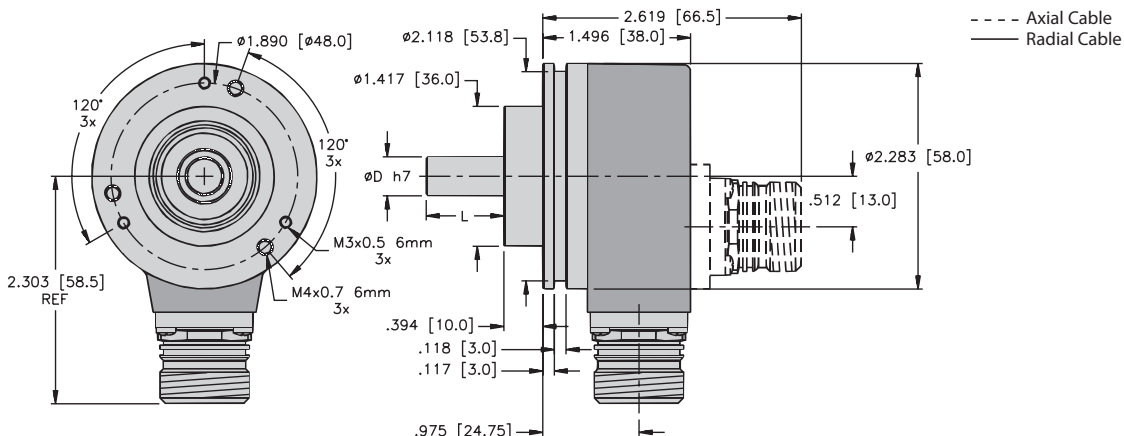
**RS-24 Flange R**  
**Connection C1M & CA1M**



**RS-24 Flange S**  
**Connection H1181 & H1481**



**RS-24 Flange C**  
**Connection 12M23 & 12M23A**

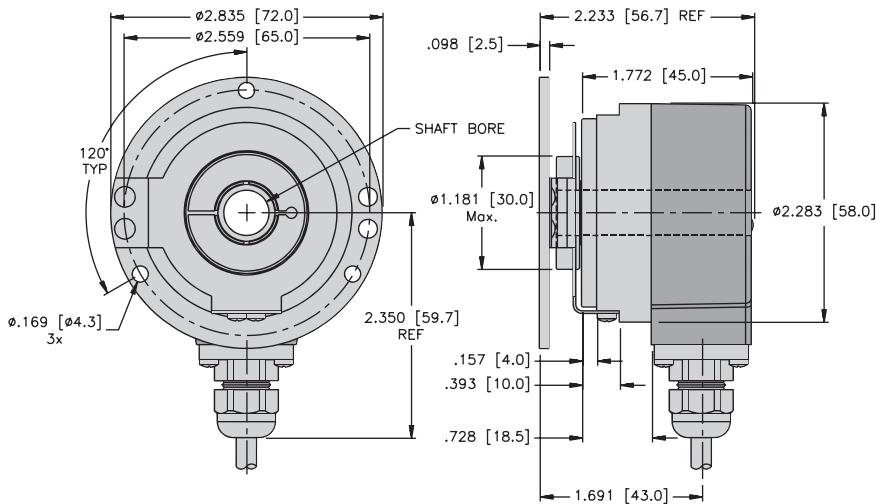


**Absolute, Singleturn Type RS-24 (Shaft) / RS-31 (Hollow Shaft)**

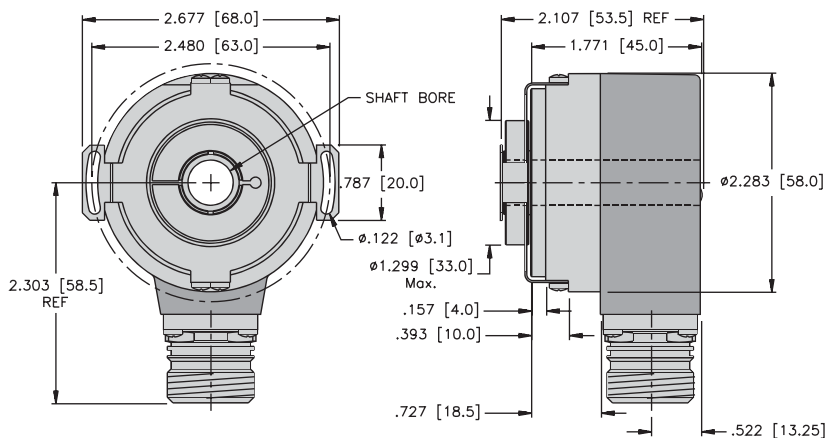
**SSI/BiSS-C**

**Dimensions: RS-31 Hollow Shaft Version**

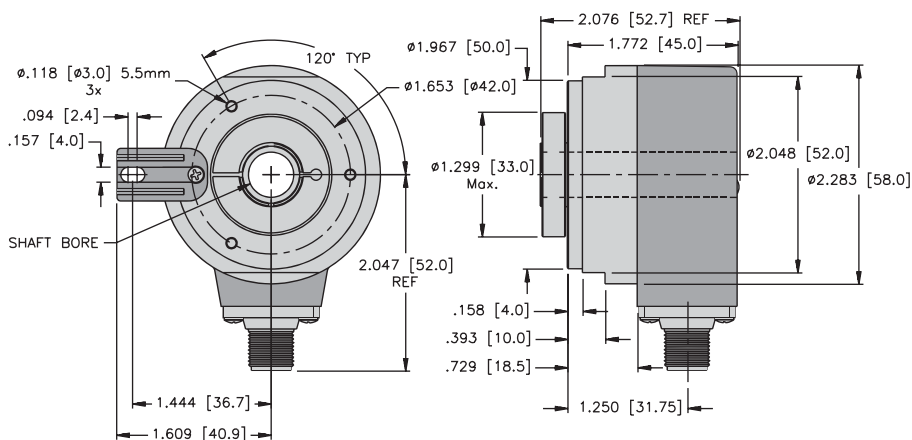
**RS-31 Flange E1  
 Connection C1M**



**RS-31 Flange E  
 Connection 12M23**

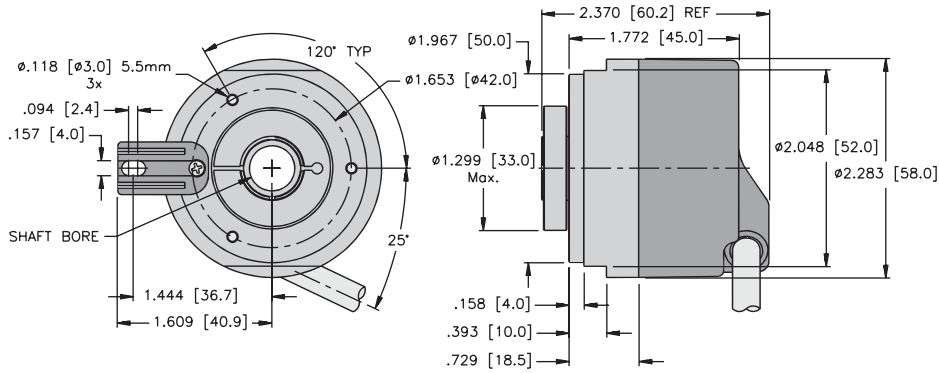


**RS-31 Flange T  
 Connection H1181**



#### Dimensions: RS-31 Hollow Shaft Version

#### RS-31 Flange T Connection CT1M





### Absolute, Singleturn Type RS-25 (Shaft) / RS-33 (Blind Hollow Shaft)

### CANopen



#### Reliable

- **Increased ability to withstand vibration and installation errors.** Sturdy Bearing Lock design structure eliminates machine downtime and repairs.
- **Fewer components and connection points increase the operational reliability.** Turck OptoASIC technology with highest integration density (Chip-on-Board).
- Die cast housing and protection up to IP67: **remains sealed even when subjected to harsh everyday use.**
- Wide temperature range.



#### Absolute



#### CANopen

#### Versatile

- **CANopen fieldbus** with the latest profiles.
- **Connections for every application:** Bus terminal cover with M12 connector or cable connection or fixed connection with M12, M23 or D-Sub connector.
- **Real-time data: Position, speed or working area.** Variable PDO mapping in the memory.
- **Fast, error-free start-up, without setting any switches.** Node address, baud rate and termination can be programmed via the bus.

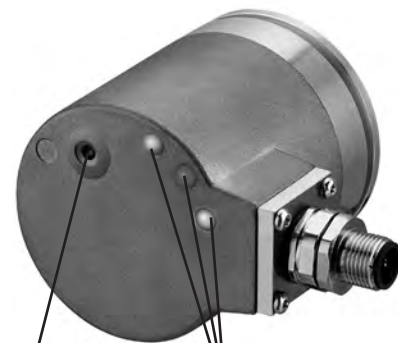
#### Fast

- **Genuine time-servo position detection of several axes.** Extended CAN Sync Mode with real-time position acquisition.
- **Fast data availability while reducing the load on the bus and the controller.** Intelligent functions like the transmission of speed, acceleration or exiting a working area.

#### Mechanical Characteristics:

|   |  |
|---|--|
| Max. speed without shaft sealing (IP65) up to 158 °F (70 °C): | 9,000 RPM, continuous 7,000 RPM  |
| Max. speed without shaft sealing (IP65) up to Tmax:           | 7,000 RPM, continuous 4,000 RPM  |
| Max. speed with shaft sealing (IP67) up to 158 °F (70 °C):    | 8,000 RPM, continuous 6,000 RPM  |
| Max. speed with shaft sealing (IP67) up to Tmax:              | 6,000 RPM, continuous 3,000 RPM  |
| Starting torque without shaft sealing (IP65):                 | < 1.4 oz-in (< 0.01 Nm)  |
| Starting torque with shaft sealing (IP67):                    | Shaft version: < 7 oz-in (< 0.05 Nm)<br>Hollow shaft version: < 4.25 oz-in (< 0.03 Nm)   |
| Moment of inertia:  | Shaft version: 0.16 oz-in <sup>2</sup> (3.0 x 10 <sup>-6</sup> kgm <sup>2</sup> )<br>Hollow shaft version: 0.328 oz-in <sup>2</sup> (6.0 x 10 <sup>-6</sup> kgm <sup>2</sup> ) |
| Radial load capacity of shaft:                                | 18 lbs (80 N)  |
| Axial load capacity of shaft:                                 | 9 lbs (40 N)   |
| Weight:   | approx. 1.17 lbs (0.53 kg) with bus terminal cover<br>approx. 1.10 lbs (0.50 kg) with fixed connection   |
| Protection acc. to EN 60 529:                                 | Housing: IP67, Shaft: IP65, opt. IP67  |
| Working temperature:  | -40 to +176 °F (-40 to +80 °C) <sup>1)</sup>   |
| Materials:  | Shaft/hollow shaft: stainless steel,<br>Flange: aluminum,<br>Housing: die cast zinc, Cable: PVC  |
| Shock resistance acc. to DIN-IEC 68-2-27:                     | > 250 g (> 2,500 m/s <sup>2</sup> ), 6 ms  |
| Vibration resistance acc. to DIN-IEC 68-2-6:                  | > 10 g (> 100 m/s <sup>2</sup> ), 55-2,000 Hz  |

<sup>1)</sup> Cable version: -22 to +167 °F (-30 to +75 °C)



**SET key:**  
For quick, simple on-site start-up.

**Green, red and yellow LEDs:**  
Failure-free operation immediately visible on the bus.

# Rotary Position Technology

## Absolute Encoders, Singleturn

### Absolute, Singleturn Type RS-25 (Shaft) / RS-33 (Blind Hollow Shaft)

### CANopen

#### General Electrical Characteristics:

|   |            |
|---|------------|
| Supply voltage:                                   | 10-30 VDC  |
| Current consumption (without output load):        | Max. 90 mA |
| Reverse polarity protection at power supply (+V): | Yes        |
| RoHS compliant acc. to EU guideline 2011/65/EU    |            |

#### Interface Characteristics CANopen:

|  |   |
|--|---|
| Singleturn resolution (maximum, scalable): | 1-65536 (16 bits), default scale value is set to 8192 (13 bits)               |
| Code:                                      | Binary  |
| Interface:                                 | CAN High-Speed according ISO 11898, Basic and Full CANCAN Specification 2.0 B |
| Protocol:                                  | CANopen profile DS 406 V3.2 with manufacturer-specific add-ons                |

#### SET Control Button (zero or defined value, option):

Protected against accidental activation, can only be depressed with the tip of a ball pen or similar.

#### Diagnostic LED (yellow):

LED on with: optical sensor path faulty (code error, LED error low voltage and over-temperature)

|                         |   |
|-------------------------|---|
| Baud rate:              | 10-1000 kbits/s (set by DIP switches/software configurable) |
| Node address:           | 1-127 (set by rotary switches/software configurable)        |
| Termination switchable: | Set by DIP switches, software configurable                  |

#### General Information about CANopen

The RS-25/33 series of encoders support the latest CANopen communication profile according to DS 301 V4.02. In addition, device-specific profiles are available, such as DS 406 V3.2.

The following operating modes may be selected: Polled Mode, Cyclic Mode, Sync Mode. Moreover, scale factors, preset values, limit switch values and many other additional parameters may be programmed via the CANopen fieldbus. When switching the device on, all parameters, which have been saved on a flash memory to protect them against power failure, are loaded again.

Position, speed, acceleration and status output values may be combined in a freely variable way as PDO mapping.

The encoders are available with a connector or a cable connection. The device address and baud rate can be set or modified by means of the software. Models with a bus terminal cover and integrated T-shaped coupler allow a particularly easy installation via M12 connectors. The device address is set by means of two hexadecimal rotary switches. Furthermore, another DIP switch allows setting the baud rate and switching on a termination resistor. Three LEDs indicate the operating or fault status of the CANopen fieldbus, as well as the status of internal diagnostics.

#### CANopen Communication Profile DS 301 V4.02

The following Class C2 functionality is integrated:

- NMT Slave
- Heartbeat Protocol
- High Resolution Sync Protocol Identity Object
- Error Behavior Object
- Variable PDO Mapping self-start programmable (power on to operational), 3 Sending PDO's
- One receiving PDO for servo preset operation with minimal jitter
- Node address, baud rate and CANbus
- Programmable termination

#### CANopen Encoder Profile DS 406 V3.2

The following parameters may be programmed:

- Event mode
- Units for speed selectable (Steps/Sec or RPM)
- Factor for speed calculation (e.g. measuring wheel periphery), integration time for speed value of 1 to 32
- Two work areas with two upper and lower limits and the corresponding output states
- Variable PDO mapping for position, speed, acceleration and work area status
- Extended failure management for position sensing with integrated temperature control
- User interface with visual display of bus and failure status – 3 LEDs
- Optional – 32 CAMs programmable
- Customer-specific memory – 16 bytes

#### Key features:

The object 6003h "Preset" is assigned to an integrated key, accessible from the outside.  
"Watchdog-controlled" device

### Absolute, Singleturn Type RS-25 (Shaft) / RS-33 (Blind Hollow Shaft)

### CANopen

#### Standard Wiring: Bus Terminal Cover with Terminal Box (Connection RC)

| Direction | OUT        |             |              |                           |                 | IN                        |                 |             |              |            |
|-----------|------------|-------------|--------------|---------------------------|-----------------|---------------------------|-----------------|-------------|--------------|------------|
| Signal:   | CAN Ground | CAN_Low (-) | CAN_High (+) | Common (0 V) power supply | +V power supply | Common (0 V) power supply | +V power supply | CAN_Low (-) | CAN_High (+) | CAN Ground |
| Abbrv:    | CG         | CL          | CH           | 0V                        | +V              | 0V                        | +V              | CL          | CH           | CG         |

#### Standard Wiring: Cable Connection (Connection BC)

| Direction | IN                        |                 |             |              |            |
|-----------|---------------------------|-----------------|-------------|--------------|------------|
| Signal:   | Common (0 V) power supply | +V power supply | CAN_Low (-) | CAN_High (+) | CAN Ground |
| Abbrv:    | 0V                        | +V              | CL          | CH           | CG         |
| Color:    | WH                        | BN              | YE          | GN           | GY         |

#### Standard Wiring: M23 Connector (Connection B1M23) or M12 Connector (Connection B1M12)

| Direction | IN                        |                 |             |              |            | Pinout |
|-----------|---------------------------|-----------------|-------------|--------------|------------|--------|
| Signal:   | Common (0 V) power supply | +V power supply | CAN_Low (-) | CAN_High (+) | CAN Ground |        |
| Abbrv:    | 0V                        | +V              | CL          | CH           | CG         |        |
| M23 pin:  | 10                        | 12              | 2           | 7            | 3          | A      |
| M12 pin:  | 3                         | 2               | 5           | 4            | 1          | C      |

#### Standard Wiring: Bus Terminal Cover with 2 - M12, 2 - M12, 2 - M23 (Connection R2M12) (Connection B2M12) (Connection B2M23)

| Direction | OUT        |             |              |                 |                 | Pinout | IN              |                 |             |              |            | Pinout |
|-----------|------------|-------------|--------------|-----------------|-----------------|--------|-----------------|-----------------|-------------|--------------|------------|--------|
|           | CAN Ground | CAN_Low (-) | CAN_High (+) | 0V power supply | +V power supply |        | 0V power supply | +V power supply | CAN_Low (-) | CAN_High (+) | CAN Ground |        |
| Signal:   | CAN Ground | CAN_Low (-) | CAN_High (+) | 0V power supply | +V power supply | Pinout | 0V power supply | +V power supply | CAN_Low (-) | CAN_High (+) | CAN Ground | Pinout |
| Abbrv:    | CG         | CL          | CH           | 0V              | +V              |        | 0V              | +V              | CL          | CH           | CG         |        |
| M23 pin:  | 3          | 2           | 7            | 10              | 12              | A      | 10              | 12              | 2           | 7            | 3          | A      |
| M12 pin:  | 1          | 5           | 4            | 3               | 2               | B      | 3               | 2               | 5           | 4            | 1          | C      |

#### Wiring Diagrams:

| A  | B   | C   |
|--|---|---|
| Male Encoder View  | Female Encoder View                                     | Male Encoder View                                       |
| <p>CCW</p> <p><b>Bus In and Out</b><br/>M23 Multifast Pinout</p> | <p><b>Bus Out</b><br/>M12 Eurofast Pinout</p>           | <p><b>Bus In</b><br/>M12 Eurofast Pinout</p>            |
| Mating Cordset: <sup>1)</sup><br>Consult factory                 | Mating Cordset: <sup>1)</sup><br><b>RSC 572-*/S3118</b> | Mating Cordset: <sup>1)</sup><br><b>RKC 572-*/S3117</b> |

<sup>1)</sup> See Connectivity section H for mating cordset color codes.  
\* Length in meters. Available in 0.1 meters increments ≥0.2 meters.

# Rotary Position Technology

## Absolute Encoders, Singleturn

### Absolute, Singleturn Type RS-25 (Shaft) / RS-33 (Blind Hollow Shaft)

CANopen

#### Part Number Key: RS-25 Shaft Version

| A      | B | C |   | D     |   | E     |   | F   |
|--------|---|---|---|-------|---|-------|---|-----|
| RS-25S | 6 | C | - | 9D16B | - | B1M12 | / | N46 |

| A      | Type                            |
|--------|---------------------------------|
| RS-25S | Ø 58 mm, Shaft, IP67 Shaft Seal |
| RS-25T | Ø 58 mm, Shaft, IP65 Shaft Seal |

| B  | Shaft (Ø x L)   |
|----|-----------------|
| 6  | Ø 6 mm x 10 mm  |
| 10 | Ø 10 mm x 20 mm |
| A0 | Ø 1/4" x 7/8"   |
| A1 | Ø 3/8" x 7/8"   |

| C | Flange                  |
|---|-------------------------|
| C | Ø 58 mm Clamping Flange |
| S | Ø 58 mm Servo Flange    |
| R | 2.5" Square Flange      |

| D     | Power Supply and Output Type    |
|-------|---------------------------------|
| 9D16B | 10-30 VDC, CANopen DS 301 V4.02 |

| E     | Type of Connection   |
|-------|--|
| B1M12 | Radial 1 x M12 Eurofast Connector w/o Bus Terminal Cover   |
| B2M12 | Radial 2 x M12 Eurofast Connectors w/o Bus Terminal Cover  |
| R2M12 | Radial 2 x M12 Eurofast Connectors w/ Bus Terminal Cover   |
| B1M23 | Radial 1 x M23 Multifast Connector w/o Bus Terminal Cover  |
| B2M23 | Radial 2 x M23 Multifast Connectors w/o Bus Terminal Cover |
| BC    | Radial Cable (2 m PVC) w/o Bus Terminal Cover              |
| RC    | Radial Cable Gland w/ Bus Terminal Cover                   |

| F       | Options    |
|---------|------------|
| (BLANK) | No Options |
| N46     | SET        |

#### Part Number Key: RS-33 Blind Hollow Shaft Version

| A      | B  | C |   | D     |   | E     |   | F   |
|--------|----|---|---|-------|---|-------|---|-----|
| RS-33B | 10 | E | - | 9D16B | - | B1M12 | / | N46 |

| A      | Type   |
|--------|--|
| RS-33B | Ø 58 mm, Blind Hollow Shaft, IP67 Shaft Seal |
| RS-33C | Ø 58 mm, Blind Hollow Shaft, IP65 Shaft Seal |

| B  | Bore (30 mm Insertion Depth) |
|----|------------------------------|
| 10 | Ø 10 mm                      |
| 12 | Ø 12 mm                      |
| 14 | Ø 14 mm                      |
| 15 | Ø 15 mm                      |
| A1 | Ø 3/8"                       |
| A3 | Ø 1/2"                       |

| C  | Flange                               |
|----|--------------------------------------|
| E  | Flange w/ Ø 63 mm Slotted Flex Mount |
| E1 | Flange w/ Ø 65 mm Flex Mount         |
| T  | Flange w/ Torque Stop                |

| D     | Power Supply and Output Type    |
|-------|---------------------------------|
| 9D16B | 10-30 VDC, CANopen DS 301 V4.02 |

| E     | Type of Connection   |
|-------|--|
| B1M12 | Radial 1 x M12 Eurofast Connector w/o Bus Terminal Cover   |
| B2M12 | Radial 2 x M12 Eurofast Connectors w/o Bus Terminal Cover  |
| R2M12 | Radial 2 x M12 Eurofast Connectors w/ Bus Terminal Cover   |
| B1M23 | Radial 1 x M23 Multifast Connector w/o Bus Terminal Cover  |
| B2M23 | Radial 2 x M23 Multifast Connectors w/o Bus Terminal Cover |
| BC    | Radial Cable (2 m PVC) w/o Bus Terminal Cover              |
| RC    | Radial Cable Gland w/ Bus Terminal Cover                   |

| F       | Options    |
|---------|------------|
| (BLANK) | No Options |
| N46     | SET        |

#### Accessories:

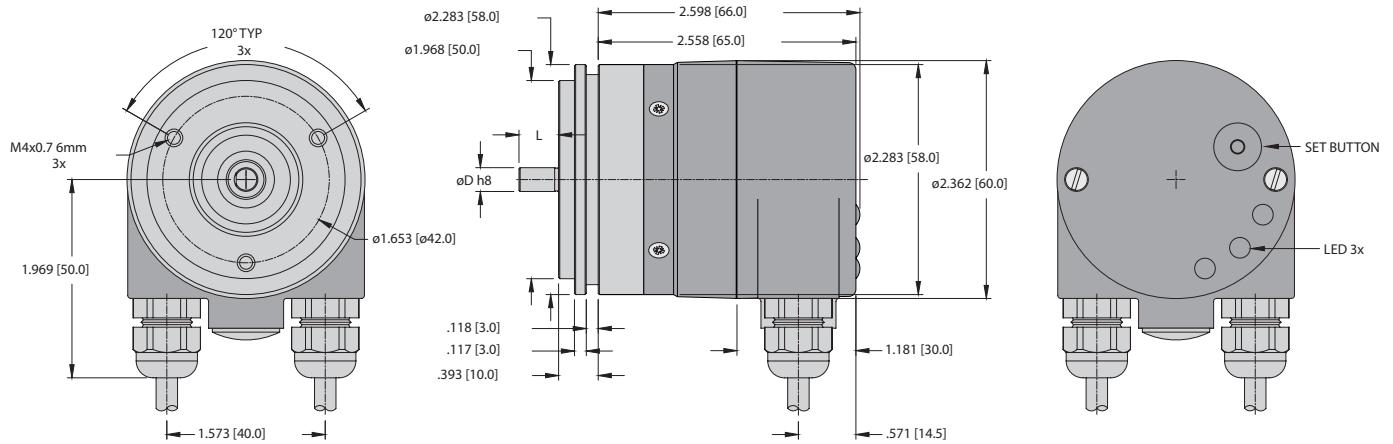
- See page H1, Connectivity, for cables and connectors
- See page G1, Accessories, for mounting attachments and couplings

**Absolute, Singleturn Type RS-25 (Shaft) / RS-33 (Blind Hollow Shaft)**

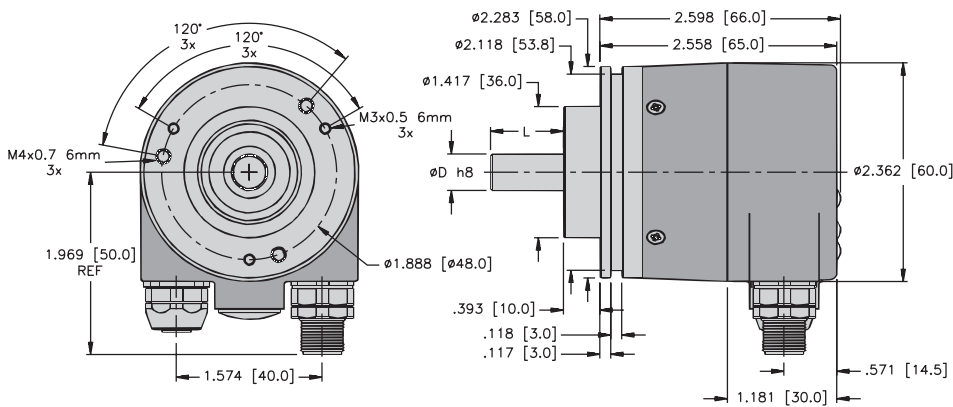
**CANopen**

**Dimensions: RS-25 Shaft Version**

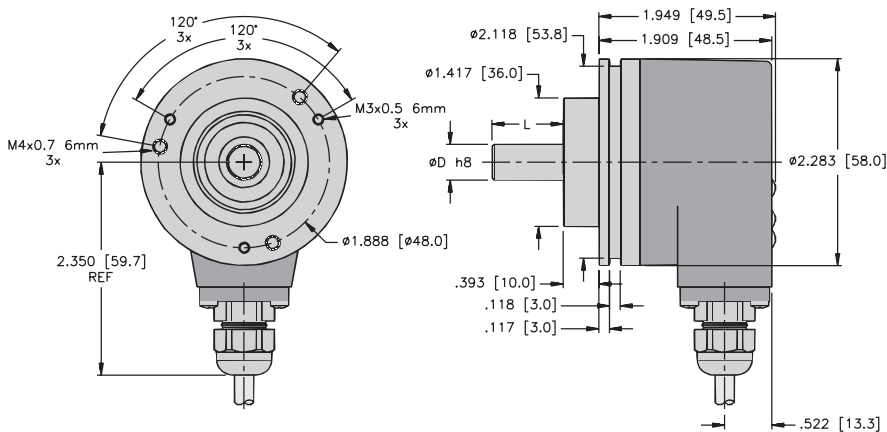
**RS-25 Flange S  
 Connection RC**



**RS-25 Flanges C  
 Connection R2M12**



**RS-25 Flange C  
 Connection BC**



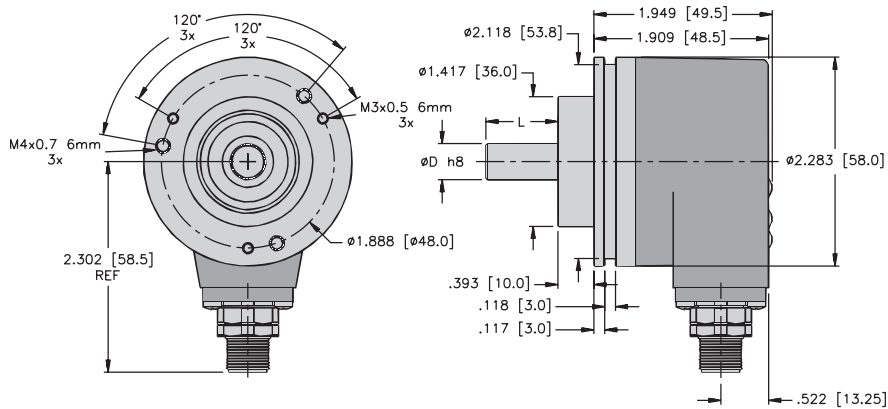
# Rotary Position Technology

## Absolute Encoders, Singleturn

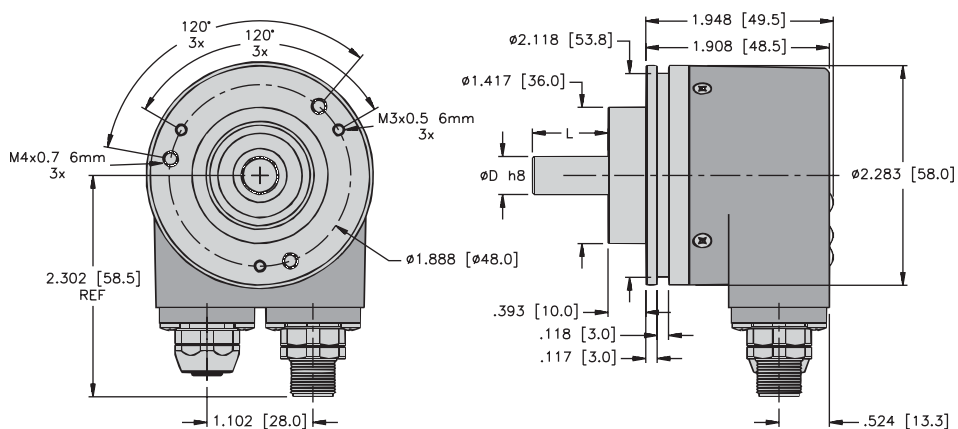
### Absolute, Singleturn Type RS-25 (Shaft) / RS-33 (Blind Hollow Shaft) CANopen

Dimensions: RS-25 Shaft Version

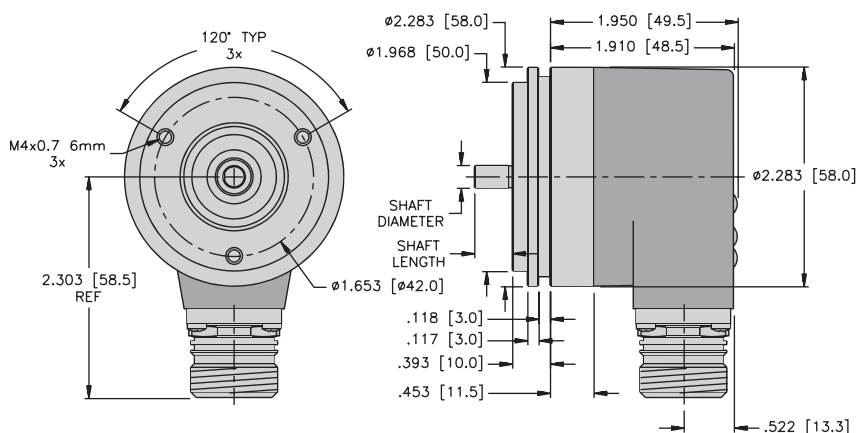
#### RS-25 Flange C Connection B1M12



#### RS-25 Flange C Connection B2M12



#### RS-25 Flange S Connection B1M23

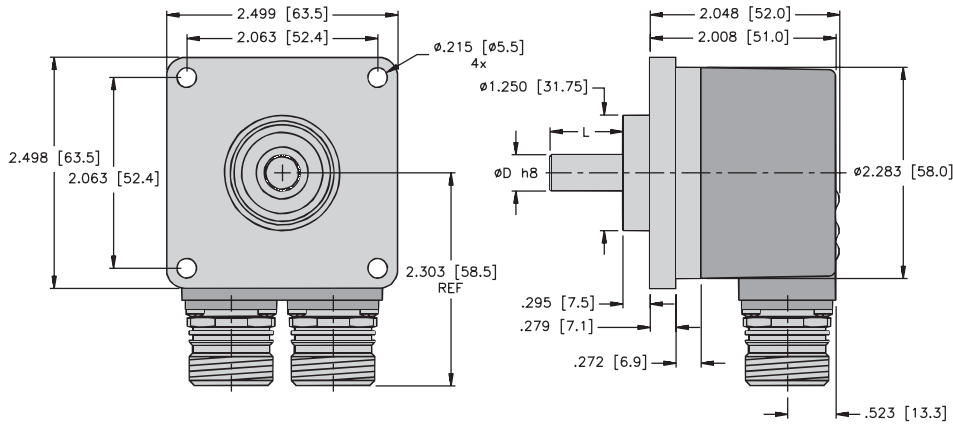


**Absolute, Singleturn Type RS-25 (Shaft) / RS-33 (Blind Hollow Shaft)**

**CANopen**

**Dimensions: RS-25 Shaft Version**

**RS-25 Flange R**  
**Connection B2M23**



# Rotary Position Technology

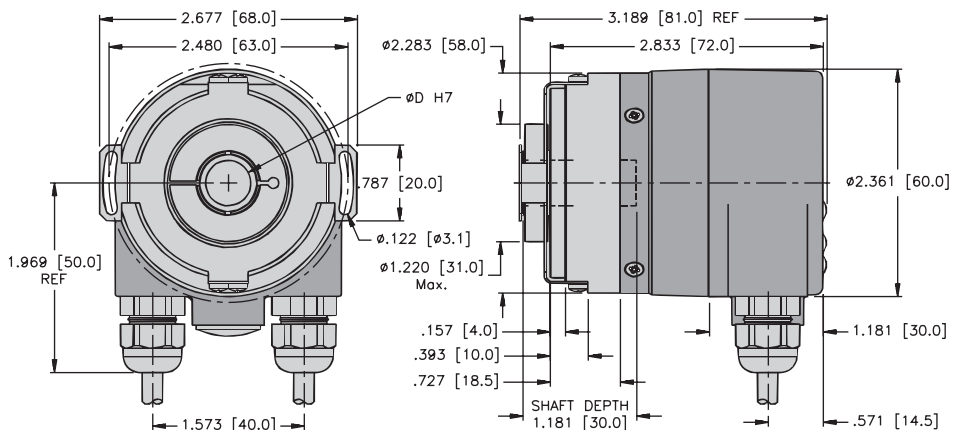
## Absolute Encoders, Singleturn

### Absolute, Singleturn Type RS-25 (Shaft) / RS-33 (Blind Hollow Shaft)

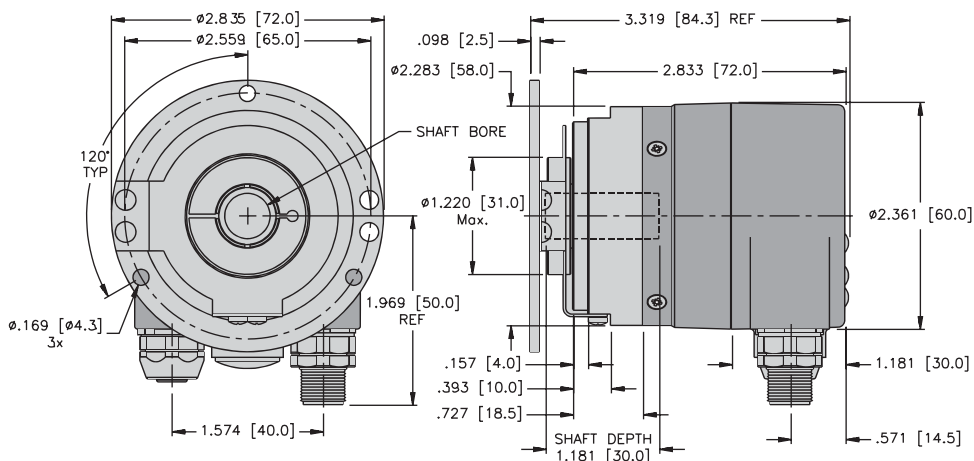
CANopen

#### Dimensions: RS-33 Blind Hollow Shaft Version

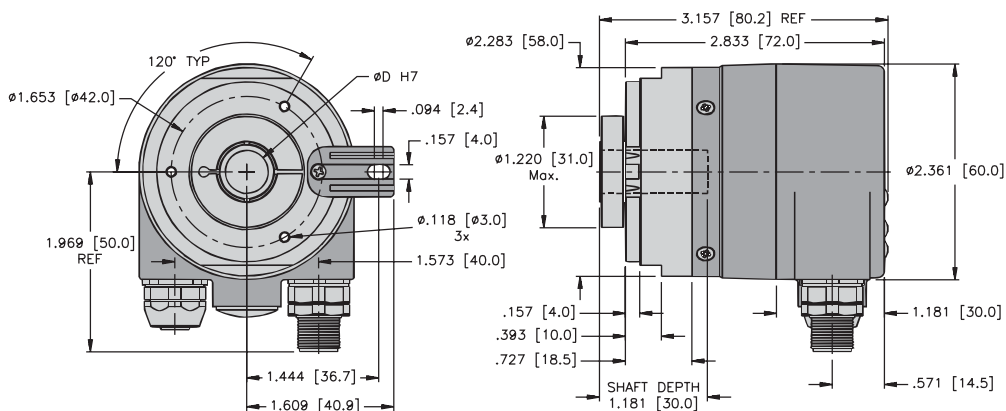
##### RS-33 Flange E Connection RC



##### RS-33 Flange E1 Connection R2M12



##### RS-33 Flange T Connection R2M12



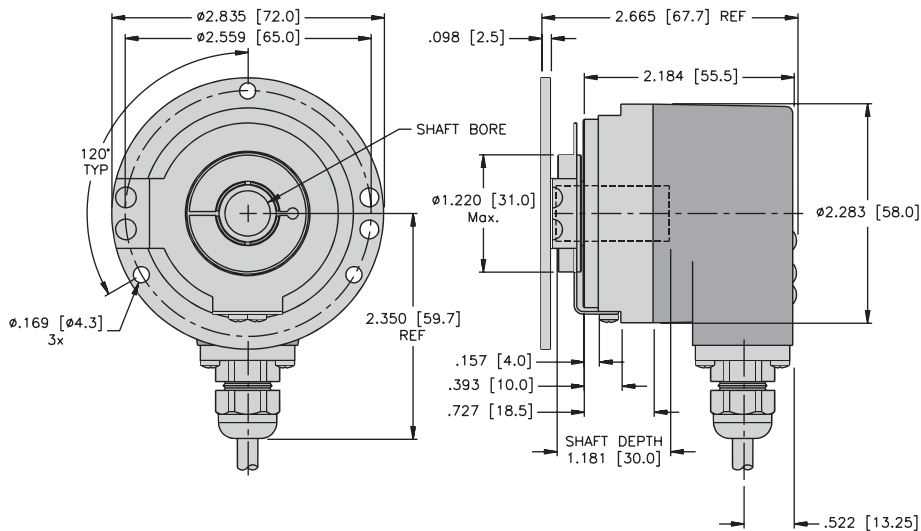


**Absolute, Singleturn Type RS-25 (Shaft) / RS-33 (Blind Hollow Shaft)**

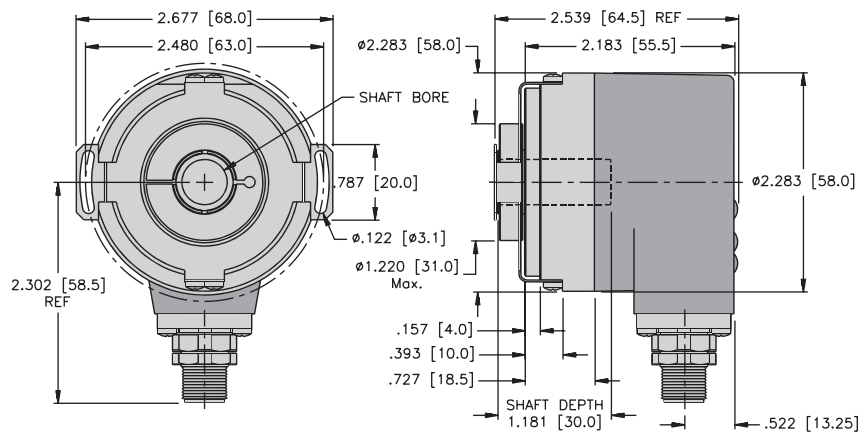
**CANopen**

**Dimensions: RS-33 Blind Hollow Shaft Version**

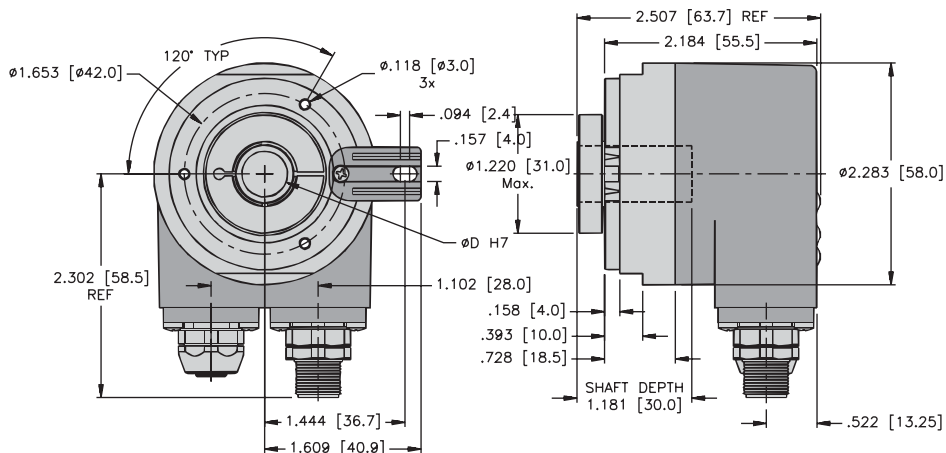
**RS-33 Flange E1  
 Connection BC**



**RS-33 Flange E  
 Connection B1M12**



**RS-33 Flange T  
 Connection B2M12**



Absolute Encoders

# Rotary Position Technology

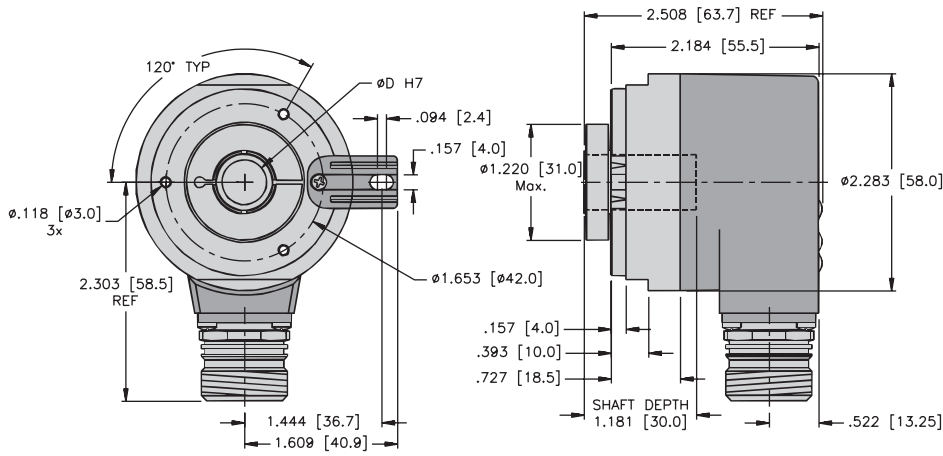
## Absolute Encoders, Singleturn

### Absolute, Singleturn Type RS-25 (Shaft) / RS-33 (Blind Hollow Shaft)

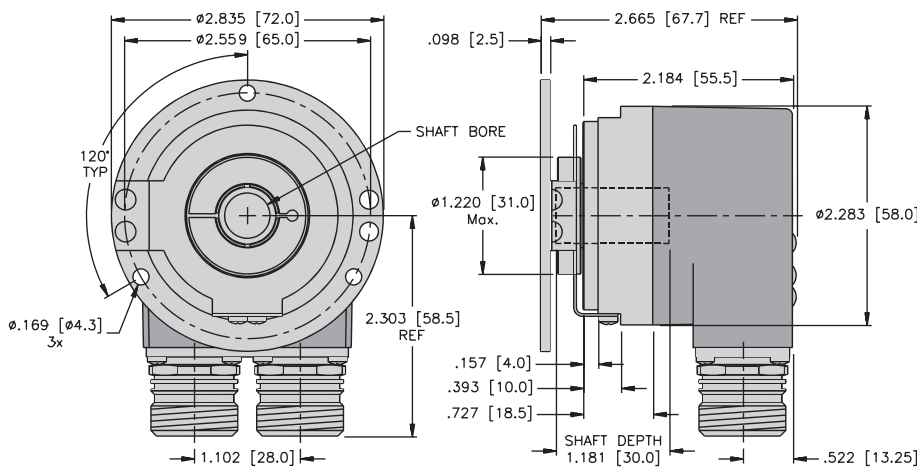
CANopen

#### Dimensions: RS-33 Blind Hollow Shaft Version

##### RS-33 Flange T Connection B1M23



##### RS-33 Flange E1 Connection B2M23



### Absolute, Singleturn Type RS-25 (Shaft) / RS-33 (Blind Hollow Shaft)

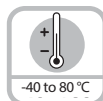
EtherCAT



Bearing-Lock



High rotational speed



Temperature  
-40 to 80 °C



High IP



High shaft load capacity



Shock/vibration resistant



Magnetic field proof



Short-circuit protected



Reverse polarity protection



Optical sensor



Seawater-resistant version on request

#### Reliable

- **Increased ability to withstand vibration and installation errors.** Sturdy Bearing-Lock design structure eliminates machine downtime and repairs.
- **Fewer components and connection points increase the operational reliability.** Turck OptoASIC technology with highest integration density (Chip-on-Board).
- Die cast housing and protection up to IP67: **Remains sealed even when subjected to harsh everyday use.**
- Wide temperature range of: -40 to +176 °F (-40 to +80 °C).



#### Absolute



EtherCAT

#### Fast

- **Genuine time-servo position detection of several axes:** Distributed clock for real-time position detection.
- **Fast data availability with reduced loading on the bus and controller:** Intelligent functions such as transmission of speed/velocity, acceleration or leaving a working area.
- **Fast, simple, error-free connection:** Bus terminal cover with 3 x M12 connectors.

#### Versatile

- **Up-to-the minute fieldbus performance in the CoE application.**
- Real-time data access including **position, speed/velocity, acceleration or working area:** PDO mapping in the memory.
- **Fast, error-free start-up without setting switches.** All parameters can be programmed via the bus.
- **Numerous special functions:** Temperature monitoring, operating time, customer data (e.g., installation location)

#### Mechanical Characteristics:

|   |  |
|---|--|
| Max. speed without shaft sealing (IP65) up to 158 °F (70 °C): | 9,000 RPM, continuous 7,000 RPM  |
| Max. speed without shaft sealing (IP65) up to Tmax:           | 7,000 RPM, continuous 4,000 RPM  |
| Max. speed with shaft sealing (IP67) up to 158 °F (70 °C):    | 8,000 RPM, continuous 6,000 RPM  |
| Max. speed with shaft sealing (IP67) up to Tmax:              | 6,000 RPM, continuous 3,000 RPM  |
| Starting torque without shaft sealing (IP65):                 | < 1.4 oz-in (< 0.01 Nm)  |
| Starting torque with shaft sealing (IP67):                    | Shaft version: < 7 oz-in (< 0.05 Nm)<br>Hollow shaft version: < 4.25 oz-in (< 0.03 Nm)   |
| Moment of inertia:  | Shaft version: 0.16 oz-in <sup>2</sup> (3.0 x 10 <sup>-6</sup> kgm <sup>2</sup> )<br>Hollow shaft version: 0.328 oz-in <sup>2</sup> (6.0 x 10 <sup>-6</sup> kgm <sup>2</sup> ) |
| Radial load capacity of shaft:                                | 18 lbs (80 N)  |
| Axial load capacity of shaft:                                 | 9 lbs (40 N)   |
| Weight:   | approx. 1.10 lbs (0.50 kg)   |
| Protection acc. to EN 60 529:                                 | Housing: IP67, Shaft: IP65, opt. IP67  |
| Working temperature:  | -40 to +176 °F (-40 to +80 °C)   |
| Materials:  | Shaft/hollow shaft: stainless steel,<br>Flange: aluminum,<br>Housing: die cast zinc  |
| Shock resistance acc. to DIN-IEC 68-2-27:                     | > 250 g (> 2,500 m/s <sup>2</sup> ), 6 ms  |
| Vibration resistance acc. to DIN-IEC 68-2-6:                  | > 10 g (> 100 m/s <sup>2</sup> ), 55-2,000 Hz  |

# Rotary Position Technology

## Absolute Encoders, Singleturn

### Absolute, Singleturn Type RS-25 (Shaft) / RS-33 (Blind Hollow Shaft)

EtherCAT

#### General Electrical Characteristics:

|   |             |
|---|-------------|
| Supply voltage:                                     | 10-30 VDC   |
| Current consumption (without output load):          | Max. 110 mA |
| Reverse polarity protection at power supply (+V):   | Yes         |
| RoHS compliant according to EU guideline 2011/65/EU |             |

#### Diagnostic LED (Red):

LED is ON with the following fault conditions:  
Sensor error (internal code or LED error), low voltage, over-temperature

#### Run LED (Green):

LED is ON with the following conditions:  
Preop-, Safeop and Op-State (EtherCat status machine)

#### 2 x Link LED (Yellow):

LED is ON with the following conditions (Port A and B)  
Link detected

#### Device Characteristics:

|                        |                                       |
|------------------------|---------------------------------------|
| Singleturn resolution: | 1-65535 (16 bit), (scalable: 1-65535) |
| Default value:         | 8192 (13 bit)                         |
| Total resolution:      | scalable from 1 to 65535 (16 bit)     |
| Interface:             | Binary                                |
| Protocol:              | EtherNet/EtherCAT                     |

#### Modes:

Freerun, Distributed Clock (cycle time for Sync 0 pulse min. 125 µs or 62.5 µs with restrictions), Sync-Mode

#### General Information about CoE (CAN over EtherCAT)

The RS-25/33 series of EtherCAT encoders support the CANopen communication profile according to DS 301. In addition, device-specific profiles are available.

Scaling, preset values, limit switch values and many other parameters can be programmed via the EtherCAT bus. When switching the device on, all parameters, which have been saved on a flash memory to protect them against power failure, are loaded again.

Position, speed, acceleration and status output values may be combined in a freely variable way as PDO mapping.

#### CANopen Encoder Profile CoE (CAN over EtherCAT)

The following parameters are programmable:

- Units for speed selectable (Steps/Sec or RPM)
- Factor for speed calculation (e.g., circumference of measuring wheel)
- Integration time for the speed value from 1 to 32
- Two working areas with two upper and lower limits and the corresponding output states
- PDO mapping of position, speed/velocity, acceleration and working area
- Extended error management for position sensing with integrated temperature control
- User interface with visual display of bus and fault status – 4 LEDs
- Alarm and warning messages

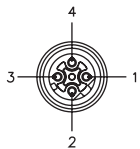
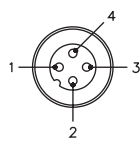
#### Standard Wiring (Bus): (M12 Connection R3M12, D-coded)

| Direction: | Port A         |               |                |               | Port B         |               |                |               |
|------------|----------------|---------------|----------------|---------------|----------------|---------------|----------------|---------------|
|            | Transmit data+ | Receive data+ | Transmit data- | Receive data- | Transmit data+ | Receive data+ | Transmit data- | Receive data- |
| Signal:    | Transmit data+ | Receive data+ | Transmit data- | Receive data- | Transmit data+ | Receive data+ | Transmit data- | Receive data- |
| Abbrv:     | TxD+           | RxD+          | TxD-           | RxD-          | TxD+           | RxD+          | TxD-           | RxD-          |
| M12 pin:   | 1              | 2             | 3              | 4             | 1              | 2             | 3              | 4             |

#### Standard Wiring (Power Supply): M12 Connector

| Signal:  | Power supply | N/C | Common | N/C |
|----------|--------------|-----|--------|-----|
| Abbrv:   | +V           | -   | 0 V    | -   |
| M12 pin: | 1            | 2   | 3      | 4   |

#### Wiring Diagrams:

| Bus  | Power Supply  |
|--|---|
| Female Encoder View  | Male Encoder View   |
|  <p>M12 Eurofast Pinout</p> <p>Mating Cordset:<br/>RSSD 441-*</p> |  <p>M12 Eurofast Pinout</p> <p>Mating Cordset:<br/>RK 4.4T-*</p> |

### Absolute, Singleturn Type RS-25 (Shaft) / RS-33 (Blind Hollow Shaft)

EtherCAT

#### Part Number Key: RS-25 Shaft Version

| A      | B | C |   | D     |   | E     |
|--------|---|---|---|-------|---|-------|
| RS-25S | 6 | C | - | 9C16B | - | R3M12 |

| A      | Type                            |
|--------|---------------------------------|
| RS-25S | Ø 58 mm, Shaft, IP67 Shaft Seal |
| RS-25T | Ø 58 mm, Shaft, IP65 Shaft Seal |

| B  | Shaft (Ø x L)   |
|----|-----------------|
| 6  | Ø 6 mm x 10 mm  |
| 10 | Ø 10 mm x 20 mm |
| A0 | Ø 1/4" x 7/8"   |
| A1 | Ø 3/8" x 7/8"   |

| C | Flange                  |
|---|-------------------------|
| C | Ø 58 mm Clamping Flange |
| S | Ø 58 mm Servo Flange    |
| R | 2.5" Square Flange      |

| D     | Power Supply and Output Type |
|-------|------------------------------|
| 9C16B | 10-30 VDC, EtherCAT          |

| E     | Type of Connection                                       |
|-------|--|
| R3M12 | Radial 3 x M12 Eurofast Connectors w/ Bus Terminal Cover |

#### Part Number Key: RS-33 Blind Hollow Shaft Version

| A      | B  | C |   | D     |   | E     |
|--------|----|---|---|-------|---|-------|
| RS-33B | 10 | E | - | 9C16B | - | R3M12 |

| A      | Type   |
|--------|--|
| RS-33B | Ø 58 mm, Blind Hollow Shaft, IP67 Shaft Seal |
| RS-33C | Ø 58 mm, Blind Hollow Shaft, IP65 Shaft Seal |

| B  | Bore (30 mm Insertion Depth) |
|----|------------------------------|
| 10 | Ø 10 mm                      |
| 12 | Ø 12 mm                      |
| 14 | Ø 14 mm                      |
| 15 | Ø 15 mm                      |
| A1 | Ø 3/8"                       |
| A3 | Ø 1/2"                       |

| C  | Flange                              |
|----|-------------------------------------|
| E  | Flange w/ Ø 63mm Slotted Flex Mount |
| E1 | Flange w/ Ø 65mm Flex Mount         |
| T  | Flange w/ Torque Stop               |

| D     | Power Supply and Output Type |
|-------|------------------------------|
| 9C16B | 10-30 VDC, EtherCAT          |

| E     | Type of Connection                                       |
|-------|--|
| R3M12 | Radial 3 x M12 Eurofast Connectors w/ Bus Terminal Cover |

#### Accessories:

- See page H1, Connectivity, for cables and connectors
- See page G1, Accessories, for mounting attachments and couplings

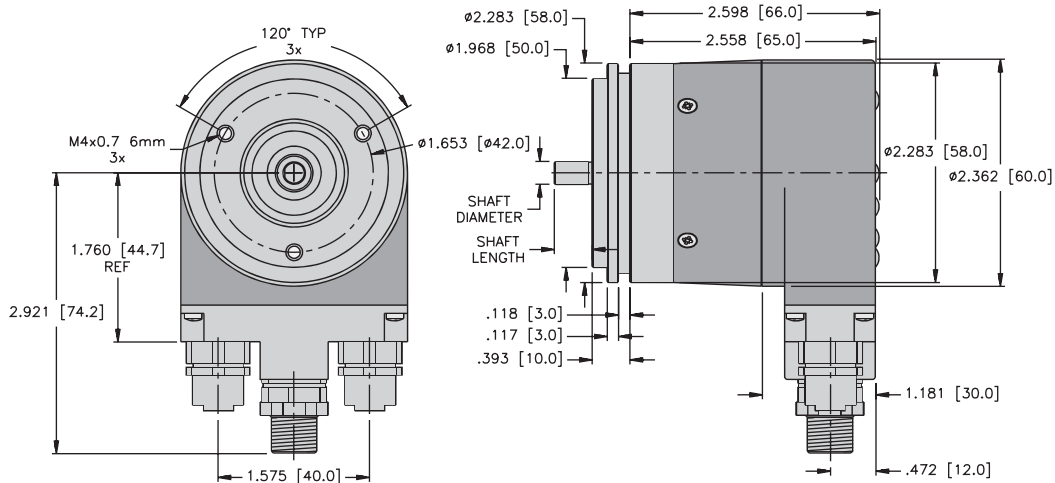
# Rotary Position Technology

## Absolute Encoders, Singleturn

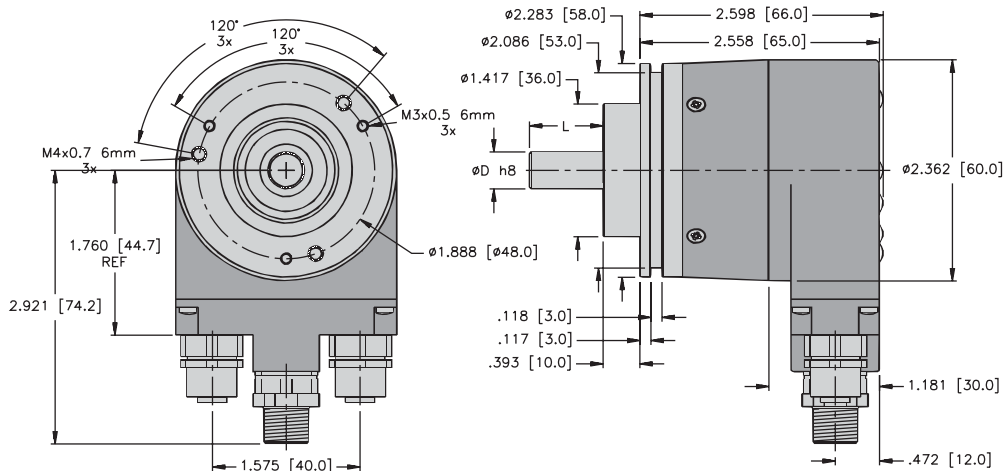
### Absolute, Singleturn Type RS-25 (Shaft) / RS-33 (Blind Hollow Shaft) EtherCAT

#### Dimensions: RS-25 Shaft Version

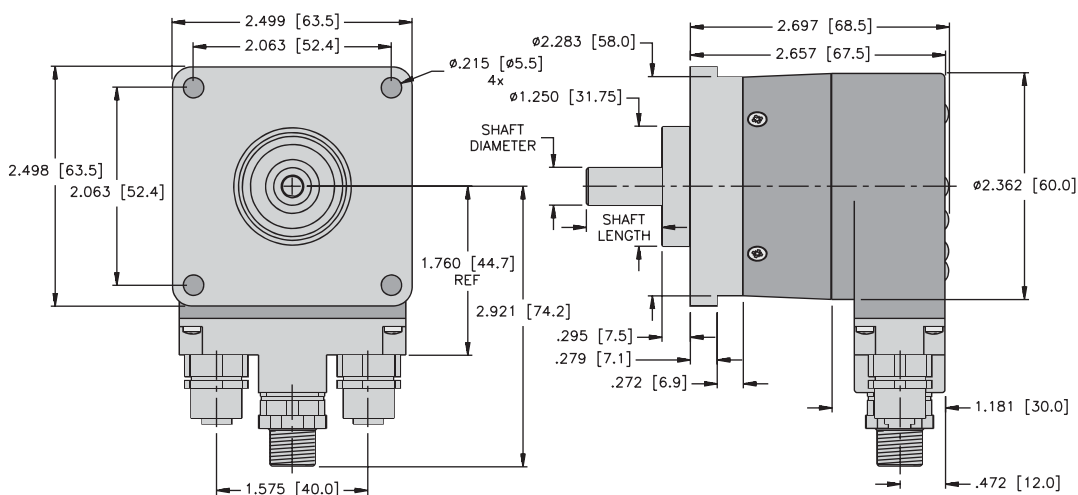
##### RS-25 Flange S Connection R3M12



##### RS-25 Flange C Connection R3M12



##### RS-25 Flange R Connection R3M12

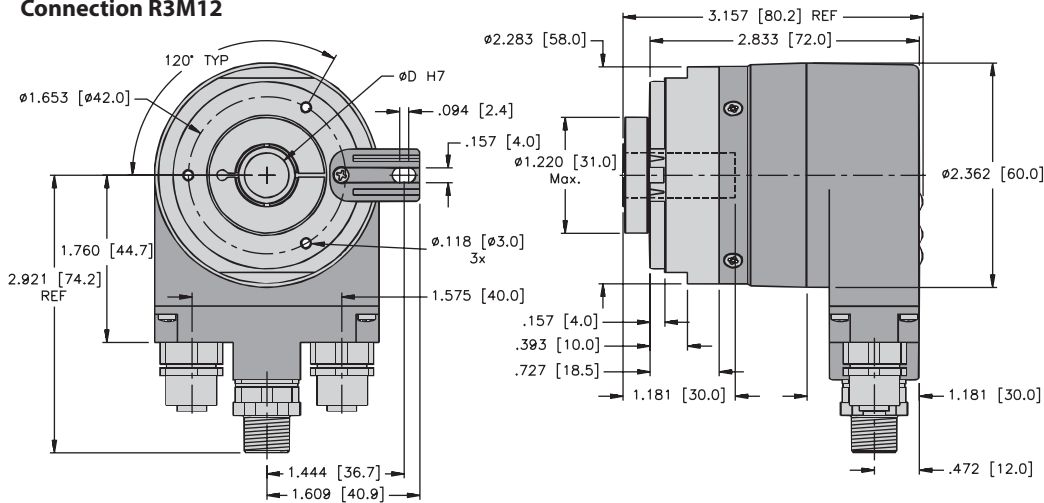


**Absolute, Singleturn Type RS-25 (Shaft) / RS-33 (Blind Hollow Shaft)**

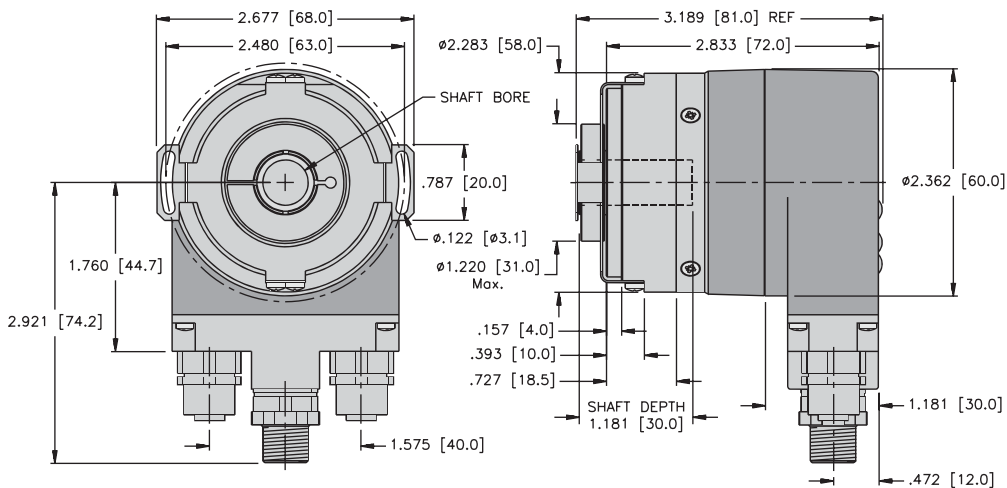
**EtherCAT**

**Dimensions: RS-33 Blind Hollow Shaft Version**

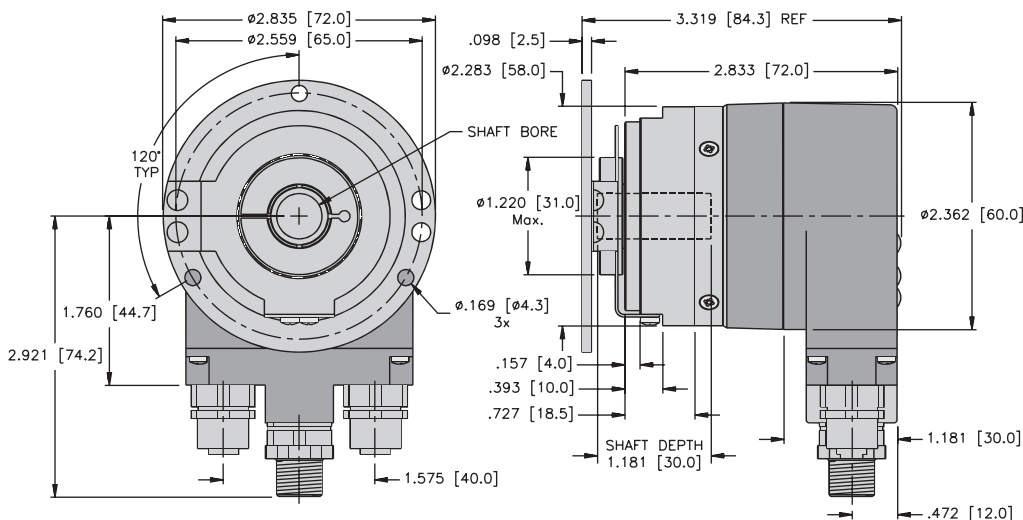
**RS-33 Flanges T  
 Connection R3M12**



**RS-33 Flange E  
 Connection R3M12**



**RS-33 Flange E1  
 Connection R3M12**



# Rotary Position Technology

## Absolute Encoders, Singleturn

Absolute, Singleturn Type RS-25 (Shaft) / RS-33 (Blind Hollow Shaft)

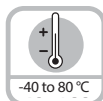
PROFIBUS-DP



Bearing-Lock



High rotational speed



Temperature  
-40 to 80 °C



High IP



High shaft load capacity



Shock/vibration resistant



Magnetic field proof



Short-circuit protected



Reverse polarity protection



Optical sensor



Seawater-resistant version on request

### Reliable

- **Increased ability to withstand vibration and installation errors.** Sturdy Bearing-Lock design bearing structure eliminates machine downtime and repairs.
- **Fewer components and connection points increase the operational reliability.** Turck OptoASIC technology with highest integration density (Chip-on-Board).
- Die cast housing and protection up to IP67: **Remains sealed even when subjected to harsh everyday use.**
- Wide temperature range.



### Absolute



### Fast

- **Fast data availability with reduced loading on the bus and controller:** Intelligent functions such as transmission of speed/velocity, acceleration or leaving a working area.
- **Fast, simple, error-free connection.**

### Versatile

- **Up-to-the minute fieldbus performance:** PROFIBUS-DP V0 with the current encoder profile supports Class I and Class II.
- **Connection options:** Bus cover with M12 connector or cable connection.
- **Fast start-up:** with pre-defined GSD file. A variety of scaling options for the most diverse applications: 16 bit singleturn resolution; comprehensive diagnostics, programmable to Class II.

### Mechanical Characteristics:

|   |  |
|---|--|
| Max. speed without shaft sealing (IP65) up to 158 °F (70 °C): | 9,000 RPM, continuous 7,000 RPM  |
| Max. speed without shaft sealing (IP65) up to Tmax:           | 7,000 RPM, continuous 4,000 RPM  |
| Max. speed with shaft sealing (IP67) up to 158 °F (70 °C):    | 8,000 RPM, continuous 6,000 RPM  |
| Max. speed with shaft sealing (IP67) up to Tmax:              | 6,000 RPM, continuous 3,000 RPM  |
| Starting torque without shaft sealing (IP65):                 | < 1.4 oz-in (< 0.01 Nm)  |
| Starting torque with shaft sealing (IP67):                    | Shaft version: < 7 oz-in ( 0.05 Nm)<br>Hollow shaft version: < 4.25 oz-in (< 0.03 Nm)  |
| Moment of inertia:  | Shaft version: 0.16 oz-in <sup>2</sup> (3.0 x 10 <sup>-6</sup> kgm <sup>2</sup> )<br>Hollow shaft version: 0.328 oz-in <sup>2</sup> (6.0 x 10 <sup>-6</sup> kgm <sup>2</sup> ) |
| Radial load capacity of shaft:                                | 18 lbs (80 N)  |
| Axial load capacity of shaft:                                 | 9 lbs (40 N)   |
| Weight:   | approx. 1.17 lbs (0.53 kg) with bus terminal cover<br>approx. 1.10 lbs (0.50 kg) with fixed connection   |
| Protection acc. to EN 60 529:                                 | Housing: IP67, Shaft: IP65, opt. IP67  |
| Working temperature:  | -40 to +176 °F (-40 to +80 °C)   |
| Materials:  | Shaft: stainless steel, Flange: aluminum,<br>Housing: die cast zinc, cable: PVC  |
| Shock resistance acc. to DIN-IEC 68-2-27:                     | > 250 g (> 2,500 m/s <sup>2</sup> ), 6 ms  |
| Vibration resistance acc. to DIN-IEC 68-2-6:                  | > 10 g (> 100 m/s <sup>2</sup> ), 55-2,000 Hz  |

### General Electrical Characteristics:

|   |             |
|---|-------------|
| Supply voltage:                                   | 10-30 VDC   |
| Current consumption (without output load):        | Max. 110 mA |
| Reverse polarity protection at power supply (+V): | Yes         |
| RoHS compliant acc. to EU guideline 2011/65/EU    |             |



### Absolute, Singleturn Type RS-25 (Shaft) / RS-33 (Blind Hollow Shaft) PROFIBUS-DP

#### Interface Characteristics PROFIBUS-DP:

|  |   |
|--|---|
| Singleturn resolution (max, scalable): | 1-65536 (16 bits), default scale value is set to 8192 (13 bits)   |
| Code:                                  | Binary  |
| Interface:                             | Specification according to PROFIBUS-DP 2.0 Standard (DIN 19245 part 3)/RS485 driver galvanically isolated |
| Protocol:                              | PROFIBUS Encoder Profile V1.1 Class I and Class II with manufacturer-specific enhancements                |
| Baud rate:                             | Max. 12 Mbits/s   |
| Node address:                          | 1-127 (set by rotary switches)  |
| Termination switchable:                | Set by DIP switches   |

#### SET Control Button (zero or defined value, option):

Protected against accidental activation, can only be pushed in with the tip of a ballpoint pen or similar.

#### Diagnostic LED (yellow):

LED on with:  
Sensor error: PROFIBUS error

#### PROFIBUS Encoder-Profile V1.1

The PROFIBUS-DP device profile describes the functionality of the communication and the user-specific component within the PROFIBUS fieldbus system. For encoders, the encoder profile is definitive. Here the individual objects are defined independent of the manufacturer. Furthermore, the profiles offer space for additional manufacturer-specific functions; this means that PROFIBUS-compliant device systems may be used with the guarantee that they are ready for the future.

#### The following parameters can be programmed:

- Direction of rotation
- Scaling (number of steps per revolution)
- Preset value
- Diagnostics mode

#### The following functionality is integrated:

- Galvanic isolation of the bus stage with DC/DC converter
- Line driver according to RS485; max. 12 MB
- Address programmable via DIP switches
- Diagnostics LED
- Full Class I and Class II functionality

#### Standard Wiring (Connection RC):

| Signal: | BUS IN |   |              |    | BUS OUT      |    |   |   |
|---------|--------|---|--------------|----|--------------|----|---|---|
|         | B      | A | Common (0 V) | +V | Common (0 V) | +V | B | A |
| Pin:    | 1      | 2 | 3            | 4  | 5            | 6  | 7 | 8 |

#### Standard Wiring (Connection R3M12):

| Bus In | Signal: | - | BUS-A | - | BUS-B | Shield |
|--------|---------|---|-------|---|-------|--------|
|        | Pin:    | 1 | 2     | 3 | 4     | 5      |

| Power Supply | Signal: | +V | - | Common (0 V) | - |
|--------------|---------|----|---|--------------|---|
|              | Pin:    | 1  | 2 | 3            | 4 |

| Bus Out | Signal: | BUS-VDC <sup>1)</sup> | BUS-A | BUS_GND <sup>1)</sup> | BUS-B | Shield |
|---------|---------|-----------------------|-------|-----------------------|-------|--------|
|         | Pin:    | 1                     | 2     | 3                     | 4     | 5      |

#### Wiring Diagrams:

| Bus In  | Power Supply                               | Bus Out   |
|---|--|---|
| Male Encoder View   | Male Encoder View                          | Female Encoder View   |
|   |  |   |
| M12 Eurofast Pinout   | M12 Eurofast Pinout                        | M12 Eurofast Pinout   |
| Mating Cordset: <sup>2)3)</sup><br>RKS <sup>W</sup> -590-*M | Mating Cordset: <sup>2)</sup><br>RK 4.4T-* | Mating Cordset: <sup>2)3)</sup><br>RSS <sup>W</sup> -590-*M |

<sup>1)</sup> For powering an external PROFIBUS-DP terminating resistor.  
<sup>2)</sup> See Connectivity section H for corresponding cable color code.  
<sup>3)</sup> "S" denotes shield tied to coupling nut.  
 \* Length in meters. Available in 0.1 meter increments ≥ 0.2 meters.

# Rotary Position Technology

## Absolute Encoders, Singleturn

### Absolute, Singleturn Type RS-25 (Shaft) / RS-33 (Blind Hollow Shaft)

PROFIBUS-DP

#### Part Number Key: RS-25 Shaft Version

| A      | B | C |   | D     |   | E     |   | F   |
|--------|---|---|---|-------|---|-------|---|-----|
| RS-25S | 6 | C | - | 9A16B | - | R3M12 | / | N46 |

| A      | Type                            |
|--------|---------------------------------|
| RS-25S | Ø 58 mm, Shaft, IP67 Shaft Seal |
| RS-25T | Ø 58 mm, Shaft, IP65 Shaft Seal |

| B  | Shaft (Ø x L)   |
|----|-----------------|
| 6  | Ø 6 mm x 10 mm  |
| 10 | Ø 10 mm x 20 mm |
| A0 | Ø 1/4" x 7/8"   |
| A1 | Ø 3/8" x 7/8"   |

| C | Flange                  |
|---|-------------------------|
| C | Ø 58 mm Clamping Flange |
| S | Ø 58 mm Servo Flange    |
| R | 2.5" Square Flange      |

| D     | Power Supply and Output Type                    |
|-------|---|
| 9A16B | 10-30 VDC, PROFIBUS-DP V0 Encoder Profile V 1.1 |

| E     | Type of Connection                                       |
|-------|--|
| R3M12 | Radial 3 x M12 Eurofast Connectors w/ Bus Terminal Cover |
| RC    | Radial Cable Gland w/ Bus Terminal Cover                 |

| F       | Options    |
|---------|------------|
| (BLANK) | No Options |
| N46     | SET        |

#### Part Number Key: RS-33 Blind Hollow Shaft Version

| A      | B  | C |   | D     |   | E     |   | F   |
|--------|----|---|---|-------|---|-------|---|-----|
| RS-33B | 10 | E | - | 9A16B | - | R3M12 | / | N46 |

| A      | Type   |
|--------|--|
| RS-33B | Ø 58 mm, Blind Hollow Shaft, IP67 Shaft Seal |
| RS-33C | Ø 58 mm, Blind Hollow Shaft, IP65 Shaft Seal |

| B  | Bore (30 mm Insertion Depth) |
|----|------------------------------|
| 10 | Ø 10 mm                      |
| 12 | Ø 12 mm                      |
| 14 | Ø 14 mm                      |
| 15 | Ø 15 mm                      |
| A1 | Ø 3/8"                       |
| A3 | Ø 1/2"                       |

| C  | Flange                               |
|----|--------------------------------------|
| E  | Flange w/ Ø 63 mm Slotted Flex Mount |
| E1 | Flange w/ Ø 65 mm Flex Mount         |
| T  | Flange w/ Torque Stop                |

| D     | Power Supply and Output Type                    |
|-------|---|
| 9A16B | 10-30 VDC, PROFIBUS-DP V0 Encoder Profile V 1.1 |

| E     | Type of Connection                                       |
|-------|--|
| R3M12 | Radial 3 x M12 Eurofast Connectors w/ Bus Terminal Cover |
| RC    | Radial Cable Gland w/ Bus Terminal Cover                 |

| F       | Options    |
|---------|------------|
| (BLANK) | No Options |
| N46     | SET        |

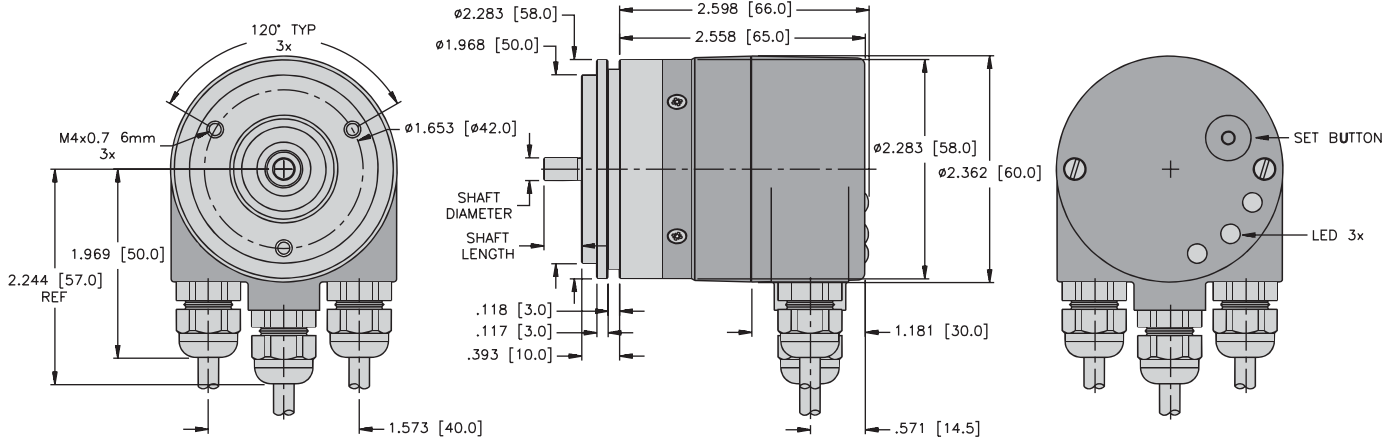
#### Accessories:

- See page H1, Connectivity, for cables and connectors
- See page G1, Accessories, for mounting attachments and couplings

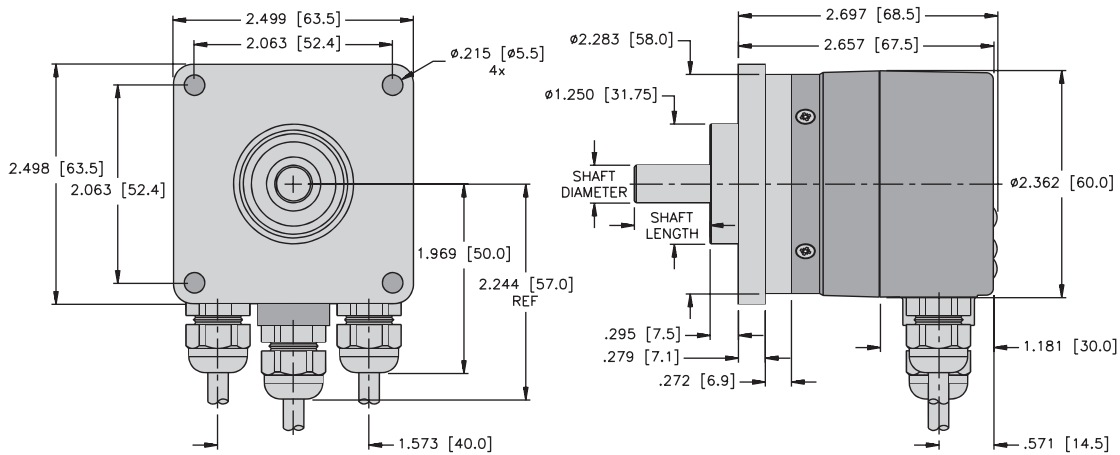
**Absolute, Singleturn T type RS-25 (Shaft) / RS-33 (Blind Hollow Shaft) PROFIBUS-DP**

**Dimensions: RS-25 Shaft Version**

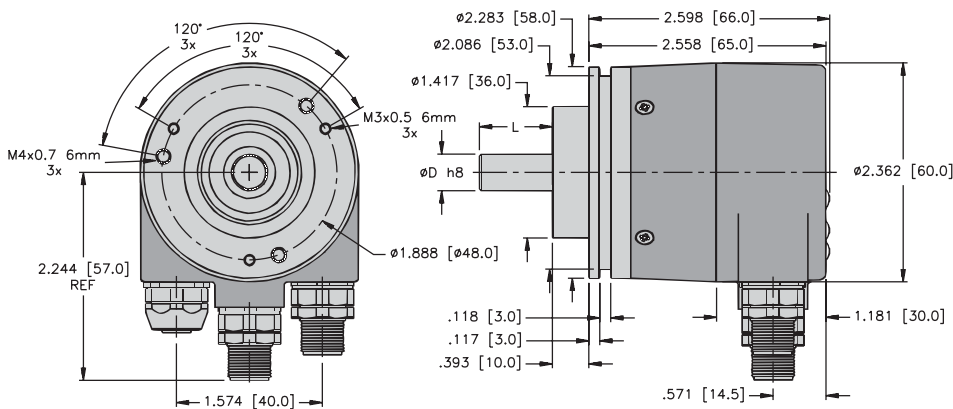
**RS-25 Flange S  
 Connection RC**



**RS-25 Flange R  
 Connection RC**



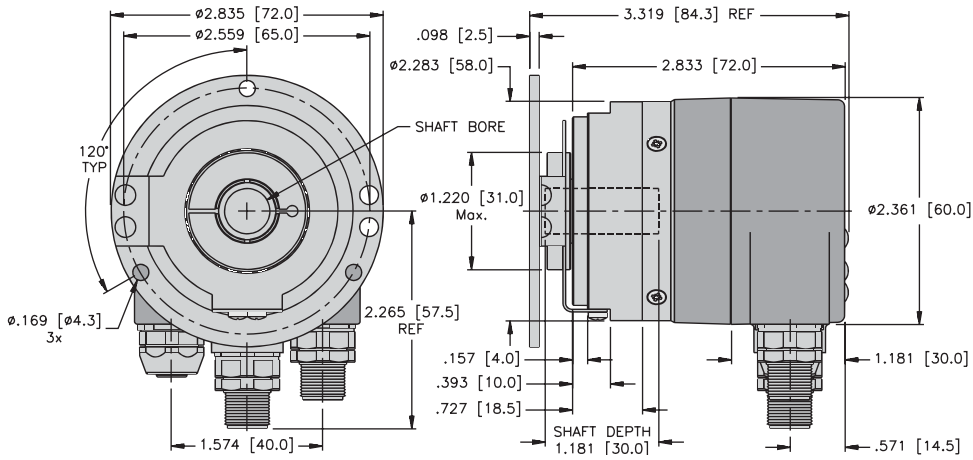
**RS-25 Flange C  
 Connection R3M12**



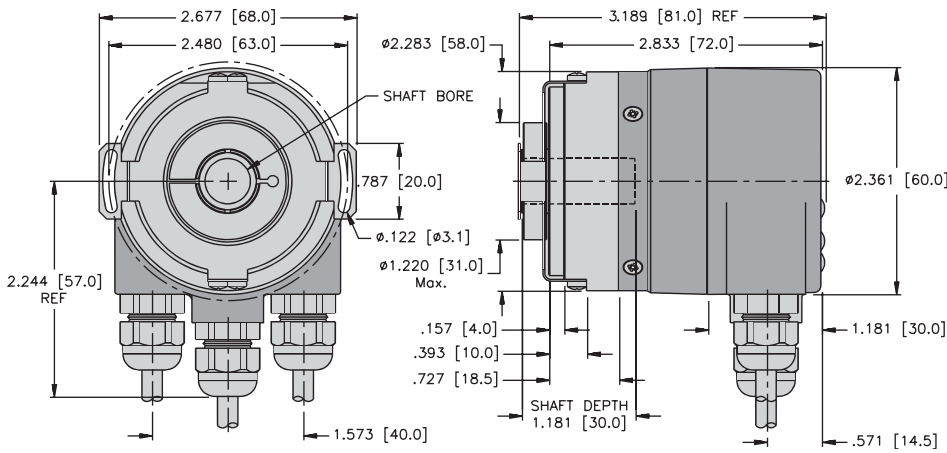
Absolute Encoders

**Dimensions: RS-33 Blind Hollow Shaft Version**

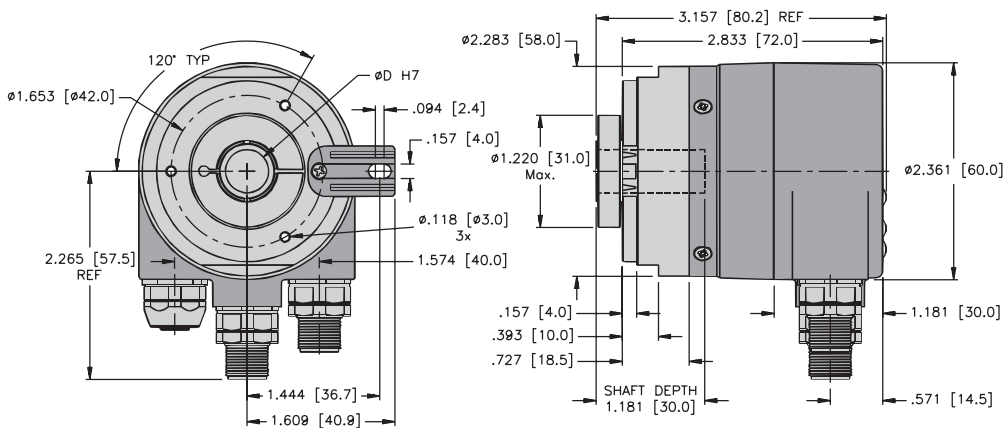
**RS-33 Flange E1  
Connection R3M12**



**RS-33 Flange E  
Connection RC**

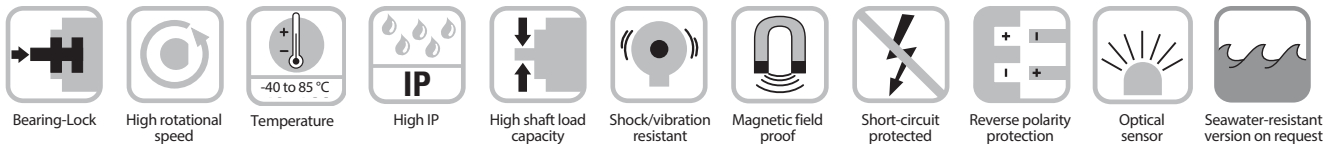


**RS-33 Flange T  
Connection R3M12**



### Absolute, Singleturn Type RS-25 (Shaft) / RS-33 (Blind Hollow Shaft)

### PROFINET IO



#### Reliable

- Ideally suited for all PROFINET applications thanks to the use of encoder profile 4.1.
- Perfect for use in harsh outdoor environments, as a result of IP67 protection and rugged housing construction.



#### Absolute



#### Fast

- Fast, simple, error-free connection.

#### Versatile

- IRT-Mode.
- Cycle time  $\leq 1$  ms.
- Firmware updater allows for easy expansion of characteristics without having to disassemble the encoder.
- M12 connector ensures fast, simple, error-free connection.

#### Mechanical Characteristics:

|   |  |
|---|--|
| Max. speed without shaft sealing (IP65) up to 158 °F (70 °C): | 9,000 RPM, continuous 7,000 RPM  |
| Max. speed without shaft sealing (IP65) up to Tmax:           | 7,000 RPM, continuous 4,000 RPM  |
| Max. speed with shaft sealing (IP67) up to 158 °F (70 °C):    | 8,000 RPM, continuous 6,000 RPM  |
| Max. speed with shaft sealing (IP67) up to Tmax:              | 6,000 RPM, continuous 3,000 RPM  |
| Starting torque without shaft sealing (IP65):                 | < 1.4 oz-in (< 0.01 Nm)  |
| Starting torque with shaft sealing (IP67):                    | Shaft version: < 7 oz-in (0.05 Nm)<br>Hollow shaft version: < 4.25 oz-in (< 0.03 Nm)   |
| Moment of inertia:  | Shaft version: 0.16 oz-in <sup>2</sup> (3.0 x 10 <sup>-6</sup> kgm <sup>2</sup> )<br>Hollow shaft version: 0.328 oz-in <sup>2</sup> (6.0 x 10 <sup>-6</sup> kgm <sup>2</sup> ) |
| Radial load capacity of shaft:                                | 18 lbs (80 N)  |
| Axial load capacity of shaft:                                 | 9 lbs (40 N)   |
| Weight:   | approx. 1.10 lbs (0.50 kg) with bus terminal cover   |
| Protection acc. to EN 60 529:                                 | Housing: IP67, Shaft: IP65, opt. IP67  |
| Working temperature:  | -40 to +185 °F (-40 to +85 °C)   |
| Materials:  | Shaft: stainless steel, Flange: aluminum, Housing: die cast zinc   |
| Shock resistance acc. to DIN-IEC 68-2-27:                     | > 250 g (> 2,500 m/s <sup>2</sup> ), 6 ms  |
| Vibration resistance acc. to DIN-IEC 68-2-6:                  | > 10 g (> 100 m/s <sup>2</sup> ), 55-2,000 Hz  |

#### General Electrical Characteristics:

|   |             |
|---|-------------|
| Supply voltage:                                   | 10-30 VDC   |
| Current consumption (without output load):        | Max. 200 mA |
| Reverse polarity protection at power supply (+V): | Yes         |
| RoHS compliant acc. to EU guideline 2011/65/EU    |             |

#### General Information about PROFINET IO

The PROFINET encoder implements the Encoder Profile 4.1. (according to the specification Encoder Version 4.1 Dec 2008).

It permits scaling and preset values, as well as many other additional parameters to be programmed via the PROFINET-Bus.

When switching on, all parameters are loaded from an EEPROM, where they were saved previously to protect them against power-failure, or taken over by the controller in the start-up phase.

Position, speed and many other states of the encoder can be transmitted.

#### PROFINET IO

The complete encoder profile according to Profile Encoder Version 4.1 as well as the Identification & Maintenance functionality Version 1.16 has been implemented. IM blocks 0, 1, 2, 3 and 4 are supported.

The **Media Redundancy Protocol** is implemented here. Basically, the advantage of MRP is that the functionality of the components, which are wired in a ring structure, is maintained in the case of a failure or breakage of the wires in any location.

# Rotary Position Technology

## Absolute Encoders, Singleturn

### Absolute, Singleturn Type RS-25 (Shaft) / RS-33 (Blind Hollow Shaft)

PROFINET IO

#### Device Characteristics:

|  |   |
|--|---|
| Singleturn resolution (max, scalable): | 1-65536 (16 bits), default scale value is set to 8192 (13 bits) |
| Code:                                  | Binary  |
| Protocol:                              | PROFINET IO   |

#### Link 1 and 2, LED (green/yellow):

|         |               |
|---------|---------------|
| Green:  | active        |
| Yellow: | data transfer |

#### Error LED (red) / PWR LED (green):

Functionality (see manual)

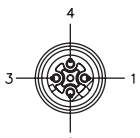
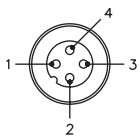
#### Standard Wiring (Bus)(Connection R3M12):

| Direction: | Port 1         |               |                |               | Port 2         |               |                |               |
|------------|----------------|---------------|----------------|---------------|----------------|---------------|----------------|---------------|
| Signal     | Transmit data+ | Receive data+ | Transmit data- | Receive data- | Transmit data+ | Receive data+ | Transmit data- | Receive data- |
| Abbrv.     | TxD+           | RxD+          | TxD-           | RxD-          | TxD+           | RxD+          | TxD-           | RxD-          |
| Pin:       | 1              | 2             | 3              | 4             | 1              | 2             | 3              | 4             |

#### Standard Wiring (Power Supply):

| Signal | +V power supply | N.C. | Common | N.C. |
|--------|-----------------|------|--------|------|
| Abbrv. | +V              | -    | 0V     | -    |
| Pin:   | 1               | 2    | 3      | 4    |

#### Wiring Diagrams:

| Bus   | Power Supply   |
|---|--|
| <b>Female Encoder View</b>  | <b>Male Encoder View</b>   |
|  <p>M12 Eurofast Pinout</p> <p>Mating Cordset:<sup>1)2)</sup><br/>RSSD 420-*</p> |  <p>M12 Eurofast Pinout</p> <p>Mating Cordset:<sup>2)</sup><br/>RK 4.4T-*</p> |

<sup>1)</sup> See Connectivity section H for corresponding cable color code.

<sup>2)</sup> "S" denotes shield tied to coupling nut.

\* Length in meters. Available in 0.1 meter increments  $\geq 0.2$  meters.

### Absolute, Singleturn Type RS-25 (Shaft) / RS-33 (Blind Hollow Shaft) PROFINET IO

#### Part Number Key: RS-25 Shaft Version

| A      | B | C |   | D     |   | E     |
|--------|---|---|---|-------|---|-------|
| RS-25S | 6 | C | - | 9E16B | - | R3M12 |

| A      | Type                            |
|--------|---------------------------------|
| RS-25S | Ø 58 mm, Shaft, IP67 Shaft Seal |
| RS-25T | Ø 58 mm, Shaft, IP65 Shaft Seal |

| B  | Shaft (Ø x L)   |
|----|-----------------|
| 6  | Ø 6 mm x 10 mm  |
| 10 | Ø 10 mm x 20 mm |
| A0 | Ø 1/4" x 7/8"   |
| A1 | Ø 3/8" x 7/8"   |

| C | Flange                  |
|---|-------------------------|
| C | Ø 58 mm Clamping Flange |
| S | Ø 58 mm Servo Flange    |
| R | 2.5" Square Flange      |

| D     | Power Supply and Output Type |
|-------|------------------------------|
| 9E16B | 10-30 VDC, PROFINET IO       |

| E     | Type of Connection                                       |
|-------|--|
| R3M12 | Radial 3 x M12 Eurofast Connectors w/ Bus Terminal Cover |

#### Part Number Key: RS-33 Blind Hollow Shaft Version

| A      | B  | C |   | D     |   | E     |
|--------|----|---|---|-------|---|-------|
| RS-33B | 10 | E | - | 9E16B | - | R3M12 |

| A      | Type   |
|--------|--|
| RS-33B | Ø 58 mm, Blind Hollow Shaft, IP67 Shaft Seal |
| RS-33C | Ø 58 mm, Blind Hollow Shaft, IP65 Shaft Seal |

| B  | Bore (30 mm Insertion Depth) |
|----|------------------------------|
| 10 | Ø 10 mm                      |
| 12 | Ø 12 mm                      |
| 14 | Ø 14 mm                      |
| 15 | Ø 15 mm                      |
| A1 | Ø 3/8"                       |
| A3 | Ø 1/2"                       |

| C  | Flange                               |
|----|--------------------------------------|
| E  | Flange w/ Ø 63 mm Slotted Flex Mount |
| E1 | Flange w/ Ø 65 mm Flex Mount         |
| T  | Flange w/ Torque Stop                |

| D     | Power Supply and Output Type |
|-------|------------------------------|
| 9E16B | 10-30 VDC, PROFINET IO       |

| E     | Type of Connection                                       |
|-------|--|
| R3M12 | Radial 3 x M12 Eurofast Connectors w/ Bus Terminal Cover |

#### Accessories:

- See page H1, Connectivity, for cables and connectors
- See page G1, Accessories, for mounting attachments and couplings



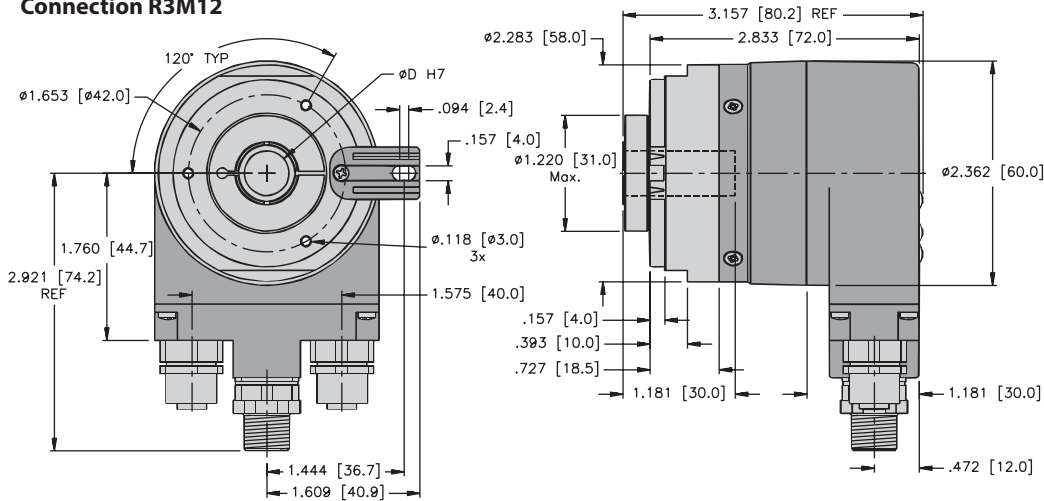


**Absolute, Singleturn Type RS-25 (Shaft) / RS-33 (Blind Hollow Shaft)**

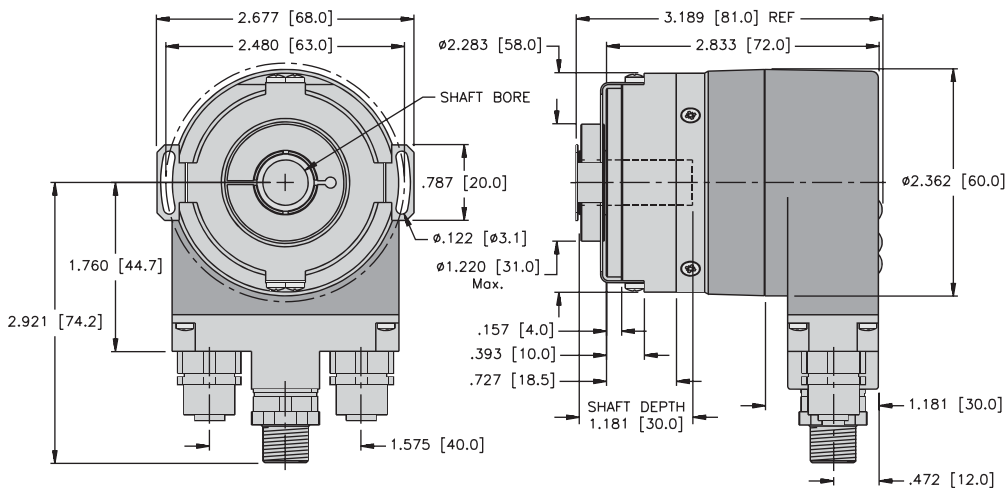
**PROFINET IO**

**Dimensions: RS-33 Blind Hollow Shaft Version**

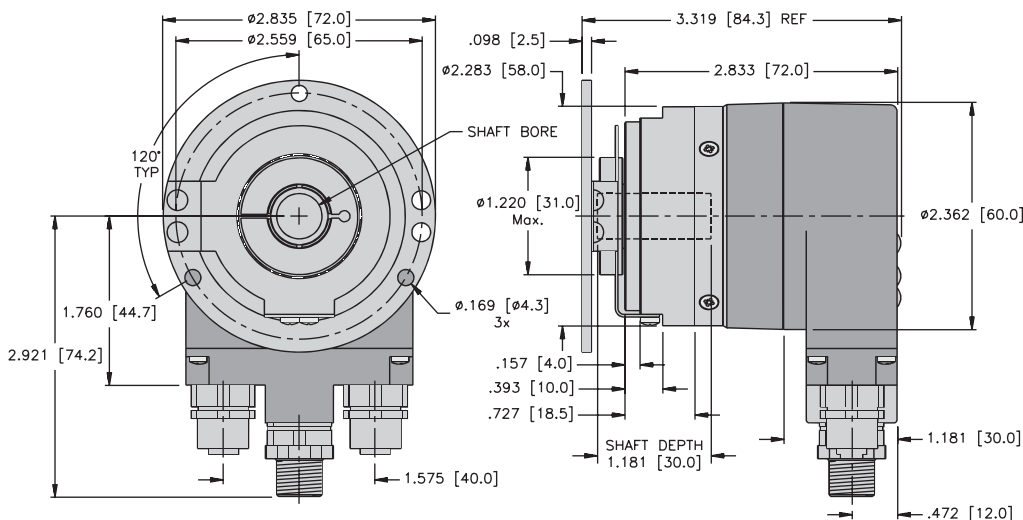
**RS-33 Flange T  
 Connection R3M12**



**RS-33 Flange E  
 Connection R3M12**



**RS-33 Flange E1  
 Connection R3M12**



# Rotary Position Technology

## Absolute Encoders, Singleturn

Absolute, Singleturn Type RS-107 (Shaft) / RS-108 (Blind Hollow Shaft)

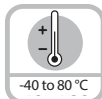
EtherNet/IP



Bearing-Lock



High rotational speed



Temperature



High IP



High shaft load capacity



Shock/vibration resistant



Magnetic field proof



Reverse polarity protection



Optical sensor

### Reliable

- Increased ability to withstand vibration and installation errors. Sturdy Bearing-Lock design structure eliminates machine downtime and repairs.
- Wide temperature range of -40 to +176 °F (-40 to +80 °C).
- Fewer components and connection points increase the operational reliability: Turck OptoASIC technology with highest integration density (Chip-on-board).



### Absolute



EtherNet/IP

### Versatile

- Thanks to the implementation of DLR (Device Level Ring) a single cable break does not lead to a "machine down" state.
- 16 bits total resolution, shafts up to 10 mm, blind hollow shafts up to 15 mm and certified EtherNet/IP functionality.
- The optical absolute singleturn EtherNet/IP encoders were designed for time sensitive applications. Their distinctive features help not only with the machine's performance as well as uptime, but also contribute to time and cost savings.

### Fast

- 5x faster position value transfer than the usual market encoder – RPI time of 1 ms
- Fast and easy commissioning, configuration possible through cyclic services
- M12 connector ensures fast, simple, error-free connection

### Mechanical Characteristics:

|  |   |
|--|---|
| Max. speed shaft version (IP65) up to 158 °F (70 °C):              | 8,000 RPM, continuous 6000 RPM  |
| Max. speed shaft version (IP65) up to Tmax:                        | 6,000 RPM, continuous 4000 RPM  |
| Max. speed blind hollow shaft version (IP65) up to 158 °F (70 °C): | 6,000 RPM, continuous 4000 RPM  |
| Max. speed blind hollow shaft version (IP65) up to Tmax:           | 4,000 RPM, continuous 3,000 RPM   |
| Starting torque at 68 °F (20 °C):                                  | 1.4 oz-in (< 0.01 Nm)   |
| Moment of inertia:   | Shaft version: 0.16 oz-in <sup>2</sup><br>(3.0 x 10 <sup>-6</sup> kgm <sup>2</sup> )<br>Hollow shaft version: 0.32 oz-in <sup>2</sup><br>(6.0 x 10 <sup>-6</sup> kgm <sup>2</sup> ) |
| Radial load capacity of shaft:                                     | 18 lbs (80 N)   |
| Axial load capacity of shaft:                                      | 9 lbs (40 N)  |
| Weight:  | approx. 1.0 lbs (0.45 kg)   |
| Protection acc. to EN 60 529:                                      | IP65  |
| Working temperature:   | -40 to +176 °F (-40 to +80 °C)  |
| Materials:   | Shaft: stainless steel,<br>Flange: aluminum,<br>Housing: aluminum   |
| Shock resistance acc. to EN 60068-2-27:                            | > 250 g (> 2,500 m/s <sup>2</sup> ), 6 ms   |
| Vibration resistance acc. to EN 60068-2-26:                        | > 10 g (> 100 m/s <sup>2</sup> ), 55-2,000 Hz   |

### General Information about EtherNetIP

EtherNet/IP conformance tested acc. to version CT-12 of Dec. 11, 2014  
EtherNet/IP specification Vol 2, Ed 1.17  
CIP specification Vol 1, Ed 3.16.

### Applications

Industrial Ethernet is increasingly imposing itself as the new communication standard in automation technology. The goal is to create a vertical integration – that is to say: only one core computer, from the control level up to the industrial production plants – that will be able to control any devices.

The Turck EtherNet/IP encoders demonstrate their abilities in the following application examples: automotive production, logistics, metal-working, textile, printing and packaging machines.

### Absolute, Singleturn Type RS-107 (Shaft) / RS-108 (Blind Hollow Shaft) EtherNet/IP

#### General Electrical Characteristics:

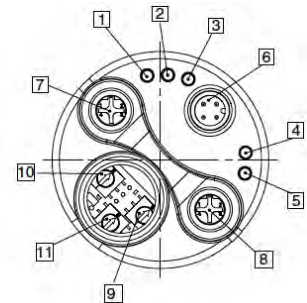
|   |   |
|---|---|
| Supply voltage:                                   | 10-30 VDC   |
| Current consumption (without output load):        | Max. 250 mA   |
| Reverse polarity protection at power supply (+V): | Yes   |
| CE compliant acc. to:                             | EMC guideline 2014/30/EU<br>RoHS guideline 2011/65/EU |

#### Device Characteristics:

|                       |                                       |
|-----------------------|---------------------------------------|
| Singleturn resolution | 1-65536 (16 bit), (scalable: 1-65536) |
| Default value:        | 65536 (16 bit)                        |
| Code:                 | Binary                                |
| Interface:            | EtherNet/IP                           |

#### Rear side connection and display elements

- 1 LED: Link 1
- 2 LED: Mod.
- 3 LED: Net.
- 4 LED: Encoder
- 5 LED: Link 2
- 6 Power
- 7 Part 1
- 8 Part 2
- 9 Switch: x1
- 10 Switch: x100
- 11 Switch: x10



#### The following functionalities are integrated:

##### Adjustable parameters

- Preset
- Count direction
- Resolution
- Unity of speed
- IP address
- Number of revolutions
- Position
- Diagnosis
- Position limit
- Warning messages

##### Objects (CIP Objects)

- Identity Object
- Message Router
- Assembly Object
- Connection Manager
- Parameter Object
- Position Sensor Object
- Qos Object
- Port Object
- TCP / IP Interface Object
- EtherNet Link Object

##### EtherNet/IP features

- DLR (Device Level Ring) possible
- Qos (Quality of Service) possible
- ACD (Address Conflict Detection)
- Multicast and unicast capability

#### Standard Wiring (Bus): (M12 Eurofast® Connector, D-Coded)

| Direction:   | Port 1         |               |                |               | Port 2         |               |                |               |
|--------------|----------------|---------------|----------------|---------------|----------------|---------------|----------------|---------------|
|              | Transmit data+ | Receive data+ | Transmit data- | Receive data- | Transmit data+ | Receive data+ | Transmit data- | Receive data- |
| Abbrv:       | TxD+           | RxD+          | TxD-           | RxD-          | TxD+           | RxD+          | TxD-           | RxD-          |
| M12 Eurofast | 1              | 2             | 3              | 4             | 1              | 2             | 3              | 4             |

#### Standard Wiring (Power Supply): M12 Eurofast Connector

| Signal:      | Power Supply | N/C | Common | N/C |
|--------------|--------------|-----|--------|-----|
| Abbrv:       | +V           | -   | 0 V    | -   |
| M12 Eurofast | 1            | 2   | 3      | 4   |

#### Wiring Diagrams:

| Bus                           | Power Supply                 |
|-------------------------------|------------------------------|
| Female Encoder View           | Male Encoder View            |
| <p>M12 Eurofast Pinout</p>    | <p>M12 Eurofast Pinout</p>   |
| Mating Cordset:<br>RSSD 441-* | Mating Cordset:<br>RK 4.4T-* |

# Rotary Position Technology

## Absolute Encoders, Singleturn

### Absolute, Singleturn Type RS-107 (Shaft) / RS-108 (Blind Hollow Shaft)

EtherNet/IP

#### Part Number Key: RS-107 Shaft Version

| A       | B | C |   | D     |   | E     |
|---------|---|---|---|-------|---|-------|
| RS-107T | 6 | C | - | 9N16B | - | B3M12 |

| A       | Type                            |
|---------|---------------------------------|
| RS-107T | Ø 58 mm, Shaft, IP65 Shaft Seal |

| B  | Shaft (Ø x L)   |
|----|-----------------|
| 6  | Ø 6 mm x 10 mm  |
| 10 | Ø 10 mm x 20 mm |
| A0 | Ø 1/4" x 7/8"   |
| A1 | Ø 3/8" x 7/8"   |

| C | Flange                  |
|---|-------------------------|
| C | Ø 58 mm Clamping Flange |
| S | Ø 58 mm Servo Flange    |
| R | 2.5" Square Flange      |

| D     | Voltage Supply and Output Type |
|-------|--------------------------------|
| 9N16B | 10-30 VDC, EtherNet/IP w/DLR   |

| E     | Type of Connection                |
|-------|-----------------------------------|
| B3M12 | Axial 3 x M12 Eurofast Connectors |

#### Part Number Key: RS-108 Blind Hollow Shaft Version

| A       | B  | C |   | D     |   | E     |
|---------|----|---|---|-------|---|-------|
| RS-108C | 10 | T | - | 9N16B | - | B3M12 |

| A       | Type   |
|---------|--|
| RS-108C | Ø 58 mm, Blind Hollow Shaft, IP65 Shaft Seal |

| B  | Bore (30 mm Insertion Depth) |
|----|------------------------------|
| 10 | Ø 10 mm                      |
| 12 | Ø 12 mm                      |
| 14 | Ø 14 mm                      |
| 15 | Ø 15 mm                      |
| A1 | Ø 3/8"                       |
| A3 | Ø 1/2"                       |

| C  | Flange                               |
|----|--------------------------------------|
| E  | Ø 63 mm Flange w/ Slotted Flex Mount |
| E1 | Ø 65 mm Flange w/ Flex Mount         |
| T  | Flange w/ Torque Stop                |

| D     | Voltage Supply and Output Type |
|-------|--------------------------------|
| 9N16B | 10-30 VDC, EtherNet/IP w/DLR   |

| E     | Type of Connection                |
|-------|-----------------------------------|
| B3M12 | Axial 3 x M12 Eurofast Connectors |

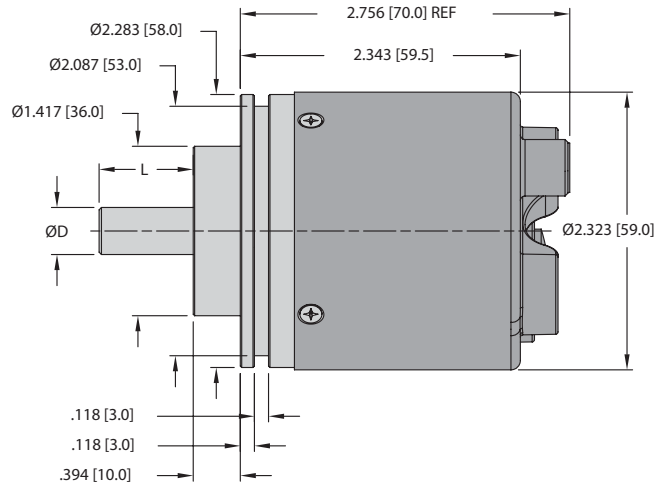
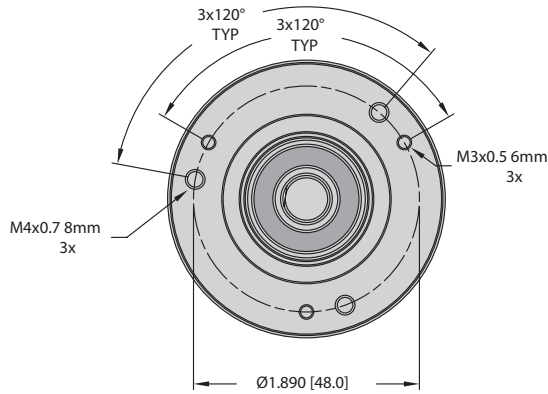
#### Accessories:

- See page H1, Connectivity, for cables and connectors
- See page G1, Accessories, for mounting attachments and couplings

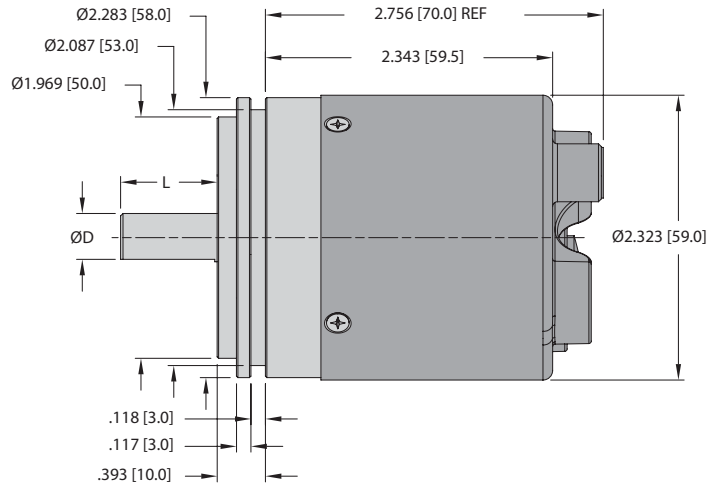
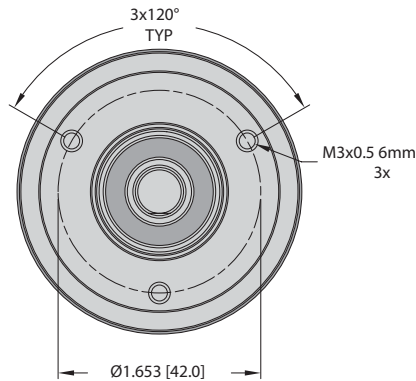
**Absolute, Singleturn Type RS-107 (Shaft) / RS-108 (Blind Hollow Shaft) EtherNet/IP**

Dimensions: RS-107 Shaft Version

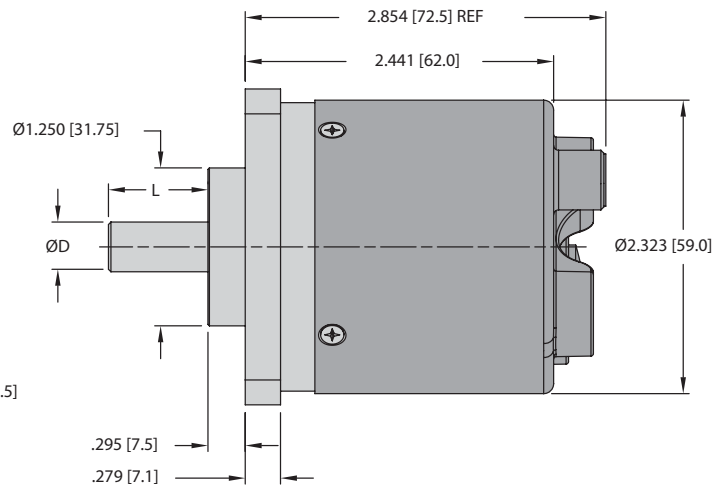
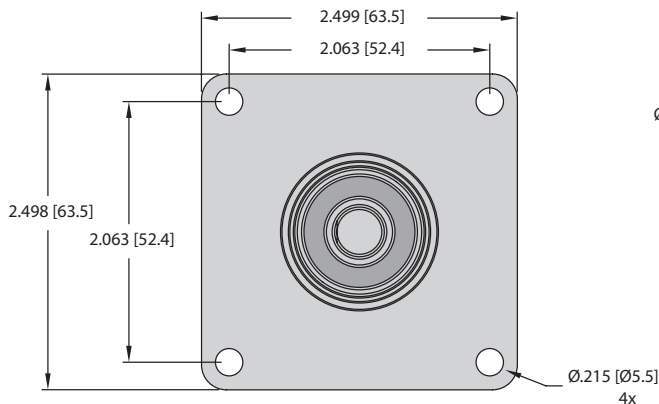
**RS-107 Flange C  
 Connection B3M12**



**RS-107 Flange S  
 Connection B3M12**



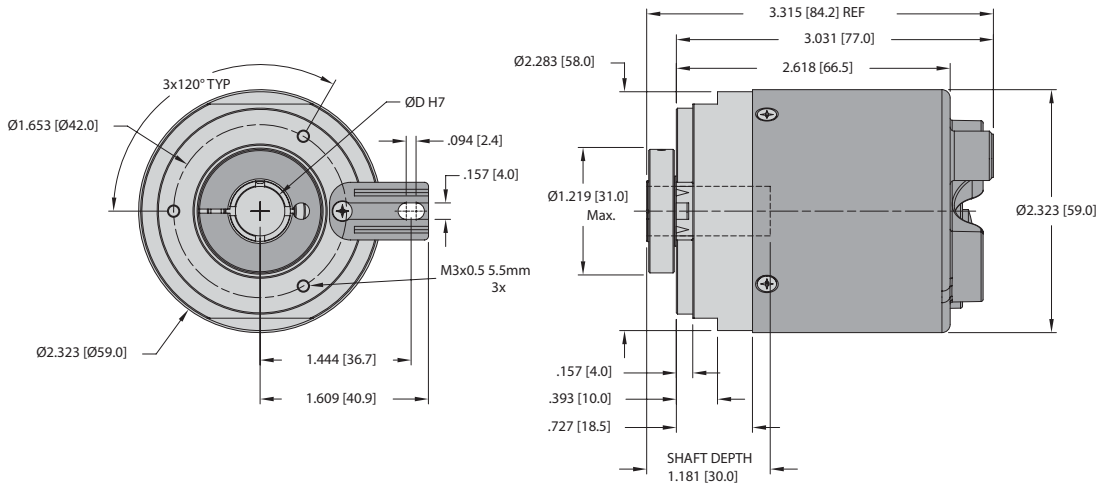
**RS-107 Flange R  
 Connection B3M12**



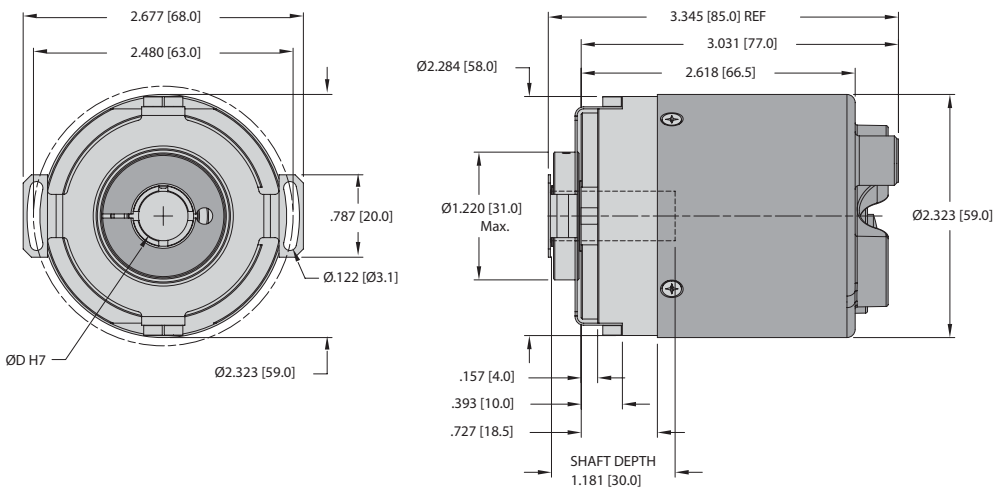
Absolute Encoders

**Dimensions: RS-108 Blind Hollow Shaft Version**

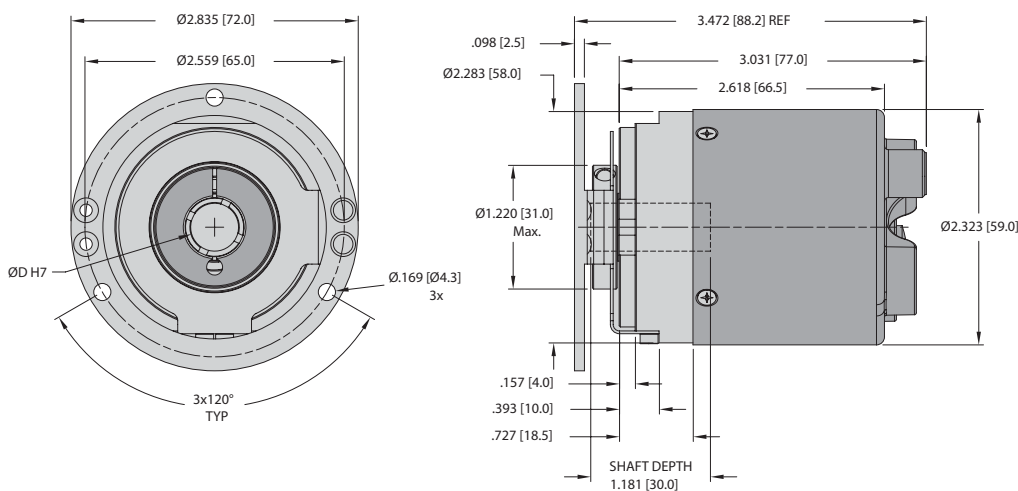
**RS-108 Flange T  
Connection B3M12**



**RS-108 Flange E  
Connection B3M12**

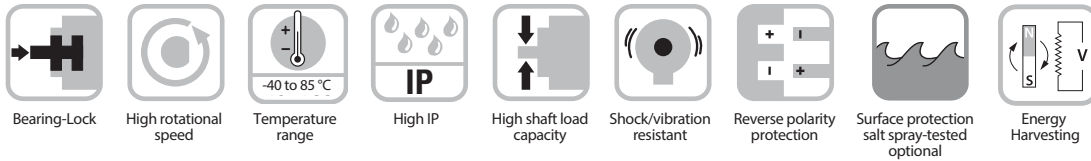


**RS-108 Flange E1  
Connection B3M12**



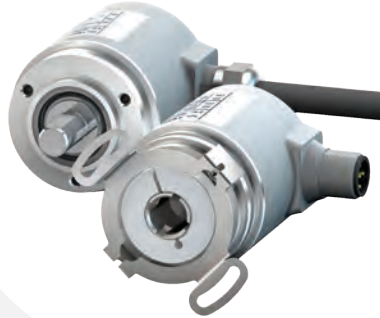
### Absolute, Multiturn Type RM-97 (Shaft) / RM-98 (Blind Hollow Shaft)

Analog



#### Reliable

- Sturdy bearing construction in Bearing-Lock design for resistance against vibration and installation errors.
- Without gear and without battery, thanks to the Energy Harvesting technology.



#### Absolute



#### Application Oriented

- Current output 4 - 20 mA.
- Voltage output 0 - 10 V or 0 - 5 V.
- Measuring range scalable.
- Limit switch function.

#### Insensitive

- Reduced number of components ensures magnetic insensitivity.
- IP67 protection and wide temperature range -40 to +85 °C.

#### Mechanical Characteristics:

##### Max. speed:

|                                      |                       |
|--------------------------------------|-----------------------|
| Shaft or blind hollow shaft version: | 6000 RPM              |
| Without shaft seal (IP65):           | 3000 RPM (continuous) |
| Shaft or blind hollow shaft version: | 4000 RPM              |
| With shaft seal (IP67):              | 2000 RPM (continuous) |

##### Starting torque (68 °F | 20 °C):

|                            |                            |
|----------------------------|----------------------------|
| Without shaft seal (IP65): | < 1.0 oz - in (< 0.007 Nm) |
| With shaft seal (IP67):    | < 1.4 oz - in (< 0.01 Nm)  |

##### Shaft load capacity:

|         |                |
|---------|----------------|
| Radial: | 9.0 lbs (40 N) |
| Axial:  | 4.5 lbs (20 N) |

Weight: approx. 0.44 lbs (0.2 kg)

Protection acc. to EN 60529: IP65 / IP67

Working temperature range: -40 to +185 °F (-40 to +85 °C)

##### Materials:

|                       |                 |
|-----------------------|-----------------|
| Shaft / Hollow shaft: | stainless steel |
| Flange:               | aluminium       |
| Housing:              | zinc die-cast   |
| Cable:                | PVC             |

Shock resistance acc. to EN 60068-2-27: 250g (2500 m/s<sup>2</sup>), 6 ms

Vibration resistance acc. to EN 60060-2-6: 30g (300 m/s<sup>2</sup>), 10 - 2000 Hz

# Rotary Position Technology

## Absolute Encoders, Multiturn

### Absolute, Multiturn Type RM-97 (Shaft) / RM-98 (Blind Hollow Shaft)

Analog

#### General Electrical Characteristics Interface 4 - 20mA:

|  |   |
|--|---|
| Power supply:  | 10 - 30 VDC   |
| Current consumption (no load):                               | max. 30 mA  |
| Reverse polarity protection at power supply (+V):            | yes   |
| Short-circuit protected outputs:                             | yes <sup>1)</sup>   |
| Measuring range:<br>Factory setting:<br>Optionally scalable: | 2 <sup>4</sup> revolutions<br>up to 2 <sup>16</sup> revolutions             |
| DA converter resolution:                                     | 12 bit  |
| Singleturn accuracy, at 77 °F   25 °C:                       | ±1 °  |
| Temperature coefficient:                                     | < 100 ppm/K   |
| Repeat accuracy at 77 °F   25 °C:                            | ±0.2 °  |
| Output load:   | max. 200 0hm at 10 VDC<br>max. 900 0hm at 24 VDC<br>max. 1200 0hm at 30 VDC |
| Setting time:  | < 1 ms, R <sub>Load</sub> =900 0hm, 77 °F   25 °C                           |

- system status
- current loop interruption—input load too high
- reference point display (only with factory settings)  
at cw: betw. 0 ° and 1 °  
at ccw: betw. 0 ° and -1 °
- status in teach mode

- output signal scalable via the teach inputs
- output signal scalable via the teach inputs + limit switch function

|                                 |  |
|---------------------------------|--|
| Teach inputs:                   | level= +V for 1 s min  |
| PowerON time:                   | < 1 s  |
| Update Rate:                    | 1 ms   |
| e1 compliant acc. to (pending): | EU guideline 2009/19/EC (acc. to EN 55025, ISO 11452 and ISO 7637) |
| UL approval:                    | file 224618  |
| CE compliant acc. to:           | EMC guideline 2014/30/EU<br>RoHS guideline 2011/65/EU              |

#### Measuring Range 'AL' or 'AR':

| Connection Type: | Common (0V) | +V | Output | Set 1 | Set 2 |
|------------------|-------------|----|--------|-------|-------|
| Cable:           | WH          | BN | GN     | N/C   | N/C   |
| M12 pin:         | 3           | 1  | 2      | N/C   | N/C   |

#### Measuring Range 'S\*NS' or 'S\*WL':

| Connection Type: | Common (0V) | +V | Output | Set 1 | Set 2 |
|------------------|-------------|----|--------|-------|-------|
| Cable:           | WH          | BN | GN     | GY    | PK    |
| M12 pin:         | 3           | 1  | 2      | 4     | 5     |

#### General Characteristics Voltage Interface 0 - 10 V / 0 - 5 V:

|  |   |
|--|---|
| Power supply:  | output 0 - 5 V 10 - 30 VDC<br>output 0 - 10 V 15 - 30 VDC       |
| Current consumption (no load):                               | max. 30 mA  |
| Reverse polarity protection at power supply (+V):            | yes   |
| Short-circuit protected outputs:                             | yes <sup>1)</sup>   |
| Measuring range:<br>Factory setting:<br>Optionally scalable: | 2 <sup>4</sup> revolutions<br>up to 2 <sup>16</sup> revolutions |
| DA converter resolution:                                     | 0 - 10 V 12 bit<br>0 - 5 V 11 bit                               |
| Singleturn accuracy, at 77 °F   25 °C:                       | ±1 °  |
| Temperature coefficient:                                     | < 100 ppm/K   |
| Repeat accuracy at 77 °F   25 °C:                            | ±0.2 °  |
| Current output:  | max. 10 mA  |
| Setting time:  | < 1 ms, R <sub>Load</sub> =1000 0hm, 77 °F   25 °C              |

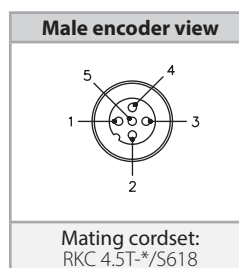
- system status
- reference point display (only with factory settings)  
at cw: betw. 0 ° and 1 °  
at ccw: betw. 0 ° and -1 °
- status in teach mode

- output signal scalable via the teach inputs
- output signal scalable via the teach inputs + limit switch function

|                                 |  |
|---------------------------------|--|
| Teach inputs:                   | level= +V for 1 s min  |
| PowerON time:                   | < 1 s  |
| Update Rate:                    | 1 ms   |
| e1 compliant acc. to (pending): | EU guideline 2009/19/EC (acc. to EN 55025, ISO 11452 and ISO 7637) |
| UL approval:                    | file 224618  |
| CE compliant acc. to:           | EMC guideline 2014/30/EU<br>RoHS guideline 2011/65/EU              |

<sup>1)</sup> = when the power supply is correctly applied.

#### Wiring Diagram:



\* Length in meters.



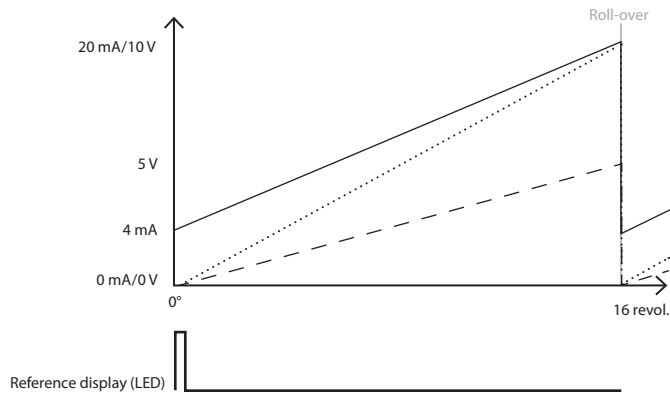
### Absolute, Multiturn Type RM-97 (Shaft) / RM-98 (Blind Hollow Shaft) Analog

**Note:** Encoders must be ordered with a clockwise or counterclockwise profile. This determines whether the analog output increases or decreases in the given direction.

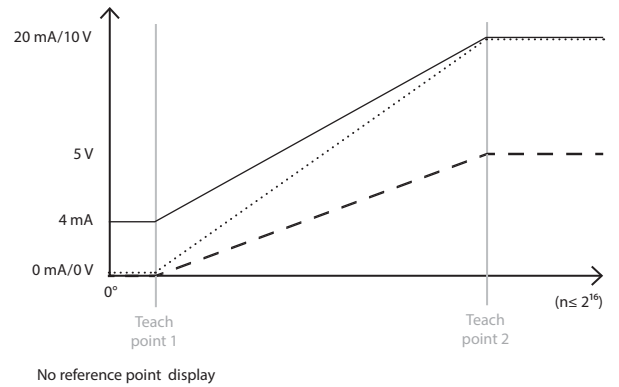
**Example (output signal profile):**

- version 4 - 20 mA
- ⋯ version 0 - 10 V
- - - version 0 - 5 V

**Clockwise (CW) version**



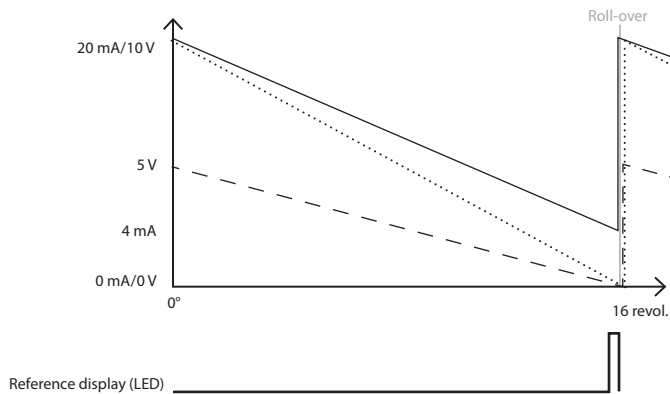
**Scalable version without limit switch function**



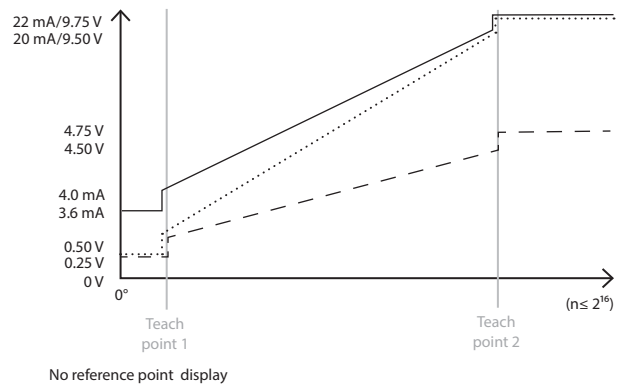
**Example (output signal profile):**

- version 4...20 mA
- ⋯ version 0...10 V
- - - version 0...5 V

**Counter Clockwise (CCW) version**



**Scalable version with limit switch function**



**Note:** Factory-set measuring range: 2<sup>4</sup> revolutions with roll-over

**Note: Limit switch function:**

|                    |          |         |           |
|--------------------|----------|---------|-----------|
| version:           | 0 - 10 V | 0 - 5 V | 4 - 20 mA |
| limit switch low:  | 0.25 V   | 0.25 V  | 3.60 mA   |
| limit switch high: | 9.75 V   | 4.75 V  | 22.00 mA  |

# Rotary Position Technology

## Absolute Encoders, Multiturn

### Absolute, Multiturn Type RM-97 (Shaft) / RM-98 (Blind Hollow Shaft)

Analog

#### Part Number Key: RS-97 Shaft Version

| A      | B | C |   | D  | E  |   | F     |
|--------|---|---|---|----|----|---|-------|
| RM-97S | 6 | C | - | 7A | AL | - | H1151 |

| A      | Type                                   |
|--------|--|
| RM-97S | Ø 39 mm, Shaft w/Flat, IP67 Shaft Seal |
| RM-97T | Ø 39 mm, Shaft w/Flat, IP65 Shaft Seal |

| B  | Shaft (Ø × L)    |
|----|------------------|
| 6  | Ø 6 mm × 12.5 mm |
| 8  | Ø 8 mm × 15 mm   |
| 10 | Ø 10 mm × 20 mm  |
| A0 | Ø 1/4" × 1/2"    |

| C | Flange                  |
|---|-------------------------|
| C | Ø 36 mm Clamping Flange |
| S | Ø 36 mm Servo Flange    |

| D  | Voltage Supply and Output Type |
|----|--------------------------------|
| 7A | 10 - 30 VDC, 4 - 20 mA         |
| 8B | 15 - 30 VDC, 0 - 10 V          |
| BA | 10 - 30 VDC, 0 - 5 V           |

| E     | Measuring Range                                  |
|-------|--|
| AL    | 16 Turns, Count Direction CCW*                   |
| AR    | 16 Turns, Count Direction CW*                    |
| SALNS | Scalable to 65,536 Turns, CCW*, w/o Limit Switch |
| SALWL | Scalable to 65,536 Turns, CCW*, w/ Limit Switch  |
| SARNS | Scalable to 65,536 Turns, CW*, w/o Limit Switch  |
| SARWL | Scalable to 65,536 Turns, CW*, w/ Limit Switch   |

\* = increasing code values when shaft turning in direction listed. Top view on shaft.

| F     | Type of Connection                  |
|-------|-------------------------------------|
| H1151 | Radial 5-pin M12 Eurofast Connector |
| H1451 | Axial 5-pin M12 Eurofast Connector  |
| C1M   | Radial Cable (1m PVC)               |
| CA1M  | Axial Cable (1m PVC)                |

#### Part Number Key: RM-98 Blind Hollow Shaft Version

| A      | B | C |   | D  | E  |   | F     |
|--------|---|---|---|----|----|---|-------|
| RM-98B | 6 | E | - | 7A | AL | - | H1151 |

| A      | Type   |
|--------|--|
| RM-98B | Ø 36 mm, Blind Hollow Shaft, IP67 Shaft Seal |
| RM-98C | Ø 36 mm, Blind Hollow Shaft, IP65 Shaft Seal |

| B  | Bore (18.5 mm insertion depth) |
|----|--------------------------------|
| 6  | Ø 6 mm                         |
| 8  | Ø 8 mm                         |
| 10 | Ø 10 mm                        |
| A0 | Ø 1/4" × 1/2"                  |

| C | Flange                               |
|---|--------------------------------------|
| E | Ø 46 mm Flange w/ Slotted Flex Mount |
| T | Flange w/ Long Torque Stop           |

| D  | Voltage Supply and Output Type |
|----|--------------------------------|
| 7A | 10 - 30 VDC, 4 - 20 mA         |
| 8B | 15 - 30 VDC, 0 - 10 V          |
| BA | 10 - 30 VDC, 0 - 5 V           |

| E     | Measuring Range                                  |
|-------|--|
| AL    | 16 Turns, Count Direction CCW*                   |
| AR    | 16 Turns, Count Direction CW*                    |
| SALNS | Scalable to 65,536 Turns, CCW*, w/o Limit Switch |
| SALWL | Scalable to 65,536 Turns, CCW*, w/ Limit Switch  |
| SARNS | Scalable to 65,536 Turns, CW*, w/o Limit Switch  |
| SARWL | Scalable to 65,536 Turns, CW*, w/ Limit Switch   |

\* = increasing code values when shaft turning in direction listed. Top view on shaft.

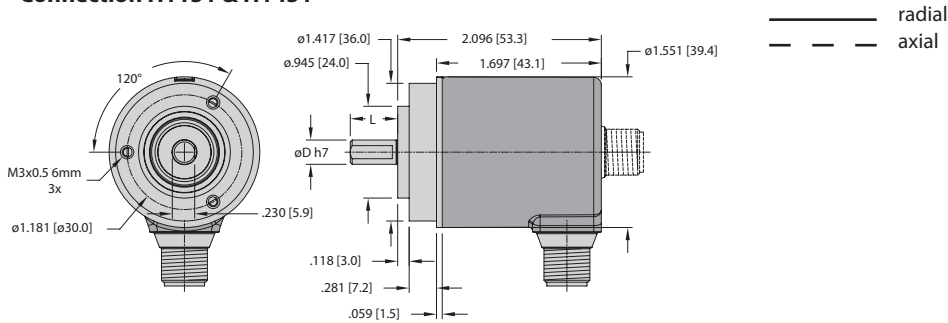
| F     | Type of Connection                  |
|-------|-------------------------------------|
| H1151 | Radial 5-pin M12 Eurofast Connector |
| H1451 | Axial 5-pin M12 Eurofast Connector  |
| C1M   | Radial Cable (1m PVC)               |
| CA1M  | Axial Cable (1m PVC)                |

### Absolute, Multiturn Type RM-97 (Shaft) / RM-98 (Blind Hollow Shaft)

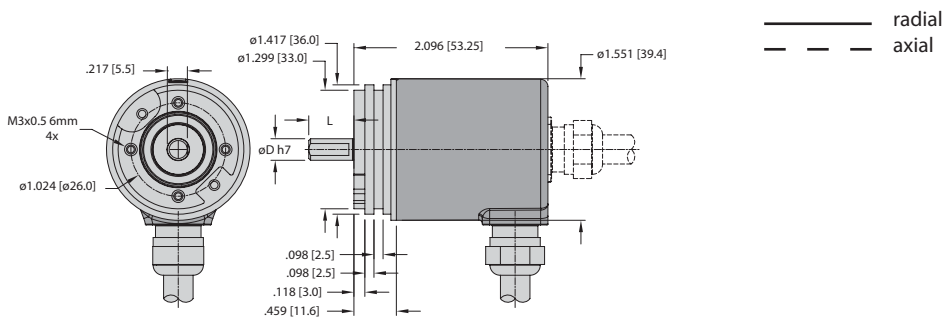
Analog

#### Dimensions: RM-97 Shaft Version

##### RM-97 Flange C Connection H1151 & H1451

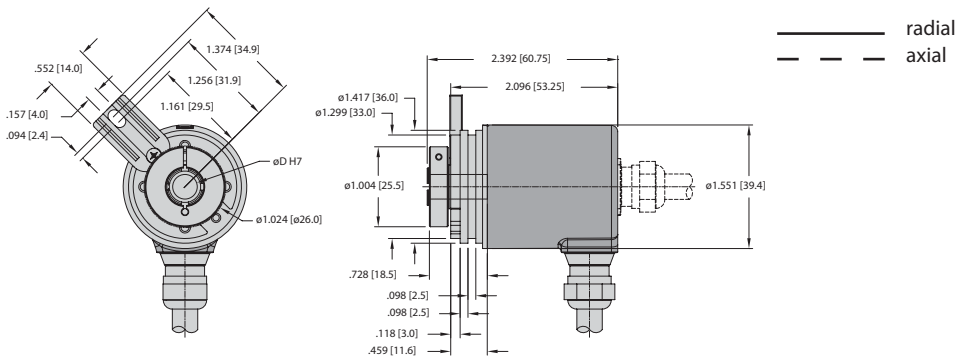


##### RM-97 Flange S Connection C1M & CA1M

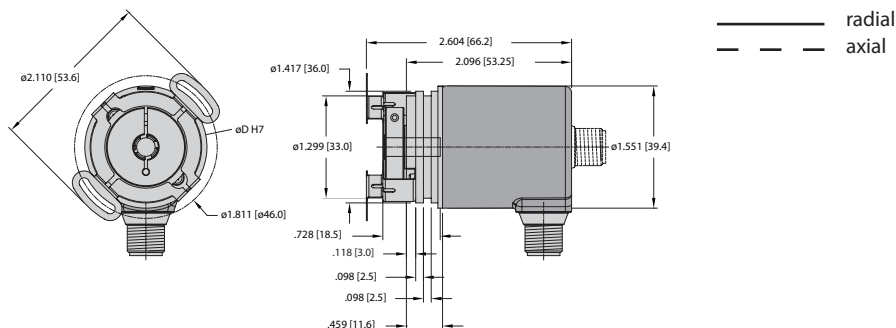


#### Dimensions: RM-98 Blind Hollow Shaft Version

##### RM-98 Flange T Connection C1M & CA1M



##### RM-98 Flange E Connection H1151 & H1451



#### Mounting advice:

The flanges and shafts of the encoder and drive should not be rigidly coupled together at the same time. We recommend the use of suitable couplings (see page G1, Accessories).

# Rotary Position Technology

## Absolute Encoders, Multiturn

### Absolute, Multiturn Type RM-99 (Shaft) / RM-100 (Blind Hollow Shaft)

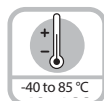
SSI



Bearing-Lock



High rotational speed



Temperature range  
-40 to 85 °C



High IP



High shaft load capacity



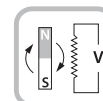
Shock/vibration resistant



Reverse polarity protection



Surface protection salt spray-tested optional



Energy Harvesting

#### Reliable

- Sturdy bearing construction in Bearing-Lock design for resistance against vibration and installation errors.
- Without gear and without battery, thanks to the Energy Harvesting technology



#### Absolute



#### Application Oriented

- Absolute accuracy  $\pm 1^\circ$ .
- Repeat accuracy  $\pm 0.2^\circ$ .
- Short control cycles, clock frequency with SSI up to 2 MHz.
- Max. resolution 38 bit (14 bit ST + 24 bit MT).

#### Insensitive

- Reduced number of components ensures magnetic insensitivity.
- IP67 protection and wide temperature range  $-40^\circ\text{C}$  to  $+85^\circ\text{C}$ .

#### Mechanical Characteristics:

##### Max. speed:

|                                      |                       |
|--------------------------------------|-----------------------|
| Shaft or blind hollow shaft version: | 6000 RPM              |
| Without shaft seal (IP65):           | 3000 RPM (continuous) |
| Shaft or blind hollow shaft version: | 4000 RPM              |
| With shaft seal (IP 67):             | 2000 RPM (continuous) |

##### Starting torque (68 °F | 20 °C):

|                            |                          |
|----------------------------|--------------------------|
| Without shaft seal (IP65): | < 1.0 oz - in (0.007 Nm) |
| With shaft seal (IP67):    | < 1.4 oz - in (0.01 Nm)  |

##### Shaft load capacity:

|         |                |
|---------|----------------|
| Radial: | 9 lbs (40 N)   |
| Axial:  | 4.5 lbs (20 N) |

##### Weight:

approx. 0.44 lbs (0.2 kg)

##### Protection acc. to EN 60529:

IP65/IP67

##### Working temperature:

$-40$  to  $+185^\circ\text{F}$  ( $-40$  to  $+85^\circ\text{C}$ )

##### Materials:

|                       |                 |
|-----------------------|-----------------|
| Shaft / Hollow shaft: | stainless steel |
| Flange:               | aluminum        |
| Housing:              | zinc die-cast   |
| Cable:                | PUR             |

Shock resistance acc. to EN 60068-2-27: 250 g (2,500 m/s<sup>2</sup>), 6 ms

Vibration resistance acc. to EN 60068-2-6: 30 g (300 m/s<sup>2</sup>), 10 - 2,000 Hz

### Absolute, Multiturn Type RM-99 (Shaft) / RM-100 (Blind Hollow Shaft)

SSI

#### General Electrical Characteristics:

|   |  |
|---|--|
| Power supply                                      | 10 - 30 VDC  |
| Current consumption (no load):                    | max. 40 mA,  |
| Reverse polarity protection at power supply (+V): | yes  |
| Short-circuit protected outputs:                  | yes <sup>1)</sup>  |
| e1 compliant acc. to (pending):                   | EU guideline 2009/19/EC (acc. to EN 55025, ISO 11452 and ISO 7637) |
| UL approval:                                      | file 224618  |
| CE compliant acc. to:                             | EMC guideline 2014/30/EU RoHS guideline 2011/65/EU                 |

<sup>1)</sup> = short circuit protection to 0V or to output when power supply correctly applied.

#### Interface Characteristics SSI:

|  |                        |
|--|------------------------|
| Output driver:                                     | RS485 transceiver type |
| Permissible load / channel:                        | max. +/- 30 mA         |
| Signal high:                                       | typ 3.8 V              |
| Signal level low with $I_{Load} = 20 \text{ mA}$ : | typ 1.3 V              |
| Resolution singleturn:                             | 10 - 14 bit            |
| Absolute accuracy <sup>2)</sup> :                  | $\pm 1^\circ$          |
| Repeat accuracy:                                   | $\pm 0.2^\circ$        |
| Number of revolutions (multiturn):                 | max. 24 bit            |
| Code:  | binary or gray         |
| SSI clock rate:                                    | 50 kHz - 2 MHz         |
| Data refresh rate:                                 | 2 ms                   |
| Monoflop time:                                     | $\leq 15 \mu\text{s}$  |

Note: If the clock cycle starts within the monoflop time a second data transfer begins with the same data. If the clock cycle starts after the monoflop time the cycle begins with the new values. The update rate is dependent on the clock speed, data length and monoflop time.

<sup>2)</sup> = over the entire temperature range.

#### SET Input:

|                                   |  |
|-----------------------------------|--|
| Input characteristics:            | active HIGH                              |
| Input type:                       | comparator                               |
| Signal level high:                | min. 60% of +V (supply voltage), max: +V |
| Signal level low:                 | max. 30% of +V (supply voltage)          |
| Input current:                    | < 0.5 mA                                 |
| Min. pulse duration (SET):        | 10 ms                                    |
| Input delay:                      | 1 ms                                     |
| New position data readable after: | 1 ms                                     |
| Internal processing time:         | 200 ms                                   |

The encoder can be set to zero at any position by means of a HIGH signal on the SET input. Other preset values can be factory-programmed. The SET in put has a signal processing time of approx. 1 ms, after which the new position data can be read via SSI or BiSS. Once the SET function has been triggered, the encoder requires an internal processing time of typ. 200 ms; during this time the power supply must not be switched off.

The SET function should be carried out while the encoder is at rest.

If this input is not used, it should be connected to 0 V (Encoder ground GND) in order to avoid interferences.

#### DIR Input:

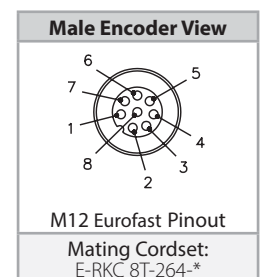
|   |     |
|---|-----|
| Direction input: A HIGH signal switches the direction of rotation from the default cw to ccw. This inverted function can also be factory-programmed. If this input is not used, it should be connected to 0 V (Encoder ground GND) in order to avoid interferences. |     |
| Response time (DIR input)   | 1ms |

#### Power-On Delay:

|  |  |
|--|--|
| After Power-ON the device requires a time of approx. 150 ms before valid data can be read. |  |
| Hot plugging of the encoder should be avoided.   |  |

| Connection Type: | GND (0 V) | V+ | +Clock | -Clock | +Data | - Data | SET | DIR | PE     |
|------------------|-----------|----|--------|--------|-------|--------|-----|-----|--------|
| Cable:           | WH        | BN | GN     | YE     | GY    | PK     | BU  | RD  | Shield |
| M12 pin:         | 1         | 2  | 3      | 4      | 5     | 6      | 7   | 8   | PH     |

#### Wiring Diagrams:



\* Length in meters.

# Rotary Position Technology

## Absolute Encoders, Multiturn

### Absolute, Multiturn Type RM-99 (Shaft) / RM-100 (Blind Hollow Shaft)

SSI

#### Part Number Key: RM-99 Shaft Version

| A      | B | C |   | D  | E1  | E2  |   | F     |
|--------|---|---|---|----|-----|-----|---|-------|
| RM-99S | 6 | C | - | 3C | 10S | 12M | - | H1181 |

| A      | Type                                    |
|--------|---|
| RM-99S | Ø 39 mm, Shaft w/ Flat, IP67 Shaft Seal |
| RM-99T | Ø 39 mm, Shaft w/ Flat, IP65 Shaft Seal |

| B  | Shaft (Ø x L)    |
|----|------------------|
| 6  | Ø 6 mm x 12.5 mm |
| 8  | Ø 8 mm x 15 mm   |
| 10 | Ø 10 mm x 20 mm  |
| A0 | Ø 1/4" x 1/2"    |

| C | Flange                  |
|---|-------------------------|
| C | Ø 36 mm Clamping Flange |
| S | Ø 36 mm Servo Flange    |

| D  | Voltage Supply and Output Type |
|----|--------------------------------|
| 3C | 10 - 30 VDC, SSI (Gray Code)   |
| 5C | 10 - 30 VDC, SSI (Binary Code) |

| E1  | Resolution (singleturn) |
|-----|-------------------------|
| 10S | 10 bit                  |
| 12S | 12 bit                  |
| 13S | 13 bit                  |
| 14S | 14 bit                  |

| E2  | Resolution (multiturn) |
|-----|------------------------|
| 12M | 12 bit                 |
| 16M | 16 bit                 |
| 20M | 20 bit                 |
| 24M | 24 bit                 |

| F     | Type of Connection                  |
|-------|-------------------------------------|
| H1181 | Radial 8-pin M12 Eurofast Connector |
| H1481 | Axial 8-pin M12 Eurofast Connector  |
| C1M   | Radial Cable (1m PUR)               |
| CA1M  | Axial Cable (1m PUR)                |

#### Part Number Key: RM-100 Blind Hollow Shaft Version

| A       | B | C |   | D  | E1  | E2  |   | F     |
|---------|---|---|---|----|-----|-----|---|-------|
| RM-100B | 6 | E | - | 3C | 10S | 12M | - | H1181 |

| A       | Type   |
|---------|--|
| RM-100B | Ø 39 mm, Blind Hollow Shaft, IP67 Shaft Seal |
| RM-100C | Ø 39 mm, Blind Hollow Shaft, IP65 Shaft Seal |

| B  | Bore (18.5 mm insertion depth) |
|----|--------------------------------|
| 6  | Ø 6 mm                         |
| 8  | Ø 8 mm                         |
| 10 | Ø 10 mm                        |
| A0 | Ø 1/4"                         |

| C | Flange                               |
|---|--------------------------------------|
| E | Ø 46 mm Flange w/ Slotted Flex Mount |
| T | Flange w/ Long Torque Stop           |

| D  | Voltage Supply and Output Type |
|----|--------------------------------|
| 3C | 10 - 30 VDC, SSI (Gray Code)   |
| 5C | 10 - 30 VDC, SSI (Binary Code) |

| E1  | Resolution (singleturn) |
|-----|-------------------------|
| 10S | 10 bit                  |
| 12S | 12 bit                  |
| 13S | 13 bit                  |
| 14S | 14 bit                  |

| E2  | Resolution (multiturn) |
|-----|------------------------|
| 12M | 12 bit                 |
| 16M | 16 bit                 |
| 20M | 20 bit                 |
| 24M | 24 bit                 |

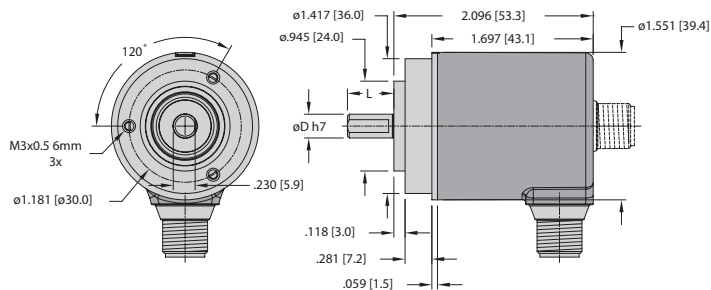
| F     | Type of Connection                  |
|-------|-------------------------------------|
| H1181 | Radial 8-pin M12 Eurofast Connector |
| H1481 | Axial 8-pin M12 Eurofast Connector  |
| C1M   | Radial Cable (1m PUR)               |
| CA1M  | Axial Cable (1m PUR)                |

**Absolute, Multiturn Type RM-99 (Shaft) / RM-100 (Blind Hollow Shaft)**

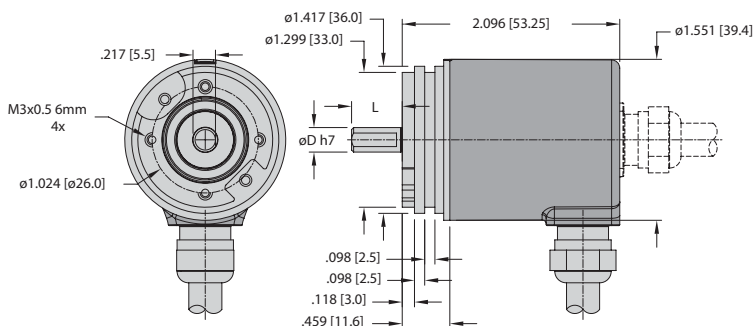
**SSI**

**Dimensions: RM-99 Shaft Version**

**RM-99 Flange C**  
**Connection H1181 & H1481**

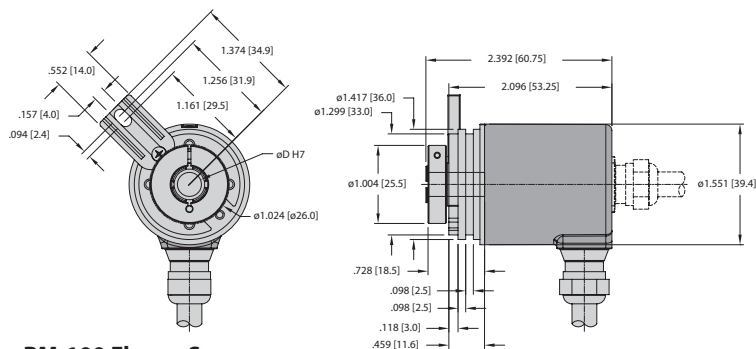


**RM-99 Flange S**  
**Connection C1M & CA1M**

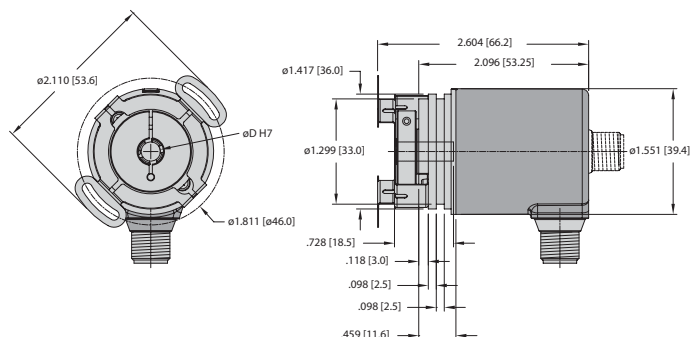


**Dimensions: RM-100 Blind Hollow Shaft Version**

**RM-100 Flange T**  
**Connection C1M & CA1M**



**RM-100 Flange S**  
**Connection H1181 & H1481**



**Mounting Advice:**

The flanges and shafts of the encoder and drive should not be rigidly coupled together at the same time. We recommend the use of suitable couplings (see page G1, Accessories).

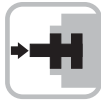
Absolute Encoders

# Rotary Position Technology

## Absolute Encoders, Multiturn

Absolute, Multiturn Type RM-101 (Shaft) / RM-102 (Blind Hollow Shaft)

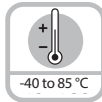
CANopen



Bearing-Lock



High rotational speed



Temperature range



High IP



High shaft load capacity



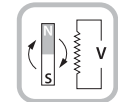
Shock/vibration resistant



Reverse polarity protection



Surface protection salt spray-tested optional



Energy Harvesting

### Reliable

- Sturdy bearing construction in Bearing-Lock design for resistance against vibration and installation errors.
- Without gear and without battery, thanks to the Energy Harvesting technology.



Absolute



CANopen



### Up-To-The-Minute

#### Fieldbus Performance

- LSS services for configuration of the node address and baud rate.
- Variable PDO mapping in the memory.
- Universal scaling function.
- Configuration management (bootloader).

### Insensitive

- Reduced number of components ensures magnetic insensitivity.
- IP67 protection and wide temperature range -40 °C to +85 °C.

### Mechanical Characteristics:

#### Max. speed:

|                                      |                       |
|--------------------------------------|-----------------------|
| Shaft or blind hollow shaft version: | 6000 RPM              |
| Without shaft seal (IP65):           | 3000 RPM (continuous) |
| Shaft or blind hollow shaft version: | 4000 RPM              |
| With shaft seal (IP67):              | 2000 RPM (continuous) |

#### Starting torque (68 °F | 20 °C):

|                            |                          |
|----------------------------|--------------------------|
| Without shaft seal (IP65): | < 1.0 oz · in (0.007 Nm) |
| With shaft seal (IP67):    | < 1.4 oz · in (0.01 Nm)  |

#### Shaft load capacity:

|         |                |
|---------|----------------|
| Radial: | 9.0 lbs (40 N) |
| Axial:  | 4.5 lbs (20 N) |

Weight: approx. 0.44 kgs (0.2 kg)

Protection acc. to EN 60529: IP65 / IP67

Working temperature range: -40 to +185 °F (-40 to +85 °C)

#### Materials:

|                       |                 |
|-----------------------|-----------------|
| Shaft / Hollow shaft: | stainless steel |
| Flange:               | aluminium       |
| Housing:              | zinc die-cast   |
| Cable:                | PVC             |

Shock resistance acc. to EN 60068-2-27: 250 g (2,500 m/s<sup>2</sup>), 6 ms

Vibration resistance acc. to EN 60068-2-6: 30 g (300 m/s<sup>2</sup>), 10 - 2,000 Hz



### Absolute, Multiturn Type RM -101 (Shaft) / RM-102 (Blind Hollow Shaft)

### CANopen

#### General Electrical Characteristics:

##### Sensor:

|   |  |
|---|--|
| Power supply:                                     | 10 - 30 VDC  |
| Current consumption (no load):                    | max. 30 mA   |
| Reverse polarity protection at power supply (+V): | yes  |
| Short-circuit protected outputs                   | yes <sup>1)</sup>  |
| e1 compliant acc. to (pending):                   | EU guideline 2009/19/EC (acc. to EN 55025, ISO 11452 and ISO 7637) |
| UL approval                                       | file 224618  |
| CE compliant acc. to                              | EMC guideline 2014/30/EU<br>RoHS guideline 2011/65/EU              |

#### General Information about CANopen

The CANopen encoders support the latest CANopen communication profile according to DS301 V4.02. In addition, device-specific profiles like the encoder profile DS406 V3.2, DS305 (LSS) and DS302 (Bootloader) are available.

The following operating modes may be selected: Polled Mode, Cyclic Mode, Sync Mode. Moreover, scale factors, preset values, limit switch values and many other additional parameters can be programmed via the CANbus. When switching the device on, all parameters, which have been saved on a flash memory to protect them against power failure, are loaded again.

The following output values may be combined in a freely variable way as PDO(PDO mapping): **position, speed, acceleration** as well as the **status of the working area**.

The encoders are available with a connector or a cable connection.

The device address and baud rate can be set/modified by means of the software.

The two-color LED located on the back indicates the operating or fault status of the CAN-bus, as well as the status of the internal diagnostics.

#### CANbus connection

The CANopen encoders are equipped with a bus trunk line in various lengths or a M12 connector and can be terminated in the device.

The devices do not have an integrated T-coupler nor are they looped internally and must therefore only be used as end devices.

#### Standard Wiring:

| Connection Type: | +V | Common (0V) | CAN GND | CAN High | CAN Low |
|------------------|----|-------------|---------|----------|---------|
| Cable:           | BN | WH          | GY      | GN       | YE      |
| M12 Eurofast:    | 2  | 3           | 1       | 4        | 5       |

#### Interface Characteristics CANopen:

|                                    |   |
|------------------------------------|---|
| Resolution singleturn:             | 1 - 16384 (14 bit), (scalable default: 8192 (13 bit))   |
| Absolute accuracy <sup>2)</sup> :  | ±1 °  |
| Repeat accuracy:                   | ±0.2 °  |
| Number of revolutions (multiturn): | max. 16.777.216 (24 bit)<br>scalable only via the total resolution  |
| Total resolution:                  | 1...274,877,906,944 (38 bit), scalable<br>default: 33,554,432 (25 bit)  |
| Code:                              | binary  |
| Interface:                         | CAN high-speed acc. to ISO 11898, Basic- and Full-CAN, CAN specification 2.0 B  |
| Protocol:                          | CANopen profile DS406 V4.0 with manufacturer-specific add-ons, LSS-Service, bootloader  |
| Power-ON time:                     | < 1200 ms   |
| SDO timeout:                       | < 1000 ms   |
| Baud rate:                         | 10 - 1000 k bit/s software configurable   |
| Node address:                      | 1 - 127 software configurable   |
| Termination:                       | software configurable   |
| LSS protocol:                      | CIA LSS protocol DS305, global command support for node address and baud rate, selective commands via attributes of the identity object |
| Bootloader:                        | configuration management<br>CIA DS 302-3  |

<sup>1)</sup> = short circuit protected to 0V or to output when power supply correctly applied.  
<sup>2)</sup> = over the entire temperature range.

#### LSS layer setting services DS305 V2.0

- Global support of node-ID and baud rate.
- Selective protocol via identity object (1018h).

- User interface with visual display of bus and failure status 1 LED two colors.
- Customer-specific protocol.
- "Watchdog controlled" device.

#### CANopen Communication Profile DS301 V4.2

Among others, the following functionality is integrated (Class C2 functionality):

- NMT Slave
- Heartbeat Protocol
- Identity Object
- Error Behavior Object
- Variable PDO Mapping self-start programmable (Power on to operational), 3 Sending PDO's.
- Node address, baud rate and CANbus / programmable termination.

#### Bootloader functionality DS302-3

Configuration Management:

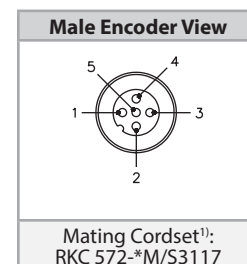
- Program download
- Program start
- Program erase

#### CANopen encoder profile DS406 V4.0

The following parameters can be programmed:

- Event mode, start optional.
- 1 work area with upper and lower limit and the corresponding output states variable PDO mapping for position, speed, work area status, error and acceleration.
- Extended failure management for position sensing.

#### Wiring Diagram:



\* Length in meters.  
<sup>1)</sup> See Connectivity section H for corresponding cable color code.

# Rotary Position Technology

## Absolute Encoders, Multiturn

### Absolute, Multiturn Type RM -101 (Shaft) / RM-102 (Blind Hollow Shaft)

CANopen

#### Part Number Key: RM-101 Shaft Version

| A       | B | C |   | D     |   | E     |
|---------|---|---|---|-------|---|-------|
| RM-101S | 6 | C | - | 9D38D | - | H1151 |

| A       | Type                                    |
|---------|---|
| RM-101S | Ø 39 mm, Shaft w/ Flat, IP67 Shaft Seal |
| RM-101T | Ø 39 mm, Shaft w/ Flat, IP65 Shaft Seal |

| D     | Voltage Supply and Output Type   |
|-------|----------------------------------|
| 9D38B | 10 - 30 VDC, CANopen DS 406 V4.0 |

| B  | Shaft (Ø × L)    |
|----|------------------|
| 6  | Ø 6 mm × 12.5 mm |
| 8  | Ø 8 mm × 15 mm   |
| 10 | Ø 10 mm × 20 mm  |
| A0 | Ø 1/4" × 1/2"    |

| E     | Type of Connection                  |
|-------|-------------------------------------|
| H1151 | Radial 5-pin M12 Eurofast Connector |
| H1451 | Axial 5-pin M12 Eurofast Connector  |
| C1M   | Radial Cable (1 m PVC)              |
| CA1M  | Radial Cable (1 m PVC)              |

| C | Flange                  |
|---|-------------------------|
| C | Ø 36 mm Clamping Flange |
| S | Ø 36 mm Servo Flange    |

#### Part Number Key: RM-102 Blind Hollow Shaft Version

| A       | B | C |   | D     |   | E     |
|---------|---|---|---|-------|---|-------|
| RM-102B | 6 | E | - | 9D38D | - | H1151 |

| A       | Type   |
|---------|--|
| RM-102B | Ø 39 mm, Blind Hollow Shaft, IP67 Shaft Seal |
| RM-102C | Ø 39 mm, Blind Hollow Shaft, IP65 Shaft Seal |

| D     | Voltage Supply and Output Type   |
|-------|----------------------------------|
| 9D38B | 10 - 30 VDC, CANopen DS 406 V4.0 |

| B  | Bore (18.5 mm insertion depth) |
|----|--------------------------------|
| 6  | Ø 6 mm                         |
| 8  | Ø 8 mm                         |
| 10 | Ø 10 mm                        |
| A0 | Ø 1/4"                         |

| E     | Type of Connection                  |
|-------|-------------------------------------|
| H1151 | Radial 5-pin M12 Eurofast Connector |
| H1451 | Axial 5-pin M12 Eurofast Connector  |
| C1M   | Radial Cable (1 m PVC)              |
| CA1M  | Radial Cable (1 m PVC)              |

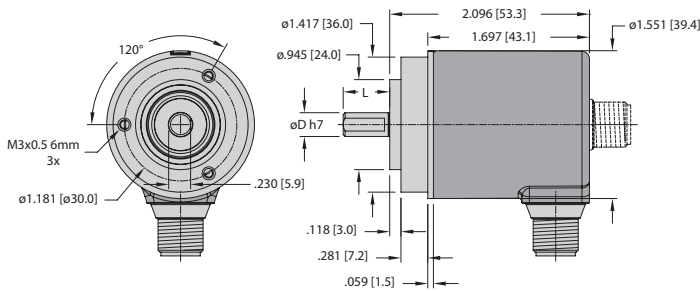
| C | Flange                               |
|---|--------------------------------------|
| E | Ø 46 mm Flange w/ Slotted Flex Mount |
| T | Flange w/ Long Torque Stop           |

**Absolute, Multiturn Type RM -101 (Shaft) / RM-102 (Blind Hollow Shaft)**

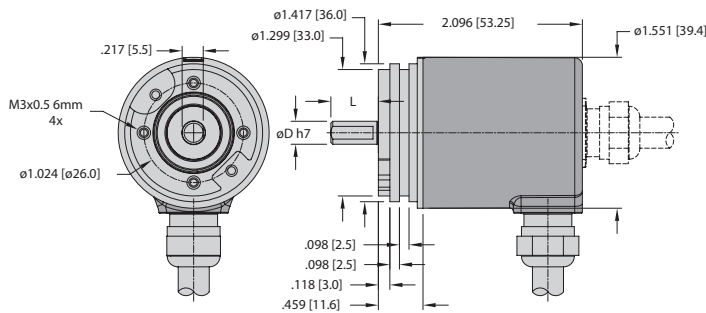
**CANopen**

**Dimensions: RM-101 Shaft Version**

**RM-101 Flange C**  
**Connection H1151 & H1451**

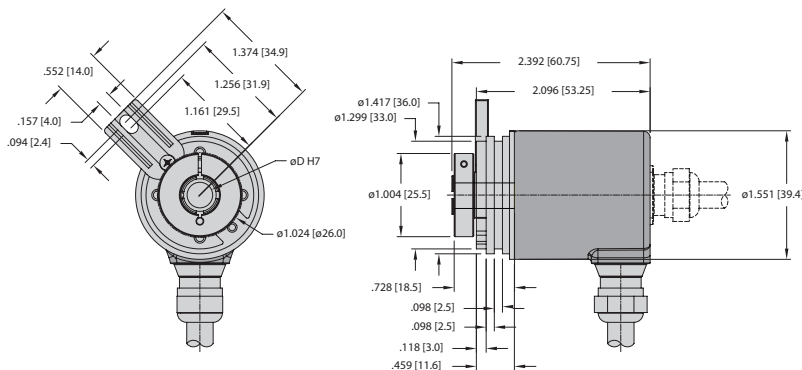


**RM-101 Flange S**  
**Connection C1M & CA1M**

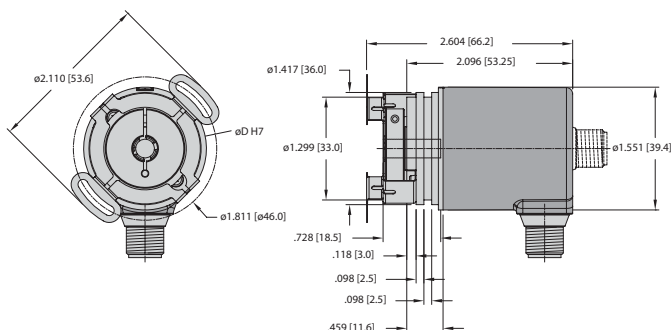


**Dimensions: RM-102 Blind Hollow Shaft Version**

**RM-102 Flange T**  
**Connection C1M & CA1M**



**RM-102 Flange E**  
**Connection H1181 & H1481**



**Mounting Advice:**

The flanges and shafts of the encoder and drive should not be rigidly coupled together at the same time. We recommend the use of suitable couplings (see page G1, Accessories).

# Rotary Position Technology

## Absolute Encoders, Multiturn

### Absolute, Multiturn Type RM-115 Series

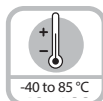
Analog



Bearing-Lock



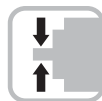
High rotational speed



Temperature range



High IP



High shaft load capacity



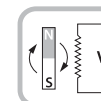
Shock/vibration resistant



Reverse polarity protection



Standard option seawater resistant



Energy Harvesting



Standard option stainless steel

#### Highest Robustness

- Sturdy bearing construction in Bearing-Lock design for particularly high resistance.
- Extra large bearings.
- Mechanically protected shaft seal.
- Protection level IP66, IP67 and IP69k in one device.
- Wide temperature range  $-40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$ .
- Without gear and without battery, thanks to the Energy Harvesting technology.



#### Application Oriented

- Current output 4 - 20 mA.
- Voltage output 0 - 10 V or 0 - 5 V.
- Measuring range scalable.
- Limit switch function.

#### Compact

- Can be used where space is tight: overall diameter is 36 mm.

#### Mechanical Characteristics:

|  |  |                        |
|--|--|------------------------|
| Max. speed:                                | 4000 RPM<br>2000 RPM (continuous)  |                        |
| Starting torque (68 °F   20 °C):           | < 1.4 oz - in (0.01 Nm)  |                        |
| Shaft load capacity:                       |  |                        |
| Radial:                                    | 18 lbs (80 N)  |                        |
| Axial:                                     | 9 lbs (40 N)   |                        |
| Weight:                                    | approx. 0.44 lbs (0.2 kgs)   |                        |
| Protection acc. to EN 60529/ DIN 40050-9:  | IP66, IP67, IP69k  |                        |
| Working temperature range:                 | $-40$ to $+185\text{ }^{\circ}\text{F}$ ( $-40$ to $+85\text{ }^{\circ}\text{C}$ ) |                        |
| Materials:                                 |  |                        |
| Shaft:                                     | Standard   | /N72 (stainless steel) |
| Flange:                                    | stainless steel: V2A(304)  | V4A (316)              |
| Housing:                                   | aluminum   | V4A (316)              |
| Cable:                                     | zinc die-cast  | V4A (316)              |
|  | PVC  | —                      |
| Shock resistance acc. to EN 60068-2-27:    | 500 g (5000 m/s <sup>2</sup> ), 4 ms   |                        |
| Vibration resistance acc. to EN 60068-2-6: | 30g (300 m/s <sup>2</sup> ), 10 - 2000 Hz  |                        |

### Absolute, Multiturn Type RM-115 Series

### Analog

#### Electrical Characteristics Current Interface 4 - 20mA:

|  |  |
|--|--|
| Power supply:  | 10 - 30 VDC  |
| Current consumption (no load):                               | max. 30 mA   |
| Reverse polarity protection at power supply (+V):            | yes  |
| Short-circuit protected outputs:                             | yes <sup>1)</sup>  |
| Measuring range:<br>factory setting:<br>Optionally scalable: | 2 <sup>4</sup> revolutions<br>up to 2 <sup>16</sup> revolutions  |
| DA converter resolution:                                     | 12 bit   |
| Singleturn accuracy, at 77 °F   25 °C:                       | ±1 °   |
| Temperature coefficient:                                     | < 100 ppm/K  |
| Repeat accuracy at 77 °F   25 °C:                            | ±0.2 °   |
| Output load:   | max. 200 0hm at 10 VDC<br>max. 900 0hm at 24 VDC<br>max. 1200 0hm at 30 VDC  |
| Setting time:  | < 1 ms, R <sub>Load</sub> =900 0hm, 77 °F   25 °C  |
| LEDs (green/red):  | <ul style="list-style-type: none"> <li>• system status</li> <li>• current loop interruption—input load too high</li> <li>• reference point display (only with factory settings)<br/>at cw: betw. 0 ° and 1 °<br/>at ccw: betw. 0 ° and -1 °</li> <li>• status in teach mode</li> </ul> |
| Options:   | <ul style="list-style-type: none"> <li>• output signal scalable via the teach inputs</li> <li>• output signal scalable via the teach inputs + limit switch function</li> </ul>   |
| Teach inputs:  | level= +V for 1 s min  |
| PowerON time:  | < 1 s  |
| Update rate:   | 1 ms   |
| e1 compliant acc. to (pending):                              | EU guideline 2009/19/EC (acc. to EN 55025, ISO 11452 and ISO 7637)   |
| UL approval:   | file 224618  |
| CE compliant acc. to:  | EMC guideline 2014/30/EU<br>RoHS guideline 2011/65/EU  |

#### Characteristics Voltage Interface 0 - 10 V / 0 - 5 V:

|  |   |
|--|---|
| Power supply:  | output 0 - 5 V 10 - 30 VDC<br>output 0 - 10 V 15 - 30 VDC   |
| Current consumption (no load):                               | max. 30 mA  |
| Reverse polarity protection at power supply (+V):            | yes   |
| Short-circuit protected outputs:                             | yes <sup>1)</sup>   |
| Measuring range:<br>factory setting:<br>Optionally scalable: | 2 <sup>4</sup> revolutions<br>up to 2 <sup>16</sup> revolutions   |
| DA converter resolution:                                     | 0 - 10 V 12 bit<br>0 - 5 V 11 bit   |
| Singleturn accuracy, at 25°C   77°F:                         | ±1 °  |
| Temperature coefficient:                                     | < 100 ppm/K   |
| Repeat accuracy at 25°C   77°F:                              | ±0.2 °  |
| Current output:  | max. 10 mA  |
| Setting time:  | < 1 ms, R <sub>Load</sub> =1000 0hm, 77 °F   25 °C  |
| LEDs (green/red):  | <ul style="list-style-type: none"> <li>• system status</li> <li>• reference point display (only with factory settings)<br/>at cw: betw. 0 ° and 1 °<br/>at ccw: betw. 0 ° and -1 °</li> <li>• status in teach mode</li> </ul> |
| Options:   | <ul style="list-style-type: none"> <li>• output signal scalable via the teach inputs</li> <li>• output signal scalable via the teach inputs + limit switch function</li> </ul>  |
| Teach inputs:  | level= +V for 1 s min   |
| PowerON time:  | < 1 s   |
| Update rate:   | 1 ms  |
| e1 compliant acc. to (pending):                              | EU guideline 2009/19/EC (acc. to EN 55025, ISO 11452 and ISO 7637)  |
| UL approval:   | file 224618   |
| CE compliant acc. to:  | EMC guideline 2014/30/EU<br>RoHS guideline 2011/65/EU   |

<sup>1)</sup> = when the power supply is correctly applied.

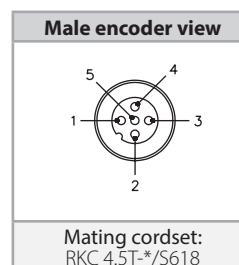
#### Measuring Range 'AL' or 'AR':

| Connection Type: | Common (0 V) | +V | Output | Set 1 | Set 2 |
|------------------|--------------|----|--------|-------|-------|
| Cable:           | BU           | BN | WH     | N/C   | N/C   |
| M12 pin:         | 3            | 1  | 2      | N/C   | N/C   |

#### Measuring Range 'S\*NS' or 'S\*WL':

| Connection Type: | Common (0 V) | +V | Output | Set 1 | Set 2 |
|------------------|--------------|----|--------|-------|-------|
| Cable:           | BU           | BN | WH     | BK    | GY    |
| M12 pin:         | 3            | 1  | 2      | 4     | 5     |

#### Wiring Diagram:



\* Length in meters.

# Rotary Position Technology

## Absolute Encoders, Multiturn

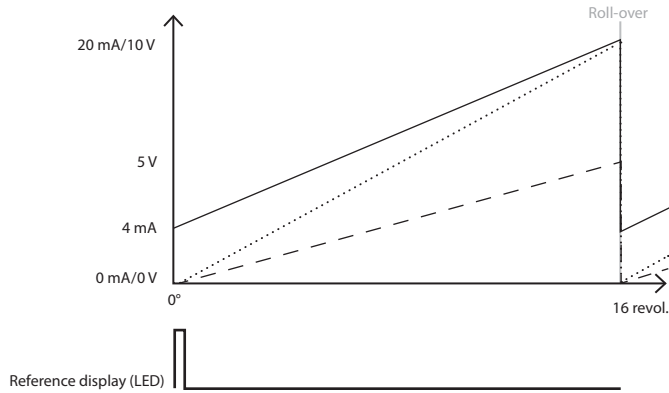
### Absolute, Multiturn Type RM-115 Series Analog

**Note:** Encoders must be ordered with a clockwise or counterclockwise profile. This determines whether the analog output increases or decreases in the given direction.

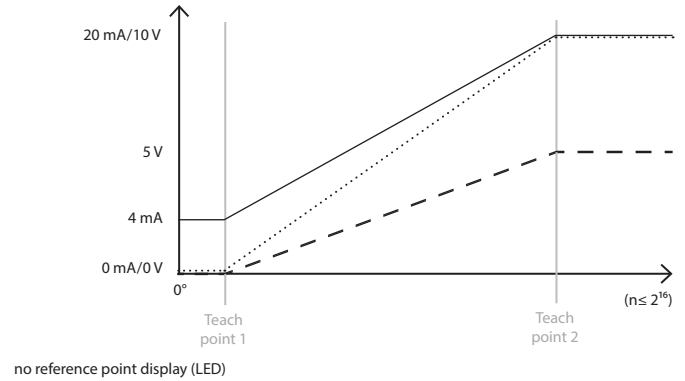
**Example (output signal profile):**

- version 4 - 20 mA
- ⋯ version 0 - 10 V
- - - version 0 - 5 V

**Clockwise (CW) version**



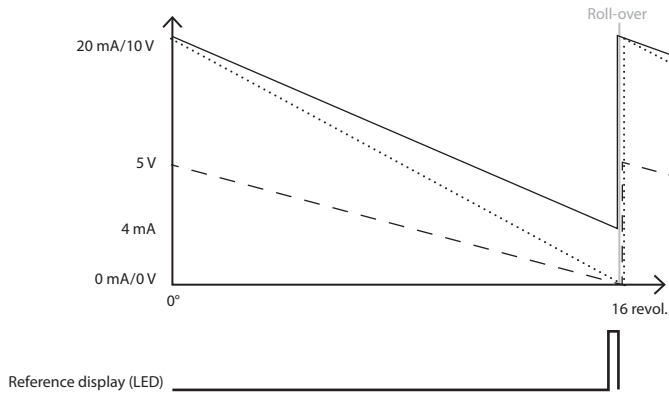
**Scalable version without limit switch function**



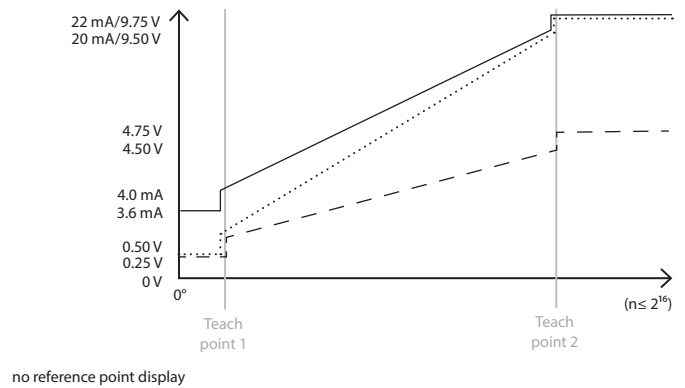
**Example (output signal profile):**

- version 4 - 20 mA
- ⋯ version 0 - 10 V
- - - version 0 - 5 V

**Counter clockwise (CCW) version**



**Scalable version with limit switch function**



**Note:** Factory-set measuring range: 2<sup>4</sup> revolutions with roll-over

**Note: Limit switch function:**

| version:           | 0 - 10 V | 0 - 5 V | 4 - 20 mA |
|--------------------|----------|---------|-----------|
| limit switch low:  | 0.25 V   | 0.25 V  | 3.60 mA   |
| limit switch high: | 9.75 V   | 4.75 V  | 22.00 mA  |

### Absolute, Multiturn Type RM-115 Series

Analog

**Part Number Key: RM-115 Shaft Version**

| A       | B | C |   | D  | E  |   | F     |   | G |
|---------|---|---|---|----|----|---|-------|---|---|
| RM-115S | 6 | C | - | 7A | AL | - | H1151 | / |   |

| A       | Type                                    |
|---------|---|
| RM-115S | ∅ 39 mm, Shaft w/Flat, IP69K Shaft Seal |

| B  | Shaft (∅ × L)    |
|----|------------------|
| 6  | ∅ 6 mm × 12.5 mm |
| 8  | ∅ 8 mm × 15 mm   |
| 10 | ∅ 10 mm × 20 mm  |
| A0 | ∅ 1/4" × 1/2"    |

| C | Flange                  |
|---|-------------------------|
| C | ∅ 42 mm Clamping Flange |

| D  | Voltage Supply and Output Type |
|----|--------------------------------|
| 7A | 10 - 30 VDC, 4 - 20 mA         |
| 8B | 15 - 30 VDC, 0 - 10 V          |
| BA | 10 - 30 VDC, 0 - 5 V           |

| E     | Measuring Range                                  |
|-------|--|
| AL    | 16 Turns, Count Direction CCW*                   |
| AR    | 16 Turns, Count Direction CW*                    |
| SALNS | Scalable to 65,536 Turns, CCW*, w/o Limit Switch |
| SALWL | Scalable to 65,536 Turns, CCW*, w/ Limit Switch  |
| SARNS | Scalable to 65,536 Turns, CW*, w/o Limit Switch  |
| SARWL | Scalable to 65,536 Turns, CW*, w/ Limit Switch   |

\* = increasing code values when shaft turning in direction listed. Top view on shaft.

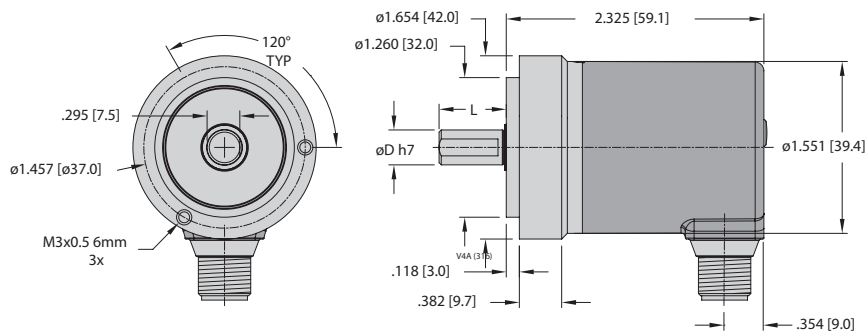
| F     | Type of Connection                  |
|-------|-------------------------------------|
| H1151 | Radial 5-pin M12 Eurofast Connector |
| C1M   | Radial Cable (1m PVC)               |

| G       | Options                                       |
|---------|---|
| (Blank) | No Options                                    |
| N72     | Stainless Steel Flange and Shaft <sup>1</sup> |

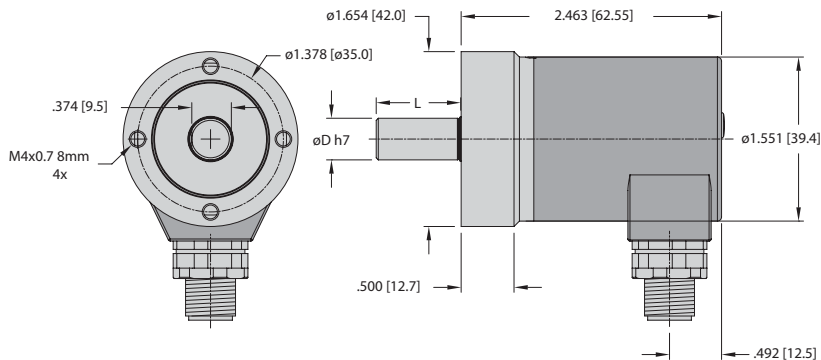
<sup>1</sup> = only available with shaft '10' and connection 'H1151'

#### Dimensions: RM-115 Shaft Version

#### RM-115 Flange C Connection H1151



#### RM-115 /N72 Flange C Connection H1151



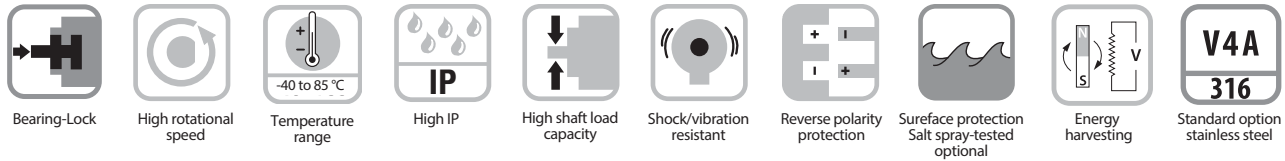
#### Mounting advice:

The flanges and shafts of the encoder and drive should not be rigidly coupled together at the same time. We recommend the use of suitable couplings (see page G1, Accessories).



### Absolute, Multiturn Type RM-117

SSI



#### High Robustness

- Sturdy bearing construction in Bearing-Lock design for particularly high resistance.
- Extra large bearings.
- Mechanically protected shaft seal.
- Protection level IP66, IP67 and IP69k in one device.
- Wide temperature range  $-40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$ .
- Without gear and without battery, thanks to the Energy Harvesting technology.



#### Compact

- Can be used where space is tight: overall diameter is 39 mm.

#### Application Oriented

- Absolute accuracy  $\pm 1\text{ }^{\circ}$ .
- Repeat accuracy  $\pm 0.2\text{ }^{\circ}$ .
- Short control cycles, clock frequency with SSI up to 2 MHz.
- Max. resolution 38 bit (14 bit ST + 24 bit MT).

#### Mechanical Characteristics:

|  |  |
|--|--|
| Max. speed:                                | 4000 RPM<br>2000 RPM (continuous)  |
| Starting torque (68 °F   20 °C):           | < 1.4 oz · in (0.01 Nm)  |
| Shaft load capacity:                       |  |
| Radial:                                    | 18 lbs (80 N)  |
| Axial:                                     | 9 lbs (40 N)   |
| Weight:                                    | approx. 0.44 lbs (0.2 kgs)   |
| Protection acc. to EN 60529:               | IP66, IP67, IP69K  |
| Working temperature:                       | $-40$ to $+185\text{ }^{\circ}\text{F}$ ( $-40$ to $+85\text{ }^{\circ}\text{C}$ ) |
| Materials:                                 | Standard /N72 (stainless steel)  |
| Shaft:                                     | stainless steel: V2A (304) V4A (316)   |
| Flange:                                    | aluminum V4A (316)   |
| Housing:                                   | zinc die-cast V4A (316)  |
| Cable:                                     | PUR —  |
| Shock resistance acc. to EN 60068-2-27:    | 500 g (5000 m/s <sup>2</sup> ) 4 ms  |
| Vibration resistance acc. to EN 60068-2-6: | 30 g (300 m/s <sup>2</sup> ), 10 - 2000 Hz   |

# Rotary Position Technology

## Absolute Encoders, Multiturn

### Absolute, Multiturn Type RM-117

SSI

#### General Electrical Characteristics:

|   |  |
|---|--|
| Power supply                                      | 10 - 30 VDC  |
| Current consumption (no load):                    | max. 30 mA,  |
| Reverse polarity protection at power supply (+V): | yes  |
| Short-circuit protected outputs:                  | yes <sup>1)</sup>  |
| e1 compliant acc. to (pending):                   | EU guideline 2009/19/EC (acc. to EN 55025, ISO 11452 and ISO 7637) |
| UL approval:                                      | file 224618  |
| CE compliant acc. to:                             | EMC guideline 2014/30/EU<br>RoHS guideline 2011/65/EU              |

#### Interface Characteristics SSI:

|  |                        |
|--|------------------------|
| Output driver:                                     | RS485 transceiver type |
| Permissible load / channel:                        | max +/- 30 mA          |
| Signal high:                                       | typ 3.8 V              |
| Signal level low with $I_{Load} = 20 \text{ mA}$ : | typ 1.3 V              |
| Resolution singleturn:                             | 10 - 14 bit            |
| Absolute accuracy <sup>2)</sup> :                  | $\pm 1^\circ$          |
| Repeat accuracy:                                   | $\pm 0.2^\circ$        |
| Number of revolutions (multiturn):                 | max 24 bit             |
| Code:  | binary or gray         |
| SSI clock rate:                                    | 50 kHz - 2 MHz         |
| Data refresh rate:                                 | 2 ms                   |
| Monoflop time:                                     | $\leq 15 \mu\text{s}$  |

Note: If the clock cycle starts within the monoflop time a second data transfer begins with the same data. If the clock cycle starts after the monoflop time the cycle begins with the new values. The update rate is dependent on the clock speed, data length and monoflop time.

#### SET Input:

|                                   |  |
|-----------------------------------|--|
| Input characteristics:            | active HIGH                            |
| Input type:                       | comparator                             |
| Signal level high:                | min. 60% of +V (power supply), max: +V |
| Signal level low:                 | max. 30% of +V (power supply)          |
| Input current:                    | < 0.5 mA                               |
| Min. pulse duration (SET):        | 10 ms                                  |
| Input delay:                      | 1 ms                                   |
| New position data readable after: | 1 ms                                   |
| Internal processing time:         | 200 ms                                 |

The encoder can be set to zero at any position by means of a HIGH signal on the SET input. Other preset values can be factory-programmed. The SET input has a signal processing time of approx. 1 ms, after which the new position data can be read via SSI or BiSS. Once the SET function has been triggered, the encoder requires an internal processing time of typ. 200 ms; during this time the power supply must not be switched off.

The SET function should be carried out while the encoder is at rest.

If this input is not used, it should be connected to 0 V (Encoder ground GND) in order to avoid interferences.

#### DIR Input:

Direction input: A HIGH signal switches the direction of rotation from the default cw to ccw. This inverted function can also be factory-programmed.

If this input is not used, it should be connected to 0 V (Encoder ground GND) in order to avoid interferences.

Response time (DIR input) 1ms

#### Power-On Delay:

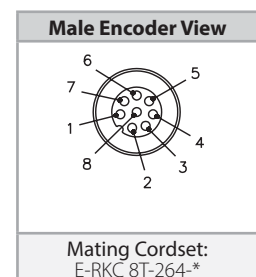
After Power-ON the device requires a time of approx. 150 ms before valid data can be read.

Hot plugging of the encoder should be avoided.

<sup>1)</sup> = short circuit protected to 0v or to output when power supply correctly applied.  
<sup>2)</sup> = over the entire temperature range.

| Connection Type: | GND (0 V) | V+ | +Clock | -Clock | +Data | - Data | SET | DIR | PE     |
|------------------|-----------|----|--------|--------|-------|--------|-----|-----|--------|
| Cable:           | WH        | BN | GN     | YE     | GY    | PK     | BU  | RD  | Shield |
| M12 pin:         | 1         | 2  | 3      | 4      | 5     | 6      | 7   | 8   | PH     |

#### Wiring Diagrams:



\* Length in meters.

### Absolute, Multiturn Type RM-117

**SSI**
**Part Number Key: RM-117 Shaft Version**

| A       | B | C |   | D  | E1  | E2  |   | F     |   | G |
|---------|---|---|---|----|-----|-----|---|-------|---|---|
| RM-117S | 6 | C | - | 3C | 10S | 12M | - | H1181 | / |   |

| A       | Type                                     |
|---------|--|
| RM-117S | Ø 39 mm, Shaft w/ Flat, IP69K Shaft Seal |

| B  | Shaft (Ø x L)    |
|----|------------------|
| 6  | Ø 6 mm x 12.5 mm |
| 8  | Ø 8 mm x 15 mm   |
| 10 | Ø 10 mm x 20 mm  |
| A0 | Ø 1/4" x 1/2"    |

| C | Flange                  |
|---|-------------------------|
| C | Ø 42 mm Clamping Flange |

| D  | Voltage Supply and Output Type |
|----|--------------------------------|
| 3C | 10 - 30VDC, SSI (Gray Code)    |
| 5C | 10 - 30VDC, SSI (Binary Code)  |

| E1  | Resolution (singleturn) |
|-----|-------------------------|
| 10S | 10 bit                  |
| 12S | 12 bit                  |
| 13S | 13 bit                  |
| 14S | 14 bit                  |

| E2  | Resolution (multiturn) |
|-----|------------------------|
| 12M | 12 bit                 |
| 16M | 16 bit                 |
| 20M | 20 bit                 |
| 24M | 24 bit                 |

| F     | Type of Connection                  |
|-------|-------------------------------------|
| H1181 | Radial 8-pin M12 Eurofast Connector |
| C1M   | Radial Cable (1 m PUR)              |

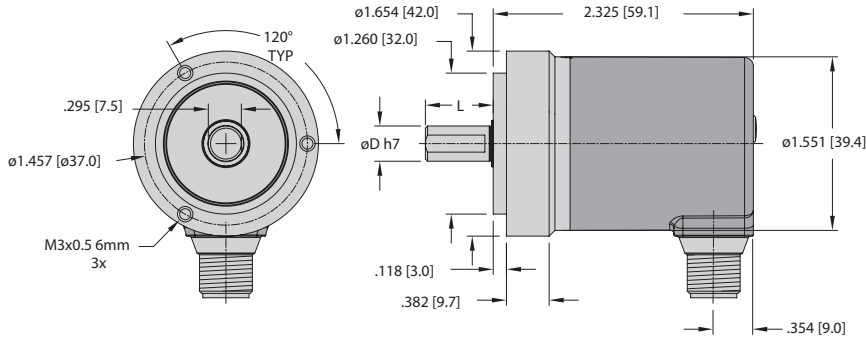
| G       | Options                                       |
|---------|---|
| (BLANK) | No Options                                    |
| N72     | Stainless Steel Flange and Shaft <sup>1</sup> |

<sup>1</sup> = only available with shaft '10' and connection 'H1181'

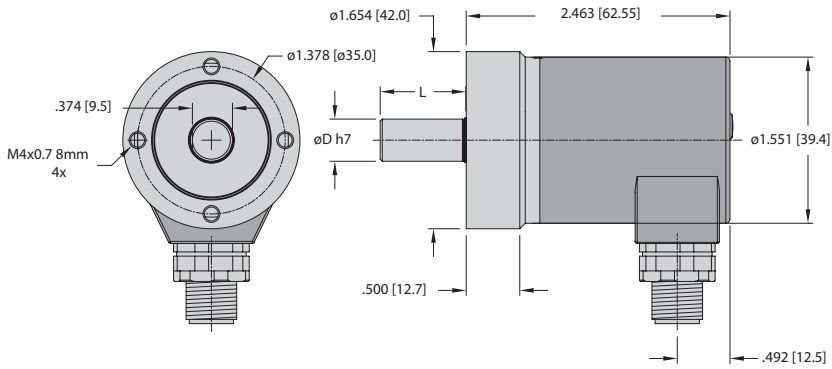
**Absolute, Multiturn Type RM-117** **SSI**

**Dimensions: RM-117 Shaft Version**

**RM-117 Flange C  
 Connection H1181**



**RM-117 / N72 Flange C  
 Connection H1181**



**Mounting Advice:**

The flanges and shafts of the encoder and drive should not be rigidly coupled together at the same time. We recommend the use of suitable couplings (see page G1, Accessories).

### Absolute, Multiturn Type RM-109

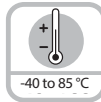
### CANopen



Bearing-Lock



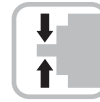
High rotational speed



Temperature range  
-40 to 85 °C



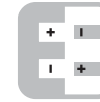
High IP



High shaft load capacity



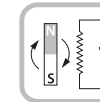
Shock/vibration resistant



Reverse polarity protection



Standard option seawater resistant



Energy Harvesting



Standard option stainless steel

#### Highest Robustness

- Sturdy bearing construction in Bearing-Lock design for particularly high resistance.
- Extra large bearings.
- Mechanically protected shaft seal.
- Protection level IP66, IP67 and IP69k in one device.
- Wide temperature range -40 °C to +85 °C.
- Without gear and without battery, thanks to the Energy Harvesting technology.



#### Absolute



CANopen



#### Compact

- Can be used where space is tight: overall diameter is 36 mm.

#### Up-To-The-Minute Fieldbus Performance

- LSS services for configuration of the node address and baud rate.
- Variable PDO mapping in the memory.
- Universal scaling function.
- Configuration management (bootloader).

#### Mechanical Characteristics:

|  |   |                                     |
|--|---|-------------------------------------|
| Max. speed:                                | 4000 RPM<br>2000 RPM (continuous)           |                                     |
| Starting torque (68 °F   20 °C):           | < 1.4 oz - in (0.01 Nm)                     |                                     |
| Shaft load capacity:                       |   |                                     |
| Radial:                                    | 18 lbs (80 N)                               |                                     |
| Axial:                                     | 9 lbs (40 N)                                |                                     |
| Weight:                                    | approx. 0.44 lbs (0.2 kg)                   |                                     |
| Protection acc. to EN 60529/DIN 40050-9:   | IP66, IP67, IP69K                           |                                     |
| Working temperature range:                 | -40 to +185 °F (-40 to +85 °C)              |                                     |
| Materials:                                 |   |                                     |
| Shaft:                                     | Standard stainless steel: V2A(304)          | /N72 (stainless steel)<br>V4A (316) |
| Flange:                                    | aluminum                                    | V4A (316)                           |
| Housing:                                   | zinc die-cast                               | V4A (316)                           |
| Cable:                                     | PVC   | —                                   |
| Shock resistance acc. to EN 60068-2-27:    | 500 g (5000 m/s <sup>2</sup> ), 4 ms        |                                     |
| Vibration resistance acc. to EN 60068-2-6: | 30 g (300 m/s <sup>2</sup> ), 10 - 2,000 Hz |                                     |

# Rotary Position Technology

## Absolute Encoders, Multiturn

### Absolute, Multiturn Type RM-109

### CANopen

#### General Electrical Characteristics:

##### Sensor:

|   |  |
|---|--|
| Power supply:                                     | 10 - 30 VDC  |
| Current consumption (no load):                    | max. 30 mA   |
| Reverse polarity protection at power supply (+V): | yes  |
| Short-circuit protected outputs                   | yes <sup>1)</sup>  |
| e1 compliant acc. to (pending):                   | EU guideline 2009/19/EC (acc. to EN 55025, ISO 11452 and ISO 7637) |
| RUL approval                                      | file 224618  |
| CE compliant acc. to                              | EMC guideline 2014/30/EU<br>RoHS guideline 2011/65/EU              |

#### Interface Characteristics CANopen:

|                                    |   |
|------------------------------------|---|
| Resolution singleturn:             | 1 - 16384 (14 bit), scalable default: 8192 (13 bit)   |
| Absolute accuracy <sup>2)</sup> :  | ±1 °  |
| Repeat accuracy:                   | ±0.2 °  |
| Number of revolutions (multiturn): | max. 16,777,216 (24 bit)<br>scalable only via the total resolution  |
| Total resolution:                  | 1 - 274,877,906,944 (38 bit), scalable default: 33,554,432 (25 bit)   |
| Code:                              | binary  |
| Interface:                         | CAN high-speed acc. to ISO 11898, Basic and Full-CAN, CAN specification 2.0 B   |
| Protocol:                          | CANopen profile DS406 V4.0 with manufacturer-specific add-ons, LSS-Service, bootloader  |
| Power-ON time:                     | < 1200 ms   |
| SDO timeout:                       | < 1000 ms   |
| Baud rate:                         | 10 - 1000 kbit/s software configurable  |
| Node address:                      | 1 - 127 software configurable   |
| Termination:                       | software configurable   |
| LSS protocol:                      | CIA LSS protocol DS305, global command support for node address and baud rate, selective commands via attributes of the identity object |
| Bootloader:                        | configuration management<br>CIA DS 302-3  |

<sup>1)</sup> = short circuit protected to 0V or to output when power supply correctly applied.  
<sup>2)</sup> = over the entire temperature range.

#### General Information about CANopen

The CANopen encoders support the latest CANopen communication profile according to DS301 V4.02. In addition, device-specific profiles like the encoder profile DS406 V3.2, DS305 (LSS) and DS302 (Bootloader) are available.

The following operating modes may be selected: Polled Mode, Cyclic Mode, Sync Mode. Moreover, scale factors, preset values, limit switch values and many other additional parameters can be programmed via the CANbus. When switching the device on, all parameters, which have been saved on a flash memory to protect them against power failure, are loaded again.

The following output values may be combined in a freely variable way as PDO(PDO mapping): **position, speed, acceleration** as well as the **status of the working area**.

The encoders are available with a connector or a cable connection.

The device address and baud rate can be set/modified by means of the software.

The two-color LED located on the back indicates the operating or fault status of the CAN-bus, as well as the status of the internal diagnostics.

#### CANbus connection

The CANopen encoders are equipped with a bus trunk line in various lengths or a M12 connector and can be terminated in the device.

The devices do not have an integrated T-coupler nor are they looped internally and must therefore only be used as end devices.

#### Standard Wiring:

| Connection Type: | +V | Common (0 V) | CAN GND | CAN High | CAN Low |
|------------------|----|--------------|---------|----------|---------|
| Cable:           | BN | WH           | GY      | GN       | YE      |
| M12 Eurofast:    | 2  | 3            | 1       | 4        | 5       |

#### LSS layer setting services DS305 V2.0

- Global support of node-ID and baud rate
- Selective protocol via identity object (1018h)
- Extended failure management for position sensing
- User interface with visual display of bus and failure status 1 LED two colors
- Customer-specific protocol
- "Watchdog controlled" device

#### CANopen Communication Profile DS301 V4.2

Among others, the following functionality is integrated. (Class C2 functionality):

- NMT Slave
- Heartbeat Protocol
- Identity Object
- Error Behavior Object
- Variable PDO Mapping self-start programmable (Power on to operational), 3 Sending PDO's
- Node address, baud rate and CANbus / programmable termination

#### CANopen encoder profile DS406 V4.0

The following parameters can be programmed:

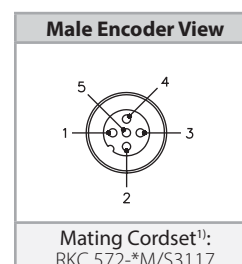
- Event mode, start optional
- 1 work area with upper and lower limit and the corresponding output states variable PDO mapping for position, speed, work area status, error and acceleration

#### Bootloader functionality DS302-3

Configuration Management:

- Program download
- Program start
- Program erase

#### Wiring Diagram:



\* Length in meters.  
<sup>1)</sup> See Connectivity section H for corresponding cable color code.

### Absolute, Multiturn Type RM-109

CANopen

#### Part Number Key: RM-109 Shaft Version

| A       | B | C |   | D     |   | E     |   | F |
|---------|---|---|---|-------|---|-------|---|---|
| RM-109S | 6 | C | - | 9D38B | - | H1151 | / |   |

| A       | Type                                     |
|---------|--|
| RM-109S | Ø 39 mm, Shaft w/ Flat, IP69K Shaft Seal |

| D     | Voltage Supply and Output Type   |
|-------|----------------------------------|
| 9D38B | 10 - 30 VDC, CANopen DS 406 V4.0 |

| B  | Shaft (Ø × L)    |
|----|------------------|
| 6  | Ø 6 mm × 12.5 mm |
| 8  | Ø 8 mm × 15 mm   |
| 10 | Ø 10 mm × 20 mm  |
| A0 | Ø 1/4" × 1/2"    |

| E     | Type of Connection                |
|-------|-----------------------------------|
| H1151 | Radial 1 × M12 Eurofast Connector |
| C1M   | Radial Cable (1 m PVC)            |

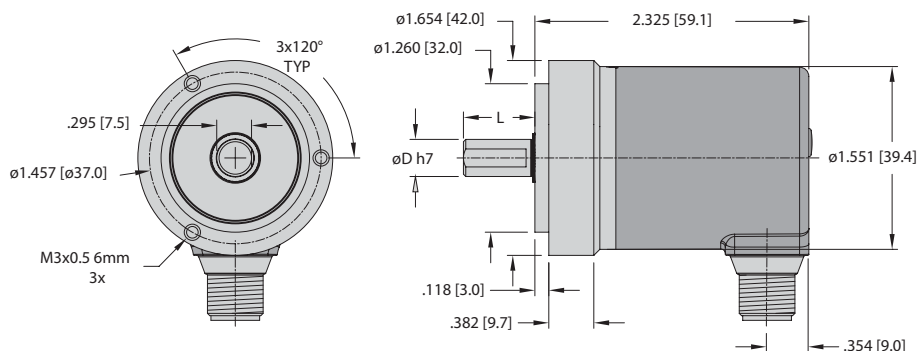
| C | Flange                  |
|---|-------------------------|
| C | Ø 42 mm Clamping Flange |

| F       | Options                                       |
|---------|---|
| (BLANK) | No Options                                    |
| N72     | Stainless Steel Flange and Shaft <sup>1</sup> |

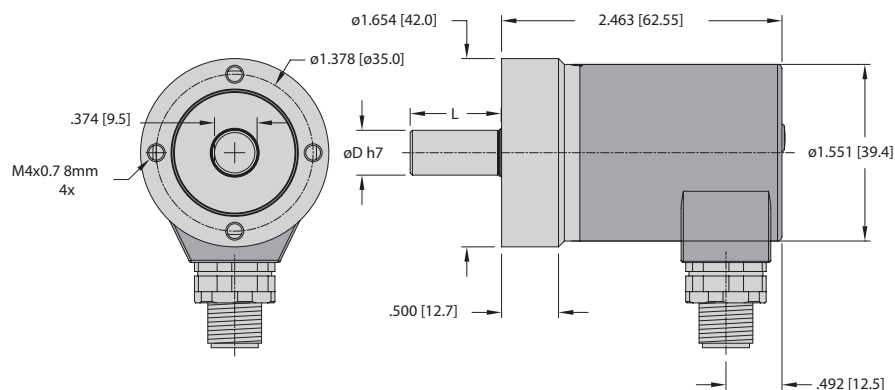
<sup>1</sup> = only available with shaft '10' and connection 'H1151'

#### Dimensions: RM-109 Shaft Version

#### RM-109 Flange C Connection H1151



#### RM-109/N72 Flange C Connection H1151



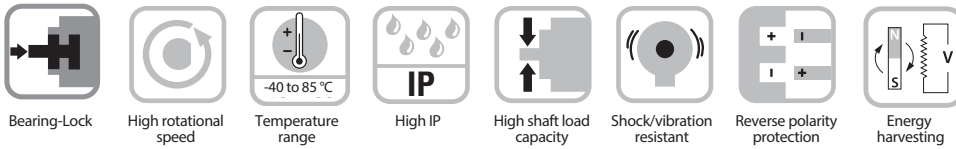
#### Mounting Advice:

The flanges and shafts of the encoder and drive should not be rigidly coupled together at the same time. We recommend the use of suitable couplings (see page G1, Accessories).



### Absolute, Multiturn Type RM-116 Series

Analog



#### Highest Robustness

- Sturdy bearing construction in Bearing-Lock design for particularly high resistance.
- Extra large bearings.
- Mechanically protected shaft seal.
- Wide temperature range –40 °C to +85 °C.
- Without gear and without battery, thanks to the Energy Harvesting technology.



#### Application Oriented

- Current output 4 - 20 mA.
- Voltage output 0 - 10 V or 0 - 5 V.
- Measuring range scalable.
- Limit switch function.

#### Compact Housing

- Can be used where space is tight: 39 mm housing with 58 mm flange.

#### Mechanical Characteristics:

|  |  |
|--|--|
| Max. speed:                                | 4000 RPM<br>2000 RPM (continuous)          |
| Starting torque (68 °F   20 °C):           | < 1.4 oz · in (0.01 Nm)                    |
| Shaft load capacity:                       |  |
| Radial:                                    | 18 lbs (80 N)                              |
| Axial:                                     | 9 lbs (40 N)                               |
| Weight:                                    | approx. 0.44 lbs (0.2 kgs)                 |
| Protection acc. to EN 60529/ DIN 40050-9:  | IP65                                       |
| Working temperature range:                 | –40 to +185 °F (–40 to +85 °C)             |
| Materials:                                 |  |
| Shaft:                                     | stainless steel: V2A(304)                  |
| Flange:                                    | aluminum                                   |
| Housing:                                   | zinc die-cast                              |
| Cable:                                     | PVC  |
| Shock resistance acc. to EN 60068-2-27:    | 500 g (5000 m/s <sup>2</sup> ), 4 ms       |
| Vibration resistance acc. to EN 60068-2-6: | 30 g (300 m/s <sup>2</sup> ), 10 - 2000 Hz |

# Rotary Position Technology

## Absolute Encoders, Multiturn

### Absolute, Multiturn Type RM-116 Series

Analog

#### Electrical Characteristics Interface 4 - 20mA:

|   |                                   |
|---|-----------------------------------|
| Power supply:                                     | 10 - 30 VDC                       |
| Current consumption (no load):                    | max. 30 mA                        |
| Reverse polarity protection at power supply (+V): | yes                               |
| Short-circuit protected outputs:                  | yes <sup>1)</sup>                 |
| Measuring range:                                  |                                   |
| Factory setting:                                  | 2 <sup>4</sup> revolutions        |
| Optionally scalable:                              | up to 2 <sup>16</sup> revolutions |

|  |   |
|--|---|
| DA converter resolution:               | 12 bit  |
| Singleturn accuracy, at 77 °F   25 °C: | ±1 °  |
| Temperature coefficient:               | < 100 ppm/K   |
| Repeat accuracy at 77 °F   25 °C:      | ±0.2 °  |
| Output load:                           | max. 200 0hm at 10 VDC<br>max. 900 0hm at 24 VDC<br>max. 1200 0hm at 30 VDC |
| Setting time:                          | < 1 ms, R <sub>Load</sub> = 900 0hm, 77 °F   25 °C                          |

- LEDs (green/red):
- system status
  - current loop interruption—input load too high
  - reference point display (only with factory settings)  
at cw: betw. 0 ° and 1 °  
at ccw: betw. 0 ° and -1 °
  - status in teach mode

- Options:
- output signal scalable via the teach inputs
  - output signal scalable via the teach inputs + limit switch function

|               |                       |
|---------------|-----------------------|
| Teach inputs: | level= +V for 1 s min |
| PowerON time: | < 1 s                 |
| Update rate:  | 1 ms                  |
| UL approval:  | file 224618           |

CE compliant acc. to: EMC guideline 2014/30/EU  
RoHS guideline 2011/65/EU

#### Characteristics Voltage Interface:

|   |   |
|---|---|
| Power supply:                                     | output 0 - 5 V 10 - 30 VDC<br>output 0 - 10 V 15 - 30 VDC |
| Current consumption (no load):                    | max. 30 mA  |
| Reverse polarity protection at power supply (+V): | yes   |
| Short-circuit protected outputs:                  | yes <sup>1)</sup>   |
| Measuring range:                                  |   |
| Factory setting:                                  | 2 <sup>4</sup> revolutions                                |
| Optionally scalable:                              | up to 2 <sup>16</sup> revolutions                         |

|  |   |
|--|---|
| DA converter resolution:               | 0 - 10 V 12 bit<br>0 - 5 V 11 bit                   |
| Singleturn accuracy, at 25 °C   77 °F: | ±1 °  |
| Temperature coefficient:               | < 100 ppm/K   |
| Repeat accuracy at 25 °C   77 °F:      | ±0.2 °  |
| Current output:                        | max. 10 mA  |
| Setting time:                          | < 1 ms, R <sub>Load</sub> = 1000 0hm, 77 °F   25 °C |

- LEDs (green/red):
- system status
  - reference point display (only with factory settings)  
at cw: betw. 0 ° and 1 °  
at ccw: betw. 0 ° and -1 °
  - status in teach mode

- Options:
- output signal scalable via the teach inputs
  - output signal scalable via the teach inputs + limit switch function

|               |                       |
|---------------|-----------------------|
| Teach inputs: | level= +V for 1 s min |
| PowerON time: | < 1 s                 |
| Update rate:  | 1 ms                  |
| UL approval:  | file 224618           |

CE compliant acc. to: EMC guideline 2014/30/EU  
RoHS guideline 2011/65/EU

<sup>1)</sup> = when the power supply is correctly applied.

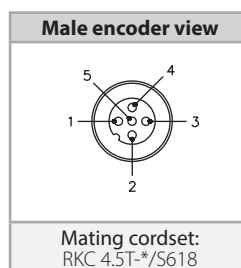
#### Measuring Range 'AL' or 'AR':

| Connection Type: | Common (0 V) | +V | Output | Set 1 | Set 2 |
|------------------|--------------|----|--------|-------|-------|
| Cable:           | BU           | BN | WH     | N/C   | N/C   |
| M12 pin:         | 3            | 1  | 2      | N/C   | N/C   |

#### Measuring Range 'S\*NS' or 'S\*WL':

| Connection Type: | Common (0 V) | +V | Output | Set 1 | Set 2 |
|------------------|--------------|----|--------|-------|-------|
| Cable:           | BU           | BN | WH     | BK    | GY    |
| M12 pin:         | 3            | 1  | 2      | 4     | 5     |

#### Wiring Diagram:



\* Length in meters.

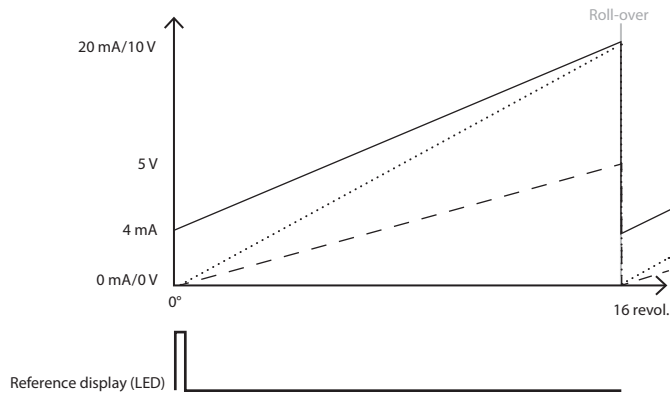
### Absolute, Multiturn Type RM-116 Series Analog

**Note:** Encoders must be ordered with a clockwise or counterclockwise profile. This determines whether the analog output increases or decreases in the given direction.

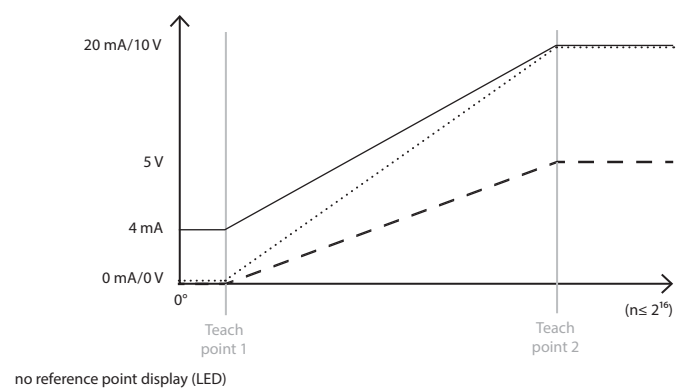
**Example (output signal profile):**

- version 4 - 20 mA
- ⋯ version 0 - 10 V
- - - version 0 - 5 V

**Clockwise (CW) version**



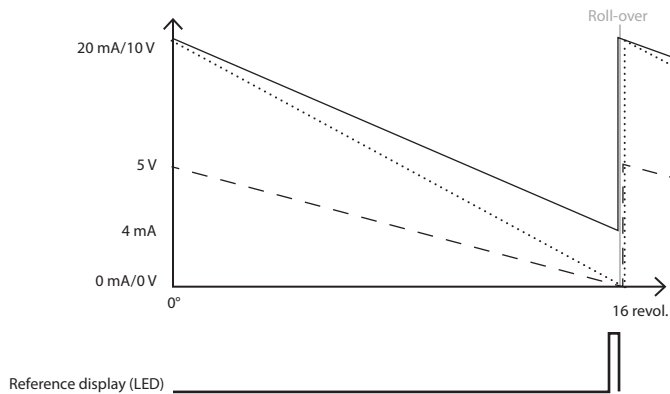
**Scalable version without limit switch function**



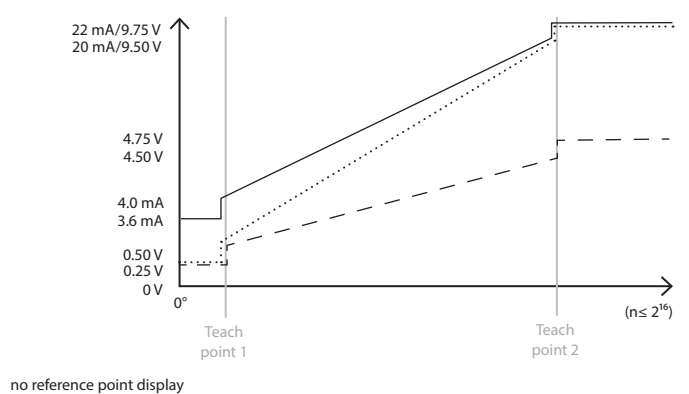
**Example (output signal profile):**

- version 4 - 20 mA
- ⋯ version 0 - 10 V
- - - version 0 - 5 V

**Counter clockwise (CCW) version**



**Scalable version with limit switch function**



**Note:** Factory-set measuring range:  $2^4$  revolutions with roll-over

**Note: Limit switch function:**

|                    |          |         |           |
|--------------------|----------|---------|-----------|
| version:           | 0 - 10 V | 0 - 5 V | 4 - 20 mA |
| limit switch low:  | 0.25 V   | 0.25 V  | 3.60 mA   |
| limit switch high: | 9.75 V   | 4.75 V  | 22.00 mA  |

# Rotary Position Technology

## Absolute Encoders, Multiturn

### Absolute, Multiturn Type RM-116 Series

Analog

#### Part Number Key: RM-116 Shaft Version

| A       | B | C |   | D  | E  |   | F     |
|---------|---|---|---|----|----|---|-------|
| RM-116T | 6 | C | - | 7A | AL | - | H1151 |

| A       | Type                                   |
|---------|--|
| RM-116T | Ø 39 mm, Shaft w/Flat, IP65 Shaft Seal |

| B  | Shaft (Ø × L)    |
|----|------------------|
| 6  | Ø 6 mm × 12.5 mm |
| 10 | Ø 10 mm × 20 mm  |

| C | Flange                  |
|---|-------------------------|
| C | Ø 58 mm Clamping Flange |
| S | Ø 58 mm Servo Flange    |

| D  | Voltage Supply and Output Type |
|----|--------------------------------|
| 7A | 10 - 30 VDC, 4 - 20 mA         |
| 8B | 15 - 30 VDC, 0 - 10 V          |
| BA | 10 - 30 VDC, 0 - 5 V           |

| E     | Measuring Range                                  |
|-------|--|
| AL    | 16 Turns, Count Direction CCW*                   |
| AR    | 16 Turns, Count Direction CW*                    |
| SALNS | Scalable to 65,536 Turns, CCW*, w/o Limit Switch |
| SALWL | Scalable to 65,536 Turns, CCW*, w/ Limit Switch  |
| SARNS | Scalable to 65,536 Turns, CW*, w/o Limit Switch  |
| SARWL | Scalable to 65,536 Turns, CW*, w/ Limit Switch   |

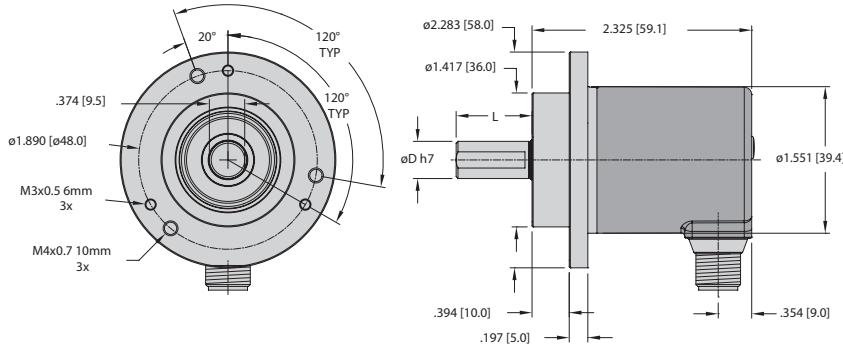
\* = increasing code values when shaft turning in direction listed. Top view on shaft.

| F     | Type of Connection                  |
|-------|-------------------------------------|
| H1151 | Radial 5-pin M12 Eurofast Connector |
| C1M   | Radial Cable (1m PVC)               |

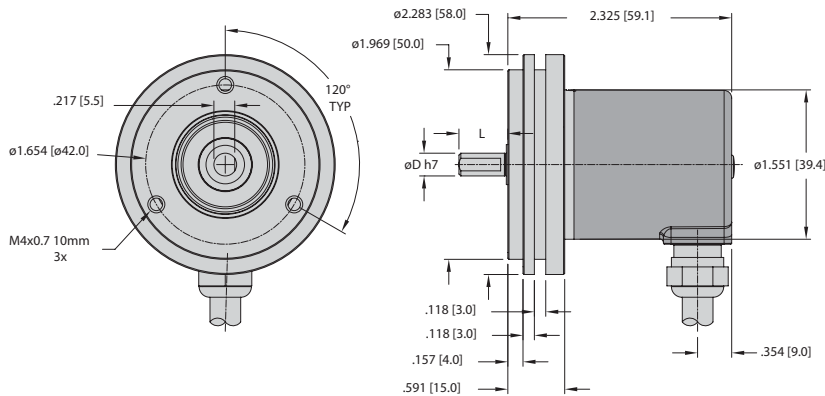
**Absolute, Multiturn Type RM-116 Series** **Analog**

**Dimensions: RM-116 Shaft Version**

**RM-116 Flange C  
 Connection H1151**



**RM-116 Flange S  
 Connection C1M**



**Mounting advice:**

The flanges and shafts of the encoder and drive should not be rigidly coupled together at the same time. We recommend the use of suitable couplings (see page G1, Accessories).

# Rotary Position Technology

## Absolute Encoders, Multiturn

### Absolute, Multiturn Type RM-118

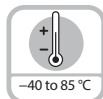
SSI



Bearing-Lock



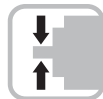
High rotational speed



Temperature range  
-40 to 85 °C



High IP



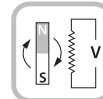
High shaft load capacity



Shock/vibration resistant



Reverse polarity protection



Energy Harvesting

#### High Robustness

- Sturdy bearing construction in Bearing-Lock design for particularly high resistance.
- Extra large bearings.
- Mechanically protected shaft seal.
- Wide temperature range -40 to +85 °C.
- Without gear and without battery, thanks to the Energy Harvesting technology..



#### Application Oriented

- Absolute accuracy  $\pm 1^\circ$ .
- Repeat accuracy  $\pm 0.2^\circ$ .
- Short control cycles, clock frequency with SSI up to 2 MHz.
- Max. resolution 38 bit (14 bit ST + 24 bit MT).

#### Compact Housing

- Can be used where space is tight: 39 mm housing with 58 mm flange

#### Mechanical Characteristics:

|  |   |
|--|---|
| Max. speed:                                | 4000 RPM<br>2000 RPM (continuous)         |
| Starting torque (68 °F   20 °C):           | < 1.4 oz - in (0.01 Nm)                   |
| Shaft load capacity:                       |   |
| Radial:                                    | 18 lbs (80 N)                             |
| Axial:                                     | 9 lbs (40 N)                              |
| Weight:                                    | approx. 0.44 lbs (0.2 kg)                 |
| Protection acc. to EN 60529:               | IP65                                      |
| Working temperature:                       | -40 to +185 °F (-40 to +85 °C)            |
| Materials:                                 |   |
| Shaft:                                     | stainless steel: V2A(304)                 |
| Flange:                                    | aluminum                                  |
| Housing:                                   | zinc die-cast                             |
| Cable:                                     | PUR                                       |
| Shock resistance acc. to EN 60068-2-27:    | 500g (5000 m/s <sup>2</sup> ), 4 ms       |
| Vibration resistance acc. to EN 60068-2-6: | 30g (300 m/s <sup>2</sup> ), 10 - 2000 Hz |

### Absolute, Multiturn Type RM-118

SSI

#### General Electrical Characteristics:

|   |   |
|---|---|
| Power supply                                      | 10 - 30 VDC   |
| Current consumption (no load):                    | max. 30 mA,   |
| Reverse polarity protection at power supply (+V): | yes   |
| Short-circuit protected outputs:                  | yes <sup>1)</sup>                                     |
| UL approval:                                      | file 224618   |
| CE compliant acc. to:                             | EMC guideline 2014/30/EU<br>RoHS guideline 2011/65/EU |

#### Interface Characteristics SSI:

|  |                        |
|--|------------------------|
| Output driver:                                     | RS485 transceiver type |
| Permissible load / channel:                        | max +/- 30 mA          |
| Signal high:                                       | typ 3.8 V              |
| Signal level low with $I_{Load} = 20 \text{ mA}$ : | typ 1.3 V              |
| Resolution singleturn:                             | 10 - 14 bit            |
| Absolute accuracy <sup>2)</sup> :                  | $\pm 1^\circ$          |
| Repeat accuracy:                                   | $\pm 0.2^\circ$        |
| Number of revolutions (multiturn):                 | max 24 bit             |
| Code:  | binary or gray         |
| SSI clock rate:                                    | 50 kHz - 2 MHz         |
| Data refresh rate:                                 | 2 ms                   |
| Monoflop time:                                     | $\leq 15 \mu\text{s}$  |

Note: If the clock cycle starts within the monoflop time a second data transfer begins with the same data. If the clock cycle starts after the monoflop time the cycle begins with the new values. The update rate is dependent on the clock speed, data length and monoflop time.

#### SET Input:

|                                   |  |
|-----------------------------------|--|
| Input characteristics:            | active HIGH                            |
| Input type:                       | comparator                             |
| Signal level high:                | min. 60% of +V (power supply), max: +V |
| Signal level low:                 | max. 30% of +V (power supply)          |
| Input current:                    | < 0.5 mA                               |
| Min. pulse duration (SET):        | 10 ms                                  |
| Input delay:                      | 1 ms                                   |
| New position data readable after: | 1 ms                                   |
| Internal processing time:         | 200 ms                                 |

The encoder can be set to zero at any position by means of a HIGH signal on the SET input. Other preset values can be factory-programmed. The SET input has a signal processing time of approx. 1 ms, after which the new position data can be read via SSI or BiSS. Once the SET function has been triggered, the encoder requires an internal processing time of typ. 200 ms; during this time the power supply must not be switched off.

The SET function should be carried out while the encoder is at rest.

If this input is not used, it should be connected to 0 V (Encoder ground GND) in order to avoid interferences.

#### DIR Input:

Direction input: A HIGH signal switches the direction of rotation from the default cw to ccw. This inverted function can also be factory-programmed.

If this input is not used, it should be connected to 0 V (Encoder ground GND) in order to avoid interferences.

|                           |      |
|---------------------------|------|
| Response time (DIR input) | 1 ms |
|---------------------------|------|

#### Power-On Delay:

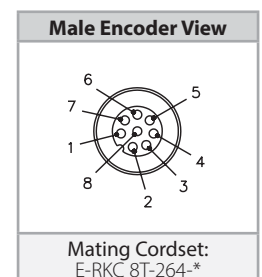
After Power-ON the device requires a time of approx. 150 ms before valid data can be read.

Hot plugging of the encoder should be avoided.

<sup>1)</sup> = when power supply is currently applied  
<sup>2)</sup> = over the entire temperature range

| Connection Type: | GND (0 V) | V+ | +Clock | -Clock | +Data | -Data | SET | DIR | PE     |
|------------------|-----------|----|--------|--------|-------|-------|-----|-----|--------|
| Cable:           | WH        | BN | GN     | YE     | GY    | PK    | BU  | RD  | Shield |
| M12 pin:         | 1         | 2  | 3      | 4      | 5     | 6     | 7   | 8   | PH     |

#### Wiring Diagrams:



\* Length in meters.

# Rotary Position Technology

## Absolute Encoders, Multiturn

### Absolute, Multiturn Type RM-118

SSI

#### Part Number Key: RM-118 Shaft Version

| A       | B | C |   | D  | E1  | E2  |   | F     |
|---------|---|---|---|----|-----|-----|---|-------|
| RM-118T | 6 | C | - | 3C | 10S | 12M | - | H1181 |

| A       | Type                                    |
|---------|---|
| RM-118T | Ø 39 mm, Shaft w/ Flat, IP65 Shaft Seal |

| B  | Shaft (Ø x L)    |
|----|------------------|
| 6  | Ø 6 mm x 12.5 mm |
| 10 | Ø 10 mm x 20 mm  |

| C | Flange                  |
|---|-------------------------|
| C | Ø 58 mm Clamping Flange |
| S | Ø 58 mm Servo Flange    |

| D  | Voltage Supply and Output Type |
|----|--------------------------------|
| 3C | 10 - 30VDC, SSI (Gray Code)    |
| 5C | 10 - 30VDC, SSI (Binary Code)  |

| E1  | Resolution (singleturn) |
|-----|-------------------------|
| 10S | 10 bit                  |
| 12S | 12 bit                  |
| 13S | 13 bit                  |
| 14S | 14 bit                  |

| E2  | Resolution (multiturn) |
|-----|------------------------|
| 12M | 12 bit                 |
| 16M | 16 bit                 |
| 20M | 20 bit                 |
| 24M | 24 bit                 |

| F     | Type of Connection                  |
|-------|-------------------------------------|
| H1181 | Radial 8-pin M12 Eurofast Connector |
| C1M   | Radial Cable (1 m PUR)              |

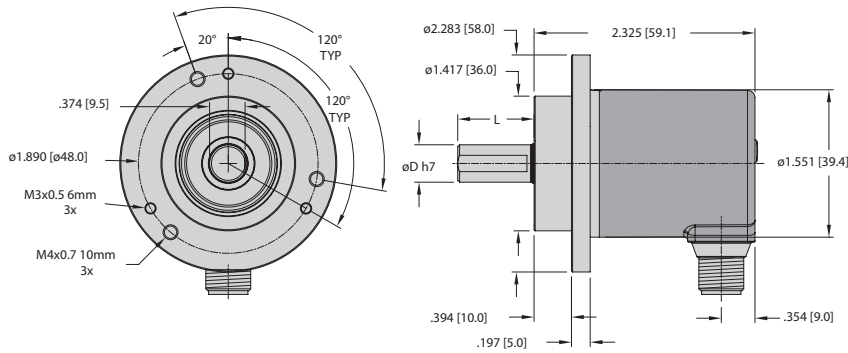


**Absolute, Multiturn Type RM-118**

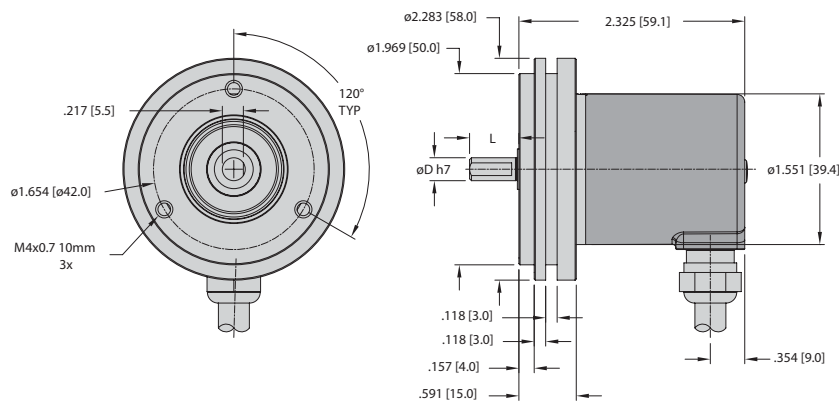
**SSI**

**Dimensions: RM-118 Shaft Version**

**RM-118 Flange C  
 Connection H1181**



**RM-118 Flange S  
 Connection C1M**



**Mounting Advice:**

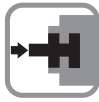
The flanges and shafts of the encoder and drive should not be rigidly coupled together at the same time. We recommend the use of suitable couplings (see page G1, Accessories).

# Rotary Position Technology

## Absolute Encoders, Multiturn

### Absolute, Multiturn Type RM-121

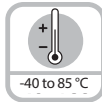
CANopen



Bearing-Lock



High rotational speed



Temperature range



High IP



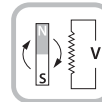
High shaft load capacity



Shock/vibration resistant



Reverse polarity protection



Energy Harvesting

#### Highest Robustness

- Sturdy bearing construction in Bearing-Lock design for particularly high resistance.
- Extra large bearings.
- Mechanically protected shaft seal.
- Wide temperature range  $-40 + 85^{\circ}\text{C}$ .
- Without gear and without battery, thanks to the Energy Harvesting technology.



Absolute



CANopen



#### Up-To-The-Minute Fieldbus Performance

- LSS services for configuration of the node address and baud rate.
- Variable PDO mapping in the memory.
- Universal scaling function.
- Configuration management (bootloader).

#### Compact Housing

- Can be used where space is tight: 39 mm housing with 58 mm flange.

#### Mechanical Characteristics:

|  |  |
|--|--|
| Max. speed:                                | 4000 RPM<br>2000 RPM (continuous)                                  |
| Starting torque (68 °F   20 °C):           | < 1.4 oz - in (0.01 Nm)  |
| Shaft load capacity:                       |  |
| Radial:                                    | 18 lbs (80 N)  |
| Axial:                                     | 9 lbs (40 N)   |
| Weight:                                    | approx. 0.44 lbs (0.2 kg)  |
| Protection acc. to EN 60529/DIN 40050-9:   | IP65   |
| Working temperature range:                 | $-40$ to $+185^{\circ}\text{F}$ ( $-40$ to $+85^{\circ}\text{C}$ ) |
| Materials:                                 |  |
| Shaft:                                     | stainless steel: V2A(304)  |
| Flange:                                    | aluminum   |
| Housing:                                   | zinc die-cast  |
| Cable:                                     | PVC  |
| Shock resistance acc. to EN 60068-2-27:    | 500 g (5000 m/s <sup>2</sup> ), 4 ms                               |
| Vibration resistance acc. to EN 60068-2-6: | 30 g (300 m/s <sup>2</sup> ), 10 - 2,000 Hz                        |

### Absolute, Multiturn Type RM-121

### CANopen

#### General Electrical Characteristics:

| Sensor:   |   |
|---|---|
| Power supply:                                     | 10 - 30 VDC   |
| Current consumption (no load):                    | max. 30 mA  |
| Reverse polarity protection at power supply (+V): | yes   |
| Short-circuit protected outputs                   | yes <sup>1)</sup>                                     |
| UL approval                                       | file 224618   |
| CE compliant acc. to                              | EMC guideline 2014/30/EU<br>RoHS guideline 2011/65/EU |

#### General Information about CANopen

The CANopen encoders support the latest CANopen communication profile according to DS301 V4.02. In addition, device-specific profiles like the encoder profile DS406 V3.2, DS305 (LSS) and DS302 (Bootloader) are available.

The following operating modes may be selected: Polled Mode, Cyclic Mode, Sync Mode. Moreover, scale factors, preset values, limit switch values and many other additional parameters can be programmed via the CANbus. When switching the device on, all parameters, which have been saved on a flash memory to protect them against power failure, are loaded again.

The following output values may be combined in a freely variable way as PDO(PDO mapping): **position, speed, acceleration** as well as the **status of the working area**.

The encoders are available with a connector or a cable connection.

The device address and baud rate can be set/modified by means of the software.

The two-color LED located on the back indicates the operating or fault status of the CAN-bus, as well as the status of the internal diagnostics.

#### CANbus connection

The CANopen encoders are equipped with a bus trunk line in various lengths or a M12 connector and can be terminated in the device.

The devices do not have an integrated T-coupler nor are they looped internally and must therefore only be used as end devices.

#### Standard Wiring:

| Connection Type: | +V | Common (0V) | CAN GND | CAN High | CAN Low |
|------------------|----|-------------|---------|----------|---------|
| Cable:           | BN | WH          | GY      | GN       | YE      |
| M12 Eurofast:    | 2  | 3           | 1       | 4        | 5       |

#### Interface Characteristics CANopen:

|                                    |   |
|------------------------------------|---|
| Resolution singleturn:             | 1 - 16384 (14 bit), scalable default: 8192 (13 bit)   |
| Absolute accuracy <sup>2)</sup> :  | ±1 °  |
| Repeat accuracy:                   | ±0.2 °  |
| Number of revolutions (multiturn): | max. 16,777,216 (24 bit)<br>scalable onl via the total resolution   |
| Total resolution:                  | 1...274,877,906,944 (38 bit), scalable default: 33,554,432 (25 bit)   |
| Code:                              | binary  |
| Interface:                         | CAN high-speed acc. to ISO 11898, Basic and Full-CAN, CAN specification 2.0 B   |
| Protocol:                          | CANopen profile DS406 V4.0 with manufacturer-specific add-ons, LSS-Service, bootloader  |
| Power-ON time:                     | < 1200 ms   |
| SDO timeout:                       | < 1000 ms   |
| Baud rate:                         | 10 - 1000 kbit/s software configurable  |
| Node address:                      | 1 - 127 software configurable   |
| Termination:                       | software configurable   |
| LSS protocol:                      | CIA LSS protocol DS305, global command support for node address and baud rate, selective commands via attributes of the identity object |
| Bootloader:                        | configuration management<br>CIA DS 302-3  |

<sup>1)</sup> = short circuit protected to 0v of to output when power supply currently applied  
<sup>2)</sup> = over the entire temperature range

#### LSS layer setting services DS305 V2.0

- Global support of node-ID and baud rate configuration.
- Selective protocol via identity object (1018h)

#### CANopen Communication Profile DS301 V4.2

Among others, the following functionality is integrated. (Class C2 functionality):

- NMT Slave
- Heartbeat Protocol
- Identity Object
- Error Behavior Object
- Variable PDO Mapping self-start programmable (Power on to operational), 3 Sending PDO's
- Node address, baud rate and CANbus / programmable termination

#### CANopen encoder profile DS406 V4.0

The following parameters can be programmed:

- Event mode, start optional
- 1 work area with upper and lower limit and the corresponding output states
- Variable PDO mapping for position, speed, work area status, error and acceleration

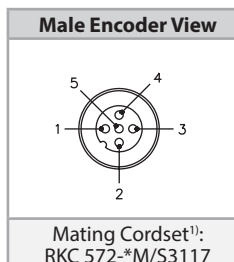
- Extended failure management for position sensing
- User interface with visual display of bus and failure status 1 LED two colors
- Customer-specific protocol
- "Watchdog controlled" device

#### Bootloader functionality DS302-3

Configuration Management:

- Program download
- Program start
- Program erase

#### Wiring Diagram:



\* Length in meters.

<sup>1)</sup> See Connectivity section H for corresponding cable color code.

# Rotary Position Technology

## Absolute Encoders, Multiturn

### Absolute, Multiturn Type RM-121

CANopen

#### Part Number Key: RM-121 Shaft Version

| A       | B | C |   | D     |   | E     |
|---------|---|---|---|-------|---|-------|
| RM-121T | 6 | C | - | 9D38B | - | H1151 |

| A       | Type                            |
|---------|---------------------------------|
| RM-121T | Ø 39 mm, Shaft, IP65 Shaft Seal |

| D     | Voltage Supply and Output Type   |
|-------|----------------------------------|
| 9D38B | 10 - 30 VDC, CANopen DS301 V4.02 |

| B  | Shaft (Ø × L)   |
|----|-----------------|
| 6  | Ø 6 mm × 10 mm  |
| 10 | Ø 10 mm × 20 mm |

| E     | Type of Connection                |
|-------|-----------------------------------|
| H1151 | Radial 1 × M12 Eurofast Connector |
| C1M   | Radial Cable (1 m PUR)            |

| C | Flange                  |
|---|-------------------------|
| C | Ø 58 mm Clamping Flange |
| S | Ø 58 mm Servo Flange    |

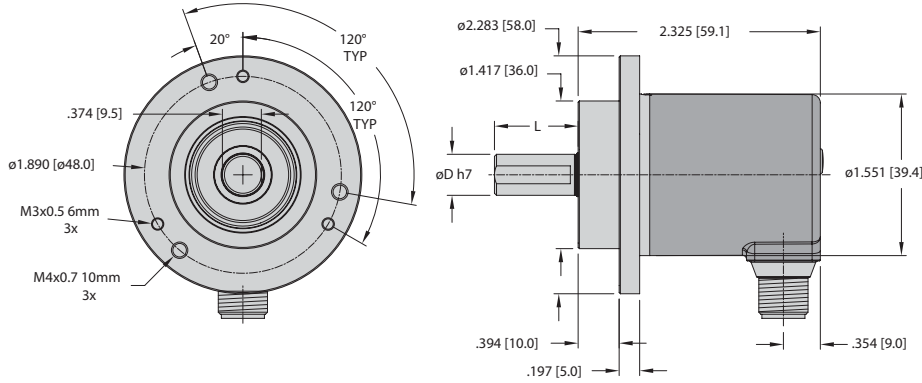
#### Accessories:

- See page H1, Connectivity, for cables and connectors
- See page G1, Accessories, for mounting attachments and couplings

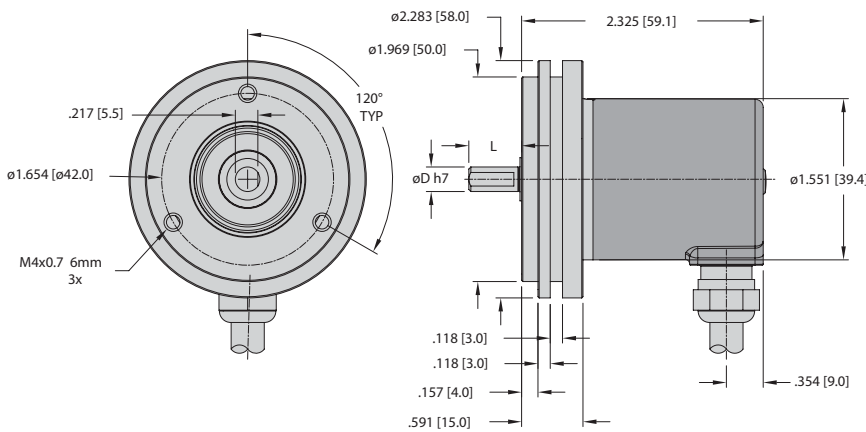
**Absolute, Multiturn Type RM-121** **CANopen**

**Dimensions: RM-121 Shaft Version**

**RM-121 Flange C  
 Connection H1151**



**RM-121 Flange S  
 Connection C1M**



**Mounting Advice:**

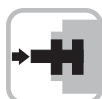
The flanges and shafts of the encoder and drive should not be rigidly coupled together at the same time. We recommend the use of suitable couplings (see page G1, Accessories).

# Rotary Position Technology

## Absolute Encoders, Multiturn

**Absolute, Multiturn Type RM-46 (Shaft) / RM-50 (Blind / Hollow Shaft)**

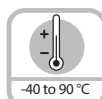
**SSI/BiSS-C**



Bearing-Lock



High rotational speed



Temperature  
-40 to 90 °C



High IP



High shaft load capacity



Shock/vibration resistant



Magnetic field proof



Short-circuit protected



Reverse polarity protection



SIN/COS



Optical sensor



Seawater-resistant version on request

### Reliable

- **Increased ability to withstand vibration and installation errors.** Sturdy Bearing-Lock design structure eliminates machine downtime and repairs.
- **Fewer components and connection points increase the operational reliability:** Turck OptoASIC technology with highest integration density (Chip-on-Board).
- Die cast housing and protection up to IP67: **Remains sealed even when subjected to harsh everyday use.**
- Wide temperature range of -40 to +194 °F (-40 to +90 °C).
- **Easy diagnosis in case of fault condition.** Status indication by means of LED, sensor, voltage and temperature monitoring.



### Absolute



### Fast

- **High accuracy:** Update rate of the whole position value above 100 kHz for a max. jitter of 1 μs (real-time).
- **High productivity due to very short regulation cycles:** Clock rate with SSI up to 2 MHz, with BiSS-C up to 10 MHz.
- **High-resolution feedback system achievable in real-time:** SinCos incremental outputs.

### Versatile

- **Connections for every application:** Tangential cable.
- **Open interfaces ensure flexibility and independence:** SSI or BiSS-C with Sine-Cosine-Option incremental track RS422.
- Multiple mounting brackets for easy installation.
- **Compact design.**
- **Fast and easy start-up on site:** Preset and reversal of rotation direction by control inputs.
- **Direct mounting on standard diameter shafts up to 10 mm** through hollow shaft up to 8 mm.

### Mechanical Characteristics:

|   |   |  |   |
|---|---|--|---|
| Max. speed, shaft or blind hollow shaft version without shaft sealing (IP65):     | 12,000 RPM, continuous operation 10,000 RPM | Protection acc. to EN 60 529:                | Housing: IP67, Shaft: IP65, opt. IP67   |
| Max. speed, shaft version (IP67) or blind hollow shaft (IP65) with shaft sealing: | 10,000 RPM, continuous operation 8,000 RPM  | Working temperature:                         | -40 to +194 °F (-40 to +90 °C)  |
| Starting torque without shaft sealing:  | < 1 oz-in (< 0.007 Nm)                      | Materials:                                   | Shaft/Hollow shaft: stainless steel, Flange: aluminum, Housing: die cast zinc, Cable: PUR |
| Starting torque with shaft sealing:   | < 1.4 oz-in (< 0.01 Nm)                     | Shock resistance acc. to DIN-IEC 68-2-27:    | > 250 g (> 2,500 m/s <sup>2</sup> ), 6 ms   |
| Radial load capacity of shaft:  | 9 lbs (40 N)                                | Vibration resistance acc. to DIN-IEC 68-2-6: | > 10 g (>100 m/s <sup>2</sup> ), 55-2,000 Hz  |
| Axial load capacity of shaft:   | 4.5 lbs (20 N)                              |  |   |
| Weight:   | approx. 0.44 lbs (0.2 kg)                   |  |   |

### General Electrical Characteristics:

|   |  |  |                        |
|---|--|--|------------------------|
| Supply voltage:                                   | 5 VDC ±5% or 10-30 VDC                   | RoHS compliant acc. to EU guideline 2011/65/EU |                        |
| Current consumption (without output load):        | 5 VDC: max. 60 mA, 10-30 VDC: max. 30 mA | Output driver:                                 | RS485 transceiver type |
| Reverse polarity protection at power supply (+V): | Yes                                      | Permissible load/channel:                      | max. ± 30 mA           |
|   |  | Signal level high:                             | typ. 3.8 V             |
|   |  | Signal level low at I <sub>load</sub> = 20 mA: | typ. 1.3 V             |
|   |  | Short-circuit protected:                       | yes <sup>1)</sup>      |

### Interface Characteristics SSI:

|                        |   |                        |   |
|------------------------|---|------------------------|---|
| Singleturn resolution: | 10-17 bit   | Date refresh rate:     | Up to 14 bits, ≤1 μs<br>Up to 15-17 bits, 4 μs  |
| Number of revolutions: | Max. 24 bit                                       | Status and Parity bit: | Optional on request   |
| Code:                  | binary or gray                                    | Note:                  | If clock starts cycling within monoflop time, a second data transfer starts with the same data. If clock starts cycling after monoflop time, the data transfer starts with updated values. Max. update rate is dependent on clock speed, data length and monoflop time. |
| SSI clock rate:        | ≤ 14 bit: 50 kHz-2 MHz / ≥ 15 bit: 50 kHz-125 kHz |                        |   |
| Monoflop time:         | ≤ 15 μs   |                        |   |

<sup>1)</sup> Short-circuit to 0 V or to output, one channel at a time, supply voltage correctly applied

### Absolute, Multiturn Type RM-46 (Shaft) / RM-50 (Blind / Hollow Shaft)

SSI/BiSS-C

#### Interface Characteristics BiSS-C:

|                        |   |
|------------------------|---|
| Singleturn resolution: | 10-17 bit   |
| Number or revolutions: | Max. 24 bit                                       |
| Code:                  | Binary  |
| Clock rate:            | up to 10 MHz                                      |
| Max. update rate:      | < 10 µs, depending on clock speed and data length |
| Data refresh rate:     | ≤ 1 µs  |

Note: Bidirectional, programmable parameters are: resolution, code, direction, alarms and warnings; Multicycle data output (e.g., for temperature); CRC data verification

#### Incremental Output (A/B). 2048 PPR:

|                      |                   |                                     |
|----------------------|-------------------|-------------------------------------|
|                      | Sin/Cos           | RS422 Compatible                    |
| Max. -3dB frequency: | 400 kHz           | 400 kHz                             |
| Signal level:        | 1 Vpp (±20%)      | High: min. 2.5 V<br>Low: max. 0.5 V |
| Short-circuit proof: | yes <sup>1)</sup> | yes <sup>1)</sup>                   |

<sup>1)</sup> Short-circuit to 0 V or to output, one channel at a time, supply voltage correctly applied

#### Status Output and LED:

|                    |   |
|--------------------|---|
| Output driver:     | open collector, internal pull up resistor 22 kOhm |
| Permissible load:  | Max. 20 mA  |
| Signal level high: | +V  |
| Signal level low:  | < 1 V   |
| Active at:         | Low   |

The optional LED (red) and the status output serve to display various alarm or error messages. In normal operation, the LED is OFF and the status output is HIGH (open-collector with int. pull-up 22 k).

If the LED is ON (status output LOW) this indicates: Sensor error, singleturn or multiturn (soiling, glass breakage etc.); LED error, failure or aging; Over temperature; Under voltage.  
In the SSI mode, the fault indication can only be reset by switching off the power-supply to the device.

#### Standard Wiring:

##### Output Circuit \*C and \*F (SSI or BiSS-C, SET, DIR, Status) (Connection CT\*M)

| Connection Type: | Common (0V) | +V | +Clock | -Clock | +Data | -Data | SET | DIR | Status | PE     |
|------------------|-------------|----|--------|--------|-------|-------|-----|-----|--------|--------|
| Cable:           | WH          | BN | GN     | YE     | GY    | PK    | BU  | RD  | VT     | Shield |

##### Output Circuit \*C and \*F (SSI or BiSS-C, SET, DIR) (Connection CT1M-RSS8T)

| Connection Type: | GND | +V | +Clock | -Clock | +Data | -Data | SET | DIR | Shield/PE |
|------------------|-----|----|--------|--------|-------|-------|-----|-----|-----------|
| M12 Eurofast:    | 1   | 2  | 3      | 4      | 5     | 6     | 7   | 8   | PH        |

##### Output Circuit \*E and \*G (SSI or BiSS-C, SET, DIR, 2048 Sin/Cos) (Connection CT\*M)

| Connection Type: | GND | +V | +Clock | -Clock | +Data | -Data | SET | DIR | A  | A inv | B     | B inv | PE     |
|------------------|-----|----|--------|--------|-------|-------|-----|-----|----|-------|-------|-------|--------|
| Cable:           | WH  | BN | GN     | YE     | GY    | PK    | BU  | RD  | BK | VT    | GY/PK | RD/BU | Shield |

##### Output Circuit \*H (SSI or BiSS-C, SET, DIR, Voltage Sense Outputs) (Connection CT\*M)

| Connection Type: | GND | +V | +Clock | -Clock | +Data | -Data | SET | DIR | 0 V sens | +V sens | PE     |
|------------------|-----|----|--------|--------|-------|-------|-----|-----|----------|---------|--------|
| Cable:           | WH  | BN | GN     | YE     | GY    | PK    | BU  | RD  | VT       | RD/BU   | Shield |

##### Output Circuit \*J (SSI or BiSS-C, SET, DIR, 2048 Sin/Cos, Voltage Sense Outputs) (Connection CT\*M)

| Connection Type: | GND | +V | +Clock | -Clock | +Data | -Data | 0 V sens | +V sens | A  | A inv | B     | B inv | PE     |
|------------------|-----|----|--------|--------|-------|-------|----------|---------|----|-------|-------|-------|--------|
| Cable:           | WH  | BN | GN     | YE     | GY    | PK    | BU       | RD      | BK | VT    | GY/PK | RD/BU | Shield |

##### Output Circuit \*K and \*L (SSI or BiSS-C, SET, DIR, 2048 Sin/Cos) (Connection CT\*M)

| Connection Type: | GND | +V | +Clock | -Clock | +Data | -Data | A  | A inv | B     | B inv | PE     |
|------------------|-----|----|--------|--------|-------|-------|----|-------|-------|-------|--------|
| Cable:           | WH  | BN | GN     | YE     | GY    | PK    | BK | VT    | GY/PK | RD/BU | Shield |

#### SET Input:

|                                   |  |
|-----------------------------------|--|
| Input characteristics:            | active HIGH                              |
| Input type:                       | comparator                               |
| Signal level high:                | min. 60% of V+ (supply voltage), max: V+ |
| Signal level low:                 | max. 30% of V+ (supply voltage)          |
| Input current:                    | < 0.5 mA                                 |
| Min. pulse duration (SET):        | 10 ms                                    |
| Input delay:                      | 1 ms                                     |
| New position data readable after: | 1 ms                                     |
| Internal processing time:         | 200 ms                                   |

The encoder may be set to zero at any position by means of a HIGH signal on the SET input or by pressing the optional SET key. Other preset values may be factory programmed. The SET input has a signal delay time of approximately 1 ms. Once the SET function has been triggered, the encoder requires an internal processing time of approximately 200 ms before the new position data can be read. During this time the LED is ON and the status output is at LOW.

Response time (DIR input) 1 ms

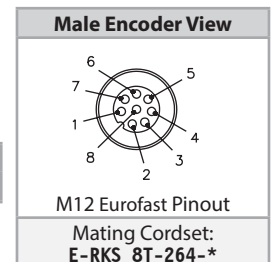
#### DIR Input:

A HIGH signal switches the direction of rotation from the default CW to CCW. This inverted function can also be factory-programmed. If DIR is changed when the device is already switched on, then this will be interpreted as an error. The LED will come ON and the status output will switch to LOW.

#### Power-On Delay:

After Power-ON the device requires a time of approx. 150 ms before valid data can be read.

#### Wiring Diagrams:



\* Length in meters.

# Rotary Position Technology

## Absolute Encoders, Multiturn

### Absolute, Multiturn Type RM-46 (Shaft) / RM-50 (Blind / Hollow Shaft)

SSI/BiSS-C

#### Part Number Key: RM-46 Shaft Version

| A      | B | C |   | D  | E1  | E2  |   | F    |
|--------|---|---|---|----|-----|-----|---|------|
| RM-46S | 6 | C | - | 5F | 10S | 12M | - | CT1M |

| A      | Type                            |
|--------|---------------------------------|
| RM-46S | Ø 39 mm, Shaft, IP67 Shaft Seal |
| RM-46T | Ø 39 mm, Shaft, IP65 Shaft Seal |

| B  | Shaft (Ø x L)    |
|----|------------------|
| 6  | Ø 6 mm x 12.5 mm |
| 8  | Ø 8 mm x 15 mm   |
| 10 | Ø 10 mm x 20 mm  |
| A0 | Ø 1/4" x 12.5 mm |
| A1 | Ø 3/8" x 5/8"    |

| C | Flange                  |
|---|-------------------------|
| C | Ø 36 mm Clamping Flange |
| S | Ø 36 mm Servo Flange    |

| E1  | Resolution (Singleturn) |
|-----|-------------------------|
| 10S | 10-bit                  |
| 12S | 12-bit                  |
| 13S | 13-bit                  |
| 14S | 14-bit                  |
| 17S | 17-bit                  |

| E2  | Resolution (Multiturn) |
|-----|------------------------|
| 12M | 12-bit                 |
| 16M | 16-bit                 |
| 24M | 24-bit                 |

| F          | Type of Connection                             |
|------------|--|
| CT1M       | Tangential Cable (1 m PUR)                     |
| CT5M       | Tangential Cable (5 m PUR)                     |
| CT1M-RSS8T | Tangential Cable w/ 1m M12 Eurofast Connector* |

\* Only Available with Output Type \*C and \*F

| D       | Voltage Supply and Output Type |         |        |  |
|---------|--------------------------------|---------|--------|--|
|         | SSI (B)                        | SSI (G) | BiSS-C | Features   |
| 5 V     | 5F                             | 3F      | DF     | 2048 PPR SinCos<br>Voltage Monitoring<br>2048 PPR SinCos Plus Voltage Monitoring<br>2048 PPR Incr., RS422 (TTL-Compatible) |
|         | 5E                             | 3E      | DE     |  |
|         | 5H                             | 3H      | DH     |  |
|         | 5J                             | 3J      | DJ     |  |
|         | 5K                             | 3K      | DK     |  |
| 10-30 V | 5C                             | 3C      | DC     | 2048 PPR SinCos<br>2048 PPR Incr., RS422   |
|         | 5G                             | 3G      | DG     |  |
|         | 5L                             | 3L      | DL     |  |

(B) = Binary, (G) = Gray

#### Accessories:

- See page H1, Connectivity, for cables and connectors
- See page G1, Accessories, for mounting attachments and couplings



### Absolute, Multiturn Type RM-46 (Shaft) / RM-50 (Blind / Hollow Shaft) SSI/BiSS-C

#### Part Number Key: RM-50 Hollow Shaft Version

| A      | B | C |   | D  | E1  | E2  |   | F    |
|--------|---|---|---|----|-----|-----|---|------|
| RM-50B | 6 | E | - | 5F | 10S | 12M | - | CT1M |

| A      | Type   |
|--------|--|
| RM-50B | Ø 39 mm, Blind Hollow Shaft, IP65 Shaft Seal <sup>1)</sup> |
| RM-50H | Ø 39 mm, Hollow Shaft, IP65 Shaft Seal                     |

<sup>1)</sup> Only Available with Bore '10'

| B  | Bore    |
|----|---------|
| 6  | Ø 6 mm  |
| 8  | Ø 8 mm  |
| 10 | Ø 10 mm |
| A0 | Ø 1/4"  |

| C  | Flange                               |
|----|--------------------------------------|
| E  | Ø 36 mm Flange w/ Slotted Flex Mount |
| T  | Ø 36 mm Flange w/ Long Torque Stop   |
| T1 | Ø 36 mm Flange w/ Short Torque Stop  |

| E1  | Resolution (Singleturn) |
|-----|-------------------------|
| 10S | 10-bit                  |
| 12S | 12-bit                  |
| 13S | 13-bit                  |
| 14S | 14-bit                  |
| 17S | 17-bit                  |

| E2  | Resolution (Multiturn) |
|-----|------------------------|
| 12M | 12-bit                 |
| 16M | 16-bit                 |
| 24M | 24-bit                 |

| F          | Type of Connection                              |
|------------|---|
| CT1M       | Tangential Cable (1 m PUR)                      |
| CT5M       | Tangential Cable (5 m PUR)                      |
| CT1M-RSS8T | Tangential Cable w/ 1 m M12 Eurofast Connector* |

\* Only Available with Output Type \*C and \*F

| D       | Voltage Supply and Output Type |         |        | Features   |
|---------|--------------------------------|---------|--------|--|
|         | SSI (B)                        | SSI (G) | BiSS-C |  |
| 5 V     | 5F                             | 3F      | DF     | 2048 PPR SinCos<br>Voltage Monitoring<br>2048 PPR SinCos Plus Voltage Monitoring<br>2048 PPR Incr., RS422 (TTL-Compatible) |
|         | 5E                             | 3E      | DE     |  |
|         | 5H                             | 3H      | DH     |  |
|         | 5J                             | 3J      | DJ     |  |
|         | 5K                             | 3K      | DK     |  |
| 10-30 V | 5C                             | 3C      | DC     | 2048 PPR SinCos<br>2048 PPR Incr., RS422   |
|         | 5G                             | 3G      | DG     |  |
|         | 5L                             | 3L      | DL     |  |

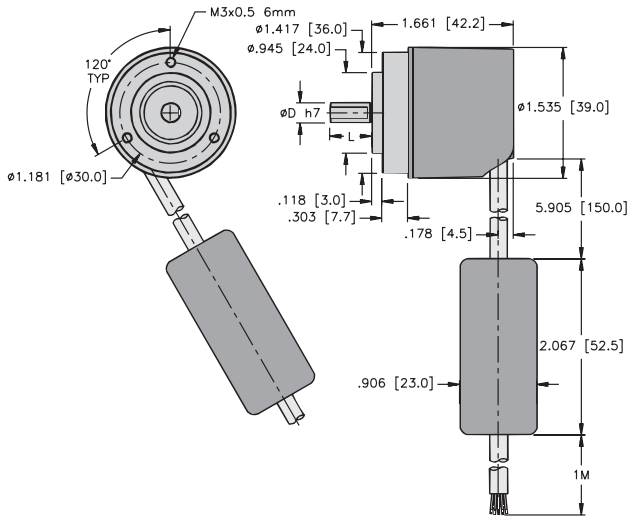
(B) = Binary, (G) = Gray

#### Accessories:

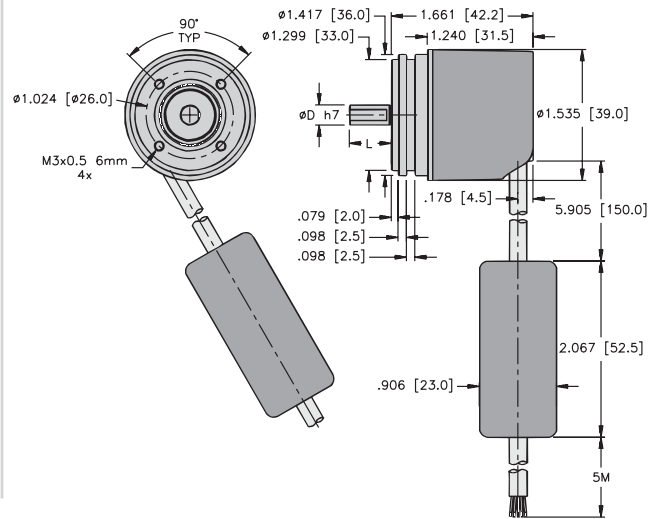
- See page H1, Connectivity, for cables and connectors
- See page G1, Accessories, for mounting attachments and couplings

**Dimensions: RM-46 Shaft Version**

**RM-46 Flange C  
 Connection CT1M**

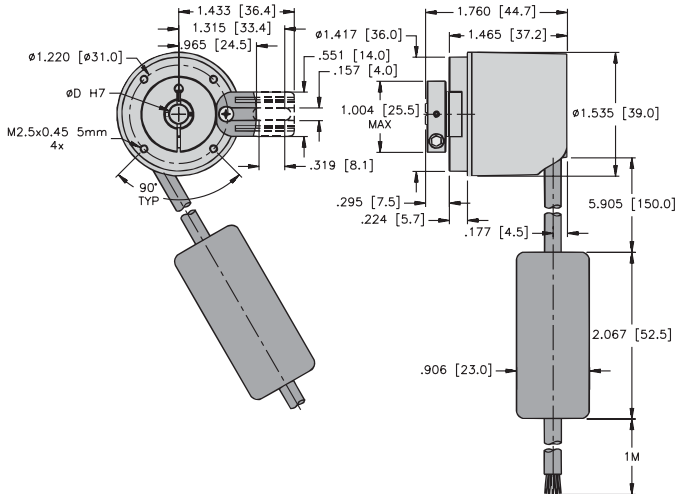


**RM-46 Flange S  
 Connection CT5M**

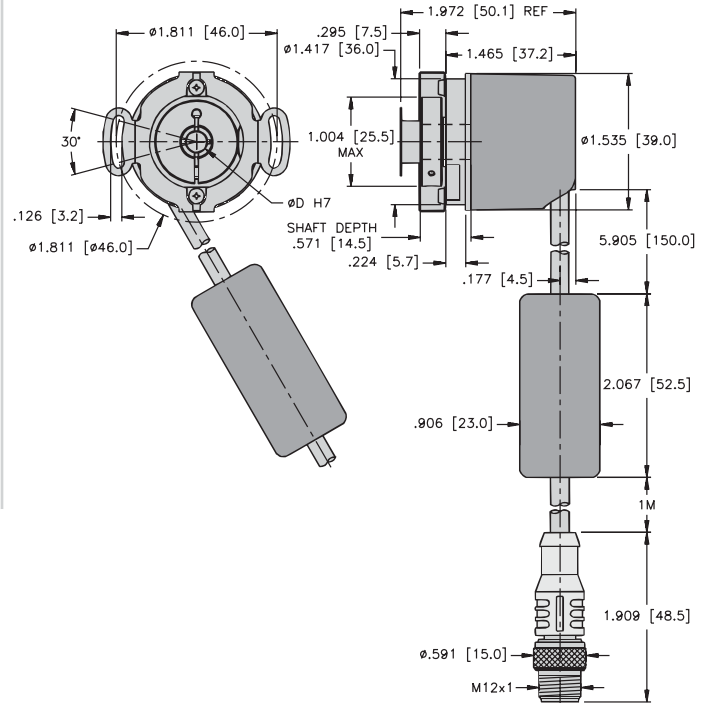


**Dimensions: RM-50 Hollow Shaft Version**

**RM-50 Flange T&T  
 Connection CT1M**

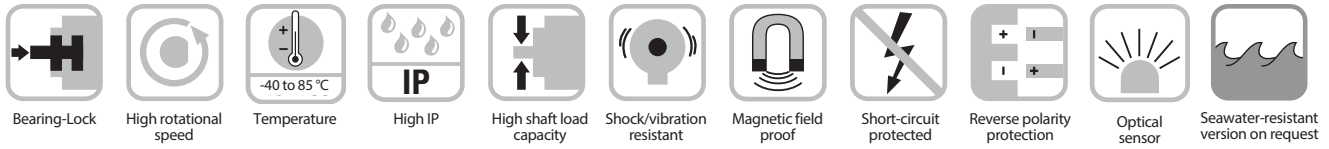


**RM-50 Flange E (Blind Hollow Shaft)  
 Connection CT1M-RSC8T**



### Absolute, Multiturn Type RM-47 (Shaft) / RM-51 (Blind Hollow Shaft)

### CANopen



#### Rugged

- Electronic multiturn is 100% magnetic-field resistant.
- Sturdy bearing construction in Bearing-Lock design for resistance against vibration and installation errors.
- Wide temperature range: -40 to +185 °F (-40 to +85 °C).



#### Absolute



#### CANopen

#### Versatile

- CANopen with current encoder profile.
- LSS services for configuration of the node address and baud rate.
- Variable PDO mapping in the memory.
- Universal scaling function.

#### Compact

- **Overall size of 36 x 42 mm:**  
Hollow shaft of up to 8 mm,  
blind hollow shaft of up to 10 mm.

#### Mechanical Characteristics:

|   |   |
|---|---|
| Max. speed:   |   |
| Shaft or blind hollow shaft without shaft sealing (IP65):             | 12,000 RPM, continuous operation 10,000 RPM   |
| Shaft version (IP67) or blind hollow shaft (IP65) with shaft sealing: | 10,000 RPM, continuous operation 8,000 RPM  |
| Starting torque without shaft sealing:                                | < 1 oz-in (< 0.007 Nm)  |
| Starting torque with shaft sealing:                                   | < 1.4 oz-in (< 0.01 Nm)   |
| Radial load capacity of shaft:  | 9 lbs (40 N)  |
| Axial load capacity of shaft:   | 4.5 lbs (20 N)  |
| Weight:   | approx. 0.44 lbs (0.2 kg)   |
| Protection acc. to EN 60 529:   | Housing: IP67<br>Shaft: IP65, opt. IP67   |
| Working temperature:  | -40 to +185 °F (-40 to +85 °C)  |
| Materials:  | Shaft/Hollow shaft: stainless steel,<br>Flange: aluminum,<br>Housing: die cast zinc, Cable: PUR |
| Shock resistance acc. to DIN-IEC 68-2-27:                             | > 250 g (> 2,500 m/s <sup>2</sup> ), 6 ms   |
| Vibration resistance acc. to DIN-IEC 68-2-6:                          | > 10 g (>100 m/s <sup>2</sup> ), 55-2,000 Hz  |

#### Diagnostic LED (two-color, red/green):

|                     |   |
|---------------------|---|
| LED ON or blinking: | red: error display<br>green: status display |
|---------------------|---|

#### General Electrical Characteristics:

|  |            |
|--|------------|
| Supply voltage:                                | 10-30 VDC  |
| Current consumption (no load):                 | Max. 80 mA |
| Reverse connection of the supply voltage (+V): | yes        |
| RoHS compliant acc. to EG-guideline 2011/65/EU |            |

#### Interface Characteristics CANopen:

|                           |   |
|---------------------------|---|
| Resolution Singleturn:    | 1-65536 (16 bit), scaleable: 1-65536  |
| Default value Singleturn: | 8192 (13 bit)   |
| Total resolution:         | 1-4.294.967.296 (32 bit); Default: 25 bit   |
| Code:                     | Binary  |
| Interface:                | CAN High-Speed according to ISO 11898, Basic- and Full-CAN, CAN Specification 2.0 B   |
| Protocol:                 | CANopen profil DS 406 V3.2 with manufacturer specific add-ons LSS-Service DS305 V2.0  |
| Baud rate:                | 10-1000 kbit/s (software configurable)  |
| Node address:             | 1-127 (software configurable)   |
| Termination switchable:   | Software configurable   |
| LSS Protocol              | CIA LSS protocol DS305<br>Global command support for node address and baud rate. Selective commands via attributes of the identity object |

# Rotary Position Technology

## Absolute Encoders, Multiturn

### Absolute, Multiturn Type RM-47 (Shaft) / RM-51 (Blind Hollow Shaft)

### CANopen

#### General Information about CANopen

The CANopen encoders support the latest CANopen communication profile according to DS 301 V4.02. In addition, device specific profiles, like the DS 406 V3.2, are available.

The following operating modes may be selected: Polled Mode, Cyclic Mode, Sync Mode. Moreover, scale factors, preset values, limit switch values and many other additional parameters can be programmed via the CANbus. When switching the device on, all parameters, which have been saved on a flash memory to protect them against power failure, are loaded again. Position, speed and status of the working area output values may be combined in a freely variable way as PDO mapping.

The encoders are available with a cable connection. The device address and baud rate may be set/modified by means of the software. A two-color LED indicates the operating or fault status of the CANbus, as well as the status of the internal diagnostics.

#### CANopen Communication Profile DS301 V4.02

The following Class C2 functionality is integrated:

- NMT Slave
- Heartbeat Protocol
- Identity Object
- Error Behavior Object
- Variable PDO Mapping self-start programmable (Power on to operational), 3 sending PDO's
- Node address, baud rate and CANbus/programmable termination

#### CANopen Encoder Profile DS406 V3.2

The following parameters may be programmed:

- Event mode
- One work area with upper and lower limit and the corresponding output states
- Variable PDO mapping for position, speed, work area status
- Extended failure management for position sensing
- User interface with visual display of bus and failure status: 1 LED, two-color
- Customer-specific memory - 16 Bytes
- "Watchdog controlled" device

#### LSS Layer Setting Services DS305 V2.0

- Global support of Node-ID and baud rate
- Selective protocol via identity object (1018h)

#### Universal scaling function

At the end of the physical resolution of an encoder, when scaling is active, an error appears if the division of the physical limit (GP\_U) by the programmed total resolution (TMR) does not produce an integer. The universal scaling function remedies this problem.

#### Standard Wiring:

| Connection Type: | +V | 0 V | CAN GND | CAN High | CAN Low |
|------------------|----|-----|---------|----------|---------|
| Cable:           | BN | WH  | GY      | GN       | YE      |

#### Part Number Key: RM-47 Shaft Version

| A      | B | C |   | D     |   | E    |
|--------|---|---|---|-------|---|------|
| RM-47S | 6 | C | - | 9D32B | - | CT1M |

| A      | Type                            |
|--------|---------------------------------|
| RM-47S | Ø 39 mm, Shaft, IP67 Shaft Seal |
| RM-47T | Ø 39 mm, Shaft, IP65 Shaft Seal |

| C | Flange                  |
|---|-------------------------|
| C | Ø 36 mm Clamping Flange |
| S | Ø 36 mm Servo Flange    |

| B  | Shaft (Ø x L)    |
|----|------------------|
| 6  | Ø 6 mm x 12.5 mm |
| 8  | Ø 8 mm x 15 mm   |
| 10 | Ø 10 mm x 20 mm  |
| A0 | Ø 1/4" x 12.5 mm |
| A1 | Ø 3/8" x 5/8"    |

| D     | Voltage Supply and Output Type  |
|-------|---------------------------------|
| 9D32B | 10-30 VDC, CANopen DS 301 V4.02 |

| E     | Type of Connection          |
|-------|-----------------------------|
| CT1M  | Tangential Cable (1 m PUR)  |
| CT5M  | Tangential Cable (5 m PUR)  |
| CT10M | Tangential Cable (10 m PUR) |

#### Part Number Key: RM-51 Blind Hollow Shaft Version

| A      | B | C |   | D     |   | E    |
|--------|---|---|---|-------|---|------|
| RM-51B | 6 | E | - | 9D32B | - | CT1M |

| A      | Type   |
|--------|--|
| RM-51B | Ø 39 mm, Blind Hollow Shaft, IP65 Shaft Seal |

| C  | Flange                               |
|----|--------------------------------------|
| E  | Ø 36 mm Flange w/ Slotted Flex Mount |
| T  | Ø 36 mm Flange w/ Long Torque Stop   |
| T1 | Ø 36 mm Flange w/ Short Torque Stop  |

| B  | Bore (14.5 mm Insertion Depth) |
|----|--------------------------------|
| 6  | Ø 6 mm                         |
| 8  | Ø 8 mm                         |
| 10 | Ø 10 mm                        |
| A0 | Ø 1/4"                         |

| D     | Voltage Supply and Output Type  |
|-------|---------------------------------|
| 9D32B | 10-30 VDC, CANopen DS 301 V4.02 |

| E     | Type of Connection          |
|-------|-----------------------------|
| CT1M  | Tangential Cable (1 m PUR)  |
| CT5M  | Tangential Cable (5 m PUR)  |
| CT10M | Tangential Cable (10 m PUR) |

#### Accessories:

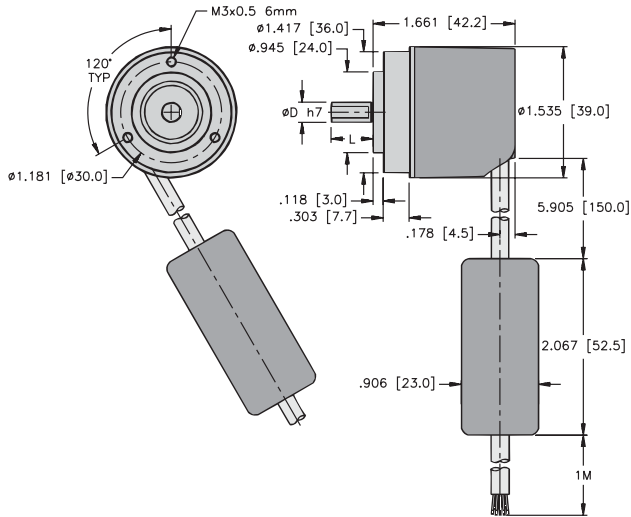
- See page H1, Connectivity, for cables and connectors
- See page G1, Accessories, for mounting attachments and couplings

**Absolute, Multiturn Type RM-47 (Shaft) / RM-51 (Blind Hollow Shaft)**

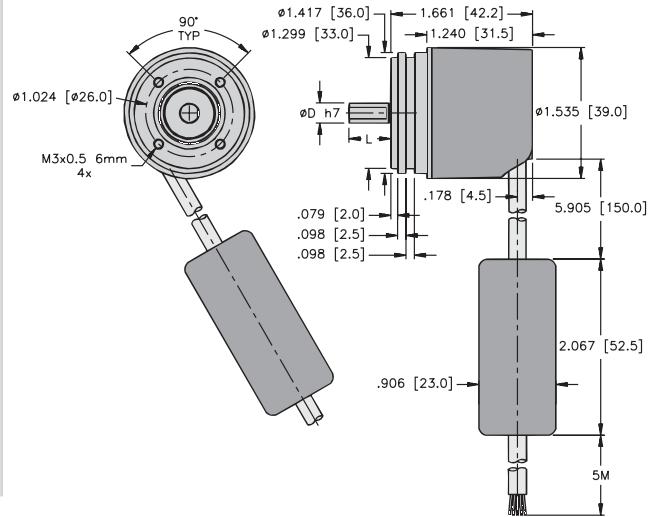
**CANopen**

**Dimensions: RM-47 Shaft Version**

**RM-47 Flange C  
 Connection CT1M**

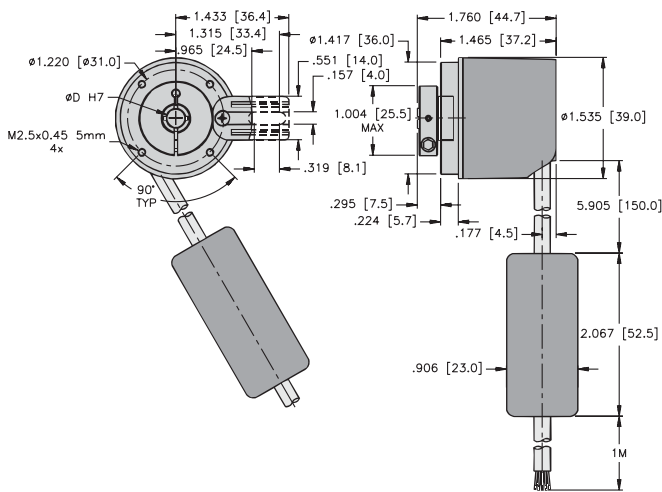


**RM-47 Flange S  
 Connection CT5M**

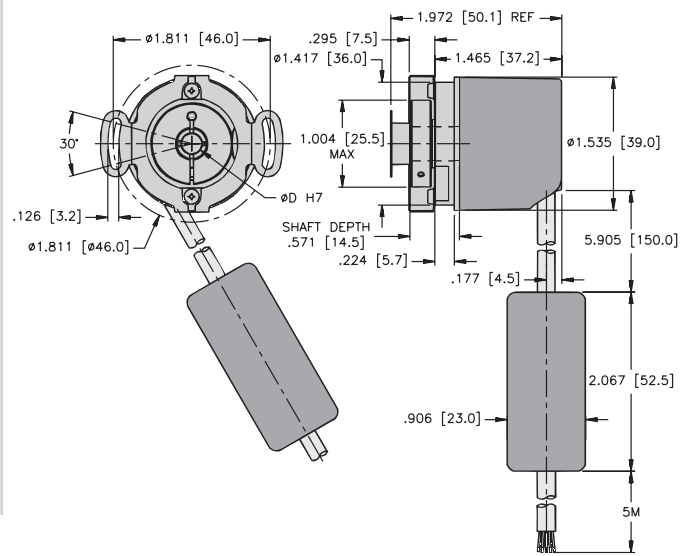


**Dimensions: RM-51 Blind Hollow Shaft Version**

**RM-51 Flange T&T1  
 Connection CT1M**



**RM-51 Flange E (Blind Hollow Shaft)  
 Connection CT5M**



Absolute Encoders

# Rotary Position Technology

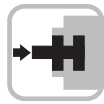
## Absolute Encoders, Multiturn

Absolute, Multiturn Type RM-28 (Shaft) / RM-35 (Hollow Shaft)

SSI/BiSS-C



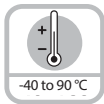
Mechanical drive



Bearing-Lock



High rotational speed



Temperature  
-40 to 90 °C



High IP



High shaft load capacity



Shock/vibration resistant



Magnetic field proof



Short-circuit protected



Reverse polarity protection



SIN/COS



Seawater-resistant version on request

### Reliable

- **Increased ability to withstand vibration and installation errors.** Sturdy Bearing-Lock design structure eliminates machine downtime and repairs.
- **Fewer components and connection points increase the operational reliability:** Turck OptoASIC technology with highest integration density (Chip-on-Board).
- Die cast housing and protection up to IP67: **Remains sealed even when subjected to harsh everyday use.**
- Wide temperature range.
- **Easy diagnosis in case of fault condition.** Status indication by means of LED, sensor, voltage and temperature monitoring.



### Absolute



### Versatile

- **Connections for every application:** M12, M23 and cable connector.
- **Open interfaces ensure flexibility and independence:** SSI or BiSS-C with Sine-Cosine-Option incremental track RS422.
- Multiple mounting brackets for easy installation.
- Status LED and set key available.
- **Quick, simple on site start-up:** Set key or preset by means of a control input.

### Fast

- **High accuracy:** Update rate of the whole position value above 100 kHz.
- **High productivity due to very short regulation cycles:** Clock rate with SSI up to 2 MHz, with BiSS-C up to 10 MHz.
- **High-resolution feedback system achievable in real-time:** SinCos incremental outputs.

### Mechanical Characteristics:

#### Shaft version:

|   |                                   |
|---|-----------------------------------|
| Max. speed without shaft sealing (IP65) up to 158 °F (70 °C): | 12,000 RPM, continuous 10,000 RPM |
| Max. speed without shaft sealing (IP65) up to Tmax:           | 8,000 RPM, continuous 5,000 RPM   |
| Max. speed with shaft sealing (IP67) up to 158 °F (70 °C):    | 11,000 RPM, continuous 9,000 RPM  |
| Max. speed with shaft sealing (IP67) up to Tmax:              | 8,000 RPM, continuous 5,000 RPM   |

#### Hollow shaft version:

|   |                                 |
|---|---------------------------------|
| Max. speed without shaft sealing (IP65) up to 158 °F (70 °C): | 9,000 RPM, continuous 6,000 RPM |
| Max. speed without shaft sealing (IP65) up to Tmax:           | 6,000 RPM, continuous 3,000 RPM |
| Max. speed with shaft sealing (IP67) up to 158 °F (70 °C):    | 8,000 RPM, continuous 4,000 RPM |
| Max. speed with shaft sealing (IP67) up to Tmax:              | 4,000 RPM, continuous 2,000 RPM |

|  |  |
|--|--|
| Starting torque without shaft seal (IP65): | Shaft version: < 1.4 oz-in (< 0.01 Nm)<br>Hollow shaft version: < 4.25 oz-in (< 0.03 Nm) |
|--|--|

|   |                       |
|---|-----------------------|
| Starting torque with shaft seal (IP67): | < 7 oz-in (< 0.05 Nm) |
|---|-----------------------|

|                    |   |
|--------------------|---|
| Moment of inertia: | Shaft version: 0.219 oz-in <sup>2</sup> (4.0 x 10 <sup>-6</sup> kgm <sup>2</sup> )<br>Hollow shaft version: 0.383 oz-in <sup>2</sup> (7.0 x 10 <sup>-6</sup> kgm <sup>2</sup> ) |
|--------------------|---|

|                                |               |
|--------------------------------|---------------|
| Radial load capacity of shaft: | 18 lbs (80 N) |
|--------------------------------|---------------|

|                               |              |
|-------------------------------|--------------|
| Axial load capacity of shaft: | 9 lbs (40 N) |
|-------------------------------|--------------|

|         |                        |
|---------|------------------------|
| Weight: | approx. 1 lb (0.45 kg) |
|---------|------------------------|

|                               |                                       |
|-------------------------------|---------------------------------------|
| Protection acc. to EN 60 529: | Housing: IP67, Shaft: IP65, opt. IP67 |
|-------------------------------|---------------------------------------|

|                      |  |
|----------------------|--|
| Working temperature: | -40 to +194 °F (-40 to +90 °C) <sup>1)</sup> |
|----------------------|--|

|            |   |
|------------|---|
| Materials: | Shaft: stainless steel, Flange: aluminum,<br>Housing: die cast zinc, Cable: PVC |
|------------|---|

|   |   |
|---|---|
| Shock resistance acc. to DIN-IEC 68-2-27: | > 250 g (> 2,500 m/s <sup>2</sup> ), 6 ms |
|---|---|

|  |   |
|--|---|
| Vibration resistance acc. to DIN-IEC 68-2-6: | > 10 g (> 100 m/s <sup>2</sup> ), 55-2,000 Hz |
|--|---|

<sup>1)</sup> Cable versions: -22 to +167 °F (-30 to +75 °C)

### Absolute, Multiturn Type RM-28 (Shaft) / RM-35 (Hollow Shaft)

### SSI/BiSS-C

#### General Electrical Characteristics:

|   |  |
|---|--|
| Supply voltage:                                     | 5 VDC +5% or 10-30 VDC                   |
| Current consumption (without output load):          | 5 VDC: max. 80 mA, 10-30 VDC: max. 50 mA |
| Reverse polarity protection at power supply (+V):   | Yes (only 10-30 VDC)                     |
| RoHS compliant according to EU guideline 2011/65/EU |  |

#### General Interface Characteristics:

|                           |                                 |
|---------------------------|---------------------------------|
| Output driver:            | RS485 Transceiver type          |
| Permissible load/channel: | max. 20 mA                      |
| Signal level high:        | typ. 3.8 V                      |
| Signal level low at       | typ. 1.3 V, $I_{load} = 20$ mA: |
| Short-circuit protected:  | Yes <sup>1)</sup>               |

#### Interface Characteristics SSI:

|                        |  |
|------------------------|--|
| Singleturn resolution: | 10-14 bits and 17 bits <sup>2)</sup>                 |
| Number of revolutions: | 4096 (12 bits)                                       |
| Code:                  | Binary or Gray                                       |
| SSI clock rate:        | ≤ 14 bits: 50 kHz-2 MHz<br>≥ 15 bits: 50 kHz -125kHz |
| Monoflop time:         | ≥ 15 μs  |

#### Note:

If clock starts cycling within monoflop time, a second data transfer starts with the same data. If clock starts cycling after monoflop time, the data transfer starts with updated values. The update rate is dependent on clock speed, data length and monoflop time.

|                        |  |
|------------------------|--|
| Data refresh rate:     | < 1 μs up to 14 bits,<br>4 μs for 15-17 bits |
| Status and Parity bit: | optional on request                          |

#### Interface Characteristics BiSS-C:

|                        |   |
|------------------------|---|
| Singleturn resolution: | 10-14 bits and 17 bits, customer programmable <sup>2)</sup> |
| Number of revolutions: | 4096 (12 bits)  |
| Code:                  | Binary  |
| Clock rate:            | up to 10 MHz  |
| Max. update rate:      | < 10 μs, depending on clock rate and data length            |
| Data refresh rate:     | ≤ 1 μs  |

#### Note:

- Bidirectional, programmable parameters are: resolution, code, direction, alarms and warnings
- Multicycle data output (e.g., for temperature)
- CRC data verification

<sup>1)</sup> Short-circuit to 0 V or to output, one channel at a time, supply voltage correctly applied

<sup>2)</sup> Other options upon request

#### SET (zero or defined value) and Direction (CW/CCW) Control Inputs

|                            |  |
|----------------------------|--|
| Input:                     | High active                              |
| Input type:                | Comparator                               |
| Signal level high:         | min. 60% of V+ (Supply voltage), max: V+ |
| Signal level low:          | max. 25% of V+ (Supply voltage)          |
| Input current:             | < 0.5 mA                                 |
| Min. pulse duration (SET): | 10 ms                                    |
| Timeout after SET input:   | 14 ms                                    |
| Reaction Time (DIR input): | 1 ms                                     |

The encoder can be set to zero at any position by means of a HIGH signal on the SET input or by pressing the optional SET key. Other preset values may be factory programmed. The SET input has a signal delay time of approximately 1 ms. Once the SET function has been triggered, the encoder requires an internal processing time of approximately 15 ms before the new position data can be read. During this time the LED is ON and the status output is at LOW.

#### Status Output and LED

|                    |   |
|--------------------|---|
| Output driver:     | Open collector, internal pull up resistor 22 kOhm |
| Permissible load:  | Max. 20 mA  |
| Signal level high: | +V  |
| Signal level low:  | < 1 V   |
| Active at:         | Low   |

The optional LED (red) and the status output serve to display various alarm or error messages. In normal operation the LED is OFF and the status output is HIGH (open-collector with int. pull-up 22 k).

If the LED is ON (status output LOW) this indicates:

- Sensor error, singleturn or multiturn (soiling, glass breakage etc.)
- LED error, failure or aging
- Over- or under-temperature

In the SSI mode, the fault indication can only be reset by switching off the power-supply to the device.

#### DIR Input

A HIGH signal switches the direction of rotation from the default CW to CCW. This inverted function can also be factory-programmed. If direction is changed when the device is already switched on, then this will be interpreted as an error. The LED will come ON and the status output will switch to LOW.

#### Power-On Delay

After Power-ON the device requires a time of approx. 150 ms before valid data can be read.

#### Option Incremental Output (A/B), 2048 PPR:

|                      | SinCos        | RS422 TTL-compatible                |
|----------------------|---------------|-------------------------------------|
| -3dB frequency:      | 400 kHz       | 400 kHz                             |
| Signal level:        | 1 Vpp (+ 20%) | High: min. 2.5 V<br>Low: max. 0.5 V |
| Short-circuit proof: | Yes           | Yes                                 |

# Rotary Position Technology

## Absolute Encoders, Multiturn

### Absolute, Multiturn Type RM-28 (Shaft) / RM-35 (Hollow Shaft)

SSI/BiSS-C

#### Standard Wiring:

##### Output Circuit \*C and \*F (2 Control Inputs, 1 Status Output) (Connection C\*1M or 12M23\*)

| Connection Type: | Common (0 V) | +V | +Clock | -Clock | +Data | -Data | ST | DIR | Status | NC | NC | NC | PE     |
|------------------|--------------|----|--------|--------|-------|-------|----|-----|--------|----|----|----|--------|
| M23 Multifast:   | 1            | 2  | 3      | 4      | 5     | 6     | 7  | 8   | 9      | 10 | 11 | 12 | PH     |
| Cable:           | WH           | BN | GN     | YE     | GY    | PK    | BU | RD  | BK     | -  | -  | -  | Shield |

##### Output Circuit \*H (2 Control Inputs, 1 Status Output, Voltage Monitor Outputs) (Connection C\*1M or 12M23\*)

| Connection Type: | Common (0 V) | +V | +Clock | -Clock | +Data | -Data | ST | DIR | Status | NC | 0 V Sens | +V Sens | PE     |
|------------------|--------------|----|--------|--------|-------|-------|----|-----|--------|----|----------|---------|--------|
| M23 Multifast:   | 1            | 2  | 3      | 4      | 5     | 6     | 7  | 8   | 9      | 10 | 11       | 12      | PH     |
| Cable:           | WH           | BN | GN     | YE     | GY    | PK    | BU | RD  | BK     | -  | GY/PK    | RD/BU   | Shield |

##### Output Circuit \*E, \*G, \*K or \*L (2 Control Inputs, Incremental Track or Sine/Cosine) (Connection C\*1M or 12M23\*)

| Connection Type: | Common (0 V) | +V | +Clock | -Clock | +Data | -Data | ST | DIR | Sin A | Sin inv A- | Cos B | Cos inv B- | PE     |
|------------------|--------------|----|--------|--------|-------|-------|----|-----|-------|------------|-------|------------|--------|
| M23 Multifast:   | 1            | 2  | 3      | 4      | 5     | 6     | 7  | 8   | 9     | 10         | 11    | 12         | PH     |
| Cable:           | WH           | BN | GN     | YE     | GY    | PK    | BU | RD  | BK    | VT         | GY/PK | RD/BU      | Shield |

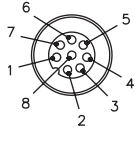
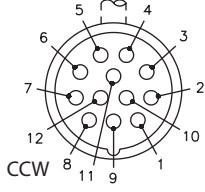
##### Output Circuit \*J and \*M (Sine/Cosine, Incremental Monitor or Voltage Outputs) (Connection C\*1M or 12M23\*)

| Connection Type: | Common (0 V) | +V | +Clock | -Clock | +Data | -Data | Sin A | Sin inv A- | Cos B | Cos inv B- | 0 V Sens | +V Sens | PE     |
|------------------|--------------|----|--------|--------|-------|-------|-------|------------|-------|------------|----------|---------|--------|
| M23 Multifast:   | 1            | 2  | 3      | 4      | 5     | 6     | 7     | 8          | 9     | 10         | 11       | 12      | PH     |
| Cable:           | WH           | BN | GN     | YE     | GY    | PK    | BU    | RD         | BK    | VT         | GY/PK    | RD/BU   | Shield |

##### Output Circuit \*C and \*F (2 Control Inputs) (Connection H1\*81)

| Connection Type: | Common (0 V) | +V | +Clock | -Clock | +Data | -Data | ST | DIR | PE |
|------------------|--------------|----|--------|--------|-------|-------|----|-----|----|
| M12 Eurofast:    | 1            | 2  | 3      | 4      | 5     | 6     | 7  | 8   | PH |

#### Wiring Diagrams:

| Male Encoder View  |  |
|--|--|
|  <p>M12 Eurofast Pinout</p> <p>Mating Cordset:<br/>E-RKC 8T-264-*</p> |  <p>M23 Multifast Pinout</p> <p>Mating Cordset:<br/>E-CKM 12-1687-* / A</p> |

\* Length in meters.



Encoder with tangential cable outlet



Safe operation in strong magnetic fields  
Special gears with specific toothing



### Absolute, Multiturn Type RM-28 (Shaft) / RM-35 (Hollow Shaft)

SSI/BiSS-C

**Part Number Key: RM-28 Shaft Version**

| A      | B | C | - | D  | E   | - | F     | / | G   |
|--------|---|---|---|----|-----|---|-------|---|-----|
| RM-28S | 6 | C | - | 5F | 22B | - | H1181 | / | N16 |

| A      | Type                            |
|--------|---------------------------------|
| RM-28S | ∅ 58 mm, Shaft, IP67 Shaft Seal |
| RM-28T | ∅ 58 mm, Shaft, IP65 Shaft Seal |

| B  | Shaft (∅ x L)   |
|----|-----------------|
| 6  | ∅ 6 mm x 10 mm  |
| 10 | ∅ 10 mm x 20 mm |
| A0 | ∅ 1/4" x 7/8"   |
| A1 | ∅ 3/8" x 7/8"   |

| C  | Flange                  |
|----|-------------------------|
| C  | ∅ 58 mm Clamping Flange |
| S  | ∅ 58 mm Servo Flange    |
| S0 | ∅ 2.5" Servo Flange     |
| R  | 2.5" Square Flange      |

| E   | Resolution <sup>1)</sup> |
|-----|--------------------------|
| 22B | 10 bits ST + 12 bits MT  |
| 23B | 11 bits ST + 12 bits MT  |
| 24B | 12 bits ST + 12 bits MT  |
| 25B | 13 bits ST + 12 bits MT  |
| 26B | 14 bits ST + 12 bits MT  |
| 29B | 17 bits ST + 12 bits MT  |

<sup>1)</sup> Resolution, Preset Value and Counting Direction Factory-Programmable

| F      | Type of Connection                                |
|--------|---|
| H1181  | Radial 8-pin M12 Eurofast Connector <sup>2)</sup> |
| H1481  | Axial 8-pin Eurofast Connector <sup>2)</sup>      |
| 12M23  | Radial 12-pin M23 Multifast Connector             |
| 12M23A | Axial 12-pin M23 Multifast Connector              |
| C1M    | Radial Cable (1 m PVC)                            |
| CA1M   | Axial Cable (1 m PVC)                             |

<sup>2)</sup> Only Available with Output Type \*C and \*F

| G       | Options                              |
|---------|--------------------------------------|
| (BLANK) | SET Button and Status LED (Standard) |
| N16     | No Option                            |
| N43     | Status LED                           |

| D       | Voltage Supply and Output Type |         |        |  |
|---------|--------------------------------|---------|--------|--|
|         | SSI (B)                        | SSI (G) | BiSS-C | Features   |
| 5 V     | 5F                             | 3F      | DF     | 2048 PPR SinCos<br>Voltage Monitoring<br>2048 PPR SinCos Plus Voltage Monitoring<br>2048 PPR Incr., RS422 (TTL-Compatible)<br>2048 PPR Incr., RS422 (TTL-Compatible) Plus Voltage Monitoring |
|         | 5E                             | 3E      | DE     |  |
|         | 5H                             | 3H      | DH     |  |
|         | 5J                             | 3J      | DJ     |  |
|         | 5K                             | 3K      | DK     |  |
|         | 5M                             | 3M      | DM     |  |
| 10-30 V | 5C                             | 3C      | DC     | 2048 PPR SinCos<br>2048 PPR Incr., RS422   |
|         | 5G                             | 3G      | DG     |  |
|         | 5L                             | 3L      | DL     |  |

(B) = Binary, (G) = Gray

**Accessories:**

- See page H1, Connectivity, for cables and connectors
- See page G1, Accessories, for mounting attachments and couplings

# Rotary Position Technology

## Absolute Encoders, Multiturn

### Absolute, Multiturn Type RM-28 (Shaft) / RM-35 (Hollow Shaft)

SSI/BiSS-C

#### Part Number Key: RM-35 Hollow Shaft Version

| A      | B  | C |   | D  | E   |   | F     |   | G   |
|--------|----|---|---|----|-----|---|-------|---|-----|
| RM-35H | 10 | T | - | 5F | 22B | - | H1181 | / | N16 |

| A      | Type                                   |
|--------|--|
| RM-35H | Ø 58 mm, Hollow Shaft, IP67 Shaft Seal |
| RM-35I | Ø 58 mm, Hollow Shaft, IP65 Shaft Seal |

| B  | Bore    |
|----|---------|
| 10 | Ø 10 mm |
| 12 | Ø 12 mm |
| 14 | Ø 14 mm |
| 15 | Ø 15 mm |
| A1 | Ø 3/8"  |
| A3 | Ø 1/2"  |

| C  | Flange                               |
|----|--------------------------------------|
| T  | Ø 50 mm Flange w/ Torque Stop        |
| E  | Ø 63 mm Flange w/ Slotted Flex Mount |
| E1 | Ø 65 mm Flange w/ Flex Mount         |

| E   | Resolution <sup>1)</sup> |
|-----|--------------------------|
| 22B | 10 bits ST + 12 bits MT  |
| 23B | 11 bits ST + 12 bits MT  |
| 24B | 12 bits ST + 12 bits MT  |
| 25B | 13 bits ST + 12 bits MT  |
| 26B | 14 bits ST + 12 bits MT  |
| 29B | 17 bits ST + 12 bits MT  |

<sup>1)</sup> Resolution, Preset Value and Counting Direction Factory-Programmable

| F     | Type of Connection                                |
|-------|---|
| H1181 | Radial 8-pin M12 Eurofast Connector <sup>2)</sup> |
| 12M23 | Radial 12-pin M23 Multifast Connector             |
| C1M   | Radial Cable (1 m PVC)                            |
| CT1M  | Tangential Cable (1 m PVC)                        |

<sup>2)</sup> Only Available with Output Type \*C and \*F

| G       | Options                              |
|---------|--------------------------------------|
| (BLANK) | SET Button and Status LED (Standard) |
| N16     | No Option                            |
| N43     | Status LED                           |

| D       | Voltage Supply and Output Type |         |        |  |
|---------|--------------------------------|---------|--------|--|
|         | SSI (B)                        | SSI (G) | BiSS-C | Features   |
| 5 V     | 5F                             | 3F      | DF     | 2048 PPR SinCos<br>Voltage Monitoring<br>2048 PPR SinCos Plus Voltage Monitoring<br>2048 PPR Incr, RS422 (TTL-Compatible)<br>2048 PPR Incr. RS422 (TTL-Compatible) Plus Voltage Monitoring |
|         | 5E                             | 3E      | DE     |  |
|         | 5H                             | 3H      | DH     |  |
|         | 5J                             | 3J      | DJ     |  |
|         | 5K                             | 3K      | DK     |  |
| 10-30 V | 5M                             | 3M      | DM     |  |
|         | 5C                             | 3C      | DC     |  |
|         | 5G                             | 3G      | DG     | 2048 PPR SinCos  |
|         | 5L                             | 3L      | DL     | 2048 PPR Incr, RS422   |

(B) = Binary, (G) = Gray

#### Accessories:

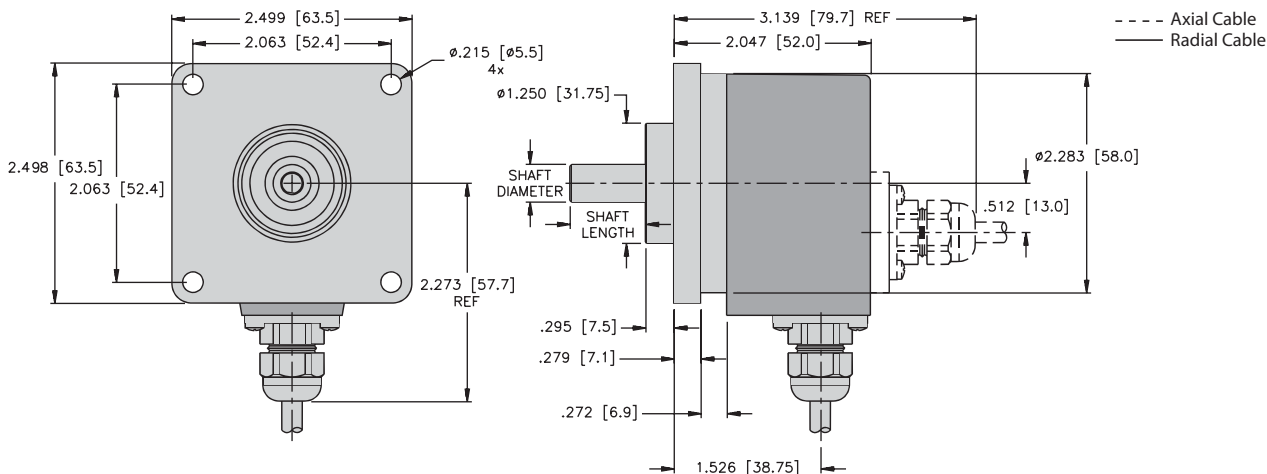
- See page H1, Connectivity, for cables and connectors
- See page G1, Accessories, for mounting attachments and couplings

**Absolute, Multiturn Type RM-28 (Shaft) / RM-35 (Hollow Shaft)**

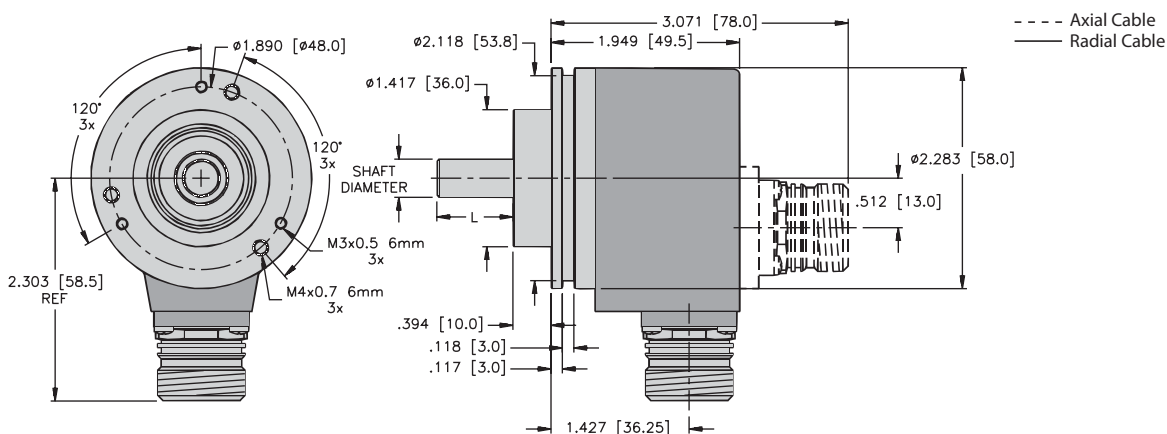
**SSI/BiSS-C**

**Dimensions: RM-28 Shaft Version**

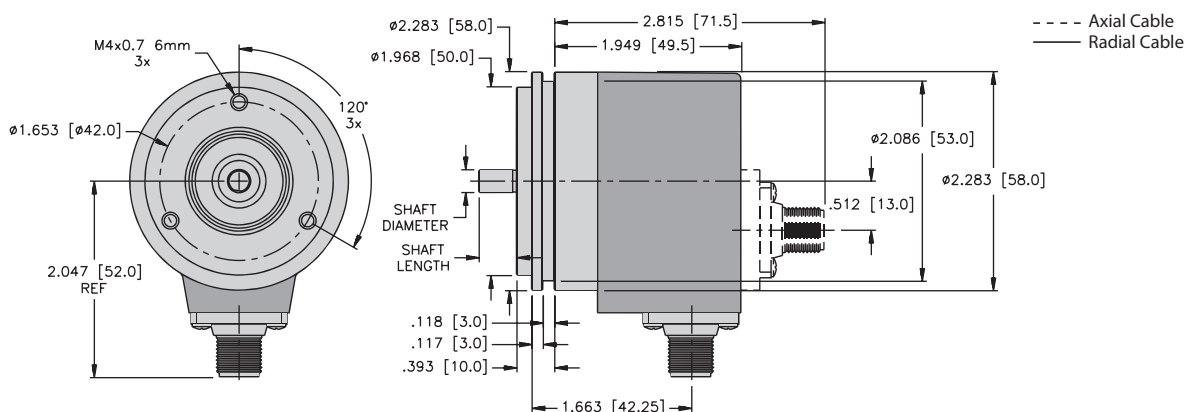
**RM-28 Flange R  
 Connection C\*1M**



**RM-28 Flange C  
 Connection 12M23\***



**RM-28 Flange S  
 Connection H1\*81**



Absolute Encoders

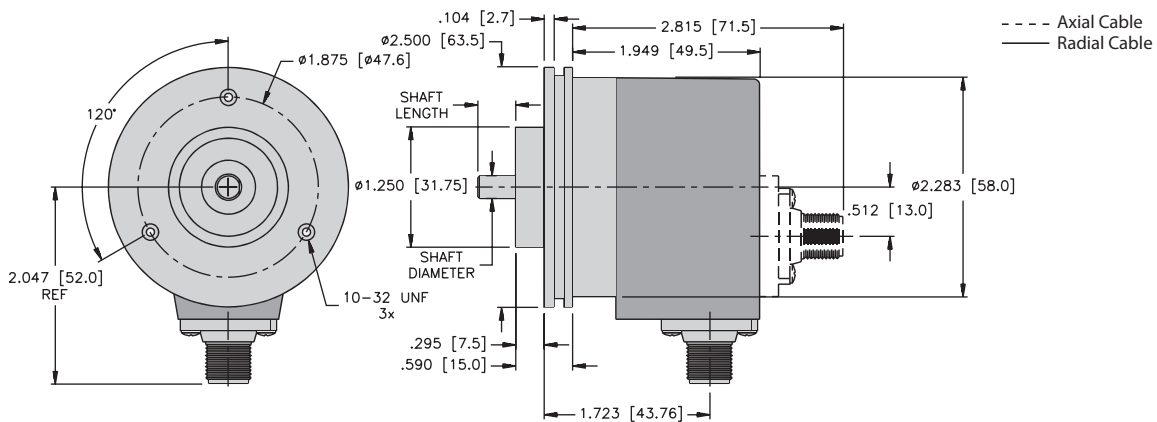
# Rotary Position Technology

## Absolute Encoders, Multiturn

### Absolute, Multiturn Type RM-28 (Shaft) / RM-35 (Hollow Shaft) SSI/BiSS-C

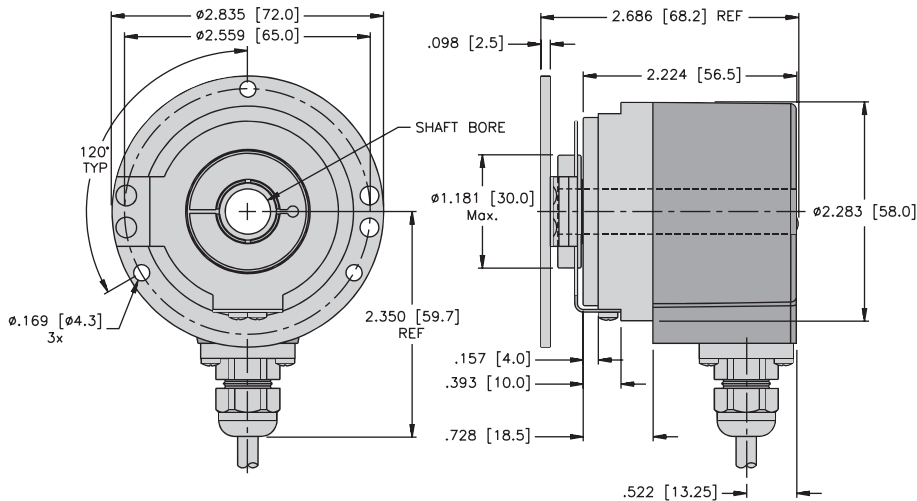
#### Dimensions: RM-28 Shaft Version

##### RM-28 Flange S0 Connection H1\*81

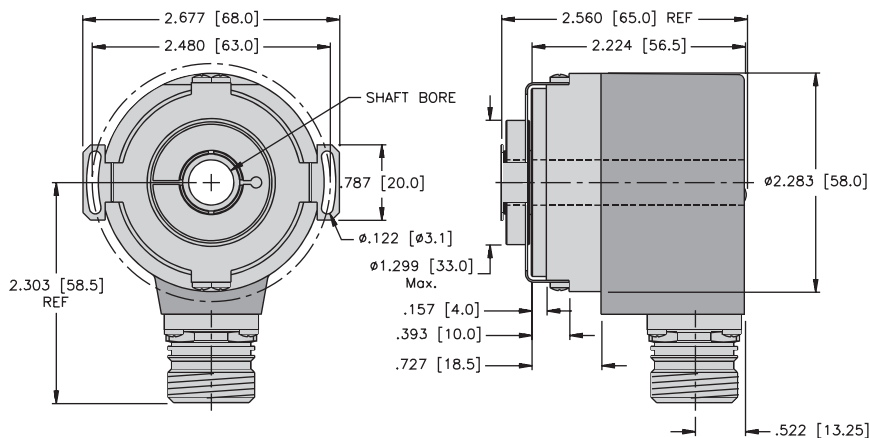


#### Dimensions: RM-35 Hollow Shaft Version

##### RM-35 Flange E1 Connection C1M



##### RM-35 Flange E Connection 12M23

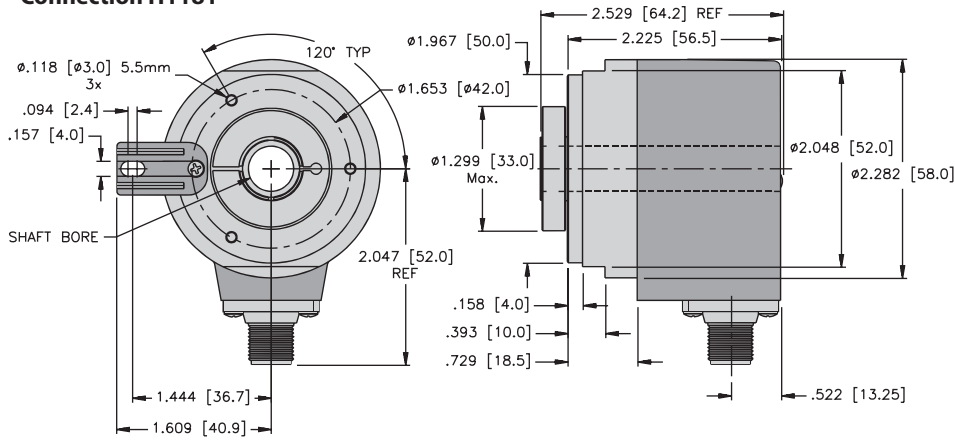


**Absolute, Multiturn Type RM-28 (Shaft) / RM-35 (Hollow Shaft)**

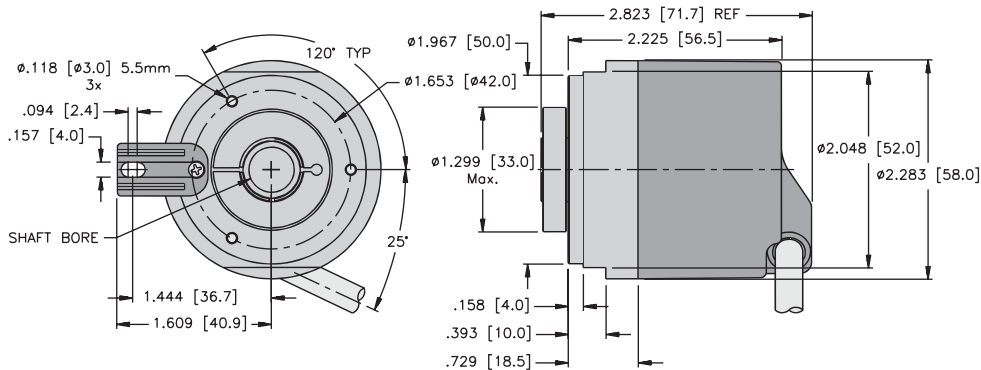
**SSI/BiSS-C**

**Dimensions: RM-35 Hollow Shaft Version**

**RM-35 Flange T  
 Connection H1181**



**RM-35 Flange T  
 Connection CT1M**



Absolute Encoders

# Rotary Position Technology

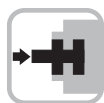
## Absolute Encoders, Multiturn

Absolute, Multiturn Type RM-29 (Shaft) / RM-36 (Blind Hollow Shaft)

CANopen/CANlift



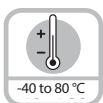
Mechanical drive



Bearing-Lock



High rotational speed



Temperature  
-40 to 80 °C



High IP



High shaft load capacity



Shock/vibration resistant



Magnetic field proof



Short-circuit protected



Reverse polarity protection



Optical sensor



Seawater-resistant version on request

### Reliable

- **Increased ability to withstand vibration and installation errors.** Sturdy Bearing-Lock design structure eliminates machine downtime and repairs.
- **Fewer components and connection points increase the operational reliability:** Turck OptoASIC technology with highest integration density (Chip-on-Board).
- Die cast housing and protection up to IP67: **Remains sealed even when subjected to harsh everyday use.**
- Wide temperature range.



### Absolute



CANopen



### Fast

- **Real time-servo position detection of several axes:** Extended CAN Sync Mode with realtime position acquisition.
- **Fast data availability, while reducing the load on the bus and the controller:** Intelligent functions like the transmission of speed, acceleration or exiting a working area.

### Versatile

- CANopen, CANlift fieldbus with the latest profiles.
- **Connections for every application:** Bus terminal cover with M12 connector or fixed connection with M12, M23 or D-Sub connector. Point-to-point connections also available.
- **Real-time data: Position, speed or working area.** Variable PDO mapping in the memory.
- **Fast, error-free start-up, without setting any switches.** Node address, baud rate and termination can be programmed via the bus.
- Direct mounting of hollow shaft on large diameter standard shafts; up to 15 mm for blind hollow shaft.

### Mechanical Characteristics:

|   |                                 |
|---|---------------------------------|
| Max. speed without shaft sealing (IP65) up to 158 °F (70 °C): | 9,000 RPM, continuous 7,000 RPM |
| Max. speed without shaft sealing (IP65) up to Tmax:           | 7,000 RPM, continuous 4,000 RPM |
| Max. speed with shaft sealing (IP67) up to 158 °F (70 °C):    | 8,000 RPM, continuous 6,000 RPM |
| Max. speed with shaft sealing (IP67) up to Tmax:              | 6,000 RPM, continuous 3,000 RPM |

Starting torque without shaft seal (IP65): 1.4 oz-in (< 0.01 Nm)

Starting torque with shaft seal (IP67): 4.25 oz-in (< 0.03 Nm)

Moment of inertia:  
Shaft version: 0.219 oz-in<sup>2</sup> (4.0 x 10<sup>-6</sup> kgm<sup>2</sup>)  
Hollow shaft version: 0.41 oz-in<sup>2</sup> (7.5 x 10<sup>-6</sup> kgm<sup>2</sup>)

Radial load capacity of shaft: 18 lbs (80 N)

Axial load capacity of shaft: 9 lbs (40 N)

Weight:  
approx. 1.26 lbs (0.57 kg) with bus terminal cover  
approx. 1.15 lbs (0.52 kg) with fixed connection

Protection acc. to EN 60 529: Housing: IP67, Shaft: IP65, opt. IP67

Working temperature: -40 to +176 °F (-40 to +80 °C)<sup>1)</sup>

Materials:  
Shaft: stainless steel, Flange: aluminum, Housing: die cast zinc, Cable: PVC

Shock resistance acc. to DIN-IEC 68-2-27: > 250 g (> 2,500 m/s<sup>2</sup>), 6 ms

Vibration resistance acc. to DIN-IEC 68-2-6: > 10 g (> 100 m/s<sup>2</sup>), 55-2,000 Hz

<sup>1)</sup> Cable versions: -22 to +167 °F (-30 to +75 °C)



- Safe operation in strong magnetic fields
- Special gears with specific toothing

### Absolute, Multiturn Type RM-29 (Shaft) / RM-36 (Blind Hollow Shaft)

### CANopen/CANlift

#### General Electrical Characteristics:

|  |             |
|--|-------------|
| Supply voltage:                                | 10-30 VDC   |
| Current consumption (w/o output load):         | Max. 100 mA |
| Reverse polarity protection                    | Yes         |
| RoHS compliant acc. to EU guideline 2011/65/EU |             |

#### SET Control Button (zero or defined value, option)

Protected against accidental activation, can only be depressed with the tip of a ballpoint pen or similar.

#### Diagnostic LED (yellow)

LED on with: optical sensor path faulty (code error, LED error), low voltage and over-temperature

#### Incremental Track Characteristics:

|                           |                                   |
|---------------------------|-----------------------------------|
| Output driver:            | RS422 (TTL-compatible)            |
| Permissible load/channel: | Max. 20 mA                        |
| Signal level:             | High typ. 3.8 V<br>Low typ. 1.3 V |
| Short circuit protected   | Yes <sup>1)</sup>                 |
| Resolution:               | 2048 ppr                          |

<sup>1)</sup>Short circuit to OV or to output, only one channel at a time, supply voltage correctly applied.

#### Interface Characteristics CANopen/CANlift:

|  |  |
|--|--|
| Singleturn resolution (max, scalable): | 1-65536 (16 bits), default scale value is set to 8192 (13 bits)                |
| Total resolution:                      | 1-268 435 456 (28 Bit) Default: 25 bit   |
| Code:                                  | Binary   |
| Interface:                             | CAN High-Speed according ISO 11898, Basic and Full-CAN CAN Specification 2.0 B |

|                         |  |
|-------------------------|--|
| Protocol:               | CANopen profile DS 406 V3.2 with manufacturer-specific add-on's or CANlift profile DS 417 V1.1 |
| Baud rate:              | 10-1000 kbits/s (set by DIP switches/software configurable)                                    |
| Node address:           | 1-127 (set by rotary switches/software configurable)   |
| Termination switchable: | Set by DIP switches (software configurable)  |

#### General Information about CAN/CANlift

The CANopen encoders support the latest CANopen communication profile according to DS 301 V4.02. In addition, device-specific profiles, like the DS 406 V3.2 and DS 417 V1.1 (for lift applications), are available. The following operating modes may be selected: Polled Mode, Cyclic Mode, Sync Mode and a High Resolution Sync Protocol. Moreover, scale factors, preset values, limit switch values and many other additional parameters may be programmed via the CANopen fieldbus. When switching the device on, all parameters, which have been saved on an EEPROM to protect them against power failure, are loaded again.

Position, speed, acceleration and status output values may be combined in a freely variable way as PDO mapping.

Encoders with a connector or a cable connection are available. Models with bus terminal cover and integrated T-shaped coupler allow a particularly easy installation via M12 connectors. The device address is set by means of two hexadecimal rotary switches. Furthermore, another DIP switch allows setting the baud rate and switching on a termination resistor. Three LEDs indicate the operating or fault status of the CANopen fieldbus, as well as the status of an internal diagnostics.

#### CANopen Communication Profile DS 301 V4.02

The following functionality is integrated: Class C2 Functionality • NMT Slave • Heartbeat Protocol • High Resolution Sync Protocol • Identity Object • Error Behavior Object • Variable PDO Mapping • Self-start programmable (power on to operational) • Three Sending PDO's • Node address, baud rate and CANbus • Programmable termination

#### CANopen Encoder Profile DS 406 V3.2

The following parameters may be programmed:

- Event mode
- Units for speed selectable (Steps/Sec or RPM)
- Factor for speed calculation (e.g. measuring wheel circumference)
- Integration time for speed value of 1 to 32
- Two work areas with 2 upper and lower limits and the corresponding output states
- Variable PDO mapping for position, speed, acceleration and work area status
- Extended failure management for position sensing with integrated temperature control
- User interface with visual display of bus and failure status – 3 LED's
- Optional – 32 CAM's programmable
- Customer-specific memory – 16 Bytes

#### CANopen Lift Profile DS 417 V1.1

The following functionality is integrated:

- Car position unit
- Two virtual devices
- One virtual device delivers the position in absolute measuring steps (steps)
- One virtual device delivers the position as an absolute travel information in millimeters
- Lift number programmable
- Independent setting of the node address in relation with the CAN identifier
- Factor for speed calculation (e.g., measuring wheel circumference)
- Integration time for speed value of 1 to 32
- Two work areas with 2 upper and lower limits and the corresponding output states
- Variable PDO mapping for position, speed, acceleration, work area status
- Extended failure management for position sensing with integrated temperature control
- User interface with visual display of bus and failure status – 3 LEDs

#### Key features:

The object 6003h "Preset" is assigned to an integrated key, accessible from the outside "Watchdog-controlled" device.

# Rotary Position Technology

## Absolute Encoders, Multiturn

### Absolute, Multiturn Type RM-29 (Shaft) / RM-36 (Blind Hollow Shaft)

### CANopen/CANlift

#### Standard Wiring: Bus Terminal Cover with Terminal Box (Connection TB)

| Direction | OUT        |             |              |                           |                 | IN                        |                 |             |              |            |
|-----------|------------|-------------|--------------|---------------------------|-----------------|---------------------------|-----------------|-------------|--------------|------------|
| Signal:   | CAN Ground | CAN_Low (-) | CAN_High (+) | Common (0 V) power supply | +V power supply | Common (0 V) power supply | +V power supply | CAN_Low (-) | CAN_High (+) | CAN Ground |
| Abbrv:    | CG         | CL          | CH           | 0V                        | +V              | 0V                        | +V              | CL          | CH           | CG         |

#### Cable Connection (Connection BC)

| Direction | IN                        |                 |             |              |            |
|-----------|---------------------------|-----------------|-------------|--------------|------------|
| Signal:   | Common (0 V) power supply | +V power supply | CAN_Low (-) | CAN_High (+) | CAN Ground |
| Abbrv:    | 0V                        | +V              | CL          | CH           | CG         |
| Cable:    | WH                        | BN              | YE          | GN           | GY         |

#### M23 Connector or M12 Connector or D-Sub 9 (Connection B1M23) (Connection B1M12) (Connection B1D9)

| Direction      | IN                        |                 |             |              |            | Pinout |
|----------------|---------------------------|-----------------|-------------|--------------|------------|--------|
| Signal:        | Common (0 V) power supply | +V power supply | CAN_Low (-) | CAN_High (+) | CAN Ground |        |
| Abbrv:         | 0V                        | +V              | CL          | CH           | CG         |        |
| M23 Multifast: | 10                        | 12              | 2           | 7            | 3          | A      |
| M12 Eurofast:  | 3                         | 2               | 5           | 4            | 1          | C      |
| D-Sub 9:       | 6                         | 9               | 2           | 7            | 3          | -      |

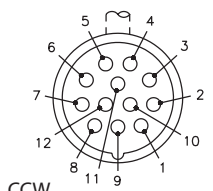
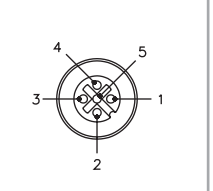
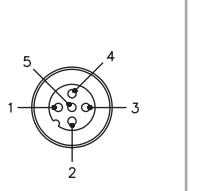
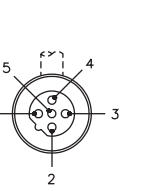
#### Bus Terminal Cover with 2 - M12, 2 - M12, 2 - M23 (Connection R2M12) (Connection B2M12) (Connection B2M23)

| Direction      | OUT        |             |              |                 |                 | Pinout | IN              |                 |             |              |            | Pinout |
|----------------|------------|-------------|--------------|-----------------|-----------------|--------|-----------------|-----------------|-------------|--------------|------------|--------|
|                | CAN Ground | CAN_Low (-) | CAN_High (+) | 0V power supply | +V power supply |        | 0V power supply | +V power supply | CAN_Low (-) | CAN_High (+) | CAN Ground |        |
| Signal:        | CAN Ground | CAN_Low (-) | CAN_High (+) | 0V power supply | +V power supply |        | 0V power supply | +V power supply | CAN_Low (-) | CAN_High (+) | CAN Ground |        |
| Abbrv:         | CG         | CL          | CH           | 0V              | +V              |        | 0V              | +V              | CL          | CH           | CG         |        |
| M23 Multifast: | 3          | 2           | 7            | 10              | 12              | A      | 10              | 12              | 2           | 7            | 3          | A      |
| M12 Eurofast:  | 1          | 5           | 4            | 3               | 2               | B      | 3               | 2               | 5           | 4            | 1          | C      |

#### Terminal Assignment Incremental Track (Connection R3M12 = Connection R2M12 plus 1-M12 for Incremental output)

|         |   |   |   |   |    |        |
|---------|---|---|---|---|----|--------|
| Signal: | A | Ā | B | B | 0V | Pinout |
| Pin:    | 1 | 2 | 3 | 4 | 5  | D      |

#### Wiring Diagrams:

| A  | B   | C   | D  |
|--|---|---|--|
| <b>Male Encoder View</b>   | <b>Female Encoder View</b>  | <b>Male Encoder View</b>  | <b>Male Encoder View</b>   |
|  |  |  |  |
| <b>Bus In and Out</b><br>M23 Multifast Pinout                                      | <b>Bus Out</b><br>M12 Eurofast Pinout   | <b>Bus In</b><br>M12 Eurofast Pinout  | <b>Incremental Track</b><br>M12 Eurofast Pinout                                      |
| Mating Cordset: <sup>1)</sup><br>Consult factory                                   | Mating Cordset: <sup>1)</sup><br>RSC 572-*M/S3118                                   | Mating Cordset: <sup>1)</sup><br>RKC 572-*M/S3117                                   | Mating Cordset: <sup>1)</sup><br>WASW 4.5T-*S618                                     |

<sup>1)</sup> See Connectivity section H for corresponding cable color code.

\* Length in meters. Available in 0.1 meter increments ≥0.2 meters.



### Absolute, Multiturn Type RM-29 (Shaft) / RM-36 (Blind Hollow Shaft) CANopen/CANlift

#### Part Number Key: RM-29 Shaft Version

| A      | B | C |   | D     |   | E     |   | F   |
|--------|---|---|---|-------|---|-------|---|-----|
| RM-29S | 6 | C | - | 9D28B | - | B1M12 | / | N46 |

| A      | Type                            |
|--------|---------------------------------|
| RM-29S | Ø 58 mm, Shaft, IP67 Shaft Seal |
| RM-29T | Ø 58 mm, Shaft, IP65 Shaft Seal |

| B  | Shaft (Ø x L)   |
|----|-----------------|
| 6  | Ø 6 mm x 10 mm  |
| 10 | Ø 10 mm x 20 mm |
| A0 | Ø 1/4" x 7/8"   |
| A1 | Ø 3/8" x 7/8"   |

| C | Flange                  |
|---|-------------------------|
| C | Ø 58 mm Clamping Flange |
| S | Ø 58 mm Servo Flange    |
| R | 2.5" Square Flange      |

| D     | Voltage Supply and Output Type  |
|-------|---|
| 9D28B | 10-30 VDC, CANopen DS 301 V4.02   |
| 9G28B | 10-30 VDC, CANopen DS 301 V4.02 w/ 2048PPR Incremental Track (TTL-Compatible) <sup>1)</sup> |

<sup>1)</sup> Only available with connector R3M12.

| E     | Type of Connection   |
|-------|--|
| B1M12 | Radial 1 x M12 Eurofast Connector w/o Bus Terminal Cover               |
| R2M12 | Radial 2 x M12 Eurofast Connectors w/ Bus Terminal Cover               |
| R3M12 | Radial 3 x M12 Eurofast Connectors w/ Bus Terminal Cover <sup>2)</sup> |
| B1M23 | Radial 1 x M23 Multifast Connector w/o Bus Terminal Cover              |
| B2M23 | Radial 2 x M23 Multifast Connectors w/o Bus Terminal Cover             |
| B1D9  | Radial 1 x 9-pin D-SUB Connector w/o Bus Terminal Cover                |
| BC    | Radial Cable (2 m PVC) w/o Bus Terminal Cover                          |
| RC    | Radial Cable Gland w/ Bus Terminal Cover                               |

<sup>2)</sup> Only valid with Incremental track output option 9G28B

| F   | Options <sup>3)</sup> |
|-----|-----------------------|
| N46 | SET Button            |
| N47 | CANlift DS 417 V1.01  |

<sup>3)</sup> CAN parameters can be factory-preset

#### Part Number Key: RM-36 Blind Hollow Shaft Version

| A      | B  | C |   | D     |   | E     |   | F   |
|--------|----|---|---|-------|---|-------|---|-----|
| RM-36B | 10 | T | - | 9D28B | - | B1M12 | / | N46 |

| A      | Type   |
|--------|--|
| RM-36B | Ø 58 mm, Blind Hollow Shaft, IP67 Shaft Seal |
| RM-36C | Ø 58 mm, Blind Hollow Shaft, IP65 Shaft Seal |

| B  | Bore (30 mm Insertion Depth) |
|----|------------------------------|
| 10 | Ø 10 mm                      |
| 12 | Ø 12 mm                      |
| 14 | Ø 14 mm                      |
| 15 | Ø 15 mm                      |
| A1 | Ø 3/8"                       |
| A3 | Ø 1/2"                       |

| C  | Flange                               |
|----|--------------------------------------|
| T  | Ø 50 mm Flange w/ Torque Stop        |
| E  | Ø 63 mm Flange w/ Slotted Flex Mount |
| E1 | Ø 65 mm Flange w/ Flex Mount         |

| D     | Voltage Supply and Output Type  |
|-------|---|
| 9D28B | 10-30 VDC, CANopen DS 301 V4.02   |
| 9G28B | 10-30 VDC, CANopen DS 301 V4.02 w/ 2048PPR Incremental Track (TTL-Compatible) <sup>1)</sup> |

<sup>1)</sup> Only available with connector R3M12.

| E     | Type of Connection   |
|-------|--|
| B1M12 | Radial 1 x M12 Eurofast Connector w/o Bus Terminal Cover               |
| R2M12 | Radial 2 x M12 Eurofast Connectors w/ Bus Terminal Cover               |
| R3M12 | Radial 3 x M12 Eurofast Connectors w/ Bus Terminal Cover <sup>2)</sup> |
| B1M23 | Radial 1 x M23 Multifast Connector w/o Bus Terminal Cover              |
| B2M23 | Radial 2 x M23 Multifast Connectors w/o Bus Terminal Cover             |
| B1D9  | Radial 1 x 9-pin D-SUB Connector w/o Bus Terminal Cover                |
| BC    | Radial Cable (2 m PVC) w/o Bus Terminal Cover                          |
| RC    | Radial Cable Gland w/ Bus Terminal Cover                               |

<sup>2)</sup> Only valid with Incremental track output option 9G28B

| F   | Options <sup>3)</sup> |
|-----|-----------------------|
| N46 | SET Button            |
| N47 | CANlift DS 417 V1.01  |

<sup>3)</sup> CAN parameters can be factory-preset

#### Accessories:

- See page H1, Connectivity, for cables and connectors
- See page G1, Accessories, for mounting attachments and couplings



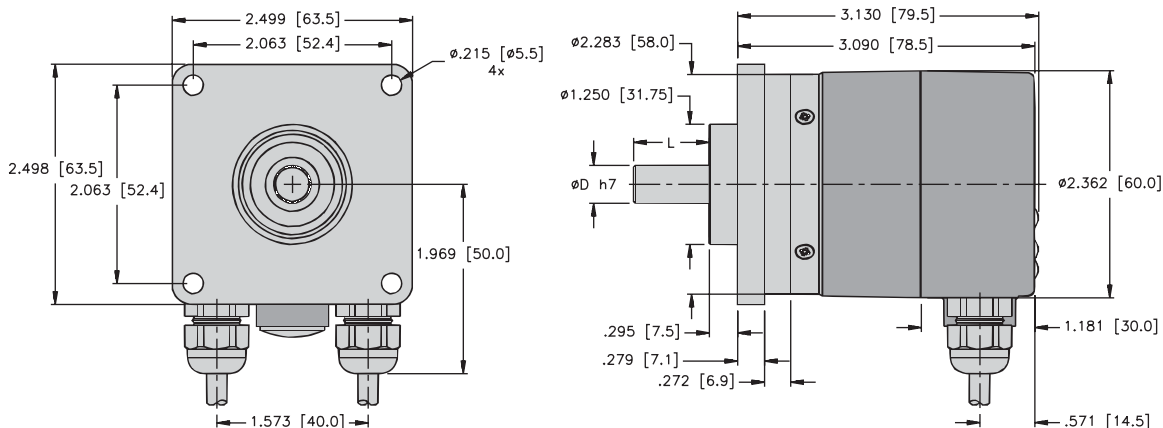
# Rotary Position Technology

## Absolute Encoders, Multiturn

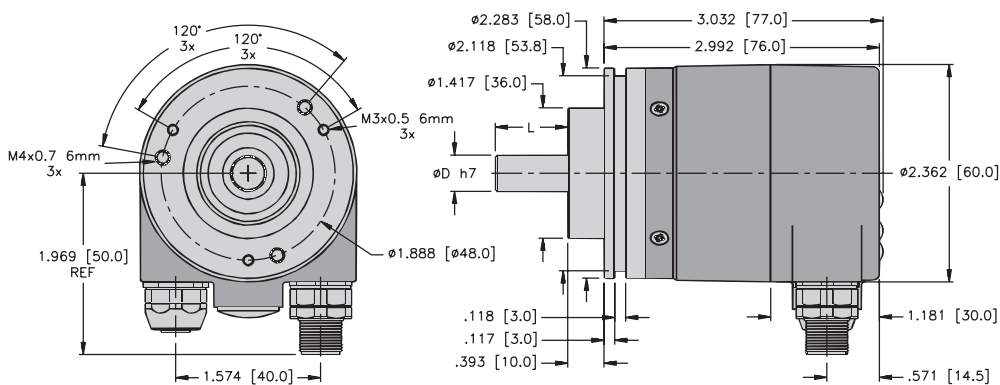
**Absolute, Multiturn Type RM-29 (Shaft) / RM-36 (Blind Hollow Shaft) CANopen/CANlift**

### Dimensions: RM-29 Shaft Version

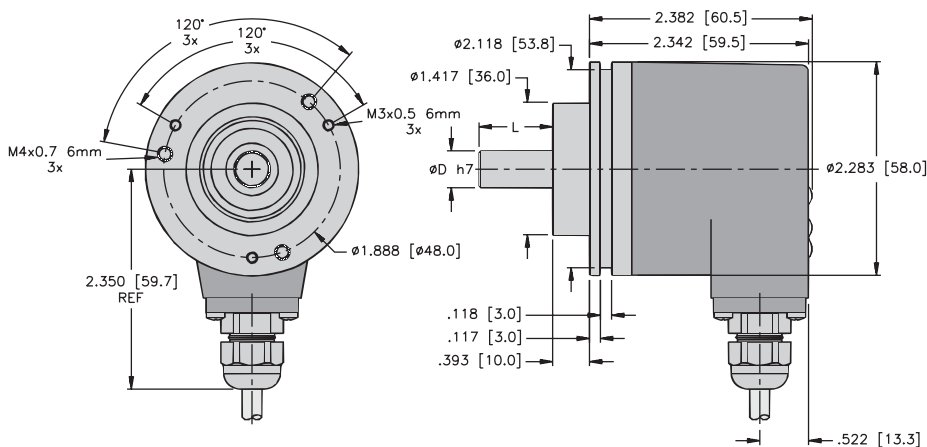
#### RM-29 Flange R Connection RC



#### RM-29 Flange C Connection R2M12

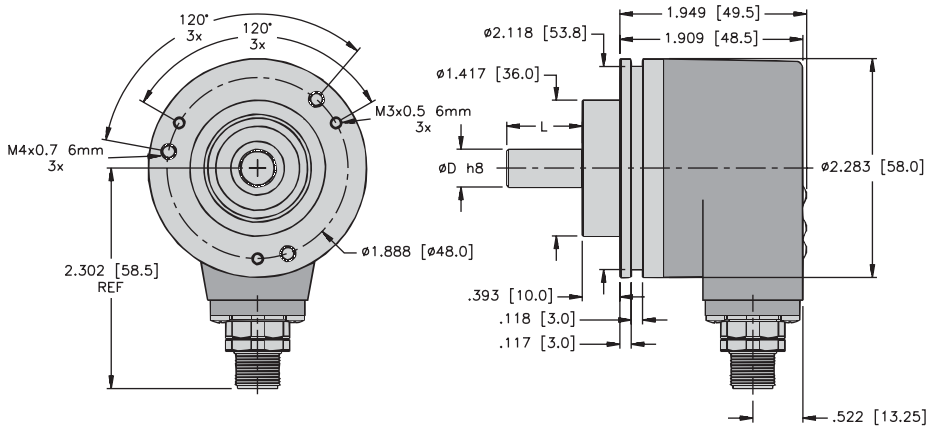


#### RM-29 Flange C Connection BC

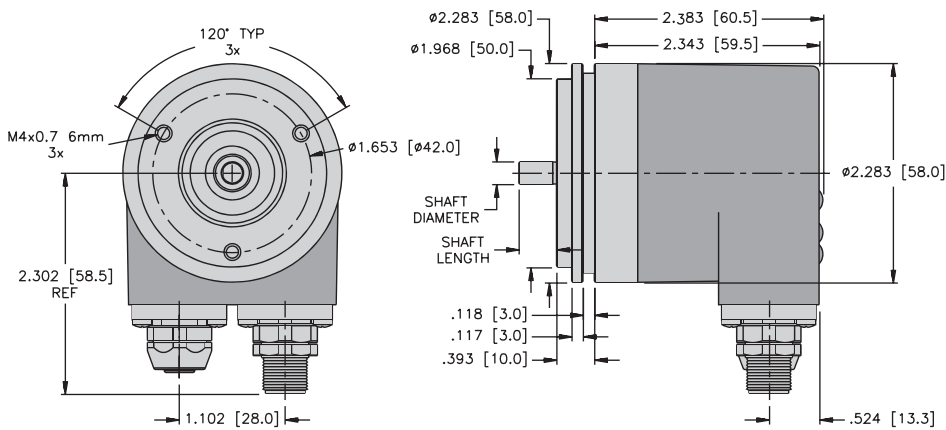


**Dimensions: RM-29 Shaft Version**

**RM-29 Flange C  
 Connection B1M12**

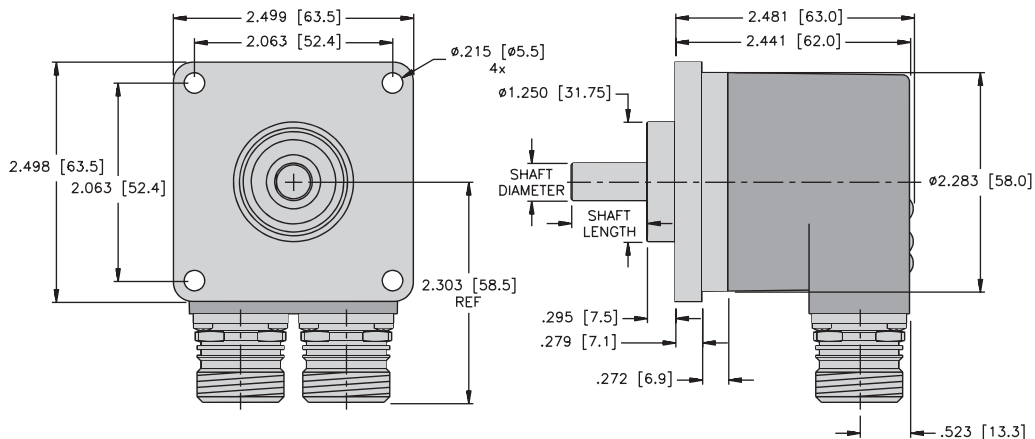


**RM-29 Flange S  
 Connection B2M12**

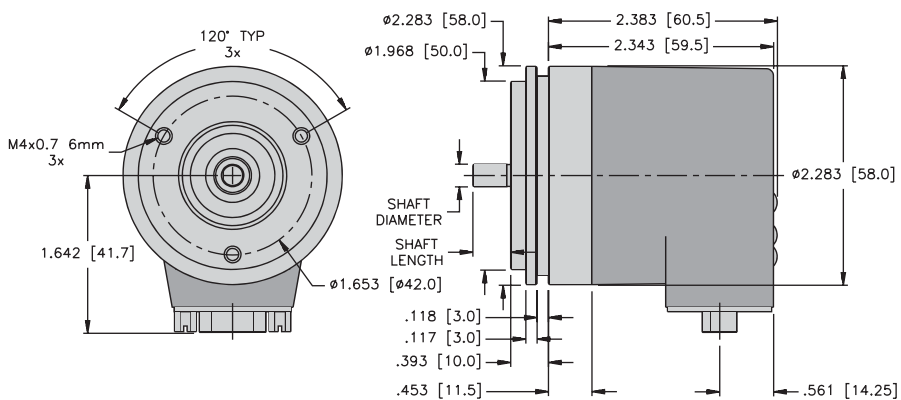


#### Dimensions: RM-29 Shaft Version

##### RM-29 Flange R Connection B2M23



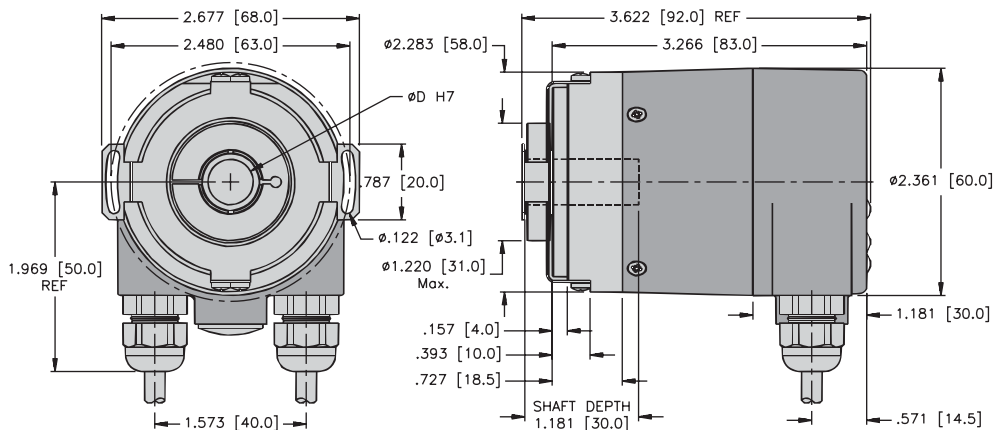
##### RM-29 Flange S Connection B1D9



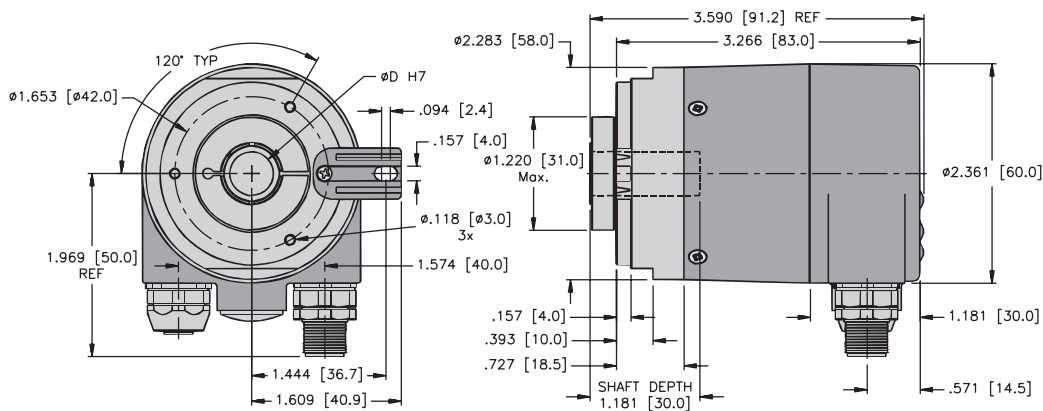
**Absolute, Multiturn Type RM-29 (Shaft) / RM-36 (Blind Hollow Shaft) CANopen/CANlift**

**Dimensions: RM-36 Blind Hollow Shaft Version**

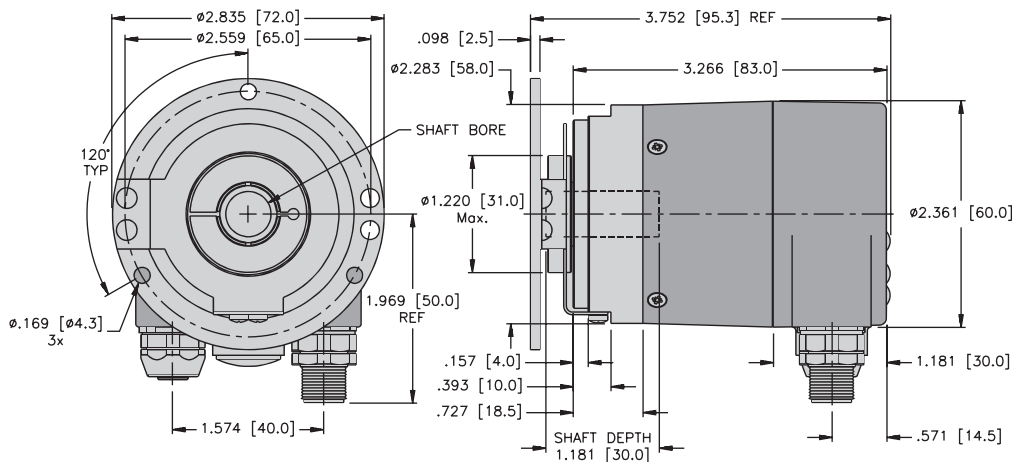
**RM-36 Flange E**  
**Connection RC**



**RM-36 Flange T**  
**Connection R2M12**



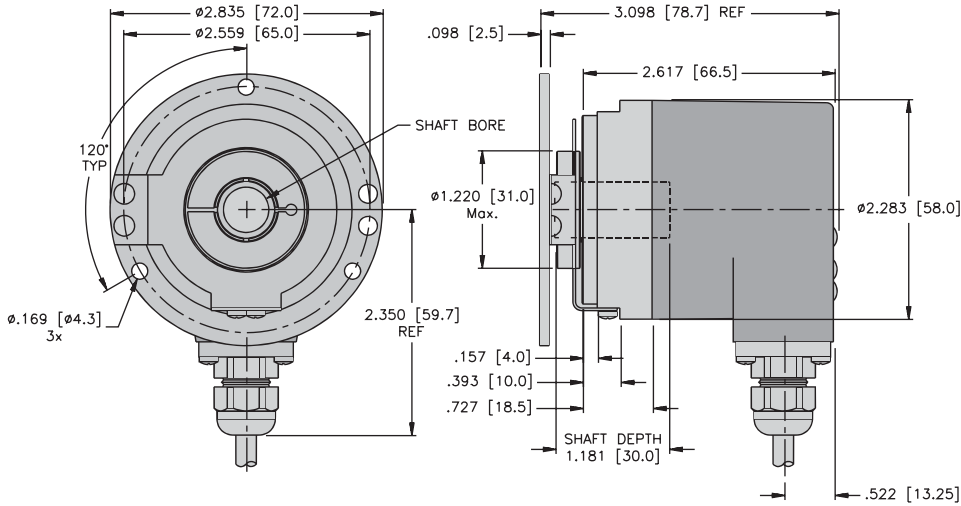
**RM-36 Flange E1**  
**Connection R2M12**



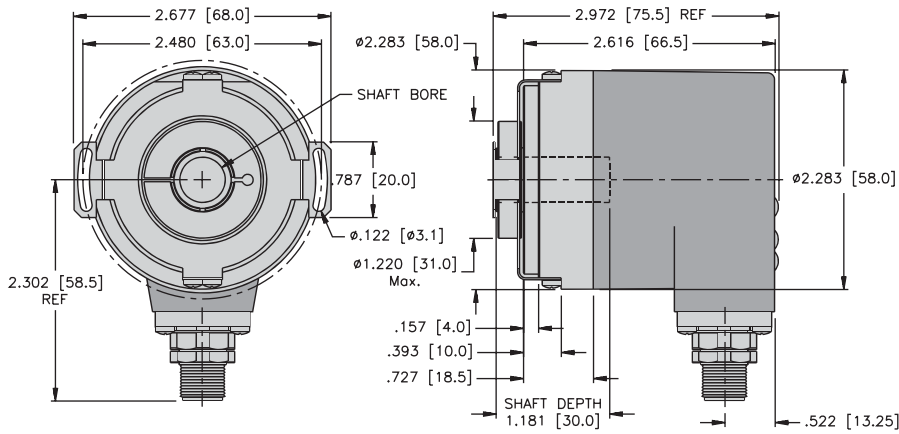
Absolute Encoders

**Dimensions: RM-36 Blind Hollow Shaft Version**

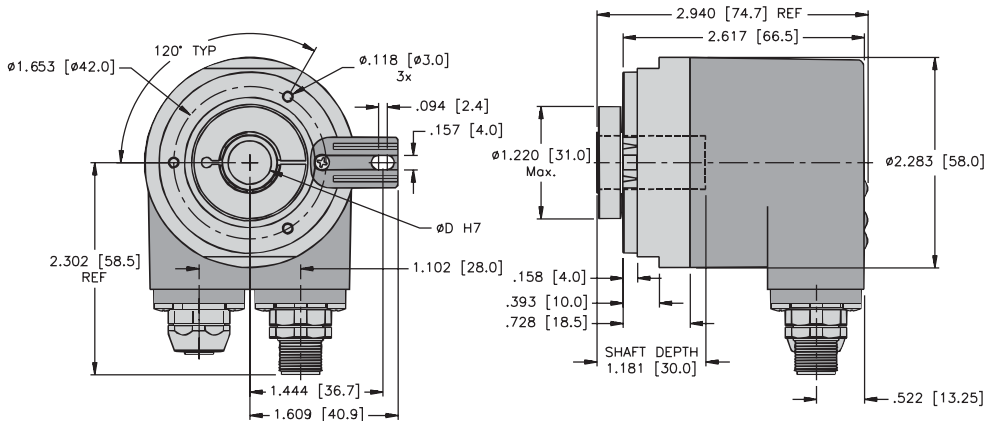
**RM-36 Flange E1  
Connection BC**



**RM-36 Flange E  
Connection B1M12**



**RM-36 Flange T  
Connection B2M12**

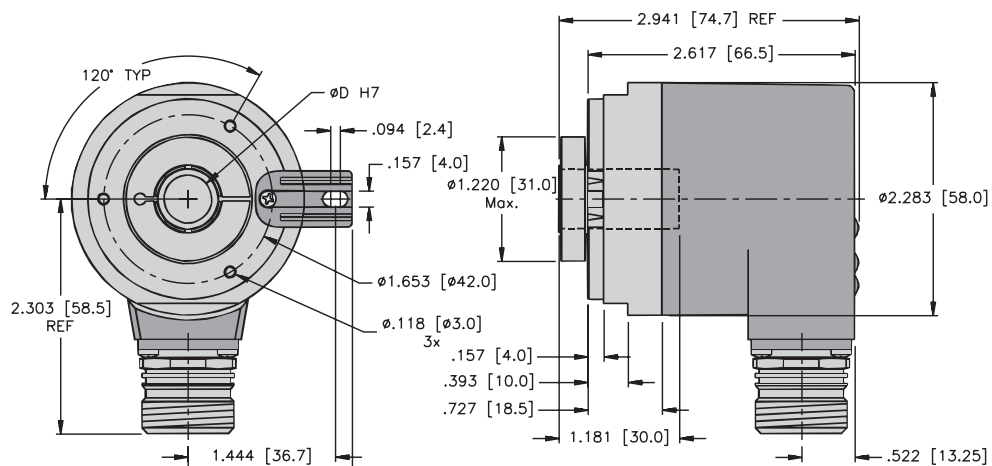


**Absolute, Multiturn Type RM-29 (Shaft) / RM-36 (Blind Hollow Shaft)**

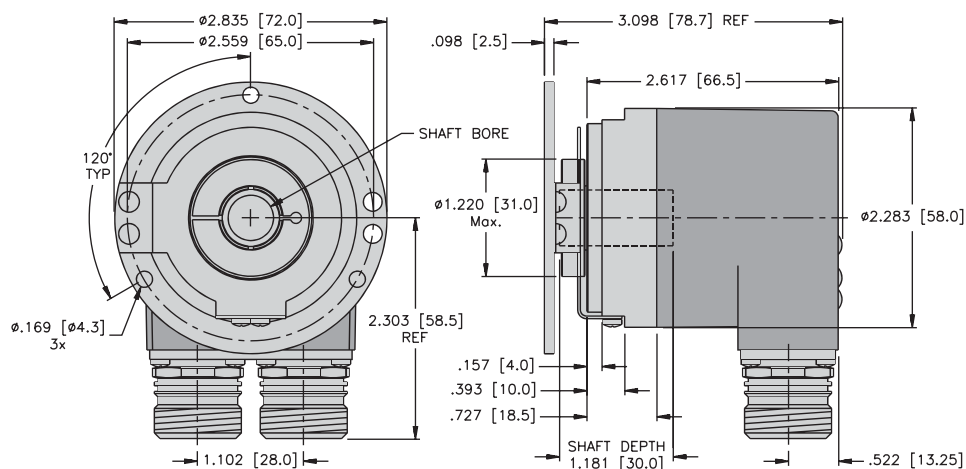
**CANopen/CANlift**

**Dimensions: RM-36 Blind Hollow Shaft Version**

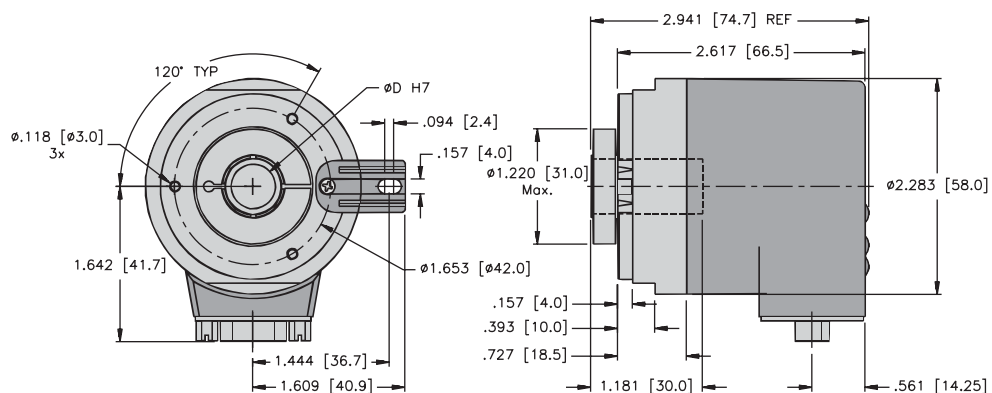
**RM-36 Flange T  
 Connection B1M23**



**RM-36 Flange E1  
 Connection B2M23**



**RM-36 Flange T  
 Connection B1D9**



Absolute Encoders

# Rotary Position Technology

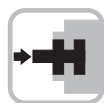
## Absolute Encoders, Multiturn

**Absolute, Multiturn Type RM-29 (Shaft) / RM-36 (Blind Hollow Shaft)**

**EtherCAT**



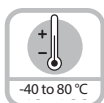
Mechanical drive



Bearing-Lock



High rotational speed



Temperature  
-40 to 80 °C



High IP



High shaft load capacity



Shock/vibration resistant



Magnetic field proof



Short-circuit protected



Reverse polarity protection



Optical sensor



Seawater-resistant version on request

### Reliable

- **Increased ability to withstand vibration and installation errors.** Sturdy Bearing-Lock design structure eliminates machine downtime and repairs.
- **Fewer components and connection points increase the operational reliability:** Turck OptoASIC technology with highest integration density (Chip-on-Board).
- Die cast housing and protection up to IP67: **Remains sealed even when subjected to harsh everyday use.**
- Wide temperature range: -40 to +176 °F (-40 to +80 °C).



### Absolute



**EtherCAT**

### Fast

- **Real time-servo position detection of several axes:** Distributed clock for real-time position detection.
- **Fast data availability with reduced loading on the bus and controller:** Intelligent functions such as transmission of speed/velocity, acceleration or leaving a working area.
- **Fast, simple, error-free connection:** Bus terminal cover with 3 x M12 connectors.

### Versatile

- Up-to-the minute fieldbus performance: CAN over Ethernet.
- **Real-time data: Position, speed or working area.** Variable PDO mapping in the memory.
- **Fast, error-free start-up, without setting any switches:** All parameters can be programmed via the bus.
- **Numerous special functions:** Temperature monitoring, operating time, customer data.

### Mechanical Characteristics:

|   |   |
|---|---|
| Max. speed without shaft sealing (IP65) up to 158 °F (70 °C): | 9,000 RPM, continuous 7,000 RPM   |
| Max. speed without shaft sealing (IP65) up to Tmax:           | 7,000 RPM, continuous 4,000 RPM   |
| Max. speed with shaft sealing (IP67) up to 158 °F (70 °C):    | 8,000 RPM, continuous 6,000 RPM   |
| Max. speed with shaft sealing (IP67) up to Tmax:              | 6,000 RPM, continuous 3,000 RPM   |
| Starting torque without shaft seal (IP65):                    | 1.4 oz-in (< 0.01 Nm)   |
| Starting torque with shaft seal (IP67):                       | Shaft version: 7 oz-in (< 0.05 Nm)<br>Hollow shaft version: 4.25 oz-in (< 0.03 Nm)  |
| Moment of inertia:  | Shaft version: 0.16 oz-in <sup>2</sup> (3.0 x 10 <sup>-6</sup> kgm <sup>2</sup> )<br>Hollow shaft version: 0.41 oz-in <sup>2</sup> (7.5 x 10 <sup>-6</sup> kgm <sup>2</sup> ) |
| Radial load capacity of shaft:                                | 18 lbs (80 N)   |
| Axial load capacity of shaft:                                 | 9 lbs (40 N)  |
| Weight:   | approx. 1.19 lbs (0.54 kg)  |
| Protection acc. to EN 60 529:                                 | Housing: IP67, Shaft: IP65, opt. IP67   |
| Working temperature:  | -40 to +176 °F (-40 to +80 °C)  |
| Materials:  | Shaft: stainless steel, Flange: aluminum, Housing: die cast zinc,   |
| Shock resistance acc. to DIN-IEC 68-2-27:                     | > 250 g (> 2,500 m/s <sup>2</sup> ), 6 ms   |
| Vibration resistance acc. to DIN-IEC 68-2-6:                  | > 10 g (> 100 m/s <sup>2</sup> ), 55-2,000 Hz   |



- Safe operation in strong magnetic fields
- Special gears with specific toothing



### Absolute, Multiturn Type RM-29 (Shaft) / RM-36 (Blind Hollow Shaft)

EtherCAT

#### General Electrical Characteristics:

|   |             |
|---|-------------|
| Supply voltage:                                     | 10-30 VDC   |
| Current consumption (without output load):          | Max. 120 mA |
| Reverse polarity protection at power supply (+V):   | Yes         |
| RoHS compliant according to EU guideline 2011/65/EU |             |

#### Device Characteristics:

|   |   |
|---|---|
| Singleturn resolution<br>Default value: | 1-65535 (16 bit), (scalable: 1-65535)<br>8192 (13 bit)    |
| Total resolution:                       | scalable from 1 to 268435456 (28 bit)<br>12 Bit Multiturn |
| Code:                                   | Binary  |
| Interface:                              | EtherNet/EtherCAT   |

#### General Information about CoE (CAN over EtherCAT)

The EtherCAT encoders support the CANopen communication profile according to DS 301. In addition, device-specific profiles like the encoder profile DS 406 are available.

Scaling, preset values, limit switch values and many other parameters may be programmed via the EtherCAT bus. When switching the device on, all parameters are loaded from an EEPROM, where they were saved to protect them against power failure.

Position, speed, acceleration, temperature and working area status output may be combined as PDO mapping).

#### Standard Wiring (Bus): (M12 Eurofast Connector D-Coded)

| Direction:    | Port A         |               |                |               | Port B         |               |                |               |
|---------------|----------------|---------------|----------------|---------------|----------------|---------------|----------------|---------------|
| Signal:       | Transmit data+ | Receive data+ | Transmit data- | Receive data- | Transmit data+ | Receive data+ | Transmit data- | Receive data- |
| Abbrv:        | TxD+           | RxD+          | TxD-           | RxD-          | TxD+           | RxD+          | TxD-           | RxD-          |
| M12 Eurofast: | 1              | 2             | 3              | 4             | 1              | 2             | 3              | 4             |

#### Standard Wiring (Power Supply): M12 Eurofast Connector

| Signal:       | Power supply | N/C | Common | N/C |
|---------------|--------------|-----|--------|-----|
| Abbrv:        | +V           | -   | 0 V    | -   |
| M12 Eurofast: | 1            | 2   | 3      | 4   |

#### Wiring Diagrams:

| Bus<br>Female Encoder View    | Power Supply<br>Male Encoder View |
|-------------------------------|-----------------------------------|
|                               |                                   |
| M12 Eurofast Pinout           | M12 Eurofast Pinout               |
| Mating Cordset:<br>RSSD 441-* | Mating Cordset:<br>RK 4.4T-*      |

#### Diagnostic LED (Red)

LED is ON with the following fault conditions:  
Sensor error (internal code or LED error), low voltage, over-temperature

#### Run LED (Green)

LED is ON with the following conditions:  
Preop-, Safeop and Op-State (EtherCat status machine)

#### 2 x Link LED (Yellow)

LED is ON with the following conditions (Port A and B):  
Link detected

#### Modes

Freerun, Distributed Clock (cycle time for Sync 0 pulse min. 125 µs or 62.5 µs with restrictions), Sync-Mode

#### CANopen Encoder Profile CoE (CAN over EtherCAT)

The following parameters are programmable:

- Units for speed selectable (Steps/Sec or RPM)
- Factor for speed calculation (e.g., circumference of measuring wheel)
- Integration time for the speed value from 1 to 32
- Two working area with 2 upper and lower limits and the corresponding output states
- PDO mapping of position, speed/velocity, acceleration and working area
- Extended error management for position sensing with integrated temperature control
- User interface with visual display of bus and fault status – 4 LEDs
- Alarm and warning messages

# Rotary Position Technology

## Absolute Encoders, Multiturn

### Absolute, Multiturn Type RM-29 (Shaft) / RM-36 (Blind Hollow Shaft)

EtherCAT

#### Part Number Key: RM-29 Shaft Version

| A      | B | C |   | D     |   | E     |
|--------|---|---|---|-------|---|-------|
| RM-29S | 6 | C | - | 9C28B | - | R3M12 |

| A      | Type                            |
|--------|---------------------------------|
| RM-29S | Ø 58 mm, Shaft, IP67 Shaft Seal |
| RM-29T | Ø 58 mm, Shaft, IP65 Shaft Seal |

| B  | Shaft (Ø x L)   |
|----|-----------------|
| 6  | Ø 6 mm x 10 mm  |
| 10 | Ø 10 mm x 20 mm |
| A0 | Ø 1/4" x 7/8"   |
| A1 | Ø 3/8" x 7/8"   |

| C | Flange                  |
|---|-------------------------|
| C | Ø 58 mm Clamping Flange |
| S | Ø 58 mm Servo Flange    |
| R | 2.5" Square Flange      |

| D     | Voltage Supply and Output Type |
|-------|--------------------------------|
| 9C28B | 10-30 VDC, EtherCAT            |

| E     | Type of Connection                                       |
|-------|--|
| R3M12 | Radial 3 x M12 Eurofast Connectors w/ Bus Terminal Cover |

#### Part Number Key: RM-36 Blind Hollow Shaft Version

| A      | B  | C |   | D     |   | E     |
|--------|----|---|---|-------|---|-------|
| RM-36B | 10 | T | - | 9C25B | - | R3M12 |

| A      | Type   |
|--------|--|
| RM-36B | Ø 58 mm, Blind Hollow Shaft, IP67 Shaft Seal |
| RM-36C | Ø 58 mm, Blind Hollow Shaft, IP65 Shaft Seal |

| B  | Bore (30 mm Insertion Depth) |
|----|------------------------------|
| 10 | Ø 10 mm                      |
| 12 | Ø 12 mm                      |
| 14 | Ø 14 mm                      |
| 15 | Ø 15 mm                      |
| A1 | Ø 3/8"                       |
| A3 | Ø 1/2"                       |

| C  | Flange                               |
|----|--------------------------------------|
| T  | Ø 50 mm Flange w/ Torque Stop        |
| E  | Ø 63 mm Flange w/ Slotted Flex Mount |
| E1 | Ø 65 mm Flange w/ Flex Mount         |

| D     | Voltage Supply and Output Type |
|-------|--------------------------------|
| 9C28B | 10-30 VDC, EtherCAT            |

| E     | Type of Connection                                       |
|-------|--|
| R3M12 | Radial 3 x M12 Eurofast Connectors w/ Bus Terminal Cover |

#### Accessories:

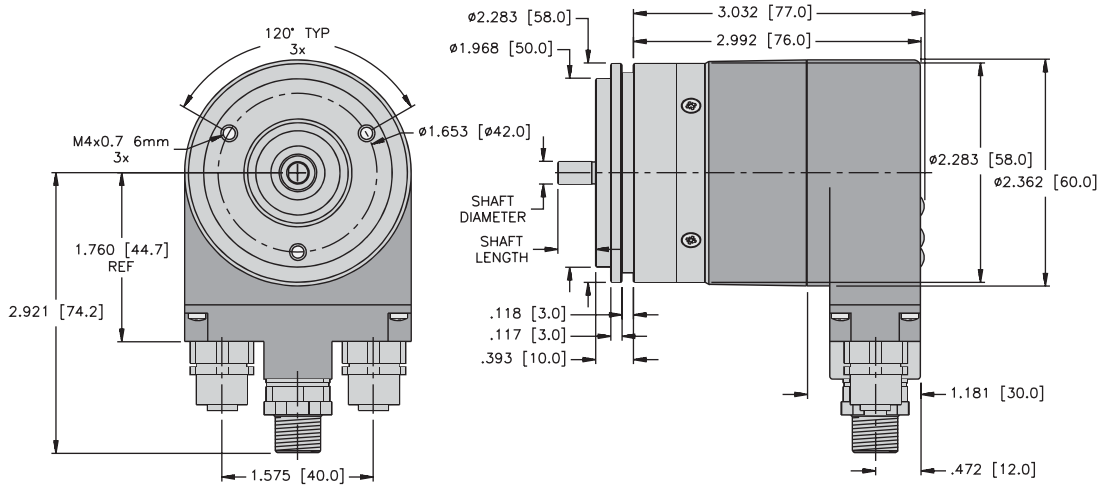
- See page H1, Connectivity, for cables and connectors
- See page G1, Accessories, for mounting attachments and couplings

**Absolute, Multiturn Type RM-29 (Shaft) / RM-36 (Blind Hollow Shaft)**

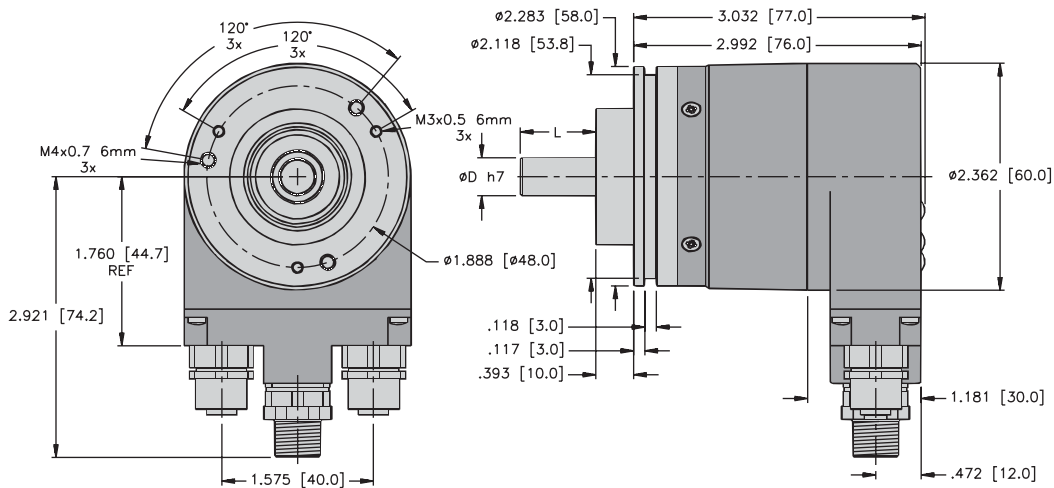
**EtherCAT**

**Dimensions: RM-29 Shaft Version**

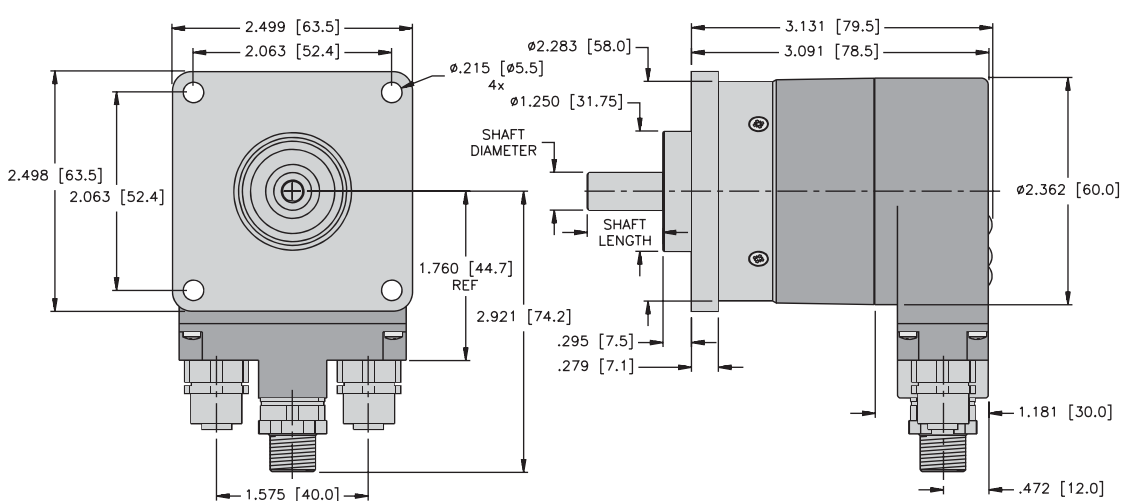
**RM-29 Flange S  
 Connection R3M12**



**RM-29 Flange C  
 Connection R3M12**



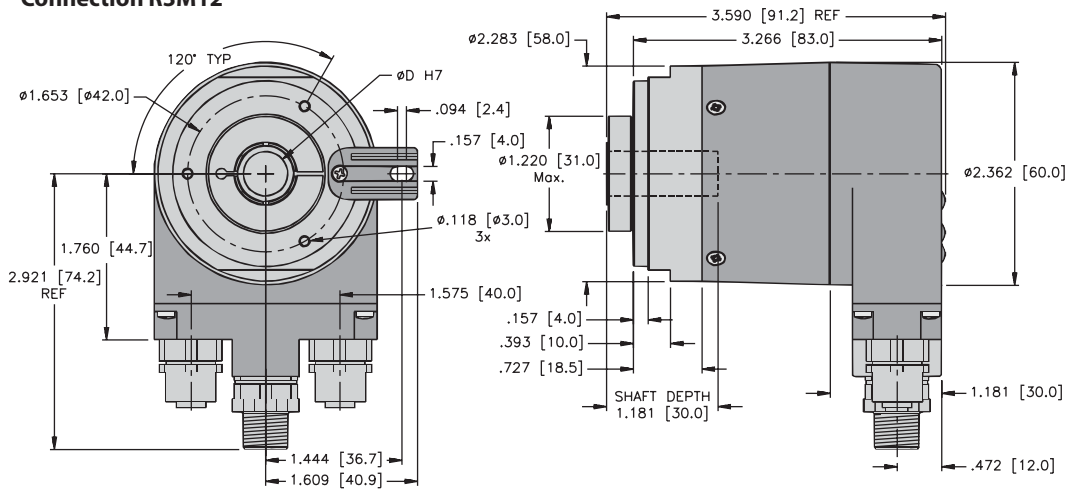
**RM-29 Flange R  
 Connection R3M12**



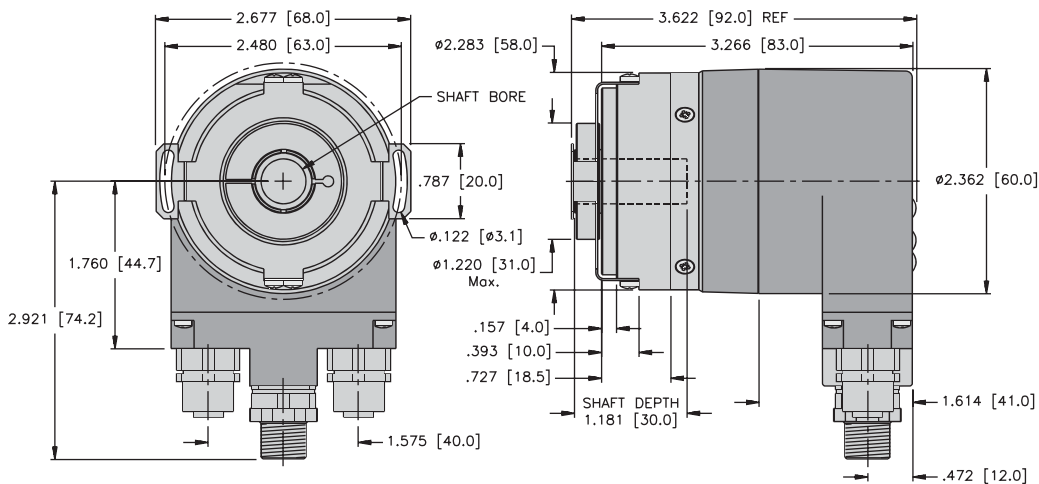
### Absolute, Multiturn Type RM-29 (Shaft) / RM-36 (Blind Hollow Shaft) EtherCAT

#### Dimensions: RM-36 Blind Hollow Shaft Version

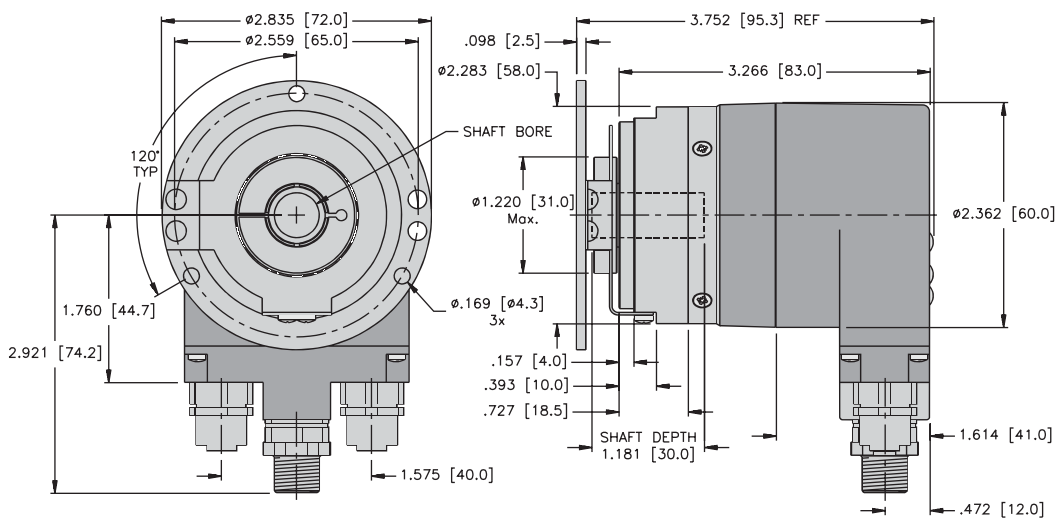
##### RM-36 Flange T Connection R3M12



##### RM-36 Flange E Connection R3M12

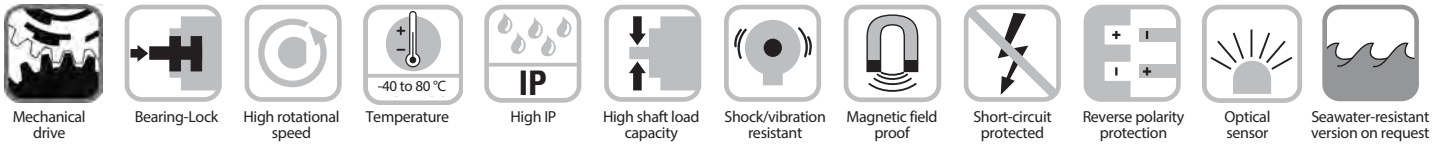


##### RM-36 Flange E1 Connection R3M12



### Absolute, Multiturn Type RM-29 (Shaft) / RM-36 (Blind Hollow Shaft)

### PROFIBUS-DP



#### Reliable

- **Increased ability to withstand vibration and installation errors.** Sturdy Bearing-Lock design structure eliminates machine downtime and repairs.
- **Fewer components and connection points increase the operational reliability:** Turck OptoASIC technology with highest integration density (Chip-on-Board).
- Die cast housing and protection up to IP67: **Remains sealed even when subjected to harsh everyday use.**
- Wide temperature range.
- **Immediate recognition of bus operation.**



#### Absolute



#### Fast

- **Fast data availability with reduced loading on the bus and controller:** Intelligent functions like the transmission of speed, acceleration or exiting a working area.
- **Fast, simple, error-free connection.**

#### Versatile

- **Up-to-the minute fieldbus performance:** PROFIBUS-DPV0 supports Class I and II.
- **Connection options:** Bus cover with M12 connector or cable connection.
- **Fast start-up** with pre-defined GSD file: A variety of scaling options, 16 bit singleturn resolution, 12 bit multiturn resolution.
- Comprehensive diagnostics, programmable to Class II.

#### Mechanical Characteristics:

|   |  |
|---|--|
| Max. speed without shaft sealing (IP65) up to 158 °F (70 °C): | 9,000 RPM, continuous 7,000 RPM  |
| Max. speed without shaft sealing (IP65) up to Tmax:           | 7,000 RPM, continuous 4,000 RPM  |
| Max. speed with shaft sealing (IP67) up to 158 °F (70 °C):    | 8,000 RPM, continuous 6,000 RPM  |
| Max. speed with shaft sealing (IP67) up to Tmax:              | 6,000 RPM, continuous 3,000 RPM  |
| Starting torque without shaft seal (IP65):                    | 1.4 oz-in (< 0.01 Nm)  |
| Starting torque with shaft seal (IP67):                       | 4.25 oz-in (< 0.03 Nm)   |
| Moment of inertia:  | Shaft version: 0.219 oz-in <sup>2</sup><br>(4.0 x 10 <sup>-6</sup> kgm <sup>2</sup> )<br>Hollow shaft version: 0.41 oz-in <sup>2</sup><br>(7.5 x 10 <sup>-6</sup> kgm <sup>2</sup> ) |
| Radial load capacity of shaft:                                | 18 lbs (80 N)  |
| Axial load capacity of shaft:                                 | 9 lbs (40 N)   |
| Weight:   | approx. 1.26 lbs (0.57 kg) with bus terminal cover<br>approx. 1.15 lbs (0.52 kg) with fixed connection   |
| Protection acc. to EN 60 529:                                 | Housing: IP67, Shaft: IP65, opt. IP67  |
| Working temperature:  | -40 to +176 °F (-40 to +80 °C)   |
| Materials:  | Shaft: stainless steel, Flange: aluminum, Housing: die cast zinc   |
| Shock resistance acc. to DIN-IEC 68-2-27:                     | > 250 g (> 2,500 m/s <sup>2</sup> ), 6 ms  |
| Vibration resistance acc. to DIN-IEC 68-2-6:                  | > 10 g (> 100 m/s <sup>2</sup> ), 55-2,000 Hz  |



- Safe operation in strong magnetic fields
- Special gears with specific toothings

# Rotary Position Technology

## Absolute Encoders, Multiturn

### Absolute, Multiturn Type RM-29 (Shaft) / RM-36 (Blind Hollow Shaft)

### PROFIBUS-DP

#### General Electrical Characteristics:

|   |                          |
|---|--------------------------|
| Supply voltage:                                     | 10-30 VDC                |
| Current consumption (w/o output load):              | Max. 120 mA              |
| Reverse polarity protection                         | Yes at power supply (+V) |
| RoHS compliant according to EU guideline 2011/65/EU |                          |

#### SET control button (zero or defined value, option):

Protected against accidental activation, can only be depressed with the tip of a ballpoint pen or similar.

#### Diagnostic LED (yellow):

LED on with: sensor error (PROFIBUS error)

#### Interface Characteristics PROFIBUS-DP:

|                        |  |
|------------------------|--|
| Singleturn resolution  | 1-65536 (16 bits), default 8192 (13 bits)  |
| Total resolution:      | 28 bit (scalable 1-2 <sup>28</sup> steps)  |
| Number of Revolutions: | 4096 (12 bits), (scalable 1-4096)  |
| Code:                  | Binary   |
| Interface:             | Specification according to PROFIBUS-DP 2.0 Standard (DIN 19245 Part 3) RS485 driver galvanically isolated. |

|                         |   |
|-------------------------|---|
| Protocol:               | PROFIBUS Encoder Profile V1.1 Class 1 and Class 2 with manufacturer-specific enhancements |
| Baud rate:              | Max. 12 Mbits/s   |
| Node address:           | 1-127 (set by rotary switches)  |
| Termination switchable: | Set by DIP switches   |

#### PROFIBUS Encoder-Profile V1.1

The PROFIBUS-DP device profile describes the functionality of the communication and the user-specific component within the PROFIBUS fieldbus system. The encoder profile is definitive. Here the individual objects are defined independent of the manufacturer. Furthermore, the profiles offer space for additional manufacturer-specific functions. This means that PROFIBUS compliant device systems can be used now with the guarantee that they are ready for the future as well.

#### The following parameters may be programmed:

- Direction of rotation
- Scaling
  - Number of steps per revolution
  - Number of revolutions
  - Total resolution over Singleturn/Multiturn
- Preset value
- Diagnostics mode
- Position 16/32 Bit
- Speed UPM or Unit/s (16/32) Bit

#### The following functionality is integrated:

- Galvanic isolation of the bus stage with DC/DC converter
- Line driver according to RS485; max. 12 MB
- Address programmable via DIP switches
- Diagnostics LED
- Full Class I and Class II functionality

#### Standard Wiring Connection RC

| Signal: | BUS IN |   |              |    | BUS OUT      |    |   |   |
|---------|--------|---|--------------|----|--------------|----|---|---|
|         | B      | A | Common (0 V) | +V | Common (0 V) | +V | B | A |
| Pin:    | 1      | 2 | 3            | 4  | 5            | 6  | 7 | 8 |

#### Connection R3M12

| Bus In | Signal: | - | BUS-A | - | BUS-B | Shield |
|--------|---------|---|-------|---|-------|--------|
| Pin:   |         | 1 | 2     | 3 | 4     | 5      |

| Power Supply | Signal: | +V | - | Common (0 V) | - |
|--------------|---------|----|---|--------------|---|
| Pin:         |         | 1  | 2 | 3            | 4 |

| Bus Out | Signal: | BUS-VDC <sup>1)</sup> | BUS-A | BUS_GND <sup>1)</sup> | BUS-B | Shield |
|---------|---------|-----------------------|-------|-----------------------|-------|--------|
| Pin:    |         | 1                     | 2     | 3                     | 4     | 5      |

#### Wiring Diagrams:

| Bus In   | Power Supply                            | Bus Out  |
|--|---|--|
| <b>Male Encoder View</b>                                 | <b>Male Encoder View</b>                | <b>Female Encoder View</b>                               |
|  |   |  |
| M12 Eurofast Pinout                                      | M12 Eurofast Pinout                     | M12 Eurofast Pinout                                      |
| Mating Cordset: <sup>2)3)</sup> RKS <sub>W</sub> -590-*M | Mating Cordset: <sup>2)</sup> RK 4.4T-* | Mating Cordset: <sup>2)3)</sup> RSS <sub>W</sub> -590-*M |

<sup>1)</sup> For powering an external PROFIBUS-DP terminating resistor.  
<sup>2)</sup> See Connectivity section H for corresponding cable color code.  
<sup>3)</sup> "S" denotes shield tied to coupling nut.  
 \* Length in meters. Available in 0.1 meter increments ≥ 0.2 meters.

### Absolute, Multiturn Type RM-29 (Shaft) / RM-36 (Blind Hollow Shaft)

PROFIBUS-DP

#### Part Number Key: RM-29 Shaft Version

| A      | B | C |   | D     |   | E     |   | F   |
|--------|---|---|---|-------|---|-------|---|-----|
| RM-29S | 6 | C | - | 9A28B | - | R3M12 | / | N46 |

| A      | Type                            |
|--------|---------------------------------|
| RM-29S | Ø 58 mm, Shaft, IP67 Shaft Seal |
| RM-29T | Ø 58 mm, Shaft, IP65 Shaft Seal |

| B  | Shaft (Ø x L)   |
|----|-----------------|
| 6  | Ø 6 mm x 10 mm  |
| 10 | Ø 10 mm x 20 mm |
| A0 | Ø 1/4" x 7/8"   |
| A1 | Ø 3/8" x 7/8"   |

| C | Flange                  |
|---|-------------------------|
| C | Ø 58 mm Clamping Flange |
| S | Ø 58 mm Servo Flange    |
| R | 2.5" Square Flange      |

| D     | Voltage Supply and Output Type                 |
|-------|--|
| 9A28B | 10-30 VDC, PROFIBUS-DP V0 encoder Profile V1.1 |

| E     | Type of Connection                                       |
|-------|--|
| R3M12 | Radial 3 x M12 Eurofast Connectors w/ Bus Terminal Cover |
| RC    | Radial Cable Gland w/ Bus Terminal Cover                 |

| F       | Options    |
|---------|------------|
| (BLANK) | No Options |
| N46     | SET Button |

#### Part Number Key: RM-36 Blind Hollow Shaft Version

| A      | B  | C |   | D     |   | E     |   | F   |
|--------|----|---|---|-------|---|-------|---|-----|
| RM-36B | 10 | T | - | 9A28B | - | R3M12 | / | N46 |

| A      | Type   |
|--------|--|
| RM-36B | Ø 58 mm, Blind Hollow Shaft, IP67 Shaft Seal |
| RM-36C | Ø 58 mm, Blind Hollow Shaft, IP65 Shaft Seal |

| B  | Bore (30 mm Insertion Depth) |
|----|------------------------------|
| 10 | Ø 10 mm                      |
| 12 | Ø 12 mm                      |
| 14 | Ø 14 mm                      |
| 15 | Ø 15 mm                      |
| A1 | Ø 3/8"                       |
| A3 | Ø 1/2"                       |

| C  | Flange                               |
|----|--------------------------------------|
| T  | Ø 50 mm Flange w/ Torque Stop        |
| E  | Ø 63 mm Flange w/ Slotted Flex Mount |
| E1 | Ø 65 mm Flange w/ Flex Mount         |

| D     | Voltage Supply and Output Type                 |
|-------|--|
| 9A28B | 10-30 VDC, PROFIBUS-DP V0 encoder Profile V1.1 |

| E     | Type of Connection                                       |
|-------|--|
| R3M12 | Radial 3 x M12 Eurofast Connectors w/ Bus Terminal Cover |
| RC    | Radial Cable Gland w/ Bus Terminal Cover                 |

| F       | Options    |
|---------|------------|
| (BLANK) | No Options |
| N46     | SET Button |

#### Accessories:

- See page H1, Connectivity, for cables and connectors
- See page G1, Accessories, for mounting attachments and couplings

# Rotary Position Technology

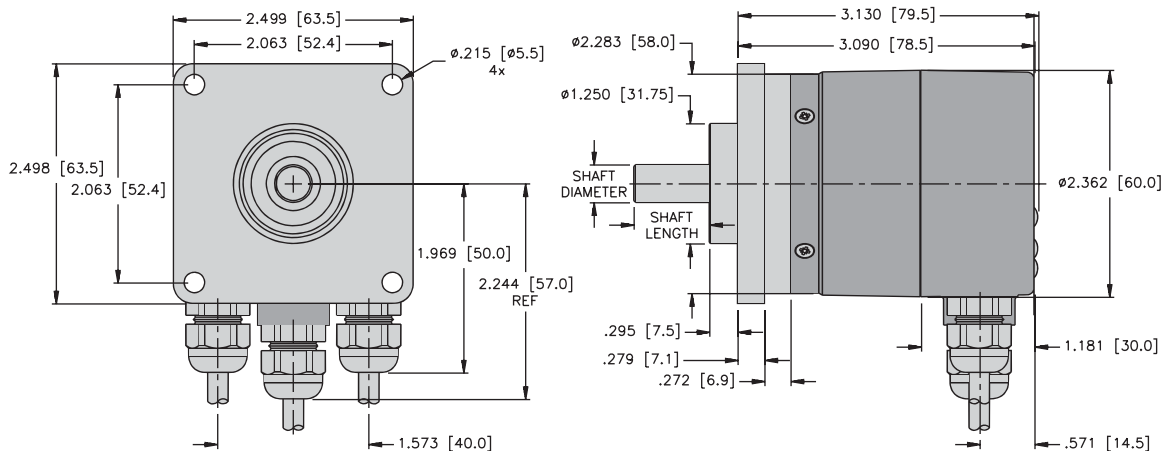
## Absolute Encoders, Multiturn

### Absolute, Multiturn Type RM-29 (Shaft) / RM-36 (Blind Hollow Shaft)

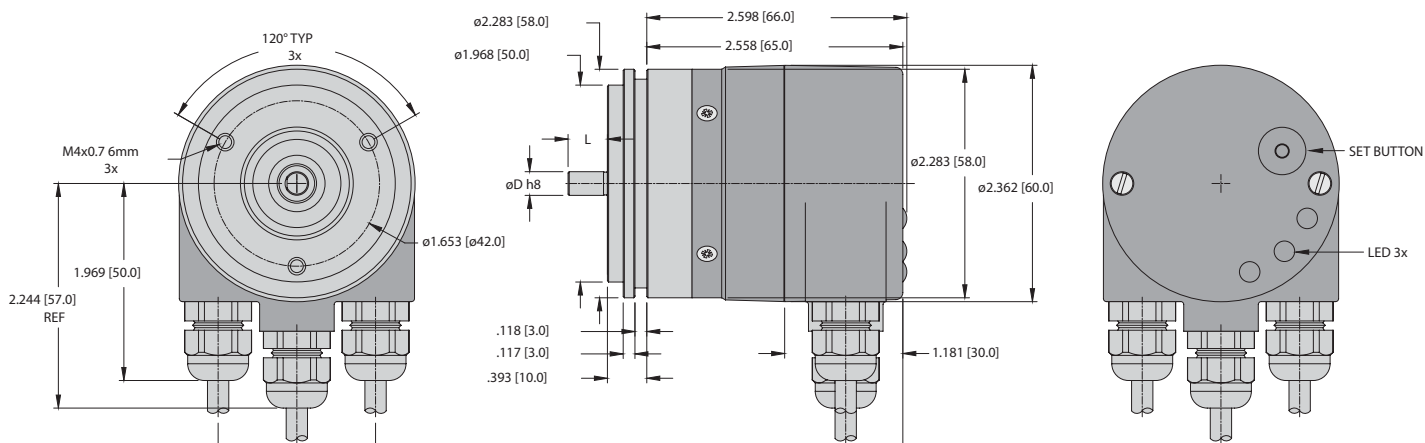
PROFIBUS-DP

#### Dimensions: RM-29 Shaft Version

##### RM-29 Flange R Connection RC



##### RM-29 Flange S Connection RC

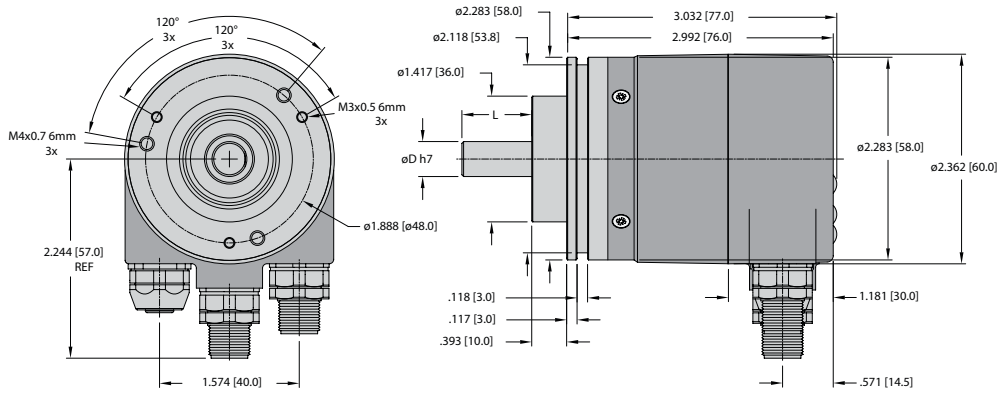




**Absolute, Multiturn Type RM-29 (Shaft) / RM-36 (Blind Hollow Shaft) PROFIBUS-DP**

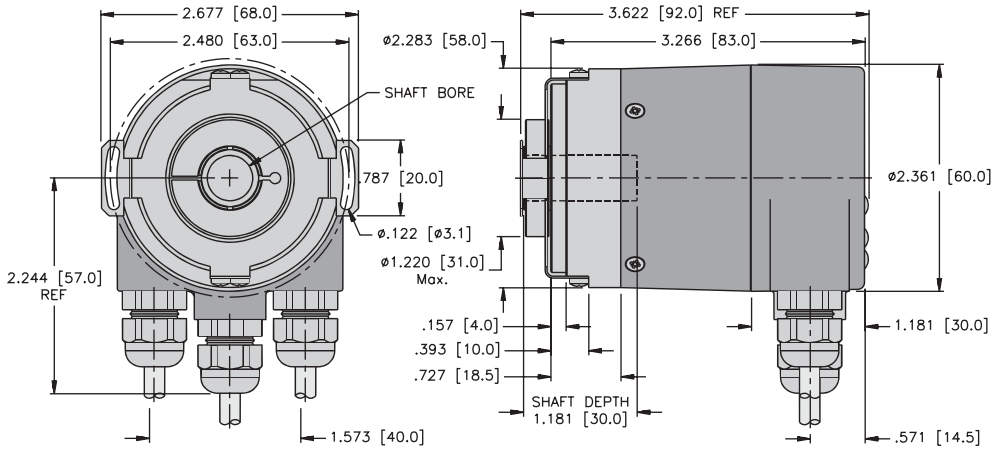
Dimensions: RM-29 Shaft Version

**RM-29 Flange C**  
**Connection R3M12**

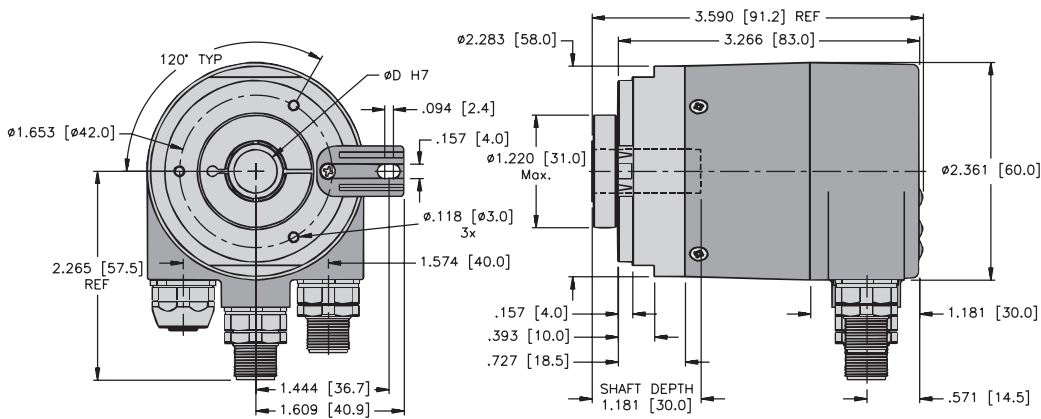


**Dimensions: RM-36 Blind Hollow Shaft Version**

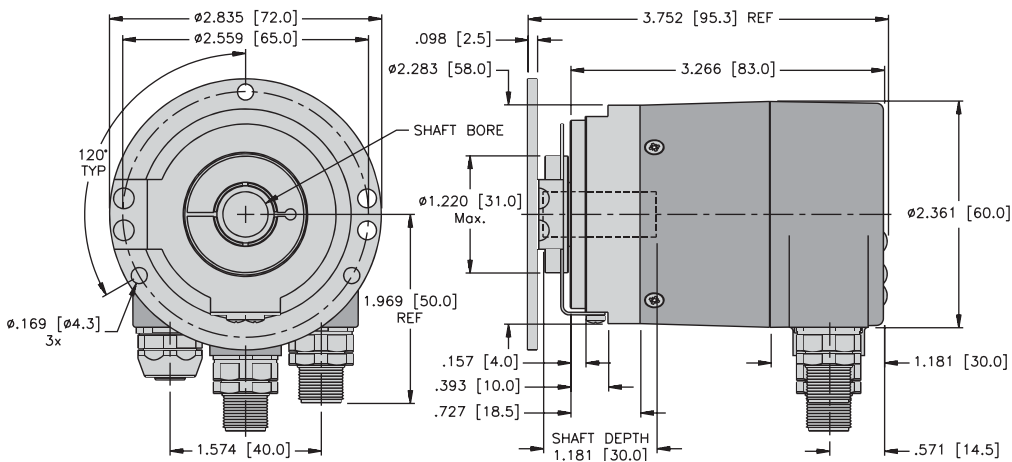
**RM-36 Flange E  
Connection RC**



**RM-36 Flange T  
Connection R3M12**

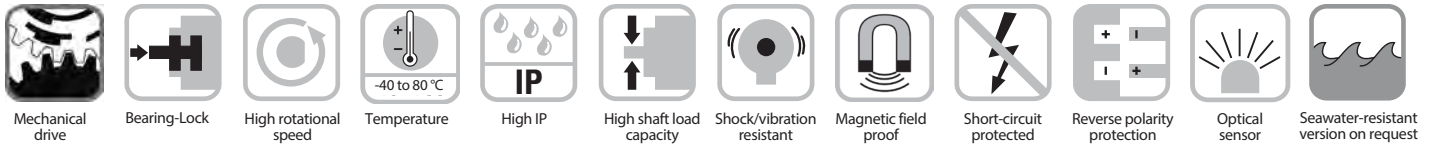


**RM-36 Flange E1  
Connection R3M12**



### Absolute, Multiturn Type RM-29 (Shaft) / RM-36 (Blind Hollow Shaft)

### PROFINET IO



#### Reliable

- Ideally suited for all PROFINET applications thanks to the use of encoder profile 4.1.
- Perfect for use in harsh outdoor environments, as a result of IP67 protection and rugged housing construction.



#### Absolute



#### Versatile

- IRT-Mode.
- Cycle time  $\leq 1$  ms
- Firmware updater allows for easy expansion of characteristics without having to disassemble the encoder.
- M12 connector ensures fast, simple, error-free connection



#### Fast

- Fast, simple, error-free connection.

#### Mechanical Characteristics:

|   |   |
|---|---|
| Max. speed without shaft sealing (IP65) up to 158 °F (70 °C): | 9,000 RPM, continuous 7,000 RPM   |
| Max. speed without shaft sealing (IP65) up to Tmax:           | 7,000 RPM, continuous 4,000 RPM   |
| Max. speed with shaft sealing (IP67) up to 158 °F (70 °C):    | 8,000 RPM, continuous 6,000 RPM   |
| Max. speed with shaft sealing (IP67) up to Tmax:              | 6,000 RPM, continuous 3,000 RPM   |
| Starting torque without shaft seal (IP65):                    | 1.4 oz-in (< 0.01 Nm)   |
| Starting torque with shaft seal (IP67):                       | Shaft version: 7 oz-in (< 0.05 Nm)<br>Hollow shaft version: 4.25 oz-in (< 0.03 Nm)  |
| Moment of inertia:  | Shaft version: 0.16 oz-in <sup>2</sup> (3.0 x 10 <sup>-6</sup> kgm <sup>2</sup> )<br>Hollow shaft version: 0.41 oz-in <sup>2</sup> (7.5 x 10 <sup>-6</sup> kgm <sup>2</sup> ) |
| Radial load capacity of shaft:                                | 18 lbs (80 N)   |
| Axial load capacity of shaft:                                 | 9 lbs (40 N)  |
| Weight:   | approx. 1.19 lbs (0.54 kg)  |
| Protection acc. to EN 60 529:                                 | Housing: IP67, Shaft: IP65, opt. IP67   |
| Working temperature:  | -40 to +185 °F (-40 to +85 °C)  |
| Materials:  | Shaft: stainless steel, Flange: aluminum, Housing: die cast zinc  |
| Shock resistance acc. to DIN-IEC 68-2-27:                     | > 250 g (> 2,500 m/s <sup>2</sup> ), 6 ms   |
| Vibration resistance acc. to DIN-IEC 68-2-6:                  | > 10 g (> 100 m/s <sup>2</sup> ), 55-2,000 Hz   |

#### General Information about PROFINET

The PROFINET encoder implements the Encoder Profile 4.1. (according to the specification Encoder Version 4.1 Dec. 2008).

It permits scaling and preset values, as well as many other additional parameters to be programmed via the PROFINET-Bus. When switching on, all parameters are loaded from an EEPROM, where they were saved previously to protect them against power-failure, or taken over by the controller in the start-up phase. Position, speed and many other states of the encoder can be transmitted.

#### PROFINET IO

The complete encoder profile according to Profile Encoder Version 4.1 as well as the Identification and maintenance functionality Version 1.16 has been implemented. IM blocks 0, 1, 2, 3 and 4 are supported.

The **Media Redundancy Protocol** is implemented here. Basically, the advantage of MRP is that the functionality of the components, which are wired in a ring structure, is maintained in case of a failure or of a breakage of the wires in any location.

# Rotary Position Technology

## Absolute Encoders, Multiturn

### Absolute, Multiturn Type RM-29 (Shaft) / RM-36 (Blind Hollow Shaft)

PROFINET IO

#### General Electrical Characteristics:

|   |             |
|---|-------------|
| Supply voltage:                                     | 10-30 VDC   |
| Current consumption (without output load):          | Max. 200 mA |
| Reverse polarity protection at power supply (+V):   | Yes         |
| RoHS compliant according to EU guideline 2011/65/EU |             |

#### Link 1 and 2, LED (green/yellow):

|         |               |
|---------|---------------|
| Green:  | active        |
| Yellow: | data transfer |

#### Error LED (red)/PWR LED (green):

Functionality see manual

#### Device Characteristics:

|   |  |
|---|--|
| Singleturn resolution<br>Default value: | 1-65535 (16 bit), (scalable: 1-65535)<br>8192 (13 bit)       |
| Multiturn resolution:                   | Max. 4096 (12 bit)<br>scalable only via the total resolution |
| Total resolution:                       | scalable from 1 to 268435456 (28 Bit)                        |
| Code:                                   | Binary   |
| Interface:                              | PROFINET IO  |

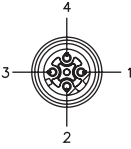
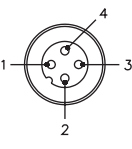
#### Standard Wiring (Bus): (M12 Eurofast Connector, D-Coded)

| Direction:    | Port 1         |               |                |               | Port 2         |               |                |               |
|---------------|----------------|---------------|----------------|---------------|----------------|---------------|----------------|---------------|
| Signal:       | Transmit data+ | Receive data+ | Transmit data- | Receive data- | Transmit data+ | Receive data+ | Transmit data- | Receive data- |
| Abbrv:        | TxD+           | RxD+          | TxD-           | RxD-          | TxD+           | RxD+          | TxD-           | RxD-          |
| M12 Eurofast: | 1              | 2             | 3              | 4             | 1              | 2             | 3              | 4             |

#### Standard Wiring (Power Supply): M12 Eurofast Connector

| Signal:       | Power Supply | N/C | Common | N/C |
|---------------|--------------|-----|--------|-----|
| Abbrv:        | +V           | -   | 0 V    | -   |
| M12 Eurofast: | 1            | 2   | 3      | 4   |

#### Wiring Diagrams:

| Bus  | Power Supply   |
|--|--|
| <b>Female Encoder View</b>   | <b>Male Encoder View</b>   |
|  <p>M12 Eurofast Pinout</p> |  <p>M12 Eurofast Pinout</p> |
| Mating Cordset:<br>RSSD 420-*  | Mating Cordset:<br>RK 4.4T-*   |

### Absolute, Multiturn Type RM-29 (Shaft) / RM-36 (Blind Hollow Shaft)

PROFINET IO

#### Part Number Key: RM-29 Shaft Version

| A      | B | C |   | D     |   | E     |
|--------|---|---|---|-------|---|-------|
| RM-29S | 6 | C | - | 9E28B | - | R3M12 |

| A      | Type                            |
|--------|---------------------------------|
| RM-29S | Ø 58 mm, Shaft, IP67 Shaft Seal |
| RM-29T | Ø 58 mm, Shaft, IP65 Shaft Seal |

| B  | Shaft (Ø x L)   |
|----|-----------------|
| 6  | Ø 6 mm x 10 mm  |
| 10 | Ø 10 mm x 20 mm |
| A0 | Ø 1/4" x 7/8"   |
| A1 | Ø 3/8" x 7/8"   |

| C | Flange                  |
|---|-------------------------|
| C | Ø 58 mm Clamping Flange |
| S | Ø 58 mm Servo Flange    |
| R | 2.5" Square Flange      |

| D     | Voltage Supply and Output Type |
|-------|--------------------------------|
| 9E28B | 10-30 VDC, PROFINET IO         |

| E     | Type of Connection                                       |
|-------|--|
| R3M12 | Radial 3 x M12 Eurofast Connectors w/ Bus Terminal Cover |

#### Part Number Key: RM-36 Blind Hollow Shaft Version

| A      | B  | C |   | D     |   | E     |
|--------|----|---|---|-------|---|-------|
| RM-36B | 10 | T | - | 9E28B | - | R3M12 |

| A      | Type   |
|--------|--|
| RM-36B | Ø 58 mm, Blind Hollow Shaft, IP67 Shaft Seal |
| RM-36C | Ø 58 mm, Blind Hollow Shaft, IP65 Shaft Seal |

| B  | Bore (30 mm Insertion Depth) |
|----|------------------------------|
| 10 | Ø 10 mm                      |
| 12 | Ø 12 mm                      |
| 14 | Ø 14 mm                      |
| 15 | Ø 15 mm                      |
| A1 | Ø 3/8"                       |
| A3 | Ø 1/2"                       |

| C  | Flange                               |
|----|--------------------------------------|
| T  | Ø 50 mm Flange w/ Torque Stop        |
| E  | Ø 63 mm Flange w/ Slotted Flex Mount |
| E1 | Ø 65 mm Flange w/ Flex Mount         |

| D     | Voltage Supply and Output Type |
|-------|--------------------------------|
| 9E28B | 10-30 VDC, PROFINET IO         |

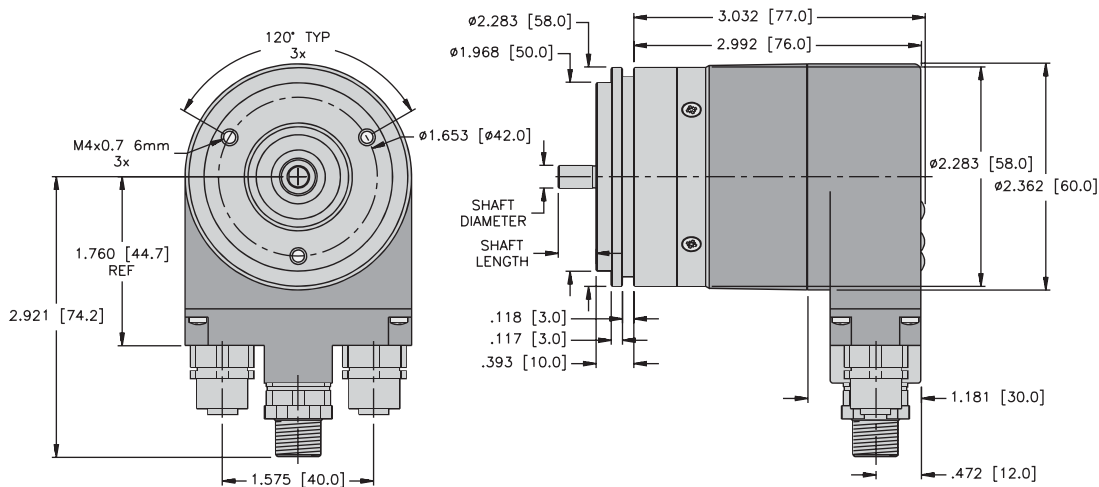
| E     | Type of Connection                                       |
|-------|--|
| R3M12 | Radial 3 x M12 Eurofast Connectors w/ Bus Terminal Cover |

#### Accessories:

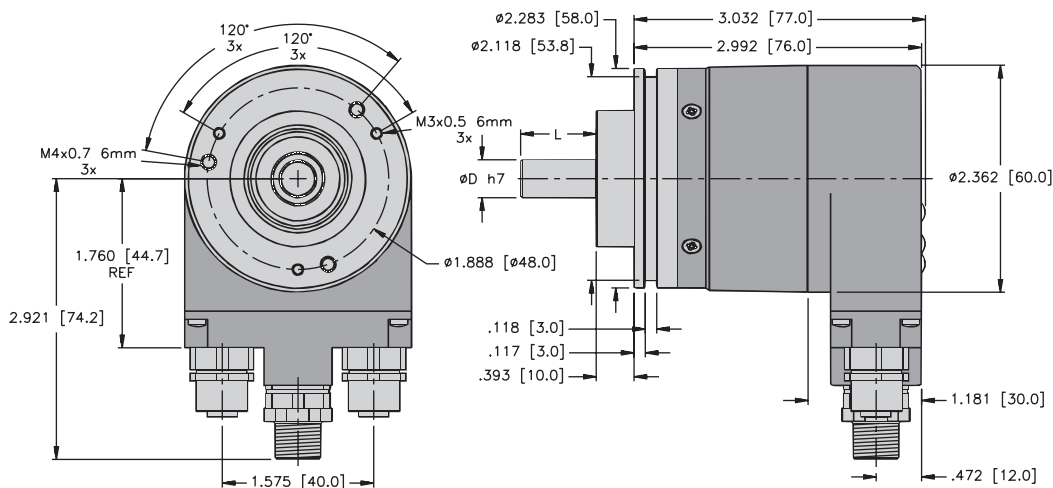
- See page H1, Connectivity, for cables and connectors
- See page G1, Accessories, for mounting attachments and couplings

#### Dimensions: RM-29 Shaft Version

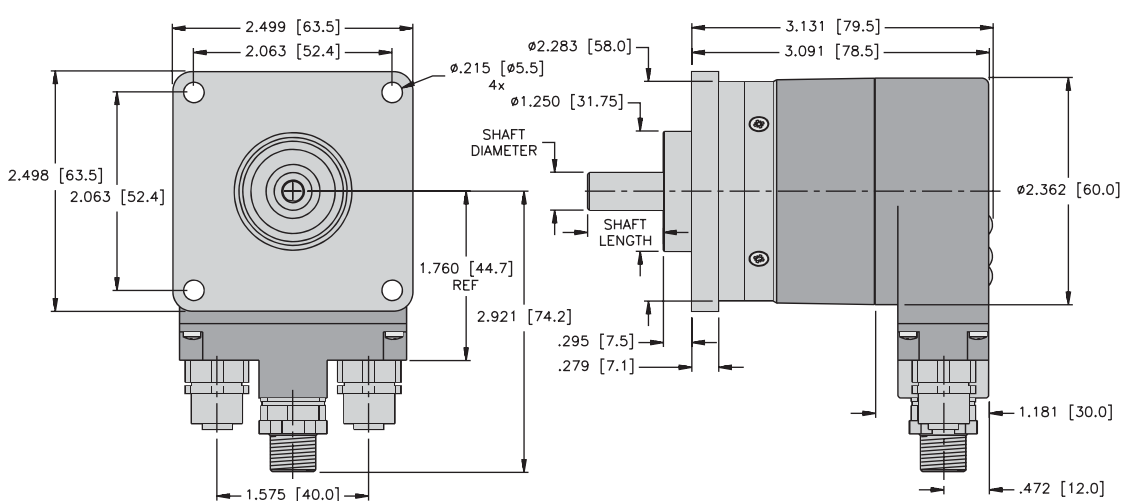
##### RM-29 Flange S Connection R3M12



##### RM-29 Flange C Connection R3M12



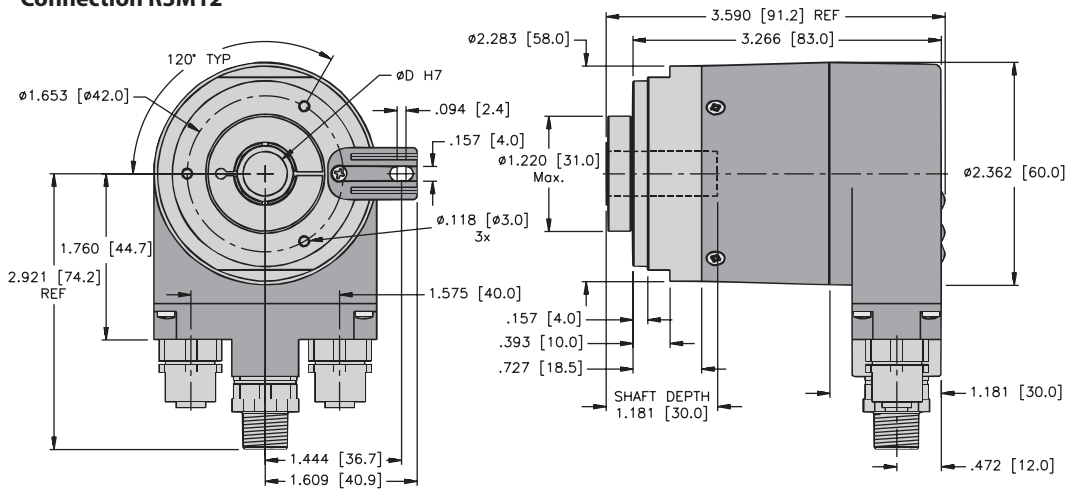
##### RM-29 Flange R Connection R3M12



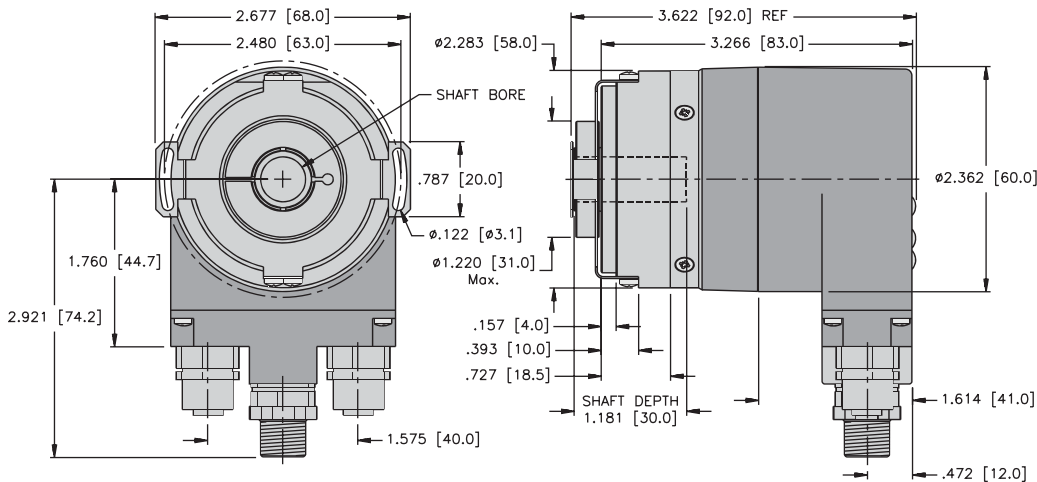
**Absolute, Multiturn Type RM-29 (Shaft) / RM-36 (Blind Hollow Shaft) PROFINET IO**

**Dimensions: RM-36 Blind Hollow Shaft Version**

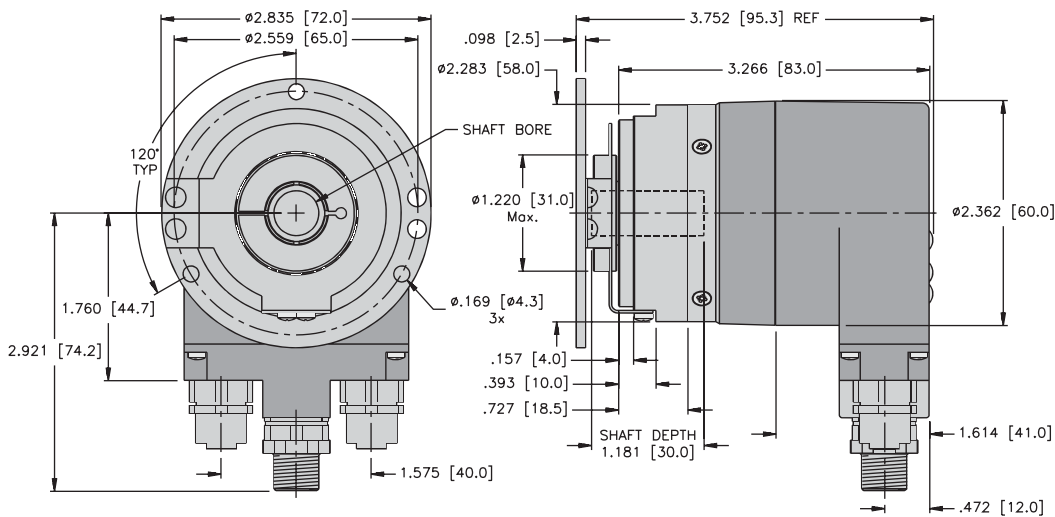
**RM-36 Flange T  
 Connection R3M12**



**RM-36 Flange E  
 Connection R3M12**



**RM-36 Flange E1  
 Connection R3M12**



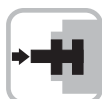
Absolute Encoders

# Rotary Position Technology

## Absolute Encoders, Multiturn

### Absolute, Multiturn Type RM-103 (Shaft) / RM-104 (Hollow Shaft)

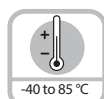
SSI/BiSS



Bearing-Lock



High rotational speed



Temperature



High IP



High shaft load capacity



Shock/vibration resistant



Reverse polarity protection



Surface protection  
Salt spray-tested optional



Intelligent San Technology



Magnetic field proof

#### Reliable

- Sturdy bearing construction in Bearing-Lock design for resistance against vibration and installation errors.
- Ideal for use outdoors thanks to IP67 protection and wide temperature range from -40 to +85 °C.



#### Absolute



#### Versatile

- Available with SSI or BiSS interface and combined with SinCos incremental signals.
- The right fixing solution or type of connection available for every application.
- SET button and LED for simple start-up.
- High resolution feedback in real-time via incremental outputs SinCos and RS422.
- Short control cycles, clock frequency with SSI up to 2 MHz / with BiSS up to 10 MHz.

#### Insensitive

- Turck OptoASIC technology with all singleturn and multiturn functions on one single OptoASIC - offering the highest reliability, a high resolution up to 41 bits and 100 % magnetic field insensitivity.

#### Mechanical Characteristics:

|                             |                                 |
|-----------------------------|---------------------------------|
| Max. speed shaft version:   | 12000 RPM, continuous 10000 RPM |
| IP65 up to 158 °F   70 °C : | 8000 RPM, continuous 5000 RPM   |
| IP65 up to T max:           | 11000 RPM, continuous 9000 RPM  |
| IP67 up to 158 °F   70 °C:  | 8000 RPM, continuous 5000 RPM   |
| IP67 up to T max:           |                                 |

|                                  |                               |
|----------------------------------|-------------------------------|
| Max. speed hollow shaft version: | 9000 RPM, continuous 6000 RPM |
| IP65 up to 158 °F   70 °C:       | 6000 RPM, continuous 3000 RPM |
| IP65 up to T max:                | 8000 RPM, continuous 4000 RPM |
| IP67 up to 158 °F   70 °C:       | 4000 RPM, continuous 2000 RPM |
| IP67 up to T max:                |                               |

|                                  |                         |
|----------------------------------|-------------------------|
| Starting torque (68 °F   20 °C): |                         |
| IP65:                            | < 1.4 oz - in (0.01 Nm) |
| IP67:                            | < 7 oz - in (0.05 Nm)   |

|                      |               |
|----------------------|---------------|
| Shaft load capacity: | 18 lbs (80 N) |
| Radial:              | 9 lbs (40 N)  |
| Axial:               |               |

|                         |   |
|-------------------------|---|
| Mass moment of inertia: |   |
| Shaft version:          | 0.16 oz - in <sup>2</sup> (3.0 × 10 <sup>-6</sup> kgm <sup>2</sup> )  |
| Hollow shaft version:   | 0.328 oz - in <sup>2</sup> (6.0 × 10 <sup>-6</sup> kgm <sup>2</sup> ) |
| Weight:                 | approx. 1.0 lbs (0.45 kg)   |

|                              |                 |
|------------------------------|-----------------|
| Protection acc. to EN 60529: |                 |
| Housing:                     | IP67            |
| Shaft:                       | IP65, opt. IP67 |

|                            |  |
|----------------------------|--|
| Working temperature range: | -40 to +185 °F (-40 to +85 °C) <sup>1)</sup> |
|----------------------------|--|

|            |                 |
|------------|-----------------|
| Materials: |                 |
| Shaft:     | stainless steel |
| Flange:    | aluminium       |
| Housing:   | zinc die-cast   |
| Cable:     | PVC             |

|   |                                       |
|---|---------------------------------------|
| Shock resistance acc. to EN 60068-2-27: | 250 g (2,500 m/s <sup>2</sup> ), 6 ms |
|---|---------------------------------------|

|  |   |
|--|---|
| Vibration resistance acc. to EN 60068-2-6: | 10 g (100 m/s <sup>2</sup> ), 55 - 2,000 Hz |
|--|---|



### Absolute, Multiturn Type RM-103 (Shaft) / RM-104 (Hollow Shaft)

SSI/BiSS

#### General Electrical Characteristics:

|  |   |
|--|---|
| Power supply:  | 5 VDC (+5%) or 10 - 30 VDC                            |
| Current consumption (no load):<br>5 VDC<br>10...30 VDC | max. 60 mA<br>max. 30 mA                              |
| Reverse polarity protection<br>at power supply (+V):   | yes (at 10 - 30 VDC)                                  |
| Short-circuit protected outputs:                       | yes <sup>1)</sup>                                     |
| UL approval:   | file 224618   |
| CE compliant acc. to:                                  | EMC guideline 2014/30/EU<br>RoHS guideline 2011/65/EU |

#### Interface Characteristics SSI:

|  |   |
|--|---|
| Output driver:   | RS485 transceiver type                  |
| Permissible load / channel:  | max +/- 30 mA                           |
| Signal high:   | typ 3.8 V                               |
| Signal level low with $I_{Load} = 20 \text{ mA}$ :                                 | typ 1.3 V                               |
| Resolution singleturn:   | 10 - 17 bit                             |
| Number of revolutions (multiturn):   | max 24 bit                              |
| Code:  | binary or gray                          |
| SSI clock rate:  | 50 kHz - 2 MHz                          |
| Data refresh rate:<br>ST resolution $\leq 14$ bit:<br>ST resolution $\geq 15$ bit: | $\leq 1 \mu\text{s}$<br>$4 \mu\text{s}$ |
| Monoflop time:   | $\leq 15 \mu\text{s}$                   |

Note: If the clock starts cycling within the monoflop time, a second data transfer starts with the same data. If the clock starts cycling after the monoflop time, the data transfer starts with the new values. The update rate is dependent on the clock speed, data length and monoflop-time.

#### BiSS Interface:

|                                    |  |
|------------------------------------|--|
| Resolution singleturn:             | 10 - 17 bit  |
| Number of revolutions (multiturn): | max 24 bit   |
| Code:                              | binary   |
| BiSS clock rate:                   | 50 kHz - 10MHz   |
| Max. update rate:                  | $< 10 \mu\text{s}$ , depends on the clock rate and the data length |
| Data refresh rate:                 | $\leq 1 \mu\text{s}$   |

#### Note:

- bidirectional, factory programmable parameters are resolution, code, direction, alarms and warnings
- CRC data verification

<sup>1)</sup> Short circuit to 0V or to output; if power supply correctly applied

#### Status Output And LED:

|                   |   |
|-------------------|---|
| Output driver:    | open collector, internal pull up resistor 22 k $\Omega$ |
| Permissible load: | max 20 mA   |
| Signal level:     | HIGH: +V / LOW: $< 1\text{V}$                           |
| Active:           | LOW   |

The optional LED (red) and the status output serve to display various alarm or error messages. In normal operation the LED is OFF and the status output is HIGH (open collector with int. pull up 22 k $\Omega$ ).

An active status output (LOW) displays:

- sensor error, singleturn or multiturn (soiling, glass breakage etc.)
- LED fault (failure or aging)
- over- or under-temperature

In the SSI mode, the fault indication can only be reset by switching off the power-supply to the device.

#### Option Incremental Outputs (A/B), 2048 ppr:

|                         |                      |                                   |
|-------------------------|----------------------|-----------------------------------|
|                         | SinCos               | RS422<br>TTL-compatible           |
| Max frequency -3dB:     | 400 kHz              | 400 kHz                           |
| Signal Level:           | 1 Vpp ( $\pm 20\%$ ) | HIGH: min 2.5 V<br>LOW: max 0.5 V |
| Short circuit protected | yes <sup>1)</sup>    | yes <sup>1)</sup>                 |

#### SET Input:

|                                   |  |
|-----------------------------------|--|
| Input characteristics:            | active HIGH                              |
| Input type:                       | comparator                               |
| Signal level high:                | min. 60% of +V (supply voltage), max: +V |
| Signal level low:                 | max. 30% of +V (supply voltage)          |
| Input current:                    | $< 0.5 \text{ mA}$                       |
| Min. pulse duration (SET):        | 10 ms                                    |
| Input delay:                      | 1 ms                                     |
| New position data readable after: | 1 ms                                     |
| Internal processing time:         | 200 ms                                   |

The encoder can be set to zero at any position by means of a HIGH signal on the SET input. Other preset values can be factory-programmed. The SET input has a signal processing time of approx. 1 ms, after which the new position data can be read via SSI or BiSS. Once the SET function has been triggered, the encoder requires an internal processing time of typ. 200 ms; during this time the power supply must not be switched off.

The SET function should be carried out while the encoder is at rest.

If this input is not used, it should be connected to 0V (Encoder ground GND) in order to avoid interferences.

# Rotary Position Technology

## Absolute Encoders, Multiturn

### Absolute, Multiturn Type RM-103 (Shaft) / RM-104 (Hollow Shaft)

SSI/BiSS

#### Standard Wiring:

#### Output Circuit \*C and \*F (2 Control Inputs, 1 Status Output) (Connection C\*1M or 12M23\*)

| Connection Type: | Common (0 V) | +V | +Clock | -Clock | +Data | -Data | ST | DIR | Status | NC | NC | NC | PE     |
|------------------|--------------|----|--------|--------|-------|-------|----|-----|--------|----|----|----|--------|
| M23 Multifast:   | 1            | 2  | 3      | 4      | 5     | 6     | 7  | 8   | 9      | 10 | 11 | 12 | PH     |
| Cable:           | WH           | BN | GN     | YE     | GY    | PK    | BU | RD  | BK     | -  | -  | -  | Shield |

#### Output Circuit \*H (2 Control Inputs, 1 Status Output, Voltage Monitor Outputs) (Connection C\*1M or 12M23\*)

| Connection Type: | Common (0 V) | +V | +Clock | -Clock | +Data | -Data | ST | DIR | Status | NC | 0 V Sens | +V Sens | PE     |
|------------------|--------------|----|--------|--------|-------|-------|----|-----|--------|----|----------|---------|--------|
| M23 Multifast:   | 1            | 2  | 3      | 4      | 5     | 6     | 7  | 8   | 9      | 10 | 11       | 12      | PH     |
| Cable:           | WH           | BN | GN     | YE     | GY    | PK    | BU | RD  | BK     | -  | GY/PK    | RD/BU   | Shield |

#### Output Circuit \*E, \*G, \*K or \*L (2 Control Inputs, Incremental Track or Sine/Cosine) (Connection C\*1M or 12M23\*)

| Connection Type: | Common (0 V) | +V | +Clock | -Clock | +Data | -Data | ST | DIR | Sin A | Sin $\bar{A}$ | Cos $\bar{B}$ | Cos   | PE     |
|------------------|--------------|----|--------|--------|-------|-------|----|-----|-------|---------------|---------------|-------|--------|
| M23 Multifast:   | 1            | 2  | 3      | 4      | 5     | 6     | 7  | 8   | 9     | 10            | 11            | 12    | PH     |
| Cable:           | WH           | BN | GN     | YE     | GY    | PK    | BU | RD  | BK    | VT            | GY/PK         | RD/BU | Shield |

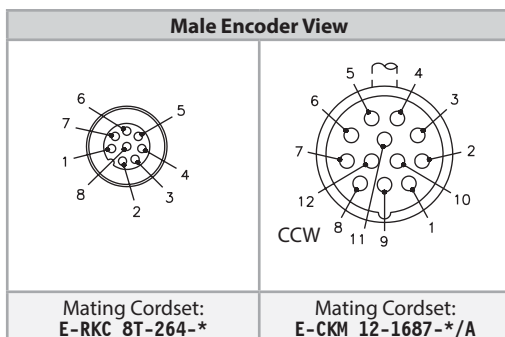
#### Output Circuit \*J (Sine/Cosine Monitor or Voltage Outputs) (Connection C\*1M or 12M23\*)

| Connection Type: | Common (0 V) | +V | +Clock | -Clock | +Data | -Data | Sin A | Sin $\bar{A}$ | Cos B | Cos $\bar{B}$ | 0 V Sens | +V Sens | PE     |
|------------------|--------------|----|--------|--------|-------|-------|-------|---------------|-------|---------------|----------|---------|--------|
| M23 Multifast:   | 1            | 2  | 3      | 4      | 5     | 6     | 7     | 8             | 9     | 10            | 11       | 12      | PH     |
| Cable:           | WH           | BN | GN     | YE     | GY    | PK    | BU    | RD            | BK    | VT            | GY/PK    | RD/BU   | Shield |

#### Output Circuit \*C and \*F (2 Control Inputs) (Connection H1\*81)

| Connection Type: | Common (0 V) | +V | +Clock | -Clock | +Data | -Data | ST | DIR | PE |
|------------------|--------------|----|--------|--------|-------|-------|----|-----|----|
| M12 Eurofast:    | 1            | 2  | 3      | 4      | 5     | 6     | 7  | 8   | PH |

#### Wiring Diagrams:



\* Length in meters.

### Absolute, Multiturn Type RM-103 (Shaft) / RM-104 (Hollow Shaft)

SSI/BiSS

**Part Number Key: RM-103 Shaft Version**

| A       | B | C |   | D  | E1 | E2  |   | F     |   | G   |
|---------|---|---|---|----|----|-----|---|-------|---|-----|
| RM-103S | 6 | C | - | 5F | 9S | 12M | - | H1181 | / | N16 |

| A       | Type                                    |
|---------|---|
| RM-103S | Ø 58 mm, Shaft w/ Flat, IP67 Shaft Seal |
| RM-103T | Ø 58 mm, Shaft w/ Flat, IP65 Shaft Seal |

| B  | Shaft (Ø x L)   |
|----|-----------------|
| 6  | Ø 6 mm x 10 mm  |
| 10 | Ø 10 mm x 20 mm |
| A0 | Ø 1/4" x 7/8"   |
| A1 | Ø 3/8" x 7/8"   |

| C | Flange                  |
|---|-------------------------|
| C | Ø 58 mm Clamping Flange |
| S | Ø 58 mm Servo Flange    |

| D         | Voltage Supply and Output Type |            |      |  |
|-----------|--------------------------------|------------|------|--|
|           | SSI (BINARY)                   | SSI (GRAY) | BiSS | Features                                 |
| 5 V       | 5F                             | 3F         | DF   | —  |
|           | 5E                             | 3E         | DE   | 2048 PPR SinCos                          |
|           | 5H                             | 3H         | DH   | Voltage Monitoring                       |
|           | 5J                             | 3J         | DJ   | 2048 PPR SinCos Plus Voltage Monitoring  |
|           | 5K                             | 3K         | DK   | 2048 PPR Incr., RS422 (TTL-compatible)   |
| 10 - 30 V | 5C                             | 3C         | DC   | —  |
|           | 5G                             | 3G         | DG   | 2048 PPR SinCos                          |
|           | 5L                             | 3L         | DL   | 2048 PPR Incr., RS422 (TTL - compatible) |

| E1  | Resolution (singleturn) |
|-----|-------------------------|
| 9S  | 9 bit                   |
| 10S | 10 bit                  |
| 12S | 12 bit                  |
| 13S | 13 bit                  |
| 14S | 14 bit                  |
| 17S | 17 bit                  |

| E2  | Resolution (multiturn) |
|-----|------------------------|
| 12M | 12 bit                 |
| 16M | 16 bit                 |
| 24M | 24 bit                 |

| F      | Type of Connection                    |
|--------|---------------------------------------|
| H1181  | Radial 8-pin M12 Eurofast Connector*  |
| H1481  | Axial 8-pin M12 Eurofast Connector*   |
| 12M23  | Radial 12-pin M23 Multifast Connector |
| 12M23A | Axial 12-pin M23 Multifast Connector  |
| C1M    | Radial Cable (1m PVC)                 |
| CA1M   | Axial Cable (1m PVC)                  |

\* = only available with output type \*C and \*F

| G       | Options                              |
|---------|--------------------------------------|
| (BLANK) | SET button and Status LED (standard) |
| N16     | No Option                            |
| N43     | Status LED                           |

# Rotary Position Technology

## Absolute Encoders, Multiturn

### Absolute, Multiturn Type RM-103 (Shaft) / RM-104 (Hollow Shaft)

SSI/BiSS

**Part Number Key: RM-104 Hollow Shaft Version**

| A       | B  | C |   | D  | E1 | E2  |   | F     |   | G   |
|---------|----|---|---|----|----|-----|---|-------|---|-----|
| RM-104H | 10 | T | - | 5F | 9S | 12M | - | H1181 | / | N16 |

| A       | Type                                   |
|---------|--|
| RM-104H | Ø 58 mm, Hollow Shaft, IP67 Shaft Seal |
| RM-104I | Ø 58 mm, Hollow Shaft, IP65 Shaft Seal |

| B  | Bore    |
|----|---------|
| 10 | Ø 10 mm |
| 12 | Ø 12 mm |
| 14 | Ø 14 mm |
| 15 | Ø 15 mm |
| A1 | Ø 3/8"  |
| A3 | Ø 1/2"  |

| C  | Flange                               |
|----|--------------------------------------|
| T  | Ø 50 mm Flange w/ Torque Stop        |
| E  | Ø 63 mm Flange w/ Slotted Flex Mount |
| E1 | Ø 65 mm Flange w/ Flex Mount         |

| D         | Voltage Supply and Output Type |            |      |  |
|-----------|--------------------------------|------------|------|--|
|           | SSI (BINARY)                   | SSI (GRAY) | BiSS | Features                                 |
| 5 V       | 5F                             | 3F         | DF   | —  |
|           | 5E                             | 3E         | DE   | 2048 PPR SinCos                          |
|           | 5H                             | 3H         | DH   | Voltage Monitoring                       |
|           | 5J                             | 3J         | DJ   | 2048 PPR SinCos Plus Voltage Monitoring  |
|           | 5K                             | 3K         | DK   | 2048 PPR Incr., RS422 (TTL-compatible)   |
| 10 - 30 V | 5C                             | 3C         | DC   | —  |
|           | 5G                             | 3G         | DG   | 2048 PPR SinCos                          |
|           | 5L                             | 3L         | DL   | 2048 PPR Incr., RS422 (TTL - compatible) |

| E1  | Resolution (singleturn) |
|-----|-------------------------|
| 9S  | 9 bit                   |
| 10S | 10 bit                  |
| 12S | 12 bit                  |
| 13S | 13 bit                  |
| 14S | 14 bit                  |
| 17S | 17 bit                  |

| E2  | Resolution (multiturn) |
|-----|------------------------|
| 12M | 12 bit                 |
| 16M | 16 bit                 |
| 24M | 24 bit                 |

| F     | Type of Connection                    |
|-------|---------------------------------------|
| H1181 | Radial 8-pin M12 Eurofast Connector*  |
| 12M23 | Radial 12-pin M23 Multifast Connector |
| C1M   | Radial Cable (1 m PVC)                |
| CT1M  | Tangential Cable (1 m PVC)            |

\* = only available with output type \*C and \*F

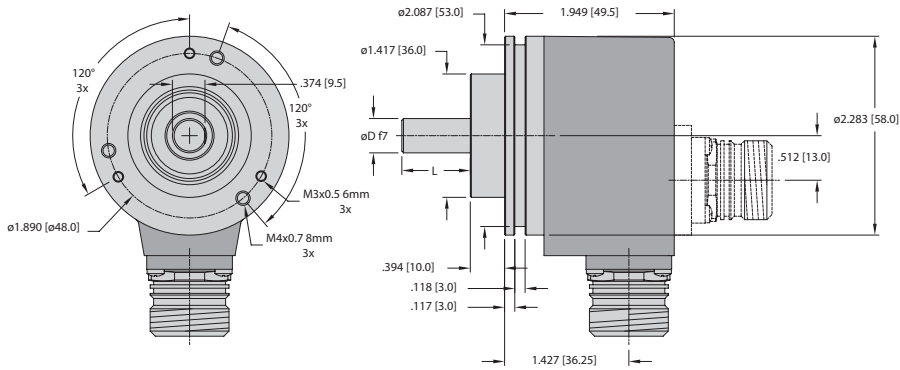
| G       | Options                              |
|---------|--------------------------------------|
| (BLANK) | SET button and Status LED (standard) |
| N16     | No Option                            |
| N43     | Status LED                           |

**Absolute, Multiturn Type RM-103 (Shaft) / RM-104 (Hollow Shaft)**

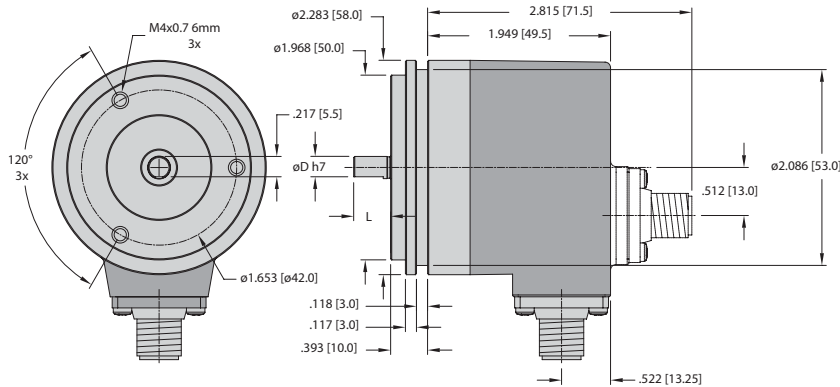
**SSI/BiSS**

**Dimensions: RM-103 Shaft Version**

**RM-103 Flange C**  
**Connection 12M23 & 12M23A**



**RM-103 Flange S**  
**Connection H1181 & H1481**

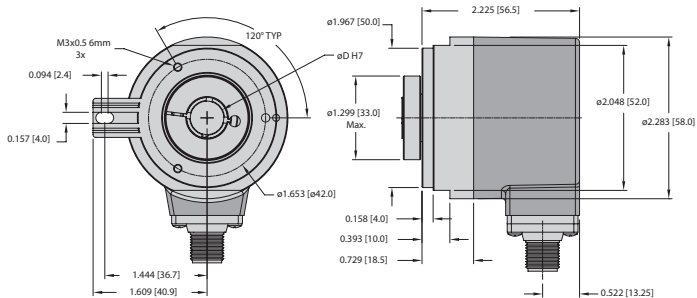


**Mounting Advice:**

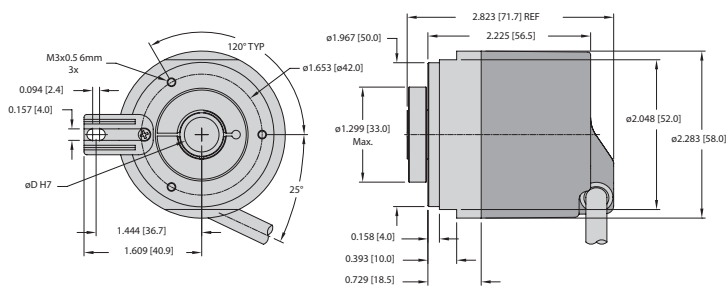
The flanges and shafts of the encoder and drive should not be rigidly coupled together at the same time. We recommend the use of suitable couplings (see page G1, Accessories).

#### Dimensions: RM-104 Hollow Shaft Version

##### RM-104 Flange T Connection H1181

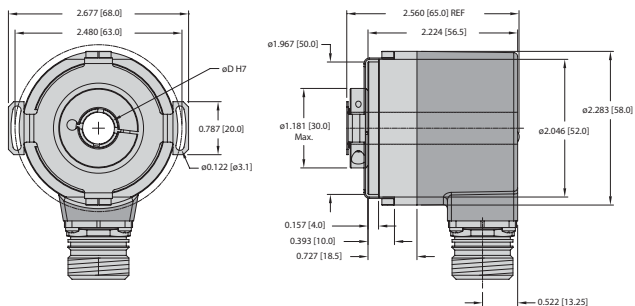


##### RM-104 Flange T Connection CT1M

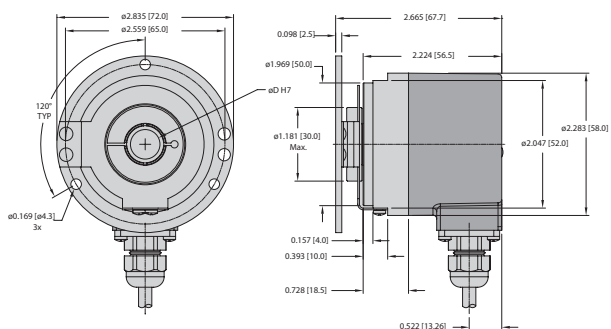


#### Dimensions: RM-104 Hollow Shaft Version

##### RM-104 Flange E Connection 12M23



##### RM-104 Flange E1 Connection C1M

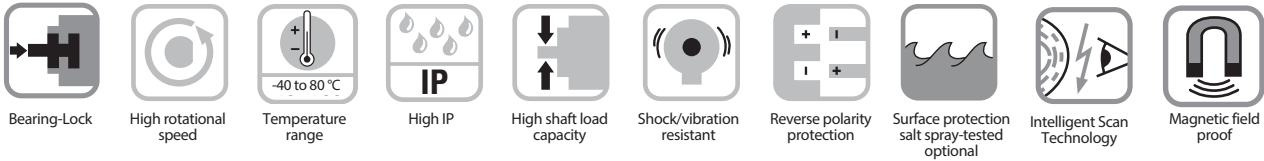


#### Mounting Advice:

The flanges and shafts of the encoder and drive should not be rigidly coupled together at the same time. We recommend the use of suitable couplings (see page G1, Accessories).

### Absolute, Multiturn Type RM-105 (Shaft) /RM-106 (Hollow Shaft)

CANopen



#### Reliable

- Sturdy bearing construction in Bearing-Lock design for resistance against vibration and installation errors.
- Ideal for use outdoors thanks to IP67 protection and wide temperature range from -40 up to +80 °C.



#### Up-To-The-Minute

##### Fieldbus Performance

- CANopen with current encoder profile.
- LSS services for configuration of the node address and baud rate.
- Variable PDO mapping in the memory.
- Universal scaling function.
- 32 bits total resolution (16 bit MT + 16 bit ST).

#### Inensitive

- Turck OptoASIC technology with all singleturn and multiturn functions on one single OptoASIC - offering the highest reliability, a high resolution up to 32 bits and 100% magnetic field insensitivity.

#### Mechanical Characteristics:

|  |   |
|--|---|
| Max. speed shaft version:                  |   |
| IP65 up to 70 °C:                          | 12000 RPM, continuous 10000 RPM                                       |
| IP65 up to T max:                          | 8000 RPM, continuous 5000 RPM   |
| IP67 up to 70 °C:                          | 11000 RPM, continuous 9000 RPM  |
| IP67 up to T max:                          | 8000 RPM, continuous 5000 RPM   |
| Max. speed hollow shaft version:           |   |
| IP65 up to 70 °C:                          | 9000 RPM, continuous 6000 RPM   |
| IP65 up to T max:                          | 6000 RPM, continuous 3000 RPM   |
| IP67 up to 70 °C:                          | 8000 RPM, continuous 4000 RPM   |
| IP67 up to T max:                          | 4000 RPM, continuous 2000 RPM   |
| Starting torque (68 °F   20 °C):           |   |
| IP65:                                      | < 1.4 oz - in (0.01 Nm)   |
| IP67:                                      | < 7.0 oz - in (0.05 Nm)   |
| Shaft load capacity:                       |   |
| Radial:                                    | 18 lbs (80 N)   |
| Axial:                                     | 9 lbs (40 N)  |
| Mass moment of inertia:                    |   |
| Shaft version:                             | 0.16 oz - in <sup>2</sup> (3.0 × 10 <sup>-6</sup> kgm <sup>2</sup> )  |
| Hollow shaft version:                      | 0.328 oz - in <sup>2</sup> (6.0 × 10 <sup>-6</sup> kgm <sup>2</sup> ) |
| Weight:                                    | approx. 1.0 lbs (0.45 kg)   |
| Protection acc. to EN 60529:               |   |
| Housing:                                   | IP67  |
| Shaft:                                     | IP65, opt. IP67   |
| Working temperature range:                 | -40 to +176 °F (-40 to +80 °C) <sup>1)</sup>                          |
| Materials:                                 |   |
| Shaft:                                     | stainless steel   |
| Flange:                                    | aluminium   |
| Housing:                                   | zinc die-cast   |
| Cable:                                     | PVC   |
| Shock resistance acc. to EN 60068-2-27:    | 250 g (2,500 m/s <sup>2</sup> ), 6 ms                                 |
| Vibration resistance acc. to EN 60068-2-6: | 10 g (100 m/s <sup>2</sup> ), 55 - 2,000 Hz                           |

# Rotary Position Technology

## Absolute Encoders, Multiturn

### Absolute, Multiturn Type RM-105 (Shaft) /RM-106 (Hollow Shaft)

### CANopen

#### General Electrical Characteristics:

|   |   |
|---|---|
| Power supply:                                     | 10 - 30 VDC   |
| Current consumption (no load):                    | max. 80 mA  |
| Reverse polarity protection at power supply (+V): | yes   |
| UL approval                                       | file 224618   |
| CE compliant acc. to                              | EMC guideline 2014/30/EU<br>RoHS guideline 2011/65/EU |

#### Diagnostic LED (two-color, red/green):

|                     |                |
|---------------------|----------------|
| LED ON or blinking: |                |
| Red:                | error display  |
| Green:              | status display |
| Combo red/ green:   | error code     |

#### Interface Characteristics CANopen:

|                                    |   |
|------------------------------------|---|
| Resolution singleturn:             | 1 - 65536 (16 bit), scalable default: 8192 (13 bit)   |
| Number of revolutions (multiturn): | max. 65536 (16 bit) scalable only via the total resolution  |
| Total resolution:                  | 1 - 4,292,967,296 (32 bit) default: 25 bit  |
| Code:                              | binary  |
| Interface:                         | CAN high-speed acc. to ISO 11898, Basic- and Full-CAN, CAN specification 2.0 B  |
| Protocol:                          | CANopen profile DS406 V3.2 with manufacturer-specific add-ons, LSS-Service DS305 V2.0   |
| Baud rate:                         | 10 - 1000 kbit/s software configurable  |
| Node address:                      | 1 - 127 software configurable   |
| Termination switchable:            | software configurable   |
| LSS protocol:                      | CIA LSS protocol DS305, global command support for node address and baud rate, selective commands via attributes of the identity object |

#### General Information About CANopen

The CANopen encoders support the latest CANopen communication profile according to DS301 V4.2. In addition, device specific profiles such as encoder profile DS406 V3.2 and DS305 (LSS) are available.

The following operating modes may be selected: Polled Mode, Cyclic Mode, Sync Mode and a High Resolution Sync Protocol. Moreover, scale factors, preset values, limit switch values and many other additional parameters can be programmed via the CAN bus.

When switching the device on, all parameters, which have been saved on an EEPROM to protect them against power failure, are loaded again.

The following output values may be combined in a freely variable way as PDO (PDO mapping): **position, speed, temperature** as well as the **status of the working area**.

The encoders are available with a connector or a cable connection.

The device address and baud rate can be set/ modified by means of the software.

The two-color LED located on the back indicates the operating or fault status of the CAN bus, as well as the status of the internal diagnostics.

#### Standard Wiring:

| Connection Type: | +V | Common (0 V) | CAN GND | CAN High | CAN Low |
|------------------|----|--------------|---------|----------|---------|
| Cable:           | BN | WH           | GY      | GN       | YE      |
| M12 Eurofast:    | 2  | 3            | 1       | 4        | 5       |

#### Universal Scaling Function

At the end of the physical resolution of an encoder, when scaling is active, an error appears if the division of the physical limit (GP\_U) by the programmed total resolution (TMR) does not produce an integer.

The universal scaling function remedies this problem.

#### CANopen Communication Profile DS301 V4.2

Among others, the following functionality is integrated. (Class C2 functionality):

- NMT Slave
- Identity Object
- Error Behavior Object
- Variable PDO Mapping self-start programmable (Power on to operational), 4 Sending PDO's.
- Node address, baud rate and CANbus / programmable termination.
- Producer / consumer heartbeat.

#### CANopen encoder profile DS406 V3.2

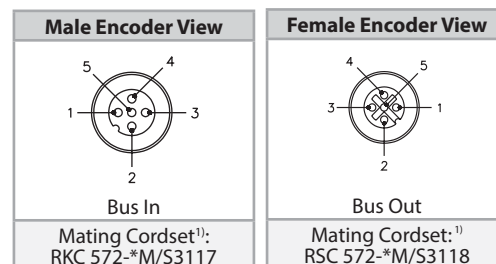
The following parameters can be programmed:

- Event mode
- 2 working areas with 2 upper and lower limits and the corresponding output states.
- Variable PDO mapping for position, speed, work area status, error message, raw data.
- Extended failure management for position sensing.
- User interface with visual display of bus and failure status.
- Customer-specific memory 16 Byte.
- Customer-specific protocol.
- Universal Scaling Function (USF).
- "Watchdog controlled" device.
- Extended diagnostic modes.

#### LSS Layer Setting Services DS305 V2.0

- Global support of node-ID and baud rate.
- Selective protocol via identity object (1018h).

#### Wiring Diagrams:



\* Length in meters.  
<sup>1)</sup> See Connectivity section H for corresponding cable color code.



### Absolute, Multiturn Type RM-105 (Shaft) /RM-106 (Hollow Shaft) CANopen

#### Part Number Key: RM-105 Shaft Version

| A       | B | C |   | D     |   | E     |   | F   |
|---------|---|---|---|-------|---|-------|---|-----|
| RM-105S | 6 | C | - | 9D32B | - | B2M12 | / | N46 |

| A       | Type                            |
|---------|---------------------------------|
| RM-105S | Ø 58 mm, Shaft, IP67 Shaft Seal |
| RM-105T | Ø 58 mm, Shaft, IP65 Shaft Seal |

| B  | Shaft (Ø × L)   |
|----|-----------------|
| 6  | Ø 6 mm × 10 mm  |
| 10 | Ø 10 mm × 20 mm |
| A0 | Ø 1/4" × 7/8"   |
| A1 | Ø 3/8" × 7/8"   |

| C | Flange                  |
|---|-------------------------|
| C | Ø 58 mm Clamping Flange |
| S | Ø 58 mm Servo Flange    |

| D     | Voltage Supply and Output Type   |
|-------|----------------------------------|
| 9D32B | 10 - 30 VDC, CANopen DS301 V4.02 |

| E     | Type of Connection                |
|-------|-----------------------------------|
| B1M12 | Radial 1 × M12 Eurofast Connector |
| B2M12 | Radial 2 × M12 Eurofast Connector |
| C     | Radial Cable (1m PVC)             |

| F       | Options    |
|---------|------------|
| (BLANK) | No Options |
| N46     | SET Button |

#### Part Number Key: RM-106 Hollow Shaft Version

| A       | B  | C |   | D     |   | E     |   | F   |
|---------|----|---|---|-------|---|-------|---|-----|
| RM-106B | 10 | T | - | 9D32B | - | B1M12 | / | N46 |

| A       | Type  |
|---------|---|
| RM-106B | Ø 58 mm, Hollow Shaft, IP67 Shaft Seal                    |
| RM-106C | Ø 58 mm, Hollow Shaft, IP65 Shaft Seal                    |
| RM-106H | Ø 58 mm, Blind Hollow Shaft, IP67 Shaft Seal <sup>1</sup> |
| RM-106I | Ø 58 mm, Blind Hollow Shaft, IP65 Shaft Seal <sup>1</sup> |

<sup>1</sup> = only available with bore "12"

| B  | Bore  |
|----|---|
| 10 | Ø 10 mm   |
| 12 | Ø 12 mm (30 mm insertion depth on blind hollow) |
| 14 | Ø 14 mm   |
| 15 | Ø 15 mm   |

| C  | Flange                               |
|----|--------------------------------------|
| T  | Ø 58 mm Flange w/ Torque Stop        |
| E  | Ø 63 mm Flange w/ Slotted Flex Mount |
| E1 | Ø 65 mm Flange w/ Flex Mount         |

| D     | Voltage Supply and Output Type    |
|-------|-----------------------------------|
| 9D32B | 10...30 VDC, CANopen DS 301 V4.02 |

| E     | Type of Connection                              |
|-------|---|
| B1M12 | Radial 1 × M12 Eurofast Connector               |
| B2M12 | Radial 2 × M12 Eurofast Connectors <sup>2</sup> |
| CT    | Tangential Cable (2m PVC)                       |

<sup>2</sup> = only available with flange "H" or "I" and bore "12".

| F       | Options    |
|---------|------------|
| (BLANK) | No Options |
| N46     | SET Button |

# Rotary Position Technology

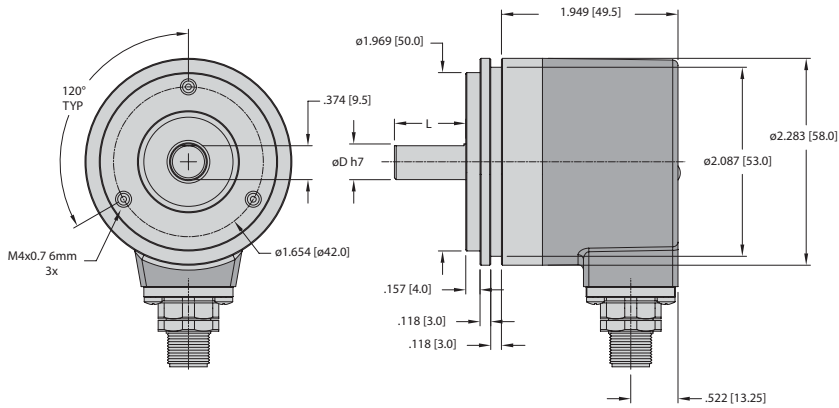
## Absolute Encoders, Multiturn

### Absolute, Multiturn Type RM-105 (Shaft) /RM-106 (Hollow Shaft)

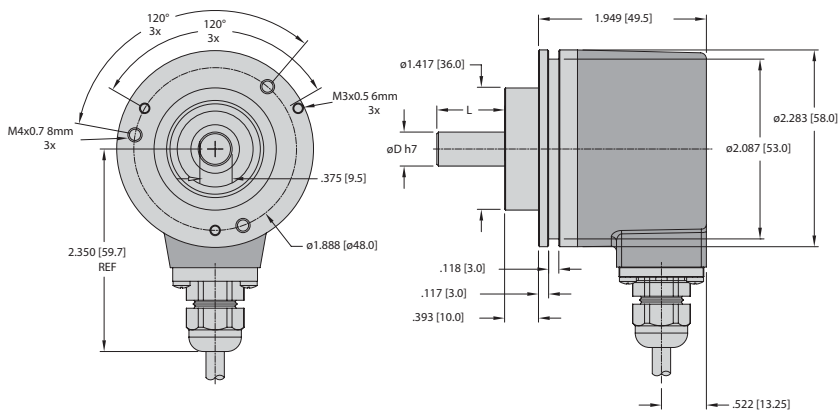
CANopen

#### Dimensions: RM-105 Shaft Version

##### RM-105 Flange S Connection B1M12



##### RM-105 Flange C Connection C

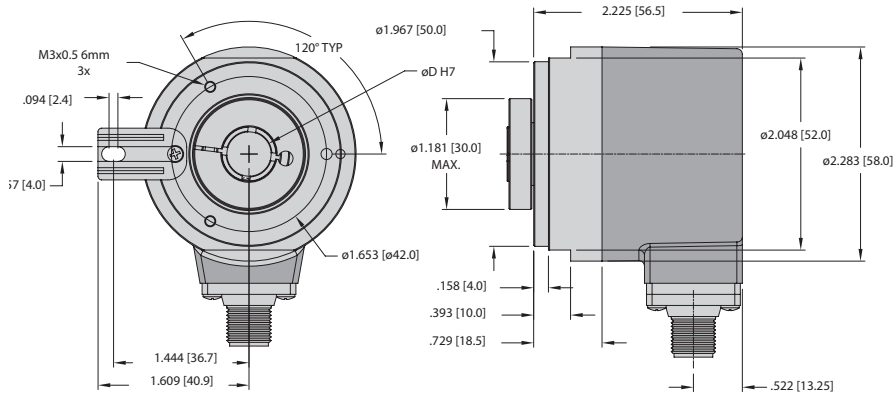


**Absolute, Multiturn Type RM-105 (Shaft) / RM-106 (Hollow Shaft)**

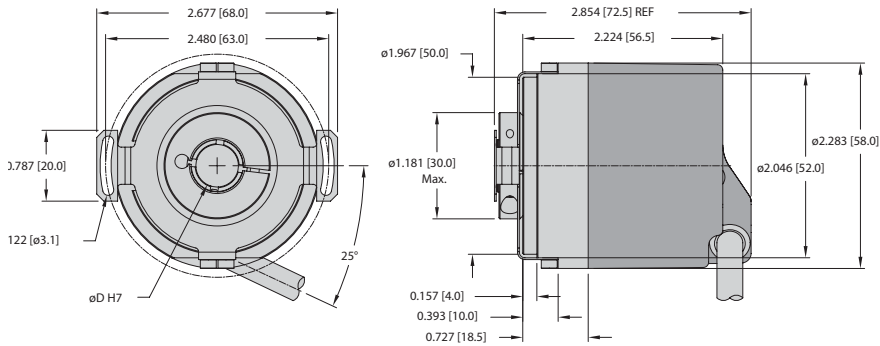
**CANopen**

**Dimensions: RM-106 Hollow Shaft Version**

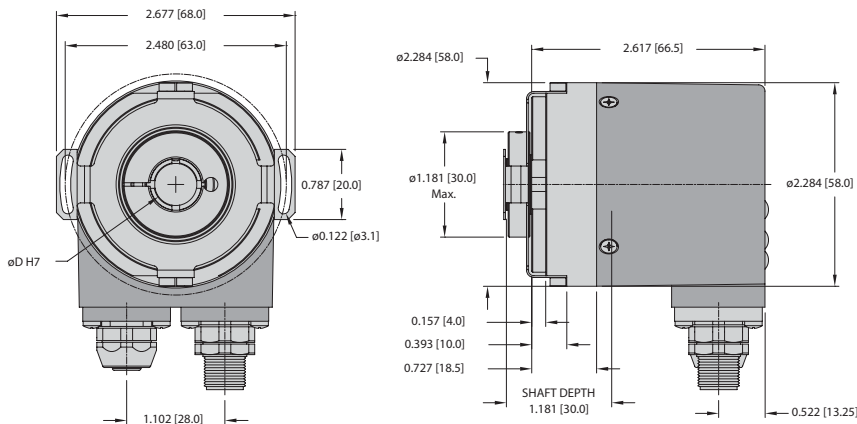
**RM-106 Flange T  
 Connection B1M12**



**RM-106 Flange E  
 Connection CT**



**RM-106 Flange E1  
 Connection B2M12**



**Mounting Advice:**

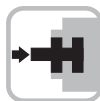
The flanges and shafts of the encoder and drive should not be rigidly coupled together at the same time. We recommend the use of suitable couplings (see page G1, Accessories).

# Rotary Position Technology

## Absolute Encoders, Multiturn

**Absolute, Multiturn Type RM-105 (Shaft) / RM-106 (Blind Hollow Shaft)**

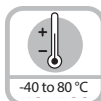
**EtherNet/IP**



Bearing-Lock



High rotational speed



Temperature



High IP



High shaft load capacity



Shock/vibration resistant



Magnetic field proof



Reverse polarity protection



Optical sensor

### Reliable

- Increased ability to withstand vibration and installation errors. Sturdy Bearing-Lock design structure eliminates machine downtime and repairs.
- Wide temperature range of -40 to +176 °F (-40 to +80 °C).
- Fewer components and connection points increase the operational reliability: Turck OptoASIC technology with highest integration density (Chip-on-board).



### Absolute



**EtherNet/IP**

### Versatile

- Thanks to the implementation of DLR (Device Level Ring) a single cable break does not lead to a "machine down" state.
- 32 bits total resolution, shafts up to 10 mm, blind hollow shafts up to 15 mm and certified EtherNet/IP functionality.
- The optical absolute multiturn EtherNet/IP encoders were designed for time sensitive applications. Their distinctive features help not only with the machine's performance as well as uptime, but also contribute to time and cost savings.

### Fast

- 5x faster position value transfer than the usual market encoder – RPI time of 1 ms
- Fast and easy commissioning, configuration possible through cyclic services
- M12 connector ensures fast, simple, error-free connection

### Mechanical Characteristics:

|  |   |
|--|---|
| Max. speed shaft version (IP65) up to 158 °F (70 °C):              | 8,000 RPM, continuous 6000 RPM  |
| Max. speed shaft version (IP65) up to Tmax:                        | 6,000 RPM, continuous 4000 RPM  |
| Max. speed blind hollow shaft version (IP65) up to 158 °F (70 °C): | 6,000 RPM, continuous 4000 RPM  |
| Max. speed blind hollow shaft version (IP65) up to Tmax:           | 4,000 RPM, continuous 3,000 RPM   |
| Starting torque at 68 °F (20 °C):                                  | 1.4 oz-in (< 0.01 Nm)   |
| Moment of inertia:   | Shaft version:<br>0.16 oz-in <sup>2</sup> (3.0 x 10 <sup>-6</sup> kgm <sup>2</sup> )<br>Hollow shaft version:<br>0.32 oz-in <sup>2</sup> (6.0 x 10 <sup>-6</sup> kgm <sup>2</sup> ) |
| Radial load capacity of shaft:                                     | 18 lbs (80 N)   |
| Axial load capacity of shaft:                                      | 9 lbs (40 N)  |
| Weight:  | approx. 1.0 lbs (0.45 kg)   |
| Protection acc. to EN 60 529:                                      | IP65  |
| Working temperature:   | -40 to +176 °F (-40 to +80 °C)  |
| Materials:   | Shaft: stainless steel,<br>Flange: aluminum,<br>Housing: aluminum   |
| Shock resistance acc. to EN 60068-2-27:                            | > 250 g (> 2,500 m/s <sup>2</sup> ), 6 ms   |
| Vibration resistance acc. to EN 60068-2-26:                        | > 10 g (> 100 m/s <sup>2</sup> ), 55-2,000 Hz   |

### General Information about EtherNetIP

EtherNet/IP conformance tested acc. to version CT-12 of Dec. 11, 2014  
EtherNet/IP specification Vol 2, Ed 1.17  
CIP specification Vol 1, Ed 3.16.

### Applications

Industrial Ethernet is increasingly imposing itself as the new communication standard in automation technology. The goal is to create a vertical integration – that is to say: only one core computer, from the control level up to the industrial production plants – that will be able to control any devices.

The Turck EtherNet/IP encoders demonstrate their abilities in the following application examples: automotive production, logistics, metal-working, textile, printing and packaging machines.

### Absolute, Multiturn Type RM-105 (Shaft) / RM-106 (Blind Hollow Shaft) EtherNet/IP

#### General Electrical Characteristics:

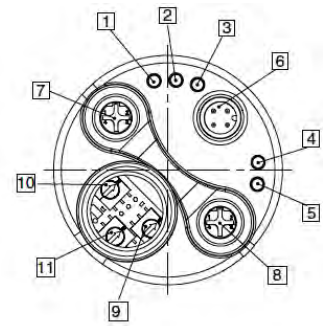
|   |   |
|---|---|
| Supply voltage:                                   | 10-30 VDC   |
| Current consumption (without output load):        | Max. 250 mA   |
| Reverse polarity protection at power supply (+V): | Yes   |
| CE compliant acc. to:                             | EMC guideline 2014/30/EU<br>RoHS guideline 2011/65/EU |

#### Device Characteristics:

|   |   |
|---|---|
| Singleturn resolution<br>Default value: | 1-65536 (16 bit), (scalable: 1-65536)<br>65536 (16 bit)       |
| Multiturn resolution:                   | Max. 65536 (16 bit)<br>scalable only via the total resolution |
| Total resolution:                       | scalable from 1 to 4,294,967,296 (32 bit)                     |
| Code:                                   | Binary  |
| Interface:                              | EtherNet/IP   |

#### Rear side connection and display elements

- 1 LED: Link 1
- 2 LED: Mod.
- 3 LED: Net.
- 4 LED: Encoder
- 5 LED: Link 2
- 6 Power
- 7 Port 1
- 8 Port 2
- 9 Switch: x1
- 10 Switch: x100
- 11 Switch: x10



#### The following functionalities are integrated:

##### Adjustable parameters

- Preset
- Count direction
- Resolution
- Unity of speed
- IP address
- Number of revolutions
- Position
- Diagnosis
- Position limit
- Warning messages

##### Objects (CIP Objects)

- Identity Object
- Message Router
- Assembly Object
- Connection Manager
- Parameter Object
- Position Sensor Object
- Qos Object
- Port Object
- TCP / IP Interface Object
- EtherNet Link Object

##### EtherNet/IP features

- DLR (Device Level Ring) possible
- Qos (Quality of Service) possible
- ACD (Address Conflict Detection)
- Multicast and unicast capability

#### Universal Scaling Function (USF)

This Encoder has the Turck Universal Scaling Function (USF) always activated. There is no position error at the end of the total measuring range, when using a decimal divider for position scaling.

Without the USF function, you can only use a binary scaling divider. Otherwise, you get a position error at the end of the total measuring range (TMR).

#### Standard Wiring (Bus):

(M12 Eurofast Connector, D-Coded)

| Direction:    | Port 1         |               |                |               | Port 2         |               |                |               |
|---------------|----------------|---------------|----------------|---------------|----------------|---------------|----------------|---------------|
| Signal:       | Transmit data+ | Receive data+ | Transmit data- | Receive data- | Transmit data+ | Receive data+ | Transmit data- | Receive data- |
| Abbrv:        | TxD+           | RxD+          | TxD-           | RxD-          | TxD+           | RxD+          | TxD-           | RxD-          |
| M12 Eurofast: | 1              | 2             | 3              | 4             | 1              | 2             | 3              | 4             |

#### Standard Wiring (Power Supply):

M12 Eurofast Connector

| Signal:       | Power Supply | N/C | Common | N/C |
|---------------|--------------|-----|--------|-----|
| Abbrv:        | +V           | -   | 0 V    | -   |
| M12 Eurofast: | 1            | 2   | 3      | 4   |

#### Wiring Diagrams:

| Bus  | Power Supply  |
|--|---|
| Female Encoder View  | Male Encoder View   |
| <p>M12 Eurofast Pinout</p> <p>Mating Cordset:<br/>RSSD 441-*</p> | <p>M12 Eurofast Pinout</p> <p>Mating Cordset:<br/>RK 4.4T-*</p> |

# Rotary Position Technology

## Absolute Encoders, Multiturn

### Absolute, Multiturn Type RM-105 (Shaft) / RM-106 (Blind Hollow Shaft)

EtherNet/IP

#### Part Number Key: RM-105 Shaft Version

| A       | B | C |   | D     |   | E     |
|---------|---|---|---|-------|---|-------|
| RM-105T | 6 | C | - | 9N32B | - | B3M12 |

| A       | Type                            |
|---------|---------------------------------|
| RM-105T | Ø 58 mm, Shaft, IP65 Shaft Seal |

| D     | Voltage Supply and Output Type |
|-------|--------------------------------|
| 9N32B | 10-30 VDC, EtherNet/IP w/DLR   |

| B  | Shaft (Ø x L)   |
|----|-----------------|
| 6  | Ø 6 mm x 10 mm  |
| 10 | Ø 10 mm x 20 mm |
| A0 | Ø 1/4" x 7/8"   |
| A1 | Ø 3/8" x 7/8"   |

| E     | Type of Connection                |
|-------|-----------------------------------|
| B3M12 | Axial 3 x M12 Eurofast Connectors |

| C | Flange                  |
|---|-------------------------|
| C | Ø 58 mm Clamping Flange |
| S | Ø 58 mm Servo Flange    |
| R | 2.5" Square Flange      |

#### Part Number Key: RM-106 Blind Hollow Shaft Version

| A       | B  | C |   | D     |   | E     |
|---------|----|---|---|-------|---|-------|
| RM-106C | 10 | T | - | 9N32B | - | B3M12 |

| A       | Type   |
|---------|--|
| RM-106C | Ø 58 mm, Blind Hollow Shaft, IP65 Shaft Seal |

| D     | Voltage Supply and Output Type |
|-------|--------------------------------|
| 9N32B | 10-30 VDC, EtherNet/IP w/DLR   |

| B  | Bore (30 mm Insertion Depth) |
|----|------------------------------|
| 10 | Ø 10 mm                      |
| 12 | Ø 12 mm                      |
| 14 | Ø 14 mm                      |
| 15 | Ø 15 mm                      |
| A1 | Ø 3/8"                       |
| A3 | Ø 1/2"                       |

| E     | Type of Connection                |
|-------|-----------------------------------|
| B3M12 | Axial 3 x M12 Eurofast Connectors |

| C  | Flange                               |
|----|--------------------------------------|
| E  | Ø 63 mm Flange w/ Slotted Flex Mount |
| E1 | Ø 65 mm Flange w/ Flex Mount         |
| T  | Flange w/ Torque Stop                |

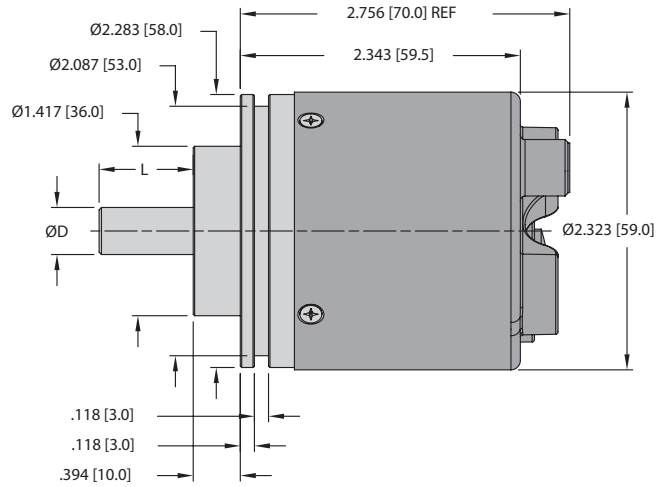
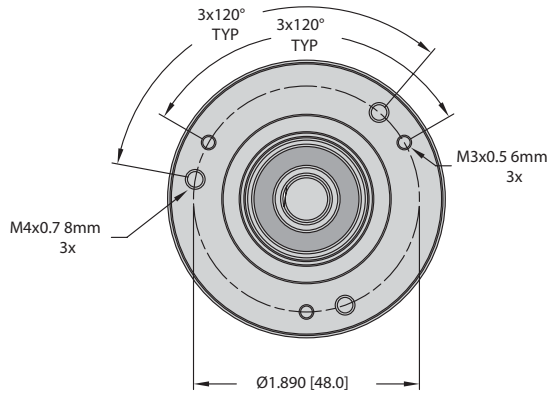
#### Accessories:

- See page H1, Connectivity, for cables and connectors
- See page G1, Accessories, for mounting attachments and couplings

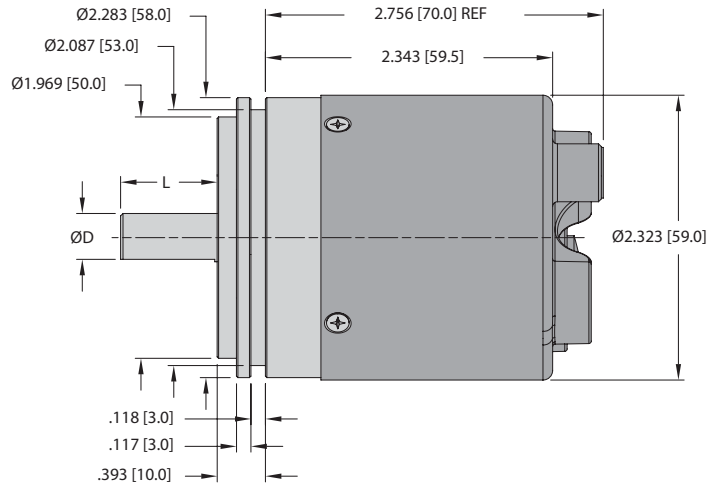
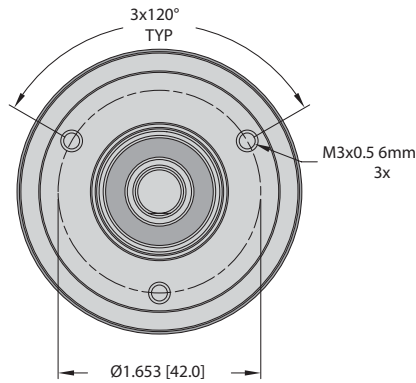
**Absolute, Multiturn Type RM-105 (Shaft) / RM-106 (Blind Hollow Shaft) EtherNet/IP**

Dimensions: RM-105 Shaft Version

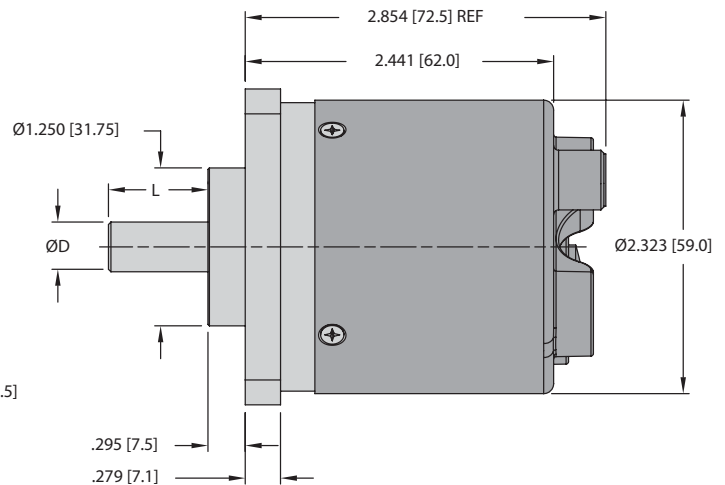
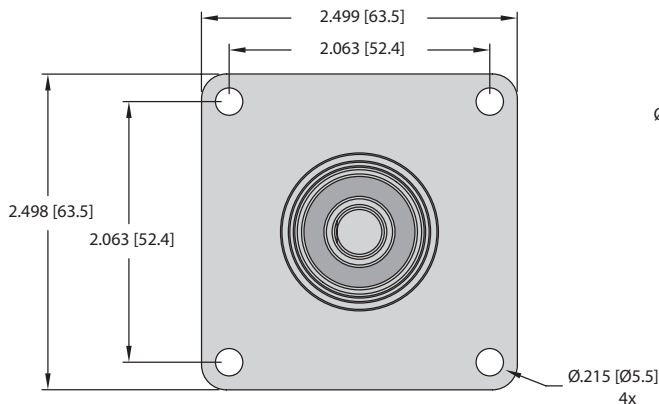
**RM-105 Flange C  
 Connection B3M12**



**RM-105 Flange S  
 Connection B3M12**

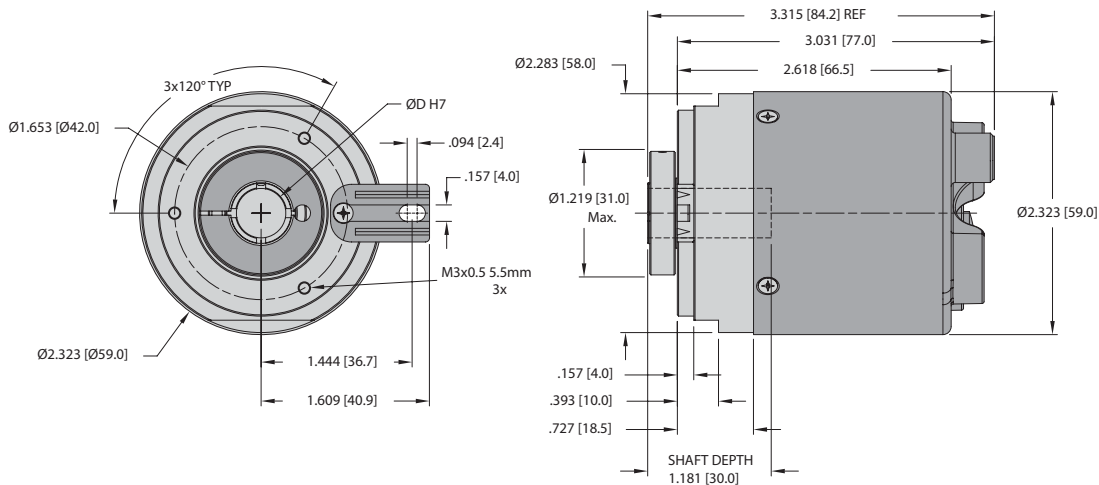


**RM-105 Flange R  
 Connection B3M12**

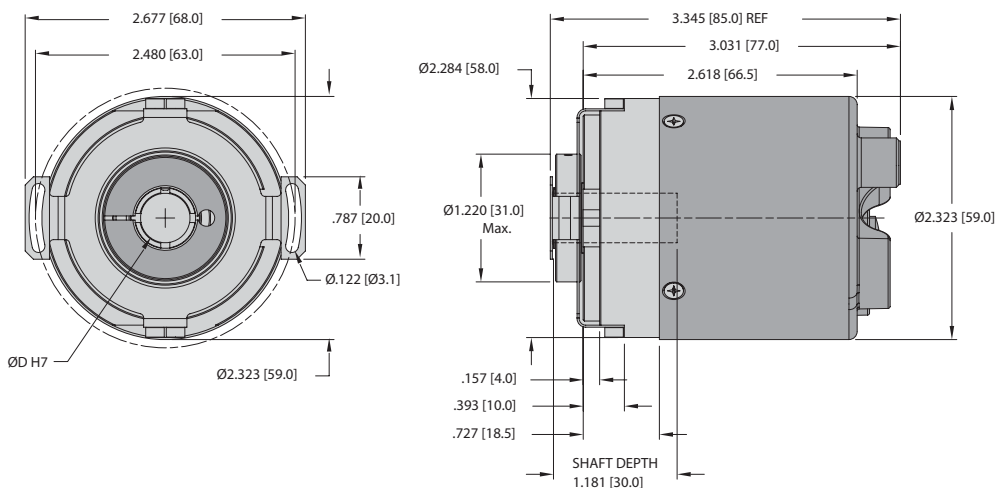


**Dimensions: RM-106 Blind Hollow Shaft Version**

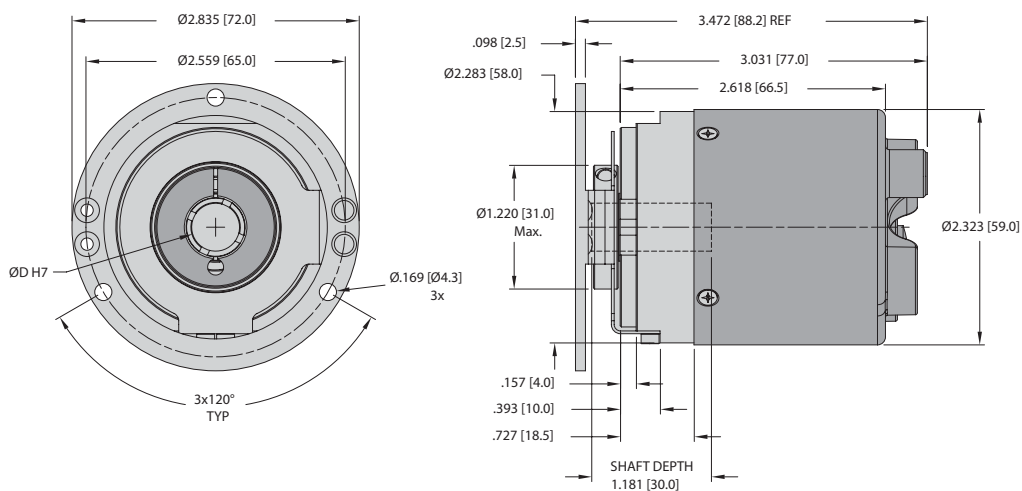
**RM-106 Flange T  
Connection B3M12**



**RM-106 Flange E  
Connection B3M12**



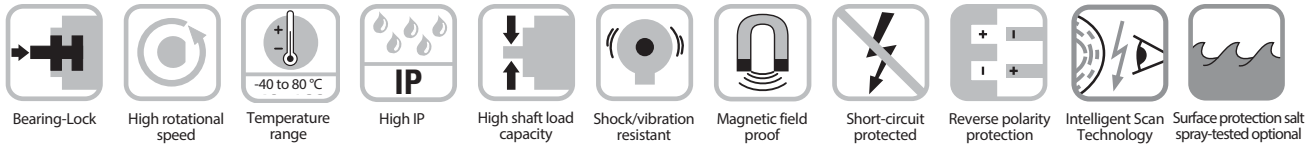
**RM-106 Flange E1  
Connection B3M12**





### Absolute, Multiturn Type RM-105 (Shaft) / RM-106 (Hollow Shaft)

### Modbus



#### Reliable

- Sturdy bearing construction in Bearing-Lock design for resistance against vibration and installation errors.
- Ideal for use outdoors thanks to IP67 protection and wide temperature range from -40 to +80 °C.



#### Current Modbus Performance

- Modbus register for configuration of the node address and baud rate.
- Scaling function.
- 32 bits total resolution (16 bit MT + 16 bit ST).
- Preset function.
- Diagnostic functions.
- Limit switch function.



#### Inensitive

- Turck OptoASIC technology with all singleturn and multiturn functions on one single OptoASIC - offering the highest reliability, a high resolution up to 32 bits and 100% magnetic field insensitivity.

#### Mechanical Characteristics:

|  |   |
|--|---|
| Max. speed shaft version:                  |   |
| IP65 up to 70 °C:                          | 12000 RPM, 10000 RPM (continuous)                                     |
| IP65 up to T max:                          | 8000 RPM, 5000 RPM (continuous)                                       |
| IP67 up to 70 °C:                          | 11000 RPM, 9000 RPM (continuous)                                      |
| IP67 up to T max:                          | 8000 RPM, 5000 RPM (continuous)                                       |
| Max. speed hollow shaft version:           |   |
| IP65 up to 70 °C:                          | 9000 RPM, 6000 RPM (continuous)                                       |
| IP65 up to T max:                          | 6000 RPM, 3000 RPM (continuous)                                       |
| IP67 up to 70 °C:                          | 8000 RPM, 4000 RPM (continuous)                                       |
| IP67 up to T max:                          | 4000 RPM, 2000 RPM (continuous)                                       |
| Starting torque (68 °F   20 °C):           |   |
| IP65:                                      | < 1.4 oz - in (0.01 Nm)   |
| IP 67:                                     | < 7.0 oz - in (0.05 Nm)   |
| Mass moment of inertia:                    |   |
| Shaft version:                             | 0.16 oz - in <sup>2</sup> (3.0 × 10 <sup>-6</sup> kgm <sup>2</sup> )  |
| Hollow shaft version:                      | 0.328 oz - in <sup>2</sup> (6.0 × 10 <sup>-6</sup> kgm <sup>2</sup> ) |
| Shaft load capacity:                       |   |
| Radial:                                    | 18 lbs (80 N)   |
| Axial:                                     | 9 lbs (40 N)  |
| Weight:                                    | approx. 1.0 lbs (0.45 kg)   |
| Protection acc. to EN 60529:               |   |
| Housing:                                   | IP67  |
| Shaft:                                     | IP65, opt. IP67   |
| Working temperature range:                 |   |
|  | -40 to +176 °F (-40 to +80 °C)  |
| Materials:                                 |   |
| Shaft:                                     | stainless steel   |
| Flange:                                    | aluminium   |
| Housing:                                   | zinc die-cast   |
| Shock resistance acc. to EN 60068-2-27:    |   |
|  | 250 g (2,500 m/s <sup>2</sup> ), 6 ms                                 |
| Vibration resistance acc. to EN 60068-2-6: |   |
|  | 10 g (100 m/s <sup>2</sup> ), 55 - 2,000 Hz                           |

# Rotary Position Technology

## Absolute Encoders, Multiturn

### Absolute, Multiturn Type RM-105 (Shaft) / RM-106 (Hollow Shaft)

### Modbus

#### General Electrical Characteristics:

|   |   |
|---|---|
| Power supply:   | 10 - 30 VDC   |
| Power consumptions (no load)                          | max. 80 mA  |
| Reverse polarity protection at the power supply (+V): | yes   |
| UL approval:  | file 224618   |
| CE compliant acc. to:                                 | EMC guideline 2014/30/<br>RoHS guideline 2011/65/EU |

#### Diagnostic LED (two-color, red/green):

|                          |                |
|--------------------------|----------------|
| LED ON or blinking:      |                |
| Red:                     | error display  |
| Green:                   | status display |
| Combination red / green: | error code     |

#### Interface Characteristics Modbus:

|                                    |  |
|------------------------------------|--|
| Singleturn resolution:             | 1 - 65536 (16 bit), scalable<br>default: 65536 (16 bit)          |
| Number of revolutions (multiturn): | max. 65536 (16 bit)<br>scalable only via the<br>total resolution |
| Total resolution:                  | 1 - 4,294,967,296 (32 bit),<br>scalable                          |
| Code:                              | binary   |
| Interface:                         | Modbus V1.02   |
| Protocol:                          | Modbus RTU V1.1b3  |
| Baud rate:                         | 9600 - 115200 kbit/s<br>software configurable                    |
| Node address                       | 1 - 63 software configurable                                     |
| Termination                        | software configurable  |

#### Read Holding Register:

| Register: | Data Name:                                     |
|-----------|--|
| 40257     | baud rate<br>number date<br>parity<br>stopbits |
| 40261     | comm update                                    |
| 40262     | node address                                   |
| 40263     | node update                                    |
| 40264     | preset value                                   |
| 40266     | preset update                                  |
| 40267     | count direct                                   |
| 40268     | count update                                   |
| 40269     | termination                                    |
| 40270     | term update                                    |

#### Write Holding Register:

| Register: | Data Name:       |
|-----------|------------------|
| 40275     | lower limit      |
| 40276     | upper limit      |
| 40277     | compare activ    |
| 40278     | MUR (MSB)        |
| 40279     | MUR (LSB)        |
| 40280     | TMR (MSB)        |
| 40281     | TMR (LSB)        |
| 40282     | scaling function |
| 40283     | delay prescaler  |

#### Modbus Communication Profile V 1.02

- Node address, baud rate and bus termination programmable.

#### Modbus Application Protocol V 1.1b3

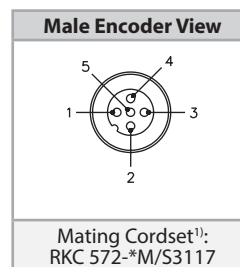
The following parameters can be programmed:

- 2 working area with 2 upper and lower limits and the corresponding output states.
- Extended failure management for position sensing.
- User interface with visual display of bus and failure status.
- "Watchdog controlled" device.
- Extended diagnostic modes.

#### Standard Wiring:

| Connection Type: | GND (0V) | V+ | D0 | D1 | Case Ground |
|------------------|----------|----|----|----|-------------|
| Cable:           | BK       | RD | BU | WH | N/C         |
| M12 Pin:         | 3        | 2  | 5  | 4  | 1           |

#### Wiring Diagram:



\* Length in meters.  
<sup>1</sup> See Connectivity section H for corresponding cable color code.

**Absolute, Multiturn Type RM-105 (Shaft) / RM-106 (Hollow Shaft)**

**Modbus**

**Part Number Key: RM-105 Shaft Version**

| A       | B | C |   | D     |   | E     |
|---------|---|---|---|-------|---|-------|
| RM-105S | 6 | C | - | 9P32B | - | B1M12 |

| A       | Type                            |
|---------|---------------------------------|
| RS-105S | Ø 58 mm, Shaft, IP67 Shaft Seal |
| RS-105T | Ø 58 mm, Shaft, IP65 Shaft Seal |

| D     | Supply Voltage and Output Type |
|-------|--------------------------------|
| 9P32B | 10 - 30 VDC, Modbus RTU V1.1b3 |

| B  | Shaft (Ø x L)   |
|----|-----------------|
| 6  | Ø 6 mm x 10 mm  |
| 10 | Ø 10 mm x 20 mm |
| A0 | Ø 1/4" x 7/8"   |
| A1 | Ø 3/8" x 7/8"   |

| E     | Type of Connection                |
|-------|-----------------------------------|
| B1M12 | Radial 1 x M12 Eurofast Connector |

| C | Flange                  |
|---|-------------------------|
| C | Ø 58 mm Clamping Flange |
| S | Ø 58 mm Servo Flange    |

**Part Number Key: RM-106 Hollow Shaft Version**

| A       | B  | C |   | D     |   | E     |
|---------|----|---|---|-------|---|-------|
| RM-106B | 10 | T | - | 9P32B | - | B1M12 |

| A       | Type                                   |
|---------|--|
| RM-106B | Ø 58 mm, Hollow Shaft, IP67 Shaft Seal |
| RM-106C | Ø 58 mm, Hollow Shaft, IP65 Shaft Seal |

| C  | Flange                               |
|----|--------------------------------------|
| T  | Ø 58 mm Flange w/ Torque Stop        |
| E  | Ø 63 mm Flange w/ Slotted Flex Mount |
| E1 | Ø 65 mm Flange w/ Flex Mount         |

| B  | Bore    |
|----|---------|
| 10 | Ø 10 mm |
| 12 | Ø 12 mm |
| 14 | Ø 14 mm |
| 15 | Ø 15 mm |

| D     | Supply Voltage and Output Type |
|-------|--------------------------------|
| 9P32B | 10 - 30 VDC, Modbus RTU V1.1b3 |

| E     | Type of Connection                |
|-------|-----------------------------------|
| B1M12 | Radial 1 x M12 Eurofast Connector |

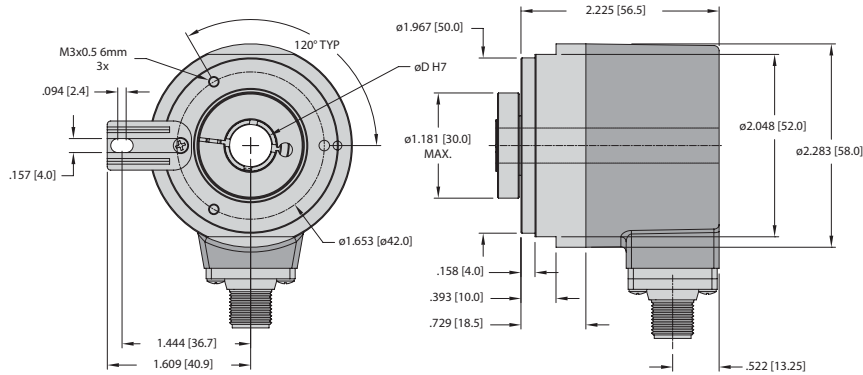
Absolute Encoders



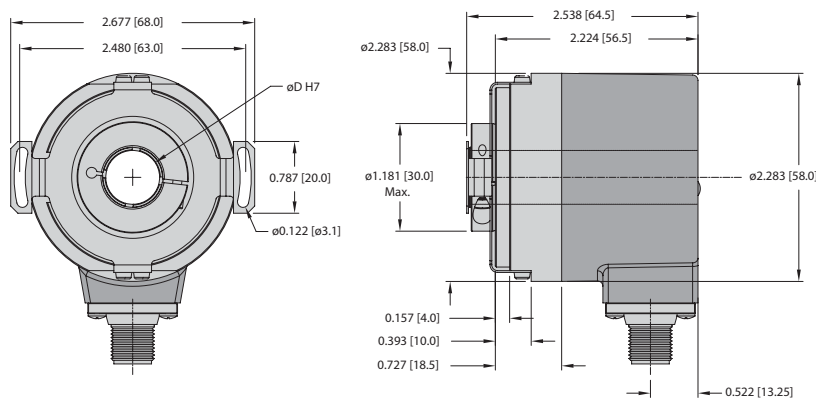
**Absolute, Multiturn Type RM-105 (Shaft) / RM-106 (Hollow Shaft) Modbus**

**Dimensions: RM-106 Shaft Version**

**RM-106 Flange T  
 Connection B1M12**



**RM-106 Flange E  
 Connection B1M12**



**Mounting advice:**

The flanges and shafts of the encoder and drive should not be rigidly coupled together at the same time. We recommend the use of suitable couplings (see page G1, Accessories).

# Rotary Position Technology

**Notes:**

# ROTARY POSITION TECHNOLOGY

## ENCODER ACCESSORIES

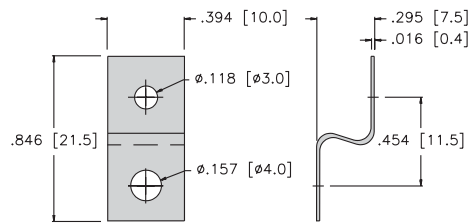
| Series                     | Type                  | Page       |
|----------------------------|-----------------------|------------|
| <b>Encoder Accessories</b> |                       |            |
|                            | Flex Brackets         | <b>G2</b>  |
|                            | Torque Pins           | <b>G8</b>  |
|                            | Torque Stop           | <b>G8</b>  |
|                            | Couplings             | <b>G9</b>  |
|                            | Spring Loaded Bracket | <b>G10</b> |
|                            | Assembly Bell         | <b>G10</b> |
|                            | Servo Cleats          | <b>G11</b> |
|                            | Mounting Attachments  | <b>G11</b> |
|                            | Brackets              | <b>G13</b> |
|                            | Rack and Pinion       | <b>G13</b> |
|                            | Wheels                | <b>G14</b> |
|                            | Bearing Unit          | <b>G15</b> |

### Flex Brackets

**Part Number:**  
RA-FB

**Description:**  
Flex bracket for Hollow Shaft  
RI-09, RS-31, RS-33

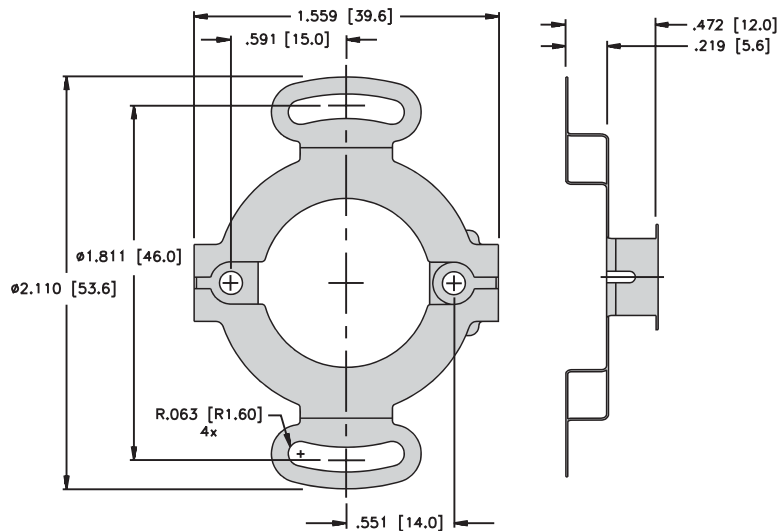
Kit includes: (2) M2.5x6 mm screws



**Part Number:**  
RA-E-46

**Description:**  
Slotted flex mount for hollow shaft series RI-05, RI-09,  
RS-07, RS-48, RS-49, RS-53, RM-50, RM-51

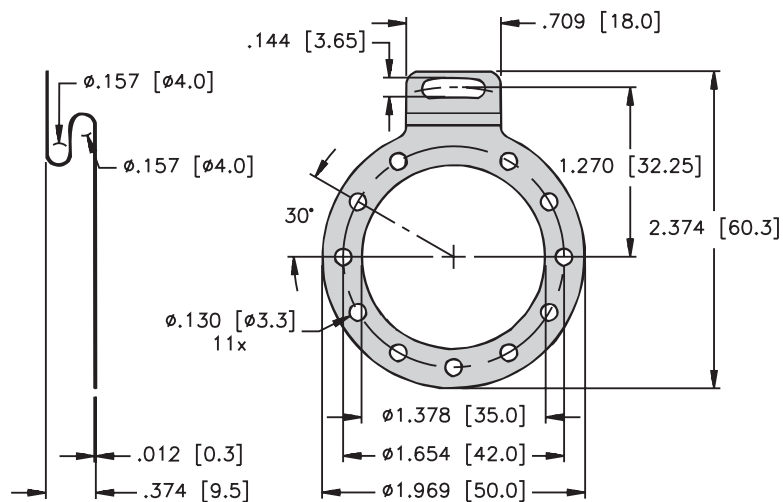
Kit includes: (2) M2.5x6 mm screws



**Part Number:**  
RA-S7

**Description:** single point tether arm, short,  
for RI-12, RS-31, RS-33, RM-35, RM-36

Kit includes: (3) M3x6 mm screws



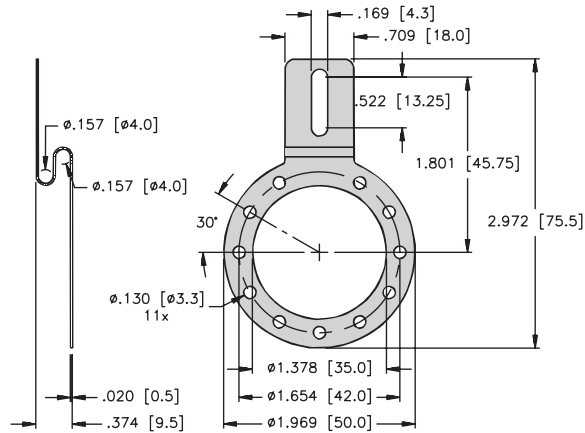


### Flex Brackets

**Part Number:**  
RA-S6

**Description:**  
Single point tether arm, medium, for RI-12, RS-31, RS-33, RM-35, RM-36,

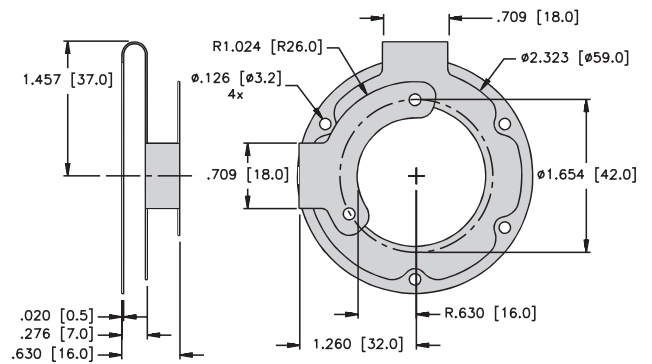
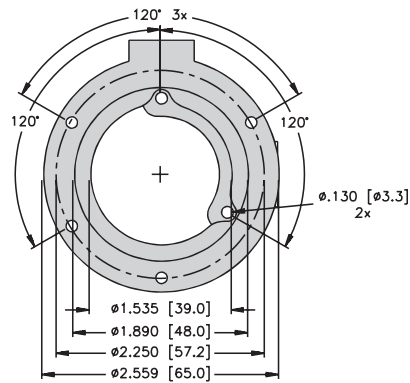
Kit includes: (3) M3x6 mm screws



**Part Number:**  
RA-E2

**Description:**  
Flex mount for hollow shaft series RI-12

Kit includes:  
(3) M3x6 mm screws,  
(3) lock washers



# Rotary Position Technology

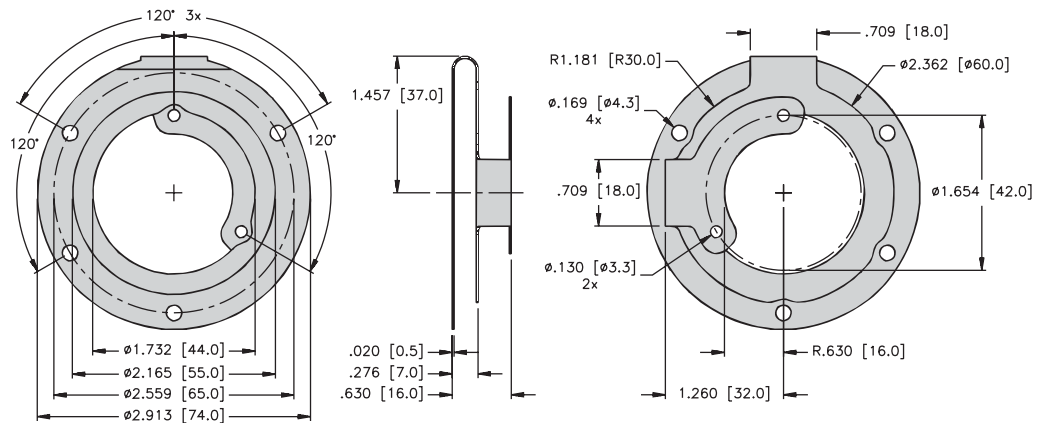
## Encoder Accessories

### Flex Brackets

**Part Number:**  
RA-E1

**Description:**  
Flex mount, pitch circle  $\varnothing$  65 mm for  
RI-12, RS-31, RS-33, RM-35, RM-36

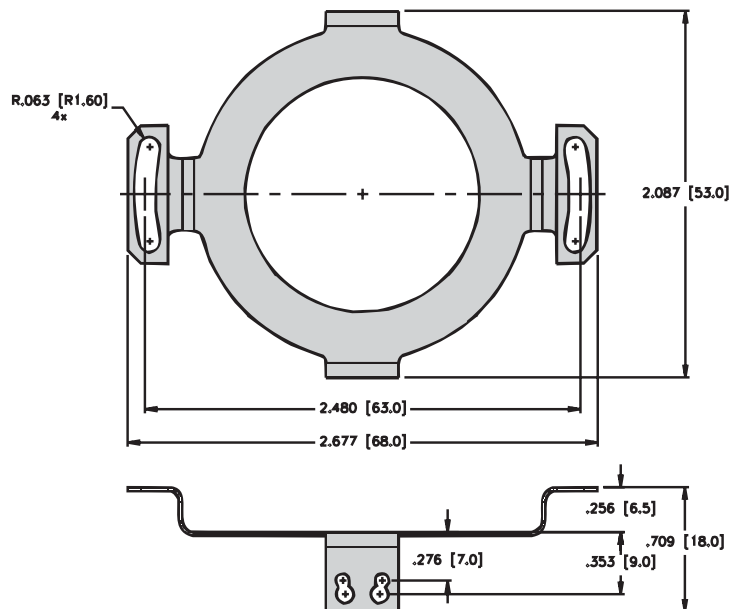
Kit includes: (2) screws to attach  
to encoder



**Part Number:**  
RA-E

**Description:**  
Slotted flex mount for RI-12(flange E),  
RS-31, RS-33, RM-35, RM-36

Kit includes: (4) M2.5x6 screws  
for RI-12, RS-31, RS-33

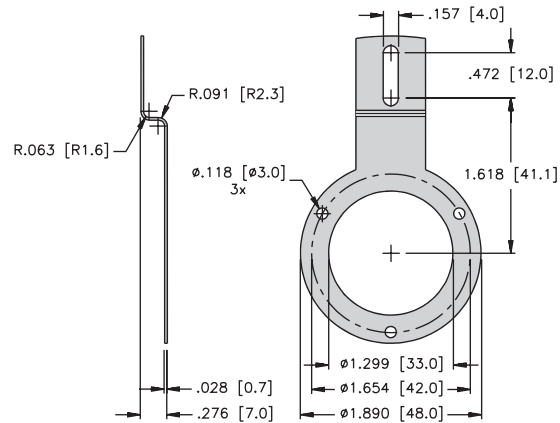


### Flex Brackets

**Part Number:**  
RA-SB

**Description:**  
Single point tether arm for hollow shaft series RI-12

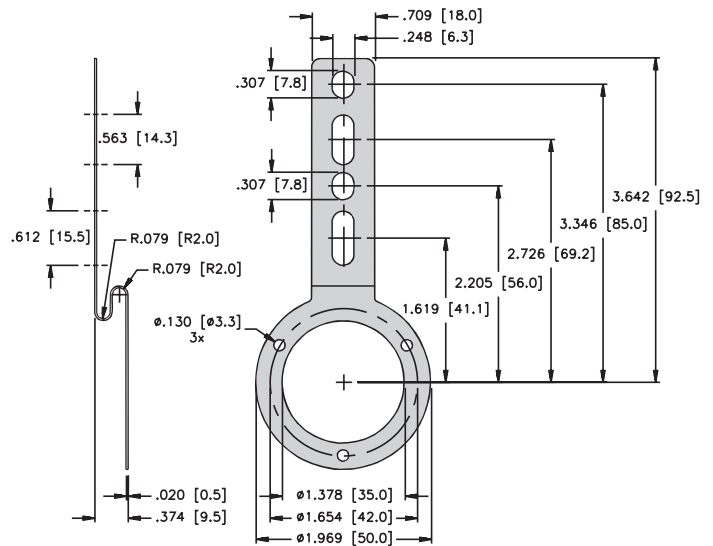
Kit includes: (3) M3x6 mm screws



**Part Number:**  
RA-SA

**Description:**  
Single point tether arm for hollow shaft series RI-12, RS-31, RS-33, RM-35, RM-36

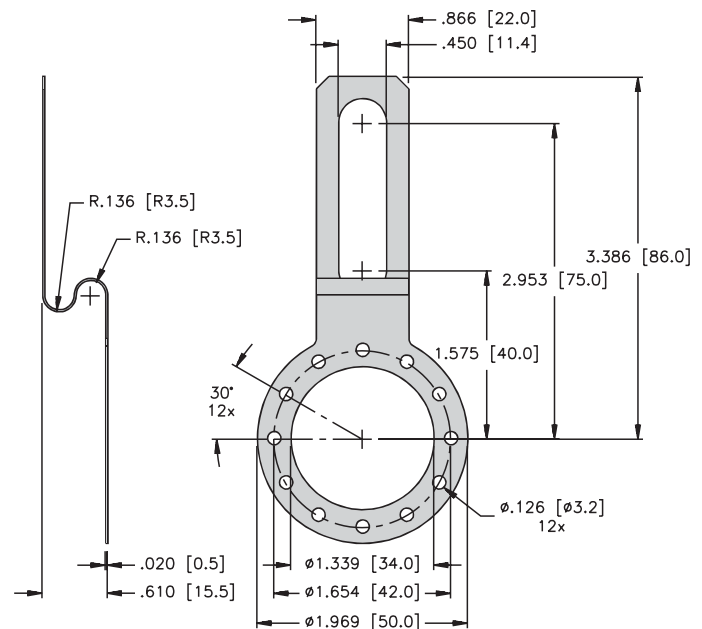
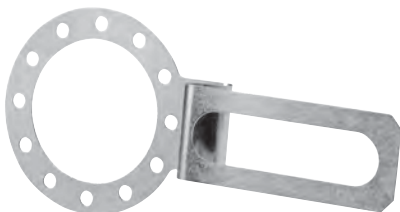
Kit includes: (3) M3x6 mm screws



**Part Number:**  
RA-S1

**Description:**  
Standard single point tether arm for hollow shaft series RI-12

Kit includes: (1) nylon step washer (9.5 mm inside diameter), (4) M3x6 screws, (4) lock washers



# Rotary Position Technology

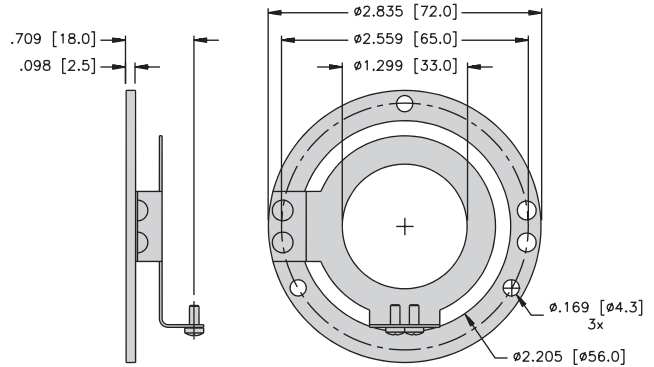
## Encoder Accessories

### Flex Brackets

**Part Number:**  
RA-E1-SM

**Description:**  
Flex mount for hollow shaft series,  
RS-31, RS-33, RM-35, RM-36 (flange E1)

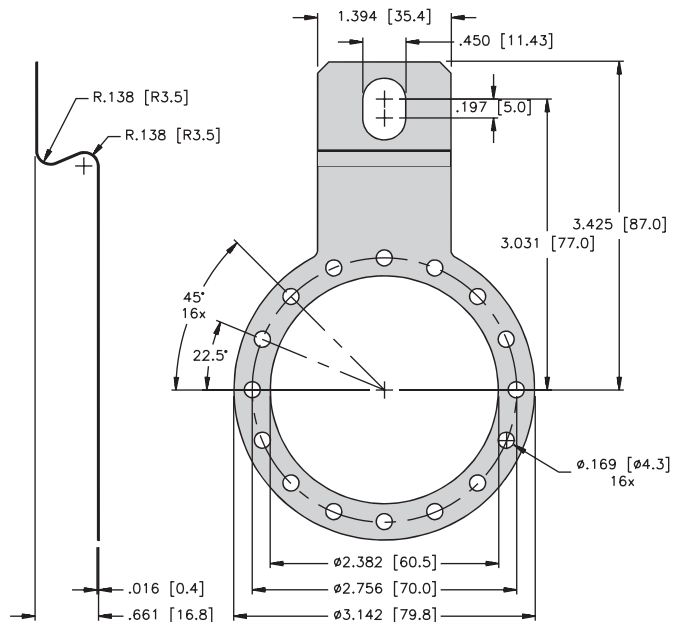
Kit includes: (2) M2.5x6 mm screws



**Part Number:**  
RA-43-E2

**Description:**  
4.5" C-face tether for RI-43

Kit includes: (3) M4x5 mm screws,  
(1) 3/8-16 x 1/0" bolt, (1) 3/8-16 nut,  
(1) Nylon step washer, (1) Nylon mating washer



**Flex Brackets**

**Part Number:**  
RA-43-S8

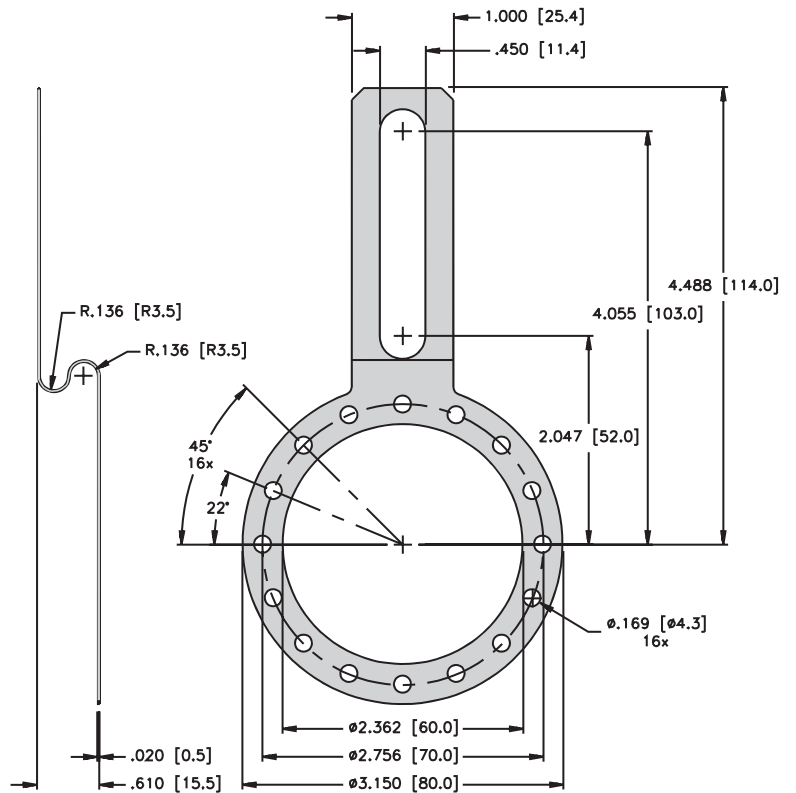
**Description:**  
Tether arm (long) for RI-43

Kit includes: (3) M4x5 mm screws

**Part Number:**  
RA-43-S8-US

**Description:**  
Tether arm (long) for RI-43

Kit includes: (3) M4x5 mm screws,  
(1) 1/4-20 x 1/0" bolt,  
(3) 1/4-20 nuts, (1) Nylon step washer,  
(1) Nylon mating washer

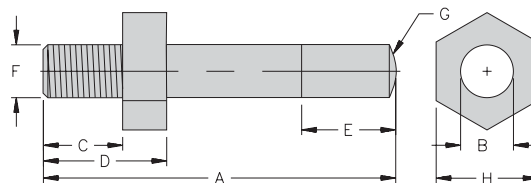


# Rotary Position Technology

## Encoder Accessories

### Torque Pins (Standard and Metric)

| Part Number | Description                | A                  | B                 | C                  | D                  | E                  | F      | G (Radius)        | H                  |
|-------------|----------------------------|--------------------|-------------------|--------------------|--------------------|--------------------|--------|-------------------|--------------------|
| RA-TP-3-S   | RI-02<br>3 mm, smooth      | 0.472<br>(12.0 mm) | 0.118<br>(3.0 mm) | ----               | ----               | ----               | ----   | 0.276<br>(7.0 mm) | N/A                |
| RA-TP-4-S   | RI-09<br>4 mm, smooth      | 0.630<br>(16.0 mm) | 0.157<br>(4.0 mm) | ----               | ----               | ----               | ----   | 0.276<br>(7.0 mm) | N/A                |
| RA-TP-4-4   | RI-12<br>4 mm, M4 thread   | 1.181<br>(30.0 mm) | 0.157<br>(4.0 mm) | 0.197<br>(5.0 mm)  | 0.315<br>(8.0 mm)  | ----               | M4x0.7 | 0.276<br>(7.0 mm) | 0.276<br>(7.0 mm)  |
| RA-TP-4-832 | RI-12<br>4 mm, 8-32 thread | 1.181<br>(30.0 mm) | 0.157<br>(4.0 mm) | 0.250<br>(6.35 mm) | 0.374<br>(9.5 mm)  | ----               | 8-32   | 0.276<br>(7.0 mm) | 1/4"<br>(6.35 mm)  |
| RA-TP-6-6   | RI-43<br>6 mm, M6 thread   | 1.575<br>(40.0 mm) | 0.236<br>(6.0 mm) | 0.354<br>(9.0 mm)  | 0.551<br>(14.0 mm) | 0.394<br>(10.0 mm) | M6x1   | 0.276<br>(7.0 mm) | 0.394<br>(10.0 mm) |

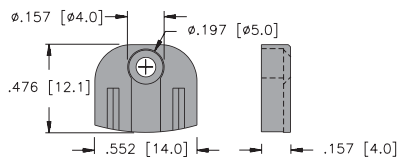


### Torque Stop

**Part Number:**  
RA-T1

**Description:**  
Torque stop for RI-05, RI-09, RI-12, RS-07, RS-31, RS-33, RS-48, RS-49, RS-53, RM-35, RM-36, RM-50, RM-51

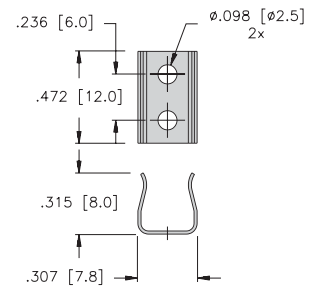
Kit includes:  
(1) M2.5x5 mm screw



**Part Number:**  
RA-43-S5

**Description:**  
Torque stop (short) for RI-43 large bore series

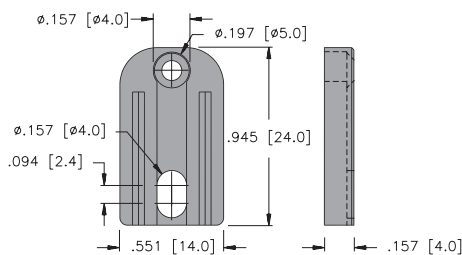
Kit includes:  
(2) M2.5x5 mm screws



**Part Number:**  
RA-T

**Description:**  
Torque stop for RI-05, RI-09, RI-12, RS-07, RS-31, RS-33, RS-48, RS-49, RS-53, RM-35, RM-36, RM-50, RM-51

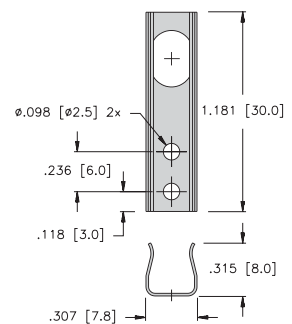
Kit includes:  
(1) M2.5x5 mm screw



**Part Number:**  
RA-43-S4

**Description:**  
Torque stop (long) for RI-43 large bore series

Kit includes:  
(2) M2.5x5 mm screws



### Couplings

Turck precision flexible couplings are engineered for optimum performance with Turck encoders. Designed to connect two misaligned shafts, our beam style couplings offer superior performance, reliability, long life and are easy to install.

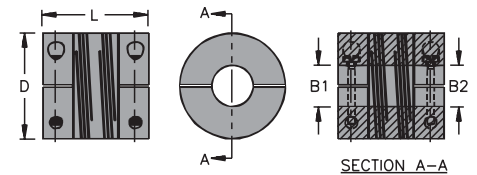
**Installation:** Clean and degrease all shafts, check parallel alignment. Do not exceed misalignment and axial motion specifications. Clamp one end of the coupling to the drive shaft. Insert encoder into the other end. Tap lightly on the coupling hub to stabilize system. Tighten the second screw.

**Note:** Light should be visible through the beams.



#### Coupling Tabulation - in (mm)

| Part Number    | D               | L                | Parallel         | Angular Misalignment | Axial Motion     |
|----------------|-----------------|------------------|------------------|----------------------|------------------|
| TFC075-XXX-XXX | 0.745<br>(19.0) | 0.750<br>(19.0)  | 0.006<br>(0.15)  | 3°                   | ±0.006<br>(0.13) |
| TFC100-XXX-XXX | 0.995<br>(25.4) | 1.000<br>(25.4)  | 0.005<br>(0.127) | 3°                   | ±0.005<br>(0.13) |
| TFC125-XXX-XXX | 1.240<br>(31.5) | 1.250<br>(31.75) | 0.005<br>(0.127) | 2°                   | ±0.005<br>(0.13) |



**B1** = encoder shaft  
**B2** = drive shaft

| Part Number    | Coupling Diameter | Encoder Shaft | Drive Shaft |
|----------------|-------------------|---------------|-------------|
| TFC075-250-M04 | 0.750 in          | 0.25 in       | 4 mm        |
| TFC075-250-M05 | 0.750 in          | 0.25 in       | 5 mm        |
| TFC075-250-M06 | 0.750 in          | 0.25 in       | 6 mm        |
| TFC075-250-M08 | 0.750 in          | 0.25 in       | 8 mm        |
| TFC075-250-125 | 0.750 in          | 0.25 in       | 0.125 in    |
| TFC075-250-187 | 0.750 in          | 0.25 in       | 0.188 in    |
| TFC075-250-250 | 0.750 in          | 0.25 in       | 0.25 in     |
| TFC075-06M-M04 | 0.750 in          | 6 mm          | 4 mm        |
| TFC075-06M-M05 | 0.750 in          | 6 mm          | 5 mm        |
| TFC075-06M-M06 | 0.750 in          | 6 mm          | 6 mm        |
| TFC075-06M-M08 | 0.750 in          | 6 mm          | 8 mm        |
| TFC075-06M-125 | 0.750 in          | 6 mm          | 0.125 in    |
| TFC075-06M-187 | 0.750 in          | 6 mm          | 0.188 in    |
| TFC075-06M-250 | 0.750 in          | 6 mm          | 0.250 in    |
| TFC100-375-125 | 1.000 in          | 0.375 in      | 0.125 in    |
| TFC100-375-187 | 1.000 in          | 0.375 in      | 0.188 in    |
| TFC100-375-250 | 1.000 in          | 0.375 in      | 0.25 in     |
| TFC100-375-375 | 1.000 in          | 0.375 in      | 0.375 in    |

| Part Number    | Coupling Diameter | Encoder Shaft | Drive Shaft |
|----------------|-------------------|---------------|-------------|
| TFC100-375-M04 | 1.000 in          | 0.375 in      | 4 mm        |
| TFC100-375-M05 | 1.000 in          | 0.375 in      | 5 mm        |
| TFC100-375-M06 | 1.000 in          | 0.375 in      | 6 mm        |
| TFC100-375-M08 | 1.000 in          | 0.375 in      | 8 mm        |
| TFC100-375-M10 | 1.000 in          | 0.375 in      | 10 mm       |
| TFC125-12M-125 | 1.250 in          | 12 mm         | 0.125 in    |
| TFC125-12M-187 | 1.250 in          | 12 mm         | 0.188 in    |
| TFC125-12M-250 | 1.250 in          | 12 mm         | 0.250 in    |
| TFC125-12M-375 | 1.250 in          | 12 mm         | 0.375 in    |
| TFC125-12M-500 | 1.250 in          | 12 mm         | 0.5 in      |
| TFC125-12M-M06 | 1.250 in          | 12 mm         | 6 mm        |
| TFC125-12M-M08 | 1.250 in          | 12 mm         | 8 mm        |
| TFC125-12M-M10 | 1.250 in          | 12 mm         | 10 mm       |
| TFC125-12M-M12 | 1.250 in          | 12 mm         | 12 mm       |
| TFC125-375-M12 | 1.250 in          | 0.375 in      | 12 mm       |
| TFC125-375-500 | 1.250 in          | 0.375 in      | 0.5 in      |

Other options available on request.

# Rotary Position Technology

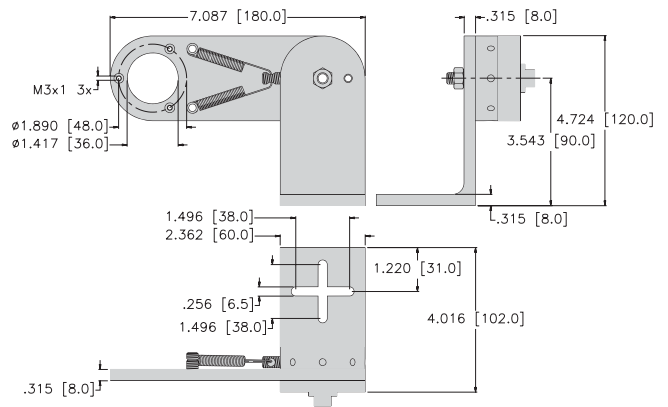
## Encoder Accessories

### Spring Loaded Bracket

**Part Number:**  
RA-SB-58

**Description:**  
Spring loaded right angle bracket for measuring wheels and rack and pinion systems

Used with clamping flange 58 mm  
face mount screws included



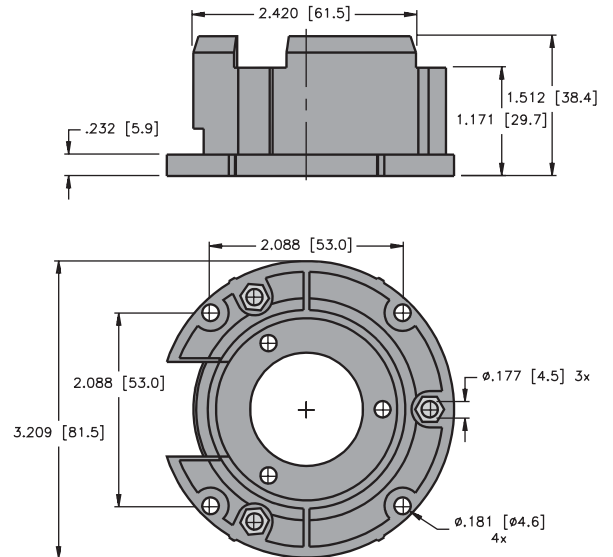
### Assembly Bell

**Part Number:**  
RA-AB-XXX-XXX

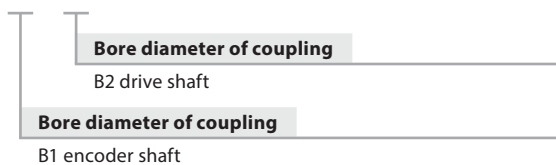
**Description:**  
Assembly bell

Kit includes:  
- Coupling  
- Mounting screws

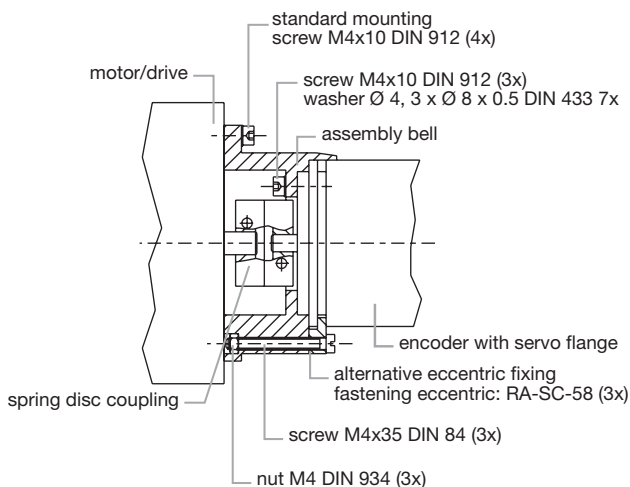
Purchase separately:  
- Optional assembly with servo cleat RA-SC-58  
- Used with servo flange  $\phi 58$  mm



**Part Number Key:**  
RA-AB-XXX-XXX



### Mounting Example:

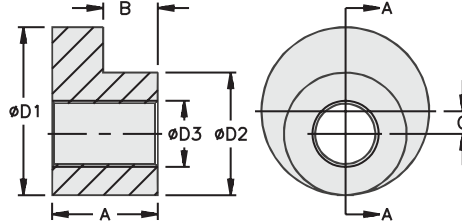




### Servo Cleats

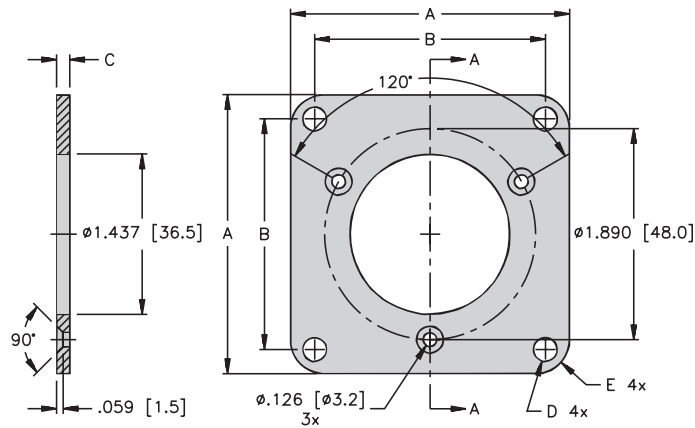
| Part Number | For Encoder Type   | D1 in. [mm] | D2 in. [mm] | D3 in. [mm] | A in. [mm]  | B in. [mm]   | C in. [mm]  |
|-------------|--------------------|-------------|-------------|-------------|-------------|--------------|-------------|
| RA-SC-36    | 36 mm servo flange | 0.267 [6.8] | 0.197 [5.0] | 0.110 [2.8] | 0.138 [3.5] | 0.089 [2.25] | 0.35 [0.9]  |
| RA-SC-58    | 58 mm servo flange | 0.350 [8.9] | 0.256 [6.5] | 0.126 [3.2] | 0.220 [5.6] | 0.114 [2.9]  | 0.047 [1.2] |

- For use with rotary encoders with servo flange
- Kit includes: 3 cleats and 3 screws
- Chrome plated steel
- Galvanized nickel finish



### Mounting Attachments

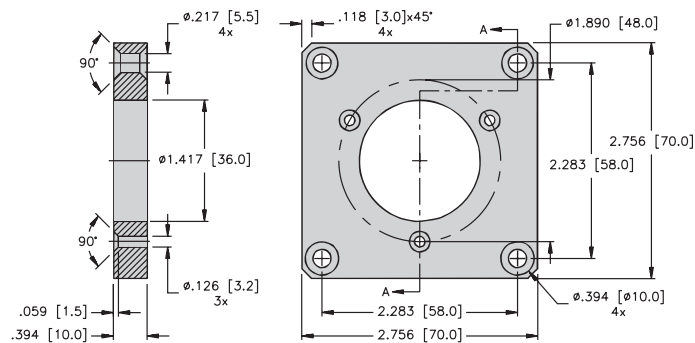
| Part Number | Description           | A in. [mm]   | B in. [mm]   | C in. [mm] | D in. [mm] | E in. [mm] |
|-------------|-----------------------|--------------|--------------|------------|------------|------------|
| RA-R-58-4   | Square adapter flange | 2.283 [58.0] | 1.890 [48.0] | .157 [4.0] | .177 [4.5] | .157 [4.0] |
| RA-R-63-3   |                       | 2.500 [63.5] | 2.067 [52.5] | .118 [3.0] | .217 [5.5] | .295 [7.5] |
| RA-R-80-4   |                       | 3.150 [80.0] | 2.559 [65.0] | .157 [4.0] | .217 [5.5] | .295 [7.5] |



**Part Number:**  
RA-R-70-10

**Description:**  
Used with 58 mm clamping flange face mount kit

Kit includes: Mounting screws

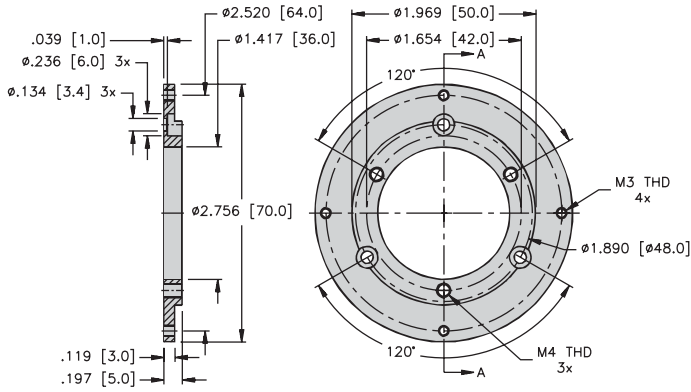


### Mounting Attachments

**Part Number:**  
RA-S-70-5

**Description:**  
70 mm flange for shafted encoders RI-10

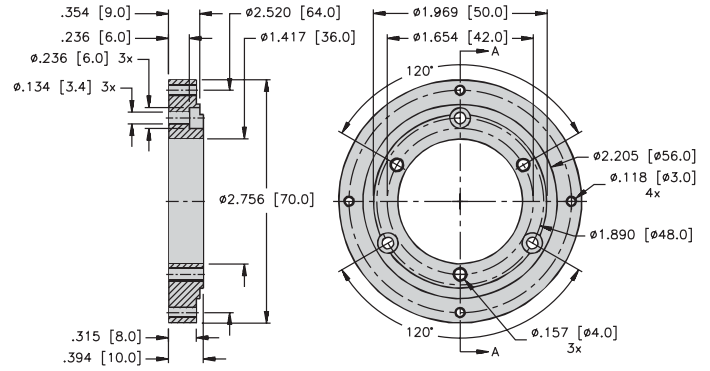
Kit includes: 3 screws to attach flange to encoder



**Part Number:**  
RA-S-70-10

**Description:**  
70 mm flange for shafted encoders RI-10, RS-24, RS-25, RM-28, RM-29

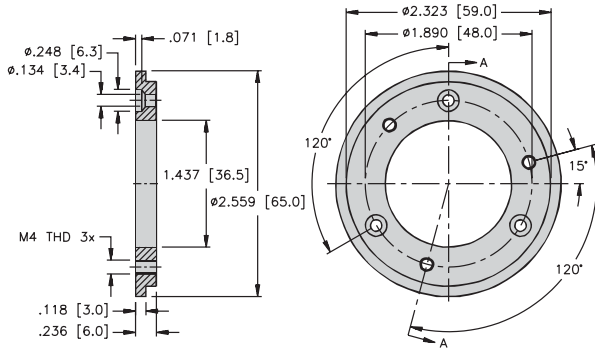
Kit includes: 3 screws to attach flange to encoder



**Part Number:**  
RA-S-65-6

**Description:**  
65 mm flange for shafted encoders RI-10, RS-24, RS-25, RM-28, RM-29

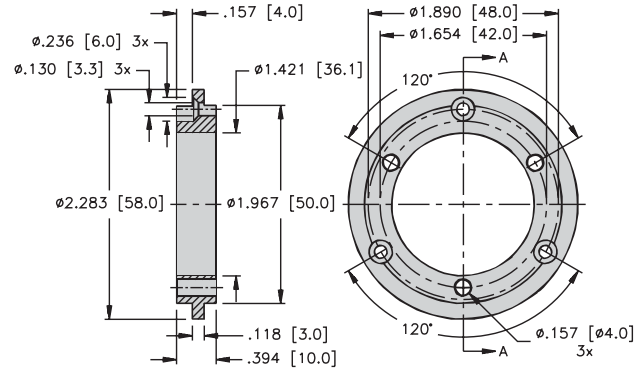
Kit includes: 3 screws to attach flange to encoder



**Part Number:**  
RA-S-58-10

**Description:**  
58 mm flange to convert encoders with clamping flange into servo flange

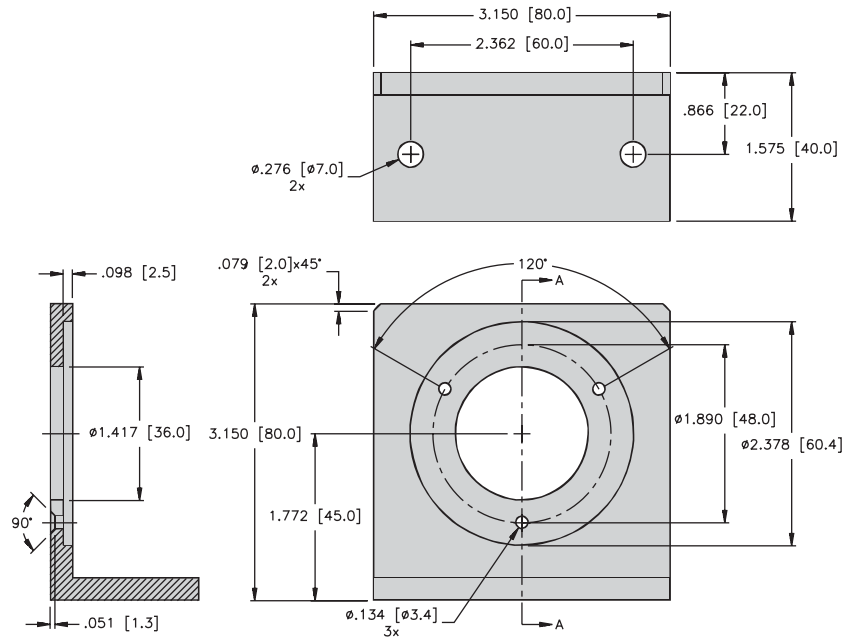
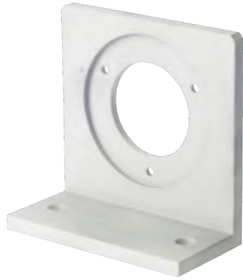
Kit includes: 3 screws to attach flange to encoder



### Brackets

**Part Number:**  
RA-MB-58

**Description:**  
Right angle bracket  
Used with clamping flange Ø 58 mm face mount  
Screws Included



### Rack and Pinion

**Part Number:**  
RA-RACK-1000

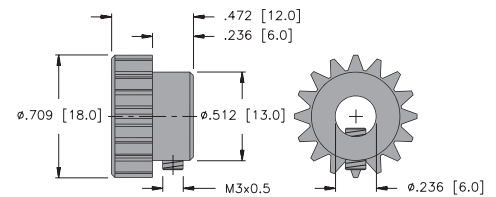
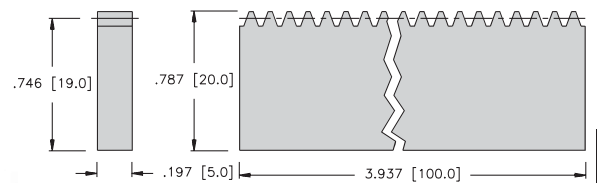
**Description:**  
Rack

**Part Number:**  
RA-P-6  
RA-P-10

**Description:**  
Pinion

**Part Number:**  
RA-RACK-95

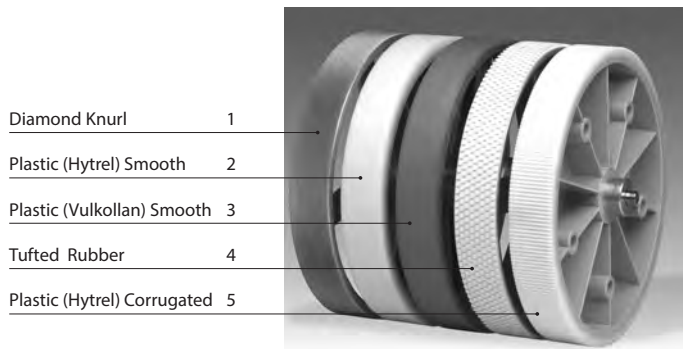
**Description:**  
Support



# Rotary Position Technology

## Encoder Accessories

### Wheels

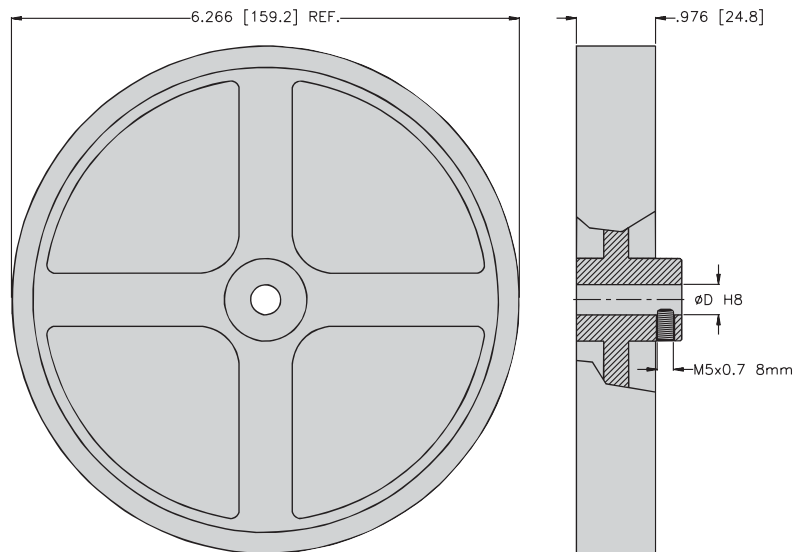


- Diamond Knurl 1
- Plastic (Hytre) Smooth 2
- Plastic (Vulkollan) Smooth 3
- Tufted Rubber 4
- Plastic (Hytre) Corrugated 5

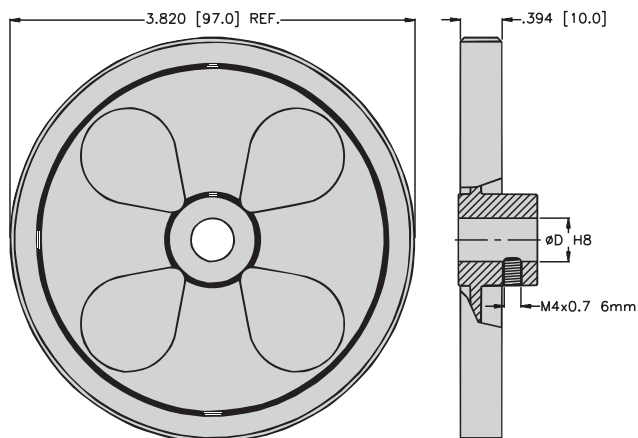
#### Selection of the measuring wheel profile according to the surface of the measured material

| Surface of the Measured Material | Recommended Profile No. |
|----------------------------------|-------------------------|
| Cardboard                        | 1, 2, 3, 6              |
| Wood                             | 1, 2, 3, 6              |
| Textile                          | 1, 4, 5                 |
| Plastic (e.g., PVC, PE, ...)     | 2, 3, 6                 |
| Paper                            | 2, 3, 6                 |
| Wire                             | 3, 6                    |
| Bare metals                      | 4                       |
| Varnished surfaces               | 4                       |

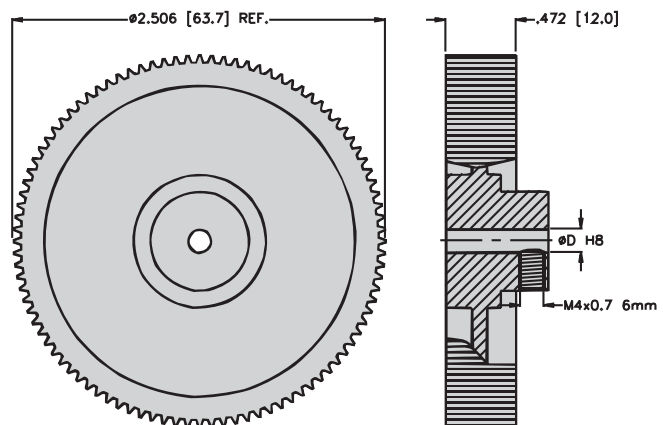
#### Measuring Wheel No. 05



#### Measuring Wheel No. A9



#### Measuring Wheel No. 02



### Wheels

| A   | B | C  | D |
|-----|---|----|---|
| RMW | - | 02 | 1 |

| "B" Measuring Wheel Circumference/Ø/ Width | "C" Profile Measuring Wheels (s.o) | Coating                      | Wheel Body Material (mm) | Working Temperature (°C) | Weight (g) | "D" Standard Bore (mm) <sup>1)</sup> |
|--|------------------------------------|------------------------------|--------------------------|--------------------------|------------|--------------------------------------|
| <b>02</b><br>0.2 m/ø 63.7 mm/12 mm         | 1                                  | Diamond knurl                | Aluminum                 | -                        | 40         | <b>4, 6, 10</b>                      |
|  | 2                                  | Plastic (Hytrel) smooth      | Plastic                  | -10 to +50               | 35         | <b>4, 6, 10</b>                      |
|  | 4                                  | Tufted rubber                | Aluminum                 | -10 to +50               | 40         | <b>6, 10</b>                         |
|  | 5                                  | Plastic (Hytrel) corrugated  | Plastic                  | -10 to +70               | 35         | <b>4, 6, 10</b>                      |
| <b>05</b><br>0.5 m/ø 159.2 mm/25 mm        | 1                                  | Diamond knurl                | Aluminum                 | -                        | 350        | <b>10</b>                            |
|  | 2                                  | Plastic (Hytrel) smooth      | Plastic                  | -10 to +50               | 260        | <b>10</b>                            |
|  | 3                                  | Plastic (Vulkollan) smooth   | Aluminum                 | -30 to +80               | 320        | <b>10</b>                            |
|  | 4                                  | Tufted rubber                | Aluminum                 | -30 to +80               | 320        | <b>10, 12</b>                        |
|  | 5                                  | Plastic (Hytrel) corrugated  | Plastic                  | -30 to +80               | 260        | <b>6, 10</b>                         |
| <b>A9</b><br>12"/ø 3.82"/0.38"             | 6                                  | Natural rubber (NR) (smooth) | Aluminum                 | -30 to +80               | 100        | <b>10</b>                            |

<sup>1)</sup> Other bore diameters on request

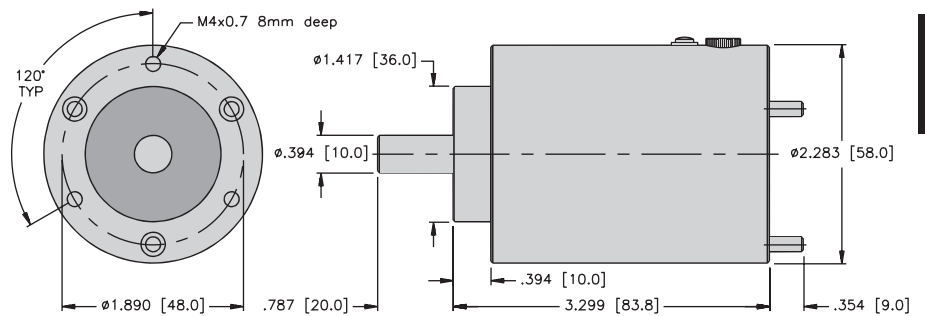
### Bearing Unit

**Part Number:**  
RA-BU-10-10

**Description:**  
Robust bearing unit for solid shaft encoders with clamping flange and shaft 10 mm

Speed: Max 6,000 RPM  
 Load: Radial: 135 lbs (600 N), Axial: 45 lbs (200 N)  
 Weight: 1.23 lbs (0.56 kg)  
 Protection: IP67 (when closure caps are used)

Kit includes:  
 - Bearing box  
 - (3) M4x25 cylindrical pins  
 - (1) O-ring



Unit shown with optional encoder attached. Consult factory for additional information.

# Rotary Position Technology

## Connection Accessories

**Notes:**

# CONNECTIVITY

| <b>SERIES</b>   | <b>TYPE</b>                             | <b>PAGE</b> |
|-----------------|---|-------------|
| <b>Cordsets</b> | M12 Eurofast Cordsets                   | <b>H2</b>   |
|                 | M12 Eurofast LED Cordsets               | <b>H9</b>   |
|                 | M12 Eurofast Field Wireable Connector   | <b>H10</b>  |
|                 | M23 Multifast Cordsets                  | <b>H11</b>  |
|                 | M23 Multifast Field Wireable Connectors | <b>H11</b>  |
|                 | Military Cordsets                       | <b>H12</b>  |
|                 | Military Field Wireable Connectors      | <b>H12</b>  |

## 4-Pin M12 Eurofast Cordsets Standard Plug Body

- Straight Female Connector
- NEMA 1, 3, 4, 6P and IEC IP68, IP69K Protection
- 250 VAC/300 VDC, 4 A



| Drawing   | Part Number                | Cable  | Features  | Pinouts                                    |
|---|----------------------------|--|---|--|
| <p><b>RK .. **</b><br/>1.673 [42.5]    <math>\phi</math>.571 [14.5]<br/>M12x1</p> <p><b>RKK .. **</b><br/>1.673 [42.5]    <math>\phi</math>.591 [15.0]<br/>M12x1</p> <p><b>RKV .. **</b><br/>1.673 [42.5]    <math>\phi</math>.591 [15.0]<br/>M12x1</p> | <b>RK 4.41T-*</b>          | AWM PVC NAMUR Blue<br>4x22 AWG<br>221 °F (105 °C)<br>5.2 mm OD<br>Cable #RF50598-*M <sup>†</sup>                           | Flexlife  | <p>1. BN<br/>2. WH<br/>3. BU<br/>4. BK</p> |
|   | <b>RK 4.41T-*/S529</b>     | AWM PUR/Heavy Braid<br>Double Jacket, Yellow<br>4x20 AWG<br>221 °F (105 °C)<br>5.8 mm OD<br>Cable #RF50526-*M <sup>†</sup> | Cut/Abrasion Immune<br>Braided Mechanical Shield    |  |
|   | <b>RK 4.43T-*</b>          | AWM PVC Yellow<br>4x22 AWG<br>221 °F (105 °C)<br>5.2 mm OD<br>Cable #RF50530-*M <sup>†</sup>                               | Flexlife  |  |
|   | <b>RK 4.43T-*/S90</b>      | AWM PUR Yellow<br>4x22 AWG<br>221 °F (105 °C)<br>5.2 mm OD<br>Cable #RF50613-*M <sup>†</sup>                               | Cut/Abrasion Immune                                 |  |
|   | <b>RK 4.4T-*</b>           | AWM PVC Grey<br>4x22 AWG<br>221 °F (105 °C)<br>5.2 mm OD<br>Cable #RF50516-*M <sup>†</sup>                                 | Flexlife  |  |
|   | <b>RK 4.4T-*/S90</b>       | AWM PUR Grey<br>4x22 AWG<br>221 °F (105 °C), 5.2 mm OD<br>Cable #RF50532-*M <sup>†</sup>                                   | Cut/Abrasion Immune                                 |  |
|   | <b>RK 4.4T-*/S101</b>      | AWM TPE Grey<br>4x22 AWG<br>221 °F (105 °C), 5.7 mm OD<br>Cable #RF50941-*M <sup>†</sup>                                   | Flexlife-10,<br>High Flex<br>Over 10 Million Cycles |  |
|   | <b>RK 4.4T-*/S824</b>      | PLTC PVC Grey<br>4x22 AWG<br>221 °F (105 °C), 5.2 mm OD<br>Cable #RF50698-*M <sup>†</sup>                                  | Tray Rated  |  |
|   | <b>RK 4.4T-*/S618</b>      | AWM PVC Grey<br>4x22 AWG, Foil/Drain<br>221 °F (105 °C), 5.2 mm OD<br>Cable #RF50577-*M <sup>†</sup>                       | RFI/EMI Shielding                                   |  |
|   | <b>RK 4.4T-*/S618/S824</b> | PLTC PVC Grey<br>4x22 AWG, Foil/Drain<br>221 °F (105 °C), 5.2 mm OD<br>Cable #RF50773-*M <sup>†</sup>                      | RFI/EMI Shielding<br>Tray Rate                      |  |

\* Length in meters. Standard cable lengths are 2, 4, 6, 8 and 10 meters. Consult factory for other lengths.

\*\* Standard coupling nut material is nickel plated brass "RK .."; "RKK .." indicates nylon, and "RKV .." indicates 316 stainless steel.

<sup>†</sup> For Reelfast<sup>®</sup> cable information see Connectivity Catalog.  
Shield is not connected to coupling nut.



**5-Pin M12 Eurofast Cordsets**

- For use with Turck's Absolute Encoders
- Straight and Right Angle Female Connectors
- NEMA 1, 3, 4, 6P, and IEC IP68, IP69K



| Drawing                | Part Number                | Cable  | Features                                   | Pinouts                                    |
|------------------------|----------------------------|--|--|--|
| <p><b>RKC ..</b></p>   | <b>E-RKC 4.5T-1695-*/A</b> | AWM PVC Grey<br>4x22 AWG 2 STP<br>221 °F (105 °C)<br>5.2 mm OD<br>Cable #RF51695-*M† | Turck's Analog Encoder                     | 1. N/C<br>2. BN<br>3. WH<br>4. GN<br>5. YE |
| <p><b>WKC ..</b></p>   | <b>E-WKC 4.5T-1695-*/A</b> |  |  |  |
| <p><b>E-RKC ..</b></p> | <b>E-RKC 4.5T-930-*</b>    | AWM PVC Black<br>5x24 AWG<br>221 °F (105 °C)<br>7.3 mm OD<br>Cable #RF50930-*M†      | Turck's Incremental Encoder (single-ended) | 1. BN<br>2. GY<br>3. WH<br>4. GN<br>5. BU  |

\* Length in meters. Standard cable lengths are 2, 5, 10 and 15 meters. Consult factory for other lengths.  
 \*\* Standard coupling nut material is nickel plated brass "E-RKC../E-WKC.," "E-RKCV../E-WKCV.." indicates 316 stainless steel.  
 † For Reelfast cable information see Connectivity Catalog.  
 Shield is not connected to coupling nut.

## 5-Pin M12 Eurofast Cordsets

- For use with Turck's Absolute Encoders
- Straight and Right Angle Female Connectors
- NEMA 1, 3, 4, 6P, and IEC IP68, IP69K



| Drawing              | Part Number             | Cable  | Features                                   | Pinouts |
|----------------------|-------------------------|--|--|---------|
| <p><b>RKC ..</b></p> | <b>RKC 572-*M/S3117</b> | TPU Blue/Grey<br>4x22 AWG 2 STP<br>167 °F (75 °C)<br>7.2 mm OD<br>Cable #RB50603-*M† | Turck's CANbus Encoder (without CANground) |         |
| <p><b>RSC ..</b></p> | <b>RSC 572-*M/S3118</b> |  |  |         |
| <p><b>RKC ..</b></p> | <b>RKC 572-*M</b>       | TPU Blue/Grey<br>4x22 AWG 2 STP<br>167 °F (75 °C)<br>7.2 mm OD<br>Cable #RB50603-*M† | Turck's CANbus Encoder (with CANground)    |         |
| <p><b>RSC ..</b></p> | <b>RSC 572-*M</b>       |  |  |         |

\* Length in meters. Standard cable lengths are 2, 5, 10 and 15 meters. Consult factory for other lengths.

\*\* Standard coupling nut material is nickel plated brass "E-RKC../E-WKC../E-RKCV../E-WKCV.. indicates 316 stainless steel.

† For Reelfast cable information see Connectivity Catalog.  
Shield is not connected to coupling nut.

5-Pin M12 Eurofast D-Coded Cordsets

CANopen

- Straight Male Connector
- NEMA 1, 3, 4, 6P and IEC IP68, IP69K Protection
- 250 V, 4 A



| Part Number      | Cable   | Features   | Pinouts   |
|------------------|---|--|---|
| WASW 4.5T-*/S618 | AWM PVC Grey<br>5x22 AWG<br>105 °C<br>5.7 mm OD<br>Cable #RF50609-*M† | Turck's CANbus multiturn encoder with incremental tracks | <ol style="list-style-type: none"> <li>1. BN</li> <li>2. WH</li> <li>3. BU</li> <li>4. BK</li> <li>5. GY</li> </ol> |

\* Length in meters. Standard cable lengths are 2, 4, 6, 8 and 10 meters. Consult factory for other lengths.  
 \*\* Standard coupling nut material is nickel plated brass "WASW .."; "WASKW .." indicates nylon, and "WASVW .." indicates 316 stainless steel.  
 † For Reelfast cable information see Connectivity Catalog.

M12 Eurofast D-Coded Cordsets Selection Matrix

Ethernet / EtherCAT

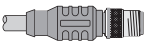

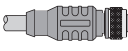

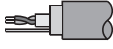
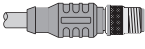
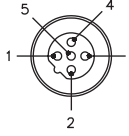
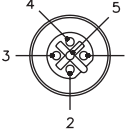
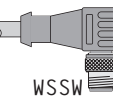
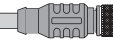
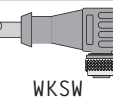
|          |                 | Eurofast         |                  |                     |                     |                    |
|----------|-----------------|------------------|------------------|---------------------|---------------------|--------------------|
|          |                 | Pin (Male)       | Socket (Female)  | Pin (Male)          | Socket (Female)     | RJ45 Plug          |
|          |                 | RSSW             | WSSW             | FSSDED              | FKSDED              | RJ45S              |
| Bare     |                 | RSSD 441-*M      | RKSD 441-*M      | FSSDED 441-*M       | FKSDED 441-*M       | RJ45S 441-*M       |
| Eurofast | Pin (Male)      | RSSD RSSD 441-*M | RSSD RKSD 441-*M | RSSD FSSDED 441-*M  | RSSD FKSDED 441-*M  | RSSD RJ45S 441-*M  |
|          | Socket (Female) |                  | RKSD RKSD 441-*M | RKSD FSSDED 441-*M  | RKSD FKSDED 441-*M  | RKSD RJ45S 441-*M  |
|          | RJ45 Plug       |                  |                  | RJ45S FSSDED 441-*M | RJ45S FKSDED 441-*M | RJ45S RJ45S 441-*M |
|          |                 |                  |                  |                     |                     |                    |

\* Cable length in meters. Refer to the Cordsets Builder at [www.turck.com](http://www.turck.com) for assistance with cordset/cable combinations. Standard cable lengths are 1, 2, 4, 5, 6, 8, 10, 15, and in +5 meter increments from there. Consult factory for other lengths. For stainless steel coupling nuts change part number RSSD...RSSDV, FSSDED...FSSDEDV. Shield is not connected to coupling nut.

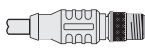
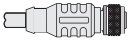
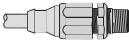
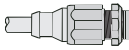

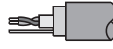
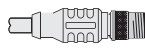
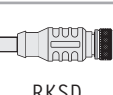

| Eurofast    | Pinout   | Eurofast      |
|-------------|--|---------------|
|             | <ol style="list-style-type: none"> <li>1. WH / OG (+ tx)</li> <li>2. WH / GR (+ rx)</li> <li>3. OG (- tx)</li> <li>4. GR (- rx)</li> </ol> |               |
| <b>Male</b> |  | <b>Female</b> |

| RJ45 Pinout  | RJ45 Plug                          | RJ45 (CR) Pinout   |
|--|------------------------------------|--|
| <ol style="list-style-type: none"> <li>1. WH / OG</li> <li>2. OG</li> <li>3. WH / GR</li> <li>4. N/C</li> <li>5. N/C</li> <li>6. GR</li> <li>7. N/C</li> <li>8. N/C</li> </ol> | <p>12345678</p> <p><b>Male</b></p> | <ol style="list-style-type: none"> <li>1. WH / GR</li> <li>2. GR</li> <li>3. WH / OG</li> <li>4. N/C</li> <li>5. N/C</li> <li>6. OG</li> <li>7. N/C</li> <li>8. N/C</li> </ol> |

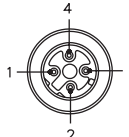
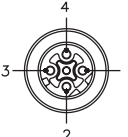
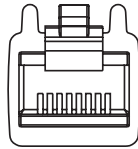
## M12 Eurofast Cordsets Selection Matrix PROFIBUS®-DP

|          |   | Eurofast  |   |   |   | Eurofast            | 590 Series Pinout  | Eurofast   |
|----------|---|---|---|---|---|---------------------|--|--|
|          |   | Pin (Male)  |   | Socket (Female)   |   |                     |  |  |
|          |   |  |  |  |  |                     |  |  |
|          |   | RSSW  | WSSW  | RKSW  | WKSX  |                     |  |  |
|          |  | RSSW 590-*M   | WSSW 590-*M   | RKSW 590-*M   | WKSX 590-*M   |                     |  |  |
| Eurofast | Pin (Male)  |  | RSSW RSSW<br>590-*M   | RSSW WSSW<br>590-*M   | RSSW RKSW<br>590-*M   | RSSW WKSX<br>590-*M |  <p><b>Male</b></p> |  <p><b>Female</b></p> |
|          |   |  |   | WSSW WSSW<br>590-*M   | WSSW RKSW<br>590-*M   | WSSW WKSX<br>590-*M |  |  |
| Eurofast | Socket (Female)   |  |   |   | RKSW RKSW<br>590-*M   | RKSW WKSX<br>590-*M |  |  |
|          |   |  |   |   |   | WKSX WKSX<br>590-*M |  |  |

## M12 Eurofast D-Coded Cordsets Selection Matrix PROFINET

|          |   | Eurofast  |   |   |  |   |                       |
|----------|---|---|---|---|--|---|-----------------------|
|          |   | Pin (Male)  |   | Socket (Female)   |  |   |                       |
|          |   |  |  |  |  |  |                       |
|          |   | RSSD  | RKSD  | FSSDED  | FKSDED   | RJ45S   |                       |
|          |  | RSSD 42x-*M   | RKSD 42x-*M   | FSSDED 42x-*M   | FKSDED 42x-*M  | RJ45S 42x-*M  |                       |
| Eurofast | Pin (Male)  |  | RSSD RSSD<br>42x-*M   | RSSD RKSD<br>42x-*M   | RSSD FSSDED<br>42x-*M  | RSSD FKSDED<br>42x-*M   | RSSD RJ45S<br>42x-*M  |
|          |   |  |   | RKSD RKSD<br>42x-*M   | RKSD FSSDED<br>42x-*M  | RKSD FKSDED<br>42x-*M   | RKSD RJ45S<br>42x-*M  |
|          | Socket (Female)   |  |   |   | RJ45S FSSDED<br>42x-*M   | RJ45S FKSDED<br>42x-*M  | RJ45S RJ45S<br>42x-*M |

\* Cable length in meters.  
 Refer to the Cordsets Builder at [www.turck.com](http://www.turck.com) for assistance with cordset/cable combinations.  
 Standard cable lengths are 1, 2, 4, 5, 6, 8, 10, 15, and in +5 meter increments from there. Consult factory for other lengths.  
 For stainless steel coupling nuts change part number RSSW...RSSWV.  
 Additional cable types available in the Fieldbus and Network I/O Catalog.  
 Shield is not connected to coupling nut.

| Eurofast   | 42x Series Pinout   | Eurofast   | RJ45 Pinout   | RJ45 Plug   | RJ45 (CR) Pinout  |
|--|---|--|---|---|---|
|  <p><b>Male</b></p> | 1. Yellow (+tx)<br>2. White (+rx)<br>3. Orange (-tx)<br>4. Blue (-rx) |  <p><b>Female</b></p> | 1. Yellow<br>2. Orange<br>3. White<br>4. N/C<br>5. N/C<br>6. Blue<br>7. N/C<br>8. N/C |  | 1. Yellow<br>2. Orange<br>3. White<br>4. N/C<br>5. N/C<br>6. Blue<br>7. N/C<br>8. N/C |

## Plug & Play with Standard Automotive Connectors

On request, Turck can also supply the encoders with short cables and connectors as commonly used with standard makes in the automotive sector: Deutsch, Packard, and Molex are just some examples. This makes connection on the prefabricated cable harness a simple plug & play operation with a proven connection technology.



## 8-Pin M12 Eurofast Cordsets

- For use with Turck's Encoders
- Straight and Right Angle Female Connectors
- NEMA 1, 3, 4, 6P, and IEC IP68, IP69K
- 60 VAC/75 VDC, 2 A



| Drawing  | Part Number                 | Cable  | Features  | Pinouts   |  |
|--|-----------------------------|--|---|---|--|
| <p><b>RKC ..</b></p> <p>1.654 [42.0]<br/>0.532 [13.5]<br/>M12x1<br/>ANTI-VIBRATION DETENT</p> <p><b>WKC ..</b></p> <p>1.736 [44.1]<br/>1.122 [28.5]<br/>0.532 [13.5]<br/>M12x1</p> | <b>E-RKC 8T-930-*</b>       | AWM PVC Black<br>8x24 AWG<br>221 °F (105 °C)<br>7.3 mm OD<br>RF50930- <sup>*</sup> M+        | Incremental,<br>Differential Mode<br>Applications, RFI/EMI<br>Protection                    | 1. WH<br>2. BN<br>3. GN<br>4. YE<br>5. GY<br>6. PK<br>7. BU<br>8. RD      |  |
|  | <b>E-WKC 8T-930-*</b>       |  |   |   |  |
|  | <b>E-RKC 8T-930-*/S1115</b> | AWM PVC Black<br>5x24 AWG<br>221 °F (105 °C)<br>7.3 mm OD<br>RF50930- <sup>*</sup> M+        | Incremental, Single<br>Ended Mode<br>Applications, RFI/EMI<br>Protection                    | 1. WH<br>2. BN<br>3. GN<br>4. N/C<br>5. GY<br>6. N/C<br>7. BU<br>8. N/C   |  |
|  | <b>E-WKC 8T-930-*/S1115</b> |  |   |   |  |
|  | <b>E-RKC 8T-074-*/S3012</b> | AWM PVC Grey<br>3x22 AWG<br>221 °F (105 °C)<br>5.2 mm OD<br>RF51074- <sup>*</sup> M+         | Incremental,<br>Single Ended Mode,<br>Single Channel<br>Applications, RFI/EMI<br>Protection | 1. BN<br>2. BU<br>3. BK<br>4. N/C<br>5. N/C<br>6. N/C<br>7. N/C<br>8. N/C |  |
|  | <b>E-WKC 8T-074-*/S3012</b> |  |   |   |  |
|  | <b>E-RKC 8T-264-*</b>       | AWM PVC Black<br>8x24 AWG, 4 STP<br>221 °F (105 °C)<br>7.3 mm OD<br>RF51264- <sup>*</sup> M+ | Incremental,<br>Absolute,<br>Differential Mode<br>Applications, RFI/EMI<br>Protection       | 1. WH<br>2. BN<br>3. GN<br>4. YE<br>5. GY<br>6. PK<br>7. BU<br>8. RD      |  |
|  | <b>E-WKC 8T-264-*</b>       |  |   |   |  |
|  |                             |  |   |   |  |

\* Length in meters. Standard cable lengths are 2, 5, 10 and 15 meters. Consult factory for other lengths.

\*\* Standard coupling nut material is nickel plated brass <sup>\*</sup>E-RKC./E-WKC.; <sup>\*</sup>E-RKC./E-WKC. indicates 316 stainless steel.

† For Reelfast cable information see Connectivity Catalog.

STP Shielded twisted pair.

Shield is not connected to coupling nut.

8-Pin M12 Eurofast Cordset with LEDs

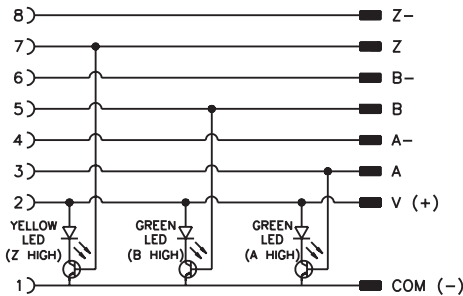
- For use with Turck’s Encoders
- Right Angle Female Connector
- NEMA 1, 3, 4, 6P, and IEC IP68, IP69K
- 5-30 VDC



| Drawing  | Part Number        | Cable  | Features  | Pinout   |
|--|--------------------|--|---|--|
| <p>LED B(Green)<br/>LED Z(YELLOW)<br/>LED A(Green)</p> <p>1.811 [46.0]<br/>1.299 [33.0]<br/>ø.591 [15.0]<br/>M12x1</p> | E-WKC 8T-PX3-930-* | AWM PVC<br>Black 8x24 AWG<br>221°F (105 °C)<br>7.2 mm OD<br>RF50930-*Mt        | Incremental,<br>3 indicator LEDs<br>in translucent<br>molded connector<br>for use with Turck<br>Incremental<br>Encoders | 1. WH<br>2. BN<br>3. GN<br>4. YE<br>5. GY<br>6. PK<br>7. BU<br>8. RD |
|  | E-WKC 8T-PX3-264-* | AWM PVC Black<br>8x24 AWG, 4 STP<br>221°F (105 °C)<br>7.3 mm OD<br>RF51264-*M+ | Incremental,<br>Absolute,<br>Differential Mode<br>Applications, RFI/<br>EMI Protection                                  | 1. WH<br>2. BN<br>3. GN<br>4. YE<br>5. GY<br>6. PK<br>7. BU<br>8. RD |

\* Length in meters. Standard cable lengths are 2, 4, 6, 8 and 10 meters.  
 \*\* Standard coupling nut material is nickel plated brass "WKC."; "WKC." indicates 316 stainless steel.  
 † For Reelfast cable information see Connectivity Catalog.  
 Shield is not connected to coupling nut.

Wiring Diagram



8-pin Cordset with Encoder



Note:

LEDs for indication of channels A, B and Z. Green LEDs indicate channels A and B, while amber is used for the index channel. LEDs can also be used during machine set-up for home position indication, and provide operational status of encoder output channels.

## 5-Wire M12 Eurofast Field Wireable Connectors

- Screw Terminals
- No Soldering Required
- IEC IP67 Protection



| Drawing | Part Number           | Specifications  | Application  | Pinouts |
|---------|-----------------------|---|--|---------|
|         | <b>B 8151-0/PG 9</b>  | PBT, Black PG 9 cable gland, accepts 6-8 mm cable diameter.                   | Mates with standard key 5-pin cordsets and receptacles |         |
|         | <b>BS 8151-0/PG 9</b> | Screw terminals accepts up to 18 AWG conductors.<br>185 °F (85 °C) 125 V, 4 A | Mates with standard key 5-pin cordsets and receptacles |         |

## 8-Wire M12 Eurofast Field Wireable Connectors, Shielded, Screw Terminals

- Screw Terminals
- No Soldering Required
- IEC IP67 Protection



| Drawing | Part Number        | Specifications  | Application   | Pinouts |
|---------|--------------------|---|---|---------|
|         | <b>CMB 8181-0</b>  | Nickel Plated Brass PG9 cable gland accepts 6-8 mm cable diameter.                    | Metal, Fully Shielded<br>Mates with standard key 8-pin cordsets and receptacles |         |
|         | <b>CMBS 8181-0</b> | Screw terminals accepts up to 18 AWG conductors.<br>185 °F (85 °C) 60 VAC/75 VDC, 4 A | Metal, Fully Shielded<br>Mates with standard key 8-pin cordsets and receptacles |         |



12-Pin and 17-Pin M23 Multifast Cordsets

- Female Coupling Nut, Female Contact
- Shielded, High Grade, Oil and UV Resistant, PVC



| Drawing                  | Part Number   | Specifications   | Application  | Pinouts  |        |        |           |       |           |        |           |        |           |           |           |        |           |       |           |       |  |
|--------------------------|---|--|--|--|--------|--------|-----------|-------|-----------|--------|-----------|--------|-----------|-----------|-----------|--------|-----------|-------|-----------|-------|--|
|                          | <b>E-CKM 12-931-*</b>   | 12x24 Black PVC<br>7.2 mm O.D. 26 AWG<br>Drain, Foil and Braided Shield<br>221 °F (105 °C) | 12-pin<br>Incremental  | <table border="0"> <tr> <td>1. PK</td> <td>7. N/C</td> </tr> <tr> <td>2. RD/BU</td> <td>8. GY</td> </tr> <tr> <td>3. BU</td> <td>9. N/C</td> </tr> <tr> <td>4. RD</td> <td>10. WH</td> </tr> <tr> <td>5. GN</td> <td>11. PK/GY</td> </tr> <tr> <td>6. YE</td> <td>12. BN</td> </tr> </table> | 1. PK  | 7. N/C | 2. RD/BU  | 8. GY | 3. BU     | 9. N/C | 4. RD     | 10. WH | 5. GN     | 11. PK/GY | 6. YE     | 12. BN |           |       |           |       |  |
|                          | 1. PK   | 7. N/C   |  |  |        |        |           |       |           |        |           |        |           |           |           |        |           |       |           |       |  |
|                          | 2. RD/BU  | 8. GY  |  |  |        |        |           |       |           |        |           |        |           |           |           |        |           |       |           |       |  |
| 3. BU                    | 9. N/C  |  |  |  |        |        |           |       |           |        |           |        |           |           |           |        |           |       |           |       |  |
| 4. RD                    | 10. WH  |  |  |  |        |        |           |       |           |        |           |        |           |           |           |        |           |       |           |       |  |
| 5. GN                    | 11. PK/GY   |  |  |  |        |        |           |       |           |        |           |        |           |           |           |        |           |       |           |       |  |
| 6. YE                    | 12. BN  |  |  |  |        |        |           |       |           |        |           |        |           |           |           |        |           |       |           |       |  |
| <b>E-CKM 12-1687-*/A</b> | 12x26 Grey PVC<br>8.4 mm O.D. 28 AWG<br>Drain, Foil and Braided Shield<br>176 °F (80 °C)    | 12-pin<br>Absolute   | <table border="0"> <tr> <td>1. WH</td> <td>7. BU</td> </tr> <tr> <td>2. BN</td> <td>8. RD</td> </tr> <tr> <td>3. GN</td> <td>9. BK</td> </tr> <tr> <td>4. YE</td> <td>10. VT</td> </tr> <tr> <td>5. GY</td> <td>11. PK/GY</td> </tr> <tr> <td>6. PK</td> <td>12. RD/BU</td> </tr> </table>   | 1. WH  | 7. BU  | 2. BN  | 8. RD     | 3. GN | 9. BK     | 4. YE  | 10. VT    | 5. GY  | 11. PK/GY | 6. PK     | 12. RD/BU |        |           |       |           |       |  |
| 1. WH                    | 7. BU   |  |  |  |        |        |           |       |           |        |           |        |           |           |           |        |           |       |           |       |  |
| 2. BN                    | 8. RD   |  |  |  |        |        |           |       |           |        |           |        |           |           |           |        |           |       |           |       |  |
| 3. GN                    | 9. BK   |  |  |  |        |        |           |       |           |        |           |        |           |           |           |        |           |       |           |       |  |
| 4. YE                    | 10. VT  |  |  |  |        |        |           |       |           |        |           |        |           |           |           |        |           |       |           |       |  |
| 5. GY                    | 11. PK/GY   |  |  |  |        |        |           |       |           |        |           |        |           |           |           |        |           |       |           |       |  |
| 6. PK                    | 12. RD/BU   |  |  |  |        |        |           |       |           |        |           |        |           |           |           |        |           |       |           |       |  |
| <b>E-CKM 17-942-*</b>    | 18x24 Yellow PVC<br>7.6 mm O.D. 26 AWG<br>Drain, Foil and Braided Shield<br>221 °F (105 °C) | 17-pin<br>Absolute   | <table border="0"> <tr> <td>1. WH</td> <td>10. VT</td> </tr> <tr> <td>2. BN</td> <td>11. PK/GY</td> </tr> <tr> <td>3. GN</td> <td>12. RD/BU</td> </tr> <tr> <td>4. YE</td> <td>13. WH/GN</td> </tr> <tr> <td>5. GY</td> <td>14. BN/GN</td> </tr> <tr> <td>6. PK</td> <td>15. WH/YE</td> </tr> <tr> <td>7. BU</td> <td>16. YE/BN</td> </tr> <tr> <td>8. RD</td> <td>17. WH/GY</td> </tr> <tr> <td>9. BK</td> <td></td> </tr> </table> | 1. WH  | 10. VT | 2. BN  | 11. PK/GY | 3. GN | 12. RD/BU | 4. YE  | 13. WH/GN | 5. GY  | 14. BN/GN | 6. PK     | 15. WH/YE | 7. BU  | 16. YE/BN | 8. RD | 17. WH/GY | 9. BK |  |
| 1. WH                    | 10. VT  |  |  |  |        |        |           |       |           |        |           |        |           |           |           |        |           |       |           |       |  |
| 2. BN                    | 11. PK/GY   |  |  |  |        |        |           |       |           |        |           |        |           |           |           |        |           |       |           |       |  |
| 3. GN                    | 12. RD/BU   |  |  |  |        |        |           |       |           |        |           |        |           |           |           |        |           |       |           |       |  |
| 4. YE                    | 13. WH/GN   |  |  |  |        |        |           |       |           |        |           |        |           |           |           |        |           |       |           |       |  |
| 5. GY                    | 14. BN/GN   |  |  |  |        |        |           |       |           |        |           |        |           |           |           |        |           |       |           |       |  |
| 6. PK                    | 15. WH/YE   |  |  |  |        |        |           |       |           |        |           |        |           |           |           |        |           |       |           |       |  |
| 7. BU                    | 16. YE/BN   |  |  |  |        |        |           |       |           |        |           |        |           |           |           |        |           |       |           |       |  |
| 8. RD                    | 17. WH/GY   |  |  |  |        |        |           |       |           |        |           |        |           |           |           |        |           |       |           |       |  |
| 9. BK                    |   |  |  |  |        |        |           |       |           |        |           |        |           |           |           |        |           |       |           |       |  |

\* Length in meters. Standard cable lengths are 2, 5, 10 and 15 meters. Consult factory for other lengths.  
 \*\* Standard coupling nut material is nickel plated brass "E-RKC./E-WKC.," "E-RKCV./E-WKCV." indicates 316 stainless steel.  
 \*\*\* Reversed from standard M23 connector.  
 † For Reelfast cable information see Connectivity Catalog. Shield is not connected to coupling nut.

12-Pin and 17-Pin M23 Multifast Field Wireable Connectors, Shielded, Solder Cup

- Solder Cup
- IEC IP65 Protection



| Drawing | Part Number       | Specifications             | Application  | Pinout |
|---------|-------------------|----------------------------|--|--------|
|         | <b>E-CKS 12-0</b> | Solder Cup<br>up to 18 AWG | Metal, fully shielded<br>Mates with 12-pin encoders  |        |
|         | <b>E-CKS 17-0</b> | Solder Cup<br>up to 17 AWG | Metal, fully shielded<br>Mates with 17-pin encoders  |        |
|         | <b>CSS 17-0</b>   | Solder Cup<br>Up to 17 AWG | Metal, fully shielded<br>For custom extension cables |        |

\*\*\* Reversed from standard M23 connector.

# Connectivity

## Military Cordsets

- 7 and 10-pin
- Shielded, High Grade, Oil and UV Resistant, PVC



| Drawing | Part Number          | Specifications  | Application                                      | Pinouts  |
|---------|----------------------|---|--|--|
|         | <b>E-MK 7-930-*</b>  | 24 AWG, Black PVC<br>7.3 mm O.D.<br>26 AWG Drain<br>Foil & Braided Shield,<br>221 °F (105 °C) | 7-pin, Threaded<br>Mates with<br>7-pin encoder   | A. WH<br>B. BN<br>C. GN<br>D. YE<br>E. GY<br>F. PK<br>G. BU                |
|         | <b>E-MK 10-931-*</b> | 24 AWG, Black PVC<br>7.2 mm O.D.<br>26 AWG Drain<br>Foil & Braided Shield<br>221 °F (105 °C)  | 10-pin, Threaded<br>Mates with<br>10-pin encoder | A. GN F. WH<br>B. GY G. YE<br>C. BU H. PK<br>D. BN I. RD<br>E. BK J. Drain |

\* Cable length in meters.  
 \*\*\* Reversed.  
 Shield is not connected to coupling nut.

## Military Field Wireable Connectors

- 6, 7 and 10-pin
- Threaded and Bayonet Styles



| Drawing | Part Number      | Specifications        | Application                                      | Pinouts |
|---------|------------------|-----------------------|--|---------|
|         | <b>E-MK 6-0</b>  |                       | 6-pin, Threaded<br>Mates with<br>6-pin encoder   |         |
|         | <b>E-MK 7-0</b>  | Solder cup connection | 7-pin, Threaded<br>Mates with<br>7-pin encoder   |         |
|         | <b>E-MK 10-0</b> |                       | 10-pin, Threaded<br>Mates with<br>10-pin encoder |         |

# GENERAL INFORMATION

| <b>SERIES</b>                        | <b>TYPE</b>                | <b>PAGE</b> |
|--------------------------------------|----------------------------|-------------|
| <b>Rotary Measurement Technology</b> | Overview                   | <b>I2</b>   |
|                                      | Encoders                   | <b>I5</b>   |
|                                      | Incremental                | <b>I9</b>   |
|                                      | Absolute                   | <b>I17</b>  |
| <b>Linear Measurement Technology</b> | Overview                   | <b>I24</b>  |
|                                      | <b>IP Protection Class</b> | <b>I25</b>  |

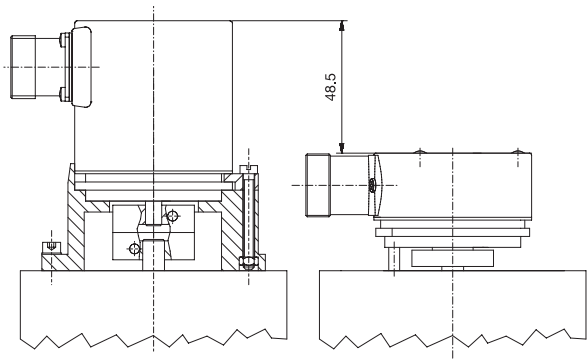
## Rotary Measurement Technology

### Introduction:

Encoders may be used in applications where length, position, speed or an angular position is measured. They transform mechanical movements into electrical signals, and can be divided into incremental and absolute measuring systems.

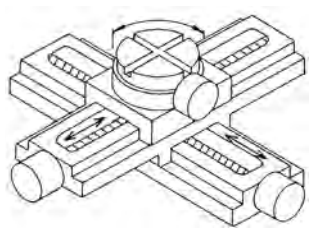
Incremental encoders generate pulses, where the number of pulses can be a measure of speed, length or position. In absolute encoders, every position corresponds to a unique code pattern, so that the actual position is recognized.

Turck can supply all encoders, whether its a solid shaft or hollow shaft version. Using a hollow shaft encoder saves up to 30% of costs and up to 50% of the required space, compared to a shaft encoder. This is achieved by avoiding additional couplings, brackets and other assembly aids.

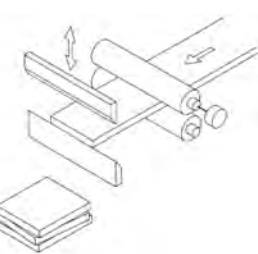


### Application Examples:

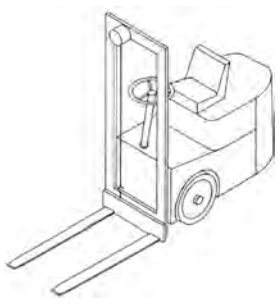
#### Positioning



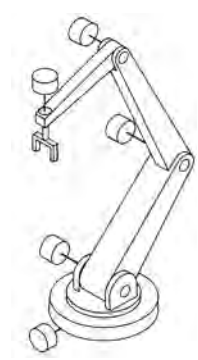
#### Length Measurement



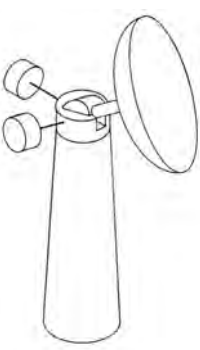
#### Detecting a Fork's Position



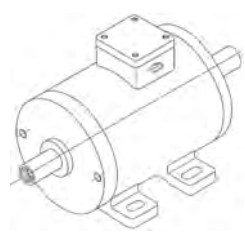
#### Detecting Position



#### Angular Measurement



#### Velocity Measurement e.g., in drive engineering (geared motors)



Rotary Measurement Technology

Approvals:



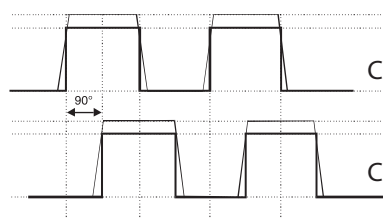
Most Turck products carry UL (Underwriters Laboratories Inc.) approvals. Turck products comply with RoHS standards.



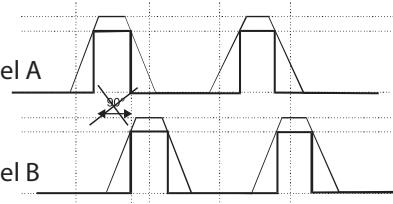
Aging Compensation:

LEDs inevitably lose power over a period of time. As a result, the output signal degrades. The phase shift between channel A and B of 90° also degrades, and the direction of rotation may no longer be detected. A special electronic circuit built into the Turck specific ASIC prevents this effect.

Signals of a new encoder or encoders with aging compensation:



Signals of an older encoder without aging compensation:



**Benefit:** The aging compensation circuit ensures the same signal, even after many years of operating time. Machine downtime is reduced dramatically, while reliability is increased.

Temperature Compensation:

This specialized circuit ensures that the quality of the signal will stay on the same high level over the whole working temperature range.

**Benefit:** The positioning accuracy of a machine will not be affected by temperature changes.

Current Consumption:

The values for current consumption in this catalog apply for ambient temperature (23 °C). Because of the temperature compensation, the current consumption of the encoder rises with the temperature. This increase in current is taken into consideration when giving the figure for maximum current consumption. The output currents are dependent on the user's input circuit and are therefore not included in the figures given; these should be calculated and added in.

Short-Circuit Protection:

The outputs of all the encoders are short-circuit protected, provided that the supply voltage is correctly wired. If an output is connected by mistake to 0 V or +Ub or with another output, the device will not be damaged. As soon as the error is corrected, the encoder is ready for use again.

**Benefit:** Wiring circuit errors during installation that often occur in the hectic day-to-day industrial environments do not lead to the encoder being permanently damaged.

Environmental Conditions:

A significant influence on the lifetime of the encoder is set by the environment in which the encoder is operating. For example, the ambient temperature, expected shaft load, and possible grade of dust/dirt and humidity/liquids. The support design and the use of high quality components makes our encoders suitable for applications in rough conditions. Many references from customers including Bosch, Siemens, and Bombardier are proof of this high quality.

# General Information

## Rotary Measurement Technology

### Temperature:

Definition according to  
DIN standards 32 878

**Working Temperature:** Is defined as the environmental temperature in which the encoder will produce the signals defined in the data sheets.

**Operating Temperature:** Is defined as the environmental temperature that the encoder can withstand without getting damaged.

### Dirt/Dust and Humidity/Water:

An ingress protection (IP) classification according to EN 60529 describes how the encoder is protected against particles and water. The first digit following IP defines the size of the particles. The higher the number, the smaller the particles. The second digit defines the resistance against water. The higher the number, the higher the water pressure can be. Turck encoders have a protection up to IP67.

#### Protection Against Particles (first digit):

|   |  |
|---|--|
| 0 | Not protected                                  |
| 1 | Protected against particles 50 mm and larger   |
| 2 | Protected against particles 12.5 mm and larger |
| 3 | Protected against particles 2.5 mm and larger  |
| 4 | Protected against particles 1.0 mm and larger  |
| 5 | Protected against dust                         |
| 6 | Dust proof                                     |

**IP69k** acc. to DIN 40050 Part 9: protected against high-pressure water/steam jet cleaning

#### Protection Against Particles (second digit):

|   |   |
|---|---|
| 0 | Not protected   |
| 1 | Protected against vertically falling drops of water   |
| 2 | Protected against falling drops of water up to 15° from vertical                                |
| 3 | Protected against water sprayed up to 60° from vertical   |
| 4 | Protected against water sprayed from all directions, limited ingress permitted                  |
| 5 | Protected against low pressure jets from all directions, limited ingress permitted              |
| 6 | Protected against strong jets of water (e.g., for use on ship decks), limited ingress permitted |
| 7 | Protection against the affects of immersion between 15 cm and 1 m                               |
| 8 | Protected against long periods of immersion under pressure                                      |

### Designation of Colors:

to DIN standard 757

| Abbreviation | Color  |
|--------------|--------|
| BK           | black  |
| BN           | brown  |
| RD           | red    |
| OG           | orange |
| YE           | yellow |
| GN           | green  |
| BU           | blue   |

| Abbreviation | Color     |
|--------------|-----------|
| VT           | violet    |
| GY           | gray      |
| WH           | white     |
| PK           | pink      |
| GD           | gold      |
| TQ           | turquoise |
| SR           | silver    |

### Bearing-Lock:

**Bearing-Lock:** The proven Bearing-Lock construction with an additionally mechanical protected shaft seal.



**Rotary Measurement Technology - Encoders**

**Installing Encoders:**

Encoder shafts and bearings are subjected to loads for a variety of reasons:

- Installation tolerances when mounting the encoders (radial and angular displacement)
- Thermal changes (e.g., linear expansion of the drive shaft)
- Effects of wear (e.g., radial runout of the drive shaft or vibrations)

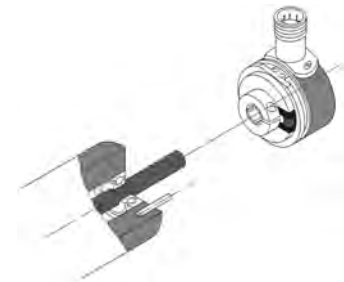
These load factors have a direct effect on the life expectancy of the shaft bearings and on the quality of the signal. For this reason, Turck provides a wide variety of accessories that should be used to compensate for these forces. For encoders with a solid shaft, this is generally done by using shaft couplings between the drive shaft and the encoder shaft. The solution with hollow shaft encoders is to use flex couplings, fixing brackets, or torque stops between the encoder bracket and the mounting surface. Not using a coupling generally leads to unacceptably high loads on the bearings; the ensuing wear will cause the encoder to fail prematurely.

In order to avoid permanent damage of the encoder, certain bearing loads should not be exceeded. If hollow shaft encoders are correctly installed and the torque stops or flex couplings that are available from Turck are used, then no problems will occur. For solid shaft encoders, the maximum permitted axial and radial loads are shown in the appropriate technical data.

**Mounting Examples for Hollow Shaft Encoders:**

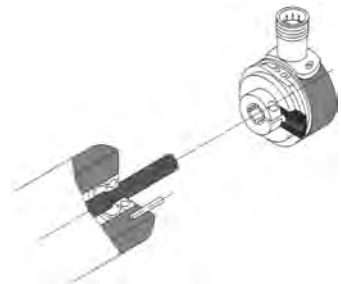
Mounting a hollow shaft encoder with torque stop and pin is easiest and fastest. Standard hollow shaft encoders are equipped with the torque stop.

**Application:** If axial play is less than 0.5 mm and a resolution of up to 2500 ppr (if no pulse doubling is used).



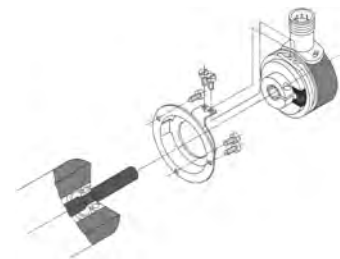
Mounting of a hollow shaft encoder with extended torque stop and long pin.

**Application:** Especially recommended if there is a large axial play. Due to the larger mounting radius of the pin, the resolution can be higher (up to 3600 ppr, if no pulse doubling is used).



Mounting of a hollow shaft encoder with a flex coupling.

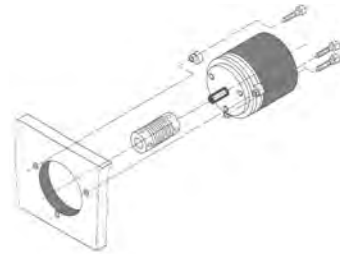
**Application:** For higher resolution or if no pin can be used due to mechanical restrictions. No restrictions on resolution.



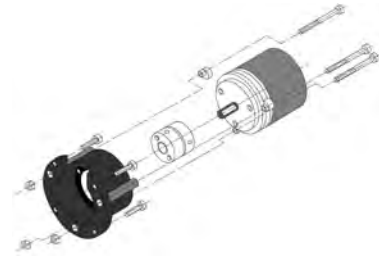
## Rotary Measurement Technology - Encoders

### Mounting Examples for Shaft Encoders with Servo Bracket:

Mounting with fastening eccentrics and coupling (to reduce shaft overload).

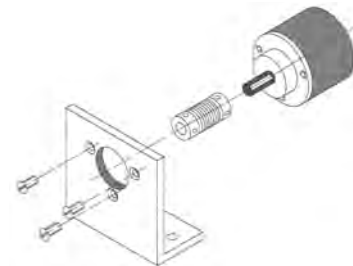


Mounting with assembly bell, fastening eccentrics and coupling (to prevent shaft overload and to insulate the encoder thermally and electrically).

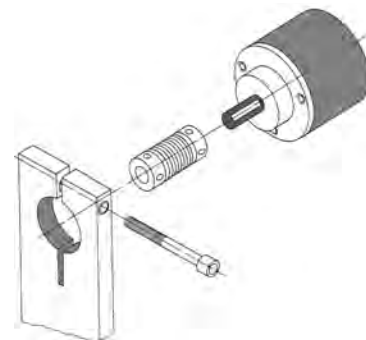


### Mounting Examples for Shaft Encoders with Clamping Bracket:

Mounting with an angular bracket and coupling (to reduce shaft overload).



Mounting with a commonly used clamping device and coupling (to reduce shaft overload).





**Rotary Measurement Technology - Encoders**

**Loading of Encoder Shaft Bearings Using Coupling Forces:**

With all spring couplings (shaft coupling, flex coupling, fixing bracket), alignment and axial errors are converted to a force that corresponds to the spring constant of the coupling. This force has to be absorbed by the encoder shaft bearings. When installing an encoder, this should be done with as little force as possible; i.e., without any unnecessary initial tension on the coupling. If this is adhered to, adequate tolerance compensation is guaranteed for the whole service life of the encoder bearings.

This force does not occur with torque stops for hollow shaft encoders, where the encoder is prevented from turning by means of a pin or rod. Although the encoder is prevented from rotating due to a rigid interlock, the encoder is still free to move in any other direction. This is dependent on it being mounted in such a way that it has freedom to move radially and axially (thermal linear expansion of the drive shaft).

**Possible Errors in Accuracy Due to Couplings:**

**1. Deviations in accuracy caused by torsion of a spring coupling (in particular shaft couplings)**

This deviation in accuracy is defined by the torque to be transmitted (bearing friction and mass moment of inertia) and by the torsional spring constant of the torque stop.

The following applies: 
$$\text{Max. error (degree)} = \frac{\text{max. torque [Ncm]}}{\text{torsional spring constant [Ncm/degree]}}$$

The following table serves to estimate the ratio between such an error and the smallest increment of an encoder:

**Relationship between the resolution of an encoder in bit and the smallest increment in angular degrees:**

|                   |                 |         |         |         |         |         |         |
|-------------------|-----------------|---------|---------|---------|---------|---------|---------|
| <b>Resolution</b> | binary          | 10 bit  | 11 bit  | 12 bit  | 13 bit  | 14 bit  | 17 bit  |
|                   | ppr             | 1024    | 2048    | 4096    | 8192    | 16384   | 131072  |
| <b>Increment</b>  | degrees         | 0.352   | 0.176   | 0.088   | 0.044   | 0.022   | 0.0028  |
|                   | degrees:min:sec | 0:21:06 | 0:10:33 | 0:05:16 | 0:02:38 | 0:01:19 | 0:00:10 |
|                   | sec             | 1266    | 633     | 316     | 158     | 79      | 010     |

**2. Deviations in accuracy caused by radial play in the drive shaft with asymmetrical mounting of the couplings**

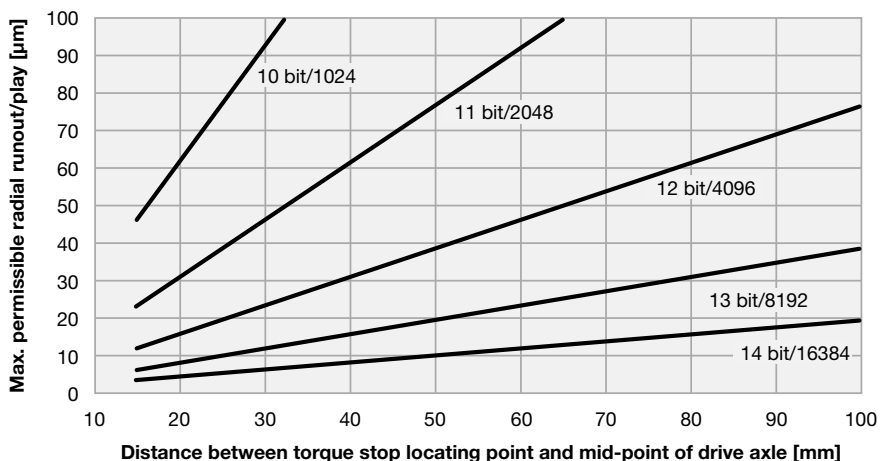
Here, one has to differentiate between couplings that are mounted in an axially symmetrical manner around the shaft (all shaft couplings, many flex couplings) and asymmetrically mounted couplings (many flex couplings, all mounting brackets and pin-based torque stops).

With asymmetrical couplings, deviations in accuracy can arise due to radial movements of the drive shaft (radial runout/play). These deviations are dependent on the amount of the radial play and the distance of the torque stop locating point from the drive shaft.

## Rotary Measurement Technology - Encoders

Maximum permissible radial runout to achieve an accuracy  $>1/2$  LSB when using an asymmetrical 1 point torque stop:

The relationship is shown in the following diagram:



### Particular Shaft Loading Due to Toothed-Wheels, Gear-Pulleys and Similar Elements:

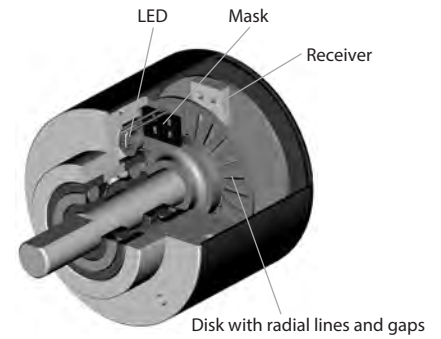
Measuring wheels, toothed wheels or gear pulleys, which are mounted directly on the encoder shaft, exert radial forces on the latter, dependent on pre-stressing and angular acceleration. Turck encoders are designed to absorb these forces to a great extent. The maximum permissible load capacity of the shaft is shown in the technical data for the encoder. If these load values are exceeded, the encoder shaft must be isolated from the radial load by selecting an appropriate shaft with its own bearings that can absorb the forces. Turck offers suitable bearing blocks and bearing boxes for this purpose (please refer to the page G1, Accessories in this catalog).

**Rotary Measurement Technology - Incremental Encoders**

**Incremental Encoders Assembly and Function:**

**Optical Scanning**

The optical encoder operates on the Moiré Fringe principal of optics. Light from the LED passes through the code disk, the mask, and onto the photo receiver. The photo receiver outputs a sine wave which corresponds to the flashing light pulses from the LED. The sine wave is then converted to a square wave by the receiver circuitry.



**Magnetic Scanning**

In addition to optical encoders, Turck offers encoders that use magnetic technology to create a robust incremental encoder. The magnetic field of the permanent magnet is rotated over the magnetic ASIC sensor that convert the changing magnetic fields into incremental encoder signals.



**Incremental**

**Mechanical Advantages of Turck Encoders:**

**Sturdy bearing construction: "Bearing-Lock design"**

- Interlocked bearings, large bearing span and strong outer bearings ensure stability when subjected to vibration.
- Ideal for outdoor use thanks to its solid die-cast housing and radial shaft seal, as well as IP67 protection rating and a temperature range from -40 to 185 °F (-40 to 85 °C).

**Processing of the Signals:**

The sine wave signals are processed in an electronic circuitry, usually a Turck specific ASIC. This is necessary because most controllers require digital signals with a certain voltage level. Signals are pre-processed in the encoder by the output circuit depending on the application.

**Selecting an Incremental Encoder:**

When selecting a suitable incremental encoder, refer to the general selection criteria shown on page G1, Accessories.

**Multiplication of Pulses:**

The resolution of a two channel encoder can be multiplied by two or four using special edge detecting.

An encoder with physically 5,000 pulses per revolution can generate 20,000 pulses per revolution using this technique.

## Rotary Measurement Technology - Incremental Encoders

### Inverted Signals:

When used in environments with high electrical noise and/or very long cable distances, it is recommended to use encoders with inverted (complementary) signals. These signals are available with RS422 and sine wave outputs. Turck also offers push-pull outputs.

### Number of Channels:

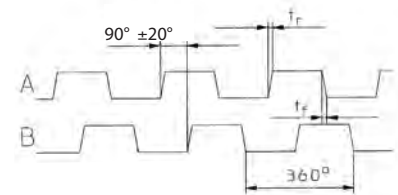
#### Encoders with one output channel:

Encoders with one output channel are used where no direction sensing is needed (e.g., speed control or length measuring).

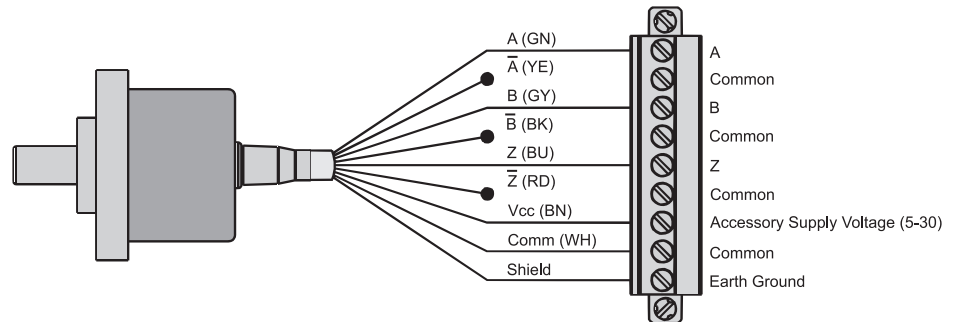
#### Encoders with two output channel:

Applications to sense the direction of a rotation require encoders with two channels (A and B) being shifted  $90^\circ$  out of phase. By detecting the phase shift, the direction can be located.

- Shaft turning clockwise, top-view of shaft
- Inverted signals available
- 0-pulse is linked with channel A and B;  
tr = rise time, tf = fall time



#### Single ended connection:



Complements (A not, B not, Z not) should never be tied to common or to each other. The unused wires should be tied back and insulated to prevent them from touching Vcc, common or any other signal wires or driver damage can occur.

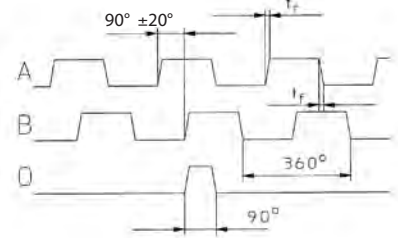
**Rotary Measurement Technology - Incremental Encoders**

**Number of Channels:**

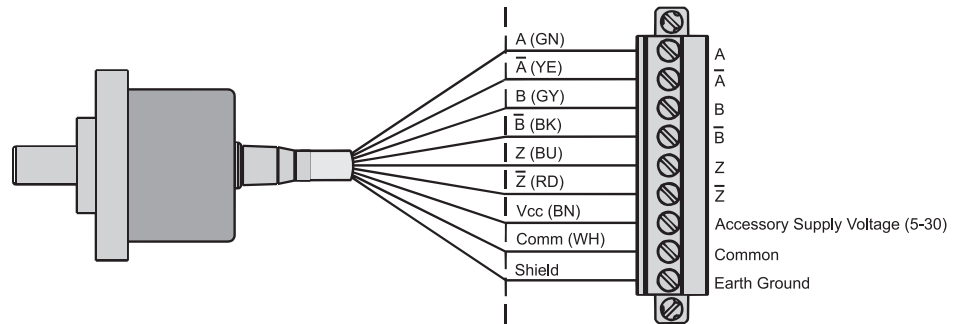
**Encoders with three output channels:**

In addition to two channels, a zero signal that appears once per turn is also available. This can be used as a reference signal during the first revolution after power up.

- Shaft turning clockwise, top-view of shaft
- Inverted signals available
- 0-pulse is linked to AND with channel A and B;  
tr = rise time, tf = fall time



**Differential Wiring:**



For general industrial environments where there are no large motor or drives present, the standard M12 Eurofast® cordset with non-twisted pair conductors will suffice. In heavy industrial environments, or when used on AC vector motors, M12 Eurofast cordsets with twisted pairs should be used.

**Resolution - Measuring Wheel:**

An encoder is equipped with a measuring wheel. Every revolution corresponds to a distance of 200 mm (circumference). The accuracy should be 0.1 mm. What is the required resolution (ppr)?

Given:

Circumference of the measuring wheel:  
U = 200 [mm]

Accuracy of the system:  
G = 0.1 [mm]

Wanted: Resolution of the encoder:

A = ? [pulses/revolution]

$$\text{resolution} = \frac{\text{circumference}}{\text{accuracy}} = \frac{U}{G}$$

**Sensor Outputs:**

The sensor outputs are used if the distance from the encoder to the control unit is very long and the voltage supply at the encoder could drop due to this long distance.

The input impedance of the sensor inputs (Controller) is very high, and the voltage drop on the sensor output line is almost zero. Due to this, it is possible to detect the actual supply voltage of the encoder (e.g., 4.2 V instead of 5 V). Based on this information, the controller will increase the voltage supply to, for example, 5.8 V. This feature is generally available on selected 5000, 5800 and A02H encoder models. Please refer to the selection guides for more information on this feature.

## Rotary Measurement Technology - Incremental Encoders

### Pulse Frequency:

The required pulse frequency can be calculated based on the number of pulses per revolution (ppr) and the speed (rpm). The maximum pulse frequency is listed for each encoder. The pulse frequency can be from 300 kHz to 800 kHz.

### Example:

How to calculate the required pulse frequency  $f_{max}$ :

Given: speed

$n = 3000$  RPM

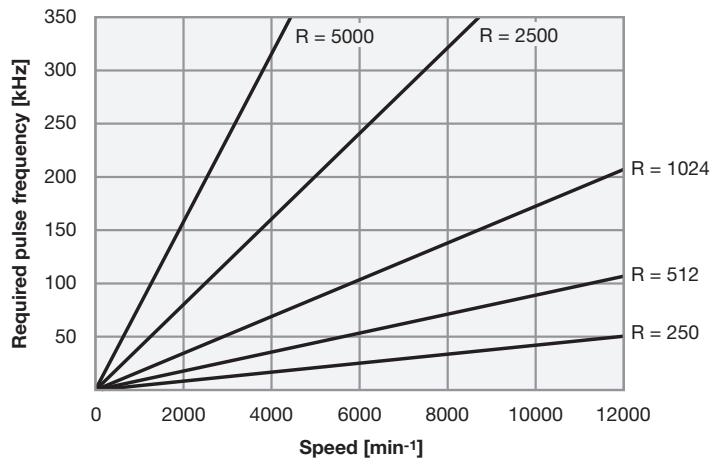
Resolution of the encoder

$R = 1000$  ppr

$$f_{max} = \frac{n \times R}{60}$$

The required pulse frequency is 50 kHz. Now you can compare this result with the data of the encoder you would like to choose.

This diagram can be used as a quick guide for the most common resolutions:



### Outputs and Voltage Supplies (overview):

Turck offers a wide range of possible outputs and voltage supplies for any application:

| Output                   | Inverted Signals | Voltage Supply        |
|--------------------------|------------------|-----------------------|
| RS422                    | Yes              | 5 VDC                 |
| RS422                    | Yes              | 10-30 VDC or 5-30 VDC |
| Push pull output         | No               | 10-30 VDC or 5-30 VDC |
| Push pull output         | Yes              | 10-30 VDC or 5-30 VDC |
| Push pull (7272)         | Yes              | 5-30 VDC              |
| Sine wave voltage output | Yes              | 5 VDC                 |
| Sine wave voltage output | Yes              | 10-30 VDC             |

If the encoder is used in an environment with high electrical noise and long cables, it is recommended to use inverted signals.

Rotary Measurement Technology - Incremental Encoders

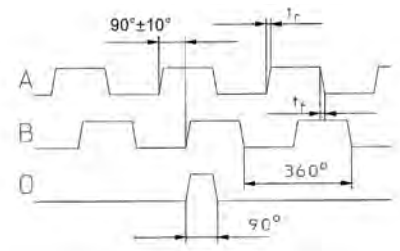
Digital Outputs:

The sine wave signal from the optical system is first digitized to have square wave signals available.

- Shaft turning clockwise, top view of shaft
- Inverted signals are available
- 0-pulse is linked to channel A and B

There are two possible outputs available to transmit the signals, RS422 (TTL compatible) or push-pull (PNP or NPN). When choosing the suitable output for the application, the following points have to be considered:

- The corresponding unit / controller the encoder will be connected to
- The distance from the encoder to the receiver unit
- The sensitivity against electrical noise or other interference



Available Output Drivers:

The IC-DL is a fast line driver with six independent channels and ideal for 10-30 VDC control circuits. It can transmit a push pull signal with inverted signals up to 250 meters. An IC-DL encoder can be used as a differential line driver, a sinking output or a sourcing output. The push-pull output stages have been designed to cope with a high driver power of typically 100 mA at 30 VDC and are compatible with TIA/EIA RS-422 standard. The outputs are current-limited and short-circuit-proof. The output channels can be shorted and are protected by a thermal overload circuit that detects the short and reactivates the output when the short circuit is removed.

The 7272 output driver is capable of transmitting digital encoder signals to 30 meters, and allows interfacing to drives, PLCs, discrete counters, etc. Depending on its physical connection to a device, this driver can be used as a differential line driver, a sinking output, or a sourcing output. This driver can provide voltage levels equal to the encoders supply voltage (up to 30 V), and can sink or source 40 mA of current. This device is also referred to as a push-pull driver. The outputs are short circuit protected by utilization of internal current limiting and thermal shutdown during overload. Caution: only one channel can be shorted at a time.

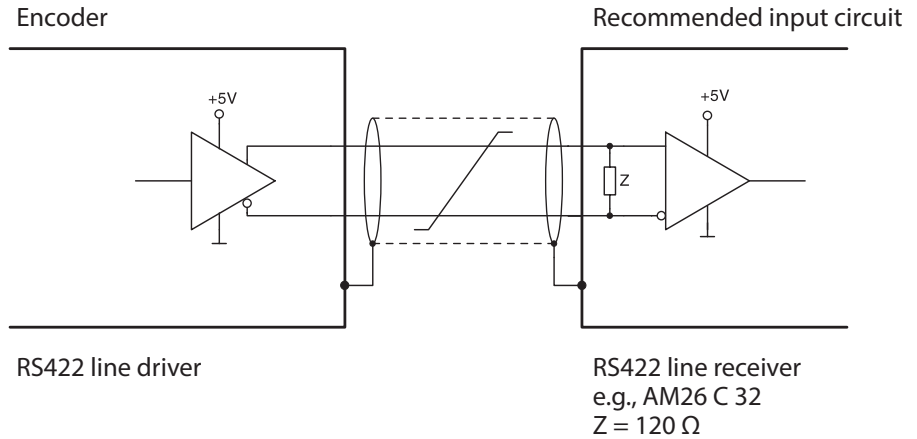
The 7272 is a replacement for the following IC's: 4469, 88C30, 8830, and 26LS31. The 7272 will also replace open collector outputs with internal pull up resistors.

The 26C31 is an output driver capable of transmitting digital encoder signals to 100 meters, and allows interfacing to drives, PLC, discrete counters, etc. Depending on its physical connection to a device, this driver can be used as a differential line driver, a sinking output or a sourcing output. This driver can provide voltage levels to 3.5 V (TTL Level), and can sink or source 20 mA of current. This device is also referred to as a push-pull driver. The outputs are short circuit protected by utilization of internal current limiting and thermal shutdown during overload. The 26C31 is a replacement for the 26LS31 and will also replace open collector outputs with internal pull up resistors

The 7273 IC is an open collector driver manufactured by Texas Instruments. This device should be used for short transmission distance (up to 5 meters) and in environments with little or no electrical interference. This driver acts like a switch sinking current to ground. Maximum sinking capability is 20 mA maximum and the maximum voltage applied to the output is 30 VDC. This output is very common for interfacing to discrete counters. This output is equal to: 3904, 7406, 3302, 681, 689.

## Rotary Measurement Technology - Incremental Encoders

### RS422: Output Circuit and Recommended Input Circuit



### Push-Pull Outputs:

Push-pull outputs are suitable for count interface cards, electronic counters or PLC inputs. They are available in **two versions**:

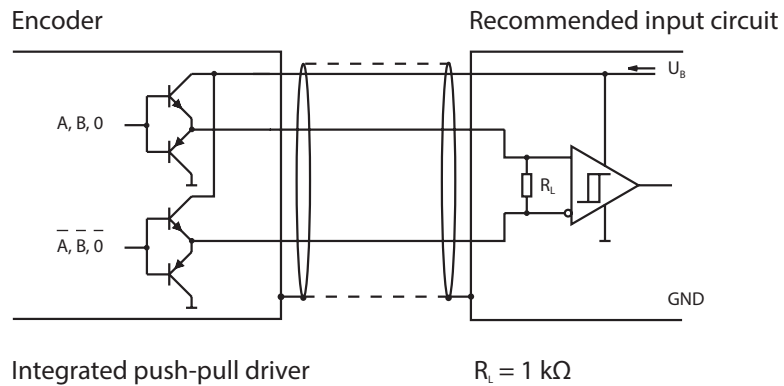
#### Push-pull:

- Push-pull with integrated wave impedance adjustment, recommended cable impedance 40-150  $\Omega$
- Recommended for long cable lengths, high pulse frequencies and output voltages up to 30 V
- With or without inverted (complementary) signals

#### Push-pull (7272):

- Universal line driver 5-30 V with low-level (max 0.5 V)
- Recommended for cable lengths up to 30 m
- With inverted signals

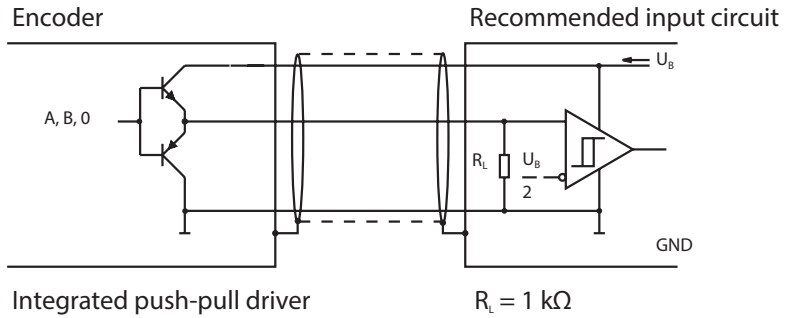
### Output Circuit and Recommended Input Circuit Push-Pull with Inverted Signals:





**Rotary Measurement Technology - Incremental Encoders**

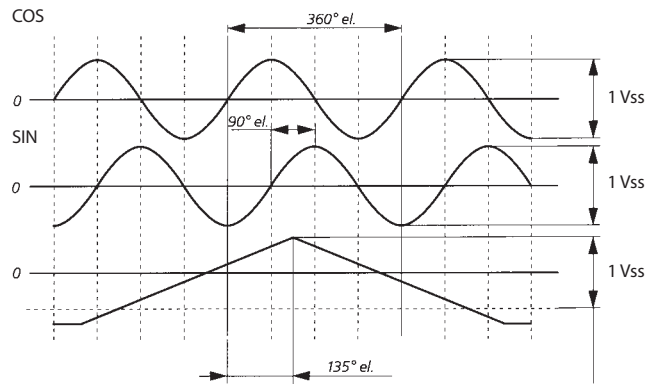
**Output Circuit and Recommended Input Circuit Push-Pull Without Inverted Signals:**



**Sine Wave Outputs:**

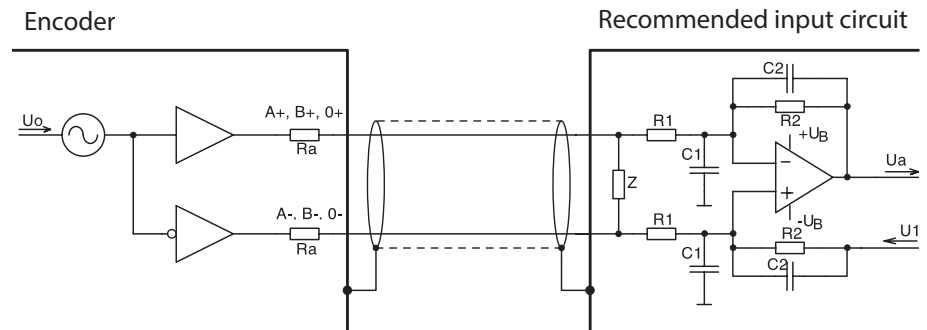
The sine wave signals are available as voltage signals. They can be further processed and multiplied by a factor of 10, 20, 50, 100, 400, 500, 1000 res. binary factors (512, 1024). Due to the interpolation of the two signals, which are 90° out of phase, a very high resolution can be achieved.

This makes these signals useful for applications where very high resolutions are required. Further they are very suitable for digital drives with a very slow and precise movement (e.g., for grinding machines or lifts and elevators).



- Shaft turning clockwise, top view of shaft
- 0-pulse is generated once per turn

**Output Circuit and Recommended Input Circuit for Sine Wave Voltage Signals:**



- $R_s = 10 \Omega$
- $C_1 = 150 \text{ pF}$
- $C_2 = 10 \text{ pF}$
- $R_1 = 10 \text{ k}\Omega$
- $R_2 = 33 \text{ k}\Omega$
- $U_0 = 2.5 \text{ V} \pm 0.5 \text{ V}$
- $Z = 120 \Omega$
- $U_i = U_0$

OPV: e.g., MC33074

## Rotary Measurement Technology - Incremental Encoders

### How Devices Interpret Encoder Signals:

PLC counter cards, discrete counters, and drives require two distinct voltage level states to trigger the input's logic state. The voltage "threshold" levels are defined by each manufacturer and will be included in their operation manuals. The lower voltage level is defined as logic "0" and the higher voltage level is defined as logic "1". The encoders square wave output toggles from logic "0" to logic "1". The PPR (pulses per revolutions) of the encoder defines how many times this will occur per revolution of the encoder, while the encoders output driver determines the voltage threshold levels. The physical communication line between the encoder and these devices will be either single ended or differential. Therefore, it is critical to take care when selecting the encoder's output driver.

### Typical Device Voltage Level Triggering Requirements:

|           | <u>Logic Level "0"</u> | <u>Logic Level "1"</u> |
|-----------|------------------------|------------------------|
| TTL Level | 0 V to 0.5 V           | 2.8 V to 5 V           |
| HTL Level | 0 V to 4 V             | 10 V to 24 V           |

### Cable Lengths for Incremental Encoders:

Depending on the output circuit and the electrical noise, the following cable lengths are recommended.

| Output circuit:                        | Max. cable length:                             | Encoder connected to: |
|--|--|-----------------------|
| Push-pull without inverted signals     | 328 ft (100 m*)                                | Counter/PLC           |
| Push-pull with inverted signals        | 820 ft (250 m*)                                | PLC/IPC <sup>1)</sup> |
| Push-pull with inverted signals (7272) | 98 ft (30 m)                                   |                       |
| RS422 with inverted signals            | Up to 3280 ft (1000 m)<br>(> 164 ft (> 50 m)*) | PLC/IPC <sup>1)</sup> |
| Voltage sine with inverted signals     | 164 ft (50 m)                                  | PLC/IPC <sup>1)</sup> |

<sup>1)</sup> IPC = industrial PC

\* depends on frequency

#### Annotations:

- Depending on the application the recommended cable length can be shorter, especially in areas with strong electrical noise.
- Always use shielded cables

- The core diameter of the signal cores should be  $\geq 0.14 \text{ mm}^2$  (26 AWG)
- The core diameter of the voltage supply cores should be large enough, depending on the cable length, that the voltage supply of the encoder is high enough and the signals do not go below the minimum levels! We strictly recommend the use of the cable types written down in the accessories.

**Rotary Measurement Technology - Absolute Encoders**

**Design and Function:**

Absolute encoders have a disk with a digital coding on concentric tracks. This code is read by a Turck Opto-Asic. A unique bit pattern is assigned to each position.

In the event of a power failure, true position verification is available as soon as power is up again, even if the shaft was rotated while the encoder was powered off. Also, no reference drives after starting-up are necessary, as with incremental systems. Thus, safety is increased and the time taken for reference drives is saved.

**Absolute**

**Mechanical Advantages of Turck Encoders:**

**Sturdy bearing construction: "Bearing-Lock design"**

- Interlocked bearings, large bearing span and strong outer bearings ensure stability when subjected to vibration.
- Ideal for outdoor use thanks to its solid die-cast housing and radial shaft seal, as well as IP67 protection rating and a temperature range from -40 to +185 °F (-40 to +85 °C).

**Selecting an Absolute Encoder:**

When selecting an absolute encoder, the following parameters should be considered in addition to the recommendations on page B1: supply voltage, type of code and interface (SSI, parallel, fieldbus, 4-20 mA)

**Versions:**

**Singleturn encoders:** Depending on the number of divisions, they generate up to 131,072 (17 Bit) unique positions per turn. This corresponds to an angular resolution of 0.0028 (= 0.168'). After one revolution the process re-starts.

Singleturn encoders can be used in applications where revolution is sufficient (e.g., measurement of angles, robotics).

**Multiturn encoders:** Available with up to 131,072 (17 Bit) definite angular positions per revolution in addition to 16,777,216 (24 Bit) definite revolutions. This corresponds to 2.19 trillion (41 Bit) definite positions.

Multiturn encoders can be used for positioning applications (e.g., automatic storage, retired systems, lift elevators, cranes, and machine tools).

**Output Codes:**

| Decimal | Binary | Gray | BCD       |
|---------|--------|------|-----------|
| 0       | 0000   | 0000 | 0000 0000 |
| 1       | 0001   | 0001 | 0000 0001 |
| 2       | 0010   | 0011 | 0000 0010 |
| 3       | 0011   | 0010 | 0000 0011 |
| 4       | 0100   | 0110 | 0000 0100 |
| 5       | 0101   | 0111 | 0000 0101 |
| 6       | 0110   | 0101 | 0000 0110 |

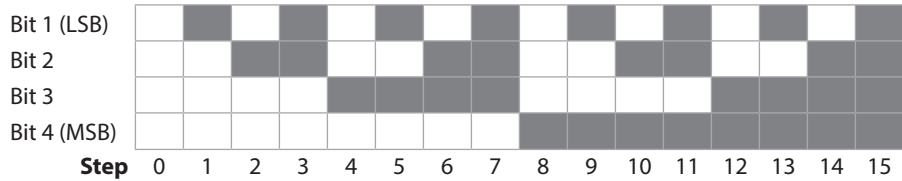
| Decimal | Binary | Gray | BCD       |
|---------|--------|------|-----------|
| 7       | 0111   | 0100 | 0000 0111 |
| 8       | 1000   | 1100 | 0000 1000 |
| 9       | 1001   | 1101 | 0000 1001 |
| 10      | 1010   | 1111 | 0001 0000 |
| 11      | 1011   | 1110 | 0001 0001 |
| 12      | 1100   | 1010 | 0001 0010 |

## Rotary Measurement Technology - Absolute Encoders

### Code Types

#### Binary Code:

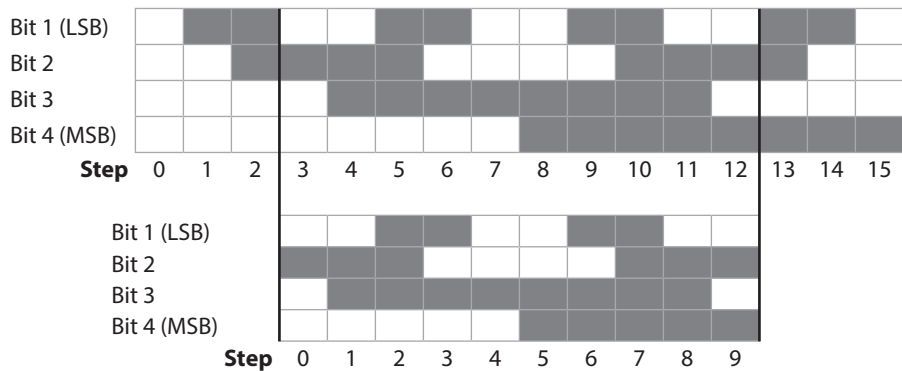
Binary Code can be processed very simply by computer systems. Gray code inside the encoder is converted via the ASIC to binary code. Binary codes have more than one bit transition for each position change. For this reason, optical systems using binary code may cause occasional transition errors. In most applications this does not present a problem due to the absolute nature of the encoder, and the position is normally corrected.



#### Gray Code:

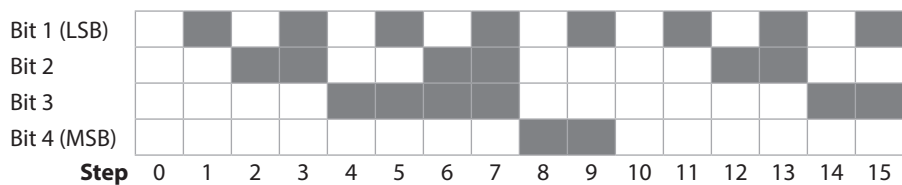
The Gray Code is a single-step code. This indicates that only 1 bit is changed from one position to the next. This leads to a high position reliability. The Gray Code is used to optically read out the position for all absolute encoders.

**Gray excess:** The extraction of a defined part of the Gray Code leads to the gray excess code. This code enables the generation of non-binary based divisions (e.g., 360, 720, 1000, and 1440).



**Reversion of the gray code:** The code values increase when the shaft is turning clockwise. If the most significant bit (MSB) is inverted, the code values decrease when the shaft is turning clockwise.

#### BCD Code:



**Rotary Measurement Technology - Absolute Encoders**

**OptoASIC and Intelligent Scan Technology™:**

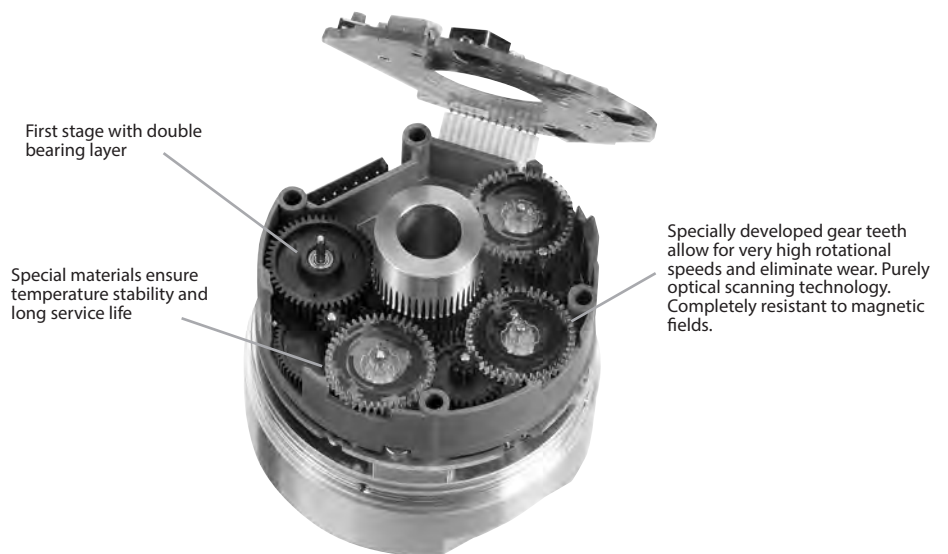


OptoASIC and Intelligent Scan Technology (IST) is the latest development in Absolute encoder technology. The development of an OptoASIC with Intelligent Scan Technology enabled Turck to build the first optical multiturn encoder without gears or magnetic sensors.

Eliminating mechanical parts like gears allowed Turck to make the encoder smaller than others currently on the market. These encoders offer a total resolution of up to 41 bits, a programmable multiturn encoder with up to 16 million revolutions, and a high-precision single turn with up to 17 bits resolution, all in a 39 mm diameter housing that is up to 45 mm long.

**The Multiturn Gear Module (12 bit resolution):**

Geared multiturn encoders are the types RM-28, RM-29, RM-35, and RM-36.



**Patented Integrative Technology:**



Integrative Technology, developed and patented, is a package of measures that ensures compact construction, high signal quality, high shock resistance (up to 2,500 m/S<sup>2</sup>), high reliability and a high level of immunity to EMC.

This is achieved using an Opto ASIC: a multilayer board, shock resistant and space-saving method of mounting the sensor unit. The use of a highly optimized ASIC interface ensures the integration of several hundred individual components. Components that had previously been needed to balance the system, such as balancing potentiometers, can be dispensed with.

**Advantages of Integrative Technology:** Singleturn shaft encoders are available with the same dimensions as their incremental correspondents. This allows an easy mechanical substitution.

# General Information

## Rotary Measurement Technology - Absolute Encoders

### Mechanical or Electronic Gears:

Absolute singleturn and multiturn encoders have established themselves as the standard method for measuring linear displacement or angular position. With absolute encoders, a reference trip is no longer needed after system start-up or a power-down. Multiturn encoders are now being employed where incremental encoders had dominated, such as with geared motors or lifts.

Today, all manner of multiturn encoders are available in a variety of designs. As a rule, the manufacturers offer either mechanical gears for 'counting turns' or electronic counters with electronic data storage. For many years, encoder companies have made both absolute multiturn encoders with gears or without gears, and then criticized each other for the perceived drawbacks to the designs. Turck offers both absolute multiturn encoders without mechanical gears and with mechanical gears. Not having mechanical gears allows Turck to make more compact absolute multiturn encoders. These encoders require batteries, whereas geared multiturn encoders do not have batteries. Battery life is often a discussion point. Based on how the encoder is actually used, the calculated battery life could be as long as 75 years.

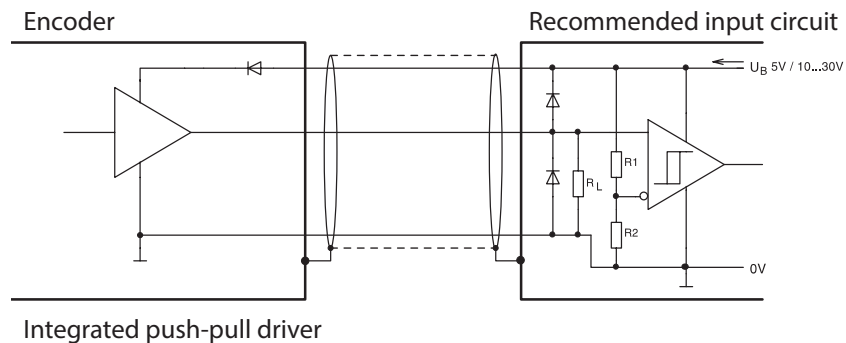
### Outputs:

Different interfaces are available to transfer the position data to a controller. Turck offers a variety of outputs detailed in the following sections.

### Parallel Output:

This type of transfer is very fast. All bits of a position are transferred simultaneously, each via a separate line.

### Output Circuit and Recommended Input Circuit Parallel Interface:

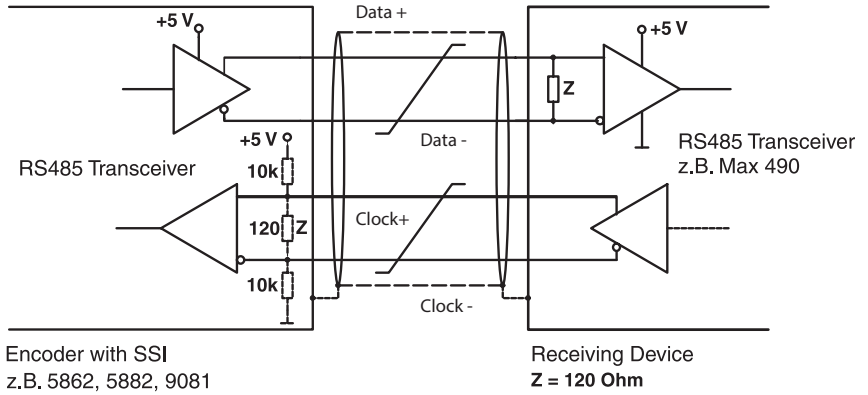


### Synchronous Serial Interface (SSI):

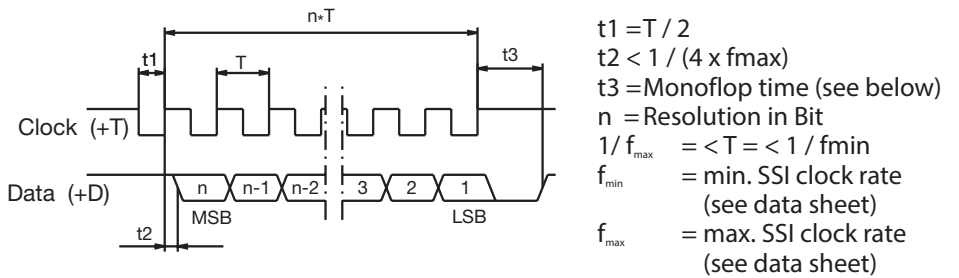
SSI is an industrial standard serial interface between an absolute encoder or sensor and a controller. The SSI protocol uses a clock pulse train from a controller to initiate a gated output from the sensor. Position data is continually updated by the sensor and made available to the shift register. Data is shifted out when the sensor receives a pulse train from the controller. SSI is widely used because of its simplicity and noise immunity.

Rotary Measurement Technology - Absolute Encoders

Output Circuit and Recommended Input Circuit for Multiturn Encoders with SSI Output:



Data Transmission SSI:



At rest, the clock and data lines are at a high level. With the first falling clock-pulse edge, the current encoder data is stored in the buffer ready to be sent. With the next rising clock-pulse edge, the data is transmitted bit by bit, starting with the MSB. The transfer of a complete data word requires n+1 rising clock-pulse edges (n = resolution in Bit). For example, 14 clock signals are needed for a complete readout of a 13 Bit encoder. After the next positive-going clock-pulse edge, the data line will remain at a low level until the encoder is ready for a new data word. The clock line must stay high for a time longer than the mono flop time, and then can begin a new read-out sequence again with the next falling edge.

Please Note:

**Only for type series RS-22, RS-30, RM-41, RM-77, RM-78:** Updating the data occurs sequentially with the read-out cycle. Therefore, the data is as up-to-date as the interval time between two read-outs. A periodic read-out of the encoder in the application is recommended, using appropriately short cycle times, so that current position values are constantly maintained. It is not possible to read out the same data word several times.

Monoflop time of the encoder:  $t3 = \text{max. } 40\mu\text{s}$

**Only for Absolute encoders:** Updating the data occurs immediately with the first falling edge of the clock signal. The data is always up-to-date. If a repeated read-out of the same data word is desired, then a new clock sequence must be started within the time interval t3. If the clock sequence is terminated before the necessary number of clock pulses needed for a complete readout of the data word has been transmitted, then the data line will go high again and signal that the last read-out sequence has been aborted. It will also indicate that it is ready for a new data word to be sent. Monoflop time of the encoder:  $t3 = \text{see data sheet.}$

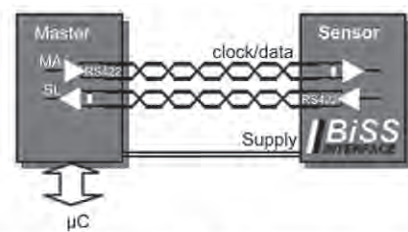
## Rotary Measurement Technology - Absolute Encoders

### BiSS Interface:

Open, digital sensor interface (BiSS). The bidirectional digital sensor interface (BiSS) assures the communication between the encoder and the measuring device or drive control and can, if required, simultaneously transfer the measured values of up to eight sensors.

For one to eight subscribers the interface master provides the clock signal for the simultaneous capturing of all position data as well as for the subsequent synchronous serial data transmission. Only four unidirectional RS422 data lines are required; the minimal slave electronics is located directly in the sensor ICs.

When the master sends the clock pulse on the line MA, the slave will reply on the return line SL with the captured position data. Commands or parameters are exchanged via a PWM clock sequence, although this is not necessary for the startup of the BiSS protocol.

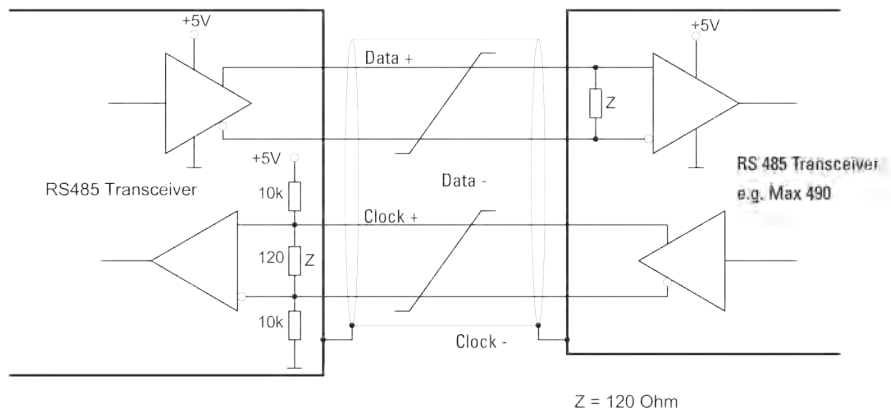


With every data cycle the master learns and compensates for the signal transit times, thus enabling high clock rates up to 10M bit/s even with cable lengths of 100 m. Varying cable conditions, for example due to drag movement, are corrected. The synchronization accuracy between several encoders on a number of axes is less than one microsecond; moreover the master keeps the signal transit times that have been experienced transparent for the controller and thus enables a further optimization.

The BiSS protocol classifies each subscriber into various data areas: sensor data, multi-cycle data and register data. These data areas are laid out differently with respect to the possibility of accessing them and to their transmission performance, which covers a wide variety of sensor applications. A bidirectional communication parameter for configuring the device, and if need be for so-called OEM parameters, is placed in the register data area. Data that change slowly, such as speed of rotation or motor temperature, occupy the multi-cycle data area, whereas data that change quickly occupy the sensor data area.

This means that there is no problem in achieving control cycle times under 10 MHz even for data words up to 64 bit. Enough space is available for redundancy, and as a rule is used for implementing a CRC (cyclic redundancy check). As they are only framed by a start and a stop bit, the sensor data is transferred at the best possible user data rate; a single multi-cycle data bit is optional. Similarly detected and triggered, the multi-cycle data bits form a second inband protocol and contribute to the redundancy of the sensor data. Permanent monitoring of the drive status and operation is possible without interfering with the controller cycle. Specific device developments by individual users are not restricted or made more expensive by a need to be compatible with other BiSS products. A BiSS subscriber is described with only a few parameters, and an XML device description file that comes with the product simplifies the startup of the controller.

Output circuit and recommended input circuit for absolute encoders with a BiSS output



Z = 120 Ohm



Rotary Measurement Technology - Absolute Encoders



Cable Length:

The following maximum cable lengths are recommended, depending on the output circuitry and any noise sources present.

| Interface and output circuit: | Max. cable length:                     | Connected to:         |
|-------------------------------|--|-----------------------|
| Parallel CMOS/TTL             | 6.5 ft (2 m)                           | SPS/IPC <sup>1)</sup> |
| Parallel push-pull            | 328 ft (100 m)                         | SPS/IPC <sup>1)</sup> |
| SSI                           | up to 3,280 ft (1,000 m) <sup>2)</sup> | SPS/IPC <sup>1)</sup> |
| RS422 /RS485                  | 3,280 ft (1,000 m)                     | SPS/IPC <sup>1)</sup> |
| Analog 4-20 mA                | 656 ft (200 m)                         |                       |

<sup>1)</sup> IPC = Industrial PC

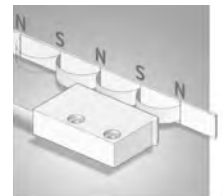
<sup>2)</sup> Depends on clock frequency: at 100 kHz L<sub>max</sub> approx. 250 m; at f = 250 kHz L<sub>max</sub> approx. 50 m

Annotations:

- Depending on the application the max. allowed cable length can be shorter, especially in areas with strong electrical noise.
- Always use shielded cables
- The core diameter of the signal cores should be ≥ 0.14 mm<sup>2</sup>
- The core diameter of the voltage supply cores should be large enough depending on the cable length, that the voltage supply of the encoder is high enough and the signals do not go below the minimum levels! We strictly recommend the use of the cable types written down in the accessories.

Magnetic Measuring System  
Up to 50 m Measuring Length  
Up to 0.005 mm Resolution:

A magnetic sensor is guided across a magnetic band without coming into contact with it. The changes in polarity on the magnetic band are counted and intermediate values are interpolated. Our engineers have fine-tuned the system to such a degree that resolutions up to 0.005 mm are possible.



The system is not affected by dust, shavings or humidity and is resistant to many liquids and to oil. Assembly is easy; the magnetic band just has to be glued into place. There are no problems for calibration. The distance between the sensor and the magnetic band can be up to two mm. Repeat accuracy is very high.

Where is Our Linear  
Measurement System Used?

The measuring system offers an economical alternative to optical systems in applications where the high accuracy of the glass rules is not absolutely necessary, but where up until now no other suitable alternative has been available.



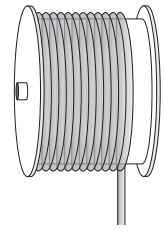
Because of its rugged construction, the measuring system can now be used even in tough industrial environments.

The system is not affected by vibration, nor is it damaged if subjected to high shock loads. Our flexible magnetic band can fit around very large shafts. The maximum length of the magnetic band is 50 m.

## Linear Measurement Technology

### Draw Wire Systems:

At the core of a draw wire encoder is a drum mounted on bearings, onto which a wire is wound. The winding takes place via a spring-loaded device. The number of revolutions is measured by means of an encoder. If the circumference of the drum is known, then the length can be calculated from it.



Thus, draw wire systems convert linear motion into rotary motion. This is then measured with encoders. Our spectrum ranges from miniature draw wire versions to models capable of measuring 40 m.

- Specially for demanding applications
- With analog sensors (0-10 V, 4-20 mA, potentiometer) or encoders (incremental, absolute, fieldbus)
- Measuring lengths from 250 mm up to 40,000 mm
- High travelling speed
- High acceleration
- Simple wire fixing using clip
- Quick mounting
- Diamond-polished ceramic guide
- Titanium anodized aluminum housing
- Dynamic spring traction by means of a constant force spring, long service life, approx. 2 million complete cycles.



### Length Measuring Kits:

\*unlimited length resolution up to 0.1 mm

Turck provides the measuring wheel, encoder and counter from one source, all in one complete kit. This kit saves you time and effort, as there is no need to assemble the component parts.



**IP Protection Class**

| IP               |   | Dust Protection   |                     |                       |                      |                      |                     |                 |
|------------------|---|-------------------|---------------------|-----------------------|----------------------|----------------------|---------------------|-----------------|
|                  |   | 0_<br>Unprotected | 1_Objects<br>≥50 mm | 2_Objects<br>≥12.5 mm | 3_Objects<br>≥2.5 mm | 4_Objects<br>≥1.0 mm | 5_Dust<br>Protected | 6_Dust<br>Tight |
| Water Protection | 0_Unprotected   | IP00              | IP10                | IP20                  | IP30                 | IP40                 | IP50                | IP60            |
|                  | _1<br>Dripping Water  |                   | IP11                | IP21                  | IP31                 | IP41                 | IP51                | IP61            |
|                  | _2<br>Dripping Water on<br>15° slant                          |                   | IP12                | IP22                  | IP32                 | IP42                 | IP52                | IP62            |
|                  | _3<br>Spraying Water  |                   |                     | IP23                  | IP33                 | IP43                 | IP53                | IP63            |
|                  | _4<br>Splashing Water   |                   |                     |                       | IP34                 | IP44                 | IP54                | IP64            |
|                  | _4K<br>Splashing Water<br>High Pressure                       |                   |                     |                       | IP34K                | IP44K                | IP54K               | IP64K           |
|                  | _5<br>Jet Water   |                   |                     |                       |                      |                      | IP55                | IP65            |
|                  | _6<br>Intense Jet Water                                       |                   |                     |                       |                      |                      | IP56K               | IP66K           |
|                  | _7<br>Temporary immersion                                     |                   |                     |                       |                      |                      |                     | IP67            |
|                  | _8<br>Continuous immersion<br>as specified by<br>manufacturer |                   |                     |                       |                      |                      |                     | IP68            |
|                  | _9K<br>Water at high pressure/<br>Steam jet cleaning          |                   |                     |                       |                      |                      |                     | IP69K           |

## General Information

### Ingress Protection Classes- IEC 60529

| First ID Number | Protection from penetration of... | Requirements   |
|-----------------|-----------------------------------|--|
| 0               | Unprotected                       | N/A  |
| 1               | Solid Foreign Particles Ø50 mm    | No full penetration of sphere with Ø50 mm  |
| 2               | Solid Foreign Particles Ø12.5 mm  | No full penetration of sphere with Ø12.5 mm  |
| 3               | Solid Foreign Particles Ø2.5 mm   | No penetration of rod with Ø2.5 mm   |
| 4               | Solid Foreign Particles Ø1.0 mm   | No penetration of wire with Ø1.0 mm  |
| 5               | Dust                              | Dust may only penetrate in such quantity that function and safety are not impacted |
| 6               | Dust                              | No penetration of dust   |

| Second ID Number | Protection from penetration of...                                       | Requirements  |
|------------------|---|---|
| 0                | Unprotected   | N/A   |
| 1                | Dripping water  | Vertically falling drips may not cause any damage   |
| 2                | Dripping water when the enclosure is in a slanted position of up to 15° | Vertically falling drips may not cause any damage   |
| 3                | Spraying water  | Spraying water, which is sprayed in a perpendicular angle of up to 60° may not cause any damage   |
| 4                | Splashing water   | Water splashing against the enclosure from every direction may not cause any damage   |
| 4K               | Splashing water with increased pressure                                 | Water splashing against the enclosure from every direction and with increased pressure may not cause any damage   |
| 5                | Jet water   | Water which is hosed against the enclosure from every direction may not cause damage  |
| 6                | Intense jet water   | Water which is hosed against the enclosure with high intensity may not cause any damage   |
| 6K               | Intense jet water with increased pressure                               | Water which is hosed against the enclosure with high intensity and increased pressure may not cause any damage  |
| 7                | Temporary immersion in water  | Water may not enter the enclosure in such quantity as to cause damage when the enclosure is held under water for a set period of time using predetermined pressure (1 m for 30 min)   |
| 8                | Continuous immersion in water   | Water may not enter the enclosure in such quantity as to cause damage when the enclosure is held under water for a set period of time using predetermined pressure (Turck standard is 6' of water, and other chemicals, for a period of 24 hours) |
| 9K               | Water at high-pressure/steam jet cleaning                               | Water which is directed against the enclosure from every direction with extremely high pressure may not cause any damage (14 to 16 l/min at 8,000 to 10,000 kPa)  |

**Notes:**

## General Information

**Notes:**

# Linear and Rotary Position

## Warranty Terms and Conditions

### RISK OF LOSS

Delivery of the equipment to a common carrier shall constitute delivery to the Purchaser and the risk of loss shall transfer at that time to Purchaser. Should delivery be delayed due to an act or omission on the part of the Purchaser, risk of loss shall transfer to the Purchaser upon notification by Turck Inc. that the order is complete and ready for shipment.

### WARRANTIES

Turck Inc. (hereinafter "Turck") offers five (5) WARRANTIES to cover all products sold. They are as follows:

- 1) The **12-MONTH WARRANTY** is available for the products listed - generally those not covered by **LIFETIME, 5-YEAR, 24-MONTH** or **18-MONTH** warranty. No registration required.
- 2) The **18-MONTH WARRANTY** is available for the products listed - generally those not covered by **LIFETIME** or **5-YEAR WARRANTY**. No registration is required.
- 3) The **24-MONTH WARRANTY** is available for the products listed - generally those not covered by **LIFETIME, 5-YEAR** or **18-MONTH**. No registration is required.
- 4) The **5-YEAR WARRANTY** is available generally for the products listed. No registration is required.
- 5) A **LIFETIME WARRANTY** is available for the products listed. It becomes effective when the accompanying **Turck LIFETIME WARRANTY REGISTRATION** is completed and returned to Turck.

### GENERAL TERMS AND CONDITIONS FOR ALL WARRANTIES

- **12-MONTH STANDARD WARRANTY**
- **18-MONTH STANDARD WARRANTY**
- **24-MONTH STANDARD WARRANTY**
- **5-YEAR WARRANTY**
- **LIFETIME WARRANTY**

Turck warrants the Products covered by the respective WARRANTY AGREEMENTS to be free from defects in material and workmanship under normal and proper usage for the respective time periods listed above from the date of shipment from Turck. In addition, certain specific terms apply to the various WARRANTIES.

**THESE EXPRESS WARRANTIES ARE IN LIEU OF AND EXCLUDE ALL OTHER REPRESENTATIONS MADE - BOTH EXPRESSED AND IMPLIED. THERE ARE NO WARRANTIES OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE FOR PRODUCTS COVERED BY THESE TERMS AND CONDITIONS.**

Turck warrants that the goods sold are as described, but no promise, description, affirmation of fact, sample model or representation, oral or written shall be part of an order, unless set forth in these terms and conditions, or are in writing and signed by an authorized representative of Turck. These WARRANTIES do not apply to any Product which has been subject to misuse, negligence, or accident - or to any Product which has been modified or repaired, improperly installed, altered, or disassembled - except according to Turck's written instructions.

These WARRANTIES are subject to the following conditions:

- 1) These WARRANTIES are limited to the electronic and mechanical performance only, as expressly detailed in the Product specifications and NOT to cosmetic performance.
- 2) These WARRANTIES shall not apply to any cables attached to, or integrated with the Product. However, the **18-MONTH WARRANTY** shall apply to cables sold separately by Turck.
- 3) These WARRANTIES shall not apply to any Products which are stored, or utilized, in harsh environmental or electrical conditions outside Turck's written specifications.
- 4) The WARRANTIES are applicable only to Products shipped from Turck subsequent to January 1, 1988.

ADDITIONAL SPECIFIC TERMS FOR:

**(12-MONTH STANDARD WARRANTY) FOR LINEAR DISPLACEMENT TRANSDUCERS, EZ TRACK, RFID PRODUCTS, DRAW WIRE ASSEMBLIES AND SLIP RINGS.**

**(18-MONTH STANDARD WARRANTY) FOR Q-TRACK INDUCTIVE SENSORS, ULTRASONIC SENSORS, FLOW SENSORS, PRESSURE SENSORS, TEMPERATURE SENSORS, INCLINOMETERS, CABLES AND ALL NON-SENSING PRODUCTS SOLD BY TURCK INC. INCLUDING MULTI-SAFE, MULTI-MODUL, MULTI-CART AND RELATED AMPLIFIER PRODUCTS, RELAYS AND TIMERS.**

**(24-MONTH STANDARD WARRANTY) FOR ENCODERS EXCLUDING DRAW WIRE ASSEMBLIES.**

**5-YEAR WARRANTY FOR INDUCTIVE AND CAPACITIVE PROXIMITY SENSORS: THE PERIODS COVERED FOR THE ABOVE WARRANTIES AND PRODUCTS SHALL BE 12 MONTHS, 18-MONTHS, 24-MONTHS AND 5-YEARS, RESPECTIVELY, FROM THE DATE OF SHIPMENT FROM TURCK.**

**LIFETIME WARRANTY (OPTIONAL - REGISTRATION REQUIRED) FOR INDUCTIVE, INDUCTIVE MAGNET OPERATED AND CAPACITIVE PROXIMITY SENSORS SOLD TO THE ORIGINAL PURCHASER FOR THE LIFETIME OF THE ORIGINAL APPLICATION.**

## Warranty Terms and Conditions

### **THE FOLLOWING TERMS APPLY TO THE LIFETIME WARRANTY IN ADDITION TO THE GENERAL TERMS:**

- 1) This WARRANTY shall be effective only when the LIFETIME WARRANTY REGISTRATION has been completed, signed by the End User and an authorized Turck Representative or Distributor and has been received by Turck no later than six (6) months after installation in the End User's Plant, or two (2) years from the date product was shipped from Turck, whichever is sooner.
- 2) This warranty is available only to Turck's authorized Representatives, Distributors and to the Original User. (The term "Original User" means that person, firm, or corporation which first uses the Product on a continuous basis in connection with the operation of a production line, piece of machinery, equipment, or similar device.) In the event the ownership of the product is transferred to a person, firm or corporation other than the Original User, this WARRANTY shall terminate.
- 3) This WARRANTY is applicable only to the Original Application. In the event the machinery, equipment, or production line to which the Product is connected, or on which it is installed, is substituted, changed, moved or replaced, the WARRANTY shall terminate.
- 4) This WARRANTY shall be valid only if the Product was purchased by the Original User from Turck, or from an authorized Turck Distributor, or was an integral part of a piece of machinery and equipment obtained by the Original user from an Original Equipment Manufacturer, which itself, was purchased directly from Turck or from an authorized Distributor.

### **PURCHASER'S REMEDIES**

This Remedy shall apply to all WARRANTIES. If a Turck Distributor desires to make a WARRANTY Claim, the Distributor shall, if requested by Turck, ship the Product to Turck's factory in Minneapolis, Minnesota, postage or freight prepaid. If the User desires to make a WARRANTY Claim, they shall notify the authorized Turck Distributor from whom it was purchased or, if such Distributor is unknown, shall notify Turck. Turck shall, at its option, take any of the following two courses of action for any products which Turck determines are defective in materials or workmanship.

- 1) Repair or replace the Product and ship the Product to the Original Purchaser or to the authorized Turck Distributor, postage or freight prepaid; or
- 2) Repay to the Original Purchaser that price paid by the Original Purchaser; provided that if the claim is made under the LIFETIME WARRANTY, and such Product is not then being manufactured by Turck, then the amount to be repaid by Turck to the Original Purchaser shall be reduced according to the following schedule:

| <u>Number of Years Since Date of Purchase by Original Purchaser</u> | <u>Percent of Original Purchase Price To Be Paid by Turck</u> |
|---|---|
| 10  | 50%   |
| 15  | 25%   |
| 20  | 10%   |
| More than 20  | 5%  |

**PURCHASER'S REMEDIES SHALL BE LIMITED EXCLUSIVELY TO THE RIGHT OF REPLACEMENT, REPAIR OR REPAYMENT AS PROVIDED AND DOES NOT INCLUDE ANY LABOR COST OR REPLACEMENT AT ORIGINAL PURCHASER'S SITE. TURCK SHALL NOT BE LIABLE FOR ANY CONSEQUENTIAL DAMAGES RESULTING FROM ANY BREACH OF ANY WARRANTY, EXPRESSED OR IMPLIED, APPLICABLE TO THE PRODUCT, INCLUDING WITHOUT LIMITATION, ANY DAMAGES RESULTING FROM PROPERTY DAMAGE, PERSONAL INJURY OR BUSINESS INTERRUPTION.**

### **CONSIDER SAFETY AND PROTECTION PRECAUTIONS**

Turck takes great care to design and build reliable and dependable products, however, some products can fail eventually. You must take precautions to design your equipment to prevent property damage and personal injury in the unlikely event of failure. As a matter of policy, Turck does NOT recommend the installation of electronic controls as the sole device FOR THE PROTECTION OF PERSONNEL in connection with power driven presses, brakes, shears and similar equipment and, therefore, the customer should build in redundancy or dual control using approved safety devices for these applications.

### **GOVERNING LAW**

The sale and purchase of Products covered hereby and all terms and conditions hereof shall be governed by the law of the States of Minnesota.



# Linear and Rotary Position

**Notes:**

**Notes:**

Turck Inc. sells its products through Authorized Distributors. These distributors provide our customers with technical support, service and local stock. Turck distributors are located nationwide – including all major metropolitan marketing areas.

For Application Assistance or for the location of your nearest Turck distributor, call:

1-800-544-7769

Specifications in this manual are subject to change without notice. Turck also reserves the right to make modifications and makes no guarantee of the accuracy of the information contained herein.

Literature and Media questions or concerns?  
Contact Turck USA Marketing – [tusa.marketing@turck.com](mailto:tusa.marketing@turck.com)

# TURCK



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60 representations worldwide!

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