Absolute multiturn encoder TRK with EtherCAT® - interface

Design and function

Recording of the angular position and revolutions by means of Hall sensors - absolute multiturn transmission for up to 4096 revolutions - data output plus parameterisation and diagnosis via EtherCAT.

Robust housing (housing sickness 5 mm) manufactured from seawater-resistant aluminium (AlMgSi1) or stainless steel - stainless steel shaft - ball bearing with shaft seal - sensors circuit consisting of ASIC with Hall elements - electrical connection via M12 connector or cable outlet.

In the model series TRK absolute encoders, the EtherCAT interface is integrated according to IEC 61158-2 to 6 and encoder profile CiA DSP406.

As a "full slave", the TRK supports all EtherCAT addressing modes such as logical addressing, position addressing and node addressing.

Use of the CANopen over EtherCAT message and the CANopen encoder profile enable parameter and diagnostic data handling as familiar from CANopen. These are contained in an object directory under the same indices as in the case of CANopen. The process data are transmitted in PDOs whose composition is defined via PDO mapping.

The draw wire version with integrated encoder offers a very compact solution for length measurement up to 10 m. See datasheet 125-D13794 for mechanical design.

The project planning and commissioning of a TWK absolute encoder with EtherCAT interface are described in detail in the CRK 11780 user manual.

EtherCAT® features

- Complex slave with CANopen over EtherCAT (CoE)
- "Full slave" - all addressing modes except segment addressing
- All EtherCAT write/read services
- Field-bus Memory Management Unit (FMMU)
- Sync-manager
- Distributed Clocks (on request)

EtherCAT® is a registered brand and patented technology licensed by Beckhoff Automation GmbH, Germany.
Absolute multiturn absolute encoder model TRK

Technical Data

Input data *
- 4 byte position data
- 2 byte speed data (on request)

Output data *
- 2 byte control

Electrical data
- Sensor system: ASIC with Hall-elements
- Operating voltage: +9 VDC to +36 VDC
- Power consumption: < 3 W, switch-on current < 500 mA
- Resolution: 4096 steps / 360°4- (12 bit) (13 bit optional)
- Measuring range: 4096 revolution
- Total number of steps: 24 bit (optional 25 bit)
- Accuracy: ± 0.2 % (with reference to one revolution)
- Output code: Binary
- Code path: CW / CCW
- Internal updating time: ≤ 2 ms

Mechanical data
- Operating speed: 4,000 rpm max.
- Angular acceleration: 10⁵ rad/s² max.
- Moment of inertia (rotor): 20 gcm²
- Operating torque: ≤ 2 Ncm
- Starting torque: ≤ 3 Ncm
- Perm. shaft load: 250 N axial
- 250 N radial
- Bearing service life **: > 10⁹ revolutions Approx
- Weight: ca. 0.450 kg (stainless steel version: ca. 0.7 kg)

Environmental data
- Operating temperature range: - 40 °C to + 85 °C
- Storage temperature range: - 40 °C to + 100 °C (without packing)
- Resistance:
  - To shock: 500 m/s²; 11 ms
    DIN EN 60068-2-27
  - To vibration: 500 m/s²; 10 ... 2000 Hz
    DIN EN 60068-2-6
- EMC:
  - DIN EN 61000-6-2 (interference immunity)
  - DIN EN 61000-6-4 (interference emission)
- Protection type: IP 66 / IP 67, with cable outlet IP68, IP69K (optional) (DIN EN 60529)

Electrical connection
- EtherCAT: M12 connector D-coded 4-pin for bus in / bus out, socket
- Supply: M12 connector A-coded 4-pin, pins

Cable output EtherCAT (optional)
- Cable type: PROFINET Type-C, 4 x 0,36 mm2 (AWG22)
- Cable jacket: PUR, color: green
- Temperatur range: - 40 °C to + 70 °C
- Outer diameter: 6,5 mm ± 0,2 mm
- Min. bend radius: 5 x d fixed installation, 10 x d freely movable

* From the point of view of the control system.
** These values apply at maximum shaft load. Higher values are achievable at lower loads.
Technical Data

Cable output power supply (optional)

- Cable type: 2 x 0,75 mm², shielded
- Cable jacket: PUR, color: gray
- Temperatur range: - 40 °C to + 80 °C fixed installation, - 5 °C to + 70 °C freely movable
- Outer diameter: 6 mm
- Min. bend radius: 6 x d fixed installation, 15 x d freely movable

Programmable parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value range</th>
<th>Parameter description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code path</td>
<td>CW / CCW</td>
<td>CW (clockwise): ascending values on rotation clockwise CCW (counter clockwise): descending values on rotation clockwise (viewed looking at the shaft).</td>
</tr>
<tr>
<td>Resolution [steps/360°]</td>
<td>1 ... 4096 (8192)</td>
<td>Steps per revolution (360°)</td>
</tr>
<tr>
<td>Total number of steps [steps]</td>
<td>1 ... 16777,216 (33,554,432)</td>
<td>Overall measuring range</td>
</tr>
<tr>
<td>Reference value</td>
<td>0 ... total number of steps -1</td>
<td>For adaptation to the application, the position value can be set to any value within the measuring range. Once programmed, a reference value can be set via bit 0 in the control word (output data).</td>
</tr>
</tbody>
</table>

(The values in brackets apply to the TRKxx-xx8192R4096C1MKxx)
Absolute multiturn absolute encoder model TRK

Electrical connection

Principle circuit

EtherCAT M12 connector connection assignment
(Port 1 and Port 2)

<table>
<thead>
<tr>
<th>PIN</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signal</td>
<td>TX+</td>
<td>RX+</td>
<td>TX-</td>
<td>RX-</td>
</tr>
<tr>
<td>Colour*</td>
<td>yellow</td>
<td>white</td>
<td>orange</td>
<td>blue</td>
</tr>
</tbody>
</table>

* Industrial Ethernet cable colours according to ISO / IEC 8802-3.

Supply M12 connector connection assignment

<table>
<thead>
<tr>
<th>PIN</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signal</td>
<td>+ UB (+ 24 VDC)</td>
<td>—</td>
<td>- UB (0 VDC)</td>
<td>—</td>
</tr>
</tbody>
</table>
# Electrical connection

## Diagnostic-LED’s:

<table>
<thead>
<tr>
<th>UB</th>
<th>Link/Activity1 (L/A1)</th>
<th>Link/Activity2 (L/A2)</th>
<th>Status (NS)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>green</td>
<td>green</td>
<td>green/red</td>
<td>Operating voltage available</td>
</tr>
<tr>
<td>on</td>
<td>green</td>
<td>green</td>
<td></td>
<td>Network connection established</td>
</tr>
<tr>
<td></td>
<td>Flashing</td>
<td>on</td>
<td></td>
<td>Network active</td>
</tr>
<tr>
<td></td>
<td>Flashing</td>
<td>off</td>
<td></td>
<td>Network connection established</td>
</tr>
<tr>
<td></td>
<td></td>
<td>green/1 x flashing</td>
<td></td>
<td>Safe operational</td>
</tr>
<tr>
<td></td>
<td></td>
<td>green/normal flashing</td>
<td></td>
<td>Pre-operational</td>
</tr>
<tr>
<td></td>
<td></td>
<td>green on</td>
<td></td>
<td>Operational</td>
</tr>
<tr>
<td></td>
<td>red flashing</td>
<td>red on</td>
<td></td>
<td>Impermissible parameter or preset value</td>
</tr>
<tr>
<td></td>
<td>red on</td>
<td></td>
<td></td>
<td>No response from the master</td>
</tr>
</tbody>
</table>
# Absolute multiturn absolute encoder model TRK

## Encoder

<table>
<thead>
<tr>
<th>TRK</th>
<th>KP</th>
<th>A</th>
<th>R</th>
<th>C1</th>
<th>M</th>
<th>K</th>
<th>01</th>
</tr>
</thead>
<tbody>
<tr>
<td>58</td>
<td></td>
<td></td>
<td>4096</td>
<td>4096</td>
<td></td>
<td></td>
<td>→ standard version</td>
</tr>
</tbody>
</table>

- **Electrical and / or mechanical variants***
  - 01 Standard
  - 02 Protection type IP69K
- **K** EtherCAT-interface
- **Electrical connection:**
  - M M12 connector
  - Kx Cable, x = length in m
- **Profile:**
  - C1 Standard EtherCAT
- **Measuring range:**
  - 4096 revolutions
  - 10 Length in meter for draw wire version. Possible values: 6 and 10
- **Output code:**
  - R Binary
- **Resolution:**
  - 4096 steps / 360° or at draw wire: steps / drum circumference (248 mm)
  - 8192
- **Housing material:**
  - A Aluminium
  - S Stainless steel 1.4305
  - V Stainless steel 1.4404
- **Flange:**
  - 58 K Clamped flange, shaft 10 mm with flat
  - KP Clamped flange, shaft 10 mm with woodruff key
  - KF Clamped flange, shaft 10 mm with parallel key
  - KZ Clamped flange, shaft for play-compensating toothed gear ZRS
  - S Synchronizer flange, shaft 6 mm
  - SR Synchronizer flange, clamping shaft 12 mm
  - ST Synchronizer flange, shaft 6 mm with flat
  - 64 NZ Cam switch flange, shaft for ZRS
  - 65 S Synchronizer flange, shaft 12 mm
  - SP Synchronizer flange, shaft 12 mm with parallel key
  - 66 K Clamped flange, shaft 10 mm with flat
  - 105 M Mounting flange, shaft 12 mm
  - MP Mounting flange, shaft 12 mm with parallel key
  - 125 D Draw wire version with integrated TRD rotary encoder, see datasheet 125-D13794

### Design form

- **Model:**
  - TRK T series multiturn with EtherCAT interface

---

* The basic versions according to the data sheet bear the number 01. Deviations are identified with a variant number and are documented in the factory.
**Accessories (to be ordered separately)**

- **Gegenstecker gerade**
  - **STK4GP81** for EtherCAT in/out (Zinc die-cast nickel-plated), see data sheet **STK14570**
  - **STK4GP110** for EtherCAT in/out (stainless steel 1.4404), see data sheet **STK14569**
  - **STK4GS60** for the power supply (Zinc die-cast nickel-plated), see data sheet **STK14572**
  - **STK4GS104** for the power supply (stainless steel 1.4404), see data sheet **STK14571**

- **Angled mating connector**
  - **STK4WP82** for EtherCAT in/out, see data sheet **STK14676**
  - **STK4WS61** for the supply voltage, see data sheet **STK14675**

- **Connecting cable**
  - **KABEL-xxx-114** Industrial Ethernet data cable with M12 connectors, D-coded, moulded on at both ends. Standard lengths: 1, 2, 3 and 5 m, see data sheet **KBL14673**
  - **KABEL-xxx-118** Industrial Ethernet data cable with M12 connector on RJ 45, IP 20 (xxx = length in metres), see data sheet **KBL14655**

- **Couplings**
  - **BKK** Folding bellows coupling, large, see data sheet **BKK11840**
  - **BKM** Folding bellows coupling, small, see data sheet **BKM11995**
  - **KK14S** Clamp coupling, see data sheet **KK12301**

- **Toothed gear**
  - **ZRS** Play-compensating toothed gear **ZRS11877**

- **Torque plate**
  - **ZMS** see data sheet **ZMS12939**

- **Further installation accessories and securing clamps are available according to data sheet MZ10111.**

**Documentation, EDS file, etc.**

The following documents plus the EDS file, a bitmap and example programmes can be found in the Internet under www.twk.de in the documentation area, model TRK

- Data sheet No. TRK12825
- Manual No. **CRK 11780**
Absolute multiturn absolute encoder model TRK

Dimensions in mm

Standard design form
Design form 58 with clamped flange, Order nuber: TRK58-KA 4096 R 4096 C1 M K01
Shaft Ø 10 mm

* Singleturn version 14 mm shorter

- Optional: Shaft "P" with groove and fitted spring

Connector view with M12-connector

- Sensor connector M12 4-pole, pins, A-coded aligned
- Sensor connector M12 4-pole, socket, D-coded aligned
- Position coding pin and coding groove

Rear view with M12-connector

- LED status displays
  (See table on page 5)

Rear view with cable output
Absolute multiturn absolute encoder model TRK

Dimensions in mm

Further design forms

Design form 58 with synchroniser flange, Order number: TRK58-SA 4096 R 4096 C1 M K01
Shaft ø 6 mm

Design form 65 with synchroniser flange, Order number: TRK65-SA 4096 R 4096 C1 M K01
Shaft ø 12 mm

Optional: Shaft "P" with groove and fitted spring

Groove for parallel key DIN 6885-A 4x4x16
Absolute multturn absolute encoder model TRK

Dimensions in mm

Design form 64 with cam switch flange, order number: TRK64-NZA 4096 R 4096 C1 M K01
Shaft ø 12 mm

Sensor connector M12 4-pole, pins, A-coded aligned
Sensor connector M12 4-pole, socket, D-coded aligned
Position coding pin and coding groove

Shaft ø 12 mm
Absolute multiturn absolute encoder model TRK

Dimensions in mm

Design form 58 with synchrouiser flange and clamping shaft,
order number: TRK58-SRA 4096 R 4096 C1 M K01
Clamping shaft ø 12 mm

Clamped shaft
Di = 12 H7
Insertion depth: 16mm

Sensor connector M12
4-pin, pins, A-coding

Sensor connector M12
4-pin, socket, D-coding

max. shaft length
23,4mm +0,2mm

PA locking washer
Torque plate

height adaption

clamping ring (Aluminium)

Reducing bush (please order separatly)
Ordering code: ZRH-A-12-X
X = 6, 6,35, 8, 9,53, 10

* 2x screw DIN 912 M4x30 (VA) with 2x locking washer (VA) and 2x flat washer DIN 9021-4,3.

** 3x screw DIN 912 M4x10 (VA) with 3x locking washer (VA).