# *INCREMENTAL ANGLE ENCODERS* *TGR61*

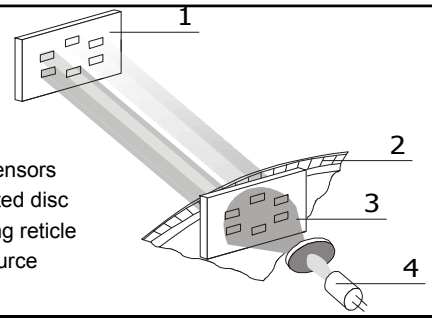
## *Optoelectronic* *61.5, 61.6*

## *GENERAL DESCRIPTION:*

The incremental angle encoders TGR 61 transform mechanical rotation to a series of electrical pulses. Operating principle is shown in the drawing below. Periodic signals of approximate sine-wave shape are generated on the photosensors via photoelectric scanning. Reference signal is generated on the similar way and can be unique or distance coded.

**Number of lines**: 5000, 6000, 9000, 18000
**Reference mark:** 1 or DCR (Distance coded) only for 18000 lines
**Diameter:** 90 mm
**Accuracy:** ± 2,5";± 7,5"
**Output signals:** DS (square wave signals, RS422)
SV (sine wave 1Vpp output signals)
SI (sine wave 11 µA signals)

## *OPERATING PRINCIPLE:*




**1** - photosensors
**2** - graduated disc
**3** - scanning reticle
**4** - light source

### *APPLICATION AREA:*

Incremental rotary encoders are applied in numerous industrial areas for high-precision measuring of angles, positions and rotation speed. Most frequent application areas: machine tool industry, positioning devices, robotics, telescopes, antennas etc.

## *MECHANICAL DATA:*

| | | | | | |
|---|---|---|---|---|---|
| **Number of lines:** | | 5000 | 6000 | 9000 | 18000 |
| **Number of periodes SI, SV:** | | 5000 | 6000 | 9000 | 18000 |
| **Number of periodes DS:** (with integrated interpolation electronics) | | 5000, 10000, 25000 50000, 125000 250000 | 6000, 12000, 30000, 60000, 150000, 300000 | 9000, 18000, 45000, 90000, 225000, 450000 | 36000, 180000, 900000 |
| **DCR** | **Number of reference marks:** | | | | 36 |
| | **Nominal increment (lines):** | | | | 1000 |
| | **Maximal rotation angle to determine position:** | | | | 20° |

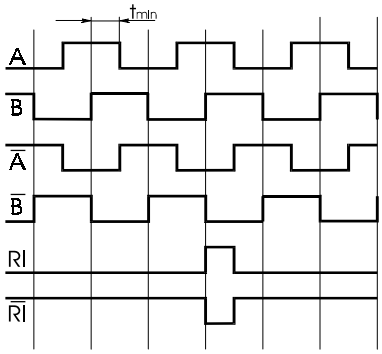
| | |
|---|---|
| **Admissible shaft loading** | ≤ 10N axial; ≤ 10N radial |
| **Rotor inertia moment** | ≤ 2 x $10^{-5}$ kgm$^2$ |
| **Starting moment at 20°C** | ≤ 0.01 Nm |
| **Life time of bearings** | 4 x $10^9$ revolutions |
| **Admissible rotation speed** | 4000 min$^{-1}$ |
| **Weight** | 0.8 kg |
| **Operating temperature** | 0°C to 70°C |
| **Relative humidity** | max 95% (IP 64) (no condensation) |
| **Protection class** (IEC 60529) | IP 64 |
| **Shocks** | 300 m/s$^2$ |
| **Admissible vibrations** (50 - 2000 Hz) | 100 m/s$^2$ |

## *ELECTRICAL DATA:*

| Output signals | Voltage $U_n$ | Current $I_n$ | Max. cable length |
|---|---|---|---|
| **DS - square wave inverted RS422A standard** | 5 V ± 5% | ≤ 100 mA | 50 m |
| **SV - sine-wave voltage 1Vpp** | 5 V ± 5% | ≤ 100 mA | 150 m |
| **SI - sine-current wave** | 5 V ± 5% | ≤ 100 mA | 30 m |

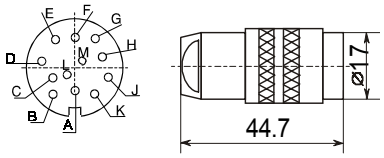
## ELECTRICAL DATA:

### Square-wave signals - DS (RS 422A):




| DS (RS - 422 A) | | |
|---|---|---|
| $I_{sink}$ | = 20 mA | $U_{OL} \leq 0,5$ V |
| $I_{source}$ | = -20mA | $U_{OH} \geq 2,5$ V |
| $t_{tLH} = t_{tHL} \leq 30$ ns; | | without load |

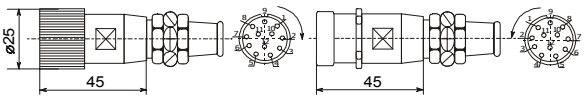
**12 pole connector (Amphenol) square-wave output signals (DS)**




| contact | A | B | C | D | E | G | H | K | L |
|---|---|---|---|---|---|---|---|---|---|
| signal | shield | 0V | A | Ā | B | RI | R̄I | + V | B̄ |

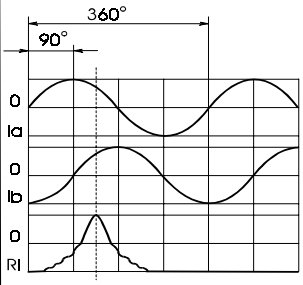
**12 pole connector (Contact) square-wave output signals (DS)**

**connector** or **coupling**




| contac | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| signal | B̄ | sense +5V | RI | R̄I | A | Ā | B̄ | B | | 0V | sense +0V | +5V |

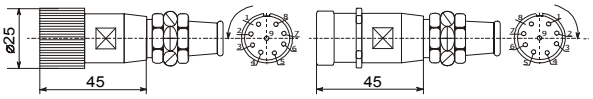
### Sinusoidal output signals SI (11 µA):




| Amplitude of signals |
|---|
| $I_b$ = $I_a$ = 7 - 16 $\mu A_{pp}$ at load 1 kOhm |
| $I_{ri}$ = 2 - 8 $\mu A_{pp}$ used component |
| **Phase - shift of signals $I_a$ and $I_b$:** |
| $\varphi$ = 90° ± 10° |

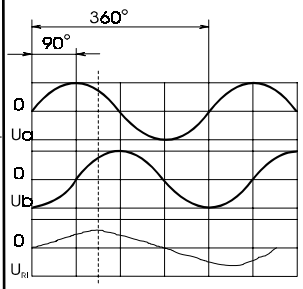
**9 pole connector (Contact) sine-wave output signals SI**

**connector** or **coupling**




| contact | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| signal | $I_a$+ | $I_a$- | +5V | 0V | $I_b$+ | $I_b$- | $I_{ri}$+ | $I_{ri}$- | shield |

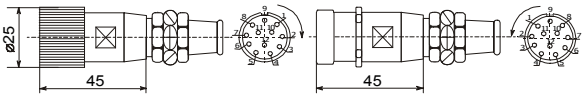
### Sine-wave voltage signals, 1Vpp (SV):




| Amplitude of signals |
|---|
| $U_b$ = $U_a$ = 0,6 - 1,2 $V_{pp}$ |
| $U_{ri}$ = 0,5 $V_{pp}$ 0,2 - 0,8 V on termination imp. 120Ohm |

**12 pole connector (Contact) sine-wave voltage 1Vpp signals**

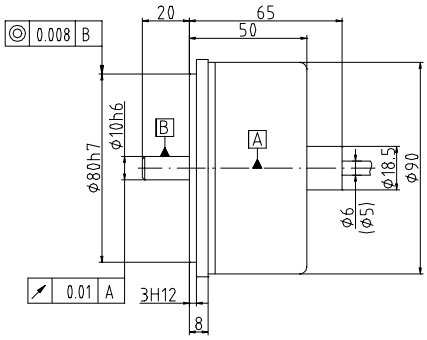
**connector** or **coupling**

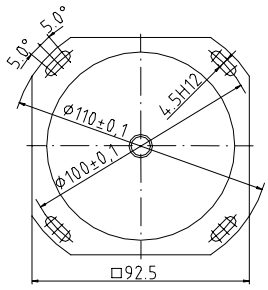



| contact | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| signal | $U_{b-}$ | sense +5V | $U_{RI+}$ | $U_{RI-}$ | $U_{A+}$ | $U_{A-}$ | — | $U_{B+}$ | — | 0V | sense +0V | +5V |

## DIMENSIONS:

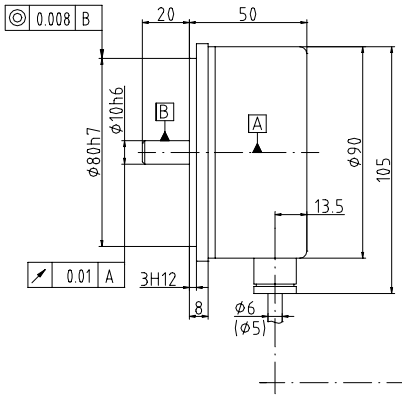
### TGR 61.5

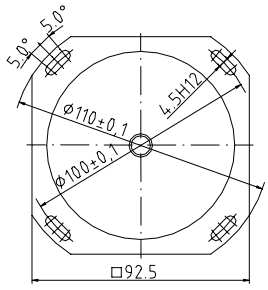


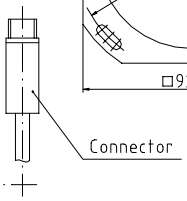




| | |
|---|---|
| Cable length | 3 m |
| Permanent bending radius | ≥ 100 mm |
| Single bending radius | ≥ 40 mm |

### TGR 61.6

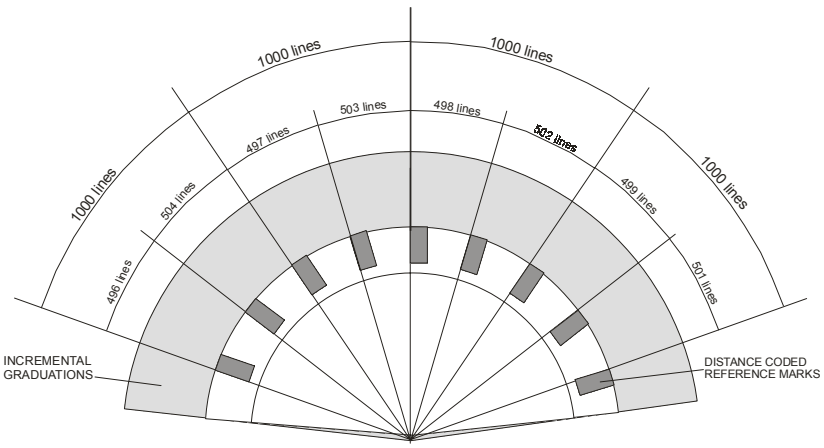



| | |
|---|---|
| Cable length | 3 m |
| Permanent bending radius | ≥ 100 mm |
| Single bending radius | ≥ 40 mm |

## DISTANCE CODED REFERENCE:



## *ORDERING DATA (example:* TGR61.$X_1$-$XX_2$-$XX_3$-$X_4$-$XX_5$-$XXXXXX_6$-$XX_7$-$X_8$*)*

| | | | | | |
|---|---|---|---|---|---|
| $X_1$ | ***Version:*** | 5 ... cable axial | 6 ... cable radial | | |
| $XX_2$ | ***Voltage supply:*** | 05 ... 5V | | | |
| $XX_3$ | ***Output signals:*** | DS | SI | SV | |
| $X_4$ | ***Reference mark:*** | 0 ... without<br>1 ... 1. reference<br>4 ... Distance Coded RI | | | |
| $XX_5$ | **Accuracy:** | 2.5... ± 2,5"<br>7.5... ± 7,5" | | | |
| $XXXXXX_6$ | ***No. of lines:*** | Enter no. of lines (SI, SV) / output signal periods (DS) per revolution<br>(see mechanical data) | | | |
| $XX_7$ | ***Cable length:*** | Standard 03 ... 3 m<br>Example: 1.5 ... 1.5 m<br>25 ... 25 m | | | |
| $X_8$ | ***Connector***<br>is defined with electrical versions: DS or SI, other type under special requirement | 1 ... Amphenol 12 pole<br>2 ... Amphenol 7 pole | 3 ... Contact 9 pole (COUPLING)<br>4 ... Contact 12 pole (CONNECTOR)<br>5 ... Contact 9 pole (CONNECTOR)<br>6 ... Contact 12 pole (COUPLING) | 7 ... D-Sub 9 pole | 9 ... other(specify)<br>0... without connector |

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