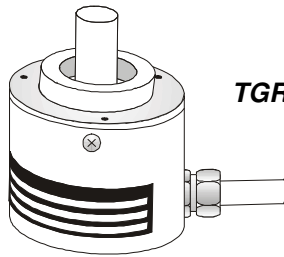


# ROTARY ENCODERS

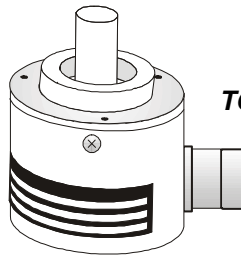
Optoelectronic

TGR10

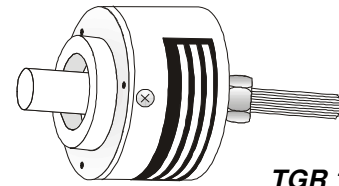
10.3, 10.4, 10.5, 10.6



TGR 10.6



TGR 10.4



TGR 10.5

## GENERAL DESCRIPTION:

The rotary encoders TGR 10 transform mechanical rotation to a series of electrical pulses. Operating principle shown in drawing right. Periodic signals of approximate sines-wave shape are generated on the photosensors via photoelectric scanning.

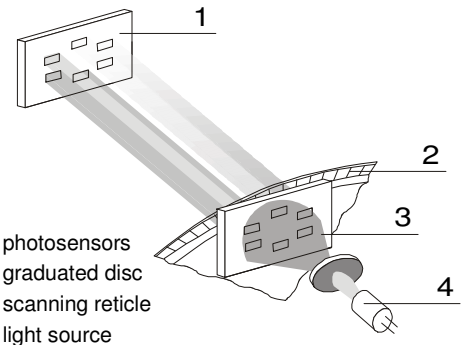
**Number of lines:** 50 to 9.000

**Diameter:** 58 mm

**Accuracy:** at temperature 20°C and frequency max 1 kHz is  $\pm 20\%/Z$  (Z = number of lines)

**Output signals:** DI (square wave inverted signals)  
 DS (square wave inverted signals with RS422)  
 DO (square wave signals)  
 SI (sine current signals)  
 SV (sine wave 1Vpp output 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, transport technique, positioning devices, robotics

## MECHANICAL DATA:

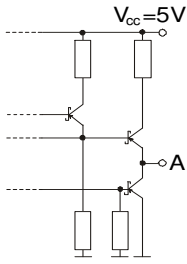
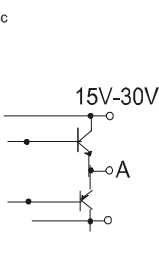
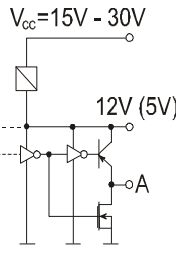
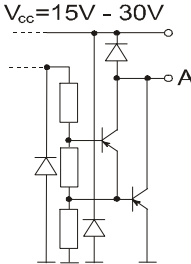
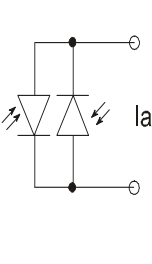
<b>Number of lines</b>	50/60/100/120/125/127/150/180/200/216/240/250/256/300/314/360/400/500/512/600/625/720/750/900/1000/1024/1250/1270/1500/1800/2000/2048/2500/3600/4000/4096/5000/9000* (* available with integrated interpolation electronics 900x10) (50...5000) x 10 Available with integrated interpolation electronics (multiplying factor x 10) valid for DO, DS
<b>Admissible shaft loading</b>	<=40N axial; <= 60N radial
<b>Rotor inertia moment</b>	<= 1.8 x 10 <sup>-6</sup> kgm <sup>2</sup>
<b>Starting moment at 20 °C</b>	<=0.01 Nm (IP64), <=0.04 Nm (IP65)
<b>Life time of bearings</b>	4 x 10 <sup>9</sup> revolutions
<b>Admissible rotation speed</b>	<=12000 min <sup>-1</sup> (IP64), <= 6000 min <sup>-1</sup> (IP65)
<b>Standard cable length</b>	3 m
<b>Max. cable length (with exstension)</b>	50 m (DI,DS and DO) and 20 m (SI)
<b>Weight</b>	250 g

## OPERATING CONDITIONS:

<b>Operating temperature</b>	0 °C to 80 °C
<b>Storage temperature</b>	-30 °C to 90 °C
<b>Relative humidity</b>	max 95% (IP 64)
<b>Protection class</b>	IP 64 by DIN 40050 IP 65 by DIN 40050
<b>Shocks</b>	300 m/s <sup>2</sup>
<b>Admissible vibrations (15-2000 Hz)</b>	100 m/s <sup>2</sup>



### ELECTRICAL DATA:

Output level design.	"T"	"P"	"L"	"C"	"S"
Output level type	TTL	Push-Pull	CMOS AMPLIFIER	OPEN COLLECTOR	SINE CURRENT
Amplifier type	SN26LS31 (RS-422)	NPN, PNP	MM88C30N	MC1413B	none
Output level schemes					
Supply voltage	5V ± 5%	15V-30V ± 5%	5V +/-5% 12V +/-5% 15V - 30V +/-5%	15V - 30V +/-5%	5V ± 5%
Power consumption	130 mA	150 mA	120mA	150mA	80mA
Output signals	<b>DO:</b> A, B, RI <b>DS:</b> A, B, RI, ,	<b>DO:</b> A, B, RI <b>DI:</b> A, B, RI, A, B, RI	<b>DO:</b> A, B, RI <b>DI:</b> A, B, RI, A, B, RI	<b>DO:</b> A, B, RI <b>DI:</b> A, B, RI, A, B, RI	<b>SI:</b> Ia+, Ia-, Ib+, Ib-, Iri+, Iri-
Output signal frequency.	f <sub>max</sub> ≤ 300 kHz	f <sub>max</sub> ≤ 150 kHz	f <sub>max</sub> ≤ 300 kHz	f <sub>max</sub> ≤ 150 kHz	f <sub>max</sub> ≤ 85 kHz
Signal edge interval	t <sub>min</sub> ≤ 1.50μs; f < 100kHz t <sub>min</sub> ≤ 0.45μs; f < 300kHz	t <sub>min</sub> ≤ 1.50μs; f < 150kHz	t <sub>min</sub> ≤ 1.50μs; f < 100kHz t <sub>min</sub> ≤ 0.45μs; f < 300kHz	t <sub>min</sub> ≤ 1.50μs; f < 100 kHz t <sub>min</sub> ≤ 0.80μs; f < 150 kHz	
Signal switch-over time	t <sub>r</sub> ≤ 20 ns t <sub>f</sub> ≤ 20 ns	t <sub>r</sub> ≤ 1 us t <sub>f</sub> ≤ 1 us	t <sub>r</sub> ≤ 60 ns t <sub>f</sub> < 60 ns	t <sub>r</sub> ≤ 1.00 μs t <sub>f</sub> ≤ 1.00 μs	
RI delay for A, B	t <sub>d</sub> ≤ 60 ns	t <sub>d</sub> ≤ 100 ns	t <sub>d</sub> ≤ 100 ns	t <sub>d</sub> ≤ 100 ns	
Load	I <sub>out</sub> = ± 20 mA; C = 1000 pF	I <sub>out</sub> ≤ 50 mA; C = 1000 pF	I <sub>out</sub> = ± 20 mA; C = 1000 pF	I <sub>out</sub> ≤ 100 mA; C = 1000pF	
Signal levels	U <sub>OH</sub> > 2.5V; I <sub>out</sub> ≤ 20mA U <sub>OL</sub> < 0.5V; I <sub>out</sub> ≤ 20mA	U <sub>OH</sub> > U <sub>b</sub> - 2V; I <sub>out</sub> = 50mA U <sub>OL</sub> < 2V; I <sub>out</sub> = -50mA	for 12 and 15-30V: U <sub>OH</sub> > 9V; I <sub>out</sub> = -20mA U <sub>OL</sub> < 0.5V; I <sub>out</sub> = 20mA for 5V: U <sub>OH</sub> > 3.5V; I <sub>out</sub> = -20mA U <sub>OL</sub> < 0.5V; I <sub>out</sub> = 20mA	U <sub>OH</sub> > 12.0V; I <sub>out</sub> = -1mA U <sub>OL</sub> < 0.9V; I <sub>out</sub> = 100mA	I <sub>a</sub> = I <sub>b</sub> = 7+16 μA (on 1kOhm load) I <sub>ri</sub> = 2-8 μA (on 1 kOhm load, usable part) phase I <sub>a</sub> to I <sub>b</sub> : j = 90° ± 15°
Note: in "S" version Admissible shaft rotation speed	$n \leq \frac{18}{z} \cdot 10^6 \text{ rev / min}$ z - number of lines	$n \leq \frac{9}{z} \cdot 10^6 \text{ rev / min}$ z - number of lines	$n \leq \frac{18}{z} \cdot 10^6 \text{ rev / min}$ z - number of lines	$n \leq \frac{9}{z} \cdot 10^6 \text{ rev / min}$ z - number of lines	$n \leq \frac{5}{z} \cdot 10^6 \text{ rev / min}$ z - number of lines

### CONNECTION DATA

Signal allocation on individual conductors in different versions:

	pink	violet		red	black	brown	green	grey	shield	white	yellow	
"DO"	-	+U* <sub>B</sub>	+U <sub>B</sub>	RI	-	A	-	B	shield	0V	0V*	
'DI', 'DS'	$\bar{B}$	+U* <sub>B</sub>	+U <sub>B</sub>	RI	$\bar{RI}$	A	$\bar{A}$	B	shield	0V	0V*	
"SI"	I <sub>ri-</sub>		I <sub>b+</sub>	I <sub>b-</sub>	-	U <sub>b</sub>	I <sub>a+</sub>	I <sub>ri+</sub>	shield	0V	I <sub>a-</sub>	

\* for compensation of supply voltage drop in long connecting cables

# ROTARY ENCODERS

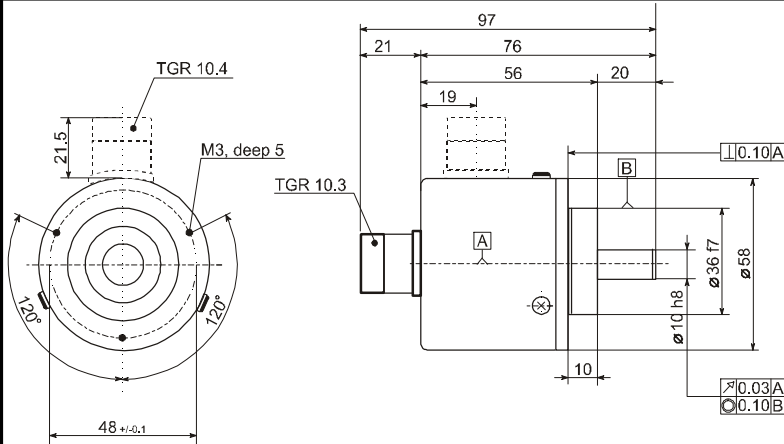
Optoelectronic

TGR10

10.3, 10.4, 10.5, 10.6

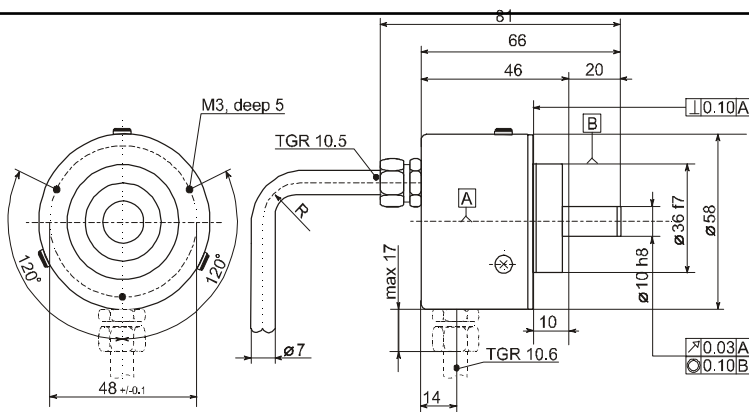
## DIMENSIONS:

### TGR 10.3, TGR 10.4



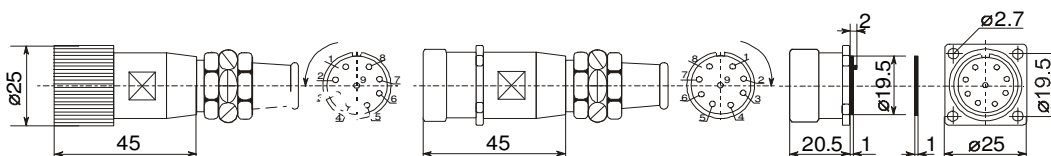
Cable length 3 m  
 Permanent bending radius ± 100 mm  
 Single bending radius ± 40 mm

### TGR 10.5, TGR 10.6



Cable length 3 m  
 Permanent bending radius ± 100 mm  
 Single bending radius ± 40 mm

## CONNECTORS FOR "SI" OUTPUT SIGNALS:



9-pin	M	421	609	131	F	421	609	132	F	421	609	130
-------	---	-----	-----	-----	---	-----	-----	-----	---	-----	-----	-----

pin	1	2	3	4	5	6	7	8	9
signal	I <sub>a+</sub>	I <sub>a-</sub>	+ U <sub>B</sub>	0 V	I <sub>b+</sub>	I <sub>b-</sub>	I <sub>ri+</sub>	I <sub>ri-</sub>	shield*
colour	green	yellow	brown	white	blue	red	grey	pink	

\*inside sheath on pin 9, outside sheath on connector housing



# ROTARY ENCODERS

Optoelectronic

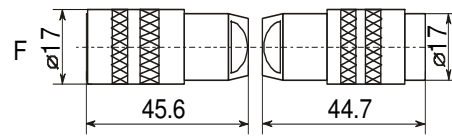
TGR10

10.3, 10.4, 10.5, 10.6

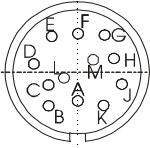
## CONNECTORS FOR "DI", "DO" AND "DS" OUTPUT SIGNALS:

DI, DS:

7-pin	F	196	4161
12-pin	F	192	4162

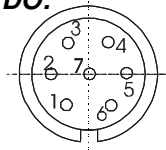


7-pin	M	192	4163
12-pin	M	192	4169

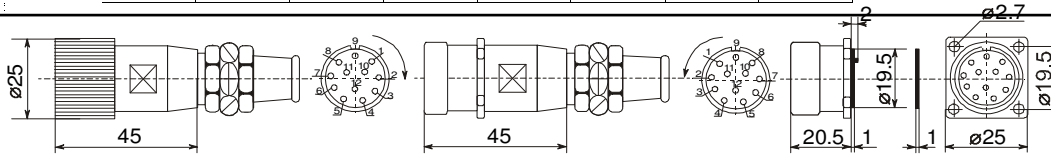


pin	A	B	C	D	E	F	G	H	J	K	L	M
signal	shield	0 V	A	$\bar{A}$	B	-	RI	$\bar{R}$	-	+ U <sub>B</sub>	$\bar{B}$	-
colour	shield	white	brown	green	grey	-	red	black	-	blue	pink	-

DO:



pin	1	2	3	4	5	6	7
signal	0 V	-	A	B	+ U <sub>B</sub>	RI	shield
colour	white	-	brown	grey	blue	red	shield



12-pin	M	421	609	129
12-pin	F	421	609	125

12-pin	F	421	609	126
--------	---	-----	-----	-----

12-pin	M	421	609	127
12-pin	F	421	609	128

\*for voltage drop compensation in long cables

pin	1	2	3	4	5	6	7	8	9	10	11	12
signal	$\bar{B}$	+ U <sub>B</sub> *	RI	$\bar{R}$	A	$\bar{A}$	-	B	shield	0 V	0 V*	+ U <sub>B</sub>
colour	pink	violet	red	black	brown	green	-	grey	shield	white	yellow	blue

## ORDERING DATA (example: TGR10 - X<sub>1</sub>-XX<sub>2</sub>-X<sub>3</sub>-X<sub>4</sub>-XX<sub>5</sub>-XXXX<sub>6</sub>-X<sub>7</sub>-XX<sub>8</sub>)

X <sub>1</sub>	Version:	3 ... connector, axial		5 ... cable axial	
XX <sub>2</sub>	Voltage supply:	05 ... 5V		12 ... 12V	
X <sub>3</sub>	Output level:	T ... TTL		L ... CMOS, P...Push-Pull, C ... open collector S ... sine current	
X <sub>4</sub>	Output signals:	DO ... A, B, RI		DI,DS ... $\bar{A}, \bar{A}, \bar{B}, \bar{B}, RI, \bar{R}$	
XX <sub>5</sub>	Protection:	64 ... IP64		65 ... IP65	
XXXX	No. of lines:	Enter no. of lines		(see mechanical data)	
X <sub>7</sub>	Cable length:	Standard 3 m : 03		Example: 1.5 m : 1.5	
XX <sub>8</sub>	Connector is defined with electrical versions: DO, DI,DS or SI other type under special	1 ... Amphenol 12 pole 2 ... Amphenol 7 pole		3 ... Contact 9 pole (M screw) 7 ... D-Sub 9 pole 4 ... Contact 12 pole (F screw) 5 ... Contact 9 pole (F screw) 6 ... Contact 12 pole (M screw)	
				9 ... other(specify) 0... without connector	

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