

Incremental encoders

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Series IE INFO

Incremental rotary encoder IE-24-T.....	TR-VCE-TI-GB-0549
Incremental rotary encoder IE-35.....	TR-VCE-TI-GB-0550
Incremental rotary encoder IE-40.....	TR-VCE-TI-GB-0560
Incremental rotary encoder IE-58.....	TR-VCE-TI-GB-0570
Incremental rotary encoder IE-80.....	TR-VCE-TI-GB-0580

Series IH..... INFO

Incremental hollow shaft encoder IH-20.....	TR-VCE-TI-GB-0600
Incremental hollow shaft encoder IH-58.....	TR-VCE-TI-GB-0610
Incremental hollow shaft encoder IH-76 (type 0500).....	TR-VCE-TI-GB-0620
Incremental hollow shaft encoder IH-76 (type 0503).....	TR-VCE-TI-GB-0630
Incremental hollow shaft encoder IH-120.....	TR-VCE-TI-GB-0650

Series ZI INFO

Incremental rotary encoder ZI-58-S (programmable).....	TR-VCE-TI-GB-0700
Incremental rotary encoder ZI-58-S with ax./rad. cable (progr.)...	TR-VCE-TI-GB-0710

Series ZHI..... INFO

Incremental hollow-shaft encoder ZHI-65 (programmable).....	TR-VCE-TI-GB-0720
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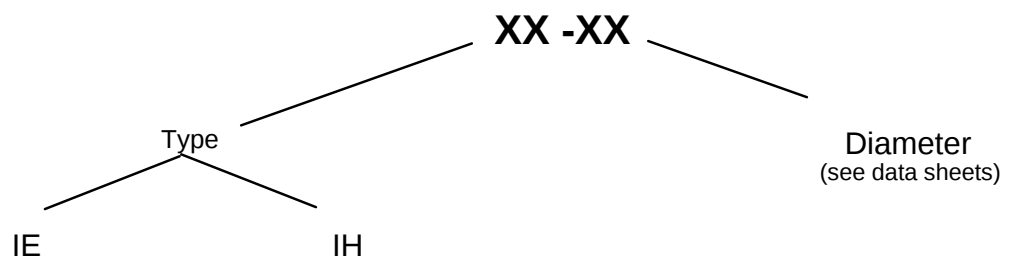
6 Incremental encoders

6.1 Explanatory notes

The various models of the incremental encoder series described in this section all comply with the mechanical, electrical and connection specifications of the TR standard.

The TR encoders also offer a variety of customization options, however (please consult the sales department regarding versions differing from the data sheets). Possible adaptation options are shown in subsection "Alternative designs", page 6-8

Series definition

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Type

IE: Incremental encoder

The series-IE encoders are driven via a coupling which is connected to the drive shaft.

IH: Incremental encoder (hollow shaft)

The mechanical structure of the IH-series encoders does not require a coupling between the drive and the hollow shaft of the encoder. Instead, the encoder is pushed directly onto the motor or spindle axle.

6.2 Functional description

A rotary movement is processed in the incremental encoder and output in the form of an electrical signal.

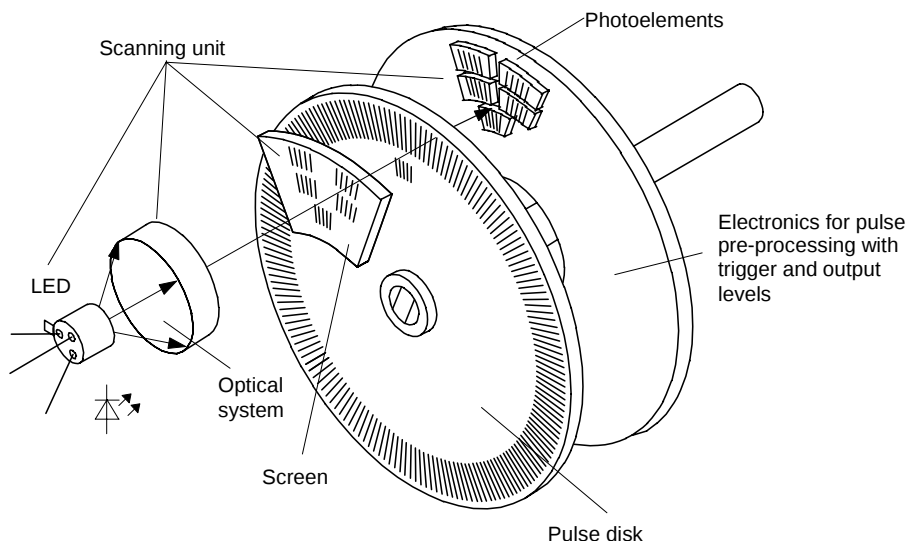
Angular increments are recorded via a pulse wheel with a fixed number of cycles per revolution. A scanning unit with an integrated optoelectronic system generates electrical signals and emits pulses (measuring increments) which are pre-processed at trigger levels.

The resolution of the measuring system is defined via the number of light/dark segments (number of graduation marks per revolution) on the pulse wheel. For example, an encoder with 1000 graduation marks will emit a signal sequence of 1000 pulses while completing a single revolution.

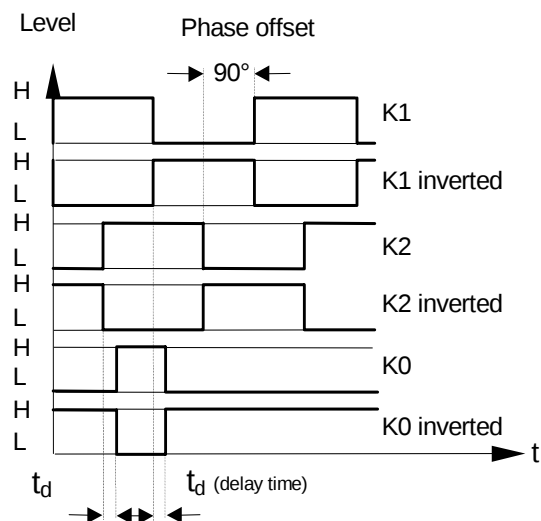
In order to evaluate the code sequence, a 2nd signal sequence with a 90° phase offset is required for control purposes.

The counter of an external control system can be reset with an additional zero pulse in order to define the mechanical control reference point.

Sketch:



Signal sequence (example)



6.3 Applications

The accurate recording of mechanical rotary movements and their conversion to electrical signals is essential for the reliable operation of positioning and CNC control systems.

The TR incremental encoders are characterized by a simple, robust structure which again guarantees reliable operation.

This robust structure allows the encoder to be used in extreme environmental conditions including shocks, vibrations, contamination and changing temperatures.

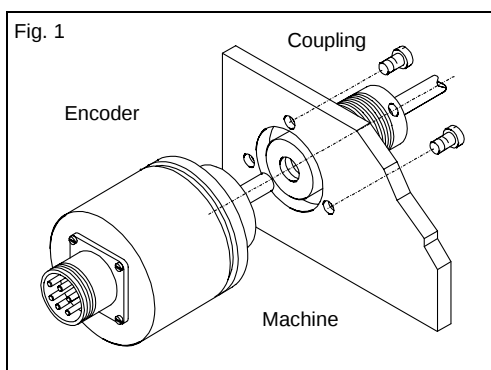
The photo-electric measuring principle allows a high degree of measuring accuracy coupled with low-cost, versatile and flexibly designed solutions for general automation.

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Examples of typical applications of incremental encoders:

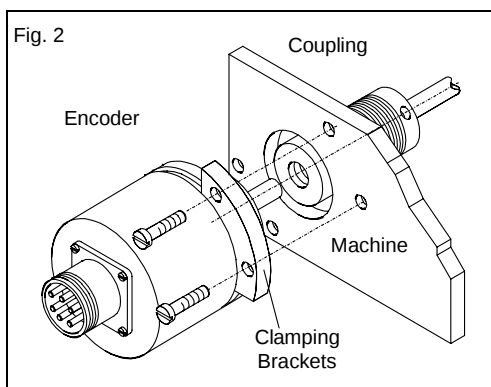
- Handling equipment
- Flexible production plants
- Assembly lines
- Woodworking machines
- Printing industry
- Apparatus engineering
- Packaging machines
- Straightening plants
- Bending machines
- Presses
- Paint shops
- etc.

6.4 Assembly examples



Encoder shaft drive

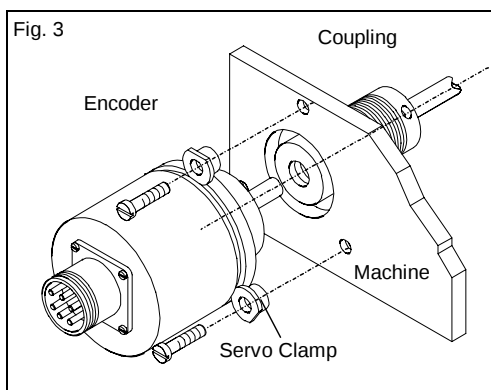
The IE-series incremental encoders are connected to the drive shaft via an elastic coupling, which compensates for any deviations in the axial and radial direction between the encoder and drive shaft. This avoids excessive strain on the bearings.



Types of mounting (type-specific)

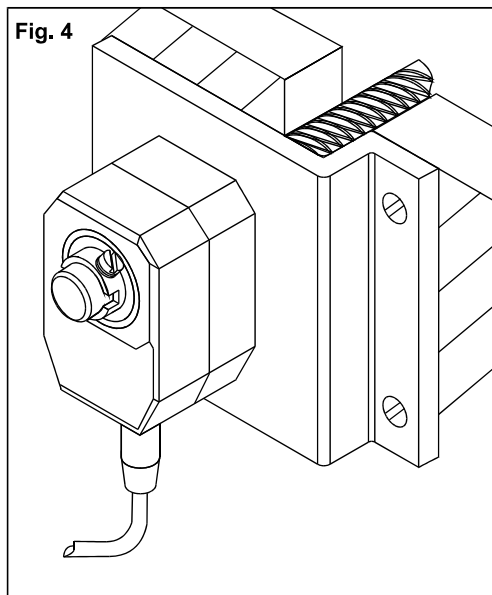
Flange mounting

A centering collar with a suitable fit centers the encoder in relation to the shaft. It is fixed to the machine by means of screws in the flange (Fig. 1)



Clamping bracket mounting

A centering collar with a suitable fit centers the encoder in relation to the shaft. The encoder is fixed by means of clamping brackets or servo clamps (Fig. 2 and 3)



Assembly examples, IH series

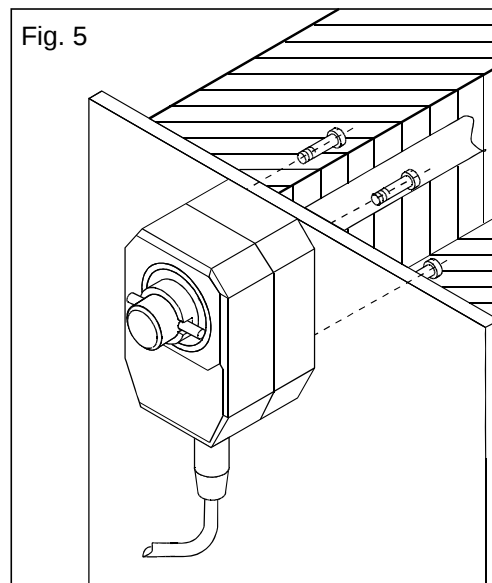
The hollow-shaft encoder IH differs significantly from the IE in terms of mechanical structure.

Care must be taken, however, to mount it correctly in the **axial and radial** directions.

The encoder is installed by simply pushing it onto the motor or spindle axle and tightening the clamping or fastening screws.

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Diagrams 4 and 5 show examples of how to assemble the IH-20 and possible ways of connecting the drive shaft to the encoder shaft.

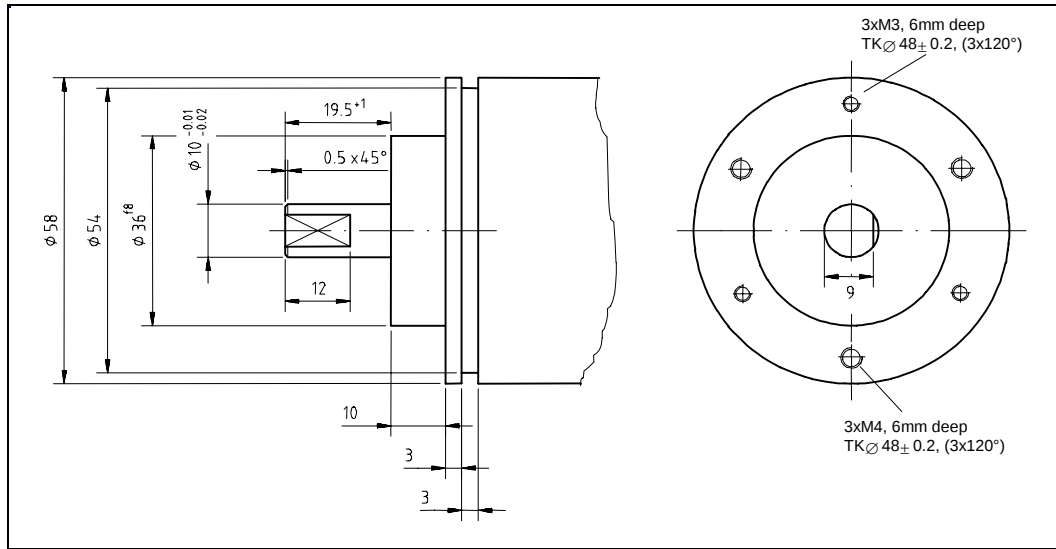


6.5 Alternative designs

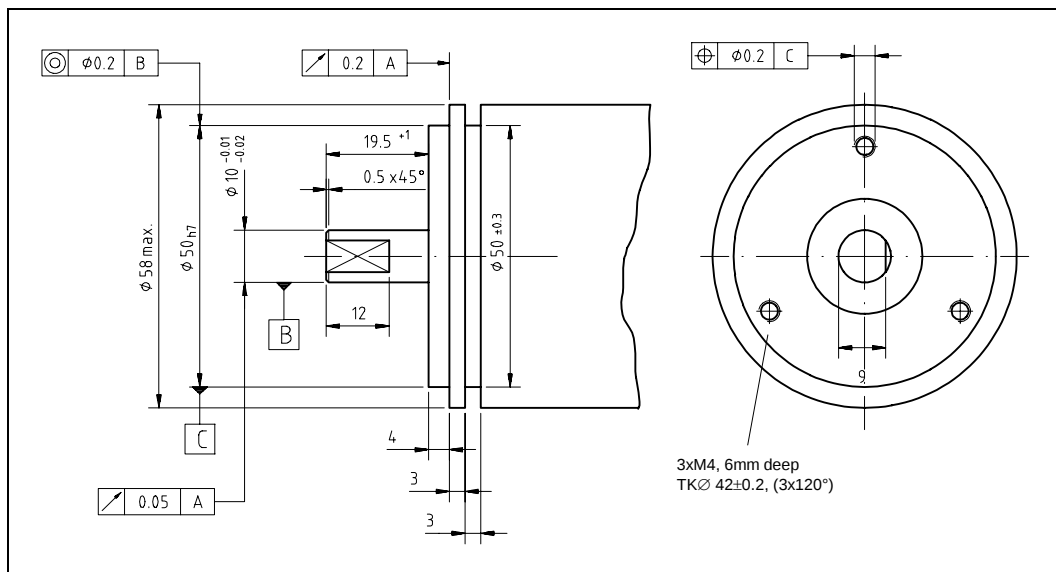
Mechanical

There are two flange types available for the IE-58 which can be used to adjust the encoder to existing constructions or to ensure uniform assembly:

IE-58 with centering collar ZB 36



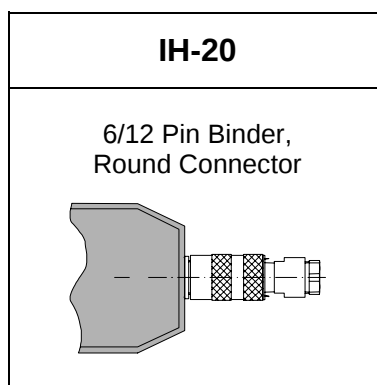
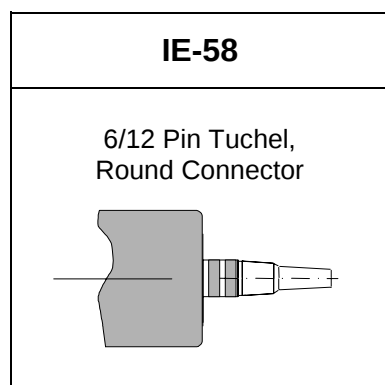
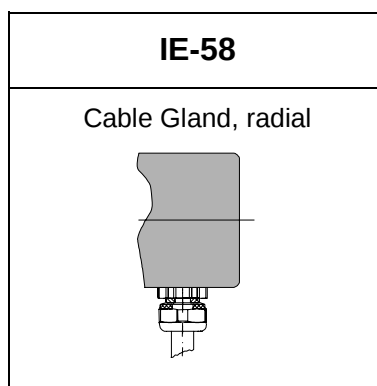
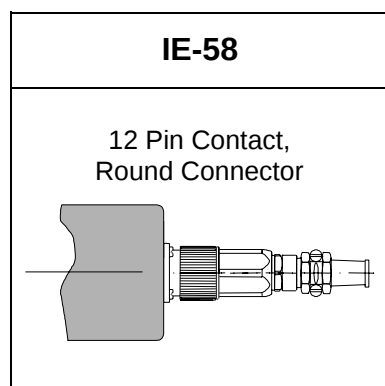
IE-58 with centering collar ZB 50



Connecting equipment

The TR encoders can be supplied with various plug or cable outlets. It is advisable to use a plug if the wiring and encoder assembly are to be performed at different times or if an encoder has to be replaced quickly and easily. On the encoder side, you will normally find a flanged plug (pins); to connect this, you will need a coupling or cable socket into which to plug the cable or control unit. Specifications and details of plug types are available on request.

Connection examples



Electrical

The encoder types can be supplied with different electrical properties in order to adapt them to the servo electronics.

Supply voltage

- +(11-27) V DC
- +5V DC

Output circuits

- Push-pull
- Cable driver (TTL-compatible)

Incremental-Encoder IE-24-T

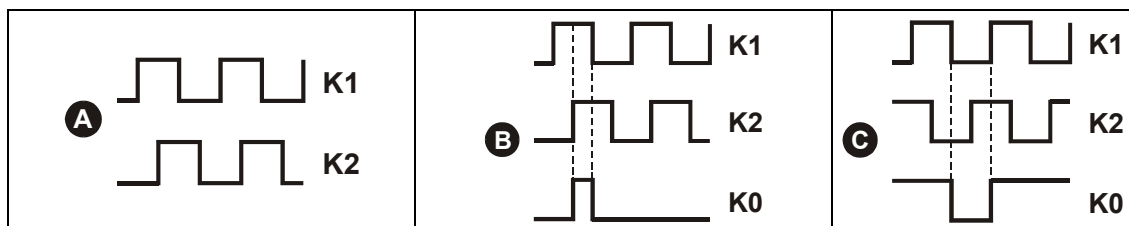


- **Very Small Compact Design**
(Diameter 24 mm)
- **Universal Applications**
- **Number of Pulses per Revolution up to 600**

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Electrical Data

Supply Voltage	optional
11 – 27 V DC	reverse polarity protected
5 V DC $\pm 5\%$	reverse polarity protected
Current Consumption (No Load)	≤ 25 mA
Outputs (11-27 V Level)	Push-Pull, short-circuit proof
Output Amplitude	$U_{LOW} \leq 1.5$ V $U_{HIGH} \geq U_{Supply Voltage} - 3$ V
Outputs (5 V Level)	Line driver
Output Amplitude	$U_{LOW} \leq 0.5$ V $U_{HIGH} \geq 2.5$ V
Pulse Duty Factor	1:1, $\pm 10\%$ at 30 kHz
Edge Steepness	≥ 15 V / s
Cut-Off Frequency	100 kHz
Output Load Current	≤ 30 mA
Number of Pulses Per Revolution	100, 360, 500, 600
Output Signals (see diagram)	2 square-wave pulse sequence with 90° ($\pm 10\%$) phase shift
Option	with reference pulse, 90° or 180° ($\pm 10\%$) electrical length



Direction of rotation CW (with view to the shaft)

Environmental Data

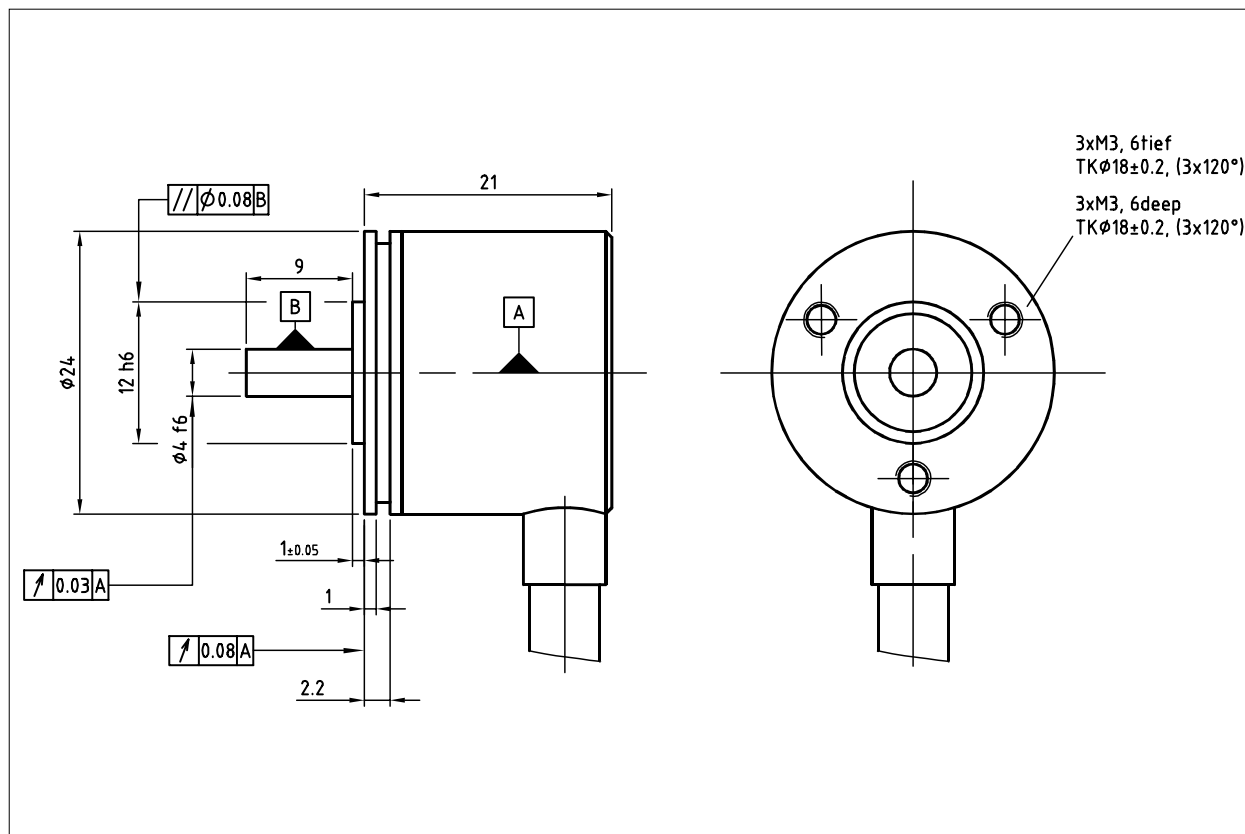
Electromagnetic compatibility (EMC)	EN 61000-4-2 (IEC-801-2) / EN 61000-4-4 (IEC-801-4)
Operating Temperature	-20 to +85°C
Protection Class	IP 54 (DIN 40 050, IEC 529)

Mechanical Data

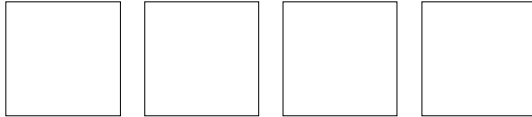
Maximum Rotational Speed	$\leq 18000 \text{ min}^{-1}$
Maximum Load on Shaft	$\leq 10 \text{ N axial}, \leq 20 \text{ N radial (at end of shaft)}$
Weight	approx. 50 g
Momentum of Inertia of the Rotor.....	approx. 2 gcm^2
Startup Momentum 20°C (68° F).....	$\leq 0.6 \text{ Ncm}$
Vibration (55-2000 Hz) according to DIN IEC 68-2-6	$\leq 100 \text{ m/s}^2 (10g)$
Shock (11ms) according to DIN IEC 68-2-27	$\leq 300 \text{ m/s}^2 (30g)$
Housing	Alloy
* Connection.....	Cable outlet radial, 1.0 m (standard)

* other cable lengths upon request

Dimensional Drawing



Incremental-Encoder IE-35



- **Small Compact Design (35 mm)**
- **Universal Applications**
- **Number of Pulses per Revolution 1 to 2500**

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Electrical Data

Supply Voltage	11-27 V DC
5 VDC	Upon request
Power Dissipation (No Load)	< 2.5 Watt
Output (11-27 V)	Push-Pull
Maximum Current	max. 20 mA
Incremental Signal	A, A neg., B, B neg.
Marker Pulse	Z, Z neg., 1 pulse per revolution
Maximum Output Frequency	160 kHz
Output (5 V)	Line Driver
Maximum Current	max. 20 mA
Incremental Signal	A, A neg., B, B neg.
Marker Pulse	Z, Z neg., 1 pulse per revolution
Maximum Output Frequency	300 kHz
Tolerance (at 100 kHz)	
Phase Shift	±30°
Pulse Width	±30°
Number of Pulses Per Revolution	1 to 2500

Environmental Data

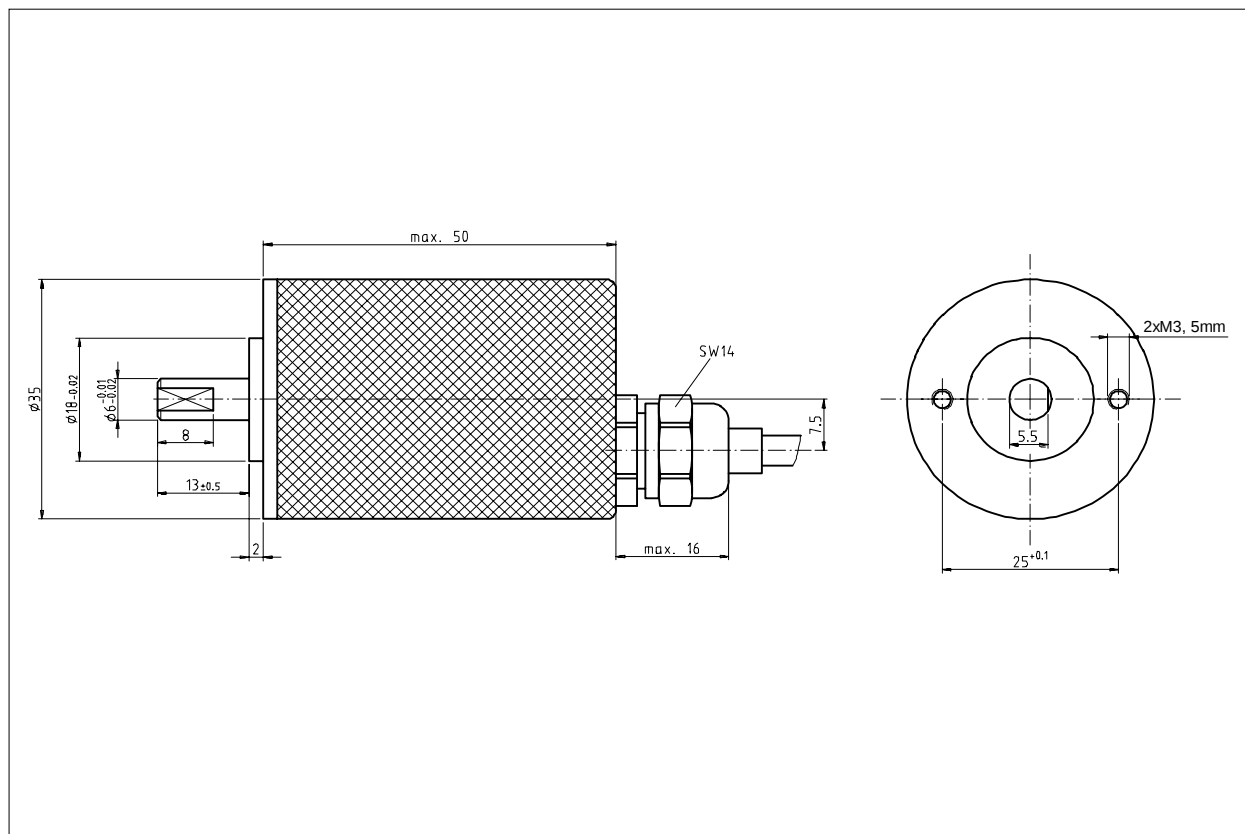
Electromagnetic compatibility (EMC)	EN 61000-4-2 (IEC-801-2) / EN 61000-4-4 (IEC-801-4)
Operating Temperature	0° to +80°C (32° to 176°F)
Extended Temperature (Optional)	-30° to +80°C (-22° to 176°F)
Relative Humidity	98 % (non condensing)
* Protection Class	IP 65 (DIN 40 050)
* The protection class of the encoder can be effected by the type of cable and connector used.	

Mechanical Data

Maximum Rotational Speed	max. 12000 RPM
Maximum Load on Shaft	10 N axial, 20 N radial (at end of shaft)
Weight	0.2 kg (0.4 lb.)
Maximum Angular Acceleration	$\leq 10^5 \text{ rad/s}^2$
Momentum of Inertia	$0.2 \times 10^{-6} \text{ kg m}^2$
Startup Momentum 20°C (68° F)	0.01 Ncm
Vibration (50-2000 Hz Sinusoidal)	
DIN IEC 68-2-6	$\leq 100 \text{ m/s}^2$ (10g)
Shock (11ms) DIN IEC 68-2-27	$\leq 1000 \text{ m/s}^2$ (100g)
* Standard Connector	PG axial cable (pigtail)

* Different Cable Lengths on Request.

Dimensional Drawing



Incremental-Encoder IE-40



- **Small Compact Design (40 mm)**
- **Universal Applications**
- **Number of Pulses per Revolution**
100 to 2500

6

Electrical Data

Supply Voltage	11-27 V DC
5 VDC	Upon request
Power Dissipation (No Load)	< 4 Watt
Output (11-27 V)	Push-Pull
Maximum Current	max. 40 mA
Incremental Signal	A, A neg., B, B neg.
Marker Pulse	Z, Z neg., 1 pulse per revolution
Maximum Output Frequency	160 kHz $\pm 15^\circ$ (300 kHz to 5 V)
Output (5 V)	TTL
Incremental Signal	A, A neg., B, B neg.
	Channel A leads channel B when rotating in a clockwise direction.
Marker Pulse (Option)	Z, Z neg., 1 pulse per revolution
Maximum Output Frequency	160 kHz $\pm 15^\circ$
Number of Pulses Per Revolution	100 - 2500

Environmental Data

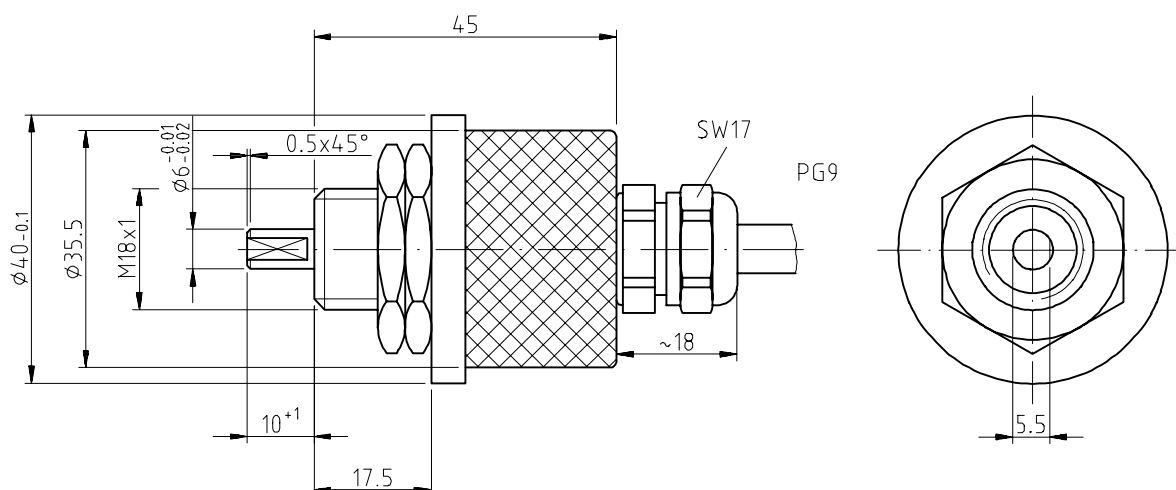
Electromagnetic compatibility (EMC)	EN 61000-4-2 (IEC-801-2) / EN 61000-4-4 (IEC-801-4)
Operating Temperature	-20° to +60°C (-4° F to 140° F)
Extended Temperature (Optional)	-30° to +80°C (-22° to 176°F)
Relative Humidity	98 % (non condensing)
* Protection Class	IP 65 (DIN 40 050)
* The protection class of the encoder can be effected by the type of cable and connector used.	

Mechanical Data

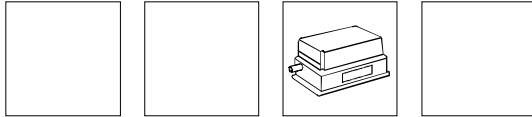
Maximum Rotational Speed	6000 RPM
Maximum Load on Shaft	5 N axial, 5 N radial (at end of shaft)
Weight	0.2 kg (0.4 lb.)
Momentum of Inertia	$0.5 \times 10^{-6} \text{ kg m}^2$
Startup Momentum 20°C (68° F)	$\leq 3 \text{ Ncm}$
Vibration (50-2000 Hz Sinusoidal)	
DIN IEC 68-2-6	$\leq 100 \text{ m/s}^2$ (10g)
Shock (11ms) DIN IEC 68-2-27	$\leq 1000 \text{ m/s}^2$ (100g)
* Standard Connector	PG axial cable (pigtail)

* Different Cable Lengths on Request.

Dimensional Drawing



Incremental-Encoder IE-58



- **Small Compact Design**
- **Universal Applications**
- **Number of Pulses per Revolution 1 to 10 000**

6

Electrical Data

Supply Voltage	11-27 V DC
5 VDC	Upon request
Power Dissipation (No Load)	< 4 Watt
Output (11-27 V)	Push-Pull
Maximum Current	max. 30 mA
Incremental Signal	A, A neg., B, B neg.
	Channel A leads channel B when rotating in a clockwise direction.
Marker Pulse	Z, Z neg., 1 pulse per revolution
Output Frequency	< 1000 PPR = 30 kHz, > 1000 PPR = 160 kHz
Rise Time of Edge	< 500 ns
Output (5 V)	Line Driver
Maximum Current	max. 50 mA
Incremental Signal	A, A neg., B; B neg.
	Channel A leads channel B when rotating in a clockwise direction.
Marker Pulse	Z, Z neg., 1 pulse per revolution
Output Frequency	< 1000 PPR = 100 kHz, > 1000 PPR = 300 kHz
Rise Time of Edge	< 100 ns
Maximum Revolutions per Minute (RPM)	(Output Frequency [Hz] / PPR) x 60 seconds
Number of Pulses Per Revolution	1 - 10 000

Environmental Data

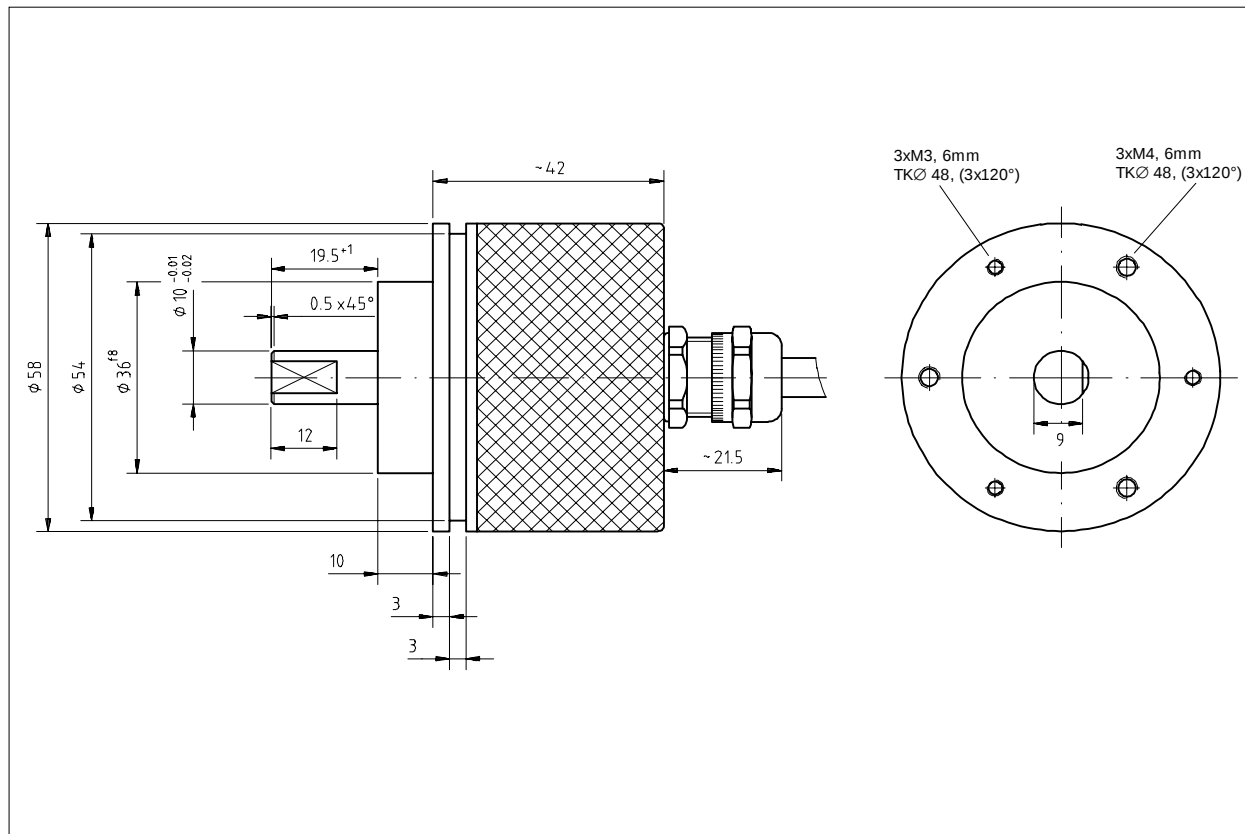
Electromagnetic compatibility (EMC)	EN 61000-4-2 (IEC-801-2) / EN 61000-4-4 (IEC-801-4)
Operating Temperature	0° to 70°C (32°F to 158°F) (Option -20° to +70°C) (-4°F to 158°F)
Extended Temperature (Optional)	-30° to +80°C (-22° to 176°F)
Relative Humidity	98 % (non condensing)
* Protection Class	IP 65 (DIN 40 050)
* The protection class of the encoder can be effected by the type of cable and connector used.	

Mechanical Data

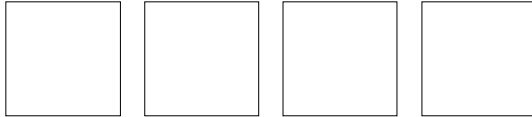
Maximum Rotational Speed	6000 RPM
Maximum Load on Shaft	40 N axial, 60 N radial (at end of shaft)
Lifetime on Bearings	3.9×10^{10} Revolutions at:
- Operational Speed.....	3000 RPM
- Maximum Load on Shaft.....	20 N axial, 30 N radial (at end of shaft)
- Operating Temperature	60°C
Weight	0.3 kg (0.7 lb.)
Maximum Angular Acceleration	$\leq 10^4 \text{ rad/s}^2$
Momentum of Inertia	$2.5 \times 10^{-6} \text{ kg m}^2$
Startup Momentum 20°C (68° F)	2 Ncm
Vibration (50-2000 Hz Sinusoidal)	
DIN IEC 68-2-6	$\leq 100 \text{ m/s}^2$ (10g)
Shock (11ms) DIN IEC 68-2-27	$\leq 1000 \text{ m/s}^2$ (100g)
* Standard Connector	PG 9 axial cable (pigtail)

* Different Cable Lengths on Request.

Dimensional Drawing



Incremental-Encoder IE-80



- **Robust design**
- **Universal Applications**
- **Two Incremental Outputs with Independent Resolutions**

Output 1: 1 to 9000 PPR

Output 2: 1 to 6500 PPR

6

Electrical Data

Supply Voltage	11-27 V DC
5 V DC	Upon Request
Power Dissipation (No Load)	< 2.5 Watt
Output (11-27 V)	Push-Pull
Maximum Current	max. 20 mA
Incremental Signal	A, A neg., B, B neg.
Marker Pulse	Z, Z neg., 1 pulse per revolution
Maximum Output Frequency	160 kHz
Output (5 V)	Line Driver
Maximum Current	max. 20 mA
Incremental Signal	A, A neg., B; B neg.
Marker Pulse	Z, Z neg., 1 pulse per revolution
Maximum Output Frequency	300 kHz
Tolerance (at 20 kHz)	
Phase Shift	±10°
Pulse Width	±10°
Tolerance (at 100 kHz)	
Phase Shift	±30°
Pulse Width	±30°
Pulses per Revolution	
Output 1	1 to 9000
Output 2	1 to 6500
Option	Sinusoidal Signal, 160 kHz (-3dB), voltage or current source

Environmental Data

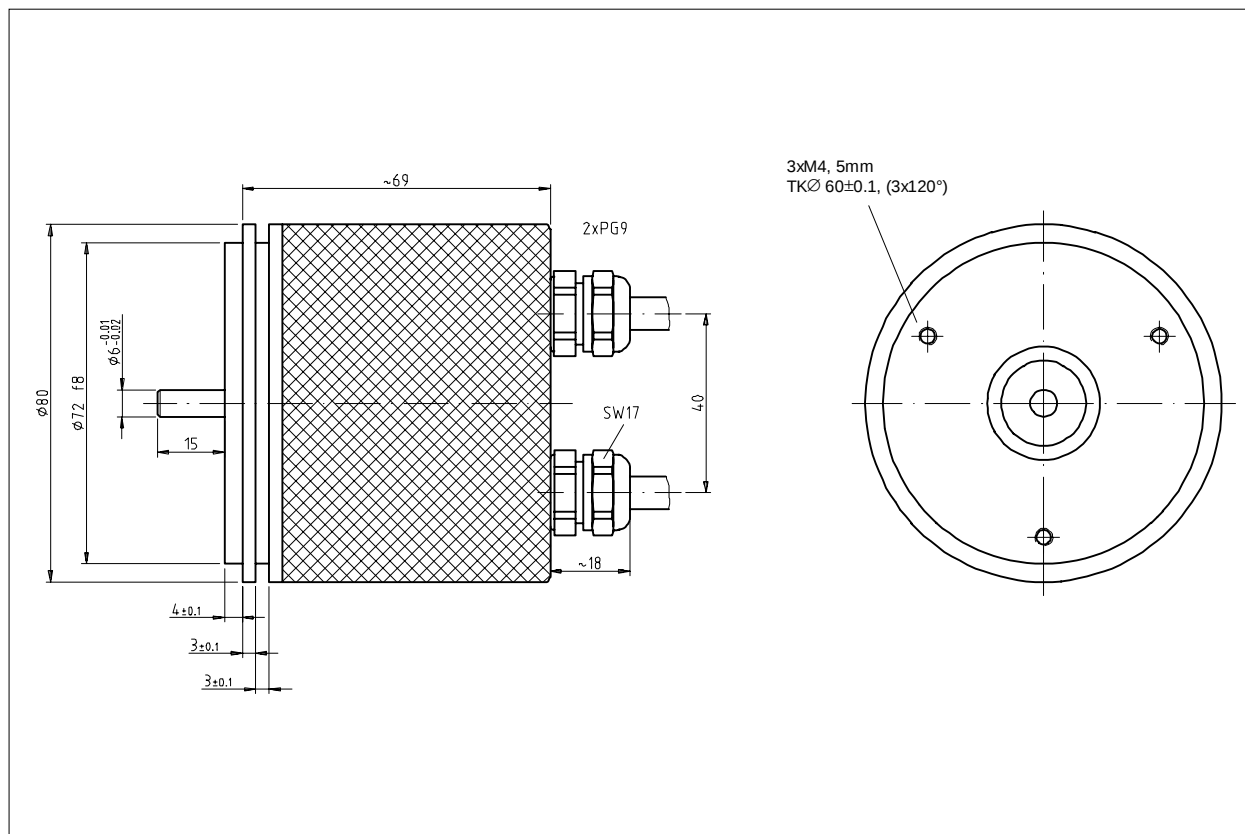
Electromagnetic compatibility (EMC)	EN 61000-4-2 (IEC-801-2) / EN 61000-4-4 (IEC-801-4)
Operating Temperature	0°-60°C (32°F to 140°F)
Extended Temperature (Optional)	-30° to +80°C (-22° to 176°F)
Relative Humidity	98 % (non condensing)
* Protection Class	IP 65 (DIN 40 050)
* The protection class of the encoder can be effected by the type of cable and connector used.	

Mechanical Data

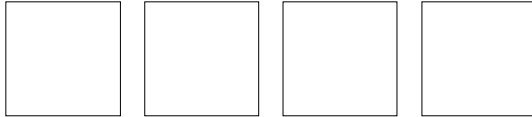
Maximum Rotational Speed	12000 RPM
Maximum Load on Shaft	10 N axial, 20 N radial (at end of shaft)
Weight	1.1 kg (2.4 lb.)
Maximum Angular Acceleration	$\leq 10^5 \text{ rad/s}^2$
Momentum of Inertia	$55 \times 10^{-6} \text{ kg m}^2$
Startup Momentum 20°C (68° F)	0.01 Ncm
Vibration (50-2000 Hz Sinusoidal)	
DIN IEC 68-2-6	$\leq 100 \text{ m/s}^2$ (10g)
Shock (11ms) DIN IEC 68-2-27	$\leq 1000 \text{ m/s}^2$ (100g)
* Standard Connector	2 x PG 9 axial cable (pigtail)

* Different Cable Lengths on Request.

Dimensional Drawing



Incremental-Encoder IH-20



- **Hollow Shaft Encoder for Direct Coupling to any Drive Shaft (I.D. = 20 mm)**
- **Number of Pulses per Revolution up to 1024**

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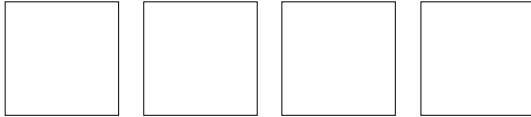
Electrical Data

Supply Voltage	11-27 V DC
5 VDC	Upon request
Power Dissipation (No Load)	< 3 Watt
Output (11-27 V)	Push-Pull
Maximum Current	max. 30 mA
Incremental Signal	A, A neg., B, B neg.
	Channel A leads channel B when rotating in a clockwise direction.
Marker Pulse	Z, Z neg., 1 pulse per revolution
Output Frequency	30 kHz
Rise Time of Edge	< 500 ns
Output (5 V)	Line Driver
Maximum Current	max. 50 mA
Incremental Signal	A, A neg., B; B neg.
	Channel A leads channel B when rotating in a clockwise direction.
Marker Pulse	Z, Z neg., 1 pulse per revolution
Output Frequency	100 kHz
Rise Time of Edge	< 100 ns
Maximum Revolutions per Minute (RPM)	(Output Frequency [Hz] / PPR) x 60 seconds
Number of Pulses per Revolution (Standard)	1, 15, 25, 30, 60, 100, 200, 218,
	360, 500, 600, 720, 800, 900, 1000, 1024
Other Resolutions	Upon request

Environmental Data

Electromagnetic compatibility (EMC)	EN 61000-4-2 (IEC-801-2) / EN 61000-4-4 (IEC-801-4)
Operating Temperature	0° to 60°C (32°F to 140°F) (Option -20° to 70°C / -4°F to 158°F)
Extended Temperature (Optional)	-30° to +80°C (-22° to 176°F)
Relative Humidity	98 % (non condensing)
* Protection Class	IP 65 (DIN 40 050)
* The protection class of the encoder can be effected by the type of cable and connector used.	

Incremental-Encoder IH-58



- **Hollow Shaft Encoder for Direct Coupling to any Drive Shaft**
(I.D. = 4 ... 12 mm)
- **Number of Pulses per Revolution Up To 10 000**

6

Electrical Data

Supply Voltage	11-27 V DC
5 V DC	Upon request
Output (11-27 V)	Push-Pull
Maximum Current	max. 20 mA
Incremental Signal	A, A neg., B, B neg.
Marker Pulse	Z, Z neg., 1 pulse per revolution
Maximum Output Frequency	160 kHz
Output (5 V)	Line Driver
Maximum Current	max. 20 mA
Incremental Signal	A, A neg., B; B neg.
Marker Pulse	Z, Z neg., 1 pulse per revolution
Maximum Output Frequency	300 kHz
Tolerance (at 20 kHz)	
Phase Shift	±10°
Pulse Width	±10°
Tolerance (at 100 kHz)	
Phase Shift	±30°
Pulse Width	±30°
Pulses per Revolution	1 to 10 000
Option	Sinusoidal Signal, 160 kHz (-3dB), voltage or current source 5 or 10 times the base PPR is possible. (i.e. 50000 or 100000 PPR)

Environmental Data

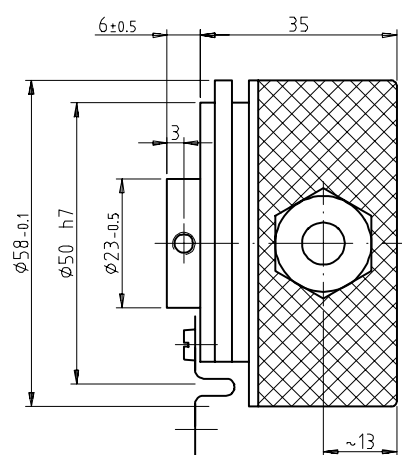
Electromagnetic compatibility (EMC)	EN 61000-4-2 (IEC-801-2) / EN 61000-4-4 (IEC-801-4)
Operating Temperature	0° to 80°C (32° F to 176° F)
Extended Temperature (Optional)	-30° to +80°C (-22° to 176°F)
Relative Humidity	98 % (non condensing)

Mechanical Data

Maximum Rotational Speed	10000 RPM
Weight	0.3 kg (.7 lb.)
Maximum Angular Acceleration.....	$\geq 10^5 \text{ rad/s}^2$
Momentum of Inertia	$1.5 \times 10^{-6} \text{ kg m}^2$
Startup Momentum 20°C (68° F)	approx. 0.02 Nm
Vibration (50-2000 Hz Sinusoidal)	
DIN IEC 68-2-6.....	$\geq 100 \text{ m/s}^2$ (10g)
Shock (11ms) DIN IEC 68-2-27.....	$\geq 1000 \text{ m/s}^2$ (100g)
* Standard Connector.....	PG 9 radial cable (pigtail)

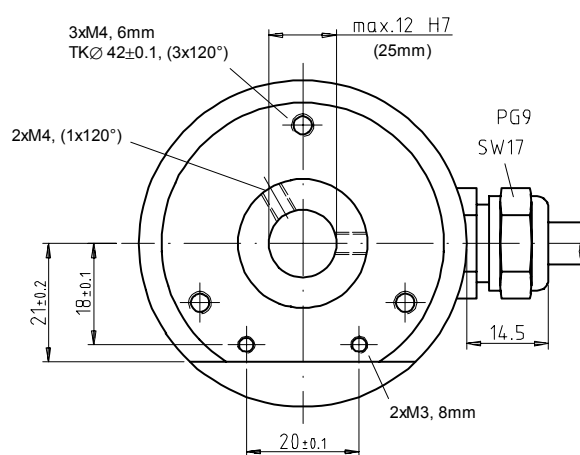
* Different Cable Lengths on Request.

Dimensional Drawing

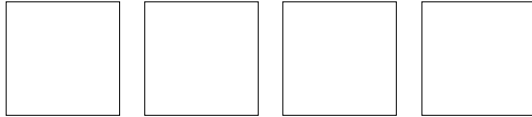


Optional mit
Drehmomentstütze lieferbar

OPTIONAL WITH TURNING
MOMENT SUPPORT



Incremental-Encoder IH-76 (Type 0500)



- **Hollow Shaft Encoder for Direct Coupling to any Drive Shaft**
(I.D. = 6 ... 16 mm)
- **Number of Pulses per Revolution Up To 10 000**

6

Electrical Data

Supply Voltage	11-27 V DC
5 V DC	Upon Request
Output (11-27 V)	Push-Pull
Maximum Current	max. 20 mA
Incremental Signal	A, A neg., B, B neg.
Marker Pulse	Z, Z neg., 1 pulse per revolution
Maximum Output Frequency	160 kHz
Output (5 V)	Line Driver
Maximum Current	max. 20 mA
Incremental Signal	A, A neg., B; B neg.
Marker Pulse	Z, Z neg., 1 pulse per revolution
Maximum Output Frequency	300 kHz
Tolerance (at 20 kHz)	
Phase Shift	±10°
Pulse Width	±10°
Tolerance (at 100 kHz)	
Phase Shift	±30°
Pulse Width	±30°
Pulses per Revolution	1 to 10 000
Option	Sinusoidal Signal, 160 kHz (-3dB), voltage or current source 5 or 10 times the base PPR is possible. (i.e. 50000 or 100000 PPR)

Environmental Data

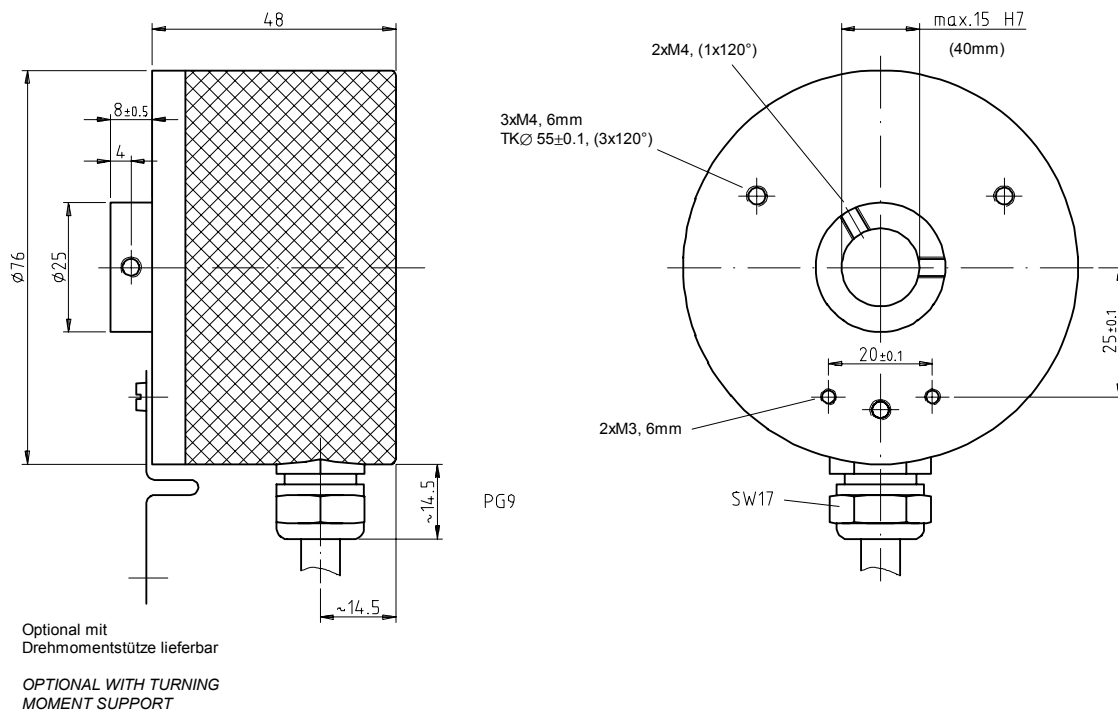
Electromagnetic compatibility (EMC)	EN 61000-4-2 (IEC-801-2) / EN 61000-4-4 (IEC-801-4)
Operating Temperature	0° to 80°C (32° F to 176° F)
Extended Temperature (Optional)	-30° to +80°C (-22° to 176°F)
Relative Humidity	98 % (non condensing)

Mechanical Data

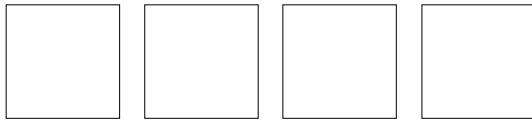
Maximum Rotational Speed	6000 RPM
Weight	0.5 kg (1.1 lb.)
Maximum Angular Acceleration.....	$\leq 10^5 \text{ rad/s}^2$
Momentum of Inertia	$60 \times 10^{-6} \text{ kg m}^2$
Startup Momentum 20°C (68° F).....	approx. 0.08 Nm
Vibration (50-2000 Hz Sinusoidal)	
DIN IEC 68-2-6.....	$\leq 100 \text{ m/s}^2$ (10g)
Shock (11ms) DIN IEC 68-2-27.....	$\leq 1000 \text{ m/s}^2$ (100g)
* Standard Connector	PG 9 radial cable (pigtail)

* Different Cable Lengths on Request.

Dimensional Drawing



Incremental-Encoder IH-76 (Type 0503)



- **Hollow Shaft Encoder for Direct Coupling to any Drive Shaft**
(I.D. = 16 ... 28 mm)
- **Number of Pulses per Revolution Up To 10 000**

6

Electrical Data

Supply Voltage	11-27 V DC
5 V DC	Upon Request
Output (11-27 V)	Push-Pull
Maximum Current	max. 20 mA
Incremental Signal	A, A neg., B, B neg.
Marker Pulse	Z, Z neg., 1 pulse per revolution
Maximum Output Frequency	160 kHz
Output (5 V)	Line Driver
Maximum Current	max. 20 mA
Incremental Signal	A, A neg., B; B neg.
Marker Pulse	Z, Z neg., 1 pulse per revolution
Maximum Output Frequency	300 kHz
Tolerance (at 20 kHz)	
Phase Shift	±10°
Pulse Width	±10°
Tolerance (at 100 kHz)	
Phase Shift	±30°
Pulse Width	±30°
Pulses per Revolution	1 to 10 000
Option	Sinusoidal Signal, 160 kHz (-3dB), voltage or current source 5 or 10 times the base PPR is possible. (i.e. 50000 or 100000 PPR)

Environmental Data

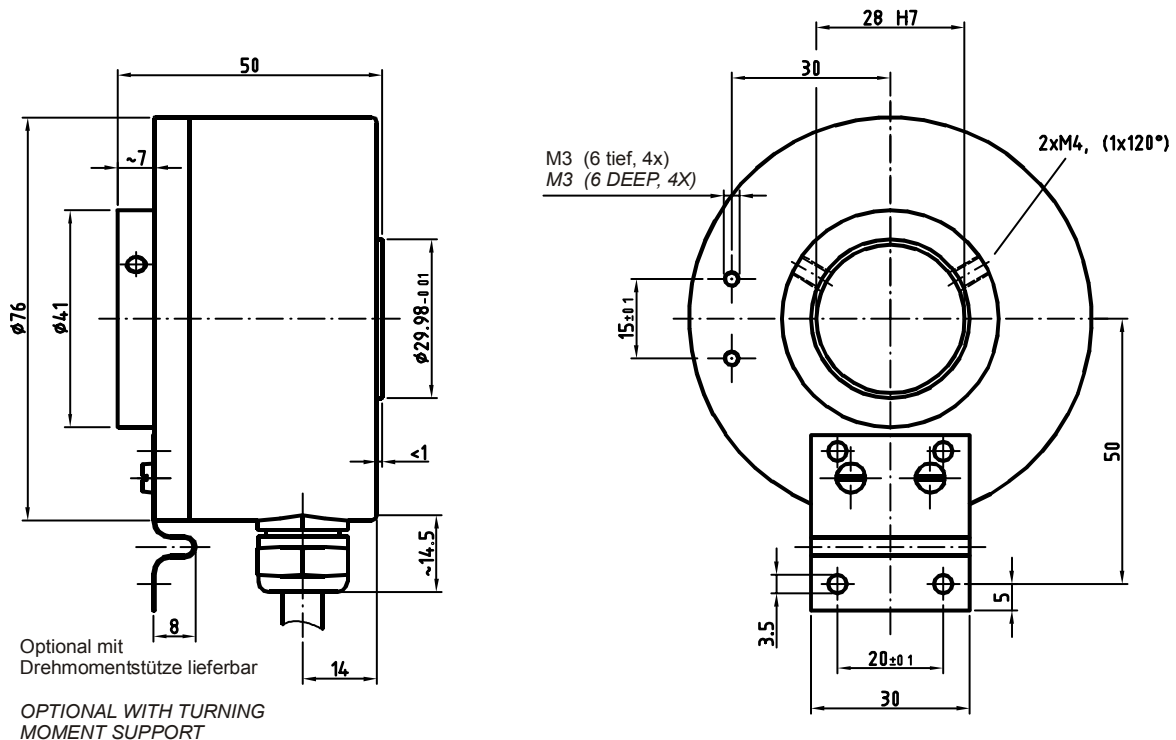
Electromagnetic compatibility (EMC)	EN 61000-4-2 (IEC-801-2) / EN 61000-4-4 (IEC-801-4)
Operating Temperature	0° to 80°C (32° F to 176° F)
Extended Temperature (Optional)	-30° to +80°C (-22° to 176°F)
Relative Humidity	98 % (non condensing)

Mechanical Data

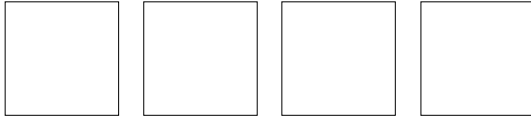
Maximum Rotational Speed	6000 RPM
Weight	0.4 kg (0.9 lb.)
Maximum Angular Acceleration.....	$\leq 10^5 \text{ rad/s}^2$
Momentum of Inertia	$60 \times 10^{-6} \text{ kg m}^2$
Startup Momentum 20°C (68° F).....	approx. 0.08 Nm
Vibration (50-2000 Hz Sinusoidal)	
DIN IEC 68-2-6.....	$\leq 100 \text{ m/s}^2$ (10g)
Shock (11ms) DIN IEC 68-2-27.....	$\leq 1000 \text{ m/s}^2$ (100g)
* Standard Connector	radial cable (pigtail)

* Different Cable Lengths on Request.

Dimensional Drawing



Incremental-Encoder IH-120



- **Hollow Shaft Encoder for Direct Coupling to any Drive Shaft**
(I.D. = 27 ... 55 mm)
- **Number of Pulses per Revolution Up To 10 000**

6

Electrical Data

Supply Voltage	11-27 V DC
5 V DC	Upon Request
Output (11-27 V)	Push-Pull
Maximum Current	max. 20 mA
Incremental Signal	A, A neg., B, B neg.
Marker Pulse	Z, Z neg., 1 pulse per revolution
Maximum Output Frequency	160 kHz
Output (5 V)	Line Driver
Maximum Current	max. 20 mA
Incremental Signal	A, A neg., B, B neg.
Marker Pulse	Z, Z neg., 1 pulse per revolution
Maximum Output Frequency	300 kHz
Tolerance (at 20 kHz)	
Phase Shift	±10°
Pulse Width	±10°
Tolerance (at 100 kHz)	
Phase Shift	±30°
Pulse Width	±30°
Pulses per Revolution (standard)	1024, 2500, 3600 and 10 000, other pulse numbers upon request
Option	Sinusoidal Signal, 160 kHz (-3dB), voltage or current source

Environmental Data

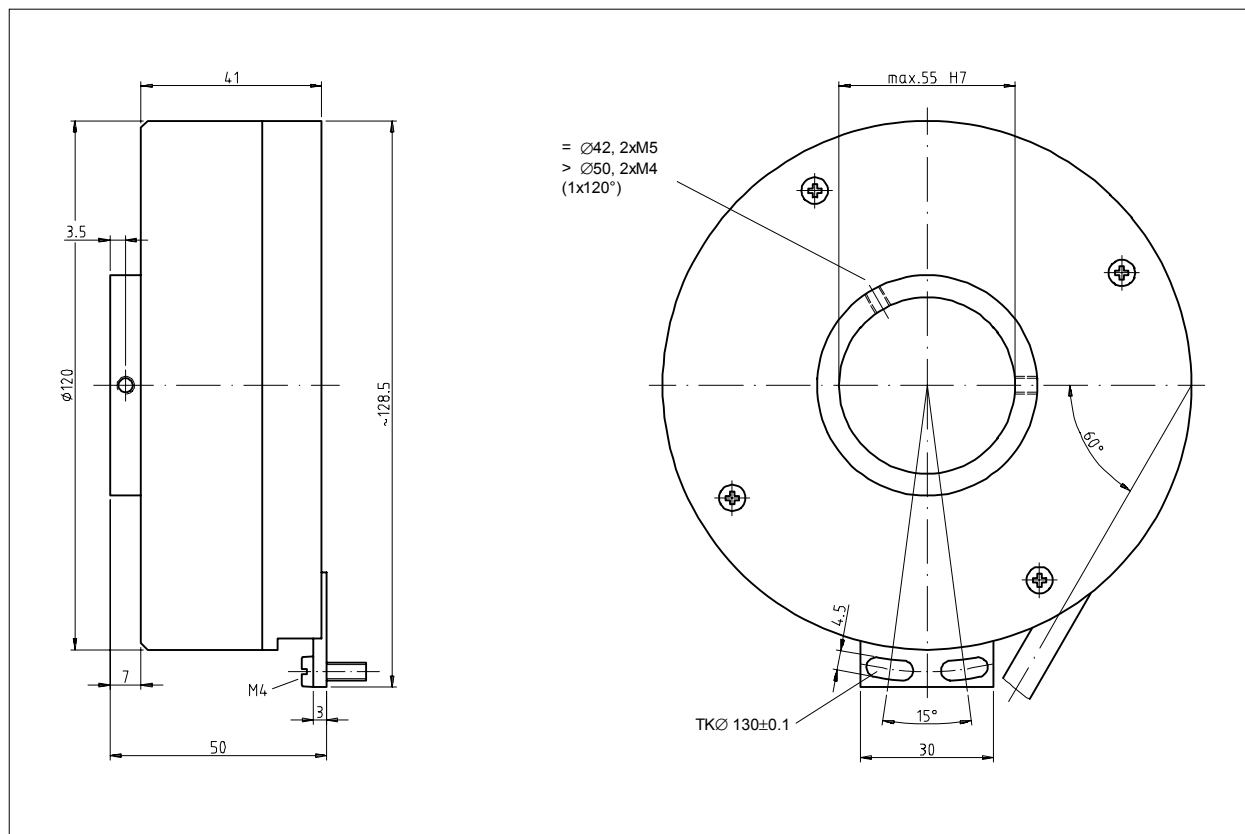
Electromagnetic compatibility (EMC)	EN 61000-4-2 (IEC-801-2) / EN 61000-4-4 (IEC-801-4)
Operating Temperature	0° to 80°C (32° F to 176° F)
Extended Temperature (Optional)	-30° to +80°C (-22° to 176°F)
Relative Humidity	98 % (non condensing)

Mechanical Data

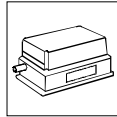
Maximum Rotational Speed	4000 RPM
Weight	1.2 kg (2.6 lb.)
Maximum Angular Acceleration.....	$\leq 10^4 \text{ rad/s}^2$
Momentum of Inertia	$400 \times 10^{-6} \text{ kg m}^2$
Startup Momentum 20°C (68° F).....	approx. 0,10 Nm
Vibration (50-2000 Hz Sinusoidal)	
DIN IEC 68-2-6.....	$\leq 100 \text{ m/s}^2$ (10g)
Shock (11ms) DIN IEC 68-2-27.....	$\leq 1000 \text{ m/s}^2$ (100g)
* Standard Connector	radial cable (pigtail)

* Different Cable Lengths on Request

Dimensional Drawing



Incremental-Encoder ZI-58-S



- **Programmable**
- **Universal Applications**
- **Number of Pulses per Revolution 5 to 32768**
- **Special output "Overspeed"**
- ¹⁾ **Set Z, Z neg.**
- **Small Compact Design**

6

Electrical Data

Supply Voltage	11-27 V DC
Power Dissipation (No Load).....	< 4 Watt
Programmable via RS485	PC IBM compatible EPROG Software
Output (11-27 V)	Push-Pull
Maximum Current	max 30 mA
Incremental Signal	A, A neg., B, B neg.
Marker Pulse.....	Z, Z neg., 1 pulse per revolution
Maximum Output Frequency.....	160 kHz ±15°
Output (5 V)	Line Driver
Maximum Current	max 50 mA
Incremental Signal	A, A neg., B, B neg.
Marker Pulse.....	Z, Z neg., 1 pulse per revolution
Maximum Output Frequency.....	300 kHz ±15°
Option	500 kHz
* Pulses per Revolution	5 to 32 768
Inputs	
¹⁾ * Preset.....	Set Z, Z neg.
Logic Levels	"0" < + 2 V DC, "1" > + 8 V DC, max. 30 V DC
Outputs	
* Overspeed.....	the switching output is set if the programmed rotation speed is exceeded
* Programmable Parameters	
¹⁾ Adjustment of the mechanical position of the zero impulse Z, Z neg. is programmable as desired (electrical)	

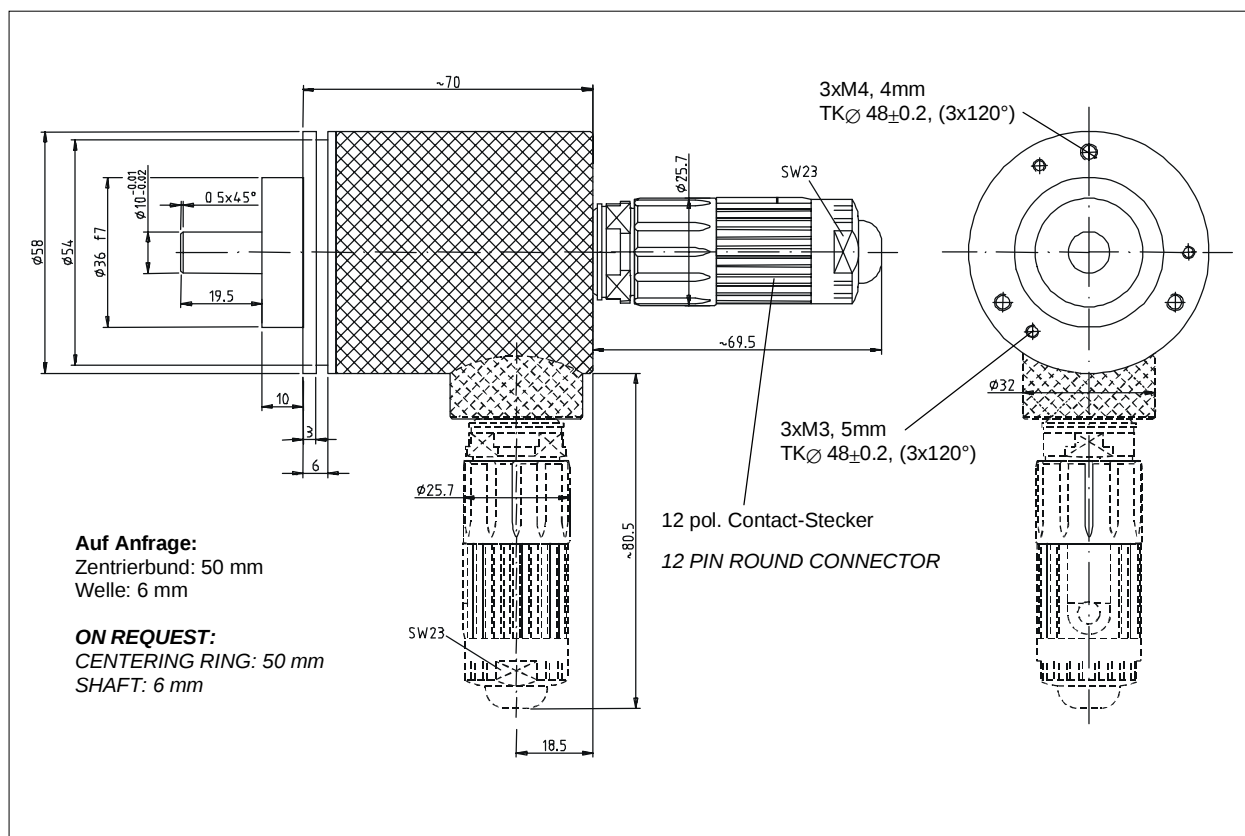
Environmental Data

Electromagnetic compatibility (EMC).....	EN 61000-4-2 (IEC-801-2) / EN 61000-4-4 (IEC-801 -4)
Operating Temperature	-20 to +70°C
Storage temperature range.....	-30 to +80°C
Relative Humidity.....	98 % (non condensing)
* Protection Class.....	IP 65 (DIN 40 050)
* The protection class of the encoder can be effected by the type of connector used.	

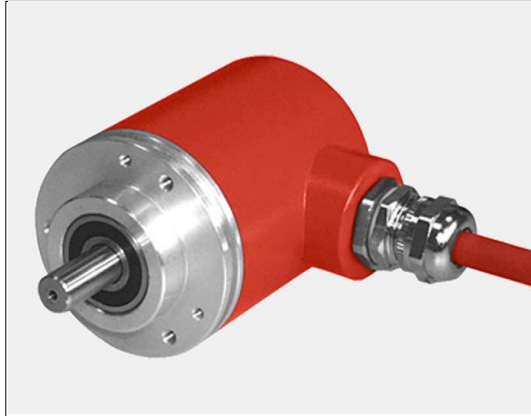
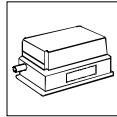
Mechanical Data

Maximum Rotational Speed	12000 min ⁻¹
Weight	ca. 0,3 kg
Maximum Angular Acceleration	≤ 10 ⁴ rad/s ²
Momentum of Inertia.....	2,5 x 10 ⁶ kg m ²
Startup Momentum 20°C (68° F).....	2 Ncm
Vibration (50-2000 Hz Sinusoidal) DIN IEC 68-2-6	≤ 100 m/s ² (10g)
Shock (11ms) DIN IEC 68-2-27	≤ 1000 m/s ² (100g)
Standard Connector.....	12 pin Contact Connector
Further types of connections / connector types	on request

Dimensional Drawing



Incremental-Encoder ZI-58-S



- **Programmable**
- **Universal Applications**
- **Number of Pulses per Revolution 5 to 32 768**
- **Special output "Overspeed"**
- ¹⁾ **Set Z, Z neg.**
- **Small Compact Design**

6

Electrical Data

Supply Voltage	11-27 V DC
Power Dissipation (No Load).....	< 4 Watt
Programmable via RS485	PC IBM compatible EPROG Software
Output (11-27 V)	Push-Pull
Maximum Current	max 30 mA
Incremental Signal	A, A neg., B, B neg.
Marker Pulse.....	Z, Z neg., 1 pulse per revolution
Maximum Output Frequency.....	160 kHz ±15°
Output (5 V)	Line Driver
Maximum Current	max 50 mA
Incremental Signal	A, A neg., B, B neg.
Marker Pulse.....	Z, Z neg., 1 pulse per revolution
Maximum Output Frequency.....	300 kHz ±15°
Option	500 kHz
* Pulses per Revolution	5 to 32 768
Inputs	
¹⁾ * Preset.....	Set Z, Z neg.
Logic Levels	"0" < + 2 V DC, "1" > + 8 V DC, max. 30 V DC
Outputs	
* Overspeed.....	the switching output is set if the programmed rotation speed is exceeded
* Programmable Parameters	
¹⁾ Adjustment of the mechanical position of the zero impulse Z, Z neg. is programmable as desired (electrical)	

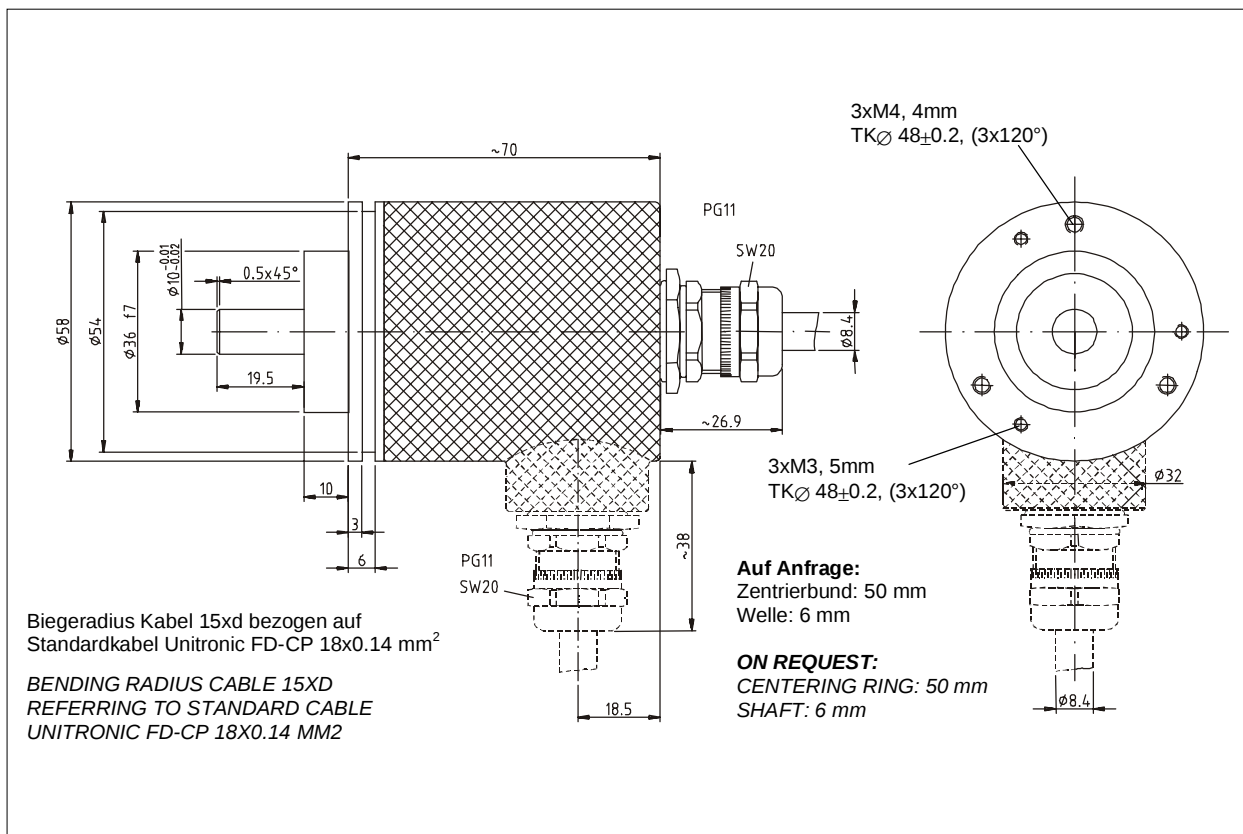
Umgebungsbedingungen

Electromagnetic compatibility (EMC).....	EN 61000-4-2 (IEC-801-2) / EN 61000-4-4 (IEC-801 -4)
Operating Temperature	-20 to +70°C
Storage temperature range.....	-30 to +80°C
Relative Humidity.....	98 % (non condensing)
* Protection Class.....	IP 65 (DIN 40 050)
* The protection class of the encoder can be effected by the type of connector used.	

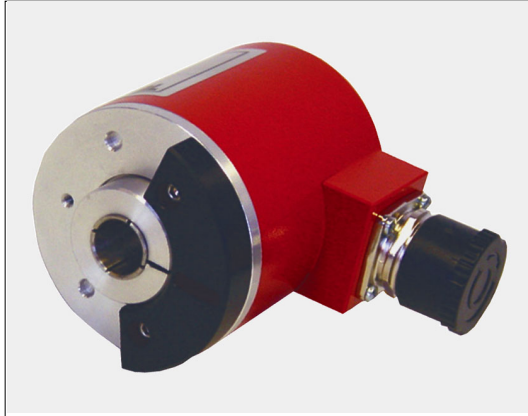
Mechanical Data

Maximum Rotational Speed	12000 min ⁻¹
Weight	ca. 0,3 kg
Maximum Angular Acceleration	≤ 10 ⁴ rad/s ²
Momentum of Inertia	2,5 x 10 ⁻⁶ kg m ²
Startup Momentum 20°C (68° F)	2 Ncm
Vibration (50-2000 Hz Sinusoidal) DIN IEC 68-2-6	≤ 100 m/s ² (10g)
Shock (11ms) DIN IEC 68-2-27	≤ 1000 m/s ² (100g)
Connection	PG axial or radial with 1m cable
Further types of connections / connector types	on request

Dimensional Drawing



Incremental-Encoder ZHI-65



- **Hollow Shaft Encoder for Direct Coupling to any Drive Shaft**
(I.D. = 14 mm)
- **Programmable**
- **Number of Pulses per Revolution 5 to 32768**
- ¹⁾ **Set Z, Z neg.**

6

Electrical Data

Supply Voltage	11-27 V DC
Power Dissipation (No Load)	≤ 3 Watt
Programmable via RS485	PC IBM compatible EPROG Software
Output (11-27 V)	Push-Pull
Maximum Current	max 30 mA
Incremental Signal	A, B
Marker Pulse	Z, 1 pulse per revolution
Maximum Output Frequency	160 kHz ±15°
Output (5 V)	Line Driver
Maximum Current	max 50 mA
Incremental Signal	A, A neg., B, B neg.
Marker Pulse	Z, Z neg., 1 pulse per revolution
Maximum Output Frequency	300 kHz ±15°
Option	500 kHz
* Pulses per Revolution	5 to 32 768
Inputs	
¹⁾ * Preset	Set Z, Z neg.
Logic Levels	"0" < + 2 V DC, "1" > + 8 V DC, max. 30 V DC
Special Outputs	
* Overspeed, Switching Outputs, Error Output, UP/Down among other things	
* Programmable Parameters	
¹⁾ Adjustment of the mechanical position of the zero impulse Z, Z neg. is programmable as desired (electrical)	

Environmental Data

Electromagnetic compatibility (EMC)	EN 61000-4-2 (IEC-801-2) / EN 61000-4-4 (IEC-801 -4)
Operating Temperature	-20 to +80°C
Storage temperature range	-30 to +80°C
Relative Humidity	98 % (non condensing)
* Protection Class	IP 65 (DIN 40 050)
* The protection class of the encoder can be effected by the type of connector used.	

Mechanical Data

Maximum Rotational Speed	6000 min ⁻¹
Maximum Load on Shaft	Self-Mass
Min. Lifetime on Bearings	3.9 x 10 ¹⁰ Revolutions at:
-Operational Speed	3000 RPM
-Operating Temperature	60°C (140°F)
Weight	approx. 0,7 kg
Maximum Angular Acceleration.....	≤ 10 ⁴ rad/s ²
Momentum of Inertia	2,5 x 10 ⁻⁶ kg m ²
Vibration (50-2000 Hz Sinusoidal) DIN IEC 68-2-6	≤ 100 m/s ² (10g)
Shock (11ms) DIN IEC 68-2-27	≤ 1000 m/s ² (100g)
Standard Connector	12 pin Contact Connector, radial
Further types of connections / connector types	on request

Dimensional Drawing

