# Absolute encoders - SSI

## Solid shaft with clamping or synchro flange

## Optical multiturn encoders up to 14 bit ST / 16 bit MT

### GM400, GM401

GM400 with clamping flange

**Features**

- **Encoder multiturn / SSI**
- **Optical sensing method**
- **Resolution: max. singleturn 14 bit, multiturn 16 bit**
- **Clamping or synchro flange**
- **Electronic setting of zero point**
- **Counting direction input**
- **Available with additional incremental output**
- **Maximum resistant against magnetic fields**

**Optional**

- **Stainless steel design**
- **Corrosion protection for offshore applications**

**Technical data - electrical ratings**

| | |
|---|---|
| Voltage supply | 10...30 VDC<br>5 VDC ±10 % |
| Reverse polarity protection | Yes (10..30 VDC) / No (5 VDC) |
| Consumption w/o load | ≤50 mA (24 VDC)<br>≤80 mA (5 VDC) |
| Initializing time typ. | 20 ms after power on |
| Interfaces | SSI, Incremental A 90° B (optional) |
| Function | Multiturn |
| Steps per turn | ≤16384 / 14 bit |
| Number of turns | ≤65536 / 16 bit |
| Incremental output | 2048 pulses A90°B<br>+ inverted |
| Absolute accuracy | ±0.025 ° |
| Sensing method | Optical |
| Code | Gray or binary |
| Code sequence | CW/CCW coded by connection |
| Inputs | SSI clock<br>Control signals UP/$\overline{\text{DOWN}}$ and zero |
| Output stages | SSI data: linedriver RS485<br>Diagnostic outputs push-pull |
| Interference immunity | DIN EN 61000-6-2 |
| Emitted interference | DIN EN 61000-6-4 |
| Diagnostic functions | Self-diagnosis<br>Multiturn sensing |
| Approval | UL approval / E63076 |

**Technical data - mechanical design**

| | |
|---|---|
| Size (flange) | ø58 mm |
| Protection DIN EN 60529 | IP 54 (without shaft seal),<br>IP 65 (with shaft seal) |
| Operating speed | ≤10000 rpm (mechanical)<br>≤6000 rpm (electric) |
| Starting acceleration | ≤1000 U/s² |
| Starting torque | ≤0.015 Nm (+25 °C, IP 54)<br>≤0.03 Nm (+25 °C, IP 65) |
| Rotor moment of inertia | 20 gcm² |
| Admitted shaft load | ≤20 N axial<br>≤40 N radial |
| Materials | Housing: steel<br>Flange: aluminium |
| Operating temperature | -25...+85 °C<br>-40...+85 °C (optional) |
| Relative humidity | 95 % non-condensing |
| Resistance | DIN EN 60068-2-6<br>Vibration 10 g, 16-2000 Hz<br>DIN EN 60068-2-27<br>Shock 200 g, 6 ms |
| Weight approx. | 400 g |
| Connection | Connector M23, 12-pin<br>Cable 1 m |
| **GM400** | |
| Shaft type | ø10 mm solid shaft |
| Flange | Clamping flange |
| **GM401** | |
| Shaft type | ø6 mm solid shaft |
| Flange | Synchro flange |

## GM400, GM401

### Part number

**Clamping flange**

**GM400.** [ ][ ][ ][ ]

Pulses / Incremental output
- 02 No incremental output
- 04 2048 pulses / push-pull
- 06 2048 pulses / RS422
- 07 2048 periods / SinCos
- 24 1024 pulses / push-pull
- 26 1024 pulses / RS422
- 27 1024 periods / SinCos
- 34 512 pulses / push-pull
- 36 512 pulses / RS422
- 37 512 periods / SinCos

Connection
- A0 Connector M23, 12-pin, axial
- A1 Connector M23, 12-pin, radial
- A2 Connector M23, 12-pin, axial, for incremental output 04/06/07/24/26/27/34/36/37
- A3 Connector M23, 12-pin, radial, for incremental output 04/06/07/24/26/27/34/36/37
- 11 Cable 1 m, axial
- 21 Cable 1 m, radial
- 31 Cable 1 m, axial, for incremental output 04/06/07/24/26/27/34/36/37
- 41 Cable 1 m, radial, for incremental output 04/06/07/24/26/27/34/36/37

Voltage supply / signals
- 10 10...30 VDC / gray code 25 bit (ST 13 + MT 12)
- 11 5 VDC / gray code 25 bit (ST 13 + MT 12)
- 12 10...30 VDC / binary code 25 bit (ST 13 + MT 12)
- 13 5 VDC / binary code 25 bit (ST 13 + MT 12)
- 20 10...30 VDC / gray code 24 bit (ST 12 + MT 12)
- 30 10...30 VDC / gray code 25 bit (ST 13 + MT 12) + parity
- 40 10...30 VDC / gray code 24 bit (ST 12 + MT 12) + DV
- 90 10...30 VDC / gray code 26 bit (ST 14 + MT 12)
- 92 10...30 VDC / binary code 26 bit (ST 14 + MT 12)
- A0 10...30 VDC / gray code 29 bit (ST 13 + MT 16)

Flange / Solid shaft
- 0 Clamping flange / ø10 mm, IP 54
- A Clamping flange / ø10 mm, IP 65

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## Solid shaft with clamping or synchro flange

## Optical multiturn encoders up to 14 bit ST / 16 bit MT

### GM400, GM401

**Part number**

**Synchro flange**

**GM401.** [ ][ ][ ][ ]

Pulses / Incremental output
- 02 No incremental output
- 04 2048 pulses / push-pull
- 06 2048 pulses / RS422
- 07 2048 periods / SinCos
- 24 1024 pulses / push-pull
- 26 1024 pulses / RS422
- 27 1024 periods / SinCos
- 34 512 pulses / push-pull
- 36 512 pulses / RS422
- 37 512 periods / SinCos

Connection
- A0 Connector M23, 12-pin, axial
- A1 Connector M23, 12-pin, radial
- A2 Connector M23, 12-pin, axial, for incremental output 04/06/07/24/26/27/34/36/37
- A3 Connector M23, 12-pin, radial, for incremental output 04/06/07/24/26/27/34/36/37
- 11 Cable 1 m, axial
- 21 Cable 1 m, radial
- 31 Cable 1 m, axial, for incremental output 04/06/07/24/26/27/34/36/37
- 41 Cable 1 m, radial, for incremental output 04/06/07/24/26/27/34/36/37

Voltage supply / signals
- 10 10...30 VDC / gray code 25 bit (ST 13 + MT 12)
- 11 5 VDC / gray code 25 bit (ST 13 + MT 12)
- 12 10...30 VDC / binary code 25 bit (ST 13 + MT 12)
- 13 5 VDC / binary code 25 bit (ST 13 + MT 12)
- 20 10...30 VDC / gray code 24 bit (ST 12 + MT 12)
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- 40 10...30 VDC / gray code 24 bit (ST 12 + MT 12) + DV
- 90 10...30 VDC / gray code 26 bit (ST 14 + MT 12)
- 92 10...30 VDC / binary code 26 bit (ST 14 + MT 12)
- A0 10...30 VDC / gray code 29 bit (ST 13 + MT 16)

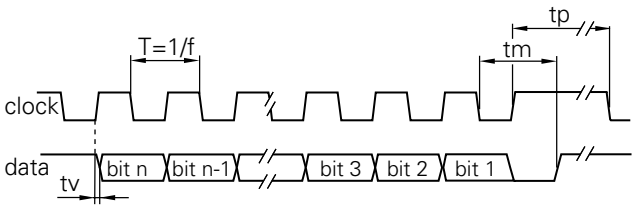
Flange / Solid shaft
- 1 Synchro flange / ø6 mm, IP 54
- B Synchro flange / ø6 mm, IP 65

## GM400, GM401

### Accessories

| Connectors and cables | |
|---|---|
| Z 130.001 | Female connector M23, 12-pin, without cable |
| Z 130.003 | Female connector M23, 12-pin, 2 m cable |
| Z 182.001 | Female connector M23, 12-pin, without cable (incr.) |
| Z 182.003 | Female connector M23, 12-pin, 2 m (incr.) |
| **Mounting accessories for GM400** | |
| Z 119.006 | Eccentric fixing, single |
| Z 119.013 | Adaptor plate for clamping flange for modification into synchro flange |
| Z 119.017 | Mounting adaptor for clamping flange (M3) |
| **Mounting accessories for GM401** | |
| Z 119.006 | Eccentric fixing, single |
| Z 119.015 | Mounting adaptor for synchro flange |
| Z 119.035 | Bearing flange for encoders with synchro flange |

### Data transfer




| | |
|---|---|
| Clock frequency f | 62.5...1500 kHz |
| Duty cycle of T | 40...60 % |
| Delay time tv | 150 ns |
| Monoflop time tm | 26 µs + T/2 |
| Clock interval tp | 30 µs |

### Trigger level

| SSI | Circuit |
|---|---|
| SSI-Clock | Optocoupler |
| SSI-Data | Linedriver RS485 |

| Control inputs | Input circuit |
|---|---|
| Input level High | >0.7 UB |
| Input level Low | <0.3 UB |
| Input resistance | 10 kΩ |

| Diagnostic outputs or Incremental outputs | Output circuit Push-pull circuit-proof |
|---|---|
| Output level High | >UB -3.5 V (I = -20 mA) |
| Output level Low | <0.5 V (I = 20 mA) |
| Load High / Low | <20 mA |

| Incremental outputs | Linedriver RS422 |
|---|---|
| Output level High | >2.5 V (I = -20 mA) |
| Output level Low | <0.5 V (I = 20 mA) |
| Load High / Low | <20 mA |

| Outputs | SinCos |
|---|---|
| Output level | 1 Vpp ±10 % |
| Load | <10 mA |

# Absolute encoders - SSI

## Solid shaft with clamping or synchro flange

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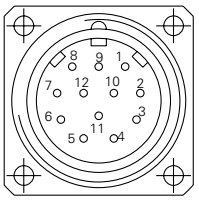
### GM400, GM401

| Terminal significance | |
|---|---|
| UB | Encoder voltage supply. |
| GND | Encoder ground connection relating to UB. |
| Data+ | Positive, serial data output of differential linedriver. |
| Data- | Negative, serial data output of differential linedriver. |
| Clock+ | Positive SS clock input.<br>Clock+ together with clock- forms a current loop. A current of approx. 7 mA towards clock+ input means logic 1 in positive logic. |
| Clock- | Negative SSI clock input.<br>Clock- together with clock+ forms a current loop. A current of approx. 7 mA towards clock- input means logic 0 in positive logic. |
| Zero setting | Input for setting a zero point anywhere within the programmed encoder resolution. The zero setting operation is triggered by a High impulse and has to be in line with the selected direction of rotation (UP/$\overline{\text{DOWN}}$). Connect to GND after setting operation for maximum interference immunity. Impulse duration $\geq$100 ms. |
| $\overline{\text{DATAVALID}}$ | Diagnostic output.<br>An error warning is given at level Low.<br>Important: Interferences must be drained by the downstram electronics. |
| $\overline{\text{DATAVALID MT}}$ | Diagnostic output for monitoring the multiturn sensor voltage supply. Upon dropping below a defined voltage level the $\overline{\text{DV MT}}$ output is switched to Low. |
| UP/$\overline{\text{DOWN}}$ | UP/$\overline{\text{DOWN}}$ counting direction input.<br>This input is standard on High. UP/$\overline{\text{DOWN}}$ means ascending output data with clockwise shaft rotation when looking at flange. UP/$\overline{\text{DOWN}}$-Low means ascending values with counterclockwise shaft rotation when looking at flange. |
| Incremental Outputs | Incremental tracks A 90° B and inverted. |

| Terminal assignment | | |
|---|---|---|
| **GM400, GM401** | | |
| Connector | Core colour | Assignment |
| Pin 1 | brown | UB |
| Pin 2 | black | GND |
| Pin 3 | blue | Clock+ |
| Pin 4 | beige | Data+ |
| Pin 5 | green | Zero setting |
| Pin 6 | yellow | Data- |
| Pin 7 | violet | Clock- |
| Pin 8 | brown/yellow | $\overline{\text{DATAVALID}}$ |
| Pin 9 | pink | UP/$\overline{\text{DOWN}}$ |
| Pin 10 | black/yellow | $\overline{\text{DATAVALID MT}}$ |
| Pin 11-12 | – | – |

**GM400, GM401 with incremental tracks | SinCos**

| Connector | Core colour | Assignment Incremental | SinCos |
|---|---|---|---|
| Pin 1 | brown | UB | UB |
| Pin 2 | white | GND | GND |
| Pin 3 | blue | Clock+ | Clock+ |
| Pin 4 | green | Data+ | Data+ |
| Pin 5 | grey | Zero setting | Zero setting |
| Pin 6 | yellow | Data- | Data- |
| Pin 7 | red | Clock- | Clock- |
| Pin 8 | red/blue | Track B inv. | $\overline{\text{Cosine}}$ |
| Pin 9 | pink | UP/$\overline{\text{DOWN}}$ | UP/$\overline{\text{DOWN}}$ |
| Pin 10 | violet | Track A inv. | $\overline{\text{Sine}}$ |
| Pin 11 | black | Track A | Sine |
| Pin 12 | grey/pink | Track B | Cosine |

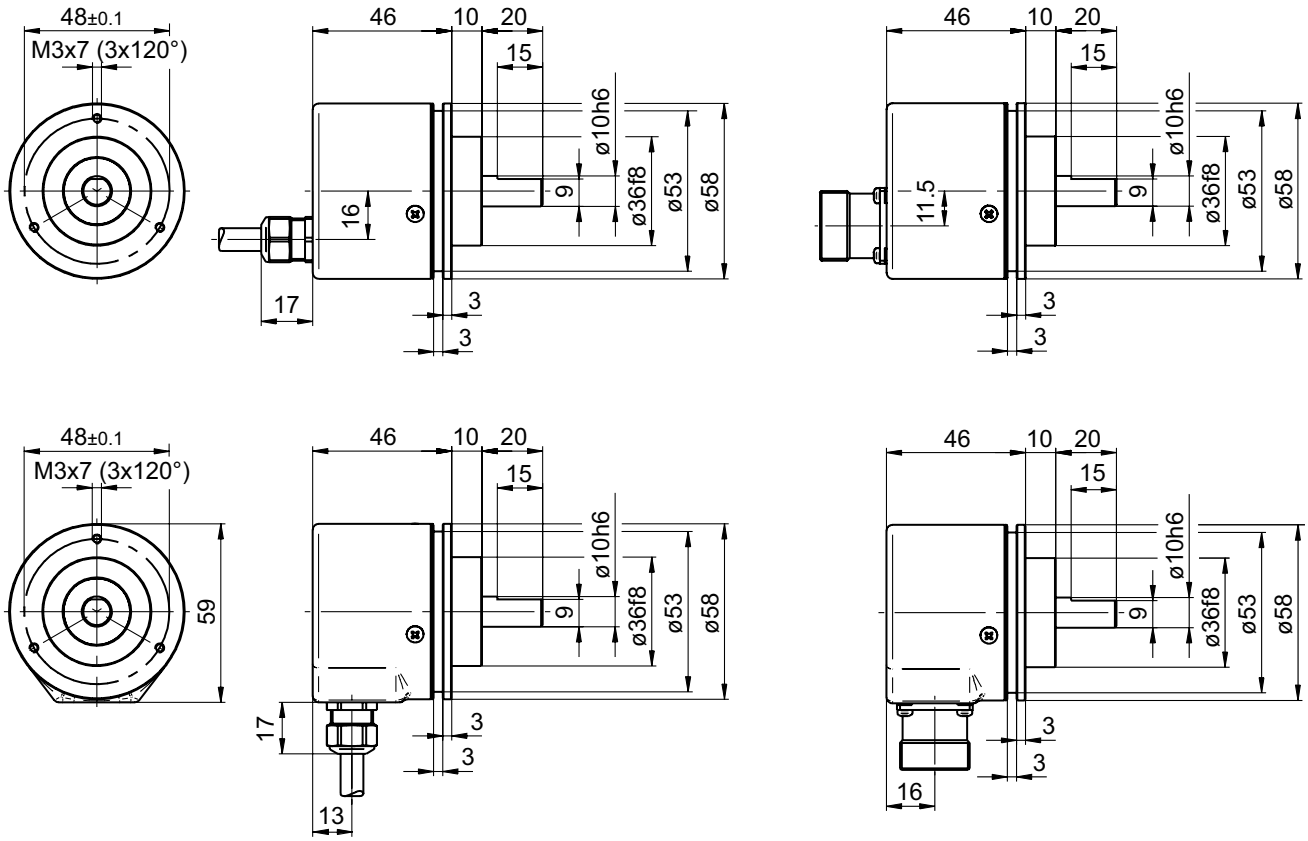



Please use cores twisted in pairs (for example clock+ / clock-) for extension cables of more than 10 m length.

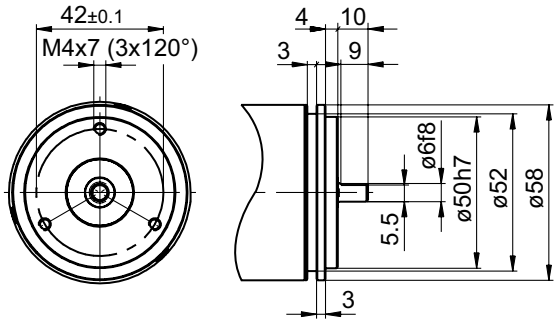
### GM400, GM401

**Dimensions**

**GM400 - clamping flange**




**GM401 - synchro flange**




**GM400, GM401 - connector dimensions**