**Standard**
**electronic multiturn, optical / magnetic**

**Sendix S5868FS3 / S5888FS3 (shaft / hollow shaft)**

**PROFIsafe**

The optical absolute Sendix S58 PROFIsafe encoders are based on the new Kübler Industrial Ethernet encoder platform and are therefore already designed today for future Industry 4.0 concepts.

One example of this is the integrated web server: Features or adjustments can be implemented quickly and easily at any time.

As certified SIL3 / PLe encoders with redundant design and PROFINET interface, they support the PROFIsafe profile and are predestined for safety applications.


Redundant multiturn drive | Safety-Lock™ | High rotational speed | Temperature range | High protection level | High shaft load capacity | Shock / vibration resistant | Reverse polarity protection | Optical sensor

## Reliable and safe

- **Robust**
  Sturdy bearing construction in Safety-Lock™ Design for resistance against vibration and installation errors.
- **High resolution**
  - Singleturn 15 bit (safe) or 24 bit (non safe).
  - Multiturn 12 bit (safe).
- **Safe**
  - SIL 3, performance level PIe, safety category Cat. 3.
  - Fully redundant multiturn information due to redundant multiturn gearbox.
  - Transmission via safety telegrams 36/37, according to BP and XP.
- **100 % future-proof**
  - Implement features and adaptations quickly and easily.
  - Cyber Security update in preparation / High system availability, protection against misuse (acc. IEC 62443).

## Latest PROFINET functionality

- PROFINET IO, RT, IRT allows integration in applications with different performance requirementsorderungen.
- Supports the Isochronous Mode, can thus be implemented in networks for hard real-time requirements with clock cycles up to 500 µs.
- PROFINET v2.4.1, encoder profile V 4.2, PROFIsafe profile v2.6.1, PROFIdrive profile v4.2
- Ideal for highly synchronous applications, such as e. g. axis synchronization.
- Interoperability between many different control and drive manufacturers thanks to the PROFIdrive profile.
- Integrated web server for firmware update.

**Standard**
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## Order code Shaft version

| 8.S5868FS3 | . | X | X | C | N | . | C1 | 1 | 1 |
|---|---|---|---|---|---|---|---|---|---|
| Type | | a | b | c | d | | e | | |

**a** *Flange*
1 = clamping flange, IP65 ø 58 mm [2.28“]
3 = clamping flange, IP67 ø 58 mm [2.28“]
2 = synchro flange, IP65 ø 58 mm [2.28“]
4 = synchro flange, IP67 ø 58 mm [2.28“]
5 = square flange, IP65 □63.5 mm [2.5“]
7 = square flange, IP67 □63.5 mm [2.5“]

**b** *Shaft (ø x L), with flat*
2 = 10 x 20 mm [0.39 x 0.79“]
5 = 12 x 20 mm [0.47 x 0.79“]
4 = 3/8“ x 7/8“
*Shaft (ø x L), with feather key DIN 6885 A-3x3x10*
A = 10 x 20 mm [0.39 x 0.79“]
B = 12 x 20 mm [0.47 x 0.79“]
C = 3/8“ x 7/8“

**c** *Interface / Supply voltage*
C = PROFINET IO / 10 ... 30 V DC

**d** *Type of connection*
N = 3 x axial M12 connector, 4-pin

**e** *Fieldbus profile*
C1 = PROFINET IO

*Optional on request*
- Ex 2/22
- surface protection salt spray tested

## Order code Hollow shaft

| 8.S5888FS3 | . | X | X | C | N | . | C1 | 1 | 1 |
|---|---|---|---|---|---|---|---|---|---|
| Type | | a | b | c | d | | e | | |

**a** *Flange*
1 = with torque stop FS, flexible, IP65
2 = with torque stop FS, flexible, IP67
5 = with stator coupling FS, ø 63 mm [2.48“] , IP65
6 = with stator coupling FS, ø 63 mm [2.48“] , IP67
7 = with torque stop FS, rigid, IP65 (incl. torque pin FS)
8 = with torque stop FS, rigid, IP67 (incl. torque pin FS)

**b** *Blind hollow shaft*
*(insertion depth max. 30 mm [1.18“])*
A = ø 10 mm [0.39“]
B = ø 12 mm [0.47“]
C = ø 14 mm [0.55“]
D = ø 15 mm [0.59“]
E = ø 3/8“
F = ø 1/2“

**c** *Interface / Supply voltage*
C = PROFINET IO / 10 ... 30 V DC

**d** *Type of connection*
N = 3 x axial M12 connector, 4-pin

**e** *Fieldbus profile*
C1 = PROFINET IO

*Optional on request*
- Ex 2/22 [1)]
- surface protection salt spray tested [1)]

1) Not possible for flange type 7 and 8.

| Standard<br>electronic multiturn, optical / magnetic | Sendix S5868FS3 / S5888FS3 (shaft / hollow shaft) | PROFIsafe |
|---|---|---|

| Mounting accessory for shaft encoders | | | Order no. |
|---|---|---|---|
| **Bellows coupling FS** | bellows coupling FS ø 25 mm [0.98“] for shaft 10 mm [0.39“] | | **8.0000.15FS.1010** |
| | bellows coupling FS ø 25 mm [0.98“] for shaft 12 mm [0.47“] | | **8.0000.15FS.1212** |
| **Accessories** | | | Order no. |
| **Screw retention** | Loctite 243, 5 ml | | **8.0000.4G05.0000** |
| **Cables and connectors** | | | Order no. |
| **Preassembled cables** | M12 male connector with external thread, 4-pin, D coded, straight<br>single-ended<br>2 m [6.56‘] PUR cable | port 1 +<br>port 2 | **05.00.6031.4411.002M** |
| | M12 male connector with external thread, 4-pin, D coded, right-angle<br>single-ended<br>2 m [6.56‘] PUR cable | port 1 +<br>port 2 | **05.00.6031.4511.002M** |
| | M12 female connector with coupling nut, 4-pin, A coded, straight<br>single-ended<br>2 m [6.56‘] PUR cable | power supply | **05.00.6061.6211.002M** |
| | M12 female connector with coupling nut, 4-pin, A coded, right-angle<br>single-ended<br>2 m [6.56‘] PUR cable | power supply | **05.00.6061.6311.002M** |
| **Connectors** | M12 female connector with coupling nut, 4-pin, A coded, straight (plastic) | | **05.B8141-0** |
| | M12 female connector with coupling nut, 5-pin, A coded, right-angle (plastic) | | **05.B-8251-0/9** |

Further Kübler accessories can be found at: kuebler.com/accessories
Further Kübler cables and connectors can be found at: kuebler.com/connection-technology

**Standard**
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## Technical data

### Notes regarding "Functional Safety"

These encoders are suitable for use in safety-related systems up to SIL3 acc. to EN 61800-5-2 and PLe to EN ISO 13849-1 in conjunction with controllers or evaluation units, which possess the necessary functionality.

Additional functions can be found in the operating manual.

### Safety characteristics

| | |
|---|---|
| **Classification** | PLe / SIL3 |
| **System structure** | 2 channel (Kat. 3) |
| **$PFH_d$ value** [1] | 9.54 x $10^{-10}$ $h^{-1}$ |
| **Mission time / Proof test interval** | 20 years |
| **Relevant standards** | EN ISO 13849-1:2015;<br>EN ISO 13849-2:2012;<br>EN 61800-5-2:2007 |

### Mechanical characteristics

| | | |
|---|---|---|
| **Max. speed** | | 9000 $min^{-1}$ (short-term – 10 min)<br>6000 $min^{-1}$ (continuous) |
| **Starting torque** at 20 °C [68 °F] | | < 0.01 Nm |
| **Moment of inertia** | | |
| | shaft version | 3.0 x $10^{-6}$ $kgm^2$ |
| | hollow shaft version | 6.0 x $10^{-6}$ $kgm^2$ |
| **Load capacity of shaft** | radial | 80 N |
| | axial | 40 N |
| **Weight** | | approx. 0.45 kg [15.87 oz] |
| **Protection** acc. to EN 60529 | | IP65, IP67 |
| **Ambient temperature** | | -40 °C ... +80 °C [-40 °F ... +176 °F] |
| **Material** | shaft/hollow shaft | stainless steel |
| | flange | aluminum |
| | housing | aluminum |
| **Shock resistance** acc. EN 60068-2-27 | | 1000 $m/s^2$, 6 ms |
| **Vibration resistance** acc. EN 60068-2-6 | | 220 $m/s^2$, 55 ... 2000 Hz |

### Electrical characteristics

| | |
|---|---|
| **Supply voltage** | 10 ... 30 V DC |
| **Power consumption** (no load) | max. 250 mA |
| **Reverse polarity protection of the supply voltage** (+V) | yes |
| **Smallest safe measuring step** | 158,4 arcsec (0,044° / 4 increments) |
| **Lowest safe speed** | 4 rpm (σ_v < 0,5 %) |

### Link 1 and 2, LED (green / yellow)

| | | |
|---|---|---|
| Two colored | green | active link |
| | yellow | data transfer |

### Error LED (red) / PWR LED (green)

Functionality see manual

### Approvals

| | | |
|---|---|---|
| **Salt spray tested** in accordance with | | IEC 68-2-11/672h<br>(for salt spray tested variants) |
| **UL compliant** in accordance with | | File no. E224618 |
| **CE compliant** in accordance with | | |
| | EMC Directive | 2014/30/EU |
| | RoHS Directive | 2011/65/EU |
| | ATEX Directive | 2014/34/EU (for Ex 2/22 variants) |
| | Machinery Directive | 2006/42/EG |
| **UKCA compliant** in accordance with | | |
| | EMC Regulations | S.I. 2016/1091 |
| | RoHS Regulations | S.I. 2012/3032 |
| | UKEX Regulations | S.I. 2016/1107 (for Ex 2/22 variants) |
| | Machinery (Safety) Regulations | S.I. 2008/1597 |

1) The specified value is based on a diagnostic coverage of 99 %, that must be achieved with an encoder evaluation unit.
The encoder evaluation unit must meet at least the requirements for SIL3.

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## Interface characteristics PROFINET IO / PROFIsafe

| | |
|---|---|
| **Resolution singleturn (MUR)** | |
| scalable safe | 1 ... 32 768 (15 bit) |
| scalable non-safe | 1 ... 16 777 216 (24 bit) |
| default | 8 192 (13 bit) |
| **Number of revolutions (NDR)** | |
| safe | 1 ... 4 096 (12 bit)<br>scalable only via the total resolution |
| **Total resolution (TMR)** | |
| scalable safe | 1 ... 134 217 728 (27 bit) |
| scalable non-safe | 1 ... 68 719 476 736 (36 bit) |
| default | 8 192 (13 bit) |
| **Protocol** | PROFINET IO / PROFIsafe |
| **Classifications** | RT Class 3 (IRT)<br>Conformance Class C<br>Application Class 6<br>Encoder Class 4 / S2<br>Netload Class III |
| **Feature** | - I&M 0 ... 4<br>- standard telegrams (81, 82, 83, 84, 86, 88)<br>- standard safety Telegrams (36, 37) BP and XP<br>- IRT up to 500 µs<br>- RT Safe up to 3 ms<br>- Isochronous Mode<br>- MRP<br>- LLDP<br>- PDEV<br>- SNMP<br>- FSU |

### General information about PROFINET IO

The PROFINET encoder implements the Encoder Profile 4.2.

It permits scaling and preset values, as well as many other additional parameters to be programmed.

Position, speed and many other states of the encoder can be transmitted.

### PROFINET IO

- The product was developed with regard to the requirements for Enhanced Motion Control and meets Conformance Class C - Encoder Class 4.
- For identification & maintenance functionality version 1.16 is implemented. I&M-Block 0 ... 4 is supported.
- The Media Redundancy Protocol (MRP) is implemented in addition.
- ProfiDrive meets the requirements of Application Class 6 and includes the Fault Buffer and Position Feedback Interface functionalities.
- Isochronous Real-Time (IRT) with a max. jitter of max. ± 1 µs.
- Neighborhood detection is possible via LLDP.
- Fast Startup ensures an up to 3x faster availability after a plant start-up.

### PROFIsafe

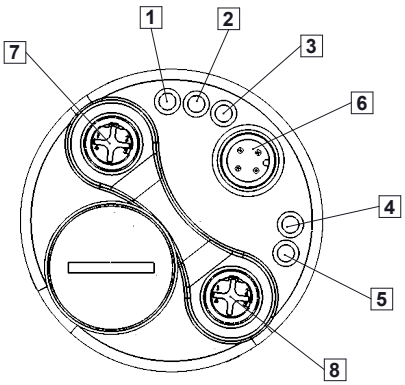
- Extension of PROFINET IO functionalities by PROFIsafe profile version 2.6.
- Extension of the identification & maintenance functionalities by I&M 4 for safety relevant information.
- Tool Calling Interface for direct and uncomplicated CRC calculation.

### Terminal assignment bus

| Interface | Type of connection | Function | M12 connector, 4-pin | | | | | |
|---|---|---|---|---|---|---|---|---|
| C | N<br>(3 x M12 connector) | Bus Port 1 | Signal: | Transmit data+ | Receive data+ | Transmit data - | Receive data - |  D coded |
| | | | Abbreviation: | TxD+ | RxD+ | TxD- | RxD- | |
| | | | Pin: | 1 | 2 | 3 | 4 | |
| | | Power supply | Signal: | Voltage + | – | Voltage – | – |  |
| | | | Abbreviation: | + V | – | 0 V | – | |
| | | | Pin: | 1 | 2 | 3 | 4 | |
| | | Bus Port 2 | Signal: | Transmit data+ | Receive data+ | Transmit data - | Receive data - |  D coded |
| | | | Abbreviation: | TxD+ | RxD+ | TxD- | RxD- | |
| | | | Pin: | 1 | 2 | 3 | 4 | |

### Rear side connections and display elements

1 LED: Link 2
2 LED: Bus error
3 LED: Collecting error
4 LED: ENC
5 LED: Link 1
6 Power
7 Link 2
8 Link 1



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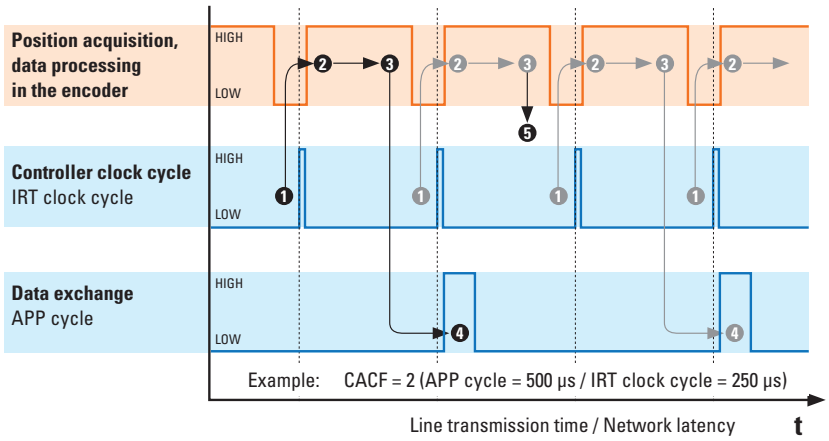
## Technology in detail

### Clock synchronicity – Isochronous Real Time (IRT) in position sensor technology

In general, for time-critical applications, focus is set on very short sensor cycle times. However, in order to achieve high control performance, simply accelerating data acquisition and processing by shortest cycle times is not sufficient. All sensors and actuators are to operate according to the same clock.

This is achieved thanks to a clock used for the whole network, defined by the controller. This transmit clock cycle (IRT clock) is however not necessarily the clock cycle used for process data exchange. Another cycle (application cycle) is used for this purpose, which can also be defined by the customer controller. The illustration below represents the connection between the different clock cycles.




❶ **Clock specification by controller**
IRT clock cycle = Transmit clock

❷ **Data acquisition position signals**
Internal sensor clock synchronizes with the IRT clock. Acquisition of the sensor raw values

❸ **Data processing in the encoder**
Position data is processed and written in the buffer memory of the encoder

❹ **Data transmission via the network**
At every application cycle (APP cycle), data is read from the buffer memory and transmitted to the controller.

❺ **All 2nd positions**
Since the APP cycle is twice as long as the IRT clock cycle, every 2nd position acquired will not be transmitted.
Or: data exchange takes place only every second IRT clock cycle.

When receiving the IRT clock signal, the sensor starts reading its current measured point. This raw value is processed internally (e.g. scaling, speed calculation, etc.) and stored in a buffer memory.

The buffer memory is read at every application cycle. If it contains a value, this value is transmitted to the controller via the network.

If the application cycle is a multiple of the IRT clock cycle, it may happen that the buffered process data is not sent directly, but is overwritten, because, even though this data is acquired with every IRT clock cycle, it is sent only with every application cycle.

The ratio between application cycle and IRT clock cycle represents the CACF (Controller Application Cycle Factor).
In this example, the CACF = 2. This indicates that only every 2nd acquired position will be transmitted to the controller.

The described methodology guarantees a determinism: since the controller defines a clock cycle for the whole network, this allows ensuring that all measured values transmitted by the sensors to the controller are never older than the selected IRT cycle! Therefore, all downstream actuators can always be regulated on the basis of the latest available measured values.

### PROFIsafe encoders – Data flow of safe and non-safe position values

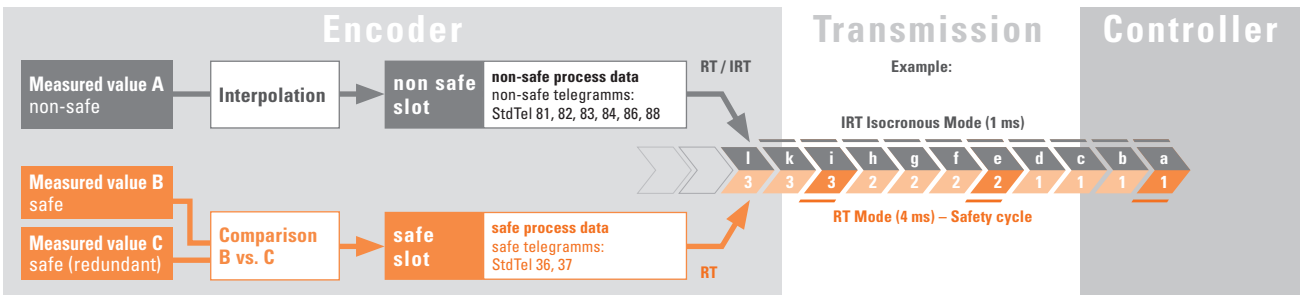
In safety-related applications, safe process data is required for sequence control, which must be detected at least redundantly and provided reliably.

With high performance controllers, it is possible to compare the two measured values against each other and thus generate safe process data. This data can be directly evaluated, calculated or scaled in the sensor before it is transferred.

Since there are restrictions on the resolution and transmission speed for safe process data due to the comparison of the redundant measured values, it can happen that non-safe process data is also required in addition to the safe data, for example to transmit a high-resolution position to the following periphery.

The safe process data is then sent via the same infrastructure as the non-safe process data according to the so-called „black channel" principle. From the point of view of the protocol used, this takes place in a separate area (safe slot) that is distinct from the non-safe area (non-safe slot). Both transmissions can run parallel to each other.

Unlike with safe data, the non-safe process data can also be sent at a specified clock cycle of the controller (isochronous mode).



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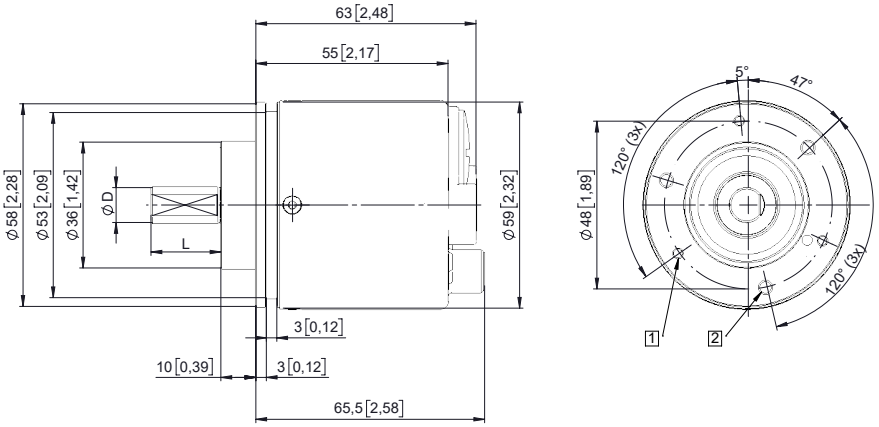
## Dimensions shaft version

Dimensions in mm [inch]

### Clamping flange, ø 58 [2.28]
### Flange type 1 + 3

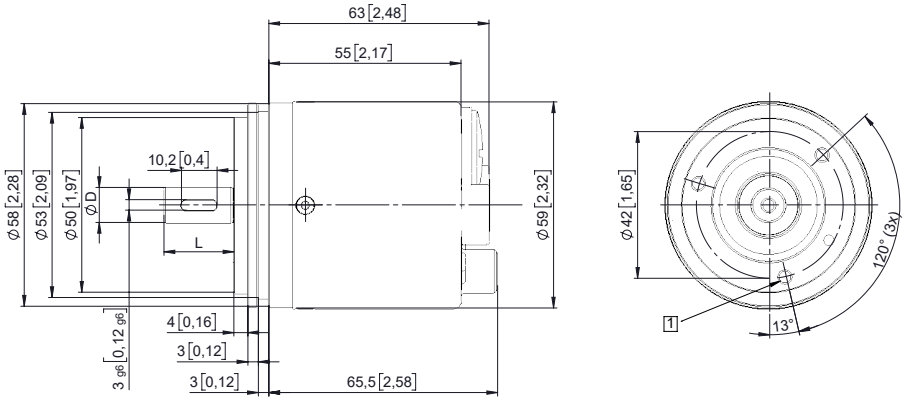
[1] 3 x M3, 6 [0.24] deep
[2] 3 x M4, 8 [0.31] deep




| D | Fit | L |
|---|---|---|
| 10 [0.39] | h7 | 20 [0.79] |
| 12 [0.47] | h7 | 20 [0.79] |
| 3/8" | h7 | 7/8" |

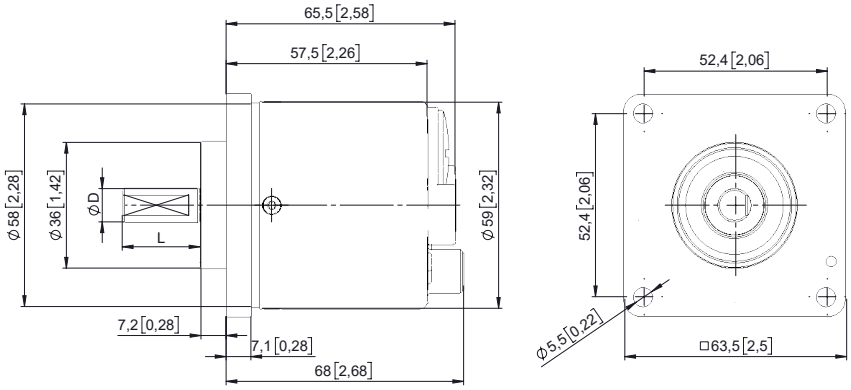
### Synchro flange, ø 58 [2.28]
### Flange type 2 + 4

[1] 3 x M4, 8 [0.31] deep




| D | Fit | L |
|---|---|---|
| 10 [0.39] | h7 | 20 [0.79] |
| 12 [0.47] | h7 | 20 [0.79] |
| 3/8" | h7 | 7/8" |

### Square flange, □ 63.5 [2.5]
### Flange type 5 + 7




| D | Fit | L |
|---|---|---|
| 10 [0.39] | h7 | 20 [0.79] |
| 12 [0.47] | h7 | 20 [0.79] |
| 3/8" | h7 | 7/8" |

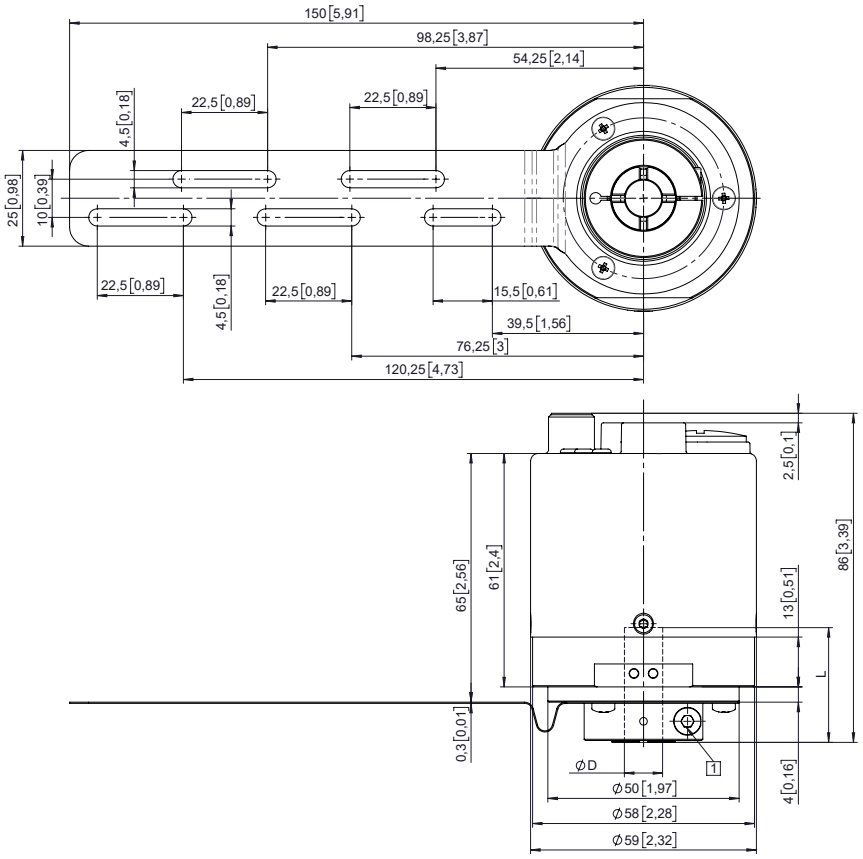
**Standard**
**electronic multiturn, optical / magnetic** | **Sendix S5868FS3 / S5888FS3 (shaft / hollow shaft)** | **PROFIsafe**

## Dimensions hollow shaft version

Dimensions in mm [inch]

**Flange with torque stop FS, flexible**
**Flange type 1 + 2**

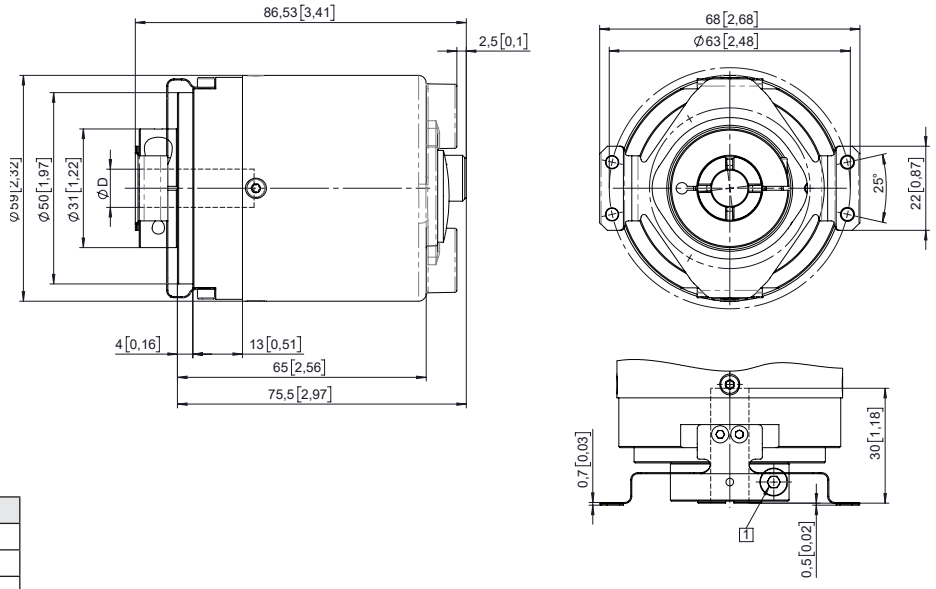
1 Recommended torque for the clamping ring 2.5 Nm




| D | Fit | L |
|---|---|---|
| 10 [0.39] | H7 | 30 [1.18] |
| 12 [0.47] | H7 | 30 [1.18] |
| 14 [0.55] | H7 | 30 [1.18] |
| 15 [0.59] | H7 | 30 [1.18] |
| 3/8" | H7 | 30 [1.18] |
| 1/2" | H7 | 30 [1.18] |
| L = insertion depth max. blind hollow shaft | | |

**Flange with stator coupling FS, ø 63 [2.48]**
**Flange type 5 + 6**

1 Recommended torque for the clamping ring 2.5 Nm




| D | Fit | L |
|---|---|---|
| 10 [0.39] | H7 | 30 [1.18] |
| 12 [0.47] | H7 | 30 [1.18] |
| 14 [0.55] | H7 | 30 [1.18] |
| 15 [0.59] | H7 | 30 [1.18] |
| 3/8" | H7 | 30 [1.18] |
| 1/2" | H7 | 30 [1.18] |
| L = insertion depth max. blind hollow shaft | | |

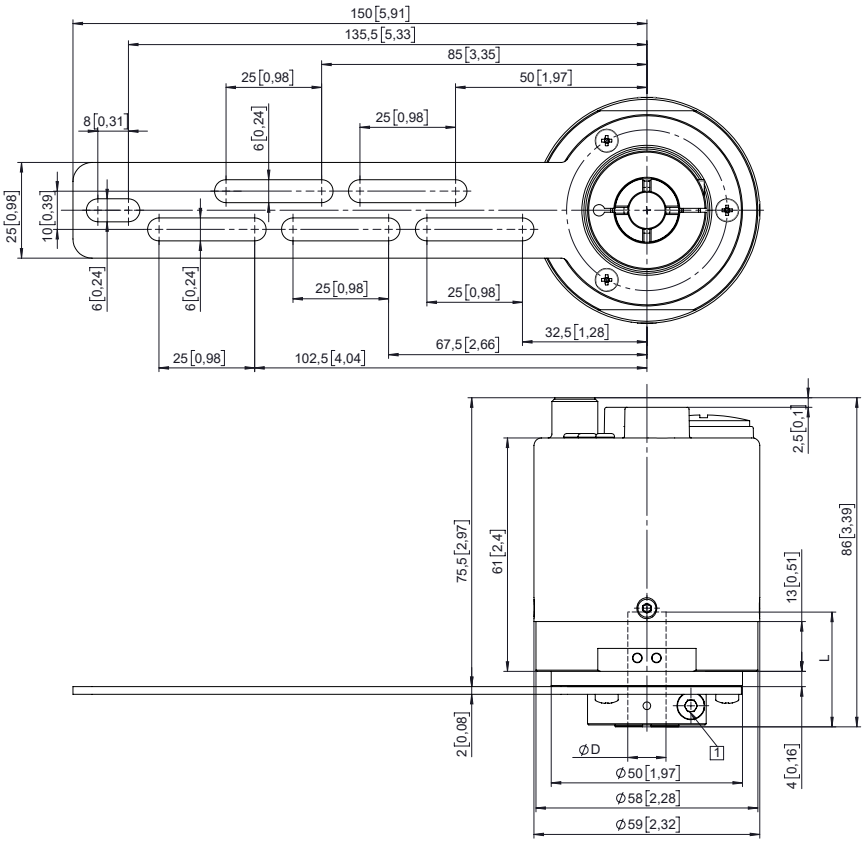
**Standard**
**electronic multiturn, optical / magnetic** | **Sendix S5868FS3 / S5888FS3 (shaft / hollow shaft)** | **PROFIsafe**

## Dimensions hollow shaft version

Dimensions in mm [inch]

**Flange with torque stop FS, rigid**
**Flange type 7 + 8**

1 Recommended torque for the clamping ring 2.5 Nm




| D | Fit | L |
|---|---|---|
| 10 [0.39] | H7 | 30 [1.18] |
| 12 [0.47] | H7 | 30 [1.18] |
| 14 [0.55] | H7 | 30 [1.18] |
| 15 [0.59] | H7 | 30 [1.18] |
| 3/8" | H7 | 30 [1.18] |
| 1/2" | H7 | 30 [1.18] |
| L = insertion depth max. blind hollow shaft | | |

Torque pin with rectangular sleeve with M4 thread

(included in scope of delivery)