Standard
electronic multiturn, optical

Sendix F5868 / F5888 (shaft / hollow shaft)

PROFINET IO

The Sendix F58 multiturn with patented Intelligent Scan Technology™ is a particularly high resolution optical encoder without gears and with 100 percent magnetic insensitivity.

43 bits total resolution, shaft up to 10 mm, blind hollow shaft up to 15 mm and certified PROFINET functionality. A minimum cycle time of 250 µs, the PROFIdrive application profile and a web server for FW updates are supported.

Latest PROFINET functionality

- PROFINET IO, RT, IRT allows integration in applications with different performance requirements.
- Supports the Isochronous Mode, can thus be implemented in networks for hard real-time requirements with clock cycles up to 250 µs.
- Encoder profile V 4.2 with full support of various Profinet features.
- Ideal for highly synchronous applications, such as e. g. axis synchronization.
- Interoperability between many different control and drive manufacturers thanks to the PROFIdrive profile.

Reliable and insensitive

- Sturdy bearing construction in Safety-Lock™ Design for resistance against vibration and installation errors.
- Patented Intelligent Scan Technology™ with all singleturn and multiturn functions on one single OptoASIC - offering the highest reliability, a high resolution up to 43 bits and 100% magnetic field insensitivity.

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Order code Shaft version

8.F5868	.	X	X	C	N	.	C1	2	2
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*
1 = 6 x 10 mm [0.24 x 0.39“]
2 = 10 x 20 mm [0.39 x 0.79“]
3 = 1/4“ x 7/8“
4 = 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

Options – Standard types (available from 1 piece)

Surface protection salt spray tested
with clamping flange IP67 and shaft ø 10 mm:
8.F58568.32CN.C122-**C**

V2A DIN 1.4305 AISI 303 — Stainless steel V2A [1]
Order expansion:
8.F5868.XXCN.C122-**V2A**

V4A DIN 1.4404 AISI 316L — Stainless steel V4A [1]
Order expansion:
8.F5868.XXCN.C122-**V4A**

Options – on request (for other flange/shaft combinations)
- Surface protection salt spray tested
- Stainless steel V2A
- Stainless steel V4A

Order code Hollow shaft

8.F5888	.	X	X	C	N	.	C1	2	2
Type		a	b	c	d		e		

a *Flange*
1 = with spring element long, IP65
2 = with spring element long, IP67
3 = with stator coupling, IP65 ø 65 mm [2.56“]
4 = with stator coupling, IP67 ø 65 mm [2.56“]
5 = with stator coupling, IP65 ø 63 mm [2.48“]
6 = with stator coupling, IP67 ø 63 mm [2.48“]
9 = with torque stop, flexible, IP65
J = with torque stop, flexible, IP67

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

Options – Standard types (available from 1 piece)

V2A DIN 1.4305 AISI 303 — Stainless steel V2A [2]
Order expansion:
8.F5888.2XCN.C122-**V2A**

V4A DIN 1.4404 AISI 316L — Stainless steel V4A [2]
Order expansion:
8.F5888.2XCN.C122-**V4A**

Options – on request (for other flange/hollow shaft combinations)
- Surface protection salt spray tested
- Stainless steel V2A
- Stainless steel V4A

1) Only in conjunction with flange **a** = 3 or 4 and shaft **b** = 1 or 2.
2) Only in conjunction with flange **a** = 2 and hollow shaft **b** = B or D.

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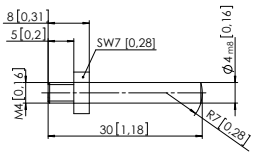
Mounting accessory for shaft encoders		Order no.
Coupling	bellows coupling ø 19 mm [0.75“] for shaft 6 mm [0.24“]	**8.0000.1102.0606**
	bellows coupling ø 19 mm [0.75“] for shaft 10 mm [0.39“]	**8.0000.1102.1010**

Mounting accessory for hollow shaft encoders Dimensions in mm [inch]		Order no.
Torque pin, ø 4 mm for flange with spring element (flange type 1)	with fixing thread 	**8.0010.4700.0000**

Cables and connectors			Order no.
Preassembled cables	M12 male connector with external thread, 4-pin, D coded, straight single-ended 2 m [6.56‘] PUR cable	port 1 + port 2	**05.00.6031.4411.002M**
	M12 male connector with external thread, 4-pin, D coded, right-angle single-ended 2 m [6.56‘] PUR cable	port 1 + port 2	**05.00.6031.4511.002M**
	M12 female connector with coupling nut, 4-pin, A coded, straight single-ended 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 single-ended 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

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Technical data

Mechanical characteristics

Max. speed		9000 min^{-1} (short-term – 10 min) 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		
Working temperature range		-40 °C ... +80 °C [-40 °F ... +176 °F]		
Material		Standard	V2A DIN 1.4305 AISI 303	V4A DIN 1.4404 AISI 316L
	shaft/hollow shaft	V2A	V2A	V4A
	flange	aluminum	V2A	V4A
	housing	aluminum	V2A	V4A
Shock resistance acc. EN 60068-2-27		2500 m/s^2, 6 ms		
Vibration resistance acc. EN 60068-2-6		100 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

Link 1 and 2, LED (green / yellow)

Two colored	green	active link
	yellow	data transfer

Error LED (red) / PWR LED (green)

Functionality see manual

Interface characteristics PROFINET IO

Resolution singleturn (MUR)		
	scalable	1 ... 524 288 (19 bit)
	default	8192 (13 bit)
Number of revolutions (NDR)		1 ... 16 777 216 (24 bit) scalable only via the total resolution
Total resolution (TMR)		
	scalable	1 ... 8 796 093 022 208 (43 bit)
	default	33 554 432 (25 bit)
Protocol		PROFINET IO
Classifications		RT Class 3 (IRT) Conformance Class C Application Class 6 Encoder Class 4 Netload Class III
Features		- I&M 0...3 - standard telegrams (81, 82, 83, 84, 86, 88) - IRT up to 250 µs - Isochrounus Mode - MRP - LLDP - PDEV - SNMP - FSU

Approvals

UL compliant in accordance with	File no. E224618
CE compliant in accordance with	
EMC Directive	2014/30/EU
RoHS Directive	2011/65/EU
UKCA compliant in accordance with	
EMC Regulations	S.I. 2016/1091
RoHS Regulations	S.I. 2012/3032

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.

When switching on, all parameters are loaded from an EEPROM, where they were saved previously to protect them against power-failure, or taken over by the controller in the start-up phase.

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

PROFINET IO

- Implementation of the whole encoder profile according to Encoder Profile Version 4.2.
- The product has been developed with regard to the Enhanced Motion Control requirements and complies with Conformance Class C - Encoder Class 4.
- Identification & maintenance functionality version 1.16 is implemented. IM-Block 0 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.
- Shared Devices allows several PLC's to access to the encoder.
- Fast Startup ensures an up to 3x faster availability after a plant start-up.

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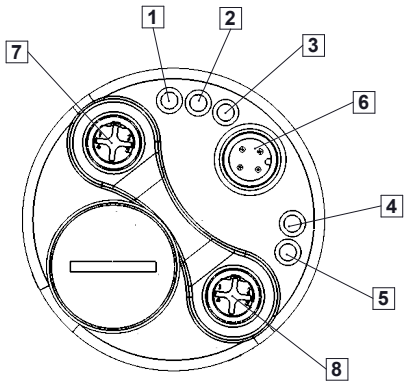
Terminal assignment bus

Interface	Type of connection	Function	M12 connector, 4-pin					
C	N (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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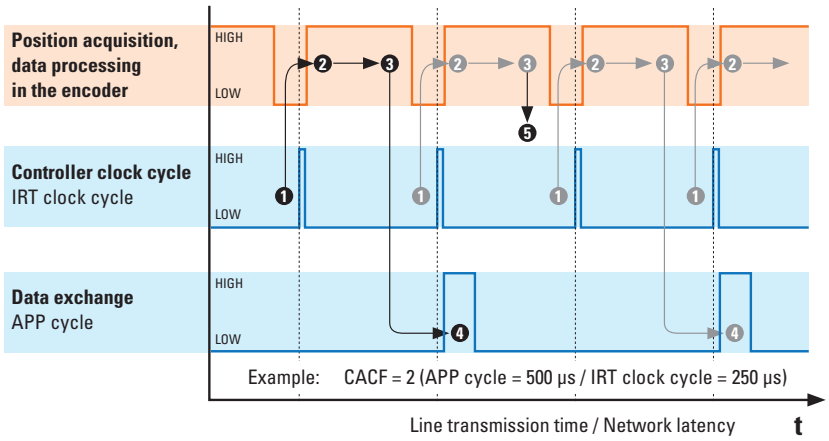
Technology in detail

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.

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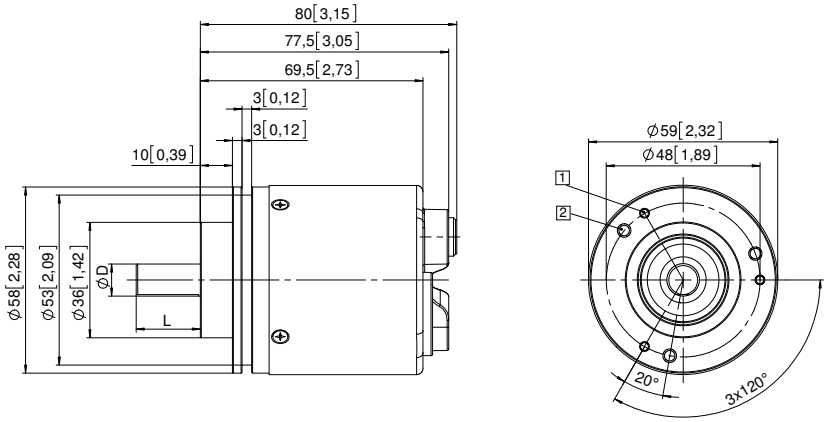
Dimensions shaft version

Dimensions in mm [inch]

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

1 3 x M3, 6 [0.24] deep

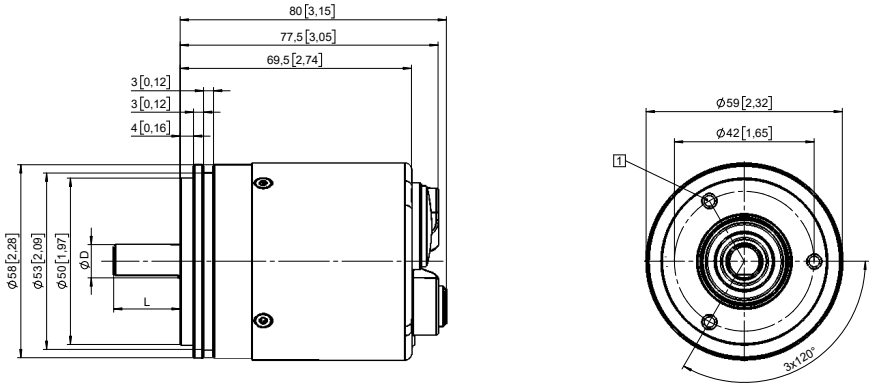
2 3 x M4, 8 [0.31] deep



D	Fit	L
6 [0.24]	h7	10 [0.39]
10 [0.39]	f7	20 [0.79]
1/4"	h7	7/8"
3/8"	h7	7/8"

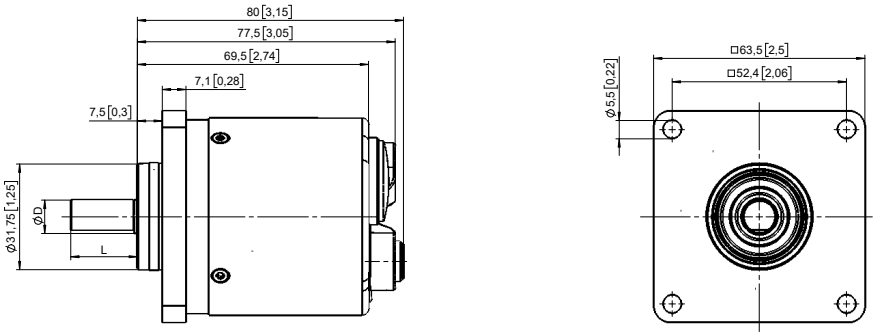
Synchro flange, ø 58 [2.28]
Flange type 2 + 4

1 3 x M3, 6 [0.24] deep



D	Fit	L
6 [0.24]	h7	10 [0.39]
10 [0.39]	f7	20 [0.79]
1/4"	h7	7/8"
3/8"	h7	7/8"

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



D	Fit	L
6 [0.24]	h7	10 [0.39]
10 [0.39]	f7	20 [0.79]
1/4"	h7	7/8"
3/8"	h7	7/8"

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Dimensions hollow shaft version

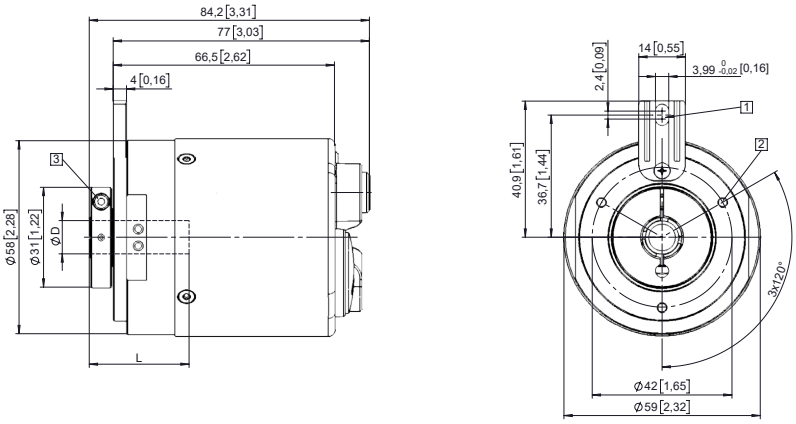
Dimensions in mm [inch]

Flange with spring element, long
Flange type 1 + 2

1 Slot spring element, recommendation: torque pin DIN 7, ø 4 [0.16]

2 3 x M3, 5.5 [0.22] deep

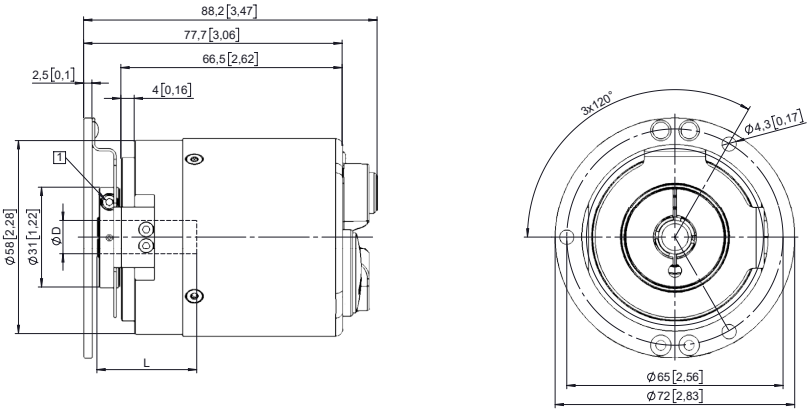
3 Recommended torque for the clamping ring 0.6 Nm



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, ø 65 [2.56]
Flange type 3 + 4

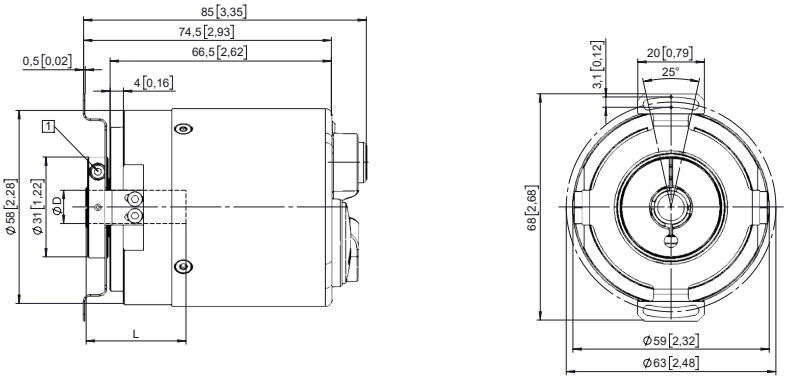
1 Recommended torque for the clamping ring 0.6 Nm



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, ø 63 [2.48]
Flange type 5 + 6

1 Recommended torque for the clamping ring 0.6 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		

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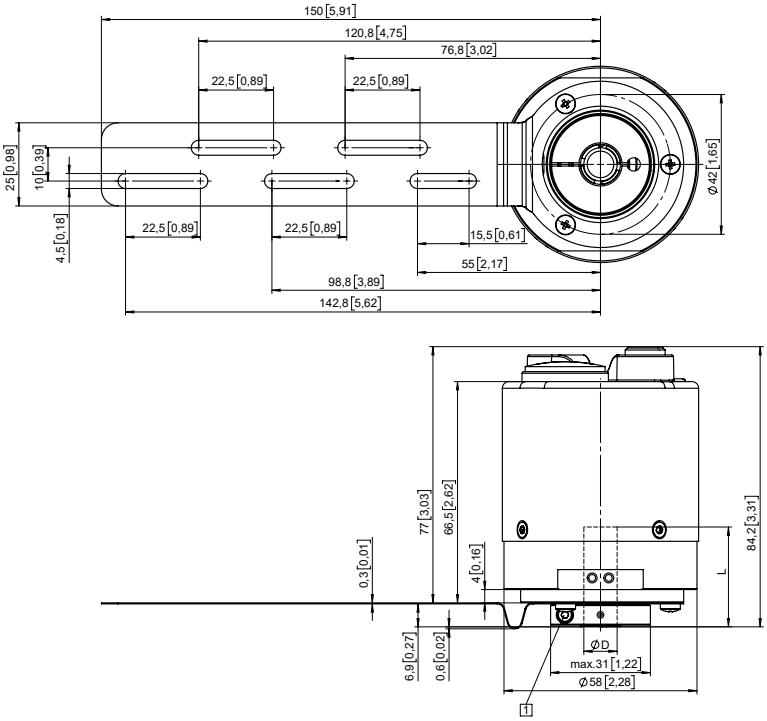
Dimensions hollow shaft version

Dimensions in mm [inch]

Flange with torque stop, flexible
Flange type 9 + J

1 Recommended torque for the clamping ring 0.6 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		