

# Absolute Encoders - Singleturn

<b>Standard Optical</b>	<b>5850 / 5870 (Shaft / Hollow shaft)</b>	<b>Parallel / Analogue</b>
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The singleturn encoders 5850 and 5870 with parallel or analogue interface and optical sensor technology feature a refresh rate of the position data of 1.6 kHz.

With the parallel output a resolution of max. 14 bit can be achieved – with the analogue output the 4 ... 20 mA signals can achieve a resolution of 13 bits.



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High rotational speed	Temperature range	High protection level	High shaft load capacity	Shock / vibration resistant	Magnetic field proof	Optical sensor

### Adaptable

- Power supply 5 V DC or 10 ... 30 V DC
- Cable or connector
- Gray code, binary code or BCD code

### Robust

- High shock resistance
- Temperature range from -20°C up to +85°C
- Protection rating up to max. IP66

**Order code** 8.5850 . XXXX . XXXX  
**Shaft version** Type a b c d e f

- |   |   |   |
|---|---|---|
| <p><b>a Flange</b></p> <p>1 = clamping flange, ø 58 mm [2.28"]<br/>                 2 = synchro flange, ø 58 mm [2.28"]</p> <p><b>b Shaft (ø x L), with flat</b></p> <p>1 = 6 x 10 mm [0.24 x 0.39"]<br/>                 2 = 10 x 20 mm [0.39 x 0.79"]</p> | <p><b>c Interface / Power supply</b></p> <p>3 = Parallel / 5 V DC<br/>                 4 = Parallel / 10 ... 30 V DC<br/>                 7 = 4 ... 20 mA / 5 V DC<br/>                 8 = 4 ... 20 mA / 10 ... 30 V DC</p> <p><b>d Type of connection</b></p> <p>1 = axial cable, 1 m [3.28'] PVC<br/>                 2 = radial cable, 1 m [3.28'] PVC<br/>                 3 = M23 connector, axial, without mating connector<br/>                 5 = M23 connector, radial, without mating connector</p> | <p><b>e Code type and division</b></p> <p>G13 = 13 bit (for interface 7 and 8, 4 ... 20 mA)<br/>                 see table 1 (for interface 3 and 4, Parallel)</p> <p><b>f Options</b></p> <p>2 = SET <sup>1)</sup> and V/R<br/>                 3 = SET and Latch <sup>1)</sup><br/>                 4 = V/R <sup>1)</sup> and Latch</p> |
|---|---|---|

**Order code** 8.5870 . XXXX . XXXX  
**Hollow shaft** Type a b c d e f

- |   |   |  |
|---|---|--|
| <p><b>a Flange</b></p> <p>1 = hollow shaft with spring element short<br/>                 2 = blind hollow shaft with spring element short<br/>                 3 = hollow shaft with stator coupling, ø 65 mm [2.56"]<br/>                 4 = blind hollow shaft with stator coupling, ø 65 mm [2.56"]</p> <p><b>b Hollow shaft</b></p> <p>6 = ø 10 mm [0.39"]<br/>                 8 = ø 12 mm [0.47"]</p> | <p><b>c Interface / Power supply</b></p> <p>3 = Parallel / 5 V DC<br/>                 4 = Parallel / 10 ... 30 V DC</p> <p><b>d Type of connection</b></p> <p>1 = radial cable, 1 m [3.28'] PVC<br/>                 2 = M23 connector, radial, without mating connector</p> | <p><b>e Code type and division</b></p> <p>see table 1 (for interface 3 and 4, Parallel)</p> <p><b>f Options</b></p> <p>2 = SET <sup>1)</sup> and V/R<br/>                 3 = SET and Latch <sup>1)</sup><br/>                 4 = V/R and Latch <sup>1)</sup></p> |
|---|---|--|

1) For parallel version, 14 bit and 17 pin connector

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Table 1: Code type and divisions for encoders with parallel output										Interface and power supply, version 3 or 4 (parallel)										
Division	250	360	500	720	900	1000	1024 10 bit	1250	1440	1800	2000	2500	2880	3600	4000	4096 12 bit	5000	7200	8192 13 bit	16384 14 bit
<b>Order code Gray / Gray-Excess</b>	E02	E03	E05	E07	E09	E01	G10	E12	E14	E18	E20	E25	E28	E36	E40	G12	E50	E72	G13	G14
<b>Order code Binary</b>	B02	B03	B05	B07	B09	B01	B10	BA2	BA1	B18	B20	B25	B28	B36	B40	B12	B50	B72	B13	B14
<b>Order code BCD</b>	D02	D03	D05	D07	D09	D01	D10	DA2	DA1	D18	D20									

<b>Mounting accessory for shaft encoders</b>	Order No.
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<b>Coupling</b>	Bellows coupling $\varnothing$ 19 mm [0.75"] for shaft 6 mm [0.24"]	<b>8.0000.1101.0606</b>
	Bellows coupling $\varnothing$ 19 mm [0.75"] for shaft 10 mm [0.39"]	<b>8.0000.1101.1010</b>

<b>Mounting accessory for hollow shaft encoders</b>	
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<b>Cylindrical pin, long</b> for torque stops		With fixing thread	<b>8.0010.4700.0000</b>

<b>Connection technology</b>	
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<b>Connector, self-assembly (straight)</b>	M23 female connector with coupling nut, 12-pin for analogue interface	<b>8.0000.5012.0000</b>
	M23 female connector with coupling nut, 17-pin for parallel interface	<b>8.0000.5042.0000</b>
<b>Cordset, pre-assembled</b>	M23 female connector w. coupling nut, for analogue interf., 2 m [6.56'] PVC cable	<b>8.0000.6901.0002.0031</b>
	M23 female connector w. coupling nut, for parallel interf., 2 m [6.56'] PVC cable	<b>8.0000.6741.0002</b>

Further accessories can be found in the accessories section or in the accessories area of our website at: [www.kuebler.com/accessories](http://www.kuebler.com/accessories)  
 Additional connectors can be found in the connection technology section or in the connection technology area of our website at: [www.kuebler.com/connection\\_technology](http://www.kuebler.com/connection_technology)

<b>Technical data</b>
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Mechanical characteristics		
<b>Max. speed</b>	shaft version	max. 12000 min <sup>-1</sup>
	hollow shaft version	max. 6000 min <sup>-1</sup> 1)
<b>Moment of inertia</b>	shaft version	approx. 1.8 x 10 <sup>-6</sup> kgm <sup>2</sup>
	hollow shaft version	approx. 6 x 10 <sup>-6</sup> kgm <sup>2</sup>
<b>Starting torque at 20°C [68°F]</b>	shaft version	< 0.01 Nm
	hollow shaft version	< 0.05 Nm
<b>Load capacity of shaft</b>	radial	80 N
	axial	40 N
<b>Weight</b>		approx. 0.4 kg [14.11 oz]

<b>Protection acc. to EN 60529</b>	shaft version	IP65
	hollow shaft version	IP66
<b>Working temperature range</b>		-20°C ... +85°C 2) 3) [-4°F ... +185°F] 2) 3)
<b>Material</b>	shaft / hollow shaft	stainless steel
<b>Shock resistance acc. EN 60068-2-27</b>		2500 m/s <sup>2</sup> , 6 ms
<b>Vibration resistance acc. EN 60068-2-6</b>		100 m/s <sup>2</sup> , 10...2000 Hz

1) For continuous operation max. 1500 min<sup>-1</sup>  
 2) 80°C [176°F] for shaft version and cable connection  
 3) 70°C [158°F] for hollow shaft version and cable connection

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Electrical characteristics parallel interface		
<b>Power supply (+V)</b>	5 V DC ( $\pm 5\%$ )	10 ... 30 V DC
<b>Output driver</b>	Push-Pull	Push-Pull
<b>Power consumption</b> (no load)	typ. 109 mA max. 169 mA	109 mA 169 mA
<b>Permissible load / channel</b>	max. +/- 10 mA	max. +/- 10 mA
<b>Refresh rate of the position data</b>	1.600/s	1.600/s
<b>Signal level</b>	HIGH min. 3.4 V LOW ( $I_{Load} = 10\text{ mA}$ ) max. 1.5 V LOW ( $I_{Load} = 1\text{ mA}$ ) max. 0.3 V	min. +V - 2.8 V max. 1.8 V -
<b>Rising edge time <math>t_r</math></b> (without cable)	max. 0.2 $\mu\text{s}$	max. 1 $\mu\text{s}$
<b>Falling edge time <math>t_f</math></b> (without cable)	max. 0.2 $\mu\text{s}$	max. 1 $\mu\text{s}$
<b>Short circuit proof outputs</b>	no	no
<b>Reverse polarity protection of the power supply</b>	no	yes
<b>UL approval</b>	File 224618	
<b>CE compliant acc. to</b>	EMC guideline 2004/108/EC	
<b>RoHS compliant acc. to</b>	guideline 2011/65/EU	

Electrical characteristics voltage interface 4 ... 20 mA		
(only shaft version)		
<b>Sensor</b>		
<b>Interface type</b>	4 ... 20 mA	4 ... 20 mA
<b>Power supply (+V)</b>	10 ... 30 V DC	5 V DC
<b>Power consumption</b> (no load)	typ. 70 mA max. 84 mA	70 mA 84 mA
<b>Current loop</b>		
<b>Power supply (+V)</b>	10 ... 30 V DC	
<b>Analogue signal</b>	4 ... 20 mA	
<b>Max. input resistance of the input circuit</b>	200 Ohm ( $U_s = 10\text{ V}$ ), 1 kOhm ( $U_s = 30\text{ V}$ )	
<b>Measuring range</b>	0 ... 360°	
<b>Max. error, 25°C [77°F]</b>	0.2°	
<b>Resolution</b>	13 bit	
<b>Setting time</b>	max. 2 ms	
<b>Temperature coefficient</b>	0.1°/10 K	
<b>Current with scan error</b>	$\leq 3.5\text{ mA}$	
<b>Sensor component and current loop are galvanically isolated</b>		
<b>UL-certified</b>	File 224618	
<b>CE compliant acc. to</b>	EMC guideline 2004/108/EC	
<b>RoHS compliant acc. to</b>	guideline 2011/65/EU	

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## Control inputs

### Switching levels of the control inputs

<b>Power supply</b>	5 V DC	10 ... 30 V DC
<b>Switching level</b>	LOW $\leq 1.7\text{ V}$ HIGH $\geq 3.4\text{ V}$	$\leq 4.5\text{ V}$ $\geq 8.7\text{ V}$

### Up/Down input to switch the counting direction

As a standard, absolute encoders deliver increasing code values when the shaft rotates clockwise (cw), when looking from the shaft side. When the shaft rotates counter-clockwise (ccw), the output delivers accordingly decreasing code values. The same applies to models with current interfaces. When the shaft rotates clockwise, the output delivers increasing current values, and decreasing values when it rotates counter-clockwise. As long as the Up/Down input receives the corresponding signal (HIGH), this feature is reversed. Clockwise rotation will deliver decreasing code/current values while counter-clockwise rotation will deliver increasing code/current values.

The response time is: for 5 V DC power supply, 0.4 ms  
for 10 ... 30 V DC power supply, 2 ms

### SET input

This input is used to reset (zero) the encoder. A control pulse (HIGH) sent to this input allows the current position value to be saved as the new zero position in the encoder.

For models equipped with a current interface, the analogue output (4 ... 20 mA) will be set accordingly to the value 4 mA.

Note : After applying power to the encoder and before activating the SET input, a count direction (cw or ccw) must be clearly defined on the Up/Down input!

The response time is: for 5 V DC power supply, 0.4 ms  
for 10 ... 30 V DC power supply, 2 ms

### LATCH input

This input is used to "freeze" the current position value. The position value will be statically available on the parallel output as long as this input remains active (HIGH).

The response time is: for 5 V DC power supply, 140  $\mu\text{s}$ ,  
for 10 ... 30 V DC power supply, 200  $\mu\text{s}$

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**Standard  
Optical**

**5850 / 5870 (Shaft / Hollow shaft)**

**Parallel / Analogue**

## Terminal assignment

max. 13 bit, max. 2 options

Interface	Type of connection	Cable (Isolate unused wires individually before initial start-up)																		
		Signal	0 V	+V	1	2	3	4	5	6	7	8	9	10	11	12	13	ST/VR	VR/LH	⊥
3, 4 (parallel)	5850: 1, 2																			
	5870: 1	Cable colour:	WH	BN	GN	YE	GY	PK	BU	RD	BK	VT	GY	RD	WH	BN	WH	YE	WH	

14 bit, max. 2 options

Interface	Type of connection	Cable (Isolate unused wires individually before initial start-up)																			
		Signal	0 V	+V	1	2	3	4	5	6	7	8	9	10	11	12	13	ST/VR	VR/LH	14	⊥
3, 4 (parallel)	5850: 1, 2																				
	5870: 1	Cable colour:	WH	BN	GN	YE	GY	PK	BU	RD	BK	VT	GY	RD	WH	BN	WH	YE	BN	WH	GY

max. 13 bit, max. 2 options

Interface	Type of connection	M23 connector, 17-pin																			
		Signal	0 V	+V	1	2	3	4	5	6	7	8	9	10	11	12	13	ST/VR	VR/LH	⊥	
3, 4 (parallel)	5850: 3, 5																				
	5870: 2	Pin:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17		

14 bit, max. 1 option

Interface	Type of connection	M23 connector, 17-pin																			
		Signal	0 V	+V	1	2	3	4	5	6	7	8	9	10	11	12	13	ST/VR/LH	14	⊥	
3, 4 (parallel)	5850: 3, 5																				
	5870: 2	Pin:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17		

13 bit

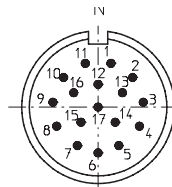
Interface	Type of connection	Cable (Isolate unused wires individually before initial start-up)																			
		Signal	0 V	+V	-	-	+I	-I	ST	VR											
7, 8 (4 ... 20 mA)	5850: 1, 2																				
		Cable colour:	WH	BN	GN	YE	GY	PK	BU	RD	BK	VT	GY	PK	RD	BU					

13 bit

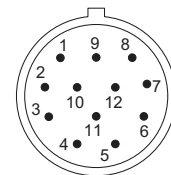
Interface	Type of connection	M23 connector, 12-pin													
		Signal	0 V	+V	-	-	+I	-I	ST	VR					⊥
7, 8 (4 ... 20 mA)	5850: 3, 5														
		Pin:	1	2	3	4	5	6	7	8	9	10	11	12	PH

- +V: Encoder power supply +V DC
- 0 V: Encoder power supply ground GND (0 V)
- Sig.: 1 =MSB; 2 = MSB-1; 3 = MSB-2 usw.
- ST: SET input
- Parallel: The current position value is stored as new zero position.
- 4 ... 20 mA: measured value set to 4 mA
- VR: Up/down input. As long as this input is active, decreasing code values are transmitted when shaft turning
- +I: Current loop input
- I: Current loop output
- LH: LATCH input. Active HIGH. The current position is saved and is statically available at the output.
- PH ⊥: Plug connector housing (shield)

Top view of mating side, male contact base:



M23 connector, 17-pin (parallel)



M12 connector, 12-pin (4... 20 mA)

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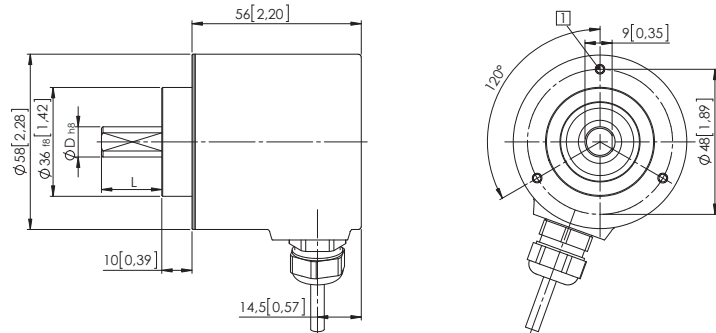
<b>Standard Optical</b>	<b>5850 / 5870 (Shaft / Hollow shaft)</b>	<b>Parallel / Analogue</b>
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## Dimensions shaft version

Dimensions in mm [inch]

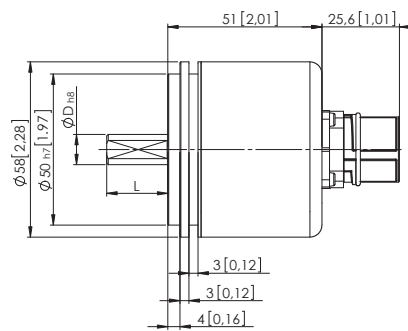
**Clamping flange,  $\varnothing$  58 [2.28]  
with shaft,  $\varnothing$  10 [0.39]  
Flange type 1**

1 3 x M3, 5 [0.20] deep



**Synchro flange,  $\varnothing$  58 [2.28]  
with shaft,  $\varnothing$  6 [0.24]  
Flange type 2**

1 3 x M3, 5 [0.20] deep



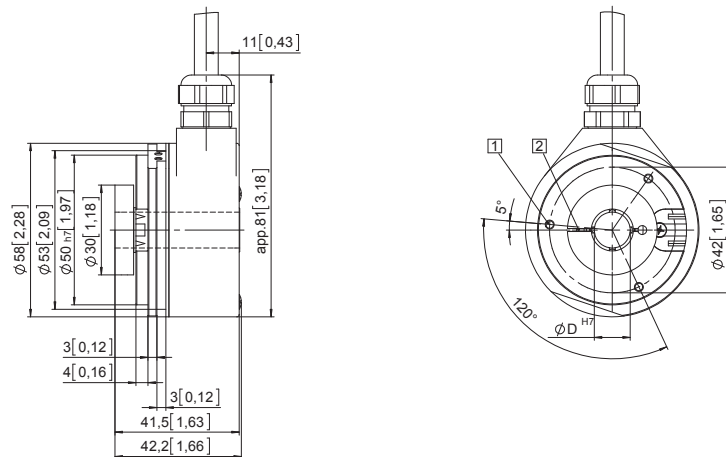
D	L	Fit
6 [0.24]	10 [0.39]	h8
10 [0.39]	20 [0.79]	h8

## Dimensions hollow shaft version

Dimensions in mm [inch]

**Flange with spring element short  
Flange type 1 and 2**

1 3 x M3, 5 [0.20] deep  
2 Recommended torque for the clamping ring 0.6 Nm



**Flange with stator coupling,  $\varnothing$  65 [2.56]  
Flange type 3 and 4**

1 Recommended torque for the clamping ring 0.6 Nm

