

Absolute encoders - singleturn

Standard optical

5850 / 5870 (shaft / hollow shaft)

Parallel / analog



The singleturn encoders 5850 and 5870 with parallel or analog 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 analog output the 4 ... 20 mA signals can achieve a resolution of 13 bits.



High rotational speed



Temperature range
-20°...+85°C



High protection level
IP



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 Shaft version

8.5850 . XXXXX . XXXX
Type a b c d e f

a Flange

- 1 = clamping flange, ø 58 mm [2.28"]
- 2 = synchro flange, ø 58 mm [2.28"]

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"]

c Interface / power supply

- 3 = parallel / 5 V DC
- 4 = parallel / 10 ... 30 V DC
- 7 = 4 ... 20 mA / 5 V DC
- 8 = 4 ... 20 mA / 10 ... 30 V DC

d Type of connection

- 1 = axial cable, 1 m [3.28'] PVC
- 2 = radial cable, 1 m [3.28'] PVC
- 3 = axial M23 connector, without mating connector
- 5 = radial M23 connector, without mating connector

e Code type and division

G13 = 13 bit (for interface 7 and 8, 4 ... 20 mA)
see table 1 (for interface 3 and 4, parallel)

f Options

- 2 = SET ¹⁾ and V/R
- 3 = SET and Latch ¹⁾
- 4 = V/R ¹⁾ and Latch

Order code Hollow shaft

8.5870 . XXXXX . XXXX
Type a b c d e f

a Flange

- 1 = hollow shaft with spring element, short
- 2 = blind hollow shaft with spring element, short
- 3 = hollow shaft with stator coupling, ø 65 mm [2.56"]
- 4 = blind hollow shaft with stator coupling, ø 65 mm [2.56"]

b Hollow shaft

- 6 = ø 10 mm [0.39"]
- 8 = ø 12 mm [0.47"]

c Interface / power supply

- 3 = parallel / 5 V DC
- 4 = parallel / 10 ... 30 V DC

d Type of connection

- 1 = radial cable, 1 m [3.28'] PVC
- 2 = radial M23 connector, without mating connector

e Code type and division

see table 1 (for interface 3 and 4, parallel)

f Options

- 2 = SET ¹⁾ and V/R
- 3 = SET and Latch ¹⁾
- 4 = V/R ¹⁾ and Latch

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

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| | | |
|-------------------------|---|--------------------------|
| Standard optical | 5850 / 5870 (shaft / hollow shaft) | Parallel / analog |
|-------------------------|---|--------------------------|

| 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 |
| Order code Gray/Gray-Excess | E02 | E03 | E05 | E07 | E09 | E01 | G10 | E12 | E14 | E18 | E20 | E25 | E28 | E36 | E40 | G12 | E50 | E72 | G13 | G14 |
| Order code Binary | B02 | B03 | B05 | B07 | B09 | B01 | B10 | BA2 | BA1 | B18 | B20 | B25 | B28 | B36 | B40 | B12 | B50 | B72 | B13 | B14 |
| Order code BCD | D02 | D03 | D05 | D07 | D09 | D01 | D10 | DA2 | DA1 | D18 | D20 | | | | | | | | | |

| Mounting accessory for shaft encoders | | Order no. |
|---------------------------------------|--|-------------------------|
| Coupling | bellows coupling \varnothing 19 mm [0.75"] for shaft 6 mm [0.24"] | 8.0000.1102.0606 |
| | bellows coupling \varnothing 19 mm [0.75"] for shaft 10 mm [0.39"] | 8.0000.1102.1010 |

| Mounting accessory for hollow shaft encoders | | Order no. |
|--|---------------------------|-------------------------|
| Cylindrical pin, long for torque stops | <p>with fixing thread</p> | 8.0010.4700.0000 |

| Connection technology | | Order no. |
|--|---|------------------------------|
| Connector, self-assembly (straight) | M23 female connector with coupling nut, 12-pin for analog interface | 8.0000.5012.0000 |
| | M23 female connector with coupling nut, 17-pin for parallel interface | 8.0000.5042.0000 |
| Cordset, pre-assembled | M23 female connector w. coupling nut, for analog interf., 2 m [6.56'] PVC cable | 8.0000.6901.0002.0031 |
| | M23 female connector w. coupling nut, for parallel interf., 2 m [6.56'] PVC cable | 8.0000.6741.0002 |

Further accessories can be found in the accessories section or in the accessories area of our website at: 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.

Technical data

| Mechanical characteristics | | |
|---------------------------------------|---------------------------|---|
| Maximum speed | shaft version | 12000 min ⁻¹ |
| | hollow shaft version | 6000 min ⁻¹ 1) |
| Mass moment of inertia | shaft version | approx. 1.8 x 10 ⁻⁶ kgm ² |
| | hollow shaft version | approx. 6 x 10 ⁻⁶ kgm ² |
| Starting torque at 20°C [68°F] | shaft version | < 0.01 Nm |
| | hollow shaft version | < 0.05 Nm |
| Load capacity of shaft | radial | 80 N |
| | axial | 40 N |
| Weight | approx. 0.4 kg [14.11 oz] | |

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

1) For continuous operation max. 1500 min⁻¹.
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 | | | |
|---|---------------------------------|---|-----------------|
| Power supply (+V) | | 5 V DC (±5 %) | 10 ... 30 V DC |
| Output driver | | Push-Pull | Push-Pull |
| Power consumption (no load) | typ. | 109 mA | 109 mA |
| | max. | 169 mA | 169 mA |
| Permissible load / channel | | max. +/- 10 mA | max. +/- 10 mA |
| Refresh rate of the position data | | 1600/s | 1600/s |
| Signal level | HIGH | min. 3.4 V | min. +V - 2.8 V |
| | LOW (I _{Load} = 10 mA) | max. 1.5 V | max. 1.8 V |
| | LOW (I _{Load} = 1 mA) | max. 0.3 V | - |
| Rising edge time t_r (without cable) | | max. 0.2 μs | max. 1 μs |
| Falling edge time t_f (without cable) | | max. 0.2 μs | max. 1 μs |
| Short circuit proof outputs | | no | no |
| Reverse polarity protection of the power supply | | no | yes |
| UL approval | | file 224618 | |
| CE compliant acc. to | | EMC guideline 2014/30/EU RoHS guideline 2011/65/EU | |

| Electrical characteristics voltage interface 4 ... 20 mA | | | |
|--|------|---|-------------|
| (only shaft version) | | | |
| Sensor | | | |
| Interface type | | 4 ... 20 mA | 4 ... 20 mA |
| Power supply (+V) | | 10 ... 30 V DC | 5 V DC |
| Power consumption (no load) | typ. | 70 mA | 70 mA |
| | max. | 84 mA | 84 mA |
| Current loop | | | |
| Power supply (+V) | | 10 ... 30 V DC | |
| Analog signal | | 4 ... 20 mA | |
| Max. input resistance of the input circuit | | 200 Ohm (U _s = 10 V), 1 kOhm (U _s = 30 V) | |
| Measuring range | | 0 ... 360° | |
| Max. error, 25°C [77°F] | | 0.2° | |
| Resolution | | 13 bit | |
| Setting time | | max. 2 ms | |
| Temperature coefficient | | 0.1°/10 K | |
| Current with scan error | | ≤ 3.5 mA | |
| Sensor component and current loop are galvanically isolated | | | |
| UL-certified | | file 224618 | |
| CE compliant acc. to | | EMC guideline 2014/30/EU RoHS guideline 2011/65/EU | |

Control inputs

Switching levels of the control inputs

| | | | |
|------------------------|------|---------|----------------|
| Power supply | | 5 V DC | 10 ... 30 V DC |
| Switching level | LOW | ≤ 1.7 V | ≤ 4.5 V |
| | HIGH | ≥ 3.4 V | ≥ 8.7 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 analog 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 μs,
for 10 ... 30 V DC power supply, 200 μs

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|-------------------------|---|--------------------------|
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|-------------------------|---|--------------------------|

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 | WH | GY | BN |

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 | 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

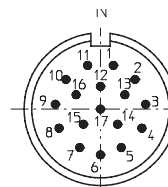
| Interface | Type of connection | Cable (isolate unused wires individually before initial start-up) | | | | | | | | | | | | | | | | | | | |
|-----------------------|--------------------|---|-----|----|----|----|----|----|----|----|----|----|----|----|--|--|--|--|--|--|--|
| | | Signal | 0 V | +V | - | - | +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 | RD | | | | | | | |

13 bit

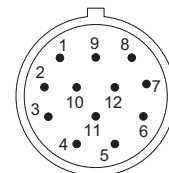
| Interface | Type of connection | M23 connector, 12-pin | | | | | | | | | | | | | |
|-----------------------|--------------------|-----------------------|-----|----|---|---|----|----|----|----|---|----|----|----|----|
| | | Signal | 0 V | +V | - | - | +I | -I | ST | VR | | | | | ⊥ |
| 7, 8 (4 ... 20 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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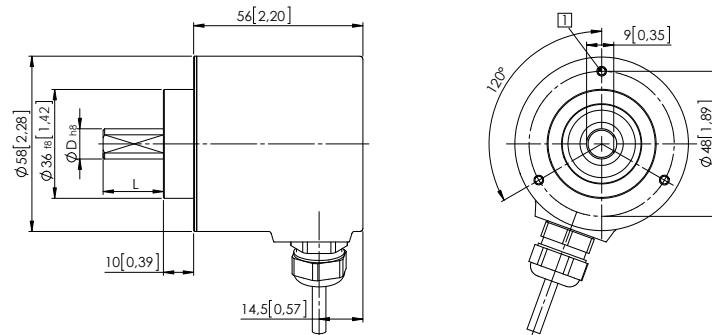
| | | |
|-------------------------|---|--------------------------|
| Standard optical | 5850 / 5870 (shaft / hollow shaft) | Parallel / analog |
|-------------------------|---|--------------------------|

Dimensions shaft version

Dimensions in mm [inch]

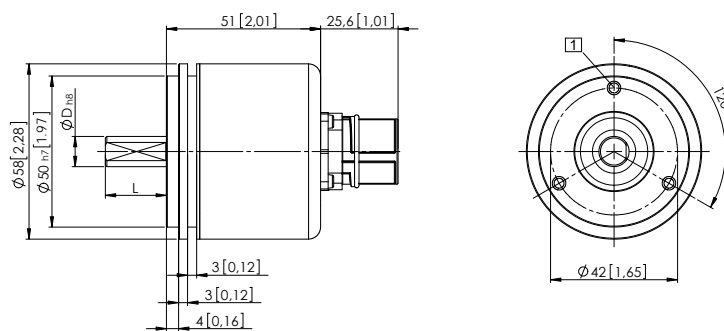
Clamping flange, \varnothing 58 [2.28]
with shaft, \varnothing 10 [0.39]
Flange type 1

- 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 M4, 10 [0.39] deep



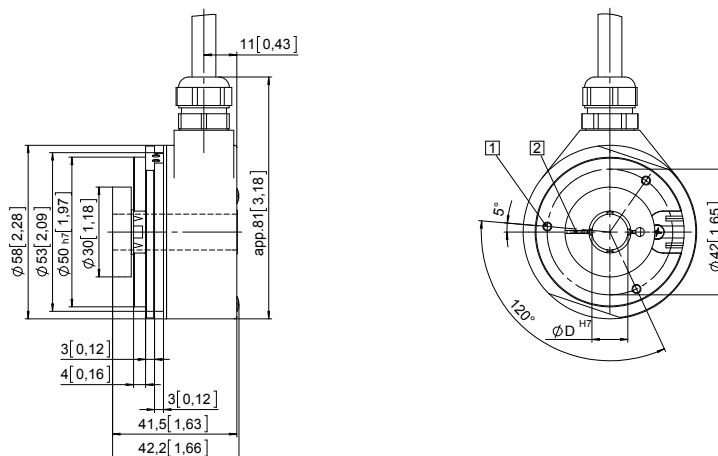
| D | L | Fit |
|-----------|-----------|-----|
| 6 [0.24] | 10 [0.39] | h8 |
| 10 [0.39] | 20 [0.79] | h8 |

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

