

# Incremental encoders

|                          |   |                         |
|--------------------------|---|-------------------------|
| <b>Miniature optical</b> | <b>2400 / 2420 (shaft / hollow shaft)</b> | <b>Push-pull, RS422</b> |
|--------------------------|---|-------------------------|



The incremental miniature encoders type 2400 / 2420 with their optical sensor technology offer a resolution of up to 1024 pulses per revolution.

With a diameter of just 24 mm this encoder is ideal for use where space is tight.



|                       |                                   |                             |                     |                      |                |
|-----------------------|-----------------------------------|-----------------------------|---------------------|----------------------|----------------|
|                       |                                   |                             |                     |                      |                |
| High rotational speed | Temperature range<br>-20°...+85°C | Shock / vibration resistant | Short-circuit proof | Magnetic field proof | Optical sensor |

### Reliable

- Robust bearing construction.
- Cable outlet boasts high degree of strain relief thanks to multiple clamping.
- Short-circuit proof outputs.

### Versatile

- Ideally suited for use in small devices.

|                      |                |              |              |
|----------------------|----------------|--------------|--------------|
| <b>Order code</b>    | <b>05.2400</b> | <b>.XXXX</b> | <b>.XXXX</b> |
| <b>Shaft version</b> | Type           | a b c d      | e            |

If for each parameter of an encoder the **underlined preferred option** is selected, then the delivery time will be 10 working days for a maximum of 10 pieces. Qts. up to 50 pcs. of these types generally have a delivery time of 15 working days.



#### a Flange

- 1** = ø 24 mm [0.94"]
- 3 = ø 28 mm [1.10"]
- 2 = ø 30 mm [1.18"]

#### b Shaft (ø x L)

- 1** = ø 4 x 10 mm [0.16 x 0.39"]
  - 3 = ø 5 x 10 mm [0.20 x 0.39"], with flat
  - 2 = ø 6 x 10 mm [0.24 x 0.39"]
- 
- 4 = ø 1/4" x 10 mm [1/4" x 0.39"], with flat <sup>1)</sup>
  - 6 = ø 6 x 10 mm [0.24 x 0.39"], with flat <sup>1)</sup>

#### c Output circuit / supply voltage

- 1 = push-pull (without inverted signal) / 5 ... 24 V DC
- 2** = **push-pull (with inverted signal) / 5 ... 24 V DC**
- 3 = push-pull (without inverted signal) / 8 ... 30 V DC
- 4 = push-pull (with inverted signal) / 8 ... 30 V DC
- 6 = RS422 (with inverted signal) / 5 V DC

#### d Type of connection

- 1 = axial cable, 2 m [6.56'] PVC
- A = axial cable, special length PVC \*)
- 2** = **radial cable, 2 m [6.56'] PVC**
- B = radial cable, special length PVC \*)

\*) Available special lengths (connection types A, B):  
3, 5, 8, 10, 15 m [9.84, 16.40, 26.25, 32.80, 49.21']  
order code expansion .XXXX = length in dm  
ex.: 05.2400.122A.1024.0030 (for cable length 3 m)

#### e Pulse rate


- 4, 6, 8, 10, 16, 20, 25, 36, 40, 50, 60, 80, **100**, 120, 125, 180, **200**, 250, 300, **360**, 400, **500**, 512, **1000**, **1024** (e.g. 360 pulses => 0360)

Optional on request  
- other pulse rates

1) US version.

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

|  |  |          |          |          |          |          |             |  |   |
|--|--|----------|----------|----------|----------|----------|-------------|--|---|
| <b>Order code</b>                        | <b>05.2420</b>   | <b>1</b> | <b>X</b> | <b>X</b> | <b>X</b> | <b>X</b> | <b>XXXX</b> | If for each parameter of an encoder the <u>underlined preferred option</u> is selected, then the delivery time will be 10 working days for a maximum of 10 pieces.<br>Qts. up to 50 pcs. of these types generally have a delivery time of 15 working days. |  |
| <b>Hollow shaft</b>                      | Type   | <b>a</b> | <b>b</b> | <b>c</b> | <b>d</b> | <b>e</b> |             |  |   |
| <b>a Flange</b>                          | <b><u>1 = ø 24 mm [0.94"]</u></b>  |          |          |          |          |          |             |  |   |
| <b>b Blind hollow shaft</b>              | <i>(insertion depth max. 14 mm [0.55"])</i>  |          |          |          |          |          |             |  |   |
|  | <b><u>1 = ø 4 mm [0.16"]</u></b>   |          |          |          |          |          |             |  |   |
|  | <b><u>2 = ø 6 mm [0.24"]</u></b>   |          |          |          |          |          |             |  |   |
|  | 4 = ø 1/4" <sup>1)</sup>   |          |          |          |          |          |             |  |   |
| <b>c Output circuit / supply voltage</b> |  |          |          |          |          |          |             |  |   |
|  | 1 = push-pull (without inverted signal) / 5 ... 24 V DC  |          |          |          |          |          |             |  |   |
|  | <b><u>2 = push-pull (with inverted signal) / 5 ... 24 V DC</u></b>   |          |          |          |          |          |             |  |   |
|  | 3 = push-pull (without inverted signal) / 8 ... 30 V DC  |          |          |          |          |          |             |  |   |
|  | 4 = push-pull (with inverted signal) / 8 ... 30 V DC   |          |          |          |          |          |             |  |   |
|  | 6 = RS422 (with inverted signal) / 5 V DC  |          |          |          |          |          |             |  |   |
| <b>d Type of connection</b>              |  |          |          |          |          |          |             |  |   |
|  | 1 = axial cable, 2 m [6.56'] PVC   |          |          |          |          |          |             |  |   |
|  | A = axial cable, special length PVC *)   |          |          |          |          |          |             |  |   |
|  | <b><u>2 = radial cable, 2 m [6.56'] PVC</u></b>  |          |          |          |          |          |             |  |   |
|  | B = radial cable, special length PVC *)  |          |          |          |          |          |             |  |   |
|  | *) Available special lengths (connection types A, B):<br>3, 5, 8, 10, 15 m [9.84, 16.40, 26.25, 32.80, 49.21']<br>order code expansion .XXXX = length in dm<br>ex.: 05.2420.122A.1024.0030 (for cable length 3 m)                          |          |          |          |          |          |             |  |   |
| <b>e Pulse rate</b>                      |  |          |          |          |          |          |             |  |   |
|  | 4, 6, 8, 10, 16, 20, 25, 36, 40, 50, 60,<br>80, <b><u>100</u></b> , 120, 125, 180, <b><u>200</u></b> , 250, 300,<br><b><u>360</u></b> , 400, <b><u>500</u></b> , 512, <b><u>1000</u></b> , <b><u>1024</u></b><br>(e.g. 360 pulses => 0360) |          |          |          |          |          |             |  |   |
|  | <i>Optional on request</i><br>- other pulse rates  |          |          |          |          |          |             |  |   |

|  |   |                         |
|--|---|-------------------------|
| <b>Mounting accessory for shaft encoders</b> |   | Order no.               |
| <b>Coupling</b>                              | bellows coupling ø 15 mm [0.59"] for shaft 4 mm [0.16"] | <b>8.0000.1202.0404</b> |

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| <b>Miniature optical</b> | <b>2400 / 2420 (shaft / hollow shaft)</b> | <b>Push-pull, RS422</b> |
|--------------------------|---|-------------------------|

## Technical data

| Mechanical characteristics                       |   |
|--|---|
| <b>Maximum speed</b>                             | 12000 min <sup>-1</sup>                                 |
| <b>Mass moment of inertia</b>                    | approx. 0.1 x 10 <sup>-6</sup> kgm <sup>2</sup>         |
| <b>Starting torque</b> – at 20 °C [68 °F]        | < 0.01 Nm <sup>3)</sup>                                 |
| <b>Shaft load capacity</b>                       | radial 20 N<br>axial 10 N                               |
| <b>Weight</b>                                    | approx. 0.06 kg [2.12 oz]                               |
| <b>Protection</b> acc. to EN 60529               | housing side IP65<br>flange side IP50 (IP64 on request) |
| <b>Working temperature range</b>                 | -20 °C ... +85 °C [-4 °F ... +185 °F]                   |
| <b>Materials</b>                                 | shaft stainless steel<br>blind hollow shaft brass       |
| <b>Shock resistance</b> acc. to EN 60068-2-27    | 1000 m/s <sup>2</sup> , 6 ms                            |
| <b>Vibration resistance</b> acc. to EN 60068-2-6 | 100 m/s <sup>2</sup> , 55 ... 2000 Hz                   |

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

## Electrical characteristics

| Output circuit                         | Push-pull <sup>1)</sup><br>(7272 compatible) | Push-pull <sup>1)</sup><br>(7272 compatible) | RS422<br>(TTL compatible) |
|--|--|--|---------------------------|
| <b>Supply voltage</b>                  | 5 ... 24 V DC <sup>2)</sup>                  | 8 ... 30 V DC                                | 5 V DC (±5 %)             |
| <b>Power consumption</b> (no load)     | max. 50 mA                                   | max. 50 mA                                   | max. 90 mA                |
| <b>Permissible load / channel</b>      | max. +/- 50 mA                               | max. +/- 50 mA                               | max. +/- 20 mA            |
| <b>Pulse frequency</b>                 | max. 160 kHz                                 | max. 160 kHz                                 | max. 300 kHz              |
| <b>Signal level</b>                    | HIGH min. +V - 2.5 V<br>LOW max. 0.5 V       | min. +V - 3.0 V<br>max. 0.5 V                | min. 2.5 V<br>max. 0.5 V  |
| <b>Rising edge time t<sub>r</sub></b>  | max. 1 μs                                    | max. 1 μs                                    | max. 200 ns               |
| <b>Falling edge time t<sub>f</sub></b> | max. 1 μs                                    | max. 1 μs                                    | max. 200 ns               |
| <b>Short circuit proof outputs</b>     | yes  | yes  | yes                       |

### Terminal assignment

| Output circuit              | Type of connection | Cable (isolate unused cores individually before initial start-up) |     |    |    |    |    |  |
|-----------------------------|--------------------|---|-----|----|----|----|----|--|
| 1, 3<br>without inv. signal | 1, 2, A, B         | Signal:   | 0 V | +V | A  | B  | 0  |  |
|                             |                    | Core color:   | WH  | BN | GN | YE | GY |  |

| Output circuit              | Type of connection | Cable (isolate unused cores individually before initial start-up) |     |    |    |           |    |           |    |           |  |
|-----------------------------|--------------------|---|-----|----|----|-----------|----|-----------|----|-----------|--|
| 2, 4, 6<br>with inv. signal | 1, 2, A, B         | Signal:   | 0 V | +V | A  | $\bar{A}$ | B  | $\bar{B}$ | 0  | $\bar{0}$ |  |
|                             |                    | Core color:   | WH  | BN | GN | YE        | GY | PK        | BU | RD        |  |

- +V: Supply voltage encoder <+V DC
- 0 V: Supply voltage encoder ground GND (0 V)
- A,  $\bar{A}$ : Incremental output channel A
- B,  $\bar{B}$ : Incremental output channel B
- 0,  $\bar{0}$ : Reference signal

1) Max. recommended cable length 30 m [98.4].  
 2) With 24 V DC there is no tolerance above 24 V DC. Please use output circuit 8 ... 30 V DC.  
 3) Also for protection level IP64 on the shaft.

# Incremental encoders

## Miniature optical

2400 / 2420 (shaft / hollow shaft)

Push-pull, RS422

### Dimensions shaft version

Dimensions in mm [inch]

#### Flange type 1, $\varnothing$ 24 [0.94]

- 1 min R50 [1.97]
- 2 3 x M3, 4 [0.16] deep

| D        | Fit | L         |
|----------|-----|-----------|
| 4 [0.16] | f7  | 10 [0.39] |
| 5 [0.20] | f7  | 10 [0.39] |
| 6 [0.24] | f7  | 10 [0.39] |
| 1/4"     | f7  | 10 [0.39] |



#### Flange type 2, $\varnothing$ 30 [1.18]

#### Flange type 3, $\varnothing$ 28 [1.10]

- 1 min R50 [1.97]
- 2 2 x M3, 4 [0.16] deep

| D        | Fit | L         |
|----------|-----|-----------|
| 4 [0.16] | f7  | 10 [0.39] |
| 5 [0.20] | f7  | 10 [0.39] |
| 6 [0.24] | f7  | 10 [0.39] |
| 1/4"     | f7  | 10 [0.39] |



| Flange type | A                       | B        |
|-------------|-------------------------|----------|
| 2           | $\varnothing$ 30 [1.18] | 3 [0.12] |
| 3           | $\varnothing$ 28 [1.10] | 2 [0.08] |

### Dimensions hollow shaft version

Dimensions in mm [inch]

#### Flange type 1, $\varnothing$ 24 [0.94]

- 1 4 x M3 DIN 915 - SW1.5

Recommended torque for the set screw in the clamping ring 0.1 Nm.  
To ensure optimal clamping by the clamping ring, the customer shaft should be without flat surface.

| D        | Fit | L         |
|----------|-----|-----------|
| 4 [0.16] | H7  | 14 [0.55] |
| 6 [0.24] | H7  | 14 [0.55] |
| 1/4"     | H7  | 14 [0.55] |

L = insertion depth max. blind hollow shaft

