GENERAL PRODUCT CATALOG
1961 Company was founded

1962 First Circular Grinding Machine 3E153

1963 Universal Circular Grinding Machine 3E12V

1965 First Circumference Measuring Device BE-20A

1966 First Gear Processing Machine 5310A

1969 First Linear Encoder BE-76

1971 Beginning of Rotary Encoder Serial Production

1974 High Precision Gear Processing Machine BE-62

1974 Developed New Device for Encoder Inspection BE-178

1977 First Coordinate Measuring Machine BE-140K

1977 The National Science Prize for Encoders Development

1979 Established a Joint Venture with Brown & Sharpe USA

1979 First Coordinate Measuring Machine BE-140K

1983 High Precision Gear Processing Machine BE-62

1983 The National Science Prize for Encoders Development

1991 100% Ownership and Name Change to Precizika Metrology

1991 Company was Purchased by Hexagon Group.

2000 Innovation Prize

2013 New Production Facilities

2015 Lithuanian Product of the Year

2016 Company was Purchased by Hexagon Group.
Precizika Metrology has a long history of old traditions in the leadership of design and production of metrological equipment – rotary, angle, linear encoders and optical encoder gratings. The Lithuanian company has been in the industry for over 50 years and with this heritage comes both pride and great responsibility to continuously move forward, improve and evolve in order to satisfy the ever-changing industry needs. A huge part of time spent in the industry was dedicated to working with top-of-the-line original equipment manufacturing (OEM) companies, listening to their feedback and providing innovative solutions to a variety of diverse conundrums.

Consistent supply of high quality products and services that match or exceed the quality standards our customers expect and deserve is the main goal that drives us forward, constantly investing in new projects, future proof equipment and bright minds. The ability to take advantage of accumulated know-how and to channel the experience provides us with a unique perspective and position in the market that opens new ways to innovate and provide industry defining product solutions.

| ABOUT US |

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| WHAT WE VALUE |

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**HOW OUR ENCODERS OPERATE**

Encoders are used to convert angular or linear displacement into electric signals containing information about the magnitude and direction of movement. After further signal processing by the numeric control devices (processor complexes, digital readout devices), this information is used to control moving parts of the equipment.

Encoders manufactured by Precizika Metrology take advantage of photoelectric technology operating on the principle of light modulation or magnetic technology using a combination of permanent magnets and magnetic sensors to detect movement and position.

Absolute encoder is a device that provides true (absolute) positional information, as it generates a unique code for each position. The resolution is equal to $2^n$ (n=number of bit), encoder uses gray or binary coding, which can be translated into different protocols. This encoder type is normally used to monitor object position during power up and power down. Unlike incremental encoders, the encoded output provides the ability to read the object position without moving the encoder. Singleturn absolute encoder delivers a single data item in the form of a “word” in parallel or serial mode for each position of the object, which can be read directly and quickly by control systems, whereas multturn absolute encoder can perform a greater number of turns and delivers, in addition to the position of the object in the turn, the number of turns performed in relation to a reference mark.

**SIGNALS**

**SINE-WAVE CURRENT SIGNAL, VERSION A (~ 11 µA); U = +5V±5%**

- $I_1$ lags $I_2$ for clockwise rotation (viewed from shaft side)
- Output signals $I_1$, $I_2$ amplitude at load 1kΩ: 7...16 µA
- Value of reference signal $I_0$ at load 1kΩ: 2...8 µA (useful part)
- Phase difference between signals $I_1$ and $I_2$: 90° ±10°
- Phase difference between signals $I_1$ and $I_2$: 135° ±10°

**SINE-WAVE VOLTAGE SIGNAL, VERSION AV (~ 1VPP); U = +5V±5%**

- B lags A for clockwise rotation (viewed from shaft side)
- Output signals A, B amplitude at load 120Ω: 0.6...1.2 V
- Value of reference signal at load 120Ω: 0.0...0.8 V (useful part)
- Phase difference between signals A and B: 90° ±10°
- Phase difference between signals A and R: 135° ±10°

**REFLECTIVE TYPE ENCODERS**

**PHOTOELECTRIC LINEAR ENCODERS**

**PHOTOCODEC ROTARY ENCODERS**

**MAGNETIC ENCODERS**

**RECOMMENDED CONNECTION DIAGRAM**

**TTL (LU) SQUARE-WAVE SIGNAL, VERSION F; U = +5V±5%**

- U2 lags U1 for clockwise rotation (viewed from shaft side)
- Output signals level at current load 20mA:
  - $I_1$ ≥ 2 mA, log $I_0$ ≥ 0.5V
- Maximum rise and fall time: 0.1...0.2 ms
- Reference signal delay is no bigger than 0.1 µs

**HTL (LU) SQUARE-WAVE SIGNAL, VERSION F; U = +(10...30V)±5%**

- U2 lags U1 with clockwise rotation (viewed from shaft side)
- Output signals level at current load 20mA:
  - $I_1$ ≥ 2 mA, log $I_0$ ≥ 0.5V
- Maximum rise and fall time: 0.3 ms
- Reference signal delay is no bigger than 0.1 µs

**SSI**

**BISS C**

**BIW**

**Recommended connection diagram**

- Interface SSI Binary - Gray
- Signals level EIA RS 485
- Clock frequency 160 Hz ÷ 4 MHz
- Position bit TTL (LU)
- Value of reference signal $I_0$ at load 120Ω: 0.2...0.8 V (useful part)
- Phase difference between signals A and B: 90° ±10°
- Phase difference between signals A and R: 135° ±10°

**Recommended connection scheme**

- Min Max
  - n 100ns 2 x timeout, ns
  - f 50ns 50ns
  - tCP 100 ns 2 x timeout, ns
  - tSH 50 ns
  - tSL 50 ns
  - tSD 10 ns 50 ns
  - ttimeout 3,28 ms 100 ns

**Recommended connection scheme**
<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>ROTARY ENCODERS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>A28</td>
<td>22</td>
<td>AK50</td>
<td>38</td>
</tr>
<tr>
<td>14</td>
<td>A36</td>
<td>24</td>
<td>A58</td>
<td>40</td>
</tr>
<tr>
<td>16</td>
<td>AK36</td>
<td>28</td>
<td>AK58</td>
<td>42</td>
</tr>
<tr>
<td>18</td>
<td>A42M</td>
<td>34</td>
<td>A58HE</td>
<td>44</td>
</tr>
<tr>
<td>20</td>
<td>A75M</td>
<td>36</td>
<td>A58HE</td>
<td></td>
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<tr>
<td>ANGLE ENCODERS</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>48</td>
<td>A90H</td>
<td>52</td>
<td>A170</td>
<td>56</td>
</tr>
<tr>
<td>50</td>
<td>A110</td>
<td>54</td>
<td>A170H</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>LINEAR ENCODERS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>L18</td>
<td>68</td>
<td>LK24</td>
<td>76</td>
</tr>
<tr>
<td>62</td>
<td>L18B</td>
<td>70</td>
<td>L35</td>
<td>78</td>
</tr>
<tr>
<td>64</td>
<td>L18T</td>
<td>72</td>
<td>L35T</td>
<td>84</td>
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<tr>
<td>66</td>
<td>L23</td>
<td>74</td>
<td>L37</td>
<td></td>
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</tr>
<tr>
<td>ACCESSORIES</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>88</td>
<td>SC</td>
<td>93</td>
<td>CS 5500</td>
<td></td>
</tr>
<tr>
<td>90</td>
<td>NK</td>
<td>94</td>
<td>Encoder electrical connection</td>
<td></td>
</tr>
<tr>
<td>92</td>
<td>CS 3000</td>
<td>97</td>
<td>Cable lengths</td>
<td></td>
</tr>
</tbody>
</table>
### ROTARY ENCODERS

<table>
<thead>
<tr>
<th>MODEL</th>
<th>CROSS SECTION</th>
<th>NUMBER OF LINES* / RESOLUTION</th>
<th>ACCURACY (ARC. SEC)</th>
<th>SHAFT TYPE</th>
<th>OUTPUT SIGNALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A28</td>
<td></td>
<td>60 – 2,500</td>
<td>± 0.1T</td>
<td>Solid</td>
<td>TTL</td>
</tr>
<tr>
<td>A36</td>
<td></td>
<td>100 – 3,600</td>
<td>± 0.1T</td>
<td>Solid</td>
<td>~1 Vpp</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>TTL, HTL</td>
</tr>
<tr>
<td>AK36</td>
<td></td>
<td>Up to 21 bit singleturn</td>
<td>± 0.1T</td>
<td>Solid</td>
<td>SSI</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Up to 40 bit multiturn</td>
<td></td>
<td></td>
<td>BiSS C</td>
</tr>
<tr>
<td>A42M</td>
<td></td>
<td>1,000, 2,500</td>
<td>± 0.1T</td>
<td>Hollow</td>
<td>1 Vpp</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>TTL</td>
</tr>
<tr>
<td>A75M</td>
<td></td>
<td>512, 2,048</td>
<td>± 0.1T</td>
<td>Hollow</td>
<td></td>
</tr>
<tr>
<td>AK50</td>
<td></td>
<td>Up to 8 bit</td>
<td>± 120</td>
<td>Solid</td>
<td>TTL, HTL</td>
</tr>
<tr>
<td>A58</td>
<td></td>
<td>100 – 10,800</td>
<td>± 0.1T</td>
<td>Solid/hollow/blind shaft**</td>
<td>~1 Vpp, TTL, HTL</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AK58</td>
<td></td>
<td>Up to 21 bit singleturn</td>
<td>± 50</td>
<td>Solid</td>
<td>SSI</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Up to 40 bit multiturn</td>
<td></td>
<td></td>
<td>BiSS C, EtherCAT</td>
</tr>
<tr>
<td>AP58</td>
<td></td>
<td>1 – 65,536 (pulses per revolution)</td>
<td>± 0.1T</td>
<td>Solid / hollow shaft</td>
<td>TTL, HTL</td>
</tr>
<tr>
<td>A102H</td>
<td></td>
<td>5,000</td>
<td>± 0.05T</td>
<td>Hollow</td>
<td>~1 Vpp</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>TTL</td>
</tr>
<tr>
<td>AM</td>
<td></td>
<td>16 – 1,024 for HTL / Up to 12 bit for SSI</td>
<td>± 0.3</td>
<td>Solid</td>
<td>TTL, HTL</td>
</tr>
</tbody>
</table>

*others only on request. Possible interpolation factor up to x10. **depending on the model
Photoelectric rotary encoder A28 is a small 28mm diameter incremental encoder that can have up to 25,000 output pulses per revolution.

Small size is its primary feature that enables the customer to fit it in tight places without any hassle.

**PHOTOELECTRIC ROTARY ENCODER**

**A28**

**PRODUCT CATALOG**

**MECHANICAL DATA**

- **Line number on disc (z):** 60, 100, 200, 250, 360, 500, 1000, 1224, 1500, 2000, 2500
- **Maximum shaft speed:** 6000 rpm
- **Maximum shaft load:**
  - axial: 5N
  - radial (at shaft end): 10N
- **Accuracy** (T1 period of lines on disc in arc sec): ±0.17 arc sec
- **Starting torque at 20°C:** 0.015 Nm
- **Rotor moment of inertia:** < 2 gcm²

**ELECTRICAL DATA**

- **Supply voltage:** ±5 V ± 5%
- **Max. supply current (without load):** 120 mA
- **Light source:** LED
- **Incremental signals:** Differential square-wave U1/U0 and U2/U0.
  - Signal levels at 20 mA load current:
    - low (logic “0”) ≲ 0.5 V
    - high (logic “1”) ≳ 2.4 V
- **Reference signal:** One differential square-wave U0/U0 per revolution.
  - Signal levels at 20 mA load current:
    - low (logic “0”) ≲ 0.5 V
    - high (logic “1”) ≳ 2.4 V
- **Maximum operating frequency:** (160 x k) kHz, k-interpolation factor
- **Maximum weight without cable:** 0.045 kg
- **Operating temperature:** -10...+70°C
- **Storage temperature:** -30...+80°C
- **Maximum humidity (non-condensing):** 98%
- **Permissible vibration (55 to 2000 Hz):** ±100 m/s²
- **Permissible shock (11 ms):** ±300 m/s²

**ACCESSORIES**

- **CONNECTORS FOR CABLE**
  - B12: 12-pin round connector
  - C12: 12-pin round connector
  - D9: 9-pin flat connector
  - D15: 15-pin flat connector
  - RS10: 10-pin round connector
  - ONC: 10-pin round connector

- **DIGITAL READOUT DEVICES**
  - CS3000
  - CS5500

- **COUPLING**
  - SC30

**ORDER FORM**

| A28 | 200000000 | X00 | X 0 X 0 |

**PULSE NUMBER PER REVOLUTION:**

| OPTIONAL LINE NUMBER ON DISC (z): | 25000 |

**CABLE LENGTH AND OUTLET:**

<table>
<thead>
<tr>
<th>CONNECTOR TYPE:</th>
<th>COUPLING:</th>
</tr>
</thead>
<tbody>
<tr>
<td>RS10 - 10-pin round connector</td>
<td>0 - without coupling</td>
</tr>
<tr>
<td>RS10 - 10-pin flat connector</td>
<td>1 - with coupling</td>
</tr>
<tr>
<td>B12 - 12-pin round connector</td>
<td></td>
</tr>
<tr>
<td>C12 - 12-pin round connector</td>
<td></td>
</tr>
<tr>
<td>D9 - 9-pin flat connector</td>
<td></td>
</tr>
<tr>
<td>D15 - 15-pin flat connector</td>
<td></td>
</tr>
<tr>
<td>RS10 - 10-pin round connector</td>
<td></td>
</tr>
<tr>
<td>ONC - 10-pin round connector</td>
<td></td>
</tr>
</tbody>
</table>

**ORDER EXAMPLES:**

1. A28-F-2000/R01/W-0
2. A28-F-2022/55B/01/500-0

**Notes:**

1. Maximum working rotation speed (with proper encoder counting) is limited by maximum operating frequency and maximum mechanical rotation speed.
2. If cable extension is used, power supply conductor cross-section should not be smaller than 0.5 mm².
**A36 PHOTOELECTRIC ROTARY ENCODER**

Photoelectric rotary encoder A36 is an incremental encoder that is available in digital or analog output signal versions depending on customer preferences. It can have up to 36,000 output pulses per revolution and, because of its quite small diameter, can be fitted in narrow areas.

**MECHANICAL DATA**

- Line number on disc (2)
  - 100; 200; 250; 360; 500; 1000; 1024; 1500; 2000; 2500; 3600
- Number of output pulses per revolution
  - k x 2, where k = 1.2, 3.4, 5.8, 10
- Maximum shaft speed
  - 10,000 rpm
- Maximum shaft load
  - Axial: 5N
  - Radial: 10N
- Accuracy
  - (1°) period of lines on disc in arc. sec: ±0.17 arc. sec
- Starting torque at 20°C: ≤ 0.002 Nm

**ELECTRICAL DATA**

- **Version**
  - A36-A: 11 µApp
  - A36-AV: 5 µApp
  - A36-F: TTL/HTL

**Supply voltage**
- A36-A
  - ±5 V ± 5%
- A36-AV
  - ±5 V ± 3%
- A36-F
  - ±5 V ± 3% (without load)

**Max. supply current (without load)**
- A36-A: 80 mA
- A36-AV: 120 mA
- A36-F: 120 mA

**Light source**
- LED

**Incremental signals**
- Two sinusoidal signals
  - for A signal and B signal
  - at 1 kHz load:
    - A = 7.16 µA
    - B = 7.16 µA
- Differential sine signal
  - A signal = -11 V to +11 V
  - B signal = -11 V to +11 V

**Reference signal**
- One quasi-triangular pulse per revolution
  - A signal = ~1.8 V
  - B signal = ~1.8 V

**Output signals**
- A = 0.6 ± 1.2 V
  - B = 0.6 ± 1.2 V

**Direction of signals**
- For clockwise rotation (viewed from shaft side)
- A = 0.6 ± 1.2 V
- B = 0.6 ± 1.2 V

**Maximum operating frequency**
- For A signal: 10 kHz
- For B signal: 20 kHz

**Maximum rise and fall time**
- < 2 µs

**Standard cable length**
- 1 m, without connector

**Maximum cable length**
- 30 m, without connector

**Output signals**
- 2.4 V at U = 10 to 30 V
- < 0.5 µs

**Note:**
1. Maximum rotation speed (with proper encoder counting) is limited by maximum operating frequency and maximum mechanical rotation speed.
2. If cable extension is used, power supply conductor cross-section should not be smaller than 0.5 mm².

**ACCESSORIES**

- **Connectors for cable**
  - B12: 12-pin round connector
  - C9: 9-pin round connector
  - D9: 9-pin flat connector
  - C12: 12-pin round connector
  - D15: 15-pin flat connector
  - RS10: 10-pin round connector
  - ONC: 10-pin round connector

- **Digital readout devices**
  - C3300
  - C3550

- **Coupling**
  - SC10

- **External interpolator**
  - NIK

**ORDER DATA**

**A36**

**Output signal version**

- B12: 12-pin connector
- C9: 9-pin connector
- C12: 12-pin connector
- D9: 9-pin connector
- D15: 15-pin connector
- RS10: 10-pin connector
- ONC: 10-pin connector

**Configuration**

- **A36-F**
  - 2500-05V-A01/W-0
  - 3600-05V-A02/C12-1

**ORDER EXAMPLES**

- A36-F-2500-05V-A01/W-0
- A36-F-3600-05V-A02/C12-1
Absolute rotary encoder AK36 uses photoelectric technology and is available in singleturn and multiturn versions. Using SSI or BiSS serial interface, it can reach up to 21 bit singleturn and 40 bit multiturn resolutions per revolution.

### MECHANICAL DATA

- **Maximum shaft speed**: 10000 rpm
- **Maximum shaft load**: SN, 10N
- **Starting torque at 20°C**: 0.052 Nm
- **Protective class (IEC 529)**: IP54, IP64
- **Protection (IEC 529)**: Standard, Optional
- **Maximum weight without cable**: 0.1 kg

### ELECTRICAL DATA

- **Resolution**:
  - Singleturn version:
    - with interface BiSS C: 21 bit
    - with interface SSI: 21 bit
  - Multiturn version:
    - angle resolution with BiSS C: 21 bit
    - multiturn resolution with BiSS C: 21 bit
    - single turn resolution with SSI: 40 bit
    - multiturn resolution with SSI: 40 bit
- **Output code**: Gray, binary
- **Data interface**: SSI, BiSS C

### ACCESSORIES

**CONNECTORS FOR CABLE**

- C9: 9-pin round connector
- C12: 12-pin round connector
- D9: 9-pin flat connector

**COUPLING**

- SC30

### ORDER FORM

- **AK36**: X X X X X X X
- **CABLE LENGTH**: X X
- **CONNECTOR TYPE**: X X
- **COUPLING**: X X X

**VARIATIONS**

- **OUTPUT SIGNALS INTERFACE (SERIAL)**:
  - Singleturn: B, B10, B11, B12, B13, M10, M11, M12, M13, M14
  - Multiturn: B1, B2, B3, M1, M2, M3, M4, M5, M6

- **OUTPUT CODE**: G, Gray

- **CABLE LENGTH**: X X X

**ORDER EXAMPLES**

1. AK36-ST-S-B9/M0-B-AR02/W-0
2. AK36-MT-B-B20/M12-G-AR01/C12-1

**Note:**
1. Error and parity bits should be determined during order.

**PHOTOELECTRIC ROTARY ENCODER**

**AK36**

**Resolution**:

- Singleturn version:
  - with interface BiSS C: 21 bit
  - with interface SSI: 21 bit
- Multiturn version:
  - angle resolution with BiSS C: 21 bit
  - multiturn resolution with BiSS C: 21 bit
  - single turn resolution with SSI: 40 bit
  - multiturn resolution with SSI: 40 bit

**Output code**: Gray, binary

**Data interface**: SSI, BiSS C

**Accuracy**: ± 30 arc sec

**Supply voltage**: +5V ± 5%

**Light source**: LED

**Maximum operating frequency**:
- with interface BiSS C: 10 MHz
- with interface SSI: 4 MHz

**Cable length (standard)**: 1 m

**Standard cable length**: 25 m

**Cable outlet**

- **Version A**: Cable axial (ver. A)
- **Version AR**: Cable axial-radial (ver. AR)

**Resolution**

- Singleturn version:
  - with interface BiSS C: 21 bit
  - with interface SSI: 21 bit
- Multiturn version:
  - angle resolution with BiSS C: 21 bit
  - multiturn resolution with BiSS C: 21 bit
  - single turn resolution with SSI: 40 bit
  - multiturn resolution with SSI: 40 bit

**Output code**: Gray, binary

**Data interface**: SSI, BiSS C

**Accuracy**: ± 30 arc sec

**Supply voltage**: +5V ± 5%

**Light source**: LED

**Maximum operating frequency**:
- with interface BiSS C: 10 MHz
- with interface SSI: 4 MHz

**Cable length (standard)**: 1 m

**Standard cable length**: 25 m

**Cable outlet**

- **Version A**: Cable axial (ver. A)
- **Version AR**: Cable axial-radial (ver. AR)

**Resolution**:

- Singleturn version:
  - with interface BiSS C: 21 bit
  - with interface SSI: 21 bit
- Multiturn version:
  - angle resolution with BiSS C: 21 bit
  - multiturn resolution with BiSS C: 21 bit
  - single turn resolution with SSI: 40 bit
  - multiturn resolution with SSI: 40 bit

**Output code**: Gray, binary

**Data interface**: SSI, BiSS C

**Accuracy**: ± 30 arc sec

**Supply voltage**: +5V ± 5%

**Light source**: LED

**Maximum operating frequency**:
- with interface BiSS C: 10 MHz
- with interface SSI: 4 MHz

**Cable length (standard)**: 1 m

**Standard cable length**: 25 m

**Cable outlet**

- **Version A**: Cable axial (ver. A)
- **Version AR**: Cable axial-radial (ver. AR)

**Resolution**:

- Singleturn version:
  - with interface BiSS C: 21 bit
  - with interface SSI: 21 bit
- Multiturn version:
  - angle resolution with BiSS C: 21 bit
  - multiturn resolution with BiSS C: 21 bit
  - single turn resolution with SSI: 40 bit
  - multiturn resolution with SSI: 40 bit

**Output code**: Gray, binary

**Data interface**: SSI, BiSS C

**Accuracy**: ± 30 arc sec

**Supply voltage**: +5V ± 5%

**Light source**: LED

**Maximum operating frequency**:
- with interface BiSS C: 10 MHz
- with interface SSI: 4 MHz

**Cable length (standard)**: 1 m

**Standard cable length**: 25 m

**Cable outlet**

- **Version A**: Cable axial (ver. A)
- **Version AR**: Cable axial-radial (ver. AR)

**Resolution**:

- Singleturn version:
  - with interface BiSS C: 21 bit
  - with interface SSI: 21 bit
- Multiturn version:
  - angle resolution with BiSS C: 21 bit
  - multiturn resolution with BiSS C: 21 bit
  - single turn resolution with SSI: 40 bit
  - multiturn resolution with SSI: 40 bit

**Output code**: Gray, binary

**Data interface**: SSI, BiSS C

**Accuracy**: ± 30 arc sec

**Supply voltage**: +5V ± 5%

**Light source**: LED

**Maximum operating frequency**:
- with interface BiSS C: 10 MHz
- with interface SSI: 4 MHz

**Cable length (standard)**: 1 m

**Standard cable length**: 25 m

**Cable outlet**

- **Version A**: Cable axial (ver. A)
- **Version AR**: Cable axial-radial (ver. AR)
**A42M PHOTOELECTRIC ROTARY ENCODER**

Photoelectric modular rotary encoder A42M is of incremental type and provides up to 25,000 output pulses per revolution. The absence of bearings and lubricants makes the encoder suitable for use in vacuum environment or situations when zero starting torque is required.

### MECHANICAL DATA

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line number on disc (z)</td>
<td>1000, 2500 (others on request)</td>
</tr>
<tr>
<td>Number of output pulses per revolution for A42M-F</td>
<td>20000 rpm</td>
</tr>
<tr>
<td>Max. permissible mechanical rotation speed</td>
<td>20000 rpm</td>
</tr>
<tr>
<td>Accuracy (θ, period of lines on disc in arc. sec.)</td>
<td>±0.1°</td>
</tr>
<tr>
<td>Permissible axial shaft run out</td>
<td>0.05 mm</td>
</tr>
<tr>
<td>Hub inside diameter</td>
<td>10, 8, 6 mm</td>
</tr>
<tr>
<td>Rotor moment of inertia</td>
<td>≤ 0.02 kg</td>
</tr>
</tbody>
</table>

### ELECTRICAL DATA

**VERSION**

<table>
<thead>
<tr>
<th>VERSION</th>
<th>A42M-A (11 µTtyp)</th>
<th>A42M-AV (11 µTtyp)</th>
<th>A42M-AD (71 µTtyp)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply</td>
<td>±2 V ± 0.5% ≤ 100 mA</td>
<td>±2 V ± 0.5% ≤ 120 mA</td>
<td>±2 V ± 0.5% ≤ 120 mA</td>
</tr>
<tr>
<td>Incremental</td>
<td>Two sinusoidal I₁ and I₂</td>
<td>Differential sine +A and +B</td>
<td>Differential square-wave U₁(TTL) and U₂(TTL)</td>
</tr>
<tr>
<td>Amplitude at 1 Hz load</td>
<td>I₁ = 7-16 µA</td>
<td>+A = 0.6-1.2 V</td>
<td>-R = 0.2-0.8 V (usable)</td>
</tr>
<tr>
<td>(I₂ = 2-8 µA (usable))</td>
<td></td>
<td>R = 0.2-0.8 V (usable)</td>
<td></td>
</tr>
<tr>
<td>Reference signal</td>
<td>One quasi-triangular I₁ and I₂</td>
<td>One quasi-triangular I₁ and I₂</td>
<td>One differential square-wave U₁(TTL) and U₂(TTL)</td>
</tr>
<tr>
<td>Amplitude at 1 Hz load</td>
<td>I₁ = 2-8 µA</td>
<td>I₁ = 2-8 µA</td>
<td>I₁ = 2-8 µA</td>
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<tr>
<td>(I₂ = 2-8 µA (usable))</td>
<td></td>
<td>(I₂ = 2-8 µA (usable))</td>
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</tr>
</tbody>
</table>

### ACCESSORIES

**CONNECTORS FOR CABLE**

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>CONNECTOR FOR PCB</td>
<td>Adapter Cable dia. 7 mm with PCB connector</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

**DIGITAL READOUT DEVICES**

- CS3000
- CS5500

**EXTERNAL INTERPOLATOR**

- NK

### ORDER FORM

| A42M | X | XXXXX | XXX | XXXC | XXXK | XXXX |

### OUTPUT SIGNAL VERSION:

<table>
<thead>
<tr>
<th>Pulse number per revolution</th>
<th>Optional line number on disc (2)</th>
<th>Hub inside diameter</th>
<th>Adapter cable</th>
<th>Connector type for adapter cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1000</td>
<td>2000</td>
<td>10 mm</td>
<td>W</td>
</tr>
<tr>
<td>B</td>
<td>2002</td>
<td>2003</td>
<td>10 mm</td>
<td>W</td>
</tr>
<tr>
<td>C</td>
<td>3003</td>
<td>2004</td>
<td>10 mm</td>
<td>W</td>
</tr>
<tr>
<td>D</td>
<td>4004</td>
<td>2005</td>
<td>10 mm</td>
<td>W</td>
</tr>
</tbody>
</table>

### ORDER EXAMPLES:

- A42M-AV-20000-10-AC01/W
- A42M-AV-20000-10-AC01/B
- A42M-AV-20000-10-AC01/R

Note:

1. Maximum working rotation speed (with proper encoder counting) is limited by maximum operating frequency and maximum mechanical rotation speed.
2. If cable extension is used, power supply conductor cross-section should not be smaller than 0.5 mm².
Photoelectric modular rotary encoder A75M is a wider diameter incremental encoder than A42M, as it is the main difference between these two open-type encoders.

**MECHANICAL DATA**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Specification Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line number on disc (z)</td>
<td>512, 2048 (others on request)</td>
</tr>
<tr>
<td>Number of output pulses per revolution for A75M-F</td>
<td>2 x k, where k = 1, 2, 3, 4, 5, 8, 10</td>
</tr>
<tr>
<td>Max. permissible mechanical rotation speed</td>
<td>16000 rpm</td>
</tr>
<tr>
<td>Accuracy (T, period of lines on disc in arc. sec.)</td>
<td>±0.1, 1.7 arc. sec.</td>
</tr>
<tr>
<td>Permissible axial shaft run out</td>
<td>±0.05 mm</td>
</tr>
<tr>
<td>Rotor moment of inertia:</td>
<td></td>
</tr>
<tr>
<td>- with shaft Ø 20 mm</td>
<td>26 x 10² kgm²</td>
</tr>
<tr>
<td>- with shaft Ø 30 mm</td>
<td>35 x 10² kgm²</td>
</tr>
</tbody>
</table>

**ELECTRICAL DATA**

<table>
<thead>
<tr>
<th>Version</th>
<th>A75M-AV</th>
<th>A75M-F TTL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply</td>
<td>+5 V ± 5% / &lt;120 mA</td>
<td>+5 V ± 5% / &lt;120 mA</td>
</tr>
<tr>
<td>Light source</td>
<td>LED</td>
<td>LED</td>
</tr>
<tr>
<td>Incremental signals</td>
<td>Differential sine +A and -B</td>
<td>Differential square wave U1 and U2</td>
</tr>
<tr>
<td>Amplitude at 120 V load</td>
<td>A = 0.6–1.2 V</td>
<td>Signal levels at 20 mA load current:</td>
</tr>
<tr>
<td></td>
<td>- B = 0.6–1.2 V</td>
<td>- low (logic “0”) ≤ 0.5 V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- high (logic “1”) ≤ 2.4 V</td>
</tr>
<tr>
<td>Reference signal</td>
<td>One quasi-rectangular +R and its complimentary</td>
<td>One differential square wave U0 per revolution:</td>
</tr>
<tr>
<td></td>
<td>-R = 0.2–0.6 V (available)</td>
<td>Signal levels at 20 mA load current:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- low (logic “0”) ≤ 0.5 V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- high (logic “1”) ≥ 2.4 V</td>
</tr>
<tr>
<td>Maximum operating frequency</td>
<td>≤3 dB</td>
<td>≤ 160 kHz</td>
</tr>
<tr>
<td>Direction of signals</td>
<td>+B lags +A for clockwise rotation (viewed from shaft side)</td>
<td>U2 lags U1 for clockwise rotation (viewed from shaft side)</td>
</tr>
<tr>
<td>Maximum load and fast time</td>
<td>≤ 0.5 µs</td>
<td></td>
</tr>
<tr>
<td>Recommended max. cable length to subsequent electronics</td>
<td>25 m</td>
<td>25 m</td>
</tr>
</tbody>
</table>

**ACCESSORIES**

| Connector for Cable | B12 12-pin round connector |
| Connector for PCB   | Connector for 1Vpp* AMP |
| Connector for PCB    | Connector for TTL |
| Digital Readout Devices | CS3000 |
| External Interpolator | NK |

**MOUNTING DIMENSIONS**

**PCB CONNECTOR**

<table>
<thead>
<tr>
<th>Version</th>
<th>A75M</th>
<th>X</th>
<th>XXX/XXXX</th>
<th>XXXX</th>
<th>XXXX</th>
<th>X</th>
</tr>
</thead>
<tbody>
<tr>
<td>OUTPUT SIGNAL</td>
<td>D1</td>
<td>32.5</td>
<td>Ø76 MIN</td>
<td>Ø6.3h6</td>
<td>A</td>
<td>39 MAX</td>
</tr>
<tr>
<td>PULSE NUMBER PER REVOLUTION</td>
<td>D1</td>
<td>32.5</td>
<td>Ø76 MIN</td>
<td>Ø6.3h6</td>
<td>A</td>
<td>39 MAX</td>
</tr>
<tr>
<td>(OPTIONAL) LINE NUMBER ON DISC (Z)</td>
<td>D1</td>
<td>32.5</td>
<td>Ø76 MIN</td>
<td>Ø6.3h6</td>
<td>A</td>
<td>39 MAX</td>
</tr>
<tr>
<td>HUB INSIDE DIAMETER</td>
<td>D1</td>
<td>32.5</td>
<td>Ø76 MIN</td>
<td>Ø6.3h6</td>
<td>A</td>
<td>39 MAX</td>
</tr>
<tr>
<td>ADAPTER CABLE:</td>
<td>D1</td>
<td>32.5</td>
<td>Ø76 MIN</td>
<td>Ø6.3h6</td>
<td>A</td>
<td>39 MAX</td>
</tr>
</tbody>
</table>

**ORDER EXAMPLES:**

1) A75M-F-4096-24-AC01/W
2) A75M-F-4096/512-24-AC01/W
3) A75M-F-4096/2048-24-AC01/W

**ORDER EXAMPLES:**

1) A75M-F-4096-34-AC01/W
2) A75M-F-4096/32-AC01/W

<table>
<thead>
<tr>
<th>VERSION</th>
<th>A75M</th>
<th>TTL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply</td>
<td>+5 V ± 5% / &lt;120 mA</td>
<td>+5 V ± 5% / &lt;120 mA</td>
</tr>
<tr>
<td>Light source</td>
<td>LED</td>
<td>LED</td>
</tr>
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<td>Incremental signals</td>
<td>Differential sine +A and -B</td>
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</tr>
<tr>
<td></td>
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<td></td>
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<td>One differential square wave U0 per revolution:</td>
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<tr>
<td></td>
<td>-R = 0.2–0.6 V (available)</td>
<td>Signal levels at 20 mA load current:</td>
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<td></td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Maximum operating frequency</td>
<td>≤3 dB</td>
<td>≤ 160 kHz</td>
</tr>
<tr>
<td>Direction of signals</td>
<td>+B lags +A for clockwise rotation (viewed from shaft side)</td>
<td>U2 lags U1 for clockwise rotation (viewed from shaft side)</td>
</tr>
<tr>
<td>Maximum load and fast time</td>
<td>≤ 0.5 µs</td>
<td></td>
</tr>
<tr>
<td>Recommended max. cable length to subsequent electronics</td>
<td>25 m</td>
<td>25 m</td>
</tr>
</tbody>
</table>

**CONNECTORS FOR CABLE:**

B12 12-pin round connector
C12 12-pin round connector
D9 9-pin flat connector
D15 15-pin flat connector
RS10 10-pin round connector
ONC 10-pin round connector

**CONNECTOR FOR PCB:**

Adapter Cable dia. 6 mm with PCB connector

**DIGITAL READOUT DEVICES:**

CS3000
CS5508

**EXTERNAL INTERPOLATOR:**

NK

**DIGITAL INTERPOLATOR:**

CS3000
CS5508
**AK50**

**PHOTOELECTRIC ROTARY ENCODER**

Photoelectric absolute rotary encoder AK50 is manufactured containing up to 8 bit resolution via Gray, binary or other custom code output. It uses photoelectric technology and provides the user with an ability to set arbitrary reference position accessible via switch of up to 256 indexed positions.

**MECHANICAL DATA**

- Maximum shaft speed without counting loss for 8 bit: 3000 rpm
- Maximum shaft load:
  - axial: 80 N
  - radial (at shaft end): 100 N
- Starting torque at 20 °C: 3 Ncm
- Rotor moment of inertia: 0.08 kgm²
- Protection (IEC 529):
  - housing: IP66
  - shaft: IP66
- Maximum weight without cable: 0.3 kg

**ELECTRICAL DATA**

- **Accuracy**: ±120 arc. sec
- **Resolution**: 2⁷ (256)
- **Code**: Gray, Binary
- **Output signals interface**: Parallel
- **Light source**: LED
- **Supply voltage**:
  - standard: +24 V ± 5% (5 bit)
  - optional: +5 V ± 5%
- **Maximum supply current**: 50 mA
- **Output signal levels**: TTL/HTL
- **Maximum cable length**: 25 m

**ACCESSORIES**

**CONNECTORS FOR CABLE**

- B12: 12-pin round connector
- C9: 9-pin round connector
- C12: 12-pin round connector
- D9: 9-pin flat connector
- D15: 15-pin flat connector
- P610: 10-pin round connector
- ONC: 10-pin round connector

**COUPLING**

- SC30

**ORDER FORM**

<table>
<thead>
<tr>
<th>CONFIGURATION TYPE</th>
<th>NUMBER OF POSITIONS¹</th>
<th>5-BIT NUMBER OF BITS¹</th>
<th>OUTPUT CODE</th>
<th>SUPPLY VOLTAGE</th>
<th>CABLE LENGTH</th>
<th>CONNECTOR TYPE</th>
<th>COUPLING</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>200</td>
<td>5</td>
<td>D7 - 12 V</td>
<td>+24 V ± 5%</td>
<td>10, 16, 24</td>
<td>round, 12 pin</td>
<td>0</td>
</tr>
</tbody>
</table>

¹ only for AK50-P

**ORDER EXAMPLES**

- AK50-B-5/6/8-G-24V-AR06/W-1
- AK50-P-16/32-B-05V-AR12/C12-0
- AK50-B-8-G-05V-AR02/W-0

**ORDER EXAMPLES**

- B - binary
- G - gray
- 05V - +5V

**INDEXING POSITION OF TURRET**

- Switches position depending on tool number in tool changer

**ENCODER CODE FULL TRUTH TABLE (24 POSITIONS)**

<table>
<thead>
<tr>
<th>Function</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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</table>

1| 2| 3| 4| 5| 6| 7| 8| 9| 10| 11| 12| 13| 14| 15| 16| 17| 18| 19| 20| 21| 22| 23| 24|
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<thead>
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</thead>
<tbody>
<tr>
<td>Stroke</td>
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<tr>
<td>1 Bit</td>
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<tr>
<td>Parity check</td>
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<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

**PRODUCT CATALOG**

**PHOTOELECTRIC ABSOLUTE ENCODERS**

- It uses photoelectric technology and provides the user with an ability to set arbitrary reference position accessible via switch of up to 256 indexed positions.

**PRODUCT CATALOG**

**PHOTOELECTRIC ABSOLUTE ENCODERS**

- It uses photoelectric technology and provides the user with an ability to set arbitrary reference position accessible via switch of up to 256 indexed positions.
**A58 PHOTOELECTRIC ROTARY ENCODER**

The A58 series is a photoelectric incremental encoder series that is comprised of 6 iterations – A58M, A58B, A58C, A58C2, A58C3 and A58D. These encoders share the same mechanical and electrical characteristics but differ in mounting options. Encoders produce up to 108,000 output pulses per revolution and depending on customer demands can have different versions of output signals: 11µApp, 1Vpp, TTL or HTL.

### A58M

#### MECHANICAL DATA

<table>
<thead>
<tr>
<th>Connector type / cable outlet</th>
<th>Ø58</th>
<th>Ø50h7</th>
<th>Connector outlet</th>
<th>Cable outlet</th>
<th>Cable outlet (rev. A)</th>
<th>Cable outlet (rev. B)</th>
<th>Cable outlet (rev. C)</th>
<th>Cable outlet (rev. D)</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>22 mm</td>
<td>22 mm</td>
<td>22 mm</td>
<td>22 mm</td>
<td>16 mm</td>
<td>16 mm</td>
<td>16 mm</td>
<td>16 mm</td>
</tr>
<tr>
<td>L2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>12 mm</td>
<td>12 mm</td>
<td>12 mm</td>
<td>12 mm</td>
</tr>
<tr>
<td>L3</td>
<td>10-Ø6</td>
<td>10-Ø6</td>
<td>10-Ø6</td>
<td>10-Ø6</td>
<td>10-Ø6</td>
<td>10-Ø6</td>
<td>10-Ø6</td>
<td>10-Ø6</td>
</tr>
</tbody>
</table>

**Line number on disc (z)**

100, 250, 500, 600, 800, 1000, 1024, 1125, 1250, 1500, 2000, 2048, 2050, 3000, 3600, 4000, 5000, 6000, 10000, 10800

**Pulse number per shaft revolution for A58-F**

Z x k, where k=1,2,3,4,5,6,10

**Maximum shaft speed**

12000 rpm

**Maximum shaft load**

- axial
- radial (at shaft end)

40 N

60 N

### ELECTRICAL DATA

#### ACCESSORIES

**CONNECTIONS FOR CABLE**

<table>
<thead>
<tr>
<th>Connector type / cable outlet</th>
<th>Ø58</th>
<th>Ø50h7</th>
<th>Connector outlet</th>
<th>Cable outlet</th>
<th>Cable outlet (rev. A)</th>
<th>Cable outlet (rev. B)</th>
<th>Cable outlet (rev. C)</th>
<th>Cable outlet (rev. D)</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>22 mm</td>
<td>22 mm</td>
<td>22 mm</td>
<td>22 mm</td>
<td>16 mm</td>
<td>16 mm</td>
<td>16 mm</td>
<td>16 mm</td>
</tr>
<tr>
<td>L2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>12 mm</td>
<td>12 mm</td>
<td>12 mm</td>
<td>12 mm</td>
</tr>
<tr>
<td>L3</td>
<td>10-Ø6</td>
<td>10-Ø6</td>
<td>10-Ø6</td>
<td>10-Ø6</td>
<td>10-Ø6</td>
<td>10-Ø6</td>
<td>10-Ø6</td>
<td>10-Ø6</td>
</tr>
</tbody>
</table>

**Digital readout devices**

- CS3000
- CS5000

**Coupling**

- BSC8

**External interpolator**

- NK

**Maximum operating frequency**

- A58-A: 1,1 Vpp: 160 kHz
- A58-B: 1,1 Vpp: 160 kHz
- A58-F: 1,1 Vpp: 160 kHz

**Direction of signals**

<table>
<thead>
<tr>
<th>Signal</th>
<th>Amplitude at 120 Ω load</th>
</tr>
</thead>
<tbody>
<tr>
<td>+A</td>
<td>0.6-1.2 V</td>
</tr>
<tr>
<td>-A</td>
<td>0.6-1.2 V</td>
</tr>
<tr>
<td>+B</td>
<td>0.6-1.2 V</td>
</tr>
<tr>
<td>-B</td>
<td>0.6-1.2 V</td>
</tr>
</tbody>
</table>

**Accuracy (T, period of lines on disc in arc. sec)**

≤0.1 T

**Starting torque at 20°C**

≤0.08 Nm

**Rotor moment of inertia**

≤0.02 kgm²

**Protection (IEC 529)**

- IP64

**Maximum weight without cable**

0.25 kg

**Operating temperature**

-10…+70 °C

**Storage temperature**

-30…+60 °C

**Maximum humidity (non-condensing)**

98 %

**Permissible vibration (55 to 2000 Hz)**

≤100 m/s²

**Permissible shock (11 ms)**

≤1000 m/s²

Note:

1. Maximum working rotation speed (with proper encoder coupling) is limited by maximum operating frequency and maximum mechanical rotation speed.
2. If cable extension is used, power supply conductor cross-section should not be smaller than 0.5 mm².
**AK58**

**PHOTOELECTRIC ROTARY ENCODER**

Photoelectric absolute singleturn and multiturn rotary encoder series AK58 is constituted of 7 different models - AK58M, AK58B, AK58C, AK58KC, AK58KC3, AK58S and AK58S EtherCAT. Encoders use SSI, BISS or EtherCAT output signal interfaces and output up to 24 bit singleturn and 40 bit multiturn resolutions through binary or Gray codes.

**MECHANICAL DATA**

- **Maximum shaft speed**: 12000 rpm
- **Maximum shaft load**:
  - single (at shaft end): 10 N (40 N for AK58KC2, AK58KC3, AK58SD), 20 N (80 N for AK58KC2, AK58KC3, AK58SD)
  - radial (at shaft end): 20 N (80 N for AK58KC2, AK58KC3, AK58SD)
- **Starting torque at 20°C**: ≤ 0.01 Nm
- **Rotor moment of inertia**: <15 gcm²
- **Protection (IEC 529)**: IP65 (IP67 EtherCAT)

- **Maximum weight without cable**: 0.35 kg
- **Operating temperature**:
  - singleturn version: -30...+80 °C
  - multiturn version: -10...+70 °C
- **Storage temperature**:
  - singleturn version: -30...+90 °C
  - multiturn version: -30...+80 °C
- **Maximum humidity (non-condensing)**: 98 %
- **Permissible vibration (55 to 2000 Hz)**: ≤ 100 m/s²
- **Permissible shock (11 ms)**: ≤ 1000 m/s²

**ACCESSORIES**

**CONNECTORS FOR CABLE**

<table>
<thead>
<tr>
<th>Connector</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>B12</td>
<td>12-pin round connector</td>
</tr>
<tr>
<td>C9</td>
<td>9-pin round connector</td>
</tr>
<tr>
<td>C12</td>
<td>12-pin round connector</td>
</tr>
<tr>
<td>D9</td>
<td>9-pin flat connector</td>
</tr>
<tr>
<td>D15</td>
<td>15-pin flat connector</td>
</tr>
<tr>
<td>R10</td>
<td>10-pin round connector</td>
</tr>
<tr>
<td>ONC</td>
<td>10-pin round connector</td>
</tr>
</tbody>
</table>

**CONNECTORS ON HOUSING**

<table>
<thead>
<tr>
<th>Connector</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>C9</td>
<td>9-pin round connector</td>
</tr>
<tr>
<td>C12</td>
<td>12-pin round connector</td>
</tr>
<tr>
<td>R10</td>
<td>10-pin round connector</td>
</tr>
</tbody>
</table>

**COUPLING**

<table>
<thead>
<tr>
<th>Material</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SC36</td>
<td>SILVER CAT</td>
</tr>
</tbody>
</table>

**ELECTRICAL DATA**

- **Resolution**:
  - SSI: 9...20 bit
  - BiSS C: 9...40 bit
- **Periods number of signals 1Vpp**: 4096
- **Accuracy**: ± 5 arc sec
- **Supply voltage**: ±15 ± 5 %
- **Light source**: LED
- **Maximum operating frequency**:
  - with interface SSI: up to 10 MHz
  - with interface BiSS C: up to 4 MHz
- **Cable length (standard)**: 1 m

**ELECTRICAL SIGNALS**

**SSI TIMING DIAGRAM**

- **Interface**: SSI
- **Tc**: 1.2 μs - 26 μs
- **Clock frequency**: 62.5 kHz = 4 MHz

**BISS TIMING DIAGRAM**

- **Interface**: BiSS C
- **Tc**: 1.2 μs - 26 μs
- **Clock frequency**: 62.5 kHz = 4 MHz

Note: Error and/or parity bits should be determined during order.

**Sine wave 1 Vpp signals**

Complementary signals are not shown.
**AK 58 EtherCAT**

The EtherCAT encoders support the CANopen communication profile according to “CanOpen Over EtherCAT” (COE) mode of data transfer with “Device profile for encoders”, Class 1. For more details please refer to “CiA Draft Standard 406” at www.can-cia.org.

- The encoder supports the following operating modes:
  - FreeRun - asynchronous mode
  - Distributed clock synchronization mode. Minimum cycle time 62.5 µs.

**ELECTRICAL DATA**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution per revolution (position number)</td>
<td>20 (1048576)</td>
</tr>
<tr>
<td>Accuracy</td>
<td>± 30 arc sec</td>
</tr>
<tr>
<td>Supply voltage</td>
<td>10...30V DC</td>
</tr>
<tr>
<td>Maximum consumed current (without load)</td>
<td>110 mA</td>
</tr>
</tbody>
</table>

The encoder has resolution up to 20 bit per revolution. Operating principle is photoelectric.

**ELECTRICAL CONNECTION AK58 EtherCAT**

**ETHERCAT MATING CONNECTOR**

**SUPPLY MATING CONNECTOR**

Suitable connection cables must at least meet CAT5 requirements, used in conjunction with an M12 4-pin plug connector D type. The signal assignments for pins M12D-coded socket and M12A-coded plug connector are shown in the table. BUS IN and BUS OUT connectors are not interchangeable. Encoder must be placed in the direction of the EtherCAT® master.

---

**AK58B**

**AK58C**
AP58
PHOTOELECTRIC ROTARY ENCODER

The AP58 series is a set of programmable photoelectric rotary encoders that consists of AP58M, AP58B, AP58C, AP58C2, AP58C3, AP58HE1 depending on required mounting parameters. Through the programming tool that constitutes of a USB cable and Windows compatible software, the user can set a desired pulse number per revolution from 1 to 65,536. Software is supplied free of charge and can be found on the official website of Precizia Metrology. It can be installed on any PC running a Windows operating system (Windows XP or later).

MECHANICAL DATA

Pulse number per shaft resolution from 1 to 65536
Maximum shaft speed: 12000 rpm
- axial
- radial (at shaft end)
Accuracy: ±0.1T, arc. sec
Starting torque at 20°C: ≤ 0.01 Nm
Rotor moment of inertia: < 15 gcm²

Protection (IEC 529): IP64
Maximum weight without cable: 0.25 kg
Operating temperature: -10...+70 °C
Storage temperature: -30...+80 °C
Maximum humidity (non-condensing): 98%
Permissible vibration (65 to 2000 Hz): ≤ 100 m/s²
Permissible shock (11 ms): ≤ 1000 m/s²

ACCESSORIES

CONNECTORS FOR CABLE
B12 - 12-pin round connector
C12 - 12-pin round connector
D9 - 9-pin flat connector
D15 - 15-pin flat connector
RS10 - 10-pin round connector
ONC - 10-pin round connector

CABLE LENGTH:
Ø 10 - 0.5 µs
Ø 17 - 2 MHz

MODIFICATION AP58HE1

1) AP58M-10-05V-AR01/B12-0
2) AP58B-12-30V-AR03/W-1

ORDER FORM

AP58X: XXXX
SUPPLY VOLTAGE:
- 6...15, 10, 14, 15 mm
- 30...+50 V
- 30...+60 V

CABLE LENGTH:
- with connector: AR01 - 1m, AR02 - 2m, AR03 - 3m
- without connector: AR01 - 1m, AR02 - 2m, AR03 - 3m

SOFTWARE

1. List of encoders connected for multi-programming
2. Number of Cycles Per Revolution (CPR) in the drop-down menu
3. Number of lines Per Revolution (LPR) in the drop-down menu
4. Program the encoder according to desired parameters
5. Current operation status indication field

ELECTRICAL DATA

VERSION
AP58-F TTL, HTL
AP58-H HTL

Power supply:
- Max. supply current (without load)
- Max. supply current (at 20 mA load current)

Incremental signals:
- Differential square-wave U1/U1 and U2/U2.
- Signal levels at 20 mA load current:
  - low (logic ‘0’): < 0.5 V at U1=0 V
  - high (logic ‘1’): > 2.4 V at U2=5 V

Reference signal:
- width
- position

Maximum operating frequency: < 2 MHz
Direction of signals: U2 lags U1 for clockwise rotation (viewed from shaft side)
Maximum max. and min. time: ±0.5 µs
Standard cable length: 1m, without connector
Maximum cable length: 25m
Output signals:
- one differential square-wave U0/U0 per revolution
- TTL;

MODIFICATION
Modification: AP58HE1
Order example: 1|  ROTARY ENCODERS
ORDER EXAMPLES:
- AP58HE1 - AP58HE1
- AP58B-12-30V-AR03/W-1

ACCESSORIES

CONNECTORS FOR CABLE
- C12 - 12-pin round connector
- D9 - 9-pin flat connector
- D15 - 15-pin flat connector
- RS10 - 10-pin round connector
- ONC - 10-pin round connector

CABLE LENGTH:
- Ø 10 - 0.5 µs
- Ø 17 - 2 MHz

MODIFICATION
- AP58H
- AP58B
- AP58C
- AP58C2
- AP58C3
- AP58M
- AP58HE1

ORDER EXAMPLES:
- AP58M-10-05V-AR01/B12-0
- AP58B-12-30V-AR03/W-1

Default manufacturer parameter set: pulse number per revolution - 1000; reference signal width - 1/4T
**A58HE**

**PHOTOELECTRIC ROTARY ENCODER**

Photoelectric rotary encoder A58HE can produce up to 108,000 output pulses per revolution and has different signal options: 11 µApp, 1 Vpp, TTL, or HTL.

---

### MECHANICAL DATA

**Line number on disc (z)**
- 100: 250, 500, 600; 800; 1000; 1200; 1125; 1250; 1500; 2000; 2400; 2500; 3000; 3600; 4000; 5000; 6000; 10800

**Pulse number per shaft revolution for A58-F**
- \( z \times k \), where \( k = 1.2, 3, 4, 5, 10 \) (k - interpolation factor)

**Maximum shaft speed**
- 10000 rpm

**Permissible motion of shaft**
- axial: ±0.03 mm
- radial (at shaft end): ±0.05 mm

**Accuracy (IT, period of line on disc in arc sec)**
- on option for \( z \leq 5000 \) ±0.17 arc sec.
- on option for \( z > 5000 \) ±12.0 arc sec.

**Starting torque at 20°C**
- \( \leq 0.025 \text{ Nm} \)

**Rotor moment of inertia**
- \( < 1.5 \times 10^5 \text{ kgm}^2 \)

**Protection (housing) (IEC 529)**
- IP64

**Protection (shaft side) (IEC 529)**
- IP64

**Maximum weight without cable**
- 0.35 kg

**Operating temperature**
- 0...+70°C

**Storage temperature**
- -30...+60°C

**Maximum humidity (non-condensing)**
- 98%

**Permissible vibration** (for 2000 Hz)
- 55 to 5000: ±100 m/s²
- ±50 to 2000: ±100 m/s²

**Permissible shock** (11 min)
- ±300 m/s²

---

### ELECTRICAL DATA

**VERSION**
- **ASHE-A**: 11 µApp
- **ASHE-AV**: 1 Vpp
- **ASHE-F-TTL**: HTL

**Supply voltage (U)**
- ASHE-A: ±5 V, ±10 V
- ASHE-AV: ±5 V, ±10 V, ±15 V
- ASHE-F: ±5 V, ±10 V, ±15 V

**Max. supply current (without load)**
- 80 mA
- 120 mA
- 1.20 mA

**Light source**
- LED
- LED
- LED

**Incremental signals**
- Two trapezoidal (+A and -A) or two complementary (-A and +A) signals

**Reference signal**
- One quasi-triangular, ±100 mV, per revolution

**Maximum operating frequency**
- 3 MHz, ±100 kHz
- 4 MHz, ±100 kHz

**Direction of signals**
- -2) V at \( U \) = 2.4 V
- -2) V at \( U \) = 1.5 V

**Maximum rise and fall time**
- 1.5 µs

**Maximum humidity (non-condensing)**
- 98%

**(without load)**

**Output signals**
- ±100 mV

---

### ORDER FORM

**ASHE**
- \( XX \)
- \( XXX/XXX \)
- \( XX \)
- \( XXX \)
- \( XX \)

**OUTPUT SIGNAL VERSION**
- PULSE NUMBER PER REVOLUTION:
- **ASHE-A**: 100
- **ASHE-AV**: 100
- **ASHE-F-TTL**: 100

**OPTIONAL LINE NUMBER ON DISC (z)**
- 6, 8, 10, 12, 14, 16, 18, 20, 24, 30, 50, 100

**SHAFT HOLE DIAMETER**
- 6, 8, 10, 12, 14, 16, 18, 20, 24, 30

**CABLE LENGTH**
- 6, 10, 18, 30, 50, 100

**ADAPTER TYPE**
- \( W \)
- \( W \)
- \( W \)
- \( W \)

---

### ORDER EXAMPLES

- **ASHE-A**: 11 µApp, ±5 V, ±10 V, ±15 V
- **ASHE-AV**: 1 Vpp, ±5 V, ±10 V, ±15 V
- **ASHE-F-TTL**: HTL, ±5 V, ±10 V, ±15 V
**A58HME**

**PHOTOELECTRIC ROTARY ENCODER**

The main difference between the two is that A58HME has a Ø6-15 mm blind hollow shaft.

---

### ELECTRICAL DATA

| VERSION | A58HME-A* | A58HME-AV | A58HME-F
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage (U)</td>
<td>±10 V, ±5%</td>
<td>±10 V, ±5%</td>
<td>±5 V, ±10 V, ±15 V</td>
</tr>
<tr>
<td>Max. supply current (without load)</td>
<td>80 mA</td>
<td>120 mA</td>
<td>120 mA</td>
</tr>
<tr>
<td>Light source</td>
<td>LED</td>
<td>LED</td>
<td>LED</td>
</tr>
<tr>
<td>Incremental signals</td>
<td>Two sinusoidal I0 and I1, Amplitude at 1 KD load: - I0 = 7.16 µA - I1 = 7.16 µA</td>
<td>Amplitude at 120 V load: - A0 = 1.1 V - A1 = 0.8 V</td>
<td>Differential square wave UI0 and UI1. Signal levels at ±20 mA load current: - low pulse: 0.05 V, high pulse: 5 V - high pulse: 1.2 V, low pulse: 0.5 V</td>
</tr>
<tr>
<td>Reference signal</td>
<td>One quasi-triangular +R and its complement -R per revolution.</td>
<td>One quasi-triangular +R and its complement -R per revolution.</td>
<td>One differential square wave LED0 per revolution.</td>
</tr>
<tr>
<td>Maximum operating frequency</td>
<td>(0.2 dB) 160 kHz</td>
<td>(0.2 dB) 160 kHz</td>
<td>(0.2 dB) 160 kHz</td>
</tr>
<tr>
<td>Direction of signals</td>
<td>I0 (I0) for clockwise rotation</td>
<td>I0 (I0) for clockwise rotation</td>
<td>I0 (I0) for clockwise rotation</td>
</tr>
<tr>
<td>Maximum rise and fall time</td>
<td>&lt; 40 ns</td>
<td>&lt; 40 ns</td>
<td>&lt; 40 ns</td>
</tr>
<tr>
<td>Standard cable length</td>
<td>1 m, without connector</td>
<td>1 m, without connector</td>
<td>1 m, without connector</td>
</tr>
<tr>
<td>Maximum cable length</td>
<td>5 m</td>
<td>25 m</td>
<td>25 m</td>
</tr>
<tr>
<td>Output signals</td>
<td>Output signals</td>
<td>Output signals</td>
<td>Output signals</td>
</tr>
</tbody>
</table>

---

### MOUNTING REQUIREMENTS

**ADAPTER**

**ACCESSORIES**

**CONNECTORS FOR CABLE**

<table>
<thead>
<tr>
<th>C12</th>
<th>9-pin flange socket</th>
</tr>
</thead>
<tbody>
<tr>
<td>C9</td>
<td>9-pin flange socket</td>
</tr>
</tbody>
</table>

**DIGITAL READOUT DEVICES**

<table>
<thead>
<tr>
<th>CS3000</th>
<th>CS5500</th>
</tr>
</thead>
</table>

**EXTERNAL INTERPOLATOR**

| NK |          |

---

**ORDER FORM**

<table>
<thead>
<tr>
<th>OUTPUT SIGNAL VERSION</th>
<th>PULSE NUMBER PER REVOLUTION</th>
<th>OPTIONAL LINE NUMBER ON DISC (D)</th>
<th>SHAFT HOLE DIAMETER</th>
<th>CABLE LENGTH</th>
<th>CONNECTOR TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>A5F</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**ORDER EXAMPLES:**

1. A58HME-AV-1024-6-05V-W
2. A58HME-F-3600-8-30V-W
3. A58HME-F-2000-5-30V-S
Photoelectric incremental hollow shaft encoder A58HE1 has an external flexible coupling and it is the main feature that differs it from other similar encoders. It is able to produce up to 108,000 output pulses per revolution and has different output signal versions: 11 µAmps, 1Vpp, TTL or HTL.

**MECHANICAL DATA**

- **Line number on disc (k)**: 100, 250, 500, 600, 800, 1000, 1024, 1125, 1250, 1500, 2000, 2048, 2500, 3000, 3600, 4000, 5000, 9000, 10000
- **Number of output pulses per revolution for A58HE1-F**: 5000; 9000; 10800
- **Maximum speed**: 10,000 rpm
- **Permissible motion of shaft**: ±0.03 mm
- **Accuracy (±, period of lines on disc in arc sec)**: ±0.17, arc sec
- **Starting torque at 20°C**: ≤ 0.025 Nm
- **Rotator moment of inertia**: < 1.5x10⁻⁹ kgm²
- **Protection housing (IEC 529)**: IP64
- **Protection (shaft side) (IEC 529)**: IP64
- **Maximum weight without cable**: 0.3 kg
- **Operating temperature**: -10...+70°C
- **Storage temperature**: -30...+60°C
- **Maximum humidity (non-condensing)**: 98%
- **Permissible vibration (at 2000 Hz)**: ≤ 100 m/s²
- **Permissible shock (5 ms)**: ≤ 1000 m/s²

**ACCESSORIES**

- **Connectors for cable**:
  - C9, 9-pin round connector
  - C12, 12-pin round connector
  - C12, 12-pin flange socket
  - C9, 9-pin flange socket
- **Digital readout devices**: CS3000, CS5500
- **External interpolator**: N/A

**ELECTRICAL DATA**

**VERSION** | A58HE1-A | A58HE1-AV | A58HE1-F
--- | --- | --- | ---
**Supply voltage (U)** | +5 V ± 5% | +5 V ± 5% | +5 V ± 5% +10 to 30 V
**Max. supply current** | 80 mA | 120 mA | 120 mA
**Light source** | LED | LED | LED
**Incremental signals** | Two strain gauge chips, Amplitude at 1 kΩ load: ±A ±B ±C/B | Differential sine ±A ±B ±C/B Amplitude at 120 Ω load: ±A ±B ±C/B | Differential square-wave U1, U2 and Ux, Uy Signals levels at 20 mA load current:
- low logic: U1(U1x) ≥ 0.5 V, U2(U2x) ≤ 2 V
- high logic: U1(U1x) ≥ 2 V, U2(U2x) ≤ 0.5 V
**Reference signal** | One quasi-triangular, for per revolu- lution, Signal magnitude at 1 kΩ load: ±I ±B ±A, (usable component) | One quasi-triangular, for per revolution, Signals magnitude at 1200 Ω load: ±I ±B ±A, (usable component) | One differential square-wave U1, U2 per revolution, Signal levels at 20 mA load current:
- low logic: U1(U1x) ≥ 0.5 V, U2(U2x) ≤ 2 V
- high logic: U1(U1x) ≥ 2 V, U2(U2x) ≤ 0.5 V
**Maximum operating frequency** | -3 dB 800 Hz | -3 dB 800 Hz | -3 dB 180 kHz
**Direction of signals** | I lag A for clockwise rotation | B lags A for clockwise rotation | U2 lags U1 with clockwise rotation
**Maximum rise and fall time** | - | - | < 0.5 µs
**Standard cable length** | 1 m, without connector | 1 m, without connector | 1 m, without connector
**Maximum cable length** | 5 m | 25 m | 25 m
**Input signals** | 100 kHz | 100 kHz | 180 kHz
**Amplitude at 1 kΩ load:** | A = 0.6-1.2 V | D = 0.6-1.2 V | B = 0.6-1.2 V
**Amplitude at 120 Ω load:** | A = 2-8 µA (usable component) | D = 2-8 µA (usable component) | B = 2-8 µA (usable component)

**Note:**
1. Maximum working rotation speed (with proper encoder counting) is limited by maximum operating frequency and maximum mechanical rotation speed.
2. If cable extension is used, power supply conductor cross-section should not be smaller than 0.5 mm².

**MOUNTING REQUIREMENTS**

**VERSION 1**

**VERSION 2**

**ORDER FORM**

**ASHE1** | X | XX | XXXXXX/XXXXX | XX | XXX | XXXX
**MECHANICAL VERSION** | OUTPUT SIGNAL VERSION | PULSE NUMBER | REVISION | SHAFT HOLE DIAMETER | SUPPLY VOLTAGE | CABLE LENGTH | CONNECTOR TYPE
--- | --- | --- | --- | --- | --- | --- | ---
Ar01-2 | A | 1 | 108000 | 6, 8, 10, 12, 14, 16 mm | 24V/ +5 V | 25 m | AR01 - 12-pin
| P | 1 | 108000 | 6, 8, 10, 12, 14, 16 mm | 24V/ +5 V | 25 m | AR01 - 12-pin
| P | 0 | 108000 | 6, 8, 10, 12, 14, 16 mm | 24V/ +5 V | 25 m | AR01 - 12-pin
| P | 1 | 108000 | 6, 8, 10, 12, 14, 16 mm | 24V/ +5 V | 25 m | AR01 - 12-pin
| P | 0 | 108000 | 6, 8, 10, 12, 14, 16 mm | 24V/ +5 V | 25 m | AR01 - 12-pin

**ORDER EXAMPLES:**
1. A58HE1-A-AV-0(1000)-6(02)-SY-12
2. A58HE1-A-AV-0(1000)-6(02)-SY-12
**A102H**

**PHOTOELECTRIC ROTARY ENCODER**

Photoelectric rotary encoder A102H contains 5,000 lines on disc in a standard version, but other modifications are possible on request. This wide diameter encoder has the biggest shaft available on our rotary encoders product range.

---

## ELECTRICAL DATA

<table>
<thead>
<tr>
<th>VERSION</th>
<th>A102H-A →, 11 μApp</th>
<th>A102H-AV →, 1 Vpp</th>
<th>A102H-F-NUTL →, μHIL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage (U)</td>
<td>±0.9 V ± 0.5%</td>
<td>±0.9 V ± 0.5%</td>
<td>±0.9 V ± 0.5%, ±1.5 to ±3.5 V</td>
</tr>
<tr>
<td>Supply current (without load)</td>
<td>100 mA</td>
<td>120 mA</td>
<td>120 mA</td>
</tr>
<tr>
<td>Max. supply current</td>
<td>125 mA</td>
<td>120 mA</td>
<td>120 mA</td>
</tr>
<tr>
<td>Light source</td>
<td>LED</td>
<td>LED</td>
<td>LED</td>
</tr>
<tr>
<td>Incremental signals</td>
<td>Two sinusoidal</td>
<td>+A and +B/</td>
<td>Differential sine +A and dB/</td>
</tr>
<tr>
<td></td>
<td>Amplitude at 1 kΩ load</td>
<td>Amplitude at 120 Ω load</td>
<td>Amplitude at 120 Ω load</td>
</tr>
<tr>
<td></td>
<td>- A = 0.8-1.2 V</td>
<td>- B = 0.8-1.2 V</td>
<td>- A = 0.8-1.2 V</td>
</tr>
</tbody>
</table>

---

## MOUNTING DIMENSIONS

---

## ORDER FORM

**A102H**

<table>
<thead>
<tr>
<th>OUTPUT SIGNAL VERSION:</th>
<th>PULSE NUMBER PER REVOLUTION:</th>
<th>CABLE LENGTH:</th>
<th>CONNECTOR TYPE:</th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td>1x1</td>
<td>ARB1 - 1 m</td>
<td>W - without connector</td>
</tr>
<tr>
<td>P</td>
<td>2x1</td>
<td>ARB2 - 3 m</td>
<td>F2 * - flat connector</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ARB2 - 3 m</td>
<td>F2 * - flat connector</td>
</tr>
</tbody>
</table>

**ORDER EXAMPLES:**

1. A102H-A100000000-A001-C9
2. A102H-F000000000-C9

---

---
AM
MAGNETIC ROTARY ENCODERS

AM36 and AM58 series encoders use magnetic technology and output up to 12 bit resolution through binary code. These encoders can have different signal modifications: incremental, serial interface, commutation.

AM36

AM58

MECHANICAL DATA

<table>
<thead>
<tr>
<th>Encoder Type</th>
<th>AM58</th>
<th>AM36</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum shaft speed</td>
<td>12000 rpm</td>
<td>10000 rpm</td>
</tr>
<tr>
<td>Maximum shaft load</td>
<td>10 N</td>
<td>5 N</td>
</tr>
<tr>
<td>- axial</td>
<td>10 N</td>
<td>5 N</td>
</tr>
<tr>
<td>- radial (at shaft end)</td>
<td>≤ 0.01 Nm</td>
<td>≤ 0.02 Nm</td>
</tr>
<tr>
<td>Starting torque at 20°C</td>
<td>&lt; 1.5 g.cm²</td>
<td>&lt; 2 g.cm²</td>
</tr>
<tr>
<td>Rotor moment of inertia</td>
<td>&lt; 1.5 g.cm²</td>
<td>&lt; 2 g.cm²</td>
</tr>
<tr>
<td>Protection (IEC 529)</td>
<td>up to IP67</td>
<td>up to IP69</td>
</tr>
<tr>
<td>Maximum weight without cable</td>
<td>0.25 kg</td>
<td>0.07 kg</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>-25...+85°C</td>
<td>-25...+85°C</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-40...+125°C</td>
<td>-40...+125°C</td>
</tr>
<tr>
<td>Maximum humidity (non-condensing)</td>
<td>98%</td>
<td>98%</td>
</tr>
<tr>
<td>Permissible vibration (55 to 2000 Hz)</td>
<td>≤ 100 m/s²</td>
<td>≤ 100 m/s²</td>
</tr>
<tr>
<td>Permissible shock (5 ms)</td>
<td>≤ 400 m/s²</td>
<td>≤ 900 m/s²</td>
</tr>
</tbody>
</table>

ELECTRICAL DATA

<table>
<thead>
<tr>
<th>Feature</th>
<th>AM58</th>
<th>AM36</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage</td>
<td>12...36 VDC, 100%</td>
<td>10...30 VDC, 100%</td>
</tr>
<tr>
<td>Light source</td>
<td>LED</td>
<td>LED</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±0.3 arc. degree</td>
<td>±0.3 arc. degree</td>
</tr>
<tr>
<td>Resolution</td>
<td>2° (4096)</td>
<td>2° (4096)</td>
</tr>
<tr>
<td>Code</td>
<td>binary</td>
<td>binary</td>
</tr>
<tr>
<td>Output signals</td>
<td>- standard</td>
<td>- standard</td>
</tr>
<tr>
<td>- incremental</td>
<td>- through synchronous serial interface</td>
<td>- commutation</td>
</tr>
<tr>
<td>- via SSI interface</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum operating frequency, kHz</td>
<td>300</td>
<td>30</td>
</tr>
<tr>
<td>Standard cable length</td>
<td>1 m</td>
<td>1200 m</td>
</tr>
<tr>
<td>Maximum cable length</td>
<td>2 m</td>
<td>500 m</td>
</tr>
<tr>
<td>Cable outlet</td>
<td>version A</td>
<td>version R</td>
</tr>
<tr>
<td>Connector outlet</td>
<td>version CR</td>
<td>version AR</td>
</tr>
</tbody>
</table>

OUTPUT SIGNALS

<table>
<thead>
<tr>
<th>Type</th>
<th>TTL/HTL</th>
<th>SSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage</td>
<td>(40...300) VDC</td>
<td>±5V</td>
</tr>
<tr>
<td>Clock frequency</td>
<td>20 kHz - 1.5 MHz</td>
<td>20 kHz</td>
</tr>
<tr>
<td>Light source</td>
<td>LED</td>
<td>LED</td>
</tr>
<tr>
<td>Light output</td>
<td>≤ 200 mW</td>
<td>≤ 50 mW</td>
</tr>
<tr>
<td>Permissible shock (5 ms)</td>
<td>≤ 20 N</td>
<td>≤ 5 N</td>
</tr>
<tr>
<td>Permissible vibration (10 to 2000 Hz)</td>
<td>≤ 100 m/s²</td>
<td>≤ 5 m/s²</td>
</tr>
</tbody>
</table>

ACCESSORIES

<table>
<thead>
<tr>
<th>Connector Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>C9</td>
<td>9-pin round connector</td>
</tr>
<tr>
<td>C12</td>
<td>12-pin round connector</td>
</tr>
<tr>
<td>D9</td>
<td>9-pin flat connector</td>
</tr>
</tbody>
</table>

COUPLING

<table>
<thead>
<tr>
<th>Coupling</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>without coupling</td>
</tr>
<tr>
<td>1</td>
<td>with couplings</td>
</tr>
</tbody>
</table>

ORDER FORM

<table>
<thead>
<tr>
<th>Encoder Type</th>
<th>AM58</th>
<th>AM36</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connector type / cable outlet</td>
<td>9-pin round connector</td>
<td>9-pin flat connector</td>
</tr>
<tr>
<td>D9</td>
<td>flat, 9 pin</td>
<td></td>
</tr>
<tr>
<td>C9</td>
<td>round, 9 pin</td>
<td></td>
</tr>
<tr>
<td>C12</td>
<td>round, 12 pin</td>
<td></td>
</tr>
<tr>
<td>D9</td>
<td>flat, 9 pin</td>
<td></td>
</tr>
<tr>
<td>C9</td>
<td>round, 9 pin</td>
<td></td>
</tr>
<tr>
<td>C12</td>
<td>round, 12 pin</td>
<td></td>
</tr>
</tbody>
</table>

ORDER EXAMPLES:

- AM58-H3-P6-6-05V-R01/W-0
- AM36-H4-P6-6-05V-R01/W-0
- AM36-H4-P6-6-05V-R01/W-0
## Angle Encoders

<table>
<thead>
<tr>
<th>MODEL</th>
<th>CROSS SECTION</th>
<th>NUMBER OF LINES*</th>
<th>ACCURACY (ARC. SEC)</th>
<th>SHAFT TYPE</th>
<th>OUTPUT SIGNALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A90H</td>
<td></td>
<td>18.000 ± 5</td>
<td>Hollow shaft w/ integrated stator coupling</td>
<td>11 uApp 1 Vpp TTL</td>
<td></td>
</tr>
<tr>
<td>A110</td>
<td></td>
<td>18.000 ± 5</td>
<td>Solid shaft</td>
<td>11 uApp 1 Vpp TTL</td>
<td></td>
</tr>
<tr>
<td>A170</td>
<td></td>
<td>18.000 ± 5</td>
<td>Solid shaft</td>
<td>11 uApp 1 Vpp TTL</td>
<td></td>
</tr>
</tbody>
</table>

*possible interpolation factor up to x100.
**A90H PHOTOELECTRIC ANGLE ENCODER**

Photoelectric angle encoder A90H is a high and incremental encoder that produces up to 1,800,000 output pulses per revolution. It has hollow shaft, integrated stator coupling and the accuracy of up to ±0.2 µs, ±0.1 A., ±0.3 A. and ±0.5 A.

**MECHANICAL DATA**

- Line number on disc (2): 18000
- Number of output pulses per revolution for A90H: 2 x k, where k = 1, 2, 3, 4, 5, 6, 10, 20, 25, 50, 100
- Reference signal: - standard (B) - distance-coded (K)
- Rotor moment of inertia: < 0.8 x 10⁻³ kgm²
- Protection (IEC 529): IP64
- Maximum weight without cable: 1.2 kg
- Operating temperature: 0...+70 °C
- Storage temperature: -30...+85 °C
- Maximum humidity (non-condensing): 98 %
- Permissible vibration (65 to 2000 Hz): 100 m/s²
- Permissible shock (5 ms): 58 g

**ACCESSORIES**

- CONNECTORS FOR CABLE: B12 - 12-pin round connector, C9 - 9-pin round connector, C12 - 12-pin round connector, D9 - 9-pin flat connector, D15 - 15-pin flat connector, RB10 - 10-pin round connector, ONC - 10-pin round connector
- DIGITAL READOUT DEVICES: CS3000, CS5500
- EXTERNAL INTERPOLATOR: NA

**ELECTRICAL DATA**

<table>
<thead>
<tr>
<th>VERSION</th>
<th>A90H-A</th>
<th>A90H-AV</th>
<th>A90H-F/NSSL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage (U)</td>
<td>±5 V ± 5%</td>
<td>±5 V ± 5%</td>
<td>±5 V ± 5%</td>
</tr>
<tr>
<td>Max. supply current (without load)</td>
<td>100 mA</td>
<td>120 mA</td>
<td>150 mA</td>
</tr>
<tr>
<td>Light source</td>
<td>LED</td>
<td>LED</td>
<td>LED</td>
</tr>
<tr>
<td>Incremental signals</td>
<td>Two sinusoidal (A) and (B), Amplitude at 10 V load: 0.1 V</td>
<td>Differential sine A and B; Amplitude at 10 V load: 0.1 V</td>
<td>Differential square-wave U1 and U2; Signal levels: at 20 mA load current: high (logic “1”): 2.4 V</td>
</tr>
<tr>
<td>Reference signal</td>
<td>One quasi-triangular ripples per revolution, Signal magnitude at 10 V load: 0.2 V</td>
<td>One quasi-triangular ripples and/or complementary ripples per revolution. Signal magnitude at 10 V load: 0.2 V</td>
<td>One differential square-wave U1, U2 per revolution. Signal levels at 20 mA load current: low (logic “0”): &lt; 0.5 V</td>
</tr>
<tr>
<td>Fault detection signal (Us)</td>
<td>- no error occur</td>
<td>- error occur</td>
<td>- one-square waves pulse</td>
</tr>
<tr>
<td>- one-square waves pulse</td>
<td>low</td>
<td>high</td>
<td></td>
</tr>
<tr>
<td>Maximum operating frequency</td>
<td>13 MHz 160 kHz</td>
<td>13 MHz 160 kHz</td>
<td>160-2500 kHz (depends on interpolation factor)</td>
</tr>
<tr>
<td>Direction of signals</td>
<td>+A leads 1, to clockwise rotation (viewed from encoder mounting side)</td>
<td>+B leads 1, for clockwise rotation (viewed from encoder mounting side)</td>
<td>U2 leads U1, for clockwise rotation (viewed from encoder mounting side)</td>
</tr>
<tr>
<td>Maximum rise and fall time</td>
<td>&lt; 0.2 µs</td>
<td>&lt; 0.2 µs</td>
<td>&lt; 0.2 µs</td>
</tr>
<tr>
<td>Standard cable length</td>
<td>1 m, without connector</td>
<td>1 m, without connector</td>
<td>1 m, without connector</td>
</tr>
<tr>
<td>Maximum cable length</td>
<td>25 m</td>
<td>25 m</td>
<td>25 m</td>
</tr>
<tr>
<td>Output signals</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**ORDER FORM**

**PRODUCT CATALOG**

**ACCESSORIES**

- CONNECTORS FOR CABLE: B12 - 12-pin round connector, C9 - 9-pin round connector, C12 - 12-pin round connector, D9 - 9-pin flat connector, D15 - 15-pin flat connector, RB10 - 10-pin round connector, ONC - 10-pin round connector
- DIGITAL READOUT DEVICES: CS3000, CS5500
- EXTERNAL INTERPOLATOR: NA
Photoelectric angle encoder A110 is a similar high end encoder to A09H, but with a solid shaft. It is able to produce up to 1,800,000 output pulses per revolution and can have a modification with a distance-coded reference mark.

**ELECTRICAL DATA**

<table>
<thead>
<tr>
<th>VERSION</th>
<th>A110-A*11 µApp</th>
<th>A110-AV*1 Vpp</th>
<th>A110-F*U TTL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage (U)</td>
<td>±5 V ± 5%</td>
<td>±5 V ± 5%</td>
<td>±5 V ± 5%</td>
</tr>
<tr>
<td>Max. supply current (without load)</td>
<td>80 mA</td>
<td>120 mA</td>
<td>120 mA</td>
</tr>
<tr>
<td>Light source</td>
<td>LED</td>
<td>LED</td>
<td>LED</td>
</tr>
<tr>
<td>Incremental signals</td>
<td>Two unipolar (A and B)</td>
<td>Differential sine (A + B) and (B - A)</td>
<td>Differential square wave (U1 and U2)</td>
</tr>
<tr>
<td>Reference signal</td>
<td>One quasi-triangular +R and its complementary -R per revolution</td>
<td>One quasi-triangular +R and its complementary -R per revolution</td>
<td>One differential square wave U1/U2 per revolution</td>
</tr>
<tr>
<td>Fault detection signal</td>
<td>no error occur</td>
<td>- error occur</td>
<td>high (logic &quot;1&quot;) &gt; 2.4 V</td>
</tr>
<tr>
<td>Maximum operating frequency</td>
<td>1 MHz ≤ 180 kHz</td>
<td>1 MHz ≤ 180 kHz</td>
<td>1 MHz ≤ 180 kHz</td>
</tr>
<tr>
<td>Direction of signals</td>
<td>A and B</td>
<td>A and B</td>
<td>A and B</td>
</tr>
<tr>
<td>Maximum rise and fall time</td>
<td>&lt; 0.5 µs</td>
<td>&lt; 0.5 µs</td>
<td>&lt; 0.5 µs</td>
</tr>
<tr>
<td>Standard cable length</td>
<td>1 m, without connector</td>
<td>1 m, without connector</td>
<td>1 m, without connector</td>
</tr>
<tr>
<td>Maximum cable length</td>
<td>25 m</td>
<td>25 m</td>
<td>25 m</td>
</tr>
</tbody>
</table>

**MECHANICAL DATA**

- Line number on disc (p) | 18000 |
- Number of output pulses per revolution for A110-F | 2 x k, where k = 1, 2, 3, 4, 5, 8, 10, 20, 25, 50, 100 |
- Reference signal: - standard (S) | one per shaft revolution |
- - distance-coded (K) | 36 per shaft revolution |
- Maximum shaft speed | 5000 rpm |
- Accuracy | ±5.0 arc. sec |
- Starting torque at 20°C | 0.07 Nm |
- Rotor moment of inertia | < 2 x 10^{-3} kgm² |
- Protection (IEC 529) | IP64 |
- Maximum weight without cable | 0.7 kg |
- Operating temperature | 0...+50°C |
- Storage temperature | -30...+80°C |
- Maximum humidity (non-condensing) | 98% |
- Permissible vibration | ± 150 m/s² |
- Permissible shock (8 ms) | ± 300 m/s² |

**ACCESSORIES**

- CONNECTORS FOR CABLE | B12 - 12-pin round connector | C9 - 9-pin round connector | C12 - 12-pin round connector | D9 - 9-pin flat connector | D15 - 15-pin connector | B10 - 10-pin round connector | ONC - 10-pin round connector |
- DIGITAL READOUT DEVICES | CS3000 | CS5500 |
- COUPLING | SC70 |
- EXTERNAL INTERPOLATOR | NK |

**ORDER FORM**

**A110** | X | ... | X | X | X | X | X | X

**OUTPUT SIGNAL VERSION**: | PULSE NUMBER PER REVOLUTION: | REFERENCE SIGNAL: | CABLE OR CONNECTOR: | CABLE LENGTH: | CONNECTOR TYPE: | COUPLING: |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A*1</td>
<td>180000</td>
<td>A09H*300000</td>
<td>B**</td>
<td>without connector</td>
<td>B12 - 12-pin connector</td>
<td>B1 - (connector outlet)</td>
</tr>
</tbody>
</table>

**ORDER EXAMPLE**: 1) A110-F - 18000 K-S AR02/C12-0;
A170 PHOTOELECTRIC ANGLE ENCODER

Photoelectric angle encoder A170 is a wide diameter solid shaft high and encoder that produces up to 3,600,000 output pulses per revolution and can reach accuracy of up to ±0.5 arc sec.

ELECTRICAL DATA

<table>
<thead>
<tr>
<th>VERSION</th>
<th>A170-A</th>
<th>A170-AV</th>
<th>A170-F/TTL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage (U)</td>
<td>±5 V ± 5% 100 mA max.</td>
<td>±5 V ± 5% 120 mA max.</td>
<td>±5 V ± 5% 100 mA max.</td>
</tr>
<tr>
<td>Light source</td>
<td>LED</td>
<td>LED</td>
<td>LED</td>
</tr>
<tr>
<td>Incremental signals</td>
<td>Two straingth - A and B: Amplitude at 1000 [Ω]: - A: 0.7 ± 0.5 µA - B: 0.7 ± 0.5 µA</td>
<td>Differential sine ±A and ±B: Amplitude at 100 [Ω]: - A: 0.6 ± 1.2 V - B: 0.6 ± 1.2 V</td>
<td>Differential square-wave UH and U’L: Signal levels at 20 mA load current: - low logic (UH) &gt; 2.4 V - high logic (U’L) &gt; 2.4 V</td>
</tr>
<tr>
<td>Reference signal</td>
<td>One quasi-trangular peak per revolution. Signal magnitude at 1000 [Ω]: z &lt; 1 m: 2 ± 0.5 [µA] (allowable component)</td>
<td>One quasi-trangular ±R and ±S is complemented by 0.6 [V] per revolution. Signal magnitude at 100 [Ω]: z &lt; 1 m: 2 ± 0.4 [V] (allowable component)</td>
<td>One differential square-wave US00 per revolution. Signal levels at 20 mA load current: - low logic (US00) &gt; 2.4 V - high logic (US00) &gt; 2.4 V</td>
</tr>
<tr>
<td>Maximum operating frequency</td>
<td>≥ 1 kHz ≤ 180 kHz</td>
<td>≤ 1 kHz ≤ 180 kHz</td>
<td>(180÷250 kHz) (depends on interpolation factor)</td>
</tr>
<tr>
<td>Direction of signals</td>
<td>+B leads +A for clockwise rotation (viewed from encoder mounting side)</td>
<td>+B leads +A for clockwise rotation (viewed from encoder mounting side)</td>
<td>L2 pulls L1 with clockwise rotation (viewed from encoder mounting side)</td>
</tr>
<tr>
<td>Maximum max. and fall time</td>
<td>≤ 5 µs</td>
<td>≤ 5 µs</td>
<td>≤ 0.5 µs</td>
</tr>
<tr>
<td>Standard cable length</td>
<td>1 m, without connector</td>
<td>1 m, without connector</td>
<td>1 m, without connector</td>
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<tr>
<td>Maximum cable length</td>
<td>5 m</td>
<td>25 m</td>
<td>25 m</td>
</tr>
<tr>
<td>Output signals</td>
<td></td>
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</tbody>
</table>

Note:
1. Maximum working rotation speed (with proper encoder counting) is limited by maximum operating frequency and maximum mechanical rotation speed.
2. If cable extension is used, power supply conductor cross-section should not be smaller than 0.5 mm².

ACCESSORIES

<table>
<thead>
<tr>
<th>CONNECTORS FOR CABLE</th>
<th>D12 - 12-pin round connector</th>
<th>D9 - 9-pin round connector</th>
<th>D12 - 12-pin round connector</th>
<th>D9 - 9-pin flat connector</th>
<th>D10 - 10-pin flat connector</th>
<th>RS0/1 - 15-pin flat connector</th>
<th>CN0 - 15-pin round connector</th>
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<tr>
<td>CONNECTOR</td>
<td>RS0/1 - 15-pin flat connector</td>
<td>C12 - 12-pin round connector</td>
<td>D9 - 9-pin round connector</td>
<td>D9 - 9-pin flat connector</td>
<td>D12 - 12-pin round connector</td>
<td>RS0/1 - 15-pin flat connector</td>
<td>CN0 - 15-pin round connector</td>
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<td>OUTPUT SIGNALS:</td>
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<td>TTL</td>
<td>TTL</td>
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<td>REFERENCE SIGNALS:</td>
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<td>TTL</td>
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<tr>
<td>CABLE LENGTH:</td>
<td>5 m</td>
<td>25 m</td>
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<td>COUPLING:</td>
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ORDER FORM

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<tr>
<th>A170</th>
<th>X</th>
<th>XXXXXX/XXXXX</th>
<th>X</th>
<th>XXX</th>
<th>X</th>
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<tr>
<td>OUTPUT SIGNAL VERSION:</td>
<td>A170-A</td>
<td>A170-AV</td>
<td>A170-F/TTL</td>
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<tr>
<td>PULSE NUMBER PER REVOLUTION:</td>
<td>5, 10, 20, 25, 50, 100</td>
<td>5, 10, 20, 25, 50, 100</td>
<td>5, 10, 20, 25, 50, 100</td>
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<tr>
<td>NUMBER OF OUTPUT PULSES</td>
<td>18000, 36000</td>
<td>18000, 36000</td>
<td>18000, 36000</td>
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<td>REFERENCE SIGNAL:</td>
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<td>A170-A</td>
<td>A170-AV</td>
<td>A170-F/TTL</td>
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<td>CONNECTOR TYPE:</td>
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<td>COUPLING:</td>
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</tbody>
</table>

ORDER EXAMPLES:
A170-F/SC98-1 - 18000, 36000 pulses
A170-A/SC98-1 - 18000, 36000 pulses
**A170H**

**PHOTOELECTRIC ANGLE ENCODER**

Photoelectric angle encoder A170H is the high end encoder of the product range. It has a hollow shaft and an integrated stator coupling and is capable of producing up to 3,600,000 output pulses per revolution with the accuracy that can reach up to ±2.5 arc. sec.

### MECHANICAL DATA

- **Line number on disc (Z):** 18000, 36000
- **Number of output pulses per revolution for A170-H:**
  - k = 1, 2, 3, 4, 5, 10, 25, 50, 100
- **Reference signal:**
  - standard (K)
  - distance-coded (K) for z = 18000, z = 36000
- **Permissible shaft load:** 100 Nm
- **Permissible mech. speed:** 1000 rpm
- **Max. operating speed (depends on number of output pulses):**
  - axial: 0.02 mm
  - radial: 0.02 mm
- **Accuracy:** ±2.5 arc. sec.

### ELECTRICAL DATA

**VERSION**

| VERSION | A170H-A | A170H-AV | A170H-F
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage (U)</td>
<td>+5 V ± 5%</td>
<td>+5 V ± 5%</td>
<td>+5 V ± 5%</td>
</tr>
<tr>
<td>Max. supply current (with load)</td>
<td>100 mA</td>
<td>120 mA</td>
<td>150 mA</td>
</tr>
<tr>
<td>Light source</td>
<td>LED</td>
<td>LED</td>
<td>LED</td>
</tr>
<tr>
<td>Incremental signals</td>
<td>Two sinusoidal, I1 and I2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LED</td>
<td>Differential sin ±A-A and ±B-B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amplitude at 1 kΩ load</td>
<td>A: ± 150 mV</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>B: ± 150 mV</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Differential square-wave U1+ and U1-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amplification at 120 Ω load</td>
<td>A: 0.6 V</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>B: 0.6 V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reference signal</td>
<td>One quasi-triangular, ±E per revolution</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Signal magnitude at 120 Ω load</td>
<td>E: ± 0.4 V</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(usable component)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum operating frequency</td>
<td>(30 dB cutoff: 140 kHz)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(60 dB cutoff: 180 kHz)</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>(60 dB cutoff: 180 kHz)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direction of signals</td>
<td>Differential square-wave U0/U0 per revolution</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(viewed from encoder mounting side)</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>(viewed from encoder mounting side)</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>(viewed from encoder mounting side)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum rise and fall time</td>
<td>&lt; 0.5 µs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard cable length</td>
<td>1 m, without connector</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 m, without connector</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 m, without connector</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output cable length</td>
<td>5 m</td>
<td>20 m</td>
<td>25 m</td>
</tr>
</tbody>
</table>

### MOUNTING REQUIREMENTS

**ORDER FORM**

**A170H**

- **VERSION:**
  - 1: A170H-3600000/36000-K-H-C-AR01/C12
  - 2: A170H-3600000-K-H-C-AR01/C12

**INPUT SIGNAL VERSION**

<table>
<thead>
<tr>
<th>INPUT SIGNAL VERSION</th>
<th>18000</th>
<th>36000</th>
</tr>
</thead>
<tbody>
<tr>
<td>A170H</td>
<td>360000000</td>
<td></td>
</tr>
<tr>
<td>A170H-AV</td>
<td>360000000</td>
<td></td>
</tr>
</tbody>
</table>

**ACCESSORIES**

- **CONNECTORS FOR CABLE**:
  - B18: 12-pin round connector
  - C9: 9-pin round connector
  - C12: 10-pin round connector
  - D9: 9-pin flat connector
  - D15: 15-pin flat connector
  - RB10: 10-pin round connector
  - DMC-10-pin round connector
- **DIGITAL READOUT DEVICES**:
  - CS3000
  - CS5000
- **EXTERNAL INTERPOLATOR**:
  - 9-pin flat connector

**MAXIMUM VOLTAGE LEVELS AT 20 mA LOAD CURRENT**

- High (logic “1”): > 2.4 V
- Low (logic “0”): < 0.5 V

**Differential Square Wave** U1 = U2 & U2 = U1

**RESOLUTION**

<table>
<thead>
<tr>
<th>Resolution</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output pulses</td>
<td>10, 20, 25, 50, 100, 72 per shaft revolution</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**MAXIMUM ALLOWED ZIP LOAD**

- 0.5Nm

**STARTING TORQUE AT 20°C**

- 0.9Nm

**OPERATING TEMPERATURE**

- 0°C to 70°C

**MAXIMUM HUMIDITY (NON-CONDENSING)**

- 98 %

**PERMISSIBLE VIBRATION**

- 100 mV

**PERMISSIBLE SHOCK (8 m/s²)**

- 300 mV

**Digital Readout Devices**

- CS3000
- CS5000

**ORDER EXAMPLES**

1. A170H-3600000-K-H-C-AR01/C12
2. A170H-3600000-K-H-C-AR01/C12
PHOTOELECTRIC ANGLE ENCODER

A200H

Photoelectric angle encoder A200H is the most sophisticated encoder in our product range. It is capable of producing up to 3,600,000 output pulses per revolution and has accuracy of up to ±2.0 arc. sec. Also, it has a 80 mm shaft hole diameter, which sets it apart from other encoders.

MECHANICAL DATA

- Line number on disc (Z): 36000
- Number of output pulses per revolution for A200-F: \( Z \times k \), where \( k = 1, 2, 3, 4, 5, 8, 10, 20, 25, 50, 100 \)
- Reference signal:
  - standard (S)
  - distance-coded (K)
- Permissible shaft load:
  - axial: 0.02 mm
  - radial: 0.02 mm
- Accuracy: ±2.0 arc. sec

Starting torque at 20°C: \( \leq 0.9 \) Nm
Rotor moment of inertia: < 0.9\( \times 10^{-4} \) kgm
Protection (IEC 529): IP64
Maximum weight without cable: 4.5 kg
Operating temperature: 0°C...+70°C
Storage temperature: -30°C...+85°C
Maximum humidity (non condensing): 98 %
Permissible vibration: \( \leq 100 \) m/s²
Permissible shock (8 ms): \( \leq 300 \) m/s²

ACCESSORIES

- CONNECTORS FOR CABLE:
  - B12: 12-pin round connector
  - C9: 9-pin round connector
  - C12: 12-pin round connector
  - D9: 9-pin flat connector
  - D15: 15-pin flat connector
  - RB10: 10-pin round connector
  - ONC: 10-pin round connector

- DIGITAL READOUT DEVICES:
  - CS3000
  - CS5500

- EXTERNAL INTERPOLATOR:
  - NK

ELECTRICAL DATA

<table>
<thead>
<tr>
<th>VERSION</th>
<th>A200H-A</th>
<th>A200H-AV</th>
<th>A200H-F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage (U), ( \pm 5 ) %</td>
<td>( +5 ) V</td>
<td>( +5 ) V</td>
<td>( +5 ) V</td>
</tr>
<tr>
<td>Max. supply current (without load)</td>
<td>100 mA</td>
<td>120 mA</td>
<td>150 mA</td>
</tr>
<tr>
<td>Light source</td>
<td>LED</td>
<td>LED</td>
<td>LED</td>
</tr>
<tr>
<td>Incremental signals</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Two sinusoidal I, and I, Amplitude at 1 kHz load</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \pm 1 ) %...( \pm 10 ) %</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Differential sine +/-A and +/-B Amplitude at 120 kHz load</td>
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</tr>
<tr>
<td>A: 0.5 V...1.2 V</td>
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<tr>
<td>B: 0.2 V...0.8 V</td>
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</tr>
<tr>
<td>Reference signal</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>One quasi-triangular +/-R and its complementary -R per revolution.</td>
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<tr>
<td>Signal magnitude at 120 kHz load</td>
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<tr>
<td>-R: 0.2 V...0.8 V (usable component)</td>
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<tr>
<td>One differential square-wave U0,...,U2 per revolution.</td>
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<tr>
<td>Signal levels at 20 mA load current:</td>
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<tr>
<td>- low (logic “0”): &lt; 0.5 V</td>
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<tr>
<td>- high (logic “1”): &gt; 2.4 V</td>
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<tr>
<td>Maximum operating frequency</td>
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<tr>
<td>( \leq 10 ) kHz...160 kHz</td>
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<tr>
<td>( \leq 10 ) kHz...180 kHz</td>
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<tr>
<td>160-250 kHz (depends on interpolation factor)</td>
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<tr>
<td>Direction of signals</td>
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<tr>
<td>One pulse per revolution (viewed from encoder mounting side)</td>
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<tr>
<td>One quasi-triangular +/-R and its complementary -R per revolution.</td>
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<tr>
<td>Signal levels at 20 mA load current:</td>
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<tr>
<td>- low (logic “0”): &lt; 0.5 V</td>
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<tr>
<td>- high (logic “1”): &gt; 2.4 V</td>
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<tr>
<td>Standard cable length</td>
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<tr>
<td>1 m, without connector</td>
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<td>1 m, without connector</td>
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<td>Maximum cable length</td>
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<td>5 m</td>
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<tr>
<td>25 m</td>
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</table>

Notes:
1. Maximum working rotation speed (with proper encoder counting) is limited by maximum operating frequency and maximum mechanical rotation speed.
2. If cable extension is used, power supply conductor cross-section should not be smaller than 0.5 mm².

MOUNTING REQUIREMENTS

ORDER FORM

<table>
<thead>
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<th>X</th>
<th>36000</th>
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<tr>
<td>A</td>
<td>F</td>
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<td>36000</td>
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<tr>
<td>36000*</td>
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<td></td>
</tr>
<tr>
<td>S</td>
<td>- one per revolution</td>
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</tr>
<tr>
<td>R</td>
<td>- distance-coded</td>
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<tr>
<td>A0E0 - 1m</td>
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<td>A0E0 - 2m</td>
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<td>A0E0 - 3m</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>W</td>
<td>- without connector</td>
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<td></td>
</tr>
<tr>
<td>B10 - round, 10 pins</td>
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<td></td>
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</tr>
<tr>
<td>D9</td>
<td>- flat, 9 pins</td>
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</tr>
<tr>
<td>D15 - flat, 10 pins</td>
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<td></td>
</tr>
<tr>
<td>ONC - round, 10 pins</td>
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<td>ORDER EXAMPLES:</td>
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<tr>
<td>1</td>
<td>A200H-AV-36000-S-A0E0/C12</td>
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<td>2</td>
<td>A200H-AV-36000-F-A0E0/C12</td>
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56

57
<table>
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<tr>
<th>MODEL</th>
<th>CROSS SECTION</th>
<th>MEASURING LENGTH (MM)</th>
<th>ACCURACY (µM/M)</th>
<th>OUTPUT SIGNALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>L18</td>
<td></td>
<td>70-2040</td>
<td>± 10; ± 5; ± 3</td>
<td>11 µApp</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 Vpp</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>TTL, HTL</td>
</tr>
<tr>
<td>L18B</td>
<td></td>
<td>70-3240</td>
<td>± 10; ± 5</td>
<td>11 µApp</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 Vpp</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>TTL</td>
</tr>
<tr>
<td>L18T</td>
<td></td>
<td>70-1240</td>
<td>± 10; ± 5</td>
<td>11 µApp</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 Vpp</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>TTL</td>
</tr>
<tr>
<td>L23</td>
<td></td>
<td>250-20,000</td>
<td>± 10; ± 5; ± 3</td>
<td>11 µApp</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 Vpp</td>
</tr>
<tr>
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<td></td>
<td>TTL</td>
</tr>
<tr>
<td>LK24</td>
<td></td>
<td>70-3240</td>
<td>± 5; ± 3</td>
<td>11 µApp</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>1 Vpp</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td>BiSS, BiSS C</td>
</tr>
<tr>
<td>L35</td>
<td></td>
<td>170-3240</td>
<td>± 5; ± 3</td>
<td>11 µApp</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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<td>1 Vpp</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>TTL, HTL</td>
</tr>
<tr>
<td>L37</td>
<td></td>
<td>140-3240</td>
<td>± 10; ± 5; ± 3</td>
<td>11 µApp</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 Vpp</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>TTL, HTL</td>
</tr>
<tr>
<td>L50</td>
<td></td>
<td>3240-30,040</td>
<td>± 10</td>
<td>1 Vpp</td>
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<td></td>
<td></td>
<td></td>
<td>TTL</td>
</tr>
<tr>
<td>MT</td>
<td></td>
<td>Up to 50,000</td>
<td>± 25</td>
<td>1 Vpp</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>TTL</td>
</tr>
<tr>
<td>MK</td>
<td></td>
<td>Up to 50,000</td>
<td>± 35</td>
<td>1 Vpp</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>BiSS, BiSS C</td>
</tr>
</tbody>
</table>
L18
PHOTOELECTRIC LINEAR ENCODER

Photoelectric linear encoder L18 is an incremental linear displacement measuring device that can have up to 2,040 mm measuring length, grating period of ±20 µm or ±40 µm and accuracy that can reach up to 3 µm.

ELECTRICAL DATA

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply</td>
<td>+5 V ± 5% / &lt; 10 mA</td>
<td>+5 V ± 5% / &lt; 120 mA</td>
<td>+5 V ± 5% / &lt; 120 mA</td>
</tr>
<tr>
<td>Light source</td>
<td>LED</td>
<td>LED</td>
<td>LED</td>
</tr>
<tr>
<td>Resolution</td>
<td>Depends on external subdividing electronics</td>
<td>Depends on external subdividing electronics</td>
<td>5; 2.5; 1.0; 0.5; 0.2; 0.1 µm (after 4-fold dividing in subsequent electronics)</td>
</tr>
<tr>
<td>Incremental signals</td>
<td>Non linear l, 1 and l', Amplitude at 1 kΩ load: A = R; B = 1.2 V</td>
<td>Non linear l, 1 and l', Amplitude at 100 Ω load: A = 0.2 V; B = 1.2 V</td>
<td>Differential square-wave U1/0 U1 and U0/0</td>
</tr>
<tr>
<td>Reference signal</td>
<td>One triangular peak per revolution. Signal magnitude at 1 kΩ load: l = 2-8 µV (usable component)</td>
<td>One triangular peak per revolution. Signal magnitude at 100 Ω load: l = 0.2-0.8 V (usable component)</td>
<td>One differential square-wave U1/0 U0 per revolution</td>
</tr>
<tr>
<td>Frequency</td>
<td>50 kHz</td>
<td>50 kHz</td>
<td>50 kHz</td>
</tr>
<tr>
<td>Permissible shock (11 ms)</td>
<td>20 µA; 40 µm (optional)</td>
<td>20 µA; 40 µm (optional)</td>
<td>20 µA; 40 µm (optional)</td>
</tr>
<tr>
<td>Standard cable length</td>
<td>3 m, without connector</td>
<td>3 m, without connector</td>
<td>3 m, without connector</td>
</tr>
<tr>
<td>Standard cable length</td>
<td>3 m, without connector</td>
<td>3 m, without connector</td>
<td>3 m, without connector</td>
</tr>
<tr>
<td>Output signals</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ACCESSORIES

CONNECTORS FOR CABLE

- B12 - 12-pin round connector
- C9 - 12-pin round connector
- C12 - 12-pin round connector
- D9 - 9-pin flat connector
- D15 - 15-pin flat connector
- R510 - 10-pin round connector
- ONC - 10-pin round connector

DIGITAL READOUT DEVICES

- CS3000
- CS5500

EXTERNAL INTERPOLATOR

- NK

ORDER FORM

<table>
<thead>
<tr>
<th>MODEL</th>
<th>XXX</th>
<th>XXX</th>
<th>XXX</th>
<th>XXX</th>
<th>XXX</th>
</tr>
</thead>
<tbody>
<tr>
<td>OUTPUT SIGNALS</td>
<td>MEASURING LENGTH</td>
<td>REFERENCE MARKS</td>
<td>ACCURACY</td>
<td>CABLE OR CONNECTOR OUTLET</td>
<td>CABLE LENGTH</td>
</tr>
<tr>
<td>A - Sinewave Av</td>
<td>Sinewave Av</td>
<td>0.0 - 10 mm</td>
<td>0.0 - 10 mm</td>
<td>Ø5 mm/0.14 mm</td>
<td>Ø5 mm/0.14 mm</td>
</tr>
<tr>
<td>B - Sinewave Dv</td>
<td>Sinewave Dv</td>
<td>0.0 - 10 mm</td>
<td>0.0 - 10 mm</td>
<td>Ø5 mm/0.14 mm</td>
<td>Ø5 mm/0.14 mm</td>
</tr>
<tr>
<td>C - Squarewave</td>
<td>Squarewave</td>
<td>0.0 - 10 mm</td>
<td>0.0 - 10 mm</td>
<td>Ø6 mm/0.14 mm</td>
<td>Ø6 mm/0.14 mm</td>
</tr>
</tbody>
</table>

ORDER EXAMPLE

1) L18-F10-0420-ML1/100-05-C-03/W
L18B
PHOTOELECTRIC LINEAR ENCODER

Photoelectrical linear encoder L18B is able to have the measuring length of up to 3.240 mm, maximum accuracy of ±5 µm to any matter within the ML and grating periods of ±20 µm, ±40 µm.

MECHANICAL DATA

| Measuring lengths (ML) mm | 70, 120, 170, 220, 270, 320, 370, 420, 470, 520, 570, 620, 670, 720, 1140, 1190, 1240, 1290, 1340, 1390, 1440, 1490, 1540, 1590, 1640, 1690, 1740, 1790, 1840, 1890, 1940, 1990, 2040, 2090, 2140, 2190, 2240, 2290, 2340, 2390, 2440, 2490, 2540, 2590, 2640, 2690, 2740, 2790, 2840, 2890, 2940, 2990, 3040, 3090, 3140, 3190, 3240 |
| Accuracy grades to any mains within the ML jet 20°C | 4.6| 5.4| 6.0| 5.0| |
| Grating period | 20 µm; 40 µm (optional) |

ELECTRICAL DATA

<table>
<thead>
<tr>
<th>VERSION</th>
<th>L18B-A</th>
<th>L18B-AV</th>
<th>L18B-F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply</td>
<td>±5 V ± 5% / &lt; 120 mA</td>
<td>±5 V ± 5% / &lt; 120 mA</td>
<td>±5 V ± 5% / &lt; 120 mA</td>
</tr>
<tr>
<td>Light source</td>
<td>LED</td>
<td>LED</td>
<td>LED</td>
</tr>
<tr>
<td>Resolution</td>
<td>Depends on external subdividing electronics</td>
<td>Depends on external subdividing electronics</td>
<td>5; 1; 2.5; 5; 2.5; 0.2; 0.1 µm (after 4-fold dividing in subsequent electronics)</td>
</tr>
<tr>
<td>Incremental signals</td>
<td>Two sinusoidal I and I Amplitude at 1 kΩ load: - I = 7.16 µA - I = 7.16 µA</td>
<td>Two sinusoidal I and I Amplitude at 120 kΩ load: - A = 0.56-1.2 V - B = 0.56-1.2 V</td>
<td>Differential square-wave U and U: Signal levels at 20 kΩ load current: - low (logic “0”) &lt; 0.5 V - high (logic “1”) &gt; 2.4 V</td>
</tr>
<tr>
<td>Reference signal</td>
<td>Quasi-triangular I Signal magnitude at 1 kΩ load: - I = 2.8 µA</td>
<td>Quasi-triangular I Signal magnitude at 120 kΩ load: - I = 0.28 µA</td>
<td>One differential square-wave U0/U0 per revolution. Signal levels at 20 µA load current: - low (logic “0”) &lt; 0.5 V - high (logic “1”) &gt; 2.4 V</td>
</tr>
<tr>
<td>Maximum operating frequency</td>
<td>50 kHz</td>
<td>50 kHz</td>
<td>50 kHz</td>
</tr>
<tr>
<td>Direction of signal</td>
<td>B+ lags A+ at reading head displacement from left to right</td>
<td>B+ lags A+ at reading head displacement from left to right</td>
<td>B+ lags A+ at reading head displacement from left to right</td>
</tr>
<tr>
<td>Standard cable length</td>
<td>3 m, without connector</td>
<td>3 m, without connector</td>
<td>3 m, without connector</td>
</tr>
<tr>
<td>Maximum cable length</td>
<td>5 m</td>
<td>25 m</td>
<td>25 m</td>
</tr>
<tr>
<td>Output signals</td>
<td>±10; ±5 µm</td>
<td>±10; ±5 µm</td>
<td>±10; ±5 µm</td>
</tr>
</tbody>
</table>

ACCESSORIES

CONNECTORS FOR CABLE

<table>
<thead>
<tr>
<th>CONNECTORS FOR CABLE</th>
<th>B12 - 12-pin round connector</th>
<th>C9 - 9-pin round connector</th>
<th>C12 - 12-pin connector</th>
<th>D8 - 8-pin flat connector</th>
<th>D15 - 15-pin flat connector</th>
<th>R810 - 8-pin round connector</th>
<th>R910 - 9-pin round connector</th>
<th>HR25 - 23-pin round connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>ML, mm</td>
<td>2040 - 2040 mm</td>
<td>2040 - 2040 mm</td>
<td>2040 - 2040 mm</td>
<td>2040 - 2040 mm</td>
<td>2040 - 2040 mm</td>
<td>2040 - 2040 mm</td>
<td>2040 - 2040 mm</td>
<td>2040 - 2040 mm</td>
</tr>
</tbody>
</table>

Note: If cable extension is used the power supply conductor section should not be smaller than 0.5 mm².

EXTERNAL INTERPOLATOR

<table>
<thead>
<tr>
<th>EXTERNAL INTERPOLATOR</th>
<th>NK</th>
</tr>
</thead>
</table>

ORDER FORM

<p>| ORDER FORM |
| L18B | X | XXX | X/XXX | X | X | X/XX |</p>
<table>
<thead>
<tr>
<th>OUTPUT AND SIGNALS AND MEASURING LENGTH</th>
<th>REFERENCE MARKS</th>
<th>ACCURACY</th>
<th>CABLE OR CONNECTOR OUTLET</th>
<th>CABLE LENGTH</th>
<th>CONNECTOR TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>A = Sinusoidal</td>
<td>D = Triangular</td>
<td>F = Square-wave</td>
<td>M = Every 50 mm</td>
<td>K = Distance-coded</td>
<td>(connector outlet)</td>
</tr>
<tr>
<td>Measuring lengths (ML) mm</td>
<td>100 - 1000 mm</td>
<td>1000 - 2000 mm</td>
<td>2000 - 3000 mm</td>
<td>3000 - 4000 mm</td>
<td>4000 - 5000 mm</td>
</tr>
<tr>
<td>Measured values</td>
<td>±10; ±5 µm</td>
<td>±10; ±5 µm</td>
<td>±10; ±5 µm</td>
<td>±10; ±5 µm</td>
<td>±10; ±5 µm</td>
</tr>
<tr>
<td>Reference signal</td>
<td>±10; ±5 µm</td>
<td>±10; ±5 µm</td>
<td>±10; ±5 µm</td>
<td>±10; ±5 µm</td>
<td>±10; ±5 µm</td>
</tr>
</tbody>
</table>

ORDER FORM: L18B-F 2440 5.0 ±0.5 CP (10) 1240 0520 0070 10 - ±10 µm 05 - ±5 µm 00 - ±0.5 µm
L18T
PHOTOELECTRIC LINEAR ENCODER

Photoelectric linear encoder L18T does not vary much from L18 series and retains almost identical parameters. However, it has a different housing fixation and more stable thermal behavior.

MECHANICAL DATA

- Measuring lengths (ML): 70, 120, 170, 220, 270, 320, 370, 420, 470, 520, 570, 620, 670, 720, 770, 820, 870, 920, 970, 1020, 1070, 1140, 1210, 1280 mm (other intermediate lengths on request)
- Accuracy grades to 0.1 mm
- Reference marks (Fr):
  - Standard for ML ≤ 1020 mm
  - Optional for ML ≥ 1140 mm
- Grating period:
  - Standard for ML ≤ 20 mm
  - Optional for ML > 20 mm
- Max. traversing speed:
  - When interpolation factor is 1, 2, 5, 10
  - When interpolation factor is 50
- Required moving force with sealing:
  - < 3 N
- Protection (IEC 529):
  - IP53
- Weight:
  - 0.4 kg + 0.8 kg/m
- Operating temperature:
  - 0°...+50°C
- Storage temperature:
  - -20°...+70°C
- Permissible vibration (40 to 2000 Hz):
  - 0.90 m/s²
- Permissible shock (11 m/s²):
  - 0.1 N/m²

ELECTRICAL DATA

- Version:
  - L18T-A: TTL 11 µA
  - L18T-AV: TTL 11 µm
  - L18T-F: TTL 11 µm
- Power supply:
  - ±5 V ± 5% < 30 mA
- Light source:
  - LED
- Resolution:
  - Depends on external subdividing electronics
- Incremental signals:
  - Two sinusoidal I1 = 7.16 µA and I2 = 7.16 µA
  - Differential sine +A and -B amplitude at 1200 load:
    - A = 0.6±1.2 V
    - B = 0.6±1.2 V
  - Differential square-wave UA and UB (at 20 mA load current):
    - Low (logic ‘0’): ≤ 0.5 V
    - High (logic ‘1’): ≥ 4 V
- Reference signal:
  - One quasi-triangular +R and its opposite
  - One quasi-triangular +R and its opposite
  - One differential square-wave U0/D0 per revolution
- Maximum operating frequency:
  - 50 kHz
- Direction of signals:
  - U1: log, A+ at reading head displacement from left to right
  - B+ log, +A at reading head displacement from left to right
- Standard cable length:
  - Without connector: 3 m, MIN
- Maximum cable length:
  - Without connector: 25 m
- Output signals:
  - TTL

ACCESSORIES

- Connectors for cable:
  - B12: 12-pin round connector
  - C9: 9-pin round connector
  - D12: 12-pin flat connector
  - D9: 9-pin flat connector
  - D15: 15-pin flat connector
  - RS10: round connector
  - CNS: connector
  - HR25: round mini connector
- Digital readout devices:
  - CD2000
  - CS500
- External interpolator:
  - N

ORDER FORM

- L18T
- X
- X
- X
- X
- X
- X
- X
- X
- X

OUTPUT SIGNALS AND RESOLUTION:

<table>
<thead>
<tr>
<th>Measuring Length</th>
<th>Reference Mark</th>
<th>Accuracy</th>
<th>Cable or Connector Type</th>
<th>Cable Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>70 10 - 1000 mm</td>
<td>002 10 - 20 mm</td>
<td>±0.2 µm</td>
<td>01 - without connector</td>
<td>0 m</td>
</tr>
<tr>
<td>12 - 1020 mm</td>
<td>003 3 - 10 mm</td>
<td>±0.3 µm</td>
<td>01 - without connector</td>
<td>1 m</td>
</tr>
<tr>
<td>12 - 1070 mm</td>
<td>004 10 - 20 mm</td>
<td>±0.2 µm</td>
<td>01 - without connector</td>
<td>2 m</td>
</tr>
<tr>
<td>12 - 1140 mm</td>
<td>005 10 - 20 mm</td>
<td>±0.2 µm</td>
<td>01 - without connector</td>
<td>3 m</td>
</tr>
<tr>
<td>12 - 1210 mm</td>
<td>006 10 - 20 mm</td>
<td>±0.2 µm</td>
<td>01 - without connector</td>
<td>4 m</td>
</tr>
<tr>
<td>12 - 1280 mm</td>
<td>007 10 - 20 mm</td>
<td>±0.2 µm</td>
<td>01 - without connector</td>
<td>5 m</td>
</tr>
<tr>
<td>12 - 1340 mm</td>
<td>008 20 - 40 mm</td>
<td>±0.2 µm</td>
<td>01 - without connector</td>
<td>6 m</td>
</tr>
<tr>
<td>12 - 1420 mm</td>
<td>009 20 - 40 mm</td>
<td>±0.2 µm</td>
<td>01 - without connector</td>
<td>7 m</td>
</tr>
</tbody>
</table>

Note: If cable extension is used, the power supply conductor section should not be smaller than 0.5 mm².
**L23**

**PHOTOELECTRIC LINEAR ENCODER**

Photoelectric modular linear encoder L23 can have up to 20,000 mm measuring length or even more on special order and is able reach up to ±3 µm accuracy.

**MECHANICAL DATA**

- Measuring lengths (ML): 250, 300, 350, 400, 450, 500...20000 mm (more on option)
- Accuracy grades to any metre within the ML (at 20°C): ±10; ±5; ±3 µm
- Grating period (T): 40; 40; 20 µm
- Max. traversing speed:
  - When T=400 µm and resolution 100, 50, 10 µm: 2 m/s
  - When T=10 µm:
    - Resolution 10, 5 µm: 1.3 m/s
    - Resolution 1 µm: 0.4 m/s
  - When T=20 µm and:
    - Resolution 5 µm: 1 m/s
    - Resolution 0.5 µm: 0.2 m/s
- Reference marks (Ri):
  - N
  - M
  - P (optional)
- Required moving force: < 4 N
- Protection (IEC 529):
  - Without compressed air: IP54
  - With compressed air: IP64
- Weight: 0.4 kg + 2.8 kg/m
- Operating temperature: 0...50°C
- Storage temperature: -20...70°C
- Permissible vibration (10...2000 Hz): 100 m/s²
- Permissible shock (11 ms): 150 m/s²
- Coefficient of thermal expansion: 19.6x10⁻⁶/°C

**ELECTRICAL DATA**

**VERSION**

- L23-F TTL, TTL
- L23-TTL

**Supply voltage (Uₚ):**

- +5V±5%/ 65 mA
- +12V±5%/ 65mA

**Light source:**

- LED

**Resolution:**

- 100, 50, 10, 5, 1, 0.5 µm (after 4-fold in subsequent electronics)

**Incremental signals:**

- Differential square-wave U1/U1 and U2/U2

**Reference signal:**

- Differential square-wave U0/U0

**Signal levels at load current 20 mA:**

- Low (logic "0") < 0.5 V at Up=+5V
- High (logic "1") > 2.4 V at Up=+5V
- Low (logic "0") < 1.5 V at Up=+12V (HTL)
- High (logic "1") > (Up-2) V at Up=+12V (HTL)

**Direction of signals:**

- U2 lags U1 (displacement from left to right and head position down)

**Standard cable length:**

- 4 m armoured, without connector

**Maximum cable length:**

- 25 m

**Output signals:**

- Measuring lengths (ML), mm: 250, 300, 350, 400, 450, 500...20000 (more on option)
- Accuracy grades to any metre within the ML (at 20°C): ±10; ±5; ±3 µm
- Grating period (T): 400; 40; 20 µm
- Max. traversing speed:
  - When T=400 µm and resolution 100, 50, 10 µm:
    - Resolution 10, 5 µm: 2 m/s
    - Resolution 1 µm: 1 m/s
  - When T=20 µm and:
    - Resolution 5 µm: 1 m/s
    - Resolution 0.5 µm: 0.2 m/s
- Reference marks (RI):
  - N
  - M
  - P (optional)
- Weight: 0.4 kg + 2.8 kg/m
- Operating temperature: 0...+50°C
- Storage temperature: -20...+70°C
- Permissible vibration (10...2000 Hz): 100 m/s²
- Permissible shock (11 ms): 150 m/s²
- Coefficient of thermal expansion: 19.6x10⁻⁶/°C

**RESOLUTION:**

- **MEASURING LENGTH:**
  - 250, 300, 350, 400, 450, 500...20000 mm (more on option)

**REFERENCE MARKS:**

- **ACCURACY:**
  - ±10; ±5; ±3 µm

**SUPPLY VOLTAGE:**

- 5V±5%/ 65 mA
- 12V±5%/ 65mA

**CABLE LENGTH:**

- 4 m armoured, without connector
- 25 m

**CONNECTORS FOR CABLE**

- B12 - 12-pin round connector
- C9 - 9-pin round connector
- C12 - 12-pin round connector
- D9 - 9-pin flat connector
- D15 - 15-pin flat connector
- RS10 - 10-pin round connector
- ONC - 10-pin round connector

**DIGITAL READOUT DEVICES**

- CS3000
- CS5500

**ACCESSORIES**

**ORDER EXAMPLE:**

1) L23-F100-16000-N-10-05V-04/C12

Note: If cable extension is used the power supply conductor section should not be smaller than 0.5 mm².
**MECHANICAL DATA**

- **Measuring lengths (ML), mm**: 70, 120, 170, 220, 270, 320, 370, 420, 470, 520, 570, 620, 670, 720, 770, 820, 920, 1024, 110, 1140, 1240, 1340, 1440, 1540, 1640, 1740, 1840, 2040, 2240, 2440, 2640, 2840, 3040, 3240
- **Incremental signal**: sine wave 1Vpp (optional)
- **Resolution 1Vpp**: up to 0.1 μm (depending on CNC division factor)
- **Serial interface**: SSI or BiSS
- **Resolution absolute measure**: 1 μm, 0.1 μm
- **Accuracy grades to any metre within the ML, at 20°C**: ± 3 μm
  - **- standard version**: ± 5 μm
  - **- optional**: ± 3 μm
- **Grating period (T)**: 30 μm
- **Max. traversing speed**: 2 m/s
- **Max. acceleration**: 2.5 m/s²
- **Required moving force**: <4N, ±2N on request
- **Power supply**: +9V ± 5%
- **Current consumption with load**: max 340 mA (with R=120Ω)
- **Protection (EN 60529)**: IP54, IP65
- **Operating temperature**: 0...+50°C
- **Storage temperature**: -20...+70°C
- **Permissible humidity (non condensed)**: ≤ 80 %
- **Permissible vibration (15...2000 Hz)**: ≤ 150 m/s²
- **Weight**: 0.42 kg ± 0.3 kg
- **Standard cable length/max. cable length**: 2,025.0 (100 m if power supply is min. 5V)
- **Electrical protections**: from inversion of power supply polarity, from short circuit on output port

**ACCESSORIES**

- **CONNECTORS FOR CABLE**
  - B12: 12-pin round connector
  - C9: 9-pin round connector
  - C12: 12-pin round connector
  - D9: 9-pin flat connector
  - D15: 15-pin flat connector

**ORDER FORM**

- **PRODUCT**: LK24
- **ORDER EXAMPLE**: LK24 F01-0070-S1-W0-W0-W0

**CABLE SERIAL OUTPUT**

Encoder is supplied with flexible cable, which is consisted of shielded twisted pairs of wires for incremental signals (A, B- and A0-B0). The encoder can have an additional 1Vpp incremental track.

**OUTPUT SIGNALS**

**SSI VERSION**

- **Interface**: SSI Binary – Gray
- **Signals level**: EIA RS 485
- **Clock frequency**: 0.1 ± 1.2 MHz
- **n**: Position bit
- **Tn**: 10 ± 20 μs

**BISS C VERSION**

- **Interface**: BiSS C unidirectional
- **Signals level**: EIA RS 485
- **Clock frequency**: 0.1 ± 4 MHz
- **n**: 26 ± 2 ± 6 bit
- **Tn**: 12 ± 20 μs

**CABLE**

**ANALOG OUTPUT + SERIAL OUTPUT**

- **Cable for serial output**:
  - 6-wire shielded cable, Ø=7 mm, PVC external sheath, with low friction coefficient, oil-resistant, suitable for continuous movements
  - conductors section: power supply 0.25 mm², signals 0.25 mm²
  - cable's bending radius should not be lower than 35 mm.
  - In case of cable extension, it is necessary to guarantee:
    - electrical connection between the body of the connectors and the cables shield;

**ACCESSORIES**

- **CONNECTORS FOR CABLE**
  - B12: 12-pin round connector
  - C9: 9-pin round connector
  - C12: 12-pin round connector
  - D9: 9-pin flat connector
  - D15: 15-pin flat connector

**ORDER FORM**

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- **ORDER EXAMPLE**: LK24 F01-0070-S1-W0-W0-W0

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**OUTPUT SIGNALS**

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- **Clock frequency**: 0.1 ± 1.2 MHz
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- **Signals level**: EIA RS 485
- **Clock frequency**: 0.1 ± 4 MHz
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**CABLE**

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  - cable's bending radius should not be lower than 35 mm.
  - In case of cable extension, it is necessary to guarantee:
    - electrical connection between the body of the connectors and the cables shield;

**ACCESSORIES**

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  - B12: 12-pin round connector
  - C9: 9-pin round connector
  - C12: 12-pin round connector
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  - D15: 15-pin flat connector

**ORDER FORM**

- **PRODUCT**: LK24
- **ORDER EXAMPLE**: LK24 F01-0070-S1-W0-W0-W0

**CABLE SERIAL OUTPUT**

Encoder is supplied with flexible cable, which is consisted of shielded twisted pairs of wires for incremental signals (A, B- and A0-B0). The encoder can have an additional 1Vpp incremental track.

**OUTPUT SIGNALS**

**SSI VERSION**

- **Interface**: SSI Binary – Gray
- **Signals level**: EIA RS 485
- **Clock frequency**: 0.1 ± 1.2 MHz
- **n**: Position bit
- **Tn**: 10 ± 20 μs

**BISS C VERSION**

- **Interface**: BiSS C unidirectional
- **Signals level**: EIA RS 485
- **Clock frequency**: 0.1 ± 4 MHz
- **n**: 26 ± 2 ± 6 bit
- **Tn**: 12 ± 20 μs

**CABLE**

**ANALOG OUTPUT + SERIAL OUTPUT**

- **Cable for serial output**:
  - 6-wire shielded cable, Ø=7 mm, PVC external sheath, with low friction coefficient, oil-resistant, suitable for continuous movements
  - conductors section: power supply 0.25 mm², signals 0.25 mm²
  - cable's bending radius should not be lower than 35 mm.
  - In case of cable extension, it is necessary to guarantee:
    - electrical connection between the body of the connectors and the cables shield;

**ACCESSORIES**

- **CONNECTORS FOR CABLE**
  - B12: 12-pin round connector
  - C9: 9-pin round connector
  - C12: 12-pin round connector
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Encoder is supplied with flexible cable, which is consisted of shielded twisted pairs of wires for incremental signals (A, B- and A0-B0). The encoder can have an additional 1Vpp incremental track.

**OUTPUT SIGNALS**

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- **Interface**: SSI Binary – Gray
- **Signals level**: EIA RS 485
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- **n**: Position bit
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- **Signals level**: EIA RS 485
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**CABLE**

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  - 6-wire shielded cable, Ø=7 mm, PVC external sheath, with low friction coefficient, oil-resistant, suitable for continuous movements
  - conductors section: power supply 0.25 mm², signals 0.25 mm²
  - cable's bending radius should not be lower than 35 mm.
  - In case of cable extension, it is necessary to guarantee:
    - electrical connection between the body of the connectors and the cables shield;
L35 PHOTOELECTRIC LINEAR ENCODER

Photoelectric linear encoder L35 is an incremental linear displacement measuring device that has up to 3,240 mm measuring length, up to ±3 μm accuracy grades to any meter within the ML depending on measuring length demanded. L35 series is more vibration resistant than L18 series of encoders.

**MECHANICAL DATA**

- Measuring lengths (ML): mm
  - 170; 220; 270; 320; 370; 420; 470; 520; 620; 720; 820; 920; 1020; 1120; 1220; 1320; 1420; 1520; 1620; 1720; 1820; 1920; 2020; 2120; 2220; 2320; 2420; 2520; 2620; 2720; 2820; 2920; 3020; 3120; 3220; 3320; 3420; 3520; 3620; 3720; 3820; 3920; 4020
- Lengths from both ends of ML: 60 mm from both ends of ML one RI at any location, two or more RIs separated by distances of (p x 50 mm).
  - ±10 µm
  - ±5; ±3 µm
  - ±1 µm
  - ±0.5; ±0.3; ±0.2; ±0.1 µm (after 4-fold dividing in subsequent electronics)
- Reference marks (RI): standard for ML from 2040 up to 3240 mm - for ML from 170 up to 2040 mm
- Reference marks (RI): ±5; ±3; ±1 µm
- Reference marks (RI): ±0.5; ±0.3; ±0.2; ±0.1 µm (after 4-fold dividing in subsequent electronics)

**ELECTRICAL DATA**

- Output signals:
  - One quasi-triangular, - I0 = 7–16 µA (stable component)
  - One quasi-triangular, - I0 = 7–16 µA (stable component)
- Reference signal:
  - One differential square-wave U0/U0 per revolution. Signal levels at 20 mA load current:
    - High level: 7.5 V ± 5% (HTL)
    - Low level: 2.4 V ± 5% (HTL)
    - High level: 7.0 V ± 5% (U12)
    - Low level: 2.0 V ± 5% (U12)
- Output signals:
  - ±1 V at Up=+12V (HTL)
  - ±0.5 V at Up=+5V (HTL)
  - 1.5 V at Up=+12V (HTL)
  - 0.5 V at Up=+5V
- Output signals:
  - 100 kHz (v=2 m/s shortly)
  - 50 kHz (v=1 m/s shortly)
  - 100 kHz (v=2 m/s shortly)

**ORDER FORM**

```
<table>
<thead>
<tr>
<th>OUTPUT SIGNALS AND RESOLUTION</th>
<th>MEASURING LENGTH</th>
<th>REFERENCE MARKS</th>
<th>ACCURACY</th>
<th>SUPPLY VOLTAGE</th>
<th>CABLE OR CONNECTOR OUTLET</th>
<th>CABLE LENGTH</th>
<th>CONNECTOR TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>10; ±1 urn (external)</td>
<td>500; 1020</td>
<td>±0.5 urn</td>
<td>±1 urn</td>
<td>±0.5 urn</td>
<td>±0.5 urn</td>
<td>±1 urn</td>
<td>±0.5 urn</td>
</tr>
<tr>
<td>500; 1020</td>
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<td>±1 urn</td>
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<td>±0.5 urn</td>
<td>±1 urn</td>
<td>±0.5 urn</td>
</tr>
</tbody>
</table>

ORDER EXAMPLE: L35-350-RS10-D-10/30V-C-CONN-012
```

**ACCESSORIES**

- Connectors for cable
  - B12 12-pin round connector
  - C9 9-pin round connector
  - C12 12-pin round connector
  - D12 12-pin round connector
  - D15 15-pin round connector
  - R10 10-pin round connector
  - QNC 10-pin round connector
  - HR10A 12-pins mini connector

**DIGITAL READOUT DEVICES**

- CS3000
  - CS5000

**EXTERNAL INTERPOLATOR**

- NK
**L35T PHOTOELECTRIC LINEAR ENCODER**

Photoelectric linear encoder L35T is very similar encoder to L35 series, but has different mounting parameters. It can also have up to 3,240 mm measuring length and is more vibration resistant than L18 series.

### MECHANICAL DATA

<table>
<thead>
<tr>
<th>Measuring lengths (ML) mm</th>
<th>110; 220; 230; 240; 250; 260; 270; 280; 290; 300; 310; 320; 330; 340; 350; 360; 370; 380; 390; 400</th>
<th>70; 80; 90; 100; 110; 120; 130; 140; 150; 160; 170; 180; 190; 200; 210; 220; 230; 240; 250; 260; 270; 280; 290; 300; 310; 320; 330; 340; 350; 360; 370; 380; 390; 400</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference marks (RI)</td>
<td>- standard for ML ≤ 1200 mm</td>
<td>- standard for ML &gt; 1200 mm</td>
</tr>
<tr>
<td>- optional</td>
<td>35mm from both ends of ML 45mm from both ends of ML</td>
<td>35mm from both ends of ML 45mm from both ends of ML</td>
</tr>
</tbody>
</table>

- distance-coded
- selection by magnets
- max. traversing speed: 1 m/s (about 2 m/sn), 0.5 m/s
- weight: 0.4 kg + 2.8 kg/m
- op. temperature: 0°C to 60°C
- storage temperature: -20°C to 70°C

### ELECTRICAL DATA

**VERSION**

| L35T-A  | +11 µVpp
| L35T-AV | +1 µVpp
| L35T-F | -11 µVpp

- Power supply: ±5 V ± 1% or ±10 mA
- Light source: LED
- Resolution: Depends on external subdividing electronics
- Incremental signals: Two sinusoidal I1 and I2 Amplitude at 1400 load: ±10 ±2 µA

### ACCESSORIES

**CONNECTORS FOR CABLE**

- B12 - 12-pin round connector
- C9 - 9-pin flat connector
- C12 - 12-pin round connector
- D8 - 8-pin flat connector
- D15 - 15-pin flat connector
- RS10 - 10-pin round connector
- C6500 - 10-pin round connector
- CSD500 - 5-pin round connector

**ELECTRICAL CHARACTERISTICS**

- Anode (true): RS
- Cathode (false): NC
- Power supply: ±5 V ± 1% or ±10 mA
- Logic levels: 0.5 V at Up=+5V
- Protection (IEC-589): without compressed air, with compressed air
- Weight: 0.4 kg ± 2.8 kg/m
- Operating temperature: -20°C to 70°C
- Storage temperature: -20°C to 70°C
- Permissible acceleration (10 to 2000 Hz): 155 m/s²

### ORDER FORM

**OUTPUT SIGNALS AND RESOLUTION**

<table>
<thead>
<tr>
<th>Measuring Length</th>
<th>4000 - 4200 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference Marks</td>
<td>A = standard (RI) out = standard (false)</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±0.3% of L (from ML)</td>
</tr>
<tr>
<td>Supply Voltage</td>
<td>±5 V ± 1% or ±10 mA</td>
</tr>
</tbody>
</table>

**CABLE AND CONNECTOR OUTLET**

<table>
<thead>
<tr>
<th>Cable Type</th>
<th>Connector Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>050 mm</td>
<td>RS</td>
</tr>
<tr>
<td>1000 mm</td>
<td>C9</td>
</tr>
<tr>
<td>200 mm</td>
<td>C9</td>
</tr>
<tr>
<td>100 mm</td>
<td>RS</td>
</tr>
</tbody>
</table>

**PRODUCT CATALOG**

**MECHANICAL DATA**

<table>
<thead>
<tr>
<th>Measuring lengths (ML) mm</th>
<th>110; 220; 230; 240; 250; 260; 270; 280; 290; 300; 310; 320; 330; 340; 350; 360; 370; 380; 390; 400</th>
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- distance-coded
- selection by magnets
- max. traversing speed: 1 m/s (about 2 m/sn), 0.5 m/s
- weight: 0.4 kg + 2.8 kg/m
- op. temperature: 0°C to 60°C
- storage temperature: -20°C to 70°C
- Permissible acceleration (10 to 2000 Hz): 155 m/s²

**ELECTRICAL DATA**

**VERSION**

| L35T-A  | +11 µVpp
| L35T-AV | +1 µVpp
| L35T-F | -11 µVpp

- Power supply: ±5 V ± 1% or ±10 mA
- Light source: LED
- Resolution: Depends on external subdividing electronics
- Incremental signals: Two sinusoidal I1 and I2 Amplitude at 1400 load: ±10 ±2 µA

**ACCESSORIES**

**CONNECTORS FOR CABLE**

- B12 - 12-pin round connector
- C9 - 9-pin flat connector
- C12 - 12-pin round connector
- D8 - 8-pin flat connector
- D15 - 15-pin flat connector
- RS10 - 10-pin round connector

**ELECTRICAL CHARACTERISTICS**

- Anode (true): RS
- Cathode (false): NC
- Power supply: ±5 V ± 1% or ±10 mA
- Logic levels: 0.5 V at Up=+5V
- Protection (IEC-589): without compressed air, with compressed air
- Weight: 0.4 kg ± 2.8 kg/m
- Operating temperature: -20°C to 70°C
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- Permissible acceleration (10 to 2000 Hz): 155 m/s²

**ORDER FORM**

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<td>RS</td>
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<td>35mm from both ends of ML 45mm from both ends of ML</td>
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</table>

- distance-coded
- selection by magnets
- max. traversing speed: 1 m/s (about 2 m/sn), 0.5 m/s
- weight: 0.4 kg + 2.8 kg/m
- op. temperature: 0°C to 60°C
- storage temperature: -20°C to 70°C
- Permissible acceleration (10 to 2000 Hz): 155 m/s²
**PHOTOELECTRIC LINEAR ENCODER**

L37 is an incremental encoder that features reproducible thermal behavior and has a reversible reading head.

It can have up to 3.240 mm measuring length and accuracy grades to any meter within the ML of up to ±5 µm.

### MECHANICAL DATA

<table>
<thead>
<tr>
<th>Measuring lengths (ML), mm</th>
<th>140, 240, 340, 440, 540, 640, 740, 840, 940, 1040, 1140, 1240, 1340, 1440, 1540, 1640, 1740, 1840, 2040, 2240, 2440, 2640, 2840, 3040, 3240</th>
</tr>
</thead>
</table>

- Accuracy: ±0.5 µm (optional)
- ±0.2 µm
- ±0.1 µm
- ±0.05 µm
- ±0.02 µm
- ±0.01 µm

### ELECTRICAL DATA

**VERSION** | L37-A | L37-AV | L37-F
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply</td>
<td>+5 V ± 0.5% / -10 mA</td>
<td>+5 V ± 0.5%</td>
<td>+5 V ± 0.5% / -120 mA ±10 V/±6 /130mA</td>
</tr>
<tr>
<td>Light source</td>
<td>R</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>Resolution</td>
<td>Depends on external subdividing electronics</td>
<td>Depends on external subdividing electronics</td>
<td>2.5; 5; 0.25; 0.125; 0.0625 µm (after 4-fold dividing in subsequent electronics)</td>
</tr>
<tr>
<td>Incremental signals</td>
<td>Two sinusoidal I1 and I2 Amplitudes of 1.0 µA load</td>
<td>AMPLITUDE OF 12.00 µA LOAD</td>
<td>Amplitude of 40 µA and 1 000 µA</td>
</tr>
<tr>
<td></td>
<td>- I1 = 710 µA</td>
<td>- I1 = 120 µA</td>
<td>- I1 = 0.612 V</td>
</tr>
<tr>
<td>Reference signal</td>
<td>One quasi-triangular +R and its complementary -R</td>
<td>One quasi-triangular +R and its complementary -R</td>
<td>One differential square-wave U1/U0 per resolution</td>
</tr>
<tr>
<td></td>
<td>Signal magnitude of 1.00 µA load</td>
<td>Signal magnitude of 1.00 µA load</td>
<td>Signal magnitude of 1.00 µA load</td>
</tr>
<tr>
<td></td>
<td>- R = 0.2-0.8 V (usable component)</td>
<td>- R = 0.2-0.8 V (usable component)</td>
<td>- R = 0.2-0.8 V (usable component)</td>
</tr>
</tbody>
</table>

### ACCESSORIES

**ORDER FORM**

**CABLE LENGTH:**

| L37 | 5 m | 10 m | 20 m |

**CABLE TYPE:**

- CP01 - 1m armoured
- CP02 - 2m armoured
- CP03 - 3m armoured
- CP04 - 4m armoured

**DIGITAL READOUT DEVICES**

- CS3000
- CS5500

**EXTERNAL INTERPOLATOR**

- IN

Note: If cable extension is used, the power supply conductor section should not be smaller than 0.5 mm².
Photoelectric modular linear encoder L50 is an incremental encoder and has the measuring length from 3,240 up to 30,040 mm, grading period of 40 µm and accuracy of any meter within the ML of up to ±10 µm.

### Electrical Data

**Version**
- **L50-AV** 1 VpE
- **L50-F** TTL

**Power supply**
- +5 V ±5% /100 mA (120Ω)
- +5 V ±5% /150 mA (120Ω)

**Light source**
- LED

**Resolution**
- Up to 0.1 µm depending on external subdividing electronics
- 10; 5; 1; 0.5 µm (after 4-fold dividing on subsequent electronics)

**Incremental signals**
- Differential sine ÷A- +A÷ and ÷B- ÷B
  - Amplitude at 120 Ω load:
    - I1 = 0.6...1.2 V
    - I2 = 0.6...1.2 V
  - Differential square-wave U1÷U1 and U2÷U2
  - Signal levels at 20 mA load current:
    - low (logic “0”): < 0.5 V
    - high (logic “1”): > 2.4 V

**Reference signal**
- Quasi-triangular R
  - Magnitude at 120 Ω load:
    - R = 0.25-0.8V (usable part)
  - One differential square-wave U0÷U0 per revolution
  - Signal levels at 20 mA load current:
    - low (logic “0”): < 0.5 V
    - high (logic “1”): > 2.4 V

**Direction of signals**
- B lags A at reading head displacement from left to right
- U2 lags U1 at reading head displacement from left to right

**Electrical protection**
- Inversion of power supply polarity and short circuit on output port

**Cable length (standard)**
- 3 m

**Maximum cable length (total with extension cable)**
- 150 m

**Output signals**
- **F - Machine guideway**
- **ML - Measuring length**

### Accessory Connectors

- **B12** 12-pin round connector
- **C12** 12-pin round connector
- **D9** 9-pin flat connector
- **D15** 15-pin flat connector
- **RS10** 10-pin round connector
- **ONC** 10-pin round connector

### Order Form

**Example**

<table>
<thead>
<tr>
<th>Encoder Type</th>
<th>Measuring Length (mm)</th>
<th>Reference Mark</th>
<th>Cable Length (m)</th>
<th>Connector Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>L50-AV</td>
<td>3040</td>
<td>C</td>
<td>3</td>
<td>B12</td>
</tr>
<tr>
<td>L50-F</td>
<td>3040</td>
<td>C</td>
<td>3</td>
<td>ONC</td>
</tr>
</tbody>
</table>

---

**Photoelectric Modular Linear Encoder L50**

Photoelectric modular linear encoder L50 is an incremental encoder and has the measuring length from 3,240 up to 30,040 mm, grading period of 40 µm and accuracy of any meter within the ML of up to ±10 µm.
MAGNETIC LINEAR ENCODER

MT

Magnetic linear encoder MT has measuring length of up to 50,000 mm and accuracy up to ±25 µm. Other parameters differ depending on required modifications.

MODIFICATION MT

VERSION 1 (POWER SUPPLY +5V)

VERSION 2 (POWER SUPPLY +5...28V)

<table>
<thead>
<tr>
<th>MPx00</th>
<th>MPx80-CV</th>
<th>MPx100-S</th>
<th>MPx50Z</th>
<th>MPx100Z-CV</th>
<th>MPx100Z-SF</th>
</tr>
</thead>
<tbody>
<tr>
<td>dmax (mm)</td>
<td>0.1...0.3</td>
<td>0.6...0.8</td>
<td>1.3...2.0</td>
<td>1.6...2.1</td>
<td>1.9...2.1</td>
</tr>
</tbody>
</table>

d - distance between reading head and magnetic band
MP or protective cover CV (protective support SP)
To get the best accuracy distance d must be the lowest possible (in the indicated range).

MODIFICATION CMT

<table>
<thead>
<tr>
<th>D (mm)</th>
</tr>
</thead>
</table>
| MP (MP100) | 2
| MP (MP200) | 2.5
| MP (MP500) | 2

Gap “d” between protective cover and reading head:
- for CMTM: d = 0.3...0.7 mm
- for CMTH: d = 0.3...2.2 mm
- for CMTP: d = 0.1...0.3 mm

Warning: To get the best accuracy distance d must be the lowest possible (in the indicated range).

MODIFICATION PCMT

<table>
<thead>
<tr>
<th>D (mm)</th>
</tr>
</thead>
</table>
| MP (MP100) | 2
| MP (MP200) | 2.5
| MP (MP500) | 2

Gap “d” between protective cover and reading head:
- for CMTM: d = 0.3...0.7 mm
- for CMTH: d = 0.3...2.2 mm
- for CMTP: d = 0.1...0.3 mm

Warning: To get the best accuracy distance d must be the lowest possible (in the indicated range).

ACCESSORIES

<table>
<thead>
<tr>
<th>CONNECTORS FOR CABLE</th>
<th>B12</th>
<th>C12</th>
<th>D9</th>
<th>D15</th>
<th>RS10</th>
<th>ONC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connector</td>
<td>12-pin</td>
<td>12-pin</td>
<td>9-pin</td>
<td>15-pin</td>
<td>10-pin</td>
<td>10-pin</td>
</tr>
<tr>
<td>Supplier</td>
<td>Festo</td>
<td>Festo</td>
<td>Festo</td>
<td>Festo</td>
<td>Festo</td>
<td>Festo</td>
</tr>
</tbody>
</table>

DIGITAL READOUT DEVICES

| CS3008 | CS5500 |
**SPECIFICATION**

<table>
<thead>
<tr>
<th>TTL OUTPUT SIGNALS (F)</th>
<th>SINE WAVE OUTPUT SIGNALS (AV) - VERSION 2 ONLY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring length (ML)</td>
<td>up to 50 m (20 m with MP 500)</td>
</tr>
<tr>
<td>Repeatability</td>
<td>± 1 increment</td>
</tr>
<tr>
<td>Max. measuring frequency</td>
<td>300 kHz</td>
</tr>
<tr>
<td>Power supply - version 1</td>
<td>5 V DC ± 5%</td>
</tr>
<tr>
<td>Current consumption without load</td>
<td>60 mA max</td>
</tr>
<tr>
<td>Current consumption with load</td>
<td>140 max (with 5 V and R=120Ω); 90 max (with 28 V and R=12)</td>
</tr>
<tr>
<td>Phase shift between signals</td>
<td>90° ± 5°</td>
</tr>
<tr>
<td>Protection (IEC 529)</td>
<td>IP67</td>
</tr>
<tr>
<td>Operating temperature - version 1</td>
<td>−20...+65 °C</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>−20...+65 °C</td>
</tr>
<tr>
<td>Permissible humidity</td>
<td>100% non-condensing</td>
</tr>
<tr>
<td>Permissible vibration (55...2000 Hz)</td>
<td>300 m/s²</td>
</tr>
<tr>
<td>Output signal shape</td>
<td>Square-wave TTL or HTL pulses</td>
</tr>
<tr>
<td>Outputs signals</td>
<td>two main + one zero and their complementary</td>
</tr>
<tr>
<td>Output scheme</td>
<td>Line driver</td>
</tr>
<tr>
<td>Weight of reading head</td>
<td>40 g</td>
</tr>
<tr>
<td>Standard cable length</td>
<td>2.0 m</td>
</tr>
<tr>
<td>Max. cable length of head</td>
<td>10.0 m</td>
</tr>
<tr>
<td>Max. cable length of encoder (2 m of head + adapter)</td>
<td>100.0 m</td>
</tr>
<tr>
<td>Electrical protections</td>
<td>from inversion of power supply polarity; from short circuit on output port</td>
</tr>
</tbody>
</table>

**READING HEAD VERSION P (MTP, CMTP, PCMTP)**

<table>
<thead>
<tr>
<th>TTL OUTPUT SIGNALS (F)</th>
<th>SINE WAVE OUTPUT SIGNALS (AV) - VERSION 2 ONLY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference (zero) signal</td>
<td>Without reference signal (version C)</td>
</tr>
<tr>
<td>Pole pitch</td>
<td>1+1 mm</td>
</tr>
<tr>
<td>Accuracy*</td>
<td>up to ±8 µm</td>
</tr>
<tr>
<td>Resolution (after x4 in CNC)</td>
<td>0.5; 1; 6; 10 µm</td>
</tr>
<tr>
<td>Max. traversing speed:</td>
<td>- MTP-F50; - MTP-F100</td>
</tr>
<tr>
<td>Max. measuring frequency</td>
<td>300 kHz</td>
</tr>
</tbody>
</table>

**READING HEAD VERSION M (MTM, CMTM, PCMTM)**

<table>
<thead>
<tr>
<th>TTL OUTPUT SIGNALS (F)</th>
<th>SINE WAVE OUTPUT SIGNALS (AV) - VERSION 2 ONLY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference (zero) signal</td>
<td>Constant pitch every 2 mm (version C)</td>
</tr>
<tr>
<td>Pole pitch</td>
<td>2+2 mm</td>
</tr>
<tr>
<td>Accuracy*</td>
<td>up to ±8 µm</td>
</tr>
<tr>
<td>Resolution (after x4 in CNC)</td>
<td>1;5;10;25;50;100;500 µm</td>
</tr>
<tr>
<td>Max. traversing speed:</td>
<td>- MTM-F10; - MTM-F100</td>
</tr>
<tr>
<td>Max. measuring frequency</td>
<td>300 kHz</td>
</tr>
</tbody>
</table>

**READING HEAD VERSION H (MTMH, CMTMH, PCMTMH)**

<table>
<thead>
<tr>
<th>TTL OUTPUT SIGNALS (F)</th>
<th>SINE WAVE OUTPUT SIGNALS (AV) - VERSION 2 ONLY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference (zero) signal</td>
<td>Constant pitch every 5 mm (version C)</td>
</tr>
<tr>
<td>Pole pitch</td>
<td>5+5 mm</td>
</tr>
<tr>
<td>Accuracy*</td>
<td>up to ±30 µm</td>
</tr>
<tr>
<td>Resolution (after x4 in CNC)</td>
<td>5; 10; 25; 50 µm</td>
</tr>
<tr>
<td>Max. traversing speed:</td>
<td>- MTH-F50; - MTH-F100</td>
</tr>
<tr>
<td>Max. measuring frequency</td>
<td>300 kHz</td>
</tr>
</tbody>
</table>

**MAGNETIC BAND**

- **Accuracy** at 20°C: ±30 (standard); ±15 (optional) µm/µm
- **Width**: 10 mm
- **Thickness**: 1.3 mm
- **Length**: 50 mm (max. 20 m max. for MP 500)
- **Thermal expansion coefficient**: 10,5 x 10⁻⁶ °C⁻¹ (at 20°C, 0°C)
- **Band radius**: 150 mm min.
- **Weight of magnetic band**: 65 g
- **Weight of protective cover**: 25 g
- **Operating temperature**: −20...+60 °C
- **Storage temperature**: −20...+60 °C

*Note: In order to ensure the accuracy of encoder magnetic band, it must be longer than ML by 80 mm (40 mm from each side).
PROTECTIVE BAND CV
Stainless steel cover CV (width 10 mm, thickness 0.3 mm) for magnetic band MP protection is glued on magnetic band (excluding MP100).

PROTECTIVE SUPPORT SP
Aluminium protective support SP for magnetic band MP protection. Fixed on machine surface and holds magnetic band. It is not possible to use the support SP if the magnetic band is already covered by stainless steel band CV.

Profile rail PS
Profile rail PS with protective band SB is used for support of magnetic band with width 10 mm. Profile rail is easy mounted and has no adhesive joints. The lengths of more than 1 m are obtained by joining together several rail modules.

Length of one module: 1 m
Length: up to 50 m (pitch 1 m)
Width and height: 25x10 mm
Material: aluminium

Protective band SB
Protective band SB is used for sliding into profile rail PS.

Length: up to 50 m (pitch 1 m)
Material: aluminium

OUTPUT SIGNALS
TTL OUTPUT SIGNALS
AV OUTPUT SIGNALS - VERSION 2 ONLY
A and B amplitude 0.6...1.2 V (~ 1 V)
R amplitude 0.25...0.6V (useful part)
A and B phase shift 90° ±10° el.
Reference voltage U0 2.5 V
Amplitudes of signals are referred to measurement made with 120 Ω impedance and power supply voltage of reading head 5V±5%.

ORDER FORM
ORDER EXAMPLE:
1) XXMT-F100-C-0-MP200/03-SP/03-W-0-02/W
2) XXMT-F500-E-0-MP500/05-CV/05-W-1-02/D9
### MK Parameters

- **Pole pitch:** 2 x 2 mm
- **Measuring length (ML):** up to 30 m
- **Incremental signal:** sine wave 1 Vpp (optional)
- **Resolution 1 Vpp:** up to 1 µm (depending on CNC division factor)
- **Repeatability:** ± 1 increment
- **Signal period:** 2 mm
- **Serial interface:** SSI or BiSS
- **Resolution absolute position:** 500, 100, 50, 10, 5, 1 µm
- **Accuracy:** ± 15 µm
- **Max. traversing speed:** 300 m/min
- **Power supply:** (5...28 V) DC ± 5%
- **Current consumption with load:** 150 mA max. (with R = 120 Ohm)

### Mechanical Data

- **Permissible tolerances for reading head mounting:**
  - Axial cable output: ± 0.5 mm
  - Radial cable output: ± 0.5 mm

### Output Signals

<table>
<thead>
<tr>
<th>Interface</th>
<th>Signals level</th>
<th>Clock frequency</th>
<th>Tc</th>
<th>Resolution 1 Vpp</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSI</td>
<td>Binary - Gray</td>
<td>0.1 - 1.2 MHz</td>
<td>12</td>
<td>65 µs</td>
</tr>
<tr>
<td>BiSS C</td>
<td>Unidirectional</td>
<td>0.1 - 4 MHz</td>
<td>12</td>
<td>20 µs</td>
</tr>
</tbody>
</table>

### Magnetic Band MP200A

- **Pole pitch:** 2 x 2 mm
- **Accuracy (at 20 °C):** ± 20 ± 80 µm/m
- **Width:** 10 mm
- **Thickness:** 1.5 mm
- **Length:** 300 m max.
- **Band radius:** 80 mm max.
- **Weight of magnetic band:** 65 g/m
- **Weight of protective cover:** 25 g/m
- **Operating temperature:** 0...+70 °C
- **Storage temperature:** 20...+80 °C

### ACCESSORIES

- **CONNECTORS FOR CABLE:**
  - B12 - 12-pin round connector
  - C12 - 12-pin round connector
  - D9 - 9-pin flat connector
  - D15 - 15-pin flat connector
  - R10 - 10-pin round connector
  - OCN - 10-pin round connector

### ORDER FORM

**MK**

| ORDER EXAMPLE: MK-XXXX-XX-XX/XX/X | CSX000 | CSX500 |

**ORDER EXAMPLE:** MK-F10-S2-V-MP200A/02-SPP/02-A02/C12

### Protective Band CV

- **Stainless steel cover:** CV (width 10 mm, thickness 0.3 mm for magnetic band)
- **Magnetic protection:** glued on magnetic band
- **Support SP:** if the magnetic band is aligned with the protective support SP. It is not possible to use the magnetic band MP protection.

### Protective Support SP

- **Aluminium protective support SP**: for magnetic band MP protection. Fixed on machine surface and holds magnetic band. It is not possible to use the support SP if the magnetic band is already covered by stainless steel band CV.

### Cable

- **For analog output + serial output:**
  - 6-wire shielded cable, Ø = 7.1 mm, PUR external sheath. Inside the cable, a further shield for the twisted pair of the digital signals (SSI-BiSS) is presented.
  - Conductors section: supply ± 0.05 mm², signals ± 0.10 mm²
  - Cable's bending radius should not be lower than 45 mm.

### ACCESSORIES

- **CONNECTORS FOR CABLE:**
  - R01-1m radial
  - D9 - flat, 9 pins
  - D12 - flat, 12 pins
  - A01-1m axial

### Digital Readout Devices

<table>
<thead>
<tr>
<th>MODEL</th>
<th>ORDER EXAMPLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSX000</td>
<td>MK-F10-S2-V-MP200A/02-SPP/02-A02/C12</td>
</tr>
</tbody>
</table>

**NOTE:** Encoder is supplied with flexible cable, that consists of twisted pair of low friction shield; electrical connection between the body of the connectors and the cables' shield; - minimum power supply voltage of 5 V to the head.
Precizika Metrology manufactured encoders are accompanied by a variety of different accessories. These include encoder couplings, external interpolators, digital readout devices and connectors. There are many options of these accessories depending on customer requirements and needs.
**MECHANICAL DATA**

<table>
<thead>
<tr>
<th>Coupling model</th>
<th>SC30</th>
<th>SC70</th>
<th>SC98-1</th>
<th>SC98-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kinematic accuracy (with parallel offset ≤ 0.05 mm and angular misalignment ≤ 0.05°)</td>
<td>±10 arc sec</td>
<td>±2 arc sec</td>
<td>±0.5 arc sec</td>
<td>±1 arc sec</td>
</tr>
<tr>
<td>Torsional rigidity</td>
<td>150 Nm/rad</td>
<td>4000 Nm/rad</td>
<td>6000 Nm/rad</td>
<td>4000 Nm/rad</td>
</tr>
<tr>
<td>Permissible torque</td>
<td>0.1 Nm</td>
<td>0.5 Nm</td>
<td>1 Nm</td>
<td>1 Nm</td>
</tr>
<tr>
<td>Moment of inertia (approx.)</td>
<td>3×10⁻¹ kgm²</td>
<td>2×10⁻¹ kgm²</td>
<td>2×10⁻¹ kgm²</td>
<td>1.7×10⁻¹ kgm²</td>
</tr>
<tr>
<td>Permissible radial misalignment</td>
<td>≤ 0.2 mm</td>
<td>≤ 0.3 mm</td>
<td>≤ 0.3 mm</td>
<td>≤ 0.3 mm</td>
</tr>
<tr>
<td>Permissible angular error</td>
<td>≤ 1°</td>
<td>≤ 0.5°</td>
<td>1°</td>
<td>0°</td>
</tr>
<tr>
<td>Permissible axial misalignment</td>
<td>≤ 0.2 mm</td>
<td>≤ 0.2 mm</td>
<td>≤ 0.2 mm</td>
<td>≤ 0.2 mm</td>
</tr>
<tr>
<td>Permissible shaft speed</td>
<td>16000 rpm</td>
<td>3000 rpm</td>
<td>1000 rpm</td>
<td>1000 rpm</td>
</tr>
<tr>
<td>Weight</td>
<td>0.027 kg</td>
<td>0.22 kg</td>
<td>0.25 kg</td>
<td>0.21 kg</td>
</tr>
<tr>
<td>Encoder compatibility</td>
<td>A28, A36, AK36, AM, AK50, AS6, AK36, AP58, A110, A170</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**ORDER FORM**

<table>
<thead>
<tr>
<th>MODEL</th>
<th>DIAMETER, D₁</th>
<th>DIAMETER, D₂</th>
<th>LENGTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>SC30</td>
<td>05 - Ø4mm</td>
<td>05 - Ø4mm</td>
<td>22 - 22mm</td>
</tr>
<tr>
<td>SC30-2</td>
<td>05 - Ø4mm</td>
<td>05 - Ø4mm</td>
<td>22 - 22mm</td>
</tr>
<tr>
<td>SC98-1</td>
<td>08 - Ø5mm</td>
<td>08 - Ø5mm</td>
<td>30 - 30mm</td>
</tr>
<tr>
<td>SC98-2</td>
<td>08 - Ø5mm</td>
<td>08 - Ø5mm</td>
<td>30 - 30mm</td>
</tr>
</tbody>
</table>

*only for SC30
**ACCESSORIES**

<table>
<thead>
<tr>
<th>CONNECTORS FOR CABLE</th>
<th>B12 12-pin round connector</th>
<th>C9 9-pin round connector</th>
<th>C12 12-pin round connector</th>
<th>D9 9-pin flat connector</th>
<th>D15 15-pin flat connector</th>
<th>RS10 10-pin round connector</th>
<th>ONC 10-pin round connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable Ø6 mm</td>
<td>Armoured cable Ø6 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**DIGITAL READOUT DEVICES**

| CS3000 | CS5500 |

**MECHANICAL DATA**

**Input signals (A):**
- Incremental signals
- Reference signal

**Input signals (AV):**
- Incremental signals
- Reference signal

**Input signals: 7-16 mA, 2-8 mA**

**Output signals:**
- TTL (RS422) compatible

**Operating voltage:** 5 V

**Max input frequency:** 50 kHz

**Possible input connector / cable:**
- C9, D9, D15, ONC, RS10

**Possible output connector / cable:**
- C12, D9, D15, ONC, RS10

**Signal interpolation:**
- NK-1
- NK-2
- NK-3
- NK-4
- NK-5
- NK-8
- NK-10

**Encoder compatibility:**

**Input signals (A):**
- Reference signal

**Input signals (AV):**
- Reference signal

**Output signals:**
- TTL (RS422) compatible

**Operating voltage:** 5 V

**Max input frequency:** 50 kHz

**Possible input connector / cable:**
- C9, D9, D15, ONC, RS10

**Possible output connector / cable:**
- C12, D9, D15, ONC, RS10

**Signal interpolation:**
- NK-1
- NK-2
- NK-3
- NK-4
- NK-5
- NK-8
- NK-10

**Encoder compatibility:**

**Output connector:**
- C9, C12

**Armoured cable:**
- Ø10

**CABLE:**
- Cable Ø6 mm
- Armoured cable Ø6 mm

**ORDER FORM**

| NK - XXX - XXXX - XXXXXXXX - XXXXX - XXXXXXXX |
|---|---|---|---|---|
| INTERPOLATION FACTOR | INPUT SIGNALS | INPUT CONNECTORS (9/12 PIN) (OR CABLE TYPE) | INPUT CABLE LENGTH (IF C OR CP SELECTED) | CONNECTION ON INPUT CABLE END |
| 1 | A - [1]/V | D9 - 9 pins (C9 - round, 10 pins) | C - cable Ø6 mm | C - without cable |
| 2 | A - [1]/V | D9 - 9 pins (C9 - round, 10 pins) | C - cable Ø6 mm | C - without cable |
| 3 | A - [1]/V | D9 - 9 pins (C9 - round, 10 pins) | C - cable Ø6 mm | C - without cable |
| 4 | A - [1]/V | D9 - 9 pins (C9 - round, 10 pins) | C - cable Ø6 mm | C - without cable |
| 5 | A - [1]/V | D9 - 9 pins (C9 - round, 10 pins) | C - cable Ø6 mm | C - without cable |
| 6 | A - [1]/V | D9 - 9 pins (C9 - round, 10 pins) | C - cable Ø6 mm | C - without cable |

**ORDER EXAMPLES:**

1) NK-5-C-01/D15-C-02-C12
2) NK-10-D9-W/W-D15-W/W
3) NK-10-D9-W/W-D15-W/W
4) NK-10-D9-W/W-D15-W/W

**The positions of switches depending on interpolation factor and linear/rotary encoder reference mark width**

**Reference mark width T/4**

**Reference mark width T/2**

**Encoder compatibility:**
CS 3000
TWO AND THREE AXIS READOUT DEVICES

**TECHNICAL DATA**

- **Input standard**: RS 422
- **Power supply for encoders**: +5 V DC
- **Resolution of linear encoders**: 0.1; 0.2; 0.5; 1; 5; 10; 20; 50 µm; 0.1; 0.2; 0.5; 1; 5 mm
- **Resolution of rotary encoder**: 1° - 0.0001°
- **LED green display, 7 digit and sign**: 14 mm height
- **Maximum input signals frequency**: 100 kHz
- **Power supply**: DC 8-30 V/0.8A
- **Power supply adapter**: - input: AC 100V ~ 240V, 50Hz/60Hz
  - output: DC 8-30 V; 0.8A
- **Power consumption**: 5 W
- **Overall dimensions**: 214 x 139 x 29.5 mm
- **Weight**: 0.9 kg
- **Operation temperature range**: 0°C - +50°C

**FEATURES**

- Measuring in millimeters or inches (inch/mm)
- Radius calculation (1/2)
- Measuring in relative or absolute coordinate system (INC/ABS)
- Entering or setting zero values for the selected axis
- Memory for last position after switch off
- Linear movement measurement (by means of linear encoders)
- Rotary movement measurement (by means of rotary encoders)
- Movement direction indication
- Error correction: linear compensation
- Serial interface RS232

**COMPATIBLE WITH:**

**ORDER FORM**

- CS - XXXX - X

<table>
<thead>
<tr>
<th>DIGITAL READOUT DEVICE</th>
<th>NUMBER OF AXIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>3000 - two or three axis</td>
<td>1 - two axis</td>
</tr>
<tr>
<td>3500 - advanced to three axis</td>
<td>1 - three axis</td>
</tr>
</tbody>
</table>

ORDER EXAMPLE:
- CS-3000-2

CS 5500
ADVANCED TWO AND THREE AXIS READOUT DEVICES

**TECHNICAL DATA**

- **Input standard**: RS 422
- **Power supply for encoders**: +5 V DC
- **Resolution of linear encoders**: 0.1; 0.2; 0.5; 1; 5; 10; 20; 50 µm
- **Resolution of rotary encoder**: 1° - 0.0001°
- **LED green display, 7 digit and sign**: 14 mm height
- **Maximum input signals frequency**: 500 kHz
- **Power supply**: AC 85V – 230V
- **Power consumption**: 5 W
- **Overall dimensions**: 295 x 182 x 30.5 mm
- **Weight**: 2.6 kg
- **Operation temperature range**: 0°C - +50°C

**FEATURES**

- Measuring in millimeters or inches (inch/mm)
- Measuring system calibration in relation to reference point (REF)
- Radius calculation (1/2)
- Measuring in relative or absolute coordinate system (INC/ABS)
- Entering or setting zero values for the selected axis
- Linear movement measurement (by means of linear encoders)
- Rotary movement measurement (by means of rotary encoders)
- Memory for last position after switch off
- Entering shrinkage rate
- Setting 999 datum systems in SMD mode
- Movement direction indication
- Error correction: linear compensation
- Inside calculator
- Serial interface RS232

**COMPATIBLE WITH:**

**ORDER FORM**

- CS - XXXX - X

<table>
<thead>
<tr>
<th>DIGITAL READOUT DEVICE</th>
<th>NUMBER OF AXIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>5500 - advanced to three axis</td>
<td>1 - two axis</td>
</tr>
<tr>
<td>3500 - advanced to three axis</td>
<td>1 - three axis</td>
</tr>
</tbody>
</table>

ORDER EXAMPLE:
- CS-5500-2

**MECHANICAL DATA**

**COMPATIBLE WITH:**
ENCODER ELECTRICAL CONNECTION
FOR ~ 11 µA

9-PINS FLAT CONNECTOR D9, MALE

For cable

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>0V</td>
</tr>
</tbody>
</table>

For housing

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
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<tbody>
<tr>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>0V</td>
</tr>
</tbody>
</table>

*External shield is connected to connector housing. Internal shield is connected to 0V. When connector is placed on encoder housing the internal shield is missing.

9-PINS ROUND CONNECTOR C9, MALE

For cable

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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<th>7</th>
<th>8</th>
<th>9</th>
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</thead>
<tbody>
<tr>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>0V</td>
<td>Shield</td>
</tr>
</tbody>
</table>

For housing

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>0V</td>
<td>Shield</td>
</tr>
</tbody>
</table>

*External shield is connected to connector housing. Internal shield is connected to 0V. When connector is placed on encoder housing the internal shield is missing.

10-PINS ROUND CONNECTOR OMC, MALE

For cable

<table>
<thead>
<tr>
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<th>3</th>
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<tbody>
<tr>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>0V</td>
<td>Shield</td>
<td></td>
</tr>
</tbody>
</table>

For housing

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>0V</td>
<td>Shield</td>
<td></td>
</tr>
</tbody>
</table>

*External shield is connected to connector housing. Internal shield is connected to 0V. When connector is placed on encoder housing the internal shield is missing.

12-PINS ROUND MINI CONNECTOR HR10A

For cable

<table>
<thead>
<tr>
<th>1</th>
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<th>3</th>
<th>4</th>
<th>5</th>
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<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
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<tr>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>0V</td>
<td>Shield</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For housing

<table>
<thead>
<tr>
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<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>0V</td>
<td>Shield</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*External shield is connected to connector housing. Internal shield is connected to 0V. When connector is placed on encoder housing the internal shield is missing.

8-PINS ROUND MINI CONNECTOR HR25

For cable

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>0V</td>
</tr>
</tbody>
</table>

For housing

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
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<tbody>
<tr>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>0V</td>
</tr>
</tbody>
</table>

ENCODER ELECTRICAL CONNECTION
FOR ~ 1 Vpp; TTL; HTL

9-PINS FLAT CONNECTOR D9, MALE

For cable

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>A+</td>
<td>A-</td>
<td>B+</td>
<td>B-</td>
<td>R+</td>
<td>R-</td>
<td>+5V</td>
<td>0V</td>
<td>Shield</td>
<td></td>
</tr>
</tbody>
</table>

TTL, U = +5V

For housing

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>A+</td>
<td>A-</td>
<td>B+</td>
<td>B-</td>
<td>R+</td>
<td>R-</td>
<td>+5V</td>
<td>0V</td>
<td>Shield</td>
<td></td>
</tr>
</tbody>
</table>

*External shield is connected to connector housing. Internal shield is connected to 0V. When connector is placed on encoder housing the internal shield is missing.

12-PINS ROUND CONNECTOR C12, MALE

For cable

<table>
<thead>
<tr>
<th>5</th>
<th>6</th>
<th>8</th>
<th>1</th>
<th>3</th>
<th>4</th>
<th>12</th>
<th>10</th>
<th>2</th>
<th>11</th>
</tr>
</thead>
<tbody>
<tr>
<td>A+</td>
<td>A-</td>
<td>B+</td>
<td>B-</td>
<td>R+</td>
<td>R-</td>
<td>+5V</td>
<td>Sensor +5V</td>
<td>Sensor 0V</td>
<td></td>
</tr>
</tbody>
</table>

TTL, U = +5V

For housing

<table>
<thead>
<tr>
<th>5</th>
<th>6</th>
<th>8</th>
<th>1</th>
<th>3</th>
<th>4</th>
<th>12</th>
<th>10</th>
<th>2</th>
<th>11</th>
</tr>
</thead>
<tbody>
<tr>
<td>A+</td>
<td>A-</td>
<td>B+</td>
<td>B-</td>
<td>R+</td>
<td>R-</td>
<td>+5V</td>
<td>Sensor +5V</td>
<td>Sensor 0V</td>
<td></td>
</tr>
</tbody>
</table>

*External shield is connected to connector housing. Internal shield is connected to 0V. When connector is placed on encoder housing the internal shield is missing.

12-PINS ROUND CONNECTOR C12T, MALE

For cable

<table>
<thead>
<tr>
<th>5</th>
<th>6</th>
<th>8</th>
<th>1</th>
<th>3</th>
<th>4</th>
<th>12</th>
<th>10</th>
<th>2</th>
<th>11</th>
</tr>
</thead>
<tbody>
<tr>
<td>A+</td>
<td>A-</td>
<td>B+</td>
<td>B-</td>
<td>R+</td>
<td>R-</td>
<td>+10...30V</td>
<td>Sensor +10...30V</td>
<td>Sensor 0V</td>
<td></td>
</tr>
</tbody>
</table>

TTL, U = +10...30V

For housing

<table>
<thead>
<tr>
<th>5</th>
<th>6</th>
<th>8</th>
<th>1</th>
<th>3</th>
<th>4</th>
<th>12</th>
<th>10</th>
<th>2</th>
<th>11</th>
</tr>
</thead>
<tbody>
<tr>
<td>A+</td>
<td>A-</td>
<td>B+</td>
<td>B-</td>
<td>R+</td>
<td>R-</td>
<td>+10...30V</td>
<td>Sensor +10...30V</td>
<td>Sensor 0V</td>
<td></td>
</tr>
</tbody>
</table>

*External shield is connected to connector housing. Internal shield is connected to 0V. When connector is placed on encoder housing the internal shield is missing.
**ENCODER ELECTRICAL CONNECTION**

**FOR ~ 1VPP; TTL; HTL**

### 12-PINS ROUND CONNECTOR B12, MALE

<table>
<thead>
<tr>
<th>Pin number</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>L</th>
<th>G</th>
<th>H</th>
<th>K</th>
<th>B</th>
<th>A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td>Pink</td>
<td>Grey</td>
<td>White</td>
<td>Brown</td>
<td>Yellow</td>
<td>Green</td>
<td>Red</td>
<td>Blue</td>
<td>Shield</td>
</tr>
<tr>
<td>AV (&lt; 1V)</td>
<td>A+</td>
<td>A-</td>
<td>B+</td>
<td>B-</td>
<td>R+</td>
<td>R-</td>
<td>+5V</td>
<td>0V</td>
<td>Shield</td>
</tr>
<tr>
<td>TTL, U = +5V</td>
<td>U1</td>
<td>U1</td>
<td>U2</td>
<td>U2</td>
<td>U0</td>
<td>U0</td>
<td>+5V</td>
<td>OV</td>
<td>OV</td>
</tr>
<tr>
<td>HTL, U = +(10...30)V</td>
<td>U1</td>
<td>U1</td>
<td>U2</td>
<td>U2</td>
<td>U0</td>
<td>U0</td>
<td>+10...30V</td>
<td>OV</td>
<td>OV</td>
</tr>
</tbody>
</table>

*External shield is connected to connector housing. Internal shield is connected to 0V.*

### 15-PINS FLAT CONNECTOR D15, MALE

#### For cable

<table>
<thead>
<tr>
<th>Pin number</th>
<th>3</th>
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<th>4</th>
<th>14</th>
<th>5</th>
<th>15</th>
<th>1</th>
<th>2</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td>Pink</td>
<td>Grey</td>
<td>White</td>
<td>Brown</td>
<td>Yellow</td>
<td>Green</td>
<td>Red</td>
<td>Blue</td>
<td>Shield</td>
</tr>
<tr>
<td>TTL, U = +5V</td>
<td>U1</td>
<td>U1</td>
<td>U2</td>
<td>U2</td>
<td>U0</td>
<td>U0</td>
<td>+5V</td>
<td>OV</td>
<td>OV</td>
</tr>
</tbody>
</table>

*External shield is connected to connector housing. Internal shield is connected to 0V.*

#### For housing

<table>
<thead>
<tr>
<th>Pin number</th>
<th>3</th>
<th>13</th>
<th>4</th>
<th>14</th>
<th>5</th>
<th>15</th>
<th>1</th>
<th>2</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td>Pink</td>
<td>Grey</td>
<td>White</td>
<td>Brown</td>
<td>Yellow</td>
<td>Green</td>
<td>Red</td>
<td>Blue</td>
<td>Shield</td>
</tr>
<tr>
<td>TTL, U = +5V</td>
<td>U1</td>
<td>U1</td>
<td>U2</td>
<td>U2</td>
<td>U0</td>
<td>U0</td>
<td>+5V</td>
<td>OV</td>
<td>OV</td>
</tr>
</tbody>
</table>

*External shield is connected to connector housing. Internal shield is connected to 0V.*

### 12-PINS FLAT CONNECTOR D15T, MALE

<table>
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<th>Pin number</th>
<th>3</th>
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<th>8</th>
<th>7</th>
<th>10</th>
<th>12</th>
<th>1</th>
<th>2</th>
<th>9</th>
<th>11</th>
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<tbody>
<tr>
<td>Color</td>
<td>Pink</td>
<td>Grey</td>
<td>White</td>
<td>Yellow</td>
<td>Green</td>
<td>Red</td>
<td>Blue</td>
<td>Black</td>
<td>Violet</td>
<td>-</td>
</tr>
<tr>
<td>TTL, U = +5V</td>
<td>U+</td>
<td>U-</td>
<td>U+</td>
<td>U-</td>
<td>U+</td>
<td>U-</td>
<td>+5V</td>
<td>OV</td>
<td>Sensor+5V</td>
<td>Sensor OV</td>
</tr>
<tr>
<td>TTL, U = +5V</td>
<td>U+</td>
<td>U-</td>
<td>U+</td>
<td>U-</td>
<td>U+</td>
<td>U-</td>
<td>+5V</td>
<td>OV</td>
<td>Sensor+5V</td>
<td>Sensor OV</td>
</tr>
</tbody>
</table>

*External shield is connected to connector housing. Internal shield is connected to 0V.*

### 10-PINS ROUND CONNECTOR RS10, MALE

#### For cable

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<th>2</th>
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<th>4</th>
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</thead>
<tbody>
<tr>
<td>Color</td>
<td>Pink</td>
<td>Grey</td>
<td>White</td>
<td>Brown</td>
<td>Yellow</td>
<td>Green</td>
<td>Red</td>
<td>Blue</td>
<td>Shield</td>
</tr>
<tr>
<td>TTL, U = +5V</td>
<td>U1</td>
<td>U1</td>
<td>U1</td>
<td>U2</td>
<td>U2</td>
<td>U0</td>
<td>U0</td>
<td>+5V</td>
<td>OV</td>
</tr>
</tbody>
</table>

*External shield is connected to connector housing. Internal shield is connected to 0V.*

#### For housing

<table>
<thead>
<tr>
<th>Pin number</th>
<th>5</th>
<th>8</th>
<th>3</th>
<th>6</th>
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<th>1</th>
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<td>Pink</td>
<td>Grey</td>
<td>White</td>
<td>Brown</td>
<td>Yellow</td>
<td>Green</td>
<td>Red</td>
<td>Blue</td>
<td>Shield</td>
</tr>
<tr>
<td>TTL, U = +5V</td>
<td>U1</td>
<td>U1</td>
<td>U1</td>
<td>U2</td>
<td>U2</td>
<td>U0</td>
<td>U0</td>
<td>+5V</td>
<td>OV</td>
</tr>
</tbody>
</table>

*External shield is connected to connector housing. Internal shield is connected to 0V.*

### 10-PINS ROUND CONNECTOR HR10A

#### For cable

<table>
<thead>
<tr>
<th>Pin number</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td>Pink</td>
<td>Grey</td>
<td>White</td>
<td>Brown</td>
<td>Yellow</td>
<td>Green</td>
<td>Red</td>
<td>Blue</td>
</tr>
<tr>
<td>TTL</td>
<td>A+</td>
<td>A-</td>
<td>B+</td>
<td>B-</td>
<td>R+</td>
<td>R-</td>
<td>+5V</td>
<td>OV</td>
</tr>
<tr>
<td>TTL</td>
<td>U+</td>
<td>U-</td>
<td>U+</td>
<td>U-</td>
<td>U+</td>
<td>U-</td>
<td>+5V</td>
<td>OV</td>
</tr>
<tr>
<td>TTL</td>
<td>U+</td>
<td>U-</td>
<td>U+</td>
<td>U-</td>
<td>U+</td>
<td>U-</td>
<td>+5V</td>
<td>OV</td>
</tr>
</tbody>
</table>

**CABLE LENGTHS**

Maximal encoder (linear of rotary) cable length depending on output signal type is:
- sine-wave current signal A (~ 11 µA) ~ 5 m;
- sine-wave voltage signal AV (~ 1V) ~ 25 m;
- square-wave signal F (TTL) ~ 25 m;
- square-wave signal F (HTL) ~ 25 m.

The encoders can be equipped with additional prolonging cable (diameter 7 mm) with different cable connectors: ONC, RS10, D9, C9, C12, B12 depending on customer requirements. This cable has an additional sensor circuits U and OV.

Linear encoder cable can be protected by metal hose with additional plastic cover (IP64) type SYV. Metal hose has diameter of 10 mm.
Precizika Metrology has a long history of old traditions in the leadership of design and production of metrological equipment – rotary, angle, linear encoders and optical encoder gratings. The Lithuanian company has been in the industry for over 50 years and with this heritage comes both pride and great responsibility to continuously move forward, improve and evolve in order to satisfy the ever-changing industry needs. A huge part of time spent in the industry was dedicated to working with top-of-the-line original equipment manufacturing (OEM) companies, listening to their feedback and providing innovative solutions to a variety of diverse conundrums.

Consistent supply of high quality products and services that match or exceed the quality standards our customers expect and deserve is the main goal that drives us forward, constantly investing in new projects, future proof equipment and bright minds.

The ability to take advantage of accumulated know-how and to channel the experience provides us with a unique perspective and position in the market that opens new ways to innovate and provide industry defining product solutions.

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