1961
Company was founded.

1962
First Circular Grinding Machine 3E153

1965
First Circumference Measuring Device BE-20A

1966
First Gear Processing Machine 5310A

1969
First Linear Encoder BE-76

1969
Established a Joint Venture with Brown & Sharpe USA

1971
Beginning of Rotary Encoder Serial Production

1974
High Precision Gear Processing Machine BE-62

1974
The National Science Prize for Encoders Development

1974
Developed New Device for Encoder Inspection BE-178

1977
First Coordinate Measuring Machine BE-140K

1977
100% Ownership and Name Change to Precizika Metrology

1979
First Coordinate Measuring Machine BE-140K

1979
Company was Purchased by Hexagon Group.

1983
The National Science Prize for Encoders Development

1991
Established a Joint Venture with Brown & Sharpe USA

2000
100% Ownership and Name Change to Precizika Metrology

2007
Company was Purchased by Hexagon Group.

2013
Innovation Prize

2016
New Production Facilities

2015
Lithuanian Product of the Year
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 |

| WHAT WE VALUE |

- **Communication** with potential customers and partners that is sincere, open and honest.
- **Timeliness** in providing high quality products and services the customer expects.
- **Reliability** and high quality standards of every single manufactured product without any exceptions.
- **Passion** for innovating, developing new technological advancements and upgrades.
- **Partnerships** that are strong, unwavering, inspired by mutual understanding and goals.
- **Flexibility** towards customer demands for adjustments and incremental updates.
**| 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%**

- I₂ lags I₁ for clockwise rotation (viewed from shaft side)
- Output signals I₁, I₂ amplitude at load 1kΩ:
  - I₁: 7...16 μA
  - I₂: 2...5 μA (useful part)
- Value of reference signal I₀ at load 1kΩ:
  - I₀: 0.6...1.2 V
- Phase difference between signals I₁ and I₂: 90° ± 10°
- Phase difference between signals I₁ and I₀: 135° ± 60°

**REFLECTIVE TYPE ENCODERS**

**PHOTOLELECTRIC LINEAR ENCODERS**

**PHOTOELECTRIC ROTARY ENCODERS**

**REFLECTIVE TYPE ENCODERS**

**MAGNETIC ENCODERS**

**Recommended connection diagram**

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

- B₂ lags A for clockwise rotation (viewed from shaft side)
- Output signals A, B amplitude at load 1kΩ:
  - A: 0.6...1.2 V
  - B: 0.2...0.8 V (useful part)
- Value of reference signal at load 1kΩ:
  - A₀: 0.6...1.2 V
  - B₀: 0.2...0.8 V
- Phase difference between signals A and B: 90° ± 10°
- Phase difference between signals A and R: 135° ± 60°

**Recommended connection diagram**

**TTL (TU) 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:
  - I₁: 1.9...2.4 V
  - I₀: 0.7...0.9 V
- Maximum rise and fall time: 0.1...0.2 ms
- Reference signal delay is no bigger than 0.1 μs

**Recommended connection diagram**

**HTL (TU) 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:
  - I₁: 1.9...2.4 V
  - I₀: 0.7...0.9 V
- Maximum rise and fall time: 0.3 ms
- Reference signal delay is no bigger than 0.1 μs

**Recommended connection diagram**

**SSI**

- Clock
- Data
- TDC 2.08 ms ± 1.2 μs
- tCP 100 ns
- tSH 50 ns
- tSL 50 ns
- tSD 50 ns
- tDD 0.16 μs
- tED 2.5 μs
- dP 3.28 ms ± 100 ns

**Recommended connection scheme**

**BISS C**

- Clock
- State
- Min 50ns
- Max 100ns
- 6V 30ns
- 6V 50ns
- 10V 10ns
- Timeout 3.28 ms ± 100 ns

**Recommended connection diagram**

**UVW**

- U
- V
- W
- Phase difference between signals U, V, W: 90° ± 10°
- Phase difference between signals U and V: 135° ± 60°
### Rotary Encoders

<table>
<thead>
<tr>
<th>Code</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>A28</td>
</tr>
<tr>
<td>14</td>
<td>A36</td>
</tr>
<tr>
<td>16</td>
<td>AK36</td>
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<tr>
<td>18</td>
<td>A42M</td>
</tr>
<tr>
<td>20</td>
<td>A75M</td>
</tr>
<tr>
<td>22</td>
<td>AK50</td>
</tr>
<tr>
<td>24</td>
<td>A58</td>
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<td>28</td>
<td>AK58</td>
</tr>
<tr>
<td>34</td>
<td>A58HE</td>
</tr>
<tr>
<td>36</td>
<td>A58HE</td>
</tr>
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<td>38</td>
<td>A58HME</td>
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<tr>
<td>40</td>
<td>A58HE1</td>
</tr>
<tr>
<td>42</td>
<td>A102H</td>
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<tr>
<td>44</td>
<td>AM</td>
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### Angle Encoders

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<thead>
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<th>Code</th>
<th>Model</th>
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<tbody>
<tr>
<td>48</td>
<td>A90H</td>
</tr>
<tr>
<td>50</td>
<td>A110</td>
</tr>
<tr>
<td>52</td>
<td>A170</td>
</tr>
<tr>
<td>54</td>
<td>A170H</td>
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<tr>
<td>56</td>
<td>A200H</td>
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### Linear Encoders

<table>
<thead>
<tr>
<th>Code</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
<td>L18</td>
</tr>
<tr>
<td>62</td>
<td>L18B</td>
</tr>
<tr>
<td>64</td>
<td>L18T</td>
</tr>
<tr>
<td>66</td>
<td>L23</td>
</tr>
<tr>
<td>68</td>
<td>LK24</td>
</tr>
<tr>
<td>70</td>
<td>L35</td>
</tr>
<tr>
<td>72</td>
<td>L35T</td>
</tr>
<tr>
<td>74</td>
<td>L37</td>
</tr>
<tr>
<td>76</td>
<td>L50</td>
</tr>
<tr>
<td>78</td>
<td>MT</td>
</tr>
<tr>
<td>84</td>
<td>MK</td>
</tr>
</tbody>
</table>

### Accessories

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>88</td>
<td>SC</td>
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<tr>
<td>90</td>
<td>NK</td>
</tr>
<tr>
<td>92</td>
<td>CS 3000</td>
</tr>
<tr>
<td>93</td>
<td>CS 5500</td>
</tr>
<tr>
<td>94</td>
<td>Encoder electrical connection</td>
</tr>
<tr>
<td>97</td>
<td>Cable lengths</td>
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</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>Σ1 Vpp, 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, BiSS C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Up to 40 bit multiturn</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A42M</td>
<td></td>
<td>1,000; 2,500</td>
<td>± 0.1T</td>
<td>Hollow</td>
<td>Σ1 Vpp + Σ1 Vpp</td>
</tr>
<tr>
<td>A75M</td>
<td></td>
<td>512; 2,048</td>
<td>± 0.1T</td>
<td>Hollow</td>
<td>Σ1 Vpp</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>(including HE, HME, HE1)</td>
<td>100 – 10,800</td>
<td>± 0.1T</td>
<td>Solid/hollow/ blind shaft**</td>
<td>Σ1 Vpp + Σ1 Vpp</td>
</tr>
<tr>
<td>AK58</td>
<td></td>
<td>Up to 21 bit singleturn</td>
<td>± 0.1T</td>
<td>Solid</td>
<td>SSI, BiSS C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Up to 40 bit multiturn</td>
<td></td>
<td></td>
<td></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>Σ1 Vpp</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**

**MECHANICAL DATA**

- **Line number on disc (Z):** 60; 100; 200; 250; 360; 500; 1000; 1224; 1500; 2000; 2500
- **Number of output pulses per revolution:** Z x k, where k=1,2,3,4,5,8,10
- **Maximum shaft speed:** 6000 rpm
- **Maximum shaft load:**
  - axial: 5N
  - radial (at shaft end): 10N
- **Accuracy:** ±0.1°, arc sec
- **Starting torque at 20°C:** < 0.015 Nm
- **Rotor moment of inertia:** < 2 gcm²

**ELECTRICAL DATA**

- **Line number on disc (Z):** 60; 100; 200; 250; 360; 500; 1000; 1224; 1500; 2000; 2500
- **Number of output pulses per revolution:** Z x k, where k=1,2,3,4,5,8,10
- **Maximum shaft speed:** 6000 rpm
- **Maximum shaft load:**
  - axial: 5N
  - radial (at shaft end): 10N
- **Accuracy:** ±0.1°, arc sec
- **Starting torque at 20°C:** < 0.015 Nm
- **Rotor moment of inertia:** < 2 gcm²

**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 | 2000000000 | 2000 / 5 / X |

**PULSE NUMBER PER REVOLUTION:**

| (OPTIONAL) LINE NUMBER ON DISC (Z): |

**CABLE LENGTH AND OUTLET:**

| CONNECTOR TYPE | COUPLING |

**ORDER EXAMPLES:**

- A28-F-2000/5/50/SC30
- A28-F-2000/5/50/SC30
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 (Z): 100; 200; 250; 360; 500; 1000; 1024; 1500; 2000; 2500; 3600
- Number of output pulses per revolution: 2 x k, where k = 1, 2, 3, 4, 5, 8, 10
- Maximum shaft speed: 10000 rpm
- Maximum shaft load: - axial: 5N; 10N
- Accuracy (T-period of lines on disc in arc. sec): ±0.17 arc. sec
- Starting torque at 20°C: 2.5 µNm
- Rotor moment of inertia: < 2 gcm²
- Protection (IEC 529): IP54 and IP64
- Maximum weight without cable: 0.07 kg

ELECTRICAL DATA

- Supply voltage: ±5 V ± 5%
- Max. supply current (without load): 80 mA; 120 mA; 120 mA
- Light source: LED
- Incremental signals: Two sinusoidal I₁ and I₂ Amplitude at 1 kHz load
  - I₁ = 7.16 µA
  - I₂ = 7.16 µA
- Differential sine -A / A and -B / B: Amplitude at 120 kHz load
  - A = 0.6 ± 0.2 V
  - B = 0.6 ± 0.2 V
- Reference signal: One complementary +R and its differential square-wave U₀ per revolution
  - Signal magnitude at 120W load: - R = 0.2 ± 0.5 V (usable component)
- Output signals: One quasi-triangular +R and its complementary -R per revolution
  - Signal magnitude at 120W load: - R = 0.2 ± 0.5 V (usable component)
- Direction of signals: +B lags +A for clockwise rotation (viewed from shaft side)
- Maximum rise and fall time: < 0.5 µs
- Standard cable length: 1 m, without connector
- Maximum cable length: 25 m
- Supply voltage: +5 V ± 5%; +(10 to 30) V
- Max. operating frequency: ±0.1 µs (usable component)
- Permissible shock (11 ms): 0.002 Nm
- Permissible vibration (200 Hz): ±100 m/s²
- Permissible shock (11 ms): ±300 m/s²
- For IP54 (standard)

ACCESSORIES

- CONNECTORS FOR CABLE: C12 - round, 12 pins, D15 - flat, 15 pins, ONC - round, 10 pins
- DIGITAL READOUT DEVICES: CS3000, CS5500
- COUPLING: SC30
- EXTERNAL INTERPOLATOR: NK

ORDER FORM

A36

- SUPPLY VOLTAGE: 0V / 5V, 30V ± 10 V
- CABLE LENGTH AND OUTLETS: W - without connector
- CONNECTOR TYPE: B12 - round, 12 pins, C12 - round, 12 pins, D12 - round, 12 pins
- COUPLING: 0 - without coupling

ORDER EXAMPLES:

1) A36-A-2500-05V-A01/W-0 / 2) A36-F-3600-05V-A02/C12-1

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.
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:
  - axial: 5N
  - radial (at shaft end): 10N
- Starting torque at 20°C: 0.002 Nm
- Rotor moment of inertia: < 2 gcm²
- Protection (IEC 529):
  - Standard: IP54
  - Optional: IP64
- Maximum weight without cable: 0.1 kg

**Operating temperature:**
- Singleturn version: -20...+80 °C
- Multiturn version: -10...+70 °C

**Storage temperature:**
- Singleturn version: -30...+60 °C
- Multiturn version: -20...+60 °C

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

**Permissible vibration (65 to 2000 Hz):** ≤ 100 m/s²

**Permissible shock (11 ms):** ≤ 500 m/s²

**ACCESSORIES**

- CONNECTORS FOR CABLE:
  - C9: 9-pin round connector
  - C12: 12-pin round connector
  - D9: 9-pin flat connector
- COUPLING:
  - SC30

**ELECTRICAL DATA**

- Resolution:
  - Singleturn version: 9...21 bit
  - Multiturn version: 9...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

**VERSIONS:***

- Singleturn
- Multiturn

**OUTPUT SIGNALS INTERFACE (SERIAL):***

- SSI
- BiSS C

**BIT NUMBER:**

- Singleturn
- Multiturn

**OUTPUT CODE:**

- Gray
- Binary

**CABLE LENGTH:**

- Connector type:
  - Without connector
  - With coupling

**COUPLING:**

- SC30

**ORDER EXAMPLES:**

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

* See electrical data for possible bit selection with specific interface.
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

- Line number on disc (z) = 1000, 2500 (others on request)
- Number of output pulses per revolution for A42M-F = 20000 rpm
- Max. permissible mechanical rotation speed = 20000 rpm
- Accuracy (T, period of lines on disc in arc. sec.) = ±0.1°/1000
- Permissible axial shaft run out = 0.05 mm
- Hub inside diameter = 10, 8, 6 mm
- Rotor moment of inertia = < 0.022 gcm²

Protection (IEC 529) = IP00

Max. weight:
- rotor assembly = 0.022 kg
- scanning unit = 0.04 kg

Operating temperature = -10...+70 °C

Storage temperature = -30...+85 °C

Maximum humidity (non-condensing) = 98 %

Permissible vibration (55 to 2000 Hz) = 100 m/s²

Permissible shock (6 ms) = 1000 m/s²

ACCESSORIES

CONNECTORS FOR CABLE
- B12 - 12-pin round connector
- C9 - 9-pin flat connector
- C12 - 12-pin round connector
- D9 - 9-pin round connector
- D15 - 15-pin flat connector
- R810 - 10-pin round connector
- DNC - 10-pin round connector

CONNECTOR FOR PCB
- Adapter Cable dia. 7 mm with PCB connector

DIGITAL READOUT DEVICES
- CS3000
- CS5500

EXTERNAL INTERPOLATOR
- NK

ELECTRICAL DATA

- Power supply = +5 V ± 0.5 V / < 120 mA
- LED: +5 V ± 5% / < 22 mA
- Connector Adapter Cable dia. 7 mm with PCB connector

- Maximum operating frequency = 1.3 MHz / 180 kHz
- Direction of signals = 30°±2°

Maximum rise and fall times:
- 1000 m/s²
- 0.5 µs

Recommended max. cable length to subsequent electronics:
- 25 m
- 25 m

OUTPUT SIGNAL VERSION:
- Incremental signals
  - A1, A2, A3
  - +A = 0.6-1.2 V
  - -B = 0.6-1.2 V
  - Inverting +R and -B per revolution.
  - Non-inverting A = 0.6-1.2 V
  - Non-inverting -B = 0.6-1.2 V

- One quasi-triangular +R and its complementary -R per revolution.
  - One differential square-wave U0/U0 per revolution.
  - One quasi-triangular +B and its complementary -B per revolution.
  - One differential square-wave U0/U0 per revolution.

- Power supply conductor cross-section should not be smaller than 0.5 mm².

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 ROTARY ENCODER

A75M

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

Line number on disc (z) 512, 2048 (others on request)
Number of output pulses per revolution for A75M-F 2 x k, where k = 1, 2, 3, 4, 5, 6, 10
Max. permissible mechanical rotation speed 16000 rpm
Accuracy (T per period of lines on disc in arc. sec.) ±0.1 T
Permissible axial shaft run out ±0.05 mm
Rotor moment of inertia:
- with shaft Ø 20 mm: 26x10^-6 kgm^2
- with shaft Ø 30 mm: 35x10^-6 kgm^2
Protection (IEC 529) IP65
Max. weight 0.2 kg
Operating temperature 0...+85°C
Storage temperature -30...+85°C
Max. permissible mechanical rotation speed 16000 rpm
Accuracy (T per period of lines on disc in arc. sec.) ±0.1 T
Permissible axial shaft run out ±0.05 mm
Permissible shock (6 ms) ≤ 1000 m/s^2
Permissible vibration (55 to 2000 Hz) ≤ 100 mV
Permissible humidity (non-condensing) 98%

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

CONNECTOR FOR PCB
Adapter Cable dia. 7 mm with PCB connector

DIGITAL READOUT DEVICES
CS2000

EXTERNAL INTERPOLATOR
NK

ELECTRICAL DATA

<table>
<thead>
<tr>
<th>VERSION</th>
<th>A75M-AV 1Vpp</th>
<th>A75M-F TTL</th>
<th>A75M-F TTL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply</td>
<td>+5 V ± 5% ≤ 100 mA</td>
<td>+5 V ± 5% &lt; 120 mA</td>
<td></td>
</tr>
<tr>
<td>Light source</td>
<td>LED</td>
<td>LED</td>
<td></td>
</tr>
<tr>
<td>Incremental signals</td>
<td>Differential sine +A and -A/B Amplitude at 120 D load: A = 0.6...1.2 V B = 0.2...0.8 V (viable)</td>
<td>Differential square wave U1 and U2 Signal levels at 20 mA load current: U1 = 0.6...0.8 V U2 = 1.0...1.2 V</td>
<td></td>
</tr>
<tr>
<td>Reference signal</td>
<td>One quasi-rectangular +R and its complimentary +R per revolution. Signal magnitude at 120 D load: R = 0.2...0.8 V (viable)</td>
<td>One differential square wave U0 per revolution. Signal levels at 20 mA load current: U0 = 0.6...0.8 V</td>
<td></td>
</tr>
<tr>
<td>Maximum operating frequency</td>
<td>≤ 100 kHz</td>
<td>≤ 160 kHz</td>
<td></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>
<td></td>
</tr>
<tr>
<td>Maximum rise and fall time</td>
<td>&lt; 0.5 µs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recommended max. cable length to subsequent electronics</td>
<td>25 m</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output signals</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ORDER FORM

A75M AC

CONNECTOR TYPE FOR ADAPTER CABLE

PCB CONNECTOR

AC Adapter Cable dia. 7 mm with PCB connector
**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, 100 N - radial (at shaft end): 100 N
- Starting torque at 20°C: 3 Ncm
- Rotor moment of inertia: 0.08 kgm²
- Maximum weight without cable: 0.3 kg

- Operating temperature: -20...+80°C
- Storage temperature: -30...+90°C
- Maximum humidity (non-condensing): 98%
- Permissible vibration (65 to 2000 Hz): ≤ 150 m/s²
- Permissible shock (11 ms): ≤ 1000 m/s²

**ELECTRICAL DATA**

- **Accuracy**: ±120 arc. sec
- **Resolution**: 2° (256)
- **Code**: Gray, Binary
- **Output signals interface**: Parallel
- **Light source**: LED
- **Supply voltage**: - standard +24 V, +5 V 5% - optional +24 V, +5 V 5%
- **Maximum supply current**: 50 mA
- **Output signal levels**: TTL/HTL
- **Maximum cable length**: 25 m

**ACCESSORIES**

<table>
<thead>
<tr>
<th>CONNECTORS FOR CABLE</th>
<th>COUPLING</th>
</tr>
</thead>
<tbody>
<tr>
<td>B12 - 12-pin round connector</td>
<td>ONC - 10-pin round connector</td>
</tr>
<tr>
<td>C9 - 9-pin round connector</td>
<td>RS10 - round, 10 pins</td>
</tr>
<tr>
<td>C12 - 12-pin round connector</td>
<td>D15 - flat, 15 pins</td>
</tr>
<tr>
<td>D9 - 9-pin flat connector</td>
<td>D9 - round, 9 pins</td>
</tr>
<tr>
<td>D15 - 15-pin flat connector</td>
<td>B12 - round, 12 pins</td>
</tr>
<tr>
<td>P610 - 10-pin round connector</td>
<td>W - without connector</td>
</tr>
</tbody>
</table>

**ORDER FORM**

**PRODUCT CATALOG**

**AK50** | **-** | **XX/XXX** | **-** | **-** | **-**

**CONNECTION TYPE**

<table>
<thead>
<tr>
<th>NUMBERS</th>
<th>CONFIGURATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>202020</td>
<td>P</td>
</tr>
</tbody>
</table>

**FUNCTION**

<table>
<thead>
<tr>
<th>INDEXING POSITION OF HOLE</th>
<th>NUMBER OF POSITIONS*</th>
<th>CODE NUMBER OF BITS*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>8</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

**OUTPUT CODE**

<table>
<thead>
<tr>
<th>CODE NUMBER OF Bits*</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>Code: 1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Code: 2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Code: 3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**SUPPLY VOLTAGE**

<table>
<thead>
<tr>
<th>SUPPLY VOLTAGE</th>
<th>CODE NUMBER OF Bits*</th>
</tr>
</thead>
<tbody>
<tr>
<td>+24 V, +5 V</td>
<td>1</td>
</tr>
<tr>
<td>+5 V</td>
<td>1</td>
</tr>
</tbody>
</table>

**CABLE LENGTH**

<table>
<thead>
<tr>
<th>CABLE LENGTH</th>
<th>CONNECTOR TYPE</th>
<th>COUPLING</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>ONC - round, 10 pins</td>
<td>P</td>
</tr>
<tr>
<td>12</td>
<td>W - without connector</td>
<td>P</td>
</tr>
<tr>
<td>8</td>
<td>rs10 - round, 10 pins</td>
<td>P</td>
</tr>
</tbody>
</table>

**EXAMPLS**

1. AK50-P-8/16/32-5V-AR01/W-1
2. AK50-P-8/16/32-5V-AR02/W-2
3. AK50-P-8/16/32-5V-AR03/W-3
4. AK50-P-8/16/32-5V-AR04/W-4
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: TTL, 1 Vpp, or HTL.

| A58M |

MECHANICAL DATA

<table>
<thead>
<tr>
<th>Connector type / cable outlet</th>
<th>Connector axial</th>
<th>Connector radial</th>
<th>Cable axial [mm, F]</th>
<th>Cable radial [mm, F]</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>12 mm</td>
<td>12 mm</td>
<td>16 mm</td>
<td>16 mm</td>
</tr>
<tr>
<td>L2</td>
<td>16 mm</td>
<td>16 mm</td>
<td>12 mm</td>
<td>12 mm</td>
</tr>
<tr>
<td>L3</td>
<td>20 mm</td>
<td>20 mm</td>
<td>20 mm</td>
<td>20 mm</td>
</tr>
</tbody>
</table>

Electrical Data

- **Accuracy**: ±0.1 arc sec
- **Starting torque**: ≤ 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 (55 to 2000 Hz)**: ≤ 100 m/s²
- **Permissible shock (11 m/s²)**: ≤ 1000 m/s²

ACCESSORIES

<table>
<thead>
<tr>
<th>CONNECTORS FOR CABLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>B12</td>
</tr>
<tr>
<td>C9</td>
</tr>
<tr>
<td>C12</td>
</tr>
<tr>
<td>D9</td>
</tr>
<tr>
<td>D15</td>
</tr>
<tr>
<td>R10</td>
</tr>
<tr>
<td>OMC</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CONNECTORS ON HOUSING</th>
</tr>
</thead>
<tbody>
<tr>
<td>C9</td>
</tr>
<tr>
<td>C12</td>
</tr>
<tr>
<td>R10</td>
</tr>
</tbody>
</table>

**DIGITAL READOUT DEVICES**

- **CS3000**: 100 kHz
- **CS5500**: 160 kHz

**COUPLING**

- **SC50**: 9-pin round connector
- **ONC**: 12-pin round connector

**EXTERNAL INTERPOLATOR**

- **NK**: 15-pin flat connector

**ELECTRICAL DATA**

<table>
<thead>
<tr>
<th>VERSION</th>
<th>A58-A △ 11 μApp</th>
<th>A58-AV △ 1 Vpp</th>
<th>A58-F TTL/HTL/1 Vpp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage (U)</td>
<td>±2 V ±5%</td>
<td>±5 V ±5%</td>
<td>±3 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 sinusoidal I₁ and I₂ (Amplitude at 1 kΩ load: I₁ = 7–16 µA, I₂ = 7–16 µA)</td>
<td>Differential sine +A- and +B- (Amplitude at 1000 Ω load: A = 0.6–1.2 V, B = 0.6–1.2 V)</td>
<td>Differential square-wave U₄ and U₅ (Signal levels at 20 mA load current: – low (logic “0”) &gt; 0.5 V at U₄ &gt; 0.5 V, – high (logic “1”) &gt; 2.4 V at U₅ &gt; 0.5 V)</td>
</tr>
<tr>
<td>Reference signal</td>
<td>One quasi-triangular +R, ±I₉ peak per revolution, Signal magnitude at 1 kΩ load: ±R = 2–8 µA (usable component)</td>
<td>One quasi-triangular +R and its complement –R per revolution. Signal magnitude at 1 kΩ load: +R = 0.2–0.8 V (usable component)</td>
<td>One differential square-wave U₆/UT per revolution. Signal levels at 20 mA load current: – low (logic “0”) &gt; 0.5 V at U₆ &gt; 0.5 V, – high (logic “1”) &gt; 2.4 V at U₇ &gt; 0.5 V</td>
</tr>
<tr>
<td>Maximum operating frequency</td>
<td>≤ 3 dB ≥ 150 kHz</td>
<td>≤ 3 dB ≥ 180 kHz</td>
<td>≤ 3 dB ≥ 180 kHz</td>
</tr>
<tr>
<td>Direction of signals</td>
<td>+I₉ lags I₁, for clockwise rotation (viewed from shaft side)</td>
<td>+I₉ lags I₁ for clockwise rotation (viewed from shaft side)</td>
<td>+I₉ leads UT with clockwise rotation (viewed from shaft side)</td>
</tr>
<tr>
<td>Maximum rise and fall times</td>
<td>≤ 0.5 µs</td>
<td>≤ 0.5 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>
</tr>
<tr>
<td>Maximum cable length</td>
<td>5 m</td>
<td>5 m</td>
<td>5 m</td>
</tr>
</tbody>
</table>

**Output signals**

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.
<table>
<thead>
<tr>
<th>A58B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connector type / cable outlet</td>
</tr>
<tr>
<td>L1</td>
</tr>
<tr>
<td>L2</td>
</tr>
<tr>
<td>L3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>A58C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connector type / cable outlet</td>
</tr>
<tr>
<td>L1</td>
</tr>
<tr>
<td>L2</td>
</tr>
<tr>
<td>L3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>A58C3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connector type / cable outlet</td>
</tr>
<tr>
<td>L1</td>
</tr>
<tr>
<td>L2</td>
</tr>
<tr>
<td>L3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>A58D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connector type / cable outlet</td>
</tr>
<tr>
<td>L1</td>
</tr>
<tr>
<td>L2</td>
</tr>
<tr>
<td>L3</td>
</tr>
</tbody>
</table>

ORDER FORM:

| A58 | X | XXX/XXXX | ... | XXX | X |

**TYPE:**

- **OUTPUT SIGNALS VERSION:**
- **PULSE NUMBER PER REVOLUTION:**
- **OPTIONAL LINE NUMBER ON DISC (f):**
- **SUPPLY VOLTAGE:**
- **CABLE LENGTH AND CABLE LENGTH AND OUTLET OR FLANGE SOCKET ON CASE OUTLET:**
- **CONNECTOR OR FLANGE SOCKET TYPE:**
- **COUPLING:**

**ORDER EXAMPLES:**

1. A58B-F-2500-05V-AR01/W-1
2. A58B-F-2500-05V-AR01/W-1
3. A58B-F-2500/500-05V-AR01/W-1
**AK58**

**PHOTOELECTRIC ROTARY ENCODER**

Photoelectric absolute singleturn and multiturn rotary encoder series AK58 is constituted of 7 different models - AK58M, AK58B, AK58C, AK58C2, AK58C3, AK58D and AK58 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.

### AK58M

**ACCESSORIES**

<table>
<thead>
<tr>
<th>CONNECTORS FOR CABLE</th>
<th>Connector</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>B12</td>
<td>12-pin round connector</td>
<td>SSI protocol</td>
</tr>
<tr>
<td>C9</td>
<td>9-pin round connector</td>
<td>SSI protocol</td>
</tr>
<tr>
<td>C12</td>
<td>12-pin round connector</td>
<td>BISS protocol</td>
</tr>
<tr>
<td>D9</td>
<td>9-pin flat connector</td>
<td>SSI protocol</td>
</tr>
<tr>
<td>D15</td>
<td>15-pin flat connector</td>
<td>BISS protocol</td>
</tr>
<tr>
<td>R10</td>
<td>10-pin round connector</td>
<td>Ethernet CAT</td>
</tr>
<tr>
<td>MNC</td>
<td>10-pin round connector</td>
<td>Ethernet CAT</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CONNECTORS ON HOUSING</th>
<th>Connector</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>C9</td>
<td>9-pin round connector</td>
<td>SSI protocol</td>
</tr>
<tr>
<td>C12</td>
<td>12-pin round connector</td>
<td>BISS protocol</td>
</tr>
<tr>
<td>R10</td>
<td>10-pin round connector</td>
<td>Ethernet CAT</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>COUPLING</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSI</td>
<td>SC38</td>
</tr>
</tbody>
</table>

### ELECTRICAL DATA

- **Resolution**:
  - Singleturn version: with interface BISS C - 9...20 bit
  - Singleturn version: with interface SSI - 9...20 bit
  - Multiturn version: with interface BISS C - 9...20 bit
  - Multiturn version: with interface SSI - 9...40 bit
- **Output code**: Gray, binary
- **Data interface**: SSI, BISS C
- **Incremental signals**: sine wave (sin, cos) 1 Vpp (optional)
- **Periods number of signals 1Vpp**: 4096
- **Accuracy**: ± 30 arc sec
- **Supply voltage**: ±50 ± 5%
- **Light source**: LED
- **Maximum operating frequency**: up to 10 MHz
- **Cable length (standard)**: 1 m

### ELECTRICAL SIGNALS

**SSI TIMING DIAGRAM**

- **Interface**: SSI
- **Clock frequency**: 62.5 kHz = 4 MHz
- **Delay**: 1.2 µs - 26 µs
- **Position bit**: 3.28 ms ± 1.2 ns

**BISS TIMING DIAGRAM**

- **Interface**: BISS
- **Clock frequency**: 62.5 kHz = 4 MHz
- **Delay**: 1.2 µs - 26 µs

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

**Sine wave 1 Vpp signals**

- **Complementary signals are not shown**

### MECHANICAL DATA

- **Maximum shaft speed**: 12000 rpm
- **Maximum shaft load**:
  - Singleturn: 10 N (40 N for AK58C2, AK58C3, AK58D)
  - Multiturn: 20 N (80 N for AK58C2, AK58C3, AK58D)
- **Starting torque at 20°C**: 0.01 Nm
- **Rotor moment of inertia**: <15 gcm²
- **Protection (IEC 529)**: IP65 (IP 67 EtherCAT)

**Maximum weight without cable**: 0.35 kg

**Operating temperature**:
- Singleturn version: -20...+80 °C
- Multiturn version: -10...+70 °C

**Storage temperature**:
- Singleturn version: -30...+90 °C
- Multiturn version: -30...+80 °C

**Maximum humidity (non-condensing)**: 88 %

**Permissible vibration (55 to 2000 Hz)**: 100 m/s²

**Permissible shock (11 ms)**: 1000 m/s²
**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. Three status LEDs are located in the rear side of the absolute encoder.

**ELECTRICAL DATA**

- **Resolution per revolution (position number)**: 22 bit (1048576)
- **Accuracy**: ± 30 arc sec
- **Supply voltage**: 10...30V DC
- **Maximum consumed current (without load)**: 110 mA

**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. IN connector must be placed in the direction of the EtherCAT® master.

**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. IN connector must be placed in the direction of the EtherCAT® master.
**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 Precizika Metrology. It can be installed on any PC running a Windows operating system (Windows XP or later).

**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
- AP58-T
- AP58-H

**Power supply**
- ±5 V ± 5 %

**Light source**
- LED

**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,U2 = 0 V
  - high (logic ’1’): > 2.4 V at U1,U2 = 5 V

**Reference signal**
- One differential square-wave U0/U0 per revolution
- T/4 or T/2

**Maximum operating frequency**
- < 2 MHz

**Direction of signals**
- U2 leads U1 for clockwise rotation (viewed from shaft side)

**Maximum max. line frequency**
- < 0.5 µs

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

**Maximum cable length**
- 25 m

**Output signals**
- Current operation status indication field
- Program the encoder according to desired parameters
- Number of lines Per Revolution (LPR) in the drop-down menu
- Number of Cycles Per Revolution (CPR) in the drop-down menu
- List of encoders connected for multi-programming

**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

**COUPLING**
- SC30

**MECHANICAL DATA**

**Pulse number per shaft resolution**
- from 1 to 65536

**Maximum shaft speed**
- 12000 rpm

**Maximum shaft load**
- axial
  - 10 N (40 N for AP58C2, AP58C3, AP58HE1)
- radial (at shaft end)
  - 20 N (60 N for AP58C2, AP58C3, AP58HE1)

**Accuracy**
- ±0.1°, arc. sec

**Starting torque at 20°C**
- ± 0.01 Nm

**Permissible moment of inertia**
- < 15 g·cm²

**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**
- 100 m/s²

**Permissible shock**
- ± 1000 m/s²

**MODIFICATION AP58HE1**

**SOFTWARE**

- 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 Precizika Metrology. It can be installed on any PC running a Windows operating system (Windows XP or later).

**ORDER FORM**

**AP58**
- XXXX

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

**SHAFT HOLE DIAMETER**
- 6, 8, 10, 12, 14, 15 mm

**SUPPLY VOLTAGE**
- ± 5 V

**CABLE LENGTH**
- ≤ 0.01 Nm

**CONNECTOR TYPE**
- LED

**COUPLING**
- 1 - without coupling

**ORDER EXAMPLES**
- 1) AP58M-10-05V-AR01/B12-0;
- 2) AP58HE1-12-00001/B12-0;
- Default manufacturer 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.

### ELECTRICAL DATA

<table>
<thead>
<tr>
<th>VERSION</th>
<th>ASHIE-A (~11 µApp)</th>
<th>ASHIE-AV (~1 Vpp)</th>
<th>ASHIE-F/NTL/HTL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage (U&lt;sub&gt;1&lt;/sub&gt;)</td>
<td>±0.1 V to ±0.15 V</td>
<td>±5 V to ±10 V</td>
<td>±10 V to ±15 V</td>
</tr>
<tr>
<td>Max. supply current [without load]</td>
<td>80 mA</td>
<td>120 mA</td>
<td>1.20 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 -A, Amplitude at 1 kHz load: +A = 2-8 µA, -A = 0.6-1.2 V</td>
<td>Differential sine +A/4 and +B/8 Amplitude at 10 kHz load: +A = 0.5-1.5 V, +B = 0.8-1.6 V</td>
<td>Differential square-wave U&lt;sub&gt;1&lt;/sub&gt; and U&lt;sub&gt;2&lt;/sub&gt;. Signal levels at 20 mA load current: low logic: 10 V, +0.5 V, +0.8 V, +10 V, +20 V, +50 V, +100 V, +200 V, high logic: 10 V, ±20 V, ±40 V, ±200 V, ±500 V, ±1000 V</td>
</tr>
<tr>
<td>Reference signal</td>
<td>One quasi-triangular, +A per revolution,</td>
<td>One quasi-triangular +A and +B per 4 revolutions,</td>
<td>One differential square wave U&lt;sub&gt;OUT&lt;/sub&gt; per revolution,</td>
</tr>
<tr>
<td></td>
<td>Signal magnitude at 10 kHz load:</td>
<td>complementary –R per revolution. Signals</td>
<td>Signal levels at 20 mA load current: low logic: 10 V, ±0.5 V, ±1 V, ±2 V, ±4 V, ±10 V, ±20 V, ±30 V, ±50 V, ±100 V, ±200 V, ±500 V, ±1000 V</td>
</tr>
<tr>
<td>Maximum operating frequency</td>
<td>90°±15' (4x)</td>
<td>90°±15' (4x)</td>
<td>(180 ±40 kHz), k-interpolation factor</td>
</tr>
<tr>
<td>Direction of signals</td>
<td>+B lags +A for clockwise rotation</td>
<td>+B lags +A for clockwise rotation</td>
<td>U2 lags U1 with clockwise rotation</td>
</tr>
<tr>
<td>Maximum rise and fall time</td>
<td>≤ 4 ms</td>
<td>≤ 4 ms</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>
</tr>
<tr>
<td>Maximum cable length</td>
<td>5 m</td>
<td>25 m</td>
<td>25 m</td>
</tr>
</tbody>
</table>

### MOUNTING REQUIREMENTS

**Connector:**
- Encoder mounting: 4xM3x5 DIN933
- Adapter mounting: 4xM3x6 DIN963
- Shaft mounting: M3 DIN913
- Encoder mounting from housing side
- Encoder mounting from encoder screws
- Adapter mounting from encoder screws
- Protective cover: longer than 56 mm, protective cover is removed

**Input signals:**
- One differential square wave U<sub>OUT</sub> per revolution, signal levels at 20 mA load current: low logic: 10 V, ±0.5 V, ±1 V, ±2 V, ±4 V, ±10 V, ±20 V, ±30 V, ±50 V, ±100 V, ±200 V, ±500 V, ±1000 V
- One quasi-triangular +A per revolution, signal magnitude at 10 kHz load: +A = 2-8 µA, -A = 0.6-1.2 V

### MECHANICAL DATA

- **Line number on disc (Z):** 100, 250, 500, 600, 800, 1000, 2000, 4000, 5000, 10000, 15000, 20000, 40000, 50000
- **Pulse number per shaft rotation for A58-F:** 2 x 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):**
  - ±1 arc. sec on option for Z = 5000
  - ±0.05 arc. sec on option for Z = 5000
- **Load (at shaft end):** Z x k, where k=1,2,3,4,5,10

### ACCESSORIES

**Connectors for cable:**
- B12: 12-pin round connector
- C9: 9-pin round connector
- C12: 12-pin round connector
- D15: 15-pin flat connector
- D9: 9-pin flat connector
- RS10: 10-pin round connector
- ONC10: 10-pin round connector

**Digital readout devices:**
- CS3000
- CS5500

**External Interpolator:**
- NK
**A58HME PHOTOELECTRIC ROTARY ENCODER**

Photoelectrical encoder A58HME can produce up to 108,000 output pulses per revolution and is a very similar encoder to the A58HE series.

The main difference between the two is that A58HME has a φ6-15 mm blind hollow shaft.

**MECHANICAL DATA**

- **Line number on disc (p)**: 100; 250; 500; 600; 800; 1000; 1024; 1120; 1250; 1620; 2000; 2048; 2500; 3000; 3600; 4000; 5000; 9000; 10800

- **Number of output pulses per revolution for A58HME-F**: Z = k × (12, 24, 36, 48, 72, 84, 108)  
  - k = interpolation factor

- **Maximum shaft speed**: 10000 rpm

- **Permissible motion of shaft - axial**: ±0.03 mm

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

- **Accuracy (+, period of line on disc in arc sec)**: ±0.1T arc sec
  - ±0.05T arc sec
  - ±12.0 arc sec

- **Starting torque at 20°C**: ≤ 0.025 Nm

- **Rotor moment of inertia**: < 1.5×10⁻² kgm²

- **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**: -40...+80°C

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

- **Permissible vibration (at 2000 Hz)**: ≤ 100 m/s²

- **Permissible shock (11 ms)**: ≤ 300 m/s²

**ACCESSORIES**

- **CONNECTORS FOR CABLE**: C12 - 12-pin flange socket
  - C9 - 9-pin flange socket
- **DIGITAL READOUT DEVICES**: CS3000
  - CS5500
- **EXTERNAL INTERPOLATOR**: NK

**ELECTRICAL DATA**

- **Version**: A58HME-A
  - A58HME-AV
  - A58HME-F

- **Supply voltage (U):** ±5 V ± 5%

- **Max. supply current (I):** 80 mA

- **Light source**: LED

- **Incremental signals**:
  - Two sinusoidal I⁺ and I⁻  
  - Amplitude at 1 kΩ load:
    - I⁺: 1.5 V ± 15%  
    - I⁻: 0.8 V ± 15%

- **Reference signal**: One quasi-triangular I and its complementary I⁺ for revolution  
  - Signal magnitude at 1 kΩ load:
    - I⁺: 7-16 µA  
    - I⁻: 0.6-1.2 V  
  - Time: 0.2-0.8 V (usable component)

- **Maximum operating frequency**: 50...+70 kHz

- **Direction of signals**:
  - I⁺: high (logic “1”) > 2.4 V at U₁  
  - I⁻: low (logic “0”) < 0.5 V at U₁

- **Maximum rise and fall time**: ≤ 0.1 µs

- **Direction of signals**:
  - I⁺: high (logic “1”) = 1.0 to 3.0 V  
  - I⁻: low (logic “0”) = 0 to 0.8 V

- **Starting torque at 20°C**: ±0.05 Nm

- **Rotor moment of inertia**: < 1.5×10⁻² kgm²

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

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

- **Maximum weight without cable**: 0.35 kg

- **Permissible motion of shaft - axial**: ±0.03 mm

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

- **Accuracy (+, period of line on disc in arc sec)**: ±0.1T arc sec

- **Permissible vibration (at 2000 Hz)**: ≤ 100 m/s²

- **Permissible shock (11 ms)**: ≤ 300 m/s²

**MOUNTING REQUIREMENTS**

**ADAPTER**

**ORDER FORM**

<table>
<thead>
<tr>
<th>OUTPUT SIGNAL VERSION</th>
<th>PULSE NUMBER PER REVOLUTION</th>
<th>OPTIONAL LINE NUMBER ON DISC (Q)</th>
<th>SHAFT HOLE DIAMETER</th>
<th>SUPPLY VOLTAGE</th>
<th>CABLE LENGTH</th>
<th>CONNECTOR TYPE</th>
<th>ADAPTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>A58HME-A</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>±5 V ± 5%</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>A58HME-AV</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>±5 V ± 5%</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>A58HME-F</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>±5 V ± 5%</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**ORDER EXAMPLES**

1. A58HME-A/AV-1024-6-05V-W
2. A58HME-A/AV-1024-6-05V-W
3. A58HME-F-2000S6-8-30V-5

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.
**A58HE1 PHOTOELECTRIC ROTARY ENCODER**

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 available: 11 µApp, 1Vpp, TTL or HTL.

**VERSION 1 - THROUGH HOLLOW SHAFT**

- **Shaft diameter**: Ø59 mm
- **Shaft length**: 300 mm
- **Length of shaft with protective cover**: 356 mm
- **Material**: M5 DIN 961
- **Protective cover**: for long shafts
- **Mounting screws**: 2xM3(4x)

**VERSION 2 - BLIND HOLLOW SHAFT**

- **Shaft diameter**: Ø17 mm
- **Shaft length**: 300 mm
- **Length of shaft with protective cover**: 356 mm
- **Material**: M3 DIN 961
- **Protective cover**: for long shafts

**MECHANICAL DATA**

<table>
<thead>
<tr>
<th>Line number on disc (z)</th>
<th>z</th>
<th>where</th>
<th>1,2,3,4,5,6,10</th>
<th>Interpolation factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of output pulses per revolution for A58HE1-F</td>
<td>Z x k</td>
<td>k = 1,2,3,4,5,6,10</td>
<td>Interpolation factor</td>
<td></td>
</tr>
<tr>
<td>Maximum shaft speed</td>
<td>10,000 rpm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Permissible motion of shaft:</td>
<td>±0.03 mm</td>
<td>±0.05 mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accuracy (ft., period of lines on disc in arc. sec)</td>
<td>±0.17 arc. sec</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Starting torque at 20°C</td>
<td>≥ 0.025 Nm</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**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

**ELECTRICAL DATA**

<table>
<thead>
<tr>
<th>VERSION</th>
<th>A58HE1-A/11 µApp</th>
<th>A58HE1-AV/1 Vpp</th>
<th>A58HE1-P/TTL/1 HTL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage (U)</td>
<td>+5 V ± 0%</td>
<td>+5 V ± 0%</td>
<td>+5 V ± 0%</td>
</tr>
<tr>
<td>Max. supply current (without load)</td>
<td>130 mA</td>
<td>130 mA</td>
<td>130 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 square wave A and B</td>
<td>Two square wave A and B</td>
<td>Differential square-wave U1 and U2</td>
</tr>
<tr>
<td>Differential signal, square wave</td>
<td>Amplitude at 1 kΩ load</td>
<td>+5 V ± 0%</td>
<td>+5 V ± 0%</td>
</tr>
<tr>
<td>Amplitude at 1 kΩ load</td>
<td>+1.5 V ± 0%</td>
<td>+1.5 V ± 0%</td>
<td></td>
</tr>
<tr>
<td>Reference signal</td>
<td>One quasi-triangular, bias voltage</td>
<td>One quasi-triangular, bias voltage</td>
<td>One differential square-wave U1 and U2</td>
</tr>
<tr>
<td>Maximum operating frequency</td>
<td>(3 dB)</td>
<td>(3 dB)</td>
<td></td>
</tr>
<tr>
<td>Direction of signals</td>
<td>I1 lags A for clockwise rotation</td>
<td>I2 lags A for clockwise rotation</td>
<td></td>
</tr>
<tr>
<td>Maximum rise and fall time</td>
<td>≤ 50 ns</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>Maximum cable length</td>
<td>25 m</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output signals</td>
<td>Differential square-wave U0/U0 per revolution</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**MOUNTING REQUIREMENTS**

**VERSION 1**

- 11 mm for one side fixation
- 58 mm for both side fixation
- 68 mm for version with protective cover

**ORDER FORM**

**MECHANICAL VERSION**

<table>
<thead>
<tr>
<th>OUTPUT SIGNAL VERSION</th>
<th>PULSE NUMBER PER REVOLUTION</th>
<th>OPTIONAL LINE NUMBER ON DISC (Q)</th>
<th>SHAFT HOLE DIAMETER</th>
<th>SUPPLY VOLTAGE</th>
<th>CABLE LENGTH</th>
<th>CONNECTOR TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - through hollow A</td>
<td>1125</td>
<td>1125000</td>
<td>6, 8, 10, 12, 14, 16 mm</td>
<td>120 V</td>
<td>40 cm</td>
<td>A58HE1 - 1 AV</td>
</tr>
<tr>
<td>2 - blind hollow shaft</td>
<td>11250</td>
<td>11250000</td>
<td>6, 8, 10, 12, 14, 16 mm</td>
<td>36 V</td>
<td>40 cm</td>
<td>A58HE1 - 2 P</td>
</tr>
</tbody>
</table>

**ORDER EXAMPLES**

1) A58HE1-1-AV-1-1125000-0102/C12
2) A58HE1-2-P-11250000-0102/C12
**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.

---

**MECHANICAL DATA**

- **Line number on disc (s)**: 5020 (others on request)
- **Number of output pulses per revolution for A102H-F**: Z x k, where k=1,2,3,4,5,8,10, 20, 25, 50, 100 and others (k - interpolation factor)
- **Maximum shaft speed**: 6000 rpm
- **Permissible motion of shaft**: ± 0.1 mm
- **Rack (at shaft end)**: ± 0.02 mm
- **Accuracy (T, period of lines on disc in arc. sec)**: ±0.05T, arc. sec
- **Starting torque at 20°C**: ≤ 0.01 Nm

---

**ELECTRICAL DATA**

**VERSION**

| A102H-A | A102H-AV | A102H-F
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage (U1)</td>
<td>±5 V ±0.5%</td>
<td>±5 V ±2%</td>
</tr>
<tr>
<td>Max. supply current (without load)</td>
<td>100 mA</td>
<td>120 mA</td>
</tr>
<tr>
<td>Light source</td>
<td>LED</td>
<td>LED</td>
</tr>
</tbody>
</table>

**Incremental signals**

- Two sinusoidal I and I2: Amplitude at 1 KΩ load
  - I = 0.1–1. μA
  - I2 = 7–16 μA
- Differential sine +I-I2 and +I2-I: Amplitude at 120 Ω load
  - +I = 0.8–1.2 V
  - +I2 = 0.6–1.2 V

**Reference signal**

- One quasi-triangular +I per revolution
  - Signal magnitude at 1 KΩ load
    - +I = 2–8 μA (usable component)
- One quasi-triangular +I2 per revolution
  - Signal magnitude at 120 Ω load
    - +I2 = 0.2–0.8 V (usable component)

**Maximum operating frequency**

- (±I, ±I2) ≤ 160 kHz
- (160 Hz x 1000 x k) – interpolation factor

**Direction of signals**

- I2 lags I1 by 90° for clockwise rotation
- I leads I1 for clockwise rotation
- I2 is 0.6–1.2 V at U1 = 10 V
- High I is +1.2 V, low I is 0 V
- High I2 is +0.6 V, low I2 is 0 V

**Output signals**

- One differential square-wave U0/U0 per revolution
  - Signal levels at 20 mA load current
    - Low U0 > 2.4 V at U1 = 5 V
    - High U0 > 10 V at U1 = 10 V
    - Low U0 > 3.4 V at U1 = 10 V
    - High U0 > 5.4 V at U1 = 10 V
- One differential square-wave U0/U1 per revolution
  - Signal levels at 20 mA load current
    - Low U0 > 2.4 V at U1 = 5 V
    - High U0 > 10 V at U1 = 10 V
- Maximum working rotation speed (with proper encoder counting) is limited by maximum operating frequency and maximum mechanical rotation speed.

**ACCESSORIES**

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

- **DIGITAL READOUT DEVICES**
  - CS3000
  - CS5000

- **EXTERNAL INTERPOLATOR**
  - NK

---

**MOUNTING DIMENSIONS**

---

**ORDER FORM**

A102H | X | XX | XXX

**OUTPUT SIGNAL VERSION**

- **PULSE NUMBER PER REVOLUTION**
  - 5020
- **CABLE LENGTH**
  - 3 m
- **CONNECTOR TYPE**
  - C9: 9-pin round connector
  - C12: 12-pin round connector
  - D9: 9-pin flat connector

**ORDER EXAMPLES**

- A102H-A: 502001/C9/C12
- A102H-F: 502001/AV/C9/C12
AM58 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.

**MECHANICAL DATA**

<table>
<thead>
<tr>
<th>AM58</th>
<th>AM56</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum shaft speed</td>
<td>12000 rpm</td>
</tr>
</tbody>
</table>
| Maximum shaft load:  
  - axial         | 10 N       |
|  - radial (at shaft end) | 20 N       |
| Starting torque at 20°C | < 0.01 Nm |
| Rotor moment of inertia | < 1.5 Nm² |
| Protection (IEC 529) | up to IP67 |
| Maximum weight without cable | 0.25 kg |
| Operating temperature | -25...+45°C |
| Storage temperature | -40...+125°C |
| Maximum humidity (non-condensing) | 98 % |
| Permissible vibration (55 to 2000 Hz) | ≤ 100 m/s² |
| Permissible shock (5 ms) | ≤ 900 m/s² |

**ELECTRICAL DATA**

<table>
<thead>
<tr>
<th></th>
<th>AM55</th>
<th>AM55</th>
</tr>
</thead>
</table>
| Supply voltage:  
  - standard     | +5V±5%     |
|  - optional    | +10...30V±5% |
| Light source   | LED        |
| Accuracy       | ±0.3 arc. degree |
| Resolution     | 2¹² (4096) |
| Code           | binary     |
| Output signals:  
  - incremental  | TTL, HTL   |
|  - through synchronous serial interface  | SSI       |
|  - commutation  | UVW (pole number 2, 4, 6, 8, 10, 12, 14, 16) |
| Maximum operating frequency, kHz | 300 |
| Standard cable length | 1m, without connector |
| Maximum cable length | 25m |

**OUTPUT SIGNALS**

- TTL / HTL
  - a=0.25T±0.125T
  - UVW (pole number 2, 4, 6, 8, 10, 12, 14, 16)
  - SSI

**ACCESSORIES**

<table>
<thead>
<tr>
<th>CONNECTORS FOR CABLE</th>
<th>AM58</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**

- 01: without coupling
- 02: with coupling
- 03: flange coupling
- 04: with coupling and abutment

**ORDER FORM**

<table>
<thead>
<tr>
<th>Encoder type</th>
<th>Output signal</th>
<th>Pole number</th>
<th>Bit number</th>
<th>Voltage supply</th>
<th>Cable length</th>
<th>Connector type</th>
<th>Coupling</th>
</tr>
</thead>
<tbody>
<tr>
<td>AM55</td>
<td>01</td>
<td>01</td>
<td>01</td>
<td>+5V±5%</td>
<td>10000 rpm</td>
<td>AM55</td>
<td>01, 02</td>
</tr>
<tr>
<td>AM55</td>
<td>01</td>
<td>01</td>
<td>01</td>
<td>+5V±5%</td>
<td>10000 rpm</td>
<td>AM55</td>
<td>01, 02</td>
</tr>
</tbody>
</table>

**SSI timing diagram**

Clock frequency: 20kHz (Max. Tc = 25 ns/15 ms)

**ORDER EXAMPLES:**

- H8 - HTL - UVW - SSI
- H7 - HTL - UVW
- H6 - HTL
- H5 - TTL - UVW - SSI
- TTL - SSI
- H3 - TTL-UVW
- H4 - TTL-UVW

**ENCODER MODIFICATION**

- AM55
- AM55C2
- AM55C
- AM55B
- AM55M

**ACCESSORIES**

<table>
<thead>
<tr>
<th>Connector type</th>
<th>Encoder type</th>
<th>CABLE LENGTH</th>
<th>CONNECTOR TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>D9</td>
<td>AM55</td>
<td>1m</td>
<td>AM55</td>
</tr>
<tr>
<td>D9</td>
<td>AM55M</td>
<td>1m</td>
<td>AM55</td>
</tr>
</tbody>
</table>

**COUPLING:**

- 01: without coupling
- 02: with coupling
- 03: flange coupling
- 04: with coupling and abutment
### 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</td>
<td>± 5</td>
<td>Hollow shaft w/ integrated stator coupling</td>
<td>11 μApp ~ 1 Vpp TTL</td>
</tr>
<tr>
<td>A110</td>
<td></td>
<td>18,000</td>
<td>± 5</td>
<td>Solid shaft</td>
<td>11 μApp ~ 1 Vpp TTL</td>
</tr>
<tr>
<td>A170</td>
<td></td>
<td>18,000 / 36,000</td>
<td>± 2.5</td>
<td>Solid shaft</td>
<td>11 μApp ~ 1 Vpp TTL</td>
</tr>
</tbody>
</table>

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

Photoelectric angle encoder A90H is a high-end 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 ±0.02 mrad. The encoder is available in two different mounting types – coupling via shaft collar or via central screw.

**MECHANICAL DATA**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line number on disk (2)</td>
<td>18000</td>
</tr>
<tr>
<td>Number of output pulses per revolution</td>
<td>2 x k, where k = 1, 2, 3, 4, 5, 6, 10, 20, 25, 50, 100</td>
</tr>
<tr>
<td>Reference signal, standard (θ)</td>
<td>one per shaft revolution</td>
</tr>
<tr>
<td>Reference signal, distance-coded (K)</td>
<td>36 per shaft revolution</td>
</tr>
<tr>
<td>Permissible shaft run-out - axial</td>
<td>0.02 mm</td>
</tr>
<tr>
<td>Permissible shaft run-out - radial</td>
<td>0.02 mm</td>
</tr>
<tr>
<td>Rotor moment of inertia</td>
<td>&lt; 0.2 × 10^-3 kgm²</td>
</tr>
<tr>
<td>Protection (IEC 529)</td>
<td>IP64</td>
</tr>
<tr>
<td>Maximum weight without cable</td>
<td>1.2 kg</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>0...+70 °C</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>30...-40 °C</td>
</tr>
<tr>
<td>Humidity (non-condensing)</td>
<td>98 %</td>
</tr>
<tr>
<td>Permissible vibration (65 to 2000 Hz)</td>
<td>≤ 100 m²/ν</td>
</tr>
<tr>
<td>Permissible shock (5 ms)</td>
<td>≤ 250 m²/ν</td>
</tr>
</tbody>
</table>

**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
  - OMC - 10-pin round connector
- **DIGITAL READOUT DEVICES**
  - CS3000
  - CS5500
- **EXTERNAL INTERPOLATOR**
  - NK

**ELECTRICAL DATA**

**VERSION**

- **A90H-A**
  - Supply voltage (UL) 5 V ± 5%
  - Max. supply current (without load) 100 mA
  - Light source LED
- **A90H-AV**
  - Supply voltage (UL) 5 V ± 5%
  - Max. supply current (without load) 120 mA
  - Light source LED
- **A90H-F**
  - Supply voltage (UL) 5 V ± 5%
  - Max. supply current (without load) 150 mA
  - Light source LED

**Incremental signals**

- Two sinusoidal (A and B) Amplitude: 1 V peak
  - A phase lags B by 90°
  - I = 7...16 mA
- Differential sine +A-A and +B-B Amplitude: 1 V peak
  - I = 0.6...1.2 V
- Differential square wave: +A and -A Amplitude: 1 V peak
  - FF and SF, Signal levels: +20 mA/0 mA (current): low (logic “0”) > 2.4 V

**Reference signal**

- One quasi-triangular pulse per revolution. Signal magnitude at 1 V peak: I = 2...8 µA (typical)

**Fault detection signal**

- One square-wave pulse
  - I = 0.2...0.8 V (typical)

**Maximum operating frequency**

- 100 kHz (depends on interpolation factor)

**Output signals**

- One differential square wave U0/U0 per revolution
  - FF and SF, Signal levels: +20 mA/0 mA (current): low (logic “0”) > 2.4 V

**Note:**

1. Maximum working rotation speed (with proper encoder counting) is limited by the 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**

**MOUNTING TYPE P (CLAMP)**

**MOUNTING TYPE H (SCREW)**

**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
  - OMC - 10-pin round connector
- **DIGITAL READOUT DEVICES**
  - CS3000
  - CS5500
- **EXTERNAL INTERPOLATOR**
  - NK

**ORDER FORM**

- **A90H**
  - **X** - **XXXX**
  - **X** - **XX**
  - **X** - **XX**
  - **X** - **XXX**

**OUTPUT SIGNAL DIAMETER**

- **PULSE NUMBER PER REVOLUTION**
  - **REFERENCES**

**MOUNTING TYPE**

- **CABLE OR CONNECTOR**
  - **OUTLET**

**CABLE LENGTH**

- **CONNECTOR TYPE**

**ORDER EXAMPLE**

## A110 PHOTOELECTRIC ANGLE ENCODER

Photoelectric angle encoder A110 is a similar high and 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.

### 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) - distance-coded (K) - standard (S) - distance-coded (K)
- **Maximum shaft speed**: 5000 rpm
- **Maximum shaft load**:
  - axial: 10 N
  - radial (at shaft end): 10 N
- **Accuracy**: ±0.01 arc sec
- **Starting torque at 20°C**: ±0.01 Nm
- **Rotor moment of inertia**: <2 x 10⁻¹⁴ kgm²
- **Protection (IEC 529)**: IP64
- **Maximum weight without cable**: 0.7 kg
- **Operating temperature**: -50°C to 50°C
- **Storage temperature**: -30°C to 80°C
- **Maximum humidity (non-condensing)**: 98%
- **Permissible vibration**: ±100 m/s²
- **Permissible shock (8 ms)**: ±300 m/s²

### ELECTRICAL DATA

#### VERSION
- **A110-A**: 11 µApp
- **A110-A**: 1 Vpp
- **A110-A**: 1 Vpp
- **A110-F**: TTL

#### Supply voltage (U):
- ±5 V ± 5%

#### Max. supply current (without load):
- 80 mA
- 120 mA
- 120 mA

#### Light source:
- LED

#### Incremental signals:
- Two sinusoidal (I and J, Amplitude at 1 kHz load):
  - I: ±7-16 µA
  - J: ±12-16 µA

#### Reference signal:
- One quasi-triangular hold pulse per revolution:
  - Signal magnitude at 1 kHz load:
    - I: ±0.2-0.6 µA
  - RI: ±2.8 µA (usable component)

#### Fault detection signal (Us):
- no error occur

#### Maximum operating frequency:
- ± dB @ 100 kHz

#### Direction of signals:
- One differential square-wave U0/U0 per revolution:
  - Signal magnitude at 1 kHz load:
    - U0: ±2.4 V (usable component)

#### Output signals:
- One differential square-wave U0/U0 per revolution:
  - Signal magnitude at 1 kHz load:
    - U0: ±2.4 V (usable component)

#### 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(s) should not be smaller than 0.5 mm².

### 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
- **RS10**: round, 10 pins
- **AR01**: 1m, without connector
- **AR02**: 2m

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

#### COUPLING
- **SC70**

#### EXTERNAL INTERPOLATOR
- **NK**

### ORDER FORM

#### OUTPUT SIGNAL VERSION:
- **PULSE NUMBER PER REVOLUTION**:
  - **REFERENCE SIGNAL**:
    - B: one per revolution K: ± 5dB per revolution, distance-coded
    - A: version 5 (connector outlet)
  - **CABLE OR CONNECTOR OUTLET**:
    - C9: 9-pin connector
    - A110: one without connector
    - AR01: 1m, without connector
    - AR02: 2m

#### CABLE LENGTH:
- **CONNECTOR TYPE**:
  - **COUPLING**:
    - NK: without coupling
    - SC70: 12-pin round connector
    - CS5500: 10-pin round connector

#### ORDER EXAMPLE:
- **A110**: 11 µApp
- **AR01**: 1m, without connector
- **AR02**: 2m
- **CS5000**: 10-pin round connector
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.

MECHANICAL DATA

- Line number on disc (Z): 18000, 36000
- Number of output pulses per revolution for A170-F: 2 x k, where k = 1, 2, 3, 4, 5, 8, 10, 20, 25, 50, 100
- Reference signal: - standard (S) - distance-coded (K) for z = 36000 - distance-coded (K) for z = 18000
- Permissible mech. speed: 1200 rpm
- Max. operating speed (depends on number of output pulses): 300 to 500 rpm
- Accuracy: ±2.5

ELECTRICAL DATA

- Supply voltage (U): ±5 V ±5% 100 mA max.
- Light source: LED
- Incremental signals: Two sinusoidal I and II Amplitude at 1 kHz load: I = 0.7...10 µA II = 0.7...16 µA Differential sine +A and +B I (signal levels at 20 mA load current): - high (logic “0”) > 2.4 V - high (logic “1”) < 0.5 V
- Reference signal: One quasi-triangular +peak per revolution. Signal magnitude at 1 kHz load: I = 2...8 µA (usable component)
- Direction of signals: I1 lags I2 for clockwise rotation (viewed from encoder mounting side)
- Maximum operating frequency: 1...10 MHz
- Standard cable length: 1 m, without connector
- Maximum cable length: 5 m
- Output signals: Incremental signals
- Analog output signals
- Reference signal: One quasi-triangular +peak per revolution. Signal magnitude at 1 kHz load: I = 2...8 µA (usable component)
- Direction of signals: I1 lags I2 for clockwise rotation (viewed from encoder mounting side)
- Maximum operating frequency: 1...10 MHz
- Standard cable length: 1 m, without connector
- Maximum cable length: 5 m
- Output signals: Incremental signals

ACCESSORIES

- CONNECTORS FOR CABLE:
  - D12 - 12-pin round connector
  - D9 - 9-pin round connector
  - D15 - flat, 15 pins connector
  - RS10 - round, 10 pins connector
  - C12 - round, 12 pins connector
  - C9 - round, 9 pins connector
  - B12 - round, 12 pins connector
  - D9 - flat, 9 pins connector
  - C12 - round, 12 pins connector
  - C9 - round, 9 pins connector
  - W - without connector

- DIGITAL READOUT DEVICES:
  - CS3000
  - CS5500

- COUPLING:
  - SC98-1
  - SC98-2

- EXTERNAL INTERPOLATOR: NK

ORDER FORM

- OUTPUT SIGNAL VERSION:
  - A170
  - X
  - XXX/XXXX/XXXX/XXX
  - X
- ORDER EXAMPLES:
  - D: A170-A-360000/36000-K-S-AR01/C2-B12-1
  - 2: A170-D-360000/36000-K-S-AR01/C2-1

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.
PHOTOELECTRIC ANGLE ENCODER

A170H

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

- Number of output pulses per revolution for A170-F: 36000
- Distance coded (K) for z = 36000
- Standard (S)
- One quasi-triangular +R and its complementatory -R per revolution.
- One quasi-triangular +A and its complementatory -A per revolution.
- One quasi-triangular +B and its complementatory -B per revolution.
- One quasi-triangular +R and its complementatory -R per revolution (viewed from encoder mounting side).
- One quasi-triangular +A and its complementatory -A per revolution (viewed from encoder mounting side).
- One quasi-triangular +B and its complementatory -B per revolution (viewed from encoder mounting side).
- One quasi-triangular +R and its complementatory -R per revolution (viewed from encoder mounting side).

ELECTRICAL DATA

- Output signals: Incremental signals
- Reference signal: One quasi-triangular +R and its complementatory -R per revolution.
- One quasi-triangular +A and its complementatory -A per revolution.
- One quasi-triangular +B and its complementatory -B per revolution.

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: N/A

MOUNTING REQUIREMENTS

ORDER FORM

PRODUCT CATALOG

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A200H PHOTOELECTRIC ANGLE ENCODER

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 A200H-F:**
  - 1 x k, where k = 1, 2, 3, 4, 5, 6, 10, 20, 25, 30, 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:** ≤ 0.5Nm
- **Rotor moment of inertia:** < 0.9 x 10⁻⁶ kgm
- **Protection (IEC 529):** IP64
- **Maximum weight without cable:** 4.5 kg
- **Operating temperature:** 0...+70°C
- **Storage temperature:** -30...+85°C
- **Maximum humidity (non-condensing):** 98%
- **Permissible vibration:** ≤ 100 m/s²
- **Permissible shock (6 ms):** ≤ 300 m/s²

### ELECTRICAL DATA

#### VERSION

<table>
<thead>
<tr>
<th>VERSION</th>
<th>A200H-A</th>
<th>11 µApp</th>
<th>A200H-AV</th>
<th>1 Vpp</th>
<th>A200H-F</th>
<th>FUTTL</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>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. supply current (w/o load)</td>
<td>100 mA</td>
<td>120 mA</td>
<td>150 mA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Light source</td>
<td>LED</td>
<td>LED</td>
<td>LED</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incremental signals</td>
<td>One quasi-triangular pulse per revolution. Signal magnitude at 1 kΩ load: +R = 0.6...1.2 V (available component)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reference signal</td>
<td>One quasi-triangular pulse and its complementary -R per revolution. Signal magnitude at 1 kΩ load: +R = 0.6...1.2 V (available component)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reference signal</td>
<td>One differential square-wave U0/U0 per revolution. Signal levels at 20 mA load current: high (logic “1”) &gt; 2.4 V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</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.

### MOUNTING REQUIREMENTS

![Diagram of mounting requirements]

### ORDER FORM

![Diagram of order form]

**A200H**

**ORDER SIGNAL VERSION:**

<table>
<thead>
<tr>
<th>OUTPUT SIGNAL VERSION</th>
<th>A</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>36000</td>
<td>36000*</td>
</tr>
<tr>
<td></td>
<td>* only for signal version x 36000 pulses</td>
<td></td>
</tr>
<tr>
<td>REFERENCE SIGNAL</td>
<td>S</td>
<td>R</td>
</tr>
<tr>
<td>CABLE LENGTH</td>
<td>1m</td>
<td>3m</td>
</tr>
<tr>
<td>CONNECTOR TYPE</td>
<td>W</td>
<td>-</td>
</tr>
</tbody>
</table>

**REFERENCE SIGNAL:**

- S - one per revolution
- R - distance-coded

**CABLE LENGTH:**

- 1m
- 3m

**CONNECTOR TYPE:**

- W - without connector
- B10 - round, 10 pins
- C12 - round, 12 pins
- D15 - 15-pin flat connector
- RS10 - round, 10 pins
- D9 - flat, 9 pins
- C10 - round, 10 pins
- C12 - round, 12 pins

**ORDER EXAMPLES:**

1. A200H-A-36000-S-AR01/C12
2. A200H-F-360000-S-AR01/C12

**ACCESSORIES**

<table>
<thead>
<tr>
<th>CONNECTORS FOR CABLE</th>
<th>B10</th>
<th>C9</th>
<th>C12</th>
<th>D9</th>
<th>D15</th>
<th>RB10</th>
<th>ONC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>12-pin round connector</td>
<td>9-pin round connector</td>
<td>12-pin round connector</td>
<td>9-pin flat connector</td>
<td>10-pin flat connector</td>
<td>10-pin round connector</td>
<td>10-pin round connector</td>
</tr>
</tbody>
</table>

**DIGITAL READOUT DEVICES:**

- CS3000

**EXTERNAL INTERPOLATOR:**

- NK
## Linear Encoders

<table>
<thead>
<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 Vpp, TTL</td>
</tr>
<tr>
<td>L18B</td>
<td></td>
<td>70-3240</td>
<td>± 10; ± 5</td>
<td>11 Vpp, TTL</td>
</tr>
<tr>
<td>L18T</td>
<td></td>
<td>70-1240</td>
<td>± 10; ± 5</td>
<td>11 Vpp, TTL</td>
</tr>
<tr>
<td>L23</td>
<td></td>
<td>250-20,000</td>
<td>± 10; ± 5; ± 3</td>
<td>TTL</td>
</tr>
<tr>
<td>LK24</td>
<td></td>
<td>70-3240</td>
<td>± 5; ± 3</td>
<td>SSI, BiSS C</td>
</tr>
<tr>
<td>L35</td>
<td></td>
<td>170-3240</td>
<td>± 5; ± 3</td>
<td>11 Vpp, TTL, HTL</td>
</tr>
<tr>
<td>L37</td>
<td></td>
<td>140-3240</td>
<td>± 10; ± 5; ± 3</td>
<td>11 Vpp, TTL, HTL</td>
</tr>
<tr>
<td>L50</td>
<td></td>
<td>3240-30,040</td>
<td>± 10</td>
<td>1 Vpp, TTL</td>
</tr>
<tr>
<td>MT</td>
<td></td>
<td>Up to 50,000</td>
<td>± 25</td>
<td>1 Vpp, TTL</td>
</tr>
<tr>
<td>MK</td>
<td></td>
<td>Up to 50,000</td>
<td>± 35</td>
<td>SSI, BiSS C</td>
</tr>
</tbody>
</table>

- **L35T**: Measuring Length 170-3240 mm, Accuracy ± 10, ± 5, ± 3 µm/m, Output Signals: 11 Vpp, TTL, HTL
- **L37**: Measuring Length 140-3240 mm, Accuracy ± 10, ± 5, ± 3 µm/m, Output Signals: 11 Vpp, TTL, HTL
- **L50**: Measuring Length 3240-30,040 mm, Accuracy ± 10 µm/m, Output Signals: 1 Vpp, TTL
- **MT**: Measuring Length Up to 50,000 mm, Accuracy ± 25 µm/m, Output Signals: 1 Vpp, TTL
- **MK**: Measuring Length Up to 50,000 mm, Accuracy ± 35 µm/m, Output Signals: SSI, BiSS C
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.

WITH MOUNTING SPAR

WITHOUT MOUNTING SPAR

MECHANICAL DATA

- Measuring lengths (ML), mm
- Accuracies to any metre within the length 2020
  ±10 µm, ±5 ±3 µm (optional)
- Grating period
  20 µm; 40 µm (optional)
- Reference marks (FR)
  - standard for ML ≤ 1240 mm
  - optional for ML ≥ 1240 mm
- 15 mm from both ends of ML

Electrical Data

- Power supply
  +5 V ± 5%; < 10 mA
- Light source
  LED
- Resolution
  Depends on external subdividing electronics
- Incremental signals
  Non-contacted ±16 V
  - A: 0-15 V
  - B: 0-16 V
- Reference signals
  One quasi-triangular peak per revolution
  - A: 0-15 V
  - B: 0-16 V
- Maximum operating frequency
  50 kHz
- Direction of signals
  I2 lags I1 at reading head displacement from left to right
- Standard cable length
  3 m, without connector
- Output signals
  0.1 ± 0.3 µm

Accessories

- Connectors for Cable
  B12 - 12-pin round connector
  C9 - 12-pin round connector
  C12 - 12-pin round connector
  C09 - 9-pin flat connector
  D9 - 9-pin flat connector
  D15 - 15-pin flat connector
  R510 - 10-pin round connector
  R049 - 4-pin round connector

Digital Readout Devices

- External Interpolator
  CS5300
  CS5500

Order Form

- L18
  XXXX

- Digital Readout
  X

- Connector:
  - cables with connector (B12)
  - without connector (D15)

Products with special features:

- with 0.2 µm resolution (CP01)
- with 0.1 µm resolution (CP51)
- with 0.05 µm resolution (CP21)
- with 0.02 µm resolution (CP11)

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, 870, 920

Accuracy grades for any metre within the ML, ±20 µm:
- 1m: ±50 µm
- 5m: ±200 µm

Grating period:
- 20 µm, 40 µm (optional)

Reference marks (RI):
- Standard for ML
- Every 50 mm
- Distance-coded

**ELECTRICAL DATA**

**VERSION**
- L18B-A: 11 µApp
- L18B-AV: 1 Vpp
- L18B-F: TTL

**Power supply**
- +5 V ± 5% / < 150 mA

**Light source**
- LED

**Resolution**
- Depends on external subdividing electronics

Incremental signals:
- Two sinusoidal signals, Amplitude at 1 kΩ load:
  - ±1.76 µA
  - ±0.88 µA

Differential signals:
- A+ = 0.6-1.2 V
- B+ = 0.6-1.2 V

**Output signals**
- Differential square-wave U1+/U1- and U2+/U2-

**Reference signal**
- Quasi-triangular +R and its complement -R.

**Maximum operating frequency**
- 50 kHz

**Direction of signals**
- B+: leads to reading head displacement from left to right
- B-: leads to reading head displacement from right to left

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

**Maximum cable length**
- 25 m

**Input signals**
- Reference signal

**Output signals**
- Incremental signals

**Accessories**

**CONNECTORS FOR CABLE**
- B12: 12-pin round connector
- C9: 9-pin round connector
- D12: 12-pin flat connector
- D15: 15-pin flat connector
- RS10: 10-pin round connector
- C10: 10-pin round connector
- B12: 12-pin round connector

**DIGITAL READOUT DEVICES**
- CS2000
- C66500

**EXTERNAL INTERPOLATOR**
- NK

**ORDER FORM**

**OUTPUT AND SIGNALS**

**Measuring length:**
- 1100 mm

**Reference marks:**
- A: sinusoidal
- B: triangular

**Accuracy:**
- ±10 µm

**Cable or connector outlet:**
- Shielded 10 pin round connector (connector outlet)

**Cable length:**
- 1100 mm

**ORDER CODE:**
- L18B-F 2440 5-C CP/AA/W

---

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

- Accuracy grades to any metre within ML ±10; ±5; ±3 µm
- Interpolation factor: 1, 2, 5, 10
- Max. traversing speed: 0.09; 0.2; 0.4; 0.8; 1.2 m/s
- Positive displacement

ELECTRICAL DATA

- Output signals
  - Reference signal: One quasi-triangular A1 and its complementary A2 signal
  - Incremental signals: One differential square-wave U1/U2 per revolution
- Reference signal
  - Resolution
    - interpolation factor: 1, 2, 5, 10
    - 4-fold dividing (version K)
- Operating frequencies
  - Standard: 50 kHz
  - Optional: 100 kHz
- Power supply: +5 V ±5% / < 120 mA
- LED
  - ~17 mA
- Cables:
  - Standard: 3 m, without connector
  - Optional: CP01 - 25 m; CP02 - 25 m; CP03 - 3 m armoured; CP04 - 3 m armoured

ACCESSORIES

- Connectors for cable
  - Standard: B12, C9, D9, D15
  - Optional: RS10, HR25
- Digital readout devices
  - COD000
  - CS6500
- External interpolator
  - N

ORDER FORM

- Model: L18T
- Reference marks
  - standard
  - version K
- Reference signals
  - Resolution
  - Interpolation factor: 1, 2, 5, 10
- Cables:
  - Standard: 3 m, without connector
  - Optional: CP01 - 25 m; CP02 - 25 m; CP03 - 3 m armoured; CP04 - 3 m armoured

Note: If cable expansion is used the power supply conductor section should not be smaller than 0.5 mm².
**PRODUCT CATALOG**

**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 to reach up to ±3 µm accuracy.

**MECHANICAL DATA**

<table>
<thead>
<tr>
<th>Measuring lengths (ML), mm</th>
<th>250, 300, 350, 400, 450, 500...20000 (more on option)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy grades to any metre within the ML, (at 20°C)</td>
<td>±0.1 ±0.5 ±0.1</td>
</tr>
<tr>
<td>Grating period (T)</td>
<td>400, 40, 20 µm</td>
</tr>
<tr>
<td>Max. traversing speed</td>
<td>- when T=400 µm and resolution 100, 50, 10 µm: 2 m/s</td>
</tr>
<tr>
<td></td>
<td>- when T=10 µm and:</td>
</tr>
<tr>
<td></td>
<td>- resolution 10, 5 µm: 1.3 m/s</td>
</tr>
<tr>
<td></td>
<td>- resolution 1 µm: 0.4 m/s</td>
</tr>
<tr>
<td></td>
<td>- when T=20 µm and:</td>
</tr>
<tr>
<td></td>
<td>- resolution 5 µm: 1 m/s</td>
</tr>
<tr>
<td></td>
<td>- resolution 0,5 µm: 0.2 m/s</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reference marks (Ri):</th>
<th>without reference mark every 50 mm Ri number and place</th>
</tr>
</thead>
<tbody>
<tr>
<td>- N</td>
<td></td>
</tr>
<tr>
<td>- M</td>
<td>(optional)</td>
</tr>
<tr>
<td>- P</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Required moving force</th>
<th>&lt;4 N</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Protection (IEC 529):</th>
<th>IP64</th>
</tr>
</thead>
<tbody>
<tr>
<td>- without compressed air</td>
<td></td>
</tr>
<tr>
<td>- with compressed air</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Weight</th>
<th>0.4 kg + 2.8 kg/m</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Operating temperature</th>
<th>0...50°C</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Storage temperature</th>
<th>-20...70°C</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Permissible vibration (10...2000 Hz)</th>
<th>≤100 m/s²</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Permissible shock (11 ms)</th>
<th>≤150 m/s²</th>
</tr>
</thead>
</table>

| Coefficient of thermal expansion | 19.6x10⁻⁶/°C |

**ELECTRICAL DATA**

**VERSION**

<table>
<thead>
<tr>
<th>L23-F</th>
<th>TTL</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Supply voltage (U_P):</th>
<th>+5V ±5% / 65 mA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light source:</td>
<td>LED</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Resolution:</th>
<th>100, 50, 10, 5, 1, 0.5 µm (after 4-fold in subsequent electronics)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incremental signals:</td>
<td>Differential square-wave U1/U1 and U2/U2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reference signals:</th>
<th>Differential square-wave U0/U0</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Signal levels at load current 30 mA:</th>
<th>- free (logic ‘1’): U_P = 0.5 V at U_P = +5V</th>
</tr>
</thead>
<tbody>
<tr>
<td>- high (logic ‘1’): U_P = 2.4 V at U_P = +5V</td>
<td></td>
</tr>
<tr>
<td>- free (logic ‘1’): U_P = 1.5 V at U_P = +12V (HTL)</td>
<td></td>
</tr>
<tr>
<td>- high (logic ‘1’): U_P = 2.2 V at U_P = +12V (HTL)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Direction of signals:</th>
<th>U2 lags U1 (displacement from left to right and head position down)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Standard cable length:</th>
<th>4 m armoured, without connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum cable length:</td>
<td>25 m</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Output signals:</th>
<th></th>
</tr>
</thead>
</table>

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

**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
- RS10: 10-pin round connector
- ONC: 10-pin round connector

**DIGITAL READOUT DEVICES**

- CS3000
- CS5500

**ORDER FORM**

**L23**

<table>
<thead>
<tr>
<th>RESOLUTION</th>
<th>MEASURING LENGTH</th>
<th>REFERENCE MARKS</th>
<th>ACCURACY</th>
<th>SUPPLY VOLTAGE</th>
<th>CABLE LENGTH</th>
<th>CONNECTOR TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 - 400µm</td>
<td>500 - 2000mm</td>
<td>N</td>
<td>±10µm</td>
<td>12 ±13V</td>
<td>1m, 2m armoured</td>
<td>B01 B02 B03 B04</td>
</tr>
<tr>
<td>50 - 100µm</td>
<td>500 - 2000mm</td>
<td>N</td>
<td>±5µm</td>
<td>12 ±13V</td>
<td>1m, 2m armoured</td>
<td>B01 B02 B03 B04</td>
</tr>
<tr>
<td>10 - 50µm</td>
<td>500 - 2000mm</td>
<td>N</td>
<td>±3µm</td>
<td>12 ±13V</td>
<td>1m, 2m armoured</td>
<td>B01 B02 B03 B04</td>
</tr>
<tr>
<td>5 - 25µm</td>
<td>500 - 2000mm</td>
<td>M every 50mm</td>
<td>±1µm</td>
<td>12 ±13V</td>
<td>1m, 2m armoured</td>
<td>B01 B02 B03 B04</td>
</tr>
<tr>
<td>2.5 - 12.5µm</td>
<td>500 - 2000mm</td>
<td>P (optional)</td>
<td>±0.5µm</td>
<td>12 ±13V</td>
<td>1m, 2m armoured</td>
<td>B01 B02 B03 B04</td>
</tr>
<tr>
<td>1 - 5µm</td>
<td>500 - 2000mm</td>
<td>-</td>
<td>±0.25µm</td>
<td>12 ±13V</td>
<td>1m, 2m armoured</td>
<td>B01 B02 B03 B04</td>
</tr>
</tbody>
</table>

**ORDER EXAMPLE:**

1) L23-F100-16000-N-10-05V-04/C12
**LK24**

**PHOTOELECTRIC LINEAR ENCODER**

Photoelectric absolute linear encoder LK24 has measuring length of up to 3,240 mm depending on customer demand, uses SSI or BISS serial interface and produces up to ±1 μm accuracy. The encoder can have an additional 1 Vpp incremental track.

---

**MECHANICAL DATA**

**Measuring lengths (ML), mm**
- 70, 120, 170, 220, 320, 370, 420, 470, 520, 570, 620, 720, 770, 820, 920, 1024, 1140, 1240, 1340, 1440, 1540, 1640, 1740, 1840, 2040, 2240, 2440, 2640, 2840, 3040, 3240

**Incremental signal**
- sine wave 1 Vpp (optional)

**Resolution 1Vpp**
- up to 0.1 μm

**Serial interface**
- SSI or BISS

**Resolution absolute measure**
- 1 μm, 0.1 μm

**Accuracy grades to any metre within the ML (at 20°C)**
- standard version + 5 μm
- optional + 3 μm

**Grating period (T)**
- 20 μm

**Max. traversing speed**
- 2 m/s

**Max. acceleration**
- 30 m/s²

**Required moving force**
- +4N, ≥2.5N on request

**Power supply**
- +5V ± 5%

**Current consumption with load**
- max. 340 mA (with R=120Ω)

**Protection (EN 60529)**
- IK15

**(IP54, IP64)**

**Clock frequency**
- 0.1 ± 1.2 MHz

**Signals level**
- EIA RS 485

**Signals level**
- EIA RS 485

**Permissible shock (11 ms)**
- ± 3 μm

**Permissible vibration (55...2000 Hz)**
- ± 5 μm

**Permissible humidity (non condensed)**
- 20...80 %

**Operating temperature**
- 0...+60°C

**Storage temperature**
- -20...+70°C

**Electrical protections**
- from inversion of power supply polarity, from short circuit on output port

---

**OUTPUT SIGNALS**

**SSI VERSION**

- Interface: SSI Binary – Gray
- Clock frequency: 0.1 ± 1.2 MHz
- Position bit: n
- Tₙ: 10 ± 20 μs

**BISS C VERSION**

- Interface: BISS C unidirectional
- Clock frequency: 0.1 ± 4 MHz
- n: 26 + 2 + 6 bit
- Tₙ: 12 ± 20 μs

---

**CABLE SERIAL OUTPUT**

- Encoder is supplied with flexible cable, which is consisted of shielded twisted pairs of wires for incremental signals (SSI-ML).

- Cable for continuous movements:
  - 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;

---

**ORDER EXAMPLE:**

- LK24 - F01 - 0070 - S1 - W - 01 - W - 01 - W - 01

---

**ACCESSORIES**

**CONNECTORS FOR CABLE**

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

**CONNECTOR TYPE**

- 9-pin round
- 12-pin round
- 15-pin flat
- 9-pin flat
- 12-pin round
- 15-pin flat

**ORDER FORM**

**MEASUREMENTS**

- S1 - SSI Binary
- S2 - SSI Binary + even parity
- S3 - SSI Binary + odd parity
- S4 - SSI Binary + error
- S5 - SSI Binary + even + parity + error
- S6 - SSI Binary + odd parity + error
- S7 - SSI Gray
- S8 - BiSS Binary
- S9 - BiSS Gray

**INPUT SIGNALS**

- E - Encoding
- N - Clock
- C - Common

**INCREMENTAL SIGNALS**

- 0 - without incremental signals

**OUTPUT SIGNALS**

- V - 1Vpp

**CABLE LENGTH**

- 1m
- 2m
- 3m
- 5m
- 10m
- 20m

**ORDER EXAMPLE:**

- LK24-F01-0070-S1-W-01-W-01-W-01
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; 670; 720; 770; 940; 990; 1140; 1240; 1340; 1440; 1540; 1640; 1740; 1840; 1940; 2040; 2140; 2240; 2340; 2440; 2540; 2640; 2740; 2840; 2940; 3040; 3140; 3240; 3340; 3440; 3540; 3640; and 3740.
- Grating period: 0.4 mm + 2.8 kg/m
- Resolution: Depends on external subwise electronics.
- Incremental signals: Two sinusoidal I1 and I2.
- Reference marks (RI): - One quasi-triangular - signal magnitude at 1400 load.

ELECTRICAL DATA

- Power supply: ±5 V ± 5% to ±15 mA
- Light source: LED
- Resolution: Depends on external subwise electronics.
- Incremental signals: - Differential sine ±A and ±B Amplitude at 1200 load - A = 0.6 to 1.2 V - B = 0.6 to 1.2 V

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
  - R10 10-pin round connector
  - GNC 10-pin round connector
  - HR10A 12-pins round mini connector

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

ACCESSORIES

- Digital readout devices:
  - CS3000
  - CS5500

EXTERNAL INTERPOLATOR

- NK

ORDER FORM

- Output signals and resolution:
  - Measuring length: 50, 100, 200, 500 kHz for k = 2, 5, 10
- Supply voltage: 12 V, 24 V
- Cable or connector outlet:
  - Standard: Connector (cable outlet)
  - Optional: Connector (cable outlet)

ORDER EXAMPLE:

1) L35-100-C-XXX-01 K-ED012
**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**

- Measuring lengths (ML) mm: 31.5, 60, 80, 1020; 1140, 1240, 1340, 1440, 1540, 1640, 1740, 1840, 1940, 2040, 2140, 2240, 2340, 2440, 2540, 2640, 2740, 2840, 2940, 3040, 3140, 3240...
- Permissible elongation (n x 50 mm): ±10 µm
- Movement accuracy ±5; ±3
- Number and locations of mounting brackets: 25, 35 mm from both ends of ML

**ACCESSORIES**

- Connectors for Cable: B12 12-pin round connector, C9 9-pin round connector, C12 12-pin round connector, D8 8-pin flat connector, D5 15-pin flat connector, RS10 10-pin round connector, C9 9-pin round connector, HR10A 10-pin round mini connector

**EXTERNAL INTERPOLATOR**

- Type: N/K

**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>
</tr>
</thead>
<tbody>
<tr>
<td>A: Sinusoidal</td>
<td>5040 - 7200 mm</td>
<td>03 - ±3 µm</td>
<td>1 µm</td>
<td>+12 V (HTL)</td>
<td>S - version S cable outlet, connector outlet</td>
</tr>
<tr>
<td>B: square wave</td>
<td>04 - 2m</td>
<td>01 - 1m</td>
<td>0.5 m</td>
<td>+12 V (HTL)</td>
<td></td>
</tr>
</tbody>
</table>

**ELECTRICAL DATA**

**VERSION**

L35T-A / 11 µkpp
L35T-A / 1 Vpp
L35T-F / TTL / HTL

- Power supply: ±5 V ± 10% < 120 mA +10 V ± 10% < 130 mA
- Light source: LED
- Resolution: Depends on external subdividing electronics
- Incremental signals: Two sinusoidal I1 and I2
- Differential sine ±A and ±B
- Differential square-wave +A and +B
- Reference signal: One quasi-triangular +R and its complementary -R per revolution
- Maximum operating frequency: 100 kHz (v=2 m/s shortly)

**ACCESSORIES**

- Cable: PUR armoured 5-pin flat, 9-pin round
- Connector: HR10A 12-pin round connector, D9 9-pin flat, D15 15-pin flat connector

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

**REFERENCES**

- Total roll length: 31.5 mm
- Min roll length: 77 mm
- Maximum cable length: 25 m
- Maximum cable length: 1100 mm for k = 25, 50, 1200 mm (optional)
- Maximum speed of rotation: 1000 rpm
- Permissible shock (11 ms): ±10 g
- Maximum acceleration: ±10 g
- Weight: 0.4 kg + 2.8 kg/m
- Storage temperature: -20...+70°C
- Operating temperature: 0...+50°C
- Compressed air inlet: 20...+70°C
- Diffuser resistance: 0.4 m/s
- Permissible vibration: 77 mm
- Analog output: ±10 Vpp ± 5% in the event of a fault

**ORDER EXAMPLE:**

F50 - TTL / HTL 5.0µm
F25 - TTL / HTL 2.5µm
F10 - TTL / HTL 1.0µm
F05 - TTL / HTL 0.5µm
F02 - TTL / HTL 0.2µm
F01 - TTL / HTL 0.1µm

**ORDER EXAMPLE:**

L35T-A / ±3 µm / 11 µkpp / +12 V ± 5% / RS10 / 10-pin round connector / S - version S cable outlet, connector outlet / |
**L37**

**PHOTOELECTRIC LINEAR ENCODER**

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 ±3 µm.

---

**MECHANICAL DATA**

- **Measuring lengths (ML):** 120 ± 20 mm, 250 ± 20 mm, 500 ± 50 mm, 1000 ± 50 mm, 2000 ± 100 mm
- **Accuracy grades to any metre within the ML:** ±1 µm
- **ML from 2040 up to 3240 mm:** ±2 µm
- **ML from 170 up to 2040 mm:** ±3 µm
- **Reference signals:** O - selection by magnets
- **Reference marks (RI):** M - every 50 mm
- **Analog output signals:** One differential square-wave U0/U0 per revolution. Signals magnitude at 120 mA load: R = 0.2-0.8 V (usable component)
- **Resolution:** 100 kHz (v=2 m/s shortly)
- **Operating temperature:** 0.5 m/s
- **Max. traversing speed:** 1 m/s (shortly 2 m/s)
- **Permissible vibration:** (40 to 2000 Hz)
- **Reproducible reading head:** 5; 2.5; 1; 0.5; 0.2; 0.1 µm (after 4-fold dividing in subsequent electronics)
- **Light source:** LED
- **Distances-coded reference marks RI:** 5 m - 3 m, without connector
- **Analog output signals:** Two sinusoidal I1 and I2
- **Reference signal:** One quasi-triangular and its complementary: R1 per revolution. Signals magnitude at 1200 load: R1 = 0.2-0.8 V (usable component)
- **Reference marks (RI):** One quasi-triangular ri and its complement R1 per revolution. Signals magnitude at 1200 load: R1 = 0.2-0.8 V (usable component)
- **ML middle:** Standard - one magnet (RI) in ML middle
- **ML (at 20°C):** 5.2 ± 0.2 mm
- **Accuracy grades to any metre within the ML:** ±3 µm.
- **ML can have up to 3.240 mm measuring length and accuracy grades to any meter within the ML of up to ±3 µm.**
**L50**

**PHOTOELECTRIC LINEAR ENCODER**

Photoelectric modular linear encoder L50 is an incremental encoder and has the measuring length from 3.240 up to 30.040 mm, grating period of 40 µm and accuracy of any meter within the ML of up to ±10 µm.

---

**ELECTRICAL DATA**

**VERSION**

- **L50-AV** 1Vpp
- **L50-F** TTL

- **Power supply**: +5 V ±5% /100 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
- **Reference signal**: Quasi-triangular R
  - Magnitude at 120 Ω load:
    - R = 0.25-0.8 V (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

---

**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**

---

**ORDER FORM**

<table>
<thead>
<tr>
<th>L50</th>
<th>ML: XXX</th>
<th>ML: XXX</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OUTPUT SIGNALS AND RESOLUTION</strong></td>
<td><strong>MEASURING LENGTH</strong></td>
<td><strong>REFERENCE MARKS</strong></td>
</tr>
<tr>
<td>F10 - TTL 1µm</td>
<td>3240 - 3240 mm</td>
<td>C - at coded distance (80 mm)</td>
</tr>
<tr>
<td>F20 - TTL 2µm</td>
<td>5240 - 5240 mm</td>
<td>P - at constant step (50 mm)</td>
</tr>
<tr>
<td>F50 - TTL 5µm</td>
<td>8040 - 8040 mm</td>
<td>E - selectable through magnet</td>
</tr>
<tr>
<td>F100 - TTL 10µm</td>
<td>30400 - 30400 mm</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**ORDER EXAMPLE**: L50-AV-3240-C-04/C12
**MAGNETIC LINEAR ENCODER**

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)

<table>
<thead>
<tr>
<th>MODIFICATION</th>
<th>MPx00</th>
<th>MPx00-CV</th>
<th>MPx00-SP</th>
<th>MPx00Z</th>
<th>MPx00Z-CV</th>
<th>MPx00Z-SP</th>
</tr>
</thead>
<tbody>
<tr>
<td>MT - 0.1</td>
<td>1.3</td>
<td>1.6</td>
<td>2.1</td>
<td>1.3</td>
<td>1.6</td>
<td>2.1</td>
</tr>
<tr>
<td>MTM - 0.2</td>
<td>0.2</td>
<td>0.4</td>
<td>0.8</td>
<td>0.3</td>
<td>0.6</td>
<td>0.3</td>
</tr>
<tr>
<td>MT HI - 0.3</td>
<td>0.3</td>
<td>4.0</td>
<td>3.7</td>
<td>2.5</td>
<td>2.0</td>
<td>1.7 MAX</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).

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

<table>
<thead>
<tr>
<th>MODIFICATION</th>
<th>MPx00</th>
<th>MPx00-CV</th>
<th>MPx00-SP</th>
<th>MPx00Z</th>
<th>MPx00Z-CV</th>
<th>MPx00Z-SP</th>
</tr>
</thead>
<tbody>
<tr>
<td>MT - 0.1</td>
<td>1.3</td>
<td>1.6</td>
<td>2.1</td>
<td>1.3</td>
<td>1.6</td>
<td>2.1</td>
</tr>
<tr>
<td>MTM - 0.2</td>
<td>0.2</td>
<td>1.4</td>
<td>1.1 MAX</td>
<td>0.6</td>
<td>0.8</td>
<td>0.6 MAX</td>
</tr>
<tr>
<td>MT HI - 0.3</td>
<td>0.3</td>
<td>4.0</td>
<td>3.7 MAX</td>
<td>2.5</td>
<td>2.0</td>
<td>1.7 MAX</td>
</tr>
</tbody>
</table>

**d** - distance between reading head and top side of S

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

#### Version 0...

<table>
<thead>
<tr>
<th>MODIFICATION</th>
<th>D (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMT MP100</td>
<td>2 mm</td>
</tr>
<tr>
<td>CMT MP200</td>
<td>2.5</td>
</tr>
<tr>
<td>CMT MP300</td>
<td>2.5</td>
</tr>
</tbody>
</table>

**d** - distance between external zero signal actuator and reading head

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

#### Version 1...

<table>
<thead>
<tr>
<th>MODIFICATION</th>
<th>D (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMT MP100</td>
<td>2 mm</td>
</tr>
<tr>
<td>CMT MP200</td>
<td>2.5</td>
</tr>
<tr>
<td>CMT MP300</td>
<td>2.5</td>
</tr>
</tbody>
</table>

**d** - distance between external zero signal actuator and reading head

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

### ACCESSORIES

**DIGITAL READOUT DEVICES**

<table>
<thead>
<tr>
<th>CONNECTOR</th>
<th>12-pin round connector</th>
<th>9-pin flat connector</th>
<th>15-pin flat connector</th>
<th>10-pin round connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS3000</td>
<td>CS5000</td>
<td>CS5500</td>
<td>CS6000</td>
<td>CS6500</td>
</tr>
</tbody>
</table>

**POWER CABLE**

<table>
<thead>
<tr>
<th>CONNECTOR</th>
<th>12-pin round connector</th>
<th>9-pin flat connector</th>
<th>15-pin flat connector</th>
<th>10-pin round connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>B12</td>
<td>C12</td>
<td>D9</td>
<td>D15</td>
<td>FS10</td>
</tr>
</tbody>
</table>

**RS232**

<table>
<thead>
<tr>
<th>CONNECTOR</th>
<th>12-pin round connector</th>
<th>9-pin flat connector</th>
<th>15-pin flat connector</th>
<th>10-pin round connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>RS232</td>
<td>RS232</td>
<td>RS232</td>
<td>RS232</td>
<td>RS232</td>
</tr>
</tbody>
</table>
**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></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></td>
<td>See tables below</td>
</tr>
<tr>
<td>Power supply</td>
<td>5V DC ± 5%</td>
</tr>
<tr>
<td></td>
<td>5V ± 28% 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>90 mA max</td>
</tr>
<tr>
<td></td>
<td>10 max with 5V and R=12</td>
</tr>
<tr>
<td>Phase shift between signals</td>
<td>90° ± 5°</td>
</tr>
<tr>
<td>Protection (EC 520)</td>
<td>IP67</td>
</tr>
<tr>
<td>Operating temperature - version 1</td>
<td>-20...+65 °C</td>
</tr>
<tr>
<td></td>
<td>0...+50 °C</td>
</tr>
<tr>
<td></td>
<td>0...+50 °C</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-20...+85 °C</td>
</tr>
<tr>
<td></td>
<td>-20...+85 °C</td>
</tr>
<tr>
<td>Permissible humidity</td>
<td>100% non-condensing</td>
</tr>
<tr>
<td></td>
<td>100% non-condensing</td>
</tr>
<tr>
<td>Permissible vibration (5...2000 Hz)</td>
<td>300 m/s2</td>
</tr>
<tr>
<td></td>
<td>300 m/s2</td>
</tr>
<tr>
<td>Permissible shock (11 ms)</td>
<td>1000 m/s2</td>
</tr>
<tr>
<td></td>
<td>1000 m/s2</td>
</tr>
<tr>
<td>Output signal shape</td>
<td>Square-wave TTL or HTL pulses</td>
</tr>
<tr>
<td></td>
<td>Sine wave</td>
</tr>
<tr>
<td>Output signals</td>
<td>two main + one zero + their complementary</td>
</tr>
<tr>
<td></td>
<td>two main sine wave + one zero squ</td>
</tr>
<tr>
<td>Output scheme</td>
<td>Line driver</td>
</tr>
<tr>
<td>Weight of reading head - M7</td>
<td>40 g</td>
</tr>
<tr>
<td></td>
<td>100 g</td>
</tr>
<tr>
<td></td>
<td>100 g</td>
</tr>
<tr>
<td>Standard cable length</td>
<td>2.0 m</td>
</tr>
<tr>
<td></td>
<td>2.0 m</td>
</tr>
<tr>
<td>Max. cable length of head</td>
<td>10.0 m</td>
</tr>
<tr>
<td></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></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></td>
<td>Without reference signal (version C)</td>
</tr>
<tr>
<td>Pole pitch</td>
<td>1+1 mm</td>
</tr>
<tr>
<td></td>
<td>1+1 mm</td>
</tr>
<tr>
<td>Accuracy*</td>
<td>up to ±30 µm</td>
</tr>
<tr>
<td></td>
<td>up to ±30 µm</td>
</tr>
<tr>
<td>Resolution (after x4 in CINC)</td>
<td>0.5; 1; 6; 10 µm</td>
</tr>
<tr>
<td></td>
<td>up to 0.1 µm</td>
</tr>
<tr>
<td>Max. traversing speed:</td>
<td>- MTP-F10</td>
</tr>
<tr>
<td></td>
<td>- MTP-F100</td>
</tr>
<tr>
<td></td>
<td>5.6 m/s</td>
</tr>
<tr>
<td></td>
<td>8 m/s</td>
</tr>
<tr>
<td>Max. measuring frequency</td>
<td>300 kHz</td>
</tr>
<tr>
<td></td>
<td>12 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></td>
<td>With external actuator (version E). Reference marks are made with constant pitch 2 mm.</td>
</tr>
<tr>
<td></td>
<td>Reference marks on magnetic band according customer requirements (version Z).</td>
</tr>
<tr>
<td>Pole pitch</td>
<td>2+2 mm</td>
</tr>
<tr>
<td></td>
<td>2+2 mm</td>
</tr>
<tr>
<td>Accuracy*</td>
<td>up to ±10 µm</td>
</tr>
<tr>
<td></td>
<td>up to ±10 µm</td>
</tr>
<tr>
<td>Resolution (after x4 in CINC)</td>
<td>1,2; 10,25; 50,100,500 µm</td>
</tr>
<tr>
<td></td>
<td>up to 0.5 µm</td>
</tr>
<tr>
<td>Max. traversing speed:</td>
<td>- MTP-F10</td>
</tr>
<tr>
<td></td>
<td>- MTP-F100</td>
</tr>
<tr>
<td></td>
<td>1,2 m/s</td>
</tr>
<tr>
<td></td>
<td>12 m/s</td>
</tr>
<tr>
<td>Max. measuring frequency</td>
<td>300 kHz</td>
</tr>
<tr>
<td></td>
<td>6 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></td>
<td>With external actuator (version E). Reference marks are made with constant pitch 5 mm.</td>
</tr>
<tr>
<td></td>
<td>Reference marks on magnetic band according customer requirements (version Z).</td>
</tr>
<tr>
<td>Pole pitch</td>
<td>5+5 mm</td>
</tr>
<tr>
<td></td>
<td>5+5 mm</td>
</tr>
<tr>
<td>Accuracy*</td>
<td>up to ±30 µm</td>
</tr>
<tr>
<td></td>
<td>up to ±30 µm</td>
</tr>
<tr>
<td>Resolution (after x4 in CINC)</td>
<td>5; 10, 25, 50, 100 µm</td>
</tr>
<tr>
<td></td>
<td>up to 1 µm</td>
</tr>
<tr>
<td>Max. traversing speed:</td>
<td>- MTH-F50</td>
</tr>
<tr>
<td></td>
<td>- MTH-F250</td>
</tr>
<tr>
<td></td>
<td>6 m/s</td>
</tr>
<tr>
<td></td>
<td>12 m/s</td>
</tr>
<tr>
<td>Max. measuring frequency</td>
<td>300 kHz</td>
</tr>
<tr>
<td></td>
<td>2.4 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 m max. (20 m max. for MP 500)             |
| Thermal expansion coefficient | 10,5 x 10^(-6) °C per (at 20°C, 1°C) |
| Band radius        | 130 mm min.                                   |
| Weight of magnetic band | 65 g                                          |
| Weight of protective cover | 25 g                                          |
| Operating temperature | ±3...+70 °C                                   |
| Storage temperature | ±20...+80 °C                                   |

Note: In order to ensure the accuracy of encoder magnetic band must be longer than ML by 80 mm (40 mm from each side).

**MAGNETIC BAND**

<table>
<thead>
<tr>
<th>Magnetic Band</th>
<th>MP100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pole pitch</td>
<td>1+1 mm</td>
</tr>
<tr>
<td></td>
<td>2+2 mm</td>
</tr>
<tr>
<td></td>
<td>2+2 mm</td>
</tr>
<tr>
<td></td>
<td>5+5 mm</td>
</tr>
<tr>
<td>Reference mark position</td>
<td>on request from left or right at pitches of 4 mm or multiples</td>
</tr>
<tr>
<td>Note: Magnetic band MP100Z is used only with reading head MTM100Z</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Magnetic Band</th>
<th>MP500/MP500Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pole pitch</td>
<td>1+1 mm</td>
</tr>
<tr>
<td></td>
<td>2+2 mm</td>
</tr>
<tr>
<td></td>
<td>2+2 mm</td>
</tr>
<tr>
<td></td>
<td>5+5 mm</td>
</tr>
<tr>
<td>Reference mark position</td>
<td>on request from left or right at pitches of 10 mm or multiples</td>
</tr>
<tr>
<td>Note: Magnetic band MP500Z is used only with reading head MTM500Z</td>
<td></td>
</tr>
</tbody>
</table>
**PRODUCT CATALOG**

**PRODUCT CATALOG**

**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**

- $a = 0.25 \pi \pm 0.125 \pi$

**AV OUTPUT SIGNALS - VERSION 2 ONLY**

- A and B amplitude 0.6 V...1.2 V (~1V)
- 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 120Ω impedance and power supply voltage of reading head 5V±5%.

**ORDER FORM**

**MODIFICATION - READING HEAD VERSION - OUTPUT SIGNALS AND RESOLUTION - REFERENCE MARKS - POWER SUPPLY - MAGNETIC BAND (MP) - PROTECTIVE STEEL COVER CV - OR ALUMINIUM PROTECTIVE SUPPORT SP - EXTERNAL REFERENCE MARK ACTUATOR - CABLE LENGTH - CONNECTOR TYPE**

<table>
<thead>
<tr>
<th>MODIFICATION (MT)</th>
<th>READING HEAD VERSION</th>
<th>OUTPUT SIGNALS AND RESOLUTION</th>
<th>REFERENCE MARKS</th>
<th>POWER SUPPLY</th>
<th>MAGNETIC BAND (MP)</th>
<th>PROTECTIVE STEEL COVER CV</th>
<th>OR ALUMINIUM PROTECTIVE SUPPORT SP</th>
<th>EXTERNAL REFERENCE MARK ACTUATOR</th>
<th>CABLE LENGTH</th>
<th>CONNECTOR TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>C</td>
<td>0 - 5V DC ±5%</td>
<td>MP100/01 - 1m</td>
<td>W - without SP</td>
<td>01 - with SME</td>
<td></td>
<td>0 - 5m</td>
<td>C12 - round, 12 pins</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>C</td>
<td>0 - 5V DC ±5%</td>
<td>MP200/01 - 1m</td>
<td>W - without SP</td>
<td>02 - with SME</td>
<td></td>
<td>100 - 200m</td>
<td>D9 - flat, 9 pins</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>C</td>
<td>0 - 5V DC ±5%</td>
<td>MP500/01 - 1m</td>
<td>W - without SP</td>
<td>03 - with SME</td>
<td></td>
<td>500 - 500m</td>
<td>D15 - flat, 15 pins</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>C</td>
<td>0 - 5V DC ±5%</td>
<td>MP100/02 - 2m</td>
<td>W - without SP</td>
<td>01 - with SME</td>
<td></td>
<td>1000 - 2000m</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>C</td>
<td>0 - 5V DC ±5%</td>
<td>MP200/03 - 3m</td>
<td>W - without SP</td>
<td>02 - with SME</td>
<td></td>
<td>1500 - 3000m</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>C</td>
<td>0 - 5V DC ±5%</td>
<td>MP500/05 - 5m</td>
<td>W - without SP</td>
<td>03 - with SME</td>
<td></td>
<td>3000 - 6000m</td>
<td></td>
</tr>
</tbody>
</table>

**ORDER EXAMPLE:**

1) MTM-F100-C-0-MP200/03-SP/03-W-0-02/W
2) PCMTH-F500-E-0-MP500/05-CV/05-W-1-02/D9
MK
MAGNETIC LINEAR ENCODER

Magnetic absolute linear encoder MK has measuring length of up to 50,000 mm, accuracy can reach up to ±x5 µm. The encoder has two versions of serial interface – SSI or BiSS C, but optionally it can have 2 analog sinusoidal signals with phase shift 90°C and amplitude approx. 1 Vpp.

MECHANICAL DATA

MK PARAMETERS

- Pole pitch: 2 ± 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: 50, 100, 50, 10, 5, 1 µm
- Accuracy: ± 15 µm
- Max. traversing speed: 30 m/min
- Power supply: 6…28 V DC ± 5%
- Current consumption with load: 150 mA max. (with R=120Ω)

Protection (EN 60529): IP67
Operating temperature: 0...+50 °C
Storage temperature: -20...+70 °C
Permissible humidity: 100%
Permissible vibration (55...2000 Hz): 0.14 MHz
Permissible shock (11 ms): 0.7 MAX
Electrical protections: from inversion of power supply polarity and from short circuit on output port

Standard cable length / max. cable length: 2.0 / 25.0 m (100 m if power supply is 24V)

OUTPUT SIGNALS

<table>
<thead>
<tr>
<th>Interface</th>
<th>Signals level</th>
<th>Clock frequency</th>
<th>± Position bit</th>
<th>± 1 increment</th>
<th>CNC division factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSI</td>
<td>5V Binary - Gray</td>
<td>0.1...1.2 MHz</td>
<td>20 + 2 x 1 bit</td>
<td>± 0.25 mm</td>
<td>± 0.25 mm</td>
</tr>
<tr>
<td>BiSS C</td>
<td>0...+70 °C</td>
<td>0.1...4 MHz</td>
<td>12 ± 0.65 µm</td>
<td>± 0.25 mm</td>
<td>± 0.25 mm</td>
</tr>
</tbody>
</table>

CABLE

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 0.35 mm², signals 0.10 mm²
- - cables’ bending radius should not be lower than 45 mm.
- In case of cable extension, it is necessary to guarantee:
  - electrical connection between the body of the connectors and the cables shield;
  - minimum power supply voltage of 5 V to the head.

PROTECTIVE BAND CV

Stainless steel cover CV width 10 mm, thickness 0.3 mm for magnetic band. It is not possible to use the protective support SP if the magnetic band is already covered by stainless steel band CV.

PROTECTIVE SUPPORT SP

Aluminium protective support SP for magnetic band MP protection is glued on magnetic band.

ACCESSORIES

CONNECTORS FOR CABLE

- B12 - 12-pin round connector
- C12 - 12-pin round connector
- D9 - 9-pin flat connector
- D15 - 15-pin flat connector
- D10 - 10-pin round connector
- D14 - 14-pin round connector
- D9C - 9-pin connector
- C12C - 12-pin connector

DIGITAL READOUT DEVICES

ORDER FORM

ORDER EXAMPLE: 1) MK-F10-20/MP200A/02-SP/02-A02/C12

<table>
<thead>
<tr>
<th>ABSOLUTE RESOLUTION</th>
<th>OUTPUT SIGNALS:</th>
<th>INCREMENTAL SIGNALS:</th>
<th>MAGNETIC BAND LENGTH:</th>
<th>MAGNETIC STEEL COVER LENGTH:</th>
<th>OR ALUMINIUM STEEL COVER LENGTH:</th>
<th>CABLE LENGTH AND OUTPUT:</th>
<th>CONNECTOR TYPE</th>
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<tr>
<td>5 µm</td>
<td>+20/0 +20/0</td>
<td>+20/0 +20/0</td>
<td>5V/0 +20/0</td>
<td>5V/0 +20/0</td>
<td>5V/0 +20/0</td>
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<td>10 µm</td>
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<td>5 kµm</td>
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<td>5V/0 +20/0</td>
<td>5V round connector</td>
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ORDER EXAMPLE: 1) MK-F10-20/MP200A/02-SP/02-A02/C12
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.
Encoder couplings

### MECHANICAL DATA

**Coupling model** | **SC30** | **SC70** | **SC98-1** | **SC98-2**
--- | --- | --- | --- | ---
Kinematic accuracy (with parallel offset ≤ 0.05 mm and angular misalignment ≤ 0.05°) | ±10 arc sec | ±2 arc sec | ±0.5 arc sec | ±1 arc sec
Torsional rigidity | 150 Nm/rad | 4000 Nm/rad | 6000 Nm/rad | 4000 Nm/rad
Permissible torque | 0.1 Nm | 0.5 Nm | 1 Nm | 1 Nm
Moment of inertia (approx.) | \(3 \times 10^{-1} \text{ kgm}^2\) | \(2 \times 10^{-1} \text{ kgm}^2\) | \(2 \times 10^{-1} \text{ kgm}^2\) | \(1.7 \times 10^{-1} \text{ kgm}^2\)
Permissible radial misalignment | ≤ 0.2 mm | ≤ 0.3 mm | ≤ 0.3 mm | ≤ 0.3 mm
Permissible angular error | ≤ 1° | ≤ 0.5° | ≤ 1° | ≤ 0.5°
Permissible axial misalignment | ≤ 0.2 mm | ≤ 0.2 mm | ≤ 0.2 mm | ≤ 0.2 mm
Permissible shaft speed | 16000 rpm | 3000 rpm | 1000 rpm | 1000 rpm
Weight | 0.027 kg | 0.22 kg | 0.25 kg | 0.21 kg
Encoder compatibility | A28, A36, A436, AA, AK50, AS8, AK38, AP58 | A110 | A170 | A170

### ORDER FORM

<table>
<thead>
<tr>
<th>MODEL</th>
<th>DIAMETER D1</th>
<th>DIAMETER D2</th>
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<td>04 - Ø4mm</td>
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<td>05 - Ø5mm</td>
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<td>SC98-2</td>
<td>05 - Ø5mm</td>
<td>05 - Ø5mm</td>
<td>22 - 32mm</td>
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</table>

*Only for SC30*
**MECHANICAL DATA**

- **Input signals (A):** Incremental signals
- **Reference signal:** 7-16 mA
- **Input signals (AV):** Incremental signals
- **Reference signal:** 0.6-1.2 V
- **Output signals:** TTL(RS422) compatible
- **Operating voltage:** 5 V
- **Max input frequency:** 50 kHz

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**Signal interpolation:**
- NK-1
- NK-2
- NK-3
- NK-4
- NK-5
- NK-6
- NK-7
- NK-8
- NK-9
- NK-10

**Encoder compatibility:**

**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
  - RS10: 10-pin round connector
  - ONC: 10-pin round connector

- **Connectors on housing:**
  - 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

- **Cable:**
  - Cable ø6 mm
  - Armoured cable ø6 mm

**Digital Readout Devices**
- CS3000
- CS5500

**ORDER FORM**

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*The positions of switches depending on interpolation factor and linear/rotary encoder reference mark width.*
**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; 2; 5; 10; 20; 50 µm; 0.1; 0.2; 0.5; 1; 5; 10 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:** AC 85V ~ 230V
- **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)
- Memory correction

---

**ORDER FORM**

- **CS**  
- XXXX  
- X

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**MECHANICAL DATA**

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**COMPATIBLE WITH:**


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**CS 5500**  
ADVANCED TWO AND THREE AXIS READOUT DEVICES

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**TECHNICAL DATA**

- **Input standard:** RS 422
- **Power supply for encoders:** +5 V DC
- **Resolution of linear encoders:** 0.1; 0.2; 0.5; 1; 2; 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

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**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

---

**ORDER FORM**

- **CS**  
- XXXX  
- X

---

**MECHANICAL DATA**

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**COMPATIBLE WITH:**

## ENCODER ELECTRICAL CONNECTION
### FOR ~ 11 µA

#### 9-PINS FLAT CONNECTOR D9, MALE

<table>
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<tr>
<th>Pin number</th>
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#### 9-PINS ROUND CONNECTOR C9, MALE

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#### 10-PINS ROUND CONNECTOR ONC, MALE

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#### 12-PINS ROUND MINI CONNECTOR HR10A

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### ENCODER ELECTRICAL CONNECTION
### FOR ~ 1Vpp; TTL; HTL

#### 9-PINS FLAT CONNECTOR D9, MALE

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#### 12-PINS ROUND CONNECTOR C12T, MALE

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#### 12-PINS ROUND CONNECTOR C12T, MALE

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**ENCODER ELECTRICAL CONNECTION**

FOR ~ 1VPP; TTL; HTL

### 12-PINS ROUND CONNECTOR B12, MALE

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<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><strong>Color</strong></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><strong>AV (~ 1V)</strong></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><strong>TTL, U = +5V</strong></td>
<td>U1</td>
<td>U1</td>
<td>U2</td>
<td>U2</td>
<td>UC</td>
<td>UC</td>
<td>UO</td>
<td>UO</td>
<td>+5V</td>
</tr>
<tr>
<td><strong>HTL, U = +12V</strong></td>
<td>U1</td>
<td>U1</td>
<td>U2</td>
<td>U2</td>
<td>UC</td>
<td>UC</td>
<td>UO</td>
<td>UO</td>
<td>+15V</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>
<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><strong>Color</strong></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><strong>TTL, U = +5V</strong></td>
<td>U1</td>
<td>U1</td>
<td>U2</td>
<td>U2</td>
<td>UC</td>
<td>UC</td>
<td>UO</td>
<td>UO</td>
<td>+5V</td>
</tr>
</tbody>
</table>

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

**For housing**

### 15-PINS FLAT CONNECTOR D15T, MALE

<table>
<thead>
<tr>
<th>Pin number</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>5/6/13/14/15</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Color</strong></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>Black</td>
<td>Violet</td>
</tr>
<tr>
<td><strong>1Vpp, U = +5V</strong></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>Sensor +5V</td>
<td>Sensor 0V</td>
</tr>
<tr>
<td><strong>TTL, U = +5V</strong></td>
<td>U1</td>
<td>U1</td>
<td>U2</td>
<td>U2</td>
<td>UC</td>
<td>UC</td>
<td>UO</td>
<td>UO</td>
<td>Sensor +5V</td>
<td>Sensor 0V</td>
</tr>
</tbody>
</table>

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

### 12-PINS ROUND MINI CONNECTOR HR10A

**For cable**

<table>
<thead>
<tr>
<th>Pin number</th>
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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>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Color</strong></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><strong>AV</strong></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>
</tr>
<tr>
<td><strong>TTL</strong></td>
<td>U1</td>
<td>U1</td>
<td>U1</td>
<td>U2</td>
<td>U2</td>
<td>U2</td>
<td>U2</td>
<td>U2</td>
</tr>
<tr>
<td><strong>HTL</strong></td>
<td>U1</td>
<td>U1</td>
<td>U1</td>
<td>U1</td>
<td>U1</td>
<td>U1</td>
<td>U1</td>
<td>U1</td>
</tr>
<tr>
<td><strong>U = +15V</strong></td>
<td>U1</td>
<td>U1</td>
<td>U1</td>
<td>U1</td>
<td>U1</td>
<td>U1</td>
<td>U1</td>
<td>U1</td>
</tr>
</tbody>
</table>

### 8-PINS ROUND MINI CONNECTOR HR25

**For cable**

<table>
<thead>
<tr>
<th>Pin number</th>
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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>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Color</strong></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><strong>AV</strong></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>
</tr>
<tr>
<td><strong>TTL</strong></td>
<td>U1</td>
<td>U1</td>
<td>U1</td>
<td>U1</td>
<td>U1</td>
<td>U1</td>
<td>U1</td>
<td>U1</td>
</tr>
<tr>
<td><strong>HTL</strong></td>
<td>U1</td>
<td>U1</td>
<td>U1</td>
<td>U1</td>
<td>U1</td>
<td>U1</td>
<td>U1</td>
<td>U1</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 (di- ameter 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 0V.

Linear encoder cable can be protected by metal hose with additional plastic cover (IP64) type SYLVIN. 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.