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**HEIDENHAIN**



Preliminary Product  
Information

## **LIC 4000 Series**

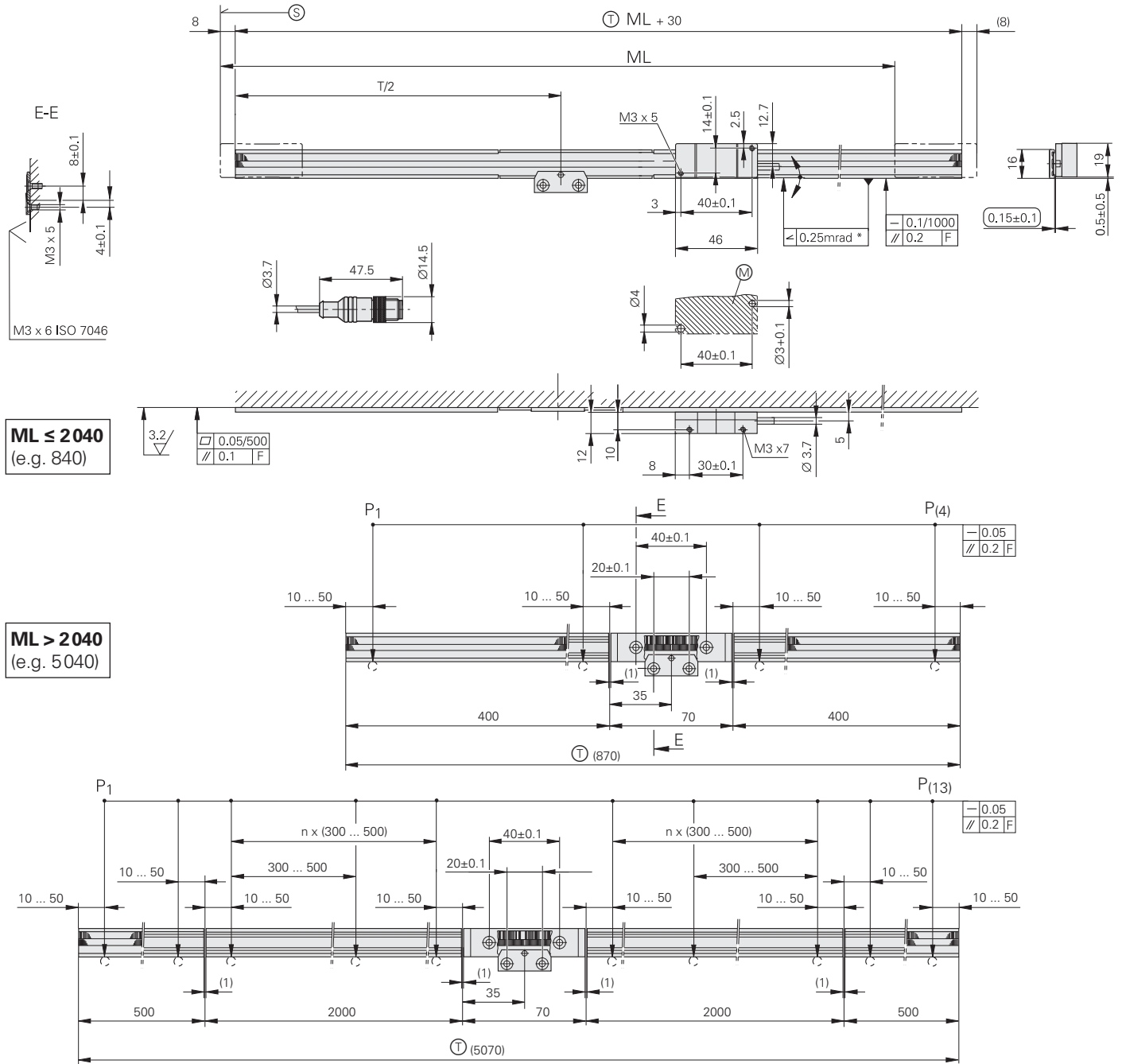
Exposed Absolute Linear  
Encoders

April 2009

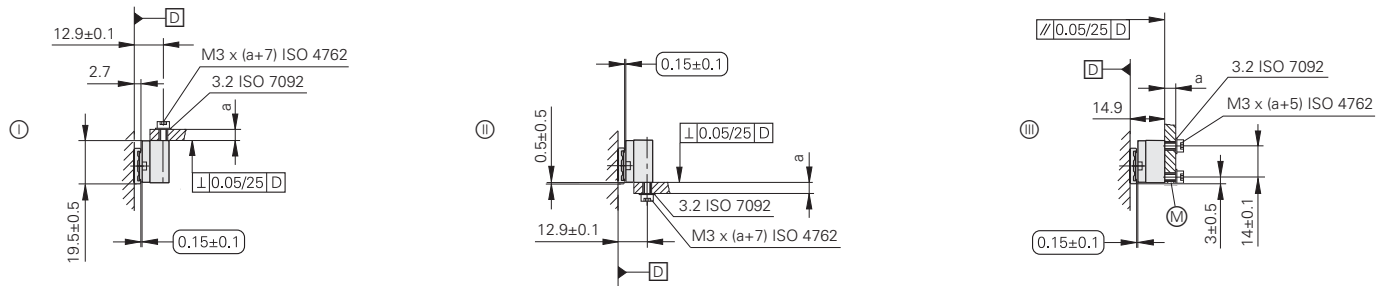
# LIC 4000 Series

## Exposed absolute linear encoders

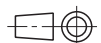
- Measuring lengths up to 27 m
- Measuring steps to 0.001  $\mu\text{m}$  (1 nm)
- Dimensions same as LIDA 400
- Absolute position value from the scale graduation in serial absolute code structure



## Possibilities for mounting the scanning head



Dimensions in mm



Tolerancing ISO 8015  
ISO 2768 - m H  
< 6 mm:  $\pm 0.2$  mm

- F = Machine guideway
- $\textcircled{O}$  = Adjust or set
- \* = Max. change during operation
- P = Gauging points for alignment
- $\textcircled{S}$  = Beginning of measuring length (ML)

- $\textcircled{T}$  = Carrier length
- $\textcircled{M}$  = Mounting surface for scanning head  $\textcircled{III}$
- $\textcircled{I}$ ,  $\textcircled{II}$ ,  $\textcircled{III}$  = Mounting options



| Specifications  | LIC 4015 <sup>1)</sup>  | LIC 4017  |   |
|---|---|---|---|
| <b>Measuring standard</b>                                   | Steel scale tape with METALLUR absolute code track                                      |   |   |
| Coefficient of linear expansion                             | Depends on the mounting surface   | $\alpha_{\text{therm}} \approx 10 \times 10^{-6} \text{ K}^{-1}$  |   |
| <b>Accuracy grade</b>                                       | $\pm 5 \mu\text{m}$   | $\pm 15 \mu\text{m}$ or $\pm 5 \mu\text{m}$ after linear length-error compensation in the subsequent electronics  |   |
| <b>Measuring length ML*</b> in mm                           | Up to 27 040 mm   | Up to 6 040 mm  |   |
| <b>Mounting</b>   | Steel scale-tape drawn into aluminum extrusions and tensioned                           | Steel scale-tape drawn into aluminum extrusions and fixed at center   |   |
| <b>Absolute position values</b>                             | EnDat 2.2   |   |   |
| Ordering designation  | EnDat 22  |   |   |
| Resolution  | 0.001 $\mu\text{m}$ (1 nm)  |   |   |
| <b>Power supply</b>   | 3.6 to 14 V   |   |   |
| <b>Power consumption of encoder</b><br>(without cable loss) | $\leq 1000 \text{ mW}$ ( $\leq 250 \text{ mA}$ at 3.6 V)                                |   |   |
| <b>Electrical connection</b>                                | Cable 3 m with 8-pin M12 connector (male)   |   |   |
| <b>Traversing speed</b>                                     | $\leq 480 \text{ m/min}$  |   |   |
| <b>Vibration</b> 55 to 2000 Hz<br><b>Shock</b> 11 ms        | $\leq 200 \text{ m/s}^2$ (EN 60068-2-6)<br>$\leq 500 \text{ m/s}^2$ (EN 60068-2-27)     |   |   |
| <b>Operating temperature</b>                                | 0 °C to 50 °C   |   |   |
| <b>Protection</b>   | IP 40   |   |   |
| <b>Weight</b>   | Scanning head<br>Scale tape<br>Set of parts<br>Scale-tape carrier<br>Cable<br>Connector | 16 g (without connecting cable)<br>31 g/m<br>$80 \text{ g} + n^2 \cdot 27 \text{ g}$<br>187 g/m<br>20 g/m<br>32 g | 16 g (without connecting cable)<br>31 g/m<br>20 g<br>68 g/m<br>20 g/m<br>32 g |

\* Please select when ordering

<sup>1)</sup> In development; dimensions only apply for LIC 4017

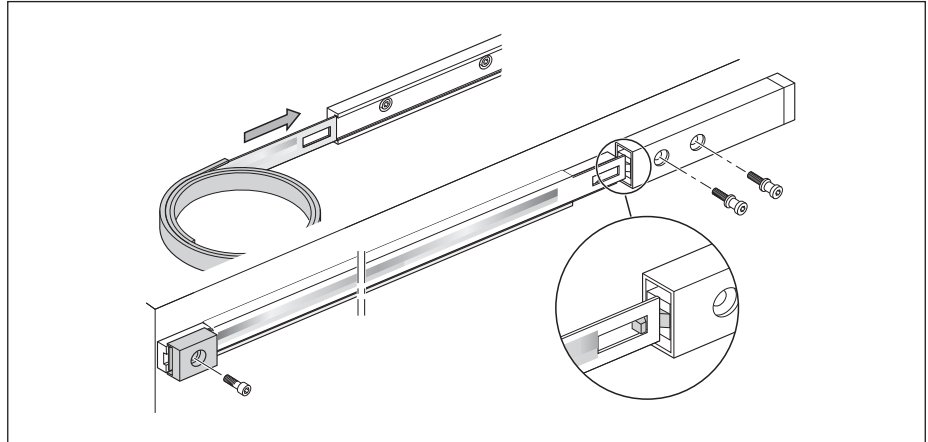
<sup>2)</sup>  $n = 1$  for ML 3 140 to 5 040 mm;  $n = 2$  for ML 5 140 to 7 040 mm; etc.

# Mechanical Design Types and Mounting

Exposed linear encoders consist of two components: the scanning head and the scale or scale tape. They are positioned to each other solely by the machine guideway.

## LIC 4015 scale

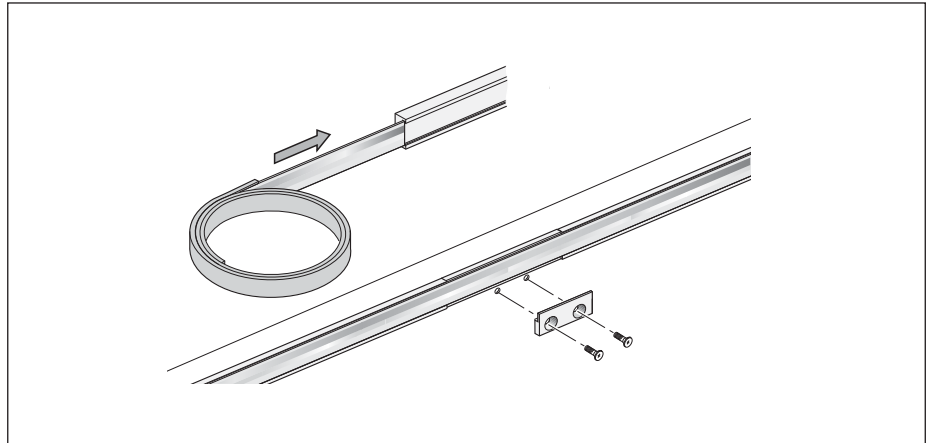
The scale carrier sections are secured to the bearing surface with screws or with PRECIMET adhesive film. Then the one-piece steel scale tape is pulled into the carrier, **tensioned in a defined manner**, and **fixed at its ends** to the machine base. The LIC 4x5 therefore shares the thermal behavior of its mounting surface.



LIC 4015 scale

## LIC 4017 scale

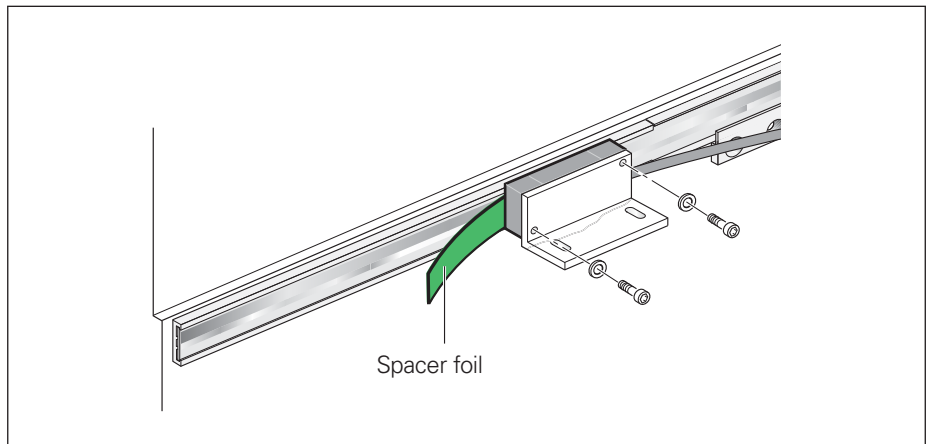
The scale carrier sections are fixed to the bearing surface with PRECIMET adhesive mounting film; the one-piece scale tape is pulled in and **the midpoint is fixed** to the machine bed. This mounting method allows the scale to expand freely at both ends and ensures a defined thermal behavior.



LIC 4017 scale

## LIC 4000 scanning head

There are three options for mounting the scanning head (see Dimensions). A spacer foil makes it quite easy to set the gap between the scanning head and the scale or scale tape.

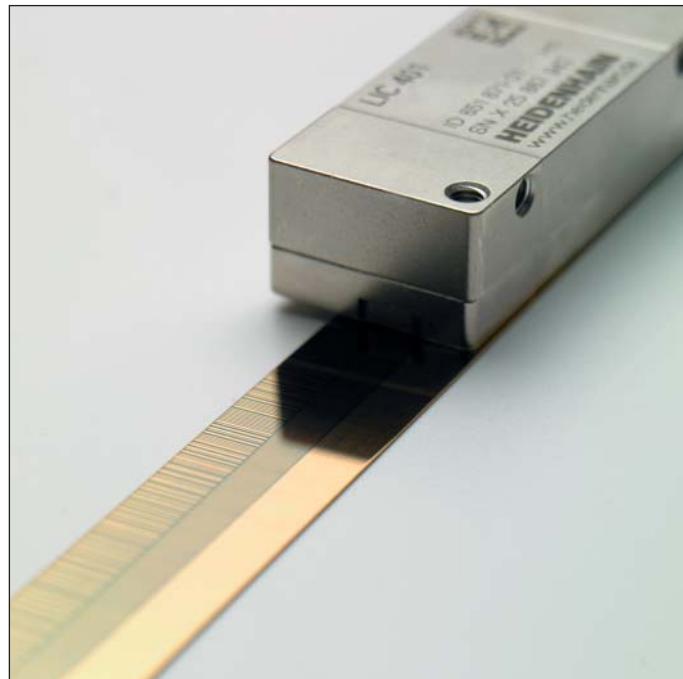


Scanning head

# Linear Encoders for Absolute Position Measurement

Linear encoders of the LIC 4000 series are exposed **absolute linear encoders** for **measuring lengths up to 27 m**. They have the same dimensions as the incremental LIDA 400.

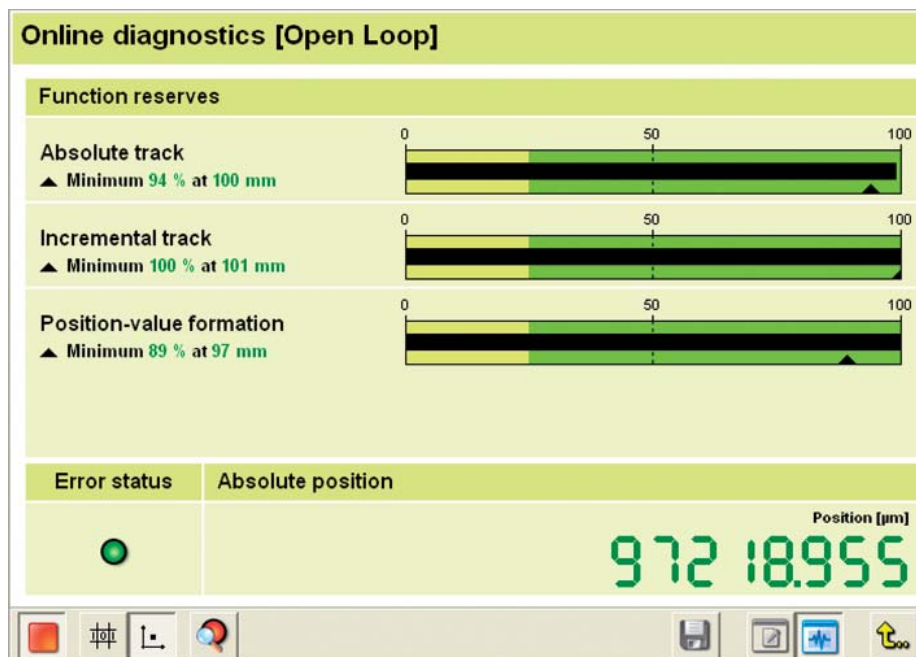
With the **absolute measuring method**, the position value is available from the encoder immediately upon switch-on and can be called at any time by the subsequent electronics. There is no need to move the axes to find the reference position. The absolute position information is read **from the scale-tape graduation**, which is formed from a serial absolute code structure.



## Adjustment and Diagnosis

Adjustment is quite easy with the Adjusting and Testing package based on valuation numbers. The valuation numbers provide the current state of the encoder and ascertain the encoder's "functional reserves."


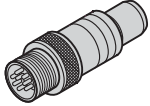



Cyclical output of the valuation numbers is also possible during normal operation in order to evaluate or diagnose the encoder functions.



Screen showing the valuation numbers as functional reserves (e.g. with IK 215)

# Electrical Connection





## Pin Layout

| 8-pin coupling M12  |   |             |           |             |   |                          |          |                           |
|---|---|-------------|-----------|-------------|---|--------------------------|----------|---------------------------|
|  |  |             |           |             |  |                          |          |                           |
|   | Power supply  |             |           |             | Absolute position values  |                          |          |                           |
|   | <b>2</b>  | <b>8</b>    | <b>1</b>  | <b>5</b>    | <b>3</b>  | <b>4</b>                 | <b>7</b> | <b>6</b>                  |
|   | $U_P^{1)}$  | $U_P$       | $0V^{1)}$ | $0V$        | DATA  | $\overline{\text{DATA}}$ | CLOCK    | $\overline{\text{CLOCK}}$ |
|   | Blue  | Brown/Green | White     | White/Green | Gray  | Pink                     | Violet   | Yellow                    |

**Cable shield** connected to housing;  $U_P$  = power supply voltage

<sup>1)</sup> For parallel supply lines

## Connecting Cables

| PUR connecting cables  |   | 8-pin: $[(4 \times 0.14 \text{ mm}^2) + (4 \times 0.34 \text{ mm}^2)] \text{ } \varnothing 6 \text{ mm}$ |
|--|---|--|
| <b>Complete</b> with 8-pin M12 connector (female) and 8-pin M12 coupling (male)                  |  | 368330-xx  |
| <b>Complete</b> with 8-pin M12 connector (female) and 15-pin D-sub connector (female) for IK 220 |  | 533627-xx  |
| <b>Complete</b> with 8-pin M12 connector (female) and 15-pin D-sub connector (male) for IK 215   |  | 524599-xx  |
| <b>With one</b> M12 connector (female) 8-pin   |  | 634265-xx  |

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### For more information

- Catalog: *Exposed Linear Encoders*
- *EnDat* Technical Information