HEIDENHAIN

Product Information

LIC 4100

Absolute Exposed
Linear Encoders

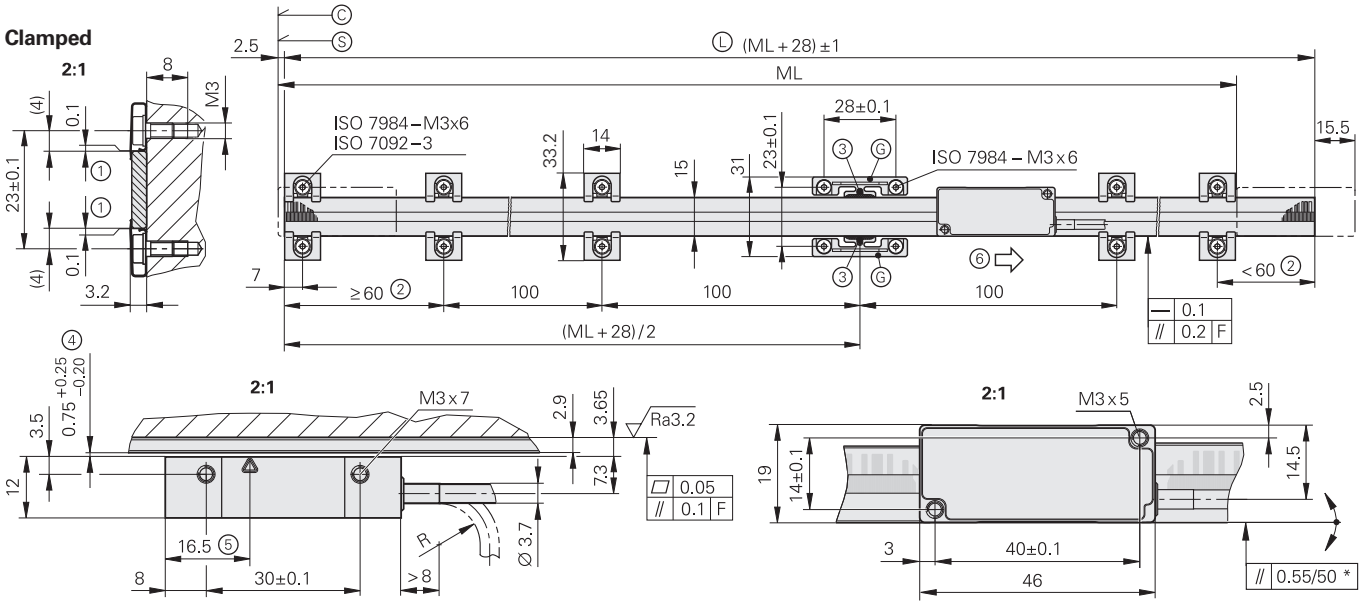
01/2020

LIC 4113, LIC 4193

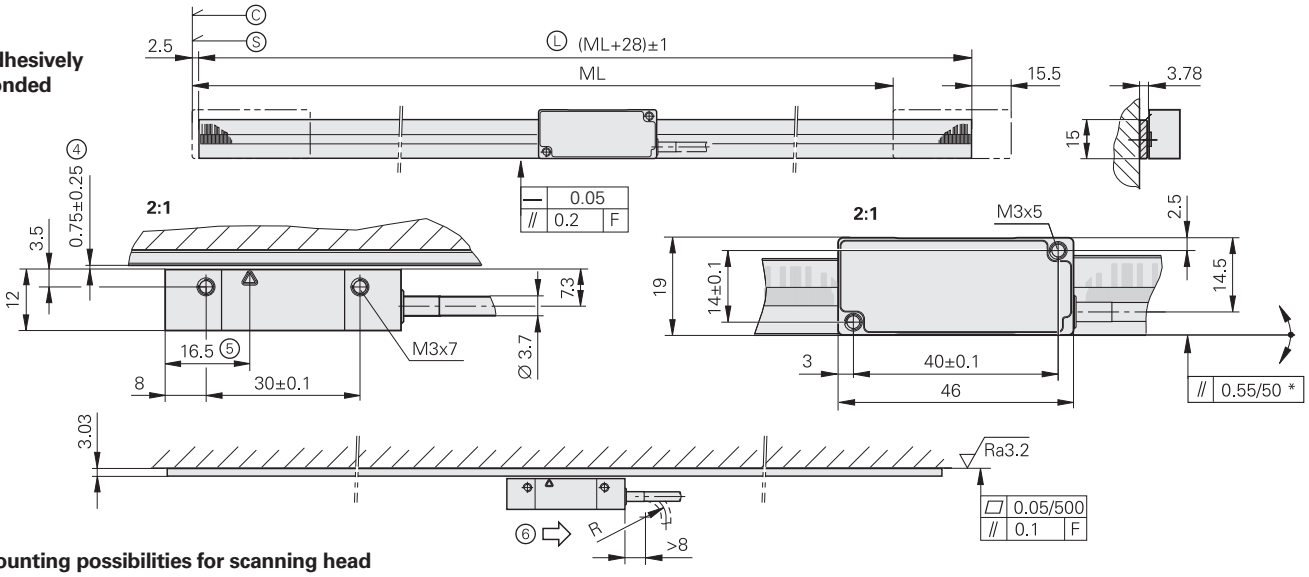
Absolute linear encoders for measuring lengths up to 3 m

- **Consisting of a linear scale and scanning head; measuring steps down to 1 nm**
- **Glass or glass ceramic measuring standard**
- **Measuring standard is secured with adhesive film or with fixing clamps**
- **Version available for use in a high vacuum (see separate Product Information document)**
- **Also available with an angled cable outlet**

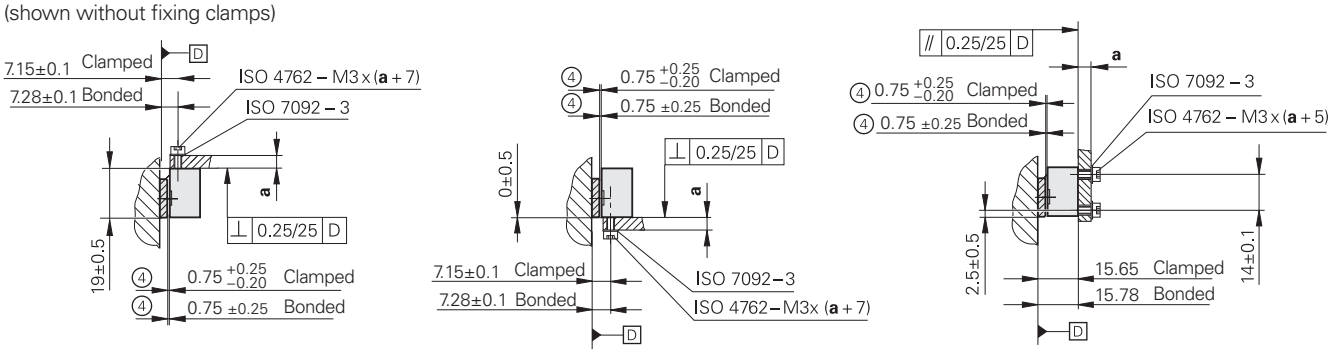
Clamped



Adhesively bonded



Mounting possibilities for scanning head
(shown without fixing clamps)



F = Machine guideway
* = Mounting error plus dynamic guideway error
Ⓢ = Beginning of measuring length (ML)
Ⓒ = Code start value: 100±1 mm
Ⓛ = Scale length
Ⓖ = Fixed-point element for defining the thermal fixed point
1 = Gap is adjusted with a spacer shim during mounting
2 = Depending on the measuring length (ML), use an additional pair of fixing clamps
3 = Adhesive
4 = Mounting clearance between scanning head and linear scale
5 = Optical centerline
6 = Direction of motion of the scanning unit for ascending position values

mm
Tolerancing ISO 8015
ISO 2768 - m H
< 6 mm: ±0.2 mm

Linear scale	LIC 4003
Measuring standard Coefficient of linear expansion*	METALLUR grating on glass ceramic or glass $\alpha_{therm} \approx 8 \cdot 10^{-6}\ K^{-1}$ (glass) $\alpha_{therm} = (0 \pm 0.5) \cdot 10^{-6}\ K^{-1}$ (Robax glass ceramic)
Accuracy grade*	±1 µm (only for Robax glass ceramic), ±3 µm, ±5 µm
Baseline error	≤ ±0.275 µm/10 mm
Measuring length (ML)* in mm	240 340 440 640 840 1040 1240 1440 1640 1840 2040 2240 2440 2640 2840 3040 (Robax glass ceramic only up to ML of 1640)
Mass	3 g + 0.11 g/mm of measuring length

Scanning head	LIC 411	LIC 419F	LIC 419M		LIC 419P	LIC 419Y
Interface	EnDat 2.2	Fanuc Serial Interface αi	Mitsubishi high speed interface		Panasonic Serial Interface	Yaskawa Serial Interface
Ordering designation*	EnDat22	Fanuc05	Mit03-4	Mit03-2	Pana02	YEC07
Measuring step*	0.01 µm (10 nm) 0.005 µm (5 nm) 0.001 µm (1 nm)[1]					
Calculation time t_{cal} Clock frequency	≤ 5 µs ≤ 16 MHz	–				
Traversing speed[2]	≤ 600 m/min					
Interpolation error	±20 nm					
Electrical connection*	Cable (1 m or 3 m) with 8-pin M12 coupling (male) or 15-pin D-sub connector (male)					
Cable length (with HEIDENHAIN cable)	≤ 100 m	≤ 50 m	≤ 30 m		≤ 50 m	
Supply voltage	DC 3.6 V to 14 V					
Power consumption[2] (max.)	*At 3.6 V:* ≤ 700 mW *At 14 V:* ≤ 800 mW	*At 3.6 V:* ≤ 850 mW *At 14 V:* ≤ 950 mW				
Current consumption (typical)	*At 5 V:* 75 mA (without load)	*At 5 V:* 95 mA (without load)				
Vibration 55 Hz to 2000 Hz **Shock** 6 ms	≤ 500 m/s² (EN 60068-2-6) ≤ 1000 m/s² (EN 60068-2-27)					
Operating temperature	–10 °C to 70 °C					
Mass Scanning head Cable Connecting element	≤ 18 g (without cable) 20 g/m *M12 coupling:* 15 g; *D-sub connector:* 32 g					

* Please select when ordering
[1] *Mitsubishi:* measuring length ≤ 2040 mm
Yaskawa: measuring length ≤ 1840 mm
[2] See *General electrical information* in the *Interfaces of HEIDENHAIN Encoders* brochure

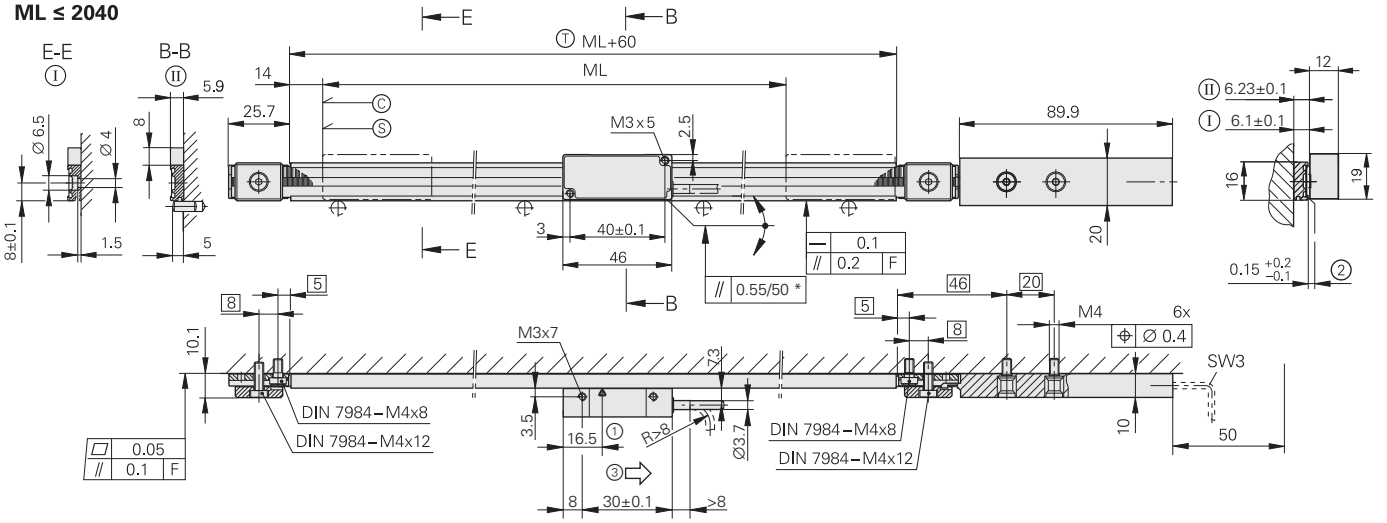
Robax is a registered trademark of Schott-Glaswerke, Mainz, Germany

LIC 4115, LIC 4195

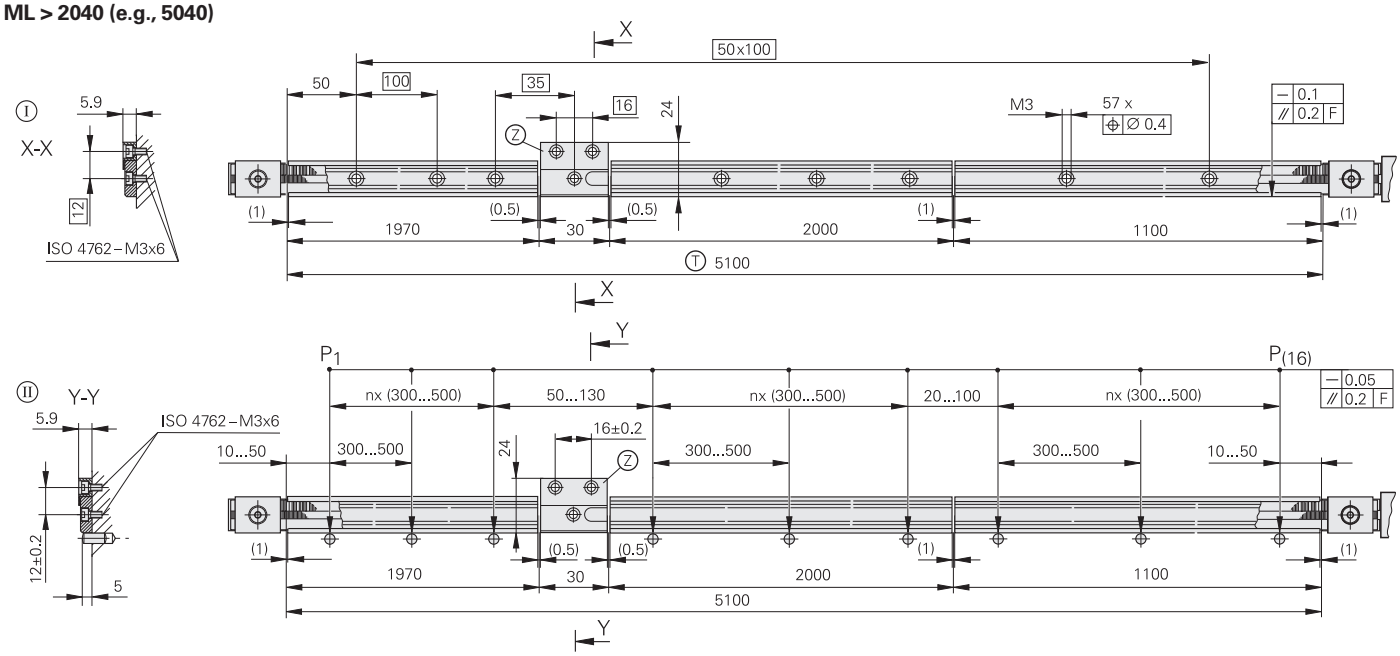
Absolute linear encoders for measuring lengths up to 28 m

- **For measuring steps down to 1 nm**
- **Steel scale tape is drawn into the aluminum extrusions and tensioned**
- **Consisting of a linear scale and scanning head**
- **Also available with an angled cable outlet**

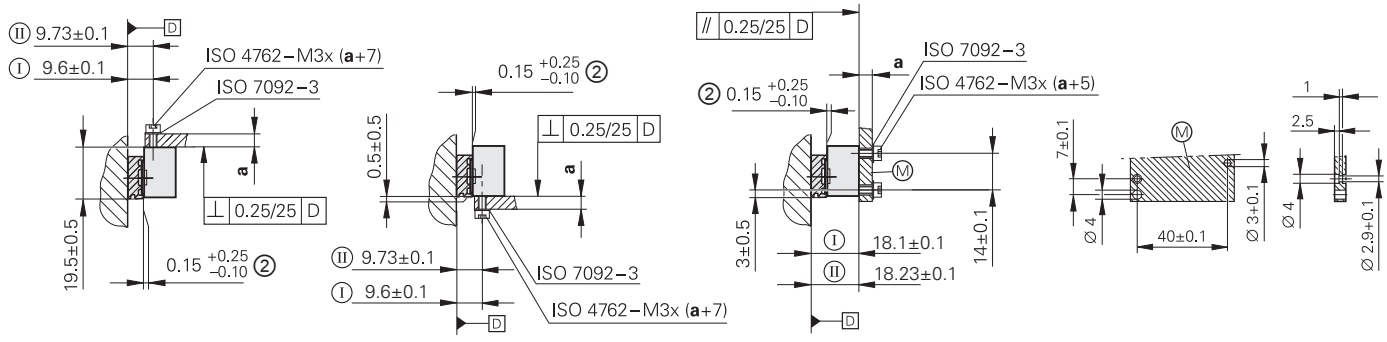
ML ≤ 2040



ML > 2040 (e.g., 5040)



Mounting possibilities for scanning head



mm

Tolerancing ISO 8015
ISO 2768 - m H
< 6 mm: ±0.2 mm

F = Machine guideway
P = Measuring points for alignment
* = Mounting error plus dynamic guideway error
© = Code start value: 100 mm
Ⓢ = Beginning of measuring length (ML)
Ⓣ = Carrier length
Ⓩ = Spacer for measuring lengths of 3040 mm or greater

1 = Optical centerline
2 = Mounting clearance between scanning head and extrusion
3 = Direction of motion of the scanning unit for ascending position values

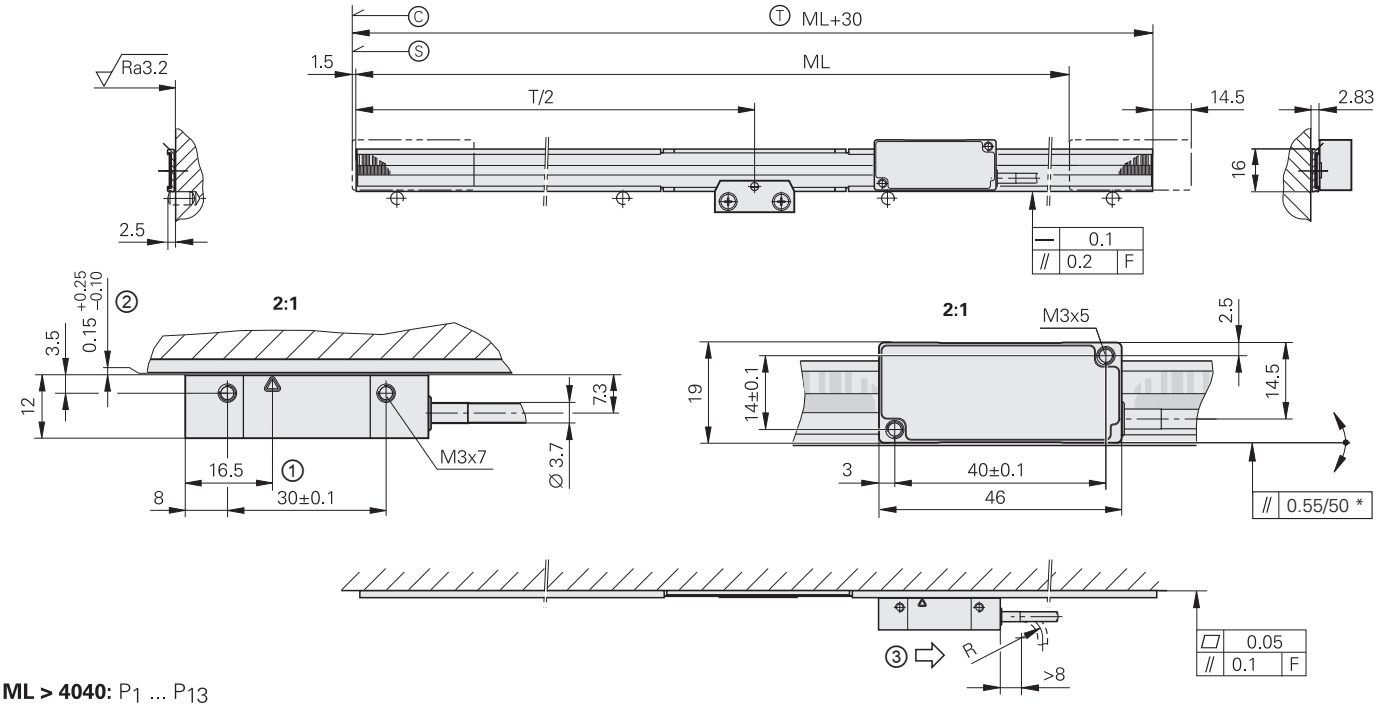
Linear scale		**LIC 4005**
Measuring standard Coefficient of linear expansion		Steel scale tape with absolute and incremental METALLUR track Depends on the mounting surface
Accuracy grade		±5 µm
Baseline error		≤ ±0.750 µm/50 mm (typical)
Measuring length (ML)* in mm		140 240 340 440 540 640 740 840 940 1040 1140 1240 1340 1440 1540 1640 1740 1840 1940 2040
		Greater measuring lengths up to 28440 mm with a single-section scale tape and individual scale tape carrier sections
Mass	Scale tape Parts kit Scale tape carrier	31 g/m 80 g + n[1] · 27 g 187 g/m

Scanning head		**LIC 411**	**LIC 419F**	**LIC 419M**		**LIC 419P**	**LIC 419Y**
Interface		EnDat 2.2	Fanuc Serial Interface αi	Mitsubishi high speed interface		Panasonic Serial Interface	Yaskawa Serial Interface
Ordering designation*		EnDat22	Fanuc05	Mit03-4	Mit03-2	Pana02	YEC07
Measuring step* (note the measuring length limitation[2])		0.01 µm (10 nm) 0.005 µm (5 nm) 0.001 µm (1 nm)					
Calculation time t_{cal} Clock frequency		≤ 5 µs ≤ 16 MHz	–				
Traversing speed[3]		≤ 600 m/min					
Interpolation error		±20 nm					
Electrical connection*		Cable (1 m or 3 m) with 8-pin M12 coupling (male) or 15-pin D-sub connector (male)					
Cable length (with HEIDENHAIN cable)		≤ 100 m	≤ 50 m	≤ 30 m		≤ 50 m	
Supply voltage		DC 3.6 V to 14 V					
Power consumption[3] (max.)		*At 3.6 V:* ≤ 700 mW *At 14 V:* ≤ 800 mW	*At 3.6 V:* ≤ 850 mW *At 14 V:* ≤ 950 mW				
Current consumption (typical)		*At 5 V:* 75 mA (without load)	*At 5 V:* 95 mA (without load)				
Vibration 55 Hz to 2000 Hz **Shock** 6 ms		≤ 500 m/s² (EN 60068-2-6) ≤ 1000 m/s² (EN 60068-2-27)					
Operating temperature		–10 °C to 70 °C					
Mass	Scanning head Cable Connecting element	≤ 18 g (without cable) 20 g/m *M12 coupling:* 15 g; *D-sub connector:* 32 g					

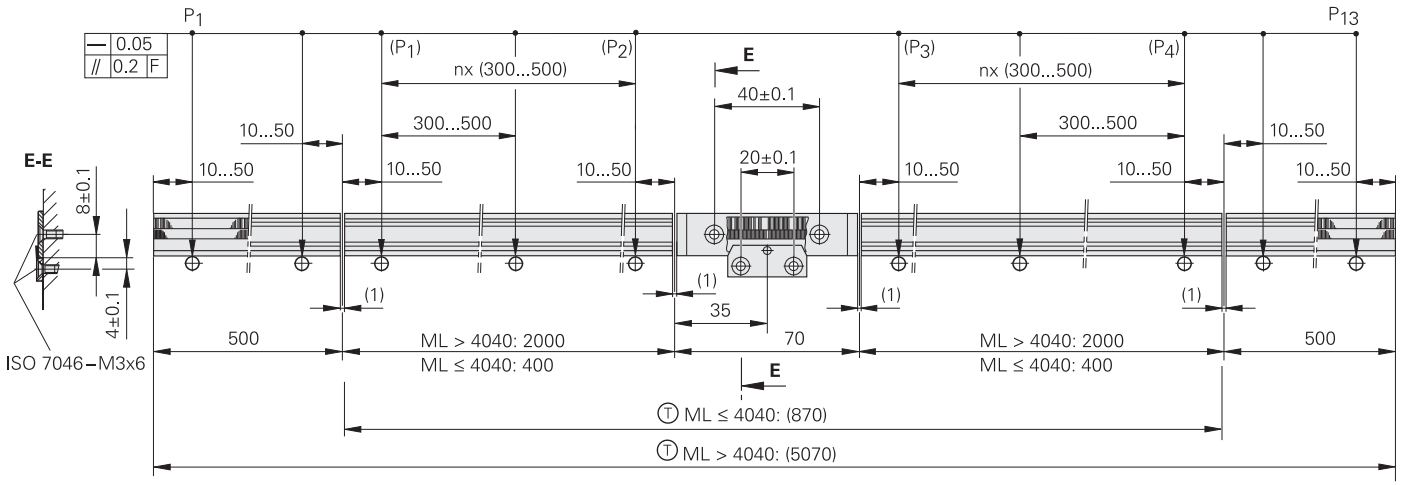
* Please select when ordering
[1] n = 1 for ML 3140 mm to 5040 mm; n = 2 for ML 5140 mm to 7040 mm; etc.*
[2] *Mitsubishi:* 1 nm: measuring length ≤ 2040 mm; 5 nm: measuring length ≤ 10040 mm; 10 nm: measuring length ≤ 20040 mm
Yaskawa: 1 nm: measuring length ≤ 1840 mm; 5 nm: measuring length ≤ 9040 mm; 10 nm: measuring length ≤ 18040 mm
[3] See *General electrical information* in the *Interfaces of HEIDENHAIN Encoders* brochure

LIC 4117, LIC 4197

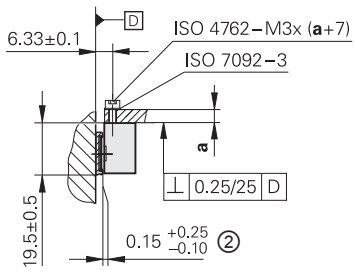
Absolute linear encoders for measuring lengths up to 6 m
- **For measuring steps down to 1 nm**
- **Steel scale tape is drawn into aluminum extrusions and fastened at center**
- **Consisting of a linear scale and scanning head**
- **Also available with an angled cable outlet**

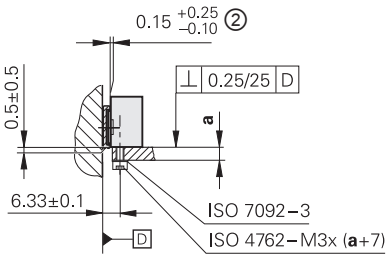


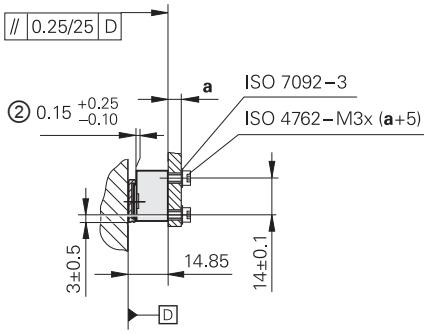
ML > 4040: P_1 ... P_{13}
ML ≤ 4040: (P_1 ... P_4)



Mounting possibilities for scanning head







mm
Tolerancing ISO 8015
ISO 2768 - m H
< 6 mm: ±0.2 mm

F = Machine guideway
P = Measuring points for alignment
* = Mounting error plus dynamic guideway error
Ⓒ = Code start value: 100 mm
Ⓢ = Beginning of measuring length (ML)
Ⓣ = Carrier length

1 = Optical centerline
2 = Mounting clearance between scanning head and extrusion
3 = Direction of motion of the scanning unit for ascending position values

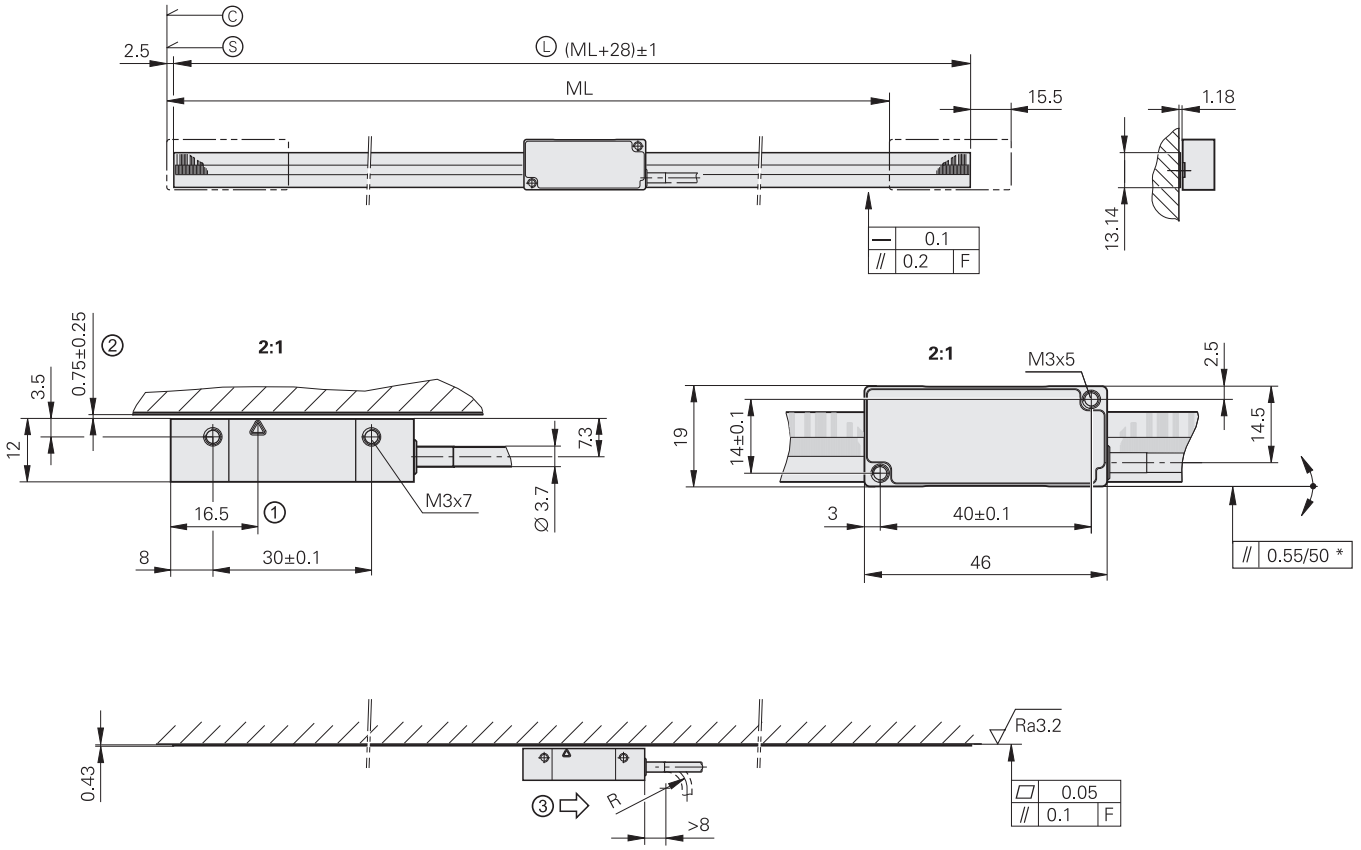
Linear scale	**LIC 4007**
Measuring standard Coefficient of linear expansion	Steel scale tape with absolute and incremental METALLUR track $\alpha_{therm} \approx 10 \cdot 10^{-6}\ K^{-1}$
Accuracy grade*	±3 µm (up to ML 1040), ±5 µm (at ML 1240 or greater), ±15 µm[1)]
Baseline error	≤ ±0.750 µm/50 mm (typical)
Measuring length ML* in mm	240 440 640 840 1040 1240 1440 1640 1840 2040 2240 2440 2640 2840 3040 3240 3440 3640 3840 4040 4240 4440 4640 4840 5040 5240 5440 5640 5840 6040
Mass Scale tape Parts kit Scale tape carrier	31 g/m 20 g 68 g/m

Scanning head	**LIC 411**	**LIC 419F**	**LIC 419M**		**LIC 419P**	**LIC 419Y**
Interface	EnDat 2.2	Fanuc Serial Interface αi	Mitsubishi high speed interface		Panasonic Serial Interface	Yaskawa Serial Interface
Ordering designation*	EnDat22	Fanuc05	Mit03-4	Mit03-2	Pana02	YEC07
Measuring step*	0.01 µm (10 nm) 0.005 µm (5 nm) 0.001 µm (1 nm)[2)]					
Calculation time t_{cal} Clock frequency	≤ 5 µs ≤ 16 MHz	–				
Traversing speed[3)]	≤ 600 m/min					
Interpolation error	±20 nm					
Electrical connection*	Cable (1 m or 3 m) with 8-pin M12 coupling (male) or 15-pin D-sub connector (male)					
Cable length (with HEIDENHAIN cable)	≤ 100 m	≤ 50 m	≤ 30 m		≤ 50 m	
Supply voltage	DC 3.6 V to 14 V					
Power consumption[3)] (max.)	*At 3.6 V:* ≤ 700 mW *At 14 V:* ≤ 800 mW	*At 3.6 V:* ≤ 850 mW *At 14 V:* ≤ 950 mW				
Current consumption (typical)	*At 5 V:* 75 mA (without load)	*At 5 V:* 95 mA (without load)				
Vibration 55 Hz to 2000 Hz **Shock** 6 ms	≤ 500 m/s² (EN 60068-2-6) ≤ 1000 m/s² (EN 60068-2-27)					
Operating temperature	–10 °C to 70 °C					
Mass Scanning head Cable Connecting element	≤ 18 g (without cable) 20 g/m *M12 coupling:* 15 g; *D-sub connector:* 32 g					

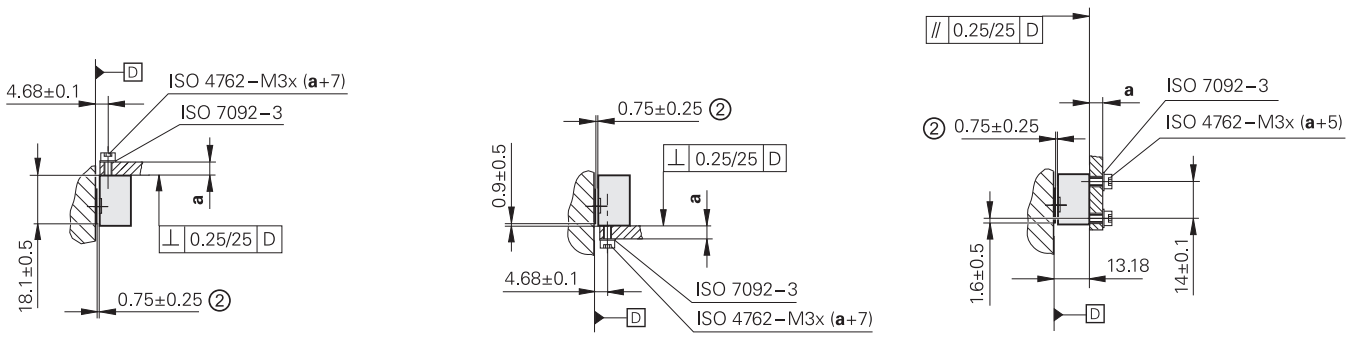
* Please select when ordering
1) ±5 µm after linear length-error compensation in the evaluation electronics
2) *Mitsubishi:* measuring length ≤ 2040 mm
Yaskawa: measuring length ≤ 1840 mm
3) See *General electrical information* in the *Interfaces of HEIDENHAIN Encoders* brochure

LIC 4119, LIC 4199

Absolute linear encoders for measuring lengths up to 1 m
- **For measuring steps down to 1 nm**
- **Steel scale tape is adhesively bonded to mounting surface**
- **Consisting of a linear scale and scanning head**
- **Also available with an angled cable outlet**



Mounting possibilities for scanning head



mm
Tolerancing ISO 8015
ISO 2768 - m H
< 6 mm: ±0.2 mm

F = Machine guideway
* = Mounting error plus dynamic guideway error
Ⓒ = Code start value: 100 mm
Ⓢ = Beginning of measuring length (ML)
Ⓛ = Scale tape length
1 = Optical centerline
2 = Mounting clearance between scanning head and linear scale
3 = Direction of motion of the scanning unit for ascending position values

Linear scale	**LIC 4009**
Measuring standard Coefficient of linear expansion	Steel scale tape with absolute and incremental METALLUR track $\alpha_{therm} \approx 10 \cdot 10^{-6}\ K^{-1}$
Accuracy grade*	±3 µm, ±15 µm[1)]
Baseline error	≤ ±0.750 µm/50 mm (typical)
Measuring length ML* in mm	70 120 170 220 270 320 370 420 520 620 720 820 920 1020
Mass	31 g/m

Scanning head	**LIC 411**	**LIC 419F**	**LIC 419M**		**LIC 419P**	**LIC 419Y**
Interface	EnDat 2.2	Fanuc Serial Interface αi	Mitsubishi high speed interface		Panasonic Serial Interface	Yaskawa Serial Interface
Ordering designation*	EnDat22	Fanuc05	Mit03-4	Mit03-2	Pana02	YEC07
Measuring step*	0.01 µm (10 nm) 0.005 µm (5 nm) 0.001 µm (1 nm)[2)]					
Calculation time t_{cal} Clock frequency	≤ 5 µs ≤ 16 MHz	–				
Traversing speed[3)]	≤ 600 m/min					
Interpolation error	±20 nm					
Electrical connection*	Cable (1 m or 3 m) with 8-pin M12 coupling (male) or 15-pin D-sub connector (male)					
Cable length (with HEIDENHAIN cable)	≤ 100 m	≤ 50 m	≤ 30 m		≤ 50 m	
Supply voltage	DC 3.6 V to 14 V					
Power consumption[3)] (max.)	*At 3.6 V:* ≤ 700 mW *At 14 V:* ≤ 800 mW	*At 3.6 V:* ≤ 850 mW *At 14 V:* ≤ 950 mW				
Current consumption (typical)	*At 5 V:* 75 mA (without load)	*At 5 V:* 95 mA (without load)				
Vibration 55 Hz to 2000 Hz **Shock** 6 ms	≤ 500 m/s² (EN 60068-2-6) ≤ 1000 m/s² (EN 60068-2-27)					
Operating temperature	–10 °C to 70 °C					
Mass Scanning head Cable Connecting element	≤ 18 g (without cable) 20 g/m *M12 coupling:* 15 g; *D-sub connector:* 32 g					

* Please select when ordering
1) ±5 µm after linear length-error compensation in the evaluation electronics
2) *Mitsubishi:* measuring length ≤ 2040 mm
Yaskawa: measuring length ≤ 1840 mm
3) See *General electrical information* in the *Interfaces of HEIDENHAIN Encoders* brochure

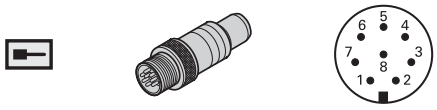
Electrical connection

EnDat connecting cables

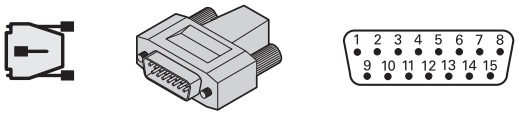
PUR (4 × 0.14 mm²) + (4 × 0.34 mm²) Ø 6 mm; A_P = 0.34 mm²		**EnDat**
With 8-pin M12 connector (female) and 8-pin M12 coupling (male)		368330-xx
With 8-pin M12 connector (female) and 15-pin D-sub connector (female) for the IK 220		533627-xx
With 8-pin M12 connector (female) and 15-pin D-sub connector (male) for the IK 215		524599-xx
With 8-pin M12 connector (female) and stripped cable end		634265-xx

EnDat pin layout

8-pin M12 coupling



15-pin D-sub connector



	Power supply				Serial data transfer			
	8	**2**	**5**	**1**	**3**	**4**	**7**	**6**
	4	**12**	**2**	**10**	**5**	**13**	**8**	**15**
	U_P	**Sensor** U_P	**0 V**	**Sensor** 0 V	**DATA**	**$\overline{\text{DATA}}$**	**CLOCK**	**$\overline{\text{CLOCK}}$**
	Brown/Green	Blue	White/Green	White	Gray	Pink	Violet	Yellow

Cable shield connected to housing; **U_P** = Power supply voltage
Sensor: The sense line is connected in the encoder with the corresponding power line.
Vacant pins or wires must not be used!

Connecting cables and pin layouts for Fanuc, Mitsubishi, Panasonic, and Yaskawa can be found in the *Exposed Linear Encoders* brochure.

HEIDENHAIN

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This Product Information document supersedes all previous editions, which thereby become invalid. The basis for ordering from HEIDENHAIN is always the Product Information document edition valid when the order is made.

Further information:

Comply with the requirements described in the following documents to ensure the correct operation of the encoder:

- Brochure: *Exposed Linear Encoders* 208960-xx
- Brochure: *Cables and Connectors* 1206103-xx
- Brochure: *Interfaces of HEIDENHAIN Encoders* 1078628-xx
- Technical Information document: *EnDat* 383942-18

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