HEIDENHAIN

Product Information

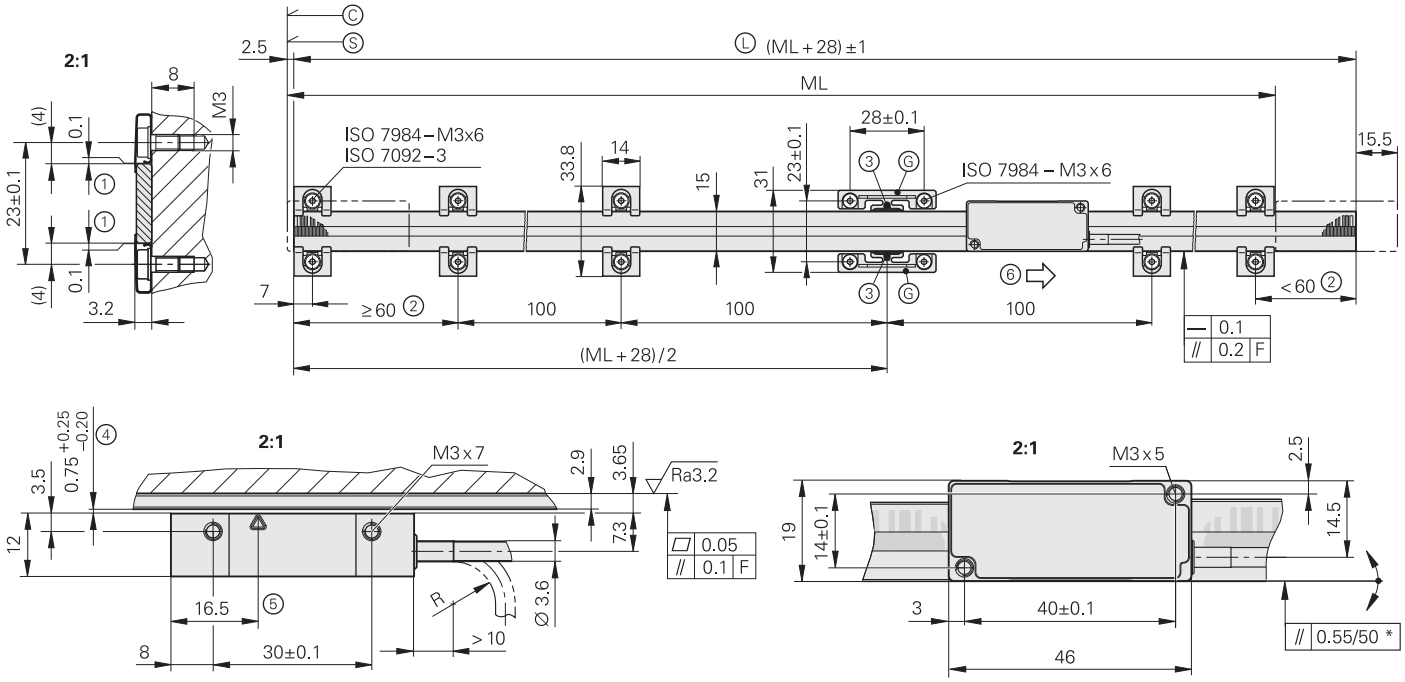
LIC 4113V
LIC 4193V

Exposed Linear Encoders
for High Vacuum

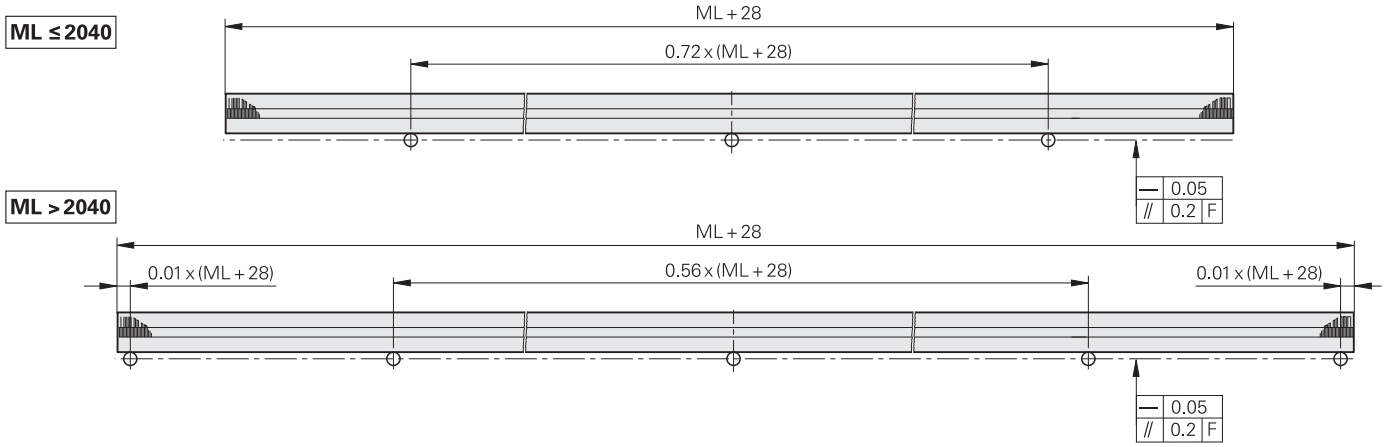
01/2020

LIC 4113V, LIC 4193V

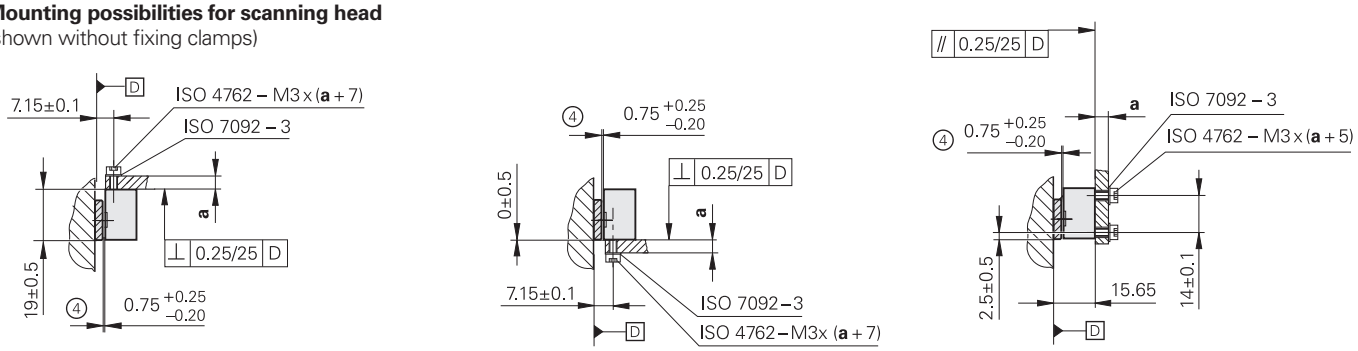
Exposed linear encoders for high vacuum applications
- **Measuring lengths up to 3 m**
- **Measuring steps down to 0.001 µm**
- **Glass or glass ceramic measuring standard**
- **Measuring standard is secured with fixing clamps**



Position of the stop pins



Mounting possibilities for scanning head
(shown without fixing clamps)



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

F = Machine guideway
* = Mounting error plus dynamic guideway error
Ⓢ = Beginning of measuring length (ML)
Ⓒ = Code start value: 100±1 mm
Ⓛ = Linear scale length
Ⓖ = Fixed-point element for defining the thermal fixed point
1 = Gap is adjusted with a spacer shim during mounting
2 = Depends on measuring length (ML); use 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

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) $\alpha_{therm} = (0\pm0.5) \cdot 10^{-6}\ K^{-1}$ (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 + 0.1 g/mm of measuring length

Scanning head	LIC 411V	LIC 419FV	LIC 419MV		LIC 419PV	LIC 419YV
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 15-pin D-sub connector (female)					
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 50 °C					
Baking temperature	100 °C					
Vacuum class	High vacuum down to 10^{-7} mbar					
Protection EN 60529	IP40					
Mass Scanning head Cable Connecting element	18 g (without cable) 21 g/m *D-sub connector:* 64 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

Encoders for use in a vacuum

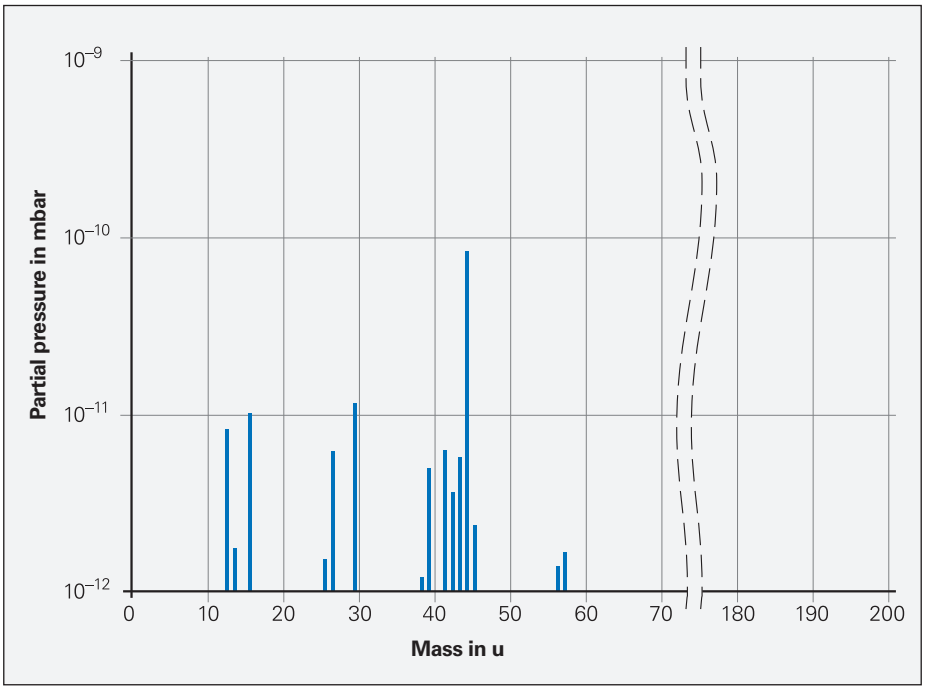
These vacuum-compatible encoders feature the following characteristics:
- Air vents
- Clean-room manufacturing
- Specialized cleaning and packaging
- Cable with PTFE insulation and tin-plated copper braiding

Residual gas analysis
The influence of encoders on the quality of a vacuum can be determined through residual gas analyses. In these analyses, a sample in a vacuum chamber is pumped out to at least 10^{-6} mbar (turbomolecular pump, pumping speed 15 l/s to 200 l/s). The residual gases are measured with a mass spectrometer (Pfeiffer QMA 200) and an absolute pressure sensor (VACOM ATMION). The outgassing behavior of the examined sample can then be deduced by subtracting the typical residual gases of the empty chamber.

The amount of remaining residual gases depends not only on the cleanliness of the sample and the tested materials, but also on the pump type used and its pumping speed. The higher the pumping speed for the measurement is, and the longer the gas is pumped out, the lower the amount of residual gases will be.

To attain the lowest possible outgassing values, HEIDENHAIN recommends baking at 100 °C for 48 hours under high vacuum conditions.

The figure shows the spectrum of the residual gas analysis of an AK LIC 411V scanning head with a 1 m cable and D-sub connector. The scanning head was baked at 100 °C in a high vacuum. The outgassing of the linear scale (with fixed-point adhesive bond) was barely measurable or depictable.



Residual gas analysis of an AK LIC 411V scanning head with 1 m cable (pumping speed: 107 l/s, pressure: $6 \cdot 10^{-8}$ mbar)

Electrical connection
Cables

PUR connecting cables [4 x (2 x 0.09 mm^2)]; A_P = 0.09 mm^2			
PUR connecting cables [(4 × 0.14 mm^2) + (4 × 0.34 mm^2)]; A_P = 0.34 mm^2		Ø 6 mm	Ø 3.7 mm[1)]
With 8-pin M12 connector (female) and 8-pin M12 coupling (male)		1036372-xx	801142-xx
With 8-pin M12 right-angle connector (female) and 8-pin M12 coupling (male)		373289-xx	801149-xx
With 8-pin M12 connector (female) and 15-pin D-sub connector (male) for the PWM 20, EIB 74x, etc.		524599-xx	801129-xx
With 8-pin M12 right-angle connector (female) and 15-pin D-sub connector (male) for the PWM 20, EIB 74x, etc.		722025-xx	801140-xx
With 8-pin M12 connector (female) and stripped cable end		634265-xx	–
With 8-pin M12 right-angle connector (female) and unstripped cable end		606317-xx	–

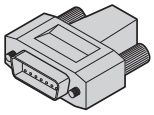
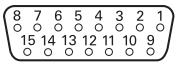
[1)] Maximum overall length: 6 m
A_P: Cross section of power supply lines

Electrical connection
Pin layout

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

EnDat pin layout

15-pin D-sub connector

	Power supply				Serial data transfer			
	5	**12**	**7**	**14**	**4**	**11**	**1**	**9**
	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!

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: *Linear Encoders for Vacuum Technology* 627568-xx

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