



HEIDENHAIN



Product Information

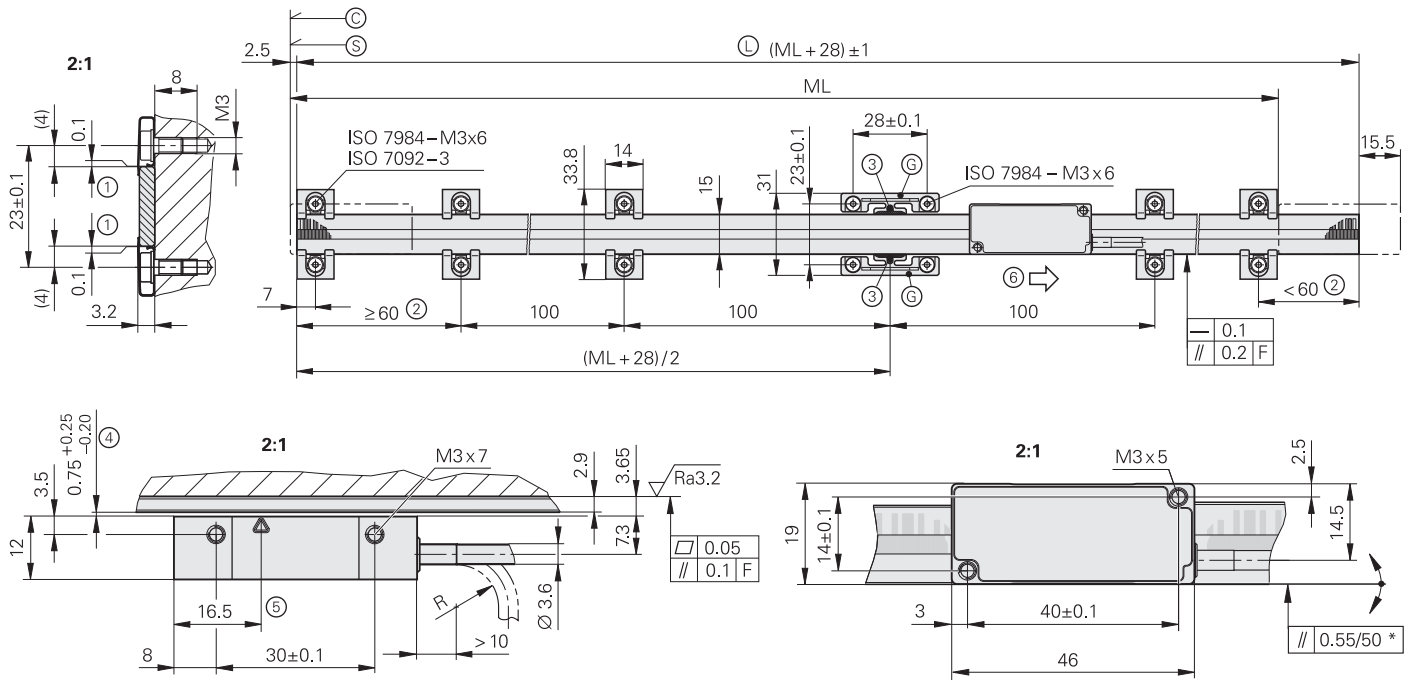
LIC 4113V **LIC 4193V**

Exposed Linear Encoders
for High Vacuum

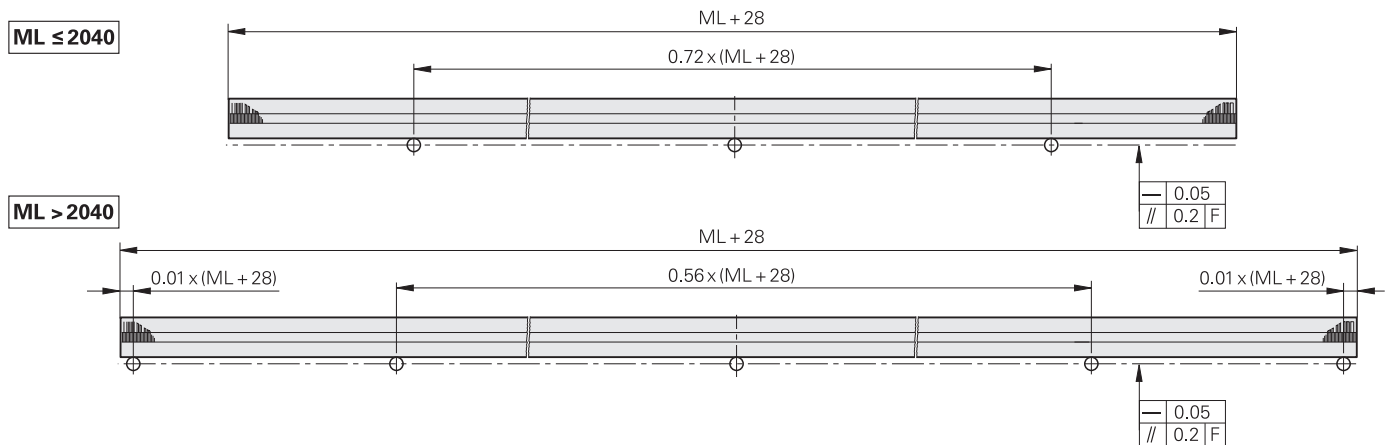
LIC 4113V, LIC 4193V

Absolute linear encoders for high vacuum

- Measuring lengths up to 3 m
- Measuring steps down to 0.001 μm
- Glass or glass ceramic measuring standard
- Measuring standard is fastened with fixing clamps

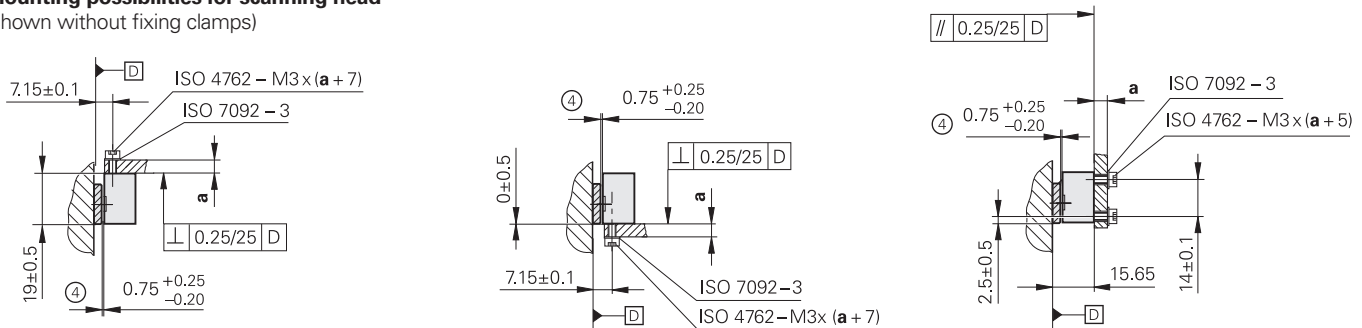


Position of the stop pins



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 assembly
- 2 = Depending on the measuring length ML, use an additional fixing clamp pair
- 3 = Adhesive
- 4 = Mounting clearance between scanning head and linear scale
- 5 = Optical centerline
- 6 = Direction of scanning unit motion for output signals as per interface description



Linear scale	LIC 4003
Measuring standard Coefficient of linear expansion*	METALLUR graduation on glass ceramic or glass $\alpha_{\text{therm}} \approx 8 \cdot 10^{-6} \text{ K}^{-1}$ (glass) $\alpha_{\text{therm}} = (0 \pm 0.5) \cdot 10^{-6} \text{ K}^{-1}$ (Robax glass ceramic)
Accuracy grade*	$\pm 1 \mu\text{m}$ (only for Robax glass ceramic), $\pm 3 \mu\text{m}$, $\pm 5 \mu\text{m}$
Baseline error	$\leq \pm 0.275 \mu\text{m}/10 \text{ mm}$
Measuring length ML* in mm	240 340 440 640 840 1040 1240 1440 1640 1840 2040 2240 2440 2640 2840 3040 (Robax glass ceramic 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	Mit02-2	Pana01	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	$\leq 5 \mu\text{s}$ 16 MHz	–				
Traversing speed ²⁾	$\leq 600 \text{ m/min}$					
Interpolation error	$\pm 20 \text{ nm}$					
Electrical connection	Cable, 1 m or 3 m, with 15-pin D-sub connector (female)					
Cable length (with HEIDENHAIN cable)	$\leq 100 \text{ m}$	$\leq 50 \text{ m}$	$\leq 30 \text{ m}$	$\leq 50 \text{ m}$		
Supply voltage	DC 3.6 V to 14 V					
Power consumption ²⁾ (max.)	At 3.6 V: $\leq 700 \text{ mW}$ At 14 V: $\leq 800 \text{ mW}$	At 3.6 V: $\leq 850 \text{ mW}$ At 14 V: $\leq 950 \text{ mW}$				
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	$\leq 500 \text{ m/s}^2$ (EN 60068-2-6) $\leq 1000 \text{ m/s}^2$ (EN 60068-2-27)					
Operating temperature	$-10 \text{ }^\circ\text{C}$ to $50 \text{ }^\circ\text{C}$					
Baking temperature	100 $^\circ\text{C}$					
Vacuum class	High vacuum down to 10^{-7} mbar					
Protection EN 60529	IP40					
Mass Scanning head Connecting cable Connecting element	18 g (without cable) 21 g/m D-sub connector: 64 g					

* Please select when ordering

¹⁾ Mitsubishi: measuring length $\leq 2040 \text{ mm}$; Yaskawa: measuring length $\leq 1840 \text{ mm}$

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

The vacuum-compatible encoders are distinguished by the following characteristics:

- Air vents
- Production in a clean room
- Specialized cleaning and packaging
- Cable with PTFE insulation and tin-plated copper braiding

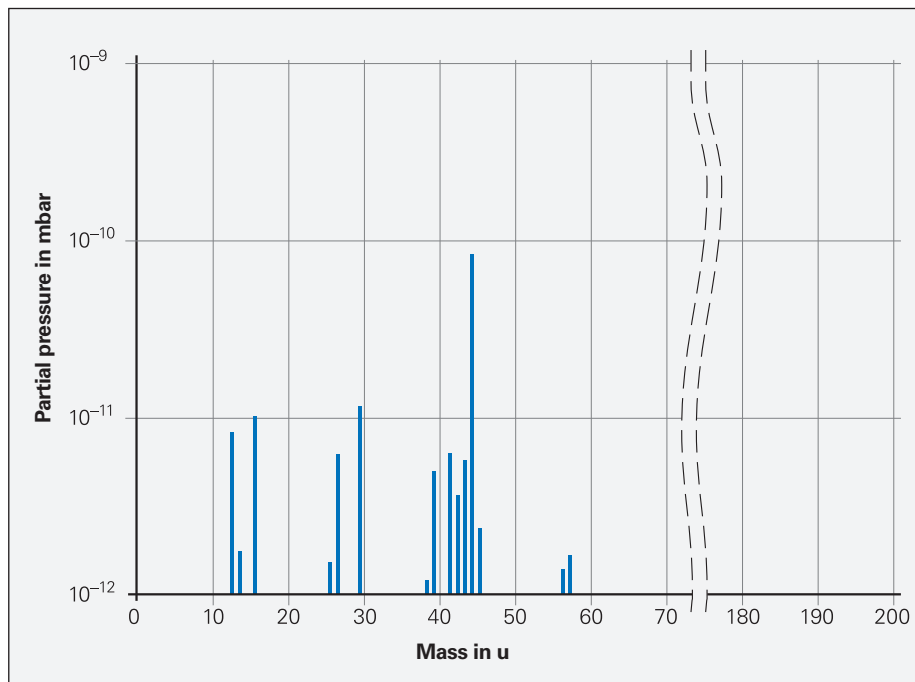
Residual gas analysis

The influence of encoders on the quality of the vacuum can be determined through residual gas analyses. In such an analysis, 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), with the residual gases measured by means of a mass spectrometer (Pfeiffer QMA 200) and an absolute pressure sensor (VACOM ATMION). When the typical residual gases in the empty chamber are then subtracted, the outgassing behavior of the examined sample can be deduced.

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

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

The graph shows the spectrum of the residual gases of an AK LIC 411V scanning head with a 1 m cable and a D-sub connector. The scanning head was baked for 48 hours in a high vacuum at 100 °C. The outgassing of the linear scale (with fixed-point bond) was scarcely measurable or representable.







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

Electrical connection

Adapter cables and connecting cables

You can find connecting cables for EnDat, Fanuc, Mitsubishi, and Panasonic in the *Exposed Linear Encoders* brochure.

Yaskawa

PUR adapter cable $4 \times (2 \times 0.14 \text{ mm}^2)$		Ø 4.5 mm
With 15-pin D-sub connector (female) and 6-pin Yaskawa connector (female)		808976-xx
PUR adapter cable $(4 \times 0.09 \text{ mm}^2) + (4 \times 0.16 \text{ mm}^2)$		Ø 4.5 mm
With 8-pin M12 connector (female) and 6-pin Yaskawa connector (female)		1269882-xx
PUR connecting cable $2 \times (2 \times 0.09 \text{ mm}^2) + 2 \times (2 \times 0.16 \text{ mm}^2)$; $A_p = 2 \times 0.16 \text{ mm}^2$		Ø 6 mm
With 8-pin M12 connector (female) and free cable end		1129581-xx
With 8-pin angled M12 connector (female) and free cable end (unstripped)		1133799-xx

A_p : Cross section of power supply lines

Pin layout


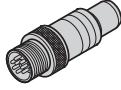


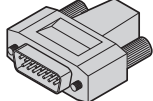
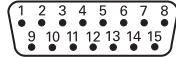



You can find pin layouts for EnDat, Fanuc, Mitsubishi, and Panasonic in the *Exposed Linear Encoders* brochure.

Yaskawa

HEIDENHAIN encoders with the code letter F after the model designation are suitable for connection to Yaskawa controls and drive systems.

- Ordering designation: YEC07

Yaskawa 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	0V	Sensor 0V	Vacant ¹⁾	Vacant ¹⁾	Data	Data	
	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!

¹⁾ Required for adjustment/testing with the PWM 21

HEIDENHAIN

DR. JOHANNES HEIDENHAIN GmbH

Dr.-Johannes-Heidenhain-Straße 5

83301 Traunreut, Germany

☎ +49 8669 31-0

FAX +49 8669 32-5061

E-mail: info@heidenhain.de

www.heidenhain.de

This product information document supersedes all previous editions, which thereby become invalid. The basis for ordering from HEIDENHAIN is always the product information document valid when the contract is made.



More 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