



HEIDENHAIN



Product Information

LIC 4113V **LIC 4193V**

Exposed Linear Encoders
for High Vacuum

LIC 4113V, LIC 4193V

[LIC 4100V series](#)



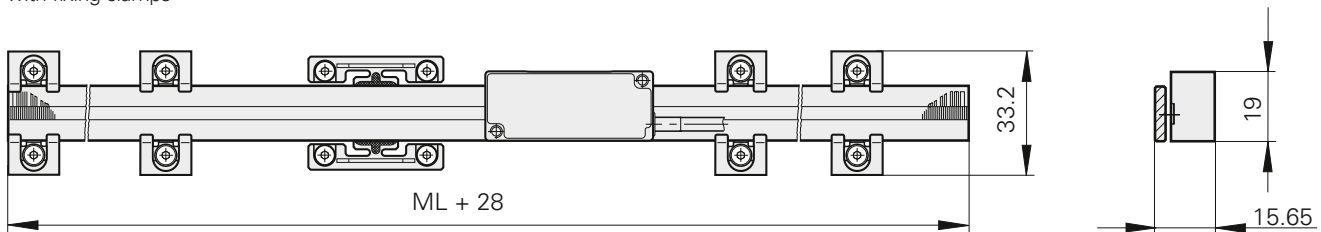
Absolute linear encoders for high vacuum applications

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



Main dimensions are stated without tolerances

Mating dimensions
with fixing clamps



For technical drawings, visit: www.heidenhain.com/documentation



Mating dimensions
[ID 828148](#)

Scale	LIC 4003
Measuring standard Coefficient of linear expansion*	METALLUR grating on glass or glass ceramic $\alpha_{\text{therm}} \approx 8 \cdot 10^{-6} \text{ K}^{-1}$ (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 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 α i	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	$\leq 5 \mu\text{s}$ 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	18 g (without cable)				
	Cable	21 g/m				
	Connecting element	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

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

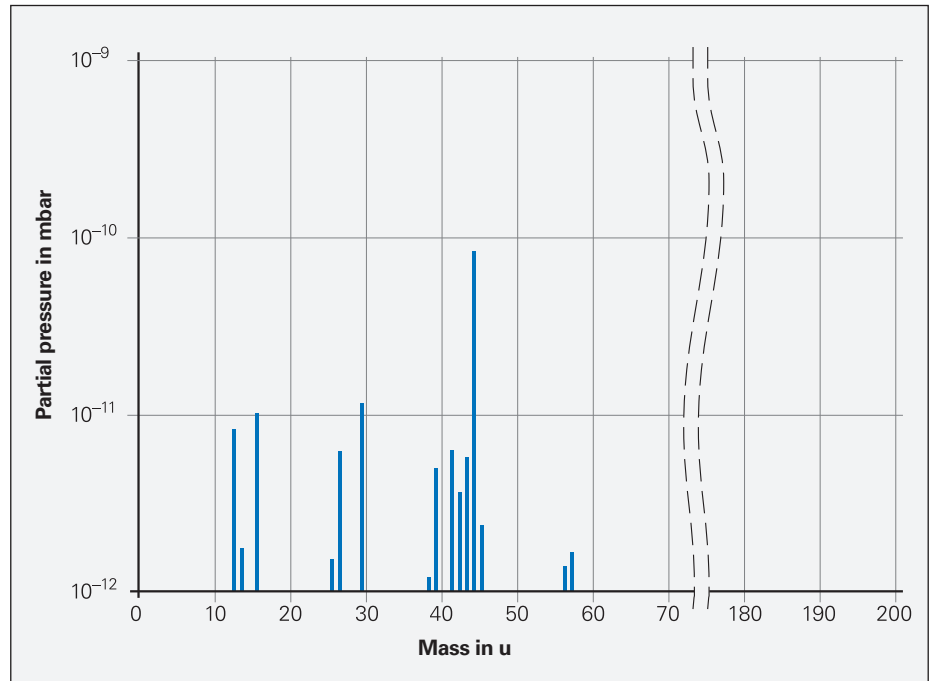
Residual gas analysis

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 411 V scanning head with a 1 m cable and D-sub connector. The scanning head was baked at 100 °C for 24 hours 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 411 V scanning head with 1 m cable (pumping speed: 107 l/s, pressure: $6 \cdot 10^{-8}$ mbar)

Electrical connection

Pin layout

EnDat pin layout



15-pin D-sub connector (female)								
	Power supply				Serial data transmission			
	5	12	7	14	4	11	1	9
	U_P	Sensor U _P	0V	Sensor 0V	DATA	DATA	CLOCK	CLOCK
	Brown	Turquoise	White	Tan	Gray	Pink	Violet	Black

Cable shield connected to housing; **U_P** = Supply voltage

Sensor: The sense line is connected in the encoder with the corresponding power line.

Vacant pins or wires must not be used!

Fanuc pin layout


15-pin D-sub connector (female)								
	Power supply				Serial data transmission			
	5	12	7	14	4	11	1	9
	U_P	Sensor U _P	0V	Sensor 0V	Serial Data	Serial Data	Request	Request
	Brown	Turquoise	White	Tan	Gray	Pink	Violet	Black

Cable shield connected to housing; **U_P** = Supply voltage

Sensor: The sense line is connected in the encoder with the corresponding power line.

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Mitsubishi pin layout


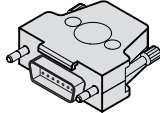
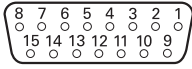


15-pin D-sub connector (female)								
	Power supply				Serial data transmission			
	5	12	7	14	4	11	1	9
Mit03-4	U_P	Sensor U _P	0V	Sensor 0V	Serial Data	Serial Data	Request Frame	Request Frame
Mit03-2					Vacant	Vacant	Request Data	Request Data
	Brown	Turquoise	White	Tan	Gray	Pink	Violet	Black

Cable shield connected to housing; **U_P** = Supply voltage

Sensor: The sense line is connected in the encoder with the corresponding power line.

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Panasonic pin layout


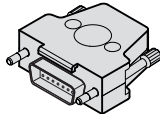
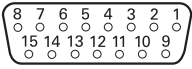


15-pin D-sub connector (female)								
								
	Power supply				Serial data transmission			
	5	12	7	14	4	11	1	9
	U _P	Sensor U _P	0V	Sensor 0V	Vacant	Vacant	Request Data	Request Data
	Brown	Turquoise	White	Tan	Gray	Pink	Violet	Black

Cable shield connected to housing; **U_P** = Supply voltage

Sensor: The sense line is connected in the encoder with the corresponding power line.

Vacant pins or wires must not be used!

Yaskawa pin layout

15-pin D-sub connector (female)								
								
	Power supply				Serial data transmission			
	5	12	7	14	4	11	1	9
	U _P	Sensor U _P	0V	Sensor 0V	Vacant	Vacant	Data	Data
	Brown	Turquoise	White	Tan	Gray	Pink	Violet	Black

Cable shield connected to housing; **U_P** = Supply voltage

Sensor: The sense line is connected in the encoder with the corresponding power line.

Vacant pins or wires must not be used!

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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 placed.



Further information:

Comply with the requirements described in the following documents to ensure 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: *Linear Encoders for Vacuum Technology* [627568-xx](#)