



# HEIDENHAIN



Product Information

## **LIC 4113V** **LIC 4193V**

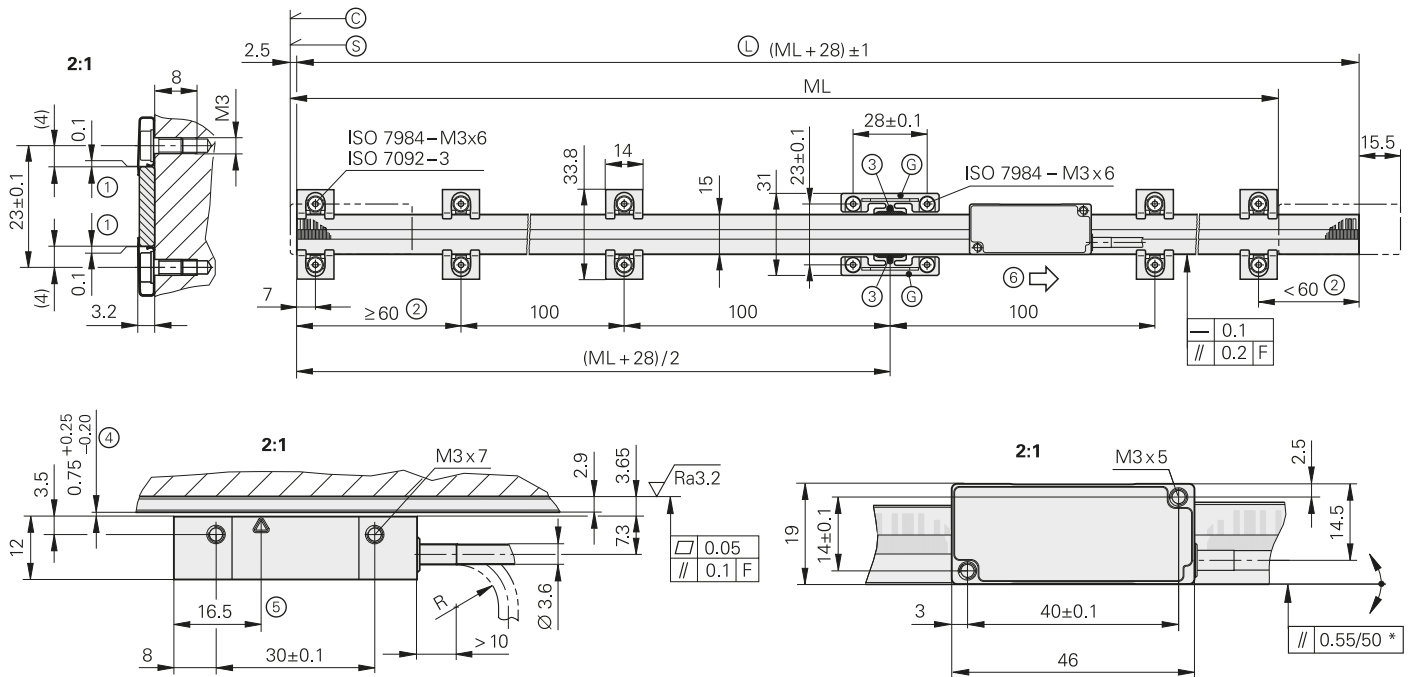
Exposed Linear Encoders  
for High Vacuum

July 2017

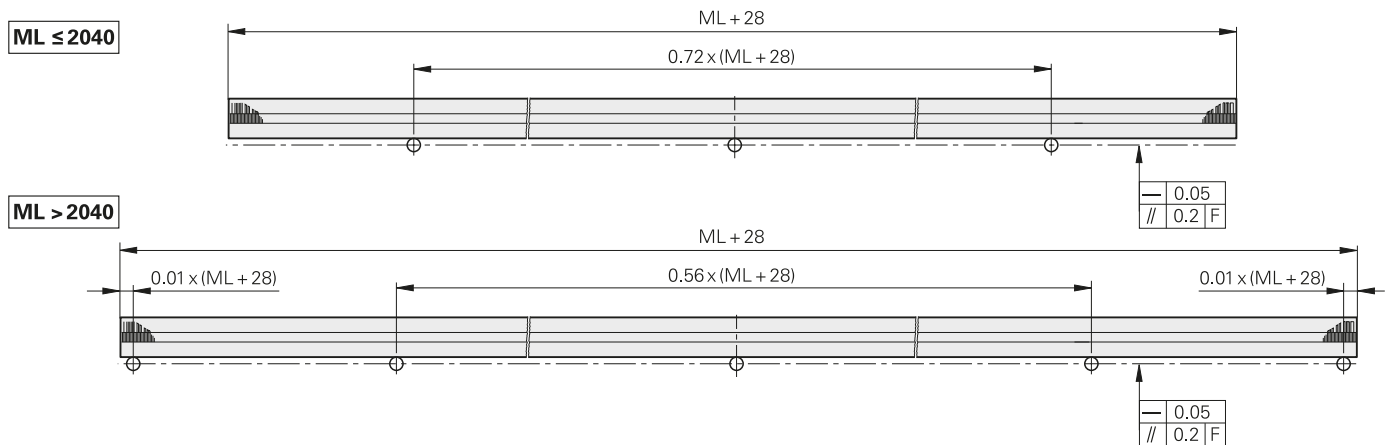
# LIC 4113V, LIC 4193V

Absolute linear encoder for high vacuum

- Measuring lengths up to 3 m
- Measuring steps to 0.001  $\mu\text{m}$
- Measuring standard of glass or glass ceramic
- Measuring standard is fastened by fixing clamps

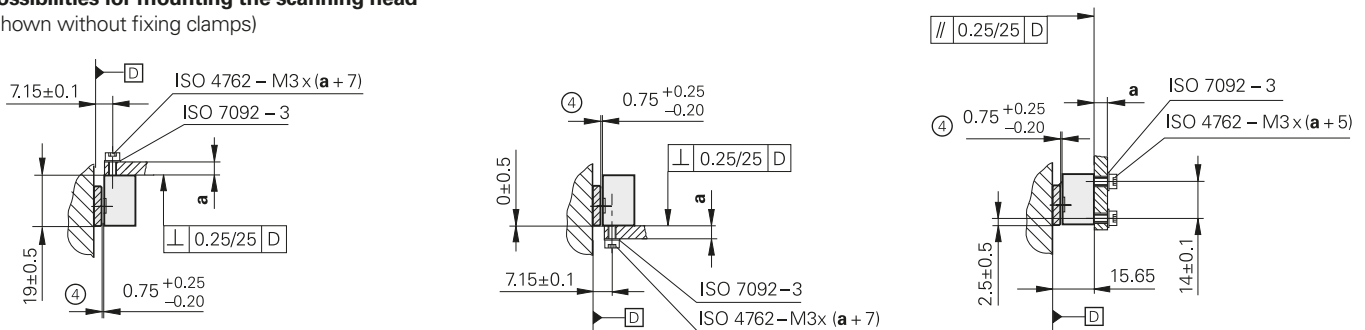


## Position of the stop pins



## Possibilities for mounting the 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
- Ⓛ = Scale length
- ⓐ = Fixed-point element for defining the thermal fixed point
- Ⓛ = Gap is set with a spacer foil during assembly
- ⓐ = Use additional fixing clamp pairs depending on the measuring length (ML)
- ⓐ = Adhesive
- ⓐ = Mounting clearance between scanning head and scale
- ⓐ = Optical centerline
- ⓐ = Direction of scanning unit motion for output signals in accordance with interface description



<b>Scale</b>	<b>LIC 4003</b>
<b>Measuring standard</b> Coefficient of linear expansion*	METALLUR scale grating 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)
<b>Accuracy grade*</b>	$\pm 1 \mu\text{m}$ (only for Robax glass ceramic), $\pm 3 \mu\text{m}$ , $\pm 5 \mu\text{m}$
<b>Baseline error</b>	$\leq \pm 0.275 \mu\text{m}/10 \text{ mm}$
<b>Measuring length ML*</b> in mm	240 340 440 640 840 1040 1240 1440 1640 1840 2040 2240 2440 2640 2840 3040 (Robax glass ceramic up to max. ML 1640)
<b>Mass</b>	3 g + 0.1 g/mm Measuring length

<b>Scanning head</b>	<b>AK LIC 411 V</b>	<b>AK LIC 419 FV</b>	<b>AK LIC 419 M V</b>	<b>AK LIC 419 P V</b>	
<b>Interface</b>	EnDat 2.2	Fanuc Serial Interface $\alpha$ i Interface	Mitsubishi High Speed Interface	Panasonic Serial Interface	
Ordering designation*	EnDat22	Fanuc05	Mit03-4	Mit02-2	Pana01
Measuring step*	0.01 $\mu\text{m}$ (10 nm) 0.005 $\mu\text{m}$ (5 nm) 0.001 $\mu\text{m}$ (1 nm)		0.01 $\mu\text{m}$ (10 nm) 0.005 $\mu\text{m}$ (5 nm)		
Calculation time $t_{\text{cal}}$ Clock frequency	$\leq 5 \mu\text{s}$ 16 MHz	–			
<b>Traversing speed</b> <sup>1)</sup>	$\leq 600 \text{ m/min}$				
<b>Interpolation error</b>	$\pm 20 \text{ nm}$				
<b>Electrical connection</b>	Cable 1 m or 3 m with D-sub connector (male) 15-pin				
Cable length (with HEIDENHAIN cable)	$\leq 100 \text{ m}$	$\leq 50 \text{ m}$	$\leq 30 \text{ m}$	$\leq 50 \text{ m}$	
Voltage supply	3.6 V DC to 14 V DC				
Power consumption <sup>1)</sup> (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)			
<b>Vibration</b> 55 Hz to 2000 Hz <b>Shock</b> 6 ms	$\leq 500 \text{ m/s}^2$ (EN 60068-2-6) $\leq 1000 \text{ m/s}^2$ (EN 60068-2-27)				
<b>Operating temperature</b>	$-10 \text{ }^\circ\text{C}$ to $50 \text{ }^\circ\text{C}$				
<b>Baking temperature</b>	100 $^\circ\text{C}$				
<b>Vacuum class</b>	High vacuum up to $10^{-7} \text{ mbar}$				
<b>Protection</b> EN 60529	IP40				
<b>Mass</b> Scanning head Connecting cable Connector	18 g (without cable) 21 g/m D-sub connector: 64 g				

\* Please select when ordering

<sup>1)</sup> See *General electrical information* in the brochure *Interfaces of HEIDENHAIN Encoders*

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

# Encoders for use in vacuum

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

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

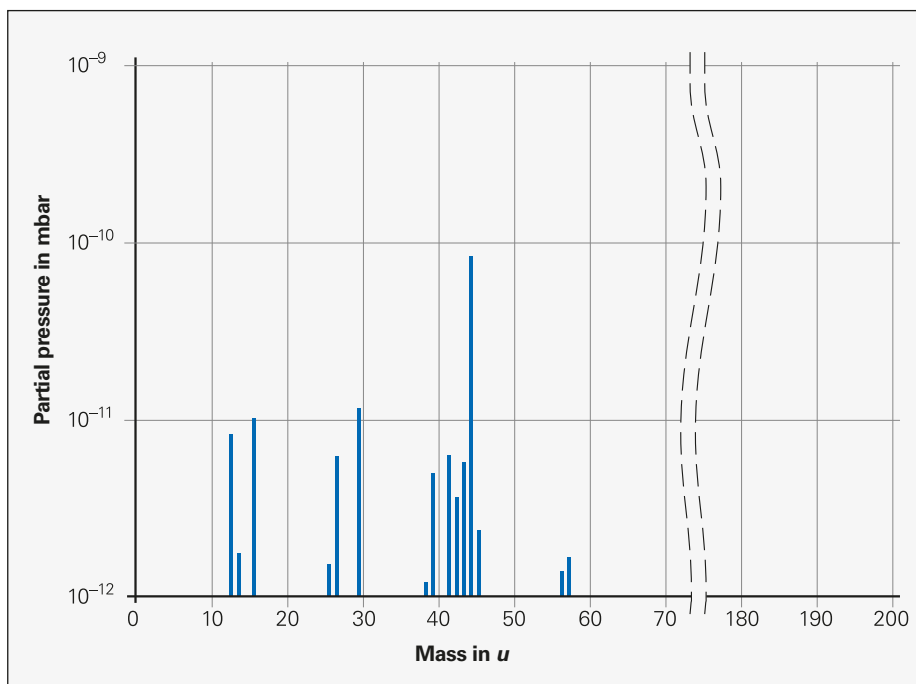
## Residual gas analysis

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 at least to  $10^{-6}$  mbar (turbomolecular pump, pumping speed 15 l/s to 200 l/s) whereby the residual gases are measured with a mass spectrometer (Pfeiffer QMA 200) and an absolute pressure sensor (VACOM ATMION). If the typical residual gases of 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 more pumping speed is used for the measurement and the longer the gas is pumped out, the lower is the quantity of residual gases.

To attain the lowest possible outgassing values, HEIDENHAIN recommends heating 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 1 m cable and D-sub connector. The scanning head was baked in a high vacuum at 100 °C for 48 hours. Hardly measurable or representable outgassing was determined for the scale (with fixed point bonding)





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

# Electrical connection



## Pin layout for EnDat

15-pin D-sub connector								
	Voltage supply				Absolute position values			
	5	12	7	14	4	11	1	9
	$U_P$	Sensor $U_P$	0V	Sensor 0V	DATA	$\overline{\text{DATA}}$	CLOCK	$\overline{\text{CLOCK}}$
	Brown/Green	Blue	White/Green	White	Gray	Pink	Violet	Yellow

## Pin layout for Fanuc

15-pin D-sub connector								
	Power supply				Absolute position values			
	5	12	7	14	4	11	1	9
	$U_P$	Sensor $U_P$	0V	Sensor 0V	Serial Data	$\overline{\text{Serial Data}}$	Request	$\overline{\text{Request}}$
	Brown/Green	Blue	White/Green	White	Gray	Pink	Violet	Yellow

## Mitsubishi pin layout

15-pin D-sub connector								
	Voltage supply				Absolute position values			
	5	12	7	14	4	11	1	9
	$U_P$	Sensor $U_P$	0V	Sensor 0V	Serial Data	$\overline{\text{Serial Data}}$	Request Frame	$\overline{\text{Request}}$ Frame
	Brown/Green	Blue	White/Green	White	Gray	Pink	Violet	Yellow

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

**Sensor:** The sensor 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 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.



### For 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: *Interfaces of HEIDENHAIN Encoders* 1078628-xx
- Technical Information *Linear Encoders for Vacuum Technology* 627568-xx