



HEIDENHAIN



Product Information

LF 185

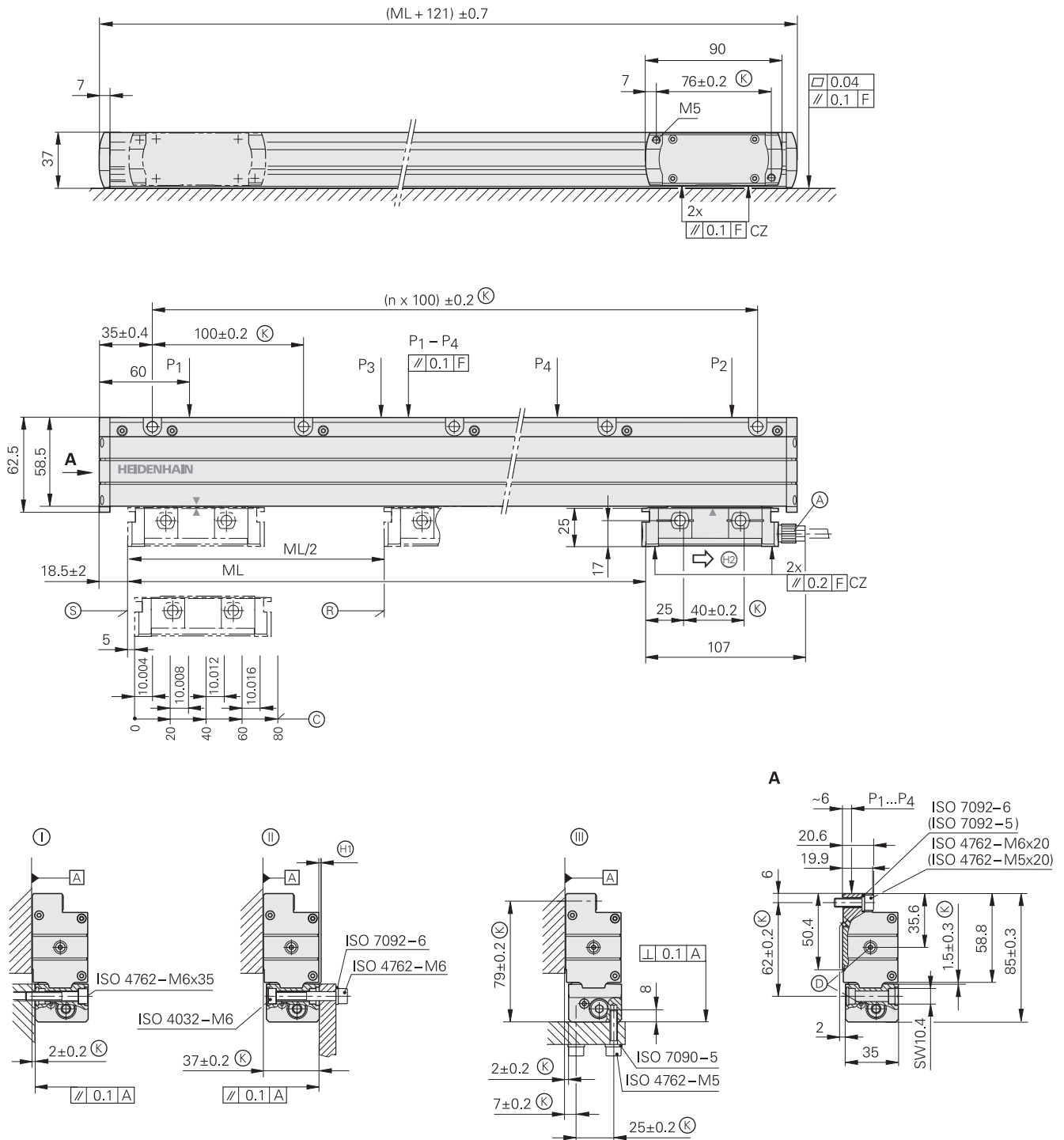
LF 485

Incremental Linear
Encoders

September 2011

LF 185

- Incremental linear encoder for measuring steps to 0.1 μm
- Thermal behavior similar to steel or cast iron
- Improved vibration resistance, high rigidity in measuring direction
- Horizontal mounting possible



mm

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

- ⓪, Ⓜ, Ⓝ = Mounting options
- F = Machine guideway
- P = Gauging points for alignment
- Ⓐ = Cable connection usable at either end
- Ⓚ = Required mating dimensions
- Ⓢ = Compressed air inlet usable at either end
- Ⓞ = Beginning of measuring length (ML)
- Ⓡ = Reference mark position on LF 185
- Ⓞ = Reference-mark position on LF 185C
- Ⓜ = No mounting/aligning surface such as on the LS and LC
- Ⓢ = Direction of scanning unit motion for output signals in accordance with interface description

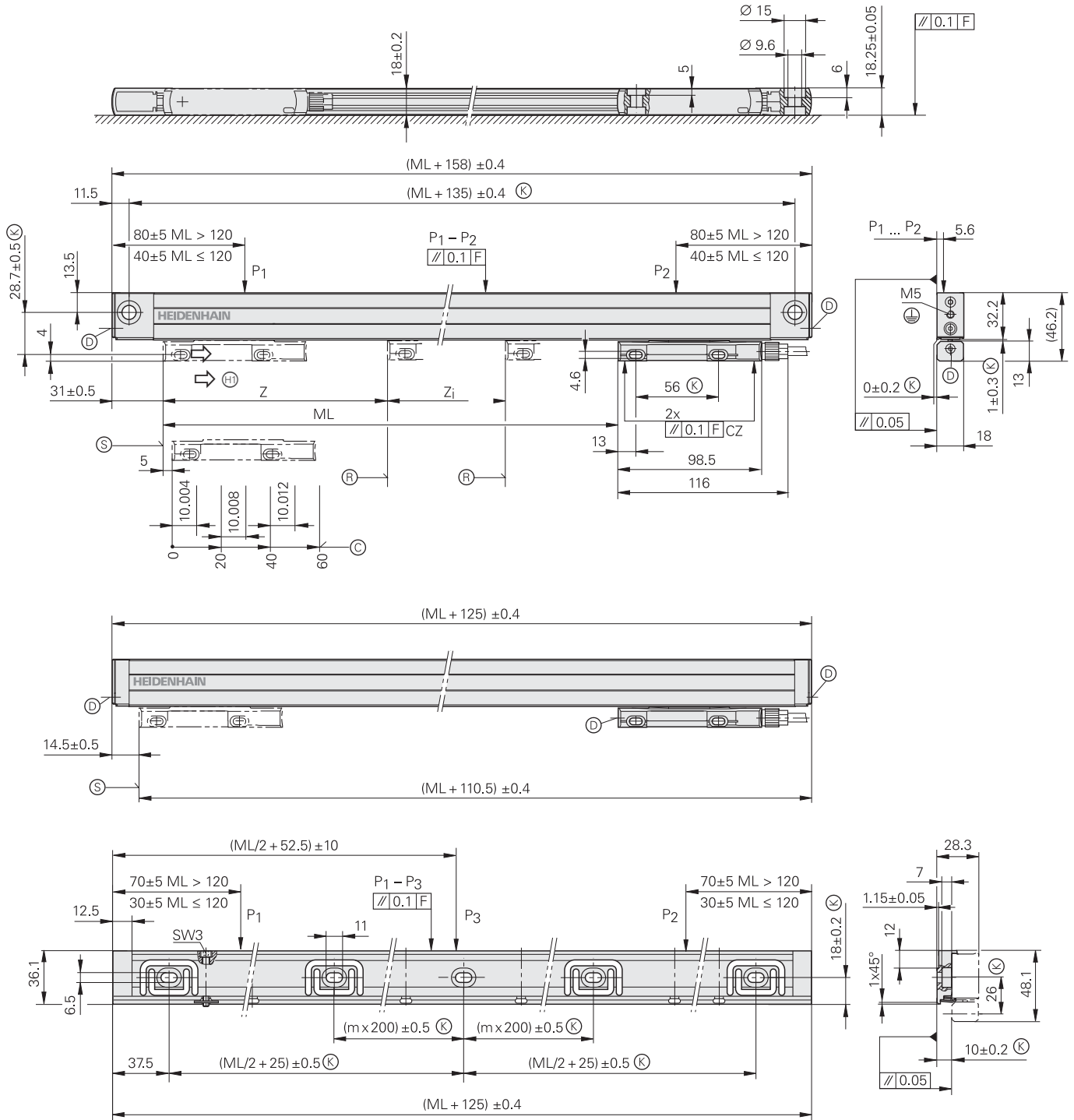



Specifications	LF 185
Measuring standard Coefficient of linear expansion	SUPRADUR phase grating on steel, grating period 8 μm $\alpha_{\text{therm}} \approx 10 \times 10^{-6} \text{ K}^{-1}$
Accuracy grade*	$\pm 3 \mu\text{m}; \pm 2 \mu\text{m}$
Measuring length ML* in mm	140 240 340 440 540 640 740 840 940 1040 1140 1240 1340 1440 1540 1640 1740 1840 2040 2240 2440 2640 2840 3040
Incremental signals	$\sim 1 \text{ V}_{\text{PP}}$
Signal period	4 μm
Reference marks* <i>LF 185</i> <i>LF 185C</i>	One reference mark at midpoint; other reference mark positions upon request Distance-coded
Cutoff frequency -3 dB	$\geq 250 \text{ kHz}$
Power supply Without load	5 V $\pm 5 \%$ / < 150 mA
Electrical connection	Separate adapter cable (1 m/3 m/6 m/9 m) connectable to mounting block
Cable length	$\leq 150 \text{ m}$ (with HEIDENHAIN cable)
Traversing speed	$\leq 60 \text{ m/min}$
Required moving force	$\leq 4 \text{ N}$
Vibration 55 Hz to 2000 Hz Affecting the:	<i>Housing:</i> $\leq 150 \text{ m/s}^2$ (EN 60068-2-6) <i>Housing:</i> $\leq 150 \text{ m/s}^2$ (EN 60068-2-6)
Shock 11 ms Acceleration	$\leq 300 \text{ m/s}^2$ (EN 60068-2-27) $\leq 100 \text{ m/s}^2$ in measuring direction
Operating temperature	0 °C to 50 °C
Protection EN 60529	IP 53 when installed according to instructions in the brochure IP 64 with sealing air via DA 300
Weight	0.8 kg + 4.6 kg/m measuring length

* Please select when ordering

LF 485

- Incremental linear encoder for measuring steps to 0.1 µm
- Thermal behavior similar to steel or cast iron
- Improved vibration resistance, high rigidity in measuring direction
- For limited installation space



mm

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

- F = Machine guideway
 P = Gauging points for alignment
 ⊙ = Required mating dimensions
 ⊕ = Compressed air inlet
 ⊗ = Reference mark position on LF 485
 Two reference marks for measuring lengths
- | | |
|--------------------------|--------------------------|
| 50 ... 1000 | 1120 ... 1220 |
| z = 25 | z = 35 |
| z _i = ML - 50 | z _i = ML - 70 |

- ⊙ = Reference mark position on LF 485 C
 ⊕ = Beginning of measuring length (ML)
 ⊗ = Direction of scanning unit for output signals in accordance with interface description

Mounting spar

ML	m
50 ... 500	0
550 ... 900	1
950 ... 1320	2
1420 ... 1720	3
1820 ... 2020	4



Specifications	LF 485
Measuring standard Coefficient of linear expansion	SUPRADUR phase grating on steel, grating period 8 μm $\alpha_{\text{therm}} \approx 10 \times 10^{-6} \text{ K}^{-1}$
Accuracy grade*	$\pm 5 \mu\text{m}; \pm 3 \mu\text{m}$
Measuring length ML* in mm	Mounting spar* recommended 50 100 150 200 250 300 350 400 450 500 550 600 650 700 750 800 900 1000 1120 1220
Incremental signals	$\sim 1 V_{\text{PP}}$
Signal period	4 μm
Reference marks* LF 485 LF 485C	ML 50 mm: One reference mark at midpoint ML 100 to 1000 mm: Two, each 25 mm from beginning and end of the measuring length From 1120 mm ML: Two, each 35 mm from the beginning and end of the measuring length Distance coded
Cutoff frequency -3 dB	$\geq 250 \text{ kHz}$
Power supply Without load	5 V $\pm 5 \%$ / < 150 mA
Electrical connection	Separate adapter cable (1 m/3 m/6 m/9 m) connectable to mounting block
Cable length	$\leq 150 \text{ m}$ (with HEIDENHAIN cable)
Traversing speed	$\leq 60 \text{ m/min}$
Required moving force	$\leq 4 \text{ N}$
Vibration 55 Hz to 2000 Hz Affecting the:	Housing with mounting spar: $\leq 150 \text{ m/s}^2$ (EN 60068-2-6) Housing: $\leq 150 \text{ m/s}^2$ (EN 60068-2-6)
Shock 11 ms Acceleration	$\leq 300 \text{ m/s}^2$ (EN 60068-2-27) $\leq 100 \text{ m/s}^2$ in measuring direction
Operating temperature	0 °C to 50 °C
Protection EN 60529	IP 53 when installed according to instructions in the brochure IP 64 with sealing air via DA 300
Weight	0.2 kg + 0.6 kg/m measuring length

* Please select when ordering

Advantages of the New LF

Design

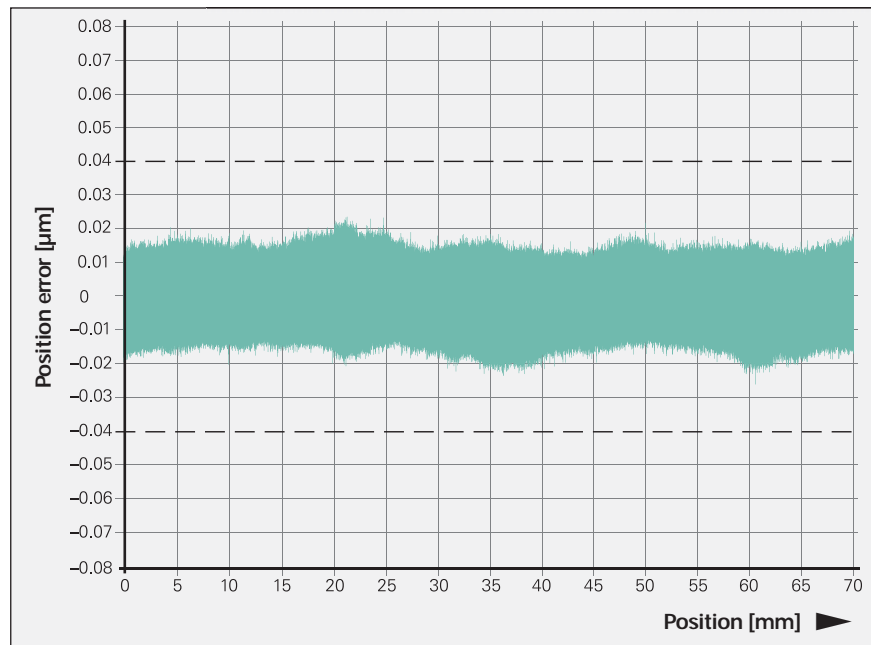
The **measuring standard**, manufactured in the SUPRADUR process, is responsible for the high accuracy and repeatability of the LF 185 and LF 485 linear encoders. Their steel **graduation carrier**, which is directly connected with the steel fastening element, gives the LF linear encoders a defined thermal behavior. In their coefficient of linear expansion $\alpha_{\text{therm}} = 10 \times 10^{-6} \text{ K}^{-1}$ they correspond to most of the materials used in machine manufacturing.

High accuracy

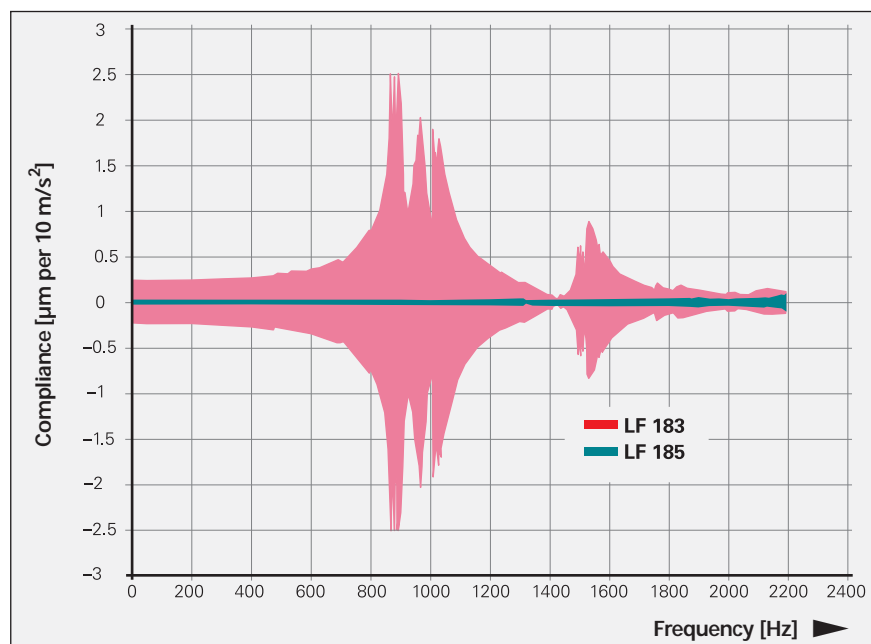
From a grating period of $8 \mu\text{m}$, the **interferential measuring principle** of the LF generates scanning signals with a signal period of $4 \mu\text{m}$. The scanning signals are largely free of harmonics and can be highly interpolated. Thanks to their high accuracy and high resolution, they are particularly well suited for precision machine tools such as jig boring machines, grinding machines and linear motors on machine tool. These applications require very small **position error within a signal period**. It is of critical importance both for accuracy of a positioning movement as well as for velocity control during the slow, even traverse of an axis, and therefore for surface quality and the quality of the machined part. With the LF 185 and LF 485, the position error within one signal period at any point on the measuring length is less than $0.04 \mu\text{m}$, which represents 1% of the signal period.

Dynamic behavior

The linear encoders LF 185 and LF 485 are characterized by their **high rigidity** in the measuring direction. This is a very important prerequisite for high-quality path accuracies on a machine tool. In addition, the low mass of components moved contributes to their excellent dynamic behavior. In particular, the LF 185 was significantly improved over its predecessor LF 183 in its compliance (see illustration). Particularly on linear motors, high rigidity in measuring direction is decisive for dynamic control behavior. The concomitant higher natural frequency of the encoder allows a **greater bandwidth** of the position and velocity control loop.



Position error within one signal period



Low compliance through high rigidity in measuring direction

Design changes

The designs of the LF 185 and LF 485 linear encoders have been oriented to the corresponding LS or LC linear encoders. This provides a number of benefits:

The LF 185 and LF 485 feature the **same mounting dimensions** as the corresponding linear encoders of the LS and LC series. They can therefore be readily exchanged mechanically. Compared with the LS 487 and LC 415, the LF 485 has only a slightly shorter **20 mm** measuring length.

LF 185 and LF 485 have a pluggable electric connection. The separately ordered **adapter cable** is available in various lengths and versions. It corresponds to the adapter cable for the LS linear encoders. The connection provides an IP 67 degree of protection.

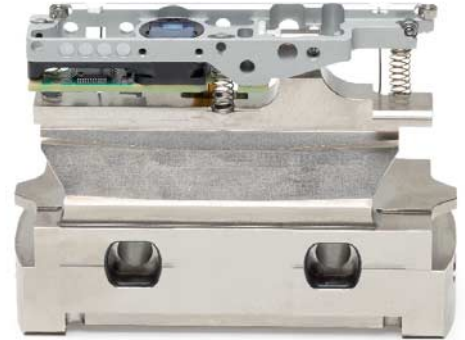
The end blocks and mounting blocks are coated with nickel to improve **electrical conductivity**. This facilitates grounding the device and therefore increases reliability. It also improves rust resistance.

The mounting holes on the mounting block are provided with O-rings to **facilitate mounting**. They prevent loosening of the fastening nut. On the LF 485, the **shipping brace** also serves a mounting aid.

The **LF 485** has a significantly **reduced overall height** compared with the LF 483. In its dimensions, the scanning unit is dimensionally identical with the equally slim LS 487 and LC 415. The housing dimensions and the position of its mounting holes remain identical to the LF 481, so that the LC 485 can be mounted unaltered to existing geometries, but also replace the LS 487 or LC 415.

Thanks to their identical dimensions, the **LF 485** can use the same **mounting spar** as the LS 400/LC 400.

Conductive scanning unit



Pluggable adapter cable



Shipping brace



Uniform overall height



LF 481



LF 485



LC 415



LS 487

Electrical Connection

Adapter cables		Cable Ø	ID
With M23 coupling (male)		6 mm	360645-xx
Without connector		6 mm	354319-xx
With 15-pin D-sub connector		6 mm	360974-xx

Available cable lengths: 1 m/3 m/6 m/9 m

PUR connecting cable 12-pin: $[4(2 \times 0.14 \text{ mm}^2) + (4 \times 0.5 \text{ mm}^2)] \text{ } \varnothing 8 \text{ mm}$		ID
Complete with M23 connector (female) and M23 coupling (male)		298401-xx
Complete with M23 connector (female) and D-sub connector (female) for IK 220		310199-xx
With one connector (female)		309777-xx
Cable without connectors, Ø 8 mm		244957-01

Pin Layout

12-pin coupling, M23	12-pin connector, M23				15-pin D-sub connector, female, for HEIDENHAIN controls and IK 220									
	Power supply				Incremental signals						Other signals			
	12	2	10	11	5	6	8	1	3	4	7/9	/	/	
	1	9	2	11	3	4	6	7	10	12	5/8/13/14/15	/	/	
	U _P	Sensor U _P	0V	Sensor 0V	A+	A-	B+	B-	R+	R-	Vacant	Vacant	Vacant	
	Brown/ Green	Blue	White/ Green	White	Brown	Green	Gray	Pink	Red	Black	/	Violet	Yellow	

Cable shield is connected to the housing; U_P = power supply

Sensor: The sensor line is connected internally to the respective power supply

Vacant pins or wires must not be used!

HEIDENHAIN

DR. JOHANNES HEIDENHAIN GmbH

Dr.-Johannes-Heidenhain-Straße 5

83301 Traunreut, Germany

☎ +49 8669 31-0

FAX +49 8669 5061

E-mail: info@heidenhain.de

www.heidenhain.de

For More Information

- Catalog: *Linear Encoders for Numerically Controlled Machine Tools*