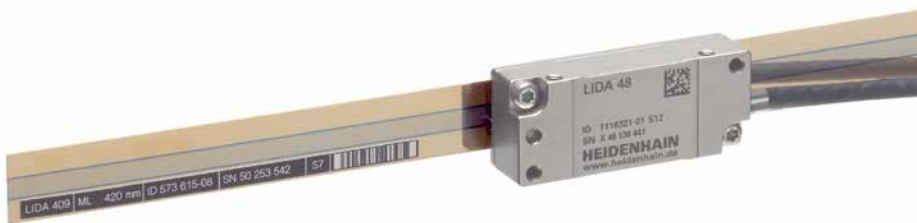




HEIDENHAIN



Preliminary
Product Information

LIDA 4xx Series

Exposed Linear Encoder

December 2015

Scanning heads – LIDA 400 status display

The LIDA 400 features an integrated function display with a multicolor LED. This makes it possible to quickly and easily check the signal quality during normal operation.

The function display offers a number of benefits:

- Quality of scanning signals displayed by multicolor LED
- Continuous monitoring of incremental signals over entire measuring length
- Function display of the reference-mark signal
- Quick check of correct operation in the field without technical aids

The integrated status display permits both a qualified judgment of the incremental signals as well as a check of the reference mark signal. The quality of the **incremental signals** is indicated by degrees of color. This makes a very detailed gradation of signal quality possible. The **reference mark signal's** compliance to tolerances is shown by a pass/fail display.



LED display of incremental signals

LED color	Quality of the scanning signals
●	Optimum
●	Good
●	Acceptable
●	Unsatisfactory

LED reference-mark-signal display (function check)

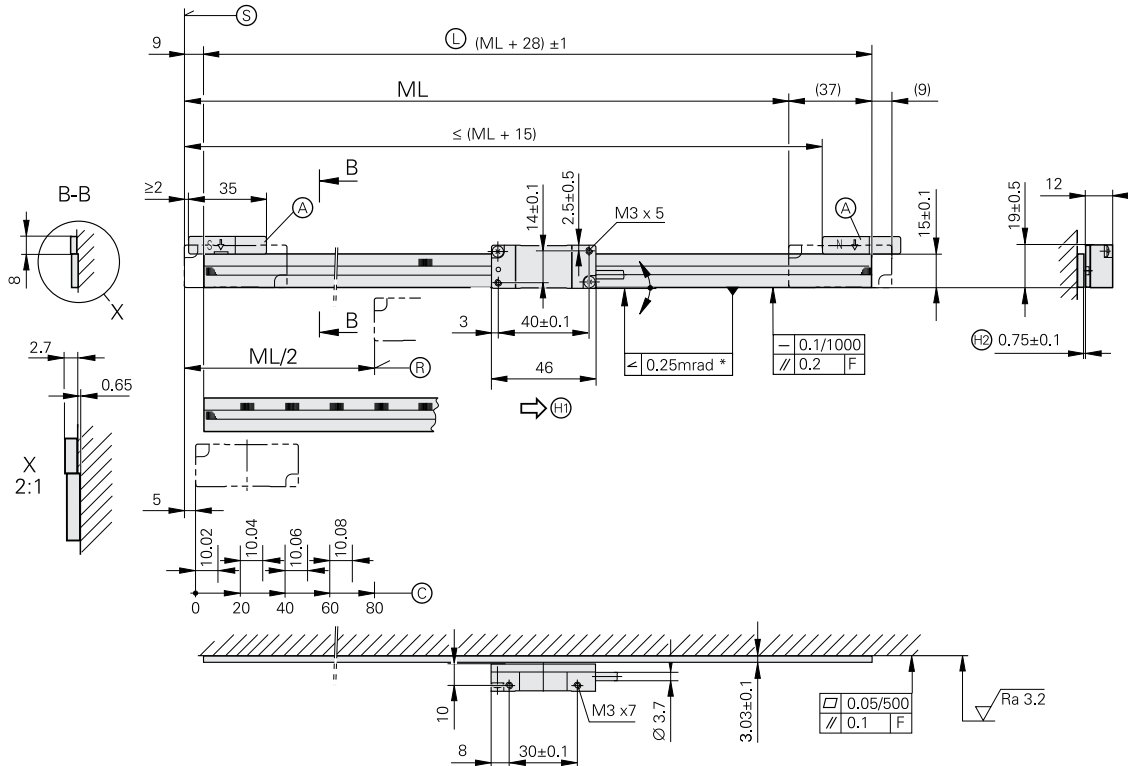
When the reference mark is scanned, the LED lights up briefly in blue or red.

- Out of tolerance
- Within tolerance

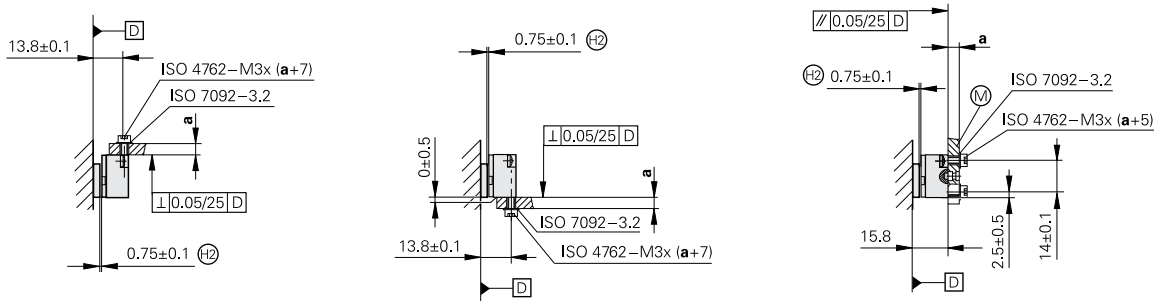
LIDA 473, LIDA 483

Incremental linear encoders with limit switches

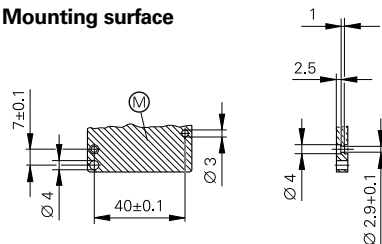
- For measuring steps of 1 μm to 0.01 μm
- Measuring standard of glass or glass ceramic
- Glass scale cemented with adhesive film
- Consists of scale and scanning head



Possibilities for mounting the scanning head



Mounting surface



mm

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

* = Max. change during operation

F = Machine guideway

Ⓛ = Scale length

Ⓐ = Selector magnet for limit switch

Ⓢ = Beginning of measuring length (ML)

Ⓔ = Reference mark position

Ⓜ = Mounting surface for scanning head

Ⓕ = Direction of scanning unit motion for output signals in accordance with interface description

Ⓗ = Adjust or set



Linear scale	LIDA 403
Measuring standard	METALLUR scale grating on glass ceramic or glass; grating period 20 µm
Coefficient of linear expansion*	$\alpha_{\text{therm}} \approx 8 \cdot 10^{-6} \text{ K}^{-1}$ (glass) $\alpha_{\text{therm}} = (0 \pm 0.5) \cdot 10^{-6} \text{ K}^{-1}$ (Robax glass ceramic)
Accuracy grade*	$\pm 1 \text{ µm}$ (only for Robax glass ceramic), $\pm 3 \text{ µm}$, $\pm 5 \text{ µm}$
Measuring length ML* in mm	240 340 440 640 840 1040 1240 1440 1640 1840 2040 2240 2440 2640, 2840, 3040 (ROBAX glass ceramic with up to ML 1640)
Reference marks*	LIP 4x3: One at midpoint of measuring length LIDA 4x3C: Distance-coded
Mass	3 g + 0.1 g/mm measuring length

Scanning head	AK LIDA 48	AK LIDA 47			
Interface	$\sim 1 \text{ V}_{\text{PP}}$	□□TTL			
Integrated interpolation* Signal period	– 20 µm	5-fold 4 µm	10-fold 2 µm	50-fold 0.4 µm	100-fold 0.2 µm
Cutoff frequency –3 dB	$\geq 400 \text{ kHz}$	–			
Scanning frequency*	–	$\leq 400 \text{ kHz}$ $\leq 200 \text{ kHz}$ $\leq 100 \text{ kHz}$ $\leq 50 \text{ kHz}$	$\leq 200 \text{ kHz}$ $\leq 100 \text{ kHz}$ $\leq 50 \text{ kHz}$ $\leq 25 \text{ kHz}$	$\leq 50 \text{ kHz}$ $\leq 25 \text{ kHz}$ $\leq 12.5 \text{ kHz}$	$\leq 25 \text{ kHz}$ $\leq 12.5 \text{ kHz}$ $\leq 6.25 \text{ kHz}$
Edge separation a ¹⁾	–	$\geq 0.100 \text{ µs}$ $\geq 0.220 \text{ µs}$ $\geq 0.465 \text{ µs}$ $\geq 0.950 \text{ µs}$	$\geq 0.100 \text{ µs}$ $\geq 0.220 \text{ µs}$ $\geq 0.465 \text{ µs}$ $\geq 0.950 \text{ µs}$	$\geq 0.080 \text{ µs}$ $\geq 0.175 \text{ µs}$ $\geq 0.370 \text{ µs}$	$\geq 0.080 \text{ µs}$ $\geq 0.175 \text{ µs}$ $\geq 0.370 \text{ µs}$
Traversing speed ¹⁾	$\leq 480 \text{ m/min}$	$\leq 480 \text{ m/min}$ $\leq 240 \text{ m/min}$ $\leq 120 \text{ m/min}$ $\leq 60 \text{ m/min}$	$\leq 240 \text{ m/min}$ $\leq 120 \text{ m/min}$ $\leq 60 \text{ m/min}$ $\leq 30 \text{ m/min}$	$\leq 60 \text{ m/min}$ $\leq 30 \text{ m/min}$ $\leq 15 \text{ m/min}$	$\leq 30 \text{ m/min}$ $\leq 15 \text{ m/min}$ $\leq 7.5 \text{ m/min}$
Limit switches	L1/L2 with two different magnets; <i>output signals</i> : TTL (without line driver)				
Electrical connection	Cable, 0.5 m, 1 m or 3 m with D-sub connector (male) 15-pin				
Cable length	See Interface Description, but <i>limit</i> : $\leq 20 \text{ m}$ (with HEIDENHAIN cable)				
Voltage supply	DC 5 V \pm 0.5 V	DC 5 V \pm 0.5 V			
Current requirement	< 130 mA	< 150 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 °C to 70 °C				
Mass	Scanning head Connecting cable Connector	20 g (without connecting cable) 22 g/m LIDA 483: 32 g, LIDA 473: 140 g			

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

* Please select when ordering

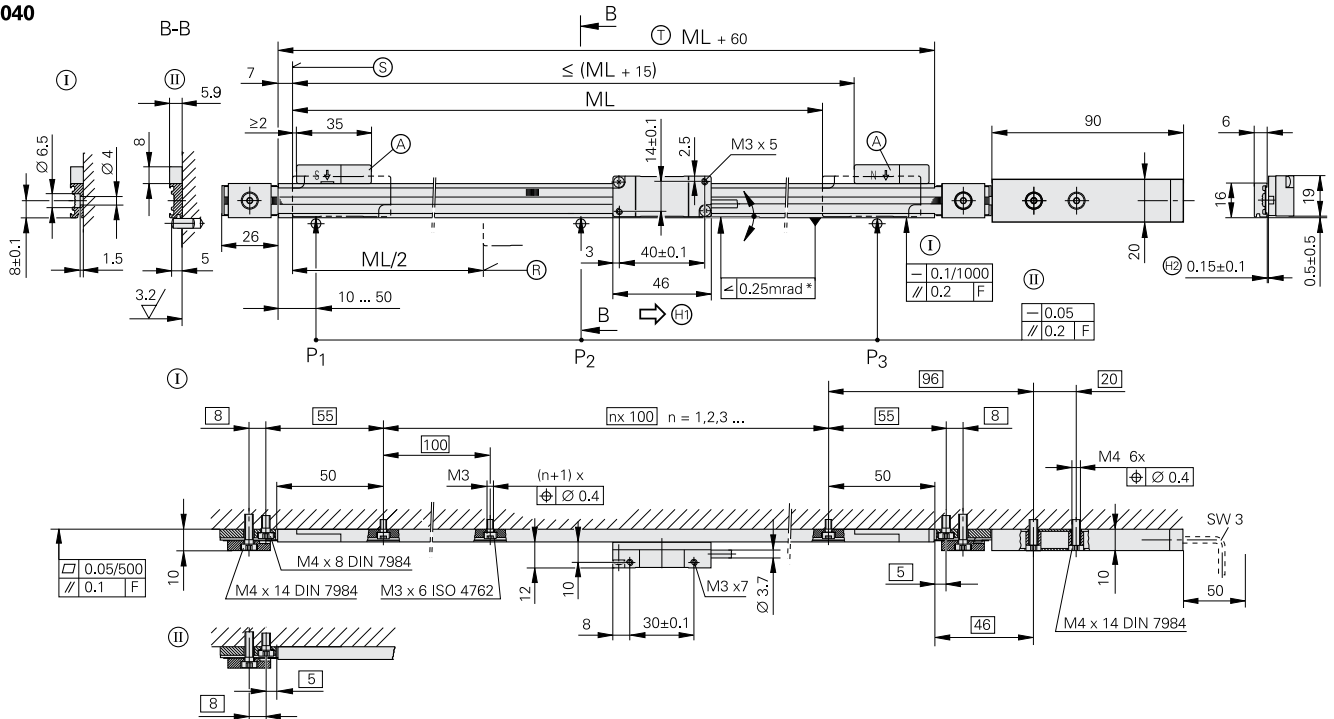
¹⁾ At the corresponding cutoff or scanning frequency

LIDA 475, LIDA 485

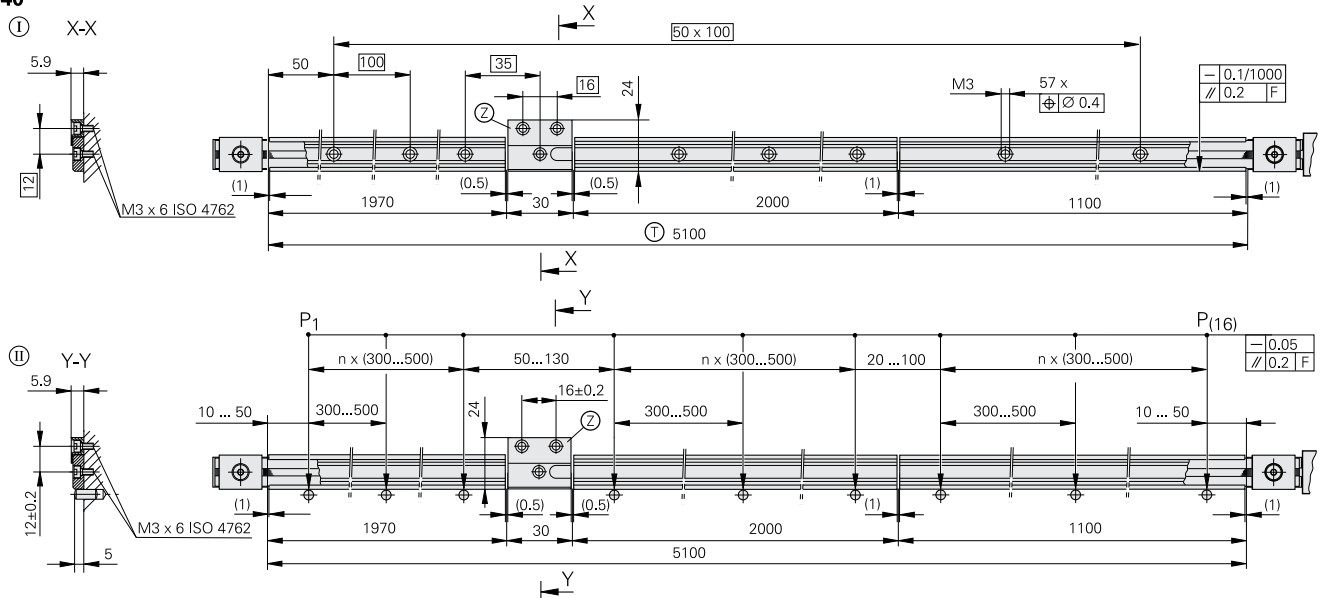
Incremental linear encoders for measuring lengths up to 30 m

- For measuring steps of 1 μm to 0.05 μm
- Limit switches
- Steel scale-tape is drawn into aluminum extrusions and tensioned
- Consists of scale and scanning head

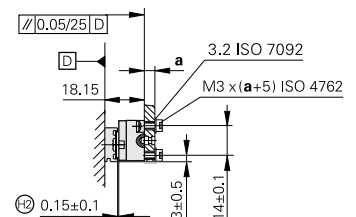
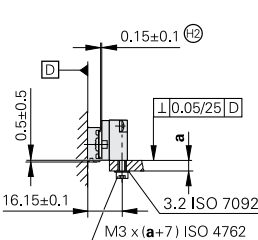
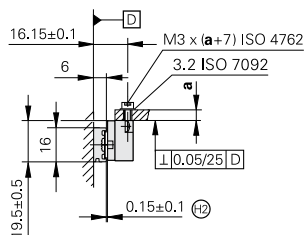
ML ≤ 2040



ML > 2040



Possibilities for mounting the scanning head



mm



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

- ⊖ = Scale carrier sections fixed with screws
- ⊕ = Scale carrier sections fixed with PRECIMET
- * = Max. change during operation
- F = Machine guideway
- P = Gauging points for alignment
- ⊙ = Reference mark position
- ⊗ = Beginning of measuring length (ML)
- ⊚ = Selector magnet for limit switch

- ⊖ = Carrier length
- ⊕ = Spacer for measuring lengths from 3040 mm
- ⊗ = Direction of scanning unit motion for output signals in accordance with interface description
- ⊚ = Adjust or set



Linear scale	LIDA 405
Measuring standard Coefficient of linear expansion	Steel scale tape with METALLUR scale grating; grating period 20 µm Depends on the mounting surface
Accuracy grade	± 5 µm
Measuring length ML* in mm	140 240 340 440 540 640 740 840 940 1040 1140 1240 1340 1440 1540 1640 1740 1840 1940 2040 Larger measuring lengths up to 30 040 mm with a single-section scale tape and individual scale-carrier sections
Reference marks	One at midpoint of measuring length
Mass	115 g + 0.25 g/mm measuring length

Scanning head	AK LIDA 48	AK LIDA 47			
Interface	~ 1 V _{PP}	□TTL			
Integrated interpolation* Signal period	– 20 µm	5-fold 4 µm	10-fold 2 µm	50-fold 0.4 µm	100-fold 0.2 µm
Cutoff frequency –3 dB	≥ 400 kHz	–			
Scanning frequency*	–	≤ 400 kHz ≤ 200 kHz ≤ 100 kHz ≤ 50 kHz	≤ 200 kHz ≤ 100 kHz ≤ 50 kHz ≤ 25 kHz	≤ 50 kHz ≤ 25 kHz ≤ 12.5 kHz	≤ 25 kHz ≤ 12.5 kHz ≤ 6.25 kHz
Edge separation a ¹⁾	–	≥ 0.100 µs ≥ 0.220 µs ≥ 0.465 µs ≥ 0.950 µs	≥ 0.100 µs ≥ 0.220 µs ≥ 0.465 µs ≥ 0.950 µs	≥ 0.080 µs ≥ 0.175 µs ≥ 0.370 µs	≥ 0.080 µs ≥ 0.175 µs ≥ 0.370 µs
Traversing speed ¹⁾	≤ 480 m/min	≤ 480 m/min ≤ 240 m/min ≤ 120 m/min ≤ 60 m/min	≤ 240 m/min ≤ 120 m/min ≤ 60 m/min ≤ 30 m/min	≤ 60 m/min ≤ 30 m/min ≤ 15 m/min	≤ 30 m/min ≤ 15 m/min ≤ 7.5 m/min
Limit switches	L1/L2 with two different magnets; <i>output signals</i> : TTL (without line driver)				
Electrical connection	Cable, 0.5 m, 1 m or 3 m with D-sub connector (male), 15-pin; with interface electronics for the AK LIDA 47 in the connector				
Cable length	See Interface Description, but <i>limit</i> : ≤ 20 m (with HEIDENHAIN cable)				
Voltage supply	DC 5 V ± 0.5 V	DC 5 V ± 0.5 V			
Current requirement	< 130 mA	< 150 mA (without load)			
Vibration 55 Hz to 2000 Hz Shock 6 ms	≤ 500 m/s ² (EN 60068-2-6) ≤ 1000 m/s ² (EN 60068-2-27)				
Operating temperature	–10 °C to 70 °C				
Mass Scanning head Connecting cable Connector	20 g (without connecting cable) 22 g/m LIDA 485: 32 g, LIDA 475: 140 g				

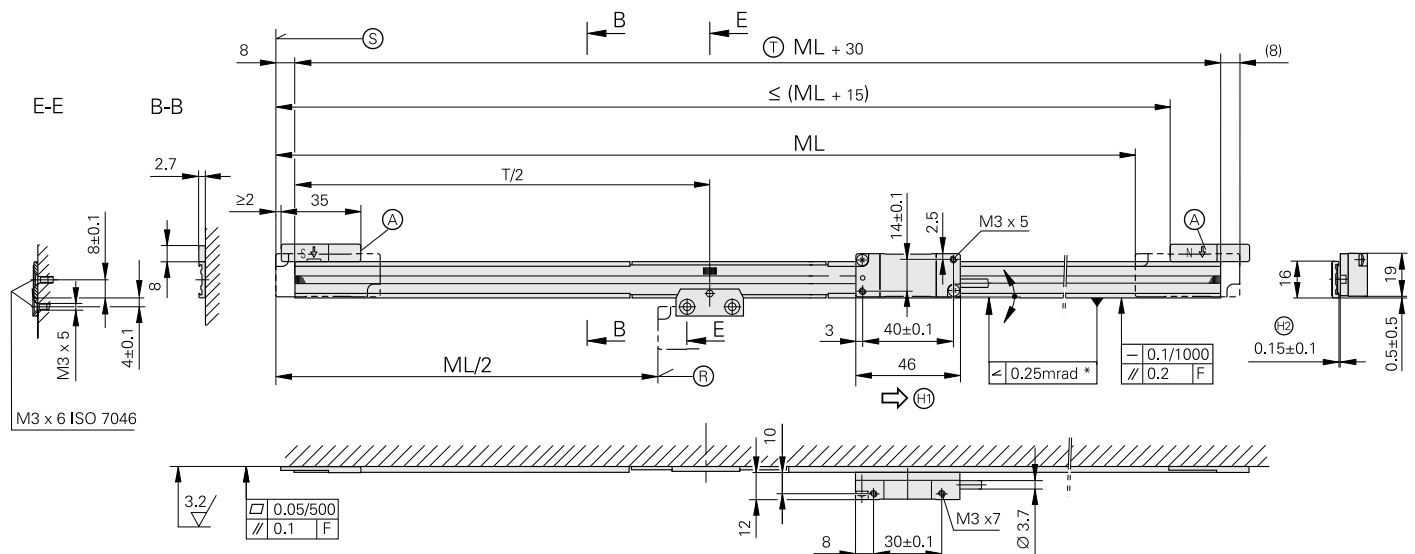
* Please select when ordering

¹⁾ At the corresponding cutoff or scanning frequency

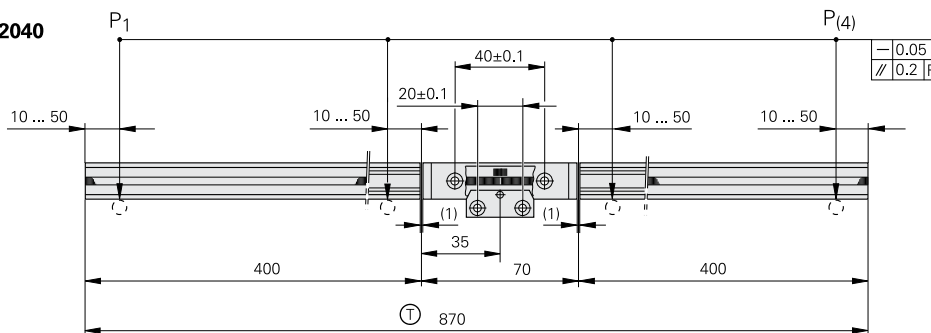
LIDA 477, LIDA 487

Incremental linear encoders for measuring ranges up to 6 m

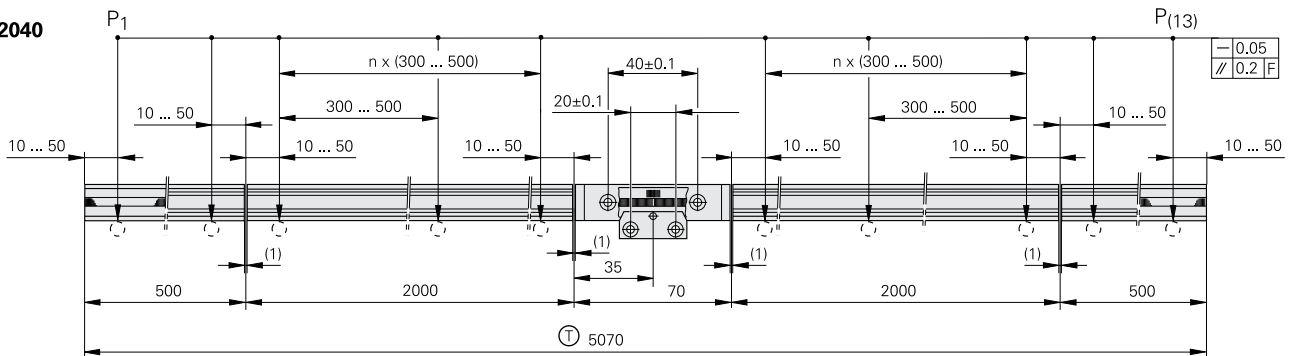
- For measuring steps of $1 \mu\text{m}$ to $0.05 \mu\text{m}$
- Limit switches
- Steel scale-tape is drawn into adhesive aluminum extrusions and fixed at center
- Consists of scale and scanning head



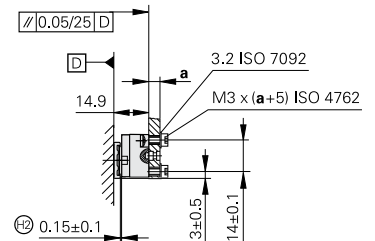
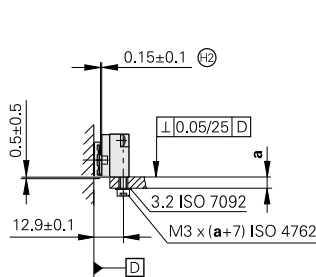
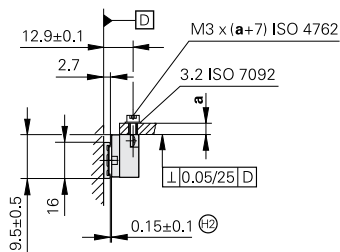
ML \leq 2040



ML $>$ 2040



Possibilities for mounting the scanning head



mm

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

- * = Max. change during operation
- F = Machine guideway
- P = Gauging points for alignment
- \textcircled{R} = Reference mark position
- \textcircled{S} = Beginning of measuring length (ML)
- \textcircled{A} = Selector magnet for limit switch
- \textcircled{C} = Carrier length

- \textcircled{H} = Direction of scanning unit motion for output signals in accordance with interface description
- \textcircled{Z} = Adjust or set



Linear scale	LIDA 407
Measuring standard Coefficient of linear expansion	Steel scale tape with METALLUR scale grating; grating period 20 µm $\alpha_{\text{therm}} \approx 10 \cdot 10^{-6} \text{ K}^{-1}$
Accuracy grade*	± 3 µm (up to ML 1040) ± 5 µm (starting from ML 1240) ± 15 µm ¹⁾
Measuring length ML* in mm	240 440 640 840 1040 1240 1440 1640 1840 2040 2240 2440 2640 2840 3040 3240 3440 3640 3840 4040 4240 4440 4640 4840 5040 5240 5440 5640 5840 6040
Reference marks	One at midpoint of measuring length
Mass	25 g + 0.1 g/mm measuring length

Scanning head	AK LIDA 48	AK LIDA 47			
Interface	~ 1 V _{PP}	□ TTL			
Integrated interpolation* Signal period	– 20 µm	5-fold 4 µm	10-fold 2 µm	50-fold 0.4 µm	100-fold 0.2 µm
Cutoff frequency –3 dB	≥ 400 kHz	–			
Scanning frequency*	–	≤ 400 kHz ≤ 200 kHz ≤ 100 kHz ≤ 50 kHz	≤ 200 kHz ≤ 100 kHz ≤ 50 kHz ≤ 25 kHz	≤ 50 kHz ≤ 25 kHz ≤ 12.5 kHz	≤ 25 kHz ≤ 12.5 kHz ≤ 6.25 kHz
Edge separation a ²⁾	–	≥ 0.100 µs ≥ 0.220 µs ≥ 0.465 µs ≥ 0.950 µs	≥ 0.100 µs ≥ 0.220 µs ≥ 0.465 µs ≥ 0.950 µs	≥ 0.080 µs ≥ 0.175 µs ≥ 0.370 µs	≥ 0.080 µs ≥ 0.175 µs ≥ 0.370 µs
Traversing speed ²⁾	≤ 480 m/min	≤ 480 m/min ≤ 240 m/min ≤ 120 m/min ≤ 60 m/min	≤ 240 m/min ≤ 120 m/min ≤ 60 m/min ≤ 30 m/min	≤ 60 m/min ≤ 30 m/min ≤ 15 m/min	≤ 30 m/min ≤ 15 m/min ≤ 7.5 m/min
Limit switches	L1/L2 with two different magnets; <i>output signals</i> : TTL (without line driver)				
Electrical connection	Cable, 0.5 m, 1 m or 3 m with D-sub connector (male), 15-pin; with interface electronics for the AK LIDA 47 in the connector				
Cable length	See Interface Description, but <i>limit</i> : ≤ 20 m (with HEIDENHAIN cable)				
Voltage supply	DC 5 V ± 0.5 V	DC 5 V ± 0.5 V			
Current requirement	< 130 mA	< 150 mA (without load)			
Vibration 55 Hz to 2000 Hz Shock 6 ms	≤ 500 m/s ² (EN 60068-2-6) ≤ 1000 m/s ² (EN 60068-2-27)				
Operating temperature	–10 °C to 70 °C				
Mass Scanning head Connecting cable Connector	20 g (without connecting cable) 22 g/m LIDA 487: 32 g, LIDA 477: 140 g				

* Please select when ordering

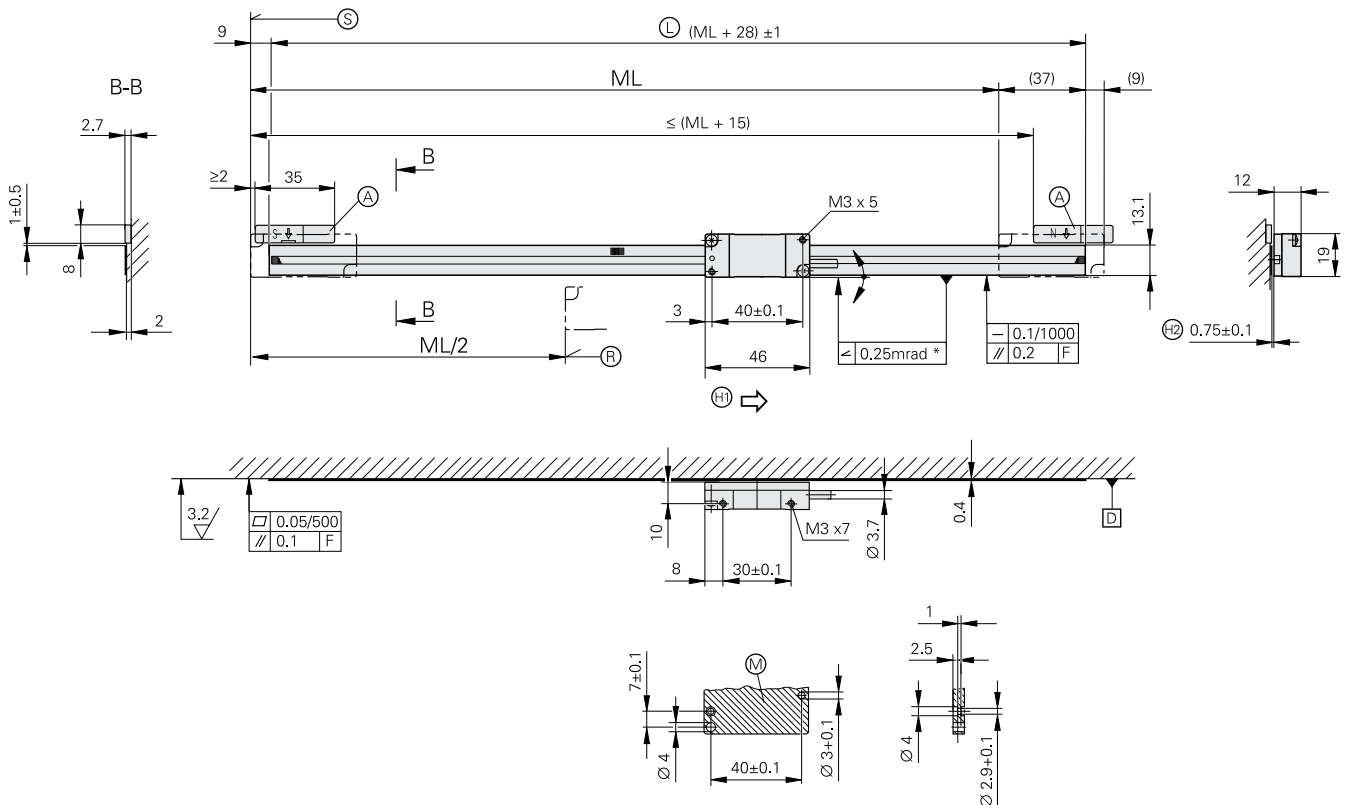
¹⁾ ± 5 µm after linear length-error compensation in the subsequent electronics

²⁾ At the corresponding cutoff or scanning frequency

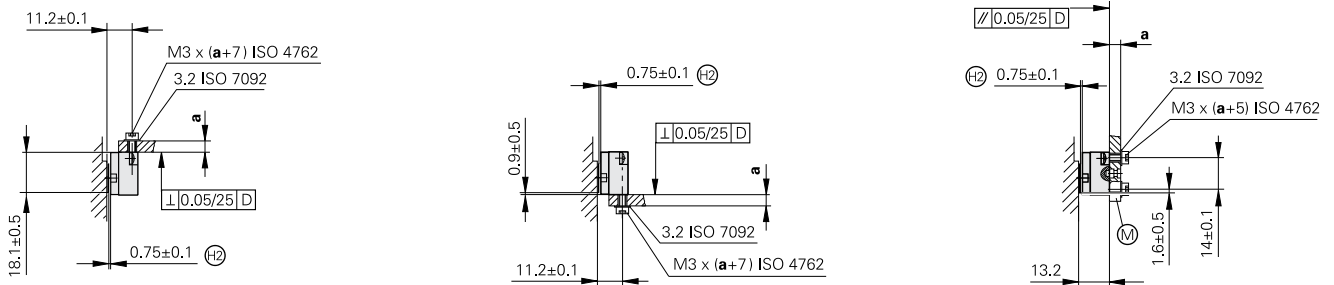
LIDA 479, LIDA 489

Incremental linear encoders for measuring ranges up to 6 m

- For measuring steps of 1 μm to 0.05 μm
- Limit switches
- Steel scale tape cemented on mounting surface
- Consists of scale and scanning head



Possibilities for mounting the scanning head



mm

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

- F = Machine guideway
- * = Max. change during operation
- Ⓢ = Reference mark position
- Ⓢ = Beginning of measuring length (ML)
- Ⓐ = Selector magnet for limit switch
- Ⓢ = Scale tape length
- Ⓢ = Mounting surface for scanning head
- Ⓢ = Direction of scanning unit for output signals in accordance with interface description
- Ⓢ = Adjust or set



Linear scale	LIDA 409	
Measuring standard Coefficient of linear expansion	Steel scale tape with METALLUR scale grating; grating period 20 μm $\alpha_{\text{therm}} \approx 10 \cdot 10^{-6} \text{ K}^{-1}$	
Accuracy grade*	$\pm 3 \mu\text{m}, \pm 15 \mu\text{m}^{1)}$	
Measuring length ML* in mm	70 120 170 220 270 320 370 420 520 620 720 820 920 1020	Scale tape from the roll: 2 m, 4 m, 6 m
Reference marks	One at midpoint of measuring length	Every 50 mm
Mass	31 g/m	

Scanning head	AK LIDA 48	AK LIDA 47			
Interface	$\sim 1 V_{\text{PP}}$	\square TTL			
Integrated interpolation* Signal period	– 20 μm	5-fold 4 μm	10-fold 2 μm	50-fold 0.4 μm	100-fold 0.2 μm
Cutoff frequency –3 dB	$\geq 400 \text{ kHz}$	–			
Scanning frequency*	–	$\leq 400 \text{ kHz}$ $\leq 200 \text{ kHz}$ $\leq 100 \text{ kHz}$ $\leq 50 \text{ kHz}$	$\leq 200 \text{ kHz}$ $\leq 100 \text{ kHz}$ $\leq 50 \text{ kHz}$ $\leq 25 \text{ kHz}$	$\leq 50 \text{ kHz}$ $\leq 25 \text{ kHz}$ $\leq 12.5 \text{ kHz}$	$\leq 25 \text{ kHz}$ $\leq 12.5 \text{ kHz}$ $\leq 6.25 \text{ kHz}$
Edge separation a ²⁾	–	$\geq 0.100 \mu\text{s}$ $\geq 0.220 \mu\text{s}$ $\geq 0.465 \mu\text{s}$ $\geq 0.950 \mu\text{s}$	$\geq 0.100 \mu\text{s}$ $\geq 0.220 \mu\text{s}$ $\geq 0.465 \mu\text{s}$ $\geq 0.950 \mu\text{s}$	$\geq 0.080 \mu\text{s}$ $\geq 0.175 \mu\text{s}$ $\geq 0.370 \mu\text{s}$	$\geq 0.080 \mu\text{s}$ $\geq 0.175 \mu\text{s}$ $\geq 0.370 \mu\text{s}$
Traversing speed ²⁾	$\leq 480 \text{ m/min}$	$\leq 480 \text{ m/min}$ $\leq 240 \text{ m/min}$ $\leq 120 \text{ m/min}$ $\leq 60 \text{ m/min}$	$\leq 240 \text{ m/min}$ $\leq 120 \text{ m/min}$ $\leq 60 \text{ m/min}$ $\leq 30 \text{ m/min}$	$\leq 60 \text{ m/min}$ $\leq 30 \text{ m/min}$ $\leq 15 \text{ m/min}$	$\leq 30 \text{ m/min}$ $\leq 15 \text{ m/min}$ $\leq 7.5 \text{ m/min}$
Limit switches	L1/L2 with two different magnets; <i>output signals</i> : TTL (without line driver)				
Electrical connection	Cable, 0.5 m, 1 m or 3 m with D-sub connector (male), 15-pin; with interface electronics for the AK LIDA 47 in the connector				
Cable length	See Interface Description, but <i>limit</i> : $\leq 20 \text{ m}$ (with HEIDENHAIN cable)				
Voltage supply	DC 5 V \pm 0.5 V	DC 5 V \pm 0.5 V			
Current requirement	< 130 mA	< 150 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 °C to 70 °C				
Mass Scanning head Connecting cable Connector	20 g (without connecting cable) 22 g/m LIDA 489: 32 g, LIDA 479: 140 g				



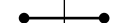
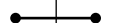

* Please select when ordering

¹⁾ $\pm 5 \mu\text{m}$ after linear length-error compensation in the subsequent electronics

²⁾ At the corresponding cutoff or scanning frequency

Electrical connection

Pin layout of LIDA 47x/48x

15-pin D-sub connector														
	Voltage supply				Incremental signals						Other signals			
	4	12	2	10	1	9	3	11	14	7	13	8	6	15
	U_P	Sensor 5V	0V	Sensor 0V	U_{a1}	\overline{U}_{a1}	U_{a2}	\overline{U}_{a2}	U_{a0}	\overline{U}_{a0}	\overline{U}_{aS}	$L1^{2)}$	$L2^{2)}$	$PWT^{1)}$
					A+	A-	B+	B-	R+	R-	As- signed			
	Brown/ Green	Blue	White/ Green	White	Brown	Green	Gray	Pink	Red	Black	Violet	Green/ Black	Yellow/ Black	Yellow

Cable shield on housing; U_P = Voltage supply

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

Vacant pins or wires must not be used.

¹⁾ TTL/11 μA_{PP} conversion for PWT

²⁾ Color assignment applies only to connecting cable

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Further Information

- Brochure: *Interfaces of HEIDENHAIN Encoders*