

Absolute Encoders for Interface EnDat3



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Hinweis

This catalog supersedes all previous editions, which thereby become invalid. The basis for ordering from AMO is always the catalog edition valid when the contract is made.

Explanation for the related documents:

For the reason of environmental protection, the devices are delivered with the assembly instructions only. The contents comparable to an operating manual are therefore composed of several documents that must all be taken into account during configuration. The original language for the documentation is German (DE), all other languages are translations.

Related documents

Comply with the information in the following documents to ensure the correct and intended operation of the encoder:

• Product information for Absolute Encoders for EnDat3	1409757
• Mounting Instructions WMKA 2010/2210	1238014
• Mounting Instructions WMKA 2110/2310	1238375
• Mounting Instructions LMKA 2010/2110	1247444
• Mounting Instructions LMKA 3010/3110	1247423
• CE- Declaration of conformity on request	-----
• Brochure Interfaces of HEIDENHAIN encoders	1078628
• Brochure Cables and Connectors	1206103

The additional documents for implementation in a controller are listed in the Technical Information, for Safety-Related Position Measuring Systems and can be requested from the Dr. Johannes HEIDENHAIN GmbH.



Further information:

- EnDat 3 Interface Specification
- www.endat.de

General electrical information

Supply voltage

Connect AMO-Encoders only to subsequent electronics whose supply voltage comes from PELV systems (for a definition, see EN 50178).

AMO-Encoders meet the requirements of the IEC 61010-1 standard if power is supplied from a secondary circuit with limited energy as per IEC 61010-1^{3rd Ed.}, Section 9.4, or with limited power as per IEC 62368-1^{2nd Ed.}, Section 6.2.2.5 PS2, or from a Class 2 secondary circuit as per UL1310.1)

A stabilized DC voltage UP is required for powering the encoders. Information on voltage and current consumption or power consumption can be obtained from the respective specifications.

Regarding the ripple voltage of the DC power, the following parameters apply:

- High-frequency interference
UPP < 250 mV with dU/dt > 5 V/μs
- Low-frequency fundamental ripple
UPP < 100 mV

However, the limits of the supply voltage must not be violated by the ripple content.

The required supply voltage depends on the encoder interface. A distinction is made between encoders without an extended supply voltage range (e.g., DC 5.0 V ±0.25 V) and those with an extended supply voltage range (e.g., DC 3.6 V to 14 V).

For interfaces without sense lines it is necessary to consider the voltage drop along the connecting cable between the measuring device and subsequent electronics during the design of the required supply voltage.

¹⁾ In place of IEC 61010-1^{3rd Ed.}, Section 9.4, the corresponding sections of the following standards can be used: DIN EN 61010-1, EN 61010-1, UL 61010-1, and CAN/CSA-C22.2 No. 61010-1. In place of IEC 62368-1^{2nd Ed.}, Section 6.2.2.5 PS2, the corresponding sections of the following standards can be used: DIN EN 62368-1, EN 62368-1, UL 62368-1, and CAN/CSA-C22.2 No. 62368-1.

Interface EnDat 3

EnDat 3 carries forward the features and benefits of EnDat into the future of digital manufacturing. To achieve this feat, EnDat3 relies on a new architecture that builds upon proven technology, ensuring optimal continuity and compatibility with predecessor interfaces.

EnDat3 characteristics:

- Hybrid cable transmission
- Bus topologies
- Sensors: versatile data contents and sensor box
- Functional safety: black channel communication
- Higher data bandwidth
- Definable send lists
- System installation: introduction of access levels

Interface	
Protocol	Request-response-procedures in half-duplex mode
Physical layer	RS-485: 4-wires oder 2-wires
Data rate	12,5 Mbit/s (25 Mbit/s)
Cable length	max. 100m at 12,5 Mbit/s / max. 40m at 25 Mbit/s
HPF - send time (position availability in the master)	Typically 10µs (the parameter XEL.timeHPFout indicates the duration between position value generation (stored via latch) and transmission of the complete HPF, without cable impacts)
cycle time	Typically > 25µs

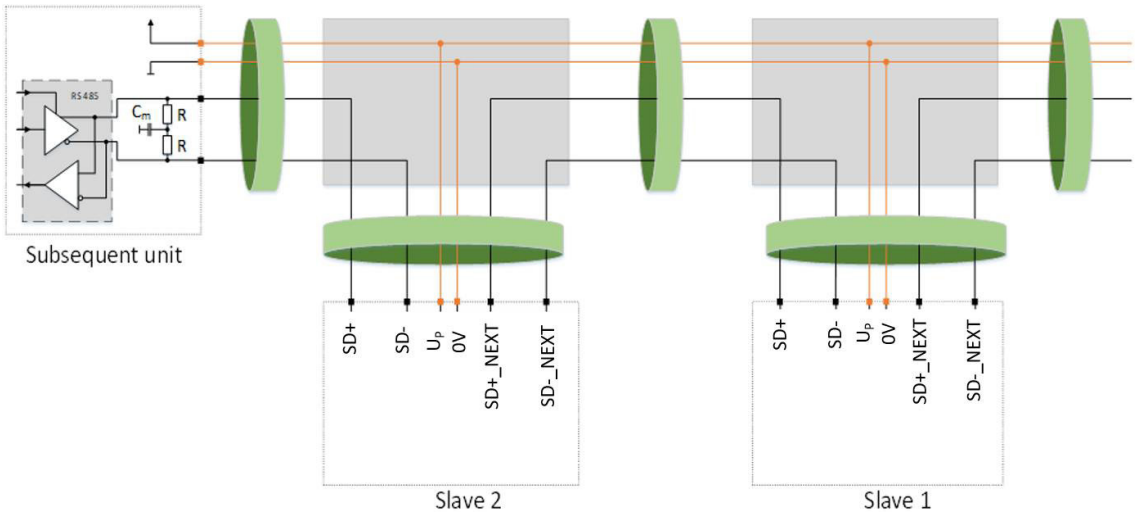
supported communications	E30-R2	E30-R4	E30-RB
EnDat 3: Communication mudulated onto power supply wires	✓	-	-
Endat 3: Communication + separate power supply wires (4 wires)	-	✓	✓
EnDat 3: bus operation	-	-	✓
Sensor box integration	-	✓	✓

Bus operation EnDat 3

Basic principle

EnDat 3 enables bus operation in daisy-chain mode. For connection to the EnDat 3 Master, the connection for the power supply and a wire pair for communication are required. The encoders have two connectors for one communication wire pair each.

Communication is passed on by the slaves, and the slave listens to the entire communication. The following image illustrates the basic principle:



Broadcast

The master sends a request as a broadcast and anticipates responses from all connected participants. The participant with Address "1" (designated "Slave 1" in the image) sends its response first (designated "RSP1" in the image).

The next participant (Slave 2) listens to the response and sends its own response immediately after completion of its own response. The following image shows the procedure based on an example with three participants:



Address assignment

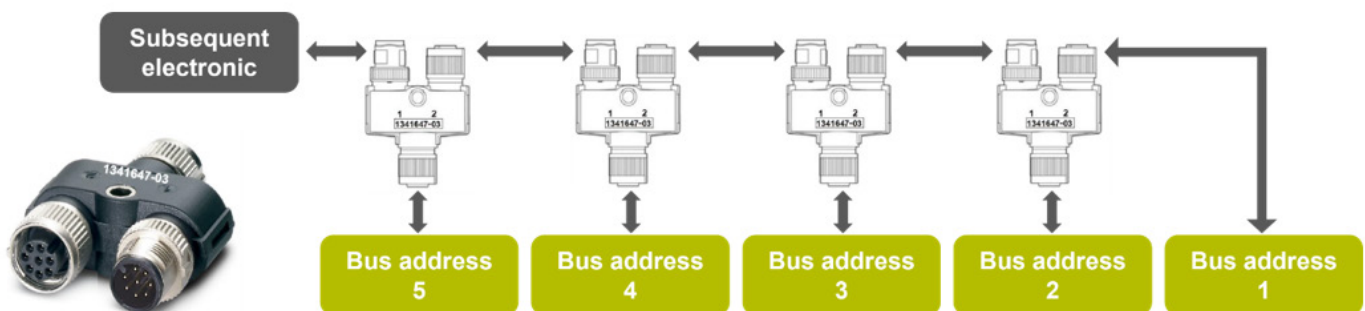
For the bus communication the corresponding bus addresses must be programmed in the encoder. This can be done with subsequent electronics or e.g. with the test equipment PWM 21 + ATS-software.

Power supply and cable requirements

By interconnecting several encoders, a relatively high supply current is created in the individual sub-areas. It is therefore important to ensure that the supply wires have a sufficient cross section.

To limit losses in the cables, the following recommendation applies: The furthest away participant (bus address 1) should be supplied with at least 9 V. The cables must be suitable for EnDat 3 communication.

It is recommended to use the Y-coupler (ID 1341647-03) and original HEIDENHAIN cable. The following graphic shows the basic structure:



The connection of the encoder to the Y-coupler can be done via the encoder cable. For the cabling from Y-coupler to Y-coupler EnDat22 cables can be used,

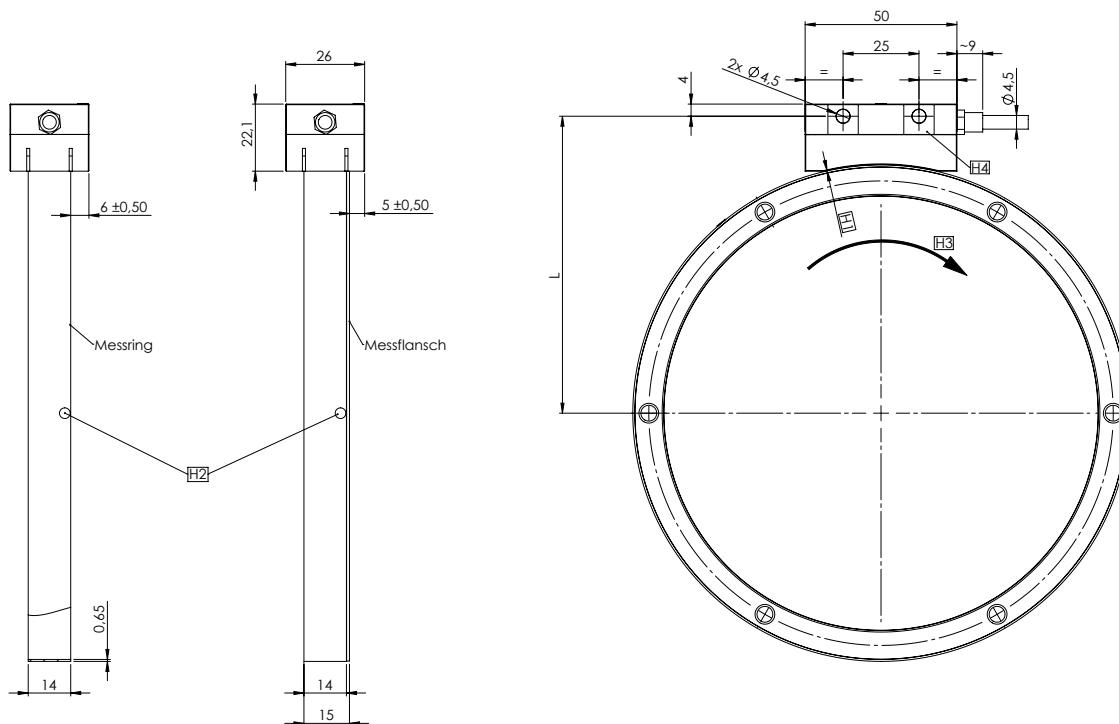
according to the brochure "Cables and Connectors".

Please note the "General Electrical Information" section in the "Interfaces of HEIDENHAIN encoders" brochure.

Series WMKA 2010

- In combination with scale tape ring on the flange WMFA 1010A or scale tape ring WMRA 1010A
- grating period 1000µm
- scanning head with integrated electronic

Design 20 - Outside scanning

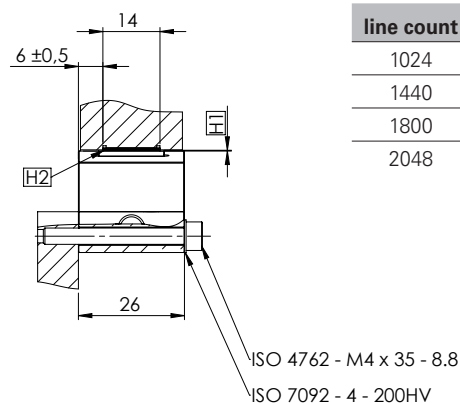
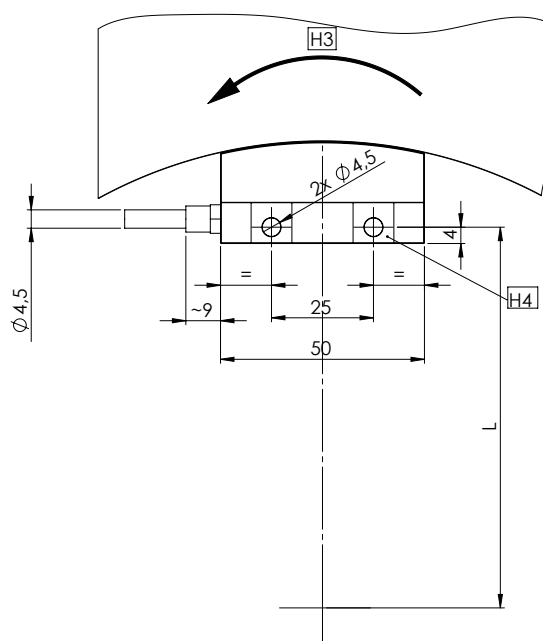


line count	L [mm]
256	56,74
360	73,29
512	97,82
720	131,64
900	160,39
1024	180,33
1440	246,74
1800	304,25
2048	343,84

Series WMKA 2110

- In combination with measuring scale WMRA 1110I
- grating period 1000µm
- scanning head with integrated electronic

Design 20 - Inside scanning



line count	L [mm]
1024	142,53
1440	209,28
1800	266,84
2048	306,44

H1 = Air gap 0,15 ± 0,10mm, set with spacer foil
H2 = Reference track marking
H3 = Direction of shaft rotation for positive counting
H4 = Ground plane (both sides)



Tolerance principle in accordance with ISO 8015
General tolerances in accordance with ISO 2768-fH
All dimensions in mm

Technical data

Scanning head		WMKA 2010 / WMKA 2110							
Interface	EnDat 3								
Designation	E30 - R2			E30 - R4			E30 - RB		
XEL.time HPFout Data rate	≤ 11µs to 12,5Mbit/s ≤ 8,2µs to 25Mbit/s						≤ 13µs to 12,5Mbit/s ≤ 10,2µs to 25Mbit/s		
Interpolation factor digital	Performance Standard: 12bit Performance High Accuracy: 14bit								
Cable length on the encoder	0,5m to 6m								
Cable length overall	≤ 100m at 12,5MBit/s ≤ 40m at 25MBit/s								
Number of participants	-			-			at 12,5MBit/s max. 6 participants at 25MBit/s max. 3 participants		
Electrical connection	Cable with M12 coupling, 8-pin, male								
Voltage supply	DC 4,0V to 14V			DC 3,6V to 14V					
Power consumption	1,5W								
Typical current consumption	12V : 115mA								
Shock 6ms	< 1000m/s² (EN 60068-2-27)								
Vibration 55 to 2000 Hz	< 200m/s² (EN 60068-2-6)								
Operating temperature	-10°C to 85°C								
Storage temperature	-20°C to 85°C								
Protection	IP67								
Mass approximate	40g								
line count	256 ²⁾	360 ²⁾	512 ²⁾	720 ²⁾	900 ²⁾	1024	1440	1800	2048
Max. Positionen/Rotation	22bit		23bit			24bit			25bit
Position error per grating period ¹⁾									
Standard	±11″	±7,5″	±5,5″	±4,0″	±3,0″	±3,0″	±2,0″	±2,0″	±1,5″
High Accuracy	±3,0″	±2,0″	±1,5″	±1,0″	±1,0″	±1,0″	± 0,5″	±0,5″	± 0,5″
Max. electrical speed [rpm]	≤ 4680	≤ 3330	≤ 2340	≤ 1660	≤ 1330	≤ 1170	≤ 830	≤ 660	≤ 580

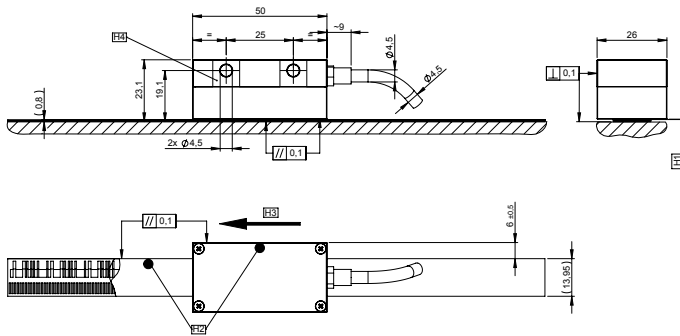
¹⁾ Other line counts on demand

²⁾ Not for inside scanning

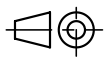
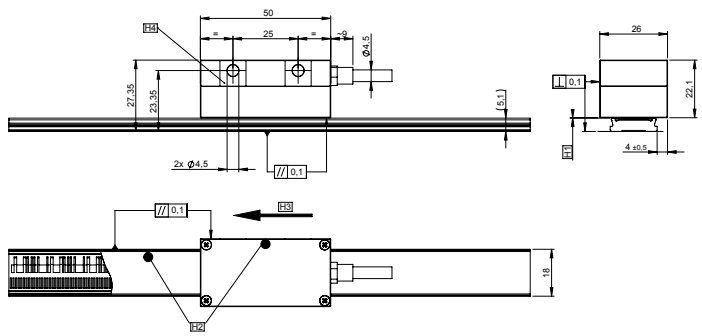
Scanning head - Design LMKA 2010 / 2110

- absolute, modular length measuring system
- grating period 1000µm
- scanning head with integrated electronic
- combination with scale tape LMBA 2010 and LMTA 4010

Design 20
with scale tape LMBA 2010



Design 20
with scale tape LMTA 4010



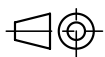
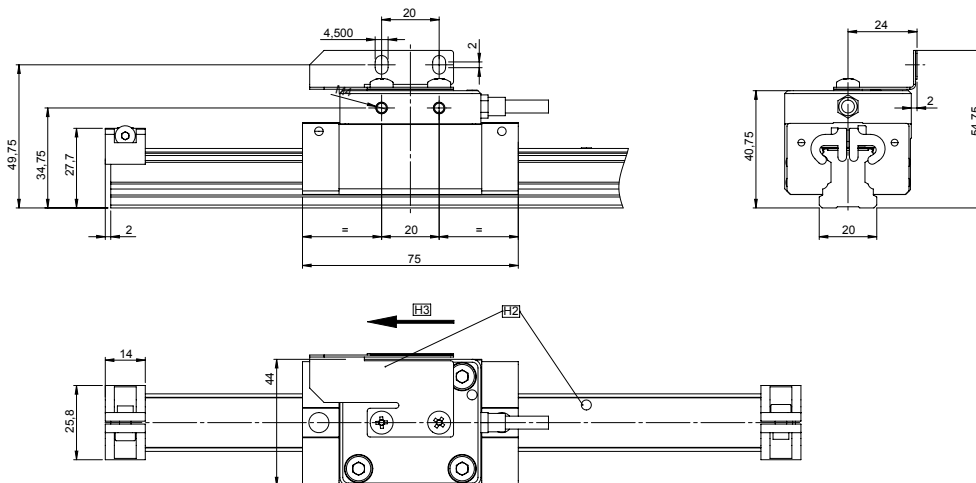
Tolerance principle in accordance with ISO 8015
General tolerances in accordance with ISO 2768-fH
All dimensions in mm

H1 = Air gap $0,15 \pm 0,10$ mm, set with spacer foil
H2 = Absolute track marking
H3 = Direction of scanning head movement for positive counting
H4 = Ground plane (both sides)

Scanning head - Design LMKA 3010 / 3110

- absolute, modular length measuring system
- grating period 1000µm
- guided scanning head with integrated electronic
- combination with scale tape LMFA 3010

Design 30
with scale tape LMFA 3010



Tolerance principle in accordance with ISO 8015
General tolerances in accordance with ISO 2768-fH
All dimensions in mm

H2 = Absolute track marking
H3 = Direction of scanning head movement for positive counting

Technical data

Scanning head				LMKA 2010 / 2110 LMKA 3010 / 3110			
Interface	EnDat 3						
Designation	E30 - R2		E30 - R4		E30 - RB		
XEL.time HPFout Data rate	≤ 11µs to 12,5Mbit/s ≤ 8,2µs to 25Mbit/s				≤ 13µs to 12,5Mbit/s ≤ 10,2µs to 25Mbit/s		
Interpolation factor digital	Performance Standard: 12bit Performance High Accuracy: 14bit						
Cable length on the encoder	0,5m to 6m						
Cable length overall	≤ 100m at 12,5MBit/s ≤ 40m at 25MBit/s						
Number of participants	-		-		at 12,5MBit/s max. 6 participants at 25MBit/s max. 3 participants		
Electrical connection	Cable with M12 coupling, 8-pin, male						
Voltage supply	DC 4,0V to 14V		DC 3,6V to 14V				
Power consumption	1,5W						
Typical current consumption	12V : 115mA						
Shock 6ms	< 1000m/s² (EN 60068-2-27)						
Vibration 55 to 2000 Hz	< 200m/s² (EN 60068-2-6)						
Operating temperature	-10°C to 85°C						
Storage temperature	-20°C to 85°C						
Protection	IP67						
Mass approximate	LMKA 2010/2110: 40g LMKA 3010/3110: 200g						

- WMKA - Scanning head for absolute angle encoder
- Grating period 1000 μ m

Ordering code

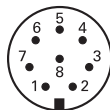
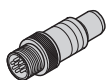
- LMKA - Scanning head for absolute linear encoders
- Grating period 1000 μ m

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Pin configuration

Pin configuration for EnDat 3 E30-R2

Electrical connection: 1SS08
8-pin coupling **M12**



Power supply / serial data transfer

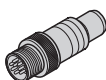
	7	6	8	2	5	1	3	4
	P_SD+¹⁾	P_SD-¹⁾	-	-	-	-	-	-
	violet	yellow	-	-	-	-	-	-

Cabel shield is connected with the housing; **U_P** = Power supply voltage

¹⁾ **Power supply and Data:** **P_SD+** included U_P ; **P_SD-** includes 0V

Pin configuration for EnDat 3 E30-R4

Electrical connection: 1SS08
8-pin coupling **M12**



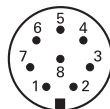
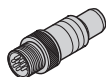
Power supply / serial data transfer

	8	5	7	6
	+V (U_P)	0V (U_n)	SD+	SD-
	brown-green	white-green	violet	yellow

Cabel shield is connected with the housing; **U_P** = Power supply voltage

Pin configuration for EnDat 3 E30-RB

Electrical connection: 1SS08
8-pin coupling **M12**



Power supply / serial data transfer

	7	6	8	2	5	1	3	4
	SD+	SD-	+V (U_P)	+V (Sensor)	0V (U_n)	0V (Sensor)	SD+_Next	SD-_Next
	violet	yellow	brown-green	blue	white-green	white	grey	pink

Cabel shield is connected with the housing; **U_P** = Power supply voltage

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