



AMO GmbH

Absolute Encoders

for safety-related applications



Functional
Safety

Product Information

August 2018

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Advice

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.

Date of issue	Comment	Documentnumber
April 2018	First edition	1238174 - 01 - A - 02
August 2018	Supplement DRIVE-CLiQ Interface	1238174 - 02 - A - 02

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 safety-related applications	1238174
• Mounting Instructions WMKA 2010	1238014
• Mounting Instructions WMKA 2110	1238375
• Mounting Instructions LMKA 2010 /2110	1247444
• Mounting Instructions LMKA 3010 / 3110	1247423
• Technical Information Safety-related position measuring systems	596632
• CE- Declaration of conformity on request	-----
• Specification for E/E/PES safety requirements for the EnDat Master and measures for the safety control (on request)	533095

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.



Advice

Applied guidelines and standards

The devices described in this product information comply with the following guidelines and standards:

- 2006 / 42 / EG idgF (Machine guidelines)
- EN ISO 13849
- EN / IEC 61508
- EN / IEC 62061
- EN / IEC 61800-5-2
- 2014 / 30 / EU (EMV)
- EN / 55011
- EN / 61000-6-7
- 2011 / 65 / EG (Statement regarding RoHS on request)

The devices can be used for applications up to PL d, Category 3 according to EN ISO 13849-1 or SIL 2 according to EN / IEC 61508.

Functional safety

General

Safety is becoming increasingly important in machine and plant construction. Proof of this can be seen in new legislation and in the heightened safety regulations of national and international standards. These high requirements mainly serve to protect human beings, but material assets and the environment are also receiving more consideration.

The goal of functional safety is to minimize or even eliminate risks that can occur during normal or impaired operation of machines or facilities. This is achieved primarily

with redundant systems. For example, axes that are moved in safety-related applications require redundant position information in order to perform the corresponding safety functions.

Various system configurations can be realized in order to capture independent position values. One possibility is the use of two encoders per axis. In many cases, however, a more economical solution requiring only one position encoder is preferred. Until now, analogue encoders with sine and cosine signals were used for this.

HEIDENHAIN offers a purely serial, single encoder solution for safety-related position measuring systems in safety-oriented applications in accordance with EN 61 508 and EN 13 849.

This means that safety applications can now take advantage of all the benefits of serial data transfer, such as optimization of costs, diagnostic possibilities, automatic commissioning and rapid formation of the position value.

Function

The safety strategy of the position measuring system is based on two mutually independent position values and additional error bits produced in the encoder and transmitted over the functional safety protocol to the safety master. The safety master assumes various monitoring functions with which errors in the encoder and during transmission can be revealed. The two position values are then compared. The sa-

fety master then makes the data available to the safe control. The control periodically tests the safety-related position measuring system to monitor its correct operation. The architecture of the functional safety protocol makes it possible to process all safety-relevant information and control mechanisms during unconstrained controller operation. This is possible because the safety-relevant information is saved in the ad-

ditional information. According to EN 61 508, the architecture of the position measuring system is regarded as a single-channel tested system. The position measuring system was considered with a HFT = 1 (Hardware Fault Tolerance).

Documentation on the integration of the position measuring system

The intended use of position measuring systems places demands on the control, the machine designer, the installation technician, service, etc. The necessary information is provided in the documentation for the position measuring systems.

In order to be able to implement a position measuring system in a safety-related application, a suitable control is required. The control assumes the fundamental task of communicating with the encoder and safely evaluating the encoder data.

The requirements for integrating the EnDat master with monitoring functions in the safe control are described in the HEIDENHAIN document 533095. It contains, for example, specifications on the

evaluation and processing of position values and error bits, and on electrical connection and cyclic tests of position measuring systems.

Machine and plant manufacturers need not attend to these details. These functions must be provided by the control. Product information sheets, catalogues and mounting instructions provide information to aid the selection of a suitable encoder. The product information sheets and catalogues contain general data on function and application of the encoders as well as specifications and permissible ambient conditions. The mounting instructions provide detailed information on installing the encoders.

The architecture of the safety system and the diagnostic possibilities of the control may call for further requirements. For example, the operating instructions of the control must explicitly state whether fault exclusion is required for the loosening of the mechanical connection between the encoder and the drive. The machine designer is obliged to inform the installation technician and service technicians, for example, of the resulting requirements (see also information under "Safety-related characteristic values"). The system integrator is responsible for the overall concept of the machine.

Boundary to applications

A complete demarcation to all unallowed conditions of use is not possible due to lack of knowledge of all possible applications. Basically, the technical data listed for the devices must be adhered to. In addition, influences such as mechanical solids between the scanning head and the measuring tape (eg mechanical damage)

should be excluded. It is also important to take structural measures, to protect against metallic particles that may influence the sampling.

Emissions of airborne sound and non-ionizing radiation do not occur. For information on basic safety requirements, operating

areas up to 6000 m above sea level are considered.

Functional Safety - Absolute angle encoders

With the absolute angle encoders of the WMKA 2010 and WMKA 2110 series, AMO offers an ideal solution for position determination on rotary axes in safety-related applications. In conjunction with safe control, the encoders can be used as single-encoder systems in applications with control category SIL 2 (according to EN 61 508) or performance level „d“ (according to EN ISO 13 849).

The basis for the safe transmission of the position are two independently formed absolute position values as well as error bits

which are provided to the safe control. The functions of the measuring instrument can be used for numerous safety functions of the entire system according to EN 61 800-5-2.

The angle encoders WMKA 2010 and WMKA 2110 create at any time – for example also immediately after switch on - a safe absolute position value. The purely serial data transmission is done via the bidirectional EnDat 2.2 or DRIVE-CLiQ Interface.

In addition to the data interface, the mechanical connection of the measuring device to the drive is also relevant for the safety.

Table D 8 of the standard for electrical drives, EN 61 800-5-2, defines the loosening of the mechanical connection between the encoder and drive as a fault that requires consideration. Since it cannot be guaranteed that the control will detect such errors, a fault exclusion for the loosening of the mechanical connection is frequently required.

Fault exclusion for the loosening of the mechanical connection

The machine manufacturer is responsible for the dimensioning of mechanical connections in a drive system. The OEM should ideally consider the application conditions for the mechanical design. Providing objective evidence of a safe connection is time-consuming, however.

For this reason, AMO has developed and confirmed by a type examination a mecha-

nical fault exclusion for the angle encoders. The qualification of the mechanical fault exclusion was performed for a broad application range of the encoders. This means that fault exclusion is ensured under the operating conditions listed below.

All information is given with respect to a mounting temperature of 15°C to 35°C. Mounting surfaces must be clean and free

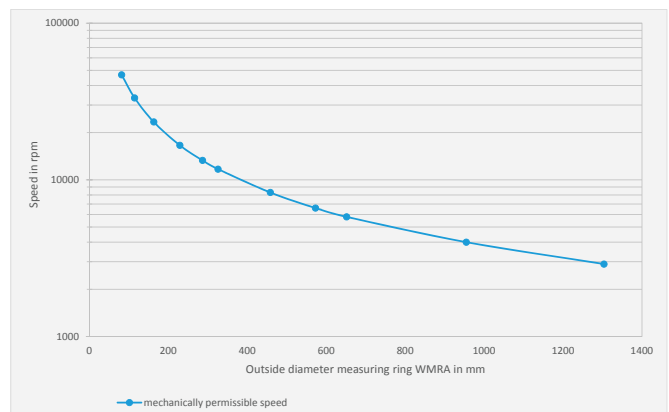
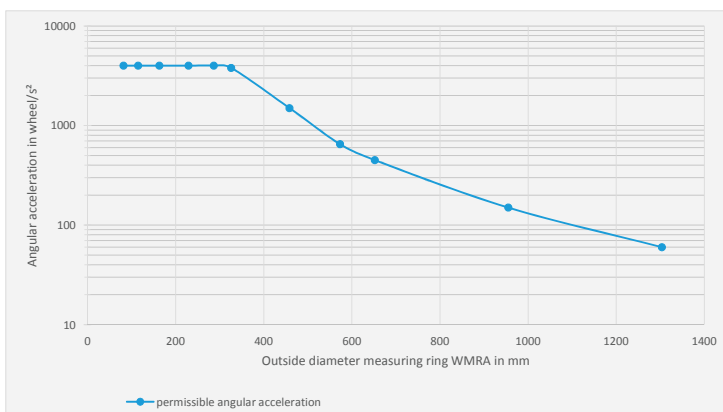
of burrs. Thread surfaces must be secured with materially bonding thread-locking fluid. All mounting screws have to be tightened torque controlled.

Fault exclusion for the loosening of the measuring ring from the carrier flange - outside scanning

A mechanical fault exclusion for the loosening of the measuring ring from the carrier flange is given, when the carrier flange is designed according to the mechanical requirements specified in the brochure for modular angle encoders (ID 1244264)

The max. mechanical speed and angular acceleration are also shown in the brochure for modular angle encoders.

Carrier Flange	
Material	Steel
Yield strength $R_{p0,2}$	$\geq 430 \text{ N/mm}^2$
Coefficient of thermal expansion α	$(10 \text{ to } 12) \cdot 10^{-6} \text{ K}^{-1}$
Shock 6ms	$\leq 1000 \text{ m/s}^2 \text{ (EN 60068-2-27)}$



Fault exclusion for the loosening of the mounting screws or of the measuring flange

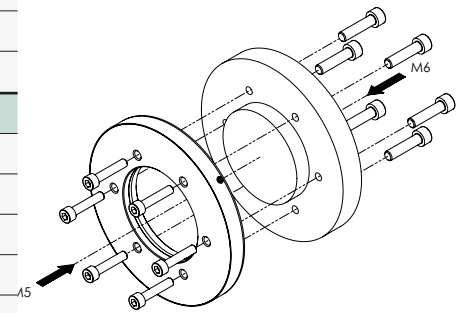
The great range of temperatures in combination with the multitude of material characteristics, as well as the maximum permissible shaft speeds and accelerations require an interference fit of the Measuring flange. Because of the dimensioning of the interference fit and taking into account all safety factors, heating the measuring flange

is necessary and affect directly the required assembling temperatures. The mounting with the mechanical fault exclusion is an option.

If there is no need of the mechanical fault exclusion for the safety concept, the measuring flange can also fixed without

the interference fit. See $\varnothing W1$ bzw. $\varnothing W2$ at the dimension of the respective measuring flange shown in the brochure for modular angle encoders (ID 1244264).

Measuring flange ¹⁾ WMFA	Option 1 (M5)	Option 2 (M6)
Mounting screws		
Screws	ISO 4762 - M5 x L-12.9	ISO 4762 - M6 x L-8.8
Torque M_d	$5,2 \pm 0,1$ Nm	$8,7 \pm 0,1$ Nm
Length of thread engagement	≥ 10 mm	≥ 12 mm
Free clamped length	≥ 15 mm	≥ 10 mm
Mating shaft		
Material	Steel	
Yield strength $R_{p0,2}$	≥ 430 N/mm ²	
Surface roughness RZ	10 μ m - 40 μ m	
Coefficient of thermal expansion α	$(10 \text{ to } 12) \cdot 10^{-6} \text{ K}^{-1}$	
Shock 6ms	< 1000 m/s ² (EN 60068-2-27)	



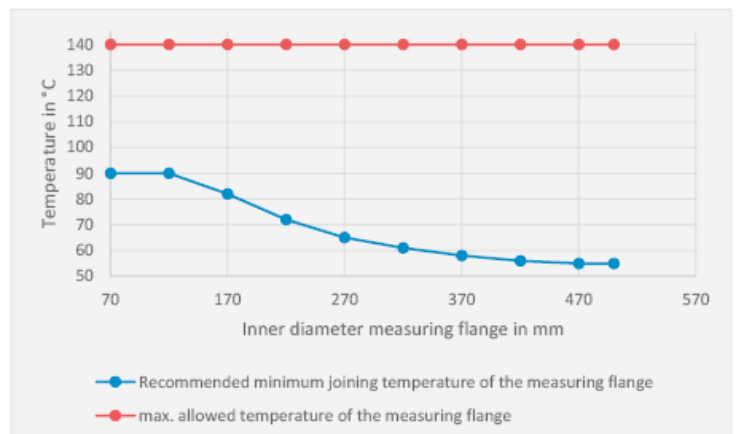
¹⁾ Information applies to those standard measuring flanges listed in the brochure „Modular Angle Encoders“; (ID 1244264)

Assembling of the measuring flange

An oversize of the shaft is required for fault exclusion. The measuring flange should preferably be shrunk thermally onto the mating shaft and additionally be fastened with screws. For this purpose, the measuring flange must be heated slowly before mounting. Use a heat chamber or a heat plate (but no induction heating sources). The diagram shows the recommended minimum temperatures for the different measuring flange diameters. The maximum temperature should not exceed 140 °C.

During shrink-fitting, make sure that the hole patterns of the scale drum and mating shaft are properly aligned. Appropriate positioning aids (setscrews) can facilitate mounting. When the scale drum has cooled down, all mounting screws have to be tightened again with the correct torque.

The mounting screws used for the assembly of the scanning head and measuring flange must be used only to secure the scanning head and the measuring flange. Do not additionally fasten any other components with these screws.



*The temperature specification refers to an ambient temperature of 22 °C. If the ambient temperature is different, adopt the assembling temperature accordingly

Functional Safety - Absolute linear encoders

With the absolute linear encoders of the LMKA 2010 and LMKA 3010 series, AMO offers an ideal solution for position determination on linear axes in safety-related applications. In conjunction with safe control, the encoders can be used as single-encoder systems in applications with control category SIL 2 (according to EN 61 508) or performance level „d“ (according to EN ISO 13 849).

The basis for the safe transmission of the position are two independently formed ab-

solute position values as well as error bits which are provided to the safe control. The functions of the measuring instrument can be used for numerous safety functions of the entire system according to EN 61 800-5-2.

The linear encoders LMKA 2010 and LMKA 3010 create at any time – for example also immediately after switch on - a safe absolute position value. The purely serial data transmission is done via the bidirectional EnDat 2.2 or DRIVE-CLiQ Interface.

In addition to the data interface, the mechanical connection of the linear encoder to the drive is also relevant for the safety.

D 8 of the standard for electrical drives, EN 61 800-5-2, defines the loosening of the mechanical connection between the encoder and drive as a fault that requires consideration. Since it cannot be guaranteed that the control will detect such errors, a fault exclusion for the loosening of the mechanical connection is frequently required.

Fault exclusion for the loosening of the mechanical connection

The machine manufacturer is responsible for the dimensioning of mechanical connections in a drive system. The OEM should ideally consider the application conditions for the mechanical design. Providing objective evidence of a safe connection is time-consuming, however.

For this reason, AMO has developed and confirmed by a type examination a mecha-

nical fault exclusion for the linear encoders. The qualification of the mechanical fault exclusion was performed for a broad application range of the encoders. This means that fault exclusion is ensured under the operating conditions listed below.

All information is given with respect to a mounting temperature of 15°C to 35°C. Mounting surfaces must be clean and free

of burrs. Thread surfaces must be secured with material bonding thread-locking fluid. All mounting screws have to be tightened torque controlled.

Fault exclusion LMBA 2010 - Scale tape to stick

The installation of the scale tape must be carried out according to the assembly instructions. As guidance for the measuring tape in the direction of travel, an insertion or stop shoulder can be provided in the machine base.

If this is not possible, an auxiliary stop can also be used to achieve sufficient straightness of the measuring tape in the direction of travel.

LMBA 2010 - Scale tape to stick	
Machine base	
Coefficient of thermal expansion α	$(10 \text{ to } 16) \cdot 10^{-6} \text{ K}^{-1}$
Environmental conditions	
Pollution	dry environment, no oils, cutting fluid or other liquid substances
Operating temperature	-10 °C to 85 °C
Max. acceleration	$\pm 50 \text{ m/s}^2$ in direction of movement
Shock 6ms	$< 1000 \text{ m/s}^2$ (EN 60068-2-27)

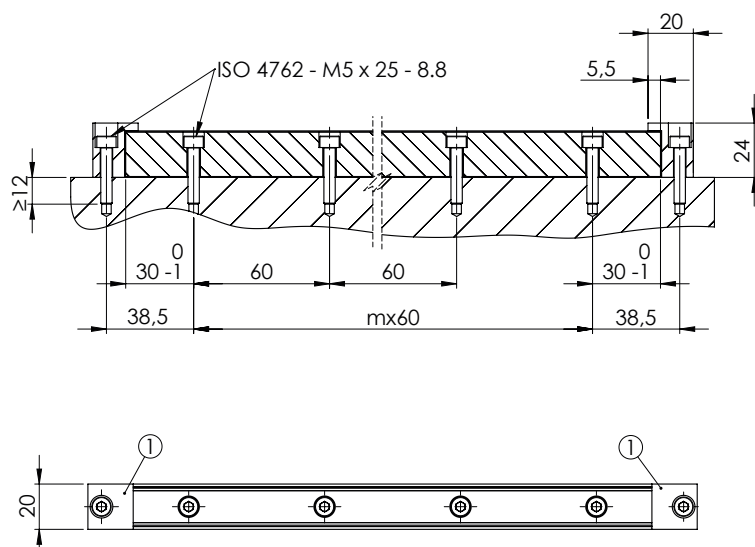
Fault exclusion LMFA 3010 - Measuring rail

The mounting of the measuring rail must be carried out according to the installation instructions. The screws and the end blocks, necessary to achieve the mechanical fault exclusion are not included in the scope of delivery.

Minimum screw length L is the sum of the length of engagement and the free clamped length.

LMFA 3010 - Measuring rail	
Machine base	
Coefficient of thermal expansion α	$(10 \text{ to } 16) \cdot 10^{-6} \text{ K}^{-1}$
Tensile strength R_m	$\geq 360 \text{ N/mm}^2$
Measuring rail assembly	
Screws	ISO 4762 - M5 x L - 8.8
Torque M_d	$5,0 \pm 0,10 \text{ Nm}$
Length of thread engagement	$\geq 10 \text{ mm}$
Free clamped length	$\geq 13,2 \text{ mm}$
Environmental conditions	
Operating temperature	-10°C to 85°C
Max. acceleration	$\pm 50 \text{ m/s}^2$ in direction of movement
Shock 6ms	$< 1000 \text{ m/s}^2$ (EN 60068-2-27)

Recommended assembly



① Accessory 1244592-04 End Clamp LMFA

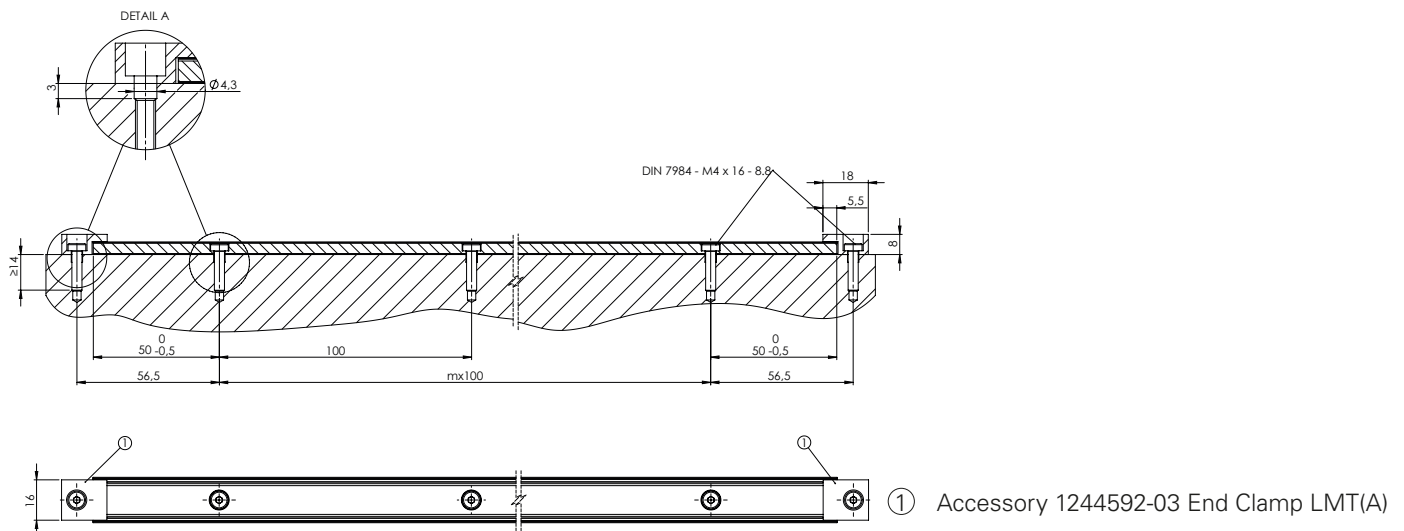
Fault exclusion LMTA 4010 - Scale tape in stainless steel carrier

The mounting of the stainless steel carrier must be carried out according to the installation instructions. The screws and the end blocks, necessary to achieve the mechanical fault exclusion are not included in the scope of delivery.

Minimum screw length L is the sum of the length of engagement and the free clamped length.

LMTA 4010 - Scale tape in stainless steel carrier	
Machine base	
Coefficient of thermal expansion α	$(10 \text{ to } 16) \cdot 10^{-6} \text{ K}^{-1}$
Tensile strength R_m	$\geq 360 \text{ N/mm}^2$
Carrier assembly	
Screws	DIN 7984 - M4x L - 8.8
Torque M_d	$2,0 \pm 0,05 \text{ Nm}$
Length of thread engagement	$\geq 8 \text{ mm}$
Free clamped length	$\geq 5 \text{ mm}$
Environmental conditions	
Operating temperature	-10°C to 100°C
Max. acceleration	$\pm 50 \text{ m/s}^2$ in direction of movement
Shock 6ms	$< 1000 \text{ m/s}^2$ (EN 60068-2-27)

Recommended assembly

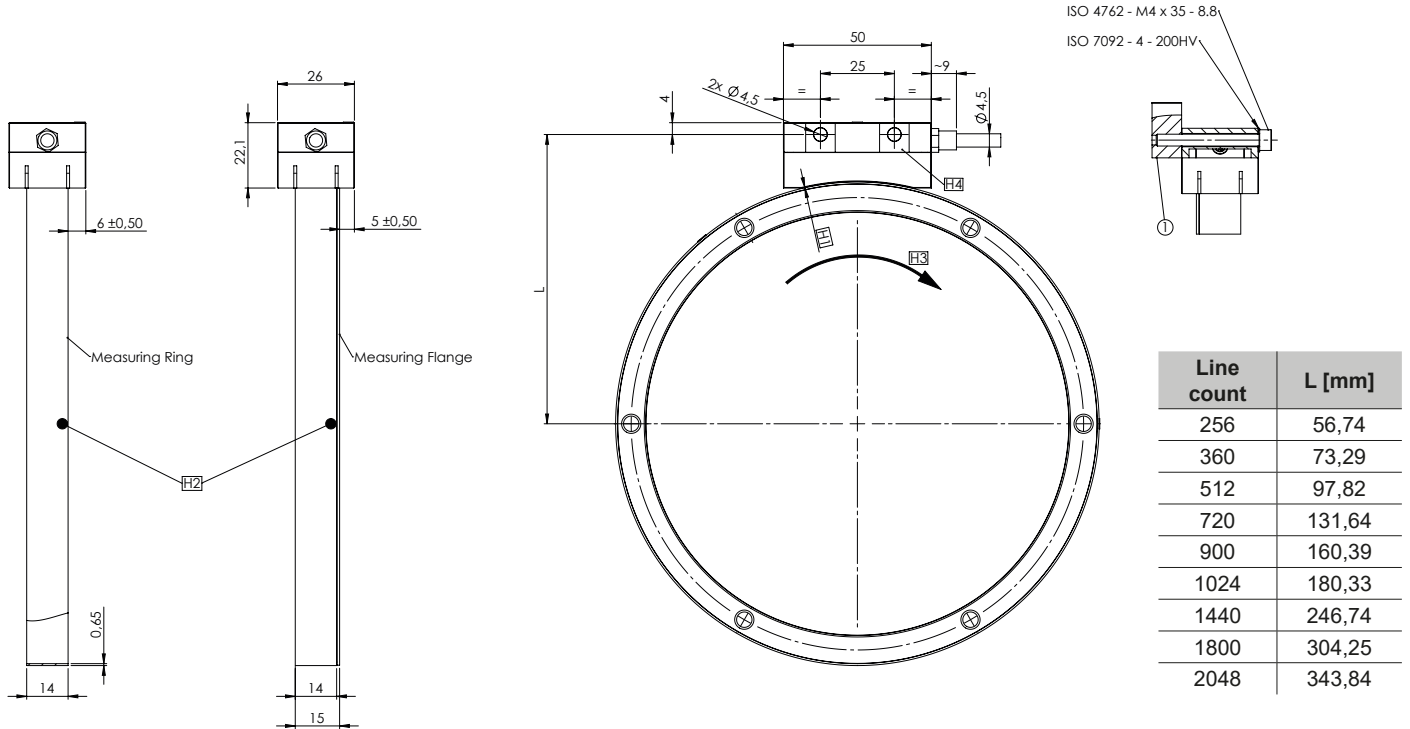


WMKA 2010/2210 series

Absolute angle encoder for safety-related applications

- Composed of scanning head WMKA 2010 and scale tape ring on flange or scale tape ring
- Safe absolute position value
- Fault exclusion for the loosening of the mechanical connection

Design 20 - Outside scanning

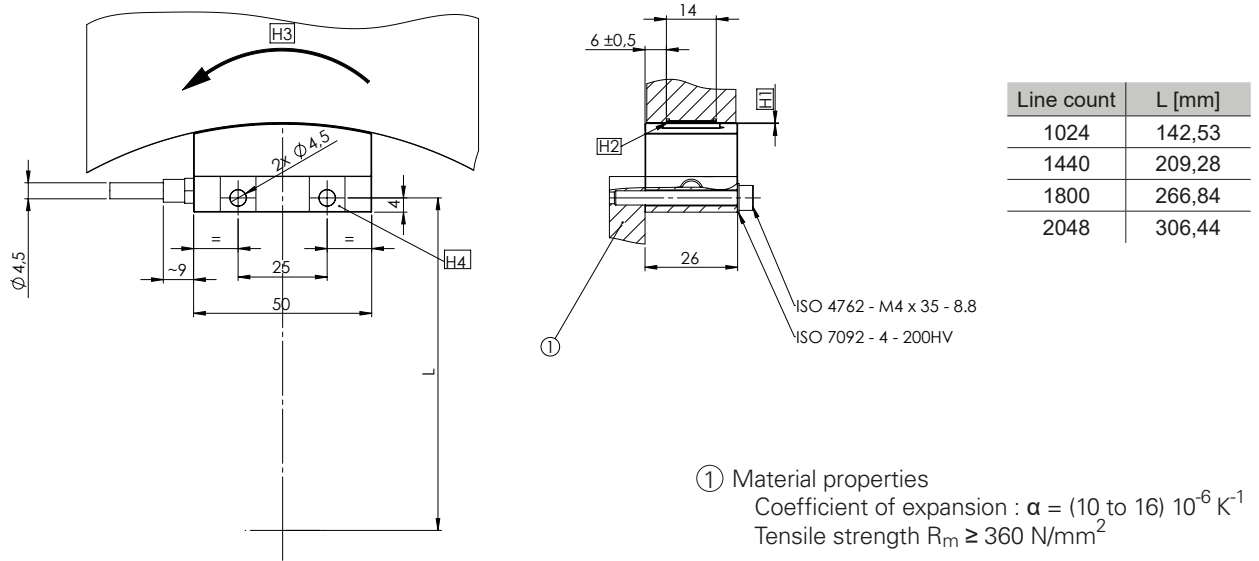


WMKA 2110/2310 series

Absolute angle encoder for safety-related applications

- Composed of scanning head WMKA 2110 and scale tape ring
- Safe absolute position value
- Fault exclusion for the loosening of the mechanical connection

Design 20 - Inside scanning



Tolerance principle in accordance with ISO8015
General tolerances in accordance with ISO 2768-fH
All dimensions in mm

① Material properties
Coefficient of expansion : $\alpha = (10 \text{ to } 16) \cdot 10^{-6} \text{ K}^{-1}$
Tensile strength $R_m \geq 360 \text{ N/mm}^2$

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

Technical data

Scanning head WMKA 2010/2210 / WMKA 2110/2310									
Line count ¹⁾	256 ²⁾	360 ²⁾	512 ²⁾	720 ²⁾	900 ²⁾	1024	1440	1800	2048
Position error per grating period ³⁾									
High accuracy	± 3,0 "	± 2,0 "	± 1,5 "	± 1,0 "	± 1,0 "	± 1,0 "	± 0,5 "	± 0,5 "	± 0,5 "
Interface	EnDat 2.2					DRIVE - CLiQ			
Designation	EnDat 2.2					DQ			
Clock frequency	≤ 16 MHz					100 - MBit/s			
Max. Position/Rotation	22 bit (4194304)		23 bit (8388608)			24 bit (16777216)		25 bit (33554432)	
Max. electrical speed [rpm]	≤ 4680	≤ 3330	≤ 2340	≤ 1660	≤ 1330	≤ 1170	≤ 830	≤ 660	≤ 580
Functional safety for applications up to	<ul style="list-style-type: none"> SIL 2 according to EN 61508 (further basic for testing: EN 61800 - 5 - 2) Category 3, PL d as per EN ISO 13849-1: 2015 								
PFH _D	≤ 36 · 10 ⁻⁹					≤ 38 · 10 ⁻⁹			
Safe position ⁴⁾	± 0,88°		± 0,44°			± 0,22°		± 0,11°	
Safety-related measuring step SM	0,352° (10 bit)		0,176° (11 bit)			0,088° (12 bit)		0,044° (13 bit)	
Electrical connection	Cable with M12 coupling, 8pin male								
Cable length on the encoder	0,5m to 6m					0,5m or 1,0m			
Voltage supply ⁵⁾	DC 3,6V to 14V					DC 10V to 36V			
Power consumption	≤ 1,5W at 5V					≤ 2,1W at 24V			
Typical current consumption	300mA at 5V					85mA at 24V			
Max. mechanical speed [rpm] ⁶⁾									
Measuring ring WMRA	46800	33300	23400	16600	13300	11700	8300	6600	5800
Measuring ring on flange WMFA	25000	20000	15000	10000	8000	6000	-	-	-
Shock 6ms	< 1000m/s ² (EN 60068-2-27)								
Vibration 55 to 2000 Hz	< 200m/s ² (EN 60068-2-6)								
Operating temperature	-10°C to 85°C					-10°C to 75°C			
Storage temperature	-20°C to 85°C								
Protection	IP67								
Mass approximate	40g (without cable)								

¹⁾ Other line counts on demand

²⁾ Not for inside scanning

³⁾ The position error per grating period and the accuracy of the grating (see technical data of the scale tape ring or scale tape ring on flange) results together in the encoder specific error; additional deviations caused by mounting and bearing are not considered in this error. Unfavourable operating conditions or operating out of the specified operating conditions can influence the specified values.

⁴⁾ Further tolerances may occur in subsequent electronic after position value comparison (contact manufacture of subsequent electronics).

⁵⁾ Only provide power from PELV systems (see EN 50178 for an explanation of the term) to position encoders.

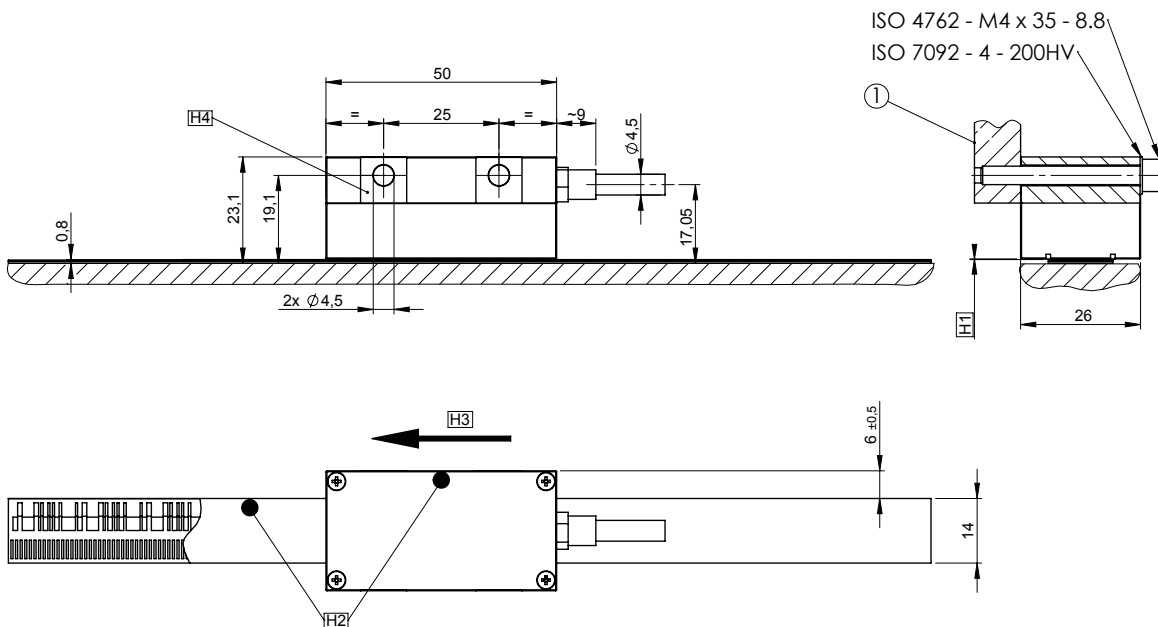
⁶⁾ Values must be taken into account to ensure a mechanical fault exclusion.

LMKA 2010 series

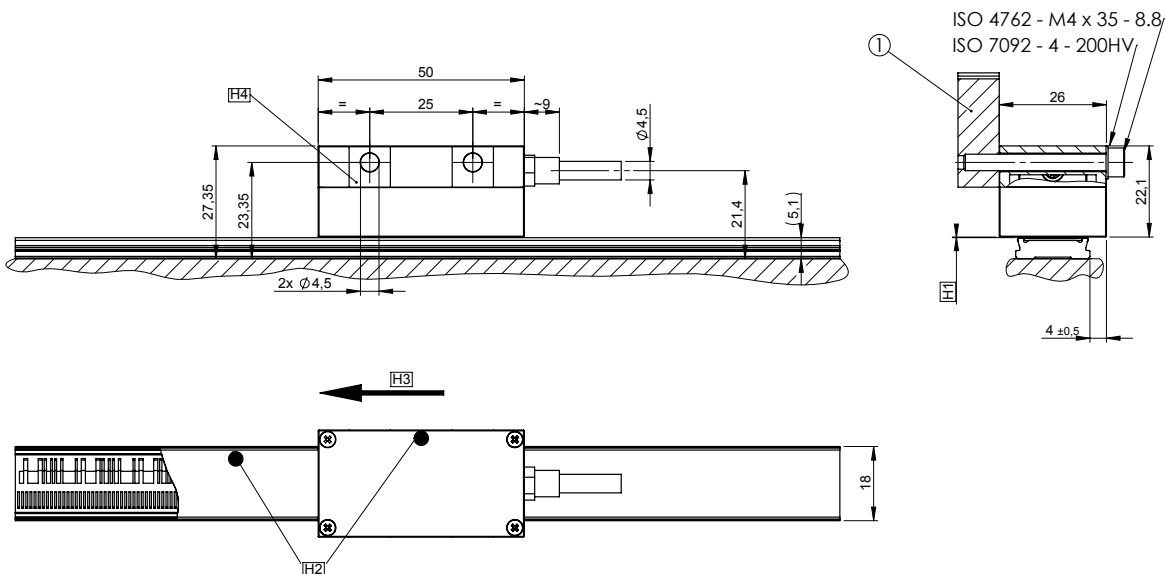
Absolute linear encoder series for safety-related applications

- Composed of scanning head LMKA 2010 and scale tape
- Safe absolute position value
- Fault exclusion for the loosening of the mechanical connection

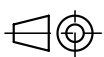
Design 20
with scale tape LMBA 2010 / 2110



Design 20
with scale tape LMTA 4010 / 4110



- ① Material properties
Coefficient of expansion : $\alpha = (10 \text{ to } 16) \cdot 10^{-6} \text{ K}^{-1}$
Tensile strength $R_m \geq 360 \text{ N/mm}^2$



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

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

Technical data

Scanning head		LMKA 2010 / LMKA 2110	
Position error per grating period ¹⁾			
High accuracy	± 0,5 µm		
Interface	EnDat 2.2	DRIVE - CLiQ	
Designation	EnDat 2.2	DQ	
Clock frequency	≤ 16 MHz	100 - MBit/s	
Measuring step			
High accuracy	0,1 µm		
Functional safety for applications up to	<ul style="list-style-type: none"> • SIL 2 according to EN 61508 (further basic for testing: EN 61800 - 5 - 2) • Category 3, PL d according to EN ISO 13849-1: 2015 		
PFH _D	≤ 36 · 10 ⁻⁹	≤ 38 · 10 ⁻⁹	
Safe position ²⁾	± 625 µm		
Safety-related measuring step SM	250 µm		
Electrical connection	Cable with M12 coupling, 8pin male		
Cable length on scanning head	0,5m to 6m	0,5m or 1,0m	
Voltage supply ³⁾	DC 3,6V to 14V	DC 10V to 36V	
Power consumption	≤ 1,5W at 5V	≤ 2,1W at 24V	
Typical current consumption	300mA at 5V	85mA at 24V	
Maximum speed	≤ 20 m/s		
Shock 6ms	< 1000m/s ² (EN 60068-2-27)		
Vibration 55 to 2000 Hz	< 200m/s ² (EN 60068-2-6)		
Operating temperature	-10°C to 85°C	-10°C to 75°C	
Storage temperature	-20°C to 85°C		
Protection	IP67		
Mass approximate	40g (without cable)		

¹⁾ The position error per grating and the accuracy of the grating result together in the encoder specific error; additional deviations caused by mounting are not considered in this error. Special operating conditions that do not correspond to normal operation or operation outside the specified range have an influence on the given values.

²⁾ Further tolerances may occur in subsequent electronic after position value comparison (contact manufacture of subsequent electronics).

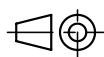
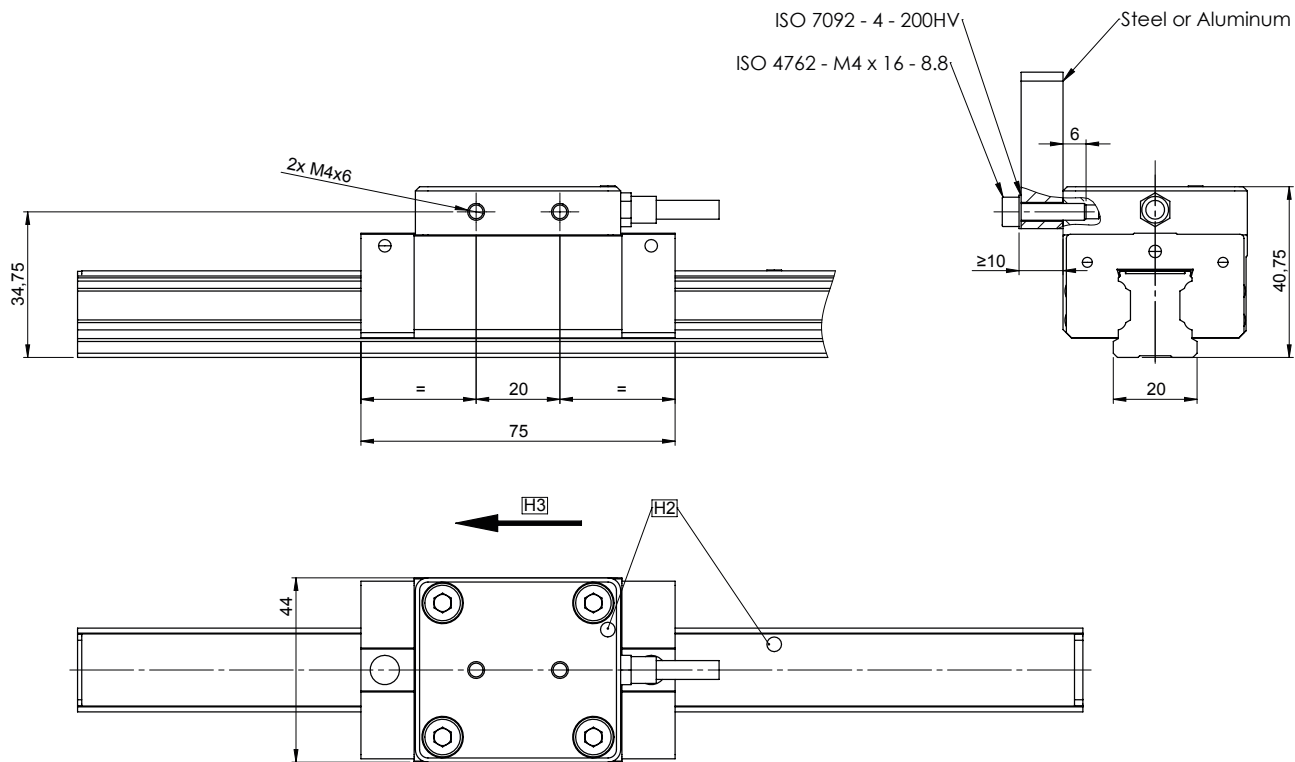
³⁾ Only provide power from PELV systems (see EN 50178 for an explanation of the term) to position encoders.

LMKA 3010 series

Absolute linear encoder for safety-related applications

- Composed of scanning head LMKA 3010 and measuring rail
- Safe absolute position value
- Fault exclusion for the loosening of the mechanical connection

Design 30
with measuring rail LMFA 3010/3110



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 3010 / LMKA 3110	
Position error per grating period ¹⁾			
High accuracy	± 0,5 µm		
Interface	EnDat 2.2	DRIVE - CLiQ	
Designation	EnDat 2.2	DQ	
Clock frequency	≤ 16 MHz	100 - MBit/s	
Measuring step			
High accuracy	0,1 µm		
Functional safety for applications up to	<ul style="list-style-type: none"> • SIL 2 according to EN 61508 (further basic for testing: EN 61800 - 5 - 2) • Categorie 3, PL d as per EN ISO 13849-1: 2015 		
PFH _D	≤ 36 · 10 ⁻⁹	≤ 38 · 10 ⁻⁹	
Safe position ²⁾	± 625 µm		
Security-related measuring step SM	250 µm		
Electrical Connection	Cable with M12 coupling, 8pin male		
Cable lenght on the encoder	0,5m to 6m	0,5m or 1,0m	
Voltage supply ³⁾	DC 3,6V to 14V	DC 10V to 36V	
Power consumption	≤ 1,5W at 5V	≤ 2,1W at 24V	
Typical current consumption	300mA at 5V	85mA at 24V	
Maximum speed	≤ 5 m/s (limited by the mechanics)		
Shock 6ms	< 1000m/s ² (EN 60068-2-27)		
Vibration 55 to 2000 Hz	< 200m/s ² (EN 60068-2-6)		
Operating temperature	-10°C to 85°C	-10°C to 75°C	
Storage temperature	-20°C to 85°C		
Protection	IP67		
Mass approximate	210g (without cable)		

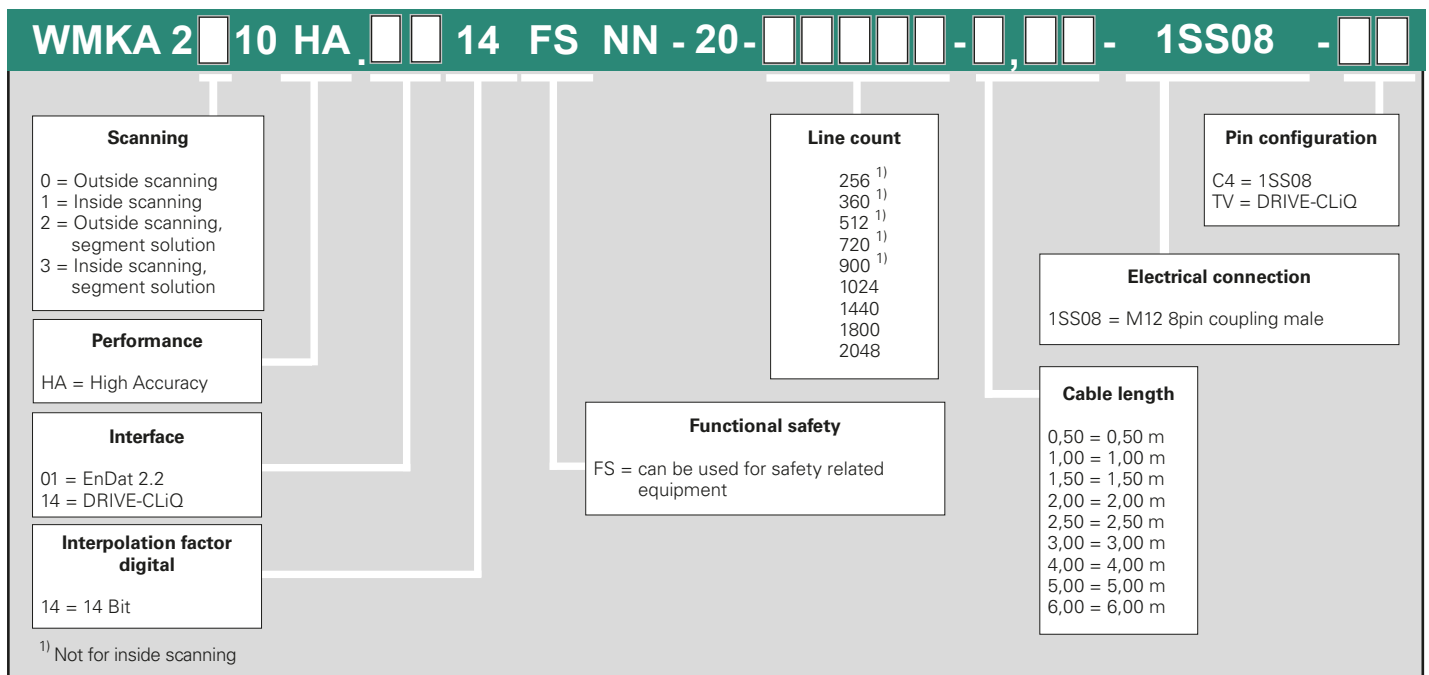
¹⁾The position error per grating and the accuracy of the grating result together in the encoder specific error; additional deviations caused by mounting are not considered in this error. Special operating conditions that do not correspond to normal operation or operation outside the specified range have an influence on the given values.

²⁾ Further tolerances may occur in subsequent electronic after position value comparison (contact manufacture of subsequent electronics).

³⁾ Only provide power from PELV systems (see EN 50178 for an explanation of the term) to position encoders.

Ordering code

- WMKA - Scanning head for absolute angle encoder
- Grating period 1000µm
- Suitable for safety-related applications



Type label, exemplary

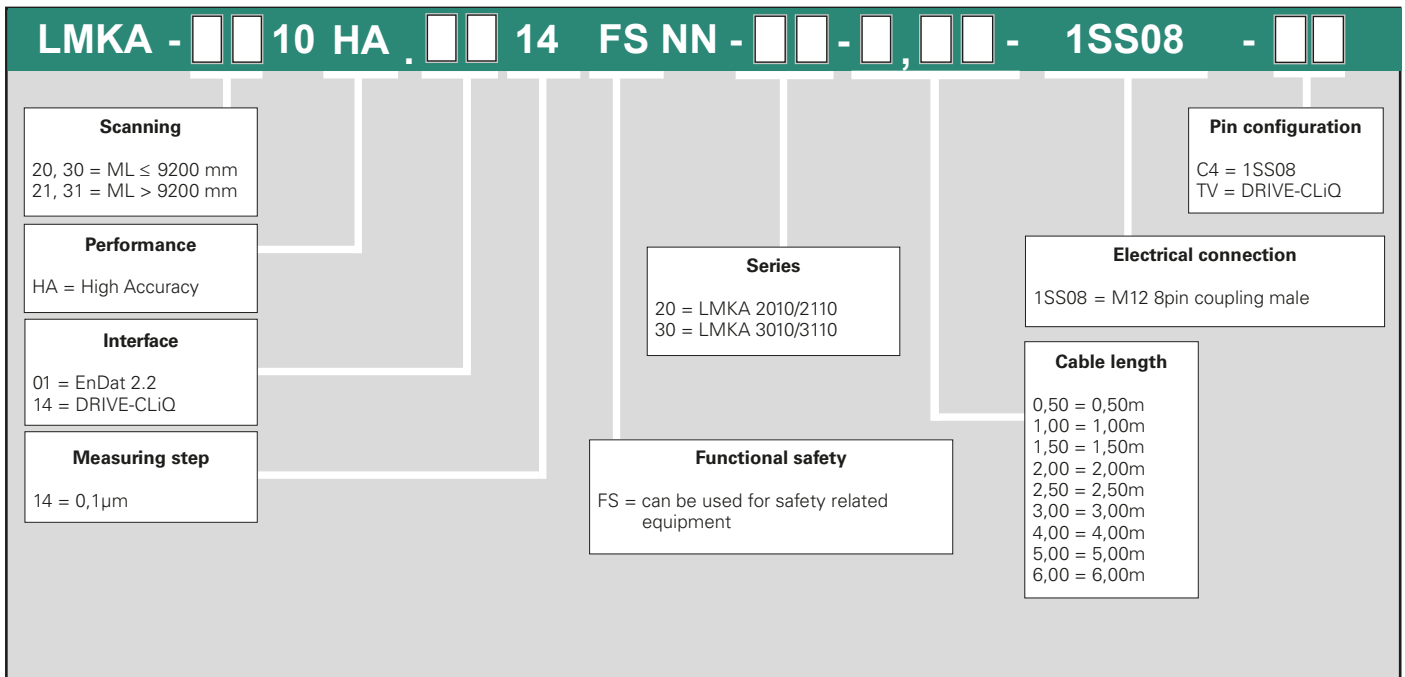


WMKA 2x10

ID	Beschreibung
1211927 - xx	WMKA 2010/2210 - EnDat 2.2, outside scanning, Functional safety
1211929 - xx	WMKA 2110/2310 - EnDat 2.2, inside scanning, Functional safety
1211932 - xx	WMKA 2010/2210 - DRIVE-CLiQ, outside scanning, Functional safety
1211933 - xx	WMKA 2110/2310 - DRIVE-CLiQ, inside scanning, Functional safety

Ordering code

- LMKA - Scanning head for absolute linear encoders
- Grating period 1000µm
- Suitable for safety-related applications



Type label, exemplary



LMKA 2x10 / 3x10

ID	Beschreibung
1211910 - xx	LMKA 2010 - EnDat 2.2, ML ≤ 9200 mm, Functional safety
1211911 - xx	LMKA 2110 - EnDat 2.2, ML > 9200 mm, Functional safety
1211914 - xx	LMKA 2010 - DRIVE-CLiQ, ML ≤ 9200 mm, Functional safety
1211915 - xx	LMKA 2110 - DRIVE-CLiQ, ML > 9200 mm, Functional safety

ID	Beschreibung
1211918 - xx	LMKA 3010 - EnDat 2.2, ML ≤ 9200 mm, Functional safety
1211919 - xx	LMKA 3110 - EnDat 2.2, ML > 9200 mm, Functional safety
1211922 - xx	LMKA 3010 - DRIVE-CLiQ, ML ≤ 9200 mm, Functional safety
1211923 - xx	LMKA 3110 - DRIVE-CLiQ, ML > 9200 mm, Functional safety

Interfaces

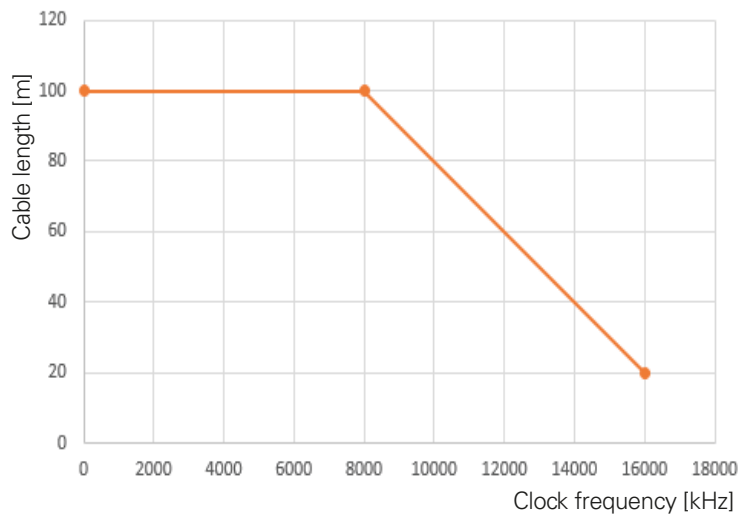
Position values

The EnDat-Interface is a digital, bi-directional Interface for measuring systems. With this interface you can read out position values and in the measuring system saved informations. This value can also be updated or new values can be saved. Due to the serial data transfer four signal wires are enough. The data DATA gets transferred synchronously to the form the subsequent electronics given clock frequency CLOCK. The selection from the mode of transmission (position values, parameter, diagnostics,...) is done with mode-commands which are sent from the subsequent electronics to the measuring system.

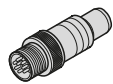




The clock frequency is variable - depending on the cable length (max. 100m). With propagation electronics, either clock frequencies up to 16MHz are possible or cable length up to 100m. For EnDat encoders the maximum clock frequency is stored in the encoder memory. Propagation-delay compensation is provided for EnDat22.

Transmission frequencies up to 16MHz in combination with large cable length place high technological demands in the cable. Greater cable lengths can be realized with an adapter cable no longer than 6m and an extension cable. As a rule, the entire transmission path must be designed for the respective clock frequency.

Ordering code	Commands	Incremental singlas
EnDat22	EnDat 2.2	Without



Pin configuration

Electrical connection: 1SS08 8-pin coupling M12								
  								
	Power supply				Absolute position values			
	8	2	5	1	3	4	7	6
	U_P	Sensor U_P	0V	Sensor 0V	DATA+	DATA-	CLOCK+	CLOCK-
	brown/green	blue	white/green	white	grey	pink	violet	yellow

Cabel shield is connected with the housing; **U_P** = Power supply voltage
Sensor: The sensor wire is connected internally with the corresponding power supply.
 Non-used pins or wires must not be assigned!

Interfaces

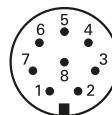
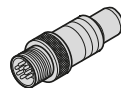
Pin configuration DRIVE - CLiQ


AMO encoders with interface type "14" according to the order designation are suitable for connection to Siemens controllers with DRIVE-CLiQ interface.

- Designation DQ

Pin configuration

Electrical connection: 1SS08
8-pin coupling M12



	Power supply		Absolute position values			
			Send data		Receive data	
	1	5	7	6	3	4
	U_P	0V	TXP	TXN	RXP	RXN

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

DRIVE-CLiQ is a registered trademark of Siemens AG.

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