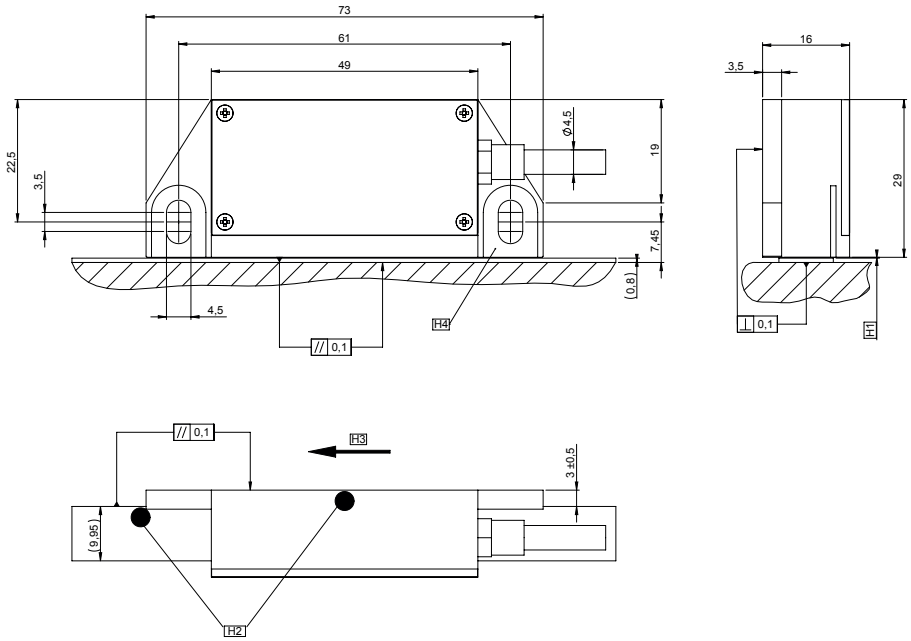
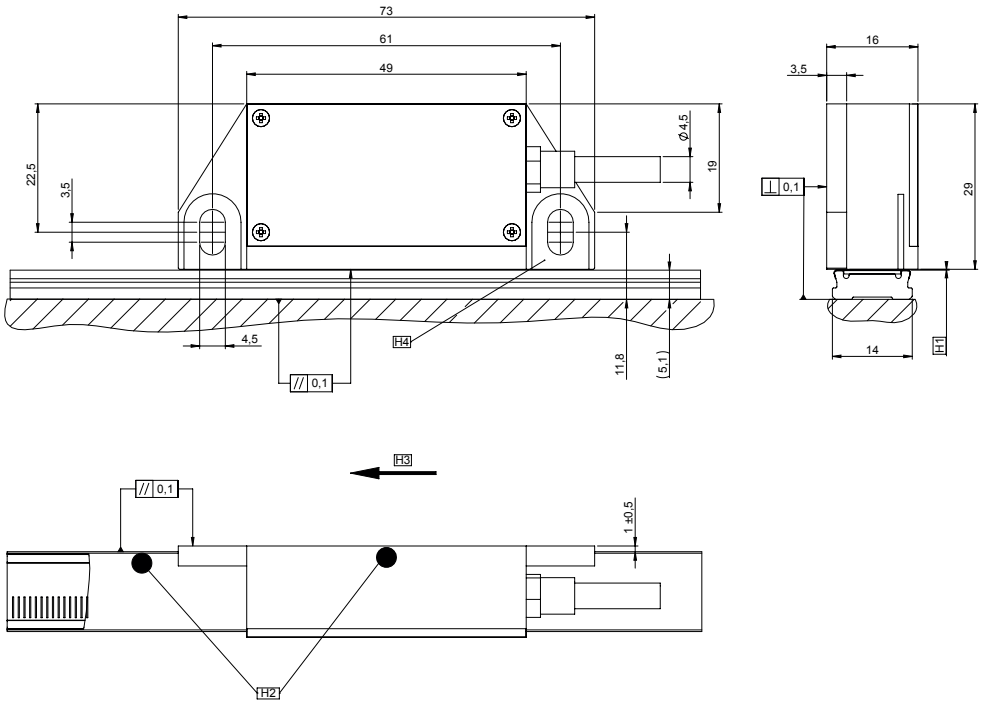
Scanning head - LMK 2010 series

- **Incremental, modular linear encoders**
- **Grating period 1000µm**
- **Scanning head with integrated electronics**
- **In combination with scale type LMB 1010 and LMT 4010**

Design 20
with scale type LMB 1010



Design 20
with scale type LMT 4010



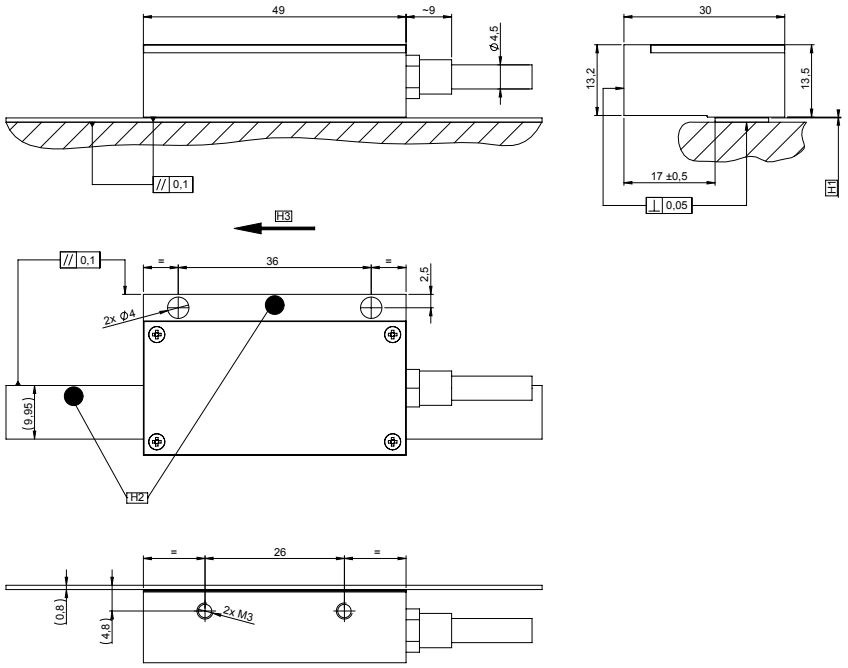
Tolerance principle in accordance withSO8015
General tolerances in accordance with ISO 2768-fH
All dimensions in mm

H1 = Air gap 0,15 ± 0,10mm, set with spacer foil
H2 = Reference track marking
H3 = Direction of scanning head movement for positive counting
H4 = Ground plane

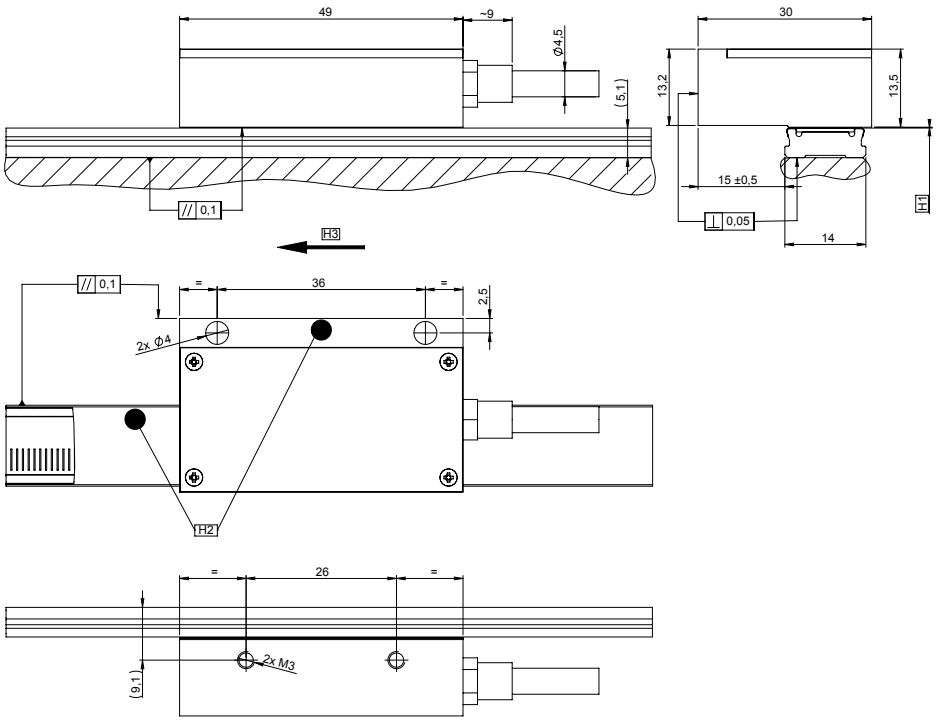
Scanning head - LMK 2010 series

- **Incremental, modular linear encoders**
- **Grating period 1000µm**
- **Scanning head with integrated electronics**
- **In combination with scale type LMB 1010 and LMT 4010**

Design 21
with scale type LMB 1010



Design 21
with scale type LMT 4010



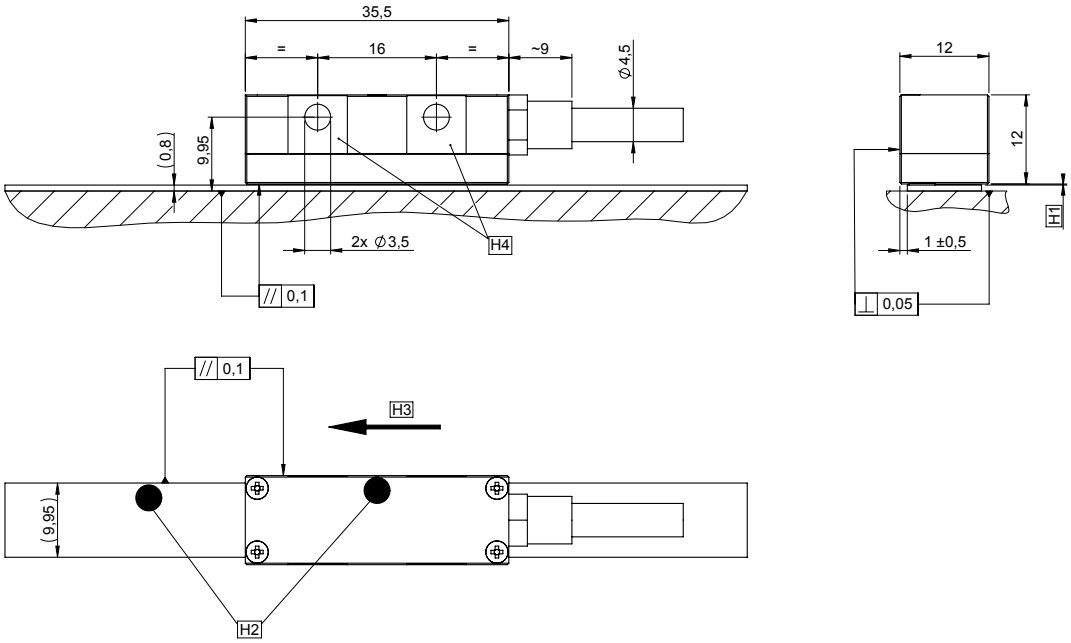
Tolerance principle in accordance withSO8015
General tolerances in accordance with ISO 2768-fH
All dimensions in mm

H1 = Air gap 0,15 ± 0,10mm, set with spacer foil
H2 = Reference track marking
H3 = Direction of scanning head movement for positive counting

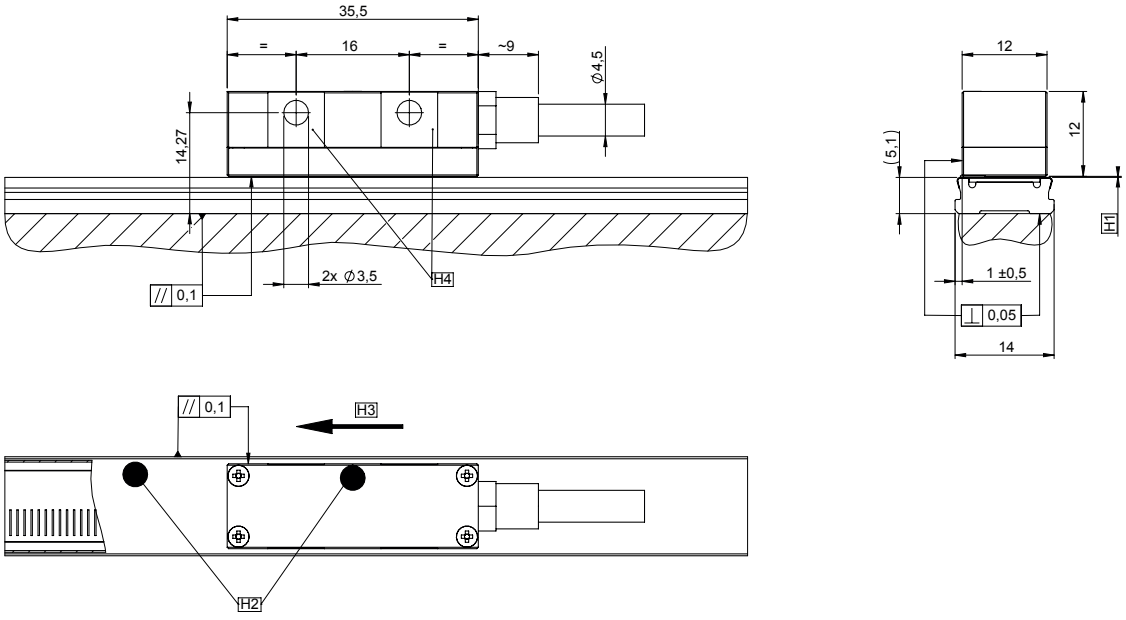
Scanning head - LMK 1010 series

- **Incremental, modular linear encoders**
- **Grating period 1000µm**
- **Miniature scanning head with external electronics**
- **In combination with scale type LMB 1010 and LMT 4010**

Design 10 and 12
with scale type LMB 1010



Design 10 and 12
with scale type LMT 4010



Tolerance principle in accordance withSO8015
General tolerances in accordance with ISO 2768-fH
All dimensions in mm

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

Technical data

- LMK - Scanning head for modular linear encoders
- Grating period 1000µm

Scanning head 1000µm	**LMK 2010/LMK 1010**			
Performance	Standard		High Accuracy	
Interface	1Vpp	TTL	1Vpp	TTL
Position error per grating period [1]	± 2µm		± 0,5µm	
Maximum speed	20m/s			
TTL - Interpolation/ 1Vpp signal period				
Signal period [2] Interpolation	- -	250µm to 1µm 1 to 250	- -	0,5µm or 0,1µm 500 or 2500
Signal period Dividing factor	1000µm or 40µm 1 or 25	- -	20µm 50	- -
Max. output frequency	400KHz	5MHz	400KHz	5MHz
Electrical connection	Cable with M23 coupling 12pin male			
Cable length on the encoder	0,50m - 6,00m			
Power supply	1Vpp: DC 4,0V to 7,0V TTL: DC 5,0V +/- 0,5V			
Power consumption	Design 20, 21: ≤ 1300mW at 5V Design 10, 12: ≤ 1500mW at 5V			
Typ. current consumption	Design 20,21: ≤ 220mA at 5V (without load) Design 10,12: ≤ 240mA at 5V (without load)			
Vibration 55 to 2000 Hz	< 200m/s² (EN 60068-2-6)			
Shock 6 ms	< 2000m/s² (EN 60068-2-27)			
Operating temperature	-10°C to 100°C			
Storage temperature	-20°C to 100°C			
Protection	IP67			
Mass	38g Design 20, 21 / 10g Design 10,12			

[1] The position error per grating period and the accuracy of the grating results toghether in the encoder specific error; additional deviations caused by mounting and bearing are not considered in this error.

[2] After 4-edge-evaluation.

Ordering code

- LMK - Scanning head for modular linear encoders
- Grating period 1000µm

LMK □□ 10 □□ . □□ □□ □□ □□ - □□ - □,□□ - □□□□□□ - □□

Scanning

10 = Encoder, miniature
20 = Encoder, with integrated electronics

Performance

S = Standard
HA = High Accuracy

Interface

07 = TTL
08 = 1Vpp

Reference mark

RV = Rectangle pulse linked (90° el.) for TTL
RI = Rectangle pulse linked (360° el.) for 1Vpp

Functional safety

.. = No
FA = Analog signal (1Vpp) can be used for safety related equipment [2]

Pin configuration

UJ = 01, 02S12, 03S12, 27S12
J5 = 16S15

Cable length

0,50 = 0,50m
1,00 = 1,00m
1,50 = 1,50m
2,00 = 2,00m
2,50 = 2,50m
3,00 = 3,00m
4,00 = 4,00m
5,00 = 5,00m
6,00 = 6,00m

Electrical connection

01 = Free cable end
02S12 = M23-12 pin connector male
03S12 = M23-12 pin coupling male
16S15 = D-SUB-15 pin 2-row male
27S12 [1] = Flange socked M23 12 pin male

Design of the scanning head

10 = Miniaturized, connector with electronics on cable, M23
12 = Miniaturized, pluggable connector with electronics on cable via M12 connector

20 = Standard
21 = Standard, flat

Incremental/Multiplication

		1Vpp		TTL	
		S	HA	S	HA
01	1-fold	×		×	
05	5-fold			×	
10	10-fold			×	
25	25-fold	×		×	
50	50-fold		×	×	
A3	250-fold			×	
A4	500-fold				×
A9	2500-fold				×

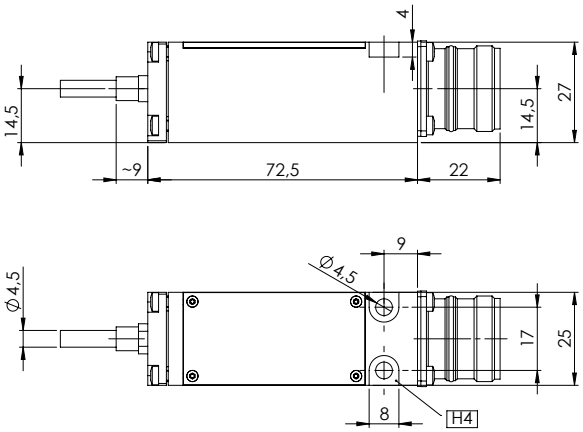
[1] Electrical connection for miniaturized design of the scanning head 10 and 12.
[2] Option „FA“ only used for dividing factor „01“.

External electronics

- **General information**
- **Dimensions**

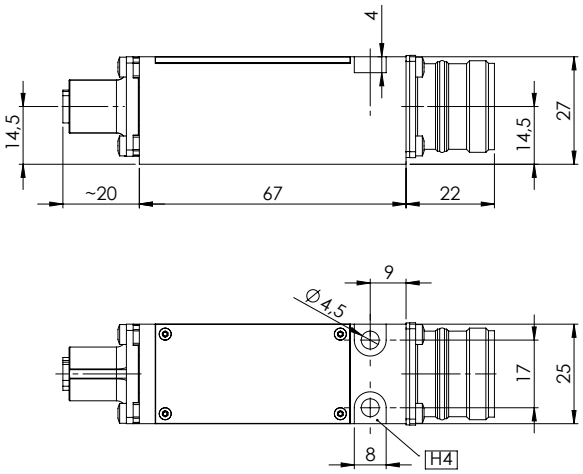
Design 10

- Miniaturized scanning head
- with external electronics on the cable
- Output: Flange socket M23



Design 12

- Miniaturized scanning head
- with external electronics, pluggable on cable via M12 connector
- Output:Flange socket M23



Tolerance principle in accordance withSO8015
General tolerances in accordance with ISO 2768-fH
All dimensions in mm

H4= Ground plane

Encoder Cable

Technical Data

	Cable for incremental encoders and SSI+1Vpp	Cable for encoders with pure serial interfaces
Jacket	PUR, high flexible, suitable for energy chains	
Diameter	4,5 +/-0,1mm	
Wires	6x2x0,09mm²	1x(4*0,09mm²) + 4x0,14mm²
Bending radius	≥ 10mm for single bending	
	≥ 50mm for continuous bending	
Max. length	6m	
Resistance according to	UL according to Style 20963 80°C 30V	

Interfaces

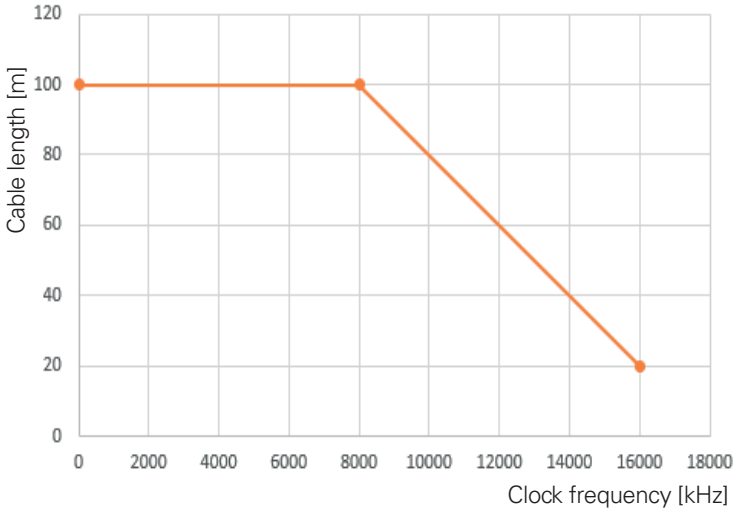
Position values EnDat

The EnDat-Interface is a digital, **bi-directional** Interface for measuring systems. With this interface you can reat 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 dada transfer four signal wires** are enought. The data DATA gets transferred **synchroniously** 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.

Order code	Instruction set	Incremental signals
EnDat2.2	EnDat 2.2	Without

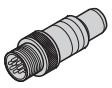
The clock frequency is variable - depending on the cable lenght (max. 100m). With propagation electronics, either clock frequencies up to 16MHz are possible or cable lenght up to 100m. For EnDat encoders the maximum clock frequency is sored in the encoder memory. Propagation-delay compensation is provided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

Transmission frequencies up to 16MHz in combination with large cable lenght place hight technological demands in the cable. Greater cable lenghts 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.



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	**0 V**	**Sensor** 0 V	**DATA+**	**DATA-**	**CLOCK+**	**CLOCK-**
	brown/green	blue	white/green	white	grey	pink	violet	yellow

Cable 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!

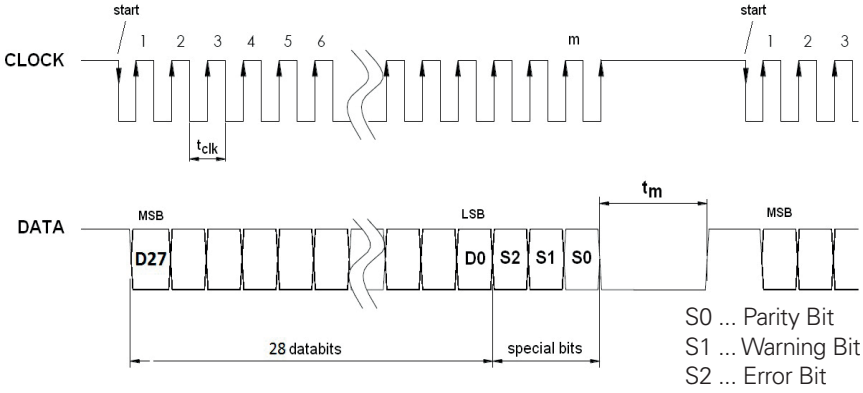
Interfaces

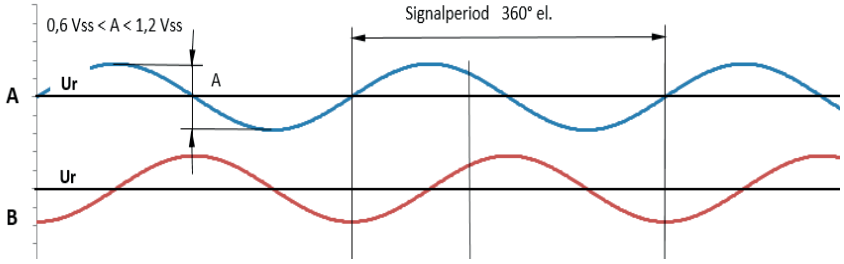
SSI + ∿1V$_{pp}$

SSI Interface is an unidirectional Interface which can output position values.
The Data DATA gets transferred synchroniously to the from the subsequent electronic given Clock freuqency CLOCK.
Additionaly three special bits (Error, Warning and Parity) will be transferred

AMO-Encoders with ∿ 1 V$_{pp}$-Interface are outputting signals which can be highly interpolated.

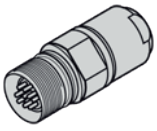
The sine shaped **incremental signals** A and B are electrically 90° phase shifted and have a signal - B after A - is valid for the in the connection drawing stated movement direction.

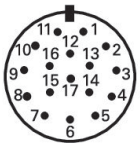




Pin configuration

Electrical connection: 03S17
17-pin coupling M23





	Power supply				Increment signals				Absolut position value			
	7	**1**	**10**	**4**	**15**	**16**	**12**	**13**	**14**	**17**	**8**	**9**
	U$_P$	**Sensor** U$_P$	**0 V**	**Sensor** 0 V	**A+**	**A–**	**B+**	**B–**	**DATA+**	**DATA-**	**CLOCK+**	**CLOCK-**
	brown/green	blue	white/green	white	brown	green	grey	pink	red	black	violet	yellow

Cable Shield is connected with the housing; **U$_P$** = Power supply voltage
Sensor: The sensor wire is connected internally with the correspondending power supply.
Non-used pins or wires must not be assigned!

Interfaces

Pin layouts Fanuc, Mitsubishi BiSS/C®

Fanuc

AMO-Encoders with Fanuc Interface are
for connection to a Fanuc-Control.

Fanuc Serial Interface - α interface
Order code: Fanuc02
normal and hight speed,
two-pair transmission.

BiSS/C

AMO-Encoders with BiSS/C® Interface are
suitable for the connection with controls, which have
the BiSS/C Interface implemented.

BiSS/C bidirektionales Protokoll
Order code: BiSS
The Standard Encoder Profile - 32bit will be used.

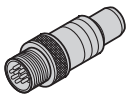
Mitsubishi

AMO-Encoders with Mitsubishi Interface are suitable for connection to a Mitsubishi-Control.

Mitsubishi high speed interface
Order code: MitA1-4 (full duplex) –> two pair transmission
Order code: MitA1-2 (half duplex) –> one pair transmission

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	**0 V**	**Sensor** 0 V	**DATA+**	**DATA-**	**CLOCK+**	**CLOCK-**
	brown/green	blue	white/green	white	grey	pink	violet	yellow

Cable 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!

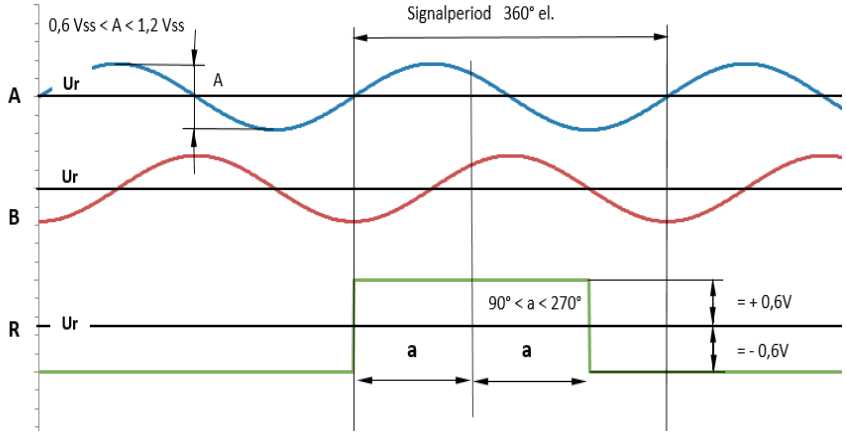
Interface

Incremental signals ∿ 1V_{pp}

AMO-Encoders with ∿ 1 V_{PP}-Interface are outputing signals which can be highly interpolated.

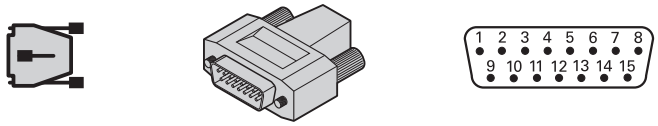
The sine shaped incremental signals A and B are electrically 90° phase shifted and have a signal strenght from 1Vpp. The showed sequence of the outputet signals - B after A - is valid for the in the connection drawing stated movement direction.

The reference mark signal R has a clear assignment to the incremental signals.

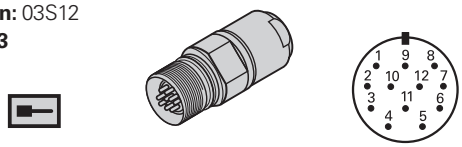


Pin configuration

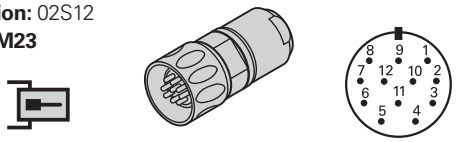
Electrical connection: 16S15
15-pin Sub-D-connector



Electrical connection: 03S12
12-pin coupling M23



Electrical connection: 02S12
12-pin connector M23



	Power supply				Incremental signals						Other signals		
	4	**12**	**2**	**10**	**1**	**9**	**3**	**11**	**14**	**7**	**5/15**	**8**	**6**
	12	**2**	**10**	**11**	**5**	**6**	**8**	**1**	**3**	**4**	**/**	**7**	**9**
	U_P	**Sensor** U_P	**0 V**	**Sensor** 0 V	**A+**	**A–**	**B+**	**B–**	**R+**	**R–**	**Frei**	**Diag+**	**Diag-**
	brown/ green	blue	white/ green	white	brown	green	grey	pink	red	black	/	violet	yellow

Cable 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!
DIAG-wires must not be assigned.
DIAG-signals are for checking the encoder with AMO-STU-60.

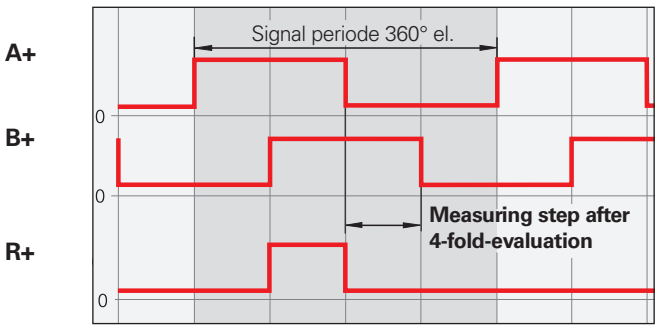
Interfaces

Incremental signals ⊓⊔TTL

AMO-Encoders with ⊓⊔TTL Interface contain electronic, which form the since-form signals - with or without- Interpolation into digital signals.

The **incremental signals** are outputed as rectangle pulses A+ and B + with 90° el. phase shifting. The **rectandle-mark-signal** is composed from one or more reference impulses R+, which are assigned with the incremental signals. The integrated electronic additionally creates the **inverse signals** A-, B- and R- for a safe transmission.
The showed sequence of the outputed signals - B after A - is valid for the in the connection drawing stated movement direction.

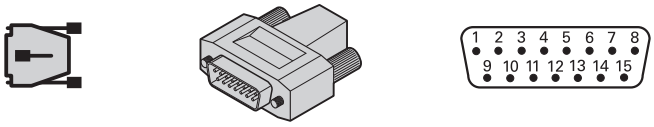
The **measuring step** results throught the distance between two flanks frim the incremental signals A+ and B+ throught 1-fold, 2-fold or 4-fold evaluation.



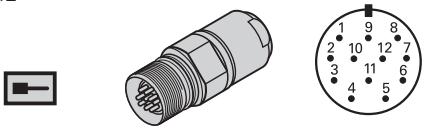
The inverse signals A-, B- und R- are not shown.

Pin configuration

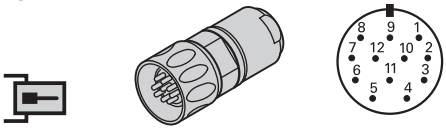
Electrical connection: 16S15
15-pin Sub-D-connector



Electrical connection: 03S12
12-pin coupling M23



Electrical connection: 02S12
12-pin connector M23



	Power supply				Incremetal signals						Other signals		
	4	**12**	**2**	**10**	**1**	**9**	**3**	**11**	**14**	**7**	**5/15**	**8**	**6**
	12	**2**	**10**	**11**	**5**	**6**	**8**	**1**	**3**	**4**	**/**	**7**	**9**
	U_P	**Sensor** U_P	**0 V**	**Sensor** 0 V	**A+**	**A–**	**B+**	**B–**	**R+**	**R–**	**Frei**	**Diag+**	**Diag-**
	brown/ green	blue	white/ green	white	brown	green	grey	pink	red	black	/	violet	yellow

Cable 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!
DIAG-wires must not me assigned!
DIAG-signals are for checking the encoder with AMO-STU-60