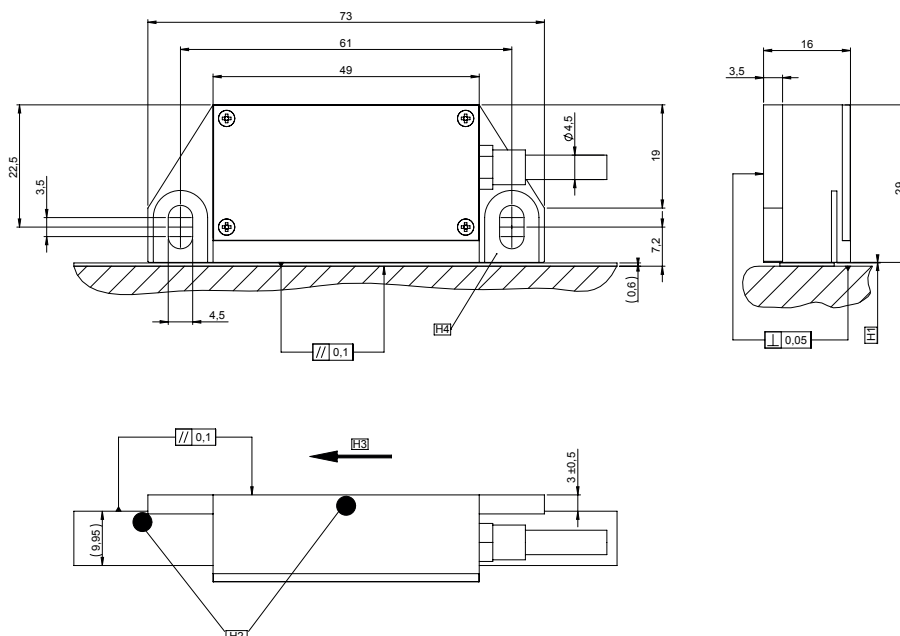


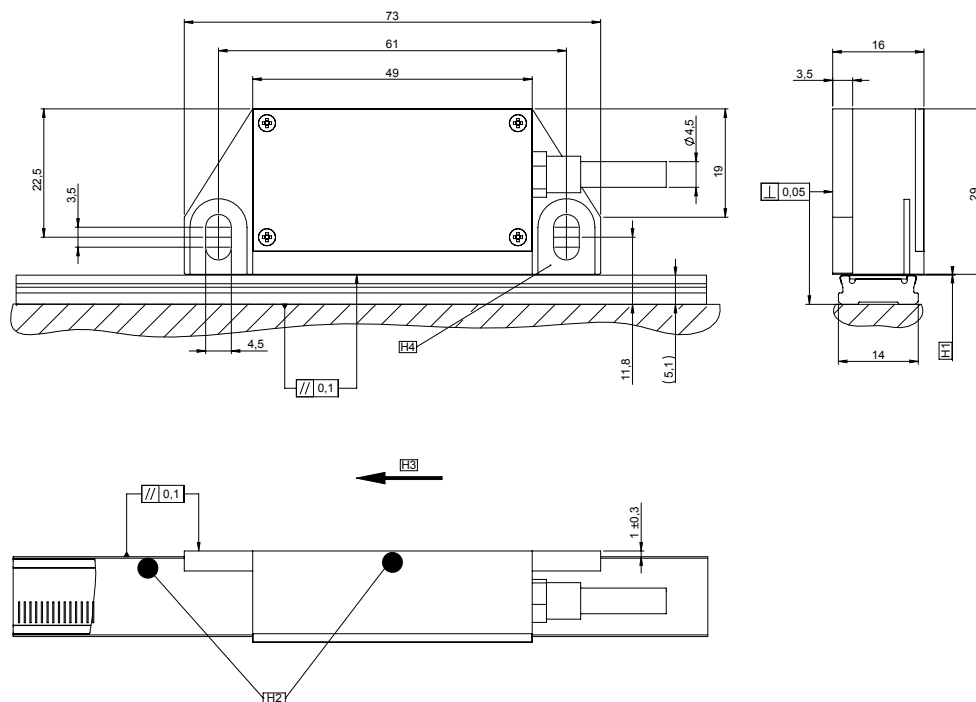
# Scanning head - LMK 2005 series

- Incremental, modular linear encoders
- Grating period 500µm
- Encoder with integrated electronics
- In combination with scale type LMB 1005 and LMT 4005

**Design 20**  
with scale type LMB 1005



**Design 20**  
with scale type LMT 4005



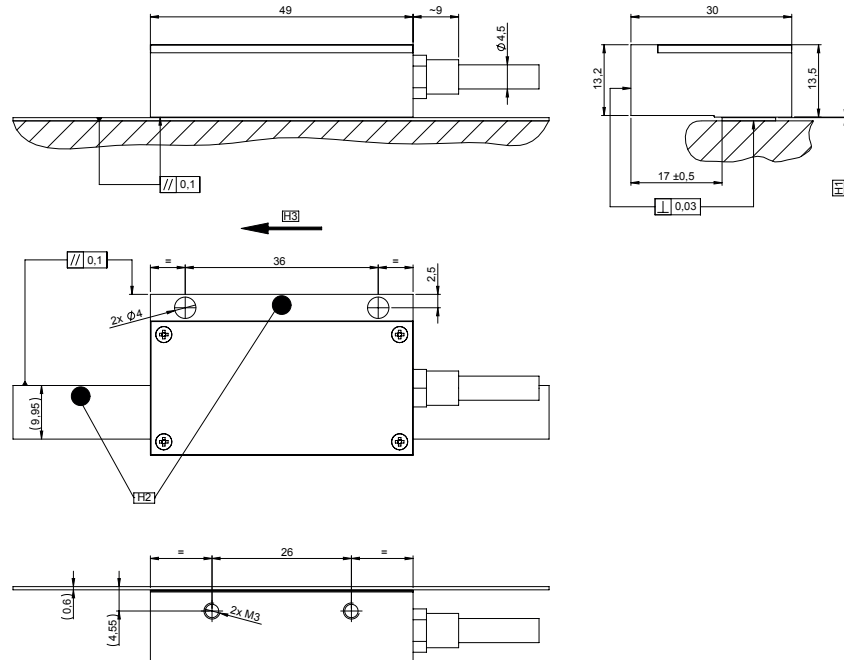
Tolerance principle in accordance with SO8015  
General tolerances in accordance with ISO 2768-fH  
All dimensions in mm

H1 = Air gap  $0,10 \pm 0,05$ mm, set with spacer foil  
H2 = Reference track marking  
H3 = Direction of scanning head movement for positive counting  
H4 = Ground plane

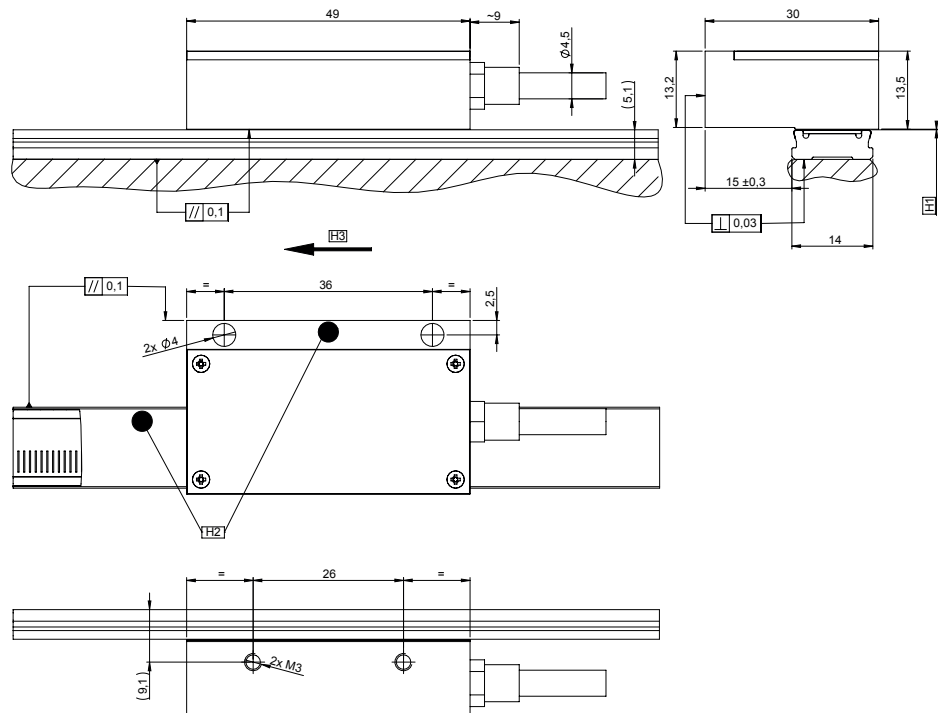
# Scanning head - LMK 2005 series

- Incremental, modular linear encoders
- Grating period 500µm
- Encoder with integrated electronics
- In combination with scale type LMB 1005 and LMT 4005

## Design 21 with scale type LMB 1005



## Design 21 with scale type LMT 4005



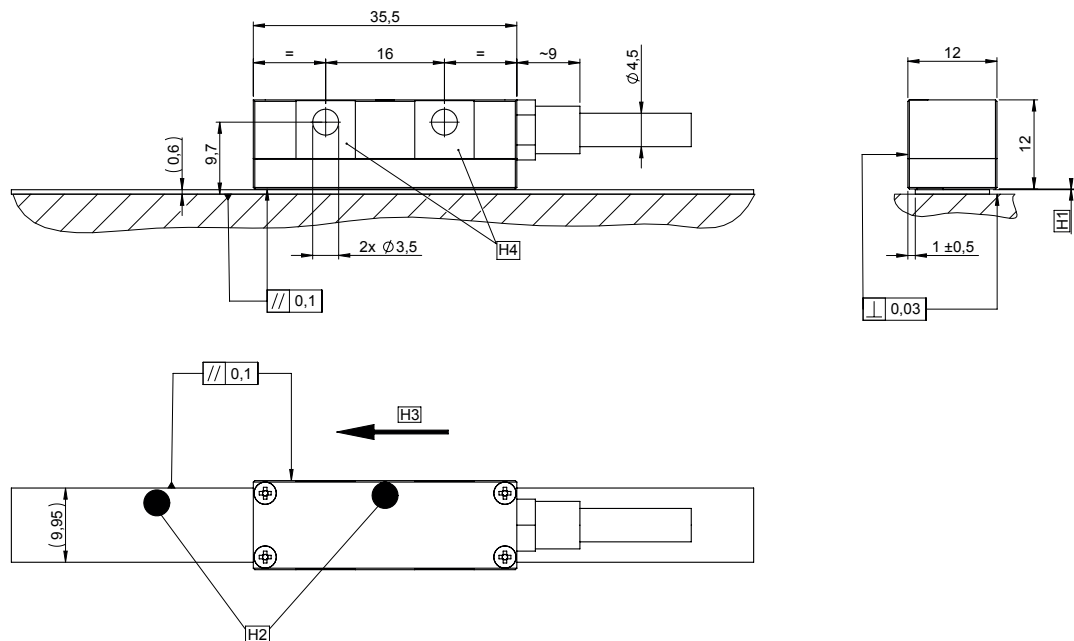
Tolerance principle in accordance with SO8015  
General tolerances in accordance with ISO 2768-FH  
All dimensions in mm

H1 = Air gap  $0,10 \pm 0,05$  mm, set with spacer foil  
H2 = Reference track marking  
H3 = Direction of scanning head movement for positive counting

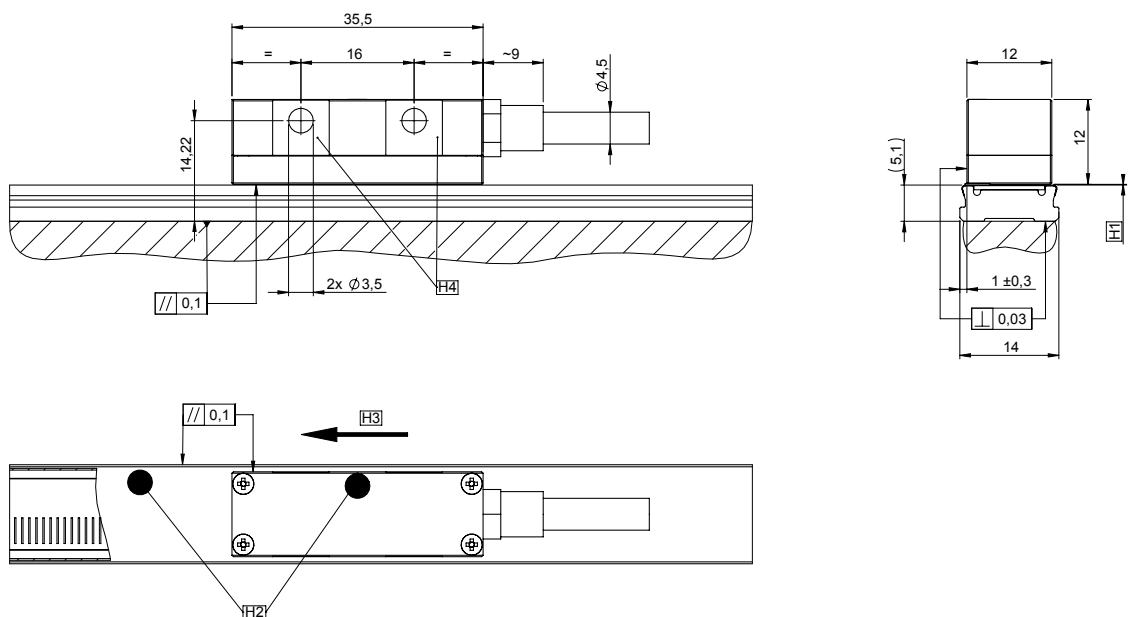
# Scanning head - LMK 1005 series

- Incremental, modular linear encoders
- Grating period 500µm
- Miniature scanning head with external electronics
- In combination with scale type LMB 1005 and LMT 4005

## Design 10 and 12 with scale type LMB 1005



## Design 10 and 12 with scale type LMT 4005



Tolerance principle in accordance with SO8015  
General tolerances in accordance with ISO 2768-fH  
All dimensions in mm

H1 = Air gap  $0,10 \pm 0,05$  mm, set with spacer foil  
H2 = Reference track marking  
H3 = Direction of scanning head movement for positive counting  
H4 = Ground plane

## Technical data

- LMK - Scanning head for modular linear encoders
- Grating period 500µm

Scanning head 500µm	LMK 2005/LMK 1005			
Performance	Standard		High Accuracy	
Interface	1Vpp	TTL	1Vpp	TTL
Position error per grating period <sup>1)</sup>	± 1,5µm		± 0,3µm	
Maximum speed	10m/s			
TTL - Interpolation/1Vpp signal period				
Signal period <sup>2)</sup> Interpolation	- -	125µm to 0,5µm 1 to 250	- -	0,25µm or 0,05µm 500 or 2500
Signal period Dividing factor	500µm or 20µm 1 or 25	- -	10µm 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			

<sup>1)</sup> The position error per grating period and the accuracy of the grating results together in the encoder specific error; additional deviations caused by mounting and bearing are not considered in this error.

<sup>2)</sup> After 4-edge-evaluation.

- LMK - Scanning head for modular linear encoders
- Grating period 500µm

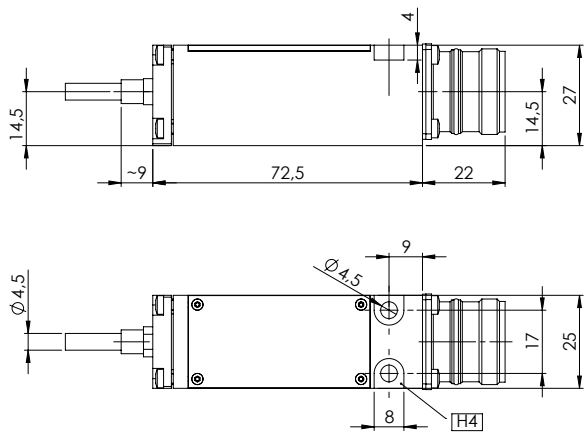
39

# External electronics

- General information
- Dimensions

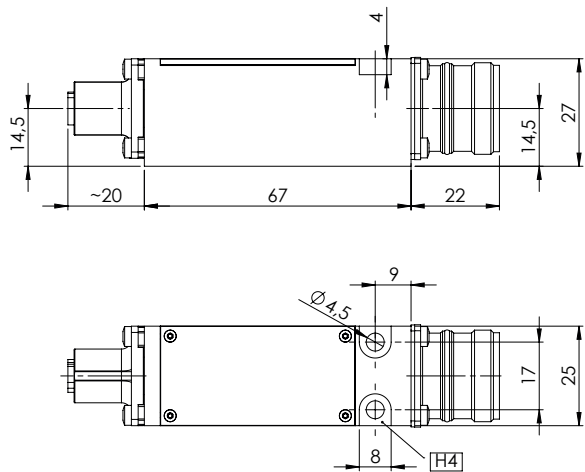
## Design 10


- 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 with SO8015  
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	6x2x0,09mm <sup>2</sup>	1x(4*0,09mm <sup>2</sup> ) + 4x0,14mm <sup>2</sup>
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

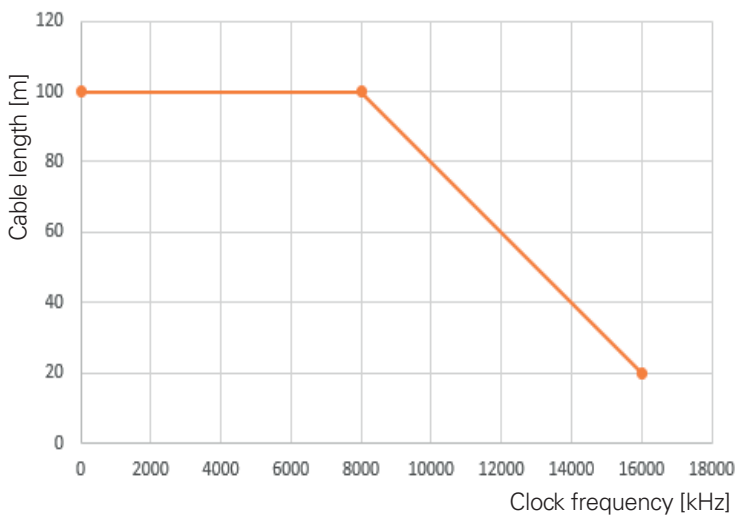
## Position values

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.



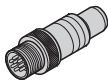


The clock frequency is variable - depending on the cable length (max. 100m). With propagation electronics, either clock frequencies up to 16MHz are possible or cable length up to 100m. For EnDat encoders the maximum clock frequency is stored in the encoder memory. Propagation-delay compensation is provided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

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



### Pin configuration

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

**Cable Shield** is connected with the housing; **U<sub>P</sub>** = Power supply voltage  
**Sensor:** The sensor wire is connected internally with the corresponding power supply.  
Non-used pins or wires must not be assigned!

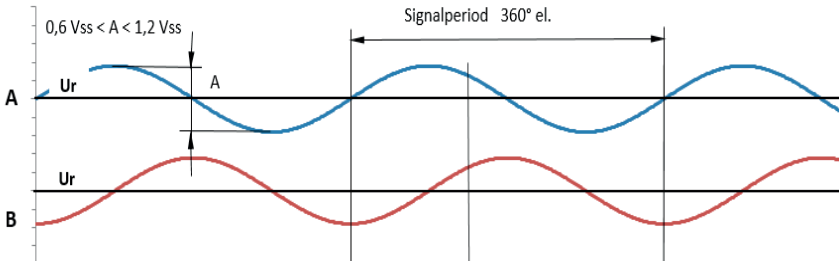
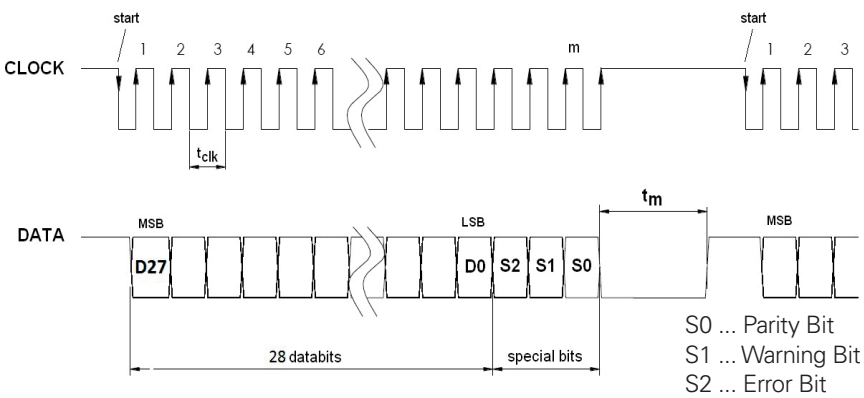
# Interfaces

SSI +  $\sim 1V_{pp}$

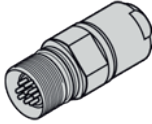




SSI Interface is an unidirectional Interface which can output position values.  
The Data DATA gets transferred synchronously to the from the subsequent electronic given Clock frequency CLOCK.  
Additionally three special bits (Error, Warning and Parity) will be transferred

AMO-Encoders with  $\sim 1 V_{pp}$ -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

<b>Electrical connection:</b> 03S17 <b>17-pin coupling M23</b>   												
	Power supply				Increment signals				Absolut position value			
	7	1	10	4	15	16	12	13	14	17	8	9
	<b>U<sub>P</sub></b>	<b>Sensor U<sub>P</sub></b>	<b>0 V</b>	<b>Sensor 0 V</b>	<b>A+</b>	<b>A-</b>	<b>B+</b>	<b>B-</b>	<b>DATA+</b>	<b>DATA-</b>	<b>CLOCK+</b>	<b>CLOCK-</b>
	brown/green	blue	white/green	white	brown	green	grey	pink	red	black	violet	yellow

**Cable Shield** is connected with the housing; **U<sub>P</sub>** = 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 layouts Fanuc, Mitsubishi BiSS/C<sup>®</sup>

### Fanuc

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

#### Fanuc Serial Interface - $\alpha$ interface

Order code: Fanuc02  
normal and high speed,  
two-pair transmission.

### BiSS/C

AMO-Encoders with BiSS/C<sup>®</sup> 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.



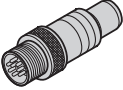


### Mitsubishi

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

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

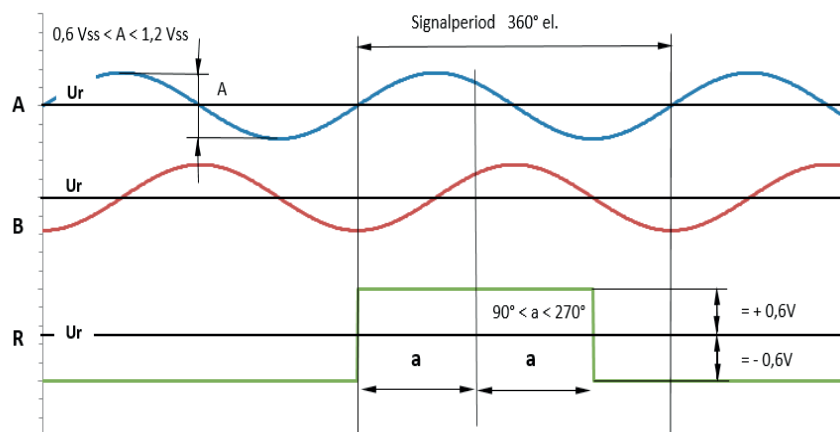
**Cable Shield** is connected with the housing; **U<sub>P</sub>** = Power supply voltage  
**Sensor:** The sensor wire is connected internally with the corresponding power supply.  
Non-used pins or wires must not be assigned!

Incremental signals  $\sim 1V_{pp}$

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

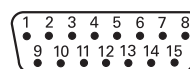
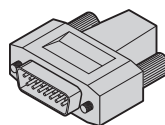
The sine shaped incremental signals A and B are electrically 90° phase shifted and have a signal strength from 1Vpp. The shown sequence of the output signals - B after A - is valid for the in the connection drawing stated movement direction.

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

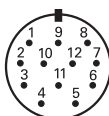
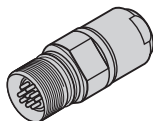


## Pin configuration

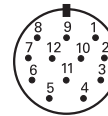
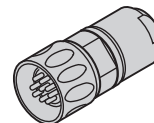
**Electrical connection:** 16S15  
15-pin Sub-D-connector








**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 <sub>P</sub> 	Sensor U <sub>P</sub>	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<sub>p</sub>** = 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.

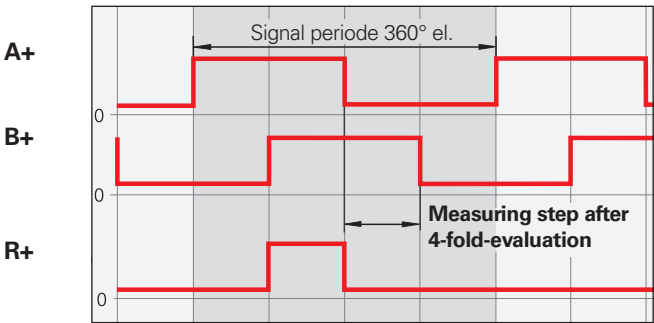
# Interfaces

## Incremental signals TTL

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

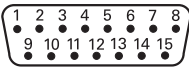
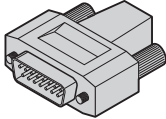


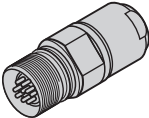

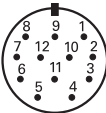
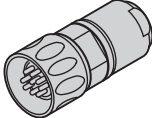




The **incremental signals** are outputed as rectangle pulses A+ and B + with 90° el. phase shifting. The **rectandle-mark-signal** is composed from one or more reference impulses R+, which are assigned with the incremental signals. The integrated electro-nic additionally creates the **inverse signals**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

The **measuring step** results throught the distance between two flanks frim the in-cremental 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

<b>Electrical connection: 16S15</b> <b>15-pin Sub-D-conconnector</b> <div></div>													
<b>Electrical connection: 03S12</b> <b>12-pin coupling M23</b> <div></div>					<b>Electrical connection: 02S12</b> <b>12-pin connector M23</b> <div></div>								
	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
	Up	Sensor Up	0V	Sensor 0V	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; **Up** = 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