

# Inclinometers

<b>Inclinometer MEMS / capacitive</b>	<b>IN88, 1- and 2-dimensional</b>	<b>Modbus</b>
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The inclinometers of the IN88 series allow measuring 2-dimensional inclinations in the range of  $\pm 85^\circ$  or 1-dimensional inclinations up to  $360^\circ$ .

With their high robustness, their protection level up to max. IP69k and their wide temperature range from  $-40^\circ\text{C}$  to  $+85^\circ\text{C}$ , these devices are ideally suitable for outdoor use – e.g. for mobile automation or solar applications.



High protection level



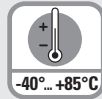
Shock / vibration resistant



Reverse polarity protection



Redundancy



Temperature range

## Robust

- High protection rating IP67 and IP69k in one device.
- Highest robustness thanks to metal housing.
- Stable accuracy over the whole temperature range from  $-40^\circ\text{C}$  up to  $+85^\circ\text{C}$ .
- Non long-term drift thanks to sensor array technique.

## Versatile

- Parameterizable filter.
- Measuring direction 1- or 2-dimensional.
- With 1 x M12 connector or 2 x M12-connector.
- Stacked installation possible for redundancy.

## Order code

8.IN88	.XX61	.12X
Type	a b c	d e

**a** Measuring direction  
1 = 1-dimensional  
2 = 2-dimensional

**b** Measuring range  
6 =  $\pm 85^\circ$  <sup>1)</sup>  
7 =  $0^\circ \dots 360^\circ$  <sup>2)</sup>

**c** Interface  
6 = Modbus RTU

**d** Supply voltage  
2 = 10 ... 30 V DC

**e** Type of connection  
1 = 1 x M12 connector, 5-pin  
3 = 2 x M12 connector, 5-pin

## Cables and connectors

Order no.

### Preassembled cables

M12 female connector with coupling nut for Bus in, 5-pin, A coded, straight single ended  
5 m [16.40'] PVC cable

**05.00.6091.A211.005M**

M12 male connector with external thread for Bus out, 5-polig, A coded, straight single ended  
5 m [16.40'] PVC cable

**05.00.6091.A411.005M**

### Connectors

M12 female conn. with coupling nut for Bus in, 5-pin, A coded, straight (metal/plastic)

**05.B-8151-0/9**

M12 male conn. with external thread for Bus out, 5-pin, A coded, straight (metal/plastic)

**05.BS-8151-0/9**

Further Kübler accessories can be found at: [kuebler.com/accessories](http://kuebler.com/accessories)

Further Kübler cables and connectors can be found at: [kuebler.com/connection-technology](http://kuebler.com/connection-technology)

1) Can only be ordered in conjunction with measuring direction 2-dimensional.

2) Can only be ordered in conjunction with measuring direction 1-dimensional.

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## Technical data

General electrical characteristics		
Supply voltage		10 ... 30 V DC
Current consumption (no load)		max. 70 mA
Reverse polarity protection of the supply voltage		yes
Measuring axes		1 or 2
Measuring range	1-dimensional 2-dimensional	360°, no limit stop ±85° (see order code)
Resolution		0.01°
Accuracy at 25 °C <sup>1)</sup>	1-dimensional 2-dimensional	typ. ±0.2° typ. ±0.4°
Repeat accuracy		±0.2°
Transverse sensitivity <sup>2)</sup>		typ. ±0.3°
Temperature coefficient		typ. ±0.006°/K
Sampling rate		50 Hz (20 ms)
Limit frequency	with Butterworth filter factory setting	0.1 ... 10 Hz, 8th order 10 Hz

Interface characteristics Modbus	
Interface	Modbus V1.02
Protocol	Modbus RTU V1.1b3
Baud rate	4800 ... 115200 kbit/s software configurable
Node address	1 ... 63 software configurable
Termination	software configurable

Approvals	
UL compliant in accordance with <sup>3)</sup>	File no. E224618
CE compliant in accordance with	
EMC Directive	2014/30/EU
RoHS Directive	2011/65/EU
UKCA compliant in accordance with	
EMC Regulations	S.I. 2016/1091
RoHS Regulations	S.I. 2012/3032

EMC		
Relevant standards	EN 61326-1	Electrical equipment for measurement, control and laboratory use
	EN 61000-6-2	Immunity for industrial environments
	EN 55011 Klasse B, EN 61000-6-3	Emitted interferences for residential environments
	EN ISO 14982	Agricultural and forestry machinery, electromagnetic compatibility, test methods and acceptance criteria
	EN 13309	Construction machinery - Electromagnetic compatibility of machines with internal supply voltage

Mechanical characteristics		
Connection	1 x M12 connector 2 x M12 connector	5-pin, male connector 5-pin, male connector / 5-pin, female connector
Weight		approx. 185 g [6.53 oz]
Protection acc. to EN 60529		IP67 / IP69k <sup>3)</sup>
Working temperature range		-40 °C ... +85 °C [-40 °F ... +185 °F]
Material	housing	aluminum
Shock resistance acc. to EN 60068-2-27		1000 m/s <sup>2</sup> , 6 ms
Vibration resistance acc. to EN 60068-2-6		100 m/s <sup>2</sup> , 10 ... 2000 Hz
Dimensions		80 x 60 x 23 mm [3.15 x 2.36 x 0.91"]

1) Over the whole temperature and max. measuring range  
1-dimensional ≤ ±0.4°; 2-dimensional ≤ ±1°.

2) Only for 2-dimensional measuring direction.

3) The IP protection class is not UL-tested. Verified by Kübler.

A full description of the technical data can be found in the relevant product manual at [www.kuebler.com](http://www.kuebler.com).

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## Modbus communication profile V 1.02

Node number, baudrate and bus termination programmable.

## Modbus application protocol V1.1b3

Read Holding Register – Function code 03 <sup>1)</sup>				
Reg.	Data name	ATT	Value	Default
00001	LOTWINKEL X-ACHSE	I16	Inclination angle in 0.01 °	-85.00 ... +85.00
00002	LOTWINKEL Y-ACHSE	I16	Rotation angle in 0.01 °	-85.00 ... +85.00
00003	EULERWINKEL X-ACHSE	I16	Euler angle (1 axis)	0 ... 180.99°
00004	EULERWINKEL Y-ACHSE	U16	Euler angle (1 axis)	0 ... 359.99°
00007	VERSORGUNG VCC	U16	VCC in 0.1 VDC	240
00008	TEMPERATURE IN 0.1°C	U16	Temp. in 0.1°	210
00016	SIDEVIEW	U16	Back = 0, Front = 1	0
00023	SYSTEM STATE	U16	No errors = 0	0
00140	BAUDRATE	U16	Current baudrate	19200 Baud (2)
00144	NODE-ID	U16	Current node address	63
00145	TERMINIERUNG	U16	Termination on/off	2 (on)
00146	FILTER AKTIVIERUNG	U16	Filter on/off	1 (on)
00147	FILTER EINSTELLUNG	F32	Filter value in HZ	5.0
00148	SERIENNUMMER	U32	Serial number	16DDNNNNN
00149	PRODUCT CODE	U32	Device type	x88616100
00150	AUFLÖSUNG	U16	Resolution X/Y axis	0.01° (10)
00151	OPERATING PARAMETER	U16	Setting X axis	0
00152	PRESET X-ACHSE	U16	Preset X axis	0
00153	OFFSET X-ACHSE	U16	Offset X axis	0
00154	DIFF.OFFSET X-ACHSE	U16	Differential offset	0
00155	Operating Parameter	U16	Setting Y axis	0
00156	PRESET Y-ACHSE	U16	Preset Y axis	0
00157	OFFSET Y-ACHSE	U16	Offset Y axis	0
00158	DIFF.OFFSET Y-ACHSE	U16	Differential offset	0
00159	OFFSET EULERWINKEL	U16	Offset Euler axis Y	0

Write Holding Register – Function code 16 (0x10)					
Reg.	Value	R/W	Format	Content	Default
300	VAR	W	U16	Baudrate	19200 Baud (2)
301	VAR	W	U16	Parity	1 = none 2 = even 3 = odd
302	VAR	W	U16	Stoppbit	1 = 1 Stoppbit 3 = 2 Stoppbits
304	VAR	W	U16	Node Number	0x3F (63d)
305	VAR	W	U16	Termination	2 = ON 1 = Off
306	VAR	W	U16	Digital Filter Active	0 = Off 1 = ON
307	VAR	W	F32	Digital Filter Coefficient	5.0
310	VAR	W	U16	Resolution of axis	10
311	VAR	W	U16	Slope long16 operating parameter	0
312	VAR	W	I16	Slope long16 preset value	0
313	VAR	W	I16	Slope long16 offset	0
314	VAR	W	I16	Differential Slope long16 offset	0
315	VAR	W	U16	Slope lateral16 operating parameter	0
316	VAR	W	I16	Slope lateral16 preset value	0
317	VAR	W	I16	Slope lateral16 offset	0
318	VAR	W	I16	Differential Slope lateral16 offset	0
320	VAR	W	U16	Preset Euleraxis (only 0)	0
261	VAR	W	U16	Delaytime for Transmission	1
360	VAR	W	U16	Save All Application Parameters	0x1010
361	VAR	W	U16	Load All Parameters (Factory default)	0x10101

1) Reads the binary contents of holding registers (4XXXX references) in the encoder slave.  
Broadcast is not supported.

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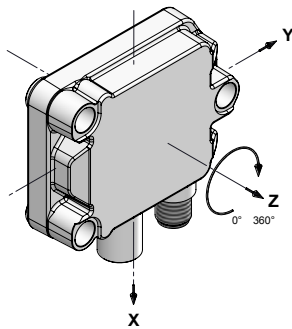
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## Terminal assignment

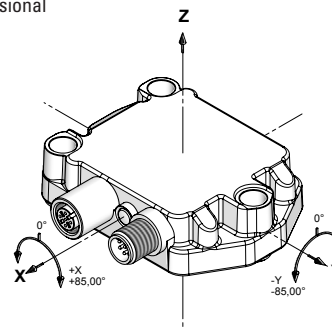
Interface	Type of connection	1 x M12 connector, 5-pin						
6	1	Bus IN						
		Signal:	+V	0 V	D0	D1		TG
		Pin:	2	3	5	4		1
Interface	Type of connection	2 x M12 connector, 5-pin						
6	3	Bus OUT						
		Signal:	+V	0 V	D0	D1		TG
		Pin:	2	3	5	4		1
		Bus IN						
		Signal:	+V	0 V	D0	D1		TG
		Pin:	2	3	5	4		1

## Direction of inclination

1-dimensional



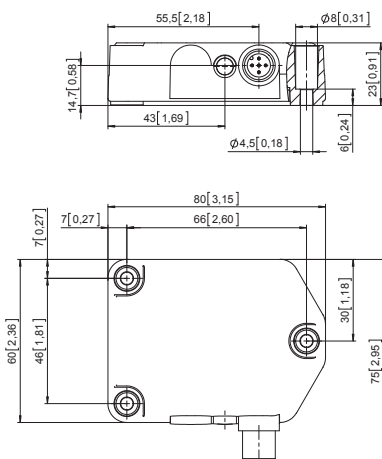
2-dimensional



## Dimensions

Dimensions in mm [inch]

1 x M12 connector 5-pin, male contacts



1 x M12 connector 5-pin, male contacts  
1 x M12 connector 5-pin, female contacts

