

# Inclinometers

**Inclinometer  
MEMS / capacitive**

**IN88, 1- and 2-dimensional**

**CANopen**



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 applications.



**CANopen**



High protection level



Shock / vibration resistant



Reverse polarity protection



Redundancy

## 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 . XX21 . 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  
2 = CANopen

**d** Power supply  
2 = 10 ... 30 V DC

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

## Connection technology

Order no.

### Cordset, pre-assembled

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

**05.00.6091.A211.005M**

M12 male connector with external thread for Bus out, 5-pin  
5 m [16.40'] PVC cable

**05.00.6091.A411.005M**

### Connector, self-assembly (straight)

M12 female connector with coupling nut for Bus in, 5-pin

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

M12 male connector with external thread for Bus out, 5-pin

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

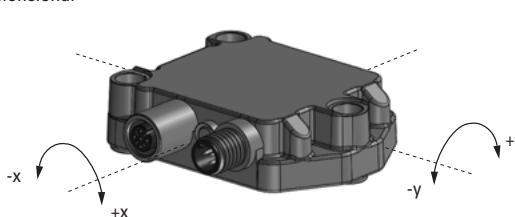
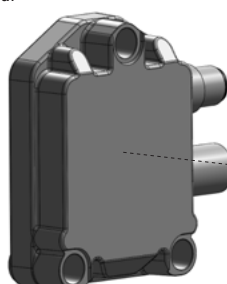
Further accessories can be found in the accessories section or in the accessories area of our website at: [www.kuebler.com/accessories](http://www.kuebler.com/accessories)

Additional connectors can be found in the connection technology section or in the connection technology area of our website at: [www.kuebler.com/connection\\_technology](http://www.kuebler.com/connection_technology)

## Direction of inclination

1-dimensional

2-dimensional



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		
Power supply		10 ... 30 V DC
Power consumption		max. 70 mA
Reverse polarity protection		yes
Measuring axes		1 or 2
Measuring range	1-dimensional	360°, no limit stop
	2-dimensional	±85°
Resolution		0.01°
Absolute accuracy (at 25°C over the whole measuring range) <sup>1)</sup>		
	1-dimensional	±0,2°
	2-dimensional	±0,4°
Transverse sensitivity <sup>2)</sup>		max. ±0.6°
Repeat accuracy		±0.2°
Temperature drift		typ. ±0,006°/K
Sampling rate		50 Hz (20 ms)
Limit frequency	with Butterworth filter factory setting	0.1 ... 10 Hz, 8th order typ. 10 Hz
CE compliant acc. to		EMC guideline 2014/30/EU RoHS guideline 2011/65/EU
E1 type-approval		10R-057989
Harmonized standards		
	DIN EN 61326-1	Electrical equipment for measurement, control and laboratory use
	DIN EN 61000-6-2	Immunity for industrial environments
	DIN EN 61000-6-3	Emitted interferences for residential environments
	DIN EN ISO 14982	Agricultural and forestry machinery, electromagnetic compatibility, test methods and acceptance criteria
	DIN EN 13309	Construction machinery - Electromagnetic compatibility of machines with internal power supply

Mechanical characteristics		
<b>Connection CAN</b>	1 x M12 connector	5-pin, male connector
	2 x M12 connector	5-pin, male connector / 5-pin, female connector
<b>Weight</b>	approx. 185 [6.53 oz]	
<b>Protection</b> acc. to EN 60529	IP67 / IP69k	
<b>Working temperature range</b>	-40°C ... +85°C [-40°F ... +185°F]	
<b>Material</b>	housing	Aluminium
<b>Shock resistance</b>	1000 m/s², 6 ms	
<b>Vibration resistance</b>	100 m/s², 10 ... 2000 Hz	
<b>Dimensions</b>	80 x 60 x 23 mm [3.15 x 2.36 x 0.91"]	

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

1) Over the whole temperature and measuring range  
1-dimensional ≤ ±0,4°; 2-dimensional ≤ ±1°.

2) Only for 2-dimensional measuring direction.

Interface characteristics CANopen	
<b>Code</b>	binary
<b>Interface</b>	CAN high-speed acc. to ISO 11898, Basic- and Full-CAN CAN specification 2.0 B
<b>Protocol</b>	CANopen profile DS410 V1.3 with manufacturer-specific add-ons, communication profile DS301 V4.2
<b>Baud rate</b>	10 kbit/s, 20 kbit/s, 50 kbit/s, 125 kbit/s, 250 kbit/s, 500 kbit/s, 800 kbit/s, 1 Mbit/s software configurable
<b>Node address</b>	1 ... 127 software configurable
<b>Termination switchable</b>	software configurable
<b>LSS protocol</b>	DS305 layer setting services 2.2

## General information on CANopen

The CANopen inclinometers support the latest CANopen communications profile according to DS301. In addition, device-specific profiles such as the inclinometer profile DS410 and DS305 (LSS) are available.

The following operating modes may be selected: Polled Mode, Cyclic Mode, Sync Mode. Moreover, scale factors, preset values and many other additional parameters can be programmed via the CAN bus. When switching the appliance on, all parameters are loaded from a flash memory. These parameters have previously been stored in a zero-voltage secure manner. The output values **position**, **position raw value**, **sensor temperature** and **sensor information** can be combined very variably as a PDO (PDO mapping). The inclinometers are available with one or two connectors.

The device address and baud rate can be set/modified by means of the software.

The two-color LED indicates the operating or fault status of the CAN bus, as well as the status of the internal diagnostics.

## LSS layer setting services DS305 V2.2

- Global command support for node address and baud rate configuration.
- Selective protocol via identity object (1018h).

## CANopen communication profile DS301 V4.2

Among others, the following functionality is integrated (Class C2 functionality):

- NMT slave.
- Heartbeat protocol.
- Identity object.
- Error behavior object.
- Variable PDO mapping, 2 sending PDO's.
- Node address, baud rate and programmable CANbus termination.

## CANopen inclinometer profile DS410 V1.3

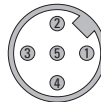
The following parameters can be programmed:

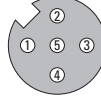
- Variable PDO mapping of position, position raw value, sensor temperature and sensor information.
- Extended failure management.
- User interface with visual display of bus and failure status - 1 LED two-color.
- Customer-specific protocol.
- "Watchdog controlled" device.

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## Terminal assignment

Interface	Type of connection	1 x M12 connector, 5-pin						
2	1		Bus IN					
		Signal:	+V	0 V	CAN_GND	CAN_H		CAN_L
		Pin:	2	3	1	4		5

Interface	Type of connection	2 x M12 connector, 5-pin						
2	3		Bus OUT					
		Signal:	+V	0 V	CAN_GND	CAN_H		CAN_L
		Pin:	2	3	1	4		5
			Bus IN					
		Signal:	+V	0 V	CAN_GND	CAN_H		CAN_L
		Pin:	2	3	1	4		5

## 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

