Inclinometer MEMS / capacitive | IN81, 1- and 2-dimensional | Analog



The inclinometers of the IN81 series allow measuring 2-dimensional inclinations in the range of ±85° or 1-dimensional inclinations up to 360°.

With their high robustness, their protection level up to max. IP69k and their wide temperature range from -40°C to +85°C, these devices are ideally suitable for outdoor use – e.g. for mobile automation applications.

Analog output



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°C up to +85°C.
- Non long-term drift thanks to sensor array technique.

Versatile

- Preset and teach function.
- Measuring direction 1- or 2-dimensional.
- With switch outputs.
- Stacked installation possible for redundancy.

Order code

8.IN81 . X X X X . X 2 X

Type | a b c d | e f g

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

b *Measuring range*
1 = ±10° [1]
2 = ±15° [1]
3 = ±30° [1]
4 = ±45° [1]
5 = ±60° [1]
6 = ±85° [1]
7 = 0 ... 360° (±180°) [2]
8 = 0 ... 180° (±90°) [2]

c *Interface*
1 = 4 ... 20 mA / 12 bit
2 = 0.1 ... 4.9 V / 12 bit
3 = 0.5 ... 4.5 V / 12 bit
4 = 0 ... 5 V / 12 bit
5 = 0 ... 10 V / 12 bit

d *Filter*
1 = no filter
2 = filter value 0.1 Hz
3 = filter value 0.3 Hz
4 = filter value 0.5 Hz
5 = filter value 1.0 Hz
6 = filter value 2.0 Hz
7 = filter value 5.0 Hz
8 = filter value 10.0 Hz

e *Optional switching outputs*
1 = none
2 = 2 switch outputs [3]

f *Power supply*
2 = 10 ... 30V / 40 mA
15 ... 30 V for interface 5

g *Type of connection*
1 = 1 x M12 connector, 8-pin
3 = 2 x M12 connector, 8-pin + 5-pin [4]

1) Can only be ordered in conjunction with measuring direction 2-dimensional.
2) Can only be ordered in conjunction with measuring direction 1-dimensional.
3) Can only be ordered in connection with type of connection 3.
4) Can only be ordered in connection with option 2 switching outputs.

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Accessories

		Order no.
Teach adapter 	for controlling the control inputs for the following functions: - Preset (reference point setting) - Teaching (measuring range) - Filter setting - Switching points setting	**8.0010.9000.0017**

Connection technology

		Order no.
Cordset, pre-assembled	M12 female connector with coupling nut, 8-pin 5 m [16.40'] PVC cable	**05.00.6041.8211.005M**
	M12 male connector with external thread, 5-pin [1] 5 m [16.40'] PVC cable	**05.00.6091.A411.005M**
Connector, self-assembly (straight)	M12 female connector with coupling nut, 8-pin	**05.CMB 8181-0**
	M12 male connector with external thread, 5-pin [1]	**8.0000.5111.0000**

Further accessories can be found in the accessories section or in the accessories area of our website at: 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

Technical data

Electrical characteristics current interface

Power supply		10 ... 30 V DC
Current consumption (no load)		max. 40 mA [2]
Reverse polarity protection of the power supply		yes
PowerON Time (PowerOn until valid output value)		< 0.5 s
Measuring axes		1 or 2
Measuring range	1-dimensional	180° / 360°
	2-dimensional	max. ±85° (see order code)
Resolution		12 bit
Accuracy at 25°C [3]	1-dimensional	typ. ±1.0°
	2-dimensional	typ. ±0.5°
Repeat accuracy		±0.2°
Transverse sensitivity [4]		typ. ±0.3°
Temperature coefficient		
	1-dimensional	typ. ±0.005 %/K
	2-dimensional	typ. ±0.015 %/K
Output load	at 10 VDC	max. 200 Ohm
	at 24 VDC	max. 900 Ohm
	at 30 VDC	max. 1200 Ohm
Setting time		< 1 ms (R_{Burden} = 900 Ohm, 25°C)
Sampling rate		50 Hz (20 ms)
Limit frequency with Butterworth filter		0.1 ... 10 Hz, 8th order
CE compliant acc. to		EMC guideline 2014/30/EU RoHS guideline 2011/65/EU
UL approval [6]		file 224618
E1 type-approval		10R-058255

Electrical characteristics voltage interface

Power supply		
0.1 ... 4.9 V / 0.5 ... 4.5 V / 0 ... 5 V		10 ... 30 V
0 ... 10 V		15 ... 30 V
Current consumption (no load)		max. 40 mA [2]
Reverse polarity protection of the power supply		yes
PowerON Time (PowerOn until valid output value)		< 0.5 s
Measuring axes		1 or 2
Measuring range	1-dimensional	180° / 360°
	2-dimensional	max. ±85° (see order code)
Resolution	0 ... 5 V / 0 ... 10 V	12 bit
	0.1 ... 4.9 V / 0.5 ... 4.5 V	11 bit
Accuracy at 25°C [5]	1-dimensional	typ. ±1.0°
	2-dimensional	typ. ±0.5°
Repeat accuracy		±0.2°
Transverse sensitivity [4]		typ. ±0.3°
Temperature coefficient		
	1-dimensional	typ. ±0.0015 %/K
	2-dimensional	typ. ±0.005 %/K
Output load		max. 10 mA
Setting time		< 1 ms (R_{Burden} = 1000 Ohm, 25°C)
Sampling rate		50 Hz (20 ms)
Limit frequency with Butterworth filter		0.1 ... 10 Hz, 8th order
CE compliant acc. to		EMC guideline 2014/30/EU RoHS guideline 2011/65/EU
UL approval [6]		file 224618
E1 type-approval		10R-058255

1) For variant with switching outputs.
2) Max. 270 mA under full load on both switching outputs.
3) Over the whole temperature and max. measuring range; 1 dim ≤ ±2.3°, 2 dim ≤ ±1.9°.
4) Only for 2-dimensional measuring direction.
5) Over the whole temperature and max. measuring range; 1 dim ≤ ±1.2°, 2 dim ≤ ±0.8°.
6) 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**.

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Mechanical characteristics

Connection	1 x M12 connector 2 x M12 connector	8-pin, male connector 8-pin, male connector / 5-pin, female connector
Weight		approx. 185 g
Protection acc. to EN 60529		IP67 + IP69k [1]
Working temperature range		-40°C ... +85°C [-40°F ... +185°F]
Material	housing	aluminum
Shock resistance		1000 m/s², 6 ms
Vibration resistance		100 m/s², 10 ... 2000 Hz
Dimensions		80 x 60 x 23 mm [3.15 x 2.36 x 0.91"]

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 [2]
	EN 13309	Construction machinery - Electromagnetic compatibility of machines with internal power supply [2]

Control inputs

Fuctions: Preset (reference point setting)
Teaching (measuring range)
Filter setting
Switching points setting

Switch output

optional: 2 switch outputs

Electrical characteristics

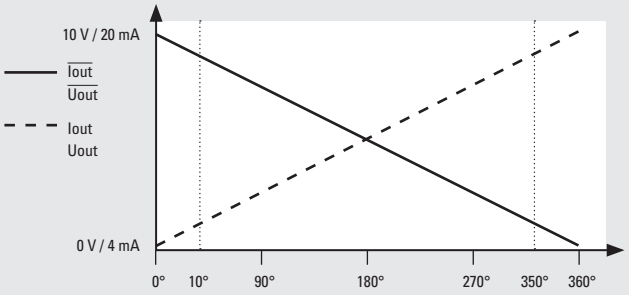
Input		active HIGH
Signal level	High	min. 60% of +V, max. +V
	Low	max. 30% of +V
Min. pulse duration		+V for min. 1 s

Electrical characteristics

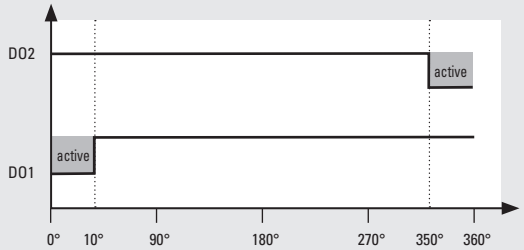
Permissible load		max. 100 mA
Signal level (under max. load)	High	min. +V - 3.0 V
	Low	max. 0.5 V
Short circuit proof outputs		yes

Course of the output signal – factory setting

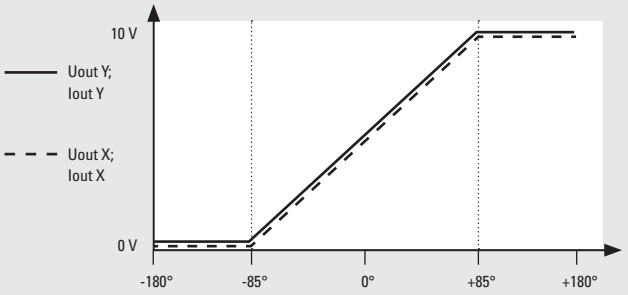
1-dimensional sensor
Example with a measuring range of 360°



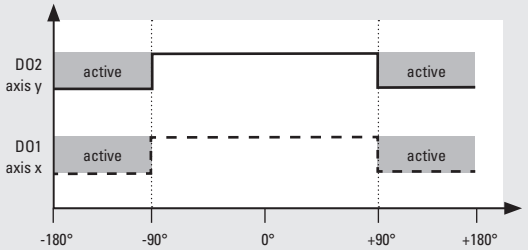
Optional with 2 switching outputs
(factory setting can be changed via the teach-function)



2-dimensional sensor
Example with a measuring range of ±85°



Optional with 2 switching outputs
(factory setting can be changed via the teach-function)

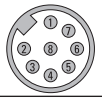


1) The IP protection class is not UL-tested. Verified by Kübler.
2) Without pulse 5.

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Inclinometer MEMS / capacitive	IN81, 1- and 2-dimensional	Analog

Terminal assignment, 1 dimensional

Interface	Type of connection	M12 connector, 8-pin									
1 current	1	Signal:	0 V	+V	Iout+	Iout-	$\overline{\text{Iout+}}$	$\overline{\text{Iout-}}$	Teach 1	Teach 2	
		Pin:	1	2	3	4	5	6	7	8	

Interface	Type of connection	M12 connector, 8-pin									
1 current	3	Signal:	0 V	+V	Iout+	Iout-	$\overline{\text{Iout+}}$	$\overline{\text{Iout-}}$	Teach 1	Teach 2	
		Pin:	1	2	3	4	5	6	7	8	
		Switching outputs option – M12 connector, 5-pin									
		Signal:	n.c.	DO1	DO2	n.c.	0 V				
		Pin:	1	2	3	4	5				

Interface	Type of connection	M12 connector, 8-pin									
2, 3, 4, 5 voltage	1	Signal:	0 V	+V	Uout+	Uout-	$\overline{\text{Uout+}}$	$\overline{\text{Uout-}}$	Teach 1	Teach 2	
		Pin:	1	2	3	4	5	6	7	8	

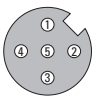
Interface	Type of connection	M12 connector, 8-pin									
2, 3, 4, 5 voltage	3	Signal:	0 V	+V	Uout+	Uout-	$\overline{\text{Uout+}}$	$\overline{\text{Uout-}}$	Teach 1	Teach 2	
		Pin:	1	2	3	4	5	6	7	8	
		Switching outputs option – M12 connector, 5-pin									
		Signal:	n.c.	DO1	DO2	n.c.	0 V				
		Pin:	1	2	3	4	5				

Terminal assignment, 2 dimensional

Interface	Type of connection	M12 connector, 8-pin									
1 current	1	Signal:	0 V	+V	Iout+ X	Iout- X	Iout+ Y	Iout- Y	Teach 1	Teach 2	
		Pin:	1	2	3	4	5	6	7	8	

Interface	Type of connection	M12 connector, 8-pin									
1 current	3	Signal:	0 V	+V	Iout+ X	Iout- X	Iout+ Y	Iout- Y	Teach 1	Teach 2	
		Pin:	1	2	3	4	5	6	7	8	
		Switching outputs option – M12 connector, 5-pin									
		Signal:	n.c.	DO1	DO2	n.c.	0 V				
		Pin:	1	2	3	4	5				

Interface	Type of connection	M12 connector, 8-pin									
2, 3, 4, 5 voltage	1	Signal:	0 V	+V	Uout+ X	Uout- X	Uout+ Y	Uout- Y	Teach 1	Teach 2	
		Pin:	1	2	3	4	5	6	7	8	

Interface	Type of connection	M12 connector, 8-pin									
2, 3, 4, 5 voltage	3	Signal:	0 V	+V	Uout+ X	Uout- X	Uout+ Y	Uout- Y	Teach 1	Teach 2	
		Pin:	1	2	3	4	5	6	7	8	
		Switching outputs option – M12 connector, 5-pin									
		Signal:	n.c.	DO1	DO2	n.c.	0 V				
		Pin:	1	2	3	4	5				

+V: Power supply +V DC
0V Power supply ground GND (0 V)

Teach 1 Input 1 for various teaching functions
Teach 2 Input 2 for various teaching functions

DO1 Digital output 1
DO2 Digital output 2

Uout+ X X axis voltage output
Uout- X X axis voltage output GND
Uout+ Y Y axis voltage output
Uout- Y Y axis voltage output GND

1-axis version
Uout+ Voltage output
Uout- Voltage output GND
$\overline{\text{Uout+}}$ Inverted voltage output
$\overline{\text{Uout-}}$ Inverted voltage output GND

Iout+ X X axis current output
Iout- X X axis current output GND
Iout+ Y Y axis current output
Iout- Y Y axis current output GND

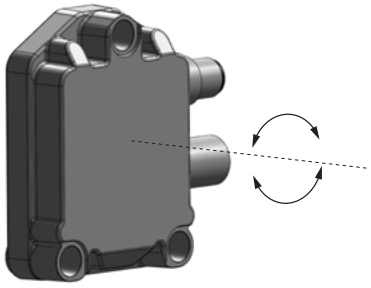
1-axis version
Iout+ Current output
Iout- Current output GND
$\overline{\text{Iout+}}$ Inverted current output
$\overline{\text{Iout-}}$ Inverted current output GND

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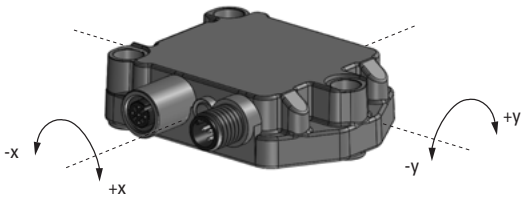
Inclinometer MEMS / capacitive	IN81, 1- and 2-dimensional	Analog

Direction of inclination

1-dimensional



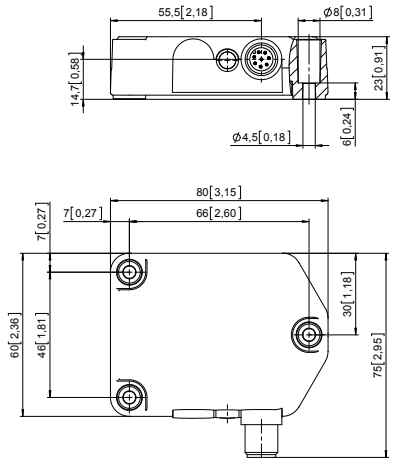
2-dimensional



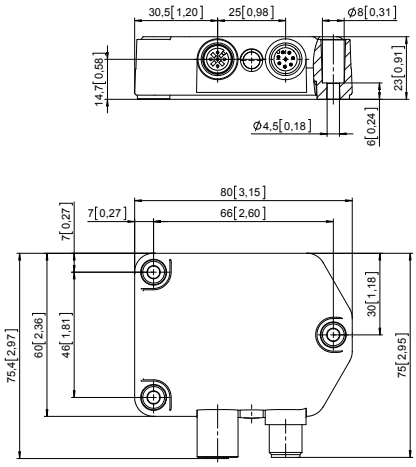
Dimensions

Dimensions in mm [inch]

1 x M12 connector 8-pin, male contacts



1 x M12 connector 8-pin, male contacts
1 x M12 connector 5-pin, female contacts



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