

Inclinometers

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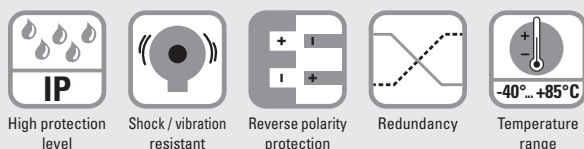


The inclinometers of the IN81 series allow measuring 2-dimensional inclinations in the range of $\pm 85^\circ$ or 1-dimensional inclinations up to 360° .

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



Analog
output



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 $+85^\circ\text{C}$.
- 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 ¹⁾

8.IN81 . XXXX . X2X
Type a b c d e f g

a Measuring direction

- 1 = 1-dimensional
- 2 = 2-dimensional

b Measuring range

- 1 = $\pm 10^\circ$ ²⁾
- 2 = $\pm 15^\circ$ ²⁾
- 3 = $\pm 30^\circ$ ²⁾
- 4 = $\pm 45^\circ$ ²⁾
- 5 = $\pm 60^\circ$ ²⁾
- 6 = $\pm 85^\circ$ ²⁾
- 7 = $0 \dots 360^\circ$ ($\pm 180^\circ$) ³⁾
- 8 = $0 \dots 180^\circ$ ($\pm 90^\circ$) ³⁾

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 ⁴⁾

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 ⁵⁾

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 ⁶⁾ 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 ⁶⁾	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

1) Series availability as from April 2017.
2) Can only be ordered in conjunction with measuring direction 2-dimensional.
3) Can only be ordered in conjunction with measuring direction 1-dimensional.

4) Can only be ordered in connection with type of connection 3.
5) Can only be ordered in connection with option 2 switching outputs.
6) For variant with switching outputs.

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Technical data

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

Electrical characteristics current interface		
Power supply	10 ... 30 V DC	
Current consumption (no load)	max. 40 mA	
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 2-dimensional	180° / 360° max. ±85° (see order code)
Resolution	12 bit	
Absolute accuracy at 25°C ²⁾ version 2 dim, ±10°, ±15°, ±30° version 2 dim, ±45°, ±60° version 2 dim, ±85° version 1 dim, 0 ... 180° version 1 dim, 0 ... 360°	typ. ±0.4° typ. ±0.5° typ. ±0.5° typ. ±0.5° typ. ±0.5°	
Temperature coefficient 2 dim up to ±30° 2 dim up to ±60° 2 dim ±85° 1 dim	typ. ±0.015°/K typ. ±0.018°/K typ. ±0.023°/K typ. ±0.03°/K	
Repeat accuracy	±0.2°	
Transverse sensitivity ³⁾	max. ±0.6°	
Output load	at 10 VDC at 24 VDC at 30 VDC	max. 200 Ohm max. 900 Ohm max. 1200 Ohm
Setting time	< 1 ms (R _{Burden} = 900 Ohm, 25°C)	
Sampling rate	50 Hz (20 ms)	
Limit frequency	with Butterworth filter factory setting	0.1 ... 10 Hz, 8th order 10 Hz
CE compliant acc. to	EMC guideline 2014/30/EU RoHS guideline 2011/65/EU	
E1 type-approval	in preparation	

EMC		
Relevant standards	EN 61326-1	Electrical equipment for measure- ment, 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 ¹⁾
	EN 13309	Construction machinery - Electro- magnetic compatibility of machines with internal power supply ¹⁾

Electrical characteristics voltage interface		
Power supply	0.1 ... 4.9 V / 0.5 ... 4.5 V / 0 ... 5 V 0 ... 10 V	10 ... 30 V 15 ... 30 V
Current consumption (no load)	max. 40 mA	
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 2-dimensional	180° / 360° max. ±85° (see order code)
Resolution	0 ... 5 V / 0 ... 10 V 0.1 ... 4.9 V / 0.5 ... 4.5 V	12 bit 11 bit
Absolute accuracy at 25°C ⁴⁾ version 2 dim, ±10°, ±15°, ±30° version 2 dim, ±45°, ±60° version 2 dim, ±85° version 1 dim, 0 ... 180° version 1 dim, 0 ... 360°	typ. ±0.4° typ. ±0.5° typ. ±0.5° typ. ±0.5° typ. ±0.5°	
Temperature coefficient 2 dim 1 dim	typ. ±0.005°/K typ. ±0.01°/K	
Repeat accuracy	±0.2°	
Transverse sensitivity ³⁾	max. ±0.6°	
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 factory setting	0.1 ... 10 Hz, 8th order 10 Hz
CE compliant acc. to	EMC guideline 2014/30/EU RoHS guideline 2011/65/EU	
E1 type-approval	in preparation	

1) Without pulse 5.
2) Over the whole temperature and measuring range; 1 dim ≤ ±2.3°, 2 dim ≤ ±1.9°.
3) Only for 2-dimensional measuring direction.
4) Over the whole temperature and measuring range; 1 dim ≤ ±1.2°, 2 dim ≤ ±0.8°.
A full description of the technical data can be found in the relevant product manual at www.kuebler.com.

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Control inputs

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

Switch output

optional: 2 switch outputs

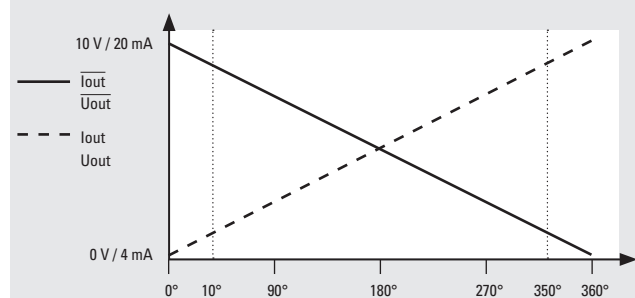
Electrical characteristics	
Input	active HIGH
Signal level	High min. 60% of +V, max. +V Low max. 30% of +V
Min. pulse duration	+V for min. 1 s

Electrical characteristics	
Permissible load	max. 100 mA
Signal level (under max. load)	High min. +V - 2,0 V Low max. 0,5 V
Short circuit proof outputs	yes

Course of the output signal – factory setting

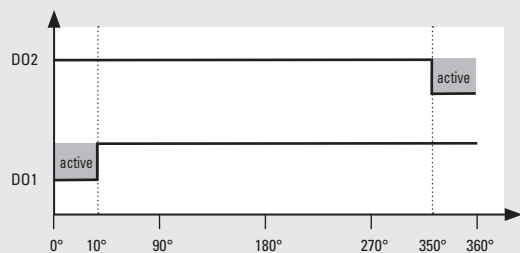
1-dimensional sensor

Example with a measuring range of 360°



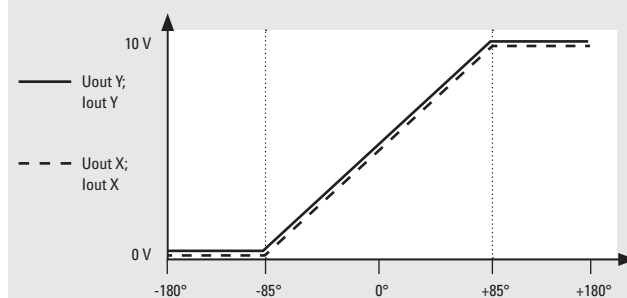
Optional with 2 switching outputs

(factory setting can be changed via the teach-function)



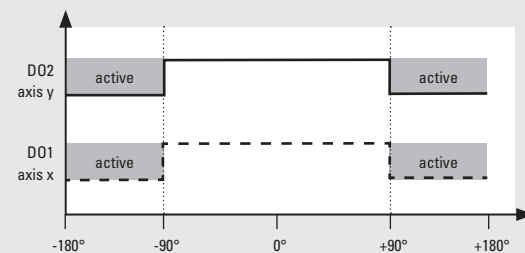
2-dimensional sensor

Example with a measuring range of ±85°



Optional with 2 switching outputs







(factory setting can be changed via the teach-function)




Inclinometers


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
Terminal assignment, 1 dimensional


Interface	Type of connection	M12 connector, 8-pin									
1 current	1	Signal:	0 V	+V	Iout +	Iout -	Iout +	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 -	Iout +	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 -	Uout +	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 -	Uout +	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
Uout+ Inverted voltage output
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
Iout+ Inverted current output
Iout- Inverted current output GND

Inclinometers

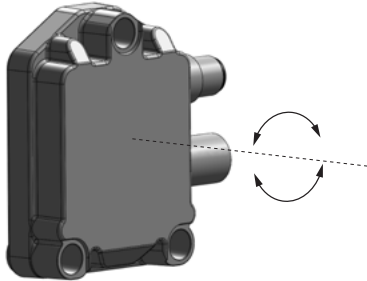
**Inclinometer
MEMS / capacitive**

IN81, 1- and 2-dimensional

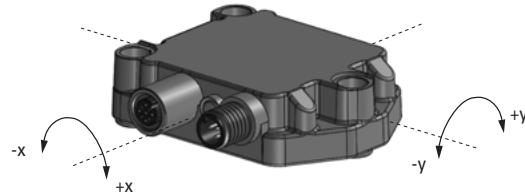
Analog

Direction of inclination

1-dimensional



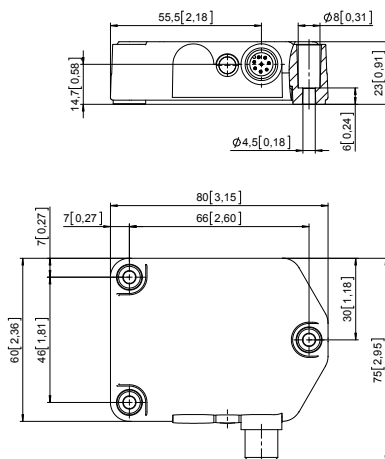
2-dimensional



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

