

Inclinometers

**Inclinometer
MEMS / capacitive**

IN81, 1- and 2-dimensional

Analog



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



High protection level



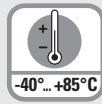
Shock / vibration resistant



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 $+85^\circ\text{C}$.
- 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

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 = $\pm 10^\circ$ ¹⁾
- 2 = $\pm 15^\circ$ ¹⁾
- 3 = $\pm 30^\circ$ ¹⁾
- 4 = $\pm 45^\circ$ ¹⁾
- 5 = $\pm 60^\circ$ ¹⁾
- 6 = $\pm 85^\circ$ ¹⁾
- 7 = 0 ... 360° ($\pm 180^\circ$) ²⁾
- 8 = 0 ... 180° ($\pm 90^\circ$) 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 M12 male connector with external thread, 5-pin ¹⁾	05.CMB 8181-0 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		Electrical characteristics voltage interface	
Power supply	10 ... 30 V DC	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	Current consumption (no load)	max. 40 mA
Reverse polarity protection of the power supply	yes	Reverse polarity protection of the power supply	yes
PowerON Time (PowerOn until valid output value)	< 0.5 s	PowerON Time (PowerOn until valid output value)	< 0.5 s
Measuring axes	1 or 2	Measuring axes	1 or 2
Measuring range	1-dimensional 180° / 360° 2-dimensional max. ±85° (see order code)	Measuring range	1-dimensional 180° / 360° 2-dimensional max. ±85° (see order code)
Resolution	12 bit	Resolution	0 ... 5 V / 0 ... 10 V 12 bit 0.1 ... 4.9 V / 0.5 ... 4.5 V 11 bit
Absolute accuracy at 25°C ²⁾	version 2 dim, ±10°, ±15°, ±30° typ. ±0.4° version 2 dim, ±45°, ±60° typ. ±0.5° version 2 dim, ±85° typ. ±0.5° version 1 dim, 0 ... 180° typ. ±0.5° version 1 dim, 0 ... 360° typ. ±0.5°	Absolute accuracy at 25°C ⁴⁾	version 2 dim, ±10°, ±15°, ±30° typ. ±0.4° version 2 dim, ±45°, ±60° typ. ±0.5° version 2 dim, ±85° typ. ±0.5° version 1 dim, 0 ... 180° typ. ±0.5° version 1 dim, 0 ... 360° typ. ±0.5°
Temperature coefficient	2 dim up to ±30° typ. ±0.015°/K 2 dim up to ±60° typ. ±0.018°/K 2 dim ±85° typ. ±0.023°/K 1 dim typ. ±0.03°/K	Temperature coefficient	1 dim typ. ±0.005°/K 2 dim typ. ±0.01°/K
Repeat accuracy	±0.2°	Repeat accuracy	±0.2°
Transverse sensitivity ³⁾	max. ±0.6°	Transverse sensitivity ³⁾	max. ±0.6°
Output load	at 10 VDC max. 200 Ohm at 24 VDC max. 900 Ohm at 30 VDC max. 1200 Ohm	Output load	max. 10 mA
Setting time	< 1 ms (R _{Burden} = 900 Ohm, 25°C)	Setting time	< 1 ms (R _{Burden} = 1000 Ohm, 25°C)
Sampling rate	50 Hz (20 ms)	Sampling rate	50 Hz (20 ms)
Limit frequency with Butterworth filter factory setting	0.1 ... 10 Hz, 8th order 10 Hz	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	CE compliant acc. to	EMC guideline 2014/30/EU RoHS guideline 2011/65/EU
E1 type-approval	in preparation	E1 type-approval	in preparation

1) For variant with switching outputs.
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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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	
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"]	

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 ¹⁾
	EN 13309	Construction machinery - Electromagnetic compatibility of machines with internal power supply ¹⁾

Control inputs

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

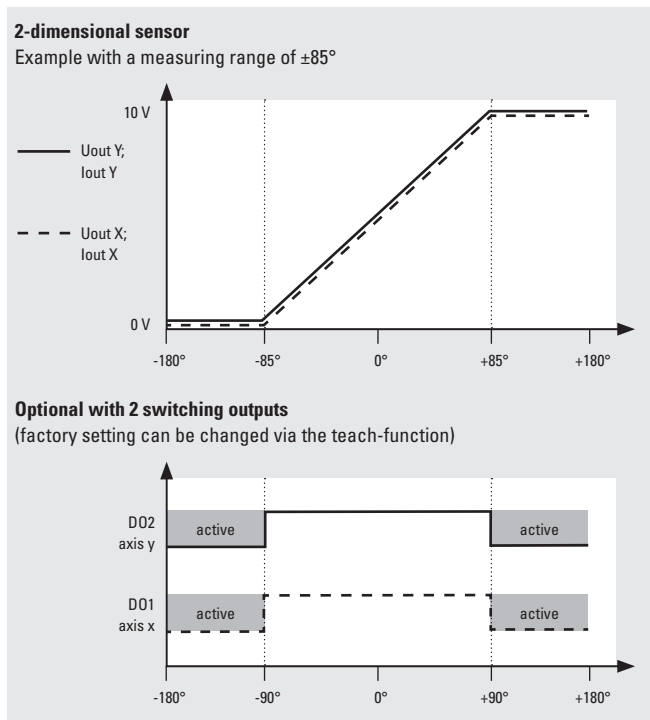
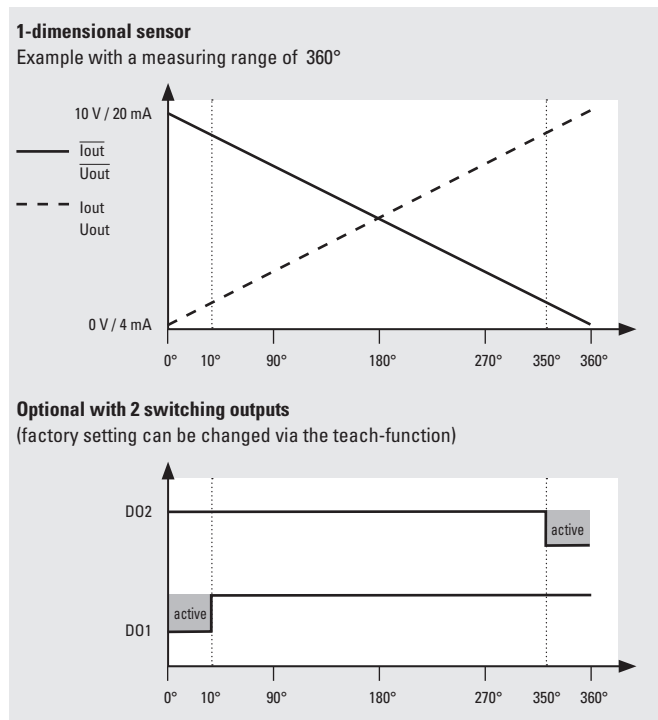
Switch output

optional: 2 switch outputs

Electrical characteristics		
Input	active HIGH	
Signal level	High Low	min. 60% of +V, max. +V 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 Low	min. +V - 2,0 V max. 0,5 V
Short circuit proof outputs	yes	

Course of the output signal – factory setting



1) Without pulse 5.

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Terminal assignment, 1 dimensional

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

Terminal assignment, 2 dimensional

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

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

lout+ X: X axis current output
 lout- X: X axis current output GND
 lout+ Y: Y axis current output
 lout- Y: Y axis current output GND

DO1: Digital output 1
 DO2: Digital output 2

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

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

Inclinometers

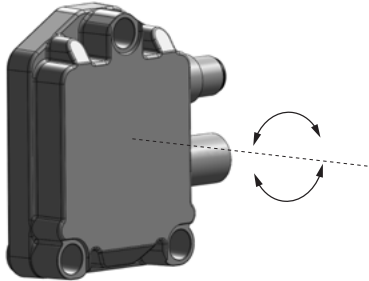
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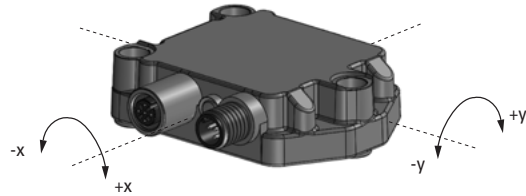
Analog

Direction of inclination

1-dimensional



2-dimensional



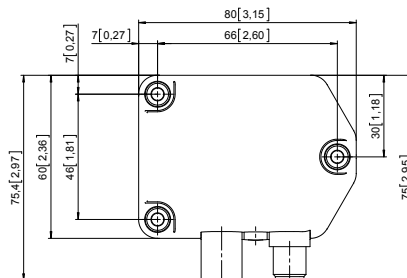
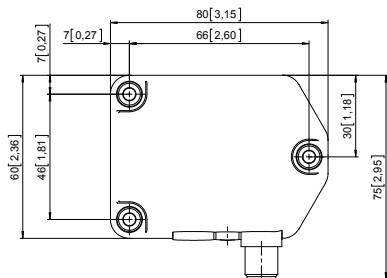
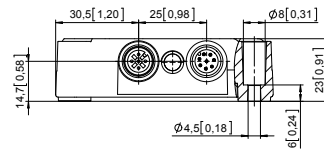
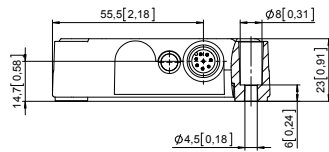
Dimensions

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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