

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



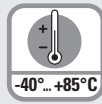
Shock / vibration resistant



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		
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	
	factory setting	10 Hz	
CE compliant acc. to	EMC guideline 2014/30/EU RoHS guideline 2011/65/EU		
UL approval ⁶⁾	file n° follows		
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	
	factory setting	10 Hz	
CE compliant acc. to	EMC guideline 2014/30/EU RoHS guideline 2011/65/EU		
UL approval ⁶⁾	file n° follows		
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	
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

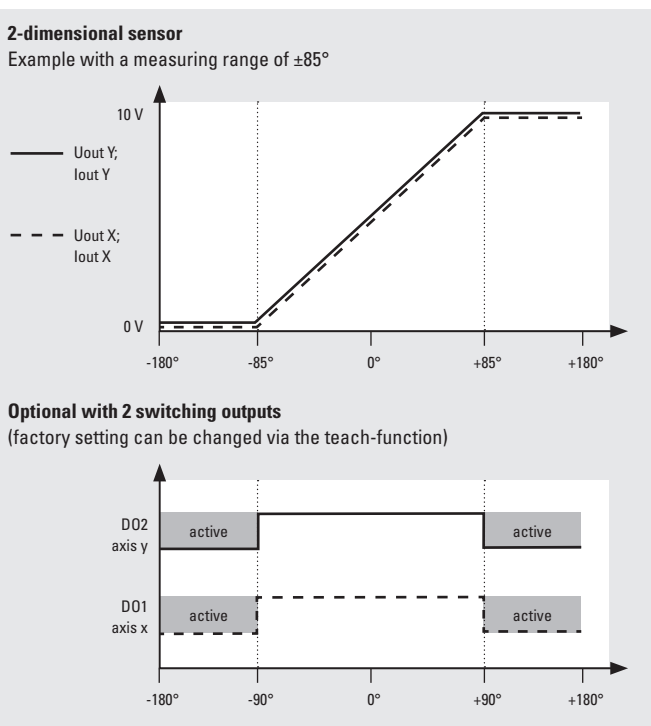
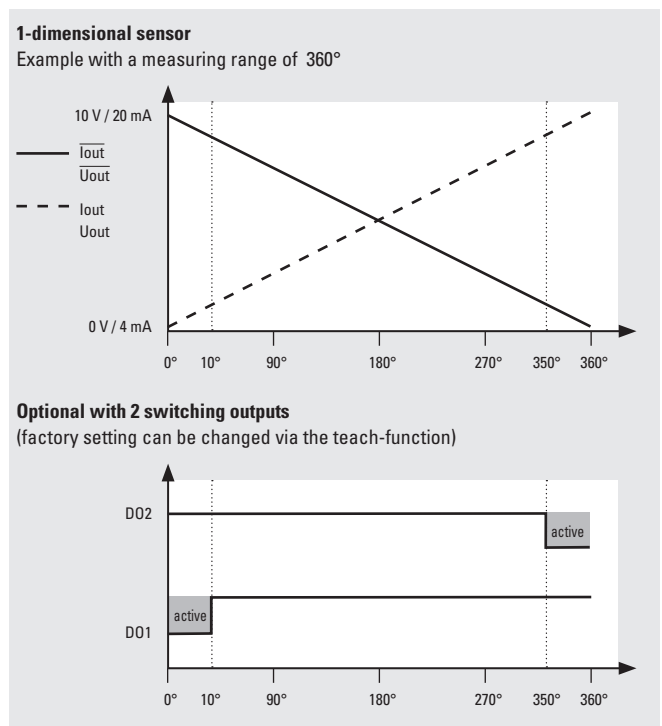
Switch output

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 - 3.0 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									
		Signal:	0 V	+V	Iout+	Iout-	Iout+	Iout-	Teach 1		Teach 2
		Pin:	1	2	3	4	5	6	7	8	
Interface 1 current	Type of connection 3	M12 connector, 8-pin									
		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 2, 3, 4, 5 voltage	Type of connection 1	M12 connector, 8-pin									
		Signal:	0 V	+V	Uout+	Uout-	Uout+	Uout-	Teach 1		Teach 2
		Pin:	1	2	3	4	5	6	7	8	
Interface 2, 3, 4, 5 voltage	Type of connection 3	M12 connector, 8-pin									
		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 1 current	Type of connection 1	M12 connector, 8-pin									
		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 1 current	Type of connection 3	M12 connector, 8-pin									
		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 2, 3, 4, 5 voltage	Type of connection 1	M12 connector, 8-pin									
		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 2, 3, 4, 5 voltage	Type of connection 3	M12 connector, 8-pin									
		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

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

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

DO1: Digital output 1
 DO2: Digital output 2

1-axis version
 Uout+: Voltage output
 Uout-: Voltage output GND
 Uout+: Inverted voltage output
 Uout-: Inverted voltage output GND

1-axis version
 Iout+: Current output
 Iout-: Current output GND
 Iout+: Inverted current output
 Iout-: Inverted current output GND

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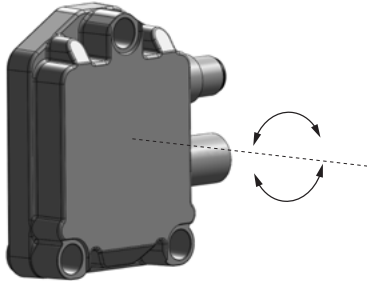
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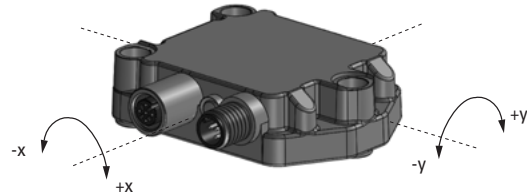
Analog

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

