R67029.0002 Index 1

Manual

Inclinometer IN81

Inclinometer 1-dimensional
Inclinometer 2-dimensional

Analog output

pulses for automation

Publisher

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1. Technical details and characteristics

1.1 Working temperature range

-40 … +85°C

1.2 Supply voltage and current consumption

Output:

4 … 20 mA:	10 … 30 VDC max. 30,0 mA
0 … 10 V:	15 … 30 VDC max. 30,0 mA
0 … 5 V/	
0.1 … 4.9 V/	
0.5 … 4.5 V :	10 … 30 VDC max. 30,0 mA

1.3 Load at the output / max. output current

Output:

4 … 20 mA:	at 10 VDC max. 200 Ohm
	at 24 VDC max. 900 Ohm
0 … 10 V/	
0 … 5 V/	
0.1 … 4.9 V/	
0.5 … 4.5 V:	1 kOhm load resistance / max. output current: 10 mA

1.4 Hardware characteristics

2-dimensional sensor: Measuring range per axis	max. ± 85°
1-dimensional sensor: Measuring range per axis	max. ± 180° (0 … 360°)
Analog output resolution (D/A)	4096 steps (12 bits)
Internal cycle	20 ms
Settling time	1 ms

Table 1

1.5 Function/status and diagnosis display

By RGB LED (red/green/blue + mixed colors: violet / orange)

1.6 Supported standard measuring ranges

- 0 … 10 V
- 0 … 5 V
- 0.1 … 4.9 V
- 0.5 … 4.5 V
- 4 … 20 mA

1.7 Supported standard functions

- Scaling of the analog measuring range per measuring axis
- Sensor filter adjustable in 7 steps
- Preset function (excepted for the measuring range: 2-dimensional ± 85°)
- Resetting to factory settings

1.8 Optional functions

- 2 adjustable switching outputs

1.9 Orientation

1-dimensional 0 … 360°

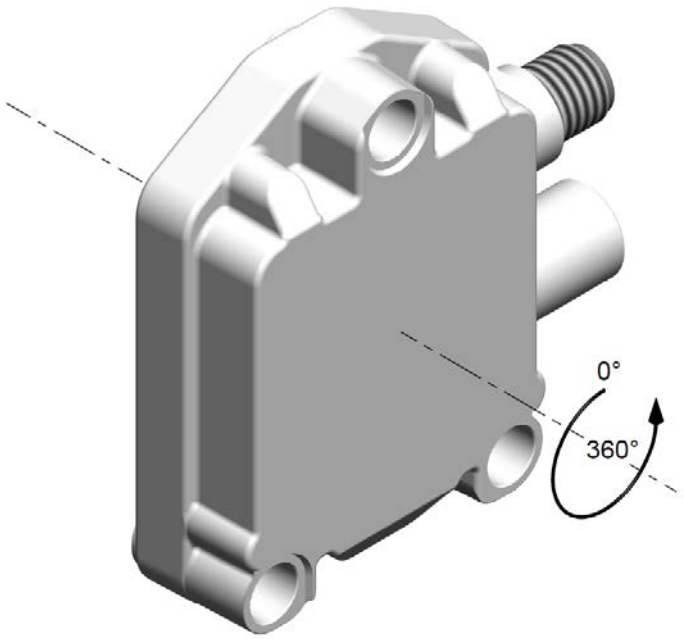


Figure 1

2-dimensional ±85°

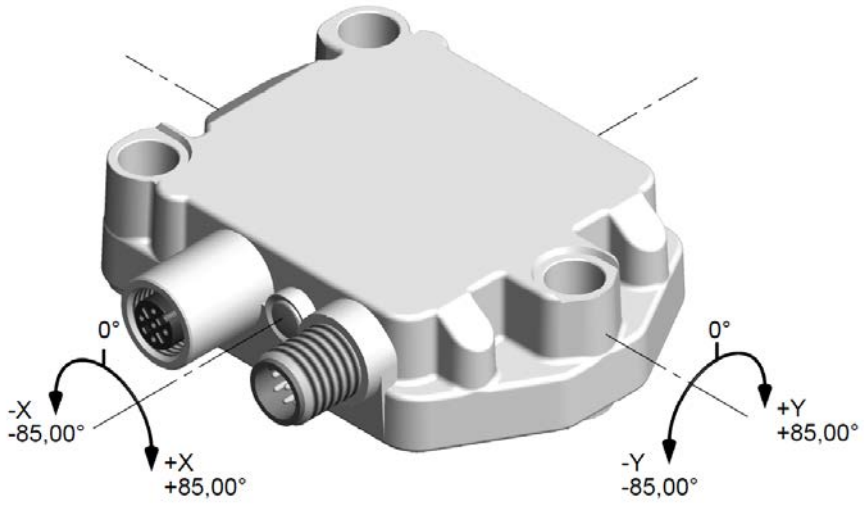


Figure 2

2. Electrical installation – Supply voltage

This chapter contains information about the electrical installation, configuration and commissioning of the inclinometer IN81 analog U/I.

Figure 3

2.1 Electrical installation

NOTICE	**Switch off the plant!** Make sure that the whole plant remains switched off during the electrical installation. Electrical installation requires connectors or connection cables (see data sheet).

2.2 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				

Table 2

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				

Table 3

+V:	Supply voltage +V DC
0V	Supply voltage GND (0V)
Uout+ X	X-axis voltage output
Uout- X	GND for X-axis voltage output
Uout+ Y	Y-axis voltage output
Uout- Y	GND for Y-axis voltage output
Uout+	Voltage output, 1-axis version
Uout-	GND for voltage output, 1-axis version
$\overline{\text{Uout +}}$	Inverted voltage output, 1-axis version
$\overline{\text{Uout -}}$	GND for inverted voltage output, 1-axis version
Iout+ X	X-axis current output
Iout- X	GND for X-axis current output
Iout+ Y	Y-axis current output
Iout- Y	GND for Y-axis current output
Iout+	Current output, 1-axis version
Iout-	GND for current output, 1-axis version
$\overline{\text{Iout+}}$	Inverted current output, 1-axis version
$\overline{\text{Iout -}}$	GND for inverted current output, 1-axis version
Teach 1	Input 1 for various teaching functions
Teach 2	Input 2 for various teaching functions
DO1	Digital output 1
DO2	Digital output 2

NOTICE	**Connect the shield to the inclinometer housing.** If possible, mount all cables with traction relief. Check the maximum supply voltage on the device.

3. Function and status LED

The device is equipped with **a RGB** LED for displaying status and error messages

3.1 LED display in normal operation

Display	RGB LED	Meaning	Addition
LED off		Device is not powered	
Green constantly on		Normal operation	
Red constantly flashing		System error	Contact the service

Table 4

3.2 LED display during preset

Display	RGB LED	Meaning	Addition
Green **6 x flashing**	6 x	Preset completed successfully for measuring axis 1	
Orange **6 x flashing**	6 x	Preset completed successfully for measuring axis 2	**Only available for inclinometers with 2 measuring axes!**
Red **6 x flashing**	6 x	Preset **FAILED**	Preset outside of the allowable measuring range

Table 5

3.3 LED display in programming mode

Display	RGB LED	Meaning	Addition
Orange » Violet » Blue in repeating sequences		You are in the programming mode	
Red » Green » Blue in a single sequence		The device is reset to factory setting	
Orange » Violet in repeating sequences		You are in the scaling mode of the analog measuring range or of the switching outputs	
Orange constantly flashing		You are in the scaling mode of the analog measuring range	
Violet constantly flashing		You are in the scaling mode of the switching outputs	
Green 6 x flashing	 6 x	User input detected on the Teach input and performed successfully	
Red 6 x flashing	 6 x	User input on the Teach input rejected!	E.g. selected measuring range too small

Table 6

3.4 LED display in scaling mode: Analog measuring range

Display	RGB LED	Meaning	Addition
Green » Orange in repeating sequences		You selected measuring axis 1 in order to scale its analog measuring range	
Red » Orange in repeating sequences		You selected measuring axis 2 in order to scale its analog measuring range	**Only available for inclinometers with 2 measuring axes!**

Table 7

3.5 LED display in scaling mode: Switching outputs (OPTIONAL!)

Display	RGB LED	Meaning	Addition
Green » Violet in repeating sequences		You selected measuring axis 1 in order to set its switching output	
Red » Violet in repeating sequences		You selected measuring axis 2 in order to set its switching output	**Only available for inclinometers with 2 measuring axes!**

Table 8

3.6 LED display in sensor filter setting mode

Display	RGB LED	Meaning	Addition
Blue constantly on		Sensor filter = OFF	
Blue flashing 1 x	 1 x	Sensor filter = 0.1 Hz	
Blue flashing 2 x	 2 x	Sensor filter = 0.3 Hz	
Blue flashing 3 x	 3 x	Sensor filter = 0.5 Hz	
Blue flashing 4 x	 4 x	Sensor filter = 1.0 Hz	
Blue flashing 5 x	 5 x	Sensor filter = 2.0 Hz	
Blue flashing 6 x	 6 x	Sensor filter = 5.0 Hz	
Blue flashing 7 x	 7 x	Sensor filter = 10.0 Hz	

Table 9

4. Standard function

4.1 1-dimensional inclinometer

The single-axis inclinometer is factory-equipped with a measuring range of 0 … 360°.
According to the selected output type, a linear output signal is emitted by the analog outputs.

- **Analog output 1:**
  - increasing measurement signal for positive direction of movement.
- **Analog output 2:**
  - measurement signal inverted with respect to analog output 1.
  - decreasing measurement signal for positive direction of movement.

After 360° the system continues from 0°.

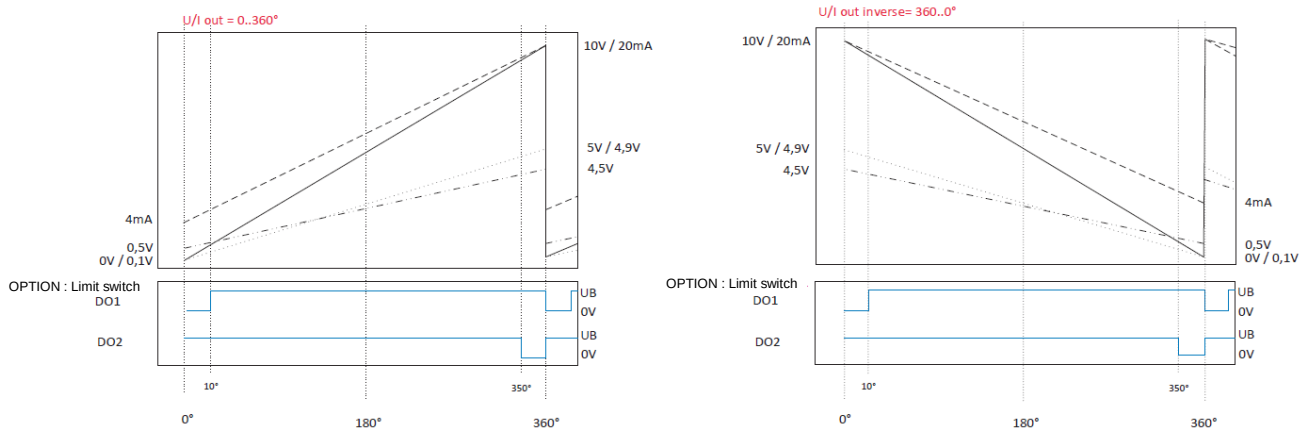


Figure 4

For the measuring range of 0 … 360° the switching outputs switch at 10° / 350°!
If a new measuring range is taught or factory-set to < 360°, the switching outputs switch at the beginning and at the end of the measuring range.

Example for a measuring range of 0 … 180°:

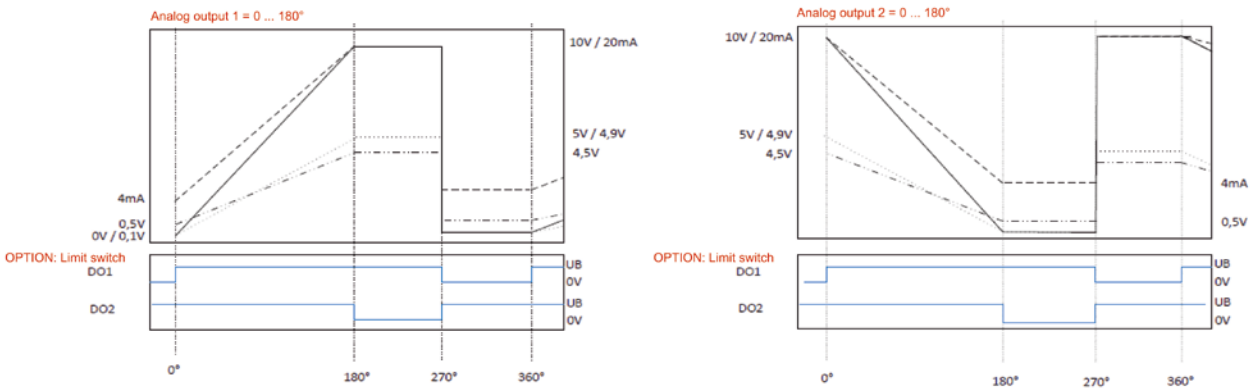


Figure 5

4.2 2-dimensional inclinometer

The 2-dimensional inclinometer is factory-set with a measuring range of +/-85°. Depending on the analog output type (4 … 20mA / 0 … 10V/…), a linearly increasing measurement signal is emitted for every measuring axis.

Analog output X: Measurement signal – X-axis movement

Analog output Y: Measurement signal – Y-axis movement

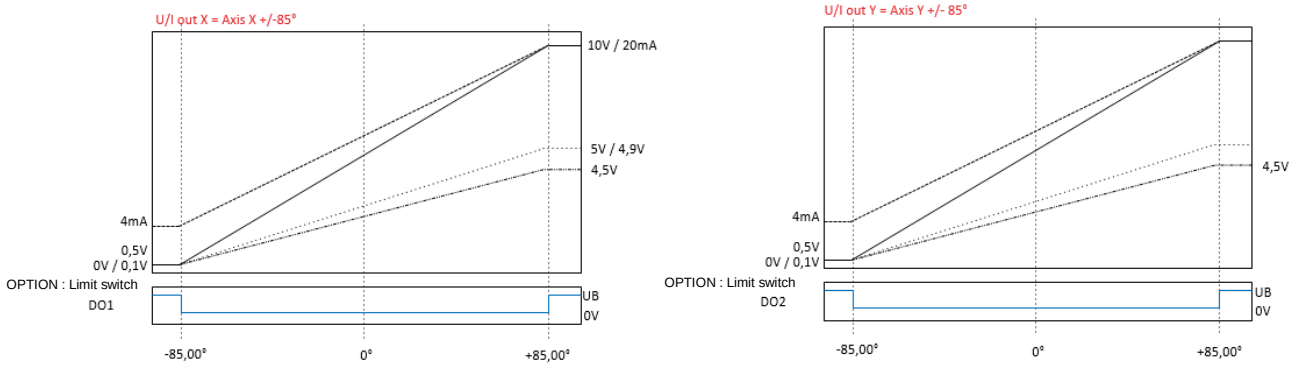


Figure 6

If the inclinometer is equipped with the limit switch function, the switching outputs switch when the analog measuring range limits are reached.

5. User settings overview

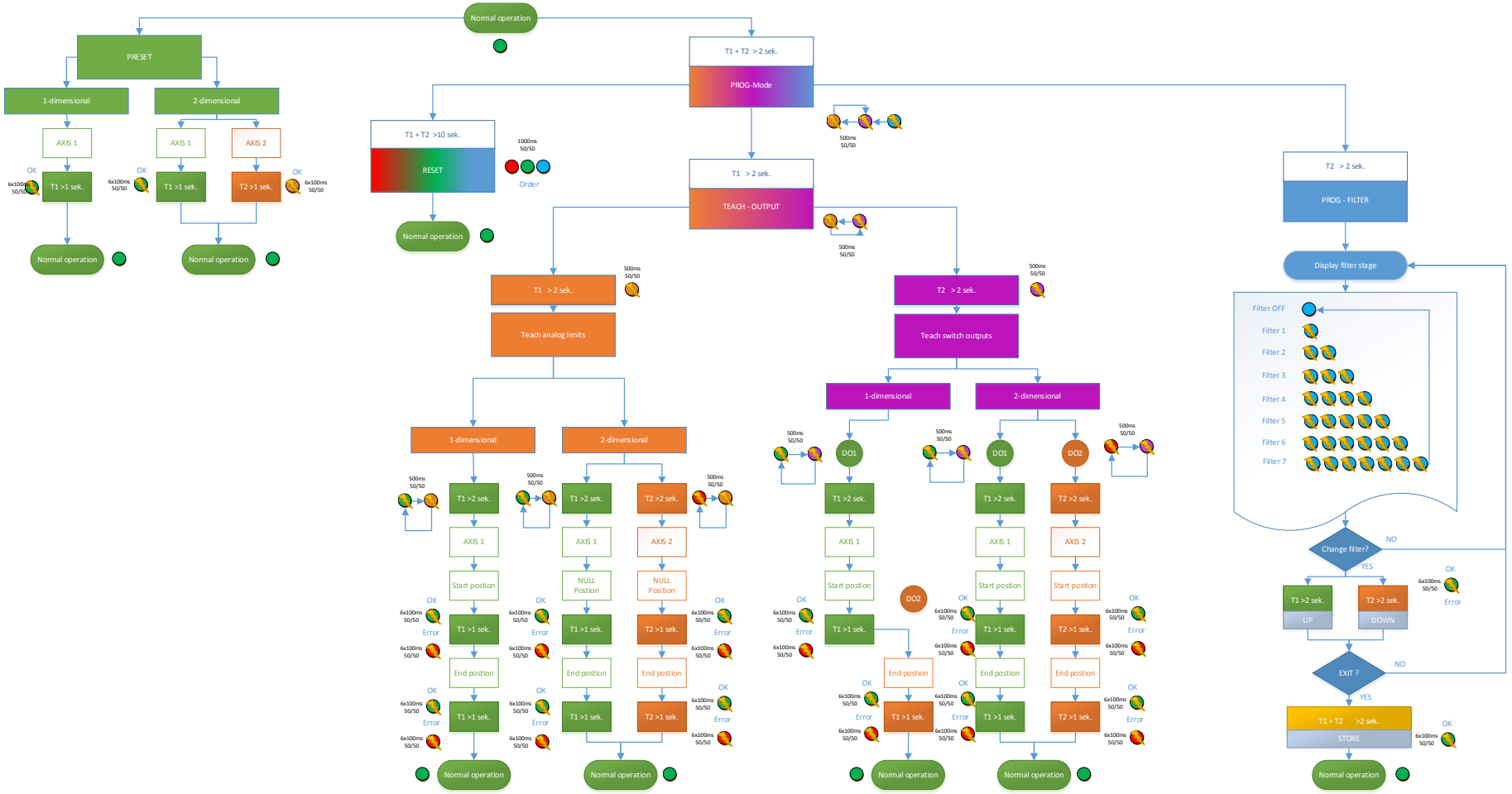


Figure 7

6. User settings

The inclinometer can be adapted to the customer application by means of two teach inputs. The following functions are available to the user. They can be operated through the two teach inputs:

- Preset function (set a new reference point)
- Scaling of the analog measuring range
- Setting of the switching points of the optional limit switches.
- Setting of the sensor filter
- Resetting to factory setting

6.1 Preset function

1-dimensional inclinometer

Preset

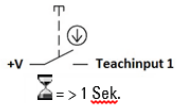
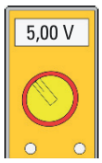
Action	RGB LED	Description
Initial state: Device in normal operation	constantly on	The device is in normal operation
	6 x	Apply +V at teach input 1 for > 1 second. The LED flashes 6 x green after preset completion.
	constantly on	The output signal of analog outputs 1 & 2 is set to 50% of the measuring range. Example: Measuring range = 0 … 10V -> Output after preset = 5V The device is in normal operation again.

Table 10

2-dimensional inclinometer

Preset axis X (not available for measuring range +/- 85º!)

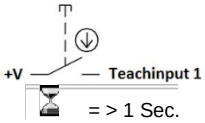
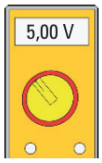
Action	RGB LED	Description
Initial state: Device in normal operation, axis X <= +/-15°	constantly on	The device is in normal operation and in factory setting. The X-axis is located in the measuring range of +/- 15°. **No preset is possible outside of the range +/-15°!**
	6 x	Apply +V at teach input 1 for > 1 second. The LED flashes 6 x green after preset completion.
	constantly on	The output signal of analog output 1 is set to 50% of the measuring range. Example: Measuring range = 0 … 10V -> Output after preset = 5V The device is in normal operation again.

Table 11

Preset axis Y(not available for measuring range +/- 85º!)

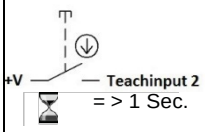
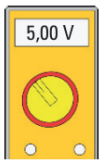
Action	RGB LED	Description
Initial state: Device in normal operation, axis Y <= +/-15°	constantly on	The device is in normal operation and in factory setting. The Y-axis is located in the measuring range of +/- 15°. **No preset is possible outside of the range +/-15°!**
	6 x	Apply +V at teach input 2 for > 1 second. The LED flashes 6 x orange after preset completion.
	constantly on	The output signal of analog output 2 is set to 50% of the measuring range. Example: Measuring range = 0 … 10V -> Output after preset = 5V The device is in normal operation again.

Table 12

6.2 Scaling the analog measuring range

** The switching points of the optional switching outputs are adapted to the new scaled analog measuring range if they have not been already taught by the user!

1-dimensional inclinometer

Scale the measuring range within 0 … 360º

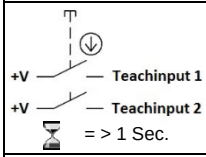
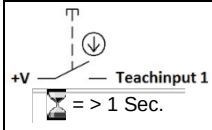
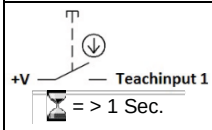
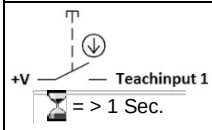
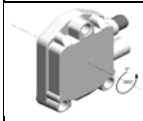
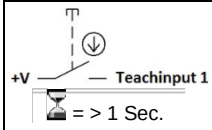
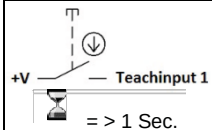
Action	RGB LED	Description
Initial state: Device in normal operation	constantly on	The device is in normal operation and in factory setting.
	> > >	Apply +V at teach inputs 1 & 2 for > 1sec. The device is switched to programming mode. This is indicated by the repeated LED flashing sequence **Orange » Violet » Blue**.
	> >	Apply +V at teach input 1 for > 1sec. The device is switched to scaling mode. This is indicated by the repeated LED flashing sequence **Orange » Violet**.
	> >	Apply +V at teach input 1 for > 1sec. The device is switched to the scaling mode.of the analog measuring range. The LED flashes orange.
	> >	Apply +V at teach input 1 for > 1sec. The measuring axis to be scaled is selected. This is indicated by the repeated LED flashing sequence **Green » Orange**.
		Position the inclinometer at the starting position of the required measuring range.
	6 x	Apply +V at teach input 1 for > 1sec. The starting position of the required measuring range is saved. The LED flashes 6 x green after successful saving of the starting position.
		Move the inclinometer **in the positive direction** to the end position of the required measuring range.
	6 x	Apply +V at teach input 1 for > 1sec. The end position of the required measuring range is saved. The new measuring range is calculated and set. The LED flashes 6 x green after successful saving of the end position.
	6 x	In case of an error, the LED flashes 6 x red. The desired measuring range cannot be saved. The device returns to the normal mode with the factory settings.
Initial state: Device in normal operation	constantly on	The device is in normal operation again. The new measuring range is set and permanently stored in the device.

Table 13

2-dimensional inclinometer

Measuring range X axis within +/- 85º

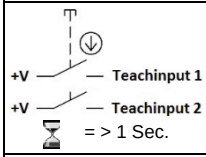
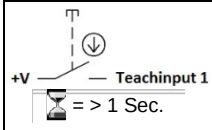
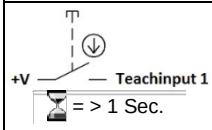
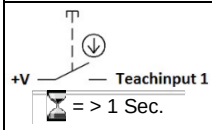
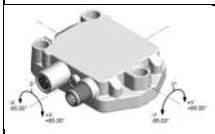
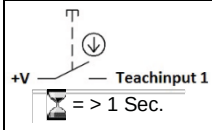
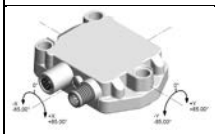
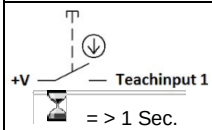
Action	RGB LED	Description
Initial state: Device in normal operation	● constantly on	The device is in normal operation and in factory setting.
	● ● ●	Apply +V at teach inputs 1 & 2 for > 1sec. The device is switched to programming mode. This is indicated by the repeated LED flashing sequence **Orange » Violet » Blue**.
	● ●	Apply +V at teach input 1 for > 1sec. The device is switched to scaling mode. This is indicated by the repeated LED flashing sequence **Orange » Violet**.
	● ●	Apply +V at teach input 1 for > 1sec. The device is switched to the scaling mode.of the analog measuring range. The LED flashes **Orange**.
	● ●	Apply +V at teach input 1 for > 1sec. The measuring axis X to be scaled is selected. This is indicated by the repeated LED flashing sequence **Green » Orange**.
		Position the X axis of the inclinometer at the reference position of the required measuring range. This position is saved as 0° and 50% of the output signal is assigned to analog output 1. You are now positioned at the center of the required measuring range. Example: Measuring range = 0 … 10V ➔ Output = 5V ➔ Position = 0°
	● ● 6 x	Apply +V at teach input 1 for > 1sec. The reference position of the required measuring range is saved. The LED flashes 6 x green after successful saving of the reference position.
		Position the X axis of the inclinometer at the end position of the required measuring range.
	● ● 6 x	Apply +V at teach input 1 for > 1sec. The end position of the required measuring range is saved. The new measuring range is calculated and set. The LED flashes 6 x green after successful saving of the end position.
	● ● 6 x	In case of an error, the LED flashes 6 x red. The desired measuring range cannot be saved. The device returns to the normal mode with the factory settings.
Initial state: Device in normal operation	● constantly on	The device is in normal operation again. The new measuring range is set and permanently stored in the device.

Table 14

Measuring range Y axis within +/- 85º

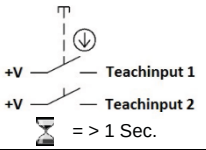
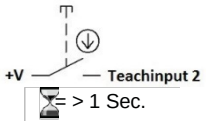
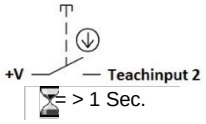
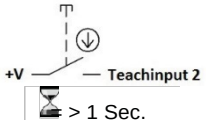
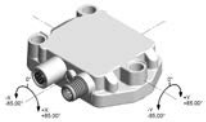
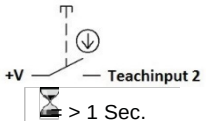
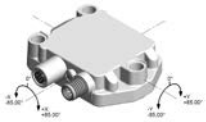
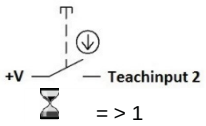
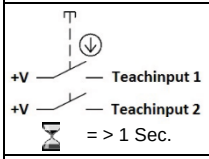
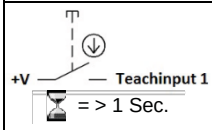
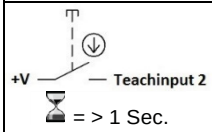
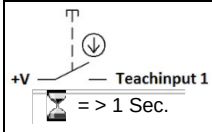
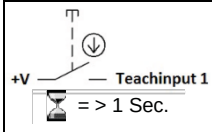
Action	RGB LED	Description
Initial state: Device in normal operation	● constantly on	The device is in normal operation and in factory setting.
	● ● ●	Apply +V at teach inputs 1 & 2 for > 1sec. The device is switched to programming mode. This is indicated by the repeated LED flashing sequence **Orange » Violet » Blue**.
	● ●	Apply +V at teach input 1 for > 1sec. The device is switched to scaling mode. This is indicated by the repeated LED flashing sequence **Orange » Violet**.
	● ●	Apply +V at teach input 1 for > 1sec. The device is switched to the scaling mode.of the analog measuring range. The LED flashes **Orange**.
	● ●	Apply +V at teach input 2 for > 1sec. The measuring axis Y to be scaled is selected. This is indicated by the repeated LED flashing sequence **Red » Orange**.
		Position the Y axis of the inclinometer at the reference position of the required measuring range. This position is saved as 0° and 50% of the output signal is assigned to analog output 2. You are now positioned at the center of the required measuring range. Example: Measuring range = 0 … 10V ➔ Output = 5V ➔ Position = 0°
	● ● 6 x	Apply +V at teach input 2 for > 1sec. The reference position of the required measuring range is saved. The LED flashes 6 x green after successful saving of the reference position.
		Position the Y axis of the inclinometer at the end position of the required measuring range.
	● ● 6 x	Apply +V at teach input 2 for > 1sec. The end position of the required measuring range is saved. The new measuring range is calculated and set. The LED flashes 6 x green after successful saving of the end position.
	● ● 6 x	In case of an error, the LED flashes 6 x red. The desired measuring range cannot be saved. The device returns to the normal mode with the factory settings.
Initial state: Device in normal operation	● constantly on	The device is in normal operation again. The new measuring range is set and permanently stored in the device.

Table 15

6.3 Setting the switching outputs

1-dimensional inclinometer

Setting the switching outputs 1 & 2 within 0 … 360º

Action	RGB LED	Description
Initial state: Device in normal operation, axis Y <= +/-15°	● constantly on	The device is in normal operation and in factory setting.
	● ● ●	Apply +V at teach inputs 1 & 2 for > 1sec. The device is switched to programming mode. This is indicated by the repeated LED flashing sequence **Orange » Violet » Blue**.
	● ●	Apply +V at teach input 1 for > 1sec. The device is switched to scaling mode. This is indicated by the repeated LED flashing sequence **Orange » Violet**.
	● ●	Apply +V at teach input 2 for > 1sec. The device is switched to the switching output setting mode. The LED flashes **Violet**.
	● ●	Apply +V at teach input 1 for > 1sec. Switching output 1 for measuring axis X is selected. This is indicated by the repeated LED flashing sequence **Green » Violet**.
		Position the inclinometer at the position where switching output 1 must be activated when the actual position falls below this position.
	● ● 6 x	Apply +V at teach input 1 for > 1sec. The switching position for switching output 1 is saved. The LED flashes 6 x green after successful saving of the switching position.
		Move the inclinometer **in the positive direction** to the position where switching output 2 must be activated when the actual position exceeds this position.

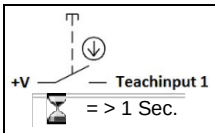
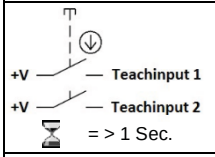
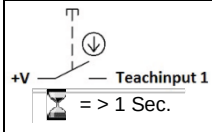
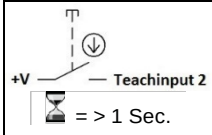
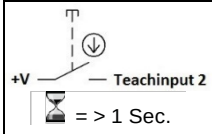
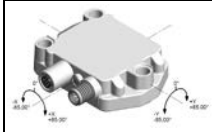
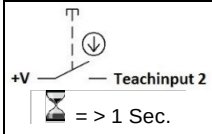
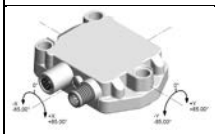
	6 x	Apply +V at teach input 1 for > 1sec. The switching position for switching output 2 is saved. The LED flashes 6 x green after successful saving of the switching position.
	6 x	In case of an error, the LED flashes 6 x red. The defined switching positions cannot be saved. The device returns to the normal mode with the factory settings.
Initial state: Device in normal operation	constantly on	The device is in normal operation again. The new switching positions are set and permanently stored in the device.

Table 16

2-dimensional inclinometer

Setting switching output 2 for the Y-axis within +/- 85º

Action	RGB LED	Description
Initial state: Device in normal operation	constantly on	The device is in normal operation and in factory setting.
		Apply +V at teach inputs 1 & 2 for > 1sec. The device is switched to programming mode. This is indicated by the repeated LED flashing sequence **Orange** » **Violet** » **Blue**.
		Apply +V at teach input 1 for > 1sec. The device is switched to scaling mode. This is indicated by the repeated LED flashing sequence **Orange** » **Violet**.
		Apply +V at teach input 2 for > 1sec. The device is switched to the switching output setting mode. The LED flashes **Violet**.
		Apply +V at teach input 2 for > 1sec. Switching output 2 for measuring axis Y is selected. This is indicated by the repeated LED flashing sequence **Red** » **Violet**.
		Position the Y-axis of the inclinometer at the position where switching output 2 must be activated when the actual position falls below this position.
	6 x	Apply +V at teach input 2 for > 1sec. The switching position for switching output 2 is saved. The LED flashes 6 x green after successful saving of the switching position.
		Move the Y-axis of the inclinometer to the position where switching output 2 must be activated when the actual position exceeds this position.

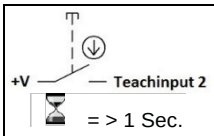
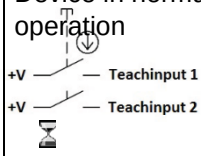
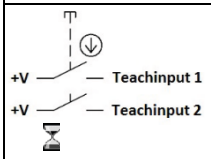
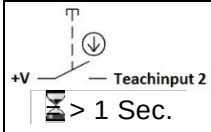
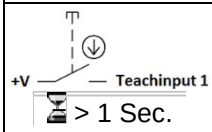
	6 x	Apply +V at teach input 2 for > 1sec. The switching position for switching output 2 is saved. The LED flashes 6 x green after successful saving of the switching position.
	6 x	In case of an error, the LED flashes 6 x in red. The defined switching positions cannot be saved. The device returns to the normal mode with the factory settings.
Initial state: Device in normal operation	constantly on	The device is in normal operation again. The new switching positions are set and permanently stored in the device.

Table 17

6.4 Setting of the sensor filter

Action	RGB LED	Description
Initial state: Device in normal operation 	constantly on	The device is in normal operation and in factory setting.
 = > 1 Sec.		Apply +V at teach inputs 1 & 2 for > 1sec. The device is switched to programming mode. This is indicated by the repeated LED flashing sequence **Orange** » **Violet** » **Blue**.
 > 1 Sec.		Apply +V at teach input 2 for > 1sec. The device is switched to the sensor filter setting mode. The **Blue** flashing of the LED shows the filter level currently set. **Constantly on**= Filter off **1 x flashing** = 0.1 Hz **2 x flashing** = 0.3 Hz **3 x flashing** = 0.5 Hz **4 x flashing** = 1.0 Hz **5 x flashing** = 2.0 Hz **6 x flashing** = 5.0 Hz **7 x flashing** = 10.0 Hz
 > 1 Sec.	6 x	**Filter level increment** Apply +V at teach input 1 for > 1sec. Filter level is increased by 1. The input is confirmed by 6 x **Green** flashing of the LED.

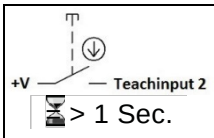
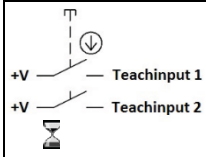
	6 x	**Filter level decrement** Apply +V at teach input 2 for > 1sec. Filter level is decreased by -1. The input is confirmed by 6 x **Green** flashing of the LED.
		**Save filter level** Apply +V at teach inputs 1 & 2 for > 1sec. The set filter level is permanently stored in the device.
Initial state: Device in normal operation	constantly on	The device is in normal operation again.

Table 18

6.5 Resetting to factory settings

** The following settings are reset:

- Scaling of the analog measuring range of the measuring axes
- Switching outputs
- Sensor filter ➔ 10.0 Hz

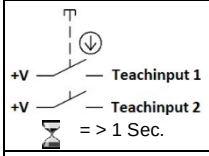
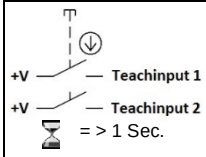
Action	RGB LED	Description
Initial state: Device in normal operation	constantly on	The device is in normal operation and in factory setting.
		Apply +V at teach inputs 1 & 2 for > 1sec. The device is switched to programming mode. This is indicated by the repeated LED flashing sequence **Orange** » **Violet** » **Blue**.
	1 x	Apply +V at teach inputs 1 & 2 for > 10sec. After 10 seconds, the device is reset to factory setting. This is indicated by the repeated LED flashing sequence **Red** » **Green** » **Blue**.

Table 19

7. Sensor filter

Filter description 1st order:

In electronics, low-pass filters are filters that let pass signal portions with frequencies lower than their limit frequency almost without attenuation and attenuate signal portions with higher frequencies.

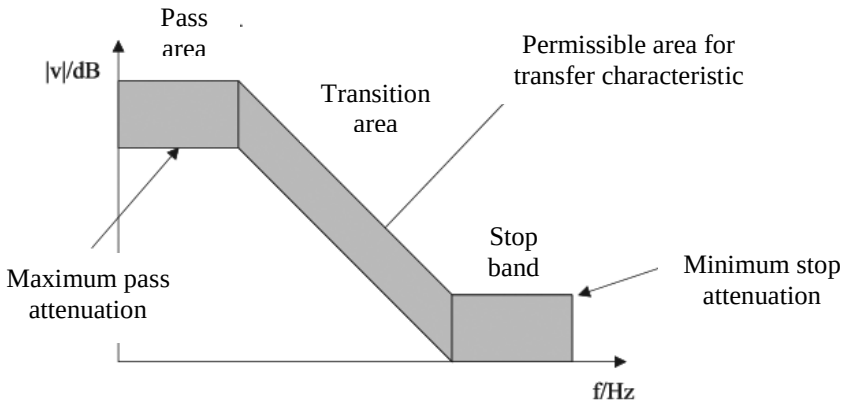


Figure 8

Setting possibilities: Filter on/off

Filter operating frequency b: **defines the starting point of the stop band (area 0.1 … 10.0 Hz)**

Filter description 2nd order:

An IIR filter is generally realized with the help of 2nd order subsystems in direct form.

The following picture shows the corresponding block diagram. A subsystem consists of 2 delay elements or memory elements that contain the intermediate values w0(n), as well as of the two coefficients a01, a02 in the recursive portion and the three coefficients b00, b01 and b02.

Functioning

The second index (j) is used for differentiation in case of several subsystems. A subsystem is described by equations, see below. The device uses 4 2nd order subsystems, resulting in an 8th order Butterworth filter.

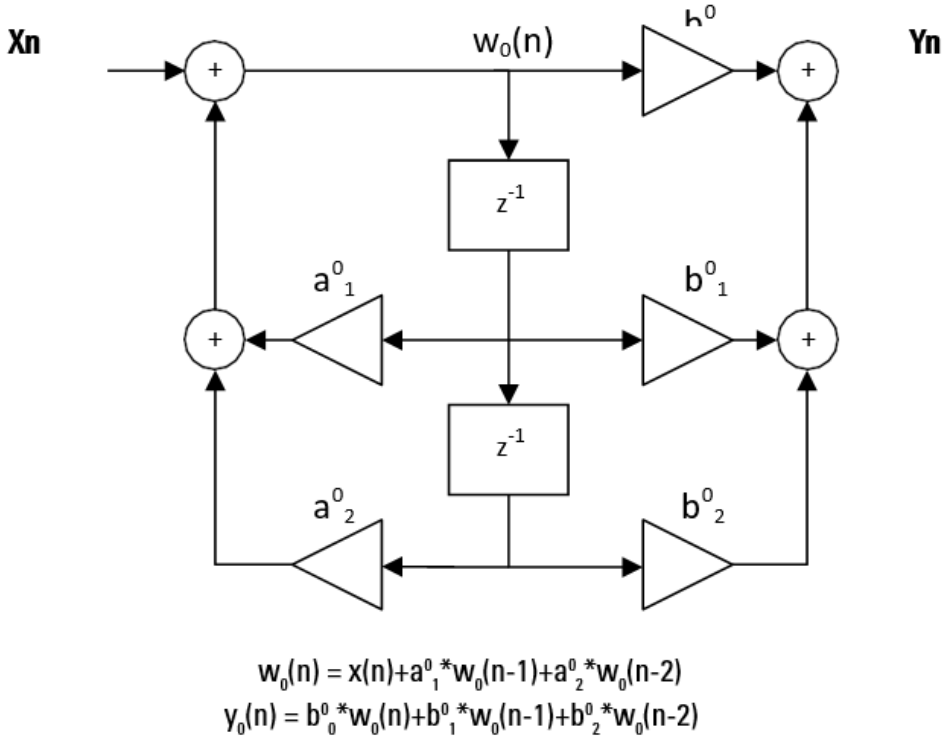


Figure 9

X_n is here the input signal, Y_n is the filter output and simultaneously the input of another subsystem.

8. Preset function restriction for the 2-dimensional inclinometer

Due to the limitation of the max. measuring range to +/- 85.00°, no preset function is available for a measuring range of > +/-70.00°.

If a measuring range < +/- 70,00° is selected, the factory setting of the preset within +/- 15,00° is possible once.

If the user scales a new analog measuring range, no preset will be possible any more.

9. Timeout in programming mode

If the inclinometer is switched to programming mode by actuating teach inputs 1 & 2 but no further function is selected, the inclinometer returns automatically to normal operation after 60 seconds.

The inclinometer can also be switched back to normal operation by switching the supply voltage off and on again.

10. Scaling behavior of the analog measuring range of the 1-dimensional inclinometer

In the 1-dimensional inclinometer, the direction of movement of the measuring axis during the scaling process of a new analog measuring range is crucial.

The lowest analog measurement value is always assigned to the defined starting position (example 0 … 10V ➔ 0V). The highest analog measurement value is always assigned to the defined end position (example 0 … 10V ➔ 10V).

The new scaled measuring range is always calculated in the positive direction of movement.

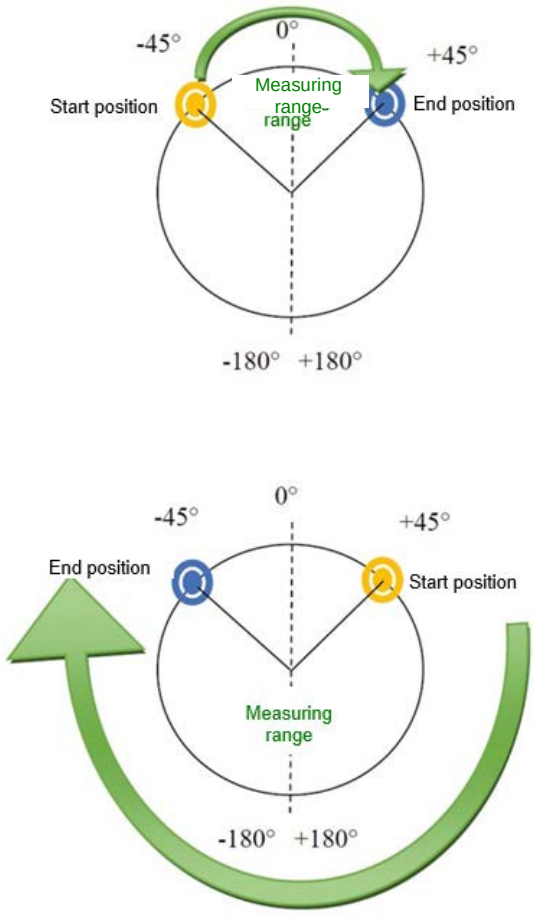
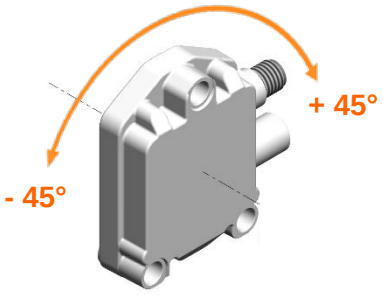


Figure 10

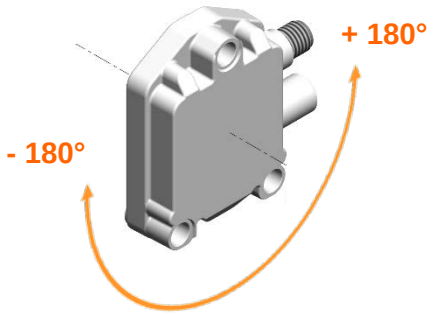
Example: +/- 45° - 0-10V

-45°	=	0V
0°	=	5V
+45°	=	10V



Example: +/- 135° - 0-10V

+45°	=	0V
+/- 180°	=	5V
-45°	=	10V



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