

INSTALLATION GUIDE

Inclination Sensors Series NGK

For further information please see the data sheet at
[LINK](#)

FIRST STEPS

WayCon Positionsmesstechnik GmbH would like to thank you for the trust you have placed in us and our products. This manual will make you familiar with the installation and operation of our draw wire sensors. Please read this manual carefully before initial operation!

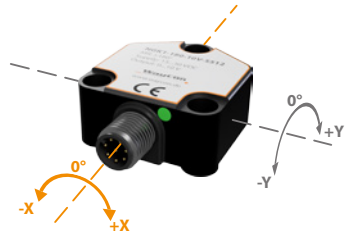
Unpacking and checking:

Carefully lift the device out of the box by grabbing the housing. After unpacking the device, check it for any visible damage as a result of rough handling during the shipment. Check the delivery for completeness.

If necessary consult the transportation company, or contact WayCon directly for further assistance.

MOUNTING OF THE SENSOR

- The sensors must be mounted in a vertical (1-axis) or horizontal (2-axis) orientation, depending on the sensor type.



- Depending on the application, multiple sensors can be mounted close together to provide redundant measurements. Multiple sensors do not interfere with each other's measurements.

Step-by-Step Mounting Instructions

- Clean the mounting surface and the surrounding area.
- Place the device with the potting side facing down on a flat surface so that the potting compound is covered.
- Secure the tilt sensor with three screws. 1-axis sensors must be mounted vertically, and 2-axis sensors horizontally (see illustration above). Use a maximum tightening torque of 3 Nm.
- 2-axis sensors can be mounted upside down. After mounting the sensor upside down, perform a "centre point teach."

ELECTRICAL CONNECTION

General Notes

- Always disconnect the power supply and secure it against being switched back on before connecting or disconnecting the signal cable. Failure to do so may damage the sensor.
- Please note that the entire system must be free of voltage during electrical installation.
- Before start-up, connect all required cable wires and connectors. Insulate all unused ends of the output signals individually to prevent short circuits. The sensor may be damaged or destroyed by electrostatic discharges at the contacts of the connector or the cable ends. Take appropriate precautions!
- Always install all cables with strain relief.
- The sensor is not designed to be connected to a local DC power supply or battery connection cable with a length of 30 meters or more.
- Route all cables so that they are not under tension, ensuring that no additional force is applied to the inclination sensor. Be sure to observe the minimum bending radius for the connection cable.
- When wiring the system, ensure that the cables are routed properly:
 - Divide the cabling into groups such as motor and power supply cables, as well as signal and data cables.
 - Route signal and data cables as close as possible to ground surfaces (support beams, metal rails, cabinet panels) and avoid running them parallel to motor and power supply cables or other cables with high levels of interference.
 - Do not connect any other devices that generate high levels of interference (e.g., frequency converters, solenoid valves, contactors) to the sensor's power supply.

EMC-compliant installation

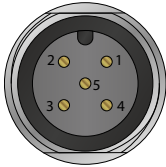
- Install the cable shield over a large area (ideally 360°). Use a shield clamp, for example.
- Make sure the cable shields are securely fastened.
- Ideally, connect the shield to the protective earth (PE) with low impedance on both sides, e.g., at the sensor and/or at the evaluation unit. If there are potential differences, the shield must be connected on only one side.
- If shielding is not possible, take appropriate filtering measures.
- Make sure that no short-term overvoltages can occur on signal and power supply lines if the protective ground is connected to the shield on only one side.
- For a large-area connection of the cable shield, use the NGK-EMV shield clamp designed for this purpose. It can be easily mounted on the top-hat rail.

Connecting the wires

- When assembling the sensor cable, ensure that adequate ESD protection is provided.
- Before connecting the wires, make sure you know the pin assignments for each wire.
- After connecting the device, check that the power supply is properly connected and that the device is functioning correctly.
- If the power supply polarity is reversed, the inclination sensor will not function.

ELECTRICAL CONNECTION

Function Version 1 Axis	Function Version 2 Axes	Cable output	Connector output	Connection cable K5P...
+V	+V	BN	1	BN
Signal _{Inverse}	Signal _{Y-Axis}	GY	2	WH
GND _{Supply}	GND _{Supply}	WH	3	BU
Signal	Signal _{X-Axis}	GN	4	BK
Teach	Teach	BU	5	GY



PARAMETRIZING

Parameter	Meaning
Restore condition on delivery	With the "Factory Reset" function the device is reset to its condition on delivery. After restoring, the device is restarted. Communication is interrupted.
Teach function via NGK-Teach	The teach function via NGK-Teach can be enabled or disabled using this parameter. The function is enabled by default.
Analog output	The analog output (current or voltage output) is factory-set depending on the order code.
Set the starting point	The current angle of inclination can be set as the starting point of the output characteristic curve. For 1- and 2-axis sensors, this function can be used to set a measurement range different from the factory default.
Set the midpoint	The Preset Mode function allows you to set the current inclination as the new centre of the measurement range. For 2-axis devices, the taught centre of the measurement range must not deviate from the physical zero point by more than $\pm 15^\circ$. Accuracy at the edges of the measurement range decreases depending on the magnitude of the zero-point offset. Presetting is not possible outside the $\pm 15^\circ$ range!
Set the end point	The endpoint of the output characteristic curve can be set by entering an angle.
Filter	Different filters can be set for the static inclination sensors.

MANUAL PARAMETRISATION

Activating the teach mode

Connect pin 5 (Teach) to pin 1 (+V) before switching on the supply voltage.

-> Teach mode is now active.

Now undo the connection again.

Caution external voltages!

Make sure that no external voltage is applied to the sensor, as this can damage it.

- The teach mode is active when the LED flashes briefly (700 ms / 100 ms).
- The teach mode will automatically be exited after 60 seconds of inactivity.
- Please refer to the corresponding flowchart for a detailed description of the procedure.
- To select the desired modes, connect pin 5 and pin 1 again for the specified time.

FILTER

The inclination sensors use a micro-electromechanical system (MEMS) accelerometer to determine angles and output angles relative to the measurement axis or axes. Due to the inertia of the accelerometer, particularly during rapid or rapidly changing rotations, as well as during vibrations, the measured data may deviate from the actual motion. To compensate for these undesirable effects, various filters can be configured in the tilt sensor.

Parameters for static inclinometers

Filter off (factory setting)

1 = 0.1 Hz

2 = 0.3 Hz

3 = 0.5 Hz

4 = 1 Hz

5 = 2 Hz

6 = 5 Hz

7 = 10 Hz

Restrictions due to filters

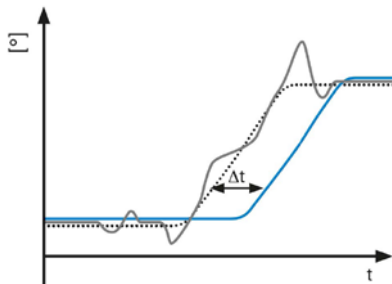
Filtering always results in time delay Δt_d between the measurement and output. The stronger the filtering (i.e., the lower the threshold frequency) the greater this delay.

A weak filter (e.g., 10 Hz threshold frequency) reacts quickly to movements and is suitable for dynamic applications with fast movements. However, fast interference accelerations are attenuated less, which can lead to a more unsteady signal. Repeating fast movements can easily falsify the mean value.

A strong filter (e.g., 0.1 Hz threshold frequency) smooths the signal significantly and effectively suppresses interference accelerations. It is especially suited to applications with slow, precise movements; however, it reacts to rapid position changes with a delay. Repeated movements barely impact the mean value and do not result in a drift.

Fast measurement

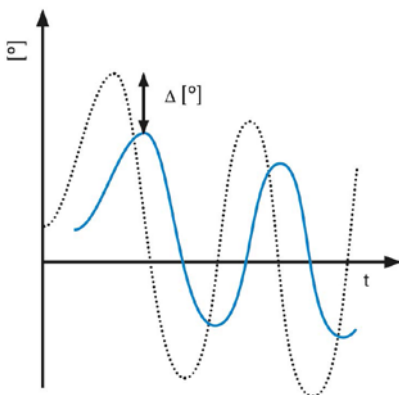
Inaccuracies due to the sluggishness of the testing mass can be compensated for with filters during the acceleration measurement. However, this results in a time delay Δt for the output of the measurement results. Sensor fusion minimizes this time delay.



Acceleration measuring cell (static)

Precise measurement

Sensor fusion provides more precise measurement results for rapid changes of direction.



Acceleration measuring cell (static)

- Actual movement
- Acceleration measurement recorded data
- Filtered measurement results of the acceleration measurement

FUNCTION AND STATUS LED

LED Display in Normal Operation

Display	LED	Meaning	Note
LED off		Device is not supplied with voltage	
Permanent green		Normal operation	
Red flashing		System error	Contact Service

LED Display for Preset

Display	LED	Meaning	Note
Green flashing 6 times	 6x	Preset performed successfully for measurement axis 1	See "Preset Mode" flowchart
Red flashing 6 times	 6x	Preset NOT successful	Preset outside the permissible measuring range

LED Display in Programming Mode

Display	LED	Meaning	Note
Orange > Purple > repeating sequence		You are in programming mode	See "Programming Mode" flowchart
Red > Green > Blue single sequence		The device is being reset to factory setting	
Orange flashing		You are in the scaling mode of the analog measurement range	
Green permanently		User input terminated, you are in Normal Operation Mode	Example, time exceeded in the teach process. Try again!

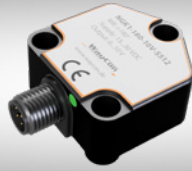
LED Display in Scaling Mode Analog Measurement Range

Display	LED	Meaning	Note
Green > Orange repeating sequence		You have selected 1 measurement axis in order to scale its analog measurement range.	Available with inclinometer with 1 measurement axis = Z axis or 2 measurement axes = X axis
Red > Orange repeating sequence		You have selected 2 measurement axes in order to scale their analog measurement range.	Only available for inclinometer with 2 measurement axes.
Green flashing 6 times	 6x	User entry through teach input detected and successfully performed	
Red flashing 6 times	 6x	User entry through teach input rejected!	Example, selected measuring range too small

FUNCTION AND STATUS LED

LED Display in Sensor Filter Setting Mode

Display	LED	Meaning	Note
Blue permanently		Sensor filter = OFF	
Blue flashes 1 times	  1x	Actual status: Sensor filter 1 = 0.1 Hz	
Blue flashes 2 times	  2x	Actual status: Sensor filter 2 = 0.3 Hz	
Blue flashes 3 times	  3x	Actual status: Sensor filter 3 = 0.5 Hz	
Blue flashes 4 times	  4x	Actual status: Sensor filter 4 = 1 Hz	
Blue flashes 5 times	  5x	Actual status: Sensor filter 5 = 2 Hz	
Blue flashes 6 times	  6x	Actual status: Sensor filter 6 = 5 Hz	
Blue flashes 7 times	  7x	Actual status: Sensor filter 7 = 10 Hz	
Green flashing 6 times	  6x	User entry through teach input detected and successfully performed	Filter changed through Up or Down or Change successfully saved
Red flashing 6 times	  6x	User entry through teach input rejected!	Example, too small measurement range selected



MAINTENANCE

In harsh environments, we recommend inspecting for secure seating and possible damage on a regular basis.

If there are questions or when ordering spare parts, have ready the data printed on the device type plate, including the serial number.

Before starting work

- Switch off the power supply and secure it against being switched on again.
- Then physically disconnect the power supply lines.
- Remove operating and auxiliary materials and residual processing materials the inclinometer's.

DISPOSAL

Please always dispose of defective or irreparable appliances in an environmentally friendly manner and in accordance with the applicable legal provisions and disposal regulations. If required, we will be happy to assist you with environmentally friendly disposal.

Caution: Incorrect disposal can cause environmental damage!

Certain components such as electrical waste, electronic components, lubricants and other auxiliary materials must be disposed of as hazardous waste.

Please note that hazardous materials may only be disposed of by authorized specialist companies.

Dismantled components should be disposed of as follows:

- Metal components with scrap metal
- Electronic components with electronic waste
- Plastic parts at the recycling centre
- Other components must be sorted and disposed of according to their material properties