R60114.0002 - 01

English

Operation Manual

Inclinometers
IN68 / IN78

IO-Link

pulses for automation

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1 Document

This is the English translation of the original operation manual in German language.

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Legal Notices

2 General Information

Please read this document carefully before working with the product, mounting it or starting it up.

These operating instructions guide the technical personnel of the machine and plant manufacturer or operator for safe assembly, installation, commissioning and operation of the product.

2.1 Target Group

The device may only be planned, mounted, commissioned and serviced by persons having the following qualifications and fulfilling the following conditions:

- Technical training.
- Briefing in the relevant safety guidelines.
- Constant access to this documentation.

2.2 Symbols used / Classification of the Warnings and Safety instructions

⚠ DANGER	**Classification:** This symbol, together with the signal word **DANGER**, warns against immediately imminent threat to life and health of persons. The non-compliance with this safety instruction will lead to death or severe adverse health effects.
⚠ WARNING	**Classification:** This symbol, together with the signal word **WARNING**, warns against a potential danger to life and health of persons. The non-compliance with this safety instruction may lead to death or severe adverse health effects.
⚠ CAUTION	**Classification:** This symbol, together with the signal word **CAUTION**, warns against a potential danger for the health of persons. The non-compliance with this safety instruction may lead to slight or minor adverse health effects.
ATTENTION	**Classification:** The non-compliance with the **ATTENTION** note may lead to material damage.

NOTICE	Classification: Additional information relating to the operation of the product, and hints and recommendations for efficient and trouble-free operation.

2.3 Preliminary Remark

The following basic safety instructions are intended to avoid personal injuries and damage to property; they relate primarily to the use of the products described herein. If you additionally use further components, also consider their warnings and safety instructions.

2.4 Feedback

We endeavor to make these instructions as informative and clear as possible. If you have any suggestions or are missing information in the instructions, please send your feedback to: support@kuebler.com.

2.5 Transport / Storage

Check the delivery immediately upon receipt for possible transport damages. If you do not mount the device immediately, store it preferably in its transport package.

The device must be stored at a dry and dust-free location, in compliance with the technical data, see chapter Technical Data [▷ 10].

2.6 Use According to the Intended Purpose

The inclinometer can be used as a measuring system for the acquisition of the inclination or rotation angle.

The device may only be operated as described in these instructions. Any other use is considered as non compliant with the intended use.

The measuring system and its evaluation unit must meet the requirements mentioned in chapter Technical Data [▷ 10].

2.7 Foreseeable Misuse

The inclinometer is not suitable for the following uses:

- Under water.
- In publicly accessible areas.
- Outside the product specification.
- These devices are not safety components; they may not be used for personal or property protection.

2.8 Other Applicable Documents

NOTICE	**Technical Data**
	All technical data, as well as the mechanical and electrical characteristics, are specified in the data sheets of the corresponding device variant, for special versions in the.corresponding quotation / customer drawing of the product.

All documents such as the original declarations of conformity or the relevant certificates can be downloaded from our homepage:

www.kuebler.com/de/docu-finder

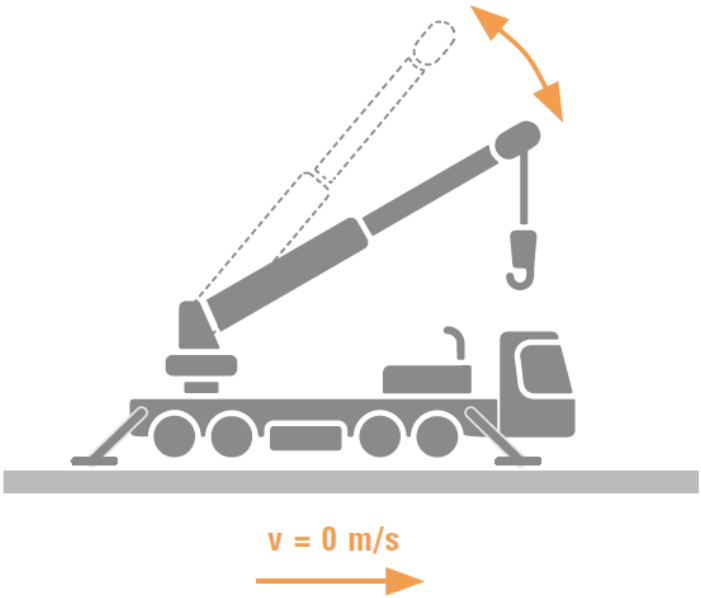
3 Product Description

3.1 Function of an Inclinometer

An inclinometer is a measuring device intended for the acquisition of the inclination angle. The sensor establishes an exact reference to the vertical direction. The gravity of earth is used as the reference. Any angular change is detected by the measuring cell. The measured angle is converted into electrical signals and output in various formats.

Static Inclinometers (IN6x)

The inclinometers use an acceleration measuring cell (MEMS) to determine the angle and output this angle according to the measuring axis or axes.



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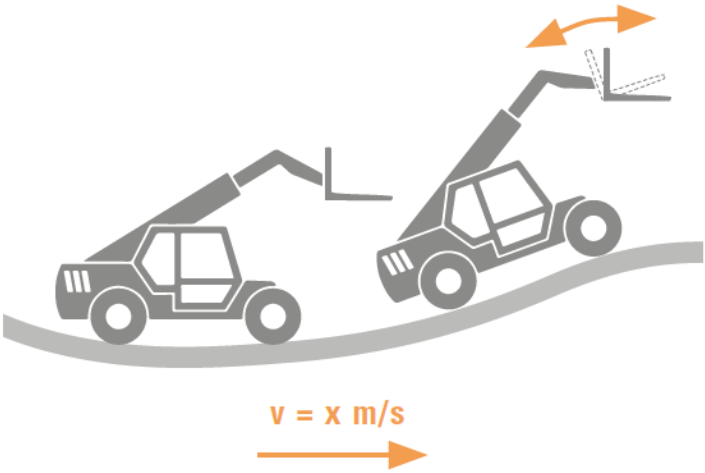
The signal is processed and linearized. Integrated filters may be used for smoothing, so as to output an angle.

In many static applications (such as e.g. solar panels, crane masts...) a pure filter function is sufficient, since a time delay of the signal is not relevant. However, in dynamic applications (e.g. vehicles in motion), this can lead to problems, as a reaction to the movement can only occur with a delay. It is then advisable to use a dynamic inclinometer with intelligent sensor fusion from Kübler, for further optimization of the measurement result.

Dynamic Inclinometers (IN7x)

The dynamic inclinometers use an acceleration measuring cell (MEMS) and a rotary rate measuring cell (gyroscope) to determine the angle.



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These devices output the angles according to the measuring axis or to the measuring axes. A fusion algorithm uses the acceleration values and the rotary rates to calculate the inclination angle. The filters minimize the influence of vibrations and other interferences, the fusion algorithm optimizes the speed and the accuracy of the output signal. Therefore, the sensor can output a stable signal even in dynamic applications.

Temperature acquisition

The temperature is measured by means of an integrated temperature measuring cell. Different electrical operating conditions in the sensor can lead to deviations of the measured temperature from the ambient temperature. The temperature value is output via the acyclic data.

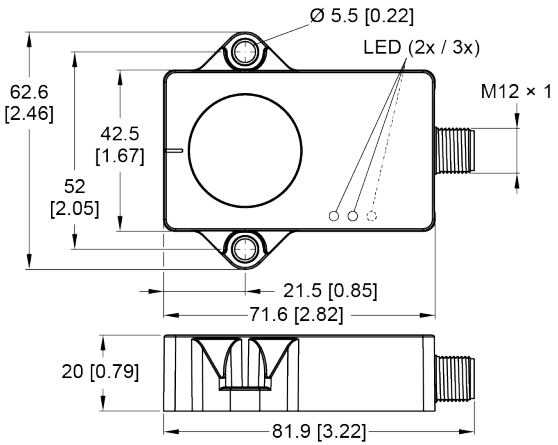
3.2 Devices Overview

The inclinometers IN6x / IN7x are equipped with an M12 connector for connecting the sensor cable. The housing is made of plastic and is entirely encapsulated.

- Angle acquisition
  - 1-axes devices: 0…360°, resolution 0.01°
  - 2-axes devices: ±85°, resolution 0.01°
- Temperature acquisition: -40…+85°C, resolution 1°
- High protection level:IP68 / IP69K
- The sensors are protected against temperature fluctuations.
- The functions of the device can be set via the IO-Link interface.
- The functions of the device can be set by means of an FDT framework (e.g. PACTware).
- The devices have a spirit level function.

The dynamic inclinometers IN7x have in addition the following features:

- Gyroscope sensor



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3.2.1 LED Display Elements

The 1-axis devices have a green and a yellow LED.

- The green LED indicates the operating voltage and the device status.
- The yellow LED lights up when the spirit level function is enabled.

The 2-axes devices have a green and two yellow LEDs.

- The green LED indicates the operating voltage and the device status.
- The yellow LEDs light up when the spirit level function is enabled.

A further description of the flashing patterns can be found in chapter Status LED [▷ 17].

3.3 Technical Data

NOTICE	**Technical Data** All technical data, as well as the mechanical and electrical characteristics, are specified in the data sheets of the corresponding device variant, for special versions in the.corresponding quotation / customer drawing of the product.
NOTICE	**Observe the configuration** The performance characteristics and the mechanical design of the product depend on the selected configuration (according to order code).

3.3.1 General

EMC - Electromagnetic Compatibility

Relevant standards	EN 61326-2-3:2013

UL - Underwriters Laboratories

UL approval	File no. E539414
Relevant standards	UL 61010-1
	Indoor use, outdoor use possible, not designed for direct UV radiation.
Maximum air humidity	93 %, 40°C [104°F]
Environment	Dry / Wet

3.3.2 Product conformity

The product meets the following criteria:

- UL approval for the North American economic area.
- Compliance with the European Directives:
  - EMC: Directive 2014/30/EU
  - RoHS: Directive 2011/65/EU

The declaration of conformity and all certificates relating to the product can be found on the homepage.

www.kuebler.com/de/docu-finder

4 Installation

4.1 Mechanical Installation

ATTENTION	**Damage to the device due to transport or storage**
	Device failure, malfunction, device lifetime reduction. • Check the packaging and the device for possible damages. • In the event of visible damages, do not use the device and do not put it into operation. • Do not install the device after falling or being dropped. • Send damaged encoders back to the manufacturer with a completed return form (RMA).

4.1.1 General Information for the Mounting of Inclinometers

NOTICE	**Do not disassemble or open the inclinometer**
	Inclinometer function may be lost partly or entirely. • In no case disassemble the inclinometer entirely or partly. • Do not modify the inclinometer.

NOTICE	**Do not expose the device to impact stress.**
	This would impair inclinometer accuracy and MEMS reliability. • Do not use a hammer to align the inclinometer. • Avoid impact stress.

4.1.2 Mounting Instructions for Inclinometers

Depending on the sensor type, the sensors must be mounted vertically (1-axis) or horizontally (2-axes).

Depending on the application, multiple sensors can be mounted without distance from each other for a redundant measurement. Multiple sensors do not influence the angle detection among each other.

4.1.3 Cable routing

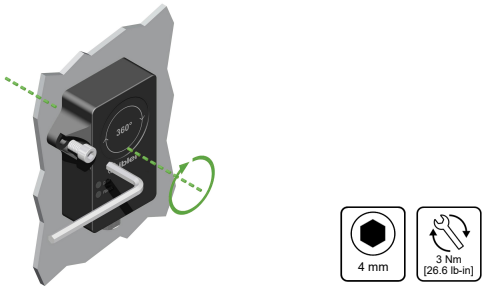
NOTICE	**Cable routing**
	Route all lines free of any tension, so that no additional force is applied on the inclinometer . Consider the minimum bending radii of the connection line. Comply with the instructions in chapter Information for EMC-Compliant Installation [▶ 14].

Wiring

When wiring the facility, pay attention to proper cable routing.

- Separate the wiring into power groups such as motor/power supply lines and signal and data lines.
- Route the signal and data lines as close as possible to ground surfaces (frames, metal rails, cabinet sides) and not parallel to motor and power supply lines or other lines carrying high interference levels.
- Do not connect other users with high interference levels (such as frequency converters, solenoid valves, contactors) to the power supply of the device.

4.1.4 Step-by-Step Installation



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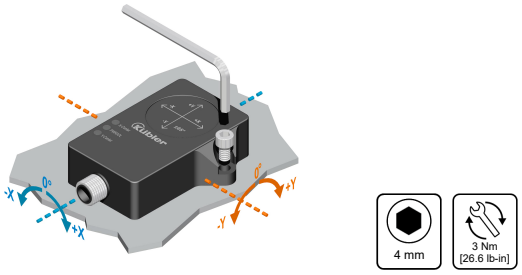

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a) Clean the mounting surface and the mounting environment.

b) Position the device with the encapsulated side on a flat surface so that the encapsulation compound is covered.

c) Fasten the device with two screws.

d) After the overhead installation of 2-axes sensors: teach the center point.

When replacing an IS40 inclinometer, Kübler offers an adapter plate with suitable drilling pattern to allow using the existing fastening holes (order code: 8.0010.4066.0000).

4.2 Electrical Installation

4.2.1 General Information for the Connection

ATTENTION	**Destruction of the device** Before connecting or disconnecting the signal cable, always disconnect the power supply and secure it against switching on again.
NOTICE	**General safety instructions** Make sure that the entire system is in a de-energized state during electrical installation.
NOTICE	**Other operating instructions applicable for the installation** To connect the device, refer to the corresponding operating and safety instructions of the external drive system / evaluation system / control. When assembling a mating connector, comply with the instructions attached to the connector.
NOTICE	**No open cable wires** Connect all required cable wires / connectors before commissioning. Insulate individually all unused ends of the output signals to avoid short-circuits. • Electrostatic discharges at the contacts of the connector or at the line ends could damage or destroy the device. Take appropriate precautionary measures.
NOTICE	**Traction relief** Always mount all lines with traction relief.

4.2.2 Information for EMC-Compliant Installation

Requirements for cables

a) Use exclusively shielded twisted-pair cables to connect the device.

b) Comply with the maximum permissible connection cables length.

Shielding and Equipotential Bonding

a) Apply the cable shield on a large contact area - ideally 360°. Use e. g. a shield terminal to this purpose.

b) Pay attention to proper cable shield fastening.

c) Preferably connect the shield on both sides with low impedance to the protective earth (PE), e.g.on the device and/or on the evaluation unit. In the event of potential differences, the shield must only be applied on one side.

d) If shielding is not possible, appropriate filtering measures must be taken.

e) Make sure that no short-time overvoltages can occur on the signal and power supply lines when the protective earth is connected to the shield on one side only.

f) For the large-area connection of the cable shield, use the shield terminal provided to this purpose. It can easily be mounted on the top-hat rail.

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Order code	8.0000.4G06.0312	8.0000.4G06.0718
Material	Spring steel, galvanized	
Shield diameter	3.0 … 12.0 mm	7.0 … 18.0 mm

Kübler offers a wide range of connection cables in various versions and lengths, see www.kuebler.com/connection technology.

Kübler offers various solutions for EMC-compliant installation, e.g. shield terminals for the electrical cabinet, see www.kuebler.com/accessories.

4.2.3 Connecting the Connecting Wires

ATTENTION	Destruction of the electronics
	When confectioning the sensor line, always take care to ensure sufficient ESD protection.

- Before connecting the connecting wires, check the assignment of the single wires.
- After connecting, check the proper presence of the supply voltage and the proper functioning.

If the supply voltage is reversed, the inclinometer will not operate.

4.2.4 Sensor Terminal Assignment

Device	IN68 / IN78				
	Signal:	+V	n.c.	0 V	IOL
	Pin:	1	2	3	4

+V : Supply voltage +V DC
0 V : Ground GND (0 V)
IOL : IO-Link interface

5 Commissioning and Operation

5.1 Functions and Operating Modes

5.1.1 Measuring axes

The measuring axis of the 1-axis inclinometers covers the angular range of 0…360°.

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The 2-axes inclinometers cover the angular range of ±85° on two axes in all directions. This results in a non-measurable angle of 10° per 180°. The angular ranges of ±85° are maximum values. Smaller angular ranges can be set depending on the parameterizing.

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5.1.2 Temperature acquisition

The inclinometers can output the temperature via the acyclic data. The acquisition range is -40 … +85°C with a resolution of 1°C. The accuracy is ±3°C.

5.2 Status LED

PWR/IOL LED

Display	LED	Meaning
LED off		No voltage
LED green		Device ready for operation
LED green flashing		IO-Link communication active.

Center LED (X and Y Center LED only for 2-axes device)

Display	LED	Meaning
LED yellow		Spirit level function – Center point position reached (±0.5°)
LED yellow flashing (increasing frequency)		Spirit level function – Approaching the center point position
LED yellow flashing (decreasing frequency)		Spirit level function – Leaving the center point position

During the device self-test, all LEDs flash alternately (running lights)

5.3 Commissioning

The device is automatically ready for operation after connecting and switching it on.

5.3.1 Commissioning Help - Spirit Level

The yellow Center LEDs are used as a spirit level when aligning the inclinometer The two yellow LEDs light up when the position of the inclinometer is in a window of ±0.5° from the center point. The flashing frequency of the LEDs increases as the sensor approaches the center point position.

One LED flashes for the 1-axis movements. Both LEDs flash for the 2-axis movements.

The spirit level function can be disabled via the Teach input.

This function is enabled by default.

5.4 Parameterizing

Various functions of the inclinometer can be parameterized.

Parameter	Meaning
Spirit level	The spirit level function can be disabled or enabled.
Restore the delivery condition	This function restores the delivery condition in the device. The device is re-started after restoring the delivery condition. The communication is interrupted.
Reset the device	This command restarts the device. The communication is interrupted briefly.
Reset the application	This function resets application-specific parameters. The communication is not interrupted and the sensor is set in a predefined operating state. The identification parameters are not affected by this command.
Self-test	The function of the measuring cell is checked. The three LEDs light up repeatedly as a running light. Do not move the device or expose it to vibrations. The self-test requires about 10 seconds. No process data can be read during the self-test.
Direction of rotation	This function allows setting the direction of rotation of the axis or of the axes. In factory setting, the sensors output ascending values in clockwise direction. Setting the parameter allows outputting ascending values in counter-clockwise direction.
Defining the center point	The function allows setting the current inclination as the new measuring range center point. For 2-axes devices, the taught measuring range center point may not deviate from the physical zero point by more than 30°.
Configuring the process data	The process data is structured in accordance with the IO-Link Smart Sensor Profile. In 1-axis sensors, the angle value is transmitted twice, one of the values being inverted. For every axis, a 16-bit value with an accuracy of 0.01° is transmitted for the angle. The angle information can be output as follows: **Signed** : 16-bit angle information is output per measuring axis. In the signed representation, one bit is used for the sign. The remaining 15 bits resolve the angle information in 0.01°. The figures are output in two's complement. **Unsigned** : 16-bit angle information with an accuracy of 0.01° is output per measuring axis. This configuration is active in factory setting.
Filter	Various filters can be set for the static and dynamic inclinometers. See chapter Filters [▶ 27].

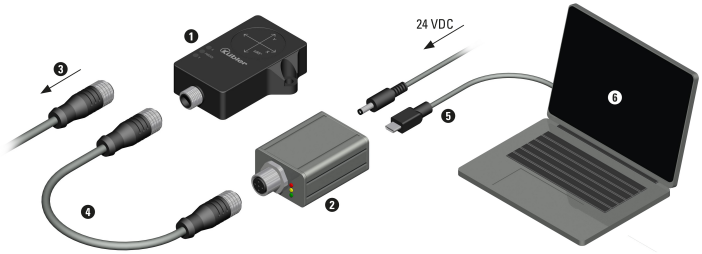
5.4.1 Software-Aided Parameterizing

There are two possibilities to parameterize the devices:

- by means of a PC with a FDT framework (e.g. PACTware) using the DTM or the IODD, see chapter Parameterizing via a PC [▶ 20].
- by means of a PLC and On-request Data Objects (e.g. near the control via an IO-Link function block), see chapter Parameterizing via a Controller [▶ 20].

5.4.2 Parameterizing via a PC

The devices can be set using a PC with an FDT framework/IODD.



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Example with IO-Link Master USB

The inclinometer (1) must be disconnected from the application (3) for setting. The IO-Link Master USB (2) is connected to the inclinometer by means of the adapter cable (4) and to the PC by means of the USB interface (5).

All necessary software components can be downloaded via the Docu Finder on Kübler's website (www.kuebler.com).

- PACTware
- Device IODD
- DTM for IO-Link Master USB
- IODD DTM Configurator

The IO-Link Master USB (2) is required for connection to the PC.

- Ordering designation: 8.IO.1K1341.ZZ1UU1

An adapter cable (4) is required to connect the sensor to the IO-Link Master USB (2).

- Ordering designation: 05.00.6061.6462.002M

The ports of the IO-Link Master are configured in the IOL mode.

In the IOL mode, the IO-Link Master tries to wake up the connected IO-Link device with the "Wakeup request". When the master receives a response from the IO-Link device, both devices start to communicate with each other. The communication parameters are exchanged first, then the cyclic data exchange of the process data (Process Data Objects) starts

When the IO-Link communication is active (IOL mode), an acyclic communication service is available besides the cyclic one.

5.4.3 Parameterizing via a Controller

The devices can be set using a controller and an IO-Link communication.

Device parameters (On-request Data Objects)

The device parameters are exchanged acyclically and on request of the IO-Link Master. The IO-Link Master always sends first a request to the device, then the device responds. This applies both to the writing of data in the device and to the reading of data from the device. The ORDO (On-request Data Objects) allow writing parameter values in the device (write) or reading device states from the device (read).

IO-Link configuration in PROFINET

SIDI (Simple IO-Link Device Integration) allows configuring IO-Link devices in PROFINET applications directly in the programming environment (e.g. TIA-Portal). The Kübler IO-Link devices are integrated in the GSDML file of the IO-Link Master and can be set in the programming environment like submodules of a modular I/O system. The user has access to all device features and parameters.

5.4.3.1 General parameters

Parameter	Contents
Vendor ID	408 (Fritz Kübler GmbH)
Device ID	Device-specific, see IODD
IO-Link version	1.1
Bit rate	COM3
Minimum cycle time	1.3 ms
Supports SIO	False
M-sequence capability	PREOPERATE = TYPE_1_V with 8 octet-data on request ISDU supported
Block parameters	True
Data storage	True

5.4.3.2 Process Input Data

Name	Byte	Bit length	Subindex access	Data Type	Value	Description
Inverse input	0.0	16	True	INT	-18000…18000	Signed
					0…35999	Unsigned
Input	2.0	16	True	INT	-18000…18000	Signed
					0…35999	Unsigned
Scaling 10^X	4.0	8	True	INT	-127…127	
Manufacturer-specific	5.0	8	True	UINT	0…3	

5.4.3.3 Process Output Data

Name	Byte	Bit length	Subindex access	Data Type	Value	Description
Process data output	5.0	8	False	UINT	0…3	Trigger center point teach

5.4.3.4 Standard Parameters

Name	Index	Subindex	Subindex access supported	Access	Byte	Bit length	Data Type	Value	Description
Minimum cycle time	0x0	0x3	True	read	2.0	8	UINT		
IO-Link version ID	0x0	0x5	True	read	4.0	8	UINT		Default: 17
Manufacturer ID 1	0x0	0x8	True	read	7.0	8	UINT		
Manufacturer ID 2	0x0	0x9	True	read	8.0	8	UINT		
Device ID 1	0x0	0xA	True	read	9.0	8	UINT		
Device ID 2	0x0	0xB	True	read	10.0	8	UINT		
Device ID 3	0x0	0xC	True	read	11.0	8	UINT		
Standard command	0x2	0x0	True	write	0.0	8	UINT	0…159	System command
								128	Reset the device
								129	Reset the application
								130	Restore the delivery condition
Disable data saving	0xC	0x2	False	read/ write	0.1	1	BOOL	False/True	Disable device access
Manufacturer name	0x10	0x0	True	read	0.0	5	STRING	Kuebler Group	Manufacturer name
Manufacturer text	0x11	0x0	True	read	0.0	13	STRING	www.kuebler.com	Additional manufacturer information
Product name	0x12	0x0	True	read	0.0	25	STRING	N68/IN78	Type designation
Product ID	0x13	0x0	True	read	0.0	9	STRING	8.INx8.xx4x.xxx	ID
Product text	0x14	0x0	True	read	0.0	30	STRING	Individual	Device category
Serial number	0x15	0x0	True	read	0.0	16	STRING	0012345678-0012	Device serial number
Hardware version	0x16	0x0	True	read	0.0	5	STRING	x.x.x	Hardware status
Firmware version	0x17	0x0	True	read	0.0	8	STRING		Firmware status

Name	Index	Subindex	Subindex access supported	Access	Byte	Bit length	Data Type	Value	Description
Application-specific marking	0x18	0x0	True	read/ write	0.0	256	STRING		To be written by the user as required
Process data input	0x28	0x0	True	read	0.0	48	Process-Data InUnion		
Process data input	0x28	0x1	True	write	0.0	8	UINT	0x04	Center point teach Z-axis
Process data output	0x29	0x0	True	write	0.0	8	Process-Data OutUnion		

5.4.3.5 Parameters

Name	Index	Subindex	Subindex access supported	Access	Byte	Bit length	Data Type	Value	Description
Function-specific marking	0x19	0x0	True	read/ write	0.0	256	STRING	NaN…NaN	Device function within an application
Site-specific marking	0x1A	0x0	True	read/ write	0.0	256	STRING	NaN…NaN	Device position within an application
Operating hours counter	0x48	0x0	True	read	0.0	32	UINT	NaN…NaN	Default: 0
									Device operating time in hours
Filter	0x101	0x0	True	read/ write	0.0	3	UINT	0…4	Default: 2
									0 = very slow
									1 = slow
									2 = balanced
									3 = fast

Name	Index	Subindex	Subindex access supported	Access	Byte	Bit length	Data Type	Value	Description
									4 = very fast
Center point	0x102	0x0	True	write	0.0	1	BOOL		Sets the current device position as the center point
									True = set center point
Direction of rotation	0x103	0x0	True	read/ write	0.0	8	UINT	0…4	Direction of rotation of the device
									0 = clockwise
									4 = counter-clockwise
Perform self-test	0x104	0x1	True	write	0.0	1	BOOL		True = start self-test
Self-test result	0x104	0x2	True	read	0.1	1	UINT	0…127	Default: 2
									0 = Device not operating properly
									2 = Device not tested
									127 = Device operating properly
Spirit level	0x112	0x0	True	read/ write	0.0	1	BOOL		Default: True (enabled)
Current temperature	0x12B	0x1	True	read	2.0	8	INT	-127…127	Current measured temperature in °C
Maximum temperature	0x12B	0x2	True	read	1.0	8	INT	-127…127	Minimum measured temperature in °C
Minimum temperature	0x12B	0x3	True	read	0.0	8	INT	-127…127	Maximum measured temperature in °C
Process data configuration	0x12E	0x0	True	read/ write	0.0	8	INT	0…1	This parameter indicates whether the process data is to be sent with (±180.00°) or unsigned (0.00°…360.00°).
									0 = Unsigned

Name	Index	Subindex	Subindex access supported	Access	Byte	Bit length	Data Type	Value	Description
									1 = Signed

5.4.4 Filters

The inclinometers use an acceleration measuring cell (MEMS) to determine the angle and output this angle according to the measuring axis or axes. Due to inertia of the measuring cell in the event of fast or quickly changing rotations and of vibrations, inaccuracies may occur in the acquired measured data with respect to the actual movement. Various filters can be parameterized in the inclinometer to compensate these undesirable effects.

Parameterizing Possibility of Static Inclinometers:

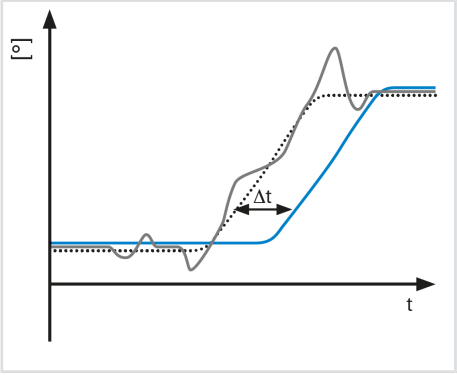
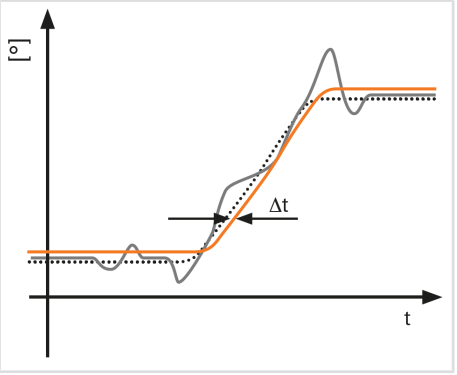
- Balanced (factory setting)
- Slow

Parameterizing Possibility of Dynamic Inclinometers:

- Balanced
- Slow
- Fast
- Very fast (factory setting)

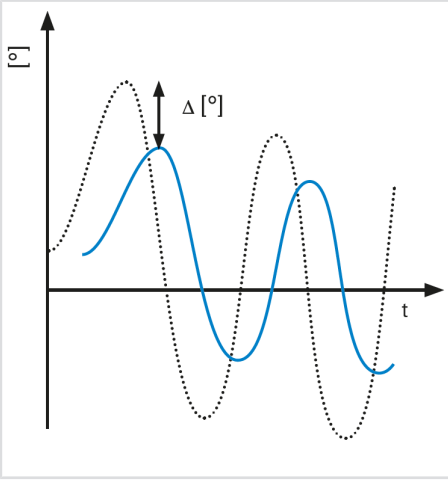
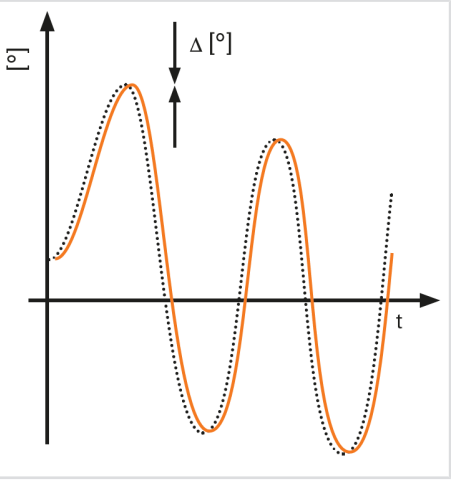
Fast Measurement

Inaccuracies due to the inertia of the test mass can be compensated for by means of filters during the acceleration measurement. However with a time lag Δt for the output of the measurement result. This time lag is reduced with the sensor fusion.

Acceleration measuring cell (static)	Sensor fusion (dynamic)
	

Accurate Measurement

In the event of quick direction changes, the sensor fusion leads to more accurate measurement results.

Acceleration measuring cell (static)	Sensor fusion (dynamic)
	

	actual movement
	data acquired by the acceleration measurement
	filtered measurement result of the acceleration measurement
	Result sensor fusion from the acceleration and rotary rate measurement

Restrictions Due to the Filters and the Sensor Fusion

Filtering always leads to a time lag Δt_d for the output of the measurement result. The more accurate the desired measurement, the larger the time lag.

The fusion algorithm integrated in the dynamic inclinometers IN7x uses the acceleration values and the rotary rate values to calculate the inclination. The setting of the filter parameters modifies important areas of the fusion algorithm. The various filters weight differently the single sensor data The different weighting of the sensor data can compensate for disadvantages in the measurement methods.

The slow filter can compensate for fast interfering accelerations in the application. The filter suits for applications with slow and accurate movements where coarse, external interference can occur. Fast repeating movements can add up and distort the filter.

Very fast and fast filters offer higher accuracy for quick movements in the application. The filter is more easily influenced by fast interfering accelerations. Repeating movements cannot add up and distort the filter.

6 Maintenance

In harsh environments, we recommend regular inspections for firm seating and possible damages at the device. Repair or maintenance work requiring opening the device may only be performed by the manufacturer.

In the event of questions or spare parts orders, please provide us the data printed on the type plate of the device.

See chapter Contact [▸ 33].

Prior to the work

- Switch off the power supply and secure it against switching on again.
- Then disconnect the power supply lines physically.
- Remove operating and auxiliary materials and remaining processing materials from the Inclinometer.

6.1 Eliminating disturbances

If the device does not operates as expected, check first whether there are ambient interferences. If there are no ambient interferences, check the device connections for errors, see chapter Sensor Terminal Assignment [▸ 16].

If there is no error, the device is probably faulty. The device must be replaced.

6.2 Disassembly

To dismount the device, proceed in the reverse order of the assembly, see chapter Installation [▸ 12].

6.3 Reassembly

Reassembling the device is only permitted under the following conditions:

- The device is not damaged.
- The screws can be newly secured against loosening.
- All safety instructions of chapter Installation [▸ 12] can be complied with.
- All assembly steps described in chapter Installation [▸ 12] can be performed.

7 Disposal

Always dispose of unusable or irreparable devices in an environmentally sound manner, according to the country-specific provisions and in compliance with the waste disposal regulations in force. We will be glad to help you dispose of the devices.

See chapter Contact [▶ 33].

NOTICE	**Environmental damage in case of incorrect disposal**
	Electrical waste, electronic components, lubricants and other auxiliary materials are subject to hazardous waste treatment. Problem substances may only be disposed of by licensed specialist companies.

Dispose of disassembled device components as follows:

- Metal components in the scrap metal.
- Electronic components in the electrical waste.
- Plastic parts in a recycling center.
- Sort and dispose of the other components depending on the material type.

8 Annex

8.1 Decimal / Hexadecimal conversion table

Dec	Hex	Dec	Hex	Dec	Hex	Dec	Hex	Dec	Hex
0	*0x0*	51	*0x33*	102	*0x66*	153	*0x99*	204	*0xCC*
1	*0x1*	52	*0x34*	103	*0x67*	154	*0x9A*	205	*0xCD*
2	*0x2*	53	*0x35*	104	*0x68*	155	*0x9B*	206	*0xCE*
3	*0x3*	54	*0x36*	105	*0x69*	156	*0x9C*	207	*0xCF*
4	*0x4*	55	*0x37*	106	*0x6A*	157	*0x9D*	208	*0xD0*
5	*0x5*	56	*0x38*	107	*0x6B*	158	*0x9E*	209	*0xD1*
6	*0x6*	57	*0x39*	108	*0x6C*	159	*0x9F*	210	*0xD2*
7	*0x7*	58	*0x3A*	109	*0x6D*	160	*0xA0*	211	*0xD3*
8	*0x8*	59	*0x3B*	110	*0x6E*	161	*0xA1*	212	*0xD4*
9	*0x9*	60	*0x3C*	111	*0x6F*	162	*0xA2*	213	*0xD5*
10	*0xA*	61	*0x3D*	112	*0x70*	163	*0xA3*	214	*0xD6*
11	*0xB*	62	*0x3E*	113	*0x71*	164	*0xA4*	215	*0xD7*
12	*0xC*	63	*0x3F*	114	*0x72*	165	*0xA5*	216	*0xD8*
13	*0xD*	64	*0x40*	115	*0x73*	166	*0xA6*	217	*0xD9*
14	*0xE*	65	*0x41*	116	*0x74*	167	*0xA7*	218	*0xDA*
15	*0xF*	66	*0x42*	117	*0x75*	168	*0xA8*	219	*0xDB*
16	*0x10*	67	*0x43*	118	*0x76*	169	*0xA9*	220	*0xDC*
17	*0x11*	68	*0x44*	119	*0x77*	170	*0xAA*	221	*0xDD*
18	*0x12*	69	*0x45*	120	*0x78*	171	*0xAB*	222	*0xDE*
19	*0x13*	70	*0x46*	121	*0x79*	172	*0xAC*	223	*0xDF*
20	*0x14*	71	*0x47*	122	*0x7A*	173	*0xAD*	224	*0xE0*
21	*0x15*	72	*0x48*	123	*0x7B*	174	*0xAE*	225	*0xE1*
22	*0x16*	73	*0x49*	124	*0x7C*	175	*0xAF*	226	*0xE2*
23	*0x17*	74	*0x4A*	125	*0x7D*	176	*0xB0*	227	*0xE3*
24	*0x18*	75	*0x4B*	126	*0x7E*	177	*0xB1*	228	*0xE4*
25	*0x19*	76	*0x4C*	127	*0x7F*	178	*0xB2*	229	*0xE5*
26	*0x1A*	77	*0x4D*	128	*0x80*	179	*0xB3*	230	*0xE6*
27	*0x1B*	78	*0x4E*	129	*0x81*	180	*0xB4*	231	*0xE7*
28	*0x1C*	79	*0x4F*	130	*0x82*	181	*0xB5*	232	*0xE8*
29	*0x1D*	80	*0x50*	131	*0x83*	182	*0xB6*	233	*0xE9*
30	*0x1E*	81	*0x51*	132	*0x84*	183	*0xB7*	234	*0xEA*

Dec	Hex	Dec	Hex	Dec	Hex	Dec	Hex	Dec	Hex
31	*0x1F*	82	*0x52*	133	*0x85*	184	*0xB8*	235	*0xEB*
32	*0x20*	83	*0x53*	134	*0x86*	185	*0xB9*	236	*0xEC*
33	*0x21*	84	*0x54*	135	*0x87*	186	*0xBA*	237	*0xED*
34	*0x22*	85	*0x55*	136	*0x88*	187	*0xBB*	238	*0xEE*
35	*0x23*	86	*0x56*	137	*0x89*	188	*0xBC*	239	*0xEF*
36	*0x24*	87	*0x57*	138	*0x8A*	189	*0xBD*	240	*0xF0*
37	*0x25*	88	*0x58*	139	*0x8B*	190	*0xBE*	241	*0xF1*
38	*0x26*	89	*0x59*	140	*0x8C*	191	*0xBF*	242	*0xF2*
39	*0x27*	90	*0x5A*	141	*0x8D*	192	*0xC0*	243	*0xF3*
40	*0x28*	91	*0x5B*	142	*0x8E*	193	*0xC1*	244	*0xF4*
41	*0x29*	92	*0x5C*	143	*0x8F*	194	*0xC2*	245	*0xF5*
42	*0x2A*	93	*0x5D*	144	*0x90*	195	*0xC3*	246	*0xF6*
43	*0x2B*	94	*0x5E*	145	*0x91*	196	*0xC4*	247	*0xF7*
44	*0x2C*	95	*0x5F*	146	*0x92*	197	*0xC5*	248	*0xF8*
45	*0x2D*	96	*0x60*	147	*0x93*	198	*0xC6*	249	*0xF9*
46	*0x2E*	97	*0x61*	148	*0x94*	199	*0xC7*	250	*0xFA*
47	*0x2F*	98	*0x62*	149	*0x95*	200	*0xC8*	251	*0xFB*
48	*0x30*	99	*0x63*	150	*0x96*	201	*0xC9*	252	*0xFC*
49	*0x31*	100	*0x64*	151	*0x97*	202	*0xCA*	253	*0xFD*
50	*0x32*	101	*0x65*	152	*0x98*	203	*0xCB*	254	*0xFE*
								255	*0xFF*

8.2 Conversion table Data types

Data type	Figure type	Length in bits	Length in bytes
BOOL	Binary	1	-
BYTE	Binary	8	1
WORD	Binary	16	2
DWORD	Binary	32	4
LWORD	Binary	64	8
SINT	Integer	8	1
INT	Integer	16	2
DINT	Integer	32	4
UINT	Integer	32	4
LINT	Integer	64	8
REAL	Floating point number	32	4
LREAL	Floating point number	64	8

9 Contact

You want to get in touch with us:

Technical advice

For technical advice, analysis or support during installation, Kübler is directly on site with its globally active application team.

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Kübler India +91 8600 147 280
Kübler Italy +39 0 26 42 33 45
Kübler Austria +43 3322 43723 12
Kübler Poland +48 6 18 49 99 02
Kübler Turkey +90 216 999 9791
Kübler USA +1 855 583 2537

Repair service / RMA-Form

For returns, please pack the product adequately and enclose the completed "Returns Form".

www.kuebler.com/rma

Send your return, specifying the RMA-reference, to the following address.

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Fritz Kübler GmbH

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Fax +49 7720 21564

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Glossary

BOOL

Data type. A BOOL (or Boolean) represents a truth value that may be either true or false.

DINT

Data type. An operand of the data type DINT (double integer) has a length of 32 bits and is made of two components: a sign and a numerical value in two's complement.

DTM

Device Type Manager

DWORD

Data type. A DWORD consists of two WORDs, each consisting of 2 bytes, each of them consisting of 8 bits.

EN 61326-2-3

Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 2-3: Particular requirements - Test configuration, operational conditions and performance criteria for transducers with integrated or remote signal conditioning

ESD

Electro-Static-Discharge, electro-static discharges are voltage punctures generated by large potential differences, a spark. These punctures create briefly a strong electric current.

FDT

Field Device Technology, is the interface specification for the open data interchange between field devices and automation systems.

GSDML

Generic Station Description Markup Language

INT

Data type. Integer. An integer is generally made of 16 bits.

IODD

Device description file IO-Link

IP protection level

The respective IP protection level corresponds to the suitability of an electrical device for certain environmental conditions.

ISDU

Indexed Service Data Unit

LED

Light Emitting Diode. Semiconductor component that emits light.

LWORD

Data type. Long WORD consisting of two DWORDs.

MEMS

Micro-Electro-Mechanical Systems. The micro-electro-mechanical sensors can detect mechanical, magnetic or also chemical changes and convert them into electrical information. Depending on their construction they can measure pressures, movements, gas or light.

ORDO

On-request Data Objects

PACTware

PACTware is a manufacturer and field bus-independent software for simple operation and parameterizing of field devices in automation.

PE

Abbreviation: Protective Earth, cable for safety protection against electric shocks (protective earth conductor).

PLC

Programmable Logic Controller

RMA

Return Material Authorization, authorization to return material, e.g. in the case of complaints.

SIDI

Simple IO-Link Device Integration

SINT

Data type. Short integer. An operand of the data type SINT (short INT) has a length of 8 bits and is made of two components: a sign and a numerical value.

TIA-Portal

Totally Integrated Automation Portal (TIA-Portal) is a platform provided by Siemens.

UINT

Data type. An operand of the data type UINT (Unsigned INT) has a length of 16 bits and contains numerical values without sign.

UL 61010-1

Safety requirements for electrical equipment for measurement, control and laboratory use - Part 1: General requirements

WORD

Data type. A WORD includes 2 bytes, each of them including 8 bits.

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