MANUAL

INX***DH-F199-IE2-***,
INY***DH-F199-IE2-***

with Analog Interface and RS232 Programming Interface

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1 Introduction

1.1 Content of this Document

This document contains information required to use the product in the relevant phases of the product life cycle. This may include information on the following:

- Product identification
- Delivery, transport, and storage
- Mounting and installation
- Commissioning and operation
- Maintenance and repair
- Troubleshooting
- Dismounting
- Disposal

Note!

For full information on the product, refer to the further documentation on the Internet at www.pepperl-fuchs.com.

The documentation comprises the following parts:

- This document
- Datasheet

In addition, the documentation may comprise the following parts, if applicable:

- EU-type examination certificate
- EU declaration of conformity
- Attestation of conformity
- Certificates
- Control drawings
- Instruction manual
- Other documents

1.2 Target Group, Personnel

Responsibility for planning, assembly, commissioning, operation, maintenance, and dismounting lies with the plant operator.

Only appropriately trained and qualified personnel may carry out mounting, installation, commissioning, operation, maintenance, and dismounting of the product. The personnel must have read and understood the instruction manual and the further documentation.

Prior to using the product make yourself familiar with it. Read the document carefully.

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1.3 Symbols Used

This document contains symbols for the identification of warning messages and of informative messages.

Warning Messages

You will find warning messages, whenever dangers may arise from your actions. It is mandatory that you observe these warning messages for your personal safety and in order to avoid property damage.

Depending on the risk level, the warning messages are displayed in descending order as follows:

Danger!

This symbol indicates an imminent danger.

Non-observance will result in personal injury or death.

Warning!

This symbol indicates a possible fault or danger.

Non-observance may cause personal injury or serious property damage.

Caution!

This symbol indicates a possible fault.

Non-observance could interrupt the device and any connected systems and plants, or result in their complete failure.

Informative Symbols

Note!

This symbol brings important information to your attention.

Action

This symbol indicates a paragraph with instructions. You are prompted to perform an action or a sequence of actions.

1.4 Intended Use

INX***DH-F199-IE2-*** and INY***DH-F199-IE2-*** series inclination sensors detect and measure the tilt angle of an object in relation to the force of gravity and provide inclination data via an analog current interface from 4 ... 20 mA.

Read through these instructions thoroughly. Familiarize yourself with the device before installing, mounting, or operating.

Always operate the device as described in these instructions to ensure that the device and connected systems function correctly. The protection of operating personnel and plant is only guaranteed if the device is operated in accordance with its intended use.

1.5 General Safety Notes

Responsibility for planning, assembly, commissioning, operation, maintenance, and dismounting lies with the plant operator.

Installation and commissioning of all devices may only be performed by trained and qualified personnel.

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The device is only approved for appropriate and intended use. Ignoring these instructions will void any warranty and absolve the manufacturer from any liability.

If serious faults occur, stop using the device. Secure the device against inadvertent operation. In the event of repairs, return the device to your local Pepperl+Fuchs representative or sales office.

Note!

Disposal

Electronic waste is hazardous waste. When disposing of the equipment, observe the current statutory requirements in the respective country of use, as well as local regulations.

1.6 Declaration of conformity

This product was developed and manufactured under observance of the applicable European standards and guidelines.

Note!

A Declaration of Conformity can be requested from the manufacturer.

The product manufacturer, Pepperl+Fuchs GmbH, D-68307 Mannheim, has a certified quality assurance system that conforms to ISO 9001.

ISO**9001**

2 Product Description

2.1 Use and Application

INX***DH-F199-IE2-*** and INY***DH-F199-IE2-*** series inclination sensors detect and measure the tilt angle (inclination/slope/elevation) of an object in relation to the force of gravity. The basic principle behind these inclination sensors is a microelectromechanical systems (MEMS) sensor cell that is embedded in a fully molded application-specific integrated circuit (ASIC). The angle is measured by the relative change in electrical capacitance in the MEMS cell.

INX***DH-F199-IE2-*** sensors are 1-axis sensors that detect and measure the tilt around the x-axis.

INY***DH-F199-IE2-*** sensors are 2-axis sensors that detect and measure the tilt around the x-axis and the y-axis.

Communication with the inclination sensors for data output occurs via an analog current interface from 4...20 mA.

Communication with the inclination sensors for programming occurs via RS232 interface and/or anlaog inputs.

2.2 Connection Cable for Normal Operation

To use the inclination sensor for normal operation in the plant, select one of the following connection cables. Additional connection cables are available as accessories.

Connection type on the inclination sensor	Connection cable	Connection type of the adapter cable
M12, 8-pin, A-coded	V19-G-2M-PUR-ABG-V19-G	■ Inclination sensor side: M12 single-ended female cordset, 8-pin ■ Other side: M12 single-ended male cordset, 8-pin
M12, 8-pin, A-coded	V19-G-2M-PUR-ABG	■ Inclination sensor side: M12 single-ended female cordset, 8-pin ■ Other side: 2 m cable with free cable end

Table 2.1

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2.3   Accessories for R232 Programming

Device/Cable	P+F type code	Description
Adapter cable M12 to Sub-D9 and power supply	V19-G-0,5M-PVC-SUBD9	Adapter cable from inclination sensor to RS232 converter Inclintion sensor side: M12, 8-pin ■ RS232 converter side: Sub-D9 (female) ■ Power supply side: Hollow connector 5.5/2.1 female
USB-RS232 converter	–	USB-RS232 converter can be purchased from any supplier. Note that operating system software of your PC and USB driver are compatible ■ Primary side: Sub-D9 (male) ■ PC side: USB plug
Power supply	–	Power supply can be purchased from any supplier. Note the technical specifiations: AC 100 ...240 V 50/60 Hz, DC 24 V, 1 A and output plug hollow connector 5.5/2.1 male

Table 2.2

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3 Installation

3.1 Instructions for Mechanical and Electrical Installation

Observe the following instructions to ensure safe operation of the inclination sensor:

⚠ ***Warning!***

Work must only be performed by trained and qualified personnel.

Commissioning and operation of this electrical equipment must only be performed by trained and qualified personnel. This means individuals who are qualified to commission (in accordance with safety technology), connect to ground, and label devices, systems, and circuits.

⚠ ***Warning!***

Only perform work when the system is in a de-energized state.

De-energize your device before performing work on the electrical connections. Short circuits, voltage peaks, and similar events can lead to faults and undefined statuses. This presents a significant risk of personal injury and property damage.

⚠ ***Warning!***

Check electrical connections before switching on the system.

Check all electrical connections before switching on the system. Incorrect connections present a significant risk of personal injury and property damage. Incorrect connections can lead to malfunctions.

△ ***Caution!***

Do not remove the housing.

Do not remove the sensor housing under any circumstances, as damage and contamination can occur as a result of taking improper action.

△ ***Caution!***

Do not perform any electrical modifications.

It is not permitted to perform electrical modifications on the inclination sensor. If you open or modify the device yourself, not only are you endangering yourself and others but you will also void any warranty and absolve the manufacturer of any liability.
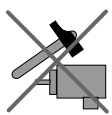
Do not allow the inclination sensor to fall or be exposed to mechanical load.
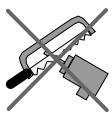
Do not make any alterations to the housing of the inclination sensor.

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3.2 Mounting Instructions

The inclination sensors are pre-calibrated devices that can be put into immediate operation following easy installation with a three point mount. The mounting surface must be flat and free of dust and grease.

Depending on the sensor model, pay attention to the correct orientation of the sensor for inclination measurement when mounting.

The following figures show the correct axis orientation for each model.

INX*DH-F199-IE2-***

Figure 3.1   1-axis sensor

INY*DH-F199-IE2-***
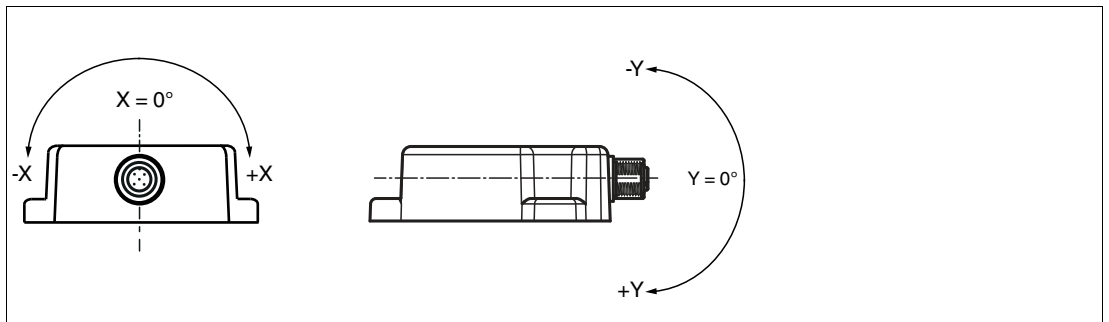
Figure 3.2   2-axis sensor

Fastening with Screws

We recommend hexagon head screws with M6 or UNC 1/4 for the best possible and most secure mounting. Use all three screws for mounting. Restrict the tightening torque to the range of 10 Nm ± 10 % for the screws. The M12 connectors are to be perfectly aligned and screwed to the end with a tightening torque in the range of 0.4 ... 0.6 Nm. Use all three screws for mounting, and use the same tightening torque for all the screws.

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3.3 Electrical Connection

The sensors are connected to the control system via an M12 x 1, 8-pin, male connector.
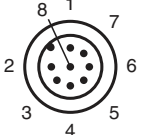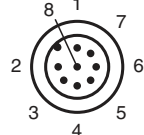
Signal	INX***DH-F199-IE2-*** Pin	INY***DH-F199-IE2-*** Pin
$+U_b$	1	1
RxD	2	2
TxD	3	3
GND	4	4
Analog output x-axis	5	5
SET 1 (analog input 1)	6	6
Analog output y-axis	7 (static 2.2 mA, INX* has no y-axis)	7
SET 2 (analog input 2)	8	8
Pinout		

Table 3.1

Warning!

Damage to the device

Connecting an alternating current or excessive supply voltage can damage the device or cause the device to malfunction.

Electrical connections with reversed polarity can damage the device or cause the device to malfunction.

Connect the sensor to direct current (DC). Ensure that the supply voltage rating is within the specified sensing range. Ensure that the connecting wires on the cordset in use are connected correctly.

Note!

Noise and unwanted variation in signals can create losses upon transmission and retransmission over long distances and for long periods of time. Electrically, these losses can be reduced by choosing suitable cable types, appropriate shielding, and good connections.

Connecting the sensor to voltage

Connect the operating voltage to pins 1 and 4 of the 8-pin connector.

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4 Firmware Features Overview

INX***DH-F199-IE2-*** and INY***DH-F199-IE2-*** series inclination sensors can be adapted for any application by programming parameters via the RS-232 and/or analog interface.

4.1 Important Factory Settings

Note!

Note the following factory settings carefully upon installation. Some of the parameters have to be reprogrammed to optimize the inclination sensor for measurement

Description	Value
Operational mode	Measurement mode
Resolution	0.01°
Output transmission rate	100 ms
Baud rate	9600 bd
Moving average filter	64
Angle offset	0°
Measurement direction	Clockwise
Configuration mode	Preset / Direction mode

Table 4.1

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4.2 Operation Modes

INX***DH-F199-IE2-*** and INY***DH-F199-IE2-*** series inclination sensors have 2 operation modes concerning the RS-232 interface.

Measurement Mode

The measurement mode of an inclination sensor is the free-running operational output mode, in which the position value is sent cyclically (according to the output transfer rate) using the RS-232 interface.

Configuration Mode

This mode is primarily used for modifying the parameters and settings of the inclination sensor using the RS-232 interface. In this mode, the position value is transmitted only upon request and is active until power off/on operation, software reset, or the inclination sensor is switched to measurement mode.

All settings saved in this level are stored in the EEPROM and are also permanently available after power off/on.

There are 2 additional configurations for the teach-in functionalities that can be configured in this mode:

- **Preset/Direction Mode**

  The Preset/Direction mode is the inclination sensor's default operating mode. In this mode, an analog input can be used to set zero position. The default direction setting is clockwise. Analog input for inverting direction is not available until set up to do so in RS-232.

  In this mode, the user can set the origin of measurement (0° reference angle) at the current point and can also change the direction of measurement. The changes done in the RS-232 mode also get reflected in the analog output.

  Preset value: Set origin at current position

  The current position value is set to the mid angle (2-axis) and zero position (1-axis) by the parameter preset.

- **Teach-in Mode (Scaling)**

  This is the mode used for scaling the inclination sensor output as per the user's requirement using RS-232 or analog inputs. The user can set the measuring range and the analog output is scaled accordingly. The measuring range is defined to lie within the origin and maximum angle positions, which then corresponds to the analog output scaling.

  The maximum angle set in this mode will not affect the RS-232 position output. This scaling only affects the analog output. The configurations/scaling set in teach 1 mode are not reflected in teach 0 mode.

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4.3 Programmable Parameters

The parameter settings of INX***DH-F199-IE2-*** and INY***DH-F199-IE2-*** series inclination sensors can be programmed via the RS-232 interface. Additionally, a few of these functionalities are also available through analog inputs SET1 and SET2.

		Programmable via
Configuration mode	Inclination sensor can be switched between preset /direction mode and teach-in mode	RS-232
Baud rate	The baud rate can be programmed between ranges of 2400 bps and 115200 bps	RS-232
Output transmission rate	The transmission rate of angular values can be adjusted between 62.5 ms and 10 s per value	RS-232
Moving average filter	Used to calculate the output position value as an average over last N values where N varies from 1 to 256 measurements (where $N = 2n$, $n = 0, 1, 2, 3 \ldots$)	RS-232
Preset value	The current position value is set to the mid angle and zero position by the parameter preset.	RS-232 and analog input1: SET1* *: only in preset/direction mode
Measurement direction	The direction of measurement can be inversed according to the measurement requirement	RS-232 and analog input2: SET2* *: only in preset/direction mode
Analog output scaling	The analog output (4 ... 20 mA) can be scaled to the required measuring range. The default ranges are 0° to 359.99°.	RS-232 and analog inputs1 and 2: SET1 and SET2* *: only in teach-in mode

Table 4.2

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5 RS232 Interface Setup and Programming

5.1 Electrical Connection for RS-232 Programming

The following figure describes how to establish a connection between a PC and an inclination sensor via USB-RS-232 converter.
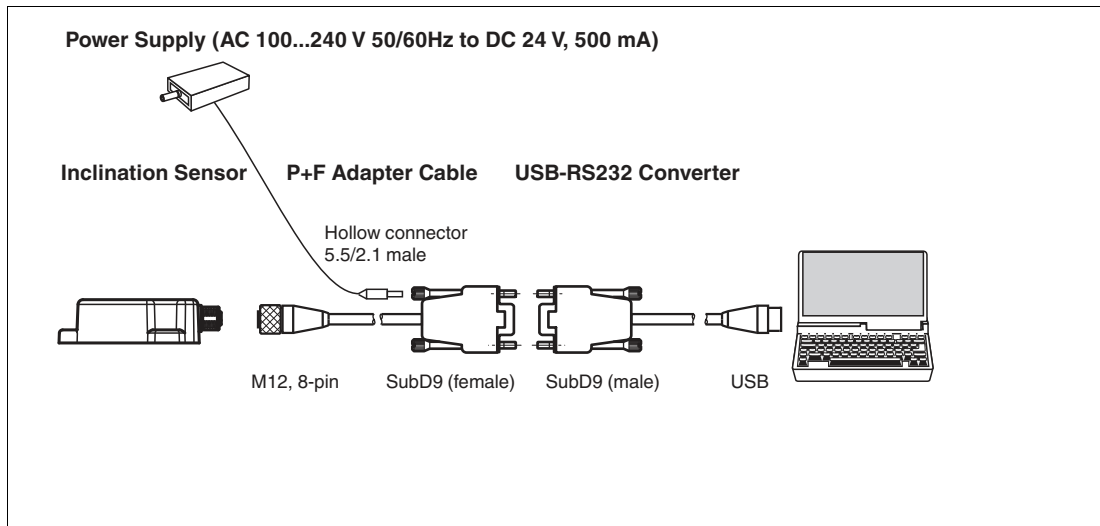

Figure 5.1

- **P+F adapter cable V19-G-0,5M-PVC-SUBD9**

    This cable is required for programming.

    The output plug of the external power supply has to be connected to the P+F adapter cable.

- **USB-RS-232 converter**

    The USB-RS-232 converter can be purchased from any supplier.

    Ensure that operating system software of your PC and USB driver are compatible.

- **Power supply for inclination sensor**

    The power supply can be purchased from any supplier. Note the technical specifiations: AC 100 ...240 V 50/60 Hz, DC 24 V, 1 A and output plug hollow connector 5.5/2.1 male

5.2 Programming Software

For programming the inclination sensor via RS-232 interface, various RS-232 terminal software is available. You can choose any suitable software.

Note!

This manual shows RS-232 programming using the software Termite 3.4 from the company CompuPhase. This software is freeware and can be downloaded from the Internet. If you use this software, you must comply with the CompuPhase copyright and conditions of use.

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▶ Setup Communication

1. Start the Termite 3.4 RS-232 terminal software.
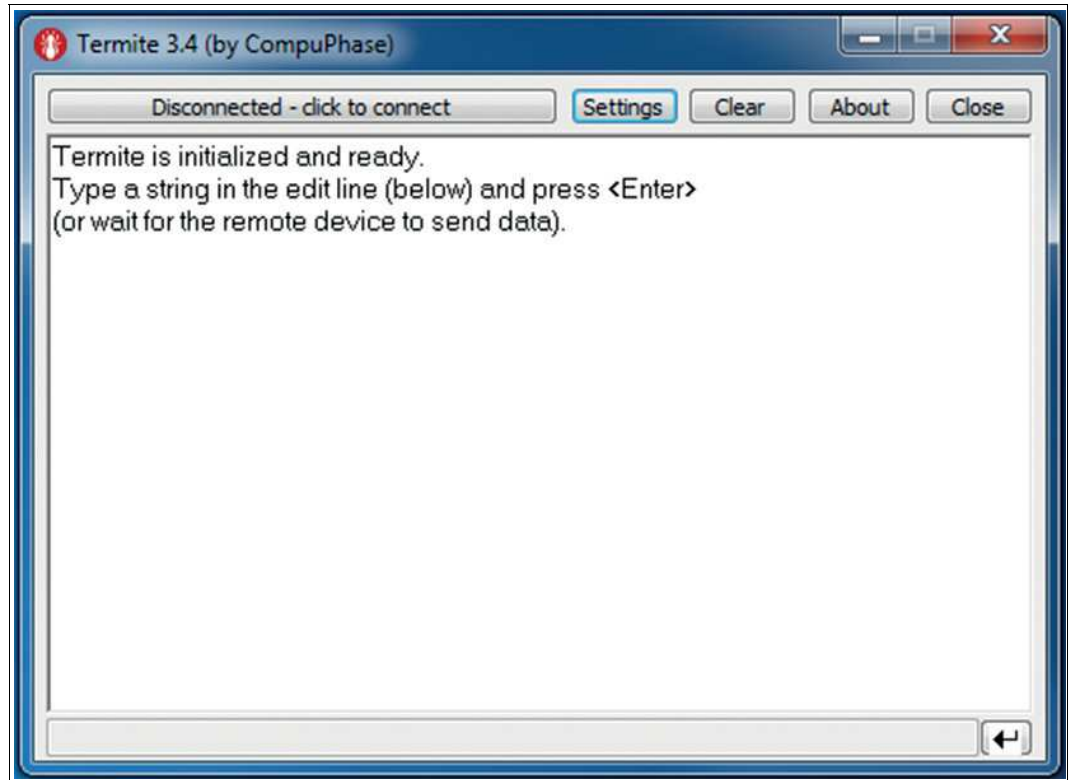
Figure 5.2

Note!

Baud Rate

We recommend accepting the default factory baud rate. If the user forgets the adjusted baud rate, testing must be conducted to find out the new value. Resetting the baud rate to the default value is not possible.

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2. Set the RS-232 communication settings for your PC as displayed in the setting dialog box below. Note the settings outlined in red must always remain the same. The setting outlined in green is user-specific.
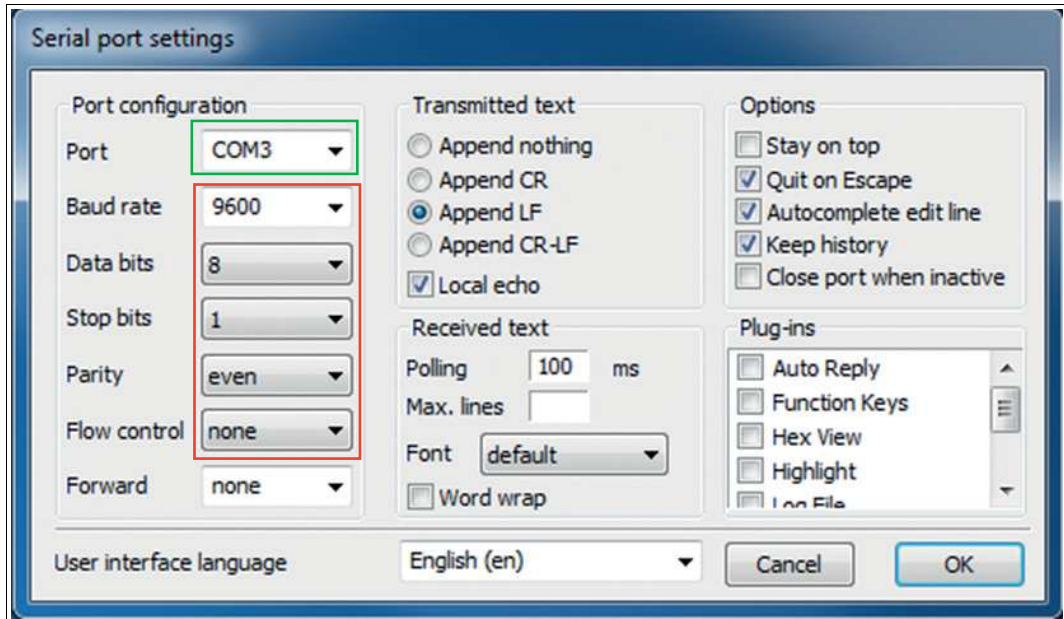
Figure 5.3

3. Confirm settings changes by pressing the OK button.

↳ The startup message will be displayed.

Figure 5.4

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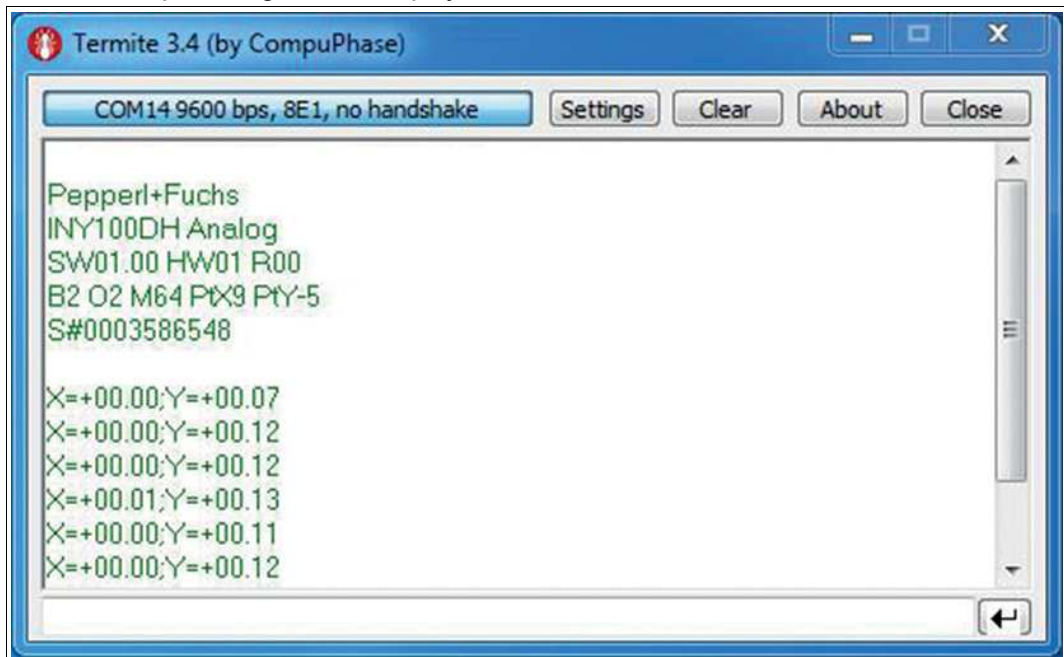
▶ Programming by Sending Commands

To start programming, switch the inclination sensor from measurement mode to configuration mode. After finalizing programming, switch from configuration mode back to measurement mode.
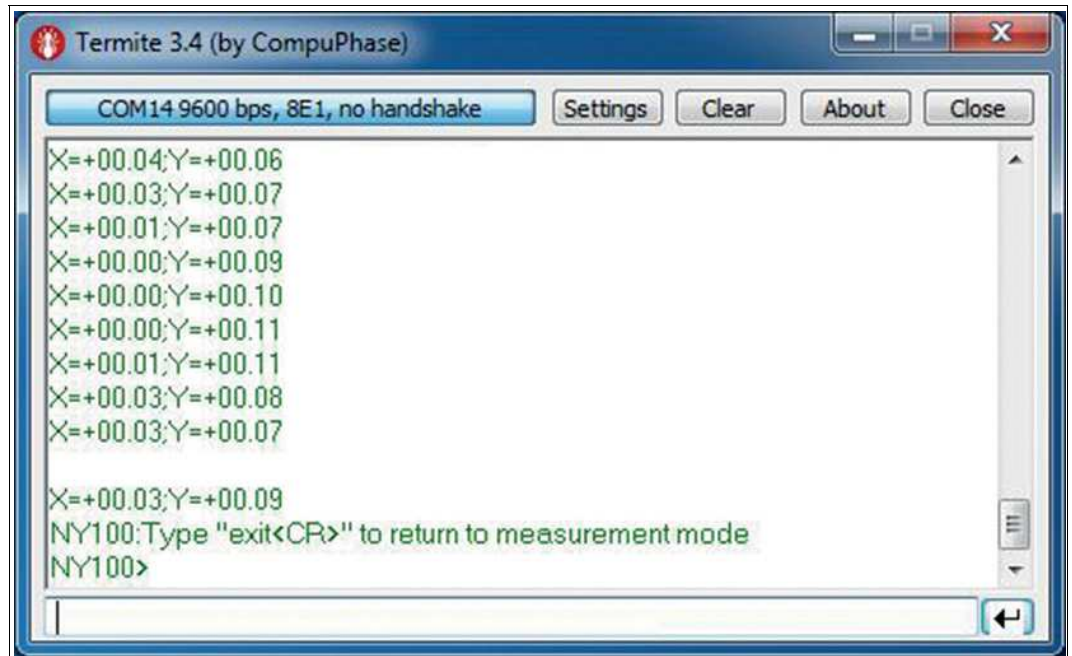
1. Press <Enter> to switch to configuration mode.

2. Type in the RS-232 programming commands needed and press <Enter> after each command sequence.

3. Type <save> and press <Enter> after configuration is done.

4. After the last programming command, exit the configuration mode by typing in <exit> and pressing <Enter>.

5. Switch the inclination sensor's power supply off/on to restart with new parameters.

   ↳ The inclination sensor programming via RS-232 is finalized. The inclination sensor operates with new programmed parameters.

Programming Examples

Type in: period?<Enter>

- ■ Reading "Output Transmission Rate":
    - • Command: period?<Enter>
    - • Response e.g.: Period 2: 100ms OK
- ■ Programming new "Output Transmission Rate"
    - • Command: period<Space> 3<Enter>
    - • Response: 200ms OK

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5.3 Programming Commands in Configuration Mode

The following table displays all programmable parameters via RS232 interface. Additionally, a few of these functionalities are programmable via analog interface.

Note!

Baud Rate

Resetting the baud rate to the default value is not possible. If the user forgets the adjusted baud rate, testing must be done to determine the new value.

Note!

General Information and Command Suffixes

Using the preset in the digital interface also affects the analog output. If both interfaces are used simultaneously, appropriate precautions must be taken. Be careful not to mix up the commands for the RS-232 teach-in modes. If in doubt, use the restore command and reconfigure sensor. The configurations/scaling set in teach 1 mode is not reflected in teach 0 mode.

When parameters are defined beyond the programmable limits, the inclination sensor gives an error "E" output.

Generally a space <SP> should sepLarate a command from a parameter.

Every command is terminated by <CR> (press Enter button).

Typing a command with a question mark <?> at the end without <SP> will return the current setting information.

General Commands

General Functions	Command
Enter configuration mode	<CR>
Leave configuration mode	exit<CR>
List of commands	help<CR>
Identity and versions	*idn<CR>
Parameter info	info<CR>
Current position value	teach<SP>parameter<CR>
Configuration modes	teach<SP>parameter<CR>
Baud rate	baud<SP>parameter<CR>
Output transmission rate	period<SP>parameter<CR>
Moving average filter	filter<SP>parameter<CR>
Preset value	setorg<CR>
Measurement direction	compl<SP>parameter<CR>
Set maximum at current position	setmax<CR>
Reset maximum to factory settings	clrmax<CR>
Restore factory settings	restore<CR>
Reset the origin to factory default position	clrorg<CR>
Software reset	*rst<CR>
Save settings to EEPROM	save<CR>

Table 5.1

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Teach-in Mode Commands

Function	Command
Set maximum V/I at current position	setmax<CR>
Reset the maximum V/I to factory default position	clrmax<CR>

Table 5.2

5.3.1 Retrieving a Setting

Function	Description	Command	Explanation	Default
Retrieving a parameter setting	Typing a command with a question mark (?) at the end (without space) will retrieve the current setting.	Example: period? Period 2: 100 ms OK	You can retrieve any parameter by typing the appropriate command.	–

Table 5.3

5.3.2 Configuration Mode

Function	Description	Command	Explanation	Default
Configuration modes	Switch between preset/direction mode and teach-in mode for scaling	■ teach<SP>0<CR> for preset/direction mode (teach 0) ■ teach<SP>1<CR> for teach-in mode (teach 1)	When using the RS-232 and analog interfaces simultaneously, take appropriate precautions. Be careful not to mix up the commands for the RS-232 teach-in modes. If in doubt, use the restore command and reconfigure sensor. The configuration/scaling set in teach 1 mode is not reflected in teach 0 mode.	Preset/Direction mode (teach 0)

Table 5.4

5.3.3 Baud Rate

Note!

Baud Rate

We recommend accepting the default factory baud rate. If the user forgets the adjusted baud rate, the new value has to be determined by testing. Resetting the baud rate to the default value is not possible.

Function	Description	Command	Parameters	Default
Baud rate	Switch between different baud rates	baud<SP>parameter<CR>	Parameters ■ 0 = 2400 bps ■ 1 = 4800 bps ■ 2 = 9600 bps ■ 3 = 19200 bps ■ 4 = 38400 bps ■ 5 = 57600 bps ■ 6 = 115200 bps	9600 bps

Table 5.5

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5.3.4 Output Transmission Rate

Function	Description	Command	Parameters	Default
Output transmission rate	The transmission rate of angular values can be adjusted.	period<SP>parameter<CR>	Parameters ■ 1 = 62.5 ms ■ 1 = 100 ms ■ 2 = 200 ms ■ 3 = 500 ms ■ 4 = 1000 ms ■ 5 = 5000 ms ■ 6 = 10000 ms	100 ms

Table 5.6

5.3.5 Moving Average Filter

The moving average filter length accepts only 2^n values such as 4, 8, 16, 32 ... etc. and the max. length is 256. If the input number is not a 2^n number from 4, 8, 16, 32 ... etc, the next lower 2^n number will be taken. E. g. input = 14 will be rounded to 8, Input =18 will be rounded to 16 etc.

Function	Description	Command	Parameters	Default
Moving Average Filter	Used to calculate the output position value as an average over last N values	filter<SP>parameter<CR>	N varies from 1 ... 256 measurements	64

Table 5.7

5.3.6 Preset Value

Function	Description	Command	Explanation	Default
Preset Value	The current position value is set to the mid angle (2-axis) and zero position (1-axis) by the parameter preset.	setorg<CR>	The analog output is also reset to read 4 mA. The use of preset in the digital interface will affect the analog output too.	–

Table 5.8

5.3.7 Restore Origin

Function	Description	Command	Explanation	Default
Reset the origin to factory default position	The origin position can be reset to factory default position by using this command. The analog output is also reset to show the factory default output.	clrorg<CR>	–	–

Table 5.9

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5.3.8 Measurement Direction

Function	Description	Command	Parameters	Default
Measurement Direction	Inverts measurement direction. Note: Before using the command, ensure that the sensor is set to "teach 0".	compl<SP>parameter<CR>	■ 0 = clockwise only ■ 1 = counterclockwise ■ = SET 2 acitvate (change only via anlog inputs: L = clockwise, H = counterclockwise)	0

Table 5.10

5.3.9 Set Maximum

Function	Description	Command	Explanation	Default
Set maximum at current position	The current angle position is set to the maximum analog output value. Note: Before using the command, ensure that the sensor is set to "teach 0".	setmax<CR>	The command execution immediately sets the analog output to 20 mA. The maximum angle set in this mode will not affect the RS-232 position output. This scaling only affects the analog output.	–

Table 5.11

5.3.10 Reset Maximum

Function	Description	Command	Explanation	Default
Reset maximum to factory settings	The execution of this function clears the previous scaling of maximum set by the user and resets the analog output to the factory default values. Before using this command, ensure sensor is set into "teach 1"	clrmax<CR>	The command execution immediately sets the analog output to 20 mA.	–

Table 5.12

5.3.11 Restore Factory Settings

Function	Description	Command	Explanation	Default
Restore factory settings	Restore factory settings	restore<CR>	–	–

Table 5.13

5.3.12 Save Settings to EEPROM

Function	Description	Command	Explanation	Default
Save Settings to EEPROM	All settings that are modified will be saved in the EEPROM	save<CR>	In case of changing the baud rate, the new baud rate will be active directly after a <CR>, a "save" command is not required.	–

Table 5.14

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6 Analog Interface Programming

Programming of the inclination sensor via analog interface is an alternative to RS-232 programming. Note that only some functions can be SET via analog inputs SET 1 and SET 2.

The following functions can be SET via analog inputs SET 1 and SET 2. Before analog programming, the analog functions must first be set via RS-232 interface to implement this function.

- Analog output scaling to set the measuring range
  - The inclination sensor must first be set to teach-in mode (teach 1) via RS-232 interface.
- Inversion of measurement direction
  - The inclination sensor must first be set to the preset/direction mode (teach 0), and the "compl" function must be set to parameter 2 (compl 2) via RS-232 interface.
- Preset of origin - 0° as reference for measurement
  - The inclination sensor must be set to the preset/direction mode (teach 0) via RS-232 interface. Preset/direction mode is the default factory setting. With a 2-axis sensor, the preset function is applied to both axes simultaneously. There is no separate preset function for each axis.

6.1 Electrical Connection and Programming

The sensors are connected via a M12 x 1, 8-pin, male connector. For programming via analog interface, only pins 1, 4, 6, 8 are relevant. The other pins do not need to be connected.
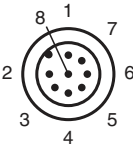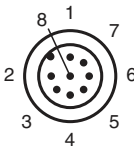
Signal	INX***DH-F199-IE2-*** Pin	INy***DH-F199-IE2-*** Pin
+U_b	1	1
GND	4	4
Analog output x-axis	5	5
SET 1 (analog input 1)	6	6
Analog output y-axis	7 (static 2.2 mA, INX* has no Y-axis)	7
SET 2 (analog input 2)	8	8
Pinout		

Table 6.1

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▶ **Programming via analog inputs SET 1 and SET 2**

1. Connect the operating voltage to pins 1 and 4 of the M12x1, 8-pin connector.

2. Apply a positive voltage (5 V ... 30 V, Rin > 110 KΩ) on the relevant inputs SET 1 and/or SET 2 for at least 100 ms for programming a function.

   ↳ A timer starts when a positive voltage is recognized. The voltage must be held for at least 100 ms. If the voltage is applied for less time, the timer will be reset.

3. Release the voltage to lock the position.

6.2   Preset Value

Function	Description	Programming Input	Explanation	Default
Preset Value	The current position value is set to the mid angle (2-axix) and zero position (1-axis).	Apply 5 V ... 30 V (Rin > 110 KΩ) on SET 1	With a 2-axis sensor, the preset function is applied to both axes simultaneously. There is no separate preset function for each axis.	–

Table 6.2

6.3   Invert Direction

To use this analog programming option, the inclination sensor must first be set to the preset/direction mode (teach 0) and the "compl" function has to be set to parameter 2 (compl 2) via RS-232 interface.

Function	Description	Programming Input	Explanation	Default
Invert Direction	Inverts measurement direction from clockwise (standard) to counterclockwise (inverted)	Apply 5 V ... 30 V (Rin > 110 KΩ) on SET 2 to set counter-clockwise direction (inverted) Apply GND, low-signal or no connection to set to clockwise direction (standard)	To set the inversion of direction, apply a continuous high signal (5 V ... 30 V) to SET 2 input. As long as the applied signal on SET 2 is greater than 5 V, the direction of measurement is always inverted.	–

Table 6.3

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6.4 Scaling of Output

To use this analog programming option, the inclination sensor must first be set to the teach-in mode (teach 1) via RS-232 interface.

Scaling of output can be set based on a user-defined angular measuring range. The range is defined by the 2 set points created by analog teach-in inputs SET 1 and SET 2. The analog output is scaled to give a full measurement output (4 ... 20 mA) over the user-defined range of measurement.

If the scaling was done correctly, the inclination sensor should give a 4 mA ... 20 mA output in the range of measurement set between the locked positions of SET 1 and SET 2.

The scaling can also be done counterclockwise. The output is scaled according to the direction of the sensor motion for the SET inputs. Upon scaling, the RS-232 angular output sets preset automatically at SET 1 position.

Scaling should be done according to the following sequence of steps:

1. Set inclination sensor to teach-in mode
2. Give high signal pulse to SET 1 at the origin of the measuring range to lock the position.

   ↳ Once position is locked, indicated by origin position output 4 mA, move to next step.
3. Give high signal pulse to SET 2 at the end of the measuring range.

   ↳ Once position is locked, indicated by end position output 20 mA, the scaling is complete.

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