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INCLINOMETER
RS232 - CURRENT

Main Features

- Two axis digital inclinometer
- Angle measurement range of +/-5°, +/-15° and
  +/-30°, Resolution up to 0.001°
- Active linearization and
  temperaturecompensation
- Interface: RS232, Code:ASCII
                  Current 4…20mA
- Housing: 70 mm $\varnothing$

Applications

- Structural engineering
- Levelling techniques
- Measuring techniques
- Inclinations
- Mechanical Structure

Programmable Parameters

- Transmission mode: Polled Mode, Cyclic Mode
- Cycle Time
- Seting of zero point
- Baud-rate 2.4 – 56 KBaud

Electrical Features

- Linear and temperature compensated
  characteristic line
- Microprocessor controlled
- Polarity inversion protection
- Over-voltage-peak protection
- Highly integrated circuit in SMD-technology

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INCLINOMETER
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Technical Data

Electrical Data

Model	AGS 5	AGS 15	AGS 30
Measuring range	+/- 5°	+/- 15°	+/- 30°
Resolution digital	0.001°	0.001°	0.01°
Resolution analog	0,001°	0,005°	0,01°
Accuracy (T = 0 °C .. +55 °C)	0,06°	0,18°	0,40°
Accuracy (T = -25 °C .. +85 °C)	0,12°	0,30°	1,00°
Inclination angle in x and y (1)	+/-15°	+/-40°	+/-60°
Damping period 5° > 0°	typical 1s 10%, 2s 1%, 3s 0.1%		
Digital interface	RS232 format ASCII		
Baud rate	Max. 56 k		
Analog interface	4...20mA , 0°= 12mA ; Load 300 Ohm		
Supply voltage (2)	10 - 30 V DC (absolute limits)		
Current consumption	typical 50 mA		
EMC	Emitted interference: EN 61000-6-3		
	Noise immunity: EN 61000-6-2		
Electrical lifetime	> 10^5 h		

(1) Supply voltage is applied.

(2) Inclinometers should be connected only to subsequent electronics whose power supplies comply with EN 50178 (protective low voltage)

Mechanical Data

Housing	Aluminum
Lifetime	> 10^5 h
Shock	A=30g; t= 11ms, halfsine ; EN 60068-2-27
Vibration	10 to 150 Hz, 2,5 mm amplitude, 5g const. Acceleration, 1 Octave /Minute ; EN 60068-2-6
Weight (standard version)	350 g

Environmental Conditions

Operating temperature	-40°C......+85°C
Storage temperature	-40°C......+85°C
Humidity	98 % (without liquid state)
Protection class	IP 67 (connected); EN 60529

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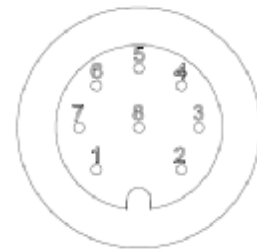
INCLINOMETER
RS232 - CURRENT

Installation

- Electrical Connection

The inclinometer is connected via 8 pin round connector or a Cable

Connector Assignment

Pin	Description	P8F-Cable	CRW-Cable
1	+UB Supply voltage	white	white
2	RxD	brown	brown
3	TxD	green	green
4	Ground (Supply)	yellow	yellow
5	X-Output	grey	grey
6	S-Ground	pink	pink
7	Y-Output	blue	red
8		red	

Front view of housing
Connector inclinometer

output signal (X,Y) analog current 4…20mA (+x,y°... -x,y°)

Instructions to mechanically install

Do not connect the inclinometer under power!

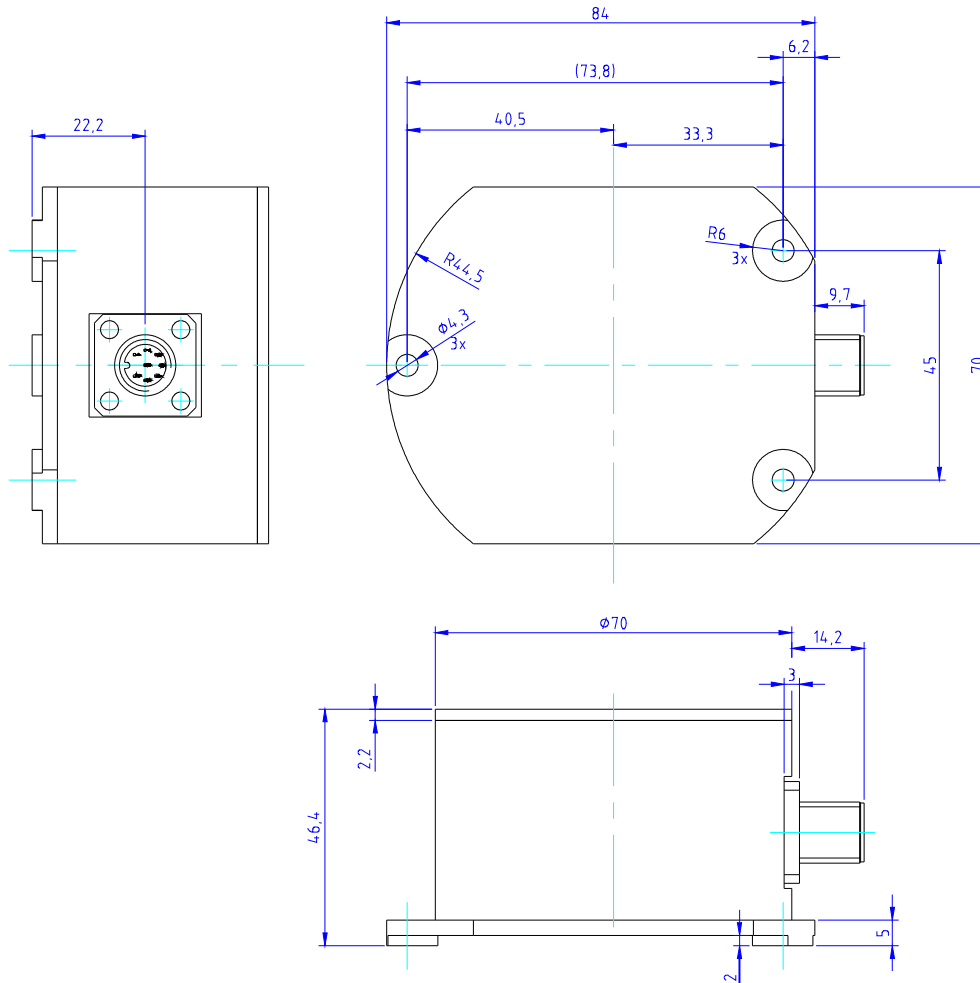**Do not stand on the inclinometer!**

Avoid mechanical load!

Serial Interface RS 232

Communication with the sensor is done through a standardized RS-232 interface. Data transmission is effected in duplex mode. The baud rate is fixed by 9600 baud. After Power On the sensor is sending continuous the angle values in degrees (°). In the setup level several settings can be permanently modified. If the continuous mode was permanently changed to the polling mode, the sensor will send after "Power On" a start information with actual parameters. On error no angle values are sending and after "Power On" a error message was add to the start information.

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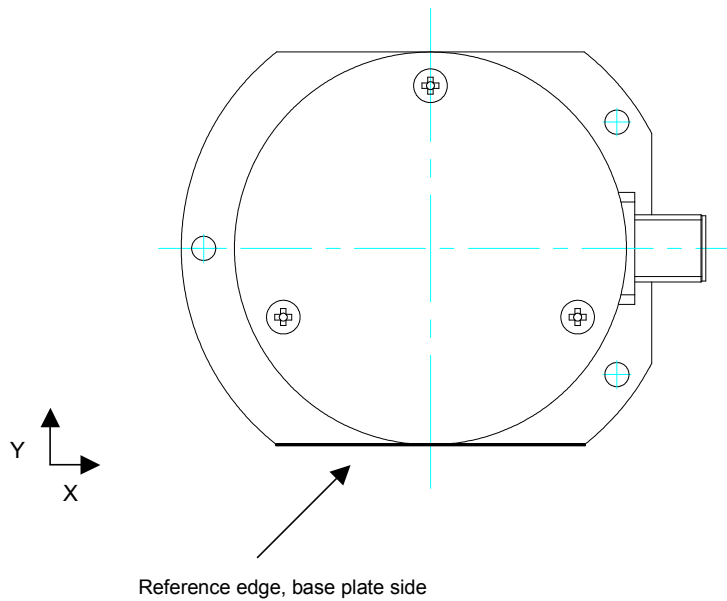INCLINOMETER
RS232 - CURRENT

Mechanical Drawings

Dimension housing (mm)

INCLINOMETER
RS232 - CURRENT

Reference Level

The Inclinometer has a mounting reference angel (black line)for an optimal mounting of the inclinometer, which is parallel to the x-axis. This reference angle must be placed exactly parallel to the object to be measured to prevent or minimize any mechanical offset/cross sensitivity.

Reference edge, base plate side

Reference angle of the inclinometer, top view

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Mounting and Installation Instruction

The inclinometer is designed for a horizontal mounting, i.e. the base plate of the inclinometer with the three mounting holes needs to be placed on the horizontal plane of the object to be measured. It can be mounted with M4 screw as a maximum.

The mounting surface must be plane and free of dust and grease.

We recommend cheese head screws with metrical thread M4 for the mounting.

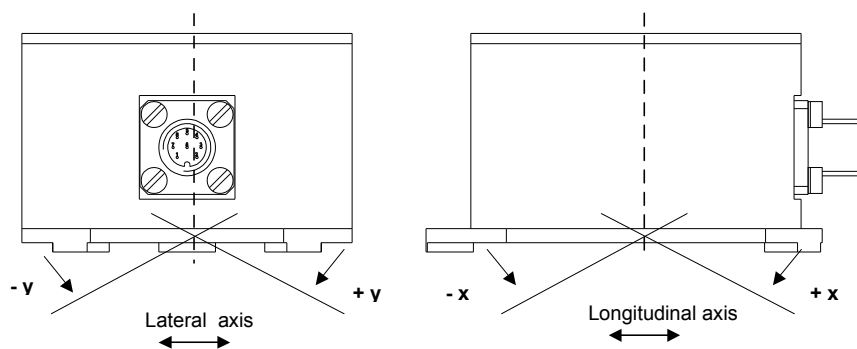Maximum fastening torque for the mounting screws is 10 Nm.

Installation

Prior to installation, please check for all connection and mounting instructions to be complied with. Please also observe the general rules and regulations on low voltage technical devices.

Avoid shock and vibration during measurement, as these could corrupt the measurement results. Inclination sensors that base on a fluidic measurement principle are optimal for static measurements and suitable to only a limited extent of dynamic measurement.

Measurement

The measurement of the tilt angle of the single measurement axis is carried out over the respective longitudinal and lateral axis of the inclination sensor. Reference is always the horizontal plane.

View of male socket   Side view

INCLINOMETER
RS232 - CURRENT

Models/Ordering Description

Description	Type Key					
Absolute inclinometer	**AGS** . . . -2-S	.	1-	H0-	. . .	-
Measuring range	**005**					
	015					
	030					
Number of axis						
RS232						
without interface		**O**				
Voltage interface		**V**				
Current interface		**C**				
PWM		**P**				
Switch		**S**				
Version						
Mechanical construction	Horizontal					
Dynamic	2 mPas					
Connection	plug, 8 pins				**P8M**	
	1 m cable exit				**CRW**	
Option						-

Accessories and Documentation

Description		Type
Connector, counterpart	8 pins	P8F
Cable	STK 8, 2m, Plug P8F	P8F-STK8.2
	STK 8, 5m, Plug P8F	P8F-STK8.5

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RS232 - CURRENT

Serial Interface RS 232

Communication with the sensor is done through a standardized RS-232 interface. Data transmission is effected in duplex mode. The baud rate is fixed by 9600 baud. After Power On the sensor is sending continuous the angle values in degrees (°). In the setup level several settings can be permanently modified. If the continuous mode was permanently changed to the polling mode, the sensor will send after "Power On" a start information with actual parameters. On error no angle values are sending and after "Power On" a error message was add to the start information.

Programming Instructions

Basic Settings

After Power On, the sensor is in the user level. In factory setting (==Free running mode) every 100ms the current angle values are continuously supplied with a baud rate of 9600 bd. In the Setup-level several settings can be changed permanent like query or free running mode, output rate, baud rate and angle offset. If query mode instead of free running mode is ser, the sensor will send start information with the current settings after Power On. In case of errors no angle values will be provided and after Power On an error message will be added to the start information.

Interface parameter:

9600 Baud , 8 data bits, parity even, 1 stop bit,

The baud rate can be adjusted to different values in the Setup-level.

Structure:

Baud rate: 9600 Baud (factory setting, changes in Setup-Mode possible)

Format: ASCII, 8 data bits, 1 stop bit, parity even

Length: 22 byte

Display: <D0 ... D21>

D0 ... D10	= "X=±xx.xxx", <CR>, <LF>
with D2	= sign (+ or -) with D5 = point
D11 ... D21	= "Y=±xx.xxx", <CR>, <LF>
with D13	= sign (+ or -) with D16 = point

display example:

```
…
X=+00.430
Y=-00.084
…
```

INCLINOMETER
RS232 - CURRENT

Commands in user level

Table 1: instructions at user level

instruction	to the sensor	response sensor	explanation
activate temporary polling mode (1) (2)	**"f"**	"f"	the continuous sending of angle values are stopped, instructions can send to the sensor
activate temporary continuous mode (1) (2)	**"F"**	„X=±xx.xxx", CR, LF, "Y=±xx.xxx", CR, LF, "X= . . .	X angle in ° Y angle in ° with „±" = „+" or „-", one string contains x and y value
read angle values at one-time (3)	**"R"**	"X=±xx.xxx", CR, LF, "Y=±xx.xxx", CR, LF,	X angle in ° Y angle in ° with „±" = „+" or „-"
switch to the setup level (3) (4)	**"prog"**	"P"	Sensor is at setup level
show active level (3)	**"*"**	"Ux" or "Sx"	„U" means Sensor is at User level „S" means Setup-level is active, with „x" Output-Mode of Sensors „U" / „I" / „P" / „S"

(1) In free running mode measurement data is continuously displayed. In query mode measurement and display is only once on command.

(2) After reset or new Power On after an interruption of power supply, the sensor will be in user-level again with the original setup or with the setup changed in the setup level.

(3) Only possible in query mode (=free running mode deactivated).

(4) The Input of „prog" must take place within 20 sec.

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INCLINOMETER
RS232 - CURRENT

Setup Level

The Setup level is active until "Power On" or Reset. All settings taken in the setup level are stored in the
EEPROM and permanent available also after Power down.

Table 2: instructions at setup level

instruction	to the sensor	response sensor	explanation
activate permanent polling mode (1)	"f"	"f"	the continuous sending of angle values are permanent stopped, instructions can send to the sensor
activate permanent continuous mode (1)	"F"	„X=±xx.xxx", CR, LF, "Y=±xx.xxx", CR, LF, "X= . . .	continuous sending of X angle in ° Y angle in ° with „±" = „+" or „-"
set rate of data transmission for continuous mode (2) (3) (4)	"O" <Code transmission rate>	"O" <Code transmission rate>	Echo, Code transmission rate or „E" for Error, if the code is outside defined values
read angle values at one-time (2)	"R"		same as at user level
read version (2)	"V"	"AGSxxx-2-Sx", CR, LF "SN:xxxx-xxx", CR, LF "HV:xx.x" , CR, LF "SV:xx.x" , CR, LF	type of Sensor serial number HW Version internal sensor SW Version
offset adjust of the specified axis (2) (3)	"n" "x" or "y"	"n" "OffsetX=±xx.xxx" or "OffsetY=±xx.xxx"	the actual angle of specified axis is set to zero, ±xx.xxx is the internal offset in degree
reset offset adjust (2) (3)	"N"	"N"	the offset adjust was reset to the original value
Set Baud rate (2) (3) (6)	"B" <Code Baud rate>	"B" <Code Baud rate>	Echo, Code Baud rate or „E" for Error, if the code is outside defined values
Set switch angle for one axis (2) (3) (7) (8)	"Sx" <switch angle> or "Sy" <switch angle>	"Sx" or "Sy" <switch angle>	Echo, switch angle or „E" for Error, if the angle is outside admissible range
Set hysteresis for switching point in both axis (2) (3) (7) (9)	"Sh" <hysterese>	"Sh" <hysterese>	Echo, hysterese or „E" for Error, if the angle is outside admissible range
show active level (2)	"*"		same as at user level
Reset (2)	"q"	"q"	Software-Reset will be executed

INCLINOMETER
RS232 - CURRENT

instructions at setup level

(1) in the continuous mode the sensor is sending continuous angle values, in the polling mode the sensor is sending one answer after an instruction

(2) only possible at polling mode.

(3) for activating a reset or power fail restart is necessary

(4) for Code transmission rate see

(5) Table 3 <Code transmission rate >

(6) for Code baud rate see Table 5 <Code Baud rate>
Attention! A reset of the baud rate to a default value is not possible. If the user forgets the adjusted baud rate, the new value must be detected by testing.

(7) this instruction is only effectual at sensors with switch output,

(8) <switch angle>: three digits from "001" until "300" for the angle in tenths of a degree, max working range of the sensor. Default value is 025 == 2,5°

(9) <hysterese>: two digits from "01" until "99" for the stitching hysterese in tenths of a degree, max working range of the sensor , Default value is 01 == 0,1°

Table 4 <Code transmission rate >

<Code transmission rate >	strings per second, 1 string contains x and y-value
"0"	reserved
"1"	25 Strings/s (10)
"2"	10 Strings/s, Default value (11)
"3"	5 Strings/s
"4"	2 Strings/s
"5"	1 Strings/s
"6"	0,2 Strings/s
"7"	0,1 Strings/s
"8", "9"	not defined

(10) only allowed with baud rate of at least 9600 Bd

(11) only allowed with baud rate of at least 4800 Bd

Table 5 <Code Baud rate>

<Code Baud rate>	baud rate
"0"	2400 Baud
"1"	4800 Baud
"2"	9600 Baud, Default value
"3"	19200 Baud
"4"	38400 Baud
"5"	57600 Baud
"6", "7", "8", "9"	not defined

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RS232 - CURRENT

Example for setting the output rate

In the following example the output rate is set to 1 string per second

instruction	to the sensor	response sensor	explanation
		„X=±xx.xxx", CR, LF, "Y=±xx.xxx", CR, LF, "X= . . .	continuous sending of angles
activate temporary polling mode	"f"	"f"	the continuous sending of angle values are stopped, instructions can send to the sensor
switch to the setup level	"prog"	"P"	Sensor is at setup level
set rate of data transmission for continuous mode	"O5"	"O5"	Code transmission rate is set to 1Strings/s
Reset	"q"	"q"	Software-Reset will be executed, the new settings are guilty
		„X=±xx.xxx", CR, LF, "Y=±xx.xxx", CR, LF, "X= . . .	continuous sending of angles at 1 Strings/s

We do not assume responsibility for technical inaccuracies or omissions. Specifications are subject to change without notice.

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INCLINOMETER
RS232 - VOLTAGE

Main Features

- Two axis digital inclinometer
- Angle measurement range of +/-5°, +/-15° and +/-30°, Resolution up to 0.001°
- Active linearization and temperaturecompensation
- Interface: RS232, Code:ASCII
                  Voltage, 0,5..4,5V
- Housing: 70 mm ∅

Applications

- Structural engineering
- Levelling techniques
- Measuring techniques
- Inclinations
- Mechanical Structure

Programmable Parameters

- Transmission mode: Polled Mode, Cyclic Mode
- Cycle Time
- Seting of zero point
- Baud-rate 2.4 – 56 KBaud

Electrical Features

- Linear and temperature compensated characteristic line
- Microprocessor controlled
- Polarity inversion protection
- Over-voltage-peak protection
- Highly integrated circuit in SMD-technology

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INCLINOMETER
RS232 - VOLTAGE

Technical Data

Electrical Data

Model	AGS 5	AGS 15	AGS 30
Measuring range	+/- 5°	+/- 15°	+/- 30°
Resolution digital	0.001°	0.001°	0.01°
Resolution analog	0,001°	0,005°	0,01°
Accuracy (T = 0 °C .. +55 °C)	0,06°	0,18°	0,40°
Accuracy (T = -25 °C .. +85 °C)	0,12°	0,30°	1,00°
Inclination angle in x and y (1)	+/-15°	+/-40°	+/-60°
Damping period 5° > 0°	typical 1s 10%, 2s 1%, 3s 0.1%		
Digital interface	RS232 format ASCII		
Baud rate	Max. 56 k		
Analog interface	0,5...4,5V , 0° = 2.5V; 1mA		
Supply voltage (2)	10 - 30 V DC (absolute limits)		
Current consumption	typical 50 mA		
EMC	Emitted interference: EN 61000-6-3		
	Noise immunity: EN 61000-6-2		
Electrical lifetime	$> 10^5$ h		

(1) Supply voltage is applied.

(2) Inclinometers should be connected only to subsequent electronics whose power supplies comply with EN 50178 (protective low voltage)

Mechanical Data

Housing	Aluminum
Lifetime	$> 10^5$ h
Shock	A=30g; t= 11ms, halfsine ; EN 60068-2-27
Vibration	10 to 150 Hz, 2,5 mm amplitude, 5g const. Acceleration, 1 Octave /Minute ; EN 60068-2-6
Weight (standard version)	350 g

Environmental Conditions

Operating temperature	-40°C......+85°C
Storage temperature	-40°C......+85°C
Humidity	98 % (without liquid state)
Protection class	IP 67 (connected); EN 60529

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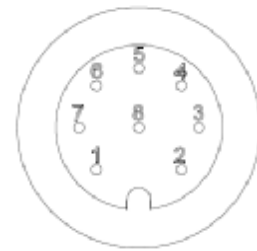## FRABA

INCLINOMETER
RS232 - VOLTAGE

Installation

- Electrical Connection
The inclinometer is connected via 8 pin round connector or a Cable

Connector Assignment

Pin	Description	P8F-Cable	CRW-Cable
1	+UB Supply voltage	white	white
2	RxD	brown	brown
3	TxD	green	green
4	Ground (Supply)	yellow	yellow
5	X-Output	grey	grey
6	S-Ground	pink	pink
7	Y-Output	blue	red
8		red	

Front view of housing
Connector inclinometer

output signal (X,Y) 0,5...4,5V (-x,y°... + x,y°)

Instructions to mechanically install

Do not connect the inclinometer under power!
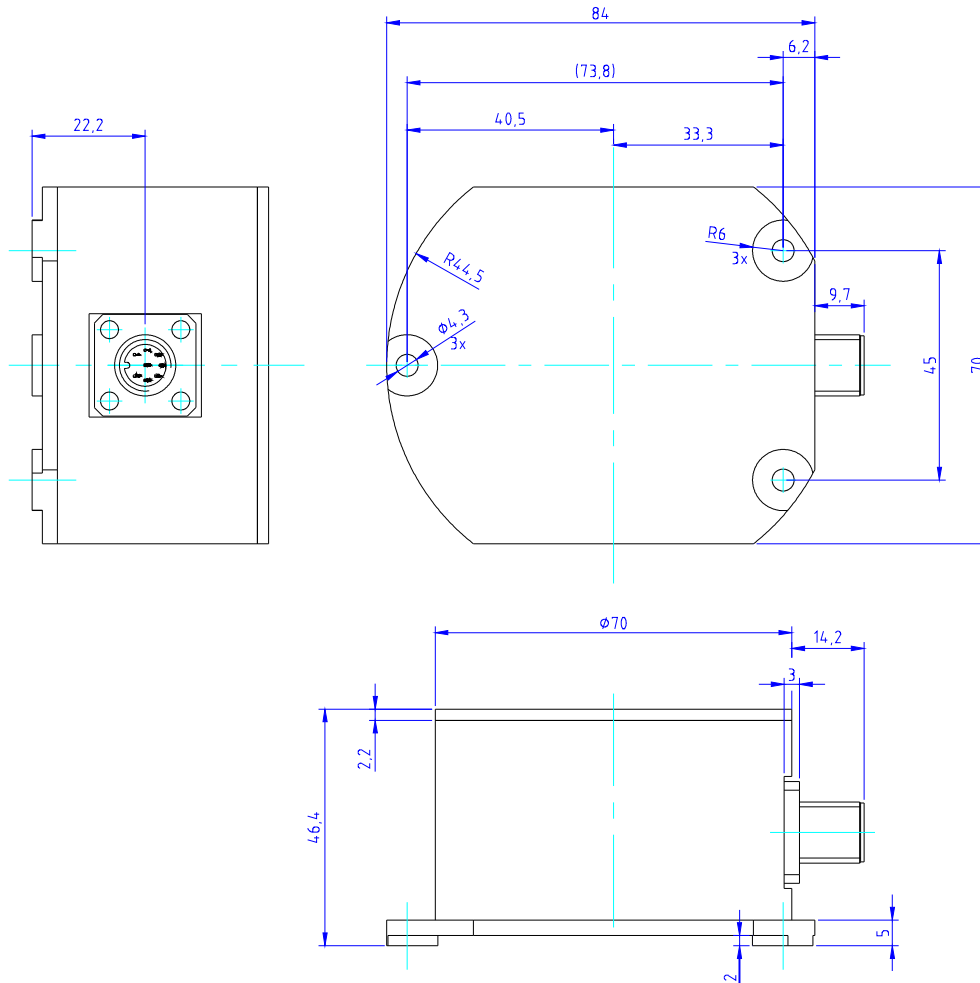
Do not stand on the inclinometer!

Avoid mechanical load!

Serial Interface RS 232
Communication with the sensor is done through a standardized RS-232 interface. Data transmission is effected in duplex mode. The baud rate is fixed by 9600 baud. After Power On the sensor is sending continuous the angle values in degrees (°). In the setup level several settings can be permanently modified. If the continuous mode was permanently changed to the polling mode, the sensor will send after "Power On" a start information with actual parameters. On error no angle values are sending and after "Power On" a error message was add to the start information.

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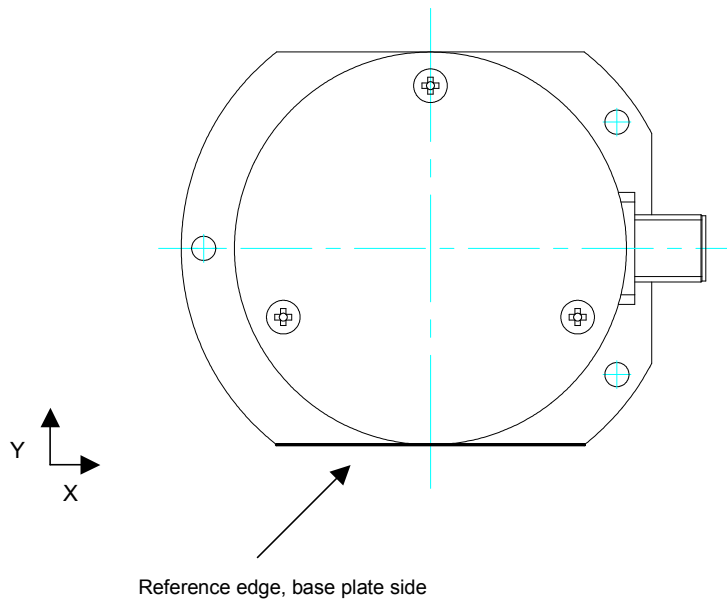
INCLINOMETER
RS232 - VOLTAGE

Mechanical Drawings

Dimension housing (mm)

INCLINOMETER
RS232 - VOLTAGE

Reference Level

The Inclinometer has a mounting reference angel (black line)for an optimal mounting of the inclinometer, which is parallel to the x-axis. This reference angle must be placed exactly parallel to the object to be measured to prevent or minimize any mechanical offset/cross sensitivity.

Reference edge, base plate side

Reference angle of the inclinometer, top view

INCLINOMETER
RS232 - VOLTAGE

Mounting and Installation Instruction

The inclinometer is designed for a horizontal mounting, i.e. the base plate of the inclinometer with the three mounting holes needs to be placed on the horizontal plane of the object to be measured. It can be mounted with M4 screw as a maximum.

The mounting surface must be plane and free of dust and grease.

We recommend cheese head screws with metrical thread M4 for the mounting.

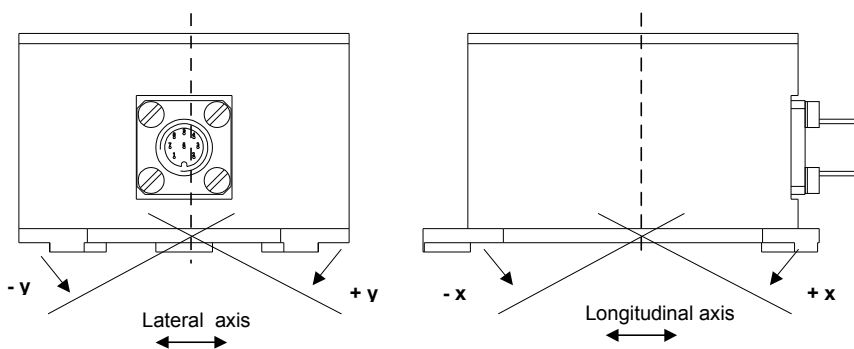Maximum fastening torque for the mounting screws is 10 Nm.

Installation

Prior to installation, please check for all connection and mounting instructions to be complied with. Please also observe the general rules and regulations on low voltage technical devices.

Avoid shock and vibration during measurement, as these could corrupt the measurement results. Inclination sensors that base on a fluidic measurement principle are optimal for static measurements and suitable to only a limited extent of dynamic measurement.

Measurement

The measurement of the tilt angle of the single measurement axis is carried out over the respective longitudinal and lateral axis of the inclination sensor. Reference is always the horizontal plane.

View of male socket   Side view

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INCLINOMETER
RS232 - VOLTAGE

Models/Ordering Description

Description	Type Key						
Absolute inclinometer	**AGS**	. . .	-2-S	.	1-	H0-	. . .	-
Measuring range	**005**						
	015						
	030						
Number of axis							
RS232							
without interface			**O**				
Voltage interface			**V**				
Current interface			**C**				
PWM			**P**				
Switch			**S**				
Version							
Mechanical construction	Horizontal						
Dynamic	2 mPas						
Connection	plug, 8 pins					**P8M**	
	1 m cable exit					**CRW**	
Option							-

Accessories and Documentation

Description		Type
Connector, counterpart	8 pins	P8F
Cable	STK 8, 2m, Plug P8F	P8F-STK8.2
	STK 8, 5m, Plug P8F	P8F-STK8.5

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INCLINOMETER
RS232 - VOLTAGE

Serial Interface RS 232

Communication with the sensor is done through a standardized RS-232 interface. Data transmission is effected in duplex mode. The baud rate is fixed by 9600 baud. After Power On the sensor is sending continuous the angle values in degrees (°). In the setup level several settings can be permanently modified. If the continuous mode was permanently changed to the polling mode, the sensor will send after "Power On" a start information with actual parameters. On error no angle values are sending and after "Power On" a error message was add to the start information.

Programming Instructions

Basic Settings

After Power On, the sensor is in the user level. In factory setting (==Free running mode) every 100ms the current angle values are continuously supplied with a baud rate of 9600 bd. In the Setup-level several settings can be changed permanent like query or free running mode, output rate, baud rate and angle offset. If query mode instead of free running mode is ser, the sensor will send start information with the current settings after Power On. In case of errors no angle values will be provided and after Power On an error message will be added to the start information.

Interface parameter:

9600 Baud , 8 data bits, parity even, 1 stop bit,

The baud rate can be adjusted to different values in the Setup-level.

Structure:

Baud rate: 9600 Baud (factory setting, changes in Setup-Mode possible)

Format: ASCII, 8 data bits, 1 stop bit, parity even

Length: 22 byte

Display: <D0 ... D21>

D0 ... D10	= "X=±xx.xxx", <CR>, <LF>
with D2	= sign (+ or -)
	with D5 = point
D11 ... D21	= "Y=±xx.xxx", <CR>, <LF>
with D13	= sign (+ or -)
	with D16 = point

display example:

```
…
X=+00.430
Y=-00.084
…
```

INCLINOMETER
RS232 - VOLTAGE

Commands in user level

Table 1: instructions at user level

instruction	to the sensor	response sensor	explanation
activate temporary polling mode (1) (2)	**"f"**	"f"	the continuous sending of angle values are stopped, instructions can send to the sensor
activate temporary continuous mode (1) (2)	**"F"**	„X=±xx.xxx", CR, LF, "Y=±xx.xxx", CR, LF, "X= . . .	X angle in ° Y angle in ° with „±" = „+" or „-", one string contains x and y value
read angle values at one-time (3)	**"R"**	"X=±xx.xxx", CR, LF, "Y=±xx.xxx", CR, LF,	X angle in ° Y angle in ° with „±" = „+" or „-"
switch to the setup level (3) (4)	**"prog"**	"P"	Sensor is at setup level
show active level (3)	**"*"**	"Ux" or "Sx"	„U" means Sensor is at User level „S" means Setup-level is active, with „x" Output-Mode of Sensors „U" / „I" / „P" / „S"

(1) In free running mode measurement data is continuously displayed. In query mode measurement and display is only once on command.

(2) After reset or new Power On after an interruption of power supply, the sensor will be in user-level again with the original setup or with the setup changed in the setup level.

(3) Only possible in query mode (=free running mode deactivated).

(4) The Input of „prog" must take place within 20 sec.

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INCLINOMETER
RS232 - VOLTAGE

Setup Level

The Setup level is active until "Power On" or Reset. All settings taken in the setup level are stored in the
EEPROM and permanent available also after Power down.

Table 2: instructions at setup level

instruction	to the sensor	response sensor	explanation
activate permanent polling mode (1)	"f"	"f"	the continuous sending of angle values are permanent stopped, instructions can send to the sensor
activate permanent continuous mode (1)	"F"	„X=±xx.xxx", CR, LF, "Y=±xx.xxx", CR, LF, "X= . . .	continuous sending of X angle in ° Y angle in ° with „±" = „+" or „-"
set rate of data transmission for continuous mode (2) (3) (4)	"O" <Code transmission rate>	"O" <Code transmission rate>	Echo, Code transmission rate or „E" for Error, if the code is outside defined values
read angle values at one-time (2)	"R"		same as at user level
read version (2)	"V"	"AGSxxx-2-Sx", CR, LF "SN:xxxx-xxx", CR, LF "HV:xx.x" , CR, LF "SV:xx.x" , CR, LF	type of Sensor serial number HW Version internal sensor SW Version
offset adjust of the specified axis (2) (3)	"n" "x" or "y"	"n" "OffsetX=±xx.xxx" or "OffsetY=±xx.xxx"	the actual angle of specified axis is set to zero, ±xx.xxx is the internal offset in degree
reset offset adjust (2) (3)	"N"	"N"	the offset adjust was reset to the original value
Set Baud rate (2) (3) (6)	"B" <Code Baud rate>	"B" <Code Baud rate>	Echo, Code Baud rate or „E" for Error, if the code is outside defined values
Set switch angle for one axis (2) (3) (7) (8)	"Sx" <switch angle> or "Sy" <switch angle>	"Sx" or "Sy" <switch angle>	Echo, switch angle or „E" for Error, if the angle is outside admissible range
Set hysteresis for switching point in both axis (2) (3) (7) (9)	"Sh" <hysterese>	"Sh" <hysterese>	Echo, hysterese or „E" for Error, if the angle is outside admissible range
show active level (2)	"*"		same as at user level
Reset (2)	"q"	"q"	Software-Reset will be executed

INCLINOMETER
RS232 - VOLTAGE

instructions at setup level

(1) in the continuous mode the sensor is sending continuous angle values, in the polling mode the sensor is sending one answer after an instruction

(2) only possible at polling mode.

(3) for activating a reset or power fail restart is necessary

(4) for Code transmission rate see

(5) Table 3 <Code transmission rate >

(6) for Code baud rate see Table 5 <Code Baud rate>
Attention! A reset of the baud rate to a default value is not possible. If the user forgets the adjusted baud rate, the new value must be detected by testing.

(7) this instruction is only effectual at sensors with switch output,

(8) <switch angle>: three digits from "001" until "300" for the angle in tenths of a degree, max working range of the sensor. Default value is 025 == 2,5°

(9) <hysterese>: two digits from "01" until "99" for the stitching hysterese in tenths of a degree, max working range of the sensor , Default value is 01 == 0,1°

Table 4 <Code transmission rate >

<Code transmission rate >	strings per second, 1 string contains x and y-value
"0"	reserved
"1"	25 Strings/s (10)
"2"	10 Strings/s, Default value (11)
"3"	5 Strings/s
"4"	2 Strings/s
"5"	1 Strings/s
"6"	0,2 Strings/s
"7"	0,1 Strings/s
"8", "9"	not defined

(10) only allowed with baud rate of at least 9600 Bd

(11) only allowed with baud rate of at least 4800 Bd

Table 5 <Code Baud rate>

<Code Baud rate>	baud rate
"0"	2400 Baud
"1"	4800 Baud
"2"	9600 Baud, Default value
"3"	19200 Baud
"4"	38400 Baud
"5"	57600 Baud
"6", "7", "8", "9"	not defined

INCLINOMETER
RS232 - VOLTAGE

Example for setting the output rate

In the following example the output rate is set to 1 string per second

instruction	to the sensor	response sensor	explanation
		„X=±xx.xxx", CR, LF, "Y=±xx.xxx", CR, LF, "X= . . .	continuous sending of angles
activate temporary polling mode	**"f"**	"f"	the continuous sending of angle values are stopped, instructions can send to the sensor
switch to the setup level	**"prog"**	"P"	Sensor is at setup level
set rate of data transmission for continuous mode	**"O5"**	"O5"	Code transmission rate is set to 1Strings/s
Reset	**"q"**	"q"	Software-Reset will be executed, the new settings are guilty
		„X=±xx.xxx", CR, LF, "Y=±xx.xxx", CR, LF, "X= . . .	continuous sending of angles at 1 Strings/s

We do not assume responsibility for technical inaccuracies or omissions. Specifications are subject to change without notice.

INCLINOMETER
RS232 - PWM

Main Features

- Two axis digital inclinometer
- Angle measurement range of +/-5°, +/-15° and +/-30°, Resolution up to 0.001°
- Active linearization and temperaturecompensation
- Interface: RS232, Code:ASCII
                   PWM 1 KHz
- Housing: 70 mm ∅

Applications

- Structural engineering
- Levelling techniques
- Measuring techniques
- Inclinations
- Mechanical Structure

Programmable Parameters

- Transmission mode: Polled Mode, Cyclic Mode
- Cycle Time
- Seting of zero point
- Baud-rate 2.4 – 56 KBaud

Electrical Features

- Linear and temperature compensated characteristic line
- Microprocessor controlled
- Polarity inversion protection
- Over-voltage-peak protection
- Highly integrated circuit in SMD-technology

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INCLINOMETER
RS232 - PWM

Technical Data

Electrical Data

Model	AGS 5	AGS 15	AGS 30
Measuring range	+/- 5°	+/- 15°	+/- 30°
Resolution digital	0.001°	0.001°	0.01°
Resolution PWM	0,001°	0,005°	0,01°
Accuracy (T = 0 °C .. +55 °C)	0,06°	0,18°	0,40°
Accuracy (T = -25 °C .. +85 °C)	0,12°	0,30°	1,00°
Inclination angle in x and y (1)	+/-15°	+/-40°	+/-60°
Damping period 5° > 0°	typical 1s 10%, 2s 1%, 3s 0.1%		
Digital interface	RS232 format ASCII		
Baud rate	Max. 56 k		
PWM interface	1KHz, 20%…80%		
Supply voltage (2)	10 - 30 V DC (absolute limits)		
Current consumption	typical 50 mA		
EMC	Emitted interference: EN 61000-6-3		
	Noise immunity: EN 61000-6-2		
Electrical lifetime	$> 10^5$ h		

(1) Supply voltage is applied.

(2) Inclinometers should be connected only to subsequent electronics whose power supplies comply with EN 50178 (protective low voltage)

Mechanical Data

Housing	Aluminum
Lifetime	$> 10^5$ h
Shock	A=30g; t= 11ms, halfsine ; EN 60068-2-27
Vibration	10 to 150 Hz, 2,5 mm amplitude, 5g const. Acceleration, 1 Octave /Minute ; EN 60068-2-6
Weight (standard version)	350 g

Environmental Conditions

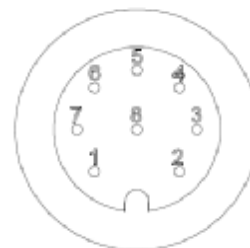| Operating temperature	-40°C......+85°C
Storage temperature	-40°C......+85°C
Humidity	98 % (without liquid state)
Protection class	IP 67 (connected); EN 60529

INCLINOMETER
RS232 - PWM

Installation

- Electrical Connection

The inclinometer is connected via 8 pin round connector or a Cable

Connector Assignment

Pin	Description	P8F-Cable	CRW-Cable
1	+UB Supply voltage	white	white
2	RxD	brown	brown
3	TxD	green	green
4	Ground (Supply)	yellow	yellow
5	X-Output	grey	grey
6	S-Ground	pink	pink
7	Y-Output	blue	red
8		red	

Front view of housing
Connector inclinometer

output signal (X,Y) PWM 1 KHz, 20%...80% (-x,y°... +x,y°)

Instructions to mechanically install

Do not connect the inclinometer under power!

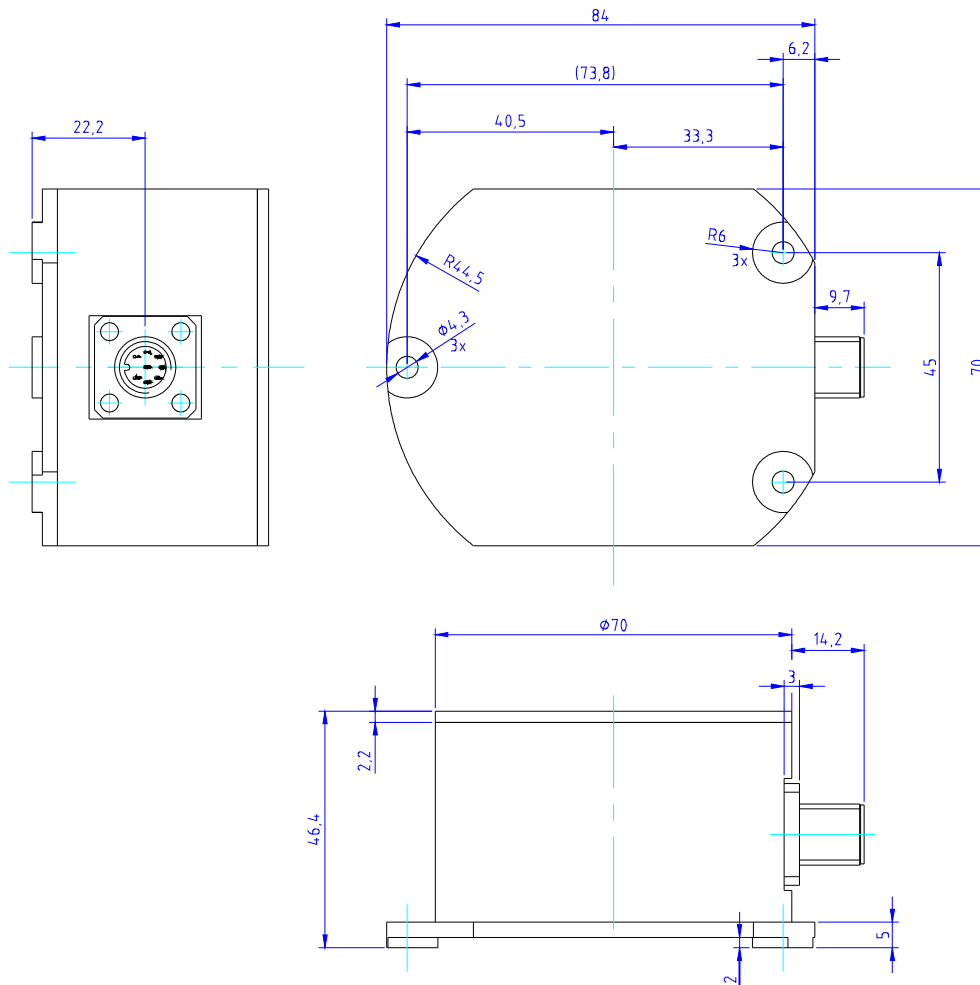**Do not stand on the inclinometer!**

Avoid mechanical load!

Serial Interface RS 232

Communication with the sensor is done through a standardized RS-232 interface. Data transmission is effected in duplex mode. The baud rate is fixed by 9600 baud. After Power On the sensor is sending continuous the angle values in degrees (°). In the setup level several settings can be permanently modified. If the continuous mode was permanently changed to the polling mode, the sensor will send after "Power On" a start information with actual parameters. On error no angle values are sending and after "Power On" a error message was add to the start information.

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INCLINOMETER
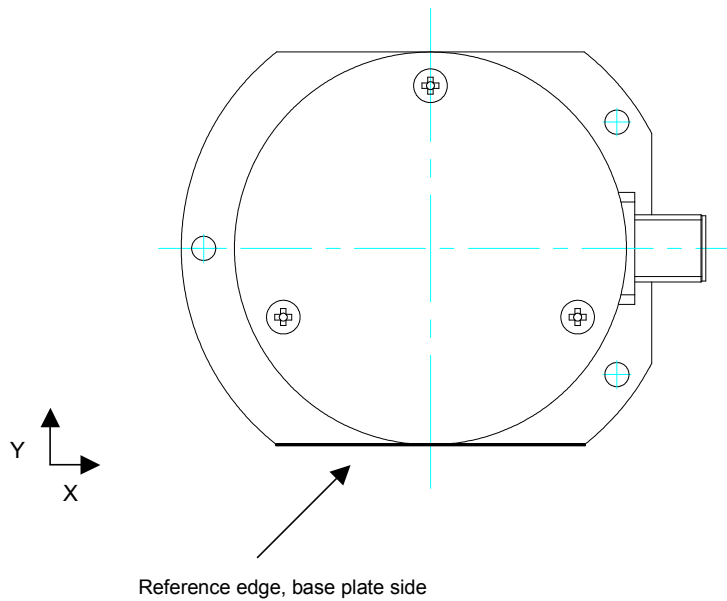RS232 - PWM

Mechanical Drawings

Dimension housing (mm)

INCLINOMETER
RS232 - PWM

Reference Level

The Inclinometer has a mounting reference angel (black line)for an optimal mounting of the inclinometer, which is parallel to the x-axis. This reference angle must be placed exactly parallel to the object to be measured to prevent or minimize any mechanical offset/cross sensitivity.

Reference edge, base plate side

Reference angle of the inclinometer, top view

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INCLINOMETER
RS232 - PWM

Mounting and Installation Instruction

The inclinometer is designed for a horizontal mounting, i.e. the base plate of the inclinometer with the three mounting holes needs to be placed on the horizontal plane of the object to be measured. It can be mounted with M4 screw as a maximum.

The mounting surface must be plane and free of dust and grease.

We recommend cheese head screws with metrical thread M4 for the mounting.

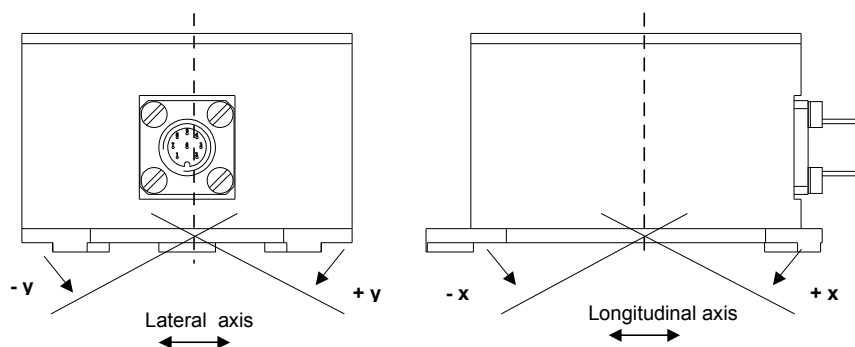Maximum fastening torque for the mounting screws is 10 Nm.

Installation

Prior to installation, please check for all connection and mounting instructions to be complied with. Please also observe the general rules and regulations on low voltage technical devices.

Avoid shock and vibration during measurement, as these could corrupt the measurement results. Inclination sensors that base on a fluidic measurement principle are optimal for static measurements and suitable to only a limited extent of dynamic measurement.

Measurement

The measurement of the tilt angle of the single measurement axis is carried out over the respective longitudinal and lateral axis of the inclination sensor. Reference is always the horizontal plane.

- y   + y

Lateral axis

- x   + x

Longitudinal axis

View of male socket   Side view

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INCLINOMETER
RS232 - PWM

Models/Ordering Description

Description	Type Key					
Absolute inclinometer	**AGS** . . . -2-S	.	1-	H0-	. . .	-
Measuring range	**005**					
	015					
	030					
Number of axis						
RS232						
without interface		**O**				
Voltage interface		**V**				
Current interface		**C**				
PWM		**P**				
Switch		**S**				
Version						
Mechanical construction	Horizontal					
Dynamic	2 mPas					
Connection	plug, 8 pins				**P8M**	
	1 m cable exit				**CRW**	
Option						-

Accessories and Documentation

Description		Type
Connector, counterpart	8 pins	P8F
Cable	STK 8, 2m, Plug P8F	P8F-STK8.2
	STK 8, 5m, Plug P8F	P8F-STK8.5

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INCLINOMETER
RS232 - PWM

Serial Interface RS 232

Communication with the sensor is done through a standardized RS-232 interface. Data transmission is effected in duplex mode. The baud rate is fixed by 9600 baud. After Power On the sensor is sending continuous the angle values in degrees (°). In the setup level several settings can be permanently modified. If the continuous mode was permanently changed to the polling mode, the sensor will send after "Power On" a start information with actual parameters. On error no angle values are sending and after "Power On" a error message was add to the start information.

Programming Instructions

Basic Settings

After Power On, the sensor is in the user level. In factory setting (==Free running mode) every 100ms the current angle values are continuously supplied with a baud rate of 9600 bd. In the Setup-level several settings can be changed permanent like query or free running mode, output rate, baud rate and angle offset. If query mode instead of free running mode is ser, the sensor will send start information with the current settings after Power On. In case of errors no angle values will be provided and after Power On an error message will be added to the start information.

Interface parameter:

9600 Baud , 8 data bits, parity even, 1 stop bit,

The baud rate can be adjusted to different values in the Setup-level.

Structure:

Baud rate:	9600 Baud (factory setting, changes in Setup-Mode possible)
Format:	ASCII, 8 data bits, 1 stop bit, parity even
Length:	22 byte
Display:	<D0 ... D21>

D0 ... D10	= "X=±xx.xxx", <CR>, <LF>
with D2	= sign (+ or -) with D5 = point
D11 ... D21	= "Y=±xx.xxx", <CR>, <LF>
with D13	= sign (+ or -) with D16 = point

display example:

```
…
X=+00.430
Y=-00.084
…
```

INCLINOMETER
RS232 - PWM

Commands in user level

Table 1: instructions at user level

instruction	to the sensor	response sensor	explanation
activate temporary polling mode (1) (2)	**"f"**	"f"	the continuous sending of angle values are stopped, instructions can send to the sensor
activate temporary continuous mode (1) (2)	**"F"**	„X=±xx.xxx", CR, LF, "Y=±xx.xxx", CR, LF, "X= . . .	X angle in ° Y angle in ° with „±" = „+" or „-", one string contains x and y value
read angle values at one-time (3)	**"R"**	"X=±xx.xxx", CR, LF, "Y=±xx.xxx", CR, LF,	X angle in ° Y angle in ° with „±" = „+" or „-"
switch to the setup level (3) (4)	**"prog"**	"P"	Sensor is at setup level
show active level (3)	**"*"**	"Ux" or "Sx"	„U" means Sensor is at User level „S" means Setup-level is active, with „x" Output-Mode of Sensors „U" / „I" / „P" / „S"

(1) In free running mode measurement data is continuously displayed. In query mode measurement and display is only once on command.

(2) After reset or new Power On after an interruption of power supply, the sensor will be in user-level again with the original setup or with the setup changed in the setup level.

(3) Only possible in query mode (=free running mode deactivated).

(4) The Input of „prog" must take place within 20 sec.

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INCLINOMETER
RS232 - PWM

Setup Level

The Setup level is active until "Power On" or Reset. All settings taken in the setup level are stored in the EEPROM and permanent available also after Power down.

Table 2: instructions at setup level

instruction	to the sensor	response sensor	explanation
activate permanent polling mode (1)	**"f"**	"f"	the continuous sending of angle values are permanent stopped, instructions can send to the sensor
activate permanent continuous mode (1)	**"F"**	„X=±xx.xxx", CR, LF, "Y=±xx.xxx", CR, LF, "X= . . .	continuous sending of X angle in ° Y angle in ° with „±" = „+" or „-"
set rate of data transmission for continuous mode (2) (3) (4)	**"O"** **<Code transmission rate>**	"O" <Code transmission rate>	Echo, Code transmission rate or „E" for Error, if the code is outside defined values
read angle values at one-time (2)	**"R"**		same as at user level
read version (2)	**"V"**	"AGSxxx-2-Sx", CR, LF "SN:xxxx-xxx", CR, LF "HV:xx.x" , CR, LF "SV:xx.x" , CR, LF	type of Sensor serial number HW Version internal sensor SW Version
offset adjust of the specified axis (2) (3)	**"n"** **"x" or "y"**	"n" "OffsetX=±xx.xxx" or "OffsetY=±xx.xxx"	the actual angle of specified axis is set to zero, ±xx.xxx is the internal offset in degree
reset offset adjust (2) (3)	**"N"**	"N"	the offset adjust was reset to the original value
Set Baud rate (2) (3) (6)	**"B"** **<Code Baud rate>**	"B" <Code Baud rate>	Echo, Code Baud rate or „E" for Error, if the code is outside defined values
Set switch angle for one axis (2) (3) (7) (8)	**"Sx"** **<switch angle> or "Sy"** **<switch angle>**	"Sx" or "Sy" <switch angle>	Echo, switch angle or „E" for Error, if the angle is outside admissible range
Set hysteresis for switching point in both axis (2) (3) (7) (9)	**"Sh"** **<hysterese>**	"Sh" <hysterese>	Echo, hysterese or „E" for Error, if the angle is outside admissible range
show active level (2)	**"*"**		same as at user level
Reset (2)	**"q"**	"q"	Software-Reset will be executed

INCLINOMETER
RS232 - PWM

instructions at setup level

(1) in the continuous mode the sensor is sending continuous angle values, in the polling mode the sensor is sending one answer after an instruction
(2) only possible at polling mode.
(3) for activating a reset or power fail restart is necessary
(4) for Code transmission rate see
(5) Table 3 <Code transmission rate >
(6) for Code baud rate see Table 5 <Code Baud rate>
Attention! A reset of the baud rate to a default value is not possible. If the user forgets the adjusted baud rate, the new value must be detected by testing.
(7) this instruction is only effectual at sensors with switch output,
(8) <switch angle>: three digits from "001" until "300" for the angle in tenths of a degree, max working range of the sensor. Default value is 025 == 2,5°
(9) <hysterese>: two digits from "01" until "99" for the stitching hysterese in tenths of a degree, max working range of the sensor , Default value is 01 == 0,1°

Table 4 <Code transmission rate >

<Code transmission rate >	strings per second, 1 string contains x and y-value
"0"	reserved
"1"	25 Strings/s (10)
"2"	10 Strings/s, Default value (11)
"3"	5 Strings/s
"4"	2 Strings/s
"5"	1 Strings/s
"6"	0,2 Strings/s
"7"	0,1 Strings/s
"8", "9"	not defined

(10) only allowed with baud rate of at least 9600 Bd
(11) only allowed with baud rate of at least 4800 Bd

Table 5 <Code Baud rate>

<Code Baud rate>	baud rate
"0"	2400 Baud
"1"	4800 Baud
"2"	9600 Baud, Default value
"3"	19200 Baud
"4"	38400 Baud
"5"	57600 Baud
"6", "7", "8", "9"	not defined

INCLINOMETER
RS232 - PWM

Example for setting the output rate

In the following example the output rate is set to 1 string per second

instruction	to the sensor	response sensor	explanation
		„X=±xx.xxx", CR, LF, "Y=±xx.xxx", CR, LF, "X= . . .	continuous sending of angles
activate temporary polling mode	**"f"**	"f"	the continuous sending of angle values are stopped, instructions can send to the sensor
switch to the setup level	**"prog"**	"P"	Sensor is at setup level
set rate of data transmission for continuous mode	**"O5"**	"O5"	Code transmission rate is set to 1Strings/s
Reset	**"q"**	"q"	Software-Reset will be executed, the new settings are guilty
		„X=±xx.xxx", CR, LF, "Y=±xx.xxx", CR, LF, "X= . . .	continuous sending of angles at 1 Strings/s

We do not assume responsibility for technical inaccuracies or omissions. Specifications are subject to change without notice.

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INCLINOMETER
RS232 - SWITCH

Main Features

- Two axis digital inclinometer
- Angle measurement range of +/-5°, +/-15° and
  +/-30°, Resolution up to 0.001°
- Active linearization and
  temperaturecompensation
- Interface: RS232, Code:ASCII
                      Switch Open Collector
- Housing: 70 mm ∅

Applications

- Structural engineering
- Levelling techniques
- Measuring techniques
- Inclinations
- Mechanical Structure

Programmable Parameters

- Transmission mode: Polled Mode, Cyclic Mode
- Cycle Time
- Seting of zero point
- Baud-rate 2.4 – 56 KBaud

Electrical Features

- Linear and temperature compensated
  characteristic line
- Microprocessor controlled
- Polarity inversion protection
- Over-voltage-peak protection
- Highly integrated circuit in SMD-technology

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INCLINOMETER
RS232 - SWITCH

Technical Data

Electrical Data

Model	AGS 5	AGS 15	AGS 30
Measuring range	+/- 5°	+/- 15°	+/- 30°
Resolution digital	0.001°	0.001°	0.01°
Resolution switch	0,1°	0,1°	0,1°
Accuracy (T = 0 °C .. +55 °C)	0,06°	0,18°	0,40°
Accuracy (T = -25 °C .. +85 °C)	0,12°	0,30°	1,00°
Inclination angle in x and y (1)	+/-15°	+/-40°	+/-60°
Damping period 5° > 0°	typical 1s 10%, 2s 1%, 3s 0.1%		
Digital interface	RS232 format ASCII		
Baud rate	Max. 56 k		
Switch	0,1 °-Step switch SGND, 50mA (Open Collector) to Uext (x,y)		
Supply voltage (2)	10 - 30 V DC (absolute limits)		
Current consumption	typical 50 mA		
EMC	Emitted interference: EN 61000-6-3		
	Noise immunity: EN 61000-6-2		
Electrical lifetime	$> 10^5$ h		

(1) Supply voltage is applied.

(2) Inclinometers should be connected only to subsequent electronics whose power supplies comply with EN 50178 (protective low voltage)

Mechanical Data

Housing	Aluminum
Lifetime	$> 10^5$ h
Shock	A=30g; t= 11ms, halfsine ; EN 60068-2-27
Vibration	10 to 150 Hz, 2,5 mm amplitude, 5g const. Acceleration, 1 Octave /Minute ; EN 60068-2-6
Weight (standard version)	350 g

Environmental Conditions

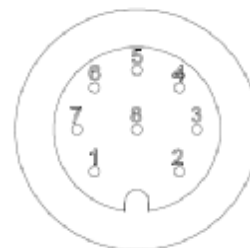| Operating temperature	-40°C......+85°C
Storage temperature	-40°C......+85°C
Humidity	98 % (without liquid state)
Protection class	IP 67 (connected); EN 60529

INCLINOMETER
RS232 - SWITCH

Installation

- Electrical Connection

The inclinometer is connected via 8 pin round connector or a Cable

Connector Assignment

Pin	Description	P8F-Cable	CRW-Cable
1	+UB Supply voltage	white	white
2	RxD	brown	brown
3	TxD	green	green
4	Ground (Supply)	yellow	yellow
5	X-Output	grey	grey
6	S-Ground	pink	pink
7	Y-Output	blue	red
8		red	

Front view of housing
Connector inclinometer

output signal (X,Y) switch, 0.1° step

Instructions to mechanically install

Do not connect the inclinometer under power!
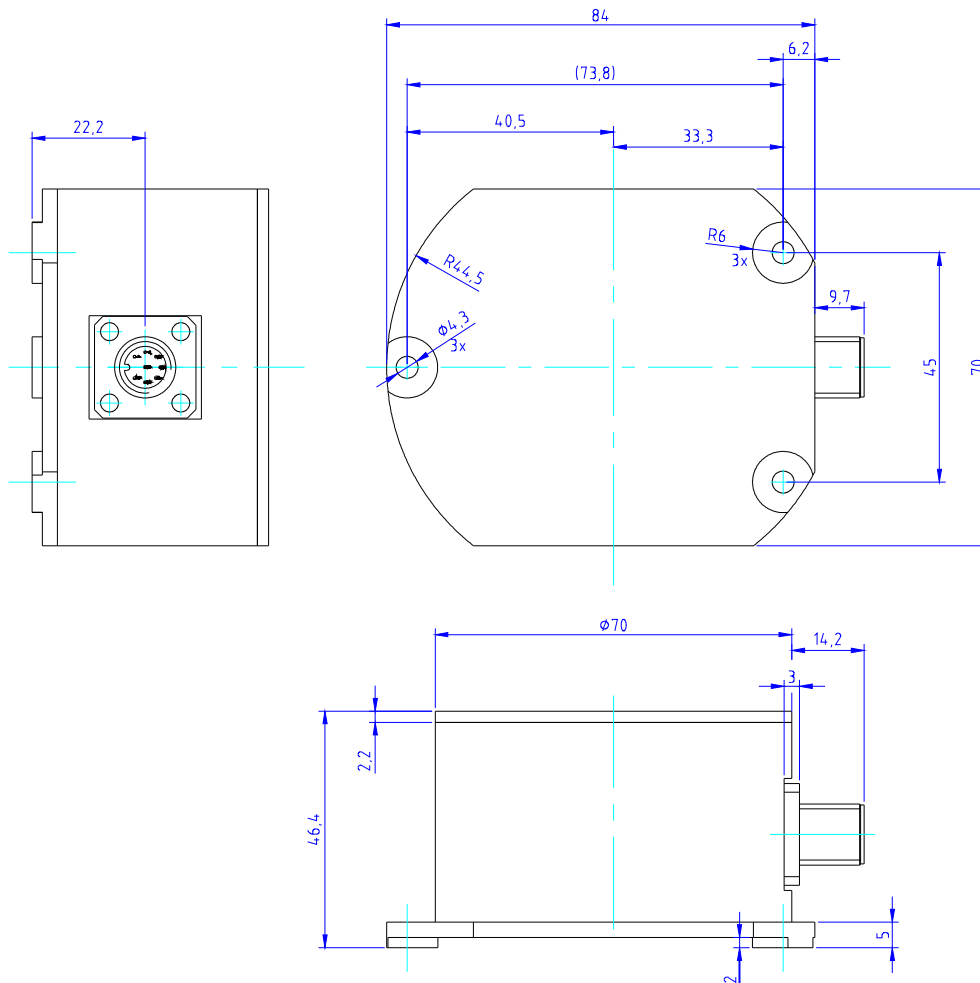
Do not stand on the inclinometer!

Avoid mechanical load!

Serial Interface RS 232

Communication with the sensor is done through a standardized RS-232 interface. Data transmission is effected in duplex mode. The baud rate is fixed by 9600 baud. After Power On the sensor is sending continuous the angle values in degrees (°). In the setup level several settings can be permanently modified. If the continuous mode was permanently changed to the polling mode, the sensor will send after "Power On" a start information with actual parameters. On error no angle values are sending and after "Power On" a error message was add to the start information.

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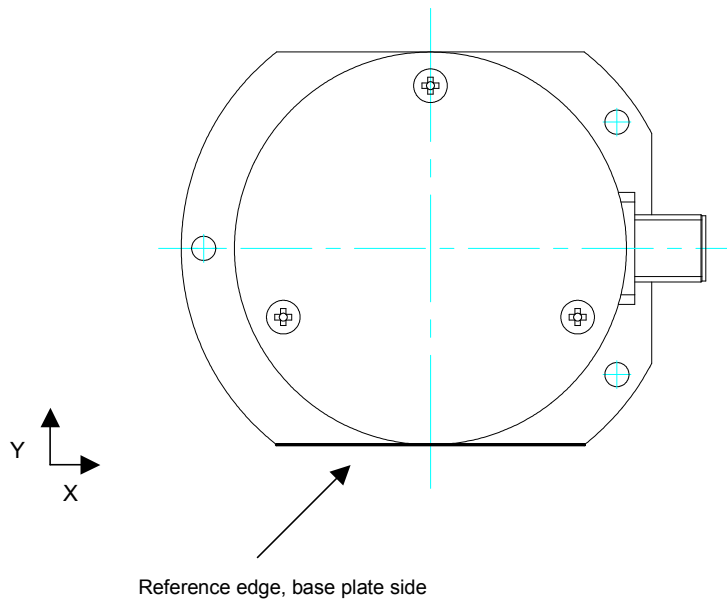INCLINOMETER
RS232 - SWITCH

Mechanical Drawings

Dimension housing (mm)

INCLINOMETER
RS232 - SWITCH

Reference Level

The Inclinometer has a mounting reference angel (black line)for an optimal mounting of the inclinometer, which is parallel to the x-axis. This reference angle must be placed exactly parallel to the object to be measured to prevent or minimize any mechanical offset/cross sensitivity.

Reference edge, base plate side

Reference angle of the inclinometer, top view

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INCLINOMETER
RS232 - SWITCH

Mounting and Installation Instruction

The inclinometer is designed for a horizontal mounting, i.e. the base plate of the inclinometer with the three mounting holes needs to be placed on the horizontal plane of the object to be measured. It can be mounted with M4 screw as a maximum.

The mounting surface must be plane and free of dust and grease.

We recommend cheese head screws with metrical thread M4 for the mounting.

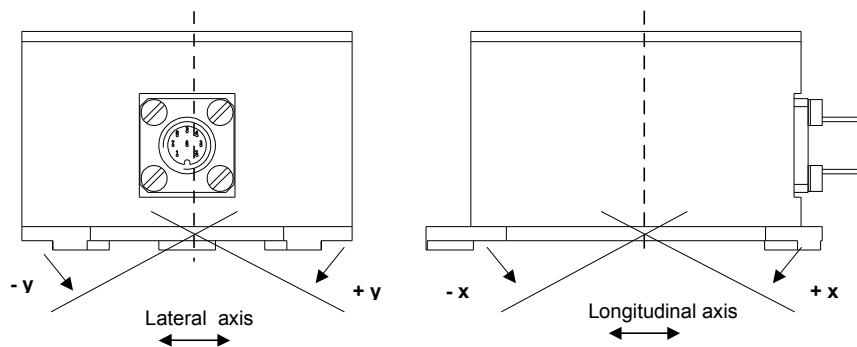Maximum fastening torque for the mounting screws is 10 Nm.

Installation

Prior to installation, please check for all connection and mounting instructions to be complied with. Please also observe the general rules and regulations on low voltage technical devices.

Avoid shock and vibration during measurement, as these could corrupt the measurement results. Inclination sensors that base on a fluidic measurement principle are optimal for static measurements and suitable to only a limited extent of dynamic measurement.

Measurement

The measurement of the tilt angle of the single measurement axis is carried out over the respective longitudinal and lateral axis of the inclination sensor. Reference is always the horizontal plane.

View of male socket   Side view

INCLINOMETER
RS232 - SWITCH

Models/Ordering Description

Description	Type Key						
Absolute inclinometer	**AGS**	. . . -2-S	.	1-	H0-	. . .	-
Measuring range	**005**						
	015						
	030						
Number of axis							
RS232							
without interface			**O**				
Voltage interface			**V**				
Current interface			**C**				
PWM			**P**				
Switch			**S**				
Version							
Mechanical construction	Horizontal						
Dynamic	2 mPas						
Connection	plug, 8 pins					**P8M**	
	1 m cable exit					**CRW**	
Option							-

Accessories and Documentation

Description		Type
Connector, counterpart	8 pins	P8F
Cable	STK 8, 2m, Plug P8F	P8F-STK8.2
	STK 8, 5m, Plug P8F	P8F-STK8.5

INCLINOMETER
RS232 - SWITCH

Serial Interface RS 232

Communication with the sensor is done through a standardized RS-232 interface. Data transmission is effected in duplex mode. The baud rate is fixed by 9600 baud. After Power On the sensor is sending continuous the angle values in degrees (°). In the setup level several settings can be permanently modified. If the continuous mode was permanently changed to the polling mode, the sensor will send after "Power On" a start information with actual parameters. On error no angle values are sending and after "Power On" a error message was add to the start information.

Programming Instructions

Basic Settings

After Power On, the sensor is in the user level. In factory setting (==Free running mode) every 100ms the current angle values are continuously supplied with a baud rate of 9600 bd. In the Setup-level several settings can be changed permanent like query or free running mode, output rate, baud rate and angle offset. If query mode instead of free running mode is ser, the sensor will send start information with the current settings after Power On. In case of errors no angle values will be provided and after Power On an error message will be added to the start information.

Interface parameter:

9600 Baud , 8 data bits, parity even, 1 stop bit,

The baud rate can be adjusted to different values in the Setup-level.

Structure:

Baud rate:	9600 Baud (factory setting, changes in Setup-Mode possible)
Format:	ASCII, 8 data bits, 1 stop bit, parity even
Length:	22 byte
Display:	<D0 ... D21>

D0 ... D10	= "X=±xx.xxx", <CR>, <LF>
with D2	= sign (+ or -) with D5 = point
D11 ... D21	= "Y=±xx.xxx", <CR>, <LF>
with D13	= sign (+ or -) with D16 = point

display example:

```
…
X=+00.430
Y=-00.084
…
```

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INCLINOMETER
RS232 - SWITCH

Commands in user level

Table 1: instructions at user level

instruction	to the sensor	response sensor	explanation
activate temporary polling mode (1) (2)	"f"	"f"	the continuous sending of angle values are stopped, instructions can send to the sensor
activate temporary continuous mode (1) (2)	"F"	„X=±xx.xxx", CR, LF, "Y=±xx.xxx", CR, LF, "X= . . .	X angle in ° Y angle in ° with „±" = „+" or „-", one string contains x and y value
read angle values at one-time (3)	"R"	"X=±xx.xxx", CR, LF, "Y=±xx.xxx", CR, LF,	X angle in ° Y angle in ° with „±" = „+" or „-"
switch to the setup level (3) (4)	"prog"	"P"	Sensor is at setup level
show active level (3)	"*"	"Ux" or "Sx"	„U" means Sensor is at User level „S" means Setup-level is active, with „x" Output-Mode of Sensors „U" / „I" / „P" / „S"

(1) In free running mode measurement data is continuously displayed. In query mode measurement and display is only once on command.

(2) After reset or new Power On after an interruption of power supply, the sensor will be in user-level again with the original setup or with the setup changed in the setup level.

(3) Only possible in query mode (=free running mode deactivated).

(4) The Input of „prog" must take place within 20 sec.

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INCLINOMETER
RS232 - SWITCH

Setup Level

The Setup level is active until "Power On" or Reset. All settings taken in the setup level are stored in the
EEPROM and permanent available also after Power down.

Table 2: instructions at setup level

instruction	to the sensor	response sensor	explanation
activate permanent polling mode (1)	"f"	"f"	the continuous sending of angle values are permanent stopped, instructions can send to the sensor
activate permanent continuous mode (1)	"F"	„X=±xx.xxx", CR, LF, "Y=±xx.xxx", CR, LF, "X= . . .	continuous sending of X angle in ° Y angle in ° with „±" = „+" or „-"
set rate of data transmission for continuous mode (2) (3) (4)	"O" <Code transmission rate>	"O" <Code transmission rate>	Echo, Code transmission rate or „E" for Error, if the code is outside defined values
read angle values at one-time (2)	"R"		same as at user level
read version (2)	"V"	"AGSxxx-2-Sx", CR, LF "SN:xxxx-xxx", CR, LF "HV:xx.x" , CR, LF "SV:xx.x" , CR, LF	type of Sensor serial number HW Version internal sensor SW Version
offset adjust of the specified axis (2) (3)	"n" "x" or "y"	"n" "OffsetX=±xx.xxx" or "OffsetY=±xx.xxx"	the actual angle of specified axis is set to zero, ±xx.xxx is the internal offset in degree
reset offset adjust (2) (3)	"N"	"N"	the offset adjust was reset to the original value
Set Baud rate (2) (3) (6)	"B" <Code Baud rate>	"B" <Code Baud rate>	Echo, Code Baud rate or „E" for Error, if the code is outside defined values
Set switch angle for one axis (2) (3) (7) (8)	"Sx" <switch angle> or "Sy" <switch angle>	"Sx" or "Sy" <switch angle>	Echo, switch angle or „E" for Error, if the angle is outside admissible range
Set hysteresis for switching point in both axis (2) (3) (7) (9)	"Sh" <hysterese>	"Sh" <hysterese>	Echo, hysterese or „E" for Error, if the angle is outside admissible range
show active level (2)	"*"		same as at user level
Reset (2)	"q"	"q"	Software-Reset will be executed

INCLINOMETER
RS232 - SWITCH

instructions at setup level

(1) in the continuous mode the sensor is sending continuous angle values, in the polling mode the sensor is sending one answer after an instruction
(2) only possible at polling mode.
(3) for activating a reset or power fail restart is necessary
(4) for Code transmission rate see
(5) Table 3 <Code transmission rate >
(6) for Code baud rate see Table 5 <Code Baud rate>
Attention! A reset of the baud rate to a default value is not possible. If the user forgets the adjusted baud rate, the new value must be detected by testing.
(7) this instruction is only effectual at sensors with switch output,
(8) <switch angle>: three digits from "001" until "300" for the angle in tenths of a degree, max working range of the sensor. Default value is 025 == 2,5°
(9) <hysterese>: two digits from "01" until "99" for the stitching hysterese in tenths of a degree, max working range of the sensor , Default value is 01 == 0,1°

Table 4 <Code transmission rate >

<Code transmission rate >	strings per second, 1 string contains x and y-value
"0"	reserved
"1"	25 Strings/s (10)
"2"	10 Strings/s, Default value (11)
"3"	5 Strings/s
"4"	2 Strings/s
"5"	1 Strings/s
"6"	0,2 Strings/s
"7"	0,1 Strings/s
"8", "9"	not defined

(10) only allowed with baud rate of at least 9600 Bd
(11) only allowed with baud rate of at least 4800 Bd

Table 5 <Code Baud rate>

<Code Baud rate>	baud rate
"0"	2400 Baud
"1"	4800 Baud
"2"	9600 Baud, Default value
"3"	19200 Baud
"4"	38400 Baud
"5"	57600 Baud
"6", "7", "8", "9"	not defined

INCLINOMETER
RS232 - SWITCH

Example for setting the output rate

In the following example the output rate is set to 1 string per second

instruction	to the sensor	response sensor	explanation
		„X=±xx.xxx", CR, LF, "Y=±xx.xxx", CR, LF, "X= . . .	continuous sending of angles
activate temporary polling mode	**"f"**	"f"	the continuous sending of angle values are stopped, instructions can send to the sensor
switch to the setup level	**"prog"**	"P"	Sensor is at setup level
set rate of data transmission for continuous mode	**"O5"**	"O5"	Code transmission rate is set to 1Strings/s
Reset	**"q"**	"q"	Software-Reset will be executed, the new settings are guilty
		„X=±xx.xxx", CR, LF, "Y=±xx.xxx", CR, LF, "X= . . .	continuous sending of angles at 1 Strings/s

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INCLINOMETER
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Main Features

- Two axis digital inclinometer
- Angle measurement range of +/-5°, +/-15° and +/-30°, Resolution up to 0.001°
- Active linearization and temperaturecompensation
- Interface: CAN according to CAL
- Code: Binary
- Housing: 70 mm ⌀

Electrical Features

- Highly integrated circuit in SMD-technology
- Polarity inversion protection
- Over-voltage-peak protection

Programmable Parameters

- Resolution
- Preset value
- Two limit switches
- Baud-rate and CAN-identifier
- Heartbeat Function
- Transmission mode: Polled mode, cyclic mode, sync mode

Applications

- Structural engineering
- Levelling techniques
- Measuring techniques
- Inclinations
- Mechanical Structure

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Technical Data

Electrical Data

Model	AGS 5	AGS 15	AGS 30
Measuring range	+/- 5°	+/- 15°	+/- 30°
Resolution	0.001°	0,001°	0,005°
Accuracy (T = 0 °C .. +55 °C)	0,06°	0,18°	0,40°
Accuracy (T = -25 °C . +85 °C)	0,12°	0,30°	1,00°
Inclination angle in x and y (1)	+/-15°	+/-40°	+/-60°
Damping period 0° -> 5°	typical 1s 10%, 2s 1%, 3s 0,1%		
Interface	Transceiver according ISO 11898, galvanically isolated by opto-couplers		
Transmission rate	max. 1 MBaud		
Device addressing	Adjustable by rotary switches in connection cap		
Supply voltage (2)	10 – 30 V DC (absolute limits)		
Current consumption	max. 230 mA with 10 V DC, max. 100 mA with 24 V DC		
Power consumption	max. 2.2 Watts		
EMC	Emitted interference: EN 61000-6-4		
	Noise immunity: EN 61000-6-3		
Electrical lifetime	> 10^5 h		

(1) Supply voltage is applied.

(2) Inclinometers should be connected only to subsequent electronics whose power supplies comply with EN 50178 (protective low voltage)

Mechanical Data

Housing	Aluminum
Lifetime	> 10^5 h
Shock	A=30g; t= 11ms, halfsine (EN 60068-2-27)
Vibration	10 to 150 Hz, 2,5 mm amplitude, 5g const. Acceleration, 1 Octave /Minute (EN 60068-2-6)
Weight (standard version)	350 g

Environmental Conditions

Operating temperature	-40°C......+85°C
Storage temperature	-40°C......+85°C
Humidity	98 % (without liquid state)
Protection class	IP 67 (connected) (EN 60529)

INCLINOMETER
CANOPEN

Installation

Electrical Connection

The inclinometer is connected via 8 pin round connector or a Cable

Instructions to mechanically install and electrically connect the inclinometer

⚠️ **Do not connect the inclinometer under power!**

Do not stand on the inclinometer!

Avoid mechanical load!

Bus Termination

If the inclinometer is connected at the end or beginning of the bus the termination resistor must be switched on. The termination resistor is switched on when the dip-switch 8 is in the 'ON' position. To switch the resistor on, the cap of the inclinometer have to unscrew.
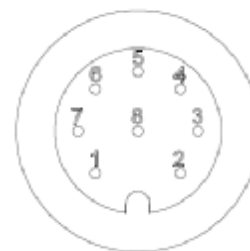
There is a resistor provided in the inclinometer, which must be used as a line termination on the last device.

Bus address

The setting of the node number is achieved via SDO-Object (see 4.2). Possible (valid) addresses lie between 0 and 96 whereby every address can only be used once.

⚠️ **The CANopen inclinometer adds internal 1 to the adjusted device address.**

Pin	Description	P8F-Cable	CRW-Cable *
1	+UB Supply voltage	White	white (3)
2	RxD	Brown	
3	TxD	Green	
4	Ground (Supply)	Yellow	brown (10)
5	CAN Low	grey	pink (13)
6	CAN Ground	Pink	green (12)
7	CAN High	Blue	yellow (5)
8		Red	

Tabelle 1 Connector Assignment

* 15 pin D-Sub Connector

Front view of housing
Connector inclinometer

INCLINOMETER
CANOPEN

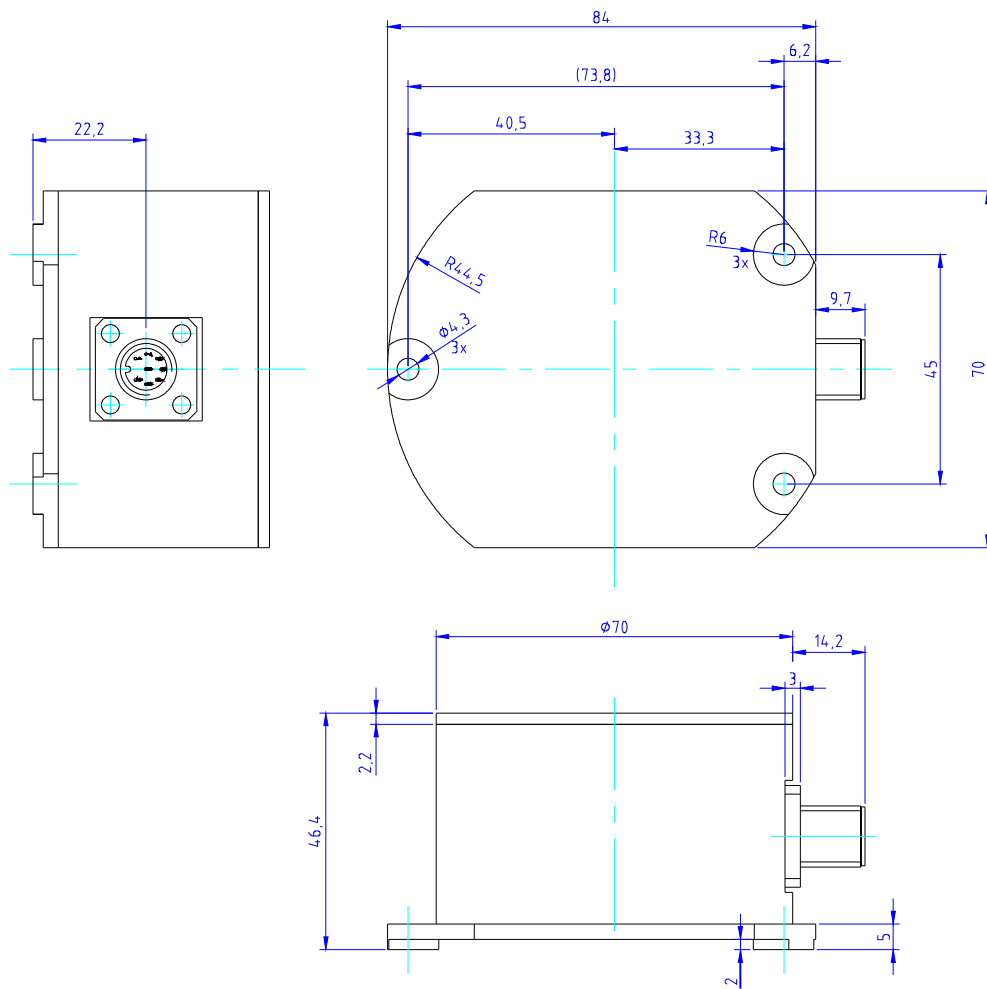**Programmable Encoder - Parameter**

Resolution per 1°	The parameter resolution per 1° is used to program the desired number of steps per revolution. The values 1, 10, 100 and 1000 can be programmed.
Preset Value	The preset value is the desired position value, which should be reached at a certain physical position of the axis. The position value is set to the desired process value by the parameter pre-set.
Baudrate	The Baudrate can be programmed via SDO, **default 20KBaud**.
Node Number	The setting of the node number is achieved via SDO-Object. Possible (valid) addresses lie between 0 and 89 whereby every address can only be used once. The CANopen inclinometer adds internal 1 to the adjusted device address. **Defauld 20Hex**

Programmable CAN Transmission Modes

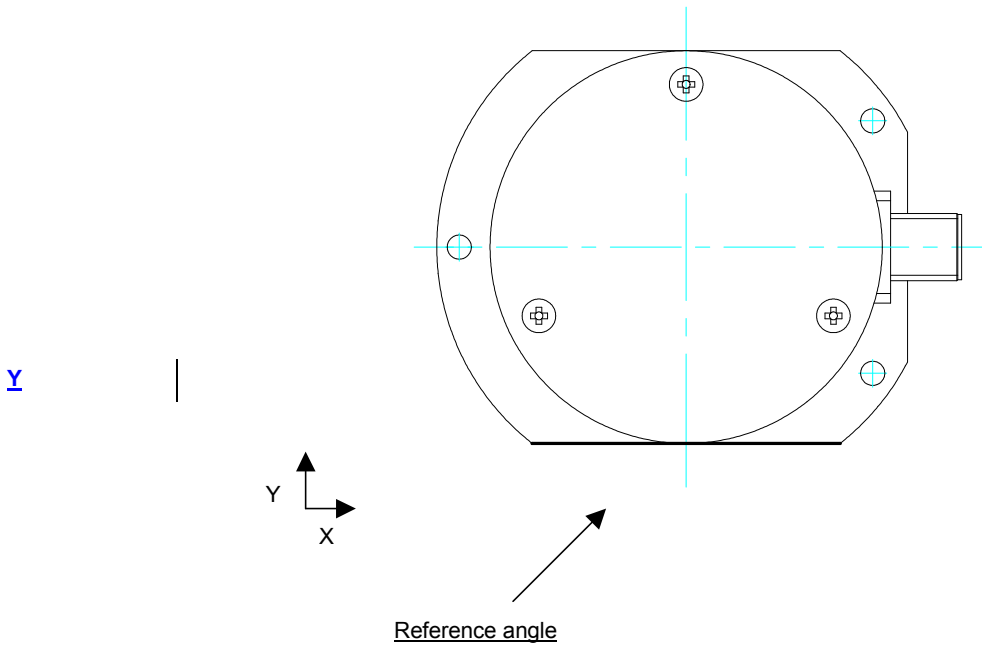|	
Polled Mode	By a remote-transmission-request telegram the connected host calls for the current process value. The inclinometer reads the current position value, calculates eventually set-parameters and sends back the obtained process value by the same identifier.
Cyclic Mode	The inclinometer transmits cyclically - without being called by the host - the current process value. The cycle time can be programmed in milliseconds for values between 1 ms and 65536 ms.
Sync Mode	After receiving a sync telegram by the host, the inclinometer answers with the current process value. If more than one node number (encoder) shall answer after receiving a sync telegram, the answer telegrams of the nodes will be received by the host in order of their node numbers. The programming of an offset-time is not necessary. If a node should not answer after each sync telegram on the CAN network, the parameter sync counter can be programmed to skip a certain number of sync telegrams before answering again.
Heartbeat-Function	A node signaled his communication status by transmiting cyclically a heartbeat message. This message could receives one, divers or each member (Heartbeat Consumer) in the bus and so they can control the dedicated node(Heartbeat Producer).

Mechanical Drawings

Dimension housing (mm)

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Reference Level

The Inclinometer has a mounting reference angel (black line)for an optimal mounting of the inclinometer, which is parallel to the x-axis. This reference angle must be placed exactly parallel to the object to be measured to prevent or minimize any mechanical offset/cross sensitivity.

Y

Reference angle

Reference angle of the inclinometer, top view.

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Mounting and Installation Instruction

The inclinometer is designed for a horizontal mounting, i.e. the base plate of the inclinometer with the three mounting holes needs to be placed on the horizontal plane of the object to be measured. It can be mounted with M4 screw as a maximum.
The mounting surface must be plane and free of dust and grease.
We recommend cheese head screws with metrical thread M4 for the mounting.
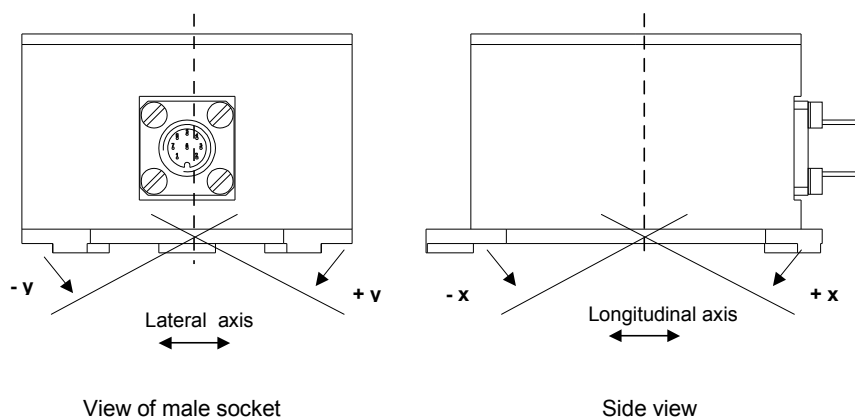Maximum fastening torque for the mounting screws is 10 Nm.

Installation

Prior to installation, please check for all connection and mounting instructions to be complied with. Please also observe the general rules and regulations on low voltage technical devices.
Avoid shock and vibration during measurement, as these could corrupt the measurement results. Inclination sensors that base on a fluidic measurement principle are optimal for static measurements and suitable to only a limited extent of dynamic measurement.

Measurement

The measurement of the tilt angle of the single measurement axis is carried out over the respective longitudinal and lateral axis of the inclination sensor. Reference is always the horizontal plane.

| View of male socket | Side view |

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Models/Ordering Description

Description	Typekey							
Absolute inclinometer	**AGS**	. . .	-2-	. .	1-	H0-	. . .	-
Measuring range	**005**							
	015							
	030							
Number of axis								
Interface				**CA**				
Version								
Mechanical construction	horizontal							
Dynamik	2 mPas							
Connection	connector, 8 pin						**P8M**	
	1 m cable						**CRW**	
Option	without							**-**

Tabelle 2 Ordering Description

Accessories and documentation

Description		Typ
Mating Connector		P8F
Cabel	Cabel STK 8, 2m, Connector P8F	P8F-STK8.2
	Cabel STK 8, 5m, Connector P8F	P8F-STK8.5
User manual *	Installation and configuration manual, german	UMD-CA
User manual *	Installation and configuration manual, english	UME-CA
EDS-File *	Disc containing EDS-file for configuration	DK-CA

Tabelle 3 Accessories

*   These can be downloaded free of charge from our homepage www.posital.com.

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INCLINOMETER
RS232 - CURRENT

Main Features

- Dual-axis X-Y direction
- Compact and heavy-duty industrial design
- Interface: RS232
- Code: ASCII
- Current: 4-20mA
- Resolution: Up to 0.001°
- Housing: 70 mm ∅

Programmable Parameters

- Transmission mode: Polled Mode, Cyclic Mode
- Cycle Time
- Preset
- Baud-rate 2.4 – 56 KBaud

Applications

- Structural engineering
- Levelling techniques
- Measuring techniques
- Inclinations
- Mechanical Structure

Electrical Features

- Linear and temperature compensated characteristic line
- Microprocessor controlled
- Polarity inversion protection
- Over-voltage-peak protection
- Highly integrated circuit in SMD-technology

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INCLINOMETER
RS232 - CURRENT

Technical Data

Electrical Data

Model	AGS 5	AGS 15	AGS 30
Measuring range	+/- 5°	+/- 15°	+/- 30°
Resolution digital	0.001°	0.001°	0.01°
Resolution analog	0,001°	0,005°	0,01°
Accuracy (T = 0 ℃ .. +55 ℃)	0,06°	0,18°	0,40°
Accuracy (T = -25 ℃ .. +85 ℃)	0,12°	0,30°	1,00°
Damping period 5° > 0°	typical 1s +/-0,5°, 2s +/-0,1°, 3s +/-0,005°		
Digital interface	RS232 format ASCII		
Baud rate	Max. 56 k		
Analog interface	4-20 mA Load 300 Ohm		
Supply voltage	10 - 30 V DC (absolute limits) *		
Current consumption	max. 100 mA (10 V DC), max. 50 mA (24 V DC)		
EMC	EN 50081-2, EN 61000-6-2		
Electrical lifetime	$> 10^5$ h		

* Supply voltage according to EN 50 178 (safety extra-low voltage)

Environmental Conditions

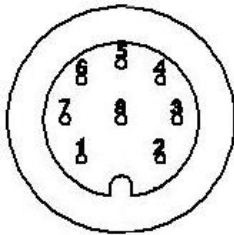|	
Operating temperature	- 25 ℃ to + 80 ℃
Storage temperature	- 40 ℃ to + 85 ℃
Shock	A=30g; t= 11ms, halfsine (EN 60068-2-27)
Vibration	10 to 150 Hz, 2,5 mm amplitude, 5g const. Acceleration, 1 Octave /Minute (EN 60068-2-6)
Humidity	98 % (without liquid state)
Protection class (DIN 40 050)	IP 67 (with connection Plug in connected state)
Weight	350 g

INCLINOMETER
RS232 - CURRENT

Installation

- Electrical Connection

The inclinometer is connected via 8 pin round connector

Connector Assignment

Pin	Description	Cable
1	+UB Supply voltage	white
2	RxD	brown
3	TxD	green
4	Ground (Supply)	yellow
5	X-Output	grey
6	Signal Ground	pink
7	Y-Output	blue
8		red

8 pin round connector
connector male inlay

Instructions to mechanically install

Do not connect the inclinometer under power!
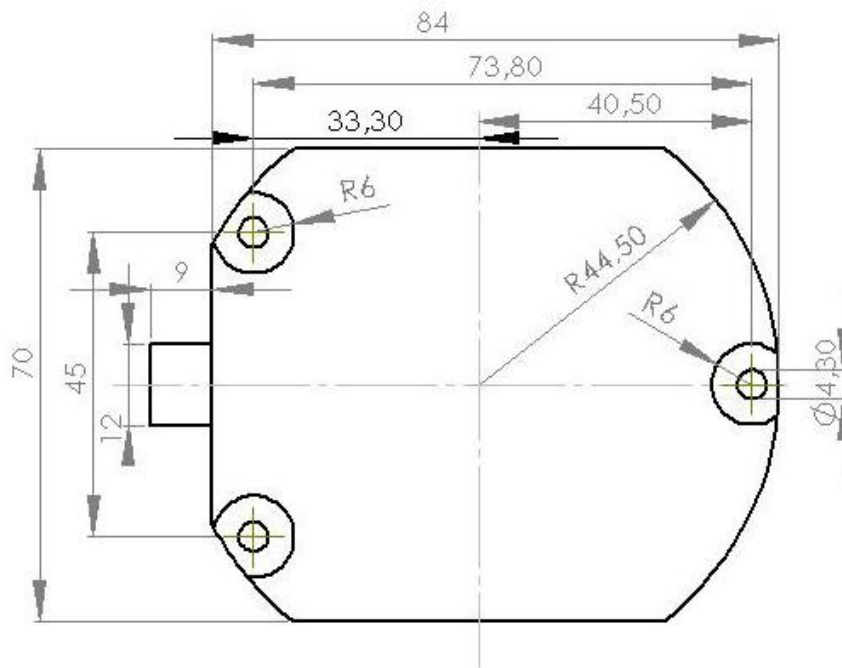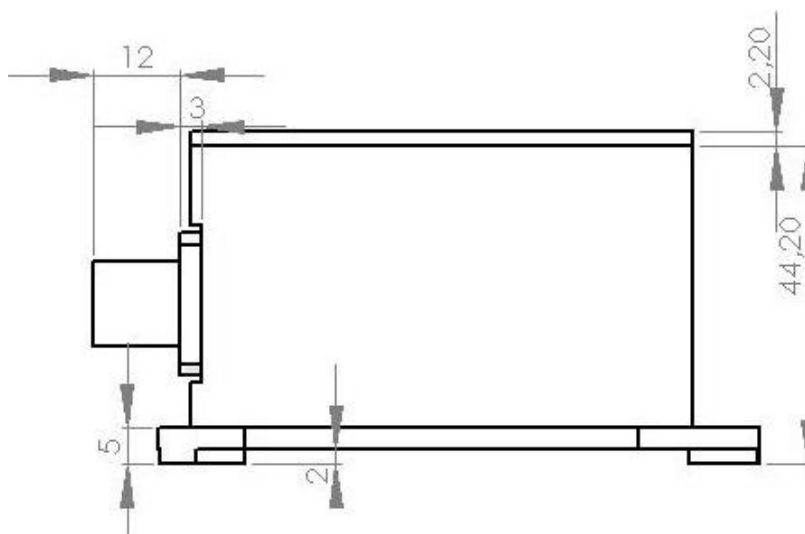
Do not stand on the inclinometer!

Avoid mechanical load!

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RS232 - CURRENT

Mechanical Drawings
Bottom View

Site View

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RS232 - CURRENT

Front View

Top View

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INCLINOMETER
RS232 - CURRENT

Models/Ordering Description

Description	Type Key							
Absolute inclinometer	AGS-	. . .	2-S	.	1	H0	. . .	-
Measuring range	**005**							
	015							
	030							
Number of axis								
RS232								
Voltage interface			**V**					
Current interface			**C**					
PWM			**P**					
Switch			**S**					
Version								
Mechanical construction	Horizontal							
Dynamic	2 mPas							
Connection	plug, 8 pins						**P8M**	
	1 m cable exit						**CRW**	
Option								-

Accessories and Documentation

Description		Type
Connector, counterpart	8 pins	P8F
Cable	STK 8, 2m, Plug P8F	P8F-STK8.2
	STK 8, 5m, Plug P8F	P8F-STK8.5

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ACCELENS INCLINOMETER
RS232 - VOLTAGE

Main Features

- Dual Axis Inclinometer +/- 80°
- Configured For One Axis Measurements 0-360°
- High Resolution 0.01°
- Accuracy: 0.1°
- Active Linearization and
  Temperature Compensation
- Digital Interface: RS232, Code ASCII
- Analog Interface: Voltage 0,5..4,5V
- High Protection Class: IP69K

Programmable Parameters

  Resolution
  Preset
  Software Filters

Electrical Features

- Highly Integrated Circuit in SMD-Technology
- Polarity Inversion Protection
- Over-Voltage-Peak Protection

Applications

- Measurement of Inclinations And
  Rotational Movements
- Construction Machines
- Cranes
- Medical Systems

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ACCELENS INCLINOMETER
RS232 - VOLTAGE

Technical Data

Electrical Data

Model	ACS 080	ACS 360
Measuring range	+/- 80°	360°
Number of axes	2	1
Resolution	0,01°	0,01°
Accuracy (T = -10 °C .. +40 °C) *	0.1°	0.1°
Sensor Response Time	10 ms (without filter)	
Recommended Measurement Rate	Up to 10 Hz	
Digital Interface	RS232 format ASCII	
Baud rate	Max. 57600 bit/s (programmable)	
Analog interface	0,5...4,5V , 0° = 2.5V; 1mA	
Supply voltage**	10-30 V DC (absolute maximum ratings)	
Current Consumption	max. 100 mA at 10 V DC, max. 80 mA at 24 V DC	
EMC	Emitted interference: EN 61000-6-4	
	Noise immunity: EN 61000-6-2	
Connection	Connector Output M12 8 pin male	

*   Further data available on request

** Inclinometers should be connected only to subsequent electronics whose power supplies comply with
     EN 50178 (protective low voltage)

Mechanical Data

Housing	Plastic (Thermelt 869)
Shock (EN 60068-2-27)	≤ 100 g (half sine, 6 ms))
Vibration (EN 60068-2-6)	≤ 10 g (10 Hz ... 1,000 Hz))
Weight	100 g

Environmental Conditions

Operating temperature	-40°C......+85°C
Humidity	98 % (without liquid state)
Protection class	IP 69K (connected) (EN 60529)

MTBF Data

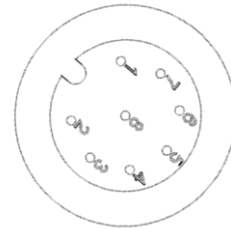| Failure Rate [FIT]	759
MTBF [Hours]	1,317,822
MTBF [Years]	150

Installation

Electrical Connection

The inclinometer is connected via an 8 pin round connector
(Standard M12, Male side at sensor, Female at connector counterpart or connection cable).

Connector Assignment

Pin	Description ACS 080	Description ACS 360
1	+UB Supply voltage	+UB Supply voltage
2	RxD	RxD
3	TxD	TxD
4	Ground	Ground
5	X-axis* output analog	Output Analog
6	Not used**	Not used**
7	Y-axis* output analog	Not used**
8	Not used**	Not used**

Front view of housing
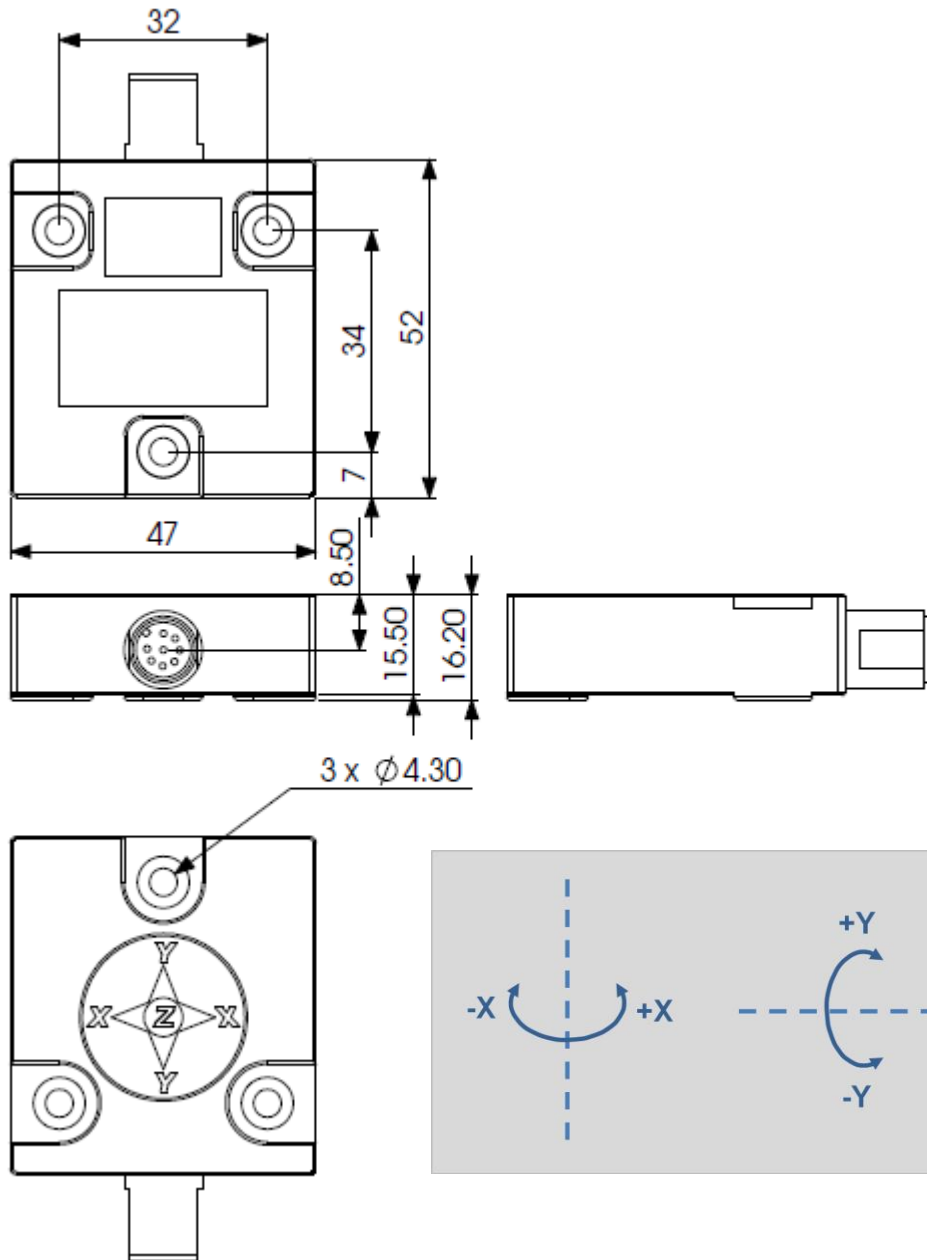Connector inclinometer

* See drawing on next page

** Should not be connected

Instructions For Installation

Please read the instruction leaflet carefully prior to installation

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Plastic H**ousing**

Serial Interface RS 232

Communication with the sensor is done through a standardized RS-232 interface. Data transmission is effected in duplex mode. The baud rate is fixed by 9600 baud. After Power On the sensor is sending continuous the angle values in degrees (°). In the setup level several settings can be permanently modified. If the continuous mode was permanently changed to the polling mode, the sensor will send after

"Power On" a start information with actual parameters. On error no angle values are sending and after "Power On" a error message was add to the start information.

Programming Instructions

Basic Settings

After Power On, the sensor is in the user level. In factory setting (==Free running mode) every 100ms the current angle values are continuously supplied with a baud rate of 9600 bd. In the Setup-level several settings can be changed permanent like query or free running mode, output rate, baud rate and angle offset. If query mode instead of free running mode is ser, the sensor will send start information with the current settings after Power On. In case of errors no angle values will be provided and after Power On an error message will be added to the start information.
Interface parameter: 9600 Baud , 8 data bits, parity even, 1 stop bit,
The baud rate can be adjusted to different values in the Setup-level

Structure:

Baud rate: 9600 Baud (factory setting, changes in Setup-Mode possible)
Format: ASCII, 8 data bits, 1 stop bit, parity even
Length: 22 byte
Display: <D0 ... D21>

D0 ... D10   = "X=±xx.xxx", <CR>, <LF>
with D2   = sign (+ or -)
                 with D5   = point

D11 ... D21   = "Y=±xx.xxx", <CR>, <LF>
with D13   = sign (+ or -)
                 with D16   = point

Display example:
```
…
X=+00.430
Y=-00.084
…
```

Commands in use

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Table 1: instructions at user level

instruction	to the sensor	response sensor	explanation
Activate temporary polling mode (1) (2)	**"f"**	"f"	the continuous sending of angle values are stopped, instructions can send to the sensor
Activate temporary continuous mode (1) (2)	**"F"**	„X=±xx.xxx", CR, LF, "Y=±xx.xxx", CR, LF, "X= . . .	X angle in ° Y angle in ° with „±" = „+" or „-", one string contains x and y value
Read angle values at one-time (3)	**"R"**	"X=±xx.xxx", CR, LF, "Y=±xx.xxx", CR, LF,	X angle in ° Y angle in ° with „±" = „+" or „-"
Switch to the setup level (3) (4)	**"prog"**	"P"	Sensor is at setup level

(1) In free running mode measurement data is continuously displayed. In query mode measurement and display is only once on command.
(2) After reset or new Power On after an interruption of power supply, the sensor will be in user-level again with the original setup or with the setup changed in the setup level.
(3) Only possible in query mode (=free running mode deactivated).
(4) The Input of „prog" must take place within 20 sec.

Setup Level

The Setup level is active until "Power On" or Reset. All settings taken in the setup level are stored in the EEPROM and permanent available also after Power down.

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Table 2: instructions at setup level

Instruction	To the sensor	Response sensor	Explanation
Activate permanent polling mode (1)	"f"	"f"	the continuous sending of angle values are permanent stopped, instructions can send to the sensor
Activate permanent continuous mode (1)	"F"	„X=±xx.xxx", CR, LF, "Y=±xx.xxx", CR, LF, "X= . . .	continuous sending of X angle in ° Y angle in ° with „±" = „+" or „-"
Set rate of data transmission for continuous mode (2) (3)	"O" <Code transmission rate>	"O" <Code transmission rate>	Echo, Code transmission rate or „E" for Error, if the code is outside defined values
Read angle values at one-time (2)	"R"		same as at user level
Reset offset adjust (2) (3)	"N"	"N"	the offset adjust was reset to the original value
Set Baud rate (2) (3) (4)	"B" <Code Baud rate>	"B" <Code Baud rate>	Echo, Code Baud rate or „E" for Error, if the code is outside defined values
Deactivate Filter	„M0"	„M0"	all filters are deactivated
Moving Average Filter (5)	„MP"	„N="	Filter: Moving Average Filter is activated
Reset (2)	"Q"	"Q"	Software-Reset will be executed

(1) in the continuous mode the sensor is sending continuous angle values, in the polling mode the sensor is sending one answer after an instruction
(2) only possible at polling mode.
(3) for activating a reset or power fail restart is necessary
(4) Attention! A reset of the baud rate to a default value is not possible. If the user forgets the adjusted baud rate, the new value must be detected by testing.
(5) Filter Configuration:
Possible values: N = 002 to 100, with N = 000 is moving average filter deactivated:
Output value = Average over last N values.
Factory settings: Activated with N = 20

Models/Ordering Description

Description	Type key								
Accelens	ACS	…-	.	..	..-	.	.	.-	..
Range	360°(1 axis) 360 +/-80° (2 axis) 080								
Number of axis	One ("ACS360-…") 1 Two ("ACS080-…") 2								
Interface	RS232+Voltage SV								
Version	00								
Mounting	Horizontal for +/-80° Version H Vertical for 360° Version V								
Housing Material	Plastic P								
Inclinometer Series	ACSII 2								
Connection	Connector M12 8-pin PM								

Accessories

Article No	Article	Description
34500800	P8F	Counter Connector for ACSXXX-XSV-…-P8M
34500801	P8F-STK8.2	Counter Connector for ACSXXX-XSV -…-P8M with 2m PUR cable
34500802	P8F-STK8.5	Counter Connector for ACSXXX-XSV …-P8M with 5m PUR cable

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Heavy Duty Magnetic Encoder Line for Thoughest Environments

Its stainless steel housing and high protection class of IP69K makse the MCD Heavy Duty rotary encoder resistant against active chemical cleaning, high-pressure water and corrosion. Combined with the sturdy ball bearings (for high shaft loads up to 300N) this sensor is an ideal choice for reliable measurement under extreme environmental conditions and outdoor applications.

website

Draw Wire Sensor to Measure Linear Displacements

To measure linear movements or linear displacements, an absolute magnetic rotary encoder can be combined with a draw wire sensor. The contact-free measuring sensor stage of the MCD Sensor didn't have any abrasion. The Sensor can directly connected to digital control units via SSI- or CANopen or Analog Interface

website