

HEAVY DUTY INCLINOMETER 360° SYNCHRONOUS SERIAL INTERFACE (SSI)



The heavy duty inclinometers are compact devices for determining the inclination or tilt in both single and dual axes with remarkable precision and at very low expenses. The aluminum housing and the metal connector enhance the mechanical strength of the sensor and make it ideal to measure the tilt /

slope in outdoor environments. The synchronous serial interface (SSI) with its RS422 differential line drivers allows transmission cable length up to 1200m. The simple protocol makes it easy to connect the sensor to common PLC systems or embedded controllers.

Main Features

- Configured for One Axis
- Measurements 0 – 360°
- 13 Bit Resolution (0.04°)
- 0.14° Accuracy/Linearity
- Active Linearization and Temperature Compensation
- Aluminium Alloy Housing
- Synchronous Serial Interface (SSI)

Electrical Features

- Polarity Inversion Protection
- Over-Voltage-Peak protection

Programmable Parameters

- Preset Value
- Counting Direction

Applications

- Cranes and Construction Machines
- Mobile Platforms
- Marine & Offshore Machinery
- Solar Trackers

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Technical Data

Electrical Data

Model	INC 360
Measuring Range	360°
Number of Axes	1
Resolution	13 Bit (0.04°) ¹
Accuracy	0.14°
Sensor Response Time	100ms ± 10% ¹
Interface	Synchronous Serial Interface (SSI)
Current Consumption	<250mA at 5V DC, <100 mA at 10 V DC, <80 mA at 24 V DC
Power Consumption	below 1.5 W
Clock Input	Via opto-coupler
Data Output	Line-driver according to RS 422
Clock Frequency	100 kHz – 2 MHz
Supply Voltage	4.5 – 30 V DC (absolute maximum ratings) ²
Turn on Time	< 1 s
EMC	Emitted interference: EN 61000-6-4 Noise immunity: EN 61000-6-2

1) Changes in response time and Resolution on request

2) According EN 50178 (SELF)

Mechanical Data

Housing Material	Aluminum
Potting Material	PUR (Polyurethane)
Weight	170 g [6 oz]

Environmental Conditions

Operating Temperature	-40 °C to +85 °C [-40 °F to 185 °F]
Protection class (EN 60529)	IP 69K & IP68 (With Mating Counter Connector)
Shock (EN 60068-2-27)	≤ 100 g (half sine, 6 ms)
Vibration (EN 60068-2-6)	1.5 mm (10 Hz to 58 Hz) ≤ 20 g (58 Hz to 2000 Hz)

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MTBF Data

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

The data above were calculated for the electronics of ACS under following conditions:

SNA: Non mobile operation ground benign (Gb),

Tu: 40°C mean component ambient temperature

Zf: Continuous operation 8760 h per year

Interface

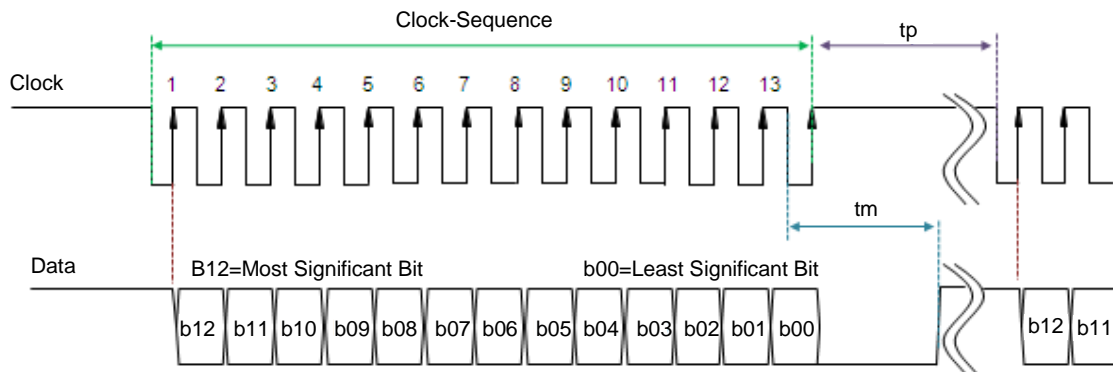
Detailed SSI-Interface description and Application example under [technical description SSI interface](#). This product is also available with analog, RS232, DeviceNET and CANopen interface, please check our [website](#) for further information.

Synchronous Serial Interface (SSI)

Driver	Driver meets EIA standard RS 422; transmission rates up to 10 MBit/s
Transfer	Transfer distance up to 1.200 m
Transmission	Balanced transmission provides high noise immunity, shielded and twisted pair cables are recommended

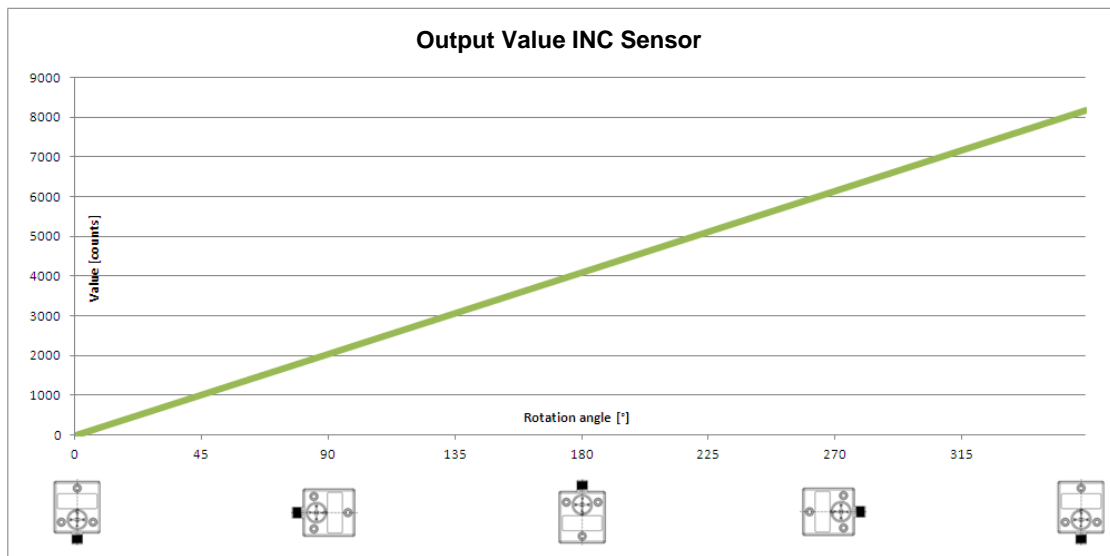
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Protocol¹



$t_m = 20\mu s$ marks the end of a single transmission. After $t_p > 25\mu s$ the output is set to idle state and a new transmission can be started anytime with a falling Clock signal. Output binary format or gray code format.

Data values according to angular position of inclinometer



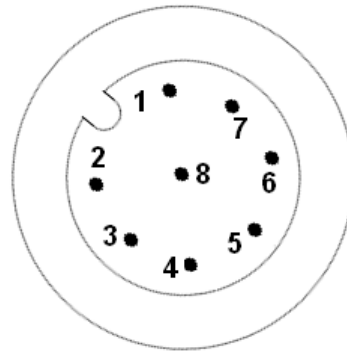
1) Changes in protocol on request

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Electrical Connection

The inclinometer is connected via an 8 pin M12 A-coded round connector (male side at sensor).

Pin	Function
1	GND
2	Supply Voltage
3	SSI Clk+
4	SSI Clk-
5	SSI Data+
6	SSI Data-
7	Preset
8	Counting Direction (Complement)



Preset Function

Voltage Level	Function
0 (Input = N.C. or GND)	Inactive
1 (Input $\geq 4.5V$ / Input \leq Supply Voltage)	Preset is activated ¹ . The inclinometer value will be set to 0 in the moment the Preset Level will change to inactive again (falling edge)
Input Resistance	110 kOhm

1) The Preset needs to be activated for at least 1s before the falling edge will be detected.

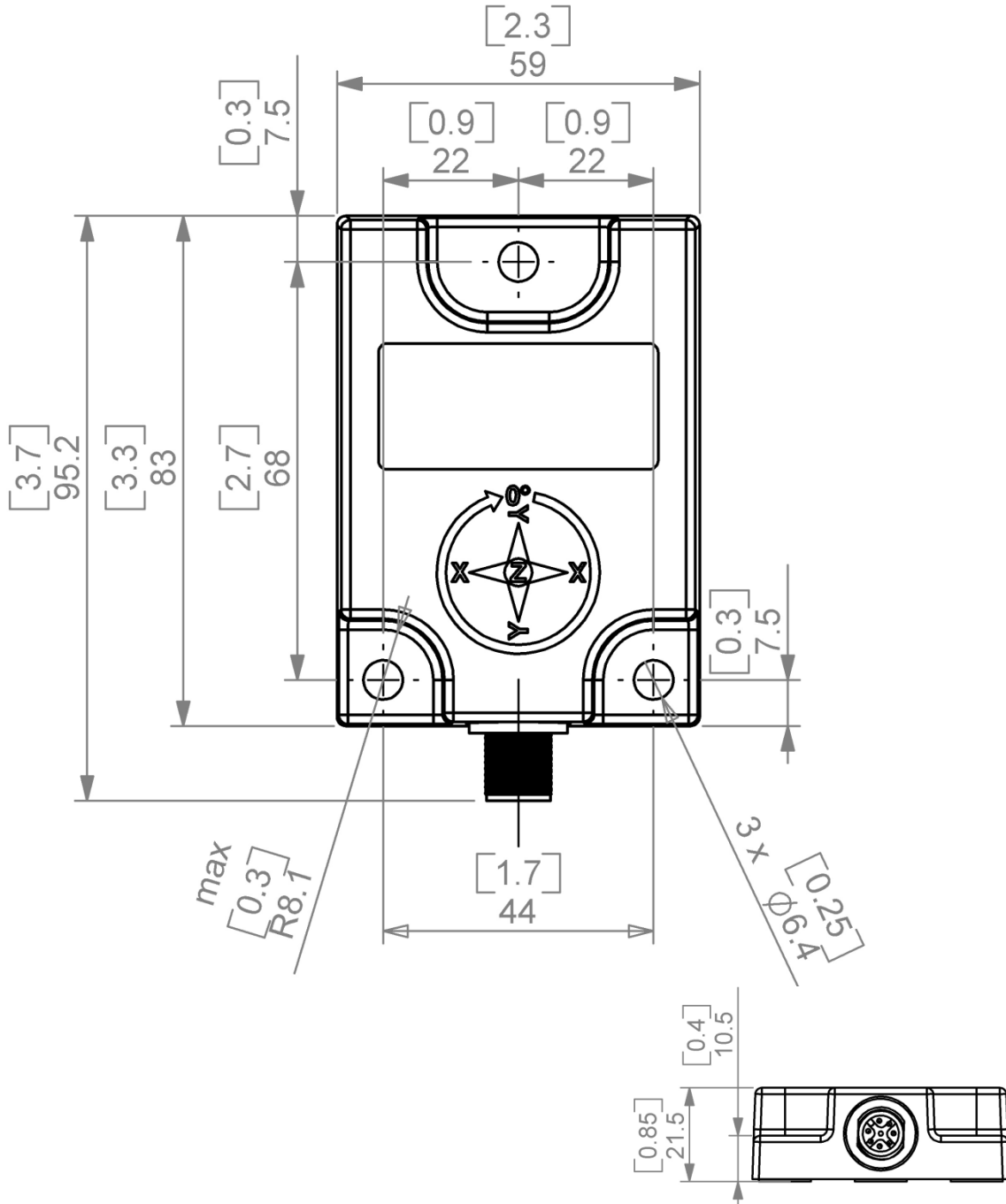
Counting Direction / Complement Function

Voltage Level	Inclinometer counting direction for clockwise rotation (Cap Facing Towards Viewer)
0 (Input = N.C. or GND)	Down
1 (Input $\geq 4.5V$ / Input \leq Supply Voltage)	Up
Input Resistance	110 kOhm

The inclinometer value is inverted after the Complement level is activated

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Mechanical Drawing



All dimensions in [inch] mm

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Models/Ordering Description

Description	Type key	XXX-	X-	XX	XX-	X	X	X-	XX
Range	360° (1 axis)	360							
Number of Axis	One for 360° Version		1						
Interface	SSI binary code			S1					
	SSI gray code			S3					
Version	Software Version				02				
Mounting	Vertical for 360° Version					V			
Housing Material	Industrial (PBT)						E		
	Heavy Duty (Aluminum)						H		
Inclinometer Series	Version II							2	
Connection	Connector								PM

Typekey:

INC-360-1-S102-VH2-PM

INC-360-1-S302-VH2-PM

INC-360-1-S102-VE2-PM

INC-360-1-S302-VE2-PM