Inclination and Acceleration Sensors

Po вопросам продаж и поддержки обращайтесь:

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Inclination and Acceleration Sensors
6. **Inclination and Acceleration Sensors**

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### Inclination Sensors

**Series**

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<thead>
<tr>
<th>Series</th>
<th>INX</th>
<th>INY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Page 821 ff</td>
<td>Page 821 ff</td>
</tr>
</tbody>
</table>

- Measurement range 360°
- Single axis
- Programmable switching window
- Programmable analog window
- Measurement range 360°
- Dual axis
- Programmable switching windows
- Programmable analog windows

### Specifications

<table>
<thead>
<tr>
<th></th>
<th>INX</th>
<th>INY</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Measurement angle</strong></td>
<td>up to 360°</td>
<td>up to 360° in both axes</td>
</tr>
<tr>
<td><strong>Resolution</strong></td>
<td>up to 0.01°</td>
<td>up to 0.01°</td>
</tr>
<tr>
<td><strong>Absolute accuracy</strong></td>
<td>0.5°</td>
<td>0.5°</td>
</tr>
<tr>
<td><strong>Operating voltage</strong></td>
<td>10 VDC ... 30 VDC</td>
<td>10 VDC ... 30 VDC</td>
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### Connection type

<table>
<thead>
<tr>
<th></th>
<th>Cable</th>
<th>Plug</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Interface</th>
<th>Analog output</th>
<th>Switching output</th>
<th>CANopen</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>
### Inclination Sensors
- Single axis
- Measuring range ± 2 g
- Analog output

### Acceleration Sensors
- Dual axis
- Measuring range ± 2 g in both axes
- Analog outputs

## Specifications

<table>
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<tr>
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<tr>
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<td>up to 0.01°</td>
</tr>
<tr>
<td>Absolute accuracy</td>
<td>0.5°</td>
<td>0.5°</td>
</tr>
<tr>
<td>Repeatability</td>
<td>5 mg</td>
<td>5 mg</td>
</tr>
<tr>
<td>Measuring range</td>
<td>-2 g to 2 g</td>
<td>-2 g to 2 g in both axes</td>
</tr>
<tr>
<td>Resolution</td>
<td>5 mg</td>
<td>5 mg</td>
</tr>
<tr>
<td>Operating voltage</td>
<td>10 VDC ... 30 VDC</td>
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<tr>
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<td></td>
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<tr>
<td>Operating voltage</td>
<td>10 VDC ... 30 VDC</td>
<td></td>
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</table>
Introduction

Do you want to monitor the inclination angle of your machine components or the acceleration values of sensitive system components?

The F99 Series of inclination and acceleration sensors by Pepperl+Fuchs offers the ideal solution. Our precise and adjustable systems for inclination and acceleration monitoring are ideal for mobile equipment, renewable energy, and factory automation applications. They provide simple solutions for protecting your investment over the long-term.

Highlights

• Customer-specific adjustment of measuring ranges and outputs
• Intelligent mounting concept with impact protection
• High IP68 and IP69K degree of protection
• Robust housing suitable for outdoor use
• Extended temperature range -40 °C … +85 °C
• Highly resistant to mechanical shock 100 g
• Increased immunity 100 V/m
• e1 approval for use on public roads
• CSA approval for worldwide use
• Wear-free and without actuator

Benefits

Mounting concept

• The F99 Series incorporates a robust metal mounting bracket with four screw holes and a sensor module, for separate and flexible mounting
• Integrated hex socket screw that enables the sensor module to be used quickly and easily replaced without having to remove the mounting bracket
• A captive locking wedge in the bracket ensures optimum distribution of forces in the event of machine vibrations

Adjustability

• All F99 Series products can be adjusted by the customer

Filters and angle ranges can be adapted to suit your application

Housing concept

• Particularly suitable for applications under extreme conditions and for outdoor applications
• Water resistance and extreme shock resistance ensure a long service life

Typical areas of application

F99 inclination sensor

• Commercial vehicle sector
  for leveling cranes, liftgates, container-loading equipment, etc.
• Construction machinery,
  e.g., for monitoring the inclined position of excavators
• Transport and loading units
  for automatic horizontal alignment of inclined positions
• Solar power systems
  for optimum solar tracking
• Automobile production plants
  for monitoring rotation during assembly
• Rail and marine vessels
  for ensuring equal loading
• Metal processing
  e.g., for monitoring the movement sequences of stamping and pressing machines

F99 acceleration sensor

• Wind power plants or large machinery
  for shutting down when defined vibration values are exceeded
• Elevators
  to control acceleration
• Large plants
  for status monitoring
• Machines
  for measuring vibrations
• Robots and picker arms
  to control acceleration

In short–what does your plant need?

Inclination...

Static value that is suitable for movement sequences that are not subject to extreme changes. The static value for the inclination is used for long-term monitoring of the machine to determine if readjustment is required.

… based on the example of a lifting platform

Continuous monitoring and leveling of the vehicle, working platform, or overall system.

Acceleration...

Dynamic value that needs to be monitored in order to quickly identify short-term dynamic influences on the machine.

… based on the example of a lifting platform

To prevent a dangerous situation when the lifting platform is extended and may be influenced by a sudden gust of high wind. This will permit early detection by the control system and readjustment before a permissible inclination angle is exceeded.
## General Data
- No-load supply current: \( \leq 65 \text{ mA} \)
- Data output code: binary code
- Ambient temperature: \(-40 \ldots 85 \, ^\circ\text{C} (-40 \ldots 185 \, ^\circ\text{F})\)
- Housing material: PA
- Protection degree: IP68 / IP69K
- Connection type: M12 x 1 connector, 5-pin

## Model Number
- Green = preferred type
- INX360D-F99-B16-V15
- INY030D-F99-B16-V15
- INY360D-F99-B16-V15
- INX360D-F99-B20-V15
- INY030D-F99-B20-V15
- INY360D-F99-B20-V15

## Properties
- 1 and 2 axes measurement
- 30° and 360° measurement range versions
- CANopen and J1939 protocol versions
- Connector version

## Electrical Connection
- INX360D-F99-B16-V15
- INY030D-F99-B16-V15
- INY360D-F99-B20-V15
- INX360D-F99-B20-V15
- INY030D-F99-B20-V15
- INY360D-F99-B20-V15

## Approvals and Certificates
- CSA approval: cCSAus Listed, General Purpose, Class 2 Power Source
- CCC approval: Products with a maximum operating voltage of \( \leq 36 \) V do not bear a CCC marking because they do not require approval.
- e1 Type approval: 2006/28/EG

## Dimensions
- Length L [mm]: 44
- Width W [mm]: 65
- Height H [mm]: 37
- Connector area lc [mm]: 18.5

## Accessories
- This and more accessories can be found in chapter 10
- Different cordsets see pages from 972...
- Mounting aids see pages 1068...

## Interface Type
- CANopen, profile CiA410, Ver. 1.2
- J1939 protocol

## Operating Voltage
- 10 ... 30 V DC
- 10 ... 60 V DC

## Interface Type
- DeviceNet/CANopen bus cable, M12 to M12, PUR cable 5-pin
- DeviceNet/CANopen bus cable, M12 to M12, PUR cable 5-pin
- DeviceNet/CANopen bus cable, M12 to M12, PUR cable 5-pin
- DeviceNet/CANopen bus cable, M12 to M12, PUR cable 5-pin

## Node ID
- 1 ... 127 , programmable
- 0 ... 253 , programmable

## Connection Type
- M12 x 1 connector, 5-pin

## Wire Colors
- 1: BN (brown)
- 2: WH (white)
- 3: BU (blue)
- 4: BK (black)
- 5: GY (gray)
Inclination and Acceleration Sensors

General Data
Type: Inclination sensor, 1-axis
Measurement range: 0 ... 360 °
Absolute accuracy: ≤ ± 0.5 °
Resolution: ≤ 0.1 °
Operating voltage: 10 ... 30 V DC
No-load supply current: ≤ 25 mA
Switch output: 2 switching outputs PNP, NO , reverse polarity and short-circuit protected
Operating current: ≤ 100 mA
Analog output: 1 current output 4 ... 20 mA
Load resistor: 0 ... 200 Ω at UB = 10 ... 18 V
0 ... 500 Ω at UB = 18 ... 30 V
Ambient temperature: -40 ... 85 °C (-40 ... 185 °F)
Housing material: PA
Protection degree: IP68 / IP69K

Model Number
Connection type: M12 x 1 connector, 5-pin
5 m, PUR cable 5 x 0.5 mm²

Approvals and Certificates
CSA approval: cCSAus Listed, General Purpose, Class 2 Power Source
CCC approval: Products with a maximum operating voltage of ≤36 V do not bear a CCC marking because they do not require approval.
e1 Type approval: 2006/28/EG

Dimensions
Length L [mm]: 44
Width W [mm]: 65
Height H [mm]: 37
Connector area lc [mm²]: 22 18.5

Accessories
This and more accessories can be found in chapter 10
See pages from 972 ... for cordsets
See pages 1068 ... for mounting aids
V15-G-2M-PUR: Cable socket, M12, 5-pin, PUR cable
V15-W-2M-PUR: Cable socket, M12, 5-pin, PUR cable

Electrical Connection

Standard symbol/Connection:

Wire colors in accordance with EN 60947-5-2

1 BN (brown)
2 WH (white)
3 BU (blue)
4 BK (black)
5 GY (gray)
Inclination and Acceleration Sensors

### General Data
- **Type**: Inclination sensor, 1-axis
- **Measurement range**: 0 ... 360 °
- **Absolute accuracy**: ≤ ± 0.5 °
- **Resolution**: ≤ 0.1 °
- **Operating voltage**: 10 ... 30 V DC
- **No-load supply current**: ≤ 25 mA
- **Switch output**
  - **Output type**: 2 switching outputs PNP, NO , reverse polarity and short-circuit protected
  - **Operating current**: ≤ 100 mA
- **Analog output**
  - **Output type**: 1 voltage output 0 ... 5 V
  - **Load resistor**: ≥ 1 kΩ
- **Ambient temperature**: -40 ... 85 °C (-40 ... 185 °F)
- **Housing material**: PA
- **Protection degree**: IP68 / IP69K

### Model Number
- **Connection type**: M12 x 1 connector, 5-pin
- **5 m, PUR cable 5 x 0.5 mm²**

### Approvals and Certificates
- **CSA approval**: cCSAus Listed, General Purpose, Class 2 Power Source
- **CCC approval**: Products with a maximum operating voltage of ≤ 36 V do not bear a CCC marking because they do not require approval.
- **e1 Type approval**: 2006/28/EG

### Dimensions
- **Length L [mm]**: 44
- **Width W [mm]**: 65
- **Height H [mm]**: 37
- **Connector area lc [mm²]**: 22 (V15-G-2M-PUR) 18.5 (V15-W-2M-PUR)

### Accessories
This and more accessories can be found in chapter 10

- **V15-G-2M-PUR**: Cable socket, M12, 5-pin, PUR cable
- **V15-W-2M-PUR**: Cable socket, M12, 5-pin, PUR cable

### Electrical Connection

#### Properties
- 1 axis measurement
- 360° measurement range
- Analog and switching outputs
- Cable and connector versions

#### Standard symbol/Connection:
- **INX360D-F99-U2E2-5M**
- **INX360D-F99-U2E2-V15**

#### Wire colors in accordance with EN 60947-5-2
- 1: BN (brown)
- 2: WH (white)
- 3: BU (blue)
- 4: BK (black)
- 5: GY (gray)
Inclination and Acceleration Sensors

**General Data**

<table>
<thead>
<tr>
<th>Type</th>
<th>Inclination sensor, 2-axis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating voltage</td>
<td>10 ... 30 V DC</td>
</tr>
<tr>
<td>No-load supply current</td>
<td>≤ 25 mA</td>
</tr>
<tr>
<td>Switch output</td>
<td>2 switching outputs PNP, NO, reverse polarity and short-circuit protected</td>
</tr>
<tr>
<td>Operating current</td>
<td>≤ 100 mA</td>
</tr>
<tr>
<td>Analog output</td>
<td>2 current outputs 4 ... 20 mA (one output for each axis)</td>
</tr>
<tr>
<td>Load resistor</td>
<td>0 ... 200 Ω at UB = 10 ... 18 V, 0 ... 500 Ω at UB = 18 ... 30 V</td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>-40 ... 85 °C (-40 ... 185 °F)</td>
</tr>
<tr>
<td>Housing material</td>
<td>PA</td>
</tr>
<tr>
<td>Protection degree</td>
<td>IP68 / IP69K</td>
</tr>
</tbody>
</table>

**Model Number**

- green = preferred type
- Measurement range: 0 ... 360 °, -15 ... 15 °
- Absolute accuracy: ≤ ± 0.5 °, ≤ ± 0.2 °
- Resolution: ≤ 0.1 °, ≤ 0.01 °
- Connection type: 8-pin, M12 x 1 connector
- 5 m, PUR cable 7 x 0.5 mm²

**Approvals and Certificates**

- CSA approval: cCSAus Listed, General Purpose, Class 2 Power Source
- CCC approval: Products with a maximum operating voltage of ≤36 V do not bear a CCC marking because they do not require approval.
- e1 Type approval: 2006/28/EG

**Dimensions**

- Length L [mm]: 44
- Width W [mm]: 65
- Height H [mm]: 37
- Connector area: lc [mm²]: 22

**Accessories**

- This and more accessories can be found in chapter 10
- See pages from 972 ... for cordsets
- See pages 1068 ... for mounting aids

**Electrical Connection**

- Standards symbol/Connection:
- Wire colors:
  1. WH (white)
  2. BN (brown)
  3. GN (green)
  4. YE (yellow)
  5. GR (gray)
  6. PK (pink)
  7. BU (blue)
  8. RD (red)
Inclination and Acceleration Sensors

General Data

- **Type**: Inclination sensor, 2-axis
- **Measurement range**: 0 ° to 360 °
- **Absolute accuracy**: ≤ ± 0.5 °
- **Resolution**: ≤ 0.1 °
- **Operating voltage**: 10 ... 30 V DC
- **No-load supply current**: ≤ 25 mA
- **Switch output**: 2 switch outputs PNP, NO, reverse polarity protected, short-circuit protected
- **Operating current**: ≤ 100 mA
- **Analog output**: 2 voltage outputs 0 ° to 5 V (one output for each axis)
- **Load resistor**: ≥ 1 kΩ
- **Ambient temperature**: -40 °C to 85 °C (-40 °F to 185 °F)
- **Housing material**: PA
- **Protection degree**: IP68 / IP69K

Model Number

- **Type**: INY360D-F99-2U2E2-5M
- **Type**: INY360D-F99-2U2E2-V17

Connection type

- **8-pin, M12 x 1 connector**
- **5 m, PUR cable 7 x 0.5 mm²**

Approvals and Certificates

- **CSA approval**: cCSAus Listed, General Purpose, Class 2 Power Source
- **CCC approval**: Products with a maximum operating voltage of ≤ 36 V do not bear a CCC marking because they do not require approval.
- **e1 Type approval**: 2006/28/EG

Dimensions

- **Length L [mm]**: 44
- **Width W [mm]**: 65
- **Height H [mm]**: 37
- **Connector area Ic [mm²]**: 22 × 18.5

Accessories

- This and more accessories can be found in chapter 10
- See pages from 972 ... for cord sets
- See pages 1068 ... for mounting aids

- **V17-G-2M-PUR**: Cable socket, M12, 8-pin, shielded, PUR cable
- **V17-G-5M-PUR**: Cable socket, M12, 8-pin, shielded, PUR cable
- **V17-G-10M-PUR**: Cable socket, M12, 8-pin, shielded, PUR cable
- **V17-G-10M-PVC ABG**: Cable socket, M12, 8-pin, shielded, PVC cable

Electrical Connection

- **INY360D-F99-2U2E2-5M**
- **INY360D-F99-2U2E2-V17**

Wire colors

1. WH (white)
2. BN (brown)
3. GN (green)
4. YE (yellow)
5. GY (gray)
6. PK (pink)
7. BU (blue)
8. RD (red)

Properties

- 2 axes measurement
- 360° measurement range
- Analog and switching outputs
- Cable and connector versions

Diagram:

[Diagram of the Inclination sensor showing the connection type and wire colors]
Inclination and Acceleration Sensors

General Data
- Measurement range: -2 ... 2 g
- Resolution: ≤ 5 mg
- Frequency range: 0 ... 100 Hz
- Operating voltage: 10 ... 30 V DC
- No-load supply current: ≤ 25 mA
- Operating display: LED, green
- TEACH-IN indication: LED, yellow
- Zero signal: 12 mA
- Slope of output characteristic: 4 mA / g
- Linearity error: ± 1.2 %
- Analog output:
  - Load resistor: 0 ... 200 Ω at U_B = 10 ... 18 V
  - 0 ... 500 Ω at U_B = 18 ... 30 V
- Ambient temperature: -40 ... 85 °C (-40 ... 185 °F)
- Housing material: PA
- Protection degree: IP68 / IP69K
- Connection type: M12 x 1 connector, 5-pin

Model Number
- green = preferred type
- Type
  - 1 axis acceleration sensor
  - 2 axis acceleration sensor
- Analog output
  - Output type: 1 current output 4 ... 20 mA
  - 2 current outputs 4 ... 20 mA (one output for each axis)
- Approvals and Certificates
  - CSA approval: cCSAus Listed, General Purpose
  - CCC approval: Products with a maximum operating voltage of ≤ 36 V do not bear a CCC marking because they do not require approval.
  - e1 Type approval: 2006/28/EG
- Dimensions
  - Length L [mm]: 44
  - Width W [mm]: 65
  - Height H [mm]: 37
  - Connector area l_c [mm]: 18.5

Accessories
- This and more accessories can be found in chapter 10
See pages from 972 ... for cordsets
See pages 1068 ... for mounting aids
- V15-W-2M-PUR: Cable socket, M12, 5-pin, PUR cable
- V15-G-2M-PUR: Cable socket, M12, 5-pin, PUR cable

Electrical Connection

Wire colors in accordance with EN 60947-5-2
- 1: BN (brown)
- 2: WH (white)
- 3: BU (blue)
- 4: BK (black)
- 5: GY (gray)
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