Contents

Inclination Sensors
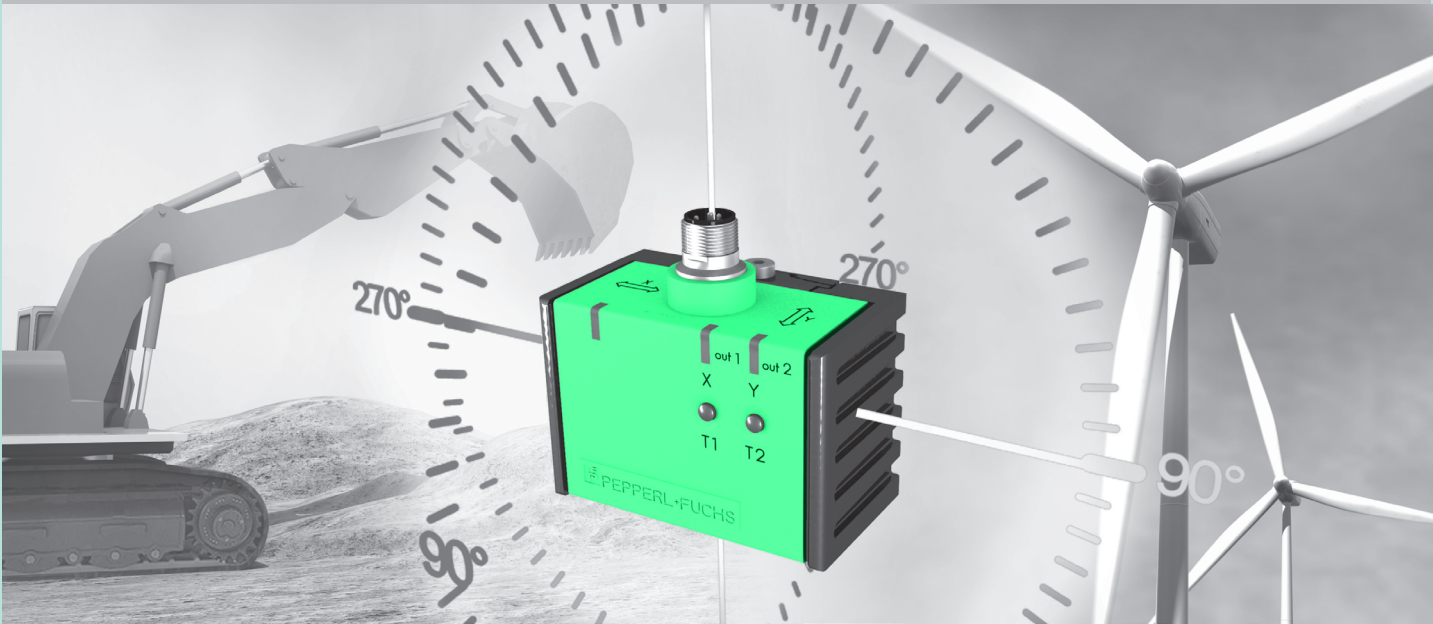
PEPPERL+FUCHS
SENSING YOUR NEEDS

Inclination and Acceleration Sensors

6

6.　　　Inclination Sensors

Inclination and Acceleration Sensors

6

PEPPERL+FUCHS
SENSING YOUR NEEDS

Inclination and Acceleration Sensors

6

Introduction

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

Pepperl+Fuchs' F99 Series of inclination and acceleration sensors 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*
- *Intelligent mounting 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

- *The F99 Series incorporates a robust metal mounting bracket for flexible mounting*
- *Integrated hex socket screw enables the sensor module to be easily replaced and used 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*
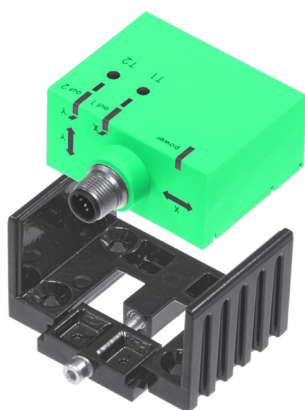
Simple mounting with a central screw

Adjustability

- *All F99 Series products can be adjusted by the customer*
- *Customized solutions can be provided with output filtering and custom right-angle ranges*

Housing

- *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***
  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***
  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*

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.
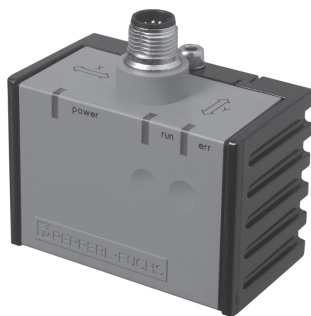
… based on the example of a lifting platform

To prevent a dangerous situation when the lifting platform is extended

and may be affected by a sudden gust of wind.

This will permit early detection by the control system and readjustment

before a permissible inclination angle is exceeded.

Courtesy of Steven Engineering, Inc - (800) 258-9200 - sales@steveneng.com - www.stevenengineering.com

Technical Data

For detailed data and product description refer to the data sheets at
www.pepperl-fuchs.us

General Data

No-load supply current	≤ 65 mA
Data output code	serial data
Ambient temperature	-40 ... 85 °C (-40 ... 185 °F)
Housing material	PA
Protection degree	IP68 / IP69K
Connection type	M12 x 1 connector, 5-pin

Inclination and Acceleration Sensors

Model Number		INX360D-F99-B16-V15	INY360D-F99-B16-V15	INY030D-F99-B16-V15	INX360D-F99-B20-V15	INY360D-F99-B20-V15
Type	Inclination sensor, 1-axis	●			●	
	Inclination sensor, 2-axis		●	●		●
Measurement range	0 ... 360 °	●	●		●	●
	-15 ... 15 °			●		
Absolute accuracy	≤ ± 0.5 °	●	●		●	●
	≤ ± 0.2 °			●		
Resolution	≤ 0.1 °	●	●		●	●
	≤ 0.01 °			●		
Operating voltage U$_B$	10 ... 30 V DC	●	●	●		
	10 ... 60 V DC				●	●
Interface type	CANopen, profile CiA410, Ver. 1.2	●	●	●		
	J1939 protocol				●	●
Transfer rate	125 ... 1000 kBit/s , programmable	●	●			
	10 ... 1000 kBit/s , programmable				●	●
Node ID	1 ... 127 , programmable	●	●	●		
	0 ... 253 , programmable				●	●

Approvals and Certificates

|						
e1 Type approval	2006/28/EG	●	●	●	●	●
CSA approval	cCSAus Listed, General Purpose, Class 2 Power Source	●	●	●	●	●
CCC approval	CCC approval / marking not required for sensors rated ≤36 V					

Dimensions

Length L [mm]	44
Width W [mm]	65
Height H [mm]	37
Connector length l$_c$ [mm]	18.5

Properties

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

Accessories

These and more accessories can be found in chapter 10
See pages from 970 ... for cordsets   See pages 1066 ... for mounting accessories
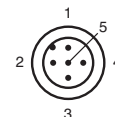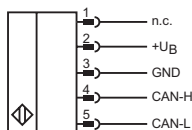
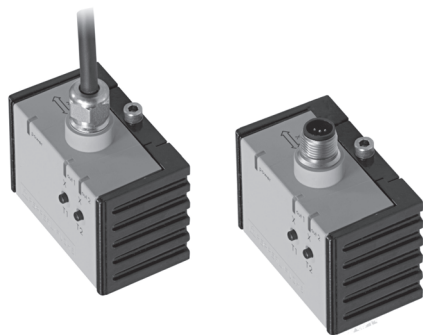|	
V15-G-2M-PUR-CAN-V15-G	DeviceNet/CANOpen bus cable, M12 to M12, PUR cable 5-pin, straight
V15-G-5M-PUR-CAN-V15-G	DeviceNet/CANOpen bus cable, M12 to M12, PUR cable 5-pin, straight
V15-G-10M-PUR-CAN-V15-G	DeviceNet/CANOpen bus cable, M12 to M12, PUR cable 5-pin, straight
V15S-T-CAN/DN-V15	T distributor, M12 socket on M12 connector/socket
ICZ-TR-CAN/DN-V15	Terminal resistor for DeviceNet, CANopen
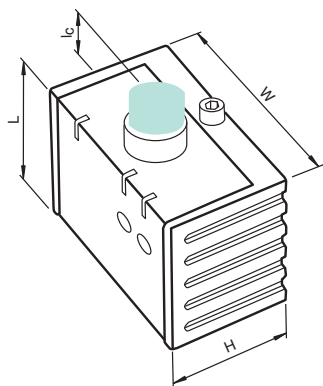
Electrical Connection

INX360D-F99-B16-V15
INY030D-F99-B16-V15
INY360D-F99-B16-V15
INX360D-F99-B20-V15
INY360D-F99-B20-V15

1	n.c.
2	+U$_B$
3	GND
4	CAN-H
5	CAN-L

Wire colors in accordance with EN 60947-5-2

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

Refer to General Notes Relating to Product Information

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857

Technical Data

For detailed data and product description refer to the data sheets at
www.pepperl-fuchs.us

General Data

Type	Inclination sensor, 1-axis
Measurement range	0 ... 360 °
Absolute accuracy	$\leq \pm 0.5$ °
Resolution	≤ 0.1 °
Operating voltage U_B	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 current output 4 ... 20 mA
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

Properties

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

Benefits

- **Push Button configurable**
- **LED indication**
- **Configurable range and switch point angles**

Model Number		INX360D-F99-I2E2-5M	INX360D-F99-U2E2-5M	INX360D-F99-I2E2-V15	INX360D-F99-U2E2-V15
Analog output					
Output type	1 current output 4 ... 20 mA	●		●	
	1 voltage output 0 ... 5 V		●		●
Load resistor	0 ... 200 Ω at U_B = 10 ... 18 V	●		●	
	0 ... 500 Ω at U_B = 18 ... 30 V	●		●	
	≥ 1 kΩ		●		●
Connection type	M12 x 1 connector, 5-pin			●	●
	5 m, PUR cable 5 x 0.5 mm^2	●	●		

Approvals and Certificates

CSA approval	cCSAus Listed, General Purpose, Class 2 Power Source	●		●	
e1 Type approval	2006/28/EG	●		●	
CCC approval	CCC approval / marking not required for sensors rated $\leq$36 V				

Dimensions

Length L [mm]		44	
Width W [mm]		65	
Height H [mm]		37	
Connector length I_c [mm]		22	18.5

Accessories

These and more accessories can be found in chapter 10
See pages from 970 ... for cordsets   See pages 1066 ... for mounting accessories

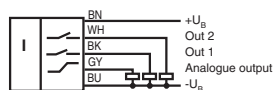|	
V15-G-2M-PUR	Female cordset, M12, 5-pin, PUR cable, straight
V15-W-2M-PUR	Female cordset, M12, 5-pin, PUR cable, angled

Electrical Connection
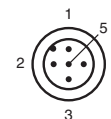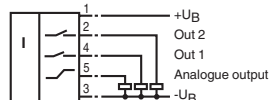
INX360D-F99-I2E2-5M
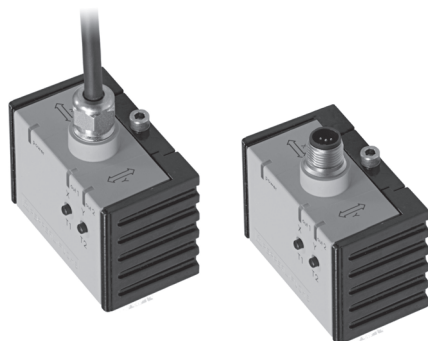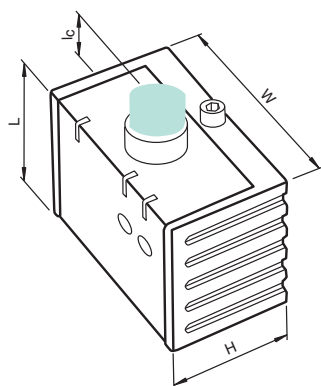INX360D-F99-U2E2-5M

Standard symbol/Connection:

BN	+U_B
WH	Out 2
BK	Out 1
GY	Analogue output
BU	-U_B

INX360D-F99-I2E2-V15
INX360D-F99-U2E2-V15

Standard symbol/Connection:

1	+U_B
2	Out 2
4	Out 1
5	Analogue output
3	-U_B

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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Technical Data

General Data

Type	Inclination sensor, 2-axis
Operating voltage U_B	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	2 current outputs 4 ... 20 mA (one output for each axis)
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

Inclination and Acceleration Sensors

Properties

- **2 axes measurement**
- **30° and 360° measurement range versions**
- **Analog and switching outputs**
- **Cable and connector versions**

Benefits

- **Push Button configurable**
- **LED indication**
- **Configurable range and switch point angles**

Model Number		INY360D-F99-2I2E2-5M	INY030D-F99-2I2E2-5M	INY360D-F99-2I2E2-V17	INY030D-F99-2I2E2-V17
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

e1 Type approval	2006/28/EG	●		●	
CSA approval	cCSAus Listed, General Purpose, Class 2 Power Source	●		●	
CCC approval	CCC approval / marking not required for sensors rated ≤36 V				

Dimensions

Length L [mm]		44	
Width W [mm]		65	
Height H [mm]		37	
Connector length I_c [mm]		22	18.5

Accessories

These and more accessories can be found in chapter 10
See pages from 970 ... for cordsets   See pages 1066 ... for mounting accessories

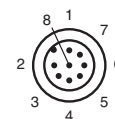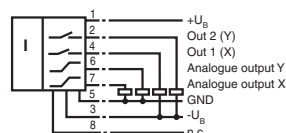|	
V17-G-2M-PUR	Female cordset, M12, 8-pin, shielded, 2 m PUR cable, straight
V17-G-5M-PUR	Female cordset, M12, 8-pin, shielded, 5 m PUR cable, straight
V17-G-10M-PUR	Female cordset, M12, 8-pin, shielded, 10 m PUR cable, straight
V17-G-10M-PVC ABG	Female cordset, M12, 8-pin, shielded, 10 m PVC cable, straight

6

Electrical Connection

INY030D-F99-2I2E2-5M
INY360D-F99-2I2E2-5M

Standard symbol/Connection:

BN	+U_B	
WH	Out 2 (Y)	
BK	Out 1 (X)	
PK	Analogue output Y	
VT	Analogue output X	
GY	GND	
BU	-U_B	
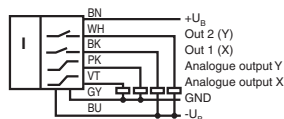
INY360D-F99-2I2E2-V17
INY030D-F99-2I2E2-V17

Standard symbol/Connection:

1	+U_B	
2	Out 2 (Y)	
4	Out 1 (X)	
6	Analogue output Y	
7	Analogue output X	
5	GND	
3	-U_B	
8	n.c.	

Wire colors

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

Refer to General Notes Relating to Product Information

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859

Inclination and Acceleration Sensors

6

Technical Data

For detailed data and product description refer to the data sheets at www.pepperl-fuchs.us

General Data

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

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

Benefits
- **Push Button configurable**
- **LED indication**
- **Configurable range and switch point angles**

Model Number		INY360D-F99-2U2E2-5M	INY360D-F99-2U2E2-V17
Connection type	8-pin, M12 x 1 connector		●
	5 m, PUR cable 7 x 0.5 mm²	●	

Approvals and Certificates

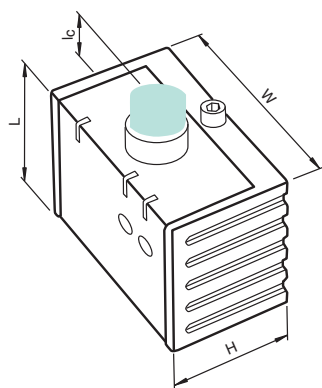|			
e1 Type approval	2006/28/EG	●	●
CSA approval	cCSAus Listed, General Purpose, Class 2 Power Source	●	●
CCC approval	CCC approval / marking not required for sensors rated ≤36 V		

Dimensions

Length L [mm]		44	
Width W [mm]		65	
Height H [mm]		37	
Connector length l_c [mm]		22	18.5

Accessories
These and more accessories can be found in chapter 10
See pages from 970 ... for cordsets   See pages 1066 ... for mounting accessories

|	
V17-G-2M-PUR	Female cordset, M12, 8-pin, shielded, 2 m PUR cable, straight
V17-G-5M-PUR	Female cordset, M12, 8-pin, shielded, 5 m PUR cable, straight
V17-G-10M-PUR	Female cordset, M12, 8-pin, shielded, 10 m PUR cable, straight
V17-G-10M-PVC ABG	Female cordset, M12, 8-pin, shielded, 10 m PVC cable, straight

Electrical Connection

INY360D-F99-2U2E2-5M

Standard symbol/Connection:

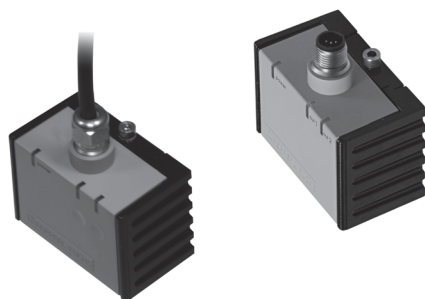| BN | +U_B |
WH	Out 2 (Y)
BK	Out 1 (X)
PK	Analogue output Y
VT	Analogue output X
GY	GND
BU	-U_B
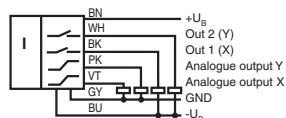
INY360D-F99-2U2E2-V17

Standard symbol/Connection:
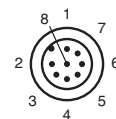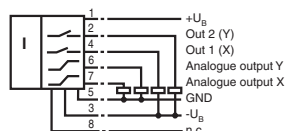
1	+U_B
2	Out 2 (Y)
4	Out 1 (X)
6	Analogue output Y
7	Analogue output X
5	GND
3	-U_B
8	n.c.

Wire colors

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

Technical Data

For detailed data and product description refer to the data sheets at
www.pepperl-fuchs.us

General Data

Type	Inclination sensor, 2-axis
Measurement range	-15 ... 15 °
Absolute accuracy	≤ ± 0.2 °
Resolution	≤ 0.01 °
No-load supply current	≤ 25 mA
Load resistor	≥ 1 kΩ
Ambient temperature	-40 ... 85 °C (-40 ... 185 °F)
Housing material	PA
Protection degree	IP68 / IP69K

CE CSA e1

Properties

- **2 axes measurement**
- **30° measurement range**
- **0 V ... 10 V and 0.5 V ... 4.5 V analog output models**
- **Cable and connector versions**

Model Number		INY030D-F99-2U-5M	INY030D-F99-2U-5M-Y239182	INY030D-F99-2U-V15	INY030D-F99-2U-V15-Y239181
Operating voltage U_B	10 ... 30 V DC		●		●
	18 ... 30 V DC	●		●	
Output type	2 voltage outputs 0 ... 10 V (one output for each axis)	●		●	
	2 voltage outputs 0.5 ... 4.5 V (one output for each axis)		●		●
Connection type	5 m, PUR cable 5 x 0.5 mm²	●	●		
	M12 x 1 connector, 5-pin			●	●

Approvals and Certificates

e1 Type approval	2006/28/EG	●	●	●	●
CSA approval	cCSAus Listed, General Purpose, Class 2 Power Source	●	●	●	●
CCC approval	CCC approval / marking not required for sensors rated ≤36 V				

Dimensions

Length L [mm]	44
Width W [mm]	65
Height H [mm]	37
Connector length l_c [mm]	18.5

Accessories

These and more accessories can be found in chapter 10
See pages from 970 ... for cordsets   See pages 1066 ... for mounting accessories

V15-G-2M-PUR	Female cordset, M12, 5-pin, PUR cable, straight
V15-W-2M-PUR	Female cordset, M12, 5-pin, PUR cable, angled

Inclination and Acceleration Sensors

6

Electrical Connection

INY030D-F99-2U-5M
INY030D-F99-2U-5M-Y239182

BN — +U_B
GY — Teach-In
BK — Analog output (X)
WH — Analog output (Y)
BU — -U_B

INY030D-F99-2U-V15
INY030D-F99-2U-V15-Y239181

1 — +U_B
5 — Teach-In
4 — Analog output (X)
2 — Analog output (Y)
3 — -U_B

Wire colors in accordance with EN 60947-5-2

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

Refer to General Notes Relating to Product Information

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PEPPERL+FUCHS
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861

Inclination and Acceleration Sensors

6

Technical Data

General Data

Measurement range	-2 ... 2 g
Resolution	≤ 5 mg
Frequency range	0 ... 100 Hz
Operating voltage U$_B$	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

Properties

- **1 and 2 axes measurement**
- **±2g measurement range**
- **Analog output(s)**
- **Connector version**

Model Number		ACX04-F99-I-V15	ACY04-F99-2I-V15
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	CCC approval / marking not required for sensors rated ≤36 V		
e1 Type approval	2006/28/EG	●	●
Dimensions			
Length L [mm]		44	
Width W [mm]		65	
Height H [mm]		37	
Connector length I$_c$ [mm]		18.5	

Accessories

These and more accessories can be found in chapter 10

V15-W-2M-PUR	Female cordset, M12, 5-pin, 2 m PUR cable, angled
V15-G-2M-PUR	Female cordset, M12, 5-pin, 2 m PUR cable, straight
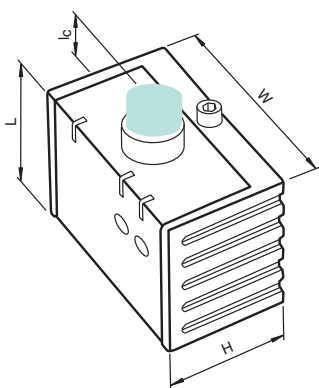
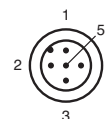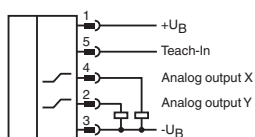## Electrical Connection

ACX04-F99-I-V15
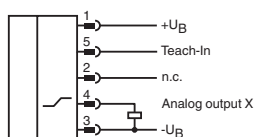
1	+U$_B$
5	Teach-In
2	n.c.
4	Analog output X
3	-U$_B$

ACY04-F99-2I-V15

1	+U$_B$
5	Teach-In
4	Analog output X
2	Analog output Y
3	-U$_B$

Wire colors in accordance with EN 60947-5-2

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

Refer to General Notes Relating to Product Information

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