



perfect in sensors.

POSITILT® - PTAM / PTDM

Analog and Digital Inclination Sensors

Installation and operation manual



Please read carefully before operation!

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Safety instructions

Do not use POSIROT® position sensors in safety critical applications where malfunction or total failure of the sensor may cause danger for man or machine.

For safety related applications additional mechanisms (devices) are necessary to maintain safety and to avoid damage.

Disregard of this advice releases the manufacturer from product liability.

The sensor must be operated only within values specified in the catalog or datasheet.

Connection to power supply must be performed in accordance with safety instructions for electrical facilities and performed only by trained staff.

Do not connect / disconnect the sensor under tension.

Disregard of this advice can lead to malfunctions, damage to property or personal injury and releases the manufacturer from product liability.

Explanation of used safety signs and signal words



WARNING, Risk of Injury:

Indicates a potentially hazardous situation, which, if not avoided, could result in serious injury or property damage.

DANGER

WARNING, Risk of Personal Injury or Death:

Indicates a situation that can result in serious personal injury or death if not properly avoided.

WARNING

WARNING, Risk of Personal Injury or Death:

Indicates a situation that can result in moderate personal injury or death if not properly avoided.

CAUTION

WARNING, Risk of Personal Injury:

Indicates a situation that can result in minor personal injury if not properly avoided.

NOTICE

WARNING, Risk of Property Damage:

Indicates a situation that can result in minor to major property damage if not properly avoided.

Intended use The angle sensor was intended for angular position measurement, when properly mounted and used in the specified ambient atmospheric and technical conditions for which the sensor is designated.


Unintended use The unintended use is when the sensor is used outside its specified technical and ambient atmospheric conditions or when incorrectly mounted.

Maintenance and service

- In order to avoid risk of injury and improper handling the customer is not allowed to repair the sensor. No warranty or liability will be granted for opened sensors.
- Damaged sensors must be shut down immediately and sent to the factory for repair.

Maintenance-interval Proper maintenance comprises the visual examination of parts (e.g. integrity of housing, connectors and cables). Maintenance intervals depend on the specific application and should be defined by the user in dependence of operating conditions.

The following maintenance steps are recommended:

 CAUTION	Integrity of housing, connector, cable	Mounting elements
PTAM2/PTDM2	X	X
PTAM5/PTDM5	X	X
PTAM27/PTDM27	X	X
Measures	Damaged parts: put sensor out of service, replace damaged parts resp. send sensor to ASM for repair	Loose mounting parts: Screw tight mounting parts with recommended torque, if applicable use screw protections

Deinstallation Disconnect electrical connections. Loosen fixing screws.

Disposal Disposal according to applicable government regulations.

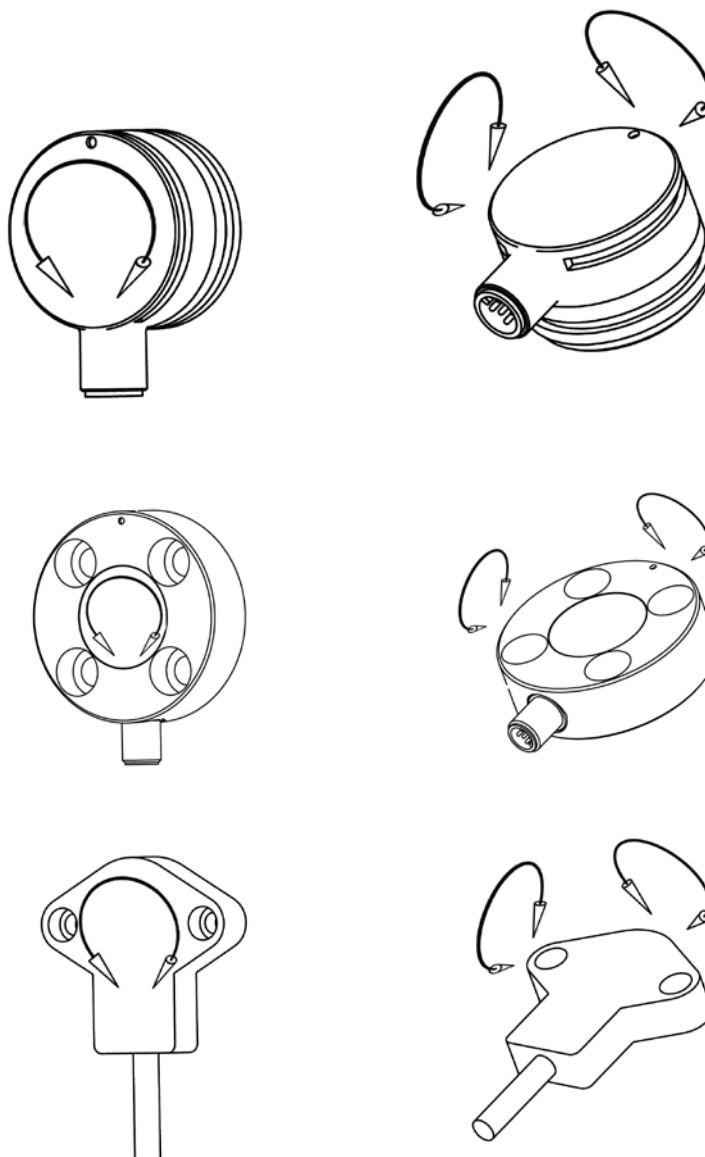
Description

Tilt sensors of the POSITILT® product family measure the angle of inclination for one or two axes. Measuring range can be specified from ± 15 up to ± 180 degree. Output configuration comprises high resolution voltage or current output and CAN interface. A wide variety of package and mounting options provide flexibility for many applications.

Home position (optional)

The home (center) position of the inclinometers POSITILT® can be configured not only via the mechanical adjustment but also via a switching input (Teach-In) when the connector pin ZERO is connected to 0 V (GND) for 2 seconds.

Mounting options



Electrical installation



CAUTION

Supply voltage, current consumption, wiring

For wiring of connector or cable outlet as well as supply voltage and current consumption refer to chapter „Output specification“.

Cable screen has to be connected to protective earth.

Caution: Observe different color code for pre-assembled accessory cables - refer to accessories pages.

The protection class of sensors with connector output is valid only if the electrical plug is connected!

Caution: Do not twist the M12 connector insert.

Cable outputs must be installed in such a way that no moisture can get into the cable.

Crossing the dew point must be avoided.

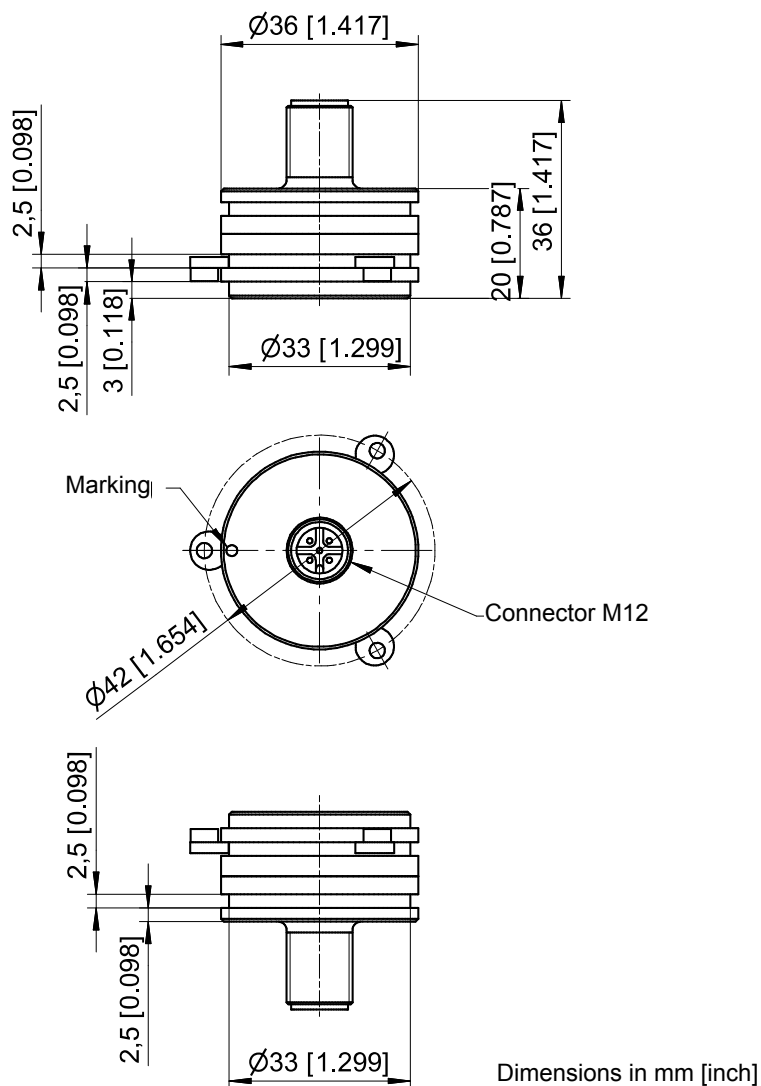
Mounting

Torque	Mounting method	Torque [Nm]
	M2,5 screws for mounting brackets (PTAM2)	0.8
	M8 screws (PTAM5)	<10
	Screws M4 with washer (PTAM27)	<2

Mechanical information PTAM27, PTDM27

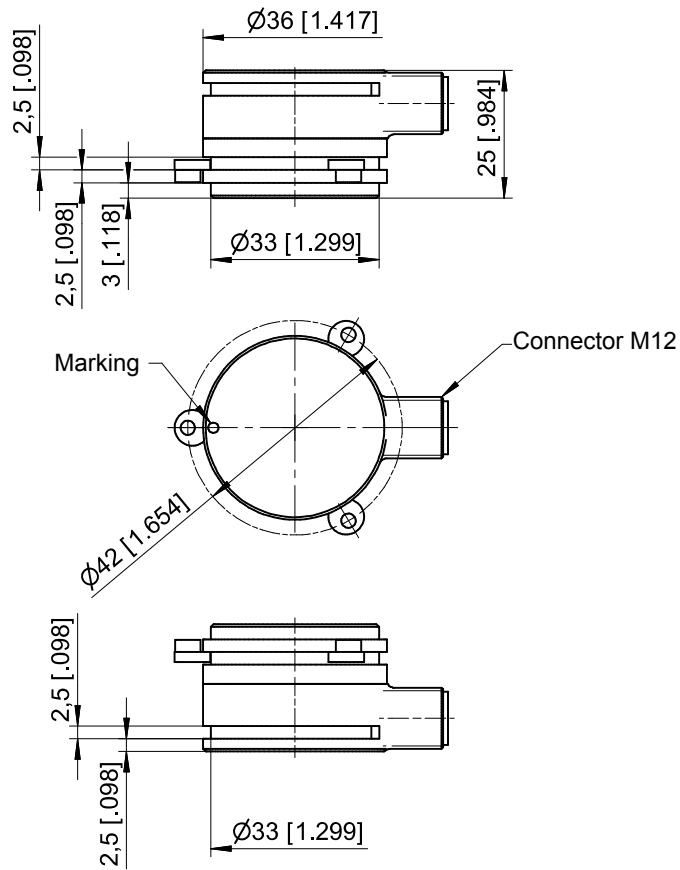
- Mount the sensor on a flat surface.
- Do not deform the sensor housing!
- Lateral inclination sensitivity:
- Up to 30° lateral inclination the resulting error is $\leq 1^\circ$.

Dimensions
PTAM2/PTDM2
Connector version
M12 axial



Dimensions informative only.
For guaranteed dimensions consult factory.

Dimensions
PTAM2/PTDM2
Connector version
M12 radial

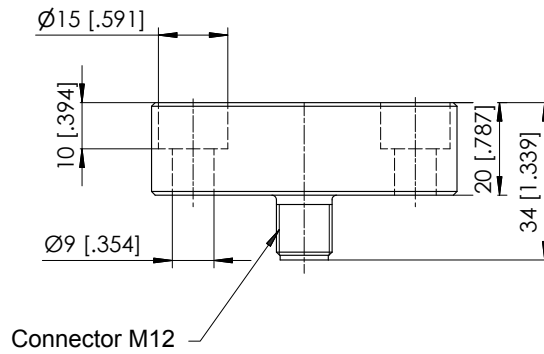
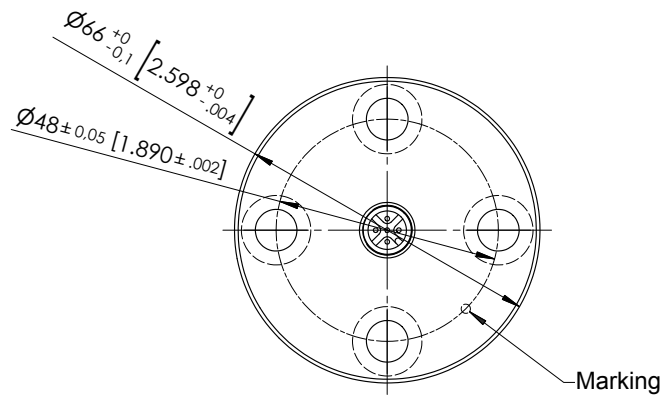


Dimensions in mm [inch]

Dimensions informative only.

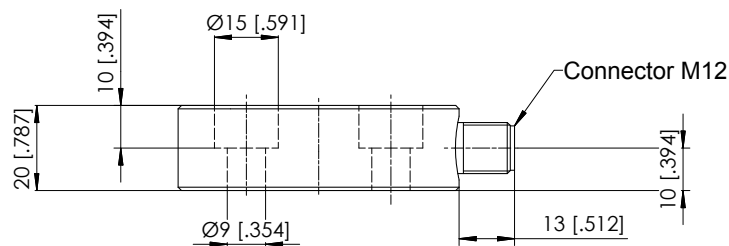
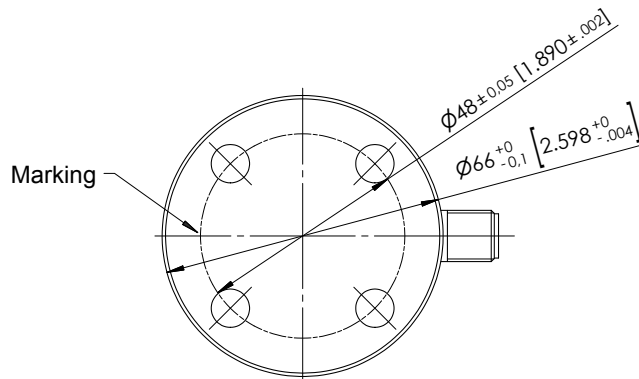
For guaranteed dimensions consult factory.

Dimensions
PTAM5/PTDM5
 Connector version
 M12 axial

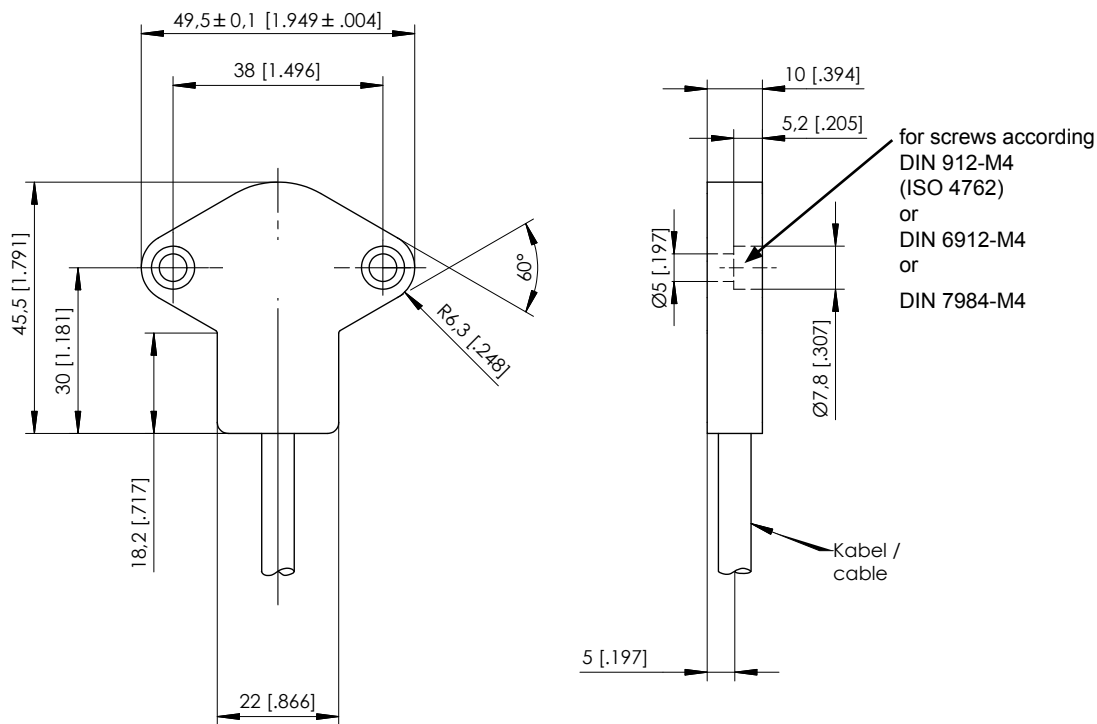


Dimensions in mm [inch]

Dimensions
PTAM5/PTDM5
 Connector version
 M12 radial



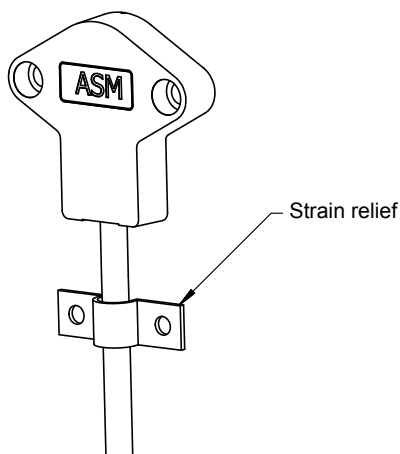
Dimensions
PTAM27



Dimensions in mm [inch]

Dimensions informative only.
For guaranteed dimensions consult factory.

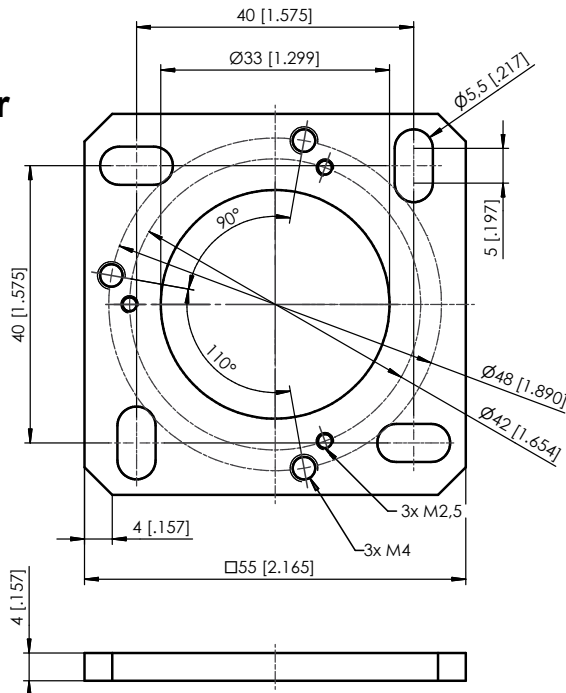
Reference position



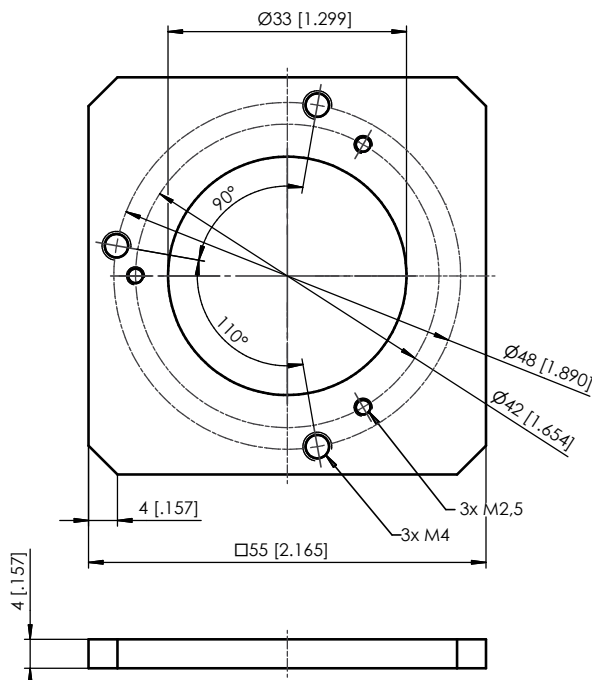
For all sensors with cable:

Cable diameter	$\varnothing 5,2$ mm	
Min. bending radius	in motion, 10 million cycles	not in motion
	10 x cable diameter,	5 x cable diameter

**Mounting plate
 PRPT-BPL1**
 (screw mounting) for
 PTAM2/PTDM2

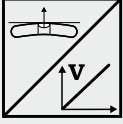
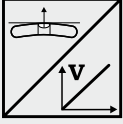
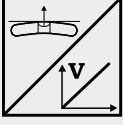
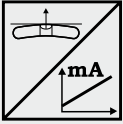


**Mounting plate
 PRPT-BPL2**
 (welding assembly)
 for PTAM2/PTDM2



Dimensions in mm [inch]

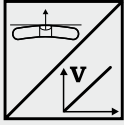
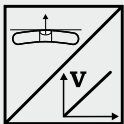
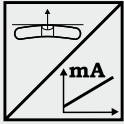
Dimensions informative only.
 For guaranteed dimensions consult factory.

<p>U2 Voltage Output 0.5 ... 10 V</p> 	Excitation voltage	18 ... 36 V DC
	Excitation current	12 mA typ., 16 mA max.
	Output voltage	0.5 ... 10 V DC
	Output current	2 mA max.
	Measuring rate	1 kHz standard
	Stability (temperature)	$\pm 100 \times 10^{-6} / ^\circ\text{C}$ f.s. (typ.)
	Operating temperature	-40 ... +85 °C
	Protection	Reverse polarity, short circuit
	EMC	EN 61326-1:2013
	<p>U6 Voltage Output 0.5 ... 4.5 V DC</p> 	Excitation voltage
Excitation current		13 mA typ., 16 mA max.
Output voltage		0.5 ... 4.5 V DC
Output current		2 mA max.
Measuring rate		1 kHz standard
Stability (temperature)		$\pm 100 \times 10^{-6} / ^\circ\text{C}$ f.s. (typ.)
Operating temperature		-40 ... +85 °C
Protection		Reverse polarity, short circuit
EMC		EN 61326-1:2013
<p>U8 Voltage output 0.5 ... 4.5 V</p> 		Excitation voltage
	Excitation current	12 mA typ., 16 mA max.
	Output voltage	0.5 ... 4.5 V DC
	Output current	2 mA max.
	Measuring rate	1 kHz standard
	Stability (temperature)	$\pm 100 \times 10^{-6} / ^\circ\text{C}$ f.s. (typ.)
	Operating temperature	-40 ... +85 °C
	Protection	Reverse polarity, short circuit
	EMC	EN 61326-1:2013
	<p>I1 Current Output 4 ... 20 mA</p> 	Excitation voltage
Excitation current		32 mA typ., 36 mA max..
Load resistor		500 Ω max.
Output current		4 ... 20 mA
Measuring rate		1 kHz standard
Stability (temperature)		$\pm 100 \times 10^{-6} / ^\circ\text{C}$ f.s. (typ.)
Operating temperature		-40 ... +85 °C
Protection		Reverse polarity, short circuit
EMC		EN 61326-1:2013

POSITILT® - PTAM

Analog Output, programmable



U2/PMZ Voltage Output 0.5 ... 10 V 	Excitation voltage	18 ... 36 V DC
	Excitation current	12 mA typ., 16 mA max.
	Output voltage	0.5 ... 10 V DC
	Output current	2 mA max.
	Measuring rate	1 kHz standard
	Stability (temperature)	$\pm 100 \times 10^{-6} / ^\circ\text{C}$ f.s. (typ.)
	Operating temperature	-40 ... +85 °C
	Protection	Reverse polarity, short circuit
	EMC	EN 61326-1:2013
	U8/PMZ Voltage output 0.5 ... 4.5 V 	Excitation voltage
Excitation current		12 mA typ., 16 mA max.
Output voltage		0.5 ... 4.5 V DC
Output current		2 mA max.
Measuring rate		1 kHz standard
Stability (temperature)		$\pm 100 \times 10^{-6} / ^\circ\text{C}$ f.s. (typ.)
Operating temperature		-40 ... +85 °C
Protection		Reverse polarity, short circuit
EMC		EN 61326-1:2013
I1/PMZ Current Output 4 ... 20 mA 		Excitation voltage
	Excitation current	32 mA typ., 36 mA max..
	Load resistor	500 Ω max.
	Output current	4 ... 20 mA
	Measuring rate	1 kHz standard
	Stability (temperature)	$\pm 100 \times 10^{-6} / ^\circ\text{C}$ f.s. (typ.)
	Operating temperature	-40 ... +85 °C
	Protection	Reverse polarity, short circuit
	EMC	EN 61326-1:2013

Function ZERO (Option)

Programming the zero point by the customer:

The function „ZERO“ allows to program the zero point of the output range by using a signal ZERO available at the connector. This Signal ZERO must be connected with GND via a push button (Teach-In). At first the sensor must be brought into the zero position. Pushing the button 2 seconds sets the actual position as the zero point. The values are available as well after switching off the sensor.

U2/PMZ
U8/PMZ
I1/PMZ

POSITILT® - PTAM

Analog Output Specification



The output signals of sensors with 2 analog outputs mustn't be connected to one another!

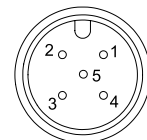
NOTICE

Cable output	Wire color	Signal
1 axis	Brown	+U _B (excitation voltage)
	White	Analog output X
	Blue	GND
	Black	Do not connect!
	Grey	ZERO (option)

Cable output	Wire color	Signal
2 axes	Brown	+U _B (excitation voltage)
	White	Analog output X
	Blue	GND
	Black	Analog output Y
	Grey	ZERO (option)

5-pin connector	Pin no.	Signal
1 axis	1	+U _B (excitation voltage)
	2	Analog output X
	3	GND
	4	Do not connect
	5	ZERO

View to sensor connector



M12A5 / M12R5


5-pin connector	Pin no.	Signal
2 axes	1	+U _B (excitation voltage)
	2	Analog output X
	3	GND
	4	Analog output Y
	5	ZERO

POSITILT® - PTDM

CANopen Output Specification



Description Inclination sensor with CANopen interface according to CiA 410.

CANopen Interface 	Communication profile	CANopen CiA 301 V 4.02, Slave
	Device profile	Inclinometer CiA 410 V 1.2
	Configuration services	LSS, CiA Draft Standard 305 (transmission rate, node ID)
	Error Control	Node Guarding, Heartbeat, Emergency Message
	Node ID	Adjustable via LSS or via object dictionary; default: 127
	PDO	1 TxPDO, 0 RxPDO, static mapping
	PDO Modes	Event-/Time triggered, Remote-request, Sync cyclic/acyclic
	SDO	1 Server, 0 Client
	Certified	Yes
	Bit rate	50 kBaud to 1 MBaud, adjustable via LSS or via object dictionary, default: 125 kBaud
	Bus connection	M12 connector, 5 pin
	Integrated Bus termination resistor	PTDM27 only, configurable
	Bus, galvanic isolation	No

Specifications	Excitation voltage	8 ... 36 V DC
	Excitation current	15 mA typical at 24 V DC, 30 mA typical at 12 V DC, 100 mA max.
	Measuring rate	1 kHz standard
	Stability (temperature)	$\pm 100 \times 10^{-6}$ / °C f.s.
	Repeatability	1 LSB
	Operating temperature	-40 ... +85 °C
	Protection	Reverse polarity, short circuit
	EMC	EN 61326-1:2013

Setup



WARNING



NOTICE

Warning notice

- Changing parameters may cause unexpected machine movement.
- Changing parameters may influence dependent parameters
- e.g. changing the resolution may have influence on position of CAM switches.
- Precautions have to be taken to avoid damage to human and machine parts!
- Change parameters only when machine is in a safe condition!

Before connecting the sensor to the CAN-Bus the devices have to be checked for correct bitrate and unique node-IDs. Both parameters are configurable by Layer-Setting-Service (LSS) or by Service Data Object (SDO). After power-on the sensor will enter pre-operational state and send a boot-up message being ready for configuration by Service Data Objects. Parameters configured by the user can be stored nonvolatile by SAVE command. On receiving „NMT-Node-Start“ the sensor transits to operational state and starts process data transmission. When „Auto-Start“ is configured the sensor will automatically transit to operational after boot-up without a need for the Node-Start message.

Node monitoring is supported by Node Guarding and Heartbeat protocol. Node Guarding implements cyclic querying of the node status by the NMT-Master within the guard time window. The Heartbeat protocol provides automatic transmission of the node status (heartbeat message) by the slave within producer heartbeat time window.

Following the CAN example protocols included in this manual the sensor may be used without CANopen master device.

Service Data Object (SDO) COB-Id

Service data objects (SDO) provide a peer to peer communication between master and slave. The communication object identifier (COB) of the SDO is defined by the Node-Id.

SDO	COB-Id	Default COB-Id
Master to Slave	600h + Node-Id	67Fh
Slave to Master	580h + Node-Id	5FFh

Process Data Object (TPDO)

Real time data transfer is provided by Process Data Objects (PDO). The PDO mapping is fixed. The PDO COB-Id is by default setting derived from the Node-Id (Predefined Connection Set) but may be changed to application specific values by PDO COB-Id 1800-1, 1801-1, DLC defines the length of the data field.

COB-Id	DLC	Data Frame
180h + Node-Id	length	Byte0 Byte7 Data Frame max 8 Byte

Transmission behaviour of TPDO-1, -2, -4 is configurable by Communication Parameter PDO COB-Id 1800, 1801, ... sub-indices -1, -2, -3 and -5.

Transmission type example for TPDO-1	COB-Id 1800-1	Transmission Type 1800-2	Inhibit Time 1800-3	Event Timer [ms] 1800-5
Cyclic Asynchronous		FEh	1 .. 07FFFh	1 .. 07FFFh
Change of State		FEh	1 .. 07FFFh	0
Synchronous		N = 1 .. 240		-
TPDO Disable	80 00 xx xx	-		-
TPDO Enable	00 00 xx xx			

Transmission type «cyclic asynchronous» triggers TPDO-transmission periodically with a time period defined by the event timer.

Transmission type «change of state» will be enabled if the event timer is set to «0». This will trigger TPDO-transmission on change of the position value where «Inhibit time» defines a minimum time delay between consecutive TPDOs.

In «synch mode» a TPDO is transmitted on reception of a number of one or multiple SYNC commands.

Enable or disable a TPDO by setting Bit 31 of the COB-Id '0' resp. '1' (Default: «0» Enabled).

Object Dictionary Communication Profile CiA 301

Object	Index [hex]	Sub-index	Access	Type	Default	Value Range / Note
Device type	1000	0	ro	U32	2019Ah	inclinometer profile, 410
Error register	1001	0	ro	U8	0	
COB-ID-Sync	1005	0	rw	U32	80	
Manufacturer device name	1008	0	ro	String	-	
Manufacturer hardware version	1009	0	ro	String	-	
Manufacturer software version	100A	0	ro	String	-	
Guard time	100C	0	rw	U16	0	0 .. 7FFFh
Life time factor	100D	0	rw	U8	0	0 .. FFh
Save Settings	1010	1	w	U32	-	„save“ 65766173h
Load Manufacturer Settings	1011	1	w	U32	-	„load“ 64616F6Ch*)
COB-ID-EMCY	1014	0	ro	U32	FFh	NodeID+80h
Producer heartbeat time	1017	0	rw	U16	0	0 .. 7FFFh
Identity Object VendorID	1018	1	ro	U32	252h	
Identity Object Product Code		2	ro	U32	-	
Identity Object Revision number		3	ro	U32	-	
Identity Object Serial number		4	ro	U32	-	
COB-ID Server->Client	1200	1	ro	U32	67Fh	- SOD
COB-ID Client-> Sever	1200	2	ro	U32	5FFh	- SDO
PDO1 COB-ID	1800	1	rw	U32	1FFh	181h .. 1FFh
PDO1 Transmission-Type		2	rw	U8	FEh	0 .. FFh
PDO1 Inhibit time		3	rw	U16	0	0 .. 7FFFh
PDO1 Event timer		5	rw	U16	0	0 .. 7FFFh
TPDO1-Mapped Object 1	1A00	1	ro	U32	60100010h	
TPDO1-Mapped Object 2		2	ro	U32	60200010h	
NMT-Startup	1F80	0	rw	U32	0	0, 8

*) Reset into default settings except Node ID.

Device Profile

Object	Index [hex]	Sub-index	Access	Type	Default	Value Range / Note
Manufacturer specific						
Node-ID	2000		rw		127	1...127
Bitrate	2010		rw		4	0..4, 6
Error	2030		ro			
Hysteresis	2040		rw			
Bus termination	2050				0	0: OFF , 1: ON (PTDM27 only)
Filter (N _{Filter}) Response Time (90%): $T_R = N_{Filter} * 5 \text{ ms}$	2102		rw		0*	0 ... 65535
Inclinometer CiA410						
Resolution (in 0,001°)	6000		rw		100	10 ... 10000
Slope long16 inclination angle round x axis	6010					
Oper. parameters slope long16, 1 or 2 axes	6011				0	
Slope long16 preset value	6012				0	
Slope lateral16 inclination angle round y axis	6020					
Oper. parameters slope lateral16, 2nd axis	6021				0	
Slope lateral16 preset value	6022				0	

*) Preconfigured to 16

Operating Parameters Bit Code

7	...	2	1	0
m			s	cs
MSB				LSB

cs = 0/1 Code sequence CW/CCW
s = 0/1 Scaling function enabled/disabled
m = 0/1 Operating mode: 1 axis x ±180°/2 axes x,y ±60°

Process Data Object (TPDO) Mapping

TPDO	COB-Id	DLC	Data Frame							
			Byte0				Byte7			
TPDO-01	180h +Node-Id	4	4 Byte Inclination Data							
			LSB _x	MSB _x	LSB _y	MSB _y				

TPDO Default Settings

TPDO	Default COB-Id	Default Transmission Type
TPDO-01: Position Data, 4 Byte	1FFh	Event Mode (FE)

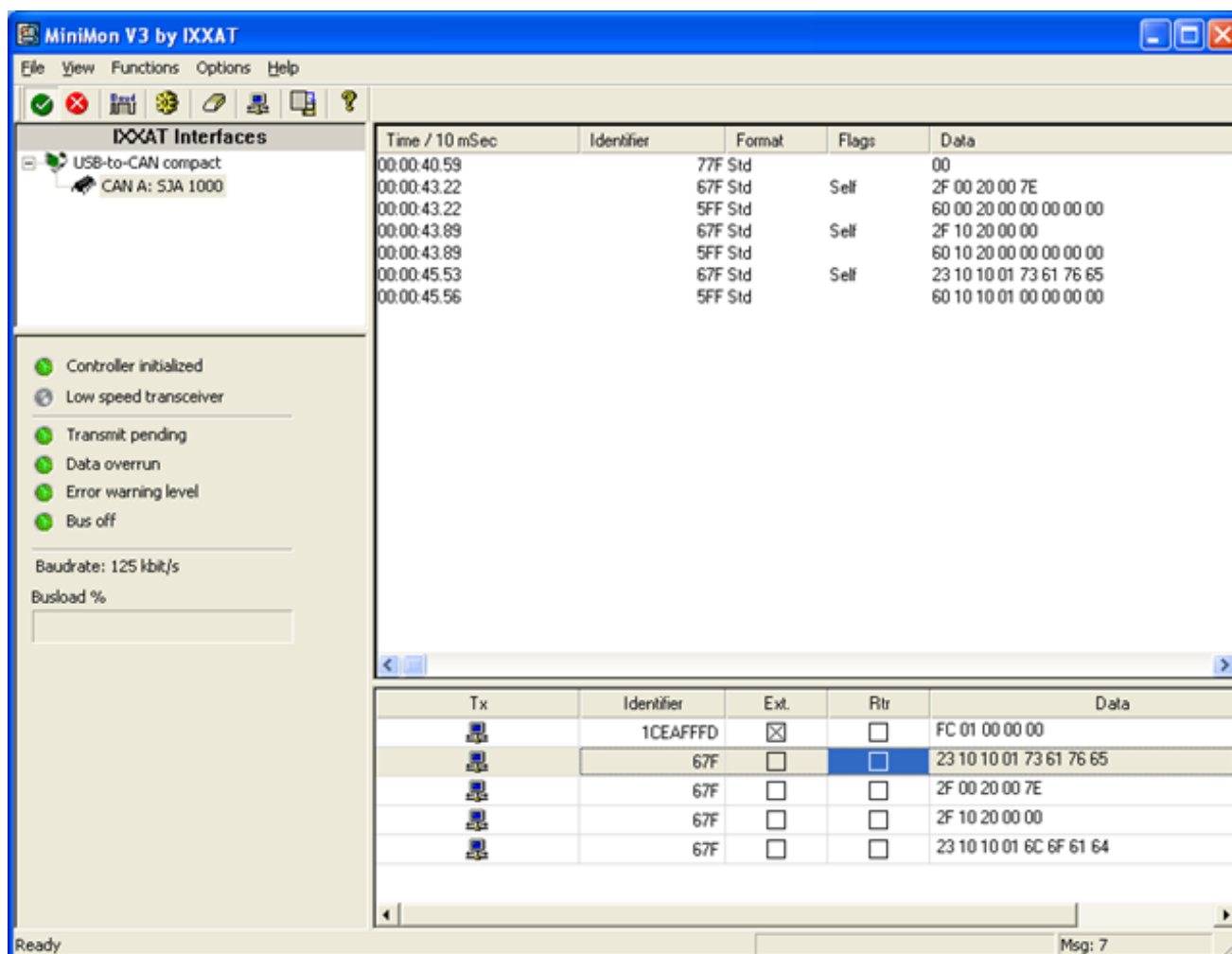
Baud Rate (Object 2010)

Bitrate Index	Bitrate [kbit/s]
0	1000
1	800
2	500
3	250
4	125
6	50

Examples

Example protocols are prepared using the IXXAT USB-to-CAN PC-Interface with CAN-Monitor „miniMon“ (IXXAT Automation GmbH, D-88250 Weingarten). These examples enable the user to configure and to run the CANopen slaves from a host PC without using a CANopen master ECU. The miniMon-screen has the configuration and status window at left side, a receive message window and a transmit message window below.

Configuration Exemple 1 - screenshot



Configuration Example 1 - detailed explanation

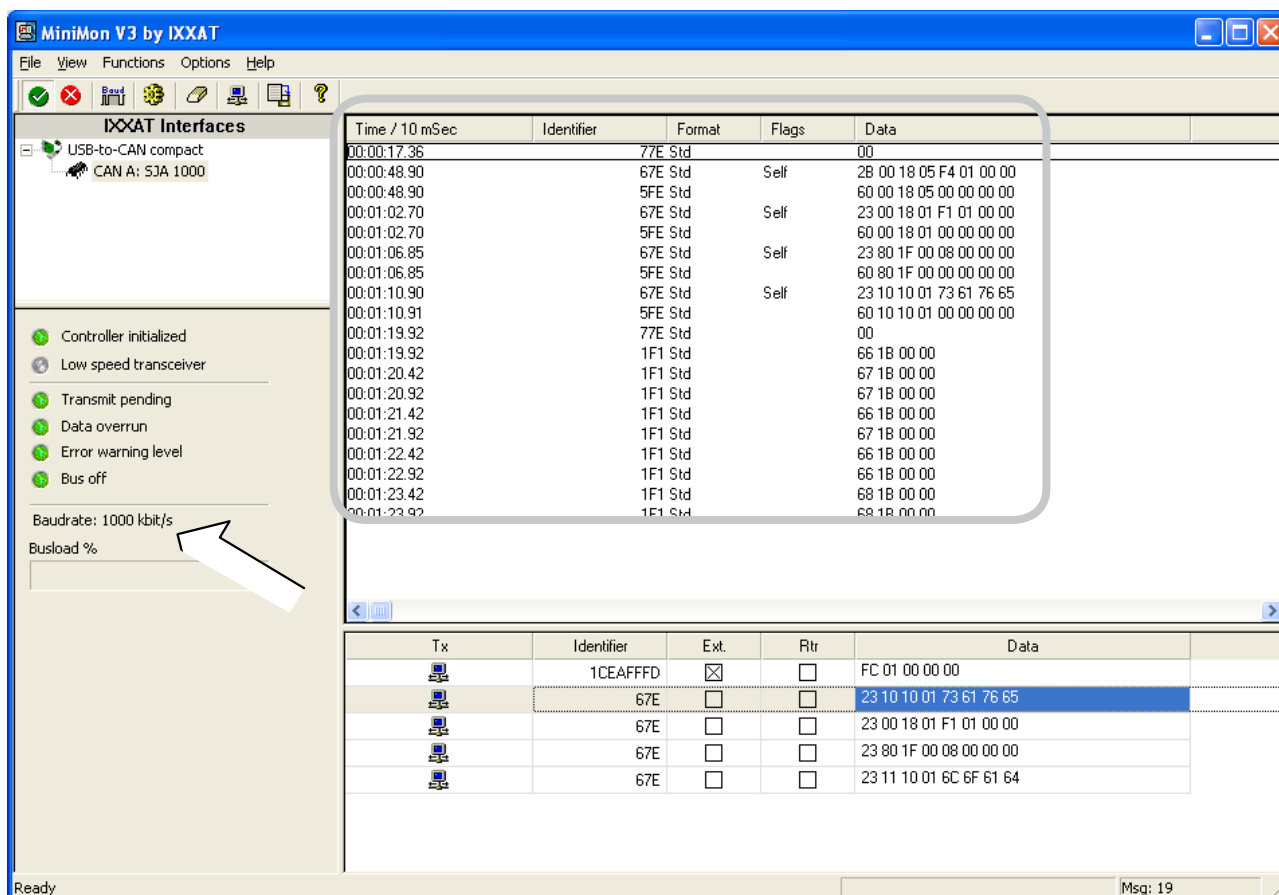
The example shows the Sensor responding on POWER ON with the Boot-Up message. By SDO message the node-Id and the bit rate will be changed to 7Eh and 1000kbit/s. Finally the host sends an SDO „SAVE“ to store the configuration nonvolatile.

Note: Changes of of node-Id and bit rate will become effective on next POWER ON sequence. So the SAVE command has to address the old SDO-COB-Id.

Screen Shot Explanation:

Time / 10 mSec	Identifier	Format	Flags	Data
00:00:40.59	Boot-Up message	77F Std		00
00:00:43.22	Set node Id to 7Eh	67F Std	Self	2F 00 20 00 7E
00:00:43.22	Response	5FF Std		60 00 20 00 00 00 00 00
00:00:43.89	Set baud rate to 1000 kbit/s	67F Std	Self	2F 10 20 00 00
00:00:43.89	Response	5FF Std		60 10 20 00 00 00 00 00
00:00:45.53	SAVE	67F Std	Self	23 10 10 01 73 61 76 65
00:00:45.56	Response	5FF Std		60 10 10 01 00 00 00 00

Configuration Example 2 - screenshot



The screenshot shows the MiniMon V3 interface. On the left, the 'IXXAT Interfaces' section shows 'USB-to-CAN compact' and 'CAN A: SJA 1000'. Below this, a list of status indicators includes 'Controller initialized', 'Low speed transceiver', 'Transmit pending', 'Data overrun', 'Error warning level', and 'Bus off'. The 'Baudrate: 1000 kbit/s' is displayed, with a white arrow pointing to it. The 'Busload %' field is empty.

The main window displays a log table with the following data:

Time / 10 mSec	Identifier	Format	Flags	Data
00:00:17.36		77E Std		00
00:00:48.90		67E Std	Self	2B 00 18 05 F4 01 00 00
00:00:48.90		5FE Std		60 00 18 05 00 00 00 00
00:01:02.70		67E Std	Self	23 00 18 01 F1 01 00 00
00:01:02.70		5FE Std		60 00 18 01 00 00 00 00
00:01:06.85		67E Std	Self	23 80 1F 00 08 00 00 00
00:01:06.85		5FE Std		60 80 1F 00 00 00 00 00
00:01:10.90		67E Std	Self	23 10 10 01 73 61 76 65
00:01:10.91		5FE Std		60 10 10 01 00 00 00 00
00:01:19.92		77E Std		00
00:01:19.92		1F1 Std		66 18 00 00
00:01:20.42		1F1 Std		67 18 00 00
00:01:20.92		1F1 Std		67 18 00 00
00:01:21.42		1F1 Std		66 18 00 00
00:01:21.92		1F1 Std		67 18 00 00
00:01:22.42		1F1 Std		66 18 00 00
00:01:22.92		1F1 Std		66 18 00 00
00:01:23.42		1F1 Std		68 18 00 00
00:01:23.92		1F1 Std		68 18 00 00

Below the log table is a table for Tx data:

Tx	Identifier	Ext.	Rtr	Data
	1CEAFFFD	<input checked="" type="checkbox"/>	<input type="checkbox"/>	FC 01 00 00 00
	67E	<input type="checkbox"/>	<input type="checkbox"/>	23 10 10 01 73 61 76 65
	67E	<input type="checkbox"/>	<input type="checkbox"/>	23 00 18 01 F1 01 00 00
	67E	<input type="checkbox"/>	<input type="checkbox"/>	23 80 1F 00 08 00 00 00
	67E	<input type="checkbox"/>	<input type="checkbox"/>	23 11 10 01 6C 6F 61 64

The status bar at the bottom shows 'Ready' on the left and 'Msg: 19' on the right.

Configuration Example 2 - detailed explanation

The message window shows the slave responding on POWER ON with the Boot-Up message on new node-id 7Eh. Event timer of PDO1 is changed to 500ms and COB-Id of PDO1 is changed to 1F1h. Finally „Autostart“ is activated (automatic transition to operational) and the configuration stored nonvolatile with „SAVE“. On POWER OFF / POWER ON the slave starts sending PDOs asynchronously with the new COB-Id after the Boot-Up message.

Screenshot explanation:

Time / 10 mSec	Identifier	Format	Flags	Data
00:00:17.36	<i>Boot-Up Message</i>	77E Std		00
00:00:48.90	<i>Set PDO1 Event Timer 500</i>	67E Std	Self	2B 00 18 05 F4 01 00 00
00:00:48.90	<i>Response</i>	5FE Std		60 00 18 05 00 00 00 00
00:01:02.70	<i>Set PDO1 COB-Id to 1F1</i>	67E Std	Self	23 00 18 01 F1 01 00 00
00:01:02.70	<i>Response</i>	5FE Std		60 00 18 01 00 00 00 00
00:01:06.85	<i>Set Autostart</i>	67E Std	Self	23 80 1F 00 08 00 00 00
00:01:06.85	<i>Response</i>	5FE Std		60 80 1F 00 00 00 00 00
00:01:10.90	<i>SAVE</i>	67E Std	Self	23 10 10 01 73 61 76 65
00:01:10.91	<i>Response .. POWER OFF</i>	5FE Std		60 10 10 01 00 00 00 00
00:01:19.92	<i>Boot Up on POWER ON</i>	77E Std		00
00:01:19.92	<i>Cyclic PDO Transfer</i>	1F1 Std		66 1B 00 00
00:01:20.42	<i>on Power On</i>	1F1 Std		67 1B 00 00
00:01:20.92	...	1F1 Std		67 1B 00 00
00:01:21.42	...	1F1 Std		66 1B 00 00
00:01:21.92	...	1F1 Std		67 1B 00 00
00:01:22.42	...	1F1 Std		66 1B 00 00
00:01:22.92	...	1F1 Std		66 1B 00 00
00:01:23.42	...	1F1 Std		68 1B 00 00
00:01:23.92	...	1F1 Std		68 1B 00 00

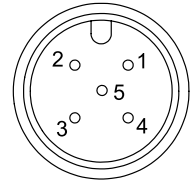
POSITILT® - PTDM

CANopen Output Specification



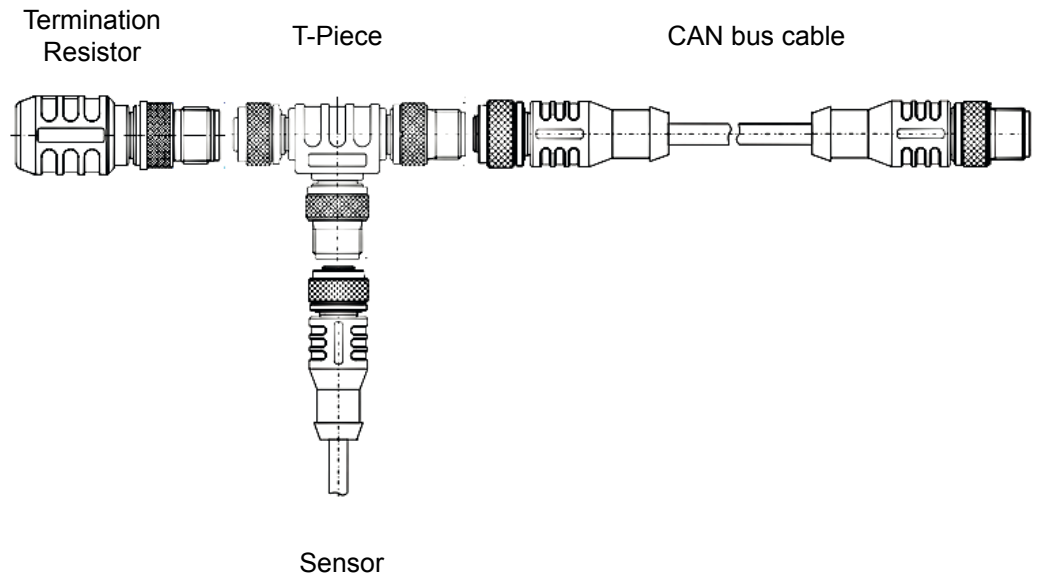
Signal wiring / connection	Signal	Plug connection	Cable connection
	Shield	1	braid
	Excitation +	2	brown
	GND	3	white
	CAN-H	4	blue
	CAN-L	5	black

View to sensor connector



CAN bus wiring

Connect the device by a T-connector to the CAN trunk line. Total length of stubs should be minimized. Do not use single stub lines longer than 0.5 m. Connect terminating resistors 120 Ohm at both ends of the trunk line.




POSITILT® - PTDM

CAN SAE J1939 Output Specification



Description

Inclination sensor according to standard SAE J1939. Configuration of operating parameters by proprietary-A-Message (peer-to-peer connection). Process data exchange by proprietary-B-Message (broadcast).

Interface J1939 	CAN specification	ISO 11898, Basic and Full CAN 2.0 B
	Transceiver	24V-compliant, not isolated
	Communication profile	SAE J1939
	Bit rate	250 kBit/s
	Internal termination resistor	PTDM27 only, configurable
	Address	Default 247d, configurable

NAME Fields	Arbitrary address capable	1	Yes
	Industry group	0	Global
	Vehicle system	7Fh (127d)	Non specific
	Vehicle system instance	0	
	Function	FFh (255d)	Non specific
	Function instance	0	
	ECU instance	0	
	Manufacturer	145h (325d)	Manufacturer ID
	Identity number	0nnn	Serial number 21 bit

Parameter Group Numbers (PGN)	Configuration data	PGN EFddh	Proprietary-A (PDU1 peer-to-peer) dd Sensor Node ID
	Process data	PGN FFnnh	Proprietary-B (PDU2 broadcast); nn Group Extension (PS) configurable

Specifications	Excitation voltage	8 ... 36 V DC
	Excitation current	15 mA typical at 24 V DC, 30 mA typical at 12 V DC, 100 mA max.
	Measuring rate	1 kHz standard
	Stability (temperature)	$\pm 100 \times 10^{-6} / ^\circ\text{C}$ f.s.
	Repeatability	1 LSB
	Operating temperature	-40 ... +85 °C
	Protection	Reverse polarity, short circuit
	EMC	EN 61326-1:2013

**Setup
 procedure**



WARNING



NOTICE

Warning notice

- Changing the parameters can cause a sudden step of the instantaneous value and can result in unexpected machine (re)actions!
- Precautions to prevent danger for man or machine are necessary!
- Execute parametrizing at standstill of the machine only!

Node-ID

The default Node-ID the sensor will claim on power up is user or factory configurable. The user can configure by "Commanded Address" service according to the J1939 standard or by Peer-to-Peer message as described below.

User configuration

User accessible parameters including node-ID may be configured by peer-to-peer proprietary A message PGN 0EF00h. The parameters are accessed by byte-index and read/write operations coded in the data frame. The slave will return the data frame including the acknowledge code. Parameter values will be effective immediately. On execution of "Store Parameters" the configuration is saved nonvolatile.

Peer-to-peer message (PGN 0x00EF00), send/receive format

PGN		8 Byte data frame							
PGN _{HIGH}	PGN _{LOW} (Node-ID)	Index	Rd/Wr	0	Ack	4-Byte Data			

Request: Control Unit → Sensor

→	0EFh	dd	i	0/1	0	0	LSB	MSB
---	------	----	---	-----	---	---	-----	----	----	-----

Response: Control Unit ← Sensor

←	0EFh	cc	i	0/1	0	a	LSB	MSB
---	------	----	---	-----	---	---	-----	----	----	-----

- a: Acknowledge codes:
 0: Acknowledge, 81: Read only parameter, 82: Range overflow,
 83: Range underflow, 84: Parameter does not exist
- dd: Sensor Node-ID (Default 0F7h, 247d)
- cc: Control-Unit Node-ID

Configuration examples

Example: Set Transmit Cycle to 10ms, Index 31, Node-ID 247d (F7h)

	PGN _{HIGH}	PGN _{LOW}	8 Byte data frame							
→	0EFh	F7h	1Fh	01h	00	00	0Ah	00	00	00
←	0EFh	cc	1Fh	01h	00	00	0Ah	00	00	00

Example: Read Transmit Cycle value, Index 31

→	0EFh	F7h	1Fh	00	00	00	00	00	00	00
←	0EFh	cc	1Fh	00	00	00	0Ah	00	00	00

Example: Store Parameters permanently, Index 28

→	0EFh	F7h	1Ch	01h	00	00	65h	76h	61h	73h
←	0EFh	cc	1Ch	01h	00	00	65h	76h	61h	73h

Example: Reload factory defaults, Index 29

→	0EFh	F7h	1Dh	01h	00	00	64h	61h	6Fh	6Ch
←	0EFh	cc	1Dh	01h	00	00	64h	61h	6Fh	6Ch

Configurable parameters

Parameter	Index [dec]	Default	Range / Selection	Unit	Read / Write
Control					
Node ID	20	247	128 ... 247		rd/wr ¹⁾
Bit rate	21	3 (250kB)	-		rd/wr ¹⁾
Termination resistor	22	0	0 (OFF) 1 (ON) PTDM27 only		rd/wr ¹⁾
Store parameters	28	-	"save" ²⁾		wr
Reload factory defaults	29	-	"load" ²⁾		wr
Communication					
Transmit mode	30	0	0 timer 1 request 2 event		rd/wr
Transmit cycle	31	100	10..65535	ms	rd/wr
PGN Group Extension	32	0	0..255		rd/wr
Event mode hysteresis	38	0	0..16383	steps	rd/wr
Process data byte order	39	0	0 little / 1 big endian		rd/wr
Measurement					
1 axis ±180° 2 axes ±60°	69	1	0: 1 axis 80h: 2 axis		rd/wr
Code sequence_X	70	0	0 CW 1 CCW		rd/wr
Code sequence_Y	71	0	0 CW 1 CCW		rd/wr
Resolution (in 0.001°)	73	100	10 ... 10000	deg	rd/wr
Preset 1 axis X/Y	74	0	±0,1..	deg	rd/wr
Preset 2 axes X	75	0	±0,1..	deg	rd/wr
Preset 2 axes Y	76	0	±0,1..	deg	rd/wr
Averaging Filter (N _{Filter}) Response Time (90%): T _R = N _{Filter} * 5 ms	77	1	1...255 ³⁾		rd/wr
Identification					
SW Version	198	-	4 bytes	number	rd
Serial number	199	-	4 bytes	number	rd
Identity number	200	-	21 bit	number	rd

1) Effective on next power-up

2) „save“ MSB...LSB: 73h, 61h, 76h, 65h

„load“ MSB...LSB: 6Ch, 6Fh, 61h, 64h

3) average on number of samples

Depending on configuration ordered default settings may be different, refer to ASM homepage.

Process data

Process data are transmitted by broadcast proprietary-B-Message PGN 0x00FFxx where the low byte is configurable.

Data field of process data

B7	B6	B5	B4	B3	B2	B1	B0
Error				Inclination Y		Inclination X	
Byte ¹⁾				MSB	LSB	MSB	LSB

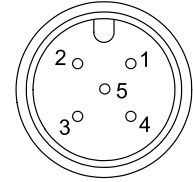
¹⁾ Error codes: 0 = no error, 1 = error, internal error

POSITILT® CAN SAE J1939 Output Specification



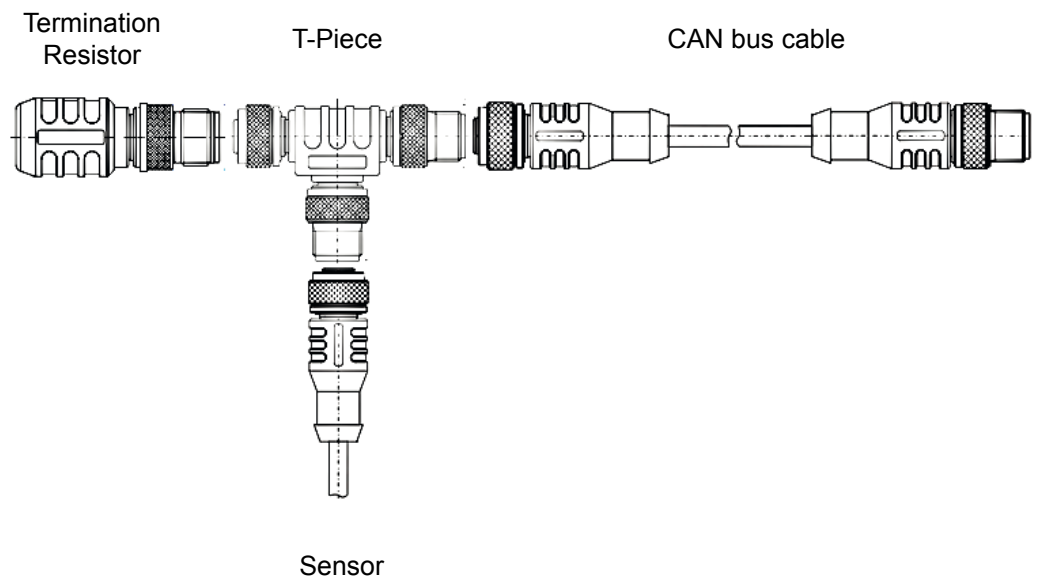
Signal wiring / connection	Signal	Plug connection
	Shield	1
	Excitation +	2
	GND	3
	CAN-H	4
	CAN-L	5

View to sensor connector



CAN bus wiring

Connect the device by a T-connector to the CAN trunk line. Total length of stubs should be minimized. Connect terminating resistors 120 Ohm at both ends of the trunk line.



Connector cable
M12, 4 pin
Suitable for 5-pin
sensor connectors
shielded*

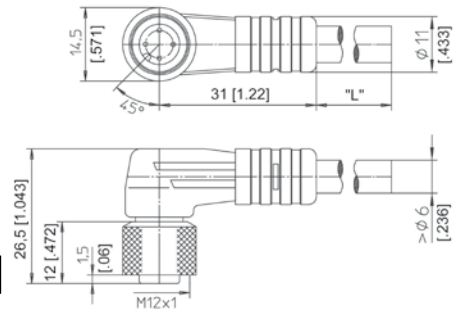
The 4-lead shielded cable is supplied with a mating 4-pin 90° M12 connector at one end and 4 wires at the other end. Available lengths are 2 m, 5 m and 10 m. Wire: cross sectional area 0.34 mm².

Order code:

KAB - XM - M12/4F/W - LITZE

IP69K: **KAB - XM - M12/4F/W/69K - LITZE**

Length in m



Connector cable
M12, 4 pin
Suitable for 5-pin
sensor connectors
shielded*

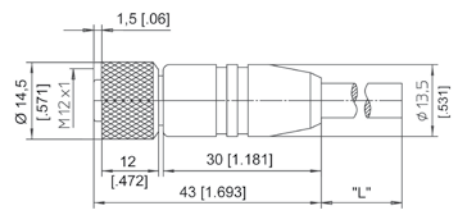
The 4-lead shielded cable is supplied with a mating 4-pin M12 connector at one end and 4 wires at the other end. Available lengths are 2 m, 5 m and 10 m. Wire: cross sectional area 0.34 mm².

Order code:

KAB - XM - M12/4F/G - LITZE

IP69K: **KAB - XM - M12/4F/G/69K - LITZE**

Length in m



Signal wiring M12, 4 pin	Connector pin / cable color			
	1	2	3	4
brown	white	blue	black	

* = Shielded connector

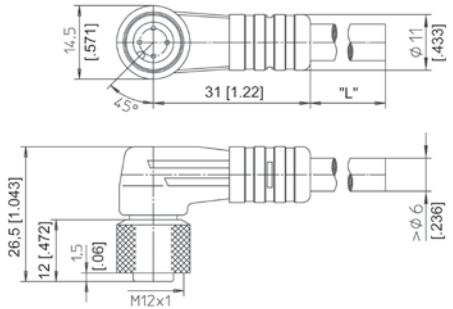
Connector cable
M12, 5 pin
shielded*

The 5-lead shielded cable is supplied with a mating 5-pin 90° M12 connector at one end and 5 wires at the other end. Available lengths are 2 m, 5 m and 10 m. Wire: cross sectional area 0.34 mm².
Order code:

KAB - XM - M12/5F/W - LITZE

IP69K: **KAB - XM - M12/5F/W/69K - LITZE**

Length in m



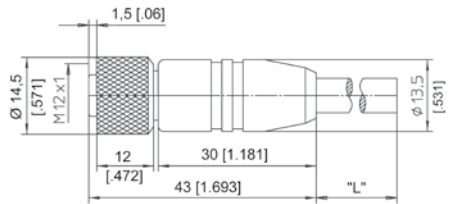
Connector cable
M12, 5 pin
shielded*

The 5-lead shielded cable is supplied with a mating 5-pin M12 connector at one end and 5 wires at the other end. Available lengths are 2 m, 5 m and 10 m. Wire: cross sectional area 0.34 mm².
Order code:

KAB - XM - M12/5F/G - LITZE

IP69K: **KAB - XM - M12/5F/G/69K - LITZE**

Length in m

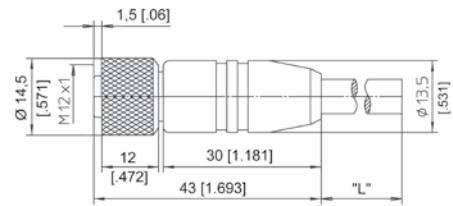


Signal wiring M12, 5 pin	Connector pin / cable color				
	1	2	3	4	5
	brown	white	blue	black	grey

* = Shielded connector

Connector/bus cable
M12, 5 pin
CAN bus
shielded*

The 5-lead shielded cable is supplied with a female 5-pin M12 connector at one end and a male 5-pin M12 connector at the other end. Available lengths are 0.3, 2, 5 and 10 m.



Order code:

KAB - XM - M12/5F/G - M12/5M/G - CAN

IP69K: **KAB - XM - M12/5F/G/69K - M12/5M/G/69K - CAN**

Length in m

T-piece for bus cable
M12, 5 pin
CAN bus

Order code:

KAB - TCONN - M12/5M - 2M12/5F - CAN



Terminating resistance
5 pin M12
CAN bus

Order code:

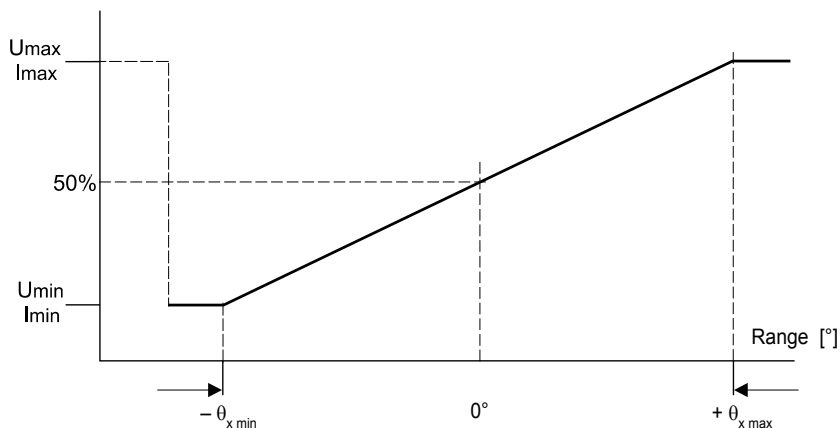
KAB - RTERM - M12/5M/G - CAN



* = Shielded connector

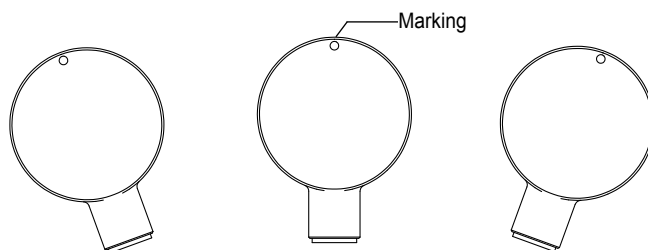
Output signal

Option: Teach-in of home (center) position by PMZ function



PTAM2/PTDM2

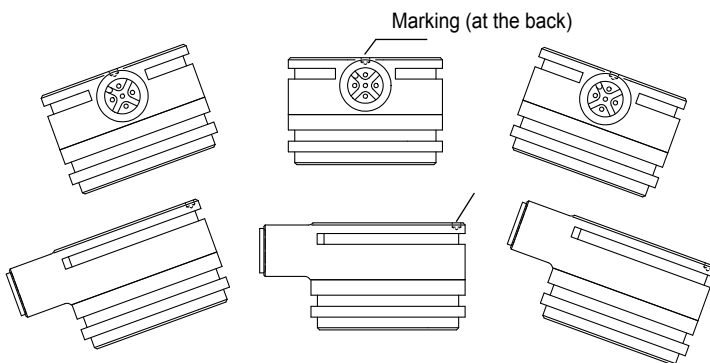
Radial, 1 axis



PTAM2/PTDM2

Radial, 2 axes

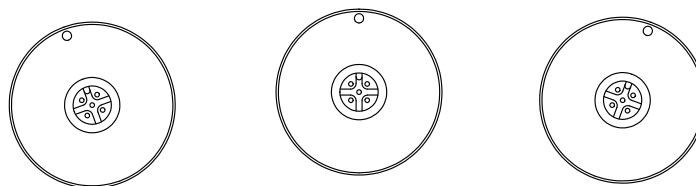
X



Y

PTAM2/PTDM2

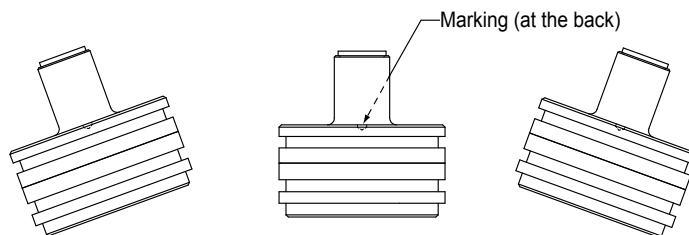
Axial, 1 axis



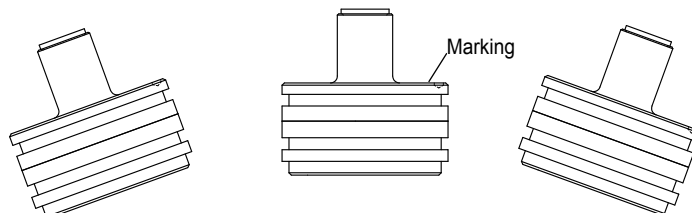
PTAM2/PTDM2

Axial, 2 axes

X

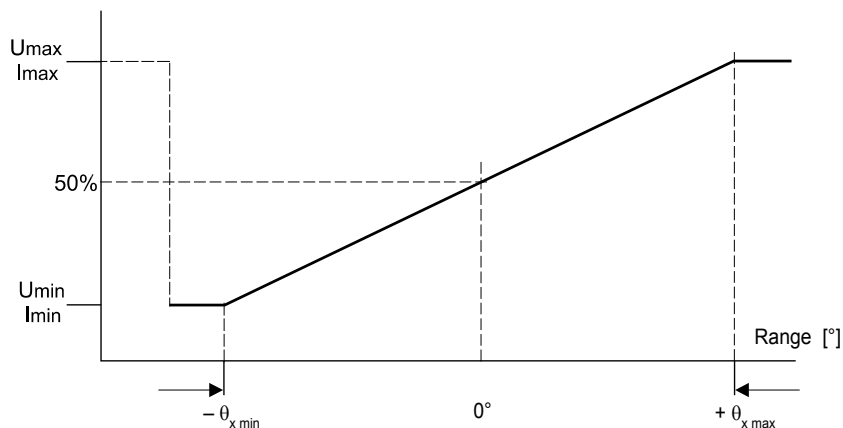


Y



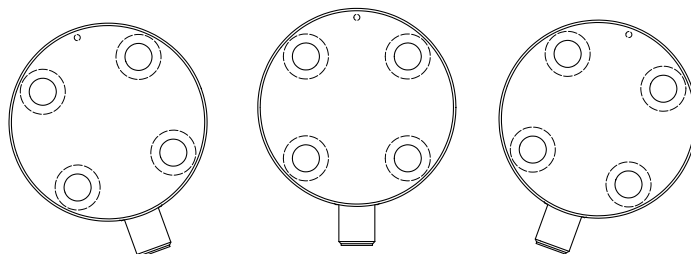
Output signal

Option: Teach-in
of home (center)
position by PMZ
function



PTAM5/PTDM5

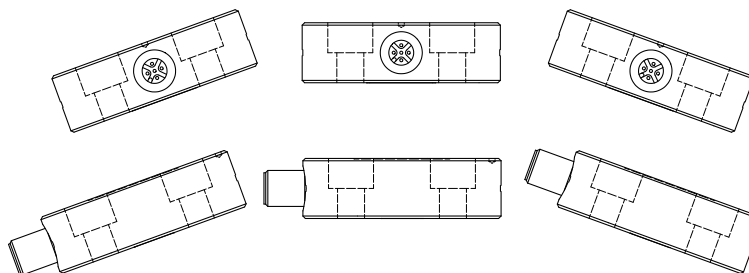
1 axis



PTAM5/PTDM5

2 axes

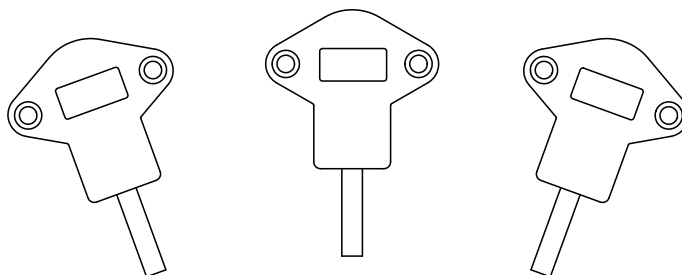
X



Y

PTAM27/PTDM27

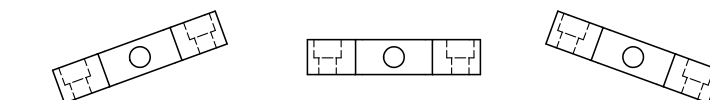
1 axis



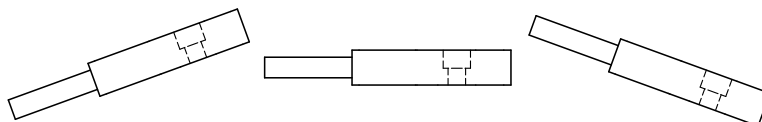
PTAM27/PTDM27

2 axes

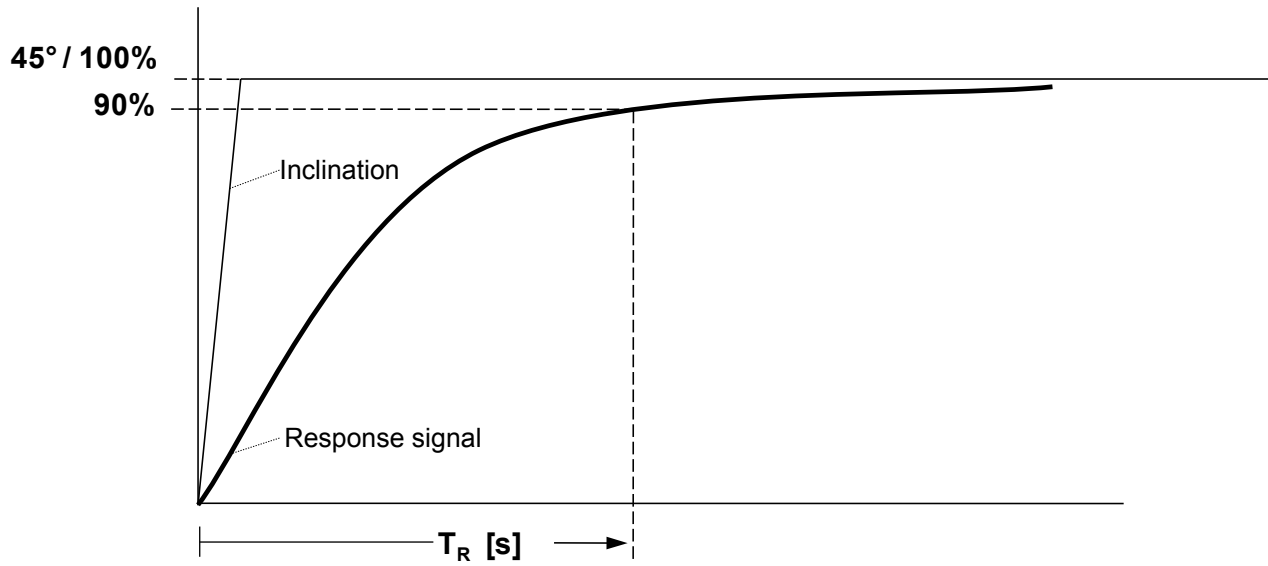
X



Y



Response time



Service

Sensors and accessories have to be repaired and adjusted at ASM in Moosinning.

In order to avoid risk of injury and improper handling the customer is not allowed to repair the sensor. No warranty or liability will be granted for opened sensors.

Damaged sensors must be shut down immediately and sent to the factory for repair.

Calibration

The recommended calibration interval is 1 year.

Test protocol is available on request.

Disposal

Disposal according to applicable government regulations.

Reliability characteristics

Models PTAM2/PTDM2, PTAM5/PTDM5, PTAM27/PTDM27

Outputs

U2	Voltage output 0.5 ... 10 V
U6	Voltage output 0.5 ... 4.5 V
U8	Voltage output 0.5 ... 4.5 V
I1	Current output 4 ... 20 mA
CANOPEN	CANopen Interface
CANJ1939	CAN SAE J1939 Interface

Characteristics	Probability of failure	1 x 10 ⁻⁶ /h
	Life period MTTF	110 years
	Working life	10 years

Standards SN29500 Failure rate electronic components (Siemens)

EU Declaration of Conformity



We **ASM**
Automation Sensorik
Messtechnik GmbH
Am Bleichbach 18 - 24
85452 Moosinning / Germany

declare under our sole responsibility that the product

Name: **POSITILT® Inclination Sensor**

Type: **PTAM2/PTDM2, PTAM5/PTDM5, PTAM27/PTDM27**

to which this declaration relates is in conformity with the following standards or other normative documents:

Directives: 2014/30/EU (EMC)

Standards: EN 61326-1:2013 (EMC)

Moosinning, 22nd February 2016

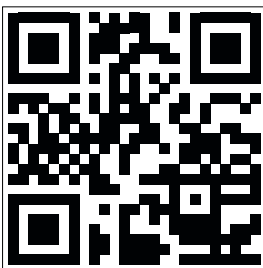


p.p. Peter Wirth
Head of Development



perfect in sensors.

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