POSIHALL®

Magnetic Multiturm
Angle Sensors
Installation and operation manual

Please read carefully before operation!

Contents

Safety instructions

If total failure or malfunction of the sensor can cause danger or injury to the operator or damage to the machinery or equipment it is recommended that additional safety measures should be incorporated into the system.

Any alteration, reconstruction or extension of the sensor is not allowed.

Sensor must be operated only within values specified in the 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.

POSIHALL®
Safety instructions

Safety instructions

Do not open the sensor!

The maximum operating voltage may not exceed the limits specified in the respective data sheet!
- Danger of injury! Danger of damage to or destruction of the sensor!

Avoid shock and vibration to the sensor!
- Danger of damage to or destruction of the sensor!

Intended use

The intended use is when the sensor is used in the properly rated 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 improperly 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:

⚠	Integrity of housing, connector, cable	Mounting elements	Visual check of shaft sealing
PH36	X	X	
PH58	X	X	X
PH68 / PH68R	X	X	
Measures	Damaged parts: Put sensor out of service and replace damaged parts resp. send sensor to ASM for repair	Loose mounting parts: Screw tight mounting parts with recommended torque, if applicable use bolt adhesive	Damaged shaft sealing: Put sensor out of service and send it to ASM for repair

Deinstallation

Disconnect electrical connections. Loosen fixing screws.

Disposal

Disposal according to applicable government regulations.

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www.asm-sensor.com / USA: www.asmsensors.com

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Delivery / shipment	Shipment damages	Check sensor immediately for shipping damage.

In case of any damage or equipment not operating appropriately, please contact supplier or ASM GmbH Moosinning. To avoid shipment damages, use original packing for further shipment.

Return consignment

Return consignment for calibration or repair: only with the RMA number (Return Material Authorization). Please contact ASM and request the RMA number:

ASM Automation Sensorik Messtechnik GmbH
Service&Repair

Am Bleichbach 18-24
85452 Moosinning
Germany

Tel. +49 8123 986-0
Fax +49 8123 986-500

service@asm-sensor.de
www.asm-sensor.com

Description

The purpose of position sensors is to transform position of a linear and guided movement into an electrical signal. Specifications of measuring range, environment, handling and connections as specified in the catalog, must be followed.

The catalog is part of this instruction manual. If the catalog is not available it may be requested by stating the respective model number.

Installation

For non-contact sensor models air gap and alignment of sensor and position magnet has to be observed. The linearity will degrade in case of misalignment.

Adjacent magnetic fields or ferromagnetic materials can influence the measurement results of the PH sensors of the POSIHALL® product family. Therefore the angle sensors should be mounted solely with nonmagnetic / non magnetisable screws and washers.

The POSIHALL® multiturn angle sensors PH36, PH58 and PH68, PH68R are equipped with an integrated magnetic shield which minimizes the sensitivity against external magnetic fields
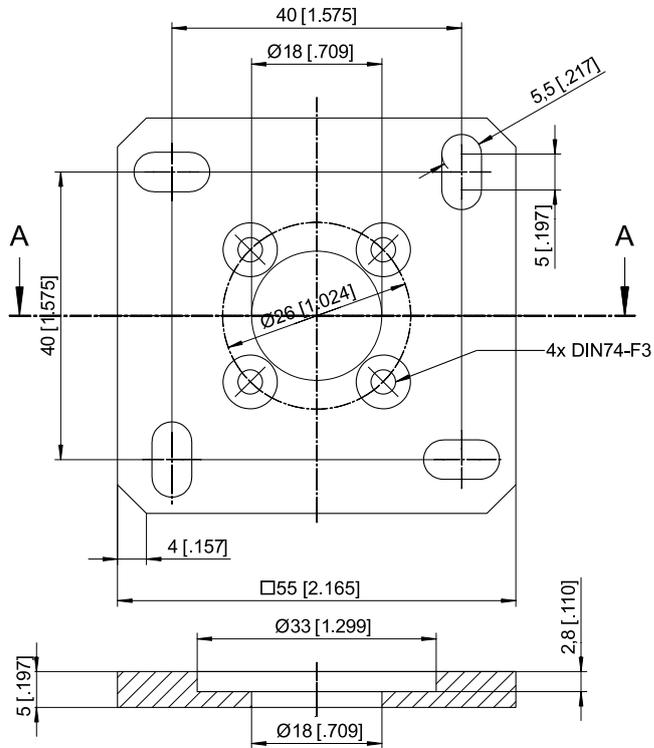
The POSIHALL® multiturn angle sensors can be mounted with clamping flange or synchro flange depending on model, and therefore offer universal mounting possibilities.

WARNING

PH36	Synchro flange for the installation with mounting clamps or mounting brackets and M3 thread at the front
PH58	Clamping flange and M3 / M4 thread at the front Synchro flange and M4 thread at the front
PH68/PH68R	Synchro flange and M4 thread at the front

Mounting plates (only for PH36)

Mounting plate
PRPT-BPL1
(screw mounting)

40 [1.575]
Ø33 [1.299]
Ø5.5 [.217]
5 [.197]
90°
40 [1.575]
110°
Ø48 [1.890]
Ø42 [1.654]
4 [.157]
3x M2,5
3x M4
□55 [2.165]
4 [.157]

In combination with the mounting clamps PRPT-BFS1 (3 x M2.5) or
in combination with the mounting bracket PRPT-BFS2 (3 x M4).
Weight approx. 30 g.

Mounting plate
PRPT-BPL2
(welding assembly)

Ø33 [1.299]
90°
110°
Ø48 [1.890]
Ø42 [1.654]
4 [.157]
3x M2,5
3x M4
□55 [2.165]
4 [.157]

In combination with the mounting clamps PRPT-BFS1 (3 x M2.5) or
in combination with the mounting bracket PRPT-BFS2 (3 x M4).
Weight approx. 30 g

Dimensions in mm [inch]

Dimensions informative only.
For guaranteed dimensions consult factory.

## Mounting plate (**only for PH36)**

Mounting plate PRPT-BPL3
(frontal mounting)

Weight approx. 30 g

40 [1.575]
Ø18 [.709]
5.5 [.217]
5 [.197]
A
40 [1.575]
A
Ø26 [1.024]
4x DIN74-F3
4 [.157]
□55 [2.165]
2,8 [.110]
Ø33 [1.299]
5 [.197]
Ø18 [.709]

Dimensions in mm [inch]

Dimensions informative only.
For guaranteed dimensions consult factory.

Mounting possibilities PH36

PRPT-BPL2
+
PRPT-BFS2

PRPT-BPL1
+
PRPT-BFS2

PRPT-BPL2
+
PRPT-BFS1

PRPT-BPL1
+
PRPT-BFS1
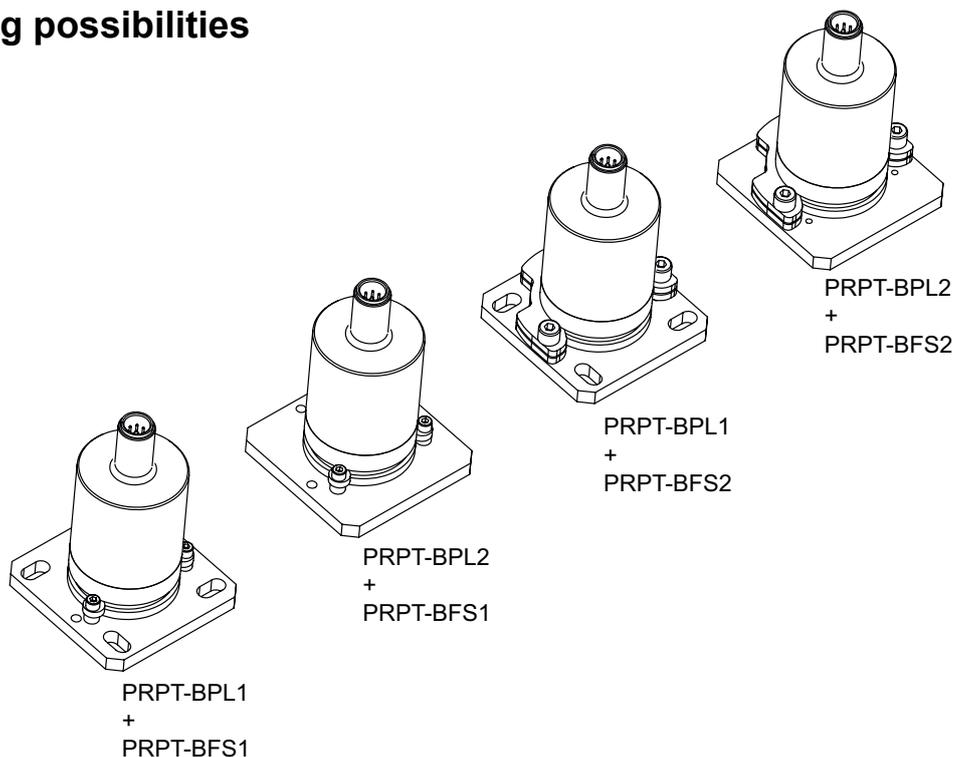
Mounting clamp/bracket
for PH36
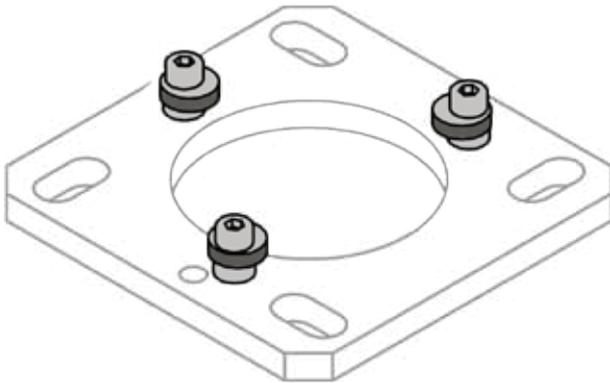
Mounting clamp BFS1
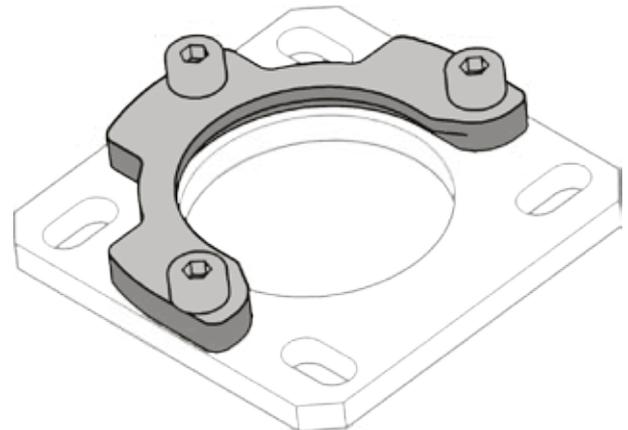
Mounting bracket BFS2

Mechanical information	• Prevent the sensor shaft from binding.
	• Use flexible coupling or torque arms to avoid misalignment errors.
	• Observe the specified torques for fixing screws (see table p. 10)
	• Avoid impact or shocks on the shaft and the shaft coupling!

Mounting

Output	Value range	50% value of output signal
U2	0.5 ... 10 V	5.25 V
U6	0.5 ... 4.5 V	2.5 V
U8	0.5 ... 4.5 V	2.5 V
I1	4 ... 20 mA	12 mA

Torque for fixing screws
- The specified torques and mounting methods are general recommendations.
- The specified torques can differ according to application and operating conditions.
- The user is responsible for the appropriate torque, since ASM does not know the operational conditions of the application.

Torque

Mounting methos	Material	Torque [Nm]
M2.5 screws for mounting brackets	Aluminium	0.8
M3 screws for mounting flange	Aluminium	1.0
Screws M4	Aluminium	1.8

Electrical installation

NOTICE

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!

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.

Do not strain the connection cable.
A separate cord grip is recommended.

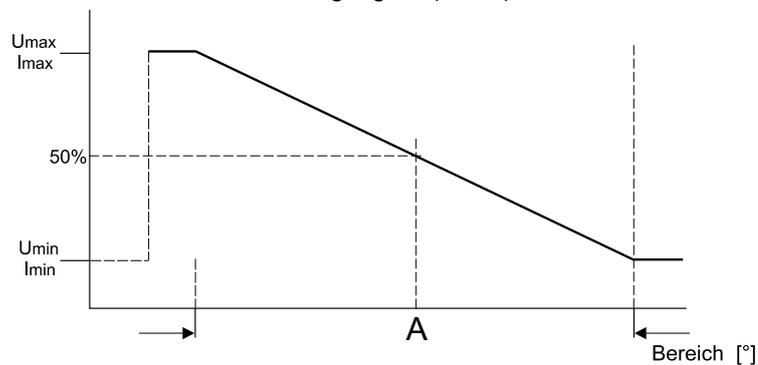**Supply voltage, current consumption**

For wiring of connector or cable outlet as well as supply voltage and current consumption see from page 13.

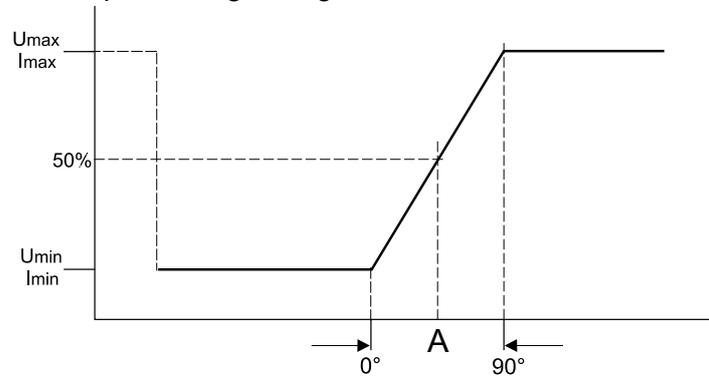Cable screen has to be connected to protective earth.

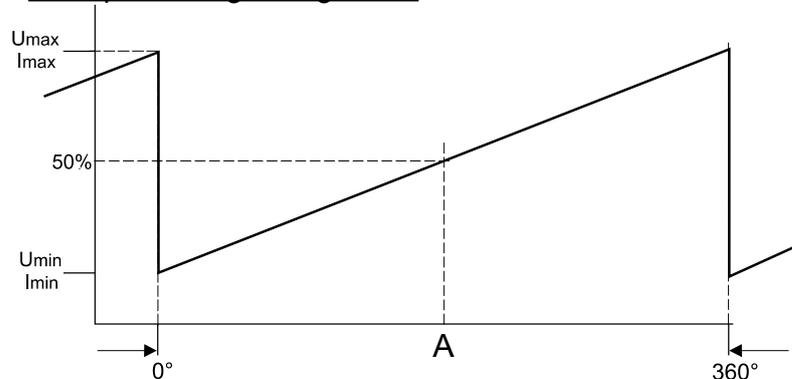Clockwise increasing signal (CW), view to sensor measuring area/shaft

Umax
Imax

50%

Umin
Imin

A

Bereich [°]
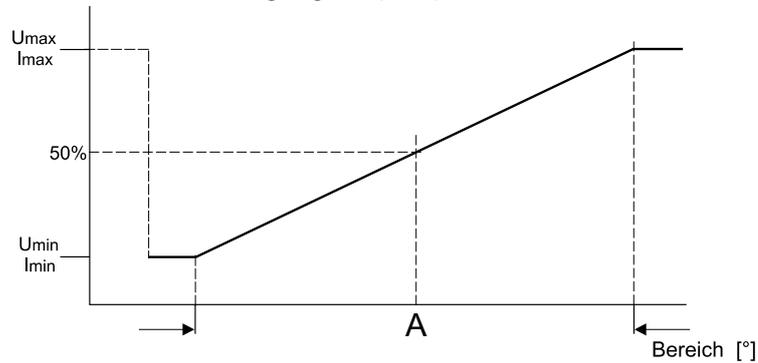
Counterclockwise increasing signal (CCW), view to sensor measuring area/shaft

Umax
Imax

50%

Umin
Imin

A

Bereich [°]

Example for angle range 90°

Umax
Imax

50%

Umin
Imin

0°

A

90°

Example for angle range 360°

Umax
Imax

50%

Umin
Imin

0°

A

360°

A = angle position at delivery

Calibration (ISO9001)

The recommended calibration interval is 1 year.

Test protocol and traceable calibration certificate (ISO9001) is available on request.

Electromagnetic Compatibility (EMC)

The electromagnetic compatibility depends on wiring practice. Recommended wiring:

- Use shielded twisted pair sensor cable.
- Ground shield single ended at switch cabinet. Connect shield directly before or at cable inlet of switch cabinet by low impedance ground cable bond. On delivery of preassembled sensor cables the shield is not connected to the sensor housing.
- Keep sensor signal well separated from power wiring e.g. AC wiring, motor or relay. Use separate conduit or ducts for each.

If application includes highly electromagnetic interference emitting equipment like switch converter drives additional measures are recommended:

- Use a twisted pair cable, shielded per pair and common.
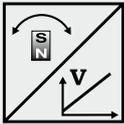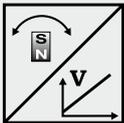- Use shielded conduits or ducts connected to ground potential.

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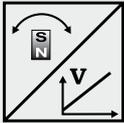
Sensors and accessories have to be repaired and adjusted at ASM in Moosinning.

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

WARNING

POSIHALL®
Analog output

U2 Voltage output 0.5 ... 10 V	Excitation voltage	8 ... 36 V DC
	Excitation current	typical 20 mA at 24 V DC typical 38 mA at 12 V DC max. 50 mA
	Output voltage	0,5 ... 10 V DC
	Output current	2 mA max.
	Measuring rate	1 kHz standard
	Stability (temperature)	$\pm 50 \times 10^{-6}/°C$ f.s. (typical)
	Protection	Reverse polarity, short circuit
	Operating temperature	-40 ... +85 °C
	EMC	DIN EN 61326-1:2013

U6 Voltage output 0,5 ... 4,5 V	Excitation voltage	5 V DC ± 5%
	Excitation current	typical 140 mA
	Output voltage	0,5 ... 4,5 V DC
	Output current	2 mA max.
	Measuring rate	1 kHz standard
	Stability (temperature)	$\pm 50 \times 10^{-6}/°C$ f.s. (typical)
	Protection	Reverse polarity, short circuit
	Operating temperature	-40 ... +85 °C
	EMC	DIN EN 61326-1:2013

U8 Voltage output 0.5 ... 4,5 V	Excitation voltage	8 ... 36 V DC
	Excitation current	typical 17 mA at 24 V DC typical 32 mA at 12 V DC max. 50 mA
	Output voltage	0,5 ... 4,5 V DC
	Output current	2 mA max.
	Measuring rate	1 kHz standard
	Stability (temperature)	$\pm 50 \times 10^{-6}/°C$ f.s. (typical)
	Protection	Reverse polarity, short circuit
	Operating temperature	-40 ... +85 °C
	EMC	DIN EN 61326-1:2013

I1 Current output 4 ... 20 mA, 3 wire	Excitation voltage	8 ... 36 V DC
	Excitation current	typical 36 mA at 24 V DC typical 70 mA at 12 V DC max. 120 mA
	Load R_L	500 Ω max.
	Output current	4 ... 20 mA
	Measuring rate	1 kHz standard
	Stability (temperature)	$\pm 50 \times 10^{-6}/°C$ f.s. (typical)
	Protection	Reverse polarity, short circuit
	Operating temperature	-40 ... +85 °C
	EMC	DIN EN 61326-1:2013

POSIHALL®
Analog output

Output signals

U2
U6
U8
I1

Excitation +

Signal +

GND
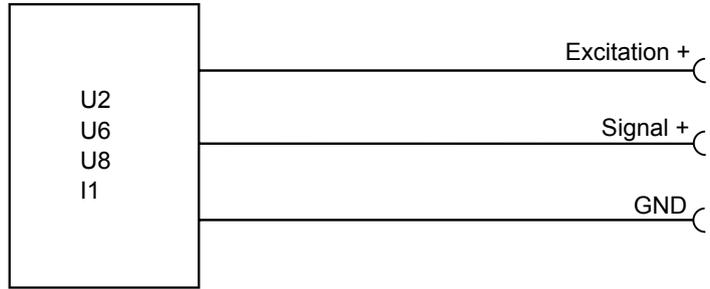
Signal Wiring	Signal	Plug connection	Cable connection
	Excitation +	1	brown
	Signal	2	white
	GND	3	blue
	Do not connect!	4	black
	Do not connect!	5	grey

Connection

View to sensor
connector

A-Coding

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Analog output, programmable

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U2PMU, U2/PMZ Voltage output 0.5 ... 10 V	Excitation voltage	8 ... 36 V DC
	Excitation current	typical 20 mA at 24 V DC typical 38 mA at 12 V DC max. 50 mA
	Output voltage	0,5 ... 10 V DC
	Output current	2 mA max.
	Measuring rate	1 kHz standard
	Stability (temperature)	$\pm 50 \times 10^{-6}/°C$ f.s. (typical)
	Protection	Reverse polarity, short circuit
	Operating temperature	-40 ... +85 °C
	EMC	DIN EN 61326-1:2013

U6PMU, U6/PMZ Voltage output 0,5 ... 4,5 V	Excitation voltage	5 V DC ± 5%
	Excitation current	typical 140 mA
	Output voltage	0,5 ... 4,5 V DC
	Output current	2 mA max.
	Measuring rate	1 kHz standard
	Stability (temperature)	$\pm 50 \times 10^{-6}/°C$ f.s. (typical)
	Protection	Reverse polarity, short circuit
	Operating temperature	-40 ... +85 °C
	EMC	DIN EN 61326-1:2013

U8PMU, U8/PMZ Voltage output 0.5 ... 4,5 V	Excitation voltage	8 ... 36 V DC
	Excitation current	typical 17 mA at 24 V DC typical 32 mA at 12 V DC max. 50 mA
	Output voltage	0,5 ... 4,5 V DC
	Output current	2 mA max.
	Measuring rate	1 kHz standard
	Stability (temperature)	$\pm 50 \times 10^{-6}/°C$ f.s. (typical)
	Protection	Reverse polarity, short circuit
	Operating temperature	-40 ... +85 °C
	EMC	DIN EN 61326-1:2013

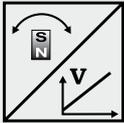| I1PMU, I1/PMZ Current output 4 ... 20 mA, 3 wire	Excitation voltage	8 ... 36 V DC
	Excitation current	typical 36 mA at 24 V DC typical 70 mA at 12 V DC max. 120 mA
	Load R_L	500 Ω max.
	Output current	4 ... 20 mA
	Measuring rate	1 kHz standard
	Stability (temperature)	$\pm 50 \times 10^{-6}/°C$ f.s. (typical)
	Protection	Reverse polarity, short circuit
	Operating temperature	-40 ... +85 °C
	EMC	DIN EN 61326-1:2013

POSIHALL®
Analog output, programmable

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Output signals

```
┌─────────────────┐
│                 │──────────────────── Excitation +  ⌒
│ U2/PMU/PMZ      │
│ U6/PMU/PMZ      │──────────────────── Signal +  ⌒
│ U8/PMU/PMZ      │
│ I1/PMU/PMZ      │──────────────────── GND  ⌒
│                 │
└─────────────────┘
```

Signal wiring	Signal	Connector pin no.	Cable color	View to sensor connector
	Excitation +	1	brown	
	Signal	2	white	
	GND	3	blue	
	Do not connect!	4	black	
	SPAN/ZERO	5	grey	
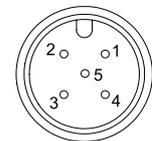
A-Coding

Option -PMU
Programming of the start and end value by the customer
Teach-In of start and end value for the options U2/PMU, I1/PMU, U8/PMU is provided by a binary signal SPAN/ZERO. At the start position connect signal SPAN/ZERO for a period of 2 … 3 seconds to GND via push button. At the end position connect signal SPAN/ZERO for a period of 5 … 6 seconds to GND via a push button. The teached positions will be stored non-volatile.
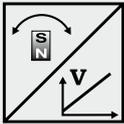To reset the sensor to factory default signal ZERO/END must be connected to ground while powering up the sensor for   2 … 3 seconds.
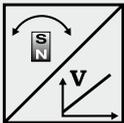
Option -PMZ
Programming of the start value by the customer
Programming of the start value of the output range for the outputs U2/U8 and I1 is provided by a programming signal ZERO available at the connector. This Signal ZERO must be connected with GND via a push button, and then the position magnet of the sensor must be moved to the start resp. the end position. Pushing the button between 1 and 4 seconds sets the actual position as start position, pushing the button more than 5 seconds sets the actual position as end position. The values will be stored and are available after switching off the sensor.
To reset the sensor to the factory values the button must be pushed when the sensor is switched on.

U2R Voltage output 0.5 ... 10 V	Excitation voltage	8 ... 36 V DC
	Excitation current	typical 20 mA at 24 V DC typical 38 mA at 12 V DC max. 50 mA per channel
	Output voltage	0,5 ... 10 V DC
	Output current	2 mA max.
	Measuring rate	1 kHz standard
	Stability (temperature)	±50 x 10^{-6}/°C f.s. (typical)
	Protection	Reverse polarity, short circuit
	Operating temperature	-40 ... +85 °C
	EMC	DIN EN 61326-1:2013

U6R Voltage output 0,5 ... 4,5 V	Excitation voltage	5 V DC ± 5%
	Excitation current	typical 140 mA per channel
	Output voltage	0,5 ... 4,5 V DC
	Output current	2 mA max.
	Measuring rate	1 kHz standard
	Stability (temperature)	±50 x 10^{-6}/°C f.s. (typical)
	Protection	Reverse polarity, short circuit
	Operating temperature	-40 ... +85 °C
	EMC	DIN EN 61326-1:2013

U8R Voltage output 0.5 ... 4,5 V	Excitation voltage	8 ... 36 V DC
	Excitation current	typical 17 mA at 24 V DC typical 32 mA at 12 V DC max. 50 mA per channel
	Output voltage	0,5 ... 4,5 V DC
	Output current	2 mA max.
	Measuring rate	1 kHz standard
	Stability (temperature)	±50 x 10^{-6}/°C f.s. (typical)
	Protection	Reverse polarity, short circuit
	Operating temperature	-40 ... +85 °C
	EMC	DIN EN 61326-1:2013

I1R Current output 4 ... 20 mA, 3 wire	Excitation voltage	8 ... 36 V DC
	Excitation current	typical 36 mA at 24 V DC typical 70 mA at 12 V DC max. 120 mA per channel
	Load R_L	500 Ω max.
	Output current	4 ... 20 mA
	Measuring rate	1 kHz standard
	Stability (temperature)	±50 x 10^{-6}/°C f.s. (typical)
	Protection	Reverse polarity, short circuit
	Operating temperature	-40 ... +85 °C
	EMC	DIN EN 61326-1:2013

POSIHALL®
Analog output, redundant

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Output signals

U2R U6R U8R I1R	Excitation +
	Signal +
	GND
	Do not connect
	Excitation +
	Signal +
	GND
	Do not connect
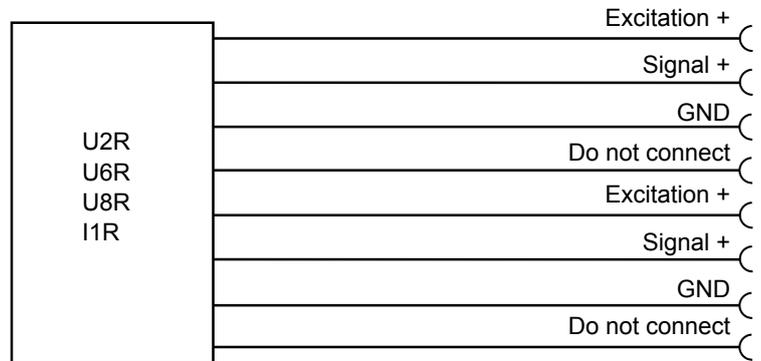
Signal wiring, redundant version with 2 channels and 1 connector	**Channel**	**Signal**	**Connector M12, 8 pins**	**Cable connection**
	1	Excitation +	1	white
	1	Signal	2	brown
	1	GND	3	green
	1	Do not connect!	4	yellow
	2	Excitation +	5	grey
	2	Signal	6	pink
	2	GND	7	blue
	2	Do not connect!	8	red

View to sensor connector

A-Coding

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POSIHALL®
Digital output MSSI

ASM®
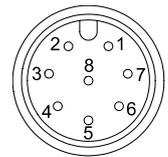
MSSI	Interface	EIA RS-422
Synchronous serial SSI	Excitation voltage	8 ... 36 V DC
	Excitation current	typ. 19 mA at 24 V DC typ. 35 mA at 12 V DC max. 80 mA
	Clock frequency	100 kHz ... 500 kHz
	Code	Gray-Code, continuous progression
	Delay between pulse trains	20 µs min.
	Stability (temperature)	±50 x 10^{-6} / °C f.s. typical
	Operating temperature	-40 ... +85 °C
	Protection	Short circuit
	EMC	DIN EN 61326-1:2013

*) WB10, WB100M: -20 ... +85 °C

Data format
(train of 26 pulses)

CLOCK +   1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25

≥0,5 µs   T   T = 1 to 10 µs   25 x T   12...30 µs

DATA +

b23 b22 b21 b20 b19 b18 b17 b16 b15 b14 b13 b12 b11 b10 b09 b08 b07 b06 b05 b04 b03 b02 b01 b00   "0"
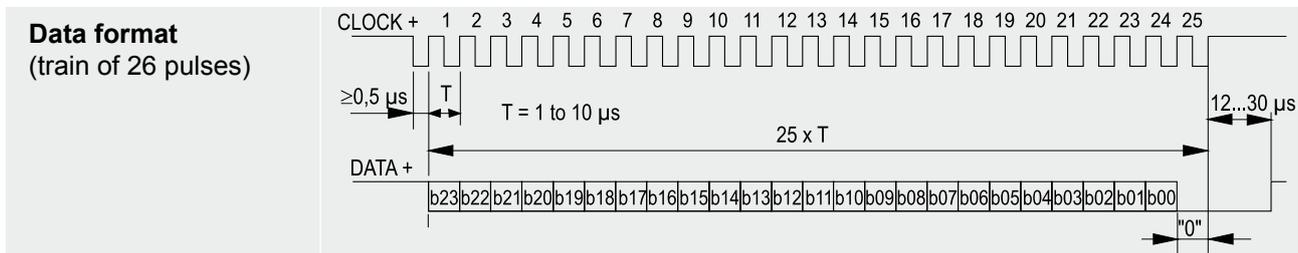
Recommended processing circuit

DATA
DATA
Z_0 RS422 Z_0

CLOCK
Z_0 RS422 Z_0
CLOCK
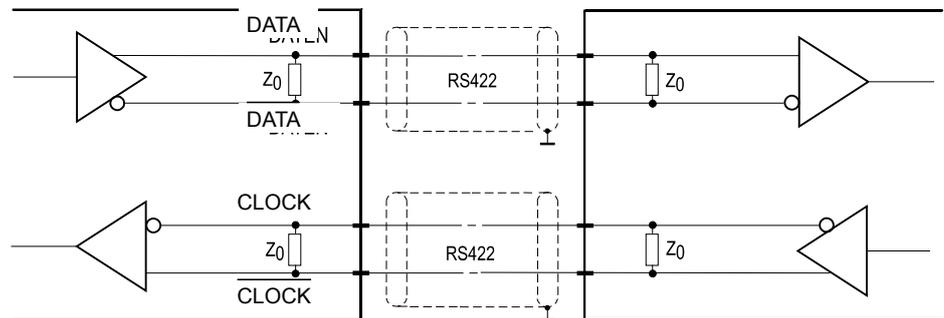
Transmission rate	**Cable length**	**Baud rate**
	50 m	100-400 kHz
	100 m	100-300 kHz

Note:
Extension of the cable length will reduce the maximum transmission rate.

Signal wiring/ Connection	**Signal**	**Connector Pin**	**Cable wire color**
	Excitation +	1	white
	Excitation GND	2	brown
	CLOCK	3	green
	$\overline{CLOCK}$	4	yellow
	DATA	5	grey
	$\overline{DATA}$	6	pink
	–	7	blu
	–	8	red

View to sensor connector
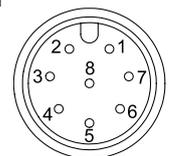
Apply the shield unilaterally! Avoid ground loops!

POSIHALL®
Digital output CANopen

ASM®

Description

CANopen Interface according to CANopen-Standards CiA DS301 DS406, for WB Linear Position Sensors. Prozess data objects for Position und CAM switches. Programmable parameters include Preset, Offset, Resolution, CAM switches, Transmission mode.

MCANOP

Communication profile	CANopen CiA 301 V 4.02, Slave
Device profile	Encoder CiA 406 V 3.2
Configuration services	Layer Setting Service (LSS), CiA Draft Standard 305 (transmission rate, node id)
Error Control	Node Guarding, Heartbeat, Emergency Message
Node ID	Default: 127; programmable via LSS or SDO
PDO	3 TxPDO, 0 RxPDO, static mapping
PDO Modes	Event-/Time triggered, Remote-request, Sync cyclic/acyclic
SDO	1 server, 0 client
CAM	8 cams
Transmission rates	50 kBaud to 1 MBaud, default: 125 kBaud; programmable via LSS or SDO
Bus connection	M12 connector, 5 pins
Integrated terminating resistor	R_T = 120 Ω, user programmable
Bus, galvanic isolated	No

Specifications

Excitation voltage	8 ... 36 V DC
Excitation current	typ. 20 mA at 24 V DC typ. 40 mA at 12 V DC max. 80 mA
Measuring rate	1 kHz (asynchronous)
Stability (temperature)	$\pm 50 \times 10^{-6}$ / °C f.s. typical
Repeatability	1 LSB
Operating temperature	-40 ... +85 °C
Protection	Reverse polarity, short circuit
Dielectric strength	1 kV (V AC, 50 Hz, 1 min.)
EMC	DIN 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 object PDO COB-Id 1800..1803 Sub-Index-1. DLC defines the length of the data field.

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

Transmission behaviour of TPDO-1, -2, -4 is configurable by object PDO Communication Parameter 1800, 1801, 1803 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		-
Disable TPDO **Enable TPDO**	80 00 xx xx 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	80196h	encoder profile ‚406'
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
Idendity Object VendorID	1018	1	ro	U32	252h	
Idendity Object Product Code		2	ro	U32	-	
Idendity Object Revision number		3	ro	U32	-	
Idendity Object Serial number		4	ro	U32	-	
COB-ID Server->Client	1200	1	ro	U32	67Fh	SOD
COBID 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	64h	0 .. 7FFFh
PDO2 COB-ID	1801	1	rw	U32	2FFh	281h .. 2FFh
PDO2 Transmission-Type		2	rw	U8	1	0 .. FFh
PDO2 Inhibit time		3	rw	U16	0	0 .. 7FFFh
PDO2 Event timer		5	rw	U16	0	0 .. 7FFFh
PDO4 COB-ID	1803	1	rw	U32	4FFh	381h .. 3FFh
PDO4 Transmission-Type		2	rw	U8	FEh	0 .. FFh
PDO4 Inhibit time		3	rw	U16	0	0 .. 7FFFh
PDO4 Event timer		5	rw	U16	0	0 .. 7FFFh
TPDO1-Mapped Object	1A00	1	ro	U32	60040020h	
TPDO2-Mapped Object	1A01	1	ro	U32	60040020h	
TPDO4-Mapped Object	1A03	1	ro	U32	63000108h	
NMT-Startup	1F80	0	rw	U32	0	0: OFF, 8: ON

*) Reset to Manufacturer Default Setting, Bitrate und Node ID not affected

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Device profile „Linear Encoder" CiA 406
Single and dual redundant devices

Object	Index	Sub-Index	Access	Default	Value range / note
Manufacturer specific					
Node ID	2000	0	rw	127 *)	1...127
Bitrate	2010	0	rw	4 *)	0...4, 6
Hysteresis (change of state)	2040	0	rw	10	0 ... 1000
Termination resistor	2050	0	rw	0	0 (off) / 1 (on)
Filter	2102	0	rw	1	1...255
Linear-Encoder CiA406					
Operating Parameters	6000	0	rw	0	Bit select
Total Measuring Range	6002	0	rw	-	Measuring range in 10 mm-Steps
Preset Value	6003	0	rw	0	
Position Value	6004	0	ro	-	
Measuring Step	6005	1	rw	10^3 nm	10^3 .. 10^6 nm
Cyclic Timer	6200	0	rw	100	10 ... 7FFFh
Profile SW Version	6507	0	ro		
Serial Number	650B	0	ro		
CAM CiA406					
Cam state register	6300	0	ro	0	
Cam enable register	6301	0	rw	0	
Cam polarity register	6302	0	rw	0	
Cam 1-8 low limit	6310.. 6317	1	rw	0	
Cam 1-8 high limit	6320.. 6327	1	rw	0	
Cam 1-8 hysteresis	6330.. 6337	1	rw	0	

*) For dual redundant devices: Always configure Baud-Rates to the same value and the Node-Ids to different values.

Operating Parameters (Object 6000)

15	..	..	..	4	3	2	1	0
-	-	-	-	-	md	sfc	-	-
msb								lsb

md = 0/1   Measuring direction in / out
sfc = 0/1   Scaling function disabled/enabled

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Process Data Object (TPDO) Mapping

TPDO	COB-Id	DLC	Data Frame Byte0							Byte7
TPDO-01	180h +Node-Id	4	4 Byte Position Data							
			(LSB)	...	...	(MSB)				
TPDO-02	280h +Node-Id	4	4 Byte Position Data							
			(LSB)	...	...	(MSB)				

TPDO	COB-Id	DLC								
TPDO-04	480h +Node-Id	1	CAM State							

CAM State Data Format

8 Bit CAM State Register							
b7	b6	b5	b4	b3	b2	b1	b0
CAM 8	CAM 7	CAM 6	CAM 5	CAM 4	CAM 3	CAM 2	CAM 1

TPDO Default Settings

TPDO	Default COB-Id	Default Transmission Type
TPDO-01: Position Data, 4 Byte	1FFh	Event Timer 100ms (FE, T!=0)
TPDO-02: Position Data, 4 Byte	2FFh	Sync Mode
TPDO-04: CAM Status, 1 Byte	4FFh	Change of State Mode

Baud Rate (Object 2010)

Baud Rate Index	Baud Rate [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 „mi-niMon" (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 Example 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 baud 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 baud 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 7E	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 1000kbit/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

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Configuration Example 2 - screenshot

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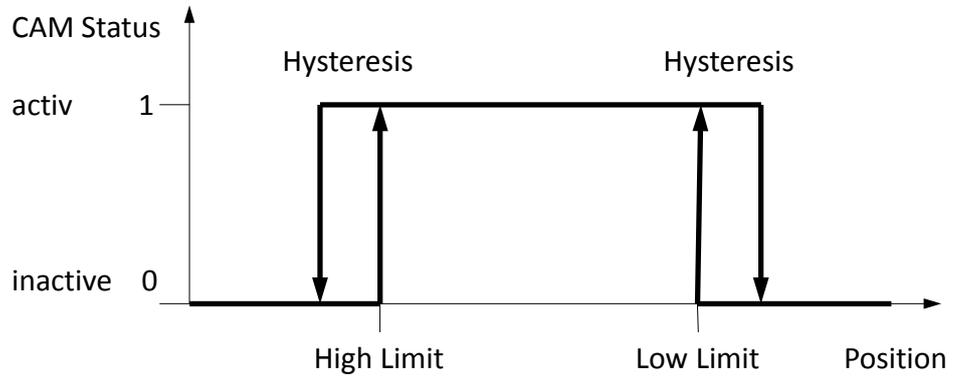www.asm-sensor.com / USA: www.asmsensors.com

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	Boot-Up Message	77E Std		00
00:00:48.90	Set PDO1 Event Timer 500	67E Std	Self	2B 00 18 05 F4 01 00 00
00:00:48.90	Response	5FE Std		60 00 18 05 00 00 00 00
00:01:02.70	Set PDO1 COB-Id to 1F1	67E Std	Self	23 00 18 01 F1 01 00 00
00:01:02.70	Response	5FE Std		60 00 18 01 00 00 00 00
00:01:06.85	Set Autostart	67E Std	Self	23 80 1F 00 08 00 00 00
00:01:06.85	Response	5FE Std		60 80 1F 00 00 00 00 00
00:01:10.90	SAVE	67E Std	Self	23 10 10 01 73 61 76 65
00:01:10.91	Response .. POWER OFF	5FE Std		60 10 10 01 00 00 00 00
00:01:19.92	Boot Up on POWER ON	77E Std		00
00:01:19.92	Cyclic PDO Transfer	1F1 Std		66 1B 00 00
00:01:20.42	on Power On	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

CAM function

	Hysteresis		Hysteresis

CAM Status

activ 1 ⎯

inactive 0

High Limit   Low Limit   Position

Signal wiring / connection

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

View to sensor connector
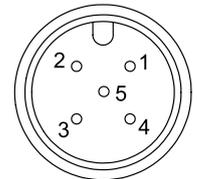
A-Coding

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.

Termination Resistor   T-Piece   CAN cable

Sensor

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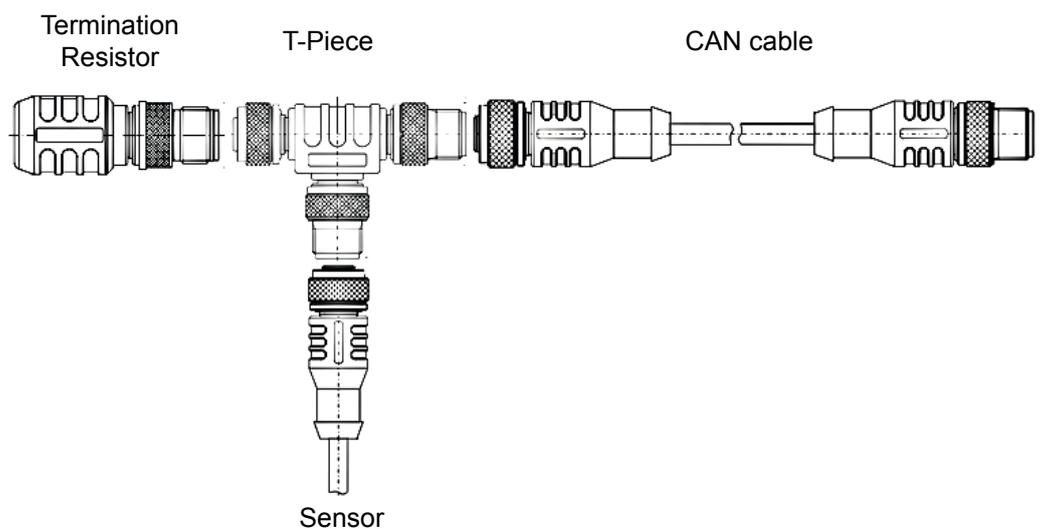
Description	Linear encoder according to standard SAE J1939. Customer configuration of operating parameters by Peer-to-Peer. Process data exchange by Broadcast message.

MCANJ1939	CAN specification	ISO 11898, Basic and Full CAN 2.0 B
	Transceiver	24V-compliant, not isolated
	Communication profile	SAE J1939
	Baud rate	250 kBit/s
	Internal temination resistor	120 Ω user programmable
	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	typ. 20 mA at 24 V DC typ. 40 mA at 12 V DC max. 80 mA
	Resolution	10 µm
	Measuring rate	1 kHz (asynchronous)
	Stability (temperature)	$\pm 50 \times 10^{-6}$ / °C f.s.
	Repeatability	1 LSB
	Operating temperature	-40 ... +85 °C
	Protection	Reverse polarity, short circuit
	Dielectric strength	1 kV (V AC, 50 Hz, 1 min.)
	EMC Automation	EN 61326-1:2013

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WARNING

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!

Setup

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 immediatly. 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

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

Example: Broadcast (PGNLow = 0FFh - Reload factory defaults of all sensors, Index 29

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

Encoder - Parameters

Parameter	Index [dec]	Default	Range / Selection	Unit	Read / Write
Control					
Node ID	20	247	128 ... 247		rd/wr [1]
Baude rate	21	3 (250kB)	-		rd
Termination resistor	22	0	0/1 (off/on)		rd/wr [2]
Store parameters	28	-	"save" [3]		wr
Reload factory defaults	29	-	"load" [3]		wr [2]
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					
Code sequence	70	0	0 CW 1 CCW		rd/wr
Measuring step	73	100	10 ... 10000	µm	rd/wr
Preset	74	0	$0 ... 2^{14} - 1$	steps	rd/wr
Averaging filter	77	1	1 ... 255		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]   Write access to index 20 (change of node ID) is effective immediately and initiates address claiming

[2]   Effective on next power-up

[3]   „save" MSB...LSB: 73h, 61h, 76h, 65h
      „load" MSB...LSB: 6Ch, 6Fh, 61h, 64h

Broadcast access by PGN_{Low} = 0FFh adresses the specified index of all sensors

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				Position value			
Byte [*]				MSB			LSB

[*] Error codes: 0 = no error, 1 = error

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

View to sensor connector
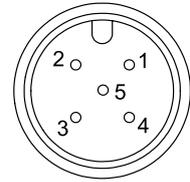
CAN Bus wiring

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.

Termination Resistor   T-Piece   CAN cable
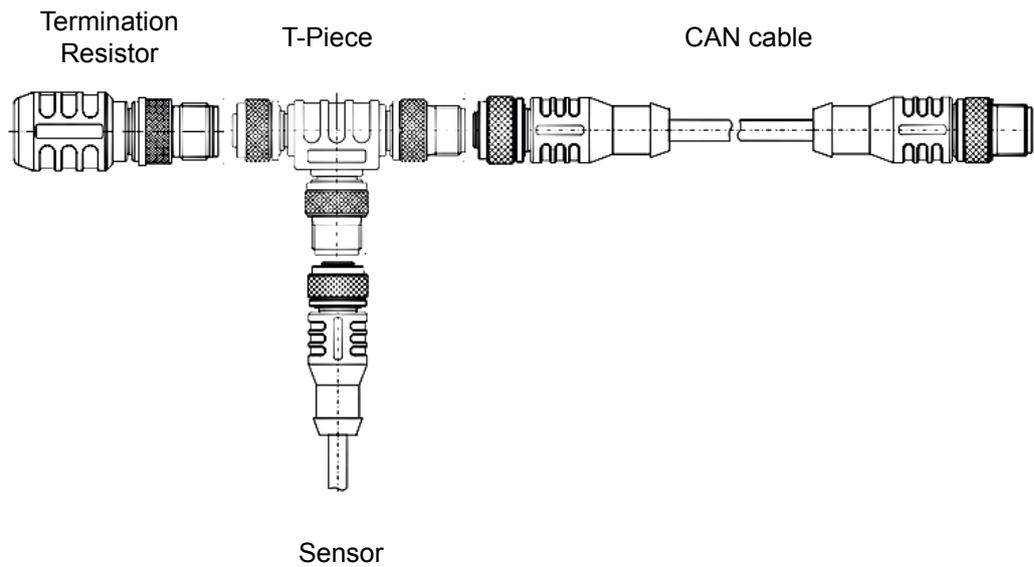
Sensor

Connector cable
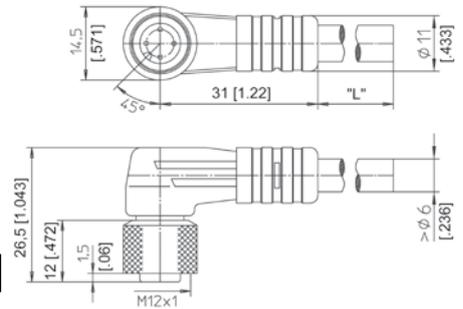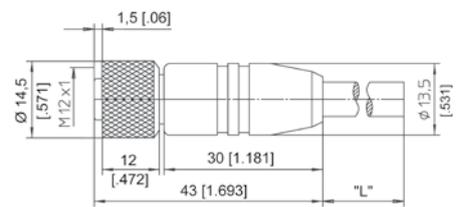M12, 4 pin

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 mm^2.

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 mm^2.

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

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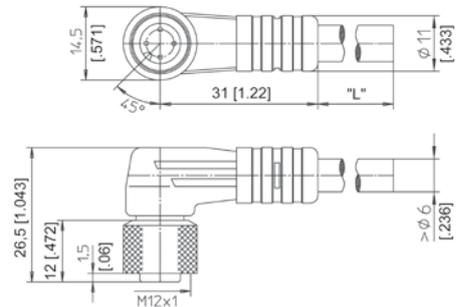# Accessories – Connector cables

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Connector cable
M12, 5 pin,
shielded connector

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 mm^2.
Order code:

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

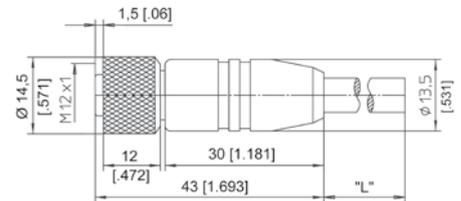IP69K: KAB - XM - M12/5F/W/69K - LITZE

Length in m

Connector cable
M12, 5 pin,
shielded connector

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 mm^2.
Order code:

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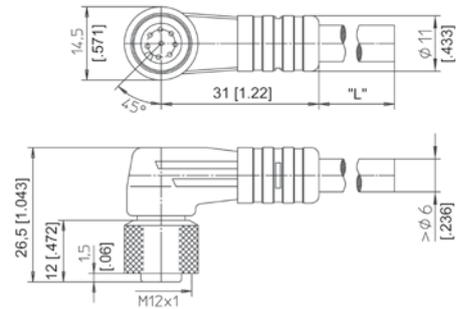
IP69K: KAB - XM - M12/5F/G/69K - LITZE

Length in m

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

Connector cable
M12, 8 pin,
shielded connector

The 8-lead shielded cable is supplied with a mating 8-pin 90° M12 connector at one end and 8 wires at the other end. Available lengths are 2 m, 5 m and 10 m. Wire: cross sectional area 0.25 mm².
Order code:

KAB - XM - M12/8F/W - LITZE

IP69: KAB - XM - M12/8F/W/69K - LITZE

Length in m

Connector cable
M12, 8 pin,
shielded connector

The 8-lead shielded cable is supplied with a mating 8-pin M12 connector at one end and 8 wires at the other end. Available lengths are 2 m, 5 m and 10 m. Wire: cross sectional area 0.25 mm².
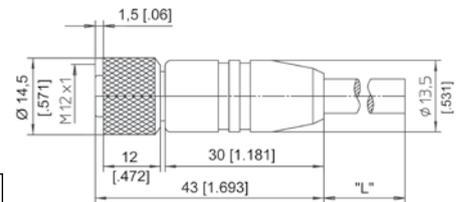Order code:

KAB - XM - M12/8F/G - LITZE

IP69: KAB - XM - M12/8F/G/69K - LITZE

Length in m

Signal wiring M12, 8 pin	Connector pin / cable color							
	1	2	3	4	5	6	7	8
	white	brown	green	yellow	grey	pink	blue	red

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

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.
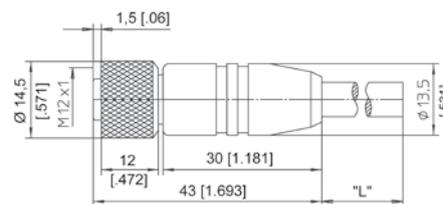
Order code:

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

IP69: | 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 |

ASM®

Models	PH36, PH58, PH68, PH68R	

Outputs	**single-channel**	
	U2, U2/PMU, U2/PMZ	Voltage output 0.5 ... 10 V
	U6, U6/PMU, U6/PMZ	Voltage output 0.5 … 4.5 V
	U8, U8/PMU, U8/PMZ	Voltage output 0.5 ... 4.5 V
	I1, I1/PMU, I1/PMZ	Current output 4 ... 20 mA
	MCANOP, MCAN SAE J1939	CAN (CANopen. CAN SAEJ1939)
	dual-channel	
	U2R	Voltage output 0,5 ... 10 V, redundant
	U6R	Voltage output 0,5 ... 4,5 V, redundant
	U8R	Voltage output 0,5 ... 4,5 V, redundant
	I1R	Current output 4 ... 20 mA, redundant
	MCANOPR, MCAN SAE J1939	CAN redundant (CANopen. CAN SAEJ1939)

Characteristics	Device type		B
	Life period (electronics) $MTTF_d$		320 years / channel[*)]
	Probability of failure PFH (λ_{DU})		350 Fit / channel
	Working life		10 years
	Bearing life expectancy		
		PH36:	$1,5 \times 10^{10}$ revolutions (4500 h per 6000 r.p.m)
		PH58:	1×10^{10} revolutions (2800 h per 6000 r.p.m)
		PH68/ PH68R:	$1,1 \times 10^{10}$ revolutions (3000 h per 6000 r.p.m)

Standards	Functional Safety	IEC 61508-1, -2, -6
	Safety of machinery	ISO 13849-1
	Failure rate of electronic components (Siemens)	SN 29500

*) = Reference Conditions: Reference Supply Voltage UB_{REF}= 24 V, Reference Temperature ϑ_{REF}= 60 °C

EU Declaration of Conformity

CE

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

declare under our sole responsibility that the product

Name: **POSIHALL® Multiturn Angle Sensor**

Type: **PH36, PH58, PH68, PH68R**

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

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