WS® / POSIWIRE®

Position Sensors

Installation and operation manual

Please read carefully before installation and operation!

Contents

Safety instructions

Do not use WS® / POSIWIRE® 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.

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

Disregard of this advice releases the manufacturer from product liability.

Sensor must be operated only within values specified in the catalog.

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

Crossing the dew point must be avoided

Safety instructions (continued)

Do not open sensor
- Release of spring under tension can result in injury!

Do not snap cable
- Uncontrolled cable or metal tape retraction can break off cable fixing (cable clip or M4 connection). Broken fixing and cable can result in injury. Also sensor will be damaged!

Do not travel over range
- Uncontrolled cable retraction can result in injury. Also sensor will be damaged!

Special attention during mounting and operation of metal tape sensors
- Risk of injury by the metal tape. The metal tape must be installed in such a way that a contact with the tape is impossible!

Sensors without cover / housing (OEM sensors)
- Risk of injury by moving parts. Mounting and operation of the sensor only with appropriate safety equipment that an injury is impossible!

Do not exceed maximum operating voltage listed in the catalog
- Risk of injury. Sensor will be damaged!

Product 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.

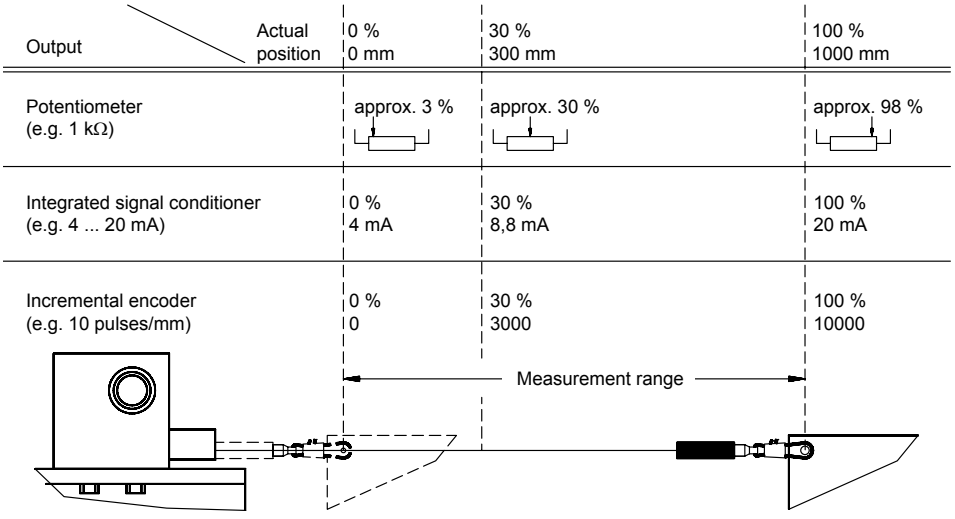
The Operating Principle

Linear motion of the measuring cable (flexible stainless steel) is converted into rotation by means of a precision cable drum. A spring motor provides torque for the cable retraction. Special design assures precise and reproducible winding of the measuring cable.
Cable extraction or retraction is transformed into an electrical signal. Depending on application different sensing elements are used.
Optional: Subsequent signal conditioners convert the signal of the sensing element into voltage, current, or digital pulses suitable for standard interfaces.

Measurement Signal and Range

Measurement signal:

Analog, not adjusted Potentiometer Sensitivity not adjustable	Resistance range is used from about 3% to 98%. 0% or 100% are not possible. Individual sensitivity is specified on the label.
Analog, adjusted Integrated signal conditioner Sensitivity adjusted	Measuring range corresponds to the electrical measuring range (e.g. 4...20 mA).
Digital incremental Incremental encoder Sensitivity not adjustable	Inividual sensitivity is specified on label in pulses or increments per millimeter.



Delivery / shipment

Unpacking	Do not unpack sensor by pulling cable or cable clip.
Shipment damages	Check sensor immediately for shipping damage.
Shipment protection loop (not to be confused with the mounting loop below!)	Do not remove until mounting. (prevents cable movement before mounting)

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

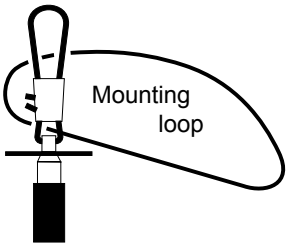
Mating connectors

Delivery does not include female connectors for electrical connection. They are available under the following order code:

90° female 8-pin connector DIN	CONN-DIN-8F-W
Female 8-pin connector M12	CONN-M12-8F-G
90° female 12-pin connector DIN	CONN-DIN-12F-W
Female 12-pin connector	CONN-CONIN-12F-G

Installation

Do not damage cable!
Cable must not be oiled or lubricated!
Do not snap cable!
Do not travel over range!
Do not crack cable!
Cable travel should be axial to the cable outlet
- no misalignment allowed!
Do not drag cable along objects!



Precautions

Do not let snap the cable
Uncontrolled retraction of cable may damage sensor.
No warranty will be granted for snapped cables.

Mounting hints for unfavourable conditions
If possible fasten cable fixing with cable in retracted position.
For example, fit a mounting loop (see diagram) and put it around your wrist.
Do not remove the mounting loop before the cable ist fastened.
The cable clip may be opened for easy attachment.

Mounting
To ensure proper operation, install the sensor only as described in this manual.

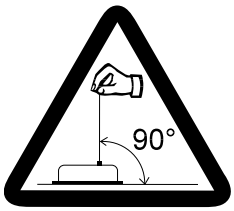
Installation
(continued)

Installation position

Covered or shielded travel of cable is preferred.	This prevents cable from damage, soiling and manipulation.
Cable outlet is preferred pointing downwards.	Soaking of liquids into the cable outlet is impossible, concentration of condensing water will be avoided.
Fit sensor on plain base or use three-point mounting on uneven surfaces.	This prevents sensor from bending and damage.

Cable travel should only be axial to the cable outlet
- no misalignment is allowed.

Cable misalignment shortens service life of sensor and causes error in measurement. Warranty will not be granted for damage caused by misalignment.



If cable travel axial to the cable outlet is not possible, the cable guide wheel SR2 (accessories) must be used in order to turn the cable.

For special applications extension cables with clips on both ends are available.

Fitting the sensor
Depending upon the sensor model, drillings in the base plate, threads or T-slots in the sensor housing enable attachment of the sensor. Dimensions required are listed in the catalog.

Cable attachment device
For fastening the cable clip the following solutions are available. For example:

a) Set screw M5: (Allen screw)	Standard fixing.
b) Attachment head GK1/GK2: (accessory)	Fast cable attachment, easy to remove.
c) Magnetic clamp MAG1: (accessory)	An easy way to fasten the cable to ferromagnetic materials.

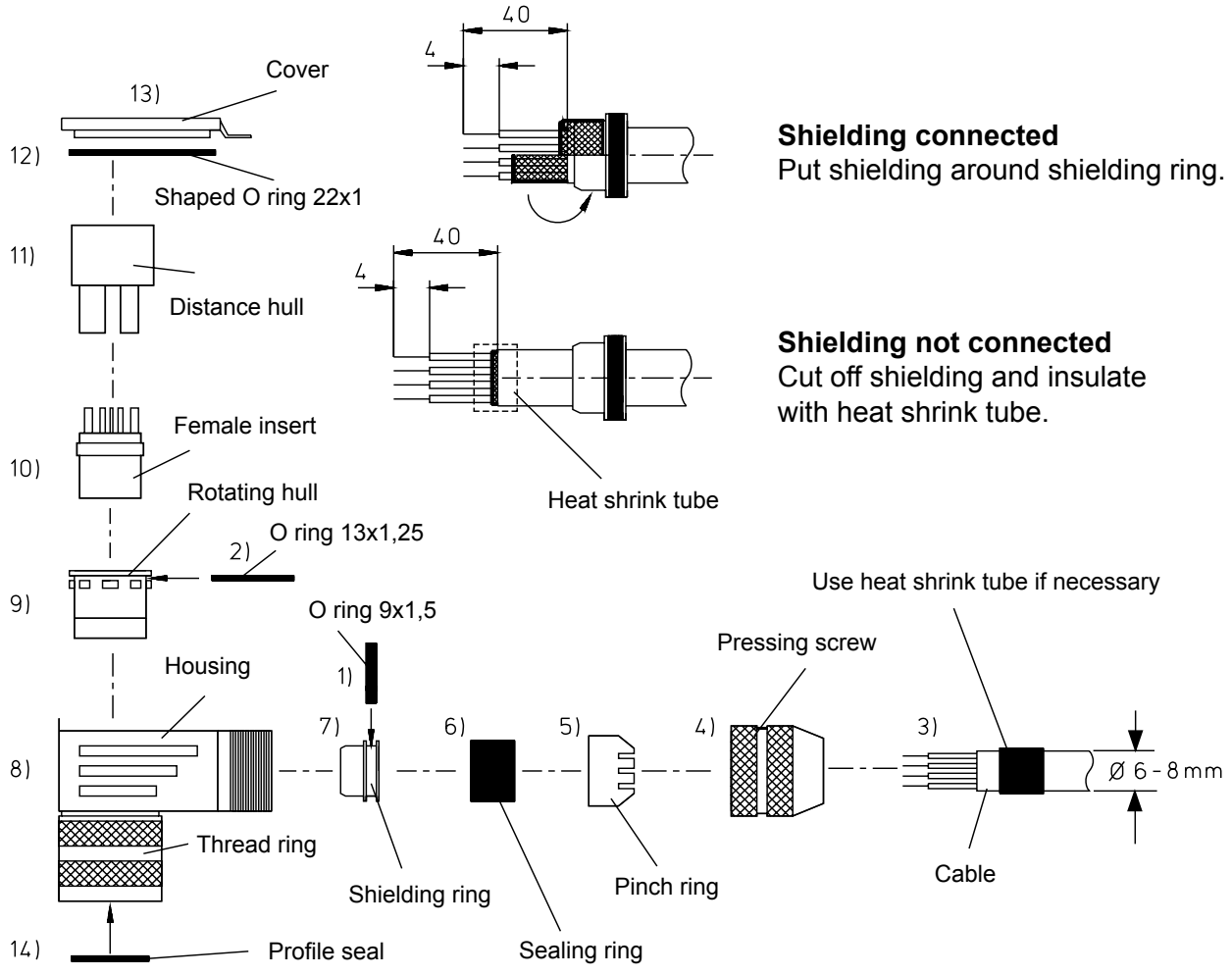
The mounting of the M4 connection is made with a through hole and a M4 nut. Note: Do not screw the M4 connection itself into a stationary object, otherwise the measuring cable will be twisted!

Cable clip attachment
When fastening the cable clip take notice of the chapter *Installation / Precautions* (page 6).

Installation (continued)

90° female connector CONN-DIN-8F-W

Part no.:	Operation:
1 to 2	Assemble O-rings (lubricate!) on shielding ring and rotating hull.
3 to 7	Stringing parts and cut off projecting braiding. Note detail drawing of shielding! (See chapter *Electromagnetic Compatibility / EMC*).
8	Thread wires through housing, then assemble shielding ring, sealing ring and pinch ring. Turn on pressing screw to fix the cable, solder wires.
9 to 13	Assemble remaining parts according to diagram, fasten pressing screw.
14	Insert profile seal and fix female connector at male socket.



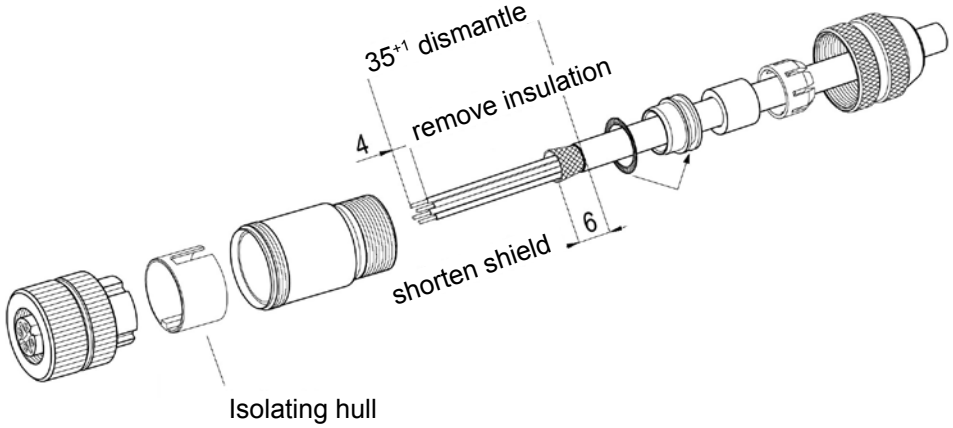
Installation (continued)

CAUTION

The sensor protection class (IP) is only valid when the electrical plug is correctly connected.
To ensure sensor protection class assemble all connector seals carefully.
The connector is suitable for cable diameters of 6 to 8 mm.
The sealing ring has to enclose the cable tightly (use heat shrink tube if necessary).
Note: Four different directions of the angled outlet are possible (4 x 90°) by changing the position of the rotating hull (part no. 9 in the drawing previous page).

Female connector CONN-M12-8F-G

1. Stringing parts.
2. Dismantle, expand shield and turn over the shielding ring.
3. Push isolating hull into the housing. Thread wires through housing, the assemble shielding ring, sealing ring and pinch ring. Turn on pressing screw to fix the cable. Screw wires.
4. Screw insert into housing and fasten pressing screw.

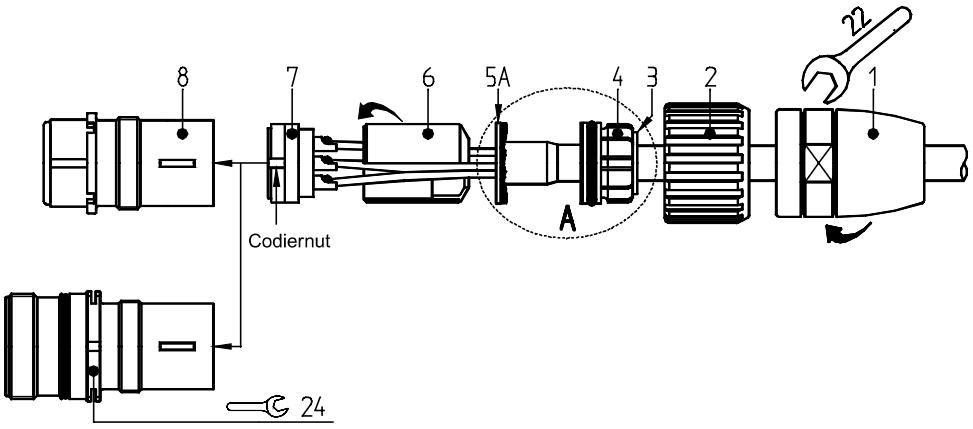


CAUTION

The sensor protection class (IP) is only valid when the electrical plug is correctly connected.
To ensure sensor protection class assemble all connector seals carefully.
The connector is suitable for cable diameters of 6 to 8 mm.
The sealing ring has to enclose the cable tightly (use heat shrink tube if necessary).

Installation (continued)

Female connector CONN-CONIN-12F-G



1. Slide the adaptor pos. 1, the sleeve nut pos. 2, the sealing element pos. 4 with sealing ring pos. 3 onto the cable.
2. Dismantle the outer sheath of the cable at a length of 23 mm.
3. Turn the shielding braid 90° up, move the shielding ring pos. 5A with a little rotation over the plastic film resp. the cotton mesh but under the shielding braid; cut off the shielding braid flushing with the outer diameter of the shielding ring pos. 5A.
4. Cut off plastic film, filler and inner isolation.
5. Strip the wires a length of 3,5 mm, twist (and tin).
6. Solder, crimp or screw the wires to the contacts.
7. Insert distance hull pos. 6.
8. Move insert pos. 7 and distance hull pos. 6 into the insert hull pos. 8; please see to it that the desired code notch of the insert pos. 7 is inserted correctly into the code bar.
9. Push in the cable with shielding and sealing unit.
10. Screw the adaptor pos. 1 tight!

CAUTION

The sensor protection class (IP) is only valid when the electrical plug is correctly connected.
To ensure sensor protection class assemble all connector seals carefully.
The connector is suitable for cable diameters of 6 to 8 mm.
The sealing ring has to enclose the cable tightly (use heat shrink tube if necessary).

Connection

Signal wiring See *Output specifications* and *Connection table* (appendix).

Operating voltage According to *Output specifications* (appendix). Do not exceed the listed maximum operating voltage.

Special encoders Instruction manuals of special encoders have to be noticed.

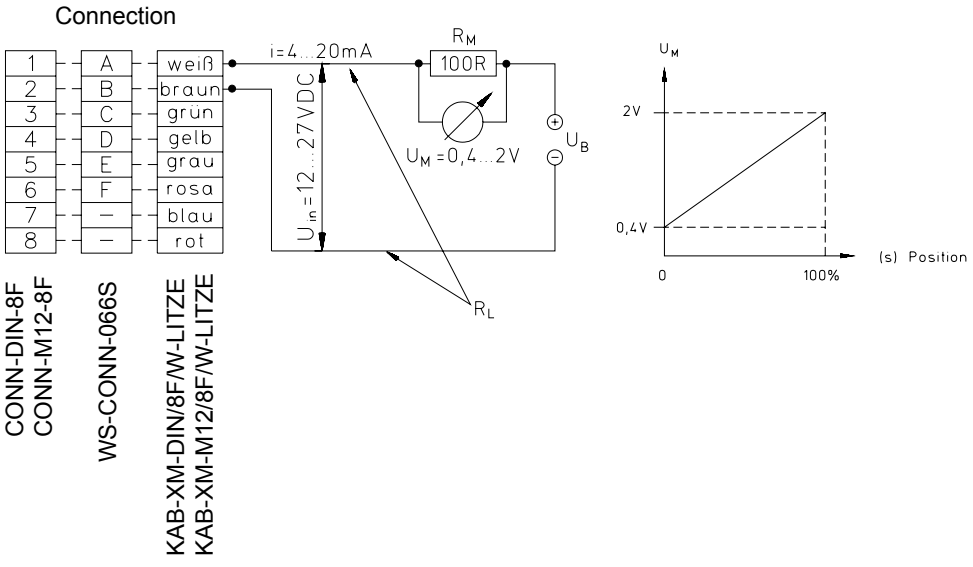
For connection of outputs not listed in the connection table see data sheets or special connection diagrams.

Connection example: current output 420A
To convert the 4 ... 20 mA signal into a voltage signal, it needs a load resistor R_M (measuring resistor) as shown in the diagram. The maximum value of R_M depends on the cable resistance R_L and the excitation voltage U_B:

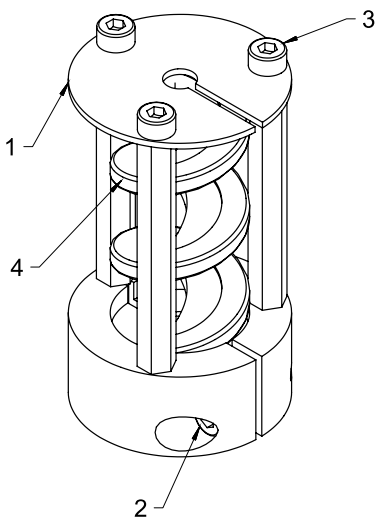
$$R_{Mmax} = ((U_B – 12\ V)/0{,}02\ A) – R_L$$

With an excitation of 24 V DC and a cable resistance R_L = 500 Ω a maximum value of R_M = 100 Ω can be used.

External circuit **Voltage drop at the precision resistor**



Cable dust wiper SAB5



1. Disassemble the aluminium washer (1) by removing the three M3 screws (3).
2. Remove the spiral wiper (4).
3. Fix the basic body at the cable outlet of the sensor by the set screw M3 (2). See to it that the sensor measurement cable is in centric position.
4. Thread the measurement cable into the spiral wiper.
   Do not bend the measurement cable!
   Don´t let snap back the cable!
5. Assemble the aluminium washer.

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:

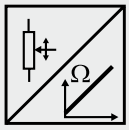
- Use a twisted pair cable, shielded per pair and common.
- Use shielded conduits or ducts connected to ground potential.

Repair and Disposal

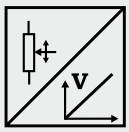
Sensors and accessories have to be repaired and adjusted at ASM in Moosinning.

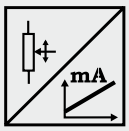
In order to avoid risk of injury and improper handling do not try to repair. No warranty or liability will be granted for opened sensors.

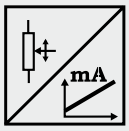
Disposal: Send metal parts for recycling!

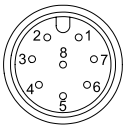
Voltage divider R1K Potentiometer 	Excitation voltage	32 V DC max. at 1 kΩ (max. power 1 W)
	Potentiometer impedance	1 kΩ ±10 %
	Thermal coefficient	±25 x 10^{-6} / °C f.s.
	Sensitivity	Depends on the measuring range, individual sensitivity of the sensor is specified on the label
	Voltage divider utilization range	Approx. 3 % ... 97 %
	Operating temperature	-20 ... +85 °C

Note: The Potentiometer must be connected as a voltage divider. The input impedance of the following processing circuit should be 10 MΩ min.

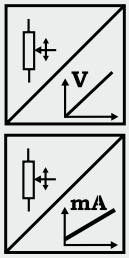
Signal conditioner 10V and 10V5 Voltage output 	Excitation voltage	18 ... 27 V DC non stabilized
	Excitation current	20 mA max.
	Output voltage	**10V**: 0 ... 10 V DC; **10V5**: 0.5 ... 10 V DC
	Output current	2 mA max.
	Output load	> 5 kΩ
	Stability (temperature)	±50 x 10^{-6} / °C f.s.
	Protection	Reverse polarity, short circuit
	Output noise	0.5 mV_{RMS}
	Operating temperature	-20 ... +85 °C
	EMC	EN 61326-1:2006

Signal conditioner 420A Current output (2 wire) 	Excitation voltage	12 ... 27 V DC non stabilized, measured at the sensor terminals
	Excitation current	35 mA max.
	Output current	4 ... 20 mA equivalent for 0 ... 100 % range
	Stability (temperature)	±100 x 10^{-6} / °C f.s.
	Protection	Reversed polarity, short circuit
	Output noise	0.5 mV_{RMS}
	Operating temperature	-20 ... +85 °C
	EMC	EN 61326-1:2006

Signal conditioner 420T Current output (3 wire) 	Excitation voltage	18 ... 27 V DC non stabilized
	Excitation curren	40 mA max.
	Load resistor	350 Ω max.
	Output current	4 ... 20 mA equivalent for 0 ... 100 % range
	Stability (temperature)	±50 x 10^{-6} / °C f.s.
	Protection	Reverse polarity, short circuit
	Output noise	0.5 mV_{RMS}
	Operating temperature	-20 ... +85 °C
	EMC	EN 61326-1:2006



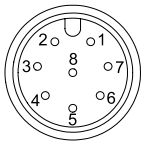
Signal wiring for R1K, 10V, 420A and 420T see page 35
(Connection table)

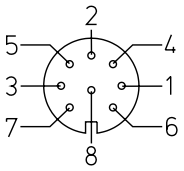
Signal conditioner PMUV / PMUI Voltage or current output (3 wire) 	Excitation voltage	18 ... 27 V DC
	Excitation current	50 mA max.
	Voltage output **PMUV** Output current Output load	0 ... 10 V 10 mA max. 1 kΩ min.
	Current output **PMUI** Working resistance	4 ... 20 mA (3 wire) 500 Ω max.
	Scaling Activation of offset and gain adjust Scalable range	 Connect with excitation GND (0 V) 90% max. f.s.
	Stability (temperature)	±50 x 10^{-6} / °C f.s.
	Operating temperature	-20 ... +85 °C
	Protection	Reversed polarity, short circuit
	EMC	EN 61326-1:2006

Signal wiring PMUV / PMUI	**Signal name**	**Connector pin no.**	**Cable output 6 wire**
	Excitation +	1	White
	Excitation GND	2	Brown
	Signal +	3	Green
	Signal GND	4	Yellow
	Not used	5	
	Not used	6	
	Offset	7	Grey
	Gain	8	Pink

View to sensor connector
- Check sensor type! -

CONN-M12-8F

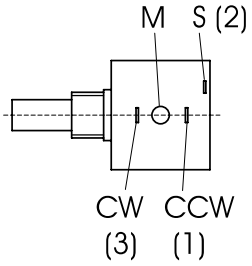


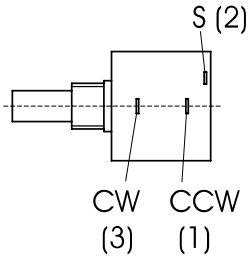


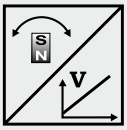
CONN-DIN-8F

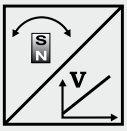
Signal wiring PMUI2	**Signal name**	**Connector pin no.**
	Excitation +	1
	Excitation GND	2
	Not used	3
	Not used	4
	Signal +	5
	Signal GND	6
	Offset	7
	Gain	8

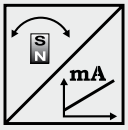
Signal wiring potentiometer WS31/42	**CT-Poti / 5 turn 250 / 500 mm**		**Multi turn-Poti / 10 turn 750 / 1000 mm**	
	Poti +	M	Poti +	CCW
	Poti GND	CW	Poti GND	CW
	Poti slider	S	Poti slider	S





U2 Voltage Output 0.5 ... 10 V 	Excitation voltage	18 ... 36 V DC
	Excitation current	40 mA max.
	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. (typ.)
	Operating temperature	-20 ... +85 °C
	Protection	Reverse polarity, short circuit

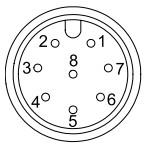
U8 Voltage Output 0.5 ... 4.5 V 	Excitation voltage	10 ... 36 V DC
	Excitation current	40 mA max.
	Output voltage	0.5 ... 4.5 V DC
	Output current	2 mA max.
	Measuring rate	1 kHz standard
	Stability (temperature)	±50 x 10^{-6} / °C f.s. (typ.)
	Operating temperature	-20 ... +85 °C
	Protection	Reverse polarity, short circuit

I1 Current Output 4 ... 20 mA 	Excitation voltage	18 ... 36 V DC (10 ... 36 V for R_L <250 Ω)
	Excitation current	60 mA max.
	Load resistor	500 Ω max.
	Output current	4 ... 20 mA
	Measuring rate	1 kHz standard
	Stability (temperature)	±50 x 10^{-6} / °C f.s. (typ.)
	Operating temperature	-20 ... +85 °C
	Protection	Reverse polarity, short circuit

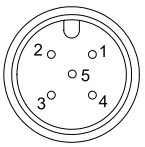
Signal Wiring	**Output signals**	**Connector M12, 5-pin**	**Cable output Wire color**
	Excitation +	1	brown
	Signal	2	white
	GND	3	blue
	Do not connect!	4	black
	ZERO/END (Option PMU)	5	grey

Signal Wiring, double-channel, redundant, one connector	**Output signals**	**Channel**	**Connector M12, 8-pin**	**Cable output Wire color**
	Excitation +	1	1	white
	Signal	1	2	brown
	GND	1	3	green
	ZERO/END (Option PMU)	1	4	yellow
	Excitation +	2	5	grey
	Signal	2	6	pink
	GND	2	7	blue
	ZERO/END (Option PMU)	2	8	red

Connection
View to sensor connector



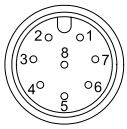
CONN-M12-8F



CONN-M12-5F

Signal conditioner PP530 Incremental 	Excitation voltage	5 ... 30 V DC
	Excitation current	25 mA typ. (w/o load), 200 mA max.
	Output frequency	200 kHz max.
	Output	Linedriver, Push-Pull, CMOS, TTL and HTL compatible
	Output current	30 mA max.
	Output voltage	Depends on the excitation voltage (e.g. to obtain TTL signals the excitation voltage must be 5 V). Compatible to EIA RS422/RS485
	Saturation voltage high/low	Ia <10 mA, U_B 5 V/24 V: <0.5 V Ia <30 mA, U_B 5 V/24 V: <1 V
	Stability (temperature)	±20 x 10^{-6} / K f.s. (sensor mechanism)
	Operation temperature	-10 ... +70 °C
	Storage temperature	-30 ... +80 °C
	Transition time positive edge	<200 ns
	Transition time negative edge	<200 ns
	Protection	Reverse polarity, short circuit *)
	EMC	EN 61326-1:2006

***) Note:** Prevent unused output signals (e.g. $\overline{A}$, $\overline{B}$, $\overline{Z}$) from unintenionally beeing shorted with each other or any other voltage like ground, excitation + or shield. Isolate and secure unused output wires. Line driver may get damaged in case of shorted output for unlimited time.



Signal wiring for PP530 see page 35 *(Connection table)*

Signal conditioner IE24LI und IE24HI
Incremental

	IE24LI	IE24HI
Excitation voltage	5 V DC ±10 %	10 ... 30 V DC
Excitation current	100 mA max.	
Output frequency	200 kHz max.	
Output	Push pull and inverted signals	
Output current	10 mA max.	
Output voltage	Depending on the excitation voltage	
Stability (temperature)	±20 x 10^{-6} / K f.s. (sensor mechanism)	
Operating temperature	-20 ... +85 °C	
Protection	Short circuit	
EMC	EN 61326-1:2006	

Signal wiring

Signal name	Cable color (WS31/42)
Excitation +	Brown
Excitation GND (0 V)	White
Signal A	Green
Signal $\overline{A}$	Yellow
Signal B (A + 90°)	Grey
Signal $\overline{B}$	Pink
Signal Z (reference pulse)	Blue
Signal $\overline{Z}$	Red

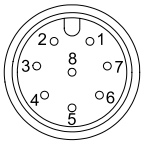
Signal conditioner IE41LI and IE41HI
Incremental

	IE41LI	IE41HI
Excitation voltage	5 V DC ±10 %	10 ... 30 V DC
Excitation current	150 mA max. w/o load	
Output frequency	300 kHz max.	200 kHz max.
Output	RS422	Push-pull antivalent
Output current	±30 mA max.	30 mA
Output voltage	Depending on the excitation voltage	
Stability (temperature)	±20 x 10^{-6} / K f.s. (sensor mechanism)	
Operating temperature	-10 ... +70 °C	
Protection against short circuit	One channel for 1 s	Yes
EMC	EN 61326-1:2006	

Signal wiring / connection

Signal name	Connector pin no. WS10	Connector pin no. WS12
Excitation +	1	1
Excitation GND (0 V)	2	2
Signal A	4	3
Signal $\overline{A}$	6	5
Signal B	3	4
Signal $\overline{B}$	5	6
Signal Z (reference pulse)	7	7
Signal $\overline{Z}$	8	8

View to sensor connector



CONN-M12-8F

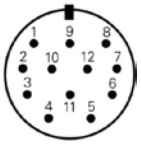
Signal conditioner PP24VC Incremental 	Interface	Push-pull line driver (24 V-HTL)
	Excitation voltage	10 ... 30 V DC
	Excitation current	150 mA max. w/o load
	Output frequency	300 kHz max.
	Output current	100 mA per channel
	Signal level	
	Ud High at Id=20 mA, Ub=24 V	≥21V
	Ud Low at Id=20 mA, Ub=24 V	≤2,8 V
	Transition time positive edge	<200 ns
	Transition time negative edge	<200 ns
	Stability (temperature)	±20 x 10^{-6} / K f.s. (sensor mechanism)
	Operating temperature	-20 ... +85 °C
	Protection	Reverse polarity, short circuit, overvoltage
	EMC	EN 61326-1:2006

Signal conditioner LD5VC Incremental 	Interface	Line driver RS422
	Excitation voltage	5 V DC ±10 %
	Excitation current	150 mA max. w/o load
	Output frequency	300 kHz max.
	Output current	20 mA per channel
	Signal level	
	Ud High at Id=20 mA	≥2,5V
	Ud Low at Id=20 mA	≤0,5 V
	Transition time positive edge	<100 ns
	Transition time negative edge	<100 ns
	Stability (temperature)	±20 x 10^{-6} / K f.s. (sensor mechanism)
	Operation temperature	-20 ... +85 °C
	Protection	Short circuit, overvoltage
	EMC	EN 61326-1:2006

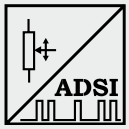
Signal wiring / connection

Signal name	**CONN-CONIN-12F, connector pin no.**
Excitation +	12
Excitation GND (0 V)	10
Signal A	5
Signal $\overline{A}$	6
Signal B	8
Signal $\overline{B}$	1
Signal Z (reference pulse)	3
Signal $\overline{Z}$	4
Fault detection signal $\overline{Uas}$	7
Shield	Housing

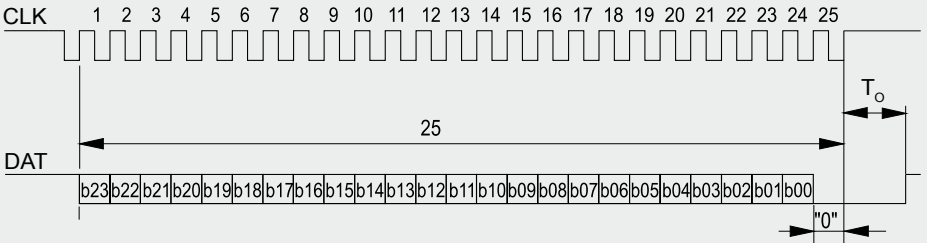
View to sensor connector



CONN-CONIN-12F

Signal conditioner ADSI16 [12/14] A/D converted synchronous serial 	Interface	EIA RS422, RS485, short-circuit proof
	Excitation voltage	11 ... 27 V DC
	Excitation current	200 mA max.
	Clock frequency	70 ... 500 kHz
	Code	Gray code, continuous progression
	Data format	24 Bit
	Delay between pulse trains	30 µs min.
	Resolution	16 bit (65536 counts) f.s.; optional 12 bit resp. 14 bit
	Stability (temperature)	±50 x 10^{-6} / °C f.s.
	Operating temperature	-20 ... +85 °C
	EMC	EN 61326-1:2006

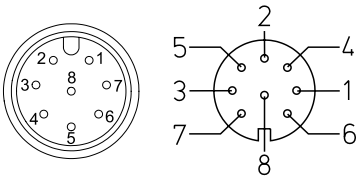
Data format
(train of 26 pulses)



Transmission rate	**Cable length**	**Baud rate**
	< 50 m	< 300 kHz
	< 100 m	< 100 kHz

Signal wiring	**Signal name**	**Connector pin no.**
	Excitation +	1
	Excitation GND (0 V)	2
	CLOCK	3
	$\overline{\text{CLOCK}}$	4
	DATA	5
	$\overline{\text{DATA}}$	6
	Shield	not connected

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

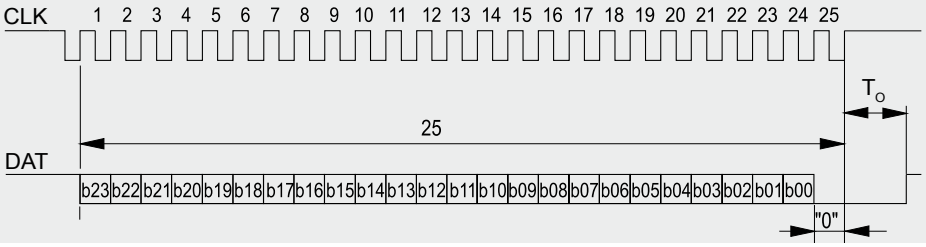


CONN-M12-8F CONN-DIN-8F

View to sensor connector
- check connector type! -

MSSI Synchronous serial SSI 	Interface	EIA RS-422
	Excitation voltage	8 ... 36 V DC
	Excitation current	typ. 19/35 mA at 24/12 V max. 80 mA
	Clock frequency	100 kHz ... 500 kHz
	Code	Gray-Code, continuous progression
	Data format	24 Bit
	Delay between pulse trains	T_O ≥ 20 µs min.
	Stability (temperature)	±50 x 10^{-6} / °C f.s. (typ.)
	Operating temperature	-40 ... +85 °C
	Protection	Short circuit
	EMC	EN61326-1:2006

Data format
(train of 26 pulses)

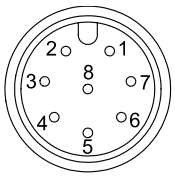


Transmission rate	**Cable length**	**Baud rate**
	50 m	100-400 kHz
	100 m	100-300 kHz

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

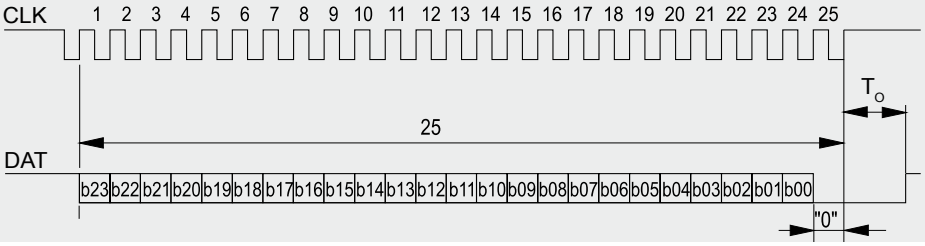
Note:
Extension of the cable length will reduce the maximum transmission rate.

View to sensor connector



Signal conditioner TSSI2 Absolute encoder synchronous serial	Interface	EIA RS422, RS485, short-circuit proof
	Excitation voltage	10 ... 30 V DC
	Excitation current	200 mA max.
	Clock frequency	100 kHz ... 1 MHz
	Code	Gray code, continuous progression
	Format	Fir tree
	Delay between pulse trains	12 to 35 µs
	Stability (temperature)	±20 x 10^{-6} / °C f.s. (sensor mechanism)
	Operating temperature	-20 ... +85 °C
	EMC	EN 61326-1:2006

Data format
(train of 26 pulses)



Transmission rate	**Cable length**	**Baud rate**
	50 m	100-1000 kHz
	100 m	100-300 kHz

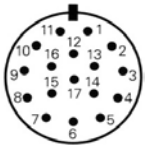
Signal wiring / connection	**Signal name**	**Connector Pin**
	Excitation +	7
	Excitation GND (0 V)	10
	CLOCK	8
	$\overline{\text{CLOCK}}$	9
	DATA	14
	$\overline{\text{DATA}}$	17
	Direction [1]	2
	Reset [2]	5

[1] Permanent connecting to Excitation + will reverse the rotating direction.

[2] A positive edge >1 ms will reset the actual position value.

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

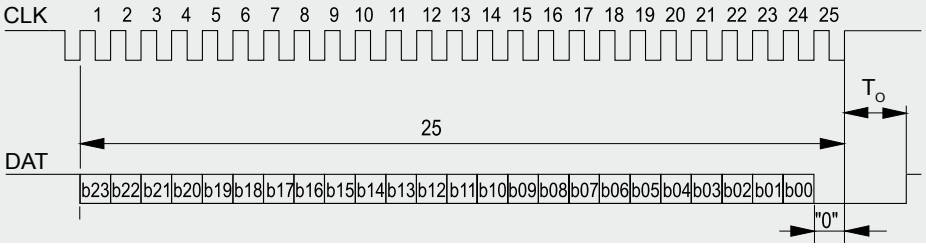
View to sensor connector



CONN-CONIN-17F

Signal conditioner HSSI Absolute encoder synchronous serial	Excitation voltage	10 ... 30 V DC
	Excitation current	100 mA
	Interface	Standard SSI
	Lines / drivers	Clock and data / RS422
	Code	Gray
	Resolution	24 Bit
	Data format	24 Bit
	3 dB cutoff frequency	500 kHz
	Control input	$\overline{\text{Direction}}$
	Preset key	Zero adjustment with optical response
	Alarm output	Alarm bit (SSI option), warning bit
	Status LED	Green = OK, red = alarm
	Connection	12 pin male socket
	EMC	EN 61326-1:2006

Data format
(train of 26 pulses)



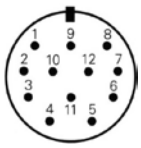
Transmission rate	**Cable length**	**Baud rate**
	< 50 m	< 400 kHz
	< 100 m	< 300 kHz
	< 200 m	< 200 kHz
	< 400 m	< 100 kHz

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

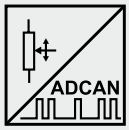
Signal wiring	**Signal name**	**Color**	**Connector pin no.**
	Excitation +	White	8
	Excitation GND (0 V)	Brown	1
	CLOCK	Yellow	3
	$\overline{\text{CLOCK}}$	Green	11
	DATA	Pink	2
	$\overline{\text{DATA}}$	Grey	10
	$\overline{\text{Direction}}$ *	Blue	5
	0 V Signal output	Black	12

* unconnected or Excitation + = cw increasing code
0 V = cw decreasing code

View to sensor connector



CONN-CONIN-12F

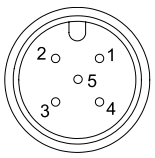
ADCANOP CANopen 	Communication profile	CANopen CiA 301 V 4.02, Slave
	Device profile	Encoder CiA 406 V 3.2
	Error Control	Node Guarding, Heartbeat, Emergency Message
	Node ID	Adjustable via LSS, default: 127
	PDO	3 TxPDO, 0 RxPDO, no linking, static mapping
	PDO Modes	Event-/Time triggered, Remote-request, Sync cyclic/acyclic
	SDO	1 Server, 0 Client
	CAM	2 cams
	Certified	Yes
	Transmission rates	50 kBit to 1 Mbit, adjustable via LSS, default: 125 kBit
	Bus connection	M12 connector, 5 pins
	Bus, galvanic isolated	No

Specifications	Excitation voltage	8 ... 36 V DC
	Excitation current	Typ. 15/30 mA for 24/12 V, max. 100 mA
	Resolution	16 bit f.s.
	Measuring rate	1 kHz (asynchronous)
	Stability (temperature)	±50 x 10^{-6} / °C f.s.
	Repeatability	1 LSB
	Operating temperature	-20 ... +85 °C
	Protection	Reverse polarity, short circuit
	Dielectric strength	1 kV (V AC, 50 Hz, 1 min.)
	Environment - EMC Automation	EN 61326:2006

Signal wiring / connection

Signal name	Connector pin no.
Shield	1
Excitation +	2
GND	3
CAN-H	4
CAN-L	5

View to sensor connector



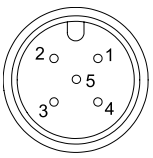
MCANOP CANopen 	Communication profile	CANopen CiA 301 V 4.02, Slave
	Encoder profile	Encoder CiA 406 V 3.2
	Error Control	Node Guarding, Heartbeat, Emergency Message
	Node ID	Adjustable via LSS; default: 127
	PDO	3 TxPDO, 0 RxPDO, no linking, static mapping
	PDO Modes	Event-/Time triggered, Remote-request, Sync cyclic/acyclic
	SDO	1 server, 0 client
	CAM	2 cams
	Certified	Yes
	Transmission rates	50 kbit to 1 Mbit, adjustable via LSS; default: 125 kbit
	Bus connection	M12 connector, 5 pins
	Integrated bus terminating resistor	120Ω
	Bus, galvanic isolated	No

Specifications	Excitation voltage	8 ... 36 V DC
	Excitation current	Typ. 20/40 mA for 24/12 V, max. 80 mA
	Measuring rate	1 kHz (asynchronous)
	Stability (temperature)	±50 x 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	According to EN 61326-1:2006

Signal wiring / connection

Signal	Connector pin
Shield	1
Excitation +	2
GND	3
CAN-H	4
CAN-L	5

View to sensor connector

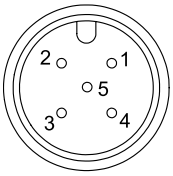


MCANJ1939 CAN SAE J1939 	CAN specification	ISO 11898, Basic and Full CAN 2.0 B	
	Transceiver	24V-compliant, not isolated	
	Communication profile	SAE J1939	
	Baud rate	250 kbit/s	
	Internal temination resistor	120 Ω	
	Address	Default 247d, configurable	
NAME Fields	Arbitrary address capable	1	Yes
	Industry 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 EF00h	Proprietary-A (PDU1 peer-to-peer)
	Process data	PGN FFnnh	Proprietary-B (PDU2 broadcast); nn Group Extension (PS) configurable
Specifications	Excitation voltage	8 ... 36 V DC	
	Excitation current	Typ. 20/40 mA for 24/12 V, max. 100 mA	
	Measuring rate	1 kHz (asynchronous)	
	Stability (temperature)	±50 x 10^{-6} / °C f.s.	
	Repeatability	1 LSB	
	Operating temperature	-20 ... +105 °C	
	Protection	Reverse polarity, short circuit	
	Dielectric strength	1 kV (V AC, 50 Hz, 1 min.)	
	EMC	EN 61326-1:2006	

Signal wiring / connection

Signal name	Connector pin no.
Shield	1
Excitation +	2
GND	3
CAN-H	4
CAN-L	5

View to sensor connector



Interface HCAN/HCANOP Absolute encoder CANopen/CAN Layer 2 	Excitation voltage	10 ... 30 V DC
	Excitation current	250 mA
	Interface	CAN highspeed according to ISO/DIS 11898
	Protocol	CANopen according DS301 with encoder profile DSP406, programmable encoder according class C2
	Resolution	12 (10 ... 14) + 12 bit
	Output code	Binary
	Data refresh	Every millisecond (selectable), on request
	Baud rate	Selectable 10 up to 1000 kbit/s
	Base identifier	Selectable via DIP switch
	Programmability	CANopen: direction, resolution, preset, offset CAN L2: direction, limit values
	Integrated special functions	CANopen: velocity, acceleration, rotary axis, limit values CAN L2: direction, limit values
	Connection	Bus cover with T manifold
	EMC	EN 61326-1:2006

Signal wiring	**Signal name**	**Cable terminal no. (bus cover)**
	U_B in	1
	0V in	2
	CAN in –	3
	CAN in +	4
	CAN GND in	5
	CAN GND out	6
	CAN out +	7
	CAN out –	8
	0V out	9
	U_B out	10

Notes: Download of the manual and the configuration file of the encoder at the ASM website **www.asm-sensor.com** in the “Downloads” section (hcanop_de_en.zip).

The encoder parameters must be set before operation!
In the subsequent electronics the 12 bit LSB resolution of the data sheet must be considered as a scaling factor.
If the encoder is set to another single turn resolution, the scaling factor is the result of the resolution of the cable drum of the WS sensor per revolution and the resolution of the encoder.

Example:
WS19KT-15000 with angle encoder 13 bit/revolution, distance/revolution 600 mm
Scaling factor: 600 mm / 2^13 = 600 mm / 8192 = 0,073242 mm / Bit (= LSB resolution)

Interface HDEV Absolute encoder DeviceNet 	Excitation voltage	10 ... 30 V DC
	Excitation current	250 mA
	Interface	CAN highspeed according to ISO/DIS 11898 CAN specification 2.0 A (11 bit identifier)
	Protocol	DeviceNet according rev. 2.0, programmable encoder
	Resolution	12 (10 ... 14) + 12 bit
	Output code	Binary
	MAC-ID	Selectable via DIP switch
	Date refresh	Every 5 ms
	Baud rate	Selectable via DIP switch: 125 kBaud, 250 kBaud, 500 kBaud
	Programmability	Resolution, preset, direction
	Bus terminating resistor	Selectable via DIP switch
	Connection	Bus cover with T manifold
	EMC	EN 61326-1:2006

Recommended transmission	Characteristic impedance	135 ... 165 Ω (3 ... 20 MHz)
	Operating capacity	< 30 pF
	Loop resistance	< 110 Ω/km
	Wire diameter	> 0.63 mm
	Wire width	> 0.34 mm²

Transmission rate	**Segment length**	**Kbit/s**
	500 m	125
	250 m	250
	100 m	500

Signal wiring	**Signal name**	**Cable terminal no. (bus cover)**
	U_B in	1
	0V in	2
	CAN-L	3
	CAN-H	4
	Drain	5
	Drain	6
	CAN-H	7
	CAN-L	8

Notes: Download of the manual and the configuration file of the encoder at the ASM website **www.asm-sensor.com** in the “Downloads” section (hdev_de_en.zip).

The encoder parameters must be set before operation!
In the subsequent electronics the 12 bit LSB resolution of the data sheet must be considered as a scaling factor.
If the encoder is set to another single turn resolution, the scaling factor is the result of the resolution of the cable drum of the WS sensor per revolution and the resolution of the encoder.

Example:
WS19KT-15000 with angle encoder 13 bit/revolution, distance/revolution 600 mm
Scaling factor: 600 mm / 2^13 = 600 mm / 8192 = 0,073242 mm / Bit (= LSB resolution)

Interface HPROF Absolute encoder Profibus 	Excitation voltage	10 ... 30 V DC
	Excitation current	250 mA
	Interface	RS485
	Protocol	Profibus DP with encoder profile C2
	Resolution	12 (10 ... 14) + 12 bit
	Output code	Binary
	Baud rate	Automatically selected between 9,6 kBaud and 12 MBaud
	Programmability	Resolution, preset, direction
	Integrated special functions	Velocity, acceleration, operating time
	Bus terminating resistor	Selectable via DIP switch
	Connection	Bus cover with T manifold
	EMC	EN 61326-1:2006

	Signal name	**Cable terminal no. (bus cover)**
Signal wiring	U_B in	1
	0V in	2
	U_B out	3
	0V out	4
	B in	5
	A in	6
	B out	7
	A out	8

Notes: Download of the manual and the configuration file of the encoder at the ASM website **www.asm-sensor.com** in the “Downloads” section (hprof_de_en.zip).

The encoder parameters must be set before operation!
In the subsequent electronics the 12 bit LSB resolution of the data sheet must be considered as a scaling factor.
If the encoder is set to another single turn resolution, the scaling factor is the result of the resolution of the cable drum of the WS sensor per revolution and the resolution of the encoder.

Example:
WS19KT-15000 with angle encoder 13 bit/revolution, distance/revolution 600 mm
Scaling factor: 600 mm / 2^13 = 600 mm / 8192 = 0,073242 mm / Bit (= LSB resolution)

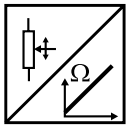
Interface HINT Absolute encoder Interbus 	Excitation voltage	10 ... 30 V DC
	Excitation current	250 mA
	Interface	Interbus, ENCOM profile K3 (configura-ble), K2
	Output code	32 Bit binary
	Baud rate	500 kBaud
	Data refresh	Every 600 µs
	Resoution	12 (10 ... 14) + 12 bit
	Programmability	Direction, preset, offset, resolution
	Connection	Bus cover with T manifold
	EMC	EN 61326-1:2006

Data format Interbus K2/K3		Differential signals (RS485) ENCOM profile K3, K2, 32 Bit, binary process data
	DT-Format	Sµpi address 0 1 2 3
	(according to the Phoenix company)	Byte No. 3 2 1 0
	ID code K2	36 H (= 54 dec.)
	ID code K3	37 H (= 55 dec.)

Signal wiring	**Signal name**	**Cable terminal no. (bus cover)**
	U_B +	1
	GND	2
	DI1	3
	$\overline{DI1}$	4
	DO1	5
	$\overline{DO1}$	6
	DO2	7
	$\overline{DO2}$	8
	DI2	9
	$\overline{DI2}$	10
	RBST	11
	GND	12

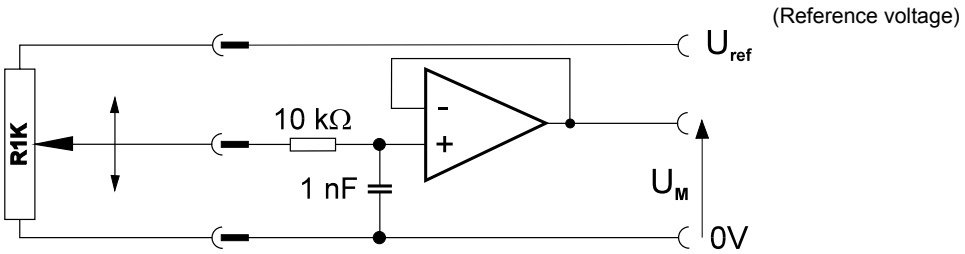
Voltage divider R1K

Potentiometer

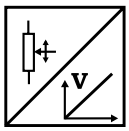


The output signal is the ratiometric voltage of a potentiometer. The potentiometer is supplied by a reference voltage source. The ratio of the output signal to the reference voltage is proportional to the measuring cable extension. For optimum performance of the sensor 94% (3% to 97%) of the potentiometers total span is used for the specified measurement range. Provision for setting the electrical zero and voltage amplification must be made in the subsequent signal processing circuit. To avoid linearity error the output load should be as low as possible. Therefore the input impedance of the processing circuit must be ≥10 MΩ.

Suggested output circuit

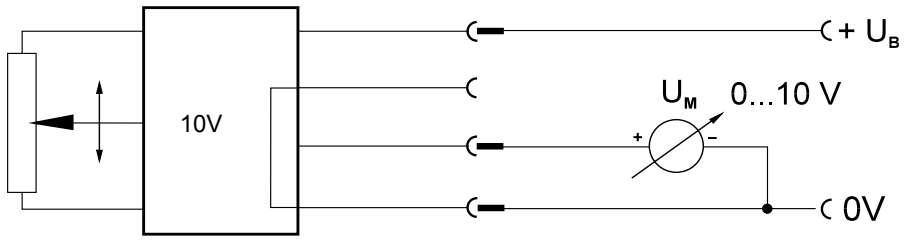


Voltage output 0 ... 10 V (10V)

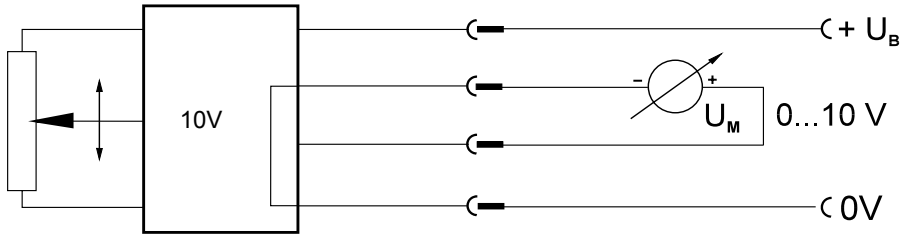


This output signal is 0 to 10 Volts proportional to the measuring cable extension of 0 to 100%. This is an industry standard output which is widely accepted because of its simple signal processing and suitability for all display, recording and automation systems. For analog signal processing the voltage output is the proven best choice, e.g. for Waveform Analyzers, Data Loggers and for analog and digital Oscilloscopes. ASM´s 0...10 V output supports a wide range of excitation voltages and is well protected against electromagnetic interference.

Suggested output circuit

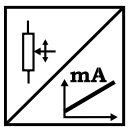


3 wire



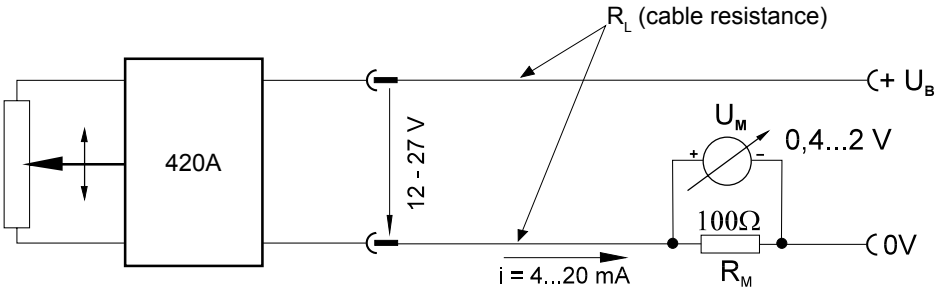
4 wire

Current output 4 ... 20 mA (420A) (2 wire)

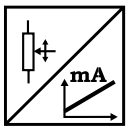


This output signal is a 4 to 20 mA current loop proportional to the measuring cable extension of 0 to 100%. It is an industry standard two-wire system for the transmission of measured values. The current loop is both measurement signal and sensor excitation current. The measured value is represented as a voltage drop across a load resistor RM. The current is constant and the signal cable resistance (RL) will have no effect on the measured value. Therefore long signal cables can be used, limited only by the cable resistance (impedance). Signal cable disconnection or failure can be detected by a 0 mA current signal.

Suggested output circuit

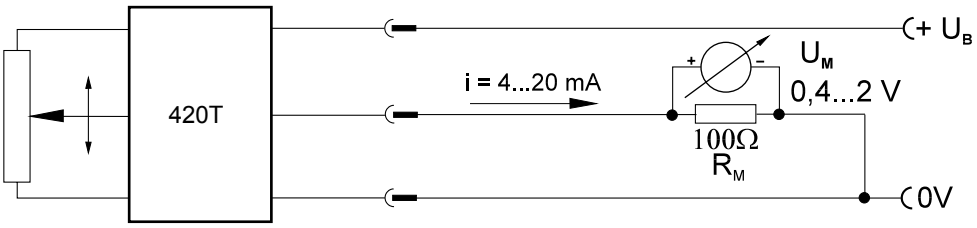


Current output 4 ... 20 mA (420T) (3 wire)



This output signal is a 4 to 20 mA current loop (alternatively 0 to 20 mA) proportional to the measuring cable extension of 0 to 100%. The 3 wire current loop system is especially resistant to electromagnetic interference because of the separate sensor excitation and the low resistance (impedance) of the signal processing electronics. As in the two-wire system the measured value is represented as a voltage drop across a load resistor RM and is, within limits, independent of the cable resistance (impedance).

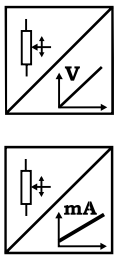
Suggested output circuit

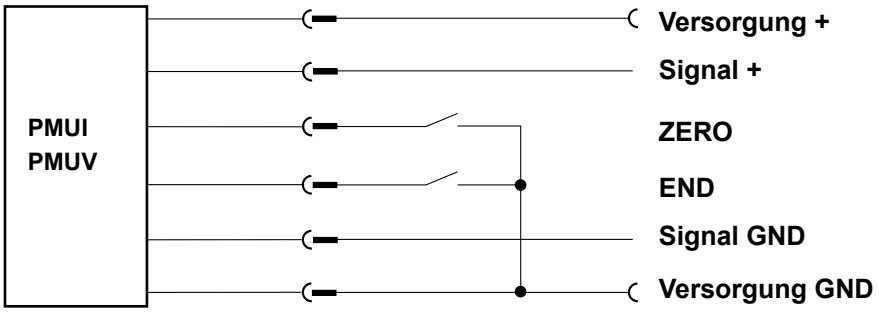


Programming of the start and end value by the customer

Option -PMUI, -PMUV
Two-wire programming

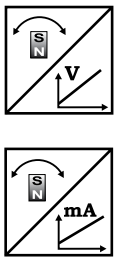
Teach-In of start and end value for the options PMUI and PMUV is provided by two binary signals ZERO and SPAN. At the start position connect signal ZERO for a short period to GND via push button. At the end position connect signal END for a short period to GND. The teached positions will be stored non-volatile. To reset the sensor to factory default both signals ZERO and SPAN must be connected to ground while powering up the sensor.

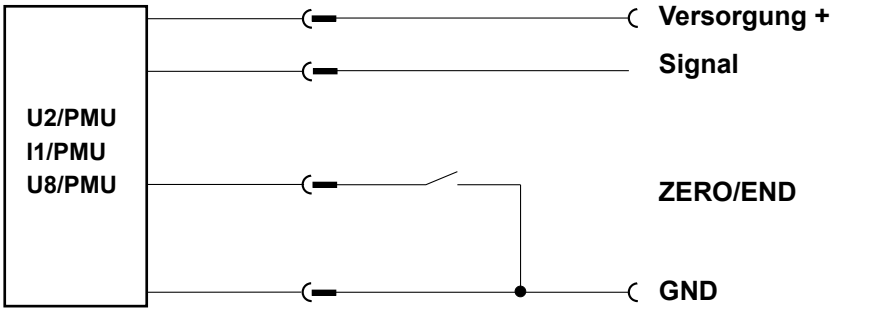




Option –U2/PMU, -I1/PMU, -U8/PMU
Single-wire programming

Teach-In of start and end value for the options U2/PMU, I1/PMU, U8/PMU is provided by a binary signal ZERO/END. At the start position connect signal ZERO/END for a period of 2 … 3 seconds to GND via push button. At the end position connect signal ZERO/END 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. For the option PMZ only teach-in of ZERO position is possible.





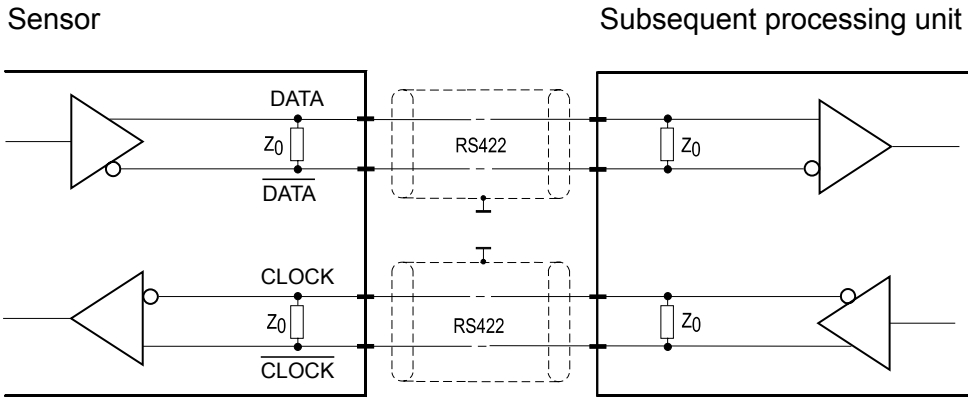
SSI Interface

The data is transmitted with the use of both the CLOCK and DATA signals. The system controller (PLC, microcomputer) sends the CLOCK signal which also determines the data transmission rate. With the first falling edge of the CLOCK signal, the position data is captured. The next rising edges control the A/D conversion, encoding and release of data word. After a time delay, the next new position data will be transmitted.

CAUTION

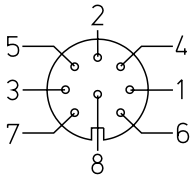
Warning Note:
If the GND (0V) signal connection is missing the signals DATA and $\overline{\text{DATA}}$ will rise to the potential of the excitation voltage. This may damage the input circuit of the subsequent processing unit if this unit is not connected with galvanic isolation (e.g. opto-coupling devices). This will happen especially when the mating connector is disconnected while power is on.

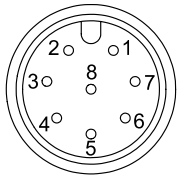
Wiring



Connection table

Signal wiring		
Male socket CONN-DIN-8F Pin No.	Cable output according to DIN47100, color	Male socket CONN-M12-8F Pin No.
1	White	1
2	Brown	2
3	Green	3
4	Yellow	4
5	Gray	5
6	Pink	6
7	Blue	7
8	Red	8
KAB-xM-xxx/8F/x-LITZE		





Output signals for position				
R1K/R500...R10K Potentiometer	10V/5V/1V/PM5V Voltage output	420A Current output 2 wire	420T Current output 3 wire	PP530 *) Pulse output Incremental
Potentiometer +	Excitation +	Signal +	Excitation +	Excitation +
Potentiometer GND	Excitation GND	Signal –	Excitation GND	Excitation GND
Pot slider	Signal +		Signal +	Signal B (A+90°)
	Signal GND		(Signal GND)	Signal A
				Signal $\overline{B}$
				Signal $\overline{A}$
				Signal Z (Ref.)
				Signal $\overline{Z}$

For output configurations not listed in this table refer to data sheets or special connection diagrams

*) See note page 16

Signal wiring		
Male socket CONN-DIN-8F Pin No.	Cable output according to DIN47100, color	Male socket CONN-M12-8F Pin No.
1	White	1
2	Brown	2
3	Green	3
4	Yellow	4
5	Grey	5
6	Pink	6
7	Blue	7
8	Red	8
KAB-xM-xxx/8F/x-LITZE		

Output signals for position and velocity					
R1K/R500...R10K Position T5/TA Velocity	10V/5V/1V/PM5V/ 420T Position T5/TA Velocity	420A Position T5/TA Velocity	R1K/R500...R10K Position V2...V250 Velocity	10V/5V/1V/PM5V/ 420T Position V2...V250 Velocity	420A Position V2...V250 Velocity
Potentiometer +	Excitation +	Signal Pos. +	Potentiometer +	Excitation +	Signal Pos. +
Potentiometer GND	Excitation GND	Signal Pos. –	Potentiometer GND	Excitation GND	Signal Pos. –
Pot slider	Signal +	Not connected	Pot slider	Signal Pos. +	Excit. velocity+
Not connected	Signal GND	Not connected	Excit. velocity+	Signal Pos. GND	Excit. velocity GND
Velocity +	Velocity +	Velocity +	Velocity +	Velocity +	Velocity +
Velocity GND	Velocity GND	Velocity GND	Excit. velocity GND	Velocity GND	Velocity GND

CE

Declaration of Conformity

We

ASM GmbH
Am Bleichbach 18 - 22
D-85452 Moosinning

declare under our sole responsibility that the product

Name: Position sensor

Type: **WS7.5, WS10, WS10P, WS12, WS12P, WS17, WS17P, WS19, WS31, WS42, WS58, WS60, WS61, WS100M**

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

Directives: 2004/108/EG (EMV)

Standards: EN 61326-1:2006 (EMV)

Moosinning, 20.07.2011

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