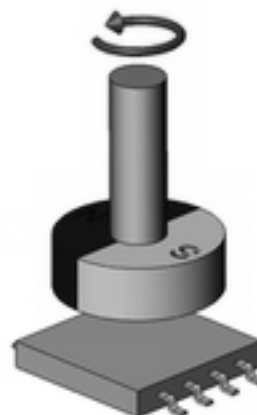


## Series ENS28 - EcoTurn® - Contactless, programmable angle sensor with serial interface, housing Ø28mm

- Contactless sensor technology
- Well-priced, rugged plastic housing Ø28mm
- 3 housing types: Bushing, Flange and Kit version
- Encapsulated electronic
- Resolution SPI-Interface 14 Bit
- Resolution SSI-Interface 12 Bit
- With and without stop (bushing version)
- With several actuating torques
- Long lifetime by polymer sleeve bearing or sinter bronze bearing
- SSI-Standard offers:
  - high interference resistance by push-pull-signals
  - simple connection to PLC's, counters, etc.
- Supply voltage 5 VDC, 9-30 VDC
- Numerous mechanical and electrical options



ENS28B - Bushing Version	ENS28F - Flange Version	ENS28K - Kit Version
		

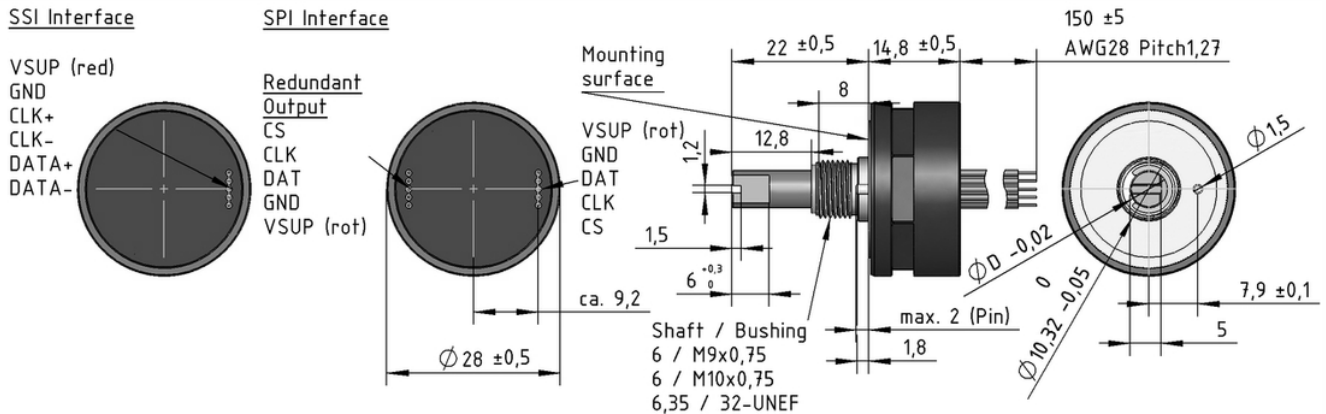
Electrical Data	
Electrical rotation angle	360°
Resolution / 360°	14 Bit SPI-Interface / 12 Bit SSI-Interface
Independent Linearity	± 0,5 %
Update rate	SPI: 5 kHz / SSI: 10 kHz
Supply voltage	4,5-5,5 VDC / 9-30VDC
Supply current (no load)	30 mA

Cable configuration		SPI Interface			SSI Interface		
Lead 1	red	VDD	Supply		VDD	Supply	
Lead 2	grey	GND	Ground		GND	Grund	
Lead 3	grey	DATA	Data	bi directional	CLK +	Clock	Input
Lead 4	grey	CLK	Clock	Input	CLK-	Inverse clock	Input
Lead 5	grey	CS	Chip select	Input	DATA +	Data	Output

# Series ENS28 - EcoTurn® - Contactless, programmable angle sensor with serial interface, housing $\varnothing 28\text{mm}$

Cable configuration		SPI Interface			SSI Interface		
Lead (SSI only)	grey	--	--	--	DATA-	Inverse data	Output

## ENS28B Bushing-Version



ENS28B	Mechanical Data	
	Mechanical angle (with stop)	320° + 5°/-0°
	Mechanical rotational speed with brass bearing with high-performance polymer sleeve bearing	400 rpm 4000 rpm
	Life time with brass bearing Life time with polymer sleeve bearing	> 10 Mio. revolutions (dependent on application) > 25 Mio. revolutions (dependent on application) tested under room temperature, with radial load 1N, without o-ring
	Starting torque: Option LT (Low Torque) Option MT (Medium Torque) Option HT (High Torque)	: < 0,5 Ncm (smooth running grease/ basic type w/o stop) 0,3 - 1 Ncm (special grease / basic type with stop) > 1 Ncm (special high viscosity grease)
	Stopper strength when endstop	< 80 Ncm
	Maximum torque mounting nut	1 Nm

ENS28B	Other Data	
	Protection class with optional sealing ring	IP65 (electronic and cable generally encapsulated) At temperature below 0°C we recommend the optional sealing ring
	Operating temperature	-40 ... + 85 °C fixed cable (please ask for other temperatures)
	Storage temperature	-40 ... + 105 °C (+ 90 °C with polymer sleeve bearing)
	Bearing basic type with Stop Bearing basic type without Stop and Option P	Brass bushing on stainless-steel shaft Polymer sleeve bearing on stainless-steel shaft
	Housing material	fiberglass reinforced polyamide (Nylon 66/30% GF)
	Shaft material	stainless steel
	Mountin parts (included)	hex-nut (wrench size 14mm), tooth washer
	Weight	approx. 20 g

# Series ENS28 - EcoTurn® - Contactless, programmable angle sensor with serial interface, housing Ø28mm

## Options and Order Description for Bushing Version

Description	Basic Type				Options					
EcoTurn with serial interface, Housing 28mm, Bushing-Version	ENS28B									
Bushing M10 / Welle Ø 6mm Bushing M9 / Welle Ø 6mm Bushing 3/8" / Welle Ø 6,35mm		1 2 3								
Redundant Verison (SPI Interface only)		X								
Resolution SPI 14 Bit Resolution SSI 12 Bit			14 12							
Supply voltage / Output signal: 5V ± 10% / SPI Interface 5V / SSI Interface 9-30V / SSI Interface				05SPI 05SSI 24SSI						
Mechanical angle: Basic type with stop 320° Mechanical angle: Basic type without stop 360°					SCW320 OCW360		MT LT			
Mechanical angle redundant, basic type		X			SCW320 /CCW320 OCW360 /CCW360		MT LT			
Mechanical angle 90°, 180°, 270° (S = with Stop) (identical to elec. angle)					SCW90 SCW180 SCW270					
Mechanical angle 90°, 180°, 270° redundant		X			SCW90 /CCW90 SCW180 /CCW180 SCW270 /CCW270					
Optional electrical direction: (O = without stop) Counter-clockwise: CCW...					OCW360 OCCW360					
Optional electrical direction redundant		X			OCW360/CW360 OCW360 /CCW360 OCCW360/CCW360 OCCW360/CW360					
Zero point orientation* (versions without stop only)							N			
Polymer sleeve bearing (not with option D) * (only with bushing M10 /shaft Ø 6mm = mounting B1)							P			
Torque: LT...Smooth running grease (basic type without stop) MT...Special grease (basic type with stop) HT...Special high viscosity grease							LT MT HT			
Sealing ring IP65 (not with option P) *								D		
Shaft length [mm] (Standard 22 mm)								Axx		
Cable length [m] (Standard 0,15m)									CVxx	
<b>Example Standard Electronics With Options</b>	<b>ENS28B</b>	<b>2</b>	<b>X</b>	<b>12</b>	<b>05SSI</b>	<b>OCW360</b>	<b>N</b>	<b>LT</b>	<b>A30</b>	<b>CV0,1</b>
EcoTurn, serial interface, 28mm housing, 9mm bushing and 6mm shaft, resolution 12 Bit, supply 12 Bit, SSI-interface, without stop, rot. angle 360°, zero-point orientation, low torque, shaft length 30mm, cable length 0,1m										
<b>Example redundant version</b>	<b>ENS28B</b>	<b>2</b>	<b>X</b>	<b>12</b>	<b>05SPI</b>	<b>OCW360 /CCW360</b>				
EcoTurn, serial interface, 28mm housing, 9mm bushing and 6mm shaft, redundant version, resolution 12 Bit, SPI-interface, without stop, 1. angle 360° - direction CW, 2. angle 360° - Direction CCW										

# Series ENS28 - EcoTurn® - Contactless, programmable angle sensor with serial interface, housing $\varnothing 28\text{mm}$

Please note before order

The meaning of CWxx is a rising signal level if you turn the shaft in clockwise direction (view on shaft top).

The mechanical zero point is adjusted when the shaft flattening is in direction of the anti rotation pin (bushing version) or with the zero score (flange version).

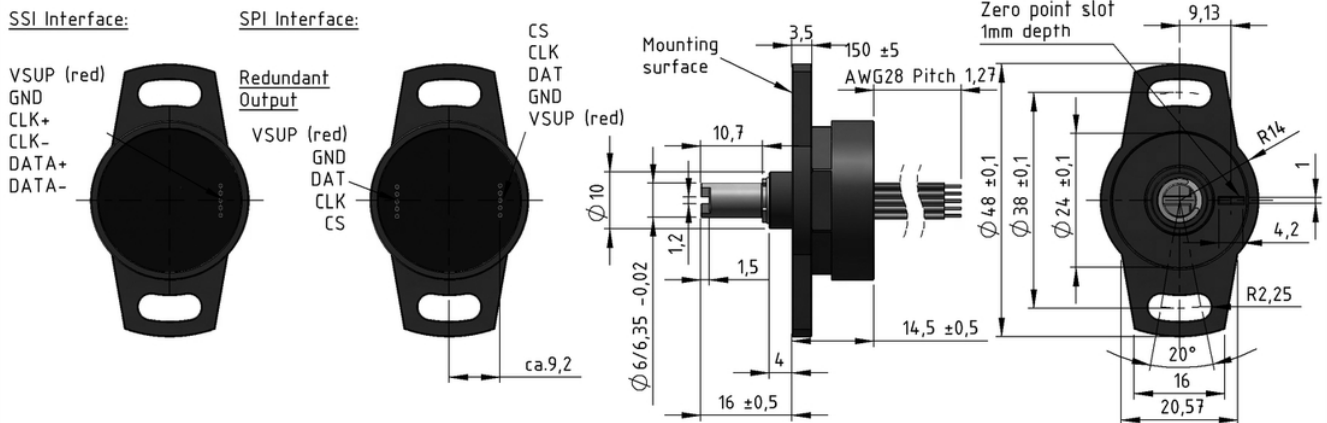
At the base type without stop there is no alignment between electrical and mechanical angle. The option "N" assigns the electrical zero position (minimum signal level) to the mechanical zero position. You also can specify an offset value (please refer to the standard option E2).

At the base types with mechanical stops the electrical zero position is on the ccw stop. That means the signal is rising from the minimum level if you turn the shaft in CW direction. When the shaft flattening is in direction of the anti rotation pin, the signal level is at 50% of full scale.

The option D (sealing ring) AND the polymer sleeve bearing are available only on special request.

## ENS28F Flange Version

In progress: Samples available, production run from July/2011



ENS28F	Mechanical Data	
	Maximum rotational speed	4000 rpm
	Life time with polymer sleeve bearing	> 25 Mio. revolutions (dependent on application) tested under room temperature, with radial load 1N
	Operating torque	0,2 -0,6 Ncm

ENS28F	Other Data	
	Protection class electronic	IP65 (electronic and cable generally encapsulated)
	Operating temperature	-40 ... +85 °C fixed cable (please ask for other temperatures)
	Storage temperature	-40 ... +90 °C
	Bearing	sinter bronze bearing
	Housing material	fiberglass reinforced polyamide (Nylon66/30% GF)
	Shaft material	stainless steel
	Weight	approx. 20 g

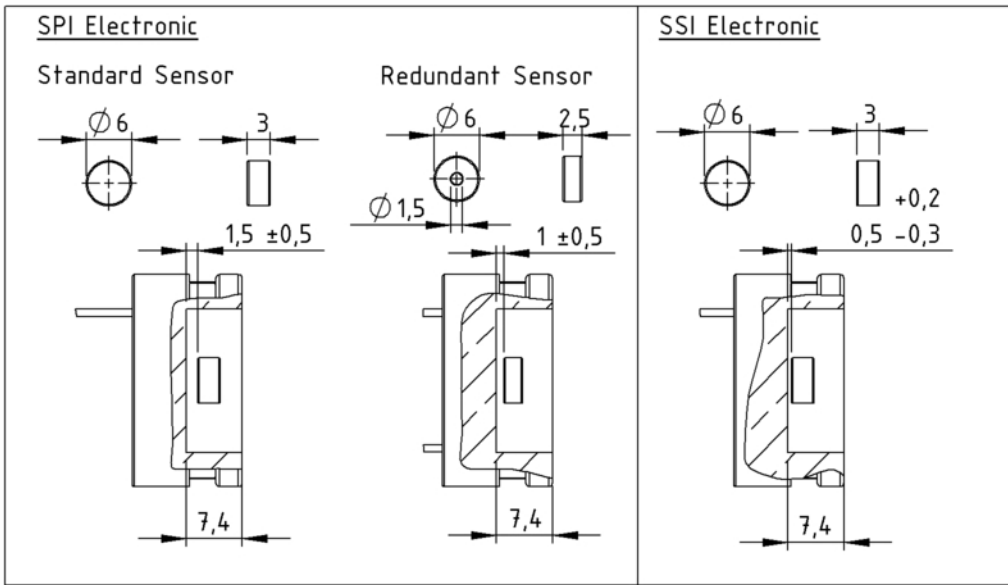
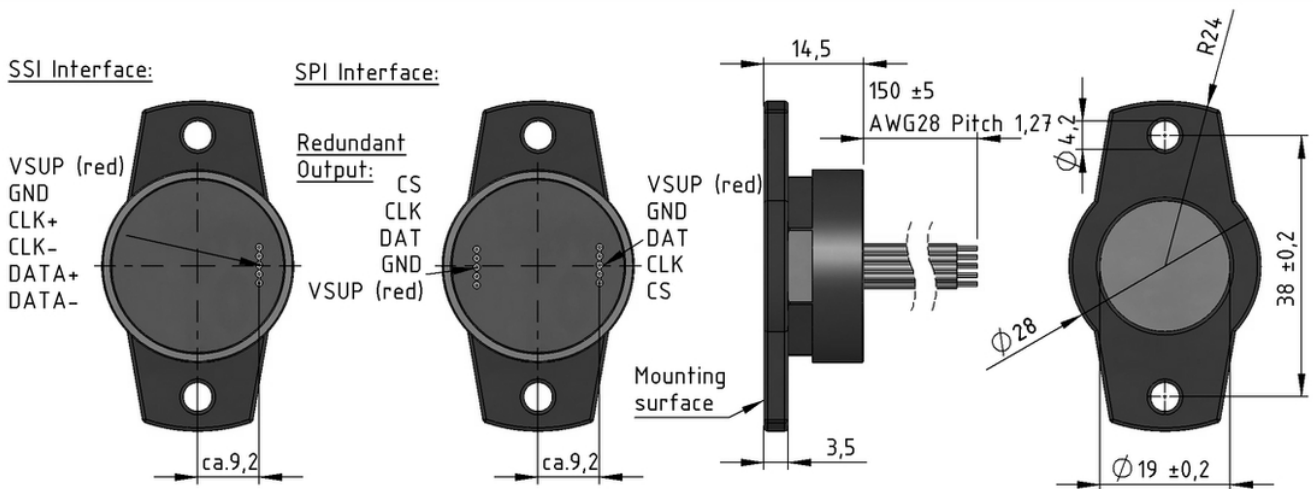
# Series ENS28 - EcoTurn® - Contactless, programmable angle sensor with serial interface, housing Ø28mm

## Options and Order Description for Flange Version

Description	Basic Type					Options			
EcoTurn with serial interface, housing 28mm, flange-version	ENS28F								
Mounting Flange (shaft Ø 6mm)		1							
Mounting Flange (shaft Ø 6,35mm)		2							
both with sinter bronze bearing									
Redundant Output (SPI-Interface only)			X						
Resolution SPI 14 Bit				14					
Resolution SSI 12 Bit				12					
Supply voltage / Output signal: 5V ± 10% / SPI Interface 5V / SSI Interface 9-30V / Interface					05SPI				
					05SSI				
					24SSI				
Mechanical angle: Basic type with stop 320° *						SCW320			
Mechanical angle: Basic type without stop 360°						OCW360			
Mechanical angle redundant			X			SCW320 /CCW320			
						OCW360 /CCW360			
Variable electrical direction (O = without stop) counter-clockwise: CCW...						OCW360			
						OCCW360			
Variable electrical direction			X			OCW360 /CCW360			
						OCCW360 /CW360			
Zero point orientation* (versions without stop only)							N		
Shaft length [mm] (Standard 16mm)								Axx	
Cable length [m] (Standard 0,15m)									CVxx
<b>Example Standard Electronics with Options</b>	<b>ENS28F</b>	<b>1</b>		<b>12</b>	<b>05SSI</b>	<b>OCW360</b>	<b>N</b>	<b>A30</b>	<b>CV0,1</b>
EcoTurn with serial interface, 28mm housing, flange and 6mm shaft, resolution 12 bit, supply voltage 5V, SSI-interface, without stop, angle direction CW, rotation angle 360°, zero point orientation, shaft length 30mm, cable length 0,1m									
<b>Example Redundant Version</b>	<b>ENS28F</b>	<b>1</b>	<b>X</b>	<b>12</b>	<b>05SPI</b>	<b>OCW360 /CCW360</b>			
EcoTurn with serial interface, 28mm housing, flange and 6mm shaft, resolution 12 bit, supply voltage 5V, SPI-interface, without stop, 1. angle 360° - direction CW, 2. angle 360° - direction CCW									

# Series ENS28 - EcoTurn® - Contactless, programmable angle sensor with serial interface, housing $\varnothing 28\text{mm}$

## ENS28K Kit Version



If the shaft is magnetical, the distance between shaft and magnet has to be  $\geq 1\text{mm}$

ENS28K	Other Data	
	Protection class	IP65
	Operating temperature	-40 ... +85 °C fixed cable (please ask for other temperatures)
	Storage temperature	-40 ... +105 °C
	Housing material	fiberglass reinforced polyamide (Nylon66/30% GF)
	Weight	approx. 20 g

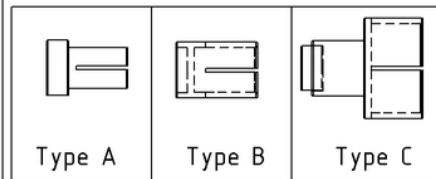
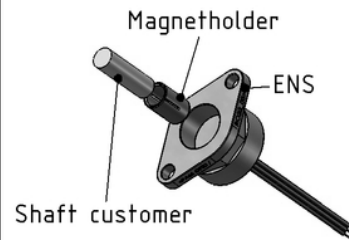
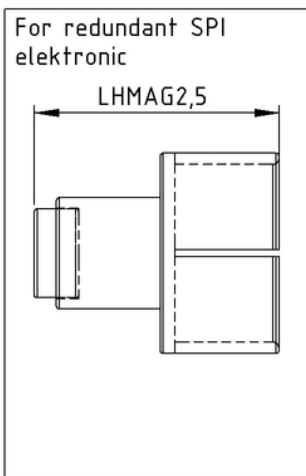
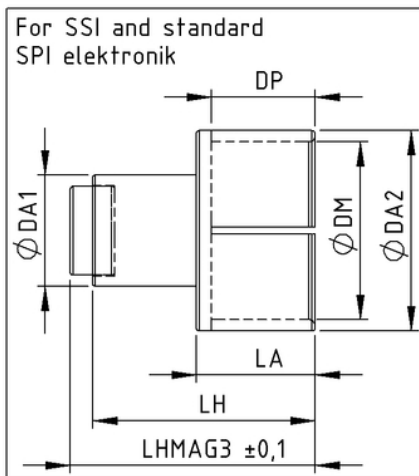
# Series ENS28 - EcoTurn® - Contactless, programmable angle sensor with serial interface, housing Ø28mm

## Options and Order Description for Kit Version

Description	Basic Type				Options	
EcoTurn with serial interface, housing 28mm, Kit-Version	ENS28K					
Redundant Output (SPI-interface only)		X				
Resolution SPI 14 Bit Resolution SSI 12 Bit			14 12			
Supply voltage / Output signal: 5V ± 10% / SPI interface 5V / SSI interface 9-30V / interface				05SPI 05SSI 24SSI		
Variable electrical direction (O = without stop) clockwise: CW.. counter-clockwise: CCW...					OCW360 OCCW360	
Variable electrical direction redundant					OCW360/CW360 OCW360 /CCW360 OCCW360/CCW360 OCCW360/CW360	
Cable length [m] (Standard 0,15m)						CVxx
<b>Example Standard Electronics with Options</b>	<b>ENS28K</b>		<b>12</b>	<b>05SSI</b>	<b>OCW360</b>	<b>CV0,1</b>
EcoTurn with serial interface, 28mm housing, kit mounting, resolution 12 bit, supply voltage 5V, SSI-interface, without stop, angle direction CW, rotation angle 360°, cable length 0,1m						
<b>Example Redundant Version</b>	<b>ENS28K</b>	<b>X</b>	<b>12</b>	<b>05SPI</b>	<b>OCW360 /CCW360</b>	
EcoTurn with serial interface, 28mm housing, kit mounting, redundant version, resolution 12 bit, supply voltage 5V, SPI-interface, without stop, 1. angle 360° - direction CW, 2. angle 360° - direction CCW						

# Series ENS28 - EcoTurn® - Contactless, programmable angle sensor with serial interface, housing $\varnothing 28\text{mm}$

## Accessories to Kit-Version



Type	DM	DA1	DA2	LH	LA	DP	LHMAG3 analog standard	LHMAG 2,5 analog redundant	$\varnothing$ Shaft (h9)
A	3	7,5	4,5	11	---	8,5	12,5	12	3 +0/-0,030
	3,175	7,5	4,5	11	---	8,5	12,5	12	3,175 +0/-0,030
	4	7,5	5,5	11	---	8,5	12,5	12	4 +0/-0,030
B	6	7,5	7,5	11	---	8,5	12,5	12	6 +0/-0,030
	6,35	7,5	7,5	11	---	8,5	12,5	12	6,35 +0/-0,036
	8	9,5	9,5	11	---	8,5	12,5	12	8 +0/-0,036
	10	11,5	11,5	11	---	8,5	12,5	12	10 +0/-0,036
C	12	7,5	13,5	15	8	7	16,5	12	12 +0/-0,043

If the shaft is magnetical, in case of Type B the distance between shaft an magnet has to be  $\geq 1$  mm

### Order Description Magnet Holder

Standard electronic	Push-On-Type DM.. * MAG6x3	available shaft diameter pls. see table above
Redundant electronic	Push-On-Type DM.. * MAG6x2,5X1,5	



# Series ENS28 - EcoTurn® - Contactless, programmable angle sensor with serial interface, housing Ø28mm

## Overview of all options (Bushing, Flange and Kit-Version)

### Mechanical Standard Options low price, short delivery time

Endstop 90°, 180°, 270° (Bushing-Version only)	SCW
Zero point orientation (offset 0°) (not for Kit-Version)	N
Low torque by smooth-running grease (Bushing-Version only): Low Torque	LT
Increased torque by special grease (Bushing-Version only): Medium Torque	MT
Increased torque by high viscosity grease (Bushing-Version only): High Torque	HT
Sealed shaft IP65 (bushing version only, not with polymer bearing)	D
Shaft length from mounting surface	A..
Extended cable, axial	CV...
Polymer sleeve bearing (only Bushing-Version: M10 / shaft Ø6mm)	P

### Mechanical Special Options (MS) possible options, additional tooling fee, increased delivery time

Without anti rotation pin (for bushing version only)	MS1
Other stop than 90° / 180° / 270° / 320°	MS2
Special shaft shape	MS3
Special shape of housing and mounting	MS4
Metal cap for magnetic protection	MS5
Special cable: round cable, connector or anything else	MS6
Special bushing: shape, diameter	MS7

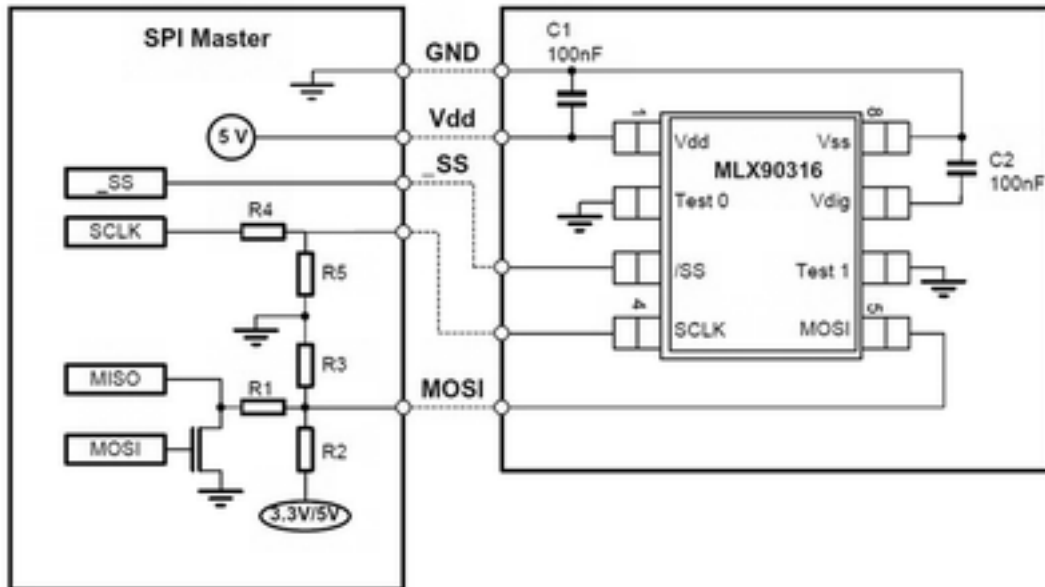
### Electrical Standard Options (ES) Electrical or programmable options to basic type, low price, short delivery time

<b>Zero point positioning</b> The mechanical zero point is established when the shaft marking is aligned with the marking on the sensor housing. The electrical zero point can be aligned to the mechanical zero point. Nevertheless the zero point can be programmed at any offset according to customer requirement. Offset 0° = Standard option N	ES1
<b>Rotational direction</b> The standard direction of rotation is clockwise (CW). It is also possible with this option to change the direction from clockwise(CW) to counter-clockwise (CCW).	ES2
<b>2-channel-output</b> This is made up of a Hall sensor Chip consisting of 2 galvanically separated sensing elements. One magnet provides magnetic field simultaneously for both elements. Channel 2 can also be programmed completely different than channel 1.	ES3

# Series ENS28 - EcoTurn® - Contactless, programmable angle sensor with serial interface, housing Ø28mm

## Brief description of serial interfaces

### SPI Interface



Schematic wiring diagram:

Left side: Master (Microprocessor Application) / Right side: Slave EcoTurn SPI

Reference: data sheet Melexis series MLX90316

Preferably microcontrollers with SPI-Interface (Serial-Peripheral-Interface) have the best performance.

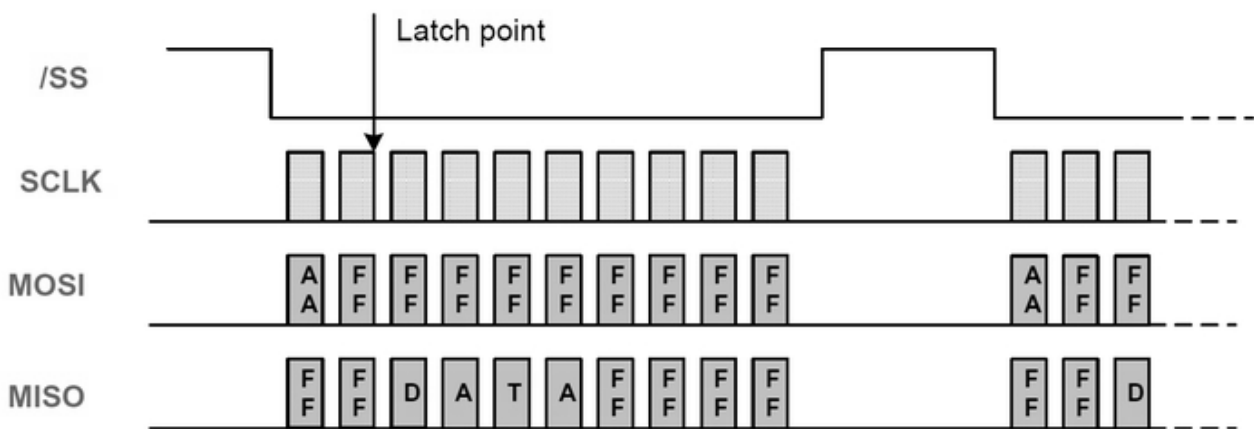
But also each other microprocessor with an open drain I/O can be used. The communication protocol is very easy and there are just 3 signal wires: > SS..Slave-Select, > SCLK..Clock, > MOSI-MISO..DataLine

The bidirectional data transmission at the EcoTurn SPI series is done only over one I/O-port because master and slave are using the line alternatively in a dedicated sequence as follows:

- Master: 2 Startbytes (AAh and FFh)
- Slave (ecoTurn): Two data bytes followed by two inverted databytes
- 4 bytes no activity from master and slave (FFh)

The following schematic shows the sequence. Please note that the 8 clock cycles for one byte is abstracted by a single clock symbol. The signals MOSI and MISO are transmitted over a single wire (according to the wiring diagram above).

For further details please have a look in the internet: [www.melexis.de](http://www.melexis.de) (Series MLX90316).

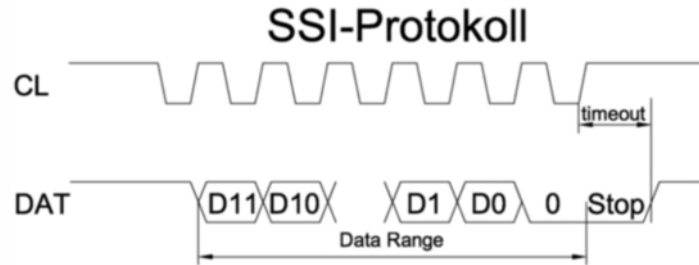


Schematic visualisation of the communication (Series MLX90316)

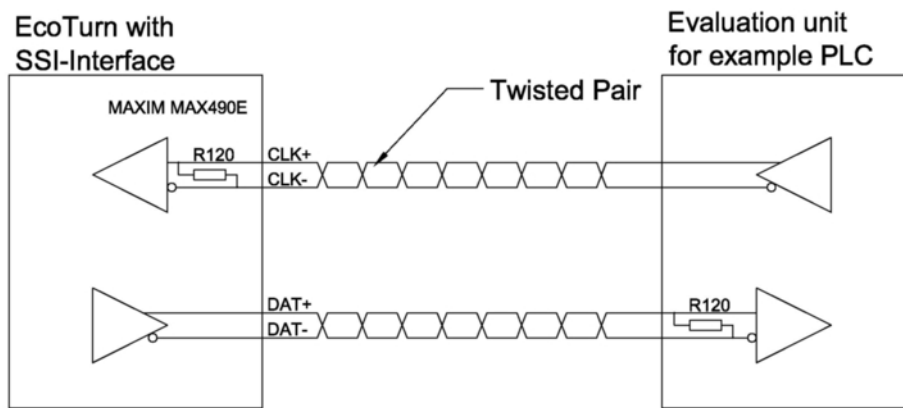
# Series ENS28 - EcoTurn® - Contactless, programmable angle sensor with serial interface, housing Ø28mm

## SSI Interface

The SSI-Interface is wide spread in industrial applications with absolute angle sensors. There are a lot of programmable logic controls (PLC) or other peripheral appliances like counters available that can be easily configured for this communication. Furthermore this interface is very insensitive against electromagnetic interferences because of the differential signals that should be transmitted via twisted pair leads.



Timing SSI-Interface



EcoTurn SSI wiring

All the specifications and information in this data sheet can not consider the special demands that are caused by the application. Because of this, they are no general description of the properties of the product. Please consider also our detail specifications. The lifetime specification was tested under room temperature 20 °C, without o-ring.

Please find the exact specifications of the output signals in the datasheets of the chip manufacturer. SPI: Melexis, (Series MLX90316) [www.melexis.de](http://www.melexis.de); SSI: IC-Haus, (series IC-MH) [www.ichaus.de](http://www.ichaus.de)

2012 July 26. All specifications are subject to change without notice.