SWOBODA SENSOR CLUSTER MODULES FOR GEARBOX APPLICATIONS

The Swoboda sensor cluster modules are customer specific solutions used in automated gearboxes to measure fork position & wheel speed.

INTRODUCTION

The Swoboda sensor cluster modules are used in automated transmissions to continuously monitor the fork positions and the speed of critical gears. They integrate various position (POS) and wheel speed (WSS) sensors into a single hybrid unit, tailored to the customer applications. Embedded conductive traces route all connections to output terminals, and the entire assembly is encapsulated in plastic for maximum durability within the gearbox. Depending on customer requirements, all sensors can support the functional safety standard ISO 26262 and provide advanced diagnostics.

FEATURES & BENEFITS

- Contactless measurement of fork positions and wheel speeds, including additional information such as the direction of rotation
- Optional: Temperature measurement using an NTC sensing element
- Signal output interfaces: Analog, PWM or SENT (POS) & two-wire PWM protocol supporting speed, direction and diagnostic (WSS)
- Position sensor transfer function customizable: Max. measurement range m_R < 20 mm
- Wheel speed detection up to 20,000 rpm (depends on target gear wheel geometry)
- Power supply V_{DD}: up to 18 V (POS), up to 24 V (WSS)
- Current consumption I_{DD}: < 11.5 mA (POS), < 16 mA (WSS)
- Stray field immune: up to 4,000 A/m
- Functional safety (ISO 26262): up to ASIL-C (POS), up to ASIL-A (B) (WSS)
- Ambient temperature: -40°C - +150°C
- Designed for use in oil environment
- Fully automotive qualified

ADVANTAGES

- Combination of different sensing elements in one hybrid assembly
- Contactless high accuracy measurement of position & wheel speed
- Stray field immune against external electromagnetic fields
- Fully EOL calibrated with offset & linearization correction

APPLICATION AREAS

- Automotive automated gearboxes

Any questions about this product?
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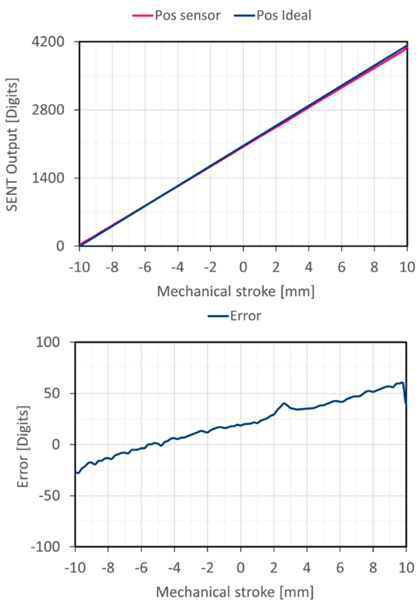
PRINCIPLE OF OPERATION

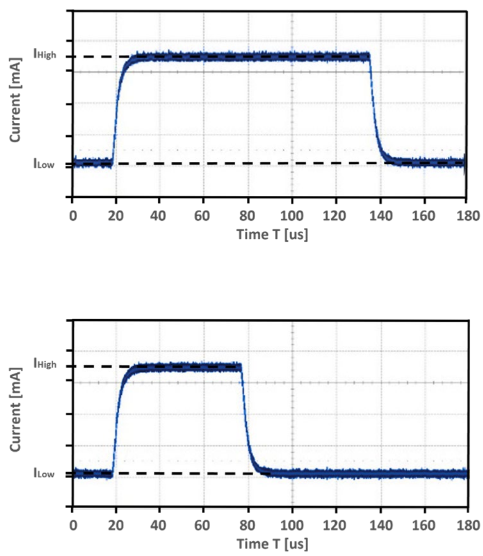
The Swoboda sensor cluster modules for automated gearboxes utilize magnetic technology to measure fork positions and wheel speeds. The position sensors detect the fork positions by measuring the magnetic flux of a magnet target.
A magnetic angle is calculated from two spatial axes and then linearized within the sensor IC to generate a mechanical position signal. The signal transfer function can be customized to meet customer requirements and achieves an accuracy of less than 1.5% full scale over temperature drift and lifetime.
To precisely measure gearbox wheel speeds, the wheel speed sensors detect the magnetic flux asymmetry generated by teeth of the measured wheel and generate an incremental, current-modulated PWM output signal. This signal includes three distinct pulse widths to provide additional information, such as the direction of rotation (forward or reverse). For functional safety diagnostics, the sensor can also provide a dedicated safety status current output level.

NOMINAL OPERATING CHARACTERISTICS

PARAMETER	SYMBOL	UNITS	MIN.	NOM.	MAX.	REMARKS
Ambient temperature	T_{Amb}	[°C]	-40	-	150	
Position sensor (POS)						
Supply voltage	V_{DD}	[V]	6.0	12.0	18.0	
Current consumption	I_{DD}	[mA]	8.0	9.0	11.5	
Measurement range	m_{R}	[mm]	-10.0	0.0	+10.0	Transfer function customizable
Wheel speed sensor (WSS)						
Supply voltage	V_{DD}	[V]	4.0	12.0	24.0	
Reverse supply current	I_{RCC}	[V]	-10.0	-	-	Vcc = -18.0 V
Supply current low	I_{LOW}	[mA]	5.9	7.0	8.0	
Supply current high	I_{HIGH}	[mA]	12.0	14.0	16.0	
ASIL safety current	I_{SAFE}	[mA]	1.5	-	3.9	
Supply current ratio	I_{HIGH} / I_{LOW}	-	1.9	-	-	
Operation frequency	f_{OP}	[kHz]	0	-	12	Depending on pulse width



Measured plots of one position sensor with a defined transfer function & error curve.



Measured plots of one wheel speed sensor with different pulse width for direction of rotation.