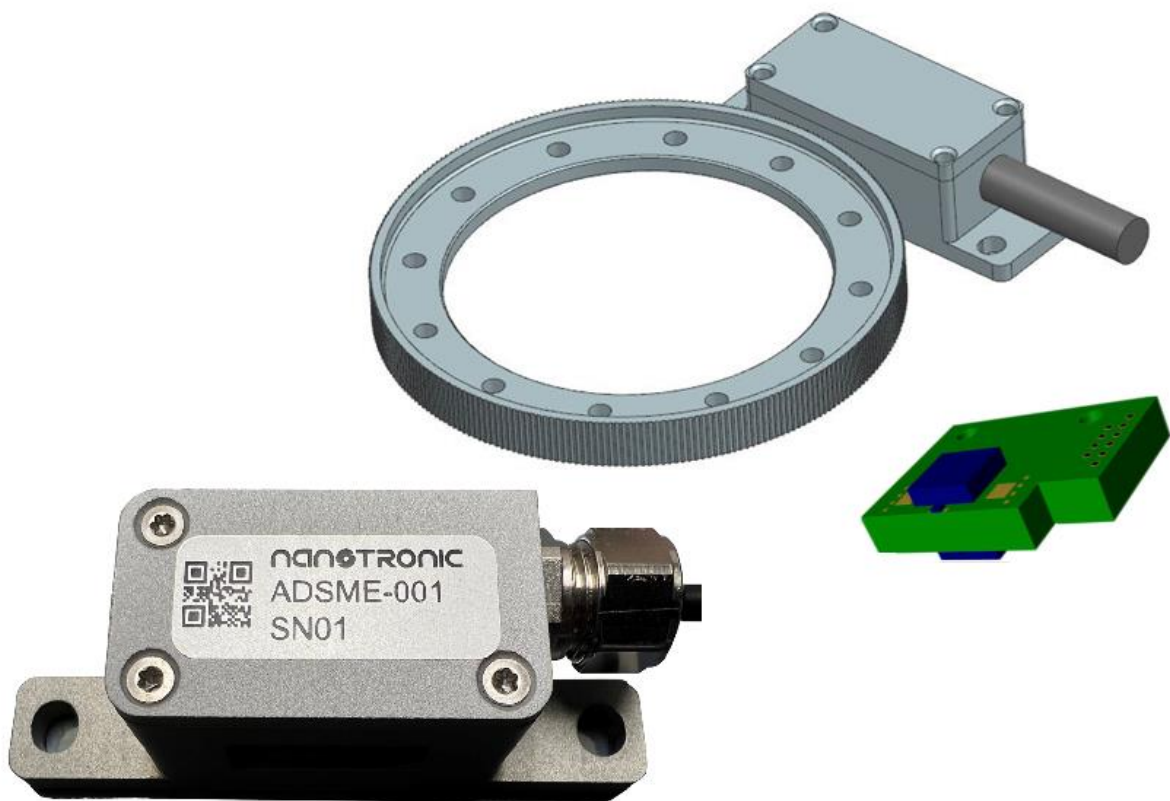




nanoTRONIC Space Encoder System

Rotary / Linear Encoder for Space and Hi-rel Applications

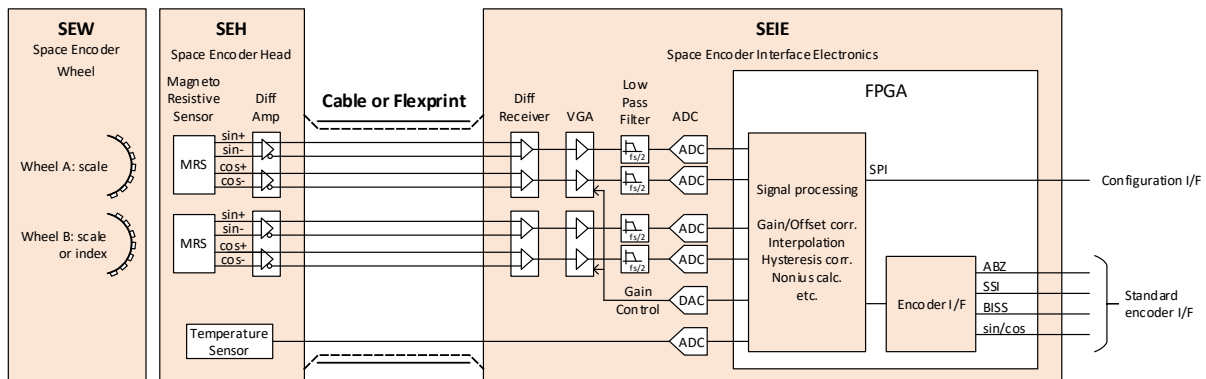
Preliminary



The nanoTRONIC Space Encoder is a position encoder system for space and hi-rel applications. It is available in absolute and incremental variants to measure either rotary or linear positions.

The system consists of an encoder scale, a read head, and an optional interface electronics. The position is measured contactless using the GMR effect (Giant Magnetoresistance). There are no components which are subject to wear, which drastically increases the lifetime compared to e.g., potentiometers. The encoder scale is a toothed wheel (or track) with teeth similar to those of miniature precision gears. Magnetized pole rings or bars are also possible. The pitch of the encoder system is 1 mm, resulting in teeth as small as 0.5 mm. Different types of steel can be used for the scale, but due to the measurement principle the material must be ferromagnetic.

System Overview



The nanoTRONIC space encoder system consists of three major components:

- SEW – Space Encoder Wheel
- SEH – Space Encoder Head
- SEIE – Space Encoder Interface Electronics

The Space Encoder Wheel (SEW) is the scale of the system and consists basically of a toothed wheel with a pitch of 1 mm. The wheel is available in different sizes (the circumference in mm must be integer). For a relative encoder system, there is no upper limit in size. For absolute encoder systems, the wheel size is limited to about 50 mm in diameter (TBC): The larger the wheel, the higher is the resolution of the system.

The Space Encoder Head (SHE) is the actual sensor or read head of the encoder system. It consists of two GMR sensors for reading the encoder wheel and a temperature sensor. The analog signals are pre-processed and amplified already in the encoder head. This allows for distances up to 10 m between the read head and the interface electronics. The output of the read head is a differential analog sin/cos signal with 1 Vpp.

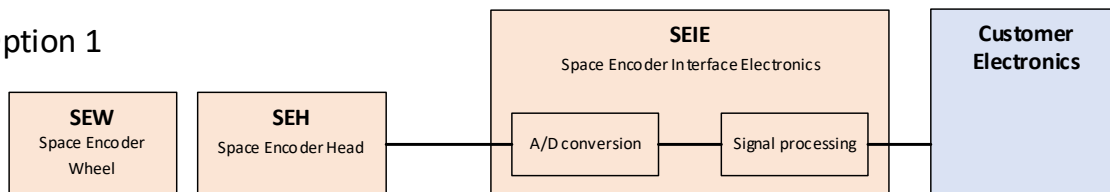
The Space Encoder Interface Electronics (SEIE) is a signal conditioning and interpolation unit. Sophisticated error correction algorithms enhance the resolution and position accuracy of the encoder system. Also, in case of absolute encoder systems, the absolute position is computed here.

Modular Design

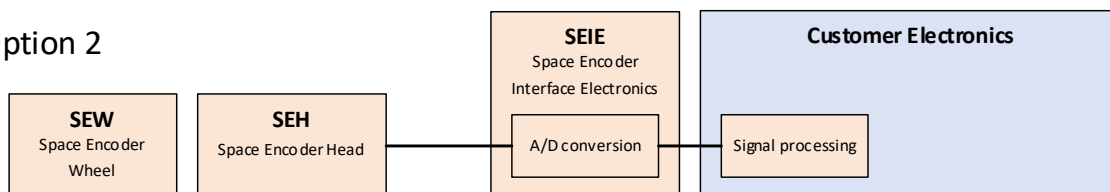
Thanks to its modular design, the nanoTRONIC Space Encoder System supports different levels of integration into the customer's system. While the scale and the read head must be procured as individual parts, there are three options for the interface electronics:

- **Option 1:** The interface electronics is a self-contained part. The interface to the customer electronics consists of a configuration interface and a position interface (e.g., a standard encoder interface).
- **Option 2:** When there is already an FPGA or microprocessor on the customer's electronics with available resources, then the signal processing part of the space encoder system can be integrated into the customer's FPGA or microprocessor. The signal processing part will be delivered as netlist (FPGA) or compiled library (microprocessor).
- **Option 3:** All functions of the interface electronics are integrated into the customer's electronics. For the A/D conversion, schematics are provided, while the signal processing is handled as in option 2.

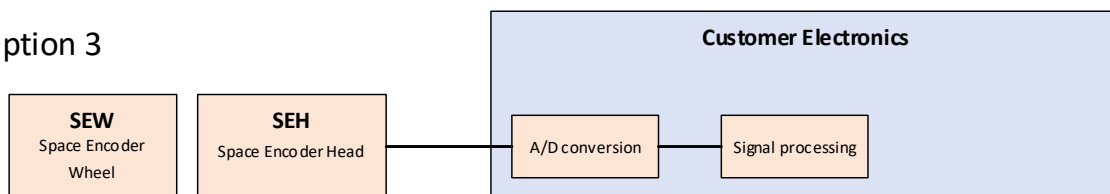
Option 1



Option 2



Option 3

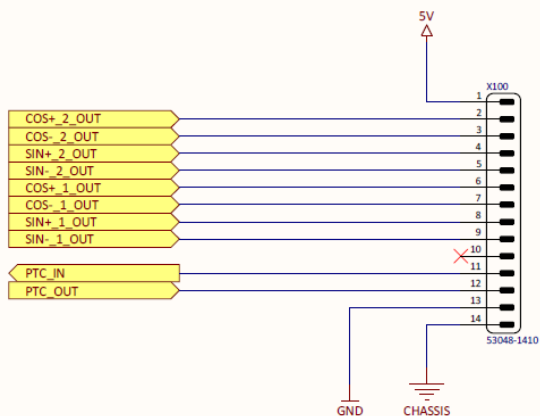


Specifications				
System Properties				
Principle	Absolute or Incremental			
Angular range	Infinite (absolute values only for 0-360°)			
Encoder wheel	Different sizes available (1 mm pitch)			
Resolution	Depending on wheel size (other wheel sizes on request):			
	Diameter	50 mm	85 mm	115 mm
	Uncalibrated	0.026 deg	0.015 deg	0.011 deg
	Calibrated	0.008 deg	0.0048 deg	0.00036 deg
	Option 1, calibrated	0.002 deg	0.0012 deg	0.00009 deg
Linearity	TBD			
Repeatability	TBD			
Mechanical Properties				
Mass	Encoder Head	5 g without housing, 35 g with housing		
	Encoder Wheel	69 g (250 teeth wheel)		
Size ¹	SEH	21 x 12 mm without housing, 62 x 18.9 x 21 mm (see drawing)		
	SEIE	60 x 60 mm		
Quasi-static load	> 31g			
Vibration loads	TBD grms			
Shock loads	TBD g			
Electrical Properties				
Supply voltage	5 V DC, <50mA (TBC)			
Power consumption	<0.25W (TBC)			
Sensor signal	Analog sin/cos, differential, <1Vpp (uncorrected)			
Temperature sensor	NTC			
Connection	Pigtail, Connector or flexible PCB			
Temperature				
Non-op.	[-60°C; +110°C]			
Operating	[-50°C; +100°C]			
Radiation				
Total Ionizing Dose (TID)	>300 kRAD (TBC)			

¹ Size can be adapted to customer needs

Interfaces

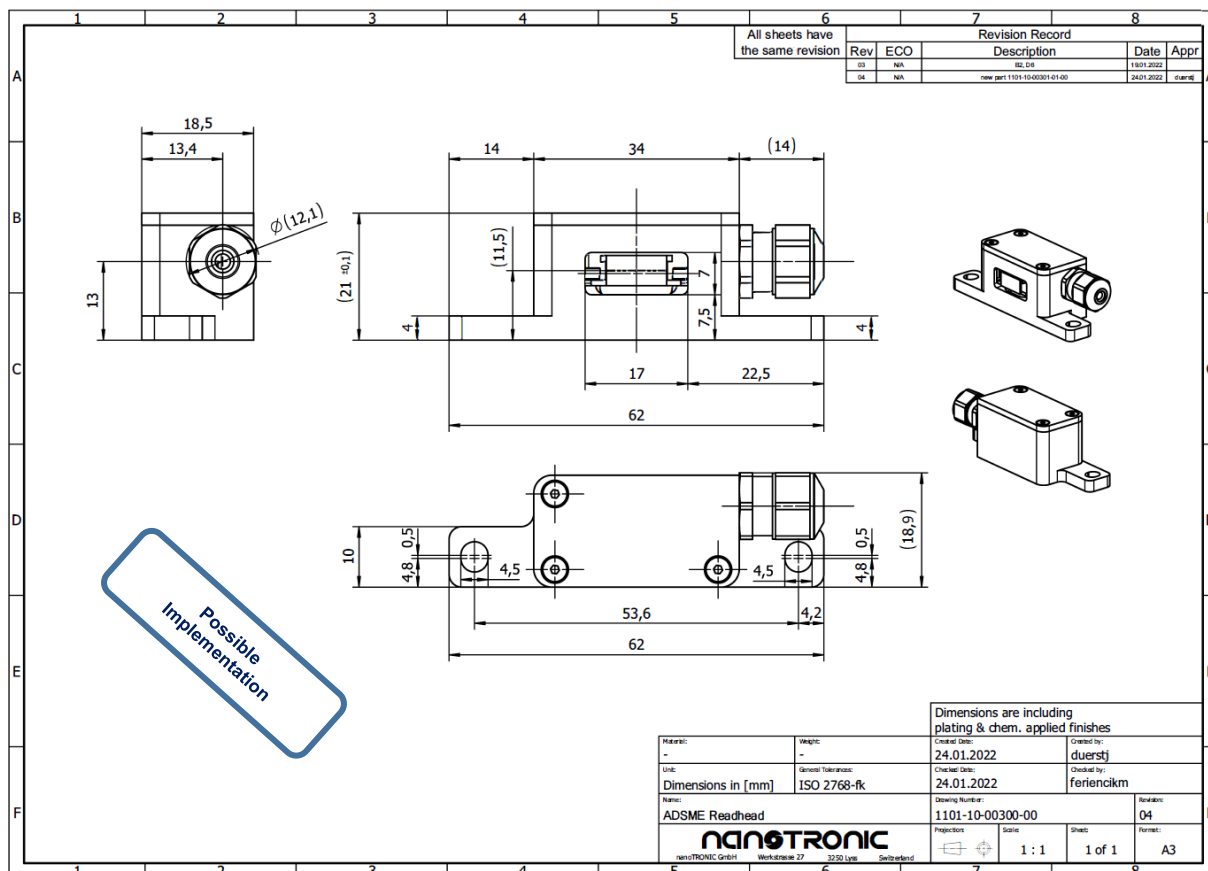
SEH



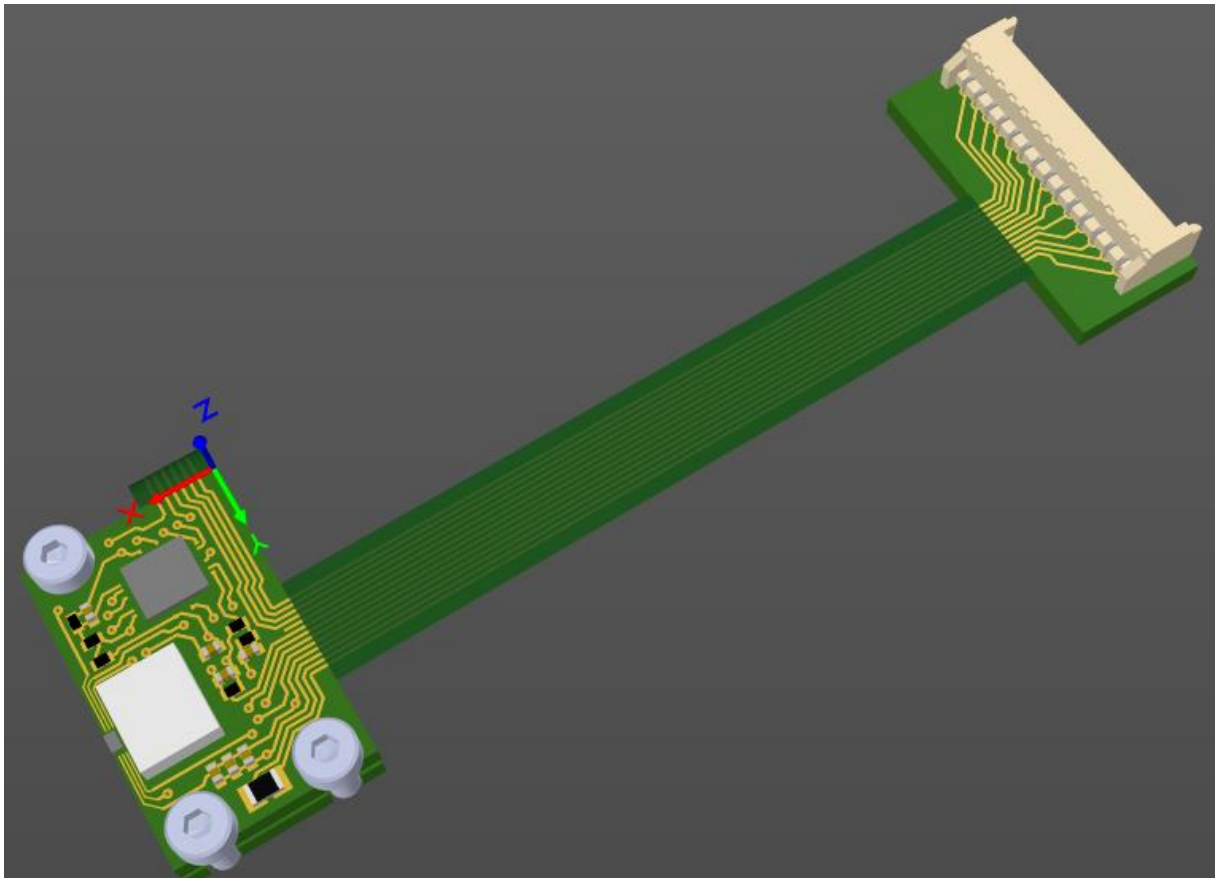
SEIE

Input	See SEH
Output	SPI (CLK, MOSI, MISO, CS)
ADC	12 Bit

SEH Housing:



SEH 3D Model:



Example: RSE-250 (Rotary Encoder with 250 teeth)

Preliminary

