

## Rotational Absolute Inductive Encoder Diameter 27 mm Aero Variant and Industrial Variant Position Sensor



### LINKS TO ADDITIONAL RESOURCES


[3D Models](#)

[Infographics](#)

[Did You Know?](#)

[Capabilities and Custom Options](#)

QUICK REFERENCE DATA	
Sensor type	ROTATIONAL, inductive technology
Output type	Cable or wires
Market appliance	Aviation, industrial, military
Dimensions	Diameter 27 mm

### FEATURES

- Especially dedicated for safety applications (aeronautic or industrial) with single or full redundant functions variants
- Dedicated architecture compatible with quality standard DO160/254 (on request)
- Rotational absolute inductive encoder
- High repeatability, high precision, high resolution, single turn
- Not sensitive to external magnetic fields (no hall effect cells), electrical fields and temperature
- Especially dedicated for harsh conditions (vibrations, shocks, EMC...)
- Plug and play, built-in self-monitoring, robust body, EMC protection, and SEU immunity
- Embedded supplying voltage survey and temperature survey to start the sensor at -40 °C
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS**  
COMPLIANT

ELECTRICAL SPECIFICATIONS	
PARAMETER	
Voltage power supply (on sensor connector)	5 V <sub>DC</sub> ± 0.25 V <sub>DC</sub> (from 5 V to 30 V ± 5 % for analog output variant)
Supply current at 5 V <sub>DC</sub>	≤ 30 mA (about 16 mA at 10 V for analog output variant)
Standard output format	SSI or analog ratiometric
Useful electrical angle	360°
Accuracy (over the temperature range)	Better than 12 bits (0.088°, 0.02 %)
Repeatability	≥ 15 bits
Resolution	262 144 points (18 bits, ≈ 0.0014° or 16 bits for analog output variant)
Startup time	≤ 20 ms
Data latency time	≤ 10 μs
Maximum sampling rate	≤ 23 kHz (at frequency SSI = 3 MHz)
Noise	0.01° peak to peak

MECHANICAL SPECIFICATIONS (All Versions)	
PARAMETER	
Mechanical angle	360°
Maximum rotation speed	5000 rpm
Weight (first stage)	≤ 23 g
Weight (additional stage)	< 11 g

SAP PART NUMBERING GUIDELINES										
TYPE	MODEL	DESIGN	SIZE (mm)	TYPE	FUNCTION	ACCURACY (BITS)	RESOLUTION (BITS)	OUTPUT	PACKAGING	OPTION
R = rotational	AI	E = encoder	027	A = aero I = industrial	1 2	12	18	A = analog CW J = SSI CCW	B = box	xxx = customized design

**Note**

- For analog output variant, contact us to provide the part number in function of supplying voltage value (5 V, or 10 V, or 24 V, ...)

PERFORMANCE	
PARAMETER	
Standard operating temperature range	-40 °C to +105 °C
Storage temperature range	-55 °C to +125 °C
Humidity	≤ 80 % no condensing
Environmental protection	Coating on PCB components (on request)
Vibrations	0.05 g <sup>2</sup> /Hz, 20 Hz to 2000 Hz for 1 hour along three major axis
Shocks	100 g, 6 ms, ½ sine (one on each axis)

EMC PARAMETERS (features tested on similar design RAIK060)		
PARAMETER	STANDARD	LEVEL
Electrostatic discharge immunity (ESD)	61000-4-2:2008	Level 4 (8 kV) - contact discharge (important: valid only on the connector interface)
Immunity of radiated radio-frequency electromagnetic field (80 MHz to 6 GHz)	EN 61000-4-3:2020	Level 3 (10 V/m)
Immunity to conducted disturbances induced by radio-frequency fields (150 kHz to 80 GHz)	EN 61000-4-6:2014	Level 3 (10 V)
Immunity to power frequency magnetic field (at 50 Hz)	EN 61000-4-8:2010	Level X (1500 A/m, 2 mT)
Radiated emission (30 MHz to 1 GHz)	EN 55011	Class A Group 1 (Industrial <sup>(1)</sup> )

**Notes**

- Levels compliant with EN IEC 61326-1, industrial
  - The sensor does not integrate protection against surges caused by overvoltages from switching and lightning transients (61000-4-5). It is recommended to use external protection if this standard is to be applied. To minimize the risk, we recommend that the power supply cable does not exceed 3 meters, and the data line does not exceed 30 meters
  - These levels of EMC parameters will be upgraded with next tests campaign
- <sup>(1)</sup> This equipment is not intended for use in residential environments and may not provide adequate protection to radio reception in such environments

**VARIANT (on request)**

Possibility of replacing the detection function in inductive technology with magnetic technology, thus allowing technological redundancy.

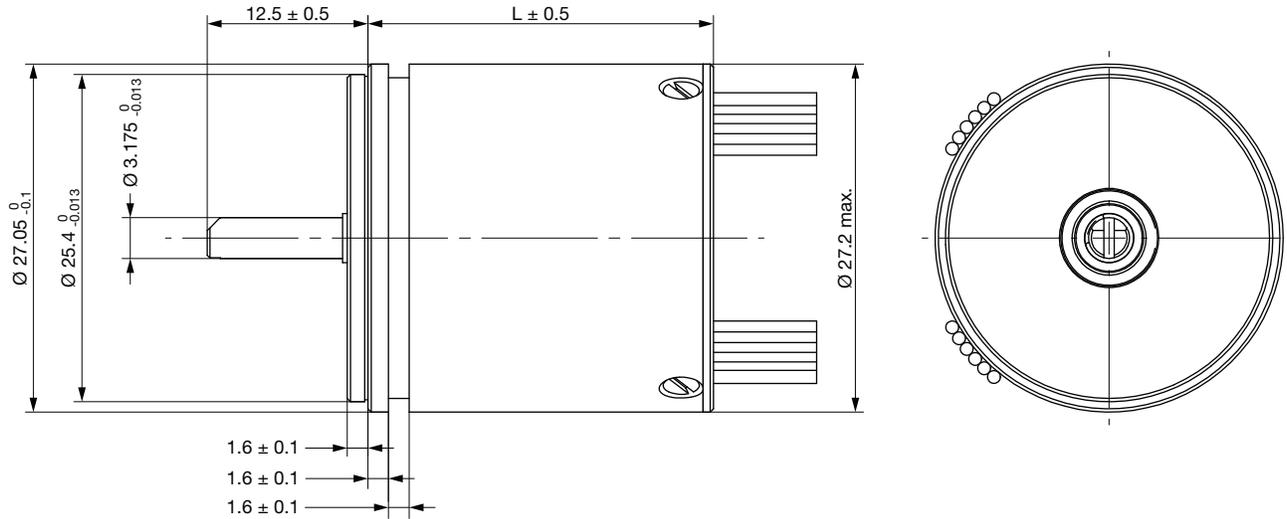
The electrical performances and mechanical parameters remain the same. Current consumption is reduced.

**OTHER INFORMATION**

**ATTENTION!**
**Observe Precautions for Handling Electrostatic Sensitive Devices!**



**SENSOR DIMENSIONS**



Number of cups	1	2
L	21.3 (TBC)	26.8 (TBC)

**MOUNTING AND ELECTRICAL CONNECTION PROCEDURE**

1. Observe precautions for handling electrostatic sensitive devices.

**COMMUNICATION INTERFACES**

SSI signal comply with the RS-422 standard, employing low voltage differential signal (LVDS). To ensure robust EMC immunity, it is highly recommended to use twisted pair wire:

- **SSI:** CLK+ twisted with CLK- / DATA+ twisted with DATA-

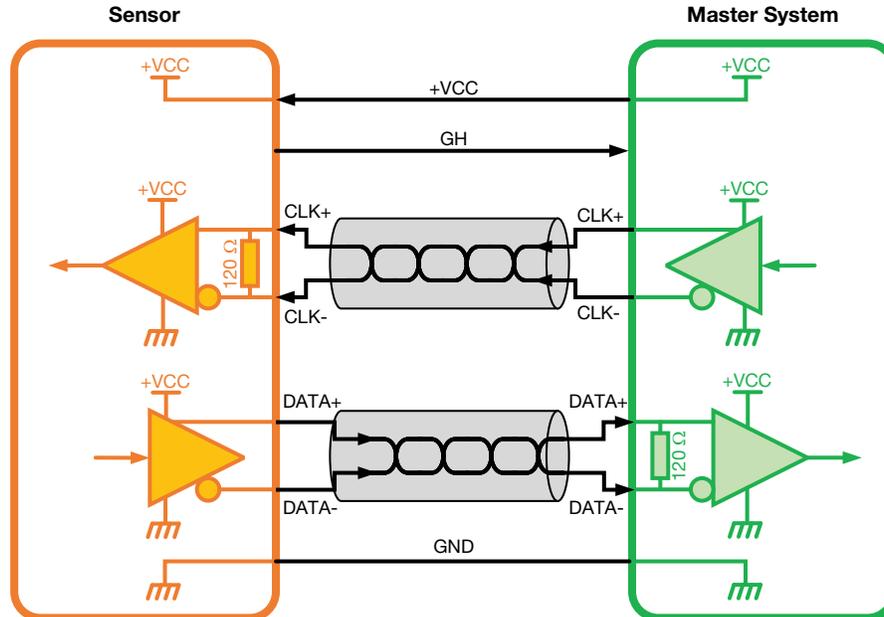
Power supply signal (VCC, GND) does not need to be twisted pair.

The typical impedance of signal lines is 120 Ω. The requirement for termination resistors depends on the total length of the communication bus and the communication speed employed.

7 WIRES CONNECTION		
NAME	WIRE COLOR	
VCC	Red	Twisted pair
GND	White	
DATA+	Green	Twisted pair
DATA-	Black	
CLK+	Blue	Twisted pair
CLK-	Yellow	
GH	<i>Color to be confirmed</i>	

**Notes**

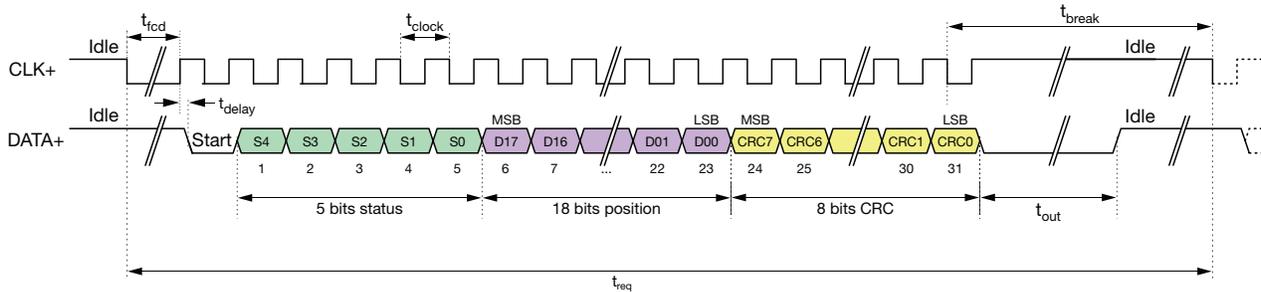
- Cable size: 28 AWG
- The **GND** wire is **white** and **DATA-** wire is **black**





**SSI OUTPUT FORMAT**

**SSI Timing Diagram**



SSI COMPATIBLE PARAMETERS		
PARAMETER	INFORMATION	
	MIN.	MAX.
SSI configuration	SLAVE mode only	
Clock and data interface	RS422 according to the EIA-RS422	
Position data (D17 to D00)	18 bits binary code (0 to 262 143)	
Error detection (CRC7 to CRC0)	CRC, 8 bits, inverted polynomial: $0x97 (X^8 + X^7 + X^4 + X^2 + X + 1)$ CRC start value = "0"	
CRC data input	23 bits (from S4 to D00)	
Total number of bit	31 bits	
First clock delay period ( $t_{fcd}$ ) <sup>(1)</sup>	4.2 $\mu$ s	14 $\mu$ s
Propagation delay ( $t_{delay}$ )	20 ns	50 ns
Transfer time-out period - monoflop time ( $t_{out}$ )	15 $\mu$ s	
Time period between two consecutive clock sequences ( $t_{break}$ )	20 $\mu$ s	-
Master clock frequency ( $f_{clk} = 1/t_{clock}$ )	100 kHz	3 MHz
Master request frequency ( $freq = 1/t_{req}$ )	-	20 kHz ( $t_{req} = 50 \mu$ s) <sup>(2)</sup>

**Notes**

- (1) Position acquisition is synchronized with the first falling edge of CLK. The first clock delay period is required for data acquisition, calculation, and storage in the communication buffer
- (2) With 3 MHz master clock frequency

**ANALOG OUTPUT**

4 wires including 1 wire for GH (Good Health) output.



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