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Rotational Absolute Inductive Kit Encoder Version 45 mm Position Sensor

LINKS TO ADDITIONAL RESOURCES



| QUICK REFERENCE DATA | | |
|----------------------|----------------------------------|--|
| Sensor type | ROTATIONAL, inductive technology | |
| Output type | Cable | |
| Market appliance | Avionics, industrial | |
| Dimensions | Diameter 45 mm | |

FEATURES

- · Especially dedicated for safety applications (aeronautic or industrial) with dual functions: one function with full performances, second function with lower performances to safe the first function
- · Customized architecture compatible with quality standard DO160/178/254 (on request)
- · Off-axis rotational absolute inductive encoder
- · High repeatability, high precision, high resolution, single turn
- Rotation speed up to 10 000 rpm
- · Not sensitive to external magnetic fields (no hall effect cells), electrical fields and temperature
- Not sensitive to moisture and pollution
- Especially dedicated for harsh conditions (vibrations, shocks, EMC...)
- Plug and play, built-in self-monitoring, ultra flat, and light weight
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

| ELECTRICAL SPECIFICATIONS | | | | |
|--|-------------------------------------|---|--|--|
| DADAMETED | FUNCTION NO. 1 | FUNCTION NO. 2 | | |
| FARAMETER | RAIK045 | | | |
| Voltage power supply (on sensor connector) | 5 V _{DC} ± 0 | 0.25 V _{DC} | | |
| Supply current at 5 V _{DC} | ≤ 90 | mA | | |
| Standard output format | SSI | | | |
| Useful electrical angle | 360° | | | |
| Accuracy at 25 °C | Better than 13 bits (0.044°) | Better than 11 bits (0.17°) | | |
| Repeatability | ≥ 17 bits | ≥ 13 bits | | |
| Resolution | 262 144 points (18 bits, ≈ 0.0014°) | 16 384 points (14 bits, \approx 0.022°) | | |
| Startup time | ≤ 5 ms | ≤ 5 ms | | |
| Data latency time | ≤ 12 μs | | | |
| Maximum sampling rate | ≤ 23 kHz (at frequency SSI = 3 MHz) | | | |

| MECHANICAL SPECIFICATIONS (All Versions) | | | |
|--|------------------------------|--|--|
| PARAMETER | | | |
| Mechanical angle | 360° | | |
| Maximum rotation speed | 10 000 rpm (more on request) | | |
| Rotor weight | ≤ 5 g | | |
| Stator weight | < 30.5 g | | |







RoHS COMPLIANT



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| SAP PART NUMBERING GUIDELINES | | | | | | | | | | |
|-------------------------------|-------|---------|--------------|----------------------------|----------|--------------------|----------------------|----------------|-----------|----------------------------|
| TYPE | MODEL | DESIGN | SIZE (mm) | TYPE | FUNCTION | ACCURACY (BITS) | RESOLUTION (BITS) | OUTPUT | PACKAGING | OPTION |
| R = rotational | AI | K = kit | 045 | A = aero I = industrial | 2 | 13 | 18 | J = SSI CCW | B = box | xxx = customized design |

| PERFORMANCE | | | |
|--------------------------------------|--|--|--|
| PARAMETER | | | |
| Standard operating temperature range | -40 °C to +100 °C | | |
| Storage temperature range | -55 °C to +125 °C | | |
| Humidity | \leq 80 % no condensing | | |
| Environmental protection | Coating on PCB components side (on request) | | |
| Vibrations | 0.05 g^2 /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 ⁽¹⁾) | |

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

⁽¹⁾ This equipment is not intended for use in residential environments and may not provide adequate protection to radio reception in such environments

OTHER INFORMATION



ATTENTION! Observe Precautions for Handling Electrostatic Sensitive Devices!

Warning: the rotor and the stator must have the same serial number!

- Do not damage the rotor disk surface
- Do not use cleaning product or chemical product

Environmental protection: conformal coating or potting on request for use in heavy-duty environments (metallic particles, oils, greases, salt spray, moisture, corrosion...)

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SENSOR DIMENSIONS







←Ø 11 ± 0.1 (E)→





RAIK045A, RAIK045I

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MOUNTING CONDITIONS



Fig. 1 - Mounting Detail



Rotor axis and stator axis are the same but the reference surfaces are not parallel

Fig. 2 - Beat

| RECOMMENDED DIMENSIONS AND TOLERANCES OF CUSTOMER INTERFACES | | | |
|--|--|---|--|
| Rep 1 | Customer shaft diameter for centering of the rotor (see Fig.1) | Diameter Ø 5 g6 (5 mm - 0.004 mm - 0.012 mm) | |
| Rep 2 | Customer interface diameter for centering of the stator (see Fig.1) | Diameter Ø 45 H7 (45 mm + 0.025 mm - 0.000 mm) | |
| Rep 3 | Diameter runout of the customer shaft for the rotor centering (included gap between customer shaft and inner rotor diameter) (see Fig.1) | < 0.005 mm | |
| Rep 4 | Misalignment: concentricity of the stator centering diameter versus shaft centering diameter (included tolerances of customer holder and stator interface) (see Fig.1) | < 0.020 mm | |
| Rep 5 | Position of the stator reference upper surface versus rotor reference bottom surface (see Fig.1) (air-gap: the condition of previous line avoids to measure the air-gap) | 0.4 mm ± 0.1 mm | |
| Rep 6 | Total beat included in the air-gap between ref. C (rotor) and ref. D (stator) (see Fig.2) | < 0.1 mm | |

Note

• Values at room temperature



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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.

| 6 WIRES CONNECTIONS | | |
|---------------------|------------|--|
| CABLE SIZE | 28 AWG | |
| NAME | WIRE COLOR | |
| GND | White | |
| +5 V | Red | |
| DATA+ | Green | |
| DATA- | Black | |
| CLK- | Yellow | |
| CLK+ | Blue | |

Note

• FYI: the GND is white and DATA- is black



RAIK045A, RAIK045I



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SSI OUTPUT FORMAT

SSI Frame Timing Diagram (Single-Turn Version)



Fig. 3

| SSI COMPATIBLE PARAMETERS | | | |
|---|---|--|--|
| PARAMETER | INFORMATION | | |
| Communication protocol | SSI | | |
| Output code | Binary signed | | |
| Interface | RS422 | | |
| Clock frequency ($f_{CLK} = 1/t_{CLK}$) | 300 kHz to 3 MHz | | |
| Termination resistor | 120 Ω | | |
| Frame bits number | 47 | | |
| Start bit | 1 bit always equal to "0" | | |
| | Bits <\$02> to <\$00> | | |
| | 000 = normal operation | | |
| Status | 110 = internal signal error for angle 1 | | |
| | 101 = internal signal error for angle 2 | | |
| | 111 = internal signal error for angle 1 and 2 | | |
| Absolute angle 1 | Bits <d31> to <d14></d14></d31> | | |
| Absolute angle 2 | Bits <d13> to <d00></d00></d13> | | |
| Temperature | Bits <t09> to <t00></t00></t09> | | |
| Parity | Bit <p> is from <s02> to <t00> "P" = 1 when sum of <s02> to <t00> is even "P" = 0 when sum of <s02> to <t00> is odd</t00></s02></t00></s02></t00></s02></p> | | |
| Acquisition time (t _{ACQ}) | ≤ 12 μs | | |
| Propagation delay (t _{delay}) | 90 ns ± 10 ns | | |
| Time-out (t _{out}) | 15 µs | | |



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