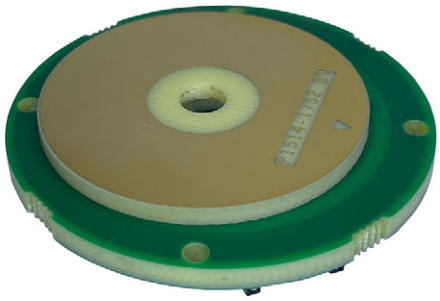
Rotational Absolute Inductive Kit Encoder Version 45 mm Medium Precision Position Sensor



FEATURES

- Off-axis rotational absolute inductive encoder
- Especially dedicated to motor drive, to robot's position and industrial motion control with accurate positioning
- Rotation speed up to 10 000 rpm
- High repeatability, high precision, high resolution, single turn
- 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…)
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free

RoHS COMPLIANT

LINKS TO ADDITIONAL RESOURCES

3D Models | Infographics | Did You Know?

QUICK REFERENCE DATA	
Sensor type	ROTATIONAL, inductive technology
Output type	Connector Molex 5037630691 or pads
Market appliance	Industrial
Dimensions	Diameter 45 mm

ELECTRICAL SPECIFICATIONS	
PARAMETER	**RAIK045I11318**
Voltage power supply (on sensor connector)	5 V_{DC} ± 0.5 V_{DC}
Supply current at 5 V_{DC}	≤ 15 mA
Output format	SPI
Useful electrical angle	360°
Accuracy at 25 °C	≥ 11 bits (0.18°)
Repeatability	≥ 14 bits
Hysteresis	No hysteresis
Output noise (at 25 °C with airgap 0.4 mm)	< ± 2 LSB
Resolution	65 536 points (16 bits, ≈ 0.0055°)
Startup time	≤ 3 ms
Data latency time	Typ. 200 µs
Maximum sampling rate	4.6 kHz

MECHANICAL SPECIFICATIONS	
PARAMETER	
Mechanical angle	360°
Maximum rotation speed	10 000 rpm (more on request)
Rotor weight	≤ 4.3 g
Stator weight	< 9.0 g

For technical questions, contact: mcbprecisionpot@vishay.com

SAP PART NUMBERING GUIDELINES										
TYPE	MODEL	DESIGN	SIZE (mm)	TYPE	FUNCTION	ACCURACY (BITS)	RESOLUTION (BITS)	OUTPUT	PACKAGING	OPTION
R = rotational	AI	K = kit	045	I = industrial	1	11	16	F = SPI CCW	B = box	xxx = customized design

Notes

- Connection by pads on request
- Analog output on request

ACCESSORY	
External connector equipped with wires to obtain a wires output (see section “Accessories on Request”)	ACCSRAIKWIRESOB073

PERFORMANCE	
PARAMETER	
Standard operating temperature range	-40 °C to +125 °C
Storage temperature range	-55 °C to +125 °C
Environmental protection	Coating on PCB components side (on request)

EMC PARAMETERS		
PARAMETER	**STANDARD**	**LEVEL**
Electrostatic discharge immunity (ESD)	61000-4-2 :2008	Level 1 (2 kV) - contact discharge (contact discharge valid only on the connector interface)

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

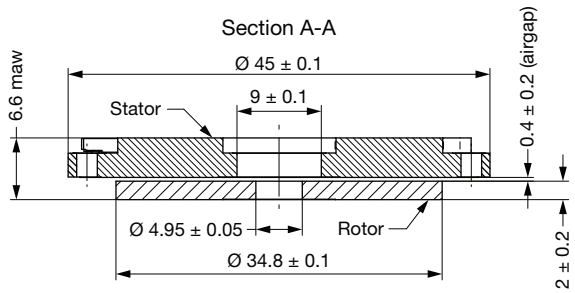
OTHER INFORMATION

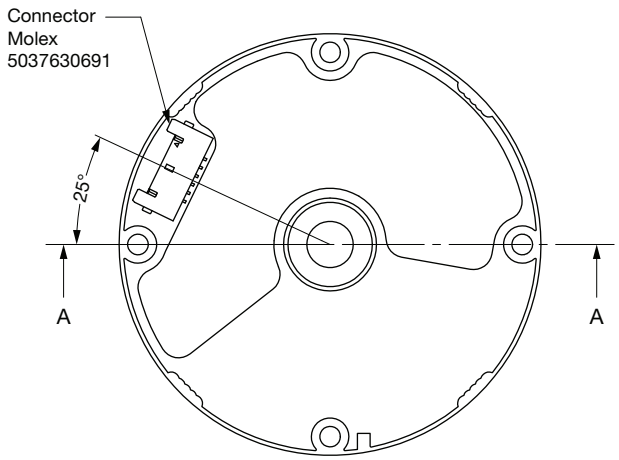
ATTENTION!
Observe Precautions for Handling Electrostatic Sensitive Devices!

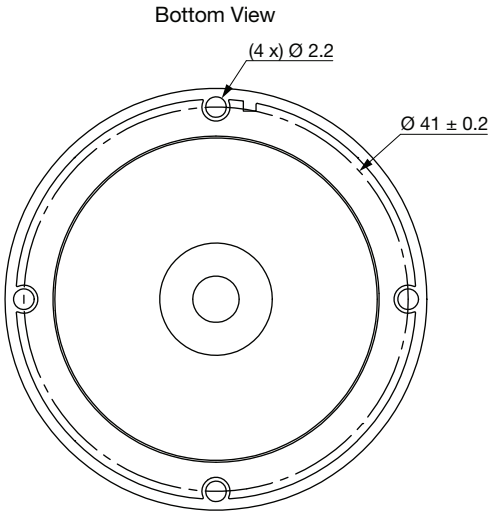
Warning: the rotor and the stator must have the same serial number!

- The sensor is delivered in an ESD packaging. To ensure safe handling, remove the sensor from its ESD bag only in an Electrostatic Protected Area (EPA)
- 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...)

SENSOR DIMENSIONS







MOUNTING CONDITIONS

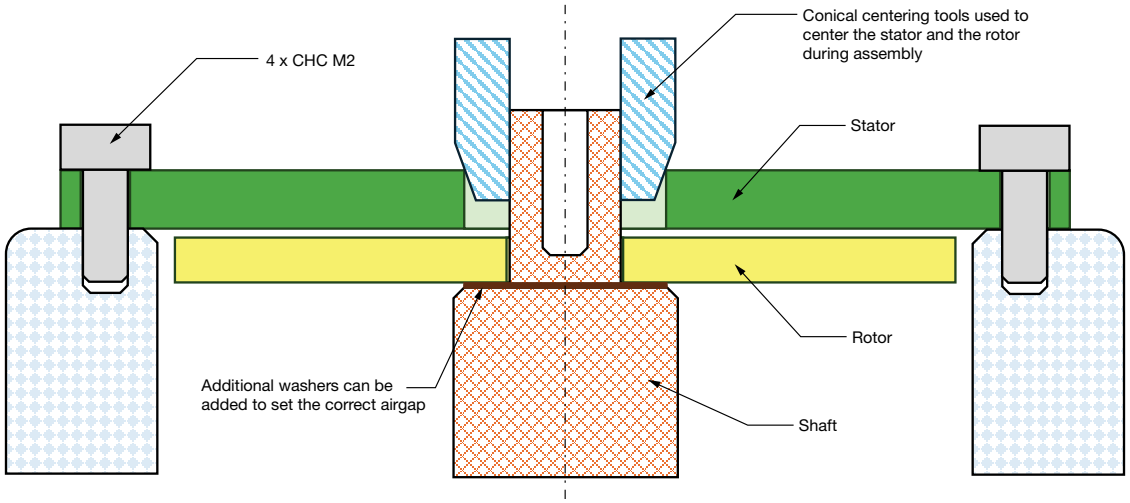
GENERAL

- Observe precautions for handling electrostatic sensitive devices
- Rotor mounting: the positioning of the rotor should be referenced to its internal diameter with respecting the tolerances given in the hereafter tab: diameter 5 g6
- Stator mounting: it is strongly recommended to center the position of the stator by the internal diameter as described in §1 with using a cone centering tool. If not possible, to center the stator by the external diameter with respecting the tolerances given in the hereafter tab: diameter 45 H7
- It is recommended to apply threadlocker to the screw depending on environmental and usage conditions

1. RECOMMENDED EASIER ASSEMBLING

With using a cone centering tool.

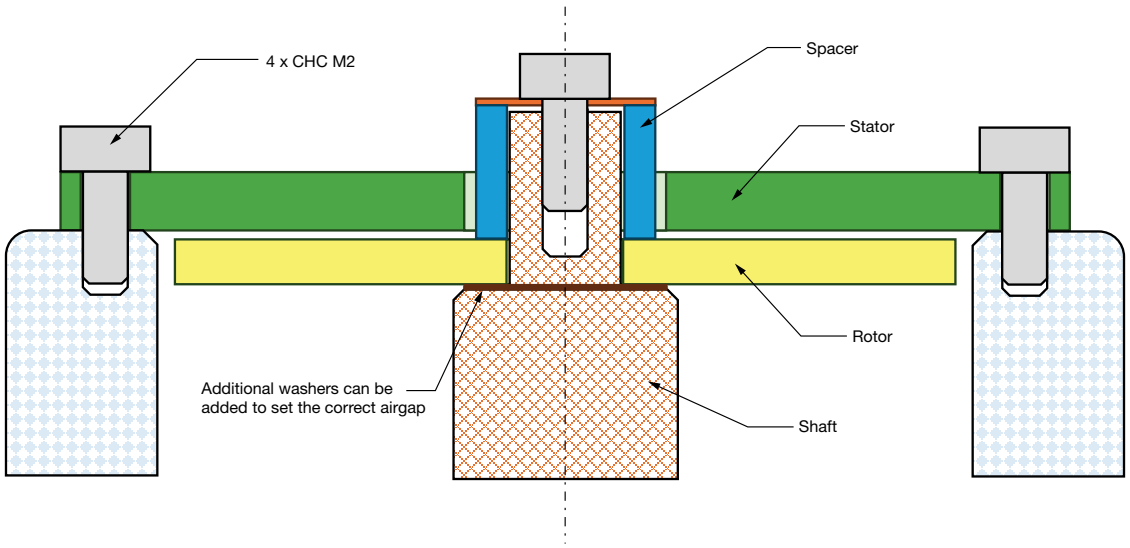
Assembly Instruction



Note

- During assembly, do not fully tighten the fastening screws to allow the stator to move and align with the shaft using the centering tool. The final tightening should be carried out while holding the tool in place

Sensor Mounting



2. ALTERNATIVE ASSEMBLING (if the customer cannot use a cone centering tool)

To center the stator by the external diameter with respecting the tolerances given in the hereafter tab: diameter 45 H7.

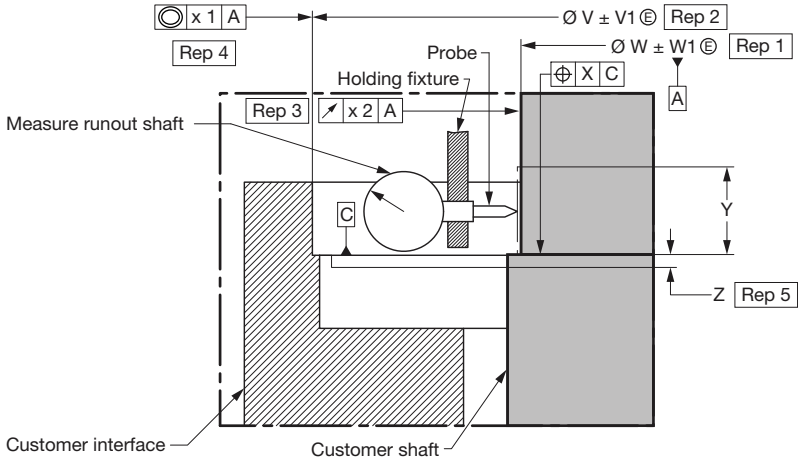
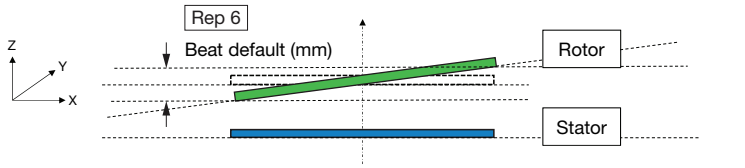


Fig. 1 - Mounting Detail



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)	< 0.120 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)	< 0.250 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 ± 0.2 mm
Rep 6	Total beat included in the air-gap between ref. C (rotor) and ref. D (stator) (see Fig. 2)	< 0.2 mm

Note

- Values at room temperature

COMMUNICATION INTERFACES

SPI protocol

Power supply signal (V_{CC}, GND) does not need to be twisted pair.

The SPI (Serial Peripheral Interface) is a four-wire bidirectional synchronous serial communications interface used for short-distance communications (≤ 30 cm). This protocol is full duplex (communication in both directions simultaneously) and signals are 3.3 V LVTTL (5 V tolerant). The master controller selects the slave with the nCS line, generates a clock signal on the SCLK line, sends commands on the MOSI line and receives data on the MISO line.

CONNECTOR TYPES:

Output connector mounted on the RAIK045: Molex 5037630691

Customer connector equipped of wires gauge 28 to plug:

- Female connector Molex 503764-0601
- Contacts Molex 503765-0098

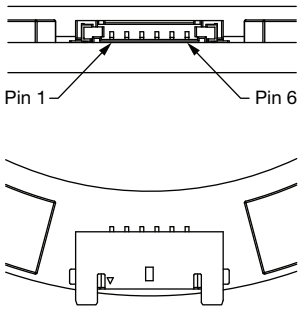


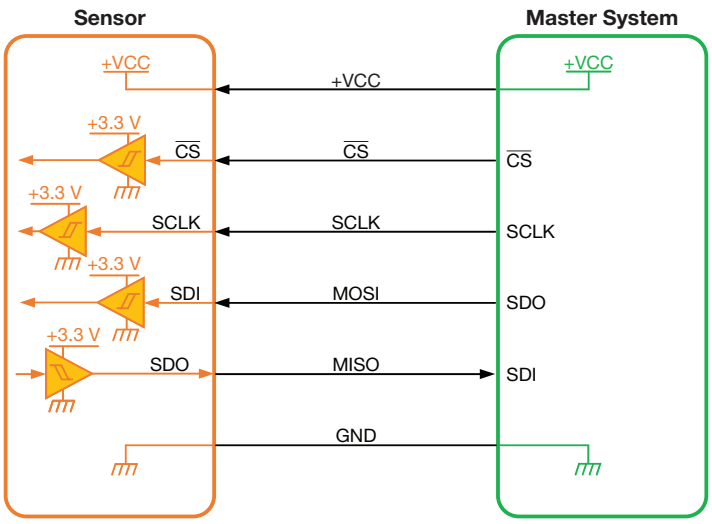
Fig. 3

SPI PINOUT				
PIN NO.	NAME	DESCRIPTION	TYPE	OPTIONAL: WIRE EQUIPED CONNECTOR (P/N: ACCSRAIKWIRESOB073)
1	VCC	Power supply input	Power	Red
2	SCLK	SPI clock input	Input	Orange
3	/CS	SPI chip select input (active low)	Input	Yellow
4	MOSI	SPI data input (from master to slave)	Input	White
5	MISO	SPI data output (from slave to master)	Output	Green
6	GND	Ground	Power	Black

Note

- See section “Accessories on Request” for details on the wire equipped connector

COMMUNICATION DIAGRAM



SPI OUTPUT FORMAT

SPI Frame

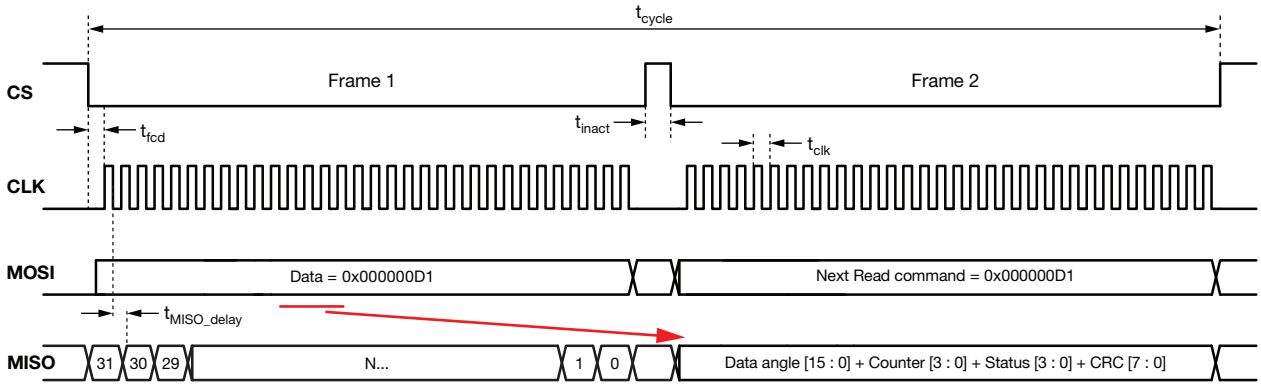


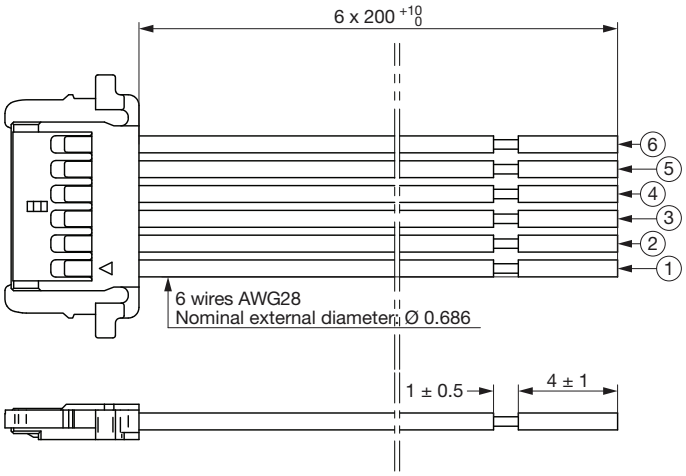
Fig. 4

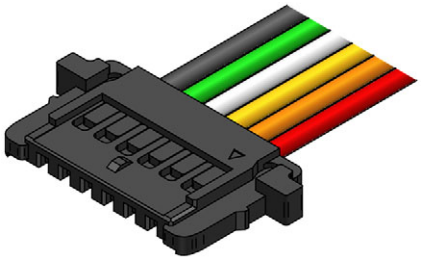
SPI PARAMETERS	
PARAMETER	**INFORMATION**
SPI compatible configuration	Direct connection (no daisy chain), single master, multiple slaves
SPI interface	3.3 V LVTTL (inputs are 5 V tolerant)
SPI mode	Mode 0 (CPOL0, CPHA0) The output shift register is clocked on the rising edge of SPI_CLK
Inactive time (t_{inact})	≥ 500 ns
Processing time (t_{fcd})	≥ 400 ns (CS falling edge to CLK first rising edge)
Clock frequency ($f_{clk} = 1/t_{clk}$)	100 kHz ≤ f_{clock} ≤ 1.4 MHz
Propagation delay (t_{MISO_delay})	214 ns
Total number of bit (simple frame)	32
Data angle [15 : 0]	16 bits, binary code, MSB first (0 to 65 535)
Counter [3 : 0]	Incremental counter per each correctly received SPI frame
Status [3 : 0]	Bits 0 and 1: value = 0 Bit 2: position error Bit 3: SPI error
Simple frame error detection [7 : 0]	CRC, 8 bits polynomial 0x107 (X8 + X2 +X1 +X0) CRC start value “0xFF”

SPI COMMANDS			
R/W	**CODE (HEX)**	**COMMAND**	**DETAILS**
R	0x000000D1	Read angle	Data angle can be read on the next SPI frame

ACCESSORIES ON REQUEST

EXTERNAL CONNECTOR EQUIPPED OF WIRES TO OBTAIN A WIRES OUTPUT (ACCSRAIKWIRESOB073)





Note

- General tolerancing according to ISO 8015

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