

Absolute Rotary Encoder “INDUCTIVE-ROTARY” Series

based on the
inductive measurement principle



Technical Datasheet

2023-11 - rev.05

www.flux.gmbh

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1. INDUCTIVE-ROTARY Encoders

The **INDUCTIVE-ROTARY** series of rotary encoders from FLUX GmbH offers motor feedback solutions for a wide range of applications, fitting optimally in designs that require precise positioning with exacting velocity and torque control.

The **INDUCTIVE-ROTARY** series of rotary encoders incorporates the FLUX inductive position sensor (patent pending) to deliver high performance feedback as part of a closed loop motion control system.

The position sensor technology and encoder architecture, developed and manufactured by FLUX, are the result of 40+ years experience in encoder development and manufacturing. It addresses in a purposeful and compact manner motion control feedback design requirements calling for:

- Precise position feedback
- Hollow shaft implementation
- High positioning accuracy
- High position stability / low noise
- Zero backlash / hysteresis
- Insensitivity to external electrical and magnetic noise
- Low signal latency

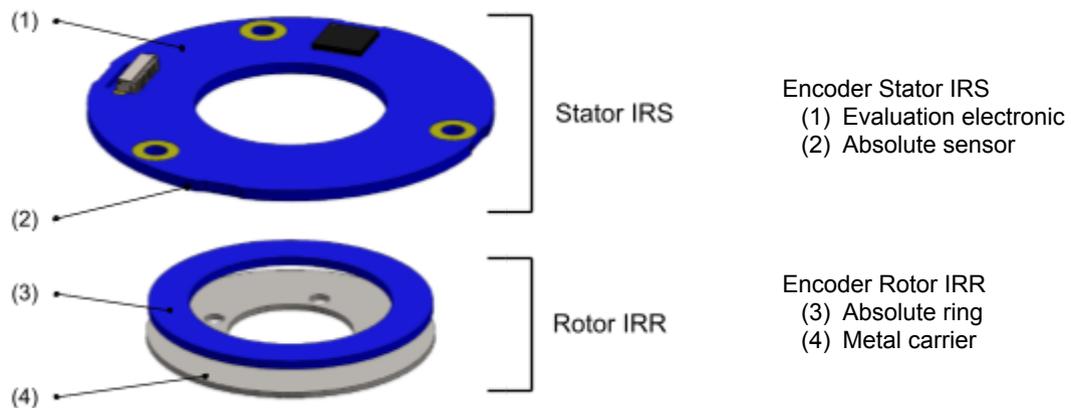
INDUCTIVE-ROTARY series performance achievements:

- Resolution up to 22 bits / revolution
- Accuracy to $\pm 0.012^\circ$ (± 45 arc seconds)
- Liberal mounting tolerance; to axial ± 0.30 mm and to radial ± 0.30 mm
- Axial stack-up as small as 8mm including air-gap
- High ratio of inner diameter (through hole) to outer diameter

INDUCTIVE-ROTARY series is the ideal choice for a wide range of applications including:

- semiconductor manufacturing
- cobots and robotics
- satcomm
- medical
- gimbals
- motors (torque, direct drive, servo, DC brushless)
- gearbox integration
- automated guided vehicles (AGV)

1.1. Inductive principle (simplified)



HOW THE INDUCTIVE TECHNOLOGY WORKS

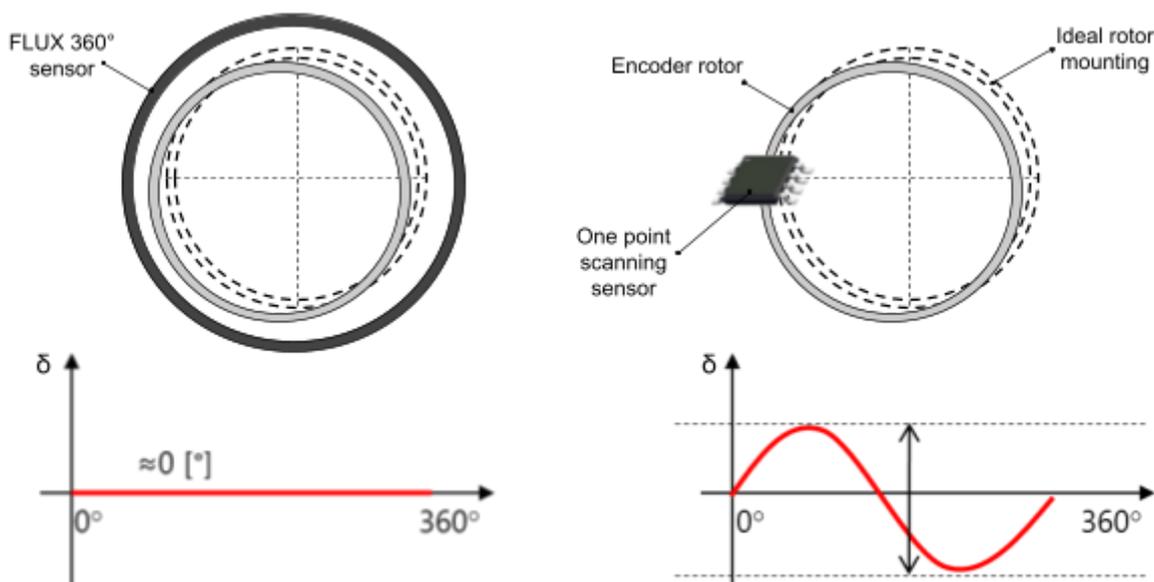
The absolute inductive sensor (3) scans the variable electrical impedance of the absolute ring (2) and generates an electrical signal. The inductive sensor (3) is connected to the evaluation electronic (4) which converts the electrical signal in digital position. Absolute position is generated through the FLUX built up (patent pending) of the sensor and the pattern of the absolute ring.

1.2. Holistic, 360° scanning principle

FLUX encoders have a holistic scanning principle, meaning that they scan and read 360° around the encoder rotor. By comparison, many other rotary encoder technologies (magnetic xMR, Hall, optical, etc.) use segment or “one point” scanning.

360° scanning has many advantages, including improved signal quality, error averaging, and, most importantly, the reduction of the eccentricity error.

Eccentricity [e] is the displacement between the geometrical center of an encoder rotor and the rotation axis. The dotted disk in the figure below is the ideal position, and the gray disk shows the eccentric location of the encoder rotor.



Sensor geometry causes FLUX encoders to inherently average out eccentricity across the circumference of the rotor, resulting in significant reduction in eccentricity error. However, a sensor with a "one-point" scanning capability will exhibit eccentricity errors [δ] over a complete rotation in the form of a sinusoidal wave.

The eccentricity error [δ] for an “one-point” encoder can be calculated using the following formula:

$$\delta["] = \pm 412 \times \frac{e [\mu m]}{D [mm]}$$

with:

- δ ... encoder eccentricity error in arcseconds
- e ... eccentricity (half of the runout) in μm
- D ... encoder diameter in mm

The eccentricity may occur both statically as a result of manufacturing or mounting tolerances as well as dynamically as the result of external forces acting on the mechanical parts during operation.

A "one-point" scanning approach could partially correct the static eccentricity with additional effort and expensive calibration procedures, but there is no possibility of correcting the dynamical eccentricity.

As a result of the 360° scanning approach of the FLUX encoders, they inherently compensate for both statically and dynamically eccentricities .

Eccentricity error is a significant source of additional error in applications that require accuracy. Using an "one-point" encoder can reduce the overall performance of the machine even for eccentricities under 20 µm. Using different sizes of encoder, a comparison of additional errors to the positioning system is presented in the following tables for both 10 and 20 µm eccentricities.

Additional error is the error exclusively generated by eccentricity and added to the error in the product inspection/calibration chart.

Additional error δ for $e = 10 \mu\text{m}$		
Diameter D	FLUX IND-ROT	One-Point
55 mm	$\pm 8''$	$\pm 75''$
69 mm	$\pm 6''$	$\pm 60''$
80 mm	$\pm 6''$	$\pm 52''$
96 mm	$\pm 5''$	$\pm 43''$

Additional error δ for $e = 20 \mu\text{m}$		
Diameter D	FLUX IND-ROT	One-Point
55 mm	$\pm 16''$	$\pm 150''$
69 mm	$\pm 12''$	$\pm 119''$
80 mm	$\pm 12''$	$\pm 103''$
96 mm	$\pm 10''$	$\pm 86''$

1.3. Environmental and EMC immunity

FLUX inductive rotary encoders provide outstanding resistance to environmental and electromagnetic disturbances.

The INDUCTIVE-ROTARY encoder exhibits high durability with an IP00 rating, rendering it impervious to dust or condensation (with the option for conformal coating).

2. Encoder Specification



*INDUCTIVE-ROTARY-096 (size 96mm)

IND-ROTARY size / OD	55 mm	69 mm	80 mm	96 mm
System data				
Type	Axial, frameless, true absolute INDUCTIVE encoder INDUCTIVE-ROTARY - FLUX GmbH (patent pending)			
Maximum Output Resolution⁽¹⁾ <i>(non binary on request)</i>	21 bits		22 bits	
	524'288 ppr (before x4) 2'097'152 cpr (after x4)		1'048'576 ppr (before x4) 4'194'304 cpr (after x4)	
ENOB in entire mounting tolerance range⁽²⁾	19 bits		20 bits	
Standard accuracy <i>(no calibration required)</i>	± 0.025°	± 0.020°	± 0.018°	± 0.012°
	± 90"	± 75"	± 65"	± 45"
	± 450 µrad	± 350 µrad	± 320 µrad	± 210 µrad
Enhanced accuracy	Enhanced accuracy can be achieved depending on the mounting setup. For more information, please contact FLUX: office@flux.gmbh			
Hysteresis	none			
Repeatability	1 count			
Position update rate	Real-time			
Maximum speed	6'000 rpm (higher on request)			
Power-up time	max. 0.8 sec			

⁽¹⁾ The maximum resolution of the encoder represents the number of delivered bits in the output. For a "close gapped" encoder, all bits will be stable. As the air-gap (distance between the rotor and stator) increases, the last 2 bits may become noisy (unstable). For best utilization of the maximum number of bits, the installer should close the gap rotor/stator.

⁽²⁾ The Effective Number of Bits (ENOB) refers to the maximum number of stable bits that can be achieved in the entire mounting tolerance range.

Electrical data	
Supply voltage <i>(at encoder connector)</i>	Option 5V: min. 4.35 Vdc. max. 6 Vdc
Reverse polarity protection	Yes
Current Consumption <i>(w/o output terminations)</i>	max. 150 mA @ 5 Vdc (Option 5V)

IND-ROTARY size / OD	55 mm	69 mm	80 mm	96 mm
Mechanical Data				
Stator base material	FR4 (CTE ~ 18 ppm/°C)			
Stator weight⁽³⁾	7 g	9 g	10 g	12 g
Rotor base material	Stainless steel (CTE ~ 10 ppm/°C)			
Rotor weight⁽⁴⁾	7 g	12 g	14 g	18 g
Vibration	EN 60068-2-6, 20 g, 55 .. 2000 Hz			
Shock	EN 60068-2-27, 200 g, 6 ms			

⁽³⁾ Guiding values. Without cable.

⁽⁴⁾ Guiding values. Values can vary with the rotor mounting option.

Mounting tolerances	
Nominal Axial Air-Gap	0.50 mm
Axial tolerance <i>(air-gap)</i>	±0.30 mm
Radial tolerances <i>(runout / lateral displacement)</i>	0.20 mm

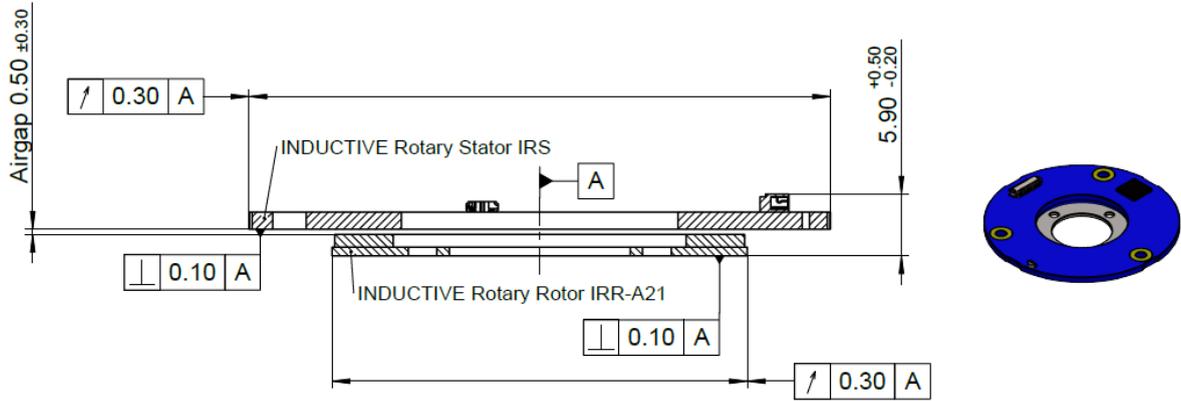
Environmental data	
Temperature range - Standard (<i>no additional option in order code</i>)	
Operating	-20°C .. +85°C
Storage	-20°C .. +85°C
Temperature range - Extended (<i>contact FLUX for more details</i>)	
Operating	-40°C .. +105°C
Storage	-40°C .. +125°C
Ingress Protection	IP00
EMC immunity	complies with EN IEC 61000-6-2
EMC emission	complies with EN IEC 61000-6-4

Output interfaces (See <i>FLUX Encoders Interface Guide</i> for complete description- www.flux.gmbh/downloads)	
Absolute: BiSS/C	BIS10, BIS21, BIS00
Absolute: SSI	SSI00, SSI01, SSI02, SSI03, SSI04
Incremental: A/B/Z	INC00, INC01, INC02, INC03
Absolute: SPI	<i>contact FLUX for more details</i>
Absolute: Asynchronous	UAT00, UAT01
Other synchronous or asynchronous	<i>contact FLUX for more details</i>

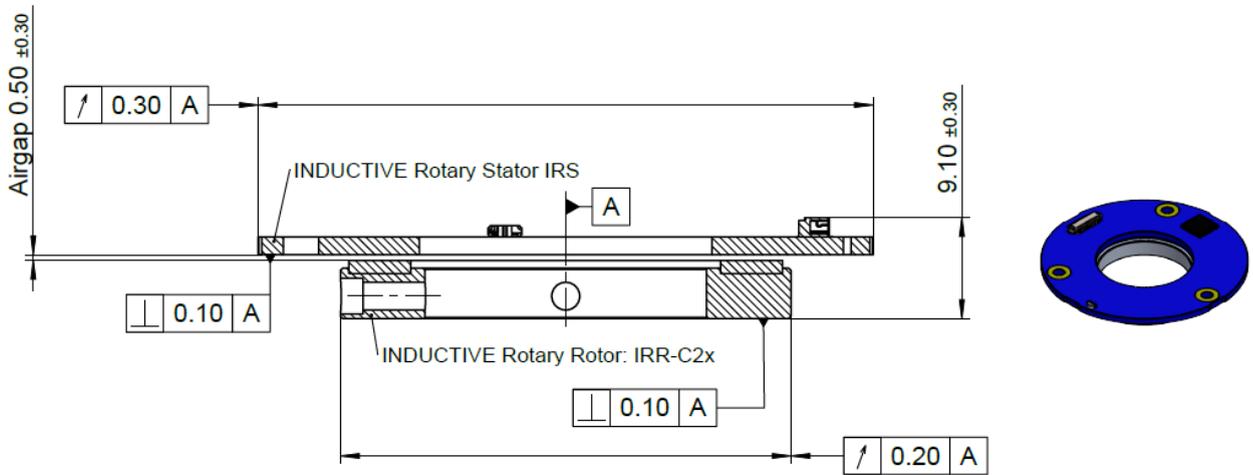
3. Mechanical dimensions and mounting tolerances

3.1. INDUCTIVE-ROTARY Series - Mounting tolerances

Rotor mounting with screws inside grating (Rotor option “-A21”):



Rotor mounting with radial set screws (Rotor option “-C2x”):



A ... axis of rotation

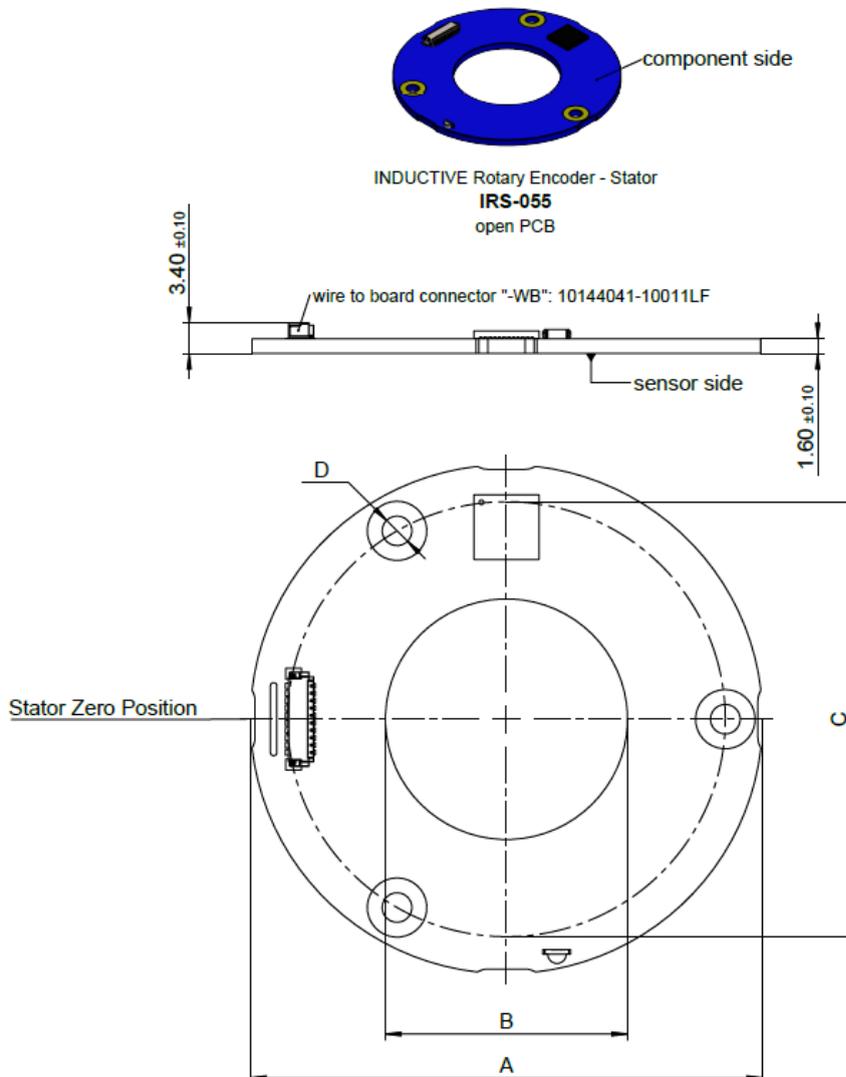
max. total runout tolerance IRS + IRR = 0.30mm $\begin{matrix} \nearrow \\ \text{IRS + IRR} \end{matrix} \begin{matrix} 0.30 \\ \text{A} \end{matrix}$

max. total perpendicularity tolerance IRS + IRR = 0.10mm $\begin{matrix} \perp \\ \text{IRS + IRR} \end{matrix} \begin{matrix} 0.10 \\ \text{A} \end{matrix}$

Dimensions are mm.

3.2. Inductive Rotary Encoder - Stator: IRS

3.2.1. Stator for IND-ROT-055: IRS-055



NOTE: The color of the stator IRS-055 may, unlike shown in the picture, possibly be delivered in green due to remaining stock. In terms of performance and functionality, there is no difference with the color of the stator.

Size comparison table. The 055 mm size is highlighted.

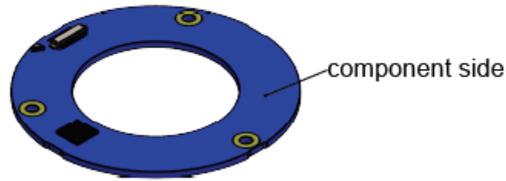
IRS-xxx	A	B	C	D
055	ø55 +0.0 /-0.2	ø26 +0.2 /-0.0	ø47	3 x ø3.20 (3x120°)
069	ø69 +0.0 /-0.2	ø40+0.2 /-0.0	ø61	3 x ø3.20 (3x120°)
080	ø80 +0.0 /-0.2	ø51+0.2 /-0.0	ø72	6 x ø3.20 (6x60°)
096	ø96 +0.0 /-0.2	ø67+0.2 /-0.0	ø88	6 x ø3.20 (6x60°)

Dimensions are in mm.

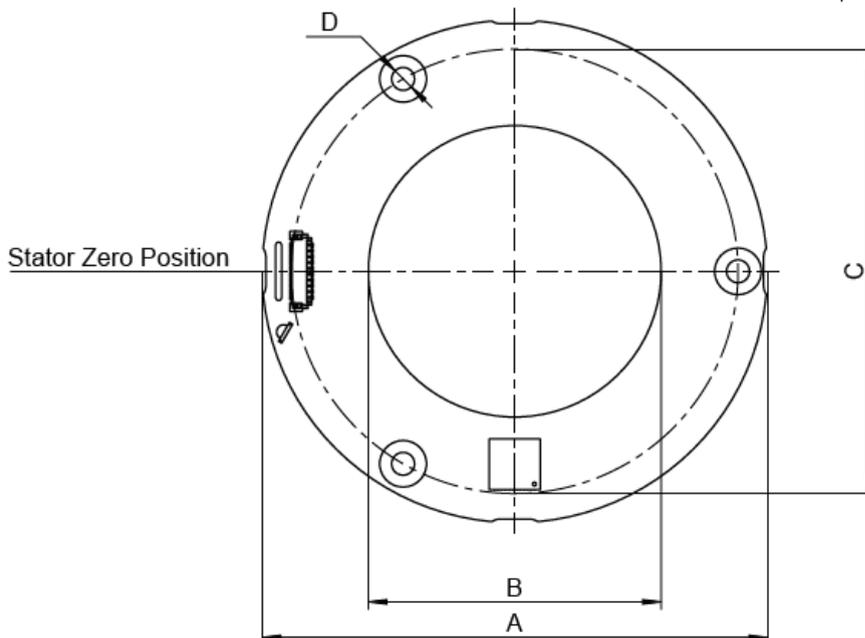
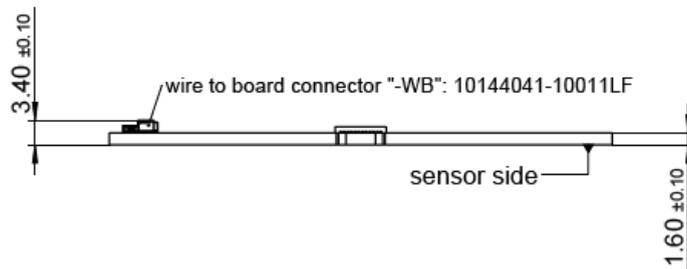
Screw hole dimensions for fastener according ISO 7380-1.

A set of mounting screws according to Section 10.1. is included with the product.

3.2.2. Stator for IND-ROT-069: **IRS-069**



INDUCTIVE Rotary Encoder - Stator
IRS-069
 open PCB



Size comparison table. The 069 mm size is highlighted.

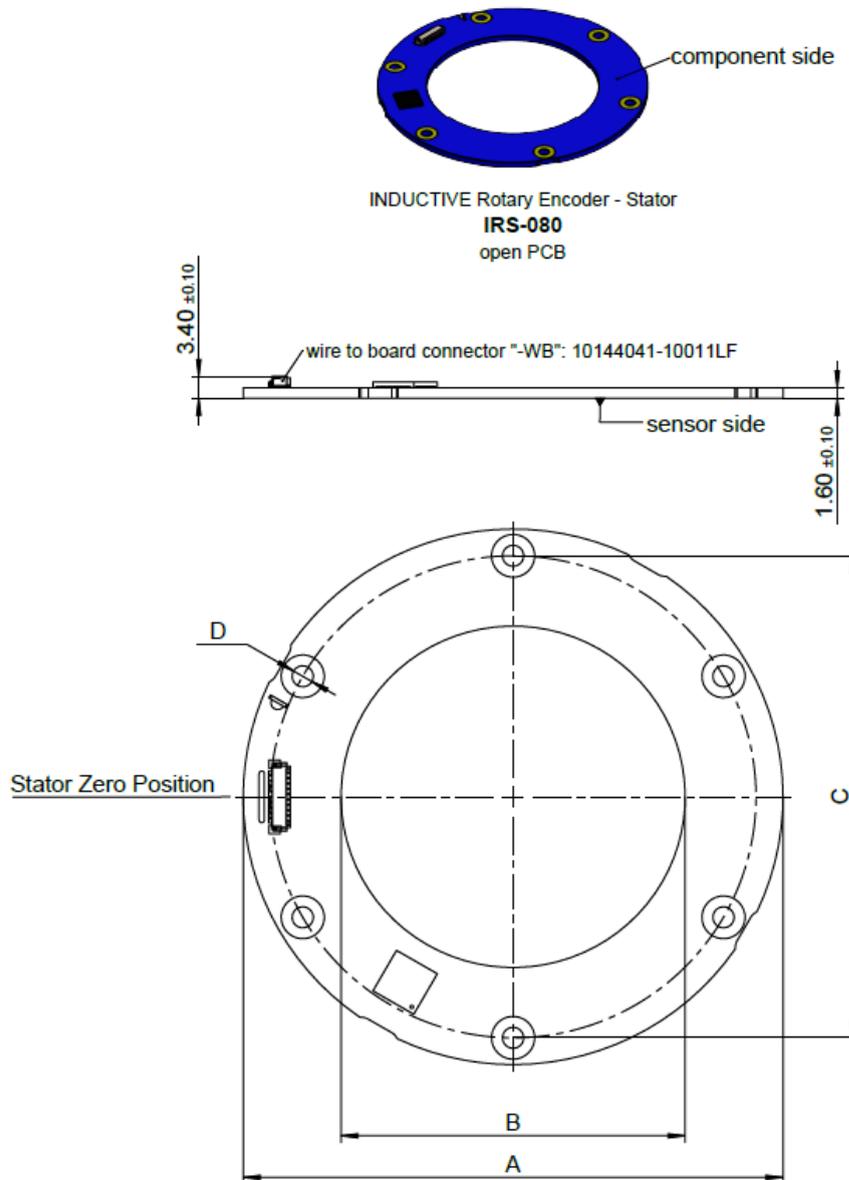
IRS-xxx	A	B	C	D
055	ø55 +0.0 /-0.2	ø26 +0.2 /-0.0	ø47	3 x ø3.20 (3x120°)
069	ø69 +0.0 /-0.2	ø40+0.2 /-0.0	ø61	3 x ø3.20 (3x120°)
080	ø80 +0.0 /-0.2	ø51+0.2 /-0.0	ø72	6 x ø3.20 (6x60°)
096	ø96 +0.0 /-0.2	ø67+0.2 /-0.0	ø88	6 x ø3.20 (6x60°)

Dimensions are in mm.

Screw hole dimensions for fastener according to ISO 7380-1.

A set of mounting screws according to Section 10.1. is included with the product.

3.2.3. Stator for IND-ROT-080: IRS-080



NOTE: The color of the stator IRS-080 may, unlike shown in the picture, possibly be delivered in green due to remaining stock. In terms of performance and functionality, there is no difference with the color of the stator.

Size comparison table. The 080 mm size is highlighted.

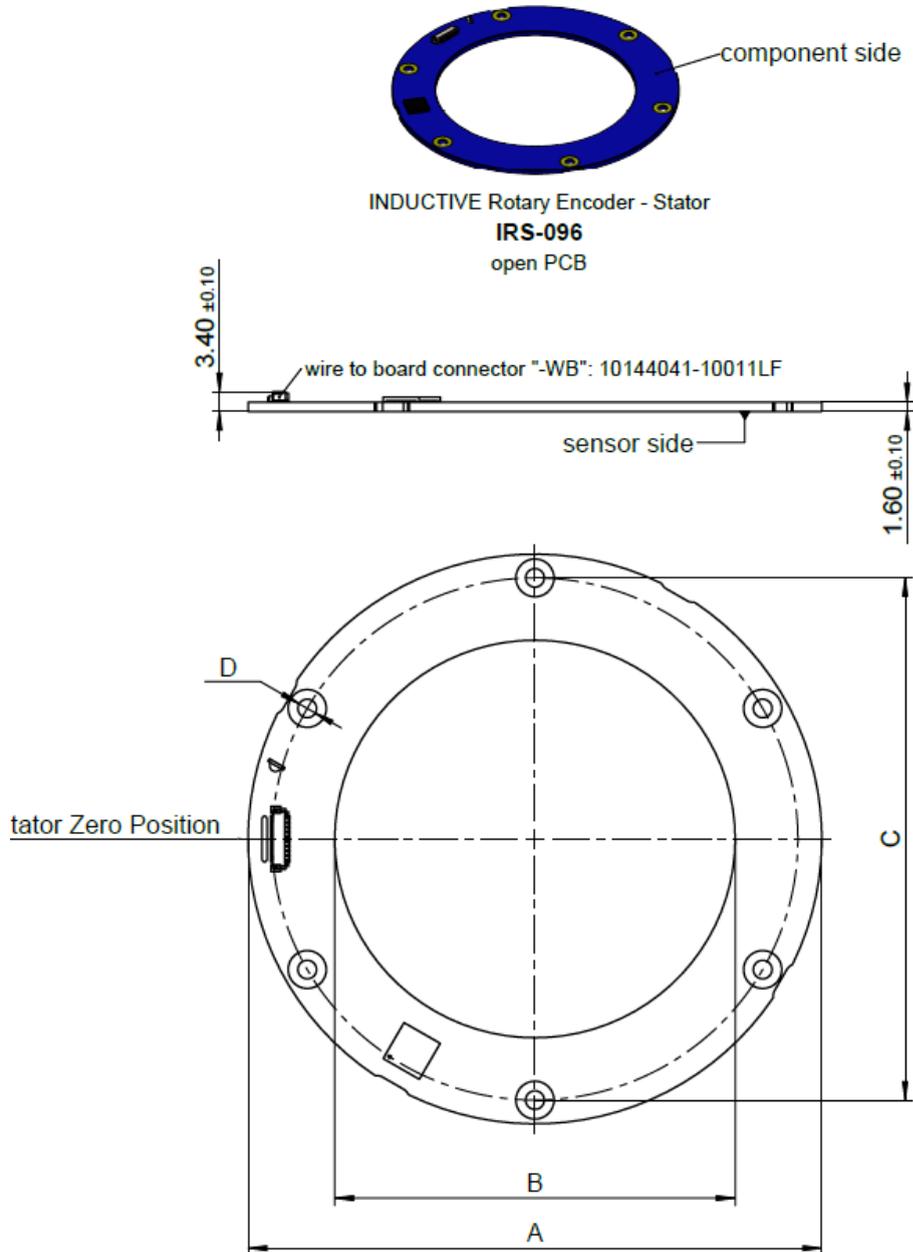
IRS-xxx	A	B	C	D
055	$\varnothing 55 +0.0 / -0.2$	$\varnothing 26 +0.2 / -0.0$	$\varnothing 47$	3 x $\varnothing 3.20$ (3x120°)
069	$\varnothing 69 +0.0 / -0.2$	$\varnothing 40 +0.2 / -0.0$	$\varnothing 61$	3 x $\varnothing 3.20$ (3x120°)
080	$\varnothing 80 +0.0 / -0.2$	$\varnothing 51 +0.2 / -0.0$	$\varnothing 72$	6 x $\varnothing 3.20$ (6x60°)
096	$\varnothing 96 +0.0 / -0.2$	$\varnothing 67 +0.2 / -0.0$	$\varnothing 88$	6 x $\varnothing 3.20$ (6x60°)

Dimensions are in mm.

Screw hole dimensions for fastener according ISO 7380-1.

A set of mounting screws according to Section 10.1. is included with the product.

3.2.4. Stator for IND-ROT-080: **IRS-096**



Size comparison table. The 096 mm size is highlighted.

IRS-xxx	A	B	C	D
055	ø55 +0.0 /-0.2	ø26 +0.2 /-0.0	ø47	3 x ø3.20 (3x120°)
069	ø69 +0.0 /-0.2	ø40+0.2 /-0.0	ø61	3 x ø3.20 (3x120°)
080	ø80 +0.0 /-0.2	ø51+0.2 /-0.0	ø72	6 x ø3.20 (6x60°)
096	ø96 +0.0 /-0.2	ø67+0.2 /-0.0	ø88	6 x ø3.20 (6x60°)

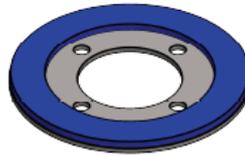
Dimensions are in mm.

Screw hole dimensions for fastener according ISO 7380-1.

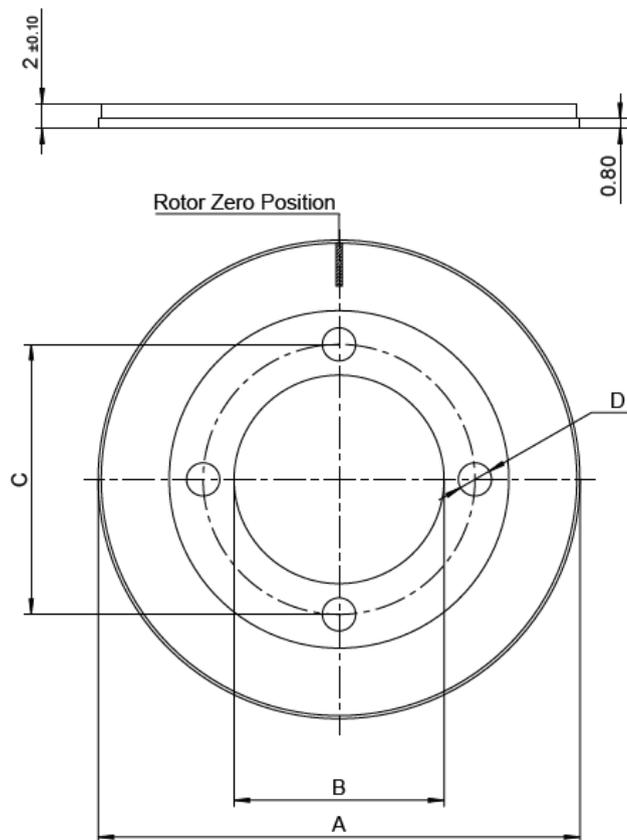
A set of mounting screws according to Section 10.1. is included with the product.

3.3 Inductive Rotary Encoder - Rotor: IRR-A21 screws axial

3.3.1. Rotor for IND-ROT-055: IRR-055-A21



INDUCTIVE Rotary Encoder - Rotor
IRR-055-A21



Size comparison table. The 055 mm size is highlighted.

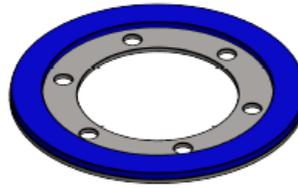
IRR-xxx-A21	A	B	C	D
055-A21	ø39 +0.00/-0.05	ø17 +0.05/-0.00	ø22	4 x ø2.70 (4x90°)
069-A21	ø53 +0.00/-0.05	ø29 +0.05/-0.00	ø35	6 x ø3.40 (6x60°)
080-A21	ø64 +0.00/-0.05	ø40 +0.05/-0.00	ø46	6 x ø3.40 (6x60°)
096-A21	ø80 +0.00/-0.05	ø56 +0.05/-0.00	ø62	6 x ø3.40 (6x60°)

Dimensions are in mm.

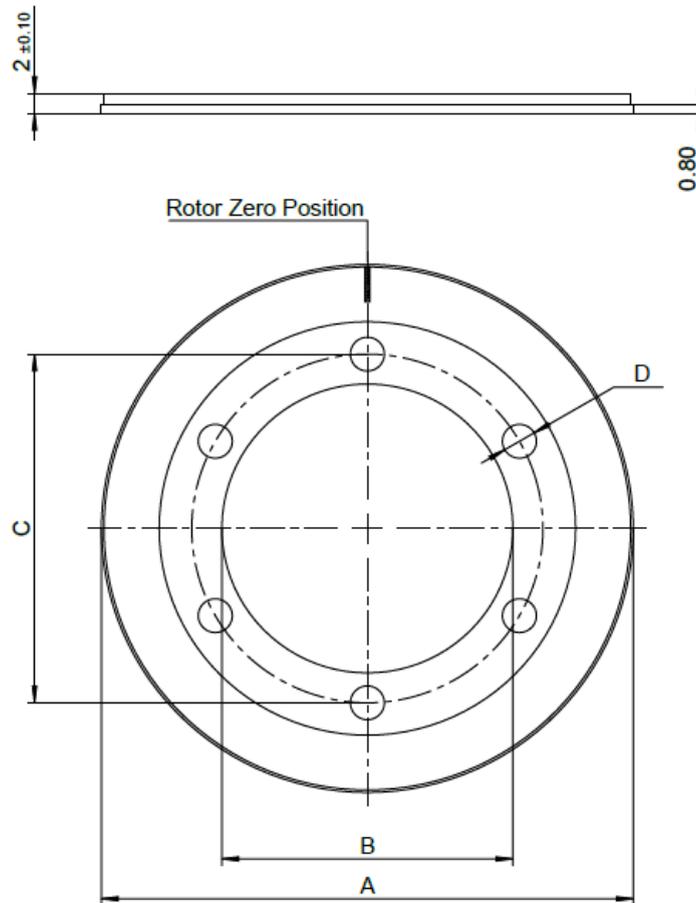
Screw hole dimensions for fastener according ISO 7380-1.

A set of mounting screws according to Section 10.1. is included with the product.

3.3.2. Rotor for IND-ROT-069: **IRR-069-A21**



INDUCTIVE Rotary Encoder - Rotor
IRR-069-A21



Size comparison table. The 069 mm size is highlighted.

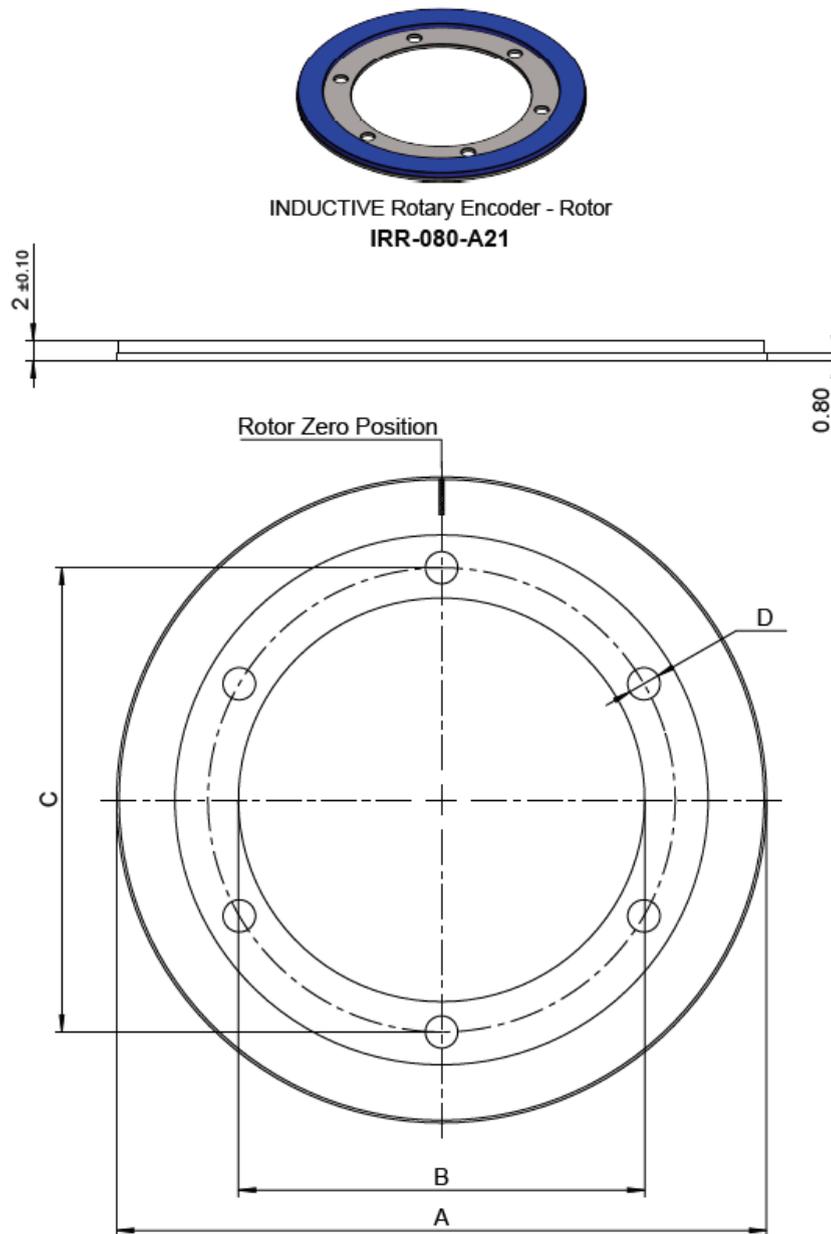
IRR-xxx-A21	A	B	C	D
055-A21	ø39 +0.00/-0.05	ø17 +0.05/-0.00	ø22	4 x ø2.70 (4x90°)
069-A21	ø53 +0.00/-0.05	ø29 +0.05/-0.00	ø35	6 x ø3.40 (6x60°)
080-A21	ø64 +0.00/-0.05	ø40 +0.05/-0.00	ø46	6 x ø3.40 (6x60°)
096-A21	ø80 +0.00/-0.05	ø56 +0.05/-0.00	ø62	6 x ø3.40 (6x60°)

Dimensions are in mm.

Screw hole dimensions for fastener according ISO 7380-1.

A set of mounting screws according to Section 10.1. is included with the product.

3.3.3. Rotor for IND-ROT-080: **IRR-080-A21**



Size comparison table. The 080 mm size is highlighted.

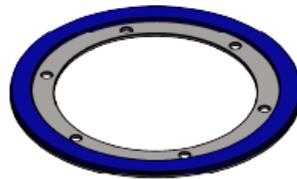
IRR-xxx-A21	A	B	C	D
055-A21	∅39 +0.00/-0.05	∅17 +0.05/-0.00	∅22	4 x ∅2.70 (4x90°)
069-A21	∅53 +0.00/-0.05	∅29 +0.05/-0.00	∅35	6 x ∅3.40 (6x60°)
080-A21	∅64 +0.00/-0.05	∅40 +0.05/-0.00	∅46	6 x ∅3.40 (6x60°)
096-A21	∅80 +0.00/-0.05	∅56 +0.05/-0.00	∅62	6 x ∅3.40 (6x60°)

Dimensions are in mm.

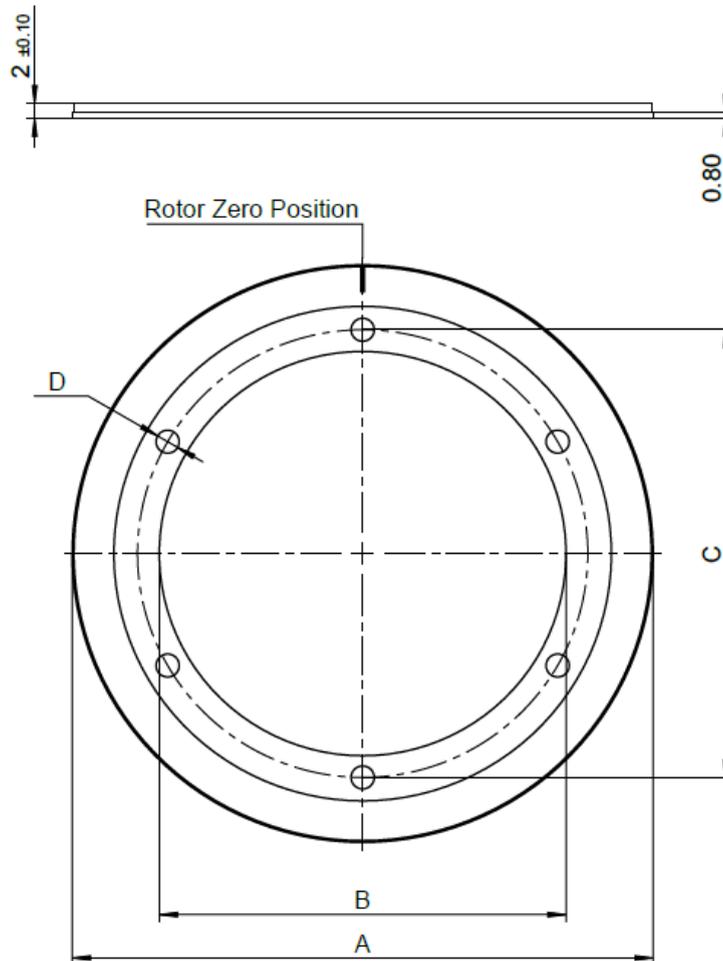
Screw hole dimensions for fastener according ISO 7380-1.

A set of mounting screws according to Section 10.1. is included with the product.

3.3.4. Rotor for IND-ROT-096: **IRR-096-A21**



INDUCTIVE Rotary Encoder - Rotor
IRR-096-A21



Size comparison table. The 096 mm size is highlighted.

IRR-xxx-A21	A	B	C	D
055-A21	∅39 +0.00/-0.05	∅17 +0.05/-0.00	∅22	4 x ∅2.70 (4x90°)
069-A21	∅53 +0.00/-0.05	∅29 +0.05/-0.00	∅35	6 x ∅3.40 (6x60°)
080-A21	∅64 +0.00/-0.05	∅40 +0.05/-0.00	∅46	6 x ∅3.40 (6x60°)
096-A21	∅80 +0.00/-0.05	∅56 +0.05/-0.00	∅62	6 x ∅3.40 (6x60°)

Dimensions are in mm.

Screw hole dimensions for fastener according ISO 7380-1.

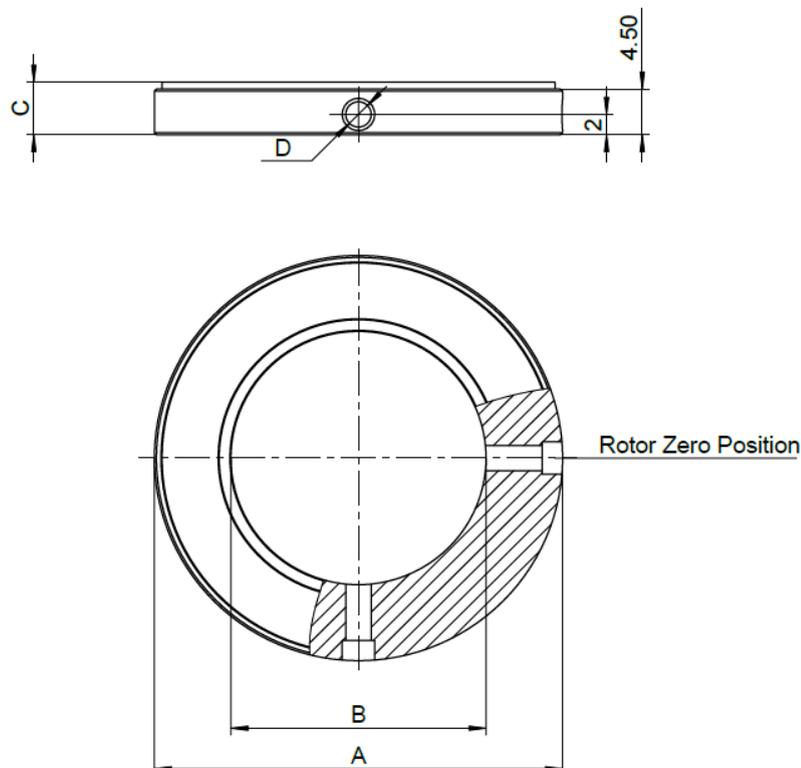
A set of mounting screws according to Section 10.1. is included with the product.

3.4. Inductive Rotary Encoder - Rotor: IRR-C21 screws radial

3.4.1. Rotor for IND-ROT-055: IRR-055-C2x-AL



INDUCTIVE Rotary Encoder - Rotor
GRR-055-C2x-AL
 anodized aluminum



Size comparison table. The 055 mm size is highlighted.

IRR-xxx	A	B	C	D
055-C21	ø40 h7	ø25 H7	5.20 ± 0.1	2 x M3 (90°)
069-C21	We offer customized rotors based on the application requirements. Please send your requirements at office@flux.gmbh			
080-C21				
096-C21				

Dimensions are in mm.

Screw hole dimensions for fastener according ISO 7380-1.

A set of mounting screws according to Section 10.1. is included with the product.

4. Mounting recommendations

4.1 Stator IRS sensor-side mounting

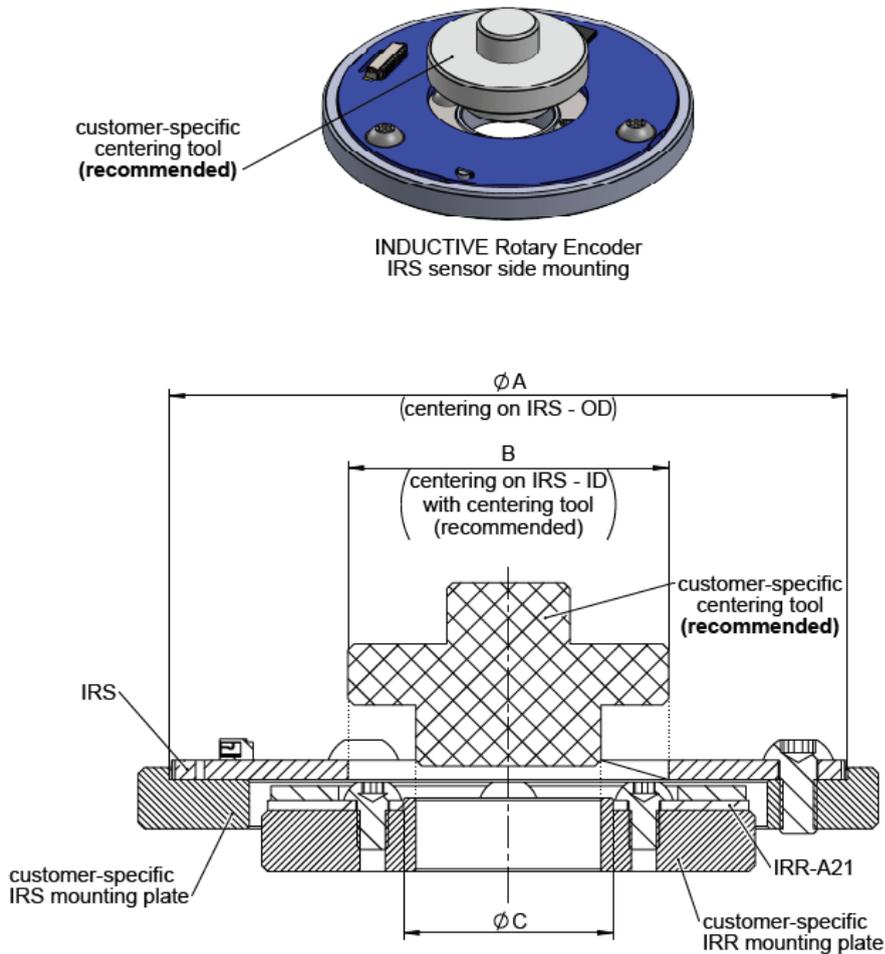


Fig. 4.1.: INDUCTIVE Rotary Encoder: IRS sensor-side mounting and centering.

IND-ROT-xxx	A	B	C
055	$\varnothing 55$ H7	$\varnothing 26$ h7	$\varnothing 17$ h7
069	$\varnothing 69$ H7	$\varnothing 40$ h7	$\varnothing 29$ h7
080	$\varnothing 80$ H7	$\varnothing 51$ h7	$\varnothing 40$ h7
096	$\varnothing 96$ H7	$\varnothing 67$ h7	$\varnothing 56$ h7

Dimensions are in mm.



IRS and IRR mounting must be adapted accordingly to its application. The customer-specific mounting plate in this visualization serves only as an illustration.

4.2 Stator IRS connector-side mounting with spacers

IRS connector-side mounting with spacers is not recommended for sizes IRS-080 and IRS-096. Therefore, sensor-side mounting is highly recommended as detailed in Section 4.1.

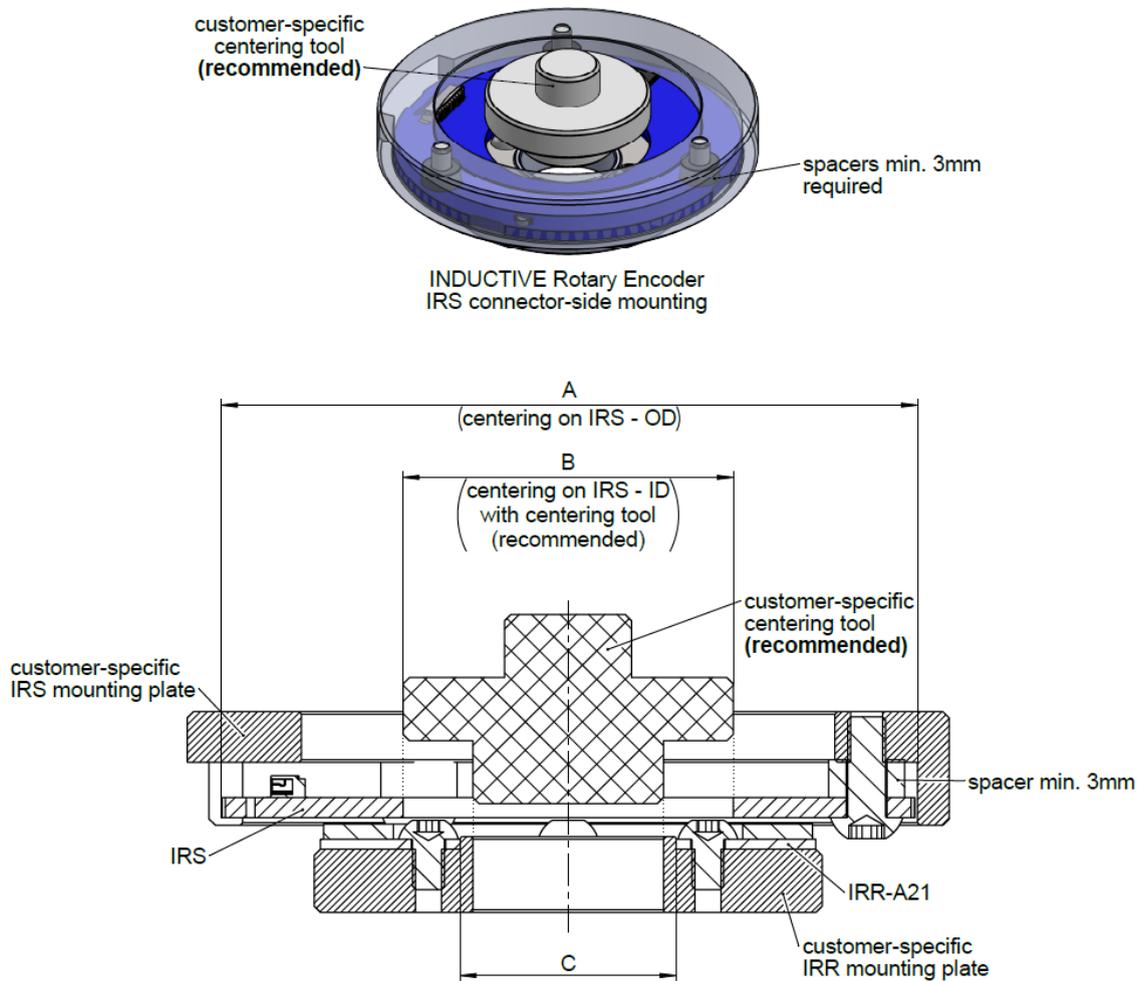


Fig. 4.2.:INDUCTIVE Rotary Encoder: IRS connector-side mounting and centering.

IND-ROT-xxx	A	B	C
055	∅55 H7	∅26 h7	∅17 h7
069	∅69 H7	∅40 h7	∅29 h7

Dimensions are in mm.



IRS and IRR mounting must be adapted accordingly to its application. The customer-specific mounting plate in this visualization serves only as an illustration.

5. Output interfaces

Given the extensive range of interfaces provided for our encoders, we have developed a dedicated resource called the "FLUX Encoders Interface Guide." This document provides a comprehensive and detailed description of all the interfaces. You can download the document from our website at www.flux.gmbh/downloads.

Output interfaces (See <i>FLUX Encoders Interface Guide</i> for complete description)	
Absolute: BiSS/C	BIS10, BIS21, BIS00
Absolute: SSI	SSI00, SSI01, SSI02, SSI03, SSI04
Incremental: A/B/Z	INC00, INC01, INC02, INC03
Absolute: SPI	<i>contact FLUX for more details</i>
Absolute: Asynchronous	UAT00, UAT01
Other synchronous or asynchronous	<i>contact FLUX for more details</i>

6. Commissioning and Debugging

6.1. Mounting and commissioning

INDUCTIVE-ROTARY encoders must be mounted in accordance with the mounting tolerances described in Chapter 3. The recommended mounting options are presented in Chapter 4.

The **INDUCTIVE-ROTARY** encoder requires no calibration or additional commissioning.

As soon as the **INDUCTIVE-ROTARY** encoders are mounted according to the specifications and powered up, they will provide high accuracy and high resolution positioning over the interface.

6.2. Debugging

The **INDUCTIVE-ROTARY** encoders are equipped with a status LED⁽¹⁾.

LED Color	Status	Recommended actions
No color	System is not (correctly) Powered-Up.	Check wiring connection to the motion controller
Red Color		
Continuous	System configuration error	Please contact FLUX
Fast blinking ⁽²⁾	Encoder in error mode	Check encoder mounting
Slow blinking ⁽³⁾	Out of operating range	Check encoder air-gap
Yellow		
Continuous	Normal operation, but error was detected	Check encoder shielding connection Check encoder mounting
Green		
Continuous	Optimal performance	
Fast blinking ⁽²⁾	Normal operation, not optimal performance	Check encoder runout
Slow blinking ⁽³⁾	Normal operation, not optimal performance	Check encoder air gap

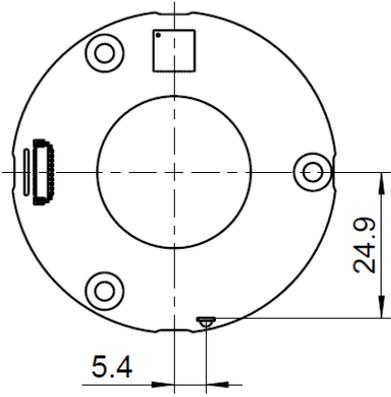
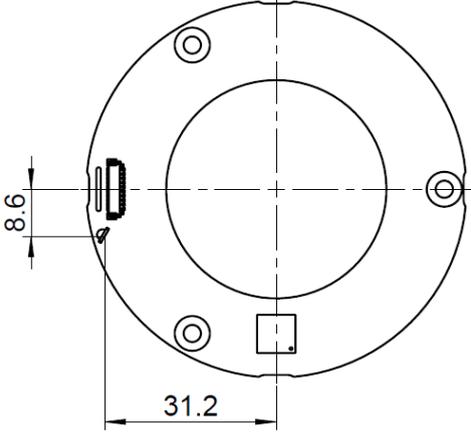
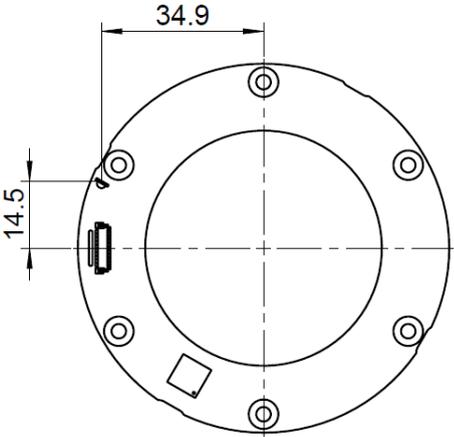
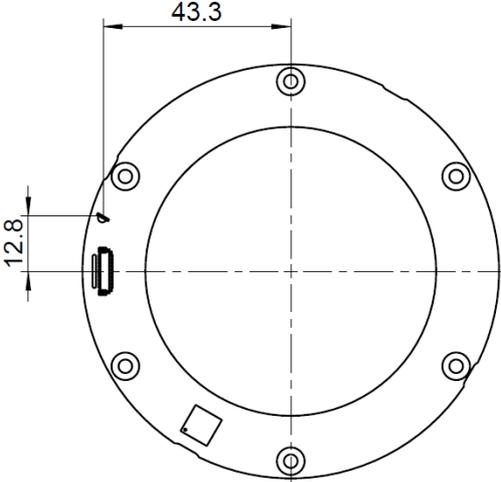
⁽¹⁾ The LED's lifespan can significantly diminish when operated under extremely low or high temperatures. Even if the LED ceases to emit light, the encoder's functionality remains unaffected.

⁽²⁾ Fast blinking ~ 0.4 sec.

⁽³⁾ Slow blinking ~ 1.6 sec

6.3. Status LED position

The **INDUCTIVE-ROTARY** encoders are equipped with a status LED. Its position for every encoder size is shown in the drawings below.

IRS-055	IRS-069
	
IRS-080	IRS-096
	

NOTE: Connector and LED positions shown in the drawings are the actual position on the stator IRS of each size. All other components are for demonstration purposes only.

7. Optional features

7.1. Multi-turn position (memory saved)

In **INDUCTIVE-ROTARY** encoders, the multi-turn position can be automatically saved at power off and restored after powering on. Therefore, even a frameless encoder such as **INDUCTIVE-ROTARY** can implement a virtual multi-turn function.

The encoder does not have any mechanism for monitoring position changes when it is not powered up, so this function should only be used when movement is either not possible or restricted to less than $\pm 180^\circ$ when power is turned off.

Please contact us at office@flux.gmbh for more information.

7.2. Setting zero position and counting direction

The **INDUCTIVE-ROTARY** encoder allows setting of the zero position and changing of the positive counting direction. Both features can be changed via the BiSS-C Interface registers. For more details, please refer to the full BiSS-C user manual for FLUX encoders.

The zero point position of the stator IRS is aligned with the connector, the zero point position of the rotor IRR is marked on the scale and aligned with a mounting hole of the rotor. A visualization for the zero position of stator and rotor can be found in the respective section in Chapter 3 for every size. The zero positions have an accuracy within a range of $\pm 5^\circ$ from their designated nominal positions.

The positive counting direction set by default is visualized in the following figure:

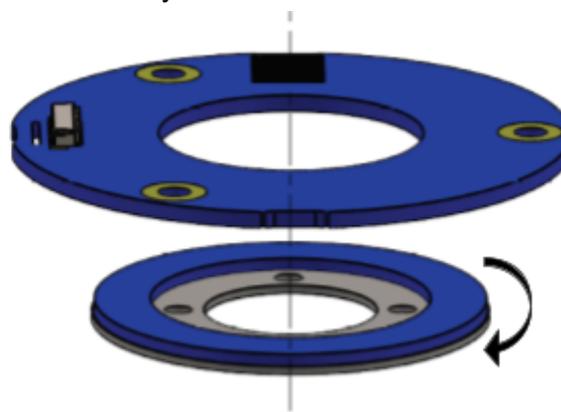
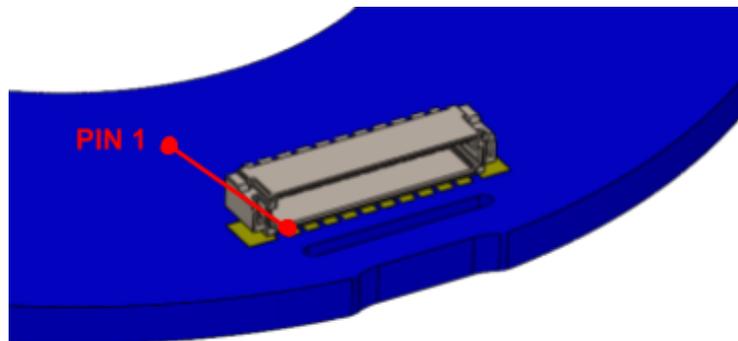


Fig. 7.1.: Visualization of the positive counting direction set by default.

8. Connector and Wiring

8.1. Option “WB” - Connector

Type	Wire to Board
Manufacturer	Amphenol ICC (FCI)
Part Number	10144041-10011LF (Series Minitek® 0.80mm)
Operating temperature	-25°C .. +85°C (<i>contact FLUX for extended temperatures</i>)
Description	Connector Header Surface Mount Right Angle 10 position 0.031" (0.80mm)
Available accessories	WB0806K0200 or WB0210K0100 - See Chapter Accessories



Pin	SSI & BISS/C	INCxx-A/B/Z	UATxx	Comments
1	Vdd	Vdd	Vdd	Power Supply
2	GND	GND	GND	Power Ground
3	<i>do not connect</i>	B+	<i>do not connect</i>	
4	<i>do not connect</i>	B-	<i>do not connect</i>	
5	<i>do not connect</i>	A+	<i>do not connect</i>	
6	<i>do not connect</i>	A-	<i>do not connect</i>	
7	SCLK+	<i>do not connect</i>	<i>do not connect</i>	
8	SCLK-	<i>do not connect</i>	<i>do not connect</i>	
9	SDATA+	Z+	TX+	
10	SDATA-	Z-	TX-	



Do not connect any unused pins.

9. Ordering code

IND-ROT	-055	-A21	-19	-BIS10	-5V	-WB	
Rotary encoder	Diameter [mm]	Rotor type	Output Resolution [Bits/Rev]	Output Interface	Supply Voltage	Connector Type	Optional features
	055	-A21	15	BIS10	5V - 4..6Vdc	WB - Wire-Board	See table below
	069	-C21	16	BIS21			
	080		17	BIS00			
	096		18	SSI00			
			19	SSI01			
			20	SSI02			
			21	SSI03			
			22	SSI04			
				INC00			
				INC01			
				INC02			
			INC03				
			UAT00				
			UAT01				

For optional features, please refer to the table provided below. When placing your order, include the desired features' code without using a dash and add them at the end of the ordering code. The standard configuration is represented by a blank entry.

Additional feature	Letter in order code
Extended temperature	E
Multiturn (memory saved)	M
High Speed	S
Acrylic Coating	A

10. Accessories

10.1. Spacers and Mounting Screws

A set of spacers and mounting screws is included with the product.

IND-ROT	Stator	Rotor A21	Rotor C2x
-055	3x screws M3x8 TORX socket button head ~ISO 7380-1	4 x screws M2.5x4 TORX socket button head ~ISO 7380-1	2 x set screws M3x6 HEX socket set screw with flat point ISO 4026 / DIN 913
	3 x plastic spacers 3mm ⁽¹⁾ OD 6.00mm / ID 3.20mm		
-069	3 x screws M3x8 TORX socket button head ~ISO 7380-1	6 x screws M3x5 TORX socket button head ~ISO 7380-1	n.a.
	3 x plastic spacers 3mm ⁽¹⁾ OD 6.00mm / ID 3.20mm		
-080⁽²⁾	6 x screws M3x8 TORX socket button head ~ISO 7380-1	6 x screws M3x5 TORX socket button head ~ISO 7380-1	n.a.
	-		
-096⁽²⁾	6 x screws M3x8 TORX socket button head ~ISO 7380-1	6 x screws M3x5 TORX socket button head ~ISO 7380-1	n.a.
	-		

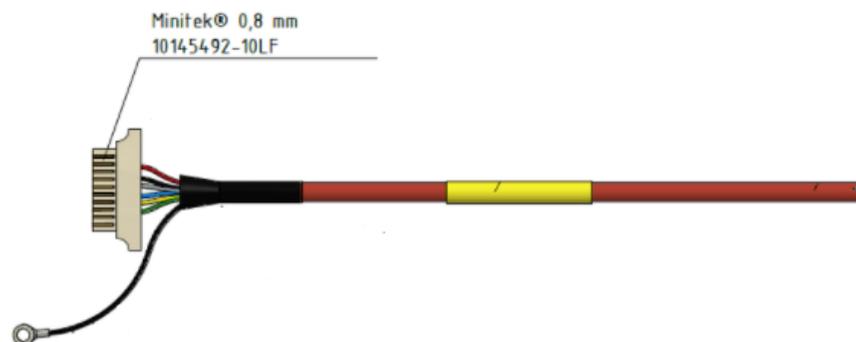
⁽¹⁾ Stainless steel spacers are available on request. Recommended for extreme temperature range.

⁽²⁾ Component-side mounting with spacers is not recommended for sizes 080 and 096, no spacers are delivered. See Chapter 4 for more information.

10.2. Assembly cable 6-wires for “WB” connector

FLUX ordering code	WB0806K0200
Cable length	0.5 m
Left cable side	Connector 10145492-10LF Series Minitex® 0.80mm
Operating temperature (connector)	-25°C .. +85°C
Right side	Open wire (connector on request)

Cable Specification - Cable “K02”	
Outer jacket	Silicone rubber-based
Temperature rating	dynamic: -25°C .. +180°C static: -60°C .. +180 °C
Wrapping	3 x 2 x AWG 30, FEP Isolation
Shield	Tinned copper braided. Coverage ≥ 95 %
Outer diameter	3.3 ± 0.1mm
Bending radius	18 mm single / 36 mm continuous bending
Certification	This product contains following SCHV candidate substances according to EU REACH regulation 1907/2006: <i>Decamethylcyclopentasiloxane, CAS-No.: 541-02-6 > 0.1%</i> <i>Dodecamethylcyclohexasiloxane (D6), CAS-No.: 540-97-6 > 0.1%</i> <i>Octamethylcyclotetrasiloxane, CAS-No.: 556-67-2 > 0.1%</i>



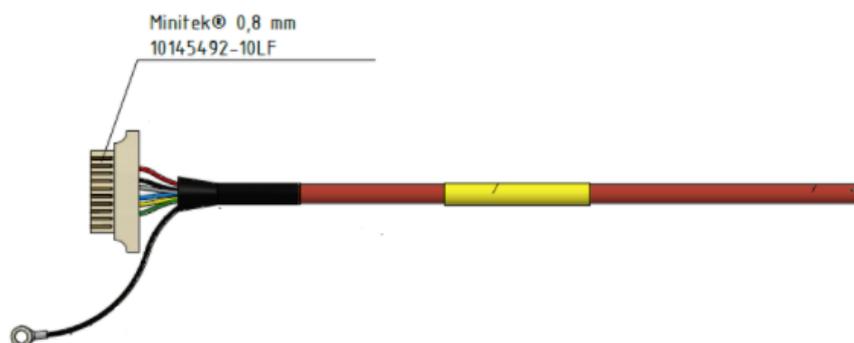
Connector pinout for 6-wire cable "K02":

No.	AWG	Color	SSI & BISS/C	INCxx- A/B/Z	SPI	UATxx	Comments
1	30	red	Vdd	<i>n.a.</i>	Vdd	Vdd	Power Supply
2	30	black	GND		GND	GND	Power Ground
3..6	<i>n.a.</i>	<i>n.a.</i>	<i>n.a.</i>		<i>n.a.</i>	<i>n.a.</i>	
7	30	grey	SCLK+		SCLK+	<i>do not connect</i>	
8	30	blue	SCLK-		SCLK+	<i>do not connect</i>	
9	30	green	SDATA+		MISO+	TX+	
10	30	yellow	SDATA-		MISO-	TX-	

10.3. Assembly cable 10-wires for “WB” connector

FLUX ordering code	WB0210K0100
Cable length	0.5 m
Left side	Connector 10145492-10LF Series Minitex® 0.80mm
Operating temperature (connector)	-25°C .. +85°C
Right side	Open wire (connector on request)

Cable Specification - Cable “K01”	
Outer jacket	Silicone rubber-based
Temperature rating	dynamic: -25°C .. +180°C static: -60°C .. +180 °C
Wrapping	3 x 2 x AWG 30, FEP Isolation
Shield	Tinned copper braided. Coverage ≥ 95 %
Outer diameter	3.3 ± 0.1mm
Bending radius	18 mm single / 36 mm continuous bending
Maximum length	3 m
Certification	This product contains following SCHV candidate substances according to EU REACH regulation 1907/2006: <i>Decamethylcyclopentasiloxane, CAS-No.: 541-02-6 > 0.1%</i> <i>Dodecamethylcyclohexasiloxane (D6), CAS-No.: 540-97-6 > 0.1%</i> <i>Octamethylcyclotetrasiloxane, CAS-No.: 556-67-2 > 0.1%</i>



Connector pinout for 10-wire cable "K01":

No.	AWG	Color	SSI & BISS/C	INCxx- A/B/Z	SPI	UATxx	Comments
1	28	violet	Vdd	Vdd	Vdd	Vdd	Power Supply
2	28	black	GND	GND	GND	GND	Power Ground
3	30.	green	<i>do not connect</i>	B+	<i>do not connect</i>	<i>do not connect</i>	
4	30	yellow	<i>do not connect</i>	B-	<i>do not connect</i>	<i>do not connect</i>	
5	30	white	<i>do not connect</i>	A+	<i>do not connect</i>	<i>do not connect</i>	
6	30	braun	<i>do not connect</i>	A-	<i>do not connect</i>	<i>do not connect</i>	
7	30	blue	SCLK+	<i>do not connect</i>	SCLK+	<i>do not connect</i>	
8	30	red	SCLK-	<i>do not connect</i>	SCLK+	<i>do not connect</i>	
9	30	grey	SDATA+	Z+	MISO+	TX+	
10	30	pink	SDATA-	Z-	MISO-	TX-	

11. Revision history

Date	Version	Comments
2022-04	00	First built - based on the AFE-200 datasheet
2023-01	01	SSlxx drawings bits number updated. INCxx output frequency information updated. Typo errors corrected
2023-02	02	New BiSS-C version added: BIS10
2023-03	03	Chapter 5.5 and 5.6: Frame format for BISxx added. Chapter 10.1: Spacers and screws accessories added. Chapter 10.3: Assembly cable for 10 wires added.
2023-07	04	Maximum output resolution increased. ENOB values added. Drawing in Cap. 3.1 Corrected. UATxx interface added.
2023-11	05	Added: (1) new interfaces, (2) Zero point position, (3) Positive counting direction (4) Shield connection. Removed: (1) Interface description. Updated: (1) Drawings.

Technical data is subject to change without notice.



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