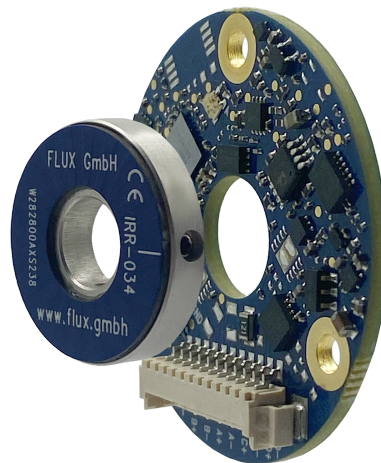


# Absolute Rotary Encoder

## “INDUCTIVE-ROTARY”

### sizes 34 mm to 45 mm



## Technical Datasheet

2023-11 - rev.07

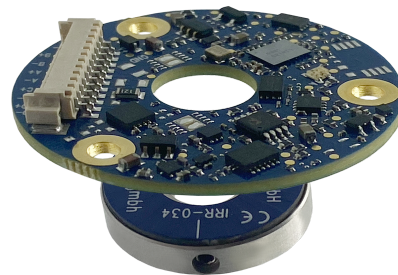
[www.flux.gmbh](http://www.flux.gmbh)

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# 1. Encoder Specification



IND-ROT-034 with rotor IRR-C2108-AL

IND-ROTARY Size / OD	34 mm	36 mm	45 mm
<b>System data</b>			
<b>Type</b>	Axial, frameless, true absolute <b>INDUCTIVE encoder</b>		
<b>Maximum Output Resolution<sup>(1)</sup></b> <i>(non binary on request)</i>	18 bits		19 bits
	65'536 ppr (before x4) 262'144 cpr (after x4)		131'072 ppr 524'288 cpr
<b>ENOB in entire mounting tolerance range<sup>(2)</sup></b>	17 bits		18 bits
<b>Achievable accuracy<sup>(3)</sup></b>	± 0.030°		± 0.025°
<b>Standard accuracy</b>	± 0.050°		± 0.040°
<b>Hysteresis</b>	none		
<b>Repeatability</b>	1 count		
<b>Position update rate</b>	< 1 microsecond		
<b>Maximum speed</b>	6'000 rpm <i>(higher on request)</i>		
<b>Power up-time</b>	max. 0.8 sec		

<sup>(1)</sup> 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.

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

<sup>(3)</sup> Achievable accuracy at nominal air-gap, with tighter (halved) tolerances for runout, lateral displacement as well as perpendicularity of stator and rotor to the axis of rotation.

IND-ROTARY Size / OD	34 mm	36 mm	45 mm
<b>Electrical data</b>			
<b>Supply voltage</b> <i>(at encoder connector)</i>	min. 4.35 Vdc. max. 36 Vdc		
<b>Reverse polarity protection</b>	Yes		
<b>Current consumption</b> <i>(w.o. terminations)</i>	max. 100 mA @ 5 Vdc max. 30 mA @ 24 Vdc		

IND-ROTARY Size / OD	34 mm	36 mm	45 mm
<b>Mechanical data</b>			
<b>Stator base material</b>	FR4 (PCB)		
<b>Stator weight<sup>(1)</sup></b>	3.5 g	4.0 g	5.5 g
<b>Rotor base material</b>	Carrier: anodized aluminum Bonded scale: FR4		
<b>Rotor weight<sup>(2)</sup></b> <i>(with aluminum carrier)</i>	5.5 g		
<b>Shock</b>	200 g, 6 ms		
<b>Vibration</b>	20 g, 55 .. 2000 Hz		

<sup>(1)</sup> Guiding values without cable.

<sup>(2)</sup> Guiding value. Value can vary with the rotor mounting option.

IND-ROTARY Size / OD	34 mm	36 mm	45 mm
<b>Mounting tolerances</b>			
<b>Nominal Axial Air-Gap</b> <i>(for best performance)</i>	0.50 mm		
<b>Axial tolerance</b> <i>(air-gap)</i>	±0.30 mm <i>(0.20 to 0.80 mm)</i>		
<b>Radial tolerances</b> <i>(runout / lateral displacement)</i>	0.30 mm		

IND-ROTARY Size / OD	34 mm	36 mm	45 mm
<b>Environmental data</b>			
Operating temperature	-20°C .. +85°C <sup>(1)</sup>		
Storage temperature	-20°C .. +85°C <sup>(1)</sup>		
Ingress Protection	IP00		
EMC immunity	complies with EN IEC 61000-6-2		
EMC emission	complies with EN IEC 61000-6-4		

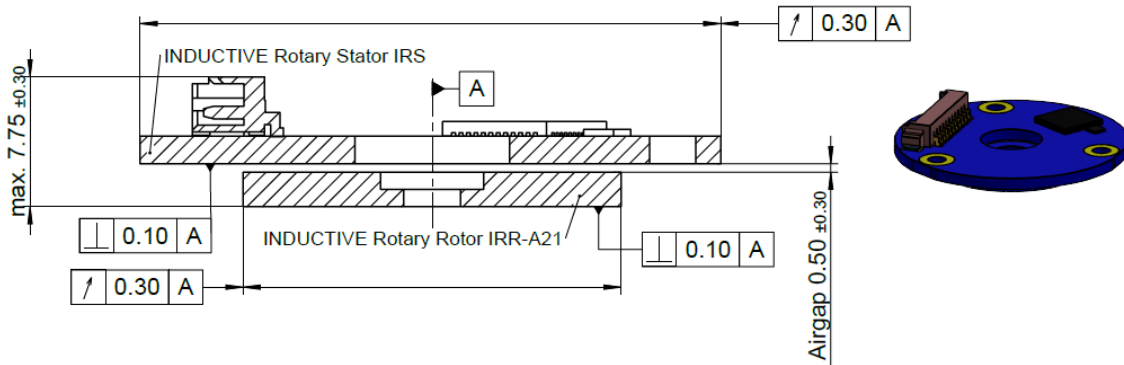
<sup>(1)</sup> Contact FLUX for extended temperature range.

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

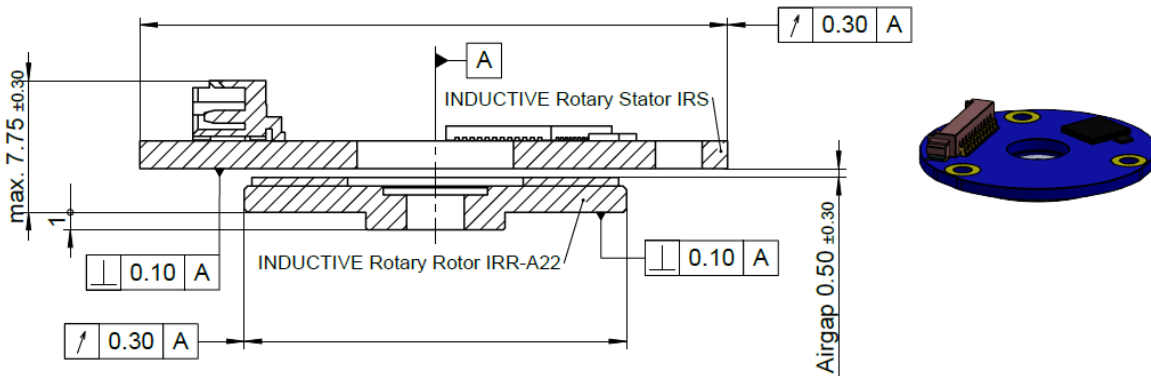
## 2. Mechanical dimensions and mounting tolerances

### 2.1. INDUCTIVE-ROTARY SINGLE - Mounting tolerances

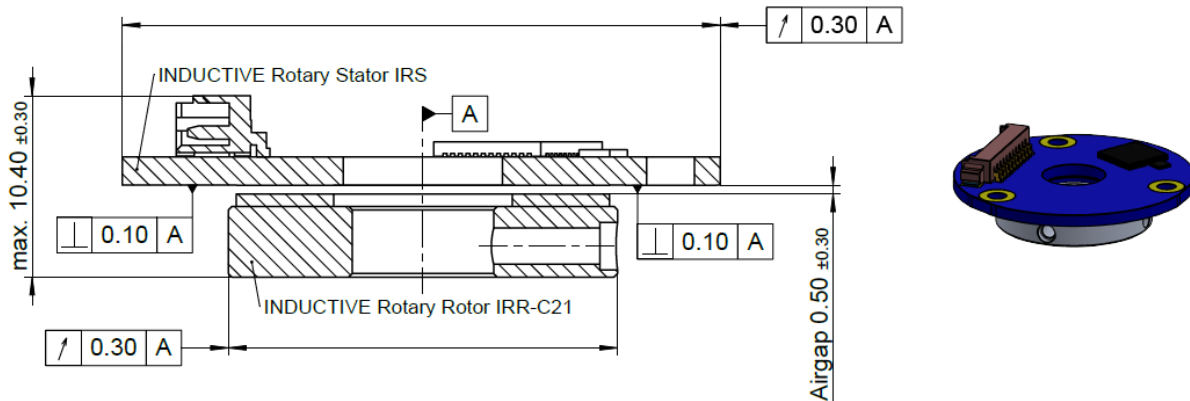
Rotor mounting with axial screw inside grating (Rotor option “-A21”):



Rotor mounting with axial screw inside grating (Rotor option “-A22”):



Rotor mounting with radial screws (Rotor option “-C21”):



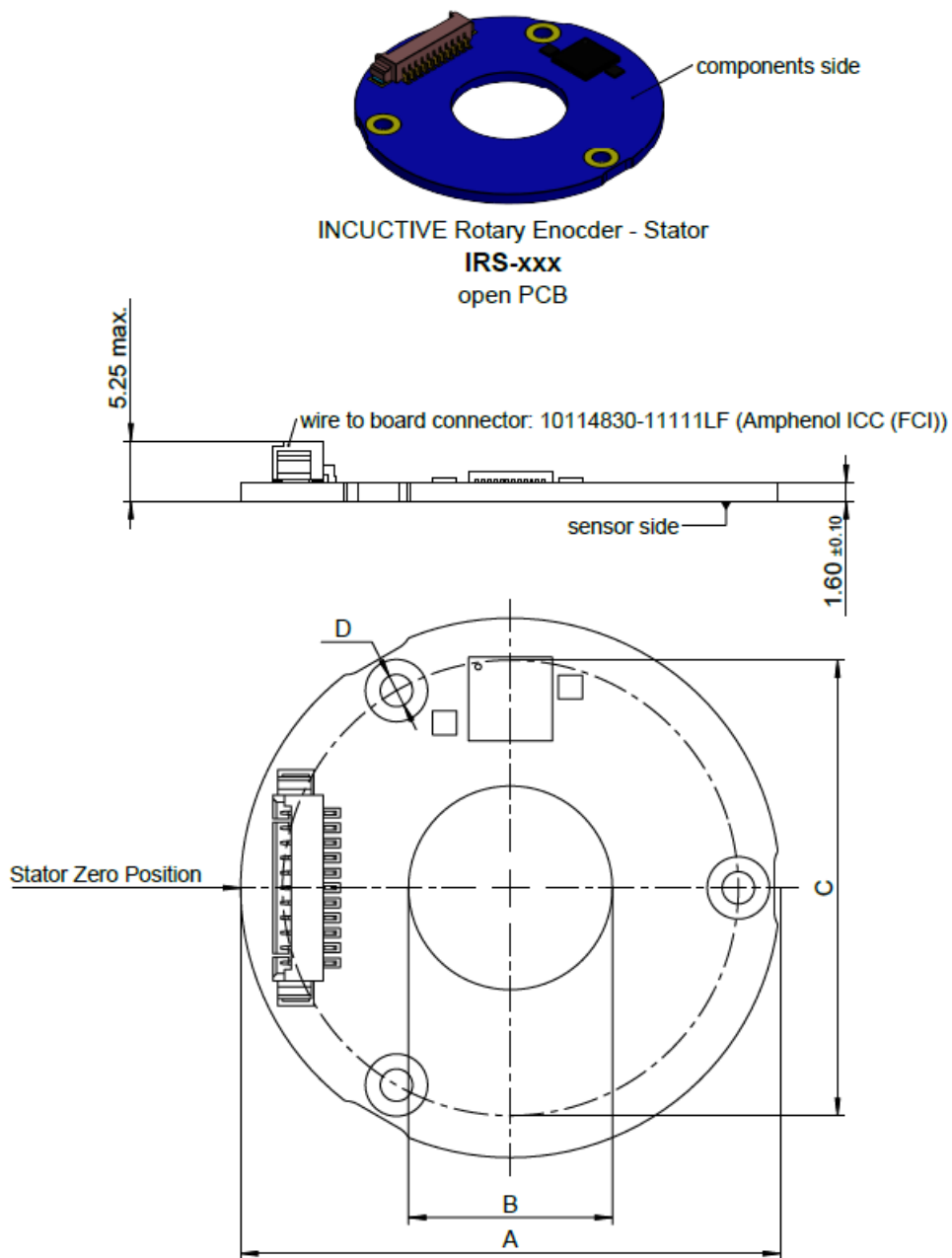
**A** ... axis of rotation

max. total 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 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.

## 2.3. Inductive Rotary Encoder - Stator: **IRS-xxx**



**INFO: A height clearance of 2 mm is necessary for the electrical components across the entire component side, while for the connector, it should be 3.60 mm.**

IRS-xxx-WB	A	B	C	D
<b>034</b>	$\varnothing 34 +0.0 /-0.2$	$\varnothing 9 +0.2 /-0.0$	$\varnothing 28$	<b>3 x <math>\varnothing 2,70</math> (3 x 120°)</b>
<b>036</b>	$\varnothing 36 +0.0 /-0.2$	$\varnothing 11 +0.2 /-0.0$	$\varnothing 30$	<b>3 x <math>\varnothing 2,70</math> (3 x 120°)</b>
<b>045</b>	$\varnothing 45 +0.0 /-0.2$	$\varnothing 17 +0.2 /-0.0$	$\varnothing 38$	<b>3 x <math>\varnothing 2,70</math> (3 x 120°)</b>

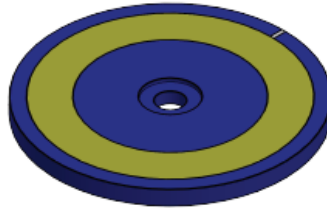
Dimensions are in mm.

Screw hole dimensions for fastener according ISO 7380-1.

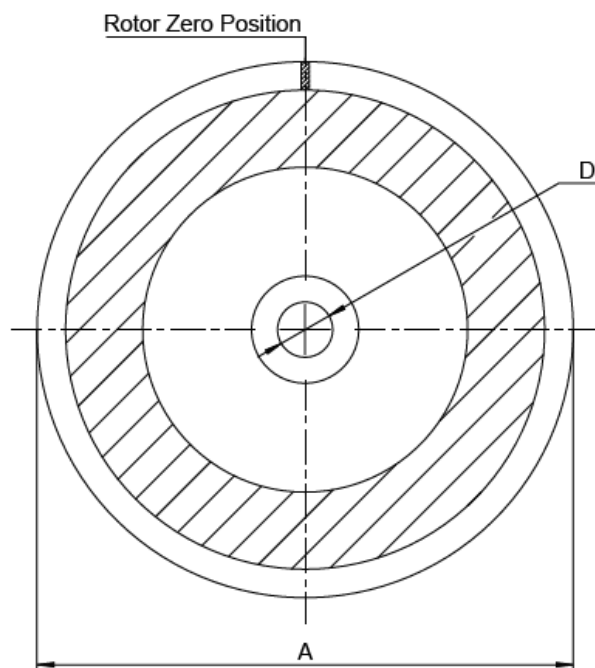
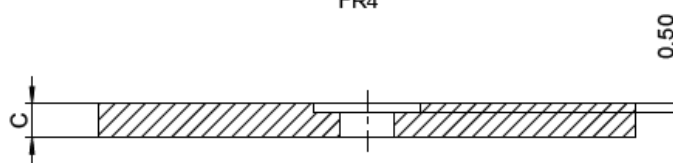
A set of mounting screws according to Section 7.1. is included with the product.

## 2.5 Inductive Rotary Encoder - Rotor: IRR

### 2.5.1. Rotor with central axial screw: IRR-xxx-A21-FR



INDUCTIVE Rotary Encoder - Rotor  
**IRR-xxx-A21-FR**  
 FR4



Size comparison table:

IRR-xxx-A21-FR	A	B	C	D
<b>034</b>	$\varnothing 22 +0.0/-0.2$	-	$2 \pm 0.1$	$\varnothing 3.30$
<b>036</b>	$\varnothing 24 +0.0/-0.2$	-	$2 \pm 0.1$	$\varnothing 3.30$
<b>045</b>	$\varnothing 32 +0.0/-0.2$	-	$2 \pm 0.1$	$\varnothing 3.30$

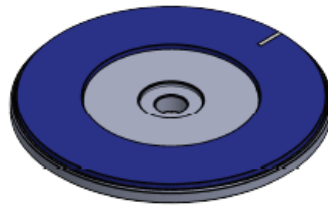
Dimensions are in mm.

Screw hole dimensions for fastener according ISO 7380-1.

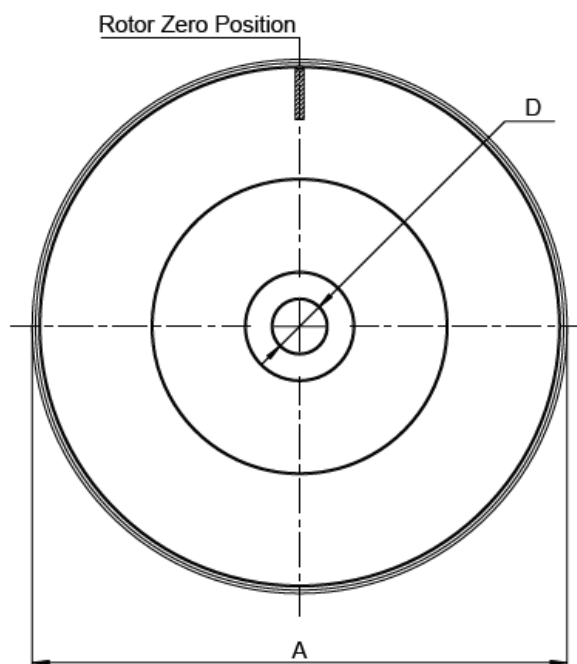
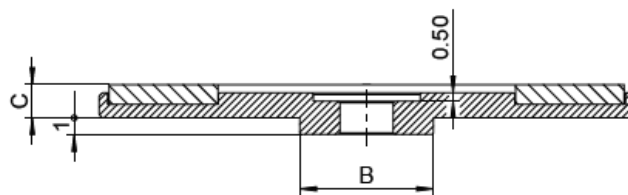
A set of mounting screws according to Section 7.1. is included with the product.



## 2.5.2. Rotor with central axial screw and centering hub: IRR-xxx-A22-AL



INDUCTIVE Rotary Encoder - Rotor  
**IRR-xxx-A22-AL**  
 anodized aluminum



Size comparison table:

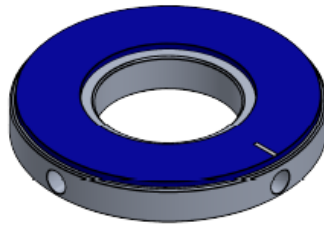
IRR-xxx-A22-AL	A	B	C	D
<b>034</b>	$\varnothing 22 +0.0 / -0.05$	$\varnothing 8 \text{ h}7$	$2 \pm 0.1$	$\varnothing 3.30$
<b>036</b>	$\varnothing 34 +0.0 / -0.05$	$\varnothing 8 \text{ h}7$	$2 \pm 0.1$	$\varnothing 3.30$
<b>045</b>	$\varnothing 32 +0.0 / -0.05$	$\varnothing 8 \text{ h}7$	$2 \pm 0.1$	$\varnothing 3.30$

Dimensions are in mm.

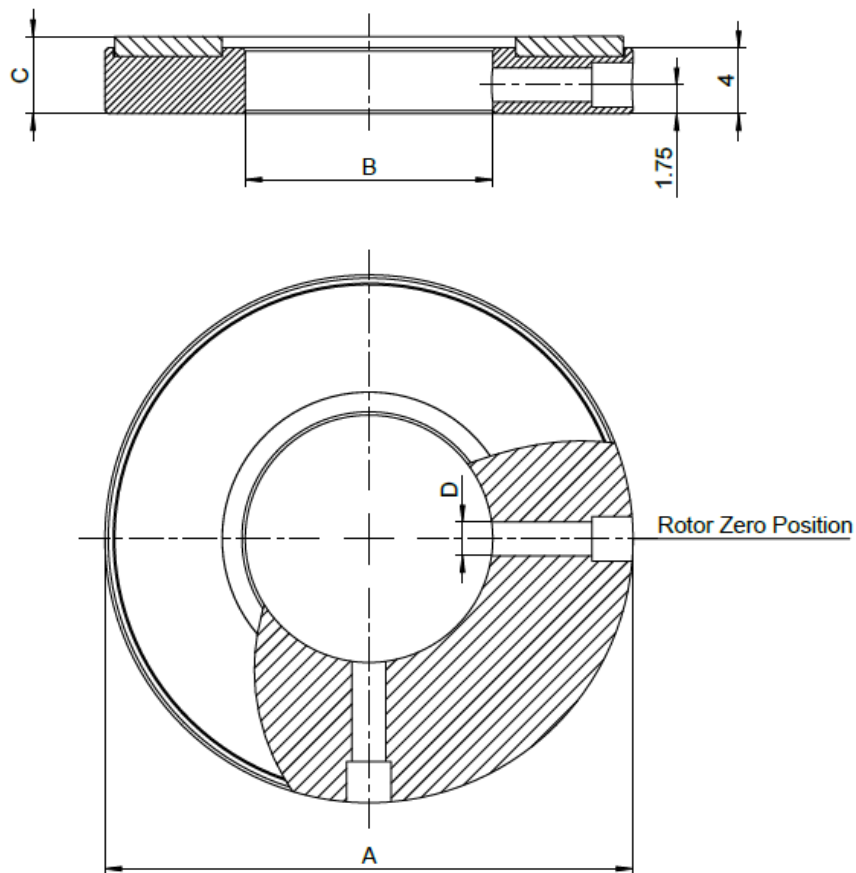
Screw hole dimensions for fastener according ISO 7380-1.

A set of mounting screws according to Section 7.1. is included with the product.

### 2.5.3. Rotor with radial set screws: IRR-xxx-C21xx-AL



INDUCTIVE Rotary Encoder - Rotor  
**IRR-xxx-C21xx-AL**  
 anodized aluminum



Size comparison table:

IRR-xxx-C21xx-AL	A	B	C	D
<b>034-C2108</b>	∅22 h7	∅8 H7	4.70 ± 0.1	2 x M2.5 (2 x 90°)
<b>036-C2110</b>	∅24 h7	∅10 H7	4.70 ± 0.1	2 x M2.5 (2 x 90°)
<b>045-C2115</b>	∅32 h7	∅15 H7	4.70 ± 0.1	2 x M2.5 (2 x 90°)

Dimensions are in mm.

Screw hole dimensions for fastener according ISO 7380-1.

A set of mounting screws according to Section 7.1. is included with the product.

### 3. 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](http://www.flux.gmbh/downloads).

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

## 4. Commissioning and Debugging

### 4.1. 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.

### 4.2. Debugging

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

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

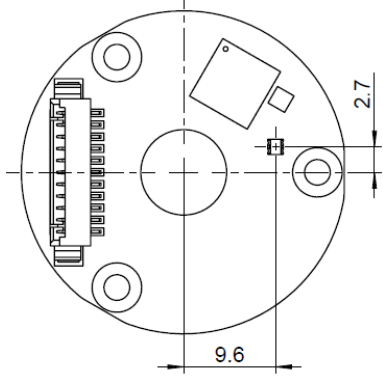
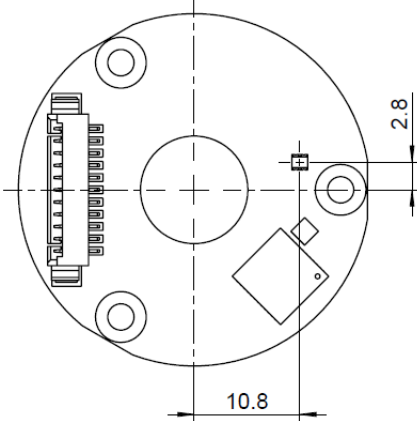
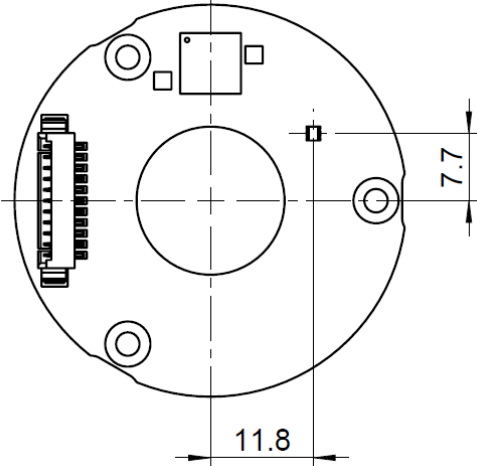
<sup>(1)</sup> The LED's lifespan can significantly diminish when operated under extremely low or high temperatures. Even if the LED ceases to emit light, the encoder's functionality remains unaffected.

<sup>(2)</sup> Fast blinking ~ 0.4 sec.

<sup>(3)</sup> Slow blinking ~ 1.6 sec

### 4.3. 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-034	IRS-036
	
IRS-045	
	

**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.

## 5. Optional features

### 5.1. 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](mailto:office@flux.gmbh) for more information.

### 5.2. 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:

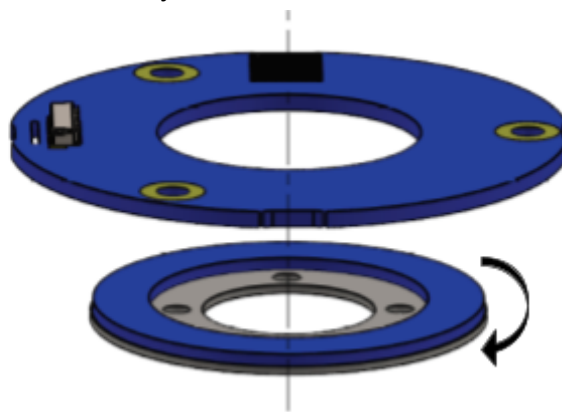
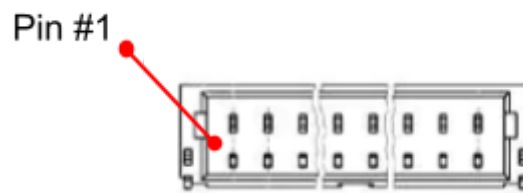


Fig. 5.1.: Visualization of the positive counting direction set by default.

## 6. Connector and Wiring

### 6.1. Connector

<b>Connector type</b>	PCB Mount Header, Right Angle, Wire-to-Board
<b>Part number</b>	10114830-11111LF (Amphenol ICC (FCI))
<b>Connector pitch</b>	1.25 mm
<b>Number of pins</b>	11



Pin No	Pin	Serial output	Incremental output
1	VDD	Power supply	
2	GND	Ground	
3	B+	<i>do not connect</i>	Incremental B+
4	B-	<i>do not connect</i>	Incremental B-
5	A+	<i>do not connect</i>	Incremental A+
6	A-	<i>do not connect</i>	Incremental A-
7	SCLK+	SSI/BISS-C Clock +	<i>do not connect</i>
8	SCLK-	SSI/BISS-C Clock -	<i>do not connect</i>
9	SDATA+ / Z+	SSI/BISS-C Data +/TX+	Incremental Z+
10	SDATA- / Z-	SSI/BISS-C Data -/TX-	Incremental Z-
11	SHIELD	Shield	

## 7. Ordering code

### 7.1. Inductive Rotary Encoder

IND-ROT	-045	-A21	-17	-BIS10	-AL	
Rotary encoder	Diam. [mm]	Rotor type	Resolution [Bits/Rev]	Output Interface	Carrier material	Optional features
	034	A21	14	BIS10	-FR <sup>(1)</sup>	See table
		A22	15	BIS21	-AL <sup>(2)</sup>	below
		C2108	16	SSI00		
	036	A21	17	SSI01		
		A22	18	SSI02		
		C2210	19	SSI03		
	045	A21		SSI04		
		A22		INC01		
		C2115		INC02		
				INC03		
				UAT00		
				UAT01		

<sup>(1)</sup> Select FR for A21 rotor type.

<sup>(2)</sup> Select AL for A22 and C21xx rotor type

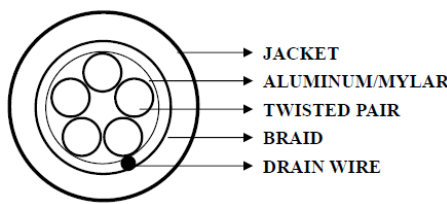
For optional features, please refer to the table provided below. When placing your order, include the desired features' code without using a dash and add them at the end of the ordering code. The standard configuration is represented by a blank entry.

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



## 8. Accessories

### 8.1. Assembly cable for Wire-To-Board (only for Single Output)

<b>FLUX ordering code</b>	WB0811K0300
<b>Cable length</b>	0.5 m ±0.03m
<b>Left side</b>	Connector 10114826-00011LF 1.25mm Pin pitch
<b>Right side</b>	Open wires
<b>Cable specifications</b>	
<b>Outer jacket</b>	PVC
<b>Temperature rating</b>	-20° ... +80°C
<b>Wire</b>	5 x 2 x 28 AWG
<b>Shield</b>	Aluminum-foil/MYLAR:Overlap 25% MIN (AL side outside). Drain Wire: 24AWG (7/0.20 TA). Braid: 16/08/0.12 TA Coverage 85% MIN
<b>Electrical properties</b>	Conductor resistance: < 237 Ω/Km at 20°C, Voltage rating: 300V
<b>Outer diameter</b>	6.0mm ± 0.12mm
<b>Bending radius</b>	30 mm
<b>Cable structure</b>	

Pin No	AWG	Color	Pin
1	28	White	VDD
2	28	White/Black	GND
3	28	Red	B+
4	28	Red/Black	B-
5	28	Yellow	A+
6	28	Yellow/Black	A-
7	28	Purple	SCLK+
8	28	Purple/Black	SCLK-
9	28	Blue	SDATA+ / Z+
10	28	Blue/Black	SDATA- / Z-
11	28	Black	SHIELD

## 9. Revision history

Date	Version	Comments
2023-09	06	Pin assignment/color updated in Chapter 7.1.
2023-11	07	Added: (1) new interfaces, (2) Zero point position, (3) Positive counting direction Removed: (1) Interface description Updated: (1) Drawings updated, (2) Connector pinout

Technical data is subject to change without notice.



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