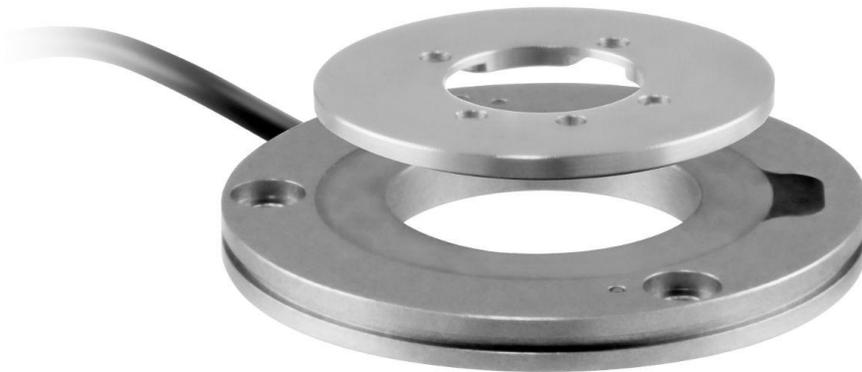


Absolute Rotary Encoder

“GMI-ROTARY” Series

based on the
Giant Magneto Impedance (GMI) principle



Technical Datasheet

2023-11 - rev02

www.flux.gmbh

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1. GMI-ROTARY Encoders

The **GMI-ROTARY** series of encoders from FLUX GmbH offers motor feedback solutions for a broad array of applications, especially in designs that require precise positioning and exact control of velocity and torque.

Through the use of the FLUX patented GMI (Giant Magneto Impedance) sensor technology, the **GMI-ROTARY** series provides high-performance feedback as part of the closed loop motion control process.

The GMI 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
- Axial scanning of the measuring ring
- Hollow shaft implementation
- High positioning accuracy
- High position stability / low noise
- Zero backlash / hysteresis
- Insensitivity to external electrical noise
- Insensitivity to environmental pollution (IP67)
- Low signal latency
- Versatile mounting with fasteners or servo clamps

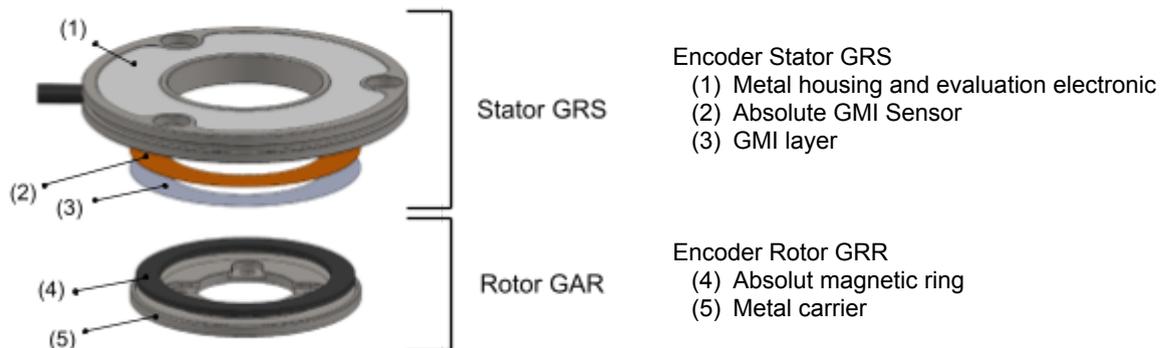
GMI-ROTARY encoder performance achievements:

- Resolution up to 23 bits / revolution
- Accuracy to $\pm 0.003^\circ$ (± 10 arc seconds)
- Liberal mounting tolerance: axial from 0.20 to 0.80 mm and runout 0.20 mm
- Axial stack-up as small as 8 mm including air-gap
- High ratio of inner diameter (through hole) to outer diameter

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

- machine tools
- semiconductor manufacturing
- cobots and robotics
- satcomm
- medical
- gimbals
- motors (torque, direct drive, servo, dc brushless)
- automated guided vehicles (AGV)

1.1. Giant Magneto Impedance principle (simplified)



HOW THE GMI TECHNOLOGY WORKS:

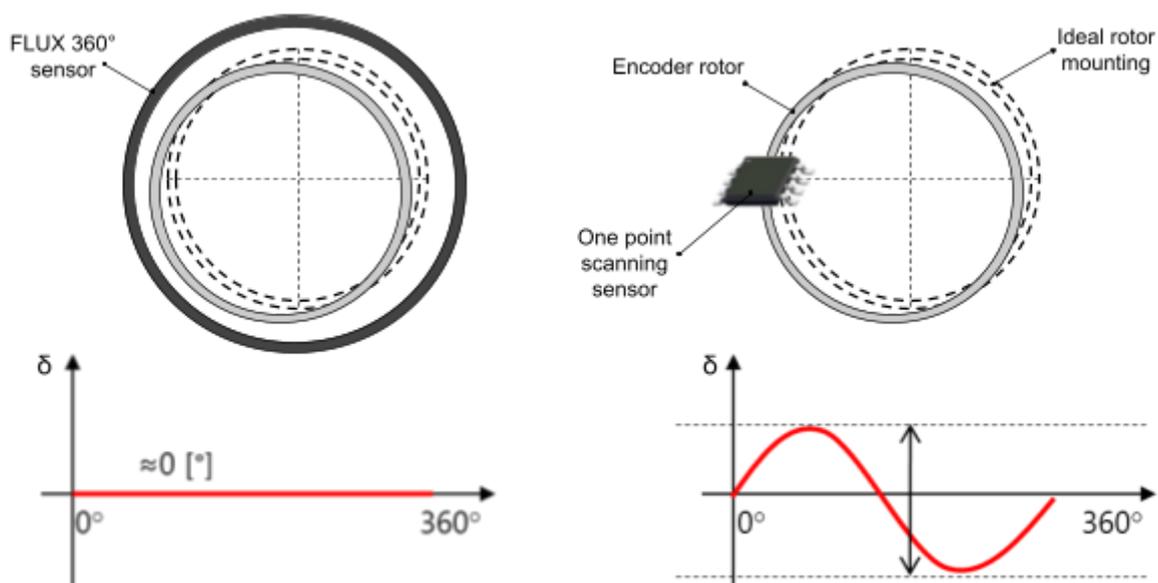
The magnetic field produced by the absolute magnet ring (4) induces variable electrical a.c. impedance regions within the GMI layer (3). The fluctuations in the a.c. impedance generated is then transformed into an electrical signal by the absolute GMI sensor (2). This GMI sensor (2) is linked to the evaluation electronic (1), which translates the electrical signal into a digital position.

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 GMI-ROT	One-Point
55 mm	$<\pm 4''$	$\pm 75''$
69 mm	$<\pm 3''$	$\pm 60''$
80 mm	$<\pm 3''$	$\pm 52''$
96 mm	$<\pm 2''$	$\pm 43''$

Additional error δ for $e = 20 \mu\text{m}$		
Diameter D	FLUX GMI-ROT	One-Point
55 mm	$<\pm 6''$	$\pm 150''$
69 mm	$<\pm 4''$	$\pm 119''$
80 mm	$<\pm 4''$	$\pm 103''$
96 mm	$<\pm 3''$	$\pm 86''$

1.3. Environmental and EMC immunity

FLUX rotary encoders based on Giant Magnetic Impedance (GMI) offer exceptional immunity to environmental and electromagnetic perturbations.

GMI-ROTARY encoders come standard with an IP67 rating. Moreover, the rotary encoder can work in extreme environmental conditions, and its performance is not compromised by dust, condensation or solvents.

2. Encoder Specification



*GMI-ROTARY-055 (size 55mm) with radial mounting rotor version (-C11)

GMI-ROTARY size (OD)	55 mm	69 mm	80 mm	96 mm
System data				
Type	Axial, frameless, true absolute Giant Magneto Impedance encoder GMI Technology - FLUX GmbH proprietary			
Maximum Output Resolution⁽¹⁾	21 bits	22 bits	23 bits	23 bits
ENOB in entire mounting tolerance range⁽²⁾	20 bits	20 bits	21 bits	22 bits
High accuracy⁽³⁾ (option "C")	± 36"	± 29"	± 14"	± 10"
	± 0.010°	± 0.008°	± 0.004°	± 0.003°
	± 175 µrad	± 140 µrad	± 70 µrad	± 48 µrad
Standard accuracy	± 50"	± 36"	± 25"	± 18"
	± 0.014°	± 0.010°	± 0.007°	± 0.005°
	± 244 µrad	± 175 µrad	± 122 µrad	± 87 µrad
Hysteresis	none			
Repeatability	1 resolution count			
Position update rate and signal latency	Real-time			
Standard maximum speed	6'000 rpm (higher on request)			
Power-up time	max. 0.8 sec			

⁽¹⁾ The encoder's maximum resolution indicates the number of output bits delivered, which may include noise.

⁽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.

⁽³⁾ Achievable accuracy at nominal air-gap, while tolerances for runout, lateral displacement as well as perpendicularity of stator and rotor to the axis of rotation are all better than 20µm.

Electrical data	
Supply voltage <i>(at encoder connector)</i>	Option AV: min. 4.35 Vdc. max. 36 Vdc Option 5V: min. 4.35 Vdc. max. 6 Vdc Option 24V: min. 6 Vdc. Max. 30 Vdc
Reverse polarity protection	Yes
Current Consumption <i>(w/o output terminations)</i>	max. 150 mA @ 5 Vdc max. 40 mA @ 24 Vdc

GMI-ROT size (OD)	55 mm	69 mm	80 mm	96 mm
Mechanical Data				
Stator base material	Stainless steel (option -ST) CTE ~ 10 ppm/°C Aluminum (option -AL) CTE ~ 24 ppm/°C			
Stator weight (ST)⁽⁴⁾	45 g	65 g	85 g	115 g
Stator weight (AL)⁽⁴⁾	22 g	30 g	35 g	45 g
Rotor base material	Stainless steel (option -ST) CTE ~ 10 ppm/°C Aluminum (option -AL) CTE ~ 24 ppm/°C			
Rotor weight (ST)⁽⁵⁾	15 g	22 g	28 g	36 g
Rotor weight (AL)⁽⁵⁾	8 g	9 g	14 g	17 g
Vibration	EN 60068-2-6, 20 g, 55 .. 2000 Hz			
Shock	EN 60068-2-27, 200 g, 6 ms			

⁽⁴⁾ Reference values without cable.

⁽⁵⁾ Reference values, they can vary depending on the rotor option.

Mounting tolerances	
Nominal axial air-gap	0.30 mm
Axial tolerance (air-gap)	-0.20 mm; +0.50 mm
Radial tolerances (runout / lateral displacement)	0.20 mm

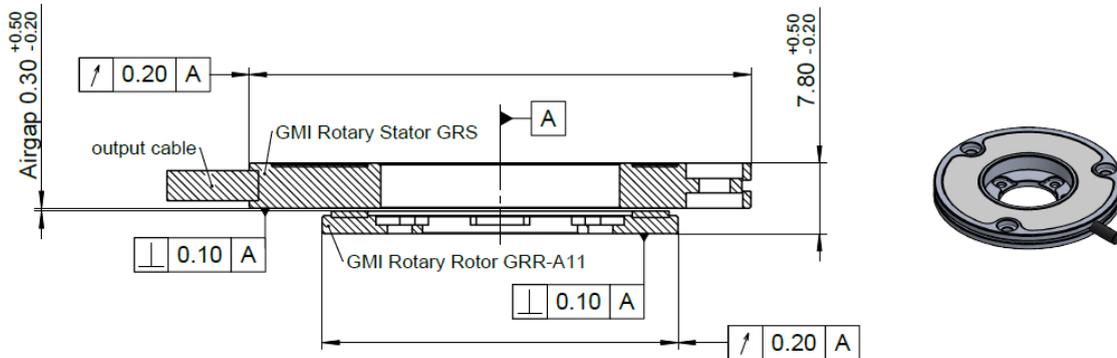
Environmental data	
Temperature range - Standard (no additional option in order code)	
Operating	-20°C .. +85°C
Storage	-20°C .. +85°C
Temperature range - Extended (contact FLUX for more details)	
Operating	-40°C .. +105°C
Storage	-55°C .. +125°C
Ingress Protection	IP67
EMC immunity	complies with EN 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	contact FLUX for more details
Absolute: Asynchronous	UAT00, UAT01

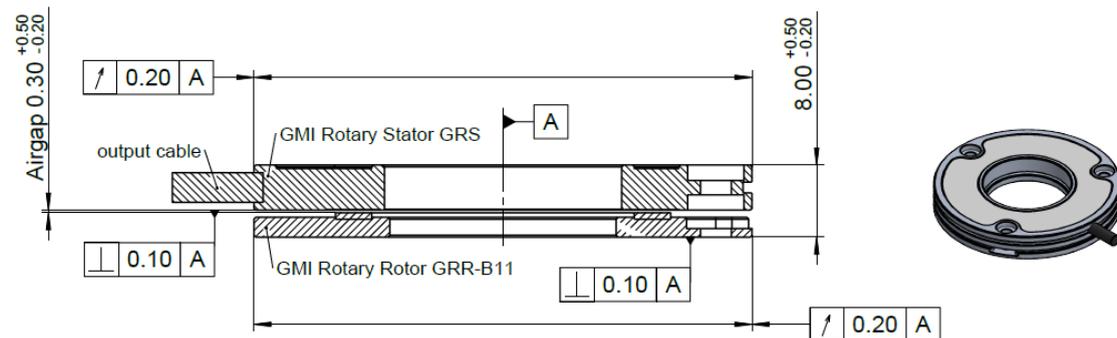
3. Mechanical dimensions and mounting tolerances

3.1. GMI-ROTARY Series - Mounting tolerances

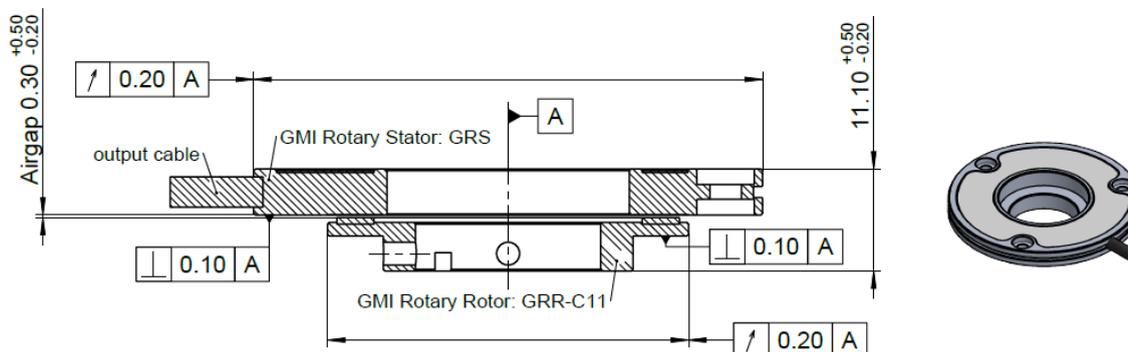
Rotor mounting with screws inside grating (Rotor option “-A11”):



Rotor mounting with screws outside grating (Rotor option “-B11”):



Rotor mounting with screws radial (Rotor option “-C11”):



A ... axis of rotation

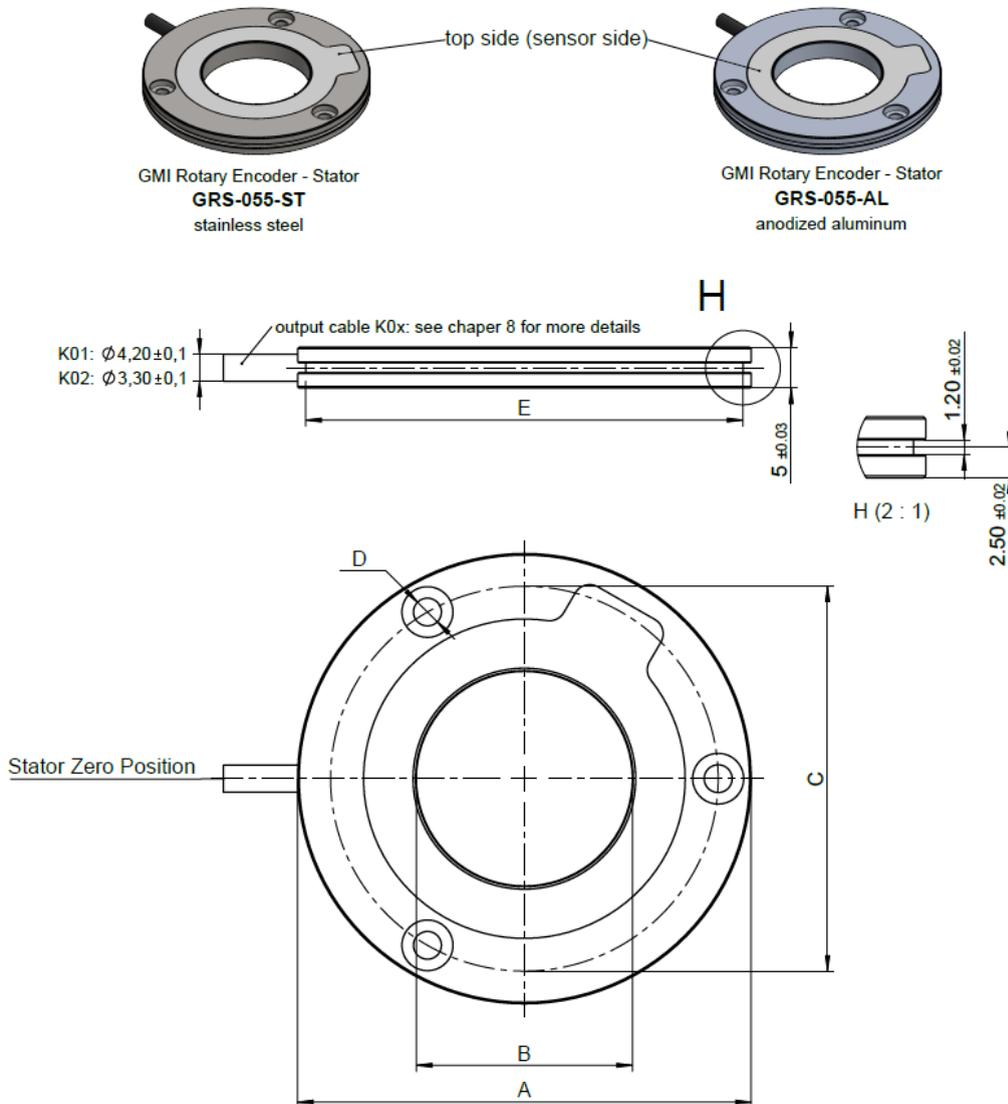
max. total runout tolerance GRS + GRR = 0.20mm $\sqrt{\text{GRS} + \text{GRR}} \begin{matrix} \text{0.20} \\ \text{A} \end{matrix}$

max. total perpendicularity tolerance GRS + GRR = 0.10mm $\sqrt{\text{GRS} + \text{GRR}} \begin{matrix} \text{0.10} \\ \text{A} \end{matrix}$

Dimensions are mm.

3.2. GMI Rotary Encoder - Stator: GRS

3.2.1. Stator for GMI-ROT-055: GRS-055



Size comparison table. The 055 mm size is highlighted.

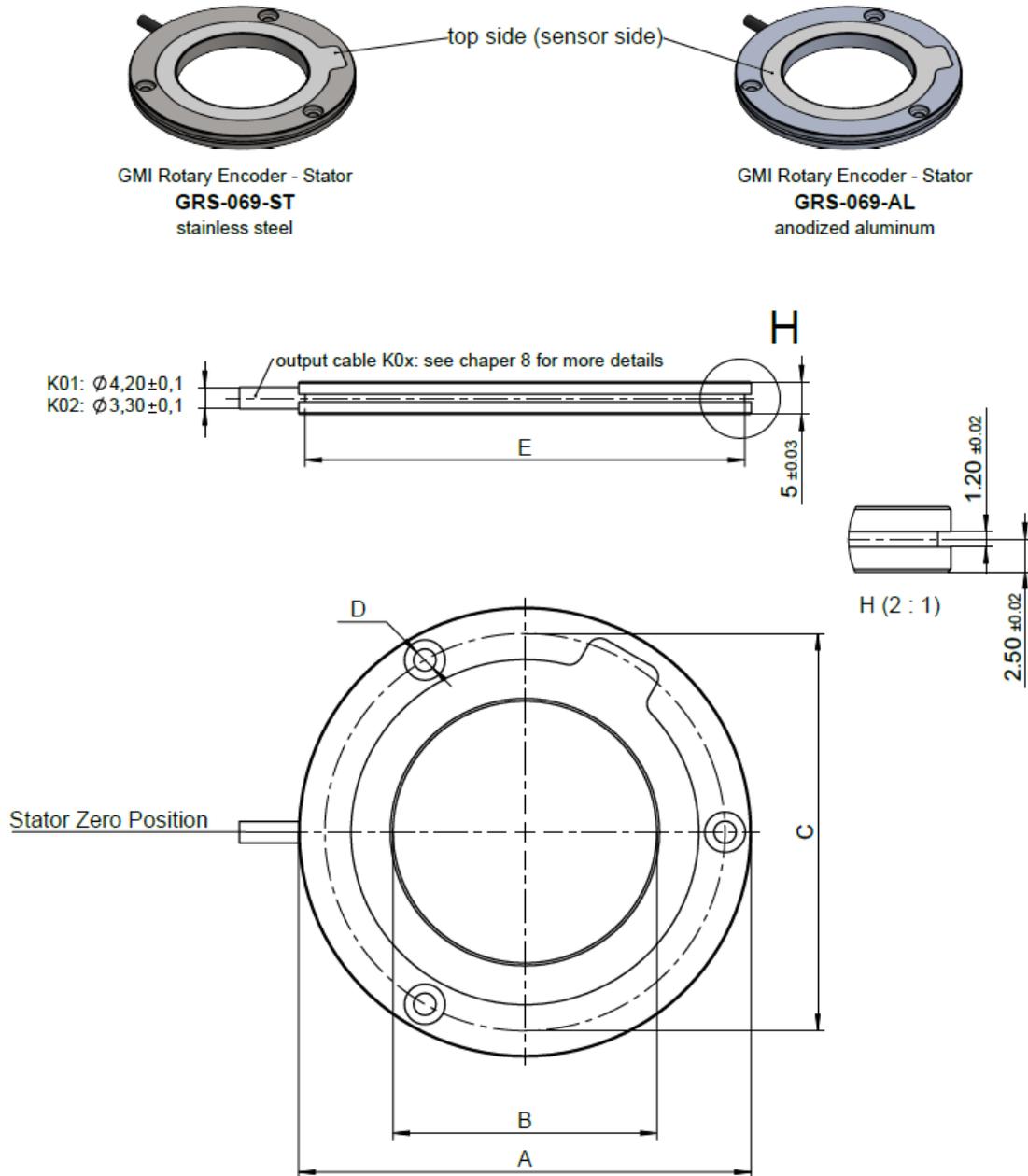
GRS-xxx	A	B	C	D	E
055	$\varnothing 55$ h7	$\varnothing 26,20$ H7	$\varnothing 47$	3 x $\varnothing 3,40$ (3x120°)	$\varnothing 53$ h7
069	$\varnothing 69$ h7	$\varnothing 40,20$ H7	$\varnothing 61$	3 x $\varnothing 3,40$ (3x120°)	$\varnothing 67$ h7
080	$\varnothing 80$ h7	$\varnothing 51,20$ H7	$\varnothing 72$	3 x $\varnothing 3,40$ (3x120°)	$\varnothing 78$ h7
096	$\varnothing 96$ h7	$\varnothing 67,20$ H7	$\varnothing 88$	6 x $\varnothing 3,40$ (6x60°)	$\varnothing 94$ h7

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 GMI-ROT-069: **GRS-069**



Size comparison table. The 069 mm size is highlighted.

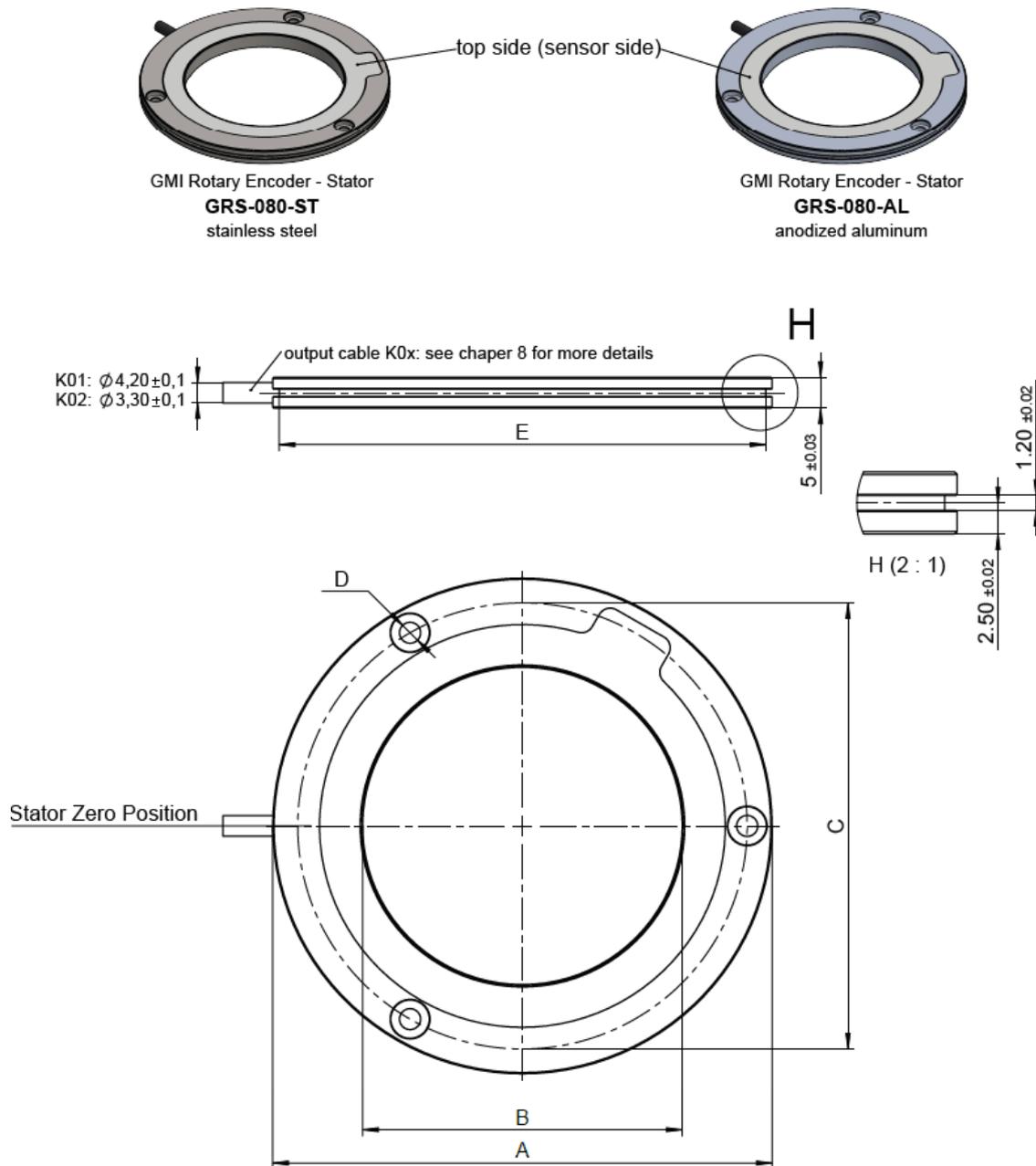
GRS-xxx	A	B	C	D	E
055	$\varnothing 55$ h7	$\varnothing 26,20$ H7	$\varnothing 47$	3 x $\varnothing 3,40$ (3x120°)	$\varnothing 53$ h7
069	$\varnothing 69$ h7	$\varnothing 40,20$ H7	$\varnothing 61$	3 x $\varnothing 3,40$ (3x120°)	$\varnothing 67$ h7
080	$\varnothing 80$ h7	$\varnothing 51,20$ H7	$\varnothing 72$	3 x $\varnothing 3,40$ (3x120°)	$\varnothing 78$ h7
096	$\varnothing 96$ h7	$\varnothing 67,20$ H7	$\varnothing 88$	6 x $\varnothing 3,40$ (6x60°)	$\varnothing 94$ h7

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 GMI-ROT-080: **GRS-080**



Size comparison table. The 080 mm size is highlighted.

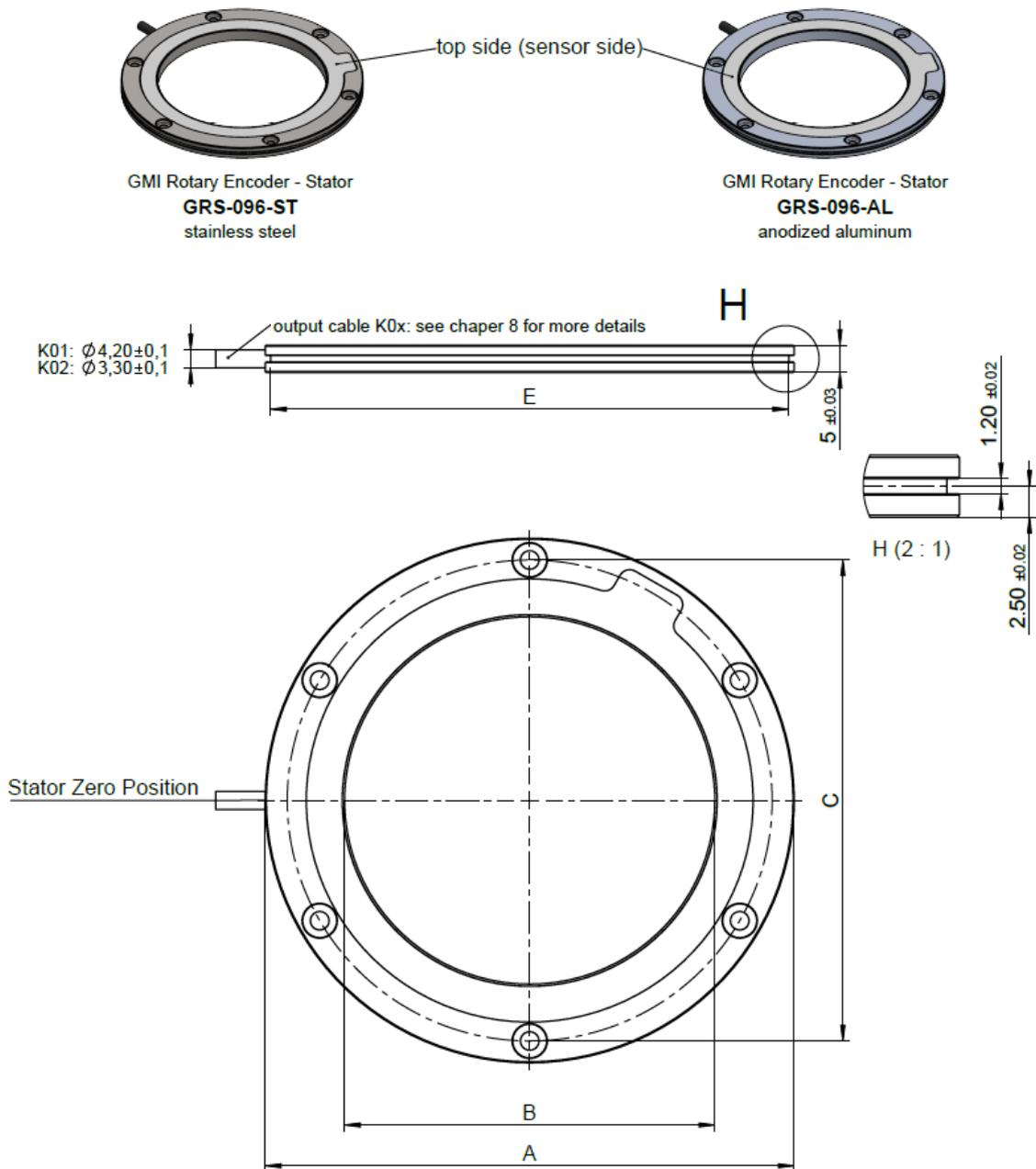
GRS-xxx	A	B	C	D	E
055	$\varnothing 55$ h7	$\varnothing 26,20$ H7	$\varnothing 47$	3 x $\varnothing 3,40$ (3x120°)	$\varnothing 53$ h7
069	$\varnothing 69$ h7	$\varnothing 40,20$ H7	$\varnothing 61$	3 x $\varnothing 3,40$ (3x120°)	$\varnothing 67$ h7
080	$\varnothing 80$ h7	$\varnothing 51,20$ H7	$\varnothing 72$	3 x $\varnothing 3,40$ (3x120°)	$\varnothing 78$ h7
096	$\varnothing 96$ h7	$\varnothing 67,20$ H7	$\varnothing 88$	6 x $\varnothing 3,40$ (6x60°)	$\varnothing 94$ h7

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 GMI-ROT-096: **GRS-096**



Size comparison table. The 096 mm size is highlighted.

GRS-xxx	A	B	C	D	E
055	$\varnothing 55$ h7	$\varnothing 26,20$ H7	$\varnothing 47$	3 x $\varnothing 3,40$ (3x120°)	$\varnothing 53$ h7
069	$\varnothing 69$ h7	$\varnothing 40,20$ H7	$\varnothing 61$	3 x $\varnothing 3,40$ (3x120°)	$\varnothing 67$ h7
080	$\varnothing 80$ h7	$\varnothing 51,20$ H7	$\varnothing 72$	3 x $\varnothing 3,40$ (3x120°)	$\varnothing 78$ h7
096	$\varnothing 96$ h7	$\varnothing 67,20$ H7	$\varnothing 88$	6 x $\varnothing 3,40$ (6x60°)	$\varnothing 94$ h7

Dimensions are in mm.

Screw hole dimensions for fastener according ISO 7380-1.

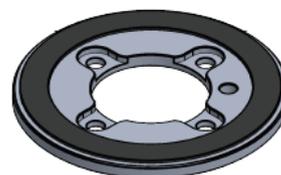
A set of mounting screws according to Section 10.1. is included with the product.

3.3. GMI Rotary Encoder - Rotor: **GRR-A11** screws inside

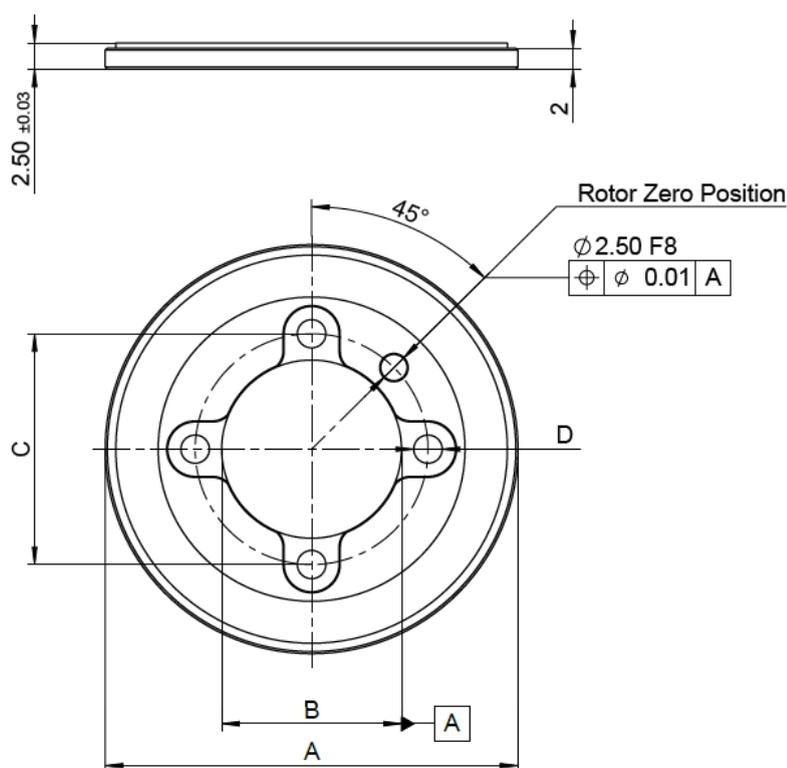
3.3.1. Rotor for GMI-ROT-055: **GRR-055-A11**



GMI Rotary Encoder - Rotor
GRR-055-A11-ST
 stainless steel



GMI Rotary Encoder - Rotor
GRR-055-A11-AL
 anodized aluminum



Size comparison table. The 055 mm size is highlighted.

GRR-xxx-A11	A	B	C	D
055-A11	$\phi 39$ h7	$\phi 17$ H7	$\phi 22$	4 x $\phi 2,70$ (4x90°)
069-A11	$\phi 53$ h7	$\phi 29$ H7	$\phi 35$	3 x $\phi 3,40$ (3x120°)
080-A11	$\phi 64$ h7	$\phi 40$ H7	$\phi 46$	6 x $\phi 3,40$ (6x60°)
096-A11	$\phi 80$ h7	$\phi 56$ H7	$\phi 62$	6 x $\phi 3,40$ (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.

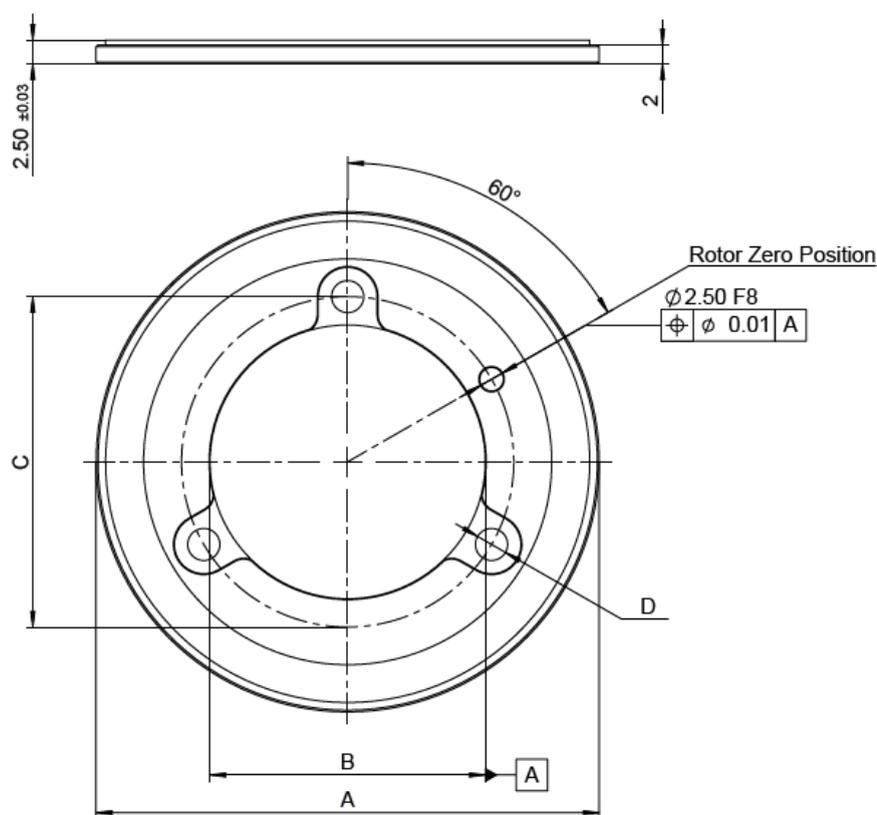
3.3.2. Rotor for GMI-ROT-069: **GRR-069-A11**



GMI Rotary Encoder - Rotor
GRR-069-A11-ST
 stainless steel



GMI Rotary Encoder - Rotor
GRR-069-A11-AL
 anodized aluminum



Size comparison table. The 069 mm size is highlighted.

GRR-xxx-A11	A	B	C	D
055-A11	ø39 h7	ø17 H7	ø22	4 x ø2,70 (4x90°)
069-A11	ø53 h7	ø29 H7	ø35	3 x ø3,40 (3x120°)
080-A11	ø64 h7	ø40 H7	ø46	6 x ø3,40 (6x60°)
096-A11	ø80 h7	ø56 H7	ø62	6 x ø3,40 (6x60°)

Dimensions are in mm.

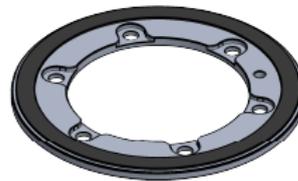
Screw hole dimensions for fastener according ISO 7380-1.

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

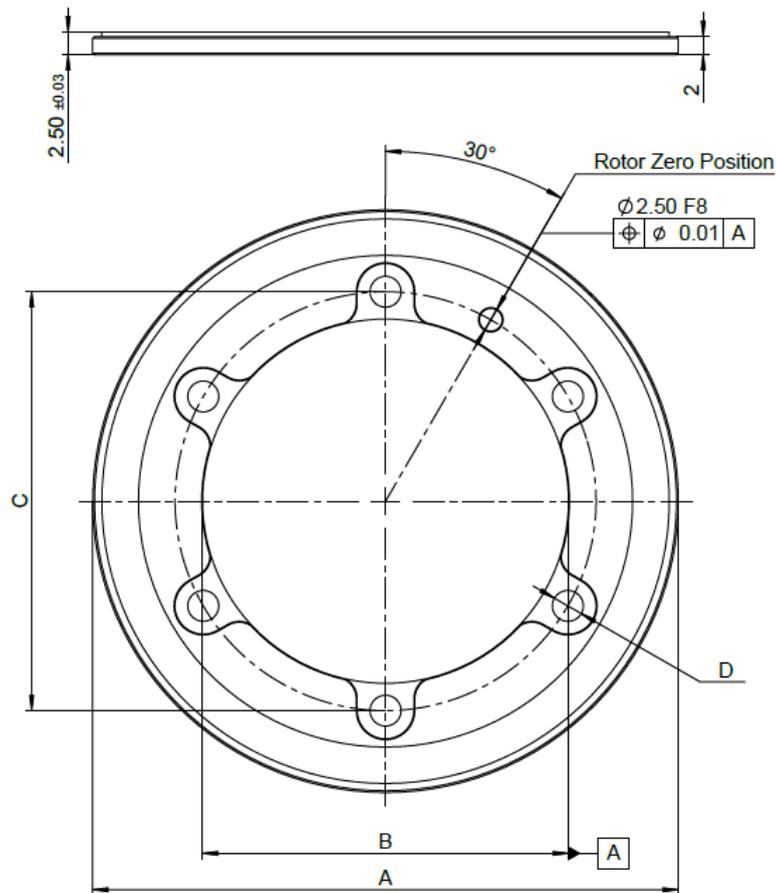
3.3.3. Rotor for GMI-ROT-080: **GRR-080-A11**



GMI Rotary Encoder - Rotor
GRR-080-A11-ST
 stainless steel



GMI Rotary Encoder - Rotor
GRR-080-A11-AL
 anodized aluminum



Size comparison table. The 080 mm size is highlighted.

GRR-xxx-A11	A	B	C	D
055-A11	ø39 h7	ø17 H7	ø22	4 x ø2,70 (4x90°)
069-A11	ø53 h7	ø29 H7	ø35	3 x ø3,40 (3x120°)
080-A11	ø64 h7	ø40 H7	ø46	6 x ø3,40 (6x60°)
096-A11	ø80 h7	ø56 H7	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.

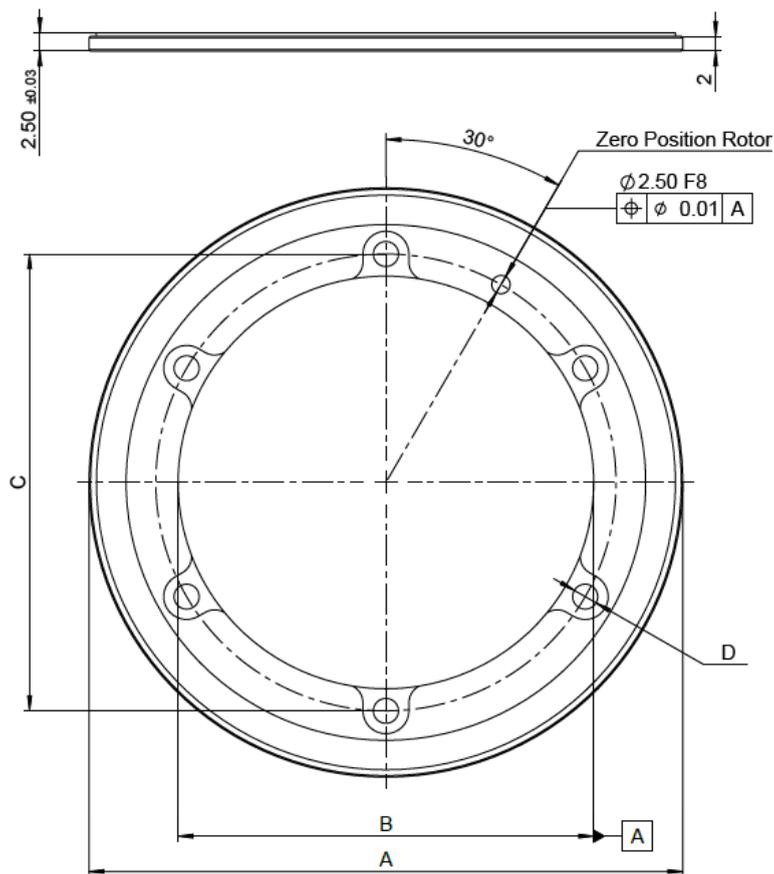
3.3.4. Rotor for GMI-ROT-096: **GRR-096-A11**



GMI Rotary Encoder - Rotor
GRR-096-A11-ST
 stainless steel



GMI Rotary Encoder - Rotor
GRR-096-A11-AL
 anodized aluminum



Size comparison table. The 096 mm size is highlighted.

GRR-xxx-A11	A	B	C	D
055-A11	$\phi 39$ h7	$\phi 17$ H7	$\phi 22$	4 x $\phi 2,70$ (4x90°)
069-A11	$\phi 53$ h7	$\phi 29$ H7	$\phi 35$	3 x $\phi 3,40$ (3x120°)
080-A11	$\phi 64$ h7	$\phi 40$ H7	$\phi 46$	6 x $\phi 3,40$ (6x60°)
096-A11	$\phi 80$ h7	$\phi 56$ H7	$\phi 62$	6 x $\phi 3,40$ (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. GMI Rotary Encoder - Rotor: **GRR-B11 screws outside**

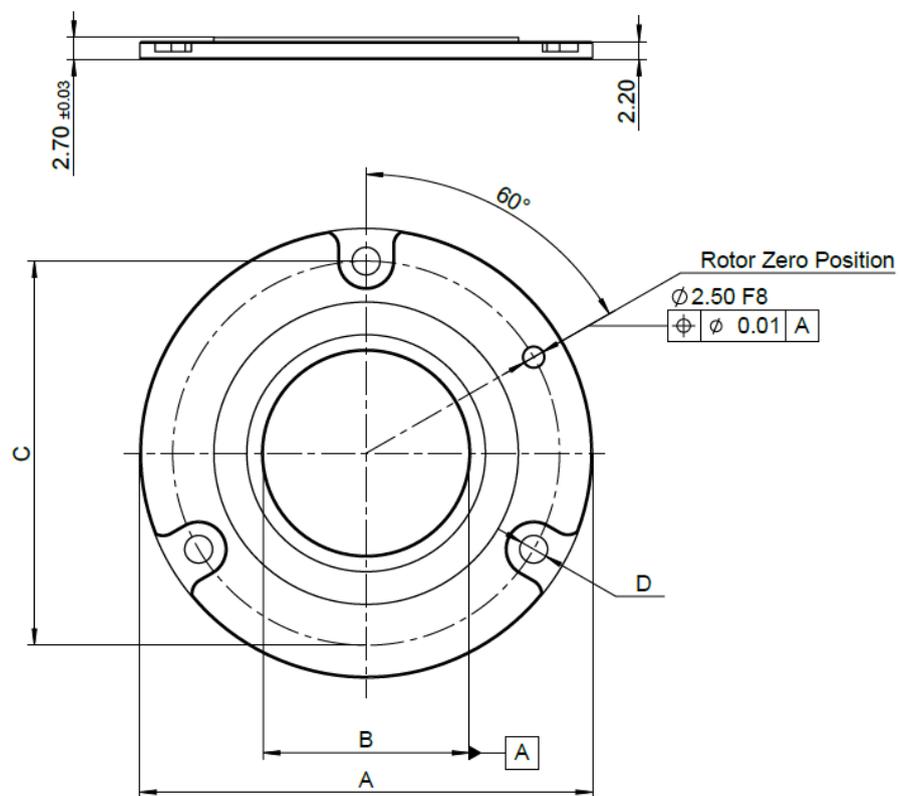
3.4.1. Rotor type B11 for GMI-ROT-055: **GRR-055-B11**



GMI Rotary Encoder - Rotor
GRR-055-B11-ST
 stainless steel



GMI Rotary Encoder - Rotor
GRR-055-B11-AL
 anodized aluminum



Size comparison table. The 055 mm size is highlighted.

GRR-xxx-B11	A	B	C	D
055-B11	$\varnothing 55$ h7	$\varnothing 25$ H7	$\varnothing 47$	3 x $\varnothing 3,40$ (3x120°)
069-B11	$\varnothing 69$ h7	$\varnothing 39$ H7	$\varnothing 61$	3 x $\varnothing 3,40$ (3x120°)
080-B11	$\varnothing 80$ h7	$\varnothing 50$ H7	$\varnothing 72$	6 x $\varnothing 3,40$ (6x60°)
096-B11	$\varnothing 96$ h7	$\varnothing 66$ H7	$\varnothing 88$	6 x $\varnothing 3,40$ (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.

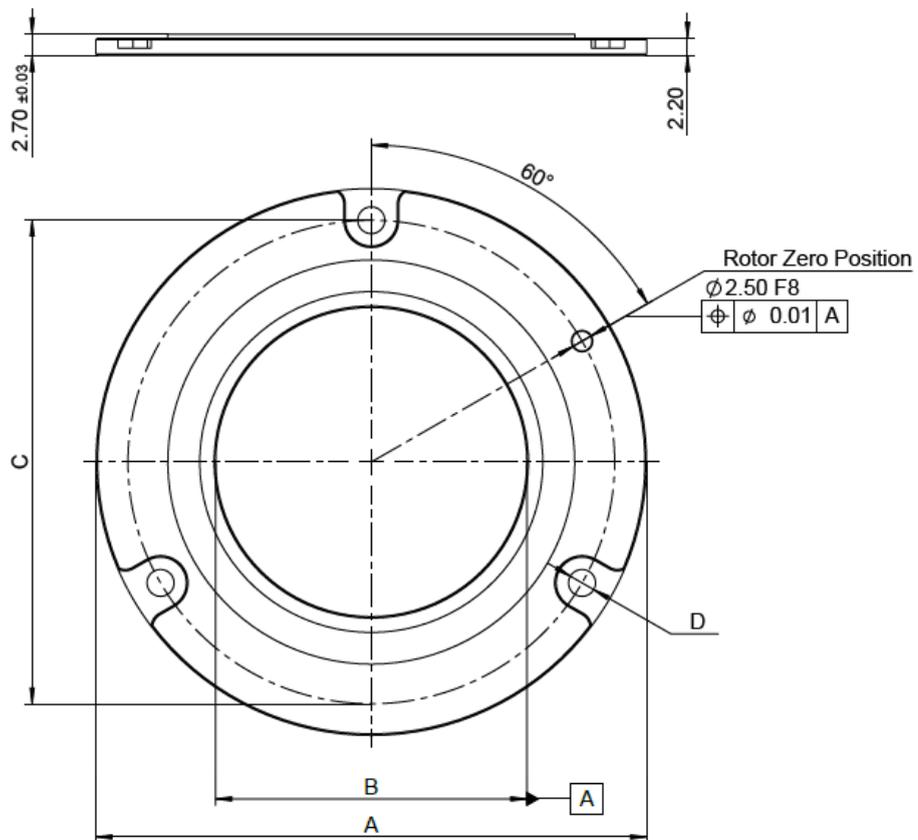
3.4.2. Rotor type B11 for GMI-ROT-069: **GRR-069-B11**



GMI Rotary Encoder - Rotor
GRR-069-B11-ST
 stainless steel



GMI Rotary Encoder - Rotor
GRR-069-B11-AL
 anodized aluminum



Size comparison table. The 069 mm size is highlighted.

GRR-xxx-B11	A	B	C	D
055-B11	ø55 h7	ø25 H7	ø47	3 x ø3,40 (3x120°)
069-B11	ø69 h7	ø39 H7	ø61	3 x ø3,40 (3x120°)
080-B11	ø80 h7	ø50 H7	ø72	6 x ø3,40 (6x60°)
096-B11	ø96 h7	ø66 H7	ø88	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.

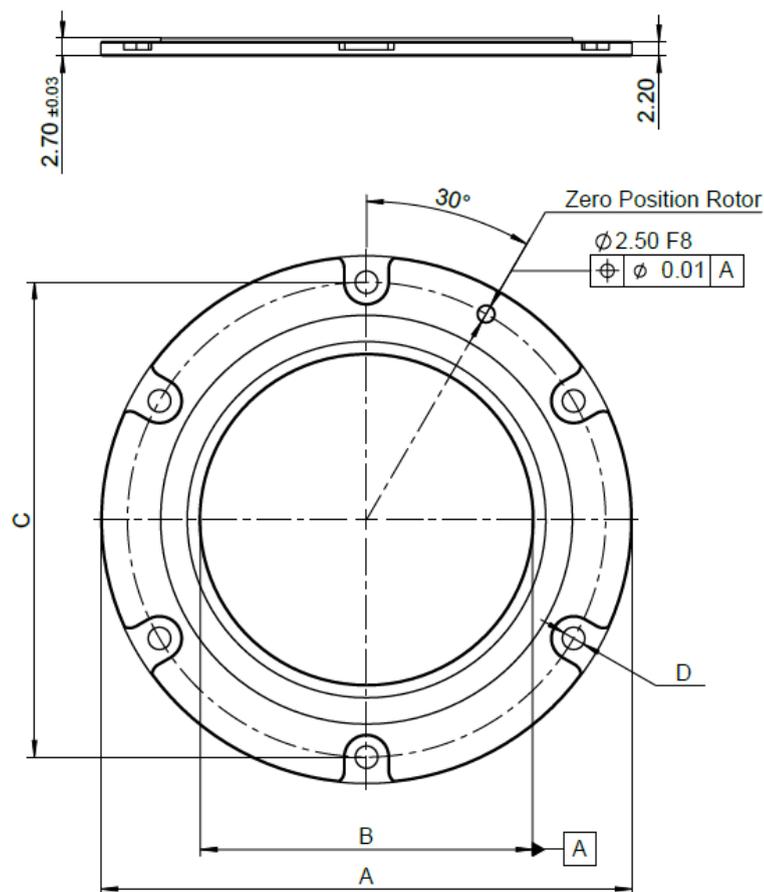
3.4.3. Rotor type B11 for GMI-ROT-080: **GRR-080-B11**



GMI Rotary Encoder - Rotor
GRR-080-B11-ST
 stainless steel



GMI Rotary Encoder - Rotor
GRR-080-B11-AL
 anodized aluminum



Size comparison table. The 080 mm size is highlighted.

GRR-xxx-B11	A	B	C	D
055-B11	ø55 h7	ø25 H7	ø47	3 x ø3,40 (3x120°)
069-B11	ø69 h7	ø39 H7	ø61	3 x ø3,40 (3x120°)
080-B11	ø80 h7	ø50 H7	ø72	6 x ø3,40 (6x60°)
096-B11	ø96 h7	ø66 H7	ø88	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.

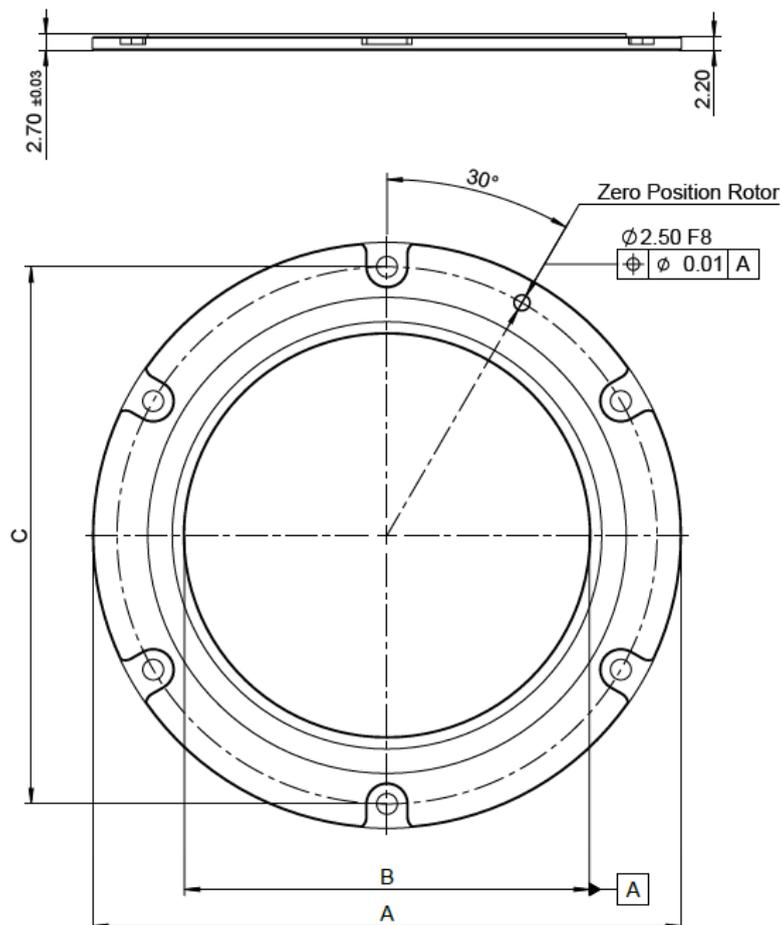
3.4.4. Rotor type B11 for GMI-ROT-096: **GRR-096-B11**



GMI Rotary Encoder - Rotor
GRR-096-B11-ST
 stainless steel



GMI Rotary Encoder - Rotor
GRR-096-B11-AL
 anodized aluminum



Size comparison table. The 096 mm size is highlighted.

GRR-xxx-B11	A	B	C	D
055-B11	ø55 h7	ø25 H7	ø47	3 x ø3,40 (3x120°)
069-B11	ø69 h7	ø39 H7	ø61	3 x ø3,40 (3x120°)
080-B11	ø80 h7	ø50 H7	ø72	6 x ø3,40 (6x60°)
096-B11	ø96 h7	ø66 H7	ø88	6 x ø3,40 (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.

3.5. GMI Rotary Encoder - Rotor: **GRR-C11** screws radial

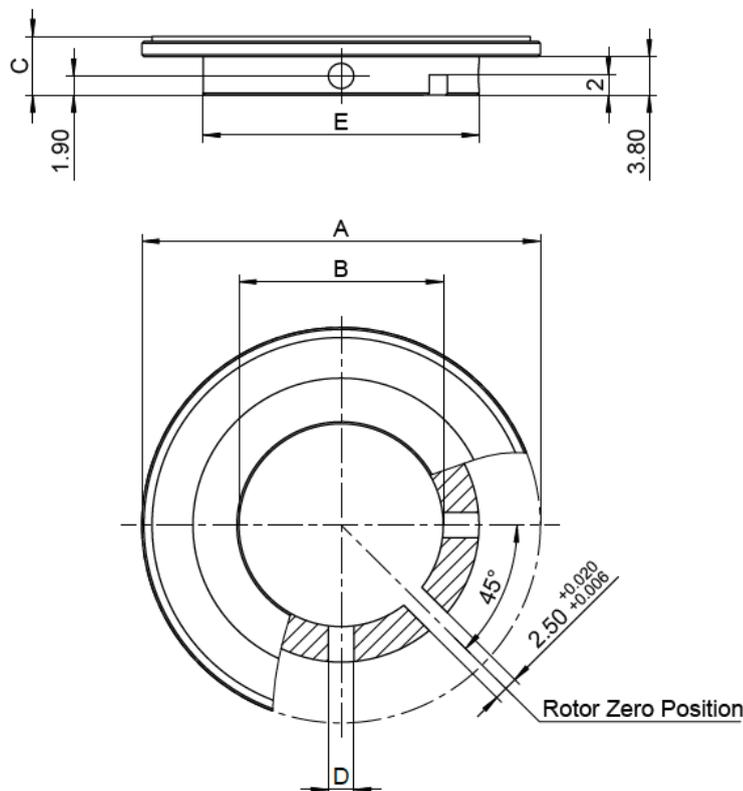
3.5.1. Rotor type C11 for GMI-ROT-055: **GRR-055-C11**



GMI Rotary Encoder - Rotor
GRR-055-C11-ST
 stainless steel



GMI Rotary Encoder - Rotor
GRR-055-C11-AL
 anodized aluminum



Size comparison table. The 055 mm size is highlighted.

GRR-xxx-C11	A	B	C	D	E
055-C11	ø39 +0.00/-0.05	ø20 H7	5.80 ±0.05	2 x M3 (90°)	ø27 ±0.05
069-C11	We offer customized rotors based on the application requirements. Please send your requirements to office@flux.gmbh				
080-C11					
096-C11					

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 recommendation

4.1. Stator GRS sensor-side mounting

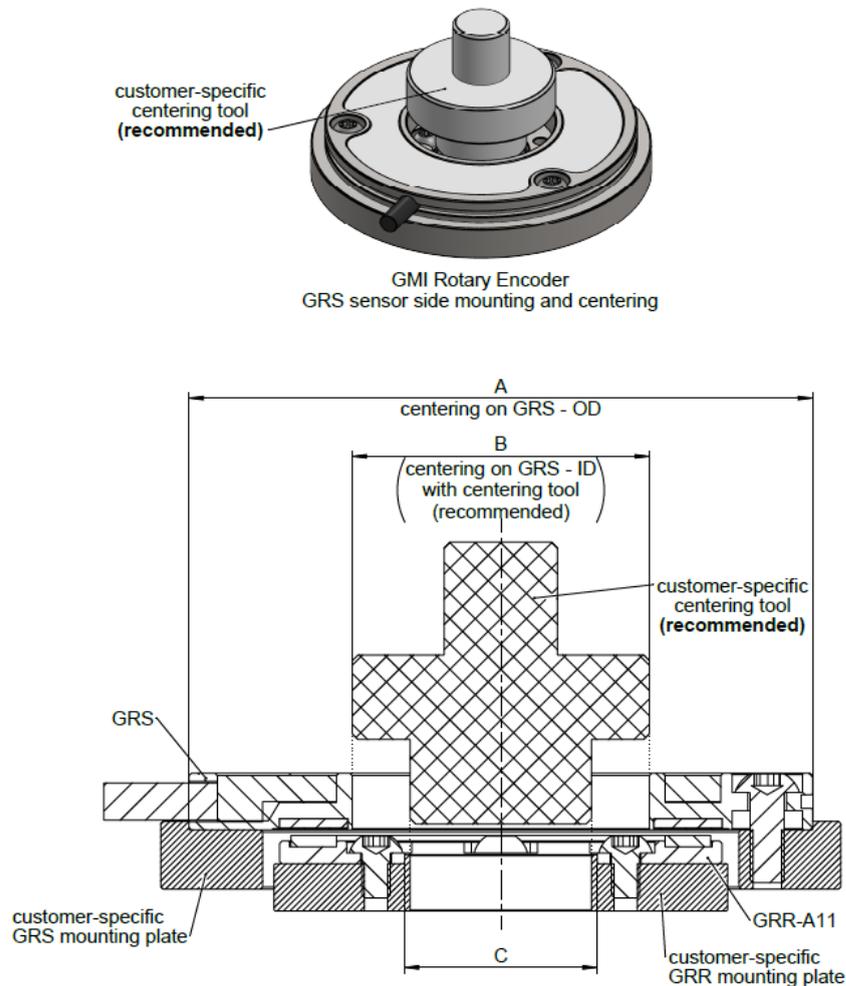


Fig. 4.1.: GMI Rotary Encoder: GRS sensor-side mounting and centering recommendation

GMI-ROT-xxx	A	B	C
055	∅55 H7	∅26.20 h7	∅17 h7
069	∅69 H7	∅40.20 h7	∅29 h7
080	∅80 H7	∅51.20 h7	∅40 h7
096	∅96 H7	∅67.20 h7	∅56 h7

Dimensions are in mm.



The mounting of the Rotor (GRR) and the Stator (GRS) needs to be adapted according to the application. The customer-specific mounting plate is shown only as an example.

4.2. Stator GRS potting-compound-side mounting

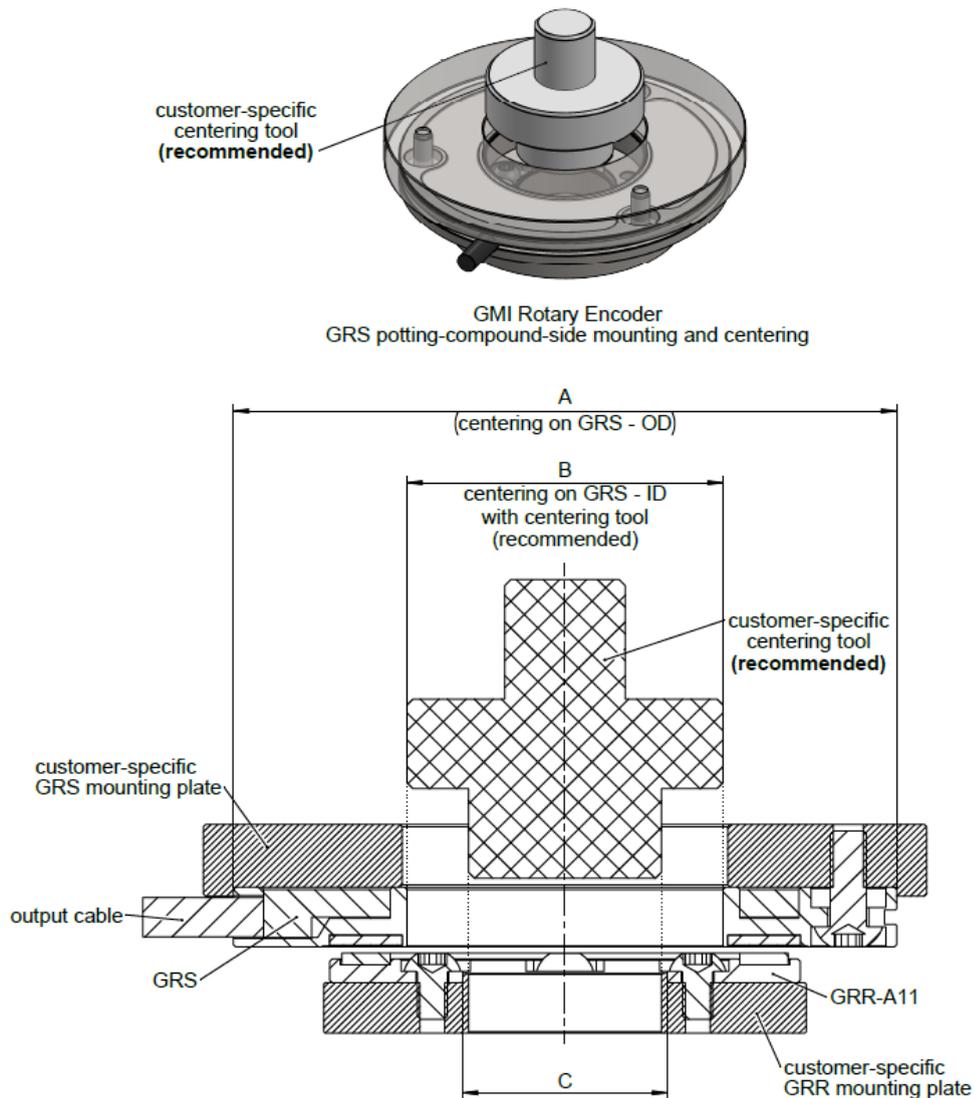


Fig 4.2.: GMI Rotary Encoder: GRS potting-compound-side mounting and centering.

GRS-xxx	A	B	C
055	∅55 H7	∅26.20 h7	∅17 h7
069	∅69 H7	∅40.20 h7	∅29 h7
080	∅80 H7	∅51.20 h7	∅40 h7
096	∅96 H7	∅67.20 h7	∅56 h7

Dimensions are in mm.



The mounting of the Rotor (GRR) and the Stator (GRS) needs to be adapted according to the application. The customer-specific mounting plate is shown only as an example.

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

GMI-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 **GMI-ROTARY** encoder requires no calibration or additional commissioning.

As soon as the **GMI-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 **GMI-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

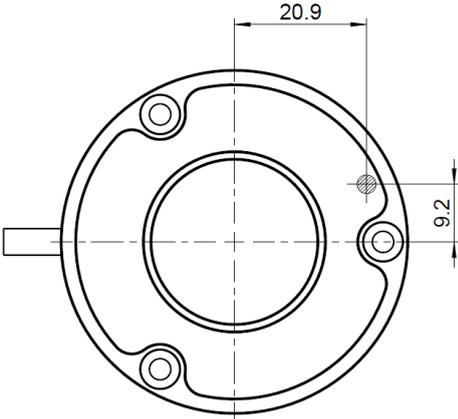
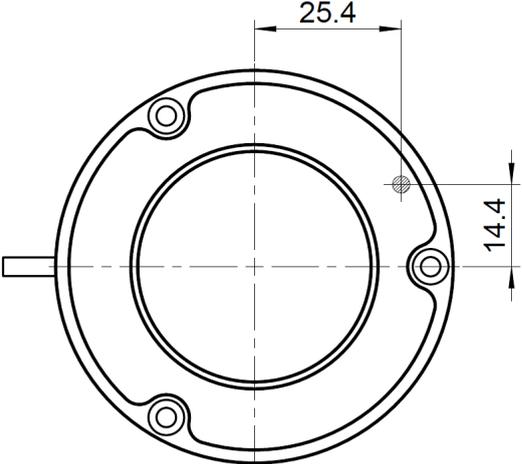
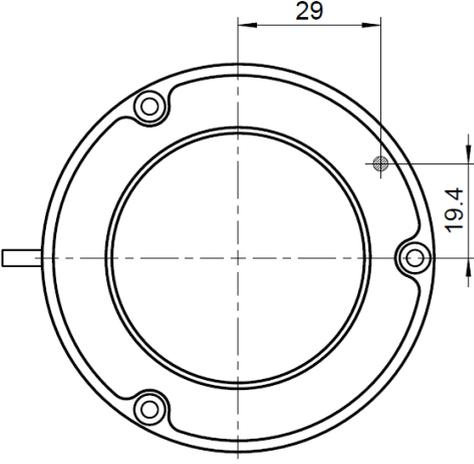
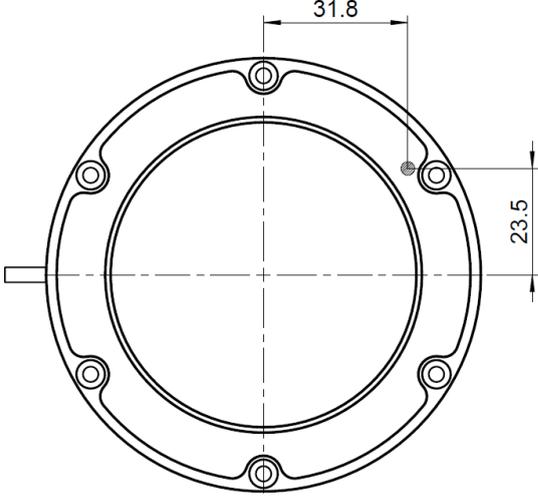
⁽¹⁾ The LED's lifespan can significantly diminish when operated under extremely low or high temperatures. Even if the LED ceases to emit light, the encoder's functionality remains unaffected.

⁽²⁾ Fast blinking ~ 0.4 sec.

⁽³⁾ Slow blinking ~ 1.6 sec

6.3. Status LED position

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

GRS-055	GRS-069
	
GRS-080	GRS-096
	

NOTE: The LED is concealed beneath the potting compound but becomes visible when the encoder is supplied with the correct voltage.

7. Optional features

7.1. Multi-turn position (memory saved)

In **GMI-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 **GMI-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 $\pm 90^\circ$ when power is turned off.

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

7.2. Setting zero position and counting direction

For more details, please see the full BiSS-C Interface Manual for FLUX Encoders.

The **GMI-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 GRS is aligned with the output cable, the zero point position of the rotor GRR is aligned with the $\varnothing 2.50$ F8 alignment 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.

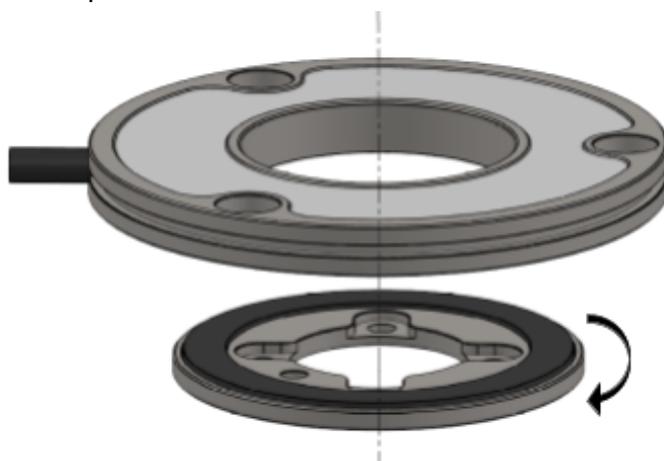


Fig. 7.1.: Visualization of the positive counting direction set by default.

8. Connector and Wiring

8.1. Option “K01” - Cable

Type	Encoder with integrated radial cable output (open wires) 
Applicable for:	Output interfaces: INCxx (A/B/Z)
Outer jacket	PUR, suitable for energy chains
Halogen free	IEC 60332-1-2
Applicable Standard	UL - AWM Style 20963 80°C 30V
Temperature rating	dynamic: -40°C .. +90°C static: -50°C .. +90°C
Wrapping	4 x 2 x AWG 30 + 2 x AWG 28, TPE Isolation
Shield	Tinned copper braided. Coverage ≥ 85%
Outer diameter	4.2 ± 0.1mm
Bending radius	21 mm single / 42 mm continuous bending
Maximum length	6 m
Certification	The product does not contain any SVHC candidate substances according EU REACH regulation 1907/2006

No.	AWG	Color	INCxx	Comments
1	28	violet	Vdd	Encoder Supply Voltage
2	28	black	GND	Encoder Power Ground
3	30	white	A+	
4	30	brown	A-	
5	30	green	B+	
6	30	yellow	B-	
7	30	grey	Z+	
8	30	pink	Z-	
9	30	blue	<i>do not connect</i>	
10	30	red	<i>do not connect</i>	

8.2. Option “K02” - Cable

Type	Encoder with integrated radial cable output (open wires) 
Recommended for:	Output interfaces: BiSS-C, SSI, UAT
Not applicable for:	Output interfaces: INCxx (A/B/Z)
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	6 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>

No.	AWG	Color	SSI & BISS-C	UATxx	Comments
1	30	red	Vdd	Vdd	Encoder Supply Voltage
2	30	black	GND	GND	Encoder Power Ground
3	30	grey	SCLK+	<i>do not connect</i>	
4	30	blue	SCLK-	<i>do not connect</i>	
5	30	green	SDATA+	TX+	
6	30	yellow	SDATA-	TX-	



Do not connect any unused pins.

8.3. Power Supply “Sense Lines”

GMI-ROTARY encoders do not support Power Supply “Sense Lines”.

With its low power consumption and minimum $4.35 V_{DC}$ operating voltage, there is no need to use the "Sense Lines" for cables up to 6 meters.

If the motion controller requires "Sense Lines", they can be connected directly to the respective Power Lines at the Motion Controller connector.

8.4. Shield connection

The encoder's housing is connected to the cable shield. It is mandatory to connect the cable shield (and implicitly the housing) to the protection earth of the machine.



Users should exercise caution to ensure effective shielding across the entire machine and prevent any shielding/current loops.

In the case of a stainless steel housing, the surface is electrically conductive. When the stainless steel housing is attached to the machine body, it establishes an electrical connection between the cable shield and the machine body.

In contrast, when an aluminum housing is employed, its anodized surface hinders conductivity, resulting in no electrical connection between the cable shield and the machine body.

9. Ordering code

GMI-ROT	-055	-A11	-19	-BIS10	-AV	-K02-100	-ST	
Rotary encoder	Diam [mm]	Rotor (GRR) type	Resol. [Bits]	Output Interf.	Supply Voltage	Cable + cable length in [cm]	Housing material	Optional features
	055	-A11	17	BIS10	AV - 4.35..36Vdc	K02-050	-ST - Steel	See
	069	-B11	18	BIS21	5V - 4.35..6Vdc	K02-100	-AL - Alu	table
	080	-C11	19	BIS00	24V - 6..30Vdc	K02-200		below
	096		20	SSI00		K02-300		
			21	SSI01		K02-400		
			22	SSI02		K02-500		
				SSI03		K02-600		
				SSI04		K01-050		
				INC00		K01-100		
				INC01		K01-200		
				INC02		K01-300		
				INC03		K01-400		
				UAT00		K01-500		
				UAT01		K01-600		

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
High Accuracy	C
Extended temperature	E
Multiturn (memory saved)	M
High Speed	S

Cable selection matrix:	K01	K02
Standard temperature range		
INCxx	yes	no
BiSS Interface	no	yes
SSI Interface	no	yes
UAT Interface	no	yes
Extended temperature range		
INCxx	no	no
BiSS Interface	no	yes
SSI Interface	no	yes
UAT Interface	no	yes

10. Accessories

10.1. Mounting Screws

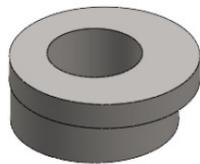
A set of mounting screws is included with the product.

NOTE: The use of a medium-strength screw retainer is recommended for secure mounting.

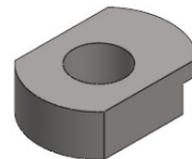
Encoder Size	Stator GRS (TORX socket button head ~ISO 7380-1)	Rotor A11 (TORX socket button head ~ISO 7380-1)	Rotor B11 (TORX socket button head ~ISO 7380-1)	Rotor C11 (HEXAGON socket head ~ISO 4026 / DIN 913)
GMI-ROT-055	3 x screws M3x8	4 x screws M2.5x4	3 x screws M3x6	2x set screws M3x3
GMI-ROT-069	3 x screws M3x8	3 x screws M3x6	3 x screws M3x6	-
GMI-ROT-080	3 x screws M3x8	6 x screws M3x6	6 x screws M3x6	-
GMI-ROT-096	6 x screws M3x8	6 x screws M3x6	6 x screws M3x6	-

10.2. Servo Clamp

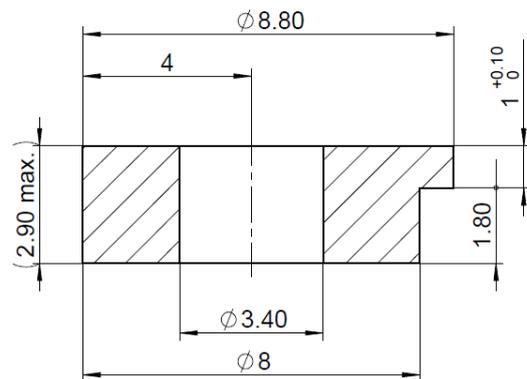
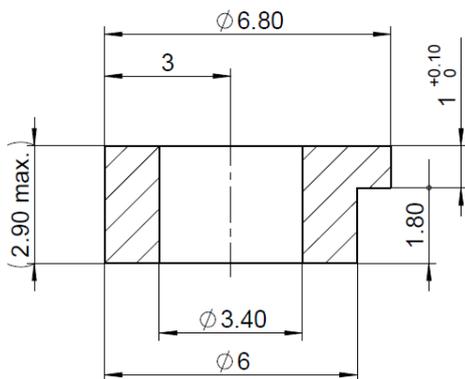
FLUX ordering code	Stainless steel: <ul style="list-style-type: none"> • SC100-M3-6-ST • SC100-M3-8-ST Aluminum: <ul style="list-style-type: none"> • SC100-M3-6-AL • SC100-M3-8-AL
Compatibility	With any size of GRS (Encoder Stator)



SC100-M3-6
 stainless steel or aluminum



SC100-M3-8
 stainless steel or aluminum



Screw circle diameter for Servo Clamps				
	GRS-055	GRS-069	GRS-080	GRS-096
SC100-M3-6 +6mm of OD	ø61	ø75	ø86	ø102
SC100-M3-8 +8mm of OD	ø63	ø77	ø88	ø104

11. Revision history

Date	Version	Comments
2022-05	00	First built - based on the AFE-100 datasheet
2023-02	01	Interfaces INCxx, BIS10 updated.
2023-11	02	Added: (1) New interfaces, (2) Zero point position, (3) Positive counting direction (4) Shield connection. Removed: (1) Interface description, (2) WBT option. Updated: (1) Drawings updated.

Technical data is subject to change without notice.



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