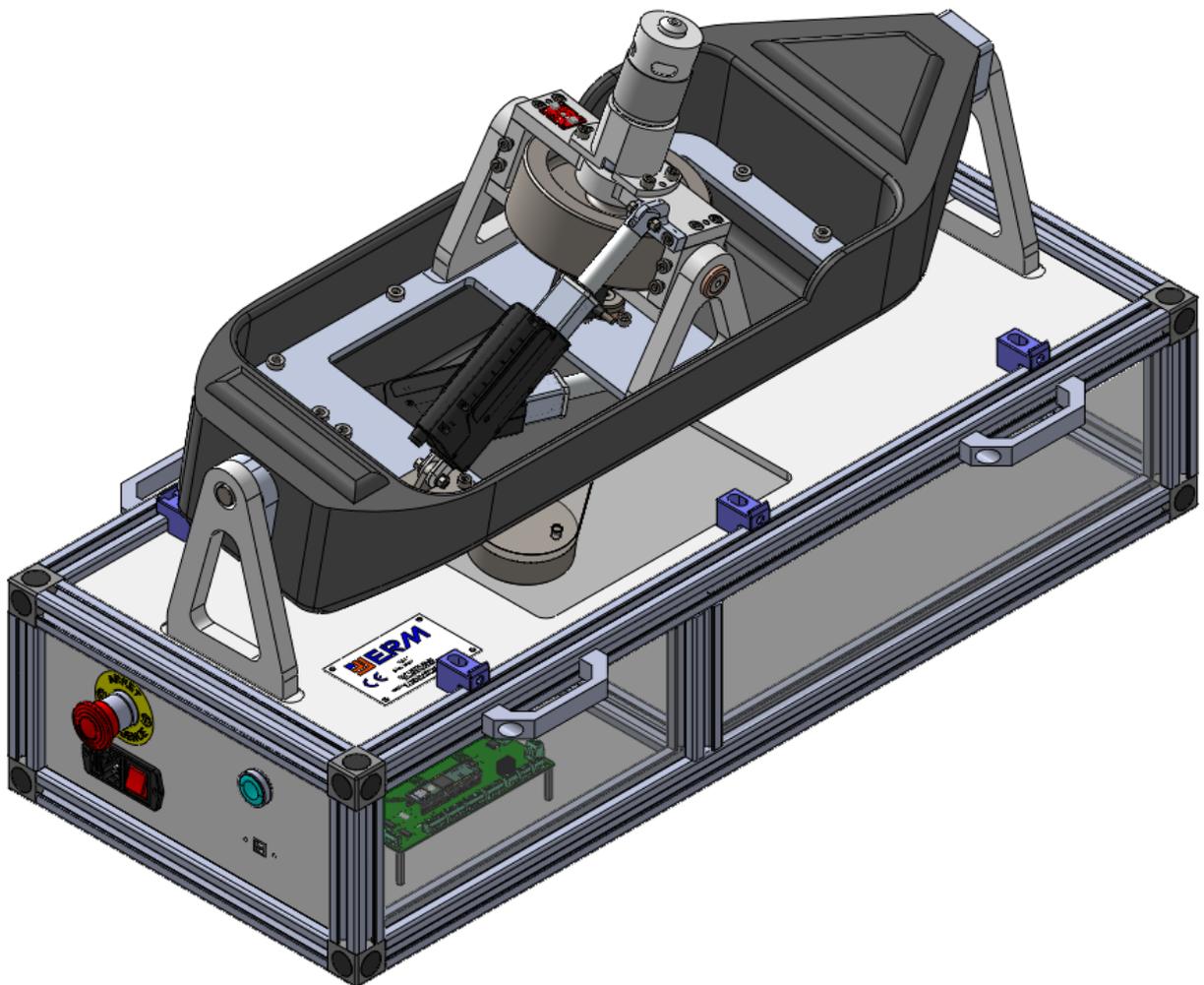


STABILISATEUR GYROSCOPIQUE DE BATEAU

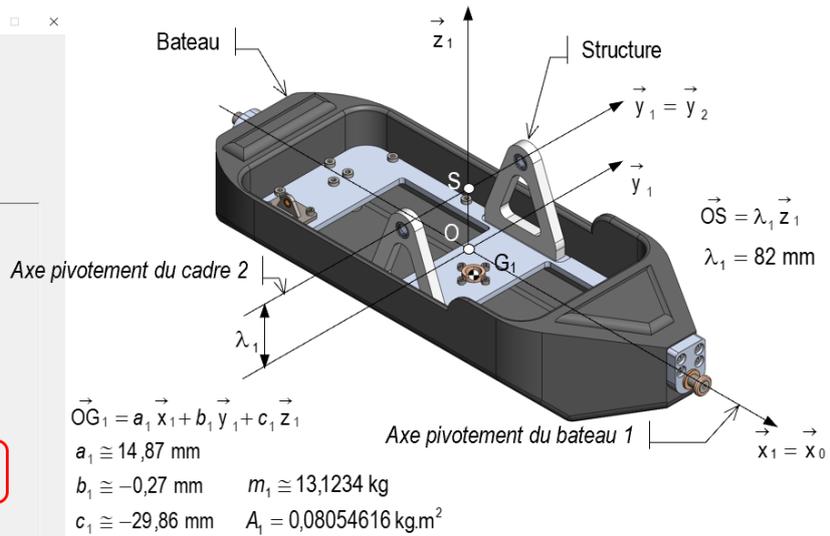
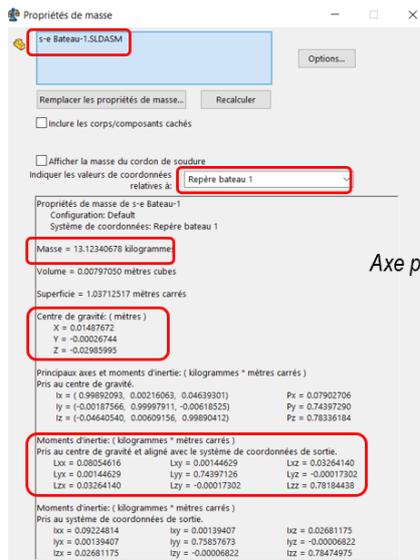
DOSSIER TECHNIQUE



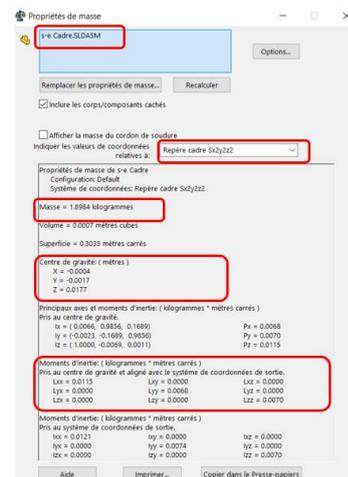
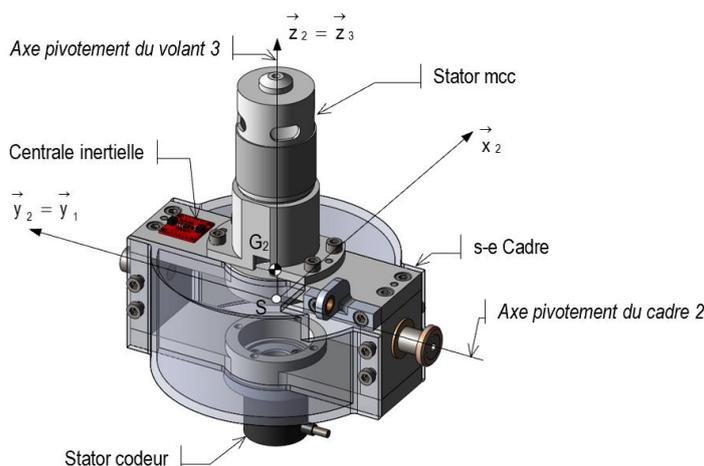
GEOMETRIE ET PROPRIETES DE MASSES DES ELEMENTS DU STABILISATEUR

Dans les maquettes numériques chaque sous-ensemble (s-e) est doté d'un repère de référence correspondant à celui des calculs qui seront menés en dynamique

Bateau 1



Cadre 2



$$SG_2 = a_2 x_2 + b_2 y_2 + c_2 z_2$$

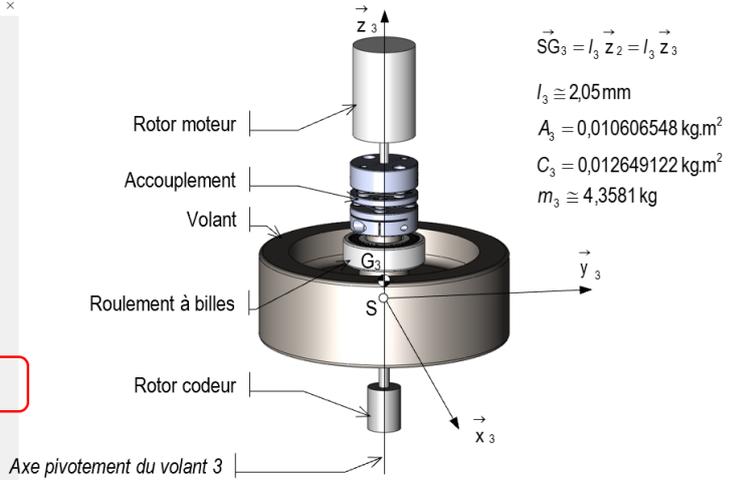
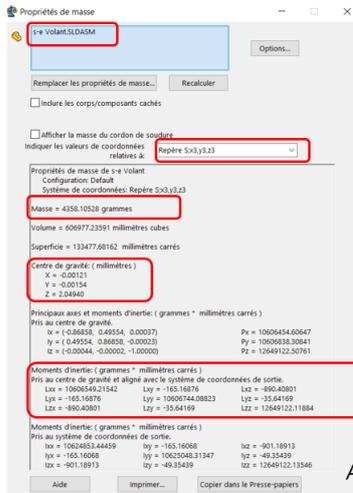
$$a_2 \approx -0,36 \text{ mm} \quad A_2 = 0,0115 \text{ kg.m}^2$$

$$b_2 \approx -1,74 \text{ mm} \quad B_2 = 0,0068 \text{ kg.m}^2$$

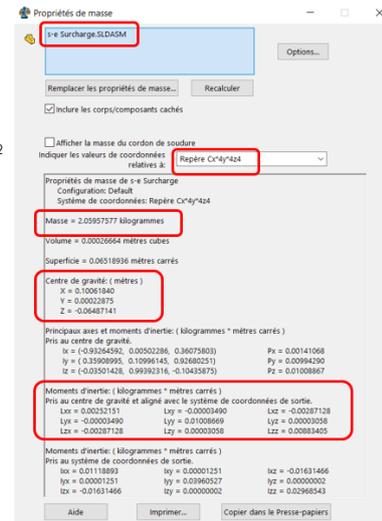
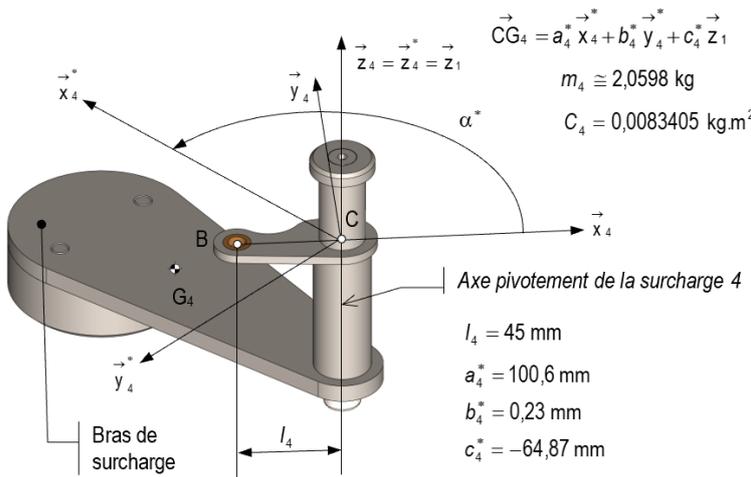
$$c_2 \approx 17,74 \text{ mm} \quad m_2 \approx 1,898 \text{ kg}$$

La masse du moteur de rotation du volant est de 497 g. Le moment d'inertie du rotor du moteur a été identifié à $3,0810^{-5} \text{ kg.m}^2$. En conséquence la masse du rotor est d'environ 192 g et celle du stator d'environ 305 g. Ces valeurs viennent s'ajouter au Cadre et au Volant.

Volant 3

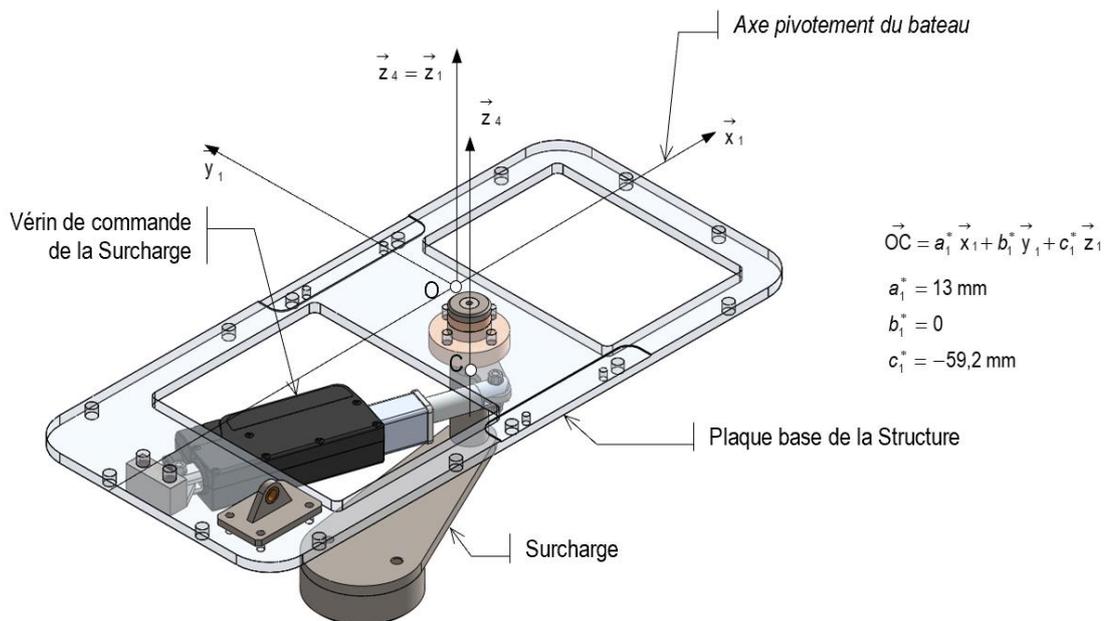


Surcharge 4

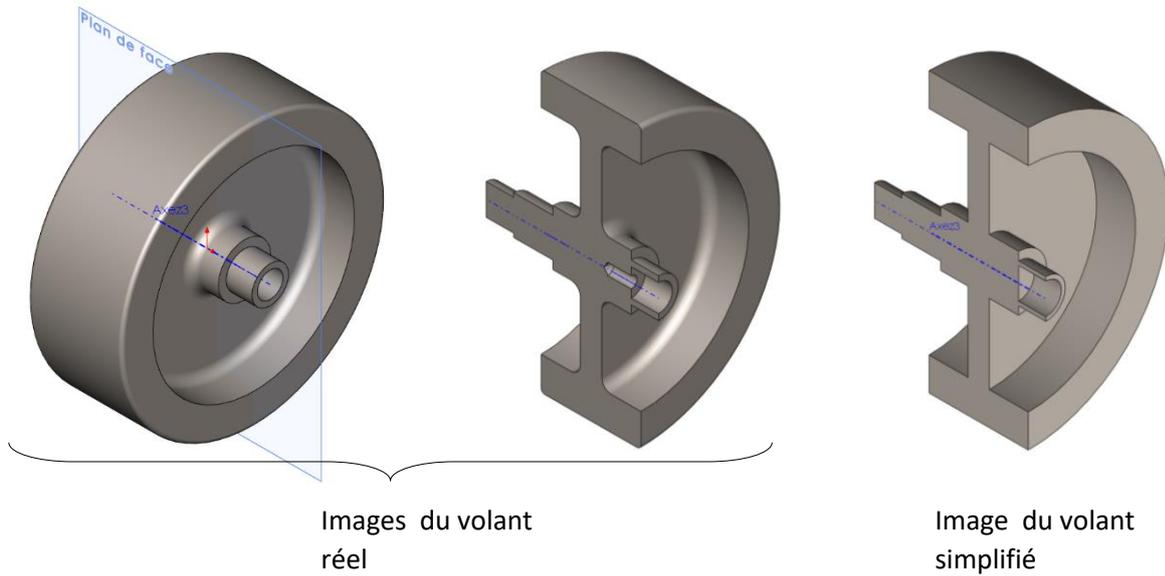


La Surcharge est placée dans le Bateau tel que $\vec{OC} = a_1^* \vec{x}_1 + b_1^* \vec{y}_1 + c_1^* \vec{z}_1 (b_1^* = 0)$.

Finalement $\vec{OG}_4 = \vec{OC} + \vec{CG}_4 = a_1^* \vec{x}_1 + a_4^* \vec{x}_4 + b_4^* \vec{y}_4 + (c_1^* + c_4^*) \vec{z}_1$

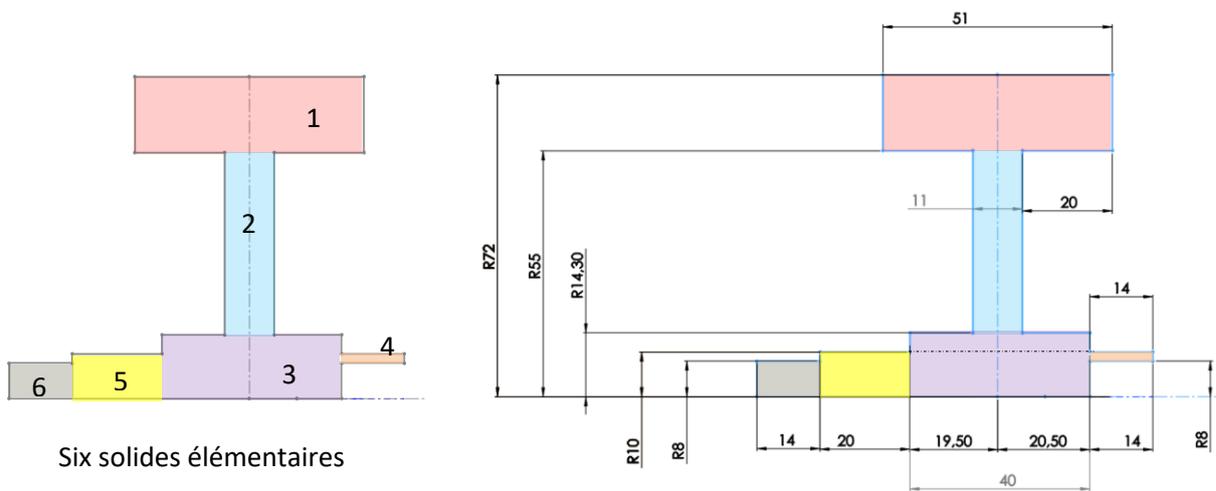


DIMENSIONS DU VOLANT D'INERTIE



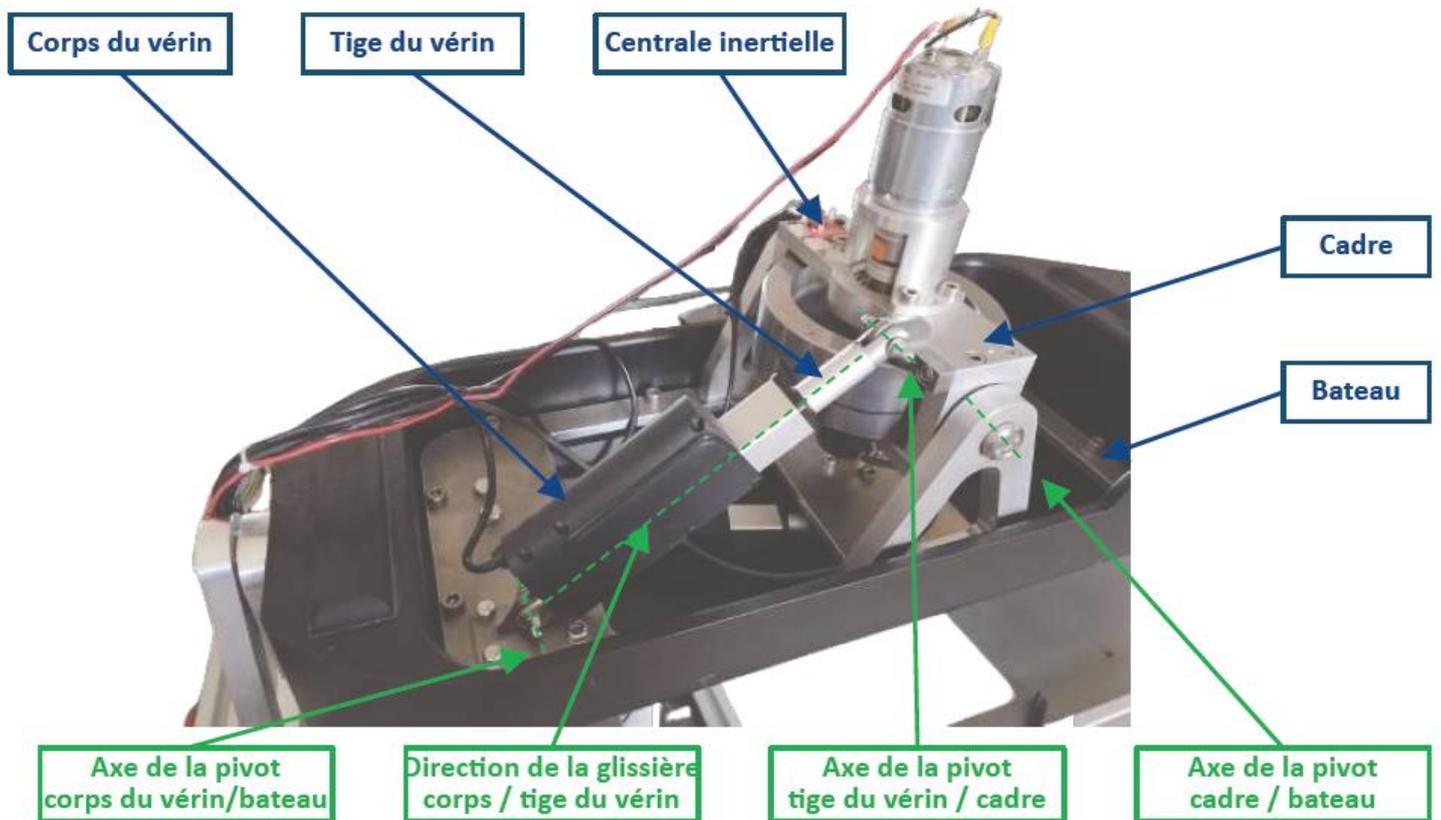
Images du volant

Le volant homogène simplifié, constitué de six solides, est en acier (AISI 4340 acier normalisé) de masse volumique $\rho = 7850 \text{ kg.m}^{-3}$.



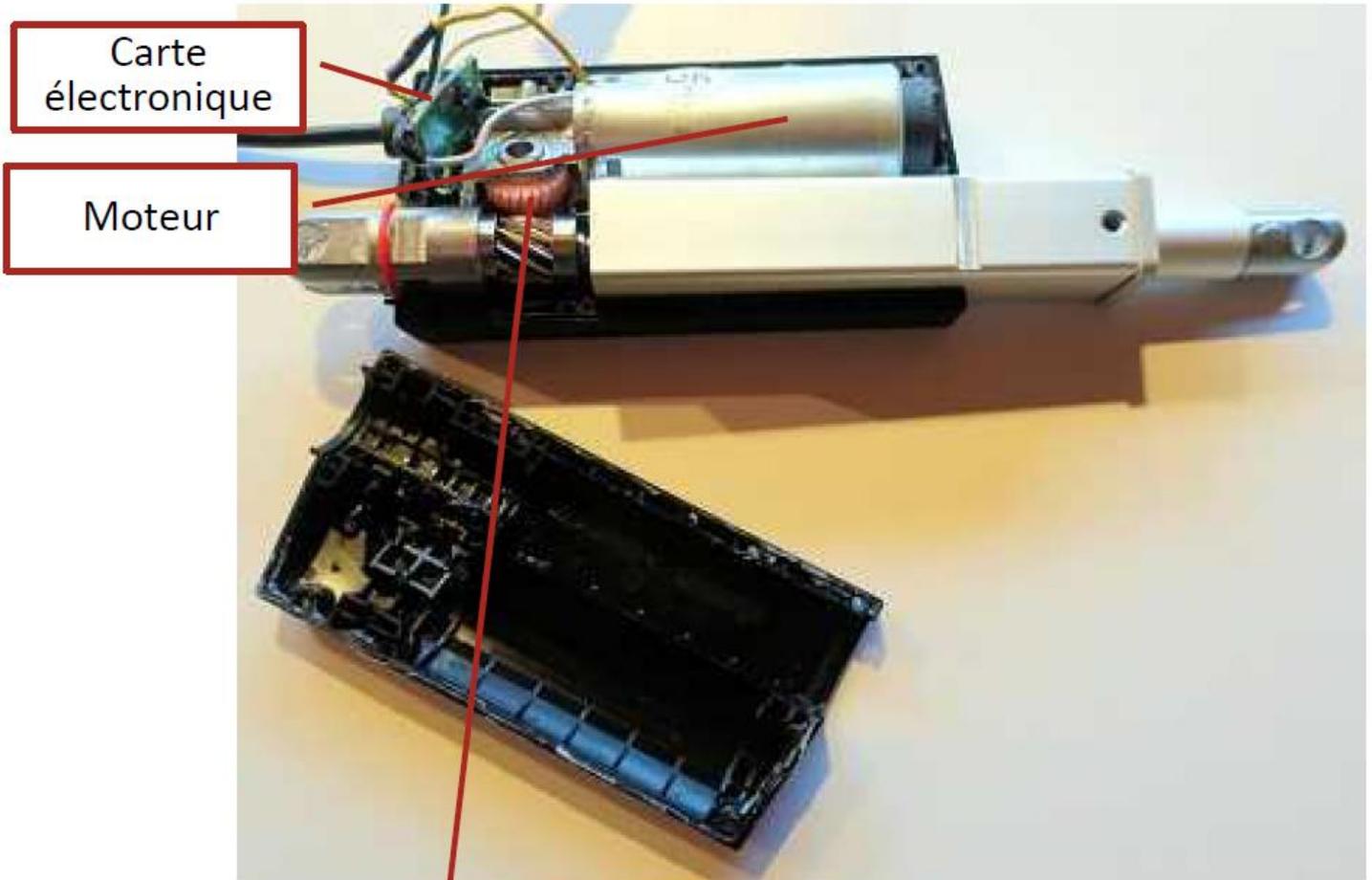
Définition et dimensions des six solides du volant

STRUCTURE DU CADRE DU GYROSCOPE



Attention à l'effet de perspective de la photo, tous les axes des liaisons pivot sont parallèles

CONSTITUANTS DU VERIN ELECTRIQUE



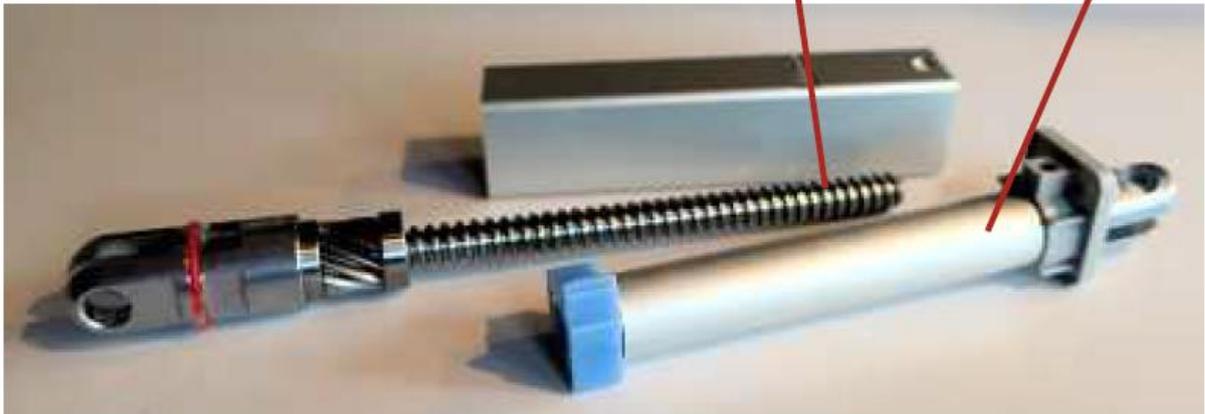
Carte électronique

Moteur

Roues dentées

Vis de manœuvre

Coulisseau



DOCUMENTATION CONSTRUCTEUR
Vérin électrique



TA38

series



Product Segments

- **Comfort Motion**
- **Industrial Motion**

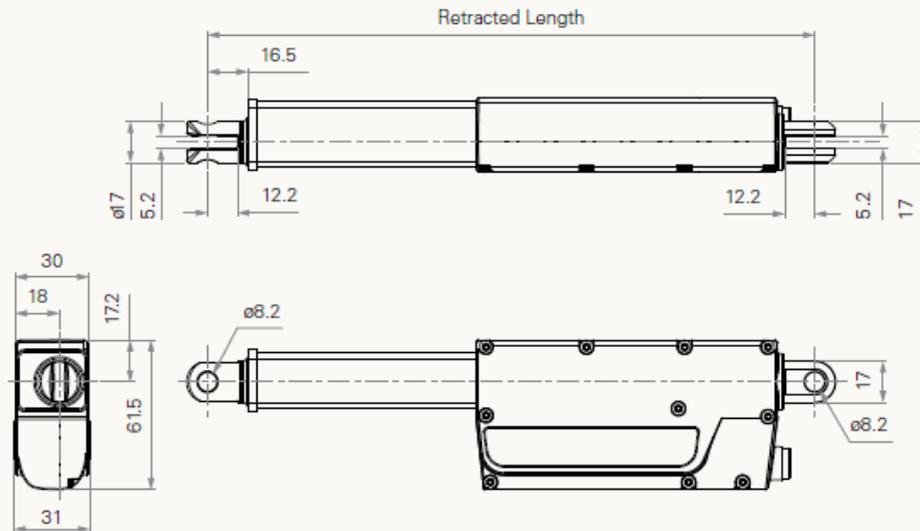
TiMOTION's TA38 series linear actuator is specially designed for low-noise applications, or where a compact linear actuator is needed. The TA38 features a very slim design with a small installation size of only 160mm, providing manufacturers great freedom during the design process. The palm sized motor with up to 1500N force is excellent for all kinds of space limited products.

General Features

Max. load	1,500N (push/pull)
Max. speed at max. load	7.9mm/s
Max. speed at no load	12.5mm/s
Retracted length	≥ 160mm
IP Rating	IP66
Stroke	20~200mm
Options	Hall sensors
Voltage	24V DC; 12/24V DC (PTC)
Color	Black or grey
Operational temperature range	+5°C~+45°C

Drawing

Standard Dimensions
(mm)



Load and Speed

CODE	Load (N)		Self Locking Force (N)	Typical Current (A)		Typical Speed (mm/s)	
	Push	Pull		No Load 32V DC	With Load 24V DC	No Load 32V DC	With Load 24V DC
Motor Speed (6000RPM, Duty Cycle 10%)							
B	1500	1500	1200	1.3	3.6	15.7	9.0

Note

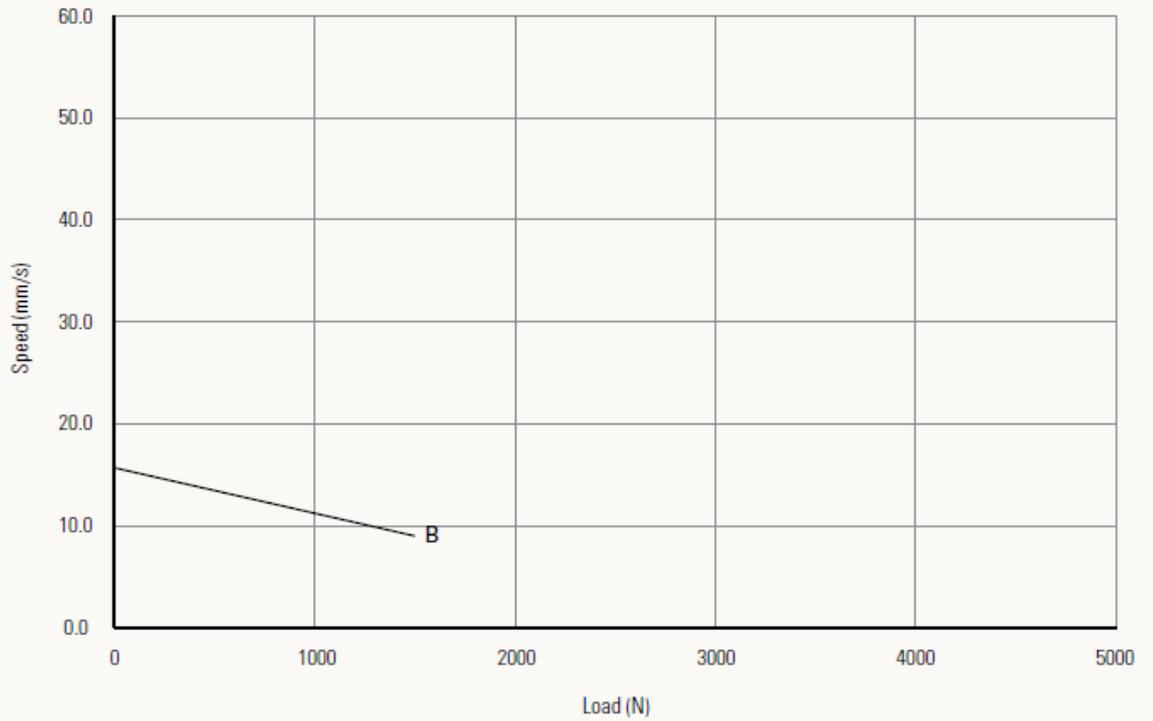
- 1 Please refer to the approved drawing for the final authentic value.
- 2 This self-locking force level is reached only when a short circuit is applied on the terminals of the motor. All the TiMOTION control boxes have this feature built-in.
- 3 The current & speed in table are tested with 24V DC motor. With a 12V DC motor, the current is approximately twice the current measured in 24V DC; speed will be similar for both voltages.
- 4 The current & speed in table are tested when the actuator is extending under push load.
- 5 The current & speed in table and diagram are tested with TiMOTION control boxes, and there will be around 10% tolerance depending on different models of the control box. (Under no load condition, the voltage is around 32V DC. At rated load, the voltage output will be around 24V DC)
- 6 Standard stroke: Min. ≥ 20mm, Max. please refer to below table.

CODE	Load (N)	Max Stroke (mm)
B	≤ 1500	200

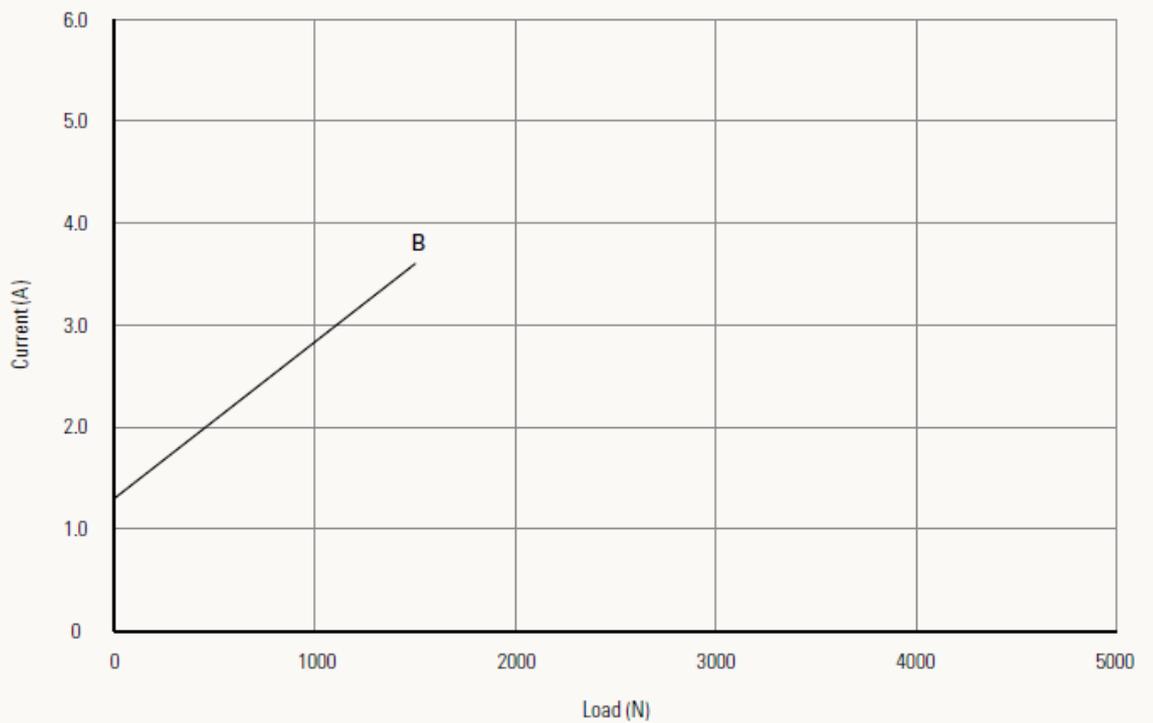
Performance Data (24V DC Motor)

Motor Speed (6000RPM, Duty Cycle 10%)

Speed vs. Load



Current vs. Load

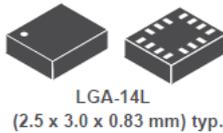


Centrale inertielle

**ISM330DHCX**

Datasheet

iNEMO inertial module with embedded Machine Learning Core: always-on 3D accelerometer and 3D gyroscope with digital output for industrial applications



Features

- 3D accelerometer with selectable full scale: $\pm 2/\pm 4/\pm 8/\pm 16\text{ g}$
- 3D gyroscope with extended selectable full scale: $\pm 125/\pm 250/\pm 500/\pm 1000/\pm 2000/\pm 4000\text{ dps}$
- Extended temperature range from -40 to $+105\text{ }^\circ\text{C}$
- Embedded compensation for high stability over temperature
- SPI/I²C serial interface
- Auxiliary SPI serial interface for data output of gyroscope and accelerometer (OIS and other stabilization applications)
- Six-channel synchronized output
- Sensor hub feature to efficiently collect data from additional external sensors
- Embedded smart FIFO up to 9 kbytes
- Programmable Finite State Machine to process data from accelerometer, gyroscope, and external sensors
- Machine Learning Core
- Smart embedded functions and interrupts: tilt detection, free-fall, wakeup, 6D/4D orientation, click and double-click
- Embedded pedometer, step detector and counter for healthcare applications
- Analog supply voltage: 1.71 V to 3.6 V
- Embedded temperature sensor
- Embedded self-test both for gyroscope and accelerometer
- High shock survivability
- ECOPACK, RoHS and "Green" compliant

Applications

- Industrial IoT and connected devices
- Antennas, platforms, and optical image and lens stabilization
- Robotics, drones and industrial automation
- Navigation systems and telematics
- Vibration monitoring and compensation

Description

The ISM330DHCX is a system-in-package featuring a high-performance 3D digital accelerometer and 3D digital gyroscope tailored for Industry 4.0 applications.

ST's family of MEMS sensor modules leverages the robust and mature manufacturing processes already used for the production of micromachined accelerometers and gyroscopes.

The various sensing elements are manufactured using specialized micromachining processes, while the IC interfaces are developed using CMOS technology that allows the design of a dedicated circuit which is trimmed to better match the characteristics of the sensing element.

Product status link	
ISM330DHCX	

Product summary		
Order code	ISM330DHCX	ISM330DHCXTR
Temp. range [°C]	-40 to +105	
Package	LGA-14L (2.5 x 3.0 x 0.83 mm)	
Packing	Tray	Tape & Reel

Product labels	

Product resources	
AN5398 (ISM330DHCX)	
AN5392 (Machine Learning Core)	
AN5388 (Finite State Machine)	
TN0018 (Design and soldering)	



4 Module specifications

4.1 Mechanical characteristics

@ Vdd = 1.8 V, T = 25 °C, unless otherwise noted.

Table 2. Mechanical characteristics

Symbol	Parameter	Test conditions	Min. ⁽¹⁾	Typ. ⁽²⁾	Max. ⁽¹⁾	Unit
LA_FS	Linear acceleration measurement range			±2		g
				±4		
				±8		
				±16		
G_FS	Angular rate measurement range			±125		dps
				±250		
				±500		
				±1000		
				±2000		
LA_So	Linear acceleration sensitivity ⁽³⁾	FS = ±2 g	-2%	0.061	+2%	mg/LSB
		FS = ±4 g		0.122		
		FS = ±8 g		0.244		
		FS = ±16 g		0.488		
G_So	Angular rate sensitivity ⁽³⁾	FS = ±125 dps	-2%	4.375	+2%	mdps/LSB
		FS = ±250 dps		8.75		
		FS = ±500 dps		17.50		
		FS = ±1000 dps		35		
		FS = ±2000 dps		70		
		FS = ±4000 dps		140		
LA_SoDr	Linear acceleration sensitivity change vs. temperature ⁽⁴⁾	from -40 °C to +105 °C	-0.01	±0.005	+0.01	%/°C
G_SoDr	Angular rate sensitivity change vs. temperature ⁽⁴⁾	from -40 °C to +105 °C	-0.015	±0.007	+0.015	%/°C
LA_TyOff	Linear acceleration zero-g level offset accuracy ⁽⁵⁾		-65	±10	+65	mg
G_TyOff	Angular rate zero-rate level ⁽⁵⁾		-3	±1	+3	dps
LA_TCOff	Linear acceleration zero-g level change vs. temperature ⁽⁴⁾		-0.5	±0.1	+0.5	mg/°C
G_TCOff	Angular rate typical zero-rate level change vs. temperature ⁽⁴⁾		-0.015	±0.005	+0.015	dps/°C
LA_Cx	Linear acceleration cross-axis sensitivity	T = 25 °C		±0.5		%
G_Cx	Angular rate cross-axis sensitivity	T = 25 °C		±1		%
Rn	Rate noise density in high-performance mode ⁽⁶⁾			5	8	mdps/√Hz
ARW	Angular random walk	T = 25 °C		0.21	0.34	deg/√h
BI	Bias instability	T = 25 °C		3		deg/h
RnRMS	Gyroscope RMS noise in low-power mode ⁽⁷⁾			70		mdps



Symbol	Parameter	Test conditions	Min. ⁽¹⁾	Typ. ⁽²⁾	Max. ⁽¹⁾	Unit
An	Acceleration noise density in high-performance mode ⁽⁸⁾			60	100	μg/√Hz
RMS	Acceleration RMS noise in low-power mode ⁽⁹⁾⁽¹⁰⁾			1.8		mg(RMS)
LA_ODR	Linear acceleration output data rate			1.6 ⁽¹¹⁾ 12.5 26 52 104 208 416 833 1666 3332 6667		Hz
G_ODR	Angular rate output data rate			12.5 26 52 104 208 416 833 1666 3332 6667		
LA_F0	Sensor resonant frequency	X,Y-axis Z-axis		2.6 2.17		kHz
G_F0	Sensor resonant frequency			20		kHz
Vst	Linear acceleration self-test output change ^{(12) (13) (14)}		40		1700	mg
	Angular rate self-test output change ⁽¹⁵⁾⁽¹⁶⁾	FS = ±250 dps	20		80	dps
		FS = ±2000 dps	150		700	dps
Top	Operating temperature range		-40		+105	°C

1. Min/Max values are based on characterization results at 3σ on a limited number of samples, not tested in production and not guaranteed.
2. Typical specifications are not guaranteed.
3. Sensitivity values after factory calibration test and trimming.
4. Measurements are performed in a uniform temperature setup and they are based on characterization data in a limited number of samples. Not measured during final test for production.
5. Values after factory calibration test and trimming.
6. Gyroscope rate noise density in high-performance mode is independent of the ODR and FS setting.
7. Gyroscope RMS noise in low-power mode is independent of the ODR and FS setting.
8. Accelerometer noise density in high-performance mode is independent of the ODR and full scale.
9. Accelerometer RMS noise in low-power mode is independent of the ODR.
10. Noise RMS related to BW = ODR/2.
11. This ODR is available when the accelerometer is in low-power mode.
12. The sign of the linear acceleration self-test output change is defined by the STx_XL bits in a dedicated register for all axes.

Encodeur

Incremental 40-mm-dia. Rotary Encoder

E6B2-C

CSM_E6B2-C_DS_E_6_3

**General-purpose Encoder with
External Diameter of 40 mm**

- Incremental model
- External diameter of 40 mm.
- Resolution of up to 2,000 ppr.



 Be sure to read Safety Precautions on page 4.

For the most recent information on models that have been certified for safety standards, refer to your OMRON website.

Ordering Information**Encoders** [Refer to *Dimensions* on page 5.]

Power supply voltage	Output configuration	Resolution (pulses/rotation)	Model
5 to 24 VDC	NPN open-collector output	10, 20, 30, 40, 50, 60, 100, 200, 300, 360, 400, 500, 600	E6B2-CWZ6C (resolution) 0.5M Example: E6B2-CWZ6C 10P/R 0.5M
		720, 800, 1,000, 1,024	
		1,200, 1,500, 1,800, 2,000	
12 to 24 VDC	PNP open-collector output	100, 200, 360, 500, 600	E6B2-CWZ5B (resolution) 0.5M Example: E6B2-CWZ5B 100P/R 0.5M
		1,000	
		2,000	
5 to 12 VDC	Voltage output	10, 20, 30, 40, 50, 60, 100, 200, 300, 360, 400, 500, 600	E6B2-CWZ3E (resolution) 0.5M Example: E6B2-CWZ3E 10P/R 0.5M
		1,000	
		1,200, 1,500, 1,800, 2,000	
5 VDC	Line-driver output	10, 20, 30, 40, 50, 60, 100, 200, 300, 360, 400, 500, 600	E6B2-CWZ1X (resolution) 0.5M Example: E6B2-CWZ1X 10P/R 0.5M
		1,000, 1,024	
		1,200, 1,500, 1,800, 2,000	

Accessories (Order Separately) [Refer to *Dimensions on Rotary Encoder Accessories.*]

Name	Model	Remarks
Couplings	E69-C06B	Provided with the product.
	E69-C68B	Different end diameter
	E69-C610B	Different end diameter
	E69-C06M	Metal construction
Flanges	E69-FBA	---
	E69-FBA02	E69-2 Servo Mounting Bracket provided.
Servo Mounting Bracket	E69-2	---

Note: 1. Refer to *Rotary Encoders Accessories* on your OMRON website for details.

2. Refer to *Precautions For Correct Use of Rotary Encoders* on your OMRON website when using the Rotary Encoders together with a Coupling.

E6B2-C

Ratings and Specifications

Item	Model	E6B2-CWZ6C	E6B2-CWZ5B	E6B2-CWZ3E	E6B2-CWZ1X
Power supply voltage		5 VDC -5% to 24 VDC +15%, ripple (p-p): 5% max.	12 VDC -10% to 24 VDC +15%, ripple (p-p): 5% max.	5 VDC -5% to 12 VDC +10%, ripple (p-p): 5% max.	5 VDC ±5%, ripple (p-p): 5% max.
Current consumption *1		0.6 W max. (80 mA max.)	0.8 W max. (100 mA max.)	0.6 W max. (100 mA max.)	160 mA max.
Resolution (pulses/rotation)		10, 20, 30, 40, 50, 60, 100, 200, 300, 360, 400, 500, 600, 720, 800, 1,000, 1,024, 1,200, 1,500, 1,800, 2,000	100, 200, 360, 500, 600, 1,000, 2,000	10, 20, 30, 40, 50, 60, 100, 200, 300, 360, 400, 500, 600, 1,000, 1,200, 1,500, 1,800, 2,000	10, 20, 30, 40, 50, 60, 100, 200, 300, 360, 400, 500, 600, 1,000, 1,024, 1,200, 1,500, 1,800, 2,000
Output phases		Phases A, B, and Z			Phases A, \bar{A} , B, \bar{B} , Z, and \bar{Z}
Phase difference between outputs		90°±45° between A and B (1/4 T ± 1/8 T)			
Output configuration		NPN open-collector output	PNP open-collector output	Voltage output (NPN output)	Line driver output *2
Output capacity		Applied voltage: 30 VDC max. Sink current: 35 mA max. Residual voltage: 0.4 V max. (at sink current of 35 mA)	Applied voltage: 30 VDC max. Source current: 35 mA max. Residual voltage: 0.4 V max. (at source current of 35 mA)	Output resistance: 2 kΩ Sink current: 20 mA max. Residual voltage: 0.4 V max. (at sink current of 20 mA)	AM26LS31 equivalent Output current High level: I _o = -20 mA Low level: I _s = 20 mA Output voltage: V _o = 2.5 V min. V _s = 0.5 V max.
Maximum response frequency *3		100 kHz	50 kHz	100 kHz	
Rise and fall times of output		1 μs max. (Control output voltage: 5 V, Load resistance: 1 kΩ, Cable length: 2 m max.)	1 μs max. (Cable length: 2 m max., Sink current: 10 mA)		0.1 μs max. (Cable length: 2 m max., I _o = -20 mA, I _s = 20 mA)
Starting torque		0.98 mN·m max.			
Moment of inertia		1×10 ⁻⁶ kg·m ² max.; 3 × 10 ⁻⁷ kg·m ² max. at 600 P/R max.			
Shaft loading	Radial	30 N			
	Thrust	20 N			
Maximum permissible speed		6,000 r/min			
Protection circuits		Power supply reverse polarity protection, Load short-circuit protection			---
Ambient temperature range		Operating: -10 to 70°C (with no icing), Storage: -25 to 85°C (with no icing)			
Ambient humidity range		Operating/Storage: 35% to 85% (with no condensation)			
Insulation resistance		20 MΩ min. (at 500 VDC) between current-carrying parts and case			
Dielectric strength		500 VAC, 50/60 Hz for 1 min between current-carrying parts and case			
Vibration resistance		Destruction: 10 to 500 Hz, 150 m/s ² or 2-mm double amplitude for 11 min 3 times each in X, Y, and Z directions			
Shock resistance		Destruction: 1,000m/s ² 3 times each in X, Y, and Z directions			
Degree of protection		IEC 60529 IP50			
Connection method		Pre-wired Models (Standard cable length: 500 mm)			
Materials		Case: ABS, Main unit: Aluminum, Shaft: SUS420J2			
Weight (packed state)		Approx. 100 g			
Accessories		Coupling, Hexagonal wrench, Instruction manual			

*1. An inrush current of approximately 9 A will flow for approximately 0.3 ms when the power is turned ON.

*2. The line driver output is a data transmission circuit compatible with RS-422A and long-distance transmission is possible with a twisted-pair cable. The quality is equivalent to AM26LS31.

*3. The maximum electrical response speed is determined by the resolution and maximum response frequency as follows:

$$\text{Maximum electrical response speed (rpm)} = \frac{\text{Maximum response frequency}}{\text{Resolution}} \times 60$$

This means that the E6B2-C Rotary Encoder will not operate electrically if its speed exceeds the maximum electrical response speed.