

BS-IC563-M-D6EC

Inertial Measurement Unit (Comm/AG/Lift)

Safety instructions

- 1、 Please read these safety instructions carefully.
- 2、 When you connect the device to the power outlet, make sure that the voltage of the power cord meets the requirements.
- 3、 Place the power cord in a place where people cannot easily stumble over it, and do not cover the power cord with any sundries.
- 4、 Unplug the power cord from the outlet before cleaning the unit. Do not use liquid or decontamination spray to clean the equipment directly. Use a cloth instead.
- 5、 Before installation, make sure that the equipment is placed on a reliable surface to prevent accidental dropping.
- 6、 If the equipment is not used for a long time, please disconnect it from the power socket to prevent the equipment from being damaged by excessive voltage fluctuations.
- 7、 Please do not allow any liquid to flow into the equipment to avoid short circuit or fire.
- 8、 Please do not open the device by yourself. To ensure your safety, have a professional technician or certified engineer open the device. In case of the following conditions, please repair by professional personnel:
 - ◆ The equipment falls or is damaged;
 - ◆ Liquid flows into the equipment;
 - ◆ Power cord or plug is damaged;
 - ◆ The equipment has obvious appearance damage;
 - ◆ The device does not work properly, or you cannot use the instructions to make it work properly;

1. Overview

BS-IC563-M-D6EC is a high-performance module that outputs 3D attitude, 3D angular velocity, 3D acceleration, and 3D magnetic field (depending on the product configuration), and is precisely calibrated in the full temperature range to meet the performance requirements under different conditions. The module can be used as an inertial measurement unit (IMU), a vertical reference unit (VRU), and an attitude and heading reference system (AHRS). It is widely used in high-speed train measurement and control system, ship and ocean engineering control, flight control and other fields.

2. Performance indicators

Specific performance index configuration of BS-IC563-M-D6EC is shown in Table 1:

Table 1 Performance index

Technical indicators	
System	
Roll/Pitch (1σ)	0.1°
Heading (1σ)	1°
Gyroscope	
Range	± 250 °/s (optional ± 500 °/s)
Zero-bias instability	≤ 4 °/h
Zero bias at full temperature	≤ 0.07 °/s
Calibration error	$\leq 0.15\%$
Accelerometer	
Range	± 4 G (optional $\pm 8/\pm 16$ G)
Zero-bias instability	≤ 0.06 mg
Zero bias at full temperature	≤ 2 mg
Scale error	$\leq 0.3\%$
Magnetometer	
Range	2gauss (optional 8gauss)

Resolution	0.1
Basic characteristics	
Operating temperature	-40 to 85°C
Supply voltage	9 V-24V/5V
Interface	RS422/232/CAN
Degrees of freedom	9DOF

3.Appearance and installation axial

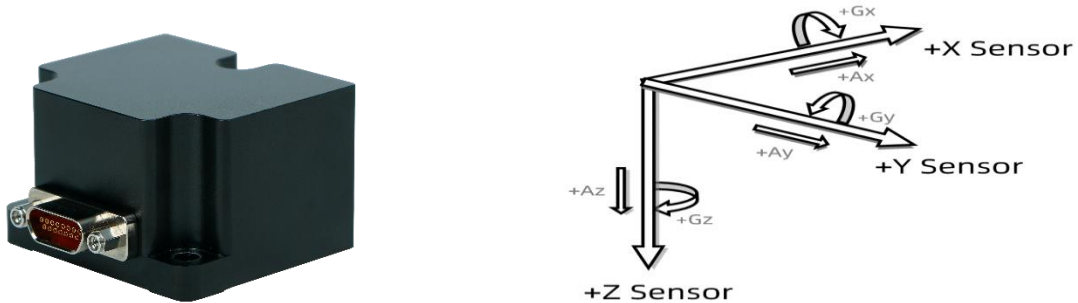


Figure 1. Figure 2

BS-IC563-M-D6EC appearance and axial view

BS-IC563-M-D6EC follows the NED coordinate system, right-handed system, and the axial direction is shown in Figure 2. When the positive direction of the X axis points to the front of the carrier, the angle of turning around the X axis is the roll angle, the angle of turning around the Y axis is the pitch angle, and the angle around the Z axis is the heading angle.

4.Instructions for use and installation

- 1) The power supply has two configurations: wide voltage and rated voltage. The rated power supply shall be 5V DC, ripple < 50 Mv, and current at least 0.5 A. If the power supply is noisy and the power supply line is long, please use a filter or an external voltage regulator.
- 2) The BS-IC563-M-D6EC shall be installed as close as possible to the working position where the measurement is required.
- 3) The coordinate axes of the BS-IC563-M-D6EC are precisely aligned with the coordinate axes of the carrier or other reference system. If the installation error angle between the two can be measured, it can be corrected by software.
- 4) Avoid hitting or falling. An impact exceeding the guideline limit can cause temporary or even

permanent damage to the BS-IC563-M-D6EC.

5) Installation notes

i) The surface of the equipment installed on the product should be flat and have good stiffness. The flatness of the installation surface should not exceed 0.1mm, and the parallelism with the horizontal reference plane of the equipment should not exceed 0.1°;

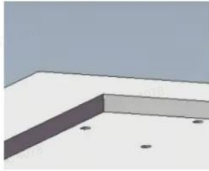


图 1 安装前

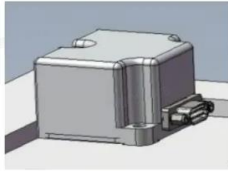


图 2 安装后

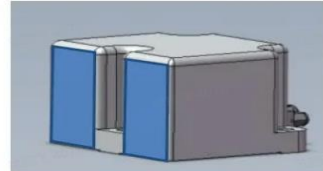


图 3 安装基准面

- ii) During product installation, the datum plane marked in blue in the drawing shall be used as the positioning plane, and the equipment shall be provided with a positioning edge in contact with this plane, or during installation, tools shall be used to ensure that the perpendicularity between this plane and the equipment axis is not greater than the 0.1°.
- iii) Rigid connection is required for product installation, M4 stainless steel combination screws are used, and M4 threaded holes are processed on the equipment. The screwing length of the aluminum alloy threaded hole is 4-6mm. The screwing length of the stainless-steel threaded hole is 2.5 to -3.5mm. It is not recommended that the mounting base surface be of sheet construction.
- iv) During product fixing, installation tools with torque display or torque control shall be used. The recommended tightening torque for screws is 1.6 -2.5kg f · cm.
- v) The product shall be installed away from high temperature and high humidity environment, and the temperature change rate shall be less than 2 °C/min (preferably less than 1 °C/min).
- vi) The product shall be installed as far away from the vibration source as possible, such as the engine, audio and other components at a distance of ≥ 300 mm. If it is installed near the strong vibration source, it will increase the noise and affect the product performance. The vibration source must be physically damped, and the mean square root acceleration of triaxial vibration within 200 Hz after damping shall not be greater than 0.2 G.
- vii) The resonant frequency of the mounting floor shall not be less than 5 times the bandwidth required by the system. (If the inertial navigation bandwidth is ≥ 80 Hz, the bottom resonance frequency is required to be $\geq 80 * 5$ Hz)
- viii) Grounding resistance: the shell shall be grounded, and the grounding resistance shall not be greater than 4 Ω .
- ix) If the carrier has a large current harness of more than 3A, the distance from the positioning module shall be ≥ 200 mm to reduce the magnetic interference around the IMU.

5.Signal Definition

Table 2 Signal definition of J30J0J-15 TJTJL

Pin	Definition	Explain
1	+Vin	Power supply positive 5V/9 ~ 24V
2	GND	Power ground
3	RS422_TX_P	RS422 sends positive
4	RS422_TX_N	RS422 sends negative
5	RS422_RX_P	RS422 receiving is positive
6	RS422_RX_N	RS422 receives negative
7	GND	RS 232 _ Ground
8	RS232_TX	RS232 _ Send
9	RS232_RX	RS232 _ Receive
10	PP1S(3.3/5/12V)	Pulse per second input
11	CAN_H	CAN bus transmit-receive high
12	CAN_L	CAN bus transmit-receive low
13	RS 232_ TX (IMU output)	RS232 _ Send
14	RS 232_ RX (IMU output)	RS232 _ Receive
15	RS232_GND	RS 232 _ Ground

6. mode of operation and packet format

Table 3 Data Packet Format (Communication on the Move)

Offset	Definition	Length	Coefficient	Unit	Byte order	Explain
0	0xBD	1	---	---	---	Header (fixed value)
1	0xDB	1	---	---	---	Header (fixed value)
2	0x84	1	---	---	---	Header (fixed value)
3	flag	1	---	---	---	Bit0 -- Magnetic Valid Flag 1 -- Valid Bit1 -- GPS _ exist GPS information 0 -- No GPS information 1--GPS information is available Bit2 -- GPS information valid flag 1 -- Valid Bit3~7 reserve
4-5	Roll	2	360/32768	deg	LSB_first	
6-7	Pitch	2	360/32768	deg	LSB_first	
8-9	Yaw	2	360/32768	deg	LSB_first	
10-11	Gx	2	Grange/32768	deg/s	LSB_first	
12-13	Gy	2	Grange/32768	deg/s	LSB_first	
14-15	Gz	2	Grange/32768	deg/s	LSB_first	
16-17	Ax	2	Arange/32768	g	LSB_first	
18-19	Ay	2	Arange/32768	g	LSB_first	

20-21	Az	2	Arange/32768	g	LSB_first	
22-23	Mx	2	Mrange/32768	gauss	LSB_first	
24-25	My	2	Mrange/32768	gauss	LSB_first	
26-27	Mz	2	Mrange/32768	gauss	LSB_first	
28-29	Temperature	2	200.0/32768.0	°C	LSB_first	
30-33	Time	4	1.00E-02	s	LSB_first	
34-37	Lon	4	1.00E-07	m	LSB_first	
38-41	Lat	4	1.00E-07	m	LSB_first	
42-45	hMSL	4	1.00E-07	m	LSB_first	
46	gpsFix	1	---	---	---	0x00 = no fix 0x01 = DR only 0x02 = 2D-fix 0x03 = 3D-fix 0x04 = GPS+DR 0x05 = Time only fix 0x06~0xFF = reserved
47	numSV	1	---	---	LSB_first	
48-49	InfoByte	2	---	---	LSB_first	
50	checksum	1	---	---	---	XOR verification (Byte0-49)

Table 4 Packet Format (AG Mode)

Offset	Definition	Length	Coefficient	Unit	Byte order	Explain
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0	0xBD	1	---	---	---	Header (fixed value)
1	0xDB	1	---	---	---	Header (fixed value)
2	0x84	1	---	---	---	Header (fixed value)
3	flag	1	---	---	---	<p>Bit0 -- Magnetic Valid Flag 1 -- Valid Bit1 -- GPS_ exist GPS information 0 -- No GPS information 1--GPS information is available Bit2 -- GPS information valid flag 1 -- Valid Bit3 ~ 7 reserve (LSB/MSB optional)</p>
4-5	Roll	2	360/32768	deg	LSB_first	
6-7	Pitch	2	360/32768	deg	LSB_first	
8-9	Yaw	2	360/32768	deg	LSB_first	
10-11	Gx	2	Grange/32768	deg/s	LSB_first	
12-13	Gy	2	Grange/32768	deg/s	LSB_first	
14-15	Gz	2	Grange/32768	deg/s	LSB_first	
16-17	Ax	2	Arange/32768	g	LSB_first	
18-19	Ay	2	Arange/32768	g	LSB_first	
20-21	Az	2	Arange/32768	g	LSB_first	

22-23	Mx	2	Mrange/32768	gauss	LSB_first	
24-25	My	2	Mrange/32768	gauss	LSB_first	
26-27	Mz	2	Mrange/32768	gauss	LSB_first	
28-29	Temperature	2	200.0/32768.0	°C	LSB_first	
30-33	Time	4	1e-2	s	LSB_first	
34	checksum	1	---	---	---	XOR verification (Byte0-33)

Table 5 Packet Format (Up and Down Mode)

Offset	Definition	Length	Coefficient	Unit	Byte order	Explain
0	0xBD	1	---	---	---	Header (fixed value)
1	0xDB	1	---	---	---	Header (fixed value)
2	0x84	1	---	---	---	Header (fixed value)
3	flag	1	---	---	---	Bit0 -- Magnetic Valid Flag 1 -- Valid Bit1 -- GPS_exist GPS information 0 -- No GPS information 1--GPS information is available Bit2 -- GPS information valid flag 1 -- Valid Bit3 ~ 7 reserve (LSB/MSB optional)

4-5	Vertical position	2	20/32768	m	LSB_first	Only
6-7	vertical velocity	2	20/32768	m/s	LSB_first	
8-9	Roll	2	360/32768	deg	LSB_first	
10-11	Pitch	2	360/32768	deg	LSB_first	
12-13	Yaw	2	360/32768	deg	LSB_first	
14-15	Gx	2	Grange/32768	deg/s	LSB_first	
16-17	Gy	2	Grange/32768	deg/s	LSB_first	
18-19	Gz	2	Grange/32768	deg/s	LSB_first	
20-21	Ax	2	Arange/32768	g	LSB_first	
22-23	Ay	2	Arange/32768	g	LSB_first	
24-25	Az	2	Arange/32768	g	LSB_first	
26-27	Mx	2	Mrange/32768	gauss	LSB_first	
28-29	My	2	Mrange/32768	gauss	LSB_first	
30-31	Mz	2	Mrange/32768	gauss	LSB_first	
31-33	Temperature	2	200.0/32768.0	°C	LSB_first	
34-35	Time	4	1e-2	s	LSB_first	
36	checksum	1	---	---	---	XOR verification (Byte0-35)

7. Size of structure

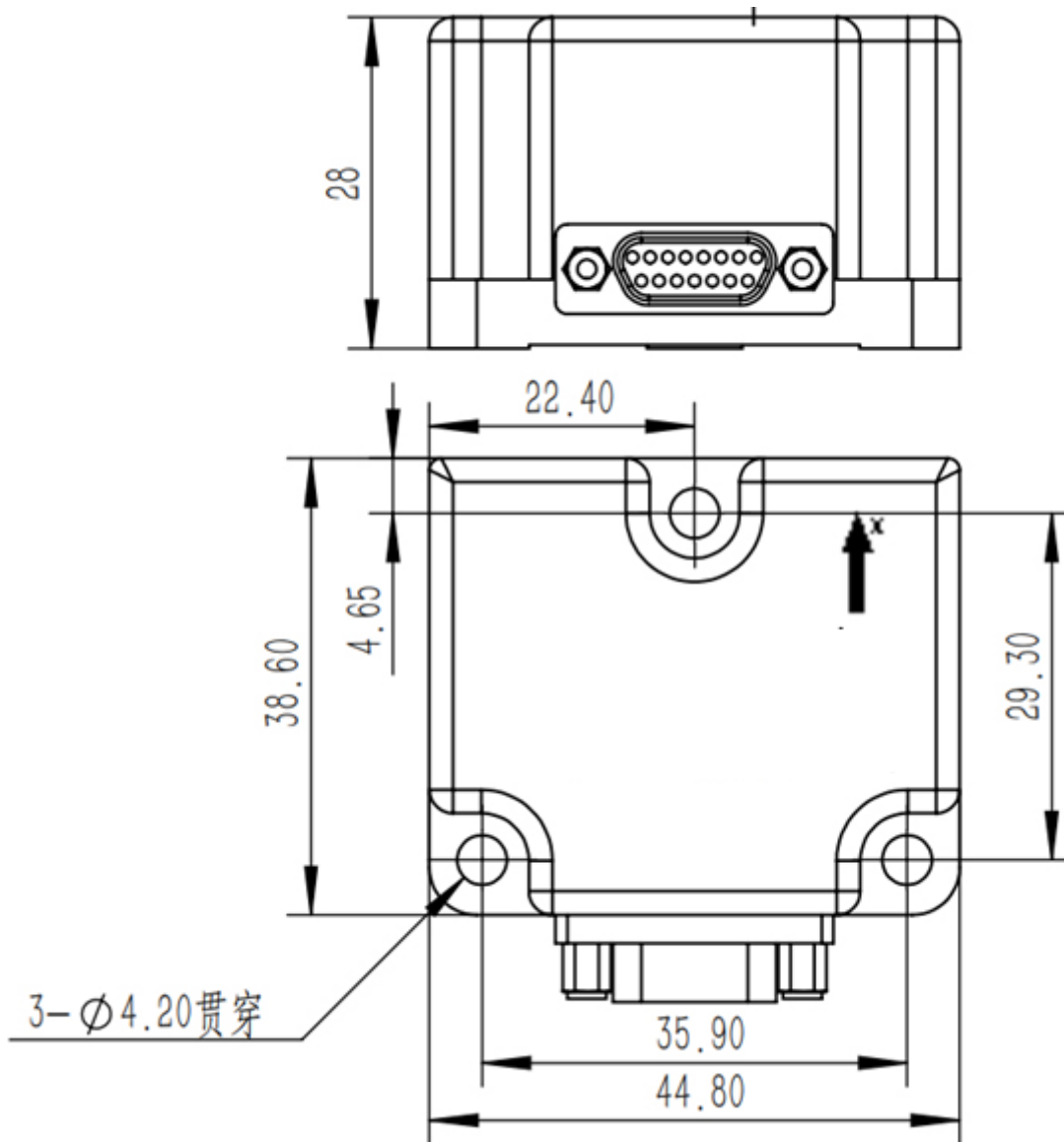


Figure 2. Structure dimension drawing (mm)

Precautions for use and maintenance

1. It is recommended to power on for self inspection at least once every three months.
2. Do not fall: high-altitude falls, impacts, etc. may cause damage to internal structural components.
3. Prevent corrosive liquids from corroding the navigation device or soaking it in any liquid.
4. Avoid radiation interference: Radiation interference from other electronic devices may affect normal operation.

Maintenance precautions

During installation and use, if the following phenomena occur, please contact the remote engineer to determine whether it can continue to be used or returned to the factory for repair.

1. There are obvious signs of damage to the appearance, including severe scratches, scratches, and missing components.
2. Unable to install properly to the bracket, or unable to meet installation accuracy requirements after installation.
3. Loss or damage to electrical interfaces.
4. Power on at room temperature and pressure, with a working current of less than 0.2A at 5V.
5. Unable to receive data properly or receiving incorrect data.
6. When used under the conditions specified in the user manual, the performance indicators are seriously inconsistent with those stated in the manual.

*The above terms are based on the contract's service life and warranty policy.