HiPNUC

HI71 Series Datasheet

Tactical-Grade IMU/VRU/MRU/AHRS/INS Module

1 Features

1.1 Hardware

- Tactical-grade MEMS IMU (“tactical-grade” is a product grade designation and does not correspond to any specific industry standard grade)
- Integrated low-noise, high-reliability LDO
- Factory calibration and compensation over -40 °C to +85 °C, including bias, scale factor, and cross-axis calibration
- 4 × UART and CAN (external CAN transceiver required).
- Support for PPS + GPRMC time synchronization
- Integrated temperature sensor
- Multi-function I/O for synchronization, data-ready, LED, alarm, and related functions
- Algorithm optimized for vibration environments
- Compact package: 24 × 24 × 14 mm
- Designed in compliance with RoHS-related requirements, Refer to the latest official compliance documents for certification status.
- Custom configurations available

1.2 Software

- Adaptive EKF fusion algorithm
- The UART output data rate supports up to 1000 Hz, depending on output type and configuration, with low output latency
- Fusion algorithm optimized for dynamic attitude tracking and vibration suppression
- HI71M4 supports heave output. Under typical installation and typical motion conditions, the typical heave accuracy is 5 cm or 5% (whichever is greater); actual performance depends on vehicle motion conditions, wave environment, installation method, and parameter configuration
- Supports serial binary protocol, Modbus RTU, NMEA 0183, as well as CAN-based communication methods such as CANopen and SAE J1939
- Rich user configuration commands
- Multifunctional GUI for easy operation
- Supports various examples for ROS1, ROS2, C, MATLAB, Python, Arduino, etc.

1.3 Key Specification Summary

Item	HI71T2	HI71T4	HI71M4	HI71N4
Function	IMU/VRU	IMU/VRU/AHRS	IMU/VRU/MRU/AHRS	IMU/VRU/AHRS/INS
Magnetometer	×	√	√	√
Barometer	×	√	√	√
Heave	×	×	√	×
INS	×	×	×	√
Interface	All series: 4 × UART, CAN, multi-function IO			
Size	All series: 24 × 24 × 14 mm			

Note 1: The above is a series-level summary. For specific standard models, please refer to Table 3.

Note 2: CAN(external CAN transceiver required)

2 Applications

The HI71 series is intended for high-performance attitude sensing and complex operating conditions, and is suitable for attitude measurement and control scenarios under temperature variation, vibration, and dynamic motion conditions. Typical applications include:

- Precision instruments and meters
- Unmanned aerial vehicles
- Low-speed autonomous driving platforms
- Active wave compensation
- Marine attitude control

3 Description

3.1 System Block Diagram

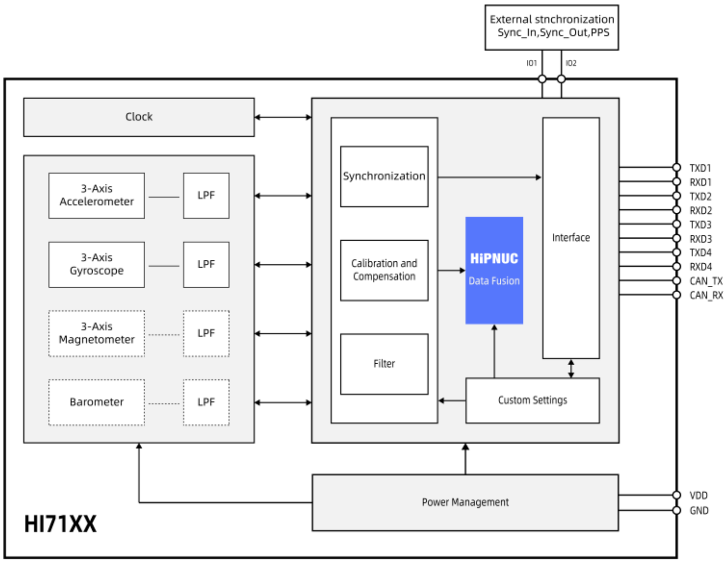

Figure 1: HI71 Series System Block Diagram

Note 1: Dashed lines indicate functions not supported by some models. Refer to Table 1: Product Selection Information for details.

3.2 Description

The HI71 series is an IMU/VRU/MRU/AHRS/INS sensor module based on a tactical-grade MEMS IMU. It is equipped with adaptive extended Kalman filtering, IMU noise dynamic analysis, heave estimation, vehicle motion state analysis, and GNSS fusion algorithms, and can output raw inertial data (acceleration, angular velocity, magnetic field), attitude data (Euler angles, quaternions), heave data, as well as velocity, position, and time information under external GNSS.

Depending on the model, the HI71 series supports IMU, VRU, MRU, AHRS, or INS functions. For specific configurations, please refer to Table 1 and Table 2.

The module can transmit data through UART or CAN interfaces. The accompanying GUI software supports parameter configuration, data visualization, firmware upgrade, and data logging.

Figure 2: GUI Software

Contents

4 Product Selection

Table 1: Selection Information

HI71a-b-c				
Identifier	Series	a - Sensor Configuration	b - Data Interface	c - Other Information
HI	71	T2: IMU/VRU T4: IMU/VRU/AHRS M4: IMU/VRU/MRU/AHRS N4: IMU/VRU/AHRS/INS	MI0: 4 × UART + CAN (external CAN transceiver required)	00: Default Other: Custom

Note 1: For current standard models, refer to the Product Ordering section. Other models can be customized.

Note 2: CAN on the MI0 interface requires an external CAN transceiver.

Table 2: HI71 Series Module Configuration

Model	3-Axis Accelerometer	3-Axis Gyroscope	3-Axis Magnetometer	Barometer	Heave	INS
HI71T2-MI0-000	√	√	×	×	×	×
HI71T4-MI0-000	√	√	√	√	×	×
HI71M4-MI0-000	√	√	√	√	√	×
HI71N4-MI0-000	√	√	√	√	×	√

5 Product Ordering

5.1 Ordering Code

Table 3: Ordering Code

Part Number	Name	Description
HI71T2-MI0-000	IMU/VRU Module	High-performance IMU/VRU module
HI71T4-MI0-000	IMU/VRU/AHRS Module	High-performance IMU/VRU/AHRS module, integrating a magnetometer and barometer
HI71M4-MI0-000	IMU/VRU/MRU/AHRS Module	High-performance IMU/VRU/MRU/AHRS module, supporting heave function
HI71N4-MI0-000	IMU/VRU/AHRS/INS Module	High-performance IMU/VRU/AHRS/INS module, supporting INS function

5.2 Contact Information

1. Email: overseas1@hipnuc.com
2. Website: www.hipnuc.com

6 Document Information

6.1 Revision History

Table 4: Revision History

Version	Date	Author	Description
1.0	August 20, 2025	HiPNUC	Initial release
1.1	April 8, 2026	HiPNUC	Reformatted and refined the description

6.2 Related Documents and Development Kits

1. Command and Programming Manual
2. STEP / Package Files
3. Certification and compliance documents
4. GUI and reference examples

7 HI71 System Architecture

The HI71 series is a sensor module supporting IMU, VRU, and AHRS function configurations. Depending on the specific model, the product can provide data outputs such as acceleration, angular velocity, magnetic field, Euler angles, and quaternions. Depending on the model configuration, the HI71 module can integrate a 3-axis accelerometer, 3-axis gyroscope, 3-axis magnetometer, and a high-performance processor. The onboard processor is responsible for sensor synchronization, calibration, sensor fusion, and user configuration. Meanwhile, based on application scenarios and sensor characteristics, the module supports operating modes such as 6-DoF and AHRS, and can provide MRU or INS functions depending on the model. For details, please refer to the Command and Programming Manual.

7.1 IMU

HI71 can be used as an inertial measurement unit (IMU), outputting 3D acceleration and 3D angular velocity data. The relevant data is collected by the internally integrated accelerometer and gyroscope and can be used to characterize the motion state and dynamic changes of the carrier in three-dimensional space. Compared with raw inertial devices without module-level compensation and calibration, HI71 has completed system-level calibration and compensation correction before leaving the factory, including cross-axis, scale factor, bias, and temperature compensation, to improve the consistency and stability of output data.

7.2 VRU

Using sensor fusion, the HI71 can output gravity-referenced attitude information, mainly including pitch angle (Pitch) and roll angle (Roll); in 6-DoF mode, it can also output an estimated heading angle (Yaw), but this value will accumulate drift over time.

7.3 MRU

Based on the VRU function, some models can further output motion information such as heave, roll, and pitch, forming the MRU function. The relevant performance is related to installation method, motion period, vibration environment, and parameter configuration.

7.4 AHRS

On the basis of IMU and VRU, by introducing a magnetometer and combining it with the fusion algorithm, the product can operate in AHRS mode and output long-term stable pitch angle, roll angle, and heading angle based on magnetic north reference. Heading performance is affected by the magnetic environment, installation method, and user calibration status.

7.5 INS

The HI71 series supports INS operation when connected to an external GNSS. By fusing GNSS data with internal IMU data, the system can output the following information:

Velocity: 3D velocity of the carrier

Position: longitude, latitude, and altitude

Attitude: pitch, roll, and heading

Timing: GNSS-related time synchronization information

Under typical configuration, GNSS and inertial data fusion can suppress inertial navigation drift to a certain extent and provide short-term continuous navigation capability in scenarios where GNSS is temporarily blocked. Actual performance is related to GNSS status, installation method, auxiliary information configuration, and motion conditions.

8 Interfaces and Pin Definitions

The HI71 connector is a 1.27 mm board-to-board connector, and the pin definitions are as follows:

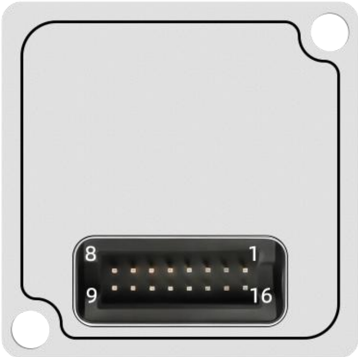

Figure 3: HI71 Board-to-Board Connector Pin Numbers

Note 1: Users can contact us to obtain the matching connector model.

Table 5: Pin Definition

Pin No.	Name	Type	Description	Remark
1	UART2_RX	I/O	UART2 receive	
2	UART2_TX	I/O	UART2 transmit	
3	UART4_RX	I/O	UART4 receive	
4	UART4_TX	I/O	UART4 transmit	
5	NRST	I	Reset pin, low level resets the module, recommended to connect to the host GPIO, can be left floating if unused	
6	GND	Power	Power ground	
7	VDD	Power	Power input 3.6 V to 5.5 V	
8	NC	NA	Reserved, leave floating	
9	UART1_RX	I/O	UART1 receive	
10	UART1_TX	I/O	UART1 transmit	
11	IO2（SYNC_OUT）	I/O	Synchronous output, can be used as a Data Ready signal	
12	IO1（SYNC_IN/PPS）	I/O	Synchronous input, can accept external trigger signals, such as the GNSS PPS signal	
13	CAN_TX	I/O	CAN transmit	1
14	CAN_RX	I/O	CAN receive	
15	UART3_TX/I2C_SCL	I/O	UART3 transmit, can connect to an external GNSS module / I2C clock	
16	UART3_RX/I2C_SDA	I/O	UART3 receive, can connect to an external GNSS module / I2C data	

Note 1: If CAN is used, an external CAN transceiver is required, such as TJA1044

Table 6: UART Function Description

Port	Data Transmission	Command Configuration	GPRMC/UTC	RTCM	External GNSS	Firmware Upgrade
UART1	√	√	√	×	×	√
UART2	√	√	√	√	×	×
UART3	×	×	√	×	√	×
UART4	×	×	×	×	×	×

Note 1: UART1(main UART)

Note 2: UART3 is used by default for communication with an external GNSS module. For specific function configuration, please refer to the Command and Programming Manual.

9 Interfaces and Reference Designs

9.1 Power Supply

The module has a built-in LDO to suppress the influence of input power noise on internal analog and digital circuits. The recommended input voltage range is 3.6 V to 5.5 V. For the operating voltage range, please refer to the electrical parameters. External power supply can use LDO or DC/DC.

9.2 UART

The HI71 series sensor supports flexible and diverse communication methods, and can communicate through UART1/UART2 in full-duplex mode. By default, the communication frame format is standard 8N1 mode, namely:

- Baud rate: 115200 bps (adjustable as needed)
- Data bits: 8 bits
- Parity: none
- Stop bits: 1 bit

This communication configuration is a standard configuration in industrial applications, with strong compatibility, and can seamlessly interface with most embedded systems, industrial control devices, robot controllers, etc.

In addition, HI71 can also expand the UART interface into RS-485 or RS-422 communication by adding external RS-485 or RS-422 transceivers, further enhancing the applicability and scalability of the module.

Note 1: Both baud rate and output data rate can be modified through commands. Refer to the Command and Programming Manual for details.

When using the HI71 series sensor for UART communication, it is recommended that the logic level of the user's processor be 3.3 V. If communication with a processor of 5 V or 1.8 V logic level is required, the user needs to add a level shifting chip to ensure reliable communication and device safety.

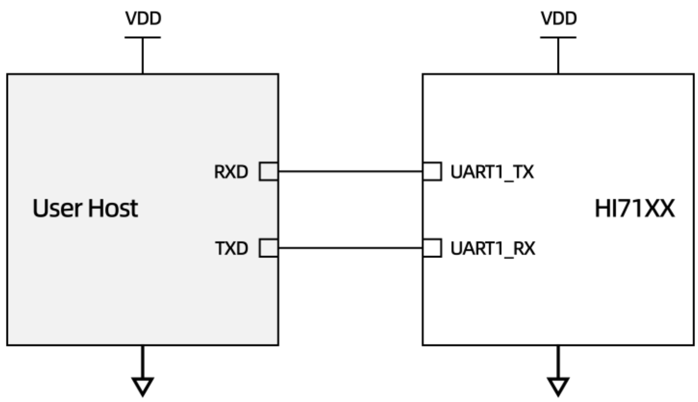

Figure 4: HI71 UART Communication Minimum System Reference Circuit

9.3 CAN

Models supporting CAN can implement the standard CAN 2.0B communication protocol. The default baud rate is 500 kbps, which can meet the needs of most industrial and embedded applications. Users can also modify the baud rate through commands to adapt to different communication scenarios. Refer to the Command and Programming Manual for details.

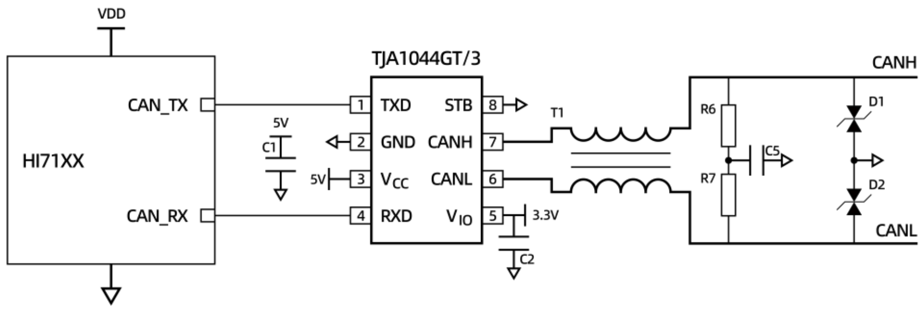

Figure 5: HI71 CAN Communication Reference Circuit

Note 1: Baud rate, ID, etc. can be modified through commands. Refer to the Command and Programming Manual for details.

Note 2: Terminal resistor configuration should be determined according to the system bus topology. R6/R7 in the reference circuit are for design reference only.

9.4 Synchronization

HI71 models supporting synchronization can implement pulse-trigger synchronization and PPS + GPRMC time synchronization, and can perform time alignment with the host or external devices (such as GNSS, cameras, radars, etc.). Refer to Table 3 for specific support.

9.4.1 HI71 Host-Triggered Synchronization (UART)

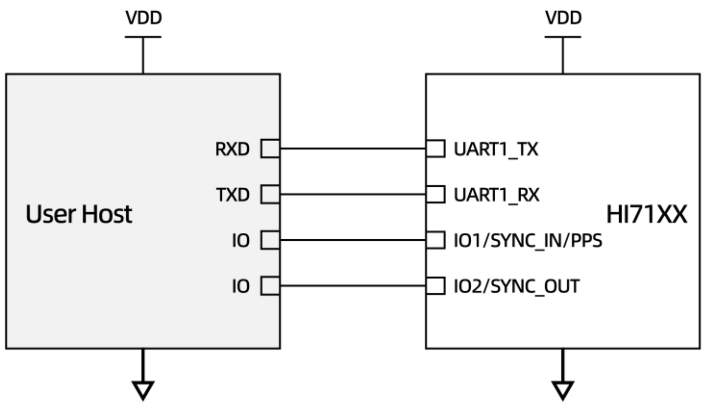

Figure 6: HI71 Host-Triggered Synchronization (UART Communication)

In this connection method, the user needs to directly connect IO1/IO2 to the host system for trigger synchronization between systems. If IO1 is used as synchronization input, then IO1 is in synchronization input mode, and the host needs to generate pulses with the same frequency as the data frame rate and send them to HI71. If IO2 is used, then IO2 needs to be in synchronization output mode, and the synchronization output pulse has the same frequency as the data frame rate and can be used as a Data Ready signal. IO1 and IO2 do not have to be used at the same time. The user can choose which synchronization method to use according to the specific system.

9.4.2 Host PPS+GPRMC Time Synchronization (UART)

In this connection method, the user needs to directly connect IO1/IO2 to the host system for inter-system time synchronization. At this time, IO1 is in synchronization input PPS mode, and the host needs to generate a PPS pulse per second to HI71. If IO2 is used, then IO2 needs to be in synchronization output mode, and the synchronization output pulse has the same frequency as the data frame rate and can be used as a Data Ready signal. UART1_RX shall receive the GPRMC message generated by the host.

9.4.3 External Device PPS+GPRMC Synchronization (UART)

HI71 can perform PPS+RMC time synchronization with external devices. The external device needs to generate PPS and RMC information. At this time, note that HI71, the user host, and GNSS must share a common ground. IO1 is responsible for receiving the PPS pulse signal generated by the external device, and UART2_RX receives the RMC information.

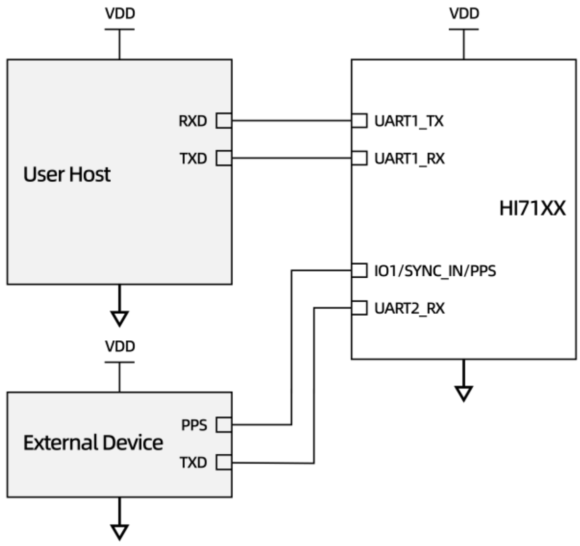

Figure 7: HI71 and External Device PPS+GPRMC Synchronization

9.4.4 CAN (Synchronization)

In CAN communication scenarios, synchronization can also be implemented. At this time, HI71 communicates with the host through the CAN interface, and the synchronization I/O can continue to be used for external triggering or time alignment. For specific synchronization timing and configuration methods, refer to the UART synchronization method.

9.5 INS System Reference Design

HI71N4 can operate as an INS when connected to an external GNSS, providing attitude, position, velocity, and timing information. Here, UM982 is used as an example to describe how HI71N4 connects to an external GNSS.

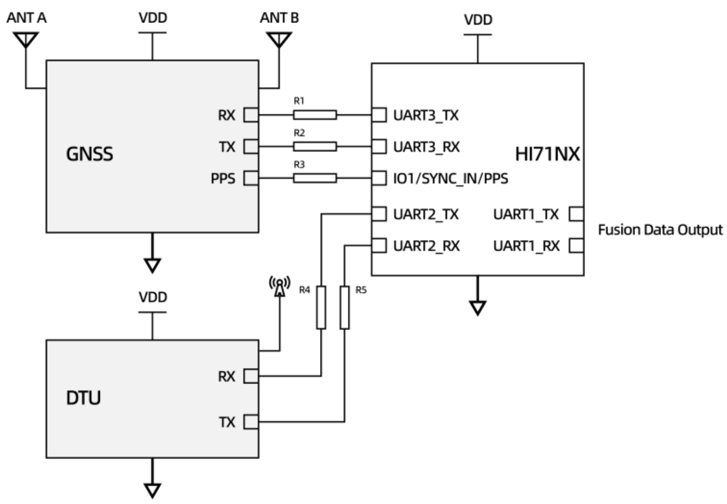

Figure 8: HI71N4 External GNSS Connection

Note 1: DTU is not a necessary element of the system. The user may decide whether to add a DTU according to the needs of their own system design.

9.6 Reference Design BOM

Table 7: Reference Design BOM

Item	Reference	Part	P/N	Vendor
Resistor	R1，R2，R3，R4，R5	1 kΩ	RC0402JR-071KL	YAGEO
Resistor	R6，R7	60.4 Ω	RC1206FR-0760R4L	YAGEO
Capacitor	C1，C2	0.1μF	CC0402KRX5R7BB104	YAGEO
Capacitor	C5	1 nF	CC0402KRX7R9BB102	YAGEO
Common Choke	T1	5.8 kΩ @ 10 MHz, 100 μH @ 100 kHz, 150 mA	ACT45B-101-2P-TL003	TDK
TVS	D1，D2	SMBJXXCA	SMBJXXCA	Littlefuse

Note 1: The series resistor can be matched according to communication distance, rate, and system anti-interference requirements. Typical options are 33 Ω, 100 Ω, or 1 kΩ.

Note 2: The voltage rating of the TVS device should be selected according to the system power platform. In multi-node cascaded scenarios, SMAJ series devices may also be selected.

10 Sensor Specifications

Unless otherwise specified, the parameters listed in this chapter are typical values, maximum values, or test values obtained under specified test conditions, and are used for product selection and system design reference, not as guaranteed values for each unit delivered from the factory. Actual results may vary due to differences in installation method, mechanical stress, environmental interference, configuration parameters, and operating conditions.

10.1 Gyroscope

If the following parameter tables do not specifically state the test conditions, they are by default measured at 3.3 V, 25 °C, and within the range of ±300 °/s, and apply to all axes.

Table 8: Gyroscope Specifications

Parameter	Condition	Min	Typ	Max	Unit	Remark
Range			±300	±327	°/s	
Offset drift over lifetime		-0.05		0.05	°/s	
Resolution	16bit mode 20bit mode		100 1600		LSB/(°/s)	
Linearity error	300 °/s， -40 ℃ ~ 110 ℃ 100 °/s， -40 ℃ ~ 110 ℃	-0.3 -0.04	±0.15 ±0.01	0.3 0.04	°/s	1, Typical: 3σ
Noise Density	XY Z		0.0004 0.0006		°/s/√Hz	
3 dB Bandwidth			235	250	Hz	
Sampling Rate			1000		Hz	
Bias Instability	Allan Variance		0.3	0.5	°/h	2, Typical: 3σ
Bias Stability	10 s averaging		0.5	0.7	°/h	Typical: 3σ
Bias Repeatability			0.8	1	°/h	
Angle Random Walk (ARW)	Allan Variance, XY Allan Variance, Z		0.015 0.025		°/√h	3, Typical: 3σ
Bias Temperature Drift	-40 ℃ ~ 110 ℃， XY -40 ℃ ~ 110 ℃， Z	-0.3 -0.1	±0.1 ±0.1	0.3 0.1	°/s	
g - Sensitivity			0.00075		°/s/g	

Note 1: Nonlinearity is the maximum deviation from the best-fit straight line determined from measured data, at the specified full scale.

Note 2: Bias instability is obtained by dividing the minimum value of the Allan variance by 0.664. Measurement uses a 13 Hz low-pass filter setting, 200 Hz sampling rate, and a 15-minute warm-up before data collection to ensure full thermal stability.

Note 3: Angle random walk is the white noise term estimated from the Allan deviation at a time constant $\tau = 1$ s.

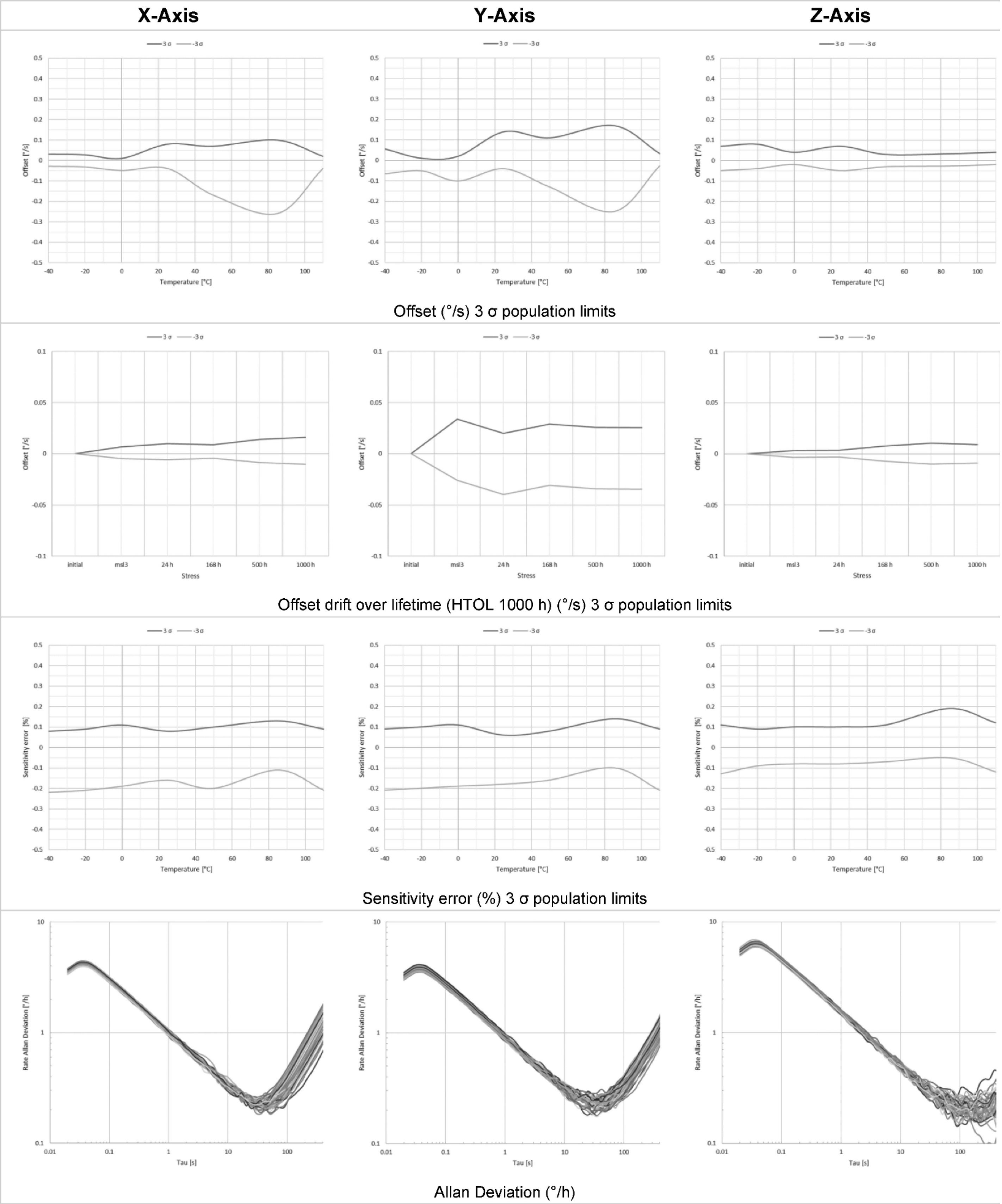

Figure 9: Gyroscope typical performance characteristics

10.2 Accelerometer

Table 9: Accelerometer Parameters

Parameter	Condition	Min	Typ	Max	Unit	Remark
Range			±16	±26	g	
Resolution	16bit mode		200		LSB/(m/s2)	1g ≈ 9.8 m/s2
	20bit mode		3200			
Offset drift over lifetime			1	2	mg	Typical: 3σ
Linearity error	8 g，-40 ℃ ~ 110 ℃	-15	±3	15	mg	1
	1 g，-40 ℃ ~ 110 ℃	-1	±0.5	1		
3 dB Bandwidth			210	235	Hz	2
Noise Density			0.08	0.1	mg/√Hz	
Sampling Rate			1000		Hz	
Bias Instability	Allan Variance		0.01		mg	Typical: 3σ
Bias Stability	10 s averaging		0.03		mg	Typical: 3σ
Bias Repeatability			0.04		mg	Typical: 3σ
Velocity Random Walk	Allan Variance		0.03		m/s/√h	Typical: 3σ
Bias Temperature Drift	-40 °C to 110 °C	6	2	6	mg	3

Note 1: Nonlinearity is the maximum deviation from the best-fit straight line determined from measured data, at the specified full scale.

Note 2: Bias instability is obtained by dividing the minimum value of the Allan variance by 0.664. Measurement uses a 13 Hz low-pass filter setting, 200 Hz sampling rate, and a 15-minute warm-up before data collection to ensure full thermal stability.

Note 3: Velocity random walk is the white noise term estimated from the Allan deviation at a time constant τ = 1 s.

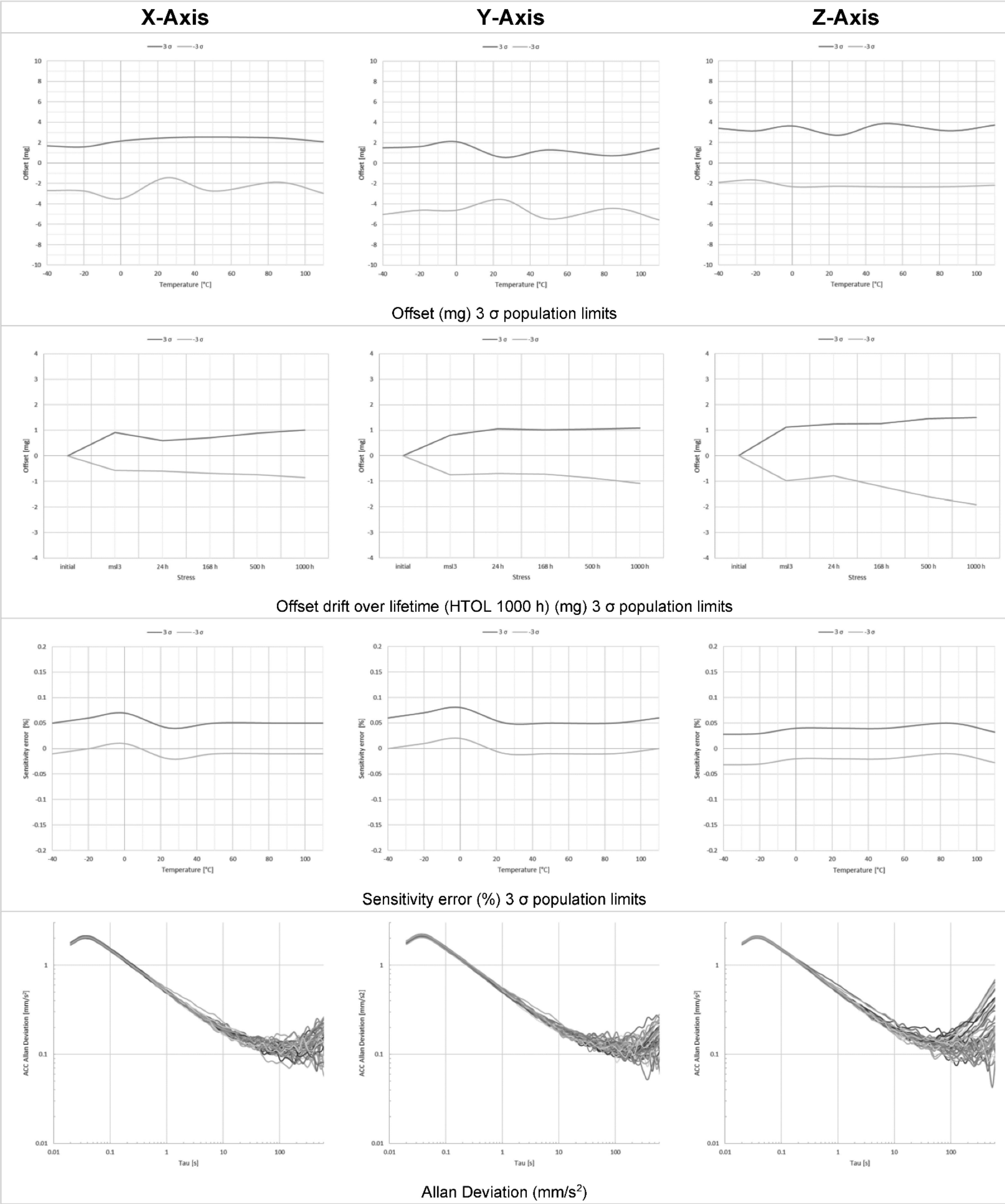

Figure 10: Accelerometer typical performance characteristics

10.3 Magnetometer

Table 10: Magnetometer Specifications

Parameter	Condition	Min	Typ	Max	Unit	Remark
Range		-2000	±2000	2000	μT	
Noise		0.19	0.45		μT	
Nonlinearity		±10	±20		μT	

10.4 Barometer

Table 11: Barometer Specifications

Parameter	Condition	Min	Typ	Max	Unit	Remark
Range		300	-	1200	hPa	
Resolution			0.006		hPa	
Accuracy			±0.06		hPa	

10.5 Temperature Sensor

Table 12: Temperature Sensor Specifications

Parameter	Condition	Min	Typ	Max	Unit	Remark
Range		-40	-	85	°C	
Offset Error			±5		°C	

10.6 Fusion Accuracy

Unless otherwise specified, the fusion accuracy data below are measured under typical installation conditions after factory calibration. Attitude accuracy is affected by installation flatness, mechanical stress, vibration environment, linear acceleration, magnetic environment, and user calibration status; therefore, actual application results may vary.

The heave performance of the HI71M4 is closely related to motion period, installation rigidity, vibration environment, and use scenario. The following data are typical results intended to reflect system performance under representative operating conditions.

10.6.1 IMU/VRU/MRU/AHRS Fusion Information

Table 13: IMU/VRU/MRU/AHRS Fusion Information

Parameter	Product	Condition	Min	Typ	Max	Unit	Remark
Pitch/Roll				0.05	0.1	°	1
Resolution				0.01		°	
Heading (6-DoF)				0.2	0.3	°	2
Heading (AHRS)	HI71T4			0.5	2	°	3
Resolution				0.01			
Startup Time	HI71T2/HI71T4	IMU/VRU/AHRS		2		s	4
	HI71M4	MRU (static)		60			
	HI71M4	MRU (marine)		180			
	HI71N4	INS		30	60		
Heave Accuracy	HI71M4			5 cm or 5%		-	5
Heave Period	HI71M4			1 ~ 10		s	

Note 1: Data are referenced to a calibrated horizontal plane and are based on testing of 20 pcs samples.

Note 2: In 6-DoF mode, heading is an estimated value and will drift over time; it is not suitable for long-term absolute heading hold.

Note 3: Measured after magnetic calibration, with no surrounding magnetic interference, and with the product configured in AHRS mode.

Note 4: Time from power-up to valid data output.

Note 5: Means 5 cm or 5%, whichever is greater.

10.6.2 INS Accuracy (External GNSS)

The following INS accuracy data are typical test results, reflecting system fusion performance under specified external conditions, installation methods, and auxiliary information configurations. These values do not constitute guaranteed performance under all application conditions.

Table 14: INS Accuracy with External GNSS (Typical Test Results)

Outage Time	Position Accuracy RMS	Velocity Accuracy RMS	Attitude Accuracy RMS	
			Pitch/Roll	Heading
3 s	3 cm	0.03 m/s	0.15°	0.1°
10 s	30 cm	0.1 m/s	0.2°	0.15°
60 s	3 m	0.15 m/s	0.2°	0.25°

Note 1: The INS accuracy values above are typical test results and do not constitute a performance commitment for all operating conditions. Test conditions include: RTK fixed solution before GNSS outage, external GNSS reference model UM982, system connected with odometer aiding information, and evaluation under typical installation conditions and typical dynamic scenarios. Actual performance may vary significantly depending on installation method, baseline layout, motion conditions, GNSS environment, auxiliary sensor configuration, and parameter settings.

10.7 Typical Operating Limits

1. In 6-DoF mode, heading drifts over time and is not suitable for long-term absolute heading hold.
2. AHRS mode depends on the magnetic environment. Motors, magnets, and high-current cables may degrade heading accuracy.
3. Attitude accuracy is affected by installation flatness, mechanical stress, vibration, and linear acceleration.
4. For high-dynamic applications, system-level validation after installation is recommended.
5. In INS applications, the HI71, GNSS antenna, and carrier platform shall maintain a rigid connection. The GNSS antenna installation position, baseline length, and relative orientation shall meet system requirements.
6. For synchronization-related applications, it is recommended to ensure that the host, HI71, and external devices share a common ground, and to verify the consistency of PPS, trigger pulses, and serial time information.
7. The actual accuracy of the heave function depends on wave period, wave height, carrier speed, installation method, and parameter configuration. Full-system validation on the target vessel type and under representative sea conditions is recommended.

11 System and Electrical Specifications

11.1 Electrical Specifications

Table 15: Electrical Specifications

Parameter	Condition	Min	Typ	Max	Unit	Remark
Operating Voltage Range VDD		3.6	5	5.5	V	
Power Consumption				370	mW	
V_{OL}			-	0.4	V	
V_{OH}		2.6			V	
V_{IL}		-0.3		1	V	
V_{IH}		1.9		3.6	V	

11.2 Interface Specifications

Table 16: Interface Specifications

Interface	Parameter	Min	Typ	Max	Unit	Remark
UART1/UART2	Baud Rate	9600	115200	921600	bps	
	Output Data Rate	0	100	1000	Hz	
UART3	Baud Rate		115200		bps	Compatible with different GNSS module models
CAN	Baud Rate	125	500	1000	kbps	
	Output Data Rate	0	100	200	Hz	
	Differential Voltage		1.5	3	V	
	Termination Resistor		None			

Note 1: Both baud rate and output data rate are configurable. The actual achievable output data rate depends on output data content, message length, and communication configuration. Refer to the Command and Programming Manual for details.

11.3 System Specifications

Table 17: System Specifications

Parameter	Value	Remark
Dimensions	24 × 24 × 14 mm	
Weight	<13 g	
Operating Temperature	-40 °C to 85 °C	
Housing Material	Aluminum alloy	
Vibration Resistance	1.0 mm (10 Hz ~ 58 Hz), ≤20 g (58 Hz ~ 600 Hz)	
Environmental Compliance	Designed in accordance with relevant RoHS requirements	1
Drop Test	Free drop 3 times from a 75 cm lab bench	
Temperature Shock Test	Temperature rises from -40 °C to 85 °C within 1 h, repeated 5 times	
Moisture Sensitivity Level (MSL)	MSL2	

Note 1: Refer to the latest official documents for certification status and compliance information

11.4 Absolute Maximum Ratings

Table 18: Absolute Maximum Ratings

Parameter	Limit	Comment
Mechanical Shock	3000 g	Duration < 0.5 ms
Storage Temperature	-40 °C to 125 °C	
ESD (HBM)	2 kV	JEDEC/ESDA JS-001
Input Voltage	9 V	
I/O to Ground Voltage	3.6 V	

Note 1: Stresses above the absolute maximum ratings may cause permanent damage to the device. Functional operation under these conditions is not guaranteed.

12 Mechanical Dimensions

All dimensions are in mm.

12.1 Dimensions and IMU Center Position

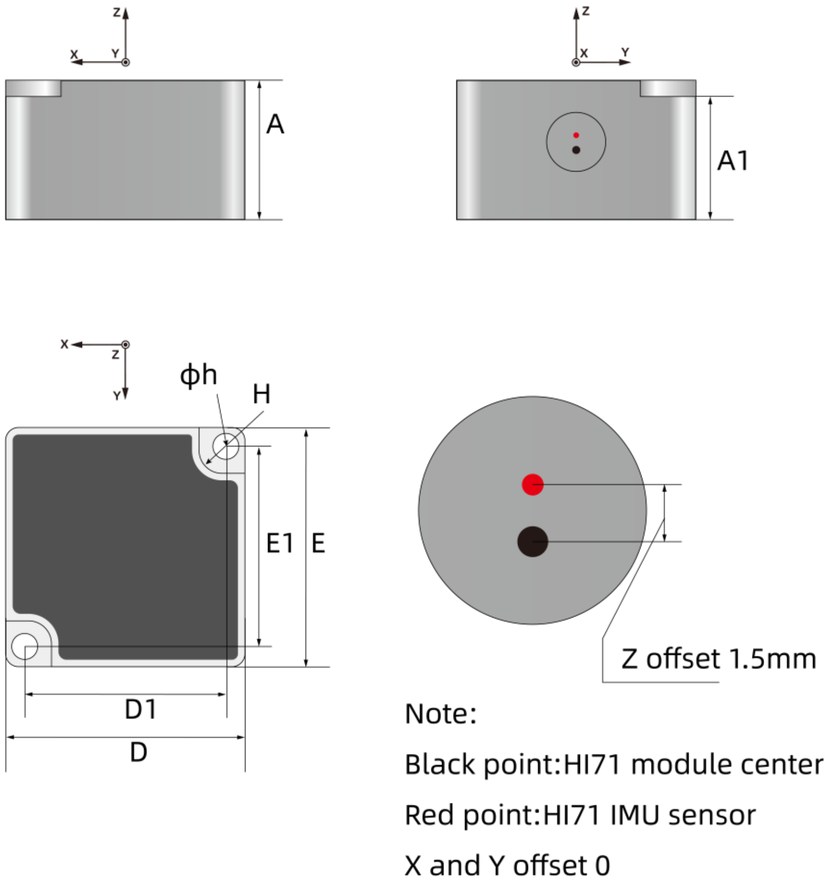

Figure 11: Mechanical Dimensions and IMU Center Position

Table 19: Product Dimension Data

Symbol	Min (mm)	Typ (mm)	Max (mm)
A	13.8	14	14.2
A1	12.2	12.4	12.6
D	23.8	24	24.2
D1	20.1	20.2	20.3
E	23.8	24	24.2
E1	20.1	20.2	20.3
H	R2.2	R2.3	R2.4
h	Φ2.55	Φ2.6	Φ2.65

12.2 Board-to-Board Connector Footprint Dimensions

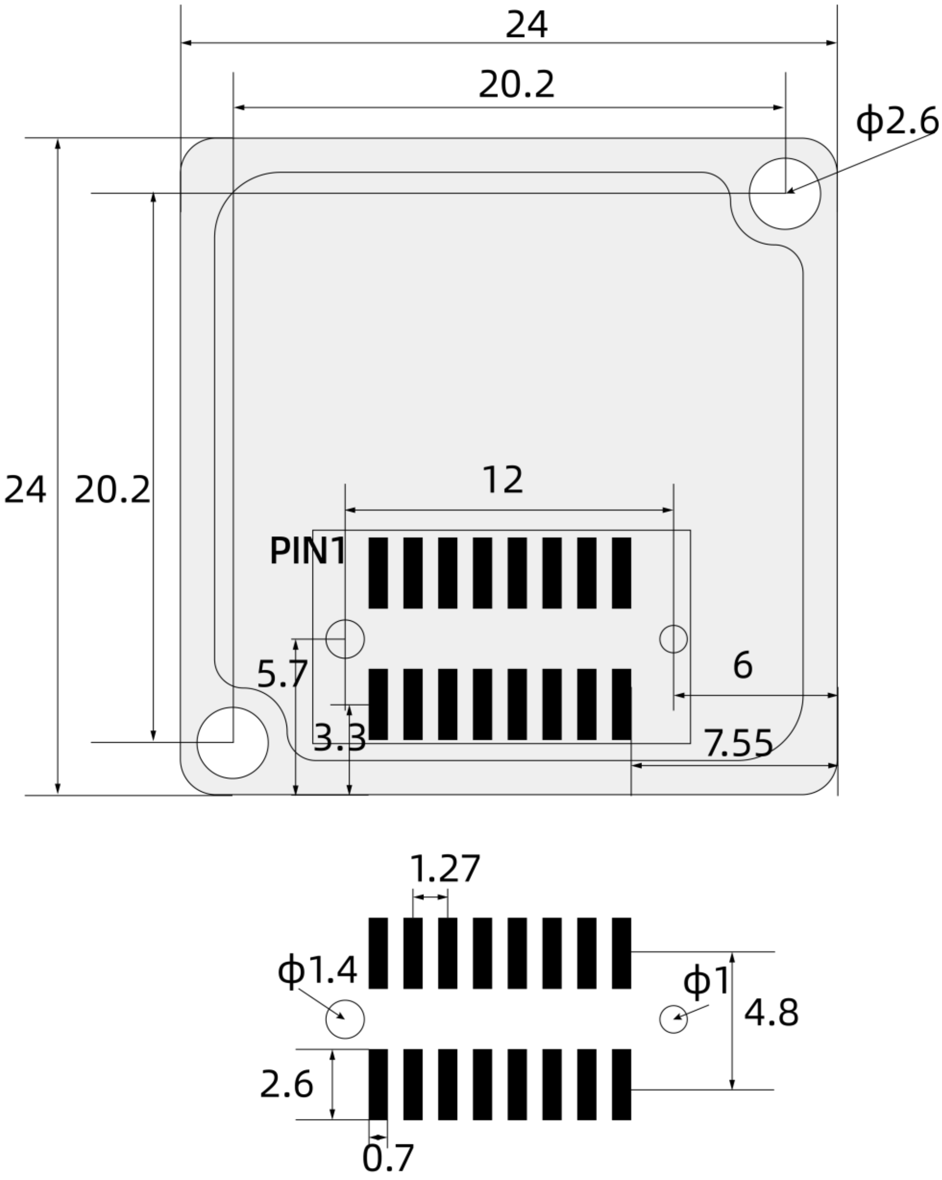

Figure 12: Recommended Footprint Dimensions

13 Coordinate System

13.1 IMU / VRU / MRU / AHRS Coordinate System

13.1.1 ENU (Default)

The body frame uses a Right-Front-Up (RFU) coordinate system, and the geographic frame uses an East-North-Up (ENU) coordinate system. The accelerometer and gyroscope axis directions are shown in the figure below:

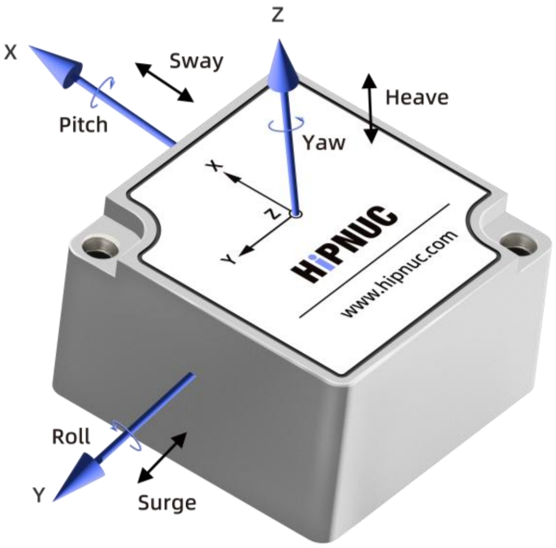

Figure 13: IMU/VRU/MRU/AHRS Coordinate System

Angular velocity positive direction follows the right-hand rule. The quaternion output order shall be subject to the definition in the Command and Programming Manual. Euler angles are output using the Z-X-Y (312) rotation sequence. For conventions involving intrinsic/extrinsic rotations and coordinate transformations, refer to the Command and Programming Manual.

- Rotation about Z-axis: Yaw, range: -180° ~ 180°
- Rotation about X-axis: Pitch, range: -90° ~ 90°
- Rotation about Y-axis: Roll, range: -180° ~ 180°

In aircraft applications, the positive Y-axis points toward the nose. When the sensor frame coincides with the inertial frame, the ideal Euler angle outputs are: Pitch = 0°, Roll = 0°, and Yaw = 0°.

In marine applications, the positive Y-axis points toward the bow. When the sensor frame coincides with the inertial frame, the ideal Euler angle outputs are: Pitch = 0°, Roll = 0°, and Yaw = 0°.

In marine applications, motion along the Z-axis is referred to as heave, motion along the X-axis as sway, and motion along the Y-axis as surge.

For coordinate system rotation, refer to the Command and Programming Manual.

13.1.2 NWU and NED

The carrier frame can also be configured as North-West-Up (NWU) or North-East-Down (NED). User configuration is required. Refer to the Command and Programming Manual for details.

13.2 INS Coordinate System

The carrier coordinate system is defined as follows: the positive Y-axis points in the forward direction of the carrier, and the X-axis points to the right side of the carrier, forming an ENU-RFU coordinate system. The carrier, GNSS antenna, and HI71 must be rigidly mounted.

For dual-antenna systems, the antennas are designated as A antenna and B antenna, with clear markings on the sensor enclosure. Antenna A is the primary antenna (positioning antenna), and antenna B is the secondary antenna (heading antenna). The vector defined by antennas A to B is referred to as the heading baseline.

The vector from A to B shall have an angle of 0° relative to the carrier forward direction (positive IMU Y-axis, clockwise positive). The recommended spacing between antennas A and B is 0.8 ~ 2 m. After antenna installation is completed, the module must be powered on again or restarted.

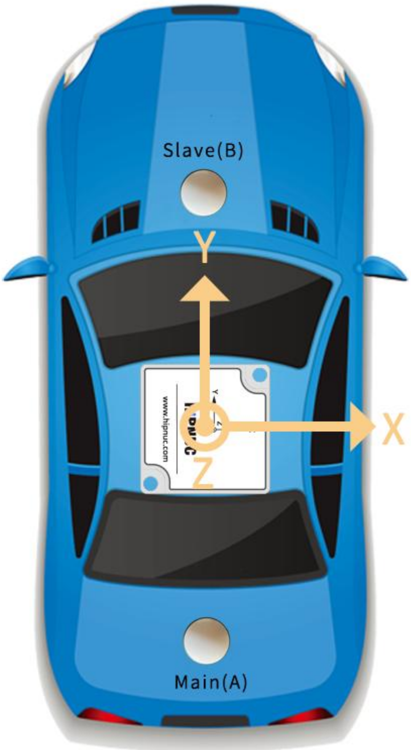

Figure 14: INS Coordinate System

14 Evaluation Kits

Figure 15: HI71 Series Evaluation Board and Cables

Note 1: The USB-to-Molex cable is 1.0 m long and includes a built-in USB-to-UART (TTL) module.

Note 2: The flying lead cable is 20 cm.

15 Communication Protocols

15.1 Serial Binary Protocol

The product supports a serial binary communication protocol. For detailed message formats, output configuration, and command definitions, refer to the Command and Programming Manual.

15.2 Modbus

By adding an external RS-485 transceiver, communication based on Modbus RTU is supported. For detailed protocol definitions, refer to the Command and Programming Manual.

15.3 CAN

CAN communication supports CANopen and SAE J1939. For detailed protocol definitions, refer to the Command and Programming Manual.

15.4 NMEA 0183

The product supports the standard NMEA 0183 protocol. For detailed sentence definitions, refer to the Command and Programming Manual.

16 Disclaimer

The parameters listed in this document are typical values, maximum values, or measured values obtained under specified test conditions and do not constitute a final delivery commitment. Product grade names such as “tactical-grade” mentioned in this document are used only for product series identification and do not constitute an express or implied commitment to any specific industry standard grade or application grade. HiPNUC reserves the right to modify products, documentation, and related information without prior notice.