1 FEATURES

1.1 Hardware

- High-performance MEMS IMU
- Factory-calibrated full-temperature compensation from -40 to +85°C; calibrated scale factor, cross-axis, and bias
- Gyroscope bias instability 1.6°/h
- Accelerometer bias instability 18 μg
- Multiple interfaces: RS-232 / RS-422 / CAN
- Compact form factor, easy to integrate
- Full-constellation, full-frequency RTK GNSS system with dual-antenna heading

1.2 Software

- Adaptive Extended Kalman filtering and fusion algorithm, up to 100 Hz output, low latency
- Dual-antenna heading: 0.2° with 1 m baseline
- Excellent suppression of linear acceleration effects
- Timing accuracy: 20 ns
- Standalone positioning accuracy: 1.5 m
- RTK positioning accuracy: 1 cm
- Velocity accuracy: 0.03 m/s
- Cold start time: < 30 s
- Hot start time: < 2 s
- Supports multiple protocols: Binary, NMEA, J1939
- Rich set of user configuration commands
- Multifunctional GUI for easy operation
- Provides sample code/support for ROS, C, and more

2 APPLICATION

- Unmanned ground vehicles (UGVs)
- Uncrewed Surface Vessel (USV)
- Unmanned aerial vehicles(UAVs)
- SATCOM-on-the-move (SOTM)
- Robot

3 DESCRIPTIONS

3.1 Appearance

Figure1: HI32

3.2 System Block Diagram

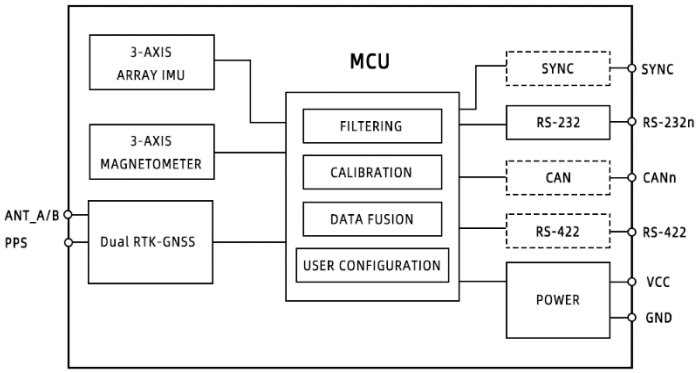

Figure2: Functional Block Diagram

Note1: T Dashed lines mean not all models support these; see Table 1.

3.3 General Description

HI32 integrates a high-performance IMU with a dual-antenna, full-band/full-frequency RTK GNSS receiver. IMU+GNSS fusion provides accurate, real-time position, velocity, attitude, and timing—even during GNSS outages.

All sensors are factory-calibrated for temperature, bias, scale factor, and cross-axis.

The multifunction GUI supports configuration, visualization, firmware updates, and data logging.

For selection and ordering, see Table 1 and Table 2.

Contents

4 SELECTION

Table 1: Slection Information

HI32a-b-cde						
Company	Series	a-Sensor	b-Interface	c-Reserved	d-Connector	e-OEM
HI	32	R6 Single RTK-GNSS/INS	MI0	0 default	0 1T12 push-pull self-locking	0 default
		R7 Dual RTK-GNSS/INS	MI1		1 J30 connector	Others OEM

Note1: Example model:HI32R7-MI0-000, MI0/MI1 denote different interface combinations; see the pin definition section for details.

Note2: MI0/MI1 denote different interface combinations; see the pin definition section for details.

5 ORDERING

5.1 Ordering Information

Table 2: Ordering Information

Part Number	Name	Description	Note
HI32R6-MI0-000	Single RTK-GNSS/INS Module	1T12 push-pull self-locking connector; MI0	
HI32R7-MI0-000	Dual RTK-GNSS/INS Module	1T12 push-pull self-locking connector; MI0	
HI32R7-MI1-000	Dual RTK-GNSS/INS Module	1T12 push-pull self-locking connector; MI1	
HI32R7-MI2-000	Dual RTK-GNSS/INS Module	1T12 push-pull self-locking connector; MI2	

5.2 Contact Us

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

6 DOCUMENTATION

6.1 Scope

6.1.1 Firmware Revision

Some features described are supported only in firmware version 2.3.0 and above. For precise feature availability, please consult us directly.

6.1.2 Hardware Revision

This document applies to modules with hardware version C5 and above. Version change history is summarized below.

Table 3: Hardware Revision Changes

Revision	Changes
C5	Initial release
C6	Added antenna protection

6.2 Document Version Information

Table 4: Document Revison

Revison	Date	Author	Changes
1.0	2024-9-6	HiPNUC	Initial release
1.1	2025-11-15	HiPNUC	Enhanced integrated navigation fusion performance

6.3 Related Documents

1. *Command and Programming Manual*
2. *3D Step*
3. *GUI and Reference Examples*
4. *HI32 Series Test Reports*

7 SPECIFICATIONS

Unless otherwise noted, tests are conducted at 25℃ with a supply voltage of 24 V.

7.1 Absolute Maximum Ratings

Table 5: Absolute Maximum Ratings

Parameters	Limit	Comment
Mechanical Shock	2000g	Duration <1ms
Storage Temperature	-40℃-85℃	
ESD HBM	15KV	JEDEC/ESDA JS-001
Input Voltage Vs	40V	
RS-232 TX to GND	±13.2V	
RS-232 RX to GND	±24V	
CAN H or CAN L to GND	±40V	
CAN H to CAN L	±27V	
RX+ or RX- to GND	-0.3V-6V	
TX+ or TX- to GND	-12V-12V	
SYNC/PPS To GND	-0.3-3.6V	

7.2 Recommended Operating Conditions

Table 6: Normal Operation

Parameters	Condition	Min	Nom	Max	Unit	Note
Input Voltage		9		36	V	
Power Consumption			1.6	2	W	
Operating Temperature		-40	-	85	℃	
Gyroscope Range		125	2000	2000	°/s	1
Accelerometer Range		3	6	24	g	1

Table 7: Communication Interface Functions

Interface	Description
COM 1/RS-422	Sensor data input/output; sensor configuration
COM 2	Differential data input for DTU; can be configured to output sensor data
CAN	Sensor data input/output; wheel speed input

7.3 Interface

Table 8: Interface Parameters

Interf	Parameters	Condition	Min	Nom	Max	Unit	Note
RS-232/RS-422	Baud Rate		9600	115200	921600	bps	
	Start Bits		0	1		bit	
	Data Length		0	8		bits	
	Stop Bits			1		bit	
	Parity			无		bit	
	Output Frame Rate		0	10	100	Hz	1
CAN	Baud Rate		125	500	1000	kbps	
	Output Frame Rate		-	10	100	Hz	1
	Logic Voltage	High	2.0	3.3	3.6	V	
		Low			0.6		
PPS SYNC	Logic Voltage	High	2.0	3.3	3.6	V	
		Low			0.6		

Note1: To modify baud rate, data frame rate, or protocol, refer to the Command and Programming Manual.

7.4 Gyroscope

Table 9: Gyroscope Specifications

Parameters	Condition	Product	Min	Nom		Note
Range				2000	°/s	
3dB Bandwidth				64	Hz	
Bias Instability	Allan Variance			1.6	°/h	
Bias Repeatability				8	°/h	
Angle Random Walk	Allan Variance			0.25	°/√h	

7.1 Accelerometer

Table 10: Accelerometer Specifications

Parameters	Condition	Product	Min	Nom	Max	Unit	Note
Range				6	24	g	
3dB Bandwidth				80		Hz	
Bias Instability	Allan Variance			0.03		mg	
Bias Repeatability				0.15		mg	
Velocity Random Walk	Allan Variance			0.04		m/s√h	

7.2 Magnetometer

Table 11: Magnetometer Specifications

Parameters	Condition	Min	Nom	Max	Unit	Note
Range			2	8	Gauss	
Resolution	Fs=2G		2		mGauss	
Sampling Rate			200Hz			

7.3 GNSS Specifications

Parameters	Description		Note
Channels	1408 channels		
Constellations	BDS/GPS/GLONASS/Galileo/QZSS		
Frequency Bands	BDS B1I/B2I/B3I GPS L1 C/A/L2P(Y)/L2C/L5 Galileo E1/E5a/E5b GLONASS L1/L2 QZSS L1/L2/L5		
Cold Start	<30s		
Hot Start	<5s		1
Positioning Accuracy (RMS):	Single(RMS)	Horizontal:1.5m Vertical:2.5m	2,3
	DGPS(RMS)	Horizontal:0.4m+1ppm Vertical:0.8m+1ppm	
	RTK(RMS)	Horizontal:0.8cm+1ppm Vertical:1.5cm+1ppm	
Heading Accuracy (RMS)	0.1°/1m baseline		
Timing Accuracy (RMS)	20ns		
Velocity Accuracy (RMS)	0.03m/s		4
Update Rate	20Hz		
Maximum Velocity	500m/s		
Maximum Altitude	50000m		

Note1: Within 10 minutes of power-off; depends on off duration. Longer outages approximate cold start.

Note2: Results vary with atmosphere, baseline length, antenna type, multipath, number of visible satellites, and satellite geometry.

Note3: Measurements assume a 1 km baseline and high-performance antennas; antenna phase center offset not considered.

Note4: Open-sky, unobstructed conditions; 99% @ static.

7.4 Fusion Parameters

7.4.1 Fusion Algorithm and Data Content

Table 12: Fusion Parameters

Parameters	Description		Data Sources
Data Outputs	COM1/RS-422	NMEA(GGA/RMC/VTG)	GNSS
		NMEA(SXT)	GNSS-INS
		Binary Protocol (HiPNUC)	GNSS/GNSS-INS
	CAN	SAE J1939	GNSS/GNSS-INS
Data Content	Velocity, position, attitude, time, and related navigation fields		
Fusion Algorithm	EKF		
External Sensors	Odometer, DTU, etc.		

7.4.2 Fusion Accuracy

Outage duration	Positioning mode	Position accuracy RMS	Velocity accuracy RMS	Attitude accuracy RMS	
				Pitch/Roll	Heading
3s	RTK and Odometer	3cm	0.03m/s	0.15°	0.1°
10s		30cm	0.1m/s	0.2°	0.15°
60s		3m	0.15m/s	0.2°	0.25°

Note1: System is in RTK mode before GNSS loss; after loss, odometer aiding is applied.

7.5 Mechanical and Environmental Specifications

Table 13: 7.5 Mechanical and Environmental Specification

Parameters	Description
Dimensions	75x70.5x25.2mm
Weight	180g
Enclosure Material	Aluminum alloy CNC
Vibration Resistance	1.0mm(10Hz-58Hz)&≤20g(58Hz-600Hz)
Environmental Compliance	RoHS 2011/65/EU
EMC	LVD Directive 2014/35/EU
Drop Test	Free fall from 75 cm height, 3 times
Thermal Shock	Temperature cycled from –40°C to +85°C within 1 hour, 5 cycles

7.6 Product Dimensions and Pin Definitions

All Dimensions in mm units.

7.6.1 Product Dimensions

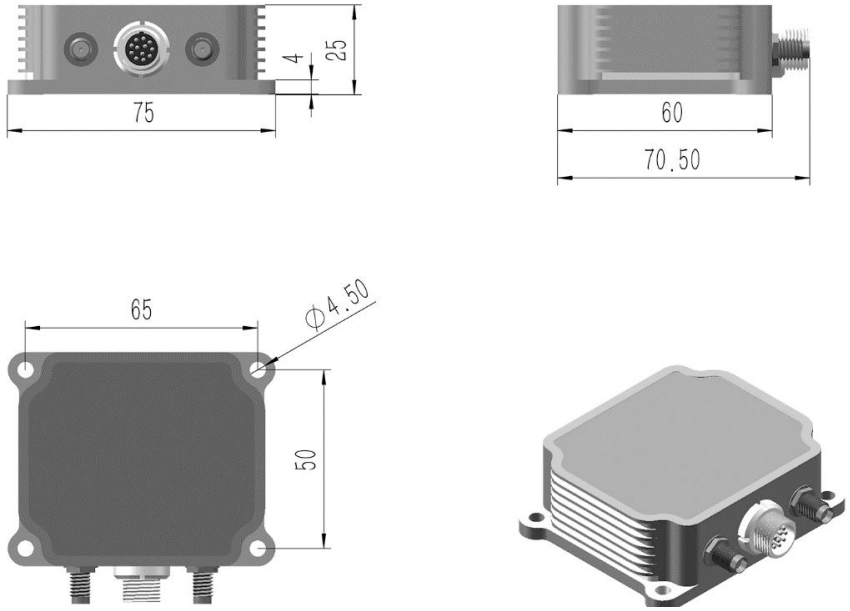

Figure3: HI32 Mechanical Dimension

7.6.2 Pin Definitions and Cable(1T12 Connector to DB9+OPEN MI0)

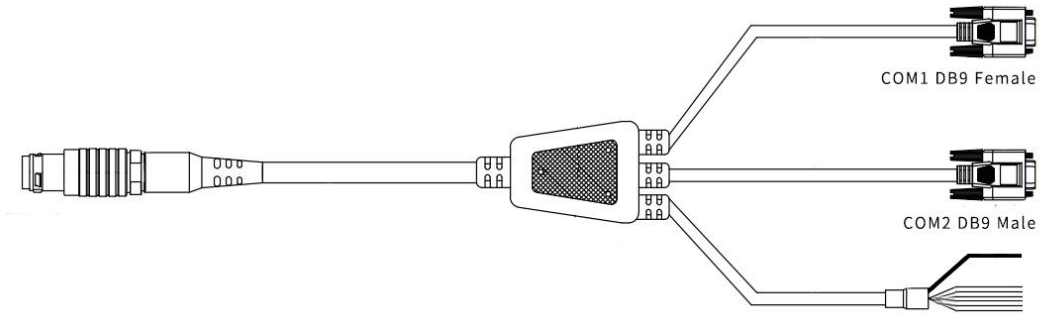

Figure4: Pin definition

Table 14: 1T12 Connector to DB9+OPEN MI0 Pin Descriptions

MI0	Pin Name	Type	Color	Description	Note
1	Vs	POWER	Red	Power input 9-36V	OPEN
2	PGND	POWER	Black	Power ground	OPEN
3	SGND	POWER		Signal ground	COM1 DB9 female Pin 5
4	RS232-TXD1	O		COM1 data transmit	COM1 DB9 female Pin 2
5	RS232-RXD1	I		COM1 data receive	COM1 DB9 female Pin 3
6	CAN1-H	AIO	Brown	CAN1 High	OPEN
7	CAN1-L	AIO	PurPle	CAN1 Low	OPEN
8	SGND	POWER	Yellow	Signal ground	OPEN
9	PPS	O	Green	Pulse-per-second (PPS)	OPEN
10	SGND	POWER		Signal ground	COM2 DB9 公头 Pin 5
11	RS232-TXD2	O		COM2 data transmit	COM2 DB9 公头 Pin 3
12	RS232-RXD2	I		COM2 data receive	COM2 DB9 公头 Pin 2

Note1: PGND and SGND are internally connected.

Note2: This cable is the default configuration.

7.6.3 Pin Definitions and Cable (1T12 Connector to OPEN MI0)

Table 15: 1T12 Connector to OPEN MI0 Pin Descriptions

MI0	Pin Name	Type	Color	Description
1	Vs	POWER	Red	Power input 9-36V
2	PGND	POWER	Black	Power ground
3	SGND	POWER	Green	Signal ground
4	RS232-TXD1	O	Yellow	COM1 data transmit
5	RS232-RXD1	I	White	COM1 data receive
6	CAN1-H	AIO	Brown	CAN1 High
7	CAN1-L	AIO	Blue	CAN1 Low
8	SGND	POWER	Grey	Signal ground
9	PPS	O	Orange	Pulse-per-second (PPS)
10	SGND	POWER	Purple	Signal ground
11	RS232-TXD2	O	Pink	COM2 data transmit
12	RS232-RXD2	I	Light Green	COM2 data receive

Note1: PGND and SGND are internally connected

7.6.4 Pin Definitions and Cable (1T12 Connector to OPEN MI1)

Table 16: 1T12 Connector to OPEN MI1 Pin Definitions

MI1	Pin Name	Type	Color	Description
1	Vs	POWER	Red	Power input 9-36V
2	PGND	POWER	Black	Power ground
3	SGND	POWER	Green	Signal ground
4	TX+	O	Yellow	RS-422 TX+
5	TX-	O	White	RS-422 TX-
6	RX+	I	Brown	RS-422 RX+
7	RX-	I	Blue	RS-422 RX-
8	SGND	POWER	Grey	Signal ground
9	PPS	O	Orange	Pulse-per-second (PPS)
10	SGND	POWER	Purple	Signal ground
11	RS232-TXD2	O	Pink	COM2 data transmit
12	RS232-RXD2	I	Light Green	COM2 data receive

Note1: PGND and SGND are internally connected

8 COORDINATE SYSTEM and INSTALLATION

8.1 Coordinate System

The carrier (vehicle) coordinate system is defined as follows: the vehicle's forward direction is the positive Y-axis; the X-axis points to the vehicle's right side; with the Z-axis pointing upward, this constitutes a Right-Forward-Up, right-handed frame consistent with the ENU convention; the measured carrier, the GNSS antenna(s), and the HI32 must be rigidly connected.

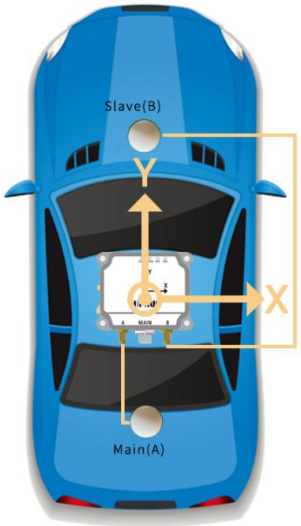

Figure5: HI32 Coordinate System

8.2 Installation (Dual-Antenna)

Dual antennas are designated as Antenna A and Antenna B, with clear markings on the sensor housing; A is the primary (positioning) antenna, and B is the secondary (heading) antenna. The vector defined from A to B is termed the orientation baseline. The included angle between the A→B vector and the vehicle forward direction (IMU Y-axis positive) shall be 0° (clockwise positive by convention). The recommended A-B separation is 0.8-2 m. After the antenna positions are finalized, power the system off and on again or reboot the module.

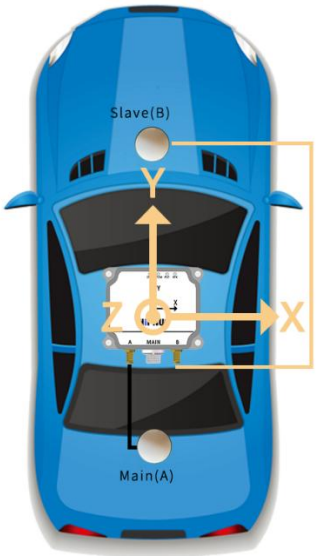

Figure6: HI32 Coordinate System

Note1: If it is necessary to change the relative installation angle between the dual antennas and the IMU, this can be done using the configuration command SETBASELINE; see the Configuration Commands chapter for details.

8.3 How to Connect

8.3.1 1T12 Connector to DB9+OPEN

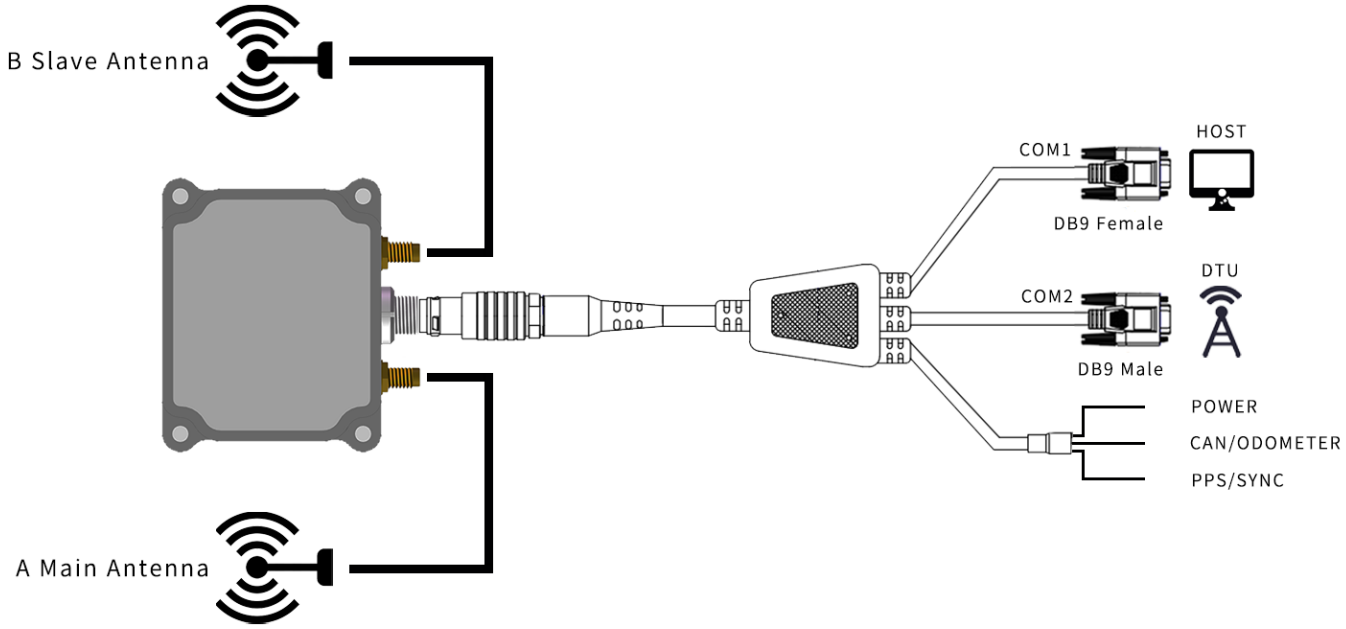

Figure7: Wiring Diagram for 1T12 Connector to DB9+OPEN

8.3.2 1T12 Connector to OPEN

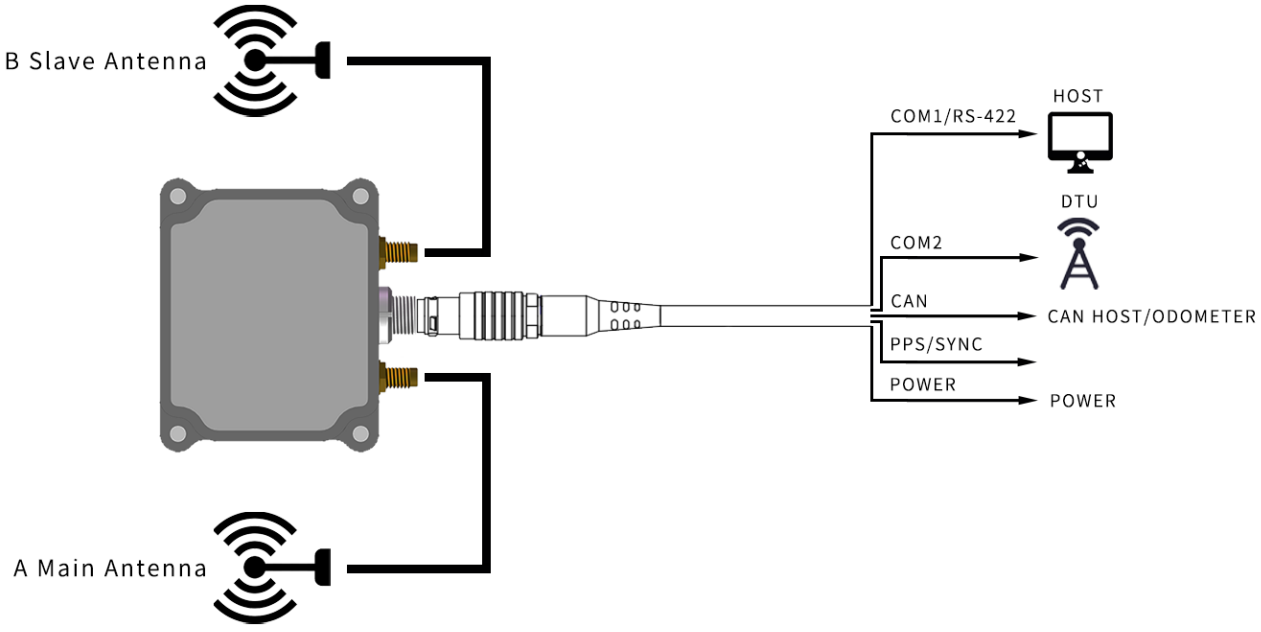

Figure8: Figure7: Wiring Diagram for 1T12 Connector to OPEN

8.3.3 DTU

For users who require high-precision positioning, the HI32's RTK functionality must be used. By default, HI32 supports Tassi's 4G DTU model TAS-LTE-360, which enables automatic configuration and RTK differential data access. For details, refer to the Command and Programming Manual.

Figure9: 4G DTU

9 INITIAL CONFIGURATION

The HI32 series is designed to require minimal user configuration to cover most application scenarios. The factory defaults are sufficient for many operating conditions, while additional options are available for special cases. Table 17 summarizes the default interface settings.

Table 17: Default Interface Configuration

Interf	Default function	Parameters	Value	Unit	Note
COM1/RS-422	Sensor data output and configuration	Baud rate	115200	bps	1
		Start bits	1	bit	
		Data length	8	bits	
		Stop bits	1	bit	
		Parity	None		
		Protocol	SXT,GGA		1
		Data rate	10	Hz	1
COM2	External DTU connection	Baud rate	115200	bps	1
		Start bits	1		
		Data length	8		
		Stop bits	1		
		Parity	None		
CAN1	Sensor data output	Protocol	SAE J1939		1
		Baud rate	500K	bps	1
		Data rate	10	Hz	1
		120 Ω termination	None		

Note1: To change baud rate, protocol, or output frame rate, refer to the Command and Programming Manual.

10 PROTOCOLS

10.1 Serial Binary Protocols

To facilitate integration, a variety of serial protocols are provided for user selection. Detailed message formats, configuration commands, and examples are available in the Command and Programming Manual.

10.2 CAN

The module's default CAN output protocol is SAE J1939. Configuration details, PGN mapping, and rate settings are described in the Command and Programming Manual.

11 PACKAGE

The HI32 series modules are fitted with custom EPE foam inserts and then boxed, as illustrated below. This ensures shock absorption and safe transport.

Figure10: HI32 Packing Schematic

The box contents include: HI32 main unit, data cable, GNSS antenna, antenna feeder cable, magnetic antenna base, and DTU, USB to RS-232 cable

Table 18: Carton Dimensions

产品	SPQ(mm)	L(mm)	W(mm)	H(mm)
HI32	2	36	36	9.2