R100 GNSS RECEIVER

Installation and Operation

User Manual

Shanghai AllyNav Technology Co., Ltd

R100 GNSS RECEIVER INSTALLATION AND OPERATION USER MANUAL

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Warranty Information

Limited warranty period：

Products and software: 12 months from the date of shipment (receiver)

Accessories: Cable and other accessories are included for 90 days from the date of shipment.

AllyNav warrants that its GNSS products are free from defects in materials and workmanship. During the applicable warranty period (“Warranty Period”), AllyNav will, at its sole discretion, repair or replace at its own facility any product, accessory, or software that does not conform to AllyNav specifications or has significant material or workmanship defects (“Defective Product”). If the software is determined to be defective during the Warranty Period, AllyNav will, at its sole discretion and at its own expense, provide the purchaser with a qualified software patch to resolve the issue, or a fix included in the next general version of the affected software. This limited warranty does not cover the costs of any software re-verification, certification, or implementation. Qualified software patches will be provided “as is” and subject to the accompanying special software license terms.

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Document Declaration

The information contained in this document is subject to change without notice.

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Customer Support

ALLYNAV Knowledge Base

If you encounter technical issues, please visit the ALLYNAV support page: ALLYNAV.com/support.This support page allows you to contact customer support, find relevant tutorials, and ask questions.

1. Chapter 1 R100 Overview of

The R100 is a high-performance GNSS receiver and antenna optimized to provide position, speed, attitude, and timing information for tractor navigation/automatic steering and precision agriculture. This series achieves centimeter-level positioning accuracy using RTK or ALLYLINK correction technology and integrates a combined navigation algorithm. This receiver can use all current GNSS constellations and signals. Full-band technology provides smooth, consistent navigation, ensuring optimal coverage even in complex conditions. Its robust, sealed housing allows for secure roof mounting, direct use of onboard power, and provides diagnostic capabilities.

1.1. Characteristics

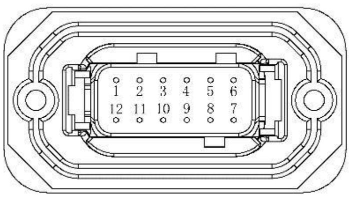
The main features of the R100 receiver are as follows:

- A complete GNSS receiver with multi-frequency, high-precision positioning capabilities.
- SBAS
- L-BAND
- PPP
- 1-channel CAN
- 2-channel RS232 serial ports
- 1-channel speed pulse output port
- 3 LED status indicator lights
- IP67 waterproof and dustproof rating
- Built-in data radio module
- Wide voltage supply: 9-36V

1.2. R100 Connector Overview

All R100 units use the same connector for power supply and communication.

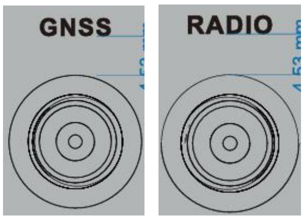
R100 interface connector



R100 Connector Pin Definitions

Pin	Function	Pin	Function
1	COM-RS232_TX	7	POW-

2	COM-RS232_RX	8	Reserved
3	USB_D+	9	CAN_L
4	USB_D-	10	CAN_H
5	POW+	11	CONFIG-RS232_RX
6	PLS	12	CONFIG-RS232_TX

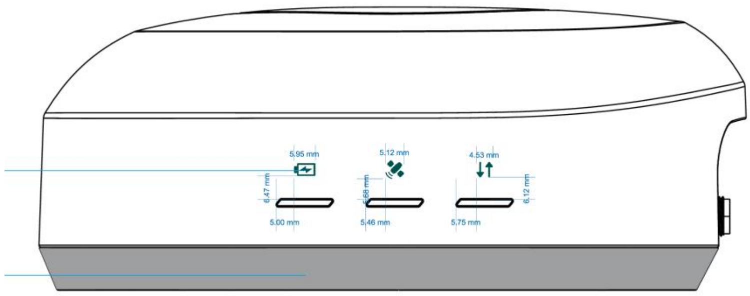


Sign	Describe
GNSS	TNC- Sub-antenna interface
RADIO	TNC - Radio Antenna Interface

1.3. R100 Indicator Light (LED)

The R100 receiver comes standard with 3 LED indicator lights.

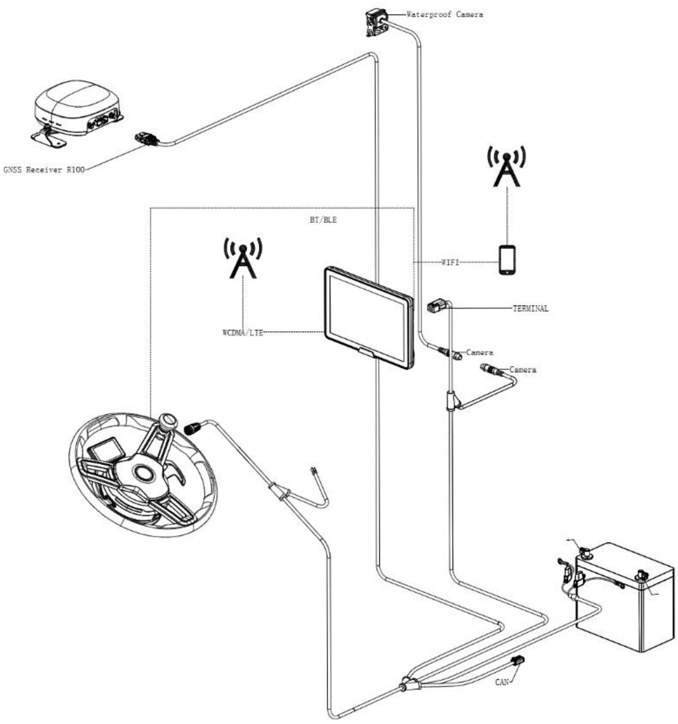
The following table provides information about the R100 indicator light and its status.



Sign	Definition	State	Describe
	POW	Green light always on	The equipment is powered normally
		Green light always off	Equipment power supply abnormality
	SA	Green light always on	The positioning state reaches a fixed solution
		Green light always off	Non-fixed solution for location state
	LINK	Green light flashes at 1Hz	Normal reception of differential correction data
		The green light turns on for 500ms and then turns off for 5 seconds.	Differential data not received correctly

2. Chapter 2 R100 Installation

The following is a connection example for the autonomous driving kit.



2.1. Additional accessories required for the R100 receiver

- 1 computer (provided by the user)
- 1 dedicated test cable (optional)
- 1-channel 12V DC regulated input power supply

2.2. Installation and Orientation of R100

2.2.1. Installation

Install the R100 receiver on a safe and stable structure to ensure its safe operation in specific environments.

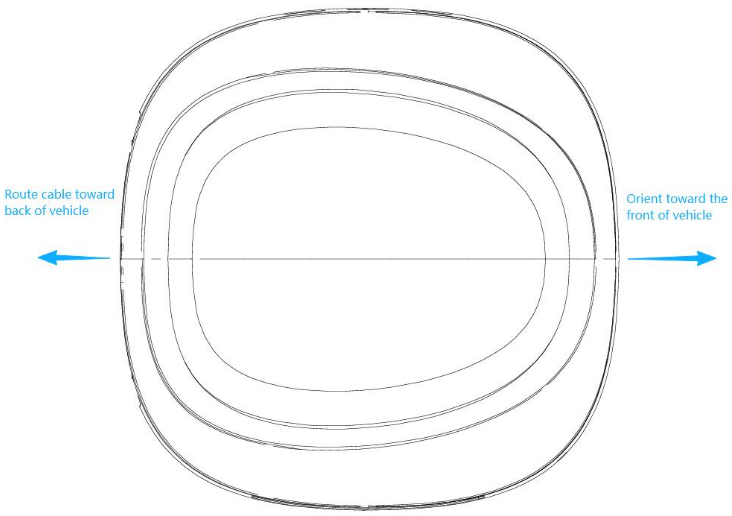
Ensure that there are no metal obstructions around the R100 receiver and that it is installed in a location with an open view and facing the sky.

- If installing on a vehicle, mount the R100 on the roof, ideally near the vehicle's pivot point. When installing the R100, the connector must face the rear of the vehicle, and ensure an unobstructed view of the sky from all directions.

The R100 can be mounted on the vehicle using an accessory bracket and secured with 3M adhesive and screws.

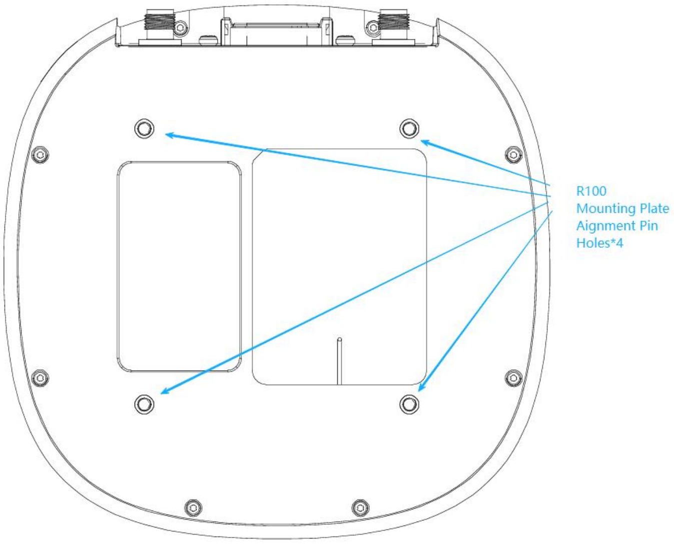
2.2.2. Orientation

Ensure that the R100 connector faces the rear of the vehicle, with the top pointing upwards, and that it has an unobstructed view of the sky from all directions.



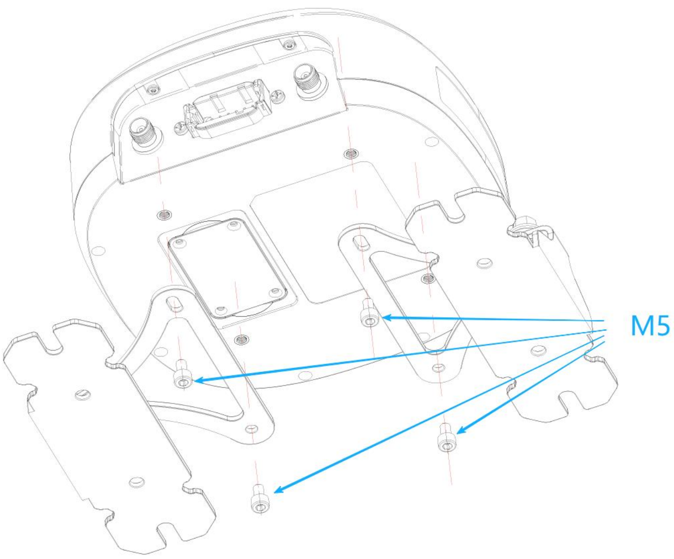
2.2.3. R100 mounting hole location

The mounting hole locations for R100 are shown in the following diagram.



2.2.4. Mounting Plate

An optional R100 mounting plate is provided to facilitate the installation of the R100. The dimensions of the mounting plate and the location of the mounting holes are as follow.



Installation steps for the installation version：

1. Align the bracket holes with the holes on the bottom of the R100 and tighten the M5 screws.

2. Pre-installed adjustment installation position

3. Remove the 3M adhesive and screw in the fixing screws.

2.3. Connect R100 to the data communication equipment

The R100 can communicate with other devices in the system, such as a computer's serial port. The R100 also features a CAN bus port for communication with other CAN-compatible devices.

2.3.1. Serial Port

The R100 has two RS-232 serial ports: CONFIG and COM (through GNSS module). These ports are located at the 12-pin connector. Pin definitions can be found in Section 1.2.

Steps to connect the serial port:

1. Connect and power the R100 receiver using a custom cable or test cable.

2. Connect the RS232 port that needs to be debugged to the serial port of a computer or other data communication device via a DB9 connector.

2.3.2. CAN Bus Port

The R100 has a CAN bus port on its 12-pin connector.

Steps to connect to the CAN bus port:

1. Connect and power the R100 receiver using a custom cable or test cable.

2. Connect the CAN receiver or analyzer to the CAN bus of the R100.

2.3.3. Speed Pulse Output Port

The R100 has a speed pulse output port on its 12-pin connector.

Steps to connect the speed pulse port:

1. Connect and power the R100 receiver using a custom cable or test cable.

2. The velocity pulse port can be connected to the implement port or an oscilloscope for observation.

2.4. R100 Power Requirements

The usable voltage range for R100 devices is 6-36V. The power supply should provide at least 5W of power.

2.5. Check if R100 is working properly.

After the receiver antenna is installed, turn on the power supply and follow these steps to confirm that the device is working properly:

1. Check if the power light is constantly green.

2. Connect the device to the computer via serial port.
3. Open CRT or other serial port tools
4. Send the following command

   SYS CONFIG

   SET CONCOM 12

   SET MODE 0

   MODE

   The device will return the following to indicate that it is working properly:

   #MODE,98,GPS,FINE,2399,196081000,0,0,18,880;MODE ROVER,HEADINGMODE FIXLENGTH*0A

3. Chapter 3 R100 Instruction Operation

3.1. Communicating with the receiver

3.1.1. Serial Port Communication

The receiver can communicate with a PC or terminal via the serial port. The default configuration of the serial port is as follows:

- 115200bps
- No parity bit
- 88 data bits
- 1 stop bit
- No need to use RTS/CTS hardware handshake
- Echo is off; the characters you type will not be displayed in the local terminal
- Break function enabled

The device can modify the communication baud rate via commands. Due to limitations in the operating environment, hardware, and cable performance, the maximum supported baud rate is 460800bps. Users can configure the communication baud rate appropriately based on their actual usage. It should also be noted that the actual transmission rate may be lower than the set value, depending on the number of currently tracked satellites and the idle time between data transmissions. To avoid data loss, it is recommended to allow for a certain margin when selecting the rate.

Using remote terminal communication

One way to communicate with the receiver is through a remote terminal. When communicating with the terminal, the receiver only needs to use three lines: CONFIG-RS232_RX (receive), CONFIG-RS232_TX (transmit), and GND (ground). It is essential to ensure that the terminal's communication settings match the receiver's port settings.

3.1.2. CAN Bus Communication

The R100 device has an onboard CAN port. It supports switching between 250kbps and 500kbps baud rates.

Note: The R100 has a built-in CAN transceiver, but a proper bus termination resistor is still required.

Modify the communication rate using the "SET CAN" command.

1.SYS CONFIG

2.SET BAUD 250 // After the command is sent, the receiver will restart and the configuration will be automatically saved.

3.2. Quick Start Guide

3.2.1. Entering Configuration Mode

Enable configuration: All configuration items that begin with the keyword SET must first be unlocked by sending this command.

[CONFIG-RS232] SYS CONFIG

Return：

OK

3.2.2. Query & Save

This command must be sent if the modified configuration items need to be saved after a power outage. It also returns system configuration information.

[CONFIG-RS232] SYS SAVE

```
GNSS RECEIVER V4.1.2
ID:R100E
PN:
SN:
BASE ID:
MODE:1 NET DIFF MODE
232 <===> GNSS
DIFF SRC   : NET BASE
SIM        : AUTO
RADIO baud:  38400bps
GNSS  baud: 115200bps
IMU   baud: 115200bps
7600G baud: 115200bps
UART1 baud: 115200bps
UART2 baud: 115200bps
CAN   baud:   500kbps
SYS TEMP   :  28 C
CPU USAGE :  0%  0%
SIM CSQ    : 0,0,0,0
HOT4G CSQ : 0,0
```

3.2.3. Reset

The device restart command will cause the baseboard, GNSS module, IMU module, and radio module to restart without changing the system configuration.

[CONFIG-RS232] SYS RESET

Return：

OK/FAILED

3.2.4. Working Mode

Switch the receiver's operating mode according to different usage scenarios.

[CONFIG-RS232] SET MODE x

Return：

OK

Query：

GET MODE

X	illustrate
0	Configuration mode allows direct configuration of each module.

2	In serial differential mode, differential data is received from external input via [CONFIG-RS232].
3	Radio differential mode, receiving differential data broadcast by the base station via radio.

3.2.5. Straight-through module configuration

In MODE 0 mode, this command allows configuration switching, enabling direct serial communication with the internal GNSS, IMU, and radio modules for configuration operations.

[CONFIG-RS232] SET CONCOM xx

Return：

OK/FAILED

Query：

GET CONCOM

XX	Module
11	SIM7600（Special hardware version）
12	GNSS
13	IMU
14	RADIO
15	WIFI（Special hardware version）

```
-----------------CONCOM cmd-----------
input "SET CONCOM 14" : 232 <===> RADIO
input "SET CONCOM 12" : 232 <===> GNSS
input "SET CONCOM 13" : 232 <===> IMU
input "SET CONCOM 11" : 232 <===> SIM7600
input "SET CONCOM 15" : 232 <===> WIFI
End
```

3.2.6. Internal serial port baud rate

This command allows you to configure the baud rate of the GNSS, IMU, and RADIO modules and the CONFIG-RS232 serial port. Before modifying, please ensure that the module's baud rate is already consistent with the one you want to change.

[CONFIG-RS232] SET UARTBD x,baud

Return：

OK/FAILED

X	Module
0	RADIO
1	GNSS
2	IMU

baud	38400、9600, 19200, 38400, 57600, 115200, 230400, 460800, 921600 Note: This parameter needs to be configured according to the actual baud rate supported by the module and usage requirements. Unless otherwise specified, the factory default configuration is recommended.

3.2.7. CAN Baud Rate Setting

This command sets the baud rate of the CAN bus.

[CONFIG-RS232] SET CAN 250/500

After the command is sent, the receiver will automatically restart and save the configuration; the entire process takes about 3 seconds.

3.3. Enable SBAS positioning

This command configures the SBAS function to be enabled or disabled. SBAS function configuration supports both user-selected SBAS correction system (AUTO mode) and specified correction system. If you are familiar with the operation of the correction system in your region, it is recommended to specify the correction system in the configuration.

command format:

CONFIG SBAS [Parameter 1] [Parameter 2]

Command Examples:

CONFIG SBAS ENABLE WAAS

CONFIG SBAS TIMEOUT 600

Command Header	Function Name	Parameter 1	Parameter 2	Parameter Description
CONFIG	SBAS	ENABLE	Auto	SBAS automatically selects the correction system mode
		ENABLE	WAAS	Enable WAAS correction function separately
			GAGAN	Enable GAGAN correction function separately

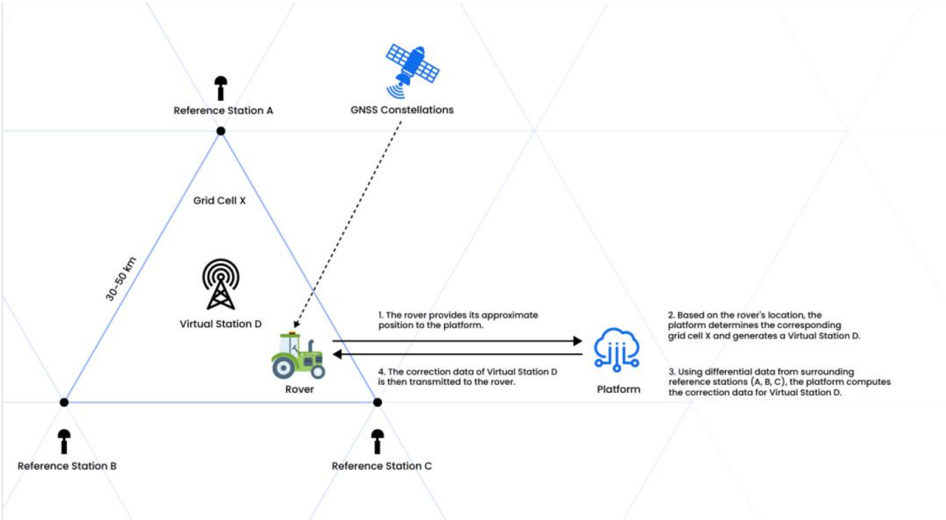
			MSAS	Enable MSAS correction function separately
			EGNOS	Enable EGNOS correction function separately
			SDCM	Enable SDCM correction function separately
			ASECNA	Enable ASECNA correction function separately
			KASS	Enable KASS correction function separately
			SPAN	Enable SPAN correction function separately
			BDS	Enable BDS SBAS correction function separately
			SLAS	Enable QZSS SLAS correction function separately
		DISABLE	-	SBAS function is disabled (default).
		TIMEOUT	t	SBAS timeout configuration, scope: 120~1800s, The default value is 1200s; if configured to 0, it is equivalent to DISABLE.

3.4. ALLYLINK Service

借 With the help of ALLYLINK service, the R100 receiver can achieve centimeter-level positioning accuracy through one of three methods.

ALLYLINK-FOCUS

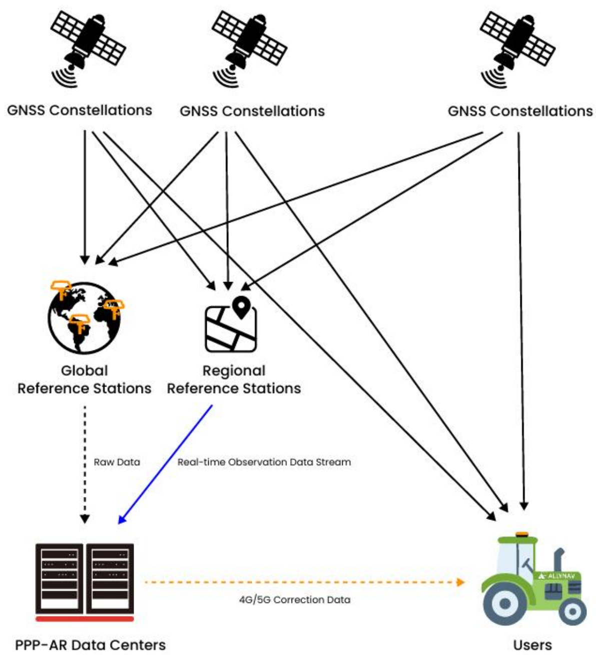
AllyLink-Focus delivers centimeter-level positioning with full-constellation, full-frequency GNSS support. Backed by AllyNav's ground-based reference station network and cloud platform, it provides high-preci sion RTK correction data through a seamless network service, ensuring AllyNav users benefit from a more accurate and reliable farming experience.



ALLYLINK-IP

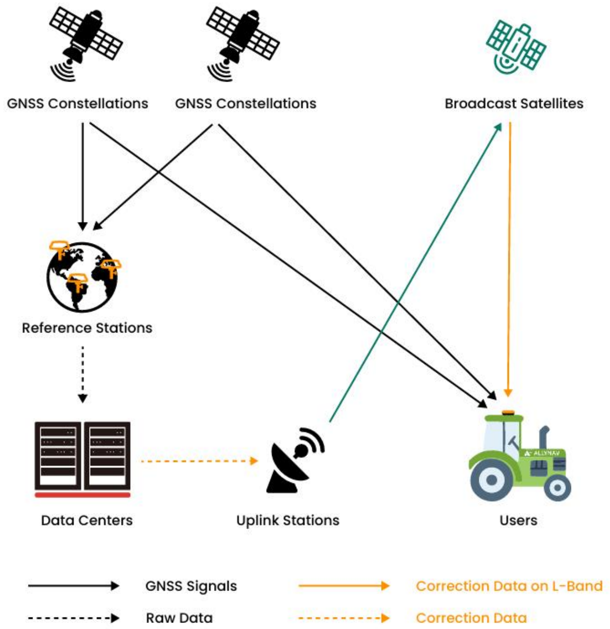
AllyLink-IP provides real-time, centimeter-level global positioning via a network connection, achieving horizontal accuracy better than 3 cm and vertical accuracy better than 6 cm*; convergence typically takes under 5 minutes. With global coverage and high availability, AllyLink-IP supports a wide range of high-pre cision applications for AllyNav customers worldwide.

*Convergence may take up to 20 minutes under open-sky, interference-free conditions to reach full accuracy.



ALLYLINK-REACH

ALLYLINK-REACH, a satellite-based augmentation system developed by Linklink Technologies, is a satellite-based positioning service that enables users to achieve centimeter-level high-precision positioning globally. It effectively addresses the need for high-precision positioning in areas without network coverage. Centimeter-level high-precision positioning can be achieved anywhere in the world without relying on a network, significantly improving operational flexibility.



To use the ALLYLINK service, please follow these steps:

1. Ensure your GNSS system has the required components. See "Required Components" below.
2. The L-BAND function is enabled by default. Please refer to "Enabling L-BAND Signal Tracking" below.
3. To obtain a standalone license for L-BAND or IP services, please refer to "ALLYLINK Service Subscription Methods" below.

3.4.1. Required Components

To use ALLYLINK services, a GNSS system requires the following components.

- One R100 receiver
- GNSS module hardware and firmware compatible with ALLYLINK services
  - ALLYLINK_FOCUS- All hardware and firmware support
  - ALLYLINK_IP-All receiver models support this feature; however, an additional

terminal capable of running IP services is required to input differential data to the receiver.

- ALLYLINK_REACH- LBAND signal tracking service requires GNSS module model numbers to end with 'C' and firmware version numbers to end with 'L'.

3.4.2. Enable L-BAND signal tracking

CONFIG LBAND Commands can configure L-band satellite information

command format:

CONFIG LBAND [Parameter 1] [Parameter 2] [Parameter 3]

Command Examples:

CONFIG LBAND ENABLE AUTO

Command Header	Function Name	Parameter 1	Parameter 2	Parameter 3	Parameter Description
CONFIG	LBAND	DISABLE			LBAND is off; this is the default setting.
		ENABLE	AUTO		The tracking lobe bundle and channel are automatically switched according to the strategy module.
			BeamID	ID	BeamID allows you to specify an L-band satellite, which will be used preferentially for PPPAR positioning. This command will not take effect if BeamID is not configured. Value range: Decimal integer 1 to 7.
		DATUM	WGS84		Reference coordinate system: WGS84 coordinate system(Default)
			LBANDORIGINAL		The coordinate system is consistent with that of the service.
		BEAM	Parameter set		The parameter set should include all parameters

				shown in Table 4-23, which describes the L band Beam parameter set configuration, with one space between each parameter.

3.4.3. ALLYLINK Service Subscription Method

- ALLYLINK-FOCUS

It requires centimeter-level accuracy within the coverage area of ALLYNAV's self-built CORS base stations, which can be built by distributors or users themselves.

- ALLYLINK-IP

By providing real-time, centimeter-level global positioning services through network connectivity, it effectively solves the challenge of achieving high-precision positioning in areas with sparse base station coverage.

- ALLYLINK-REACH

Developed by AllyNav, satellite-based location services enable users to achieve centimeter-level accuracy globally.

For more information about ALLYLINK services, please contact ALLYNAV technical support or visit the ALLYNAV website.

3.5. R100 speed pulse signal

By configuring the receiver to output a speed pulse signal, this signal can be sent to external agricultural implements.

3.5.1. Velocity Pulse Signal Configuration

The speed specified in the GPRMC statement is converted into a PWM frequency with a 50% duty cycle according to a specific ratio.

SET PWMFREQ mode,freq

Return:

Set pwm freg auto

SET PWMRATIO x

Return：

Set pwm speedratio x success\r\n

Parameter	value	illustrate
Mode	0	In automatic mode, the program automatically converts the RMC speed to PWM frequency. In this mode, the value is invalid and can be left blank.
	1	Manual mode allows users to manually specify a fixed PWM output frequency.
freq	[0, MAX]	The value of MAX depends on the requirements. When freq is 0, it can be understood as disabling PWM functionality. The duty cycle is 0.
x	10-60	If we set the frequency to 10 for a speed of 1 km/h, the proportional relationship is that 1 km/h corresponds to a frequency of 10 Hz.

Example 1：

Switch to automatically output PWM frequency based on RMC speed.

SYS CONFIG

SET PWMFREQ 0

SYS SAVE

Example 2：

Manually configure the PWM frequency to 500Hz

SYS CONFIG

SET PWMFREQ 1,500

SYS SAVE

Example 3：

SYS CONFIG

SET PWMRATIO 10

SYS SAVE

This indicates that the output is set to correspond to a frequency of 10Hz for a speed of 1km/h.

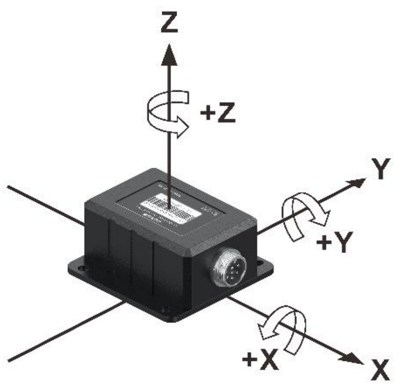
4. Chapter 4 IMU Combinatorial Navigation

A data fusion algorithm combining IMU and GNSS data is run within the R100 receiver to achieve high-precision orientation and attitude measurement with resistance to magnetic interference.

4.1. IMU Axial Description

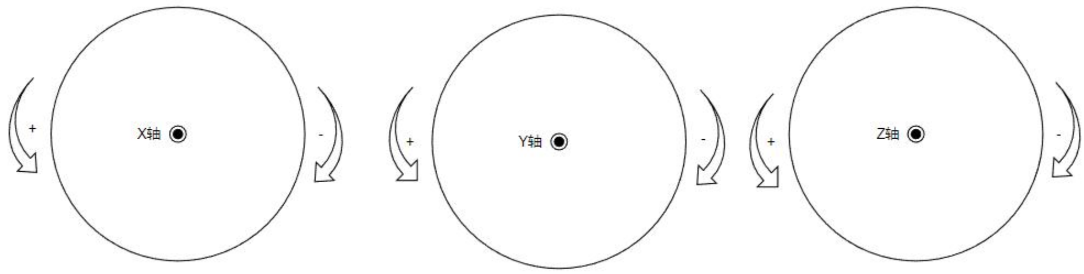
4.1.1. Axial Acceleration

The diagram below defines the axial acceleration of a gyroscope: the arrow points in the positive direction. The acceleration range for all three axes is -8g to 8g.



4.1.2. Axial angular velocity

Angular velocity is axially aligned with acceleration, as shown in the diagram below during rotation: all three axes are perpendicular to the document and point outwards; clockwise rotation results in negative values, and counterclockwise rotation results in positive values. The acceleration range for all three axes is -640°/s to 640°/s.

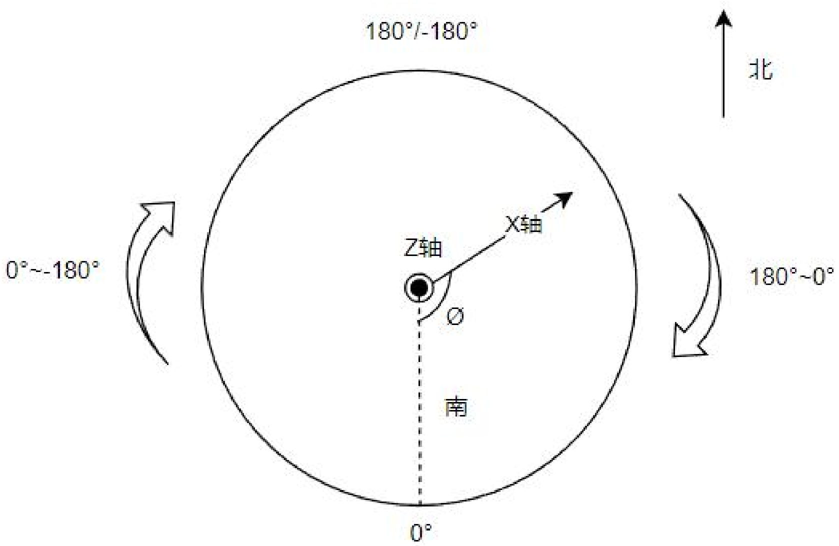


4.1.3. Heading Angle

4.1.3.1. Absolute heading

In reality, the gyroscope cannot obtain the absolute heading on its own. Therefore, it can be assumed that the heading is south during initialization. If the absolute heading is obtained during integrated navigation, it will be output according to the following description. At this time, the data format can directly correspond to the heading of the positioning data, and the data can be transmitted directly in bytes.

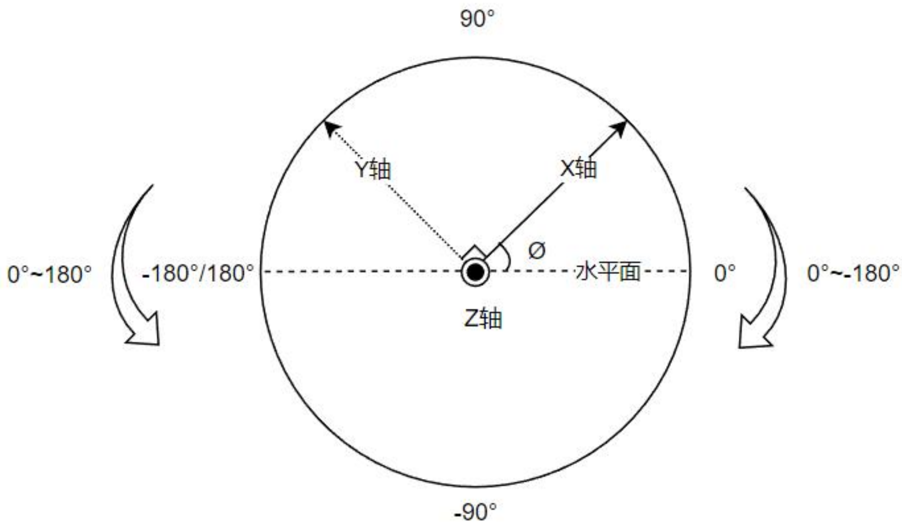
As shown in the figure: The disk surface is parallel to the horizontal plane, the dashed line is the north-south line, the Z-axis points upwards and is perpendicular to the horizontal plane and outwards from the document. Due to the data offset of 180°, true north corresponds to +180°/-180°, and the heading angle is Ø, ranging from -180° to 180°.



4.1.3.2. The Z-axis is parallel to the horizontal plane.

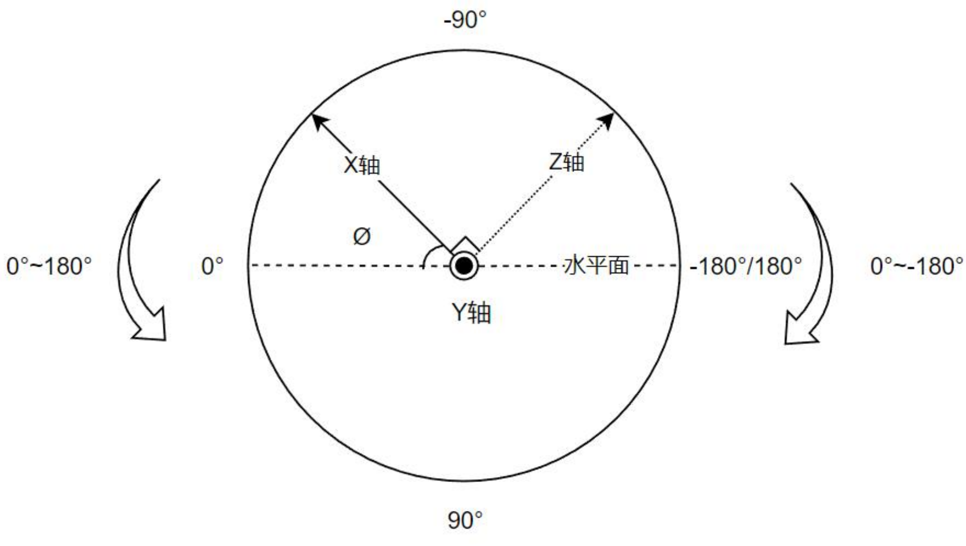
When vertical mounting is used, the Z-axis is parallel to the horizontal plane and is affected by the neutral force. In order to make the attitude data continuous, the output angle is actually pitch or roll, and the data calculation method is also the same as that of two axes.

The image below shows a disk perpendicular to the horizontal plane, with the Z-axis parallel to the horizontal plane. The outward yaw angle perpendicular to the document is Ø, ranging from -180° to 180°. Values above the horizontal plane are positive, and values below are negative.



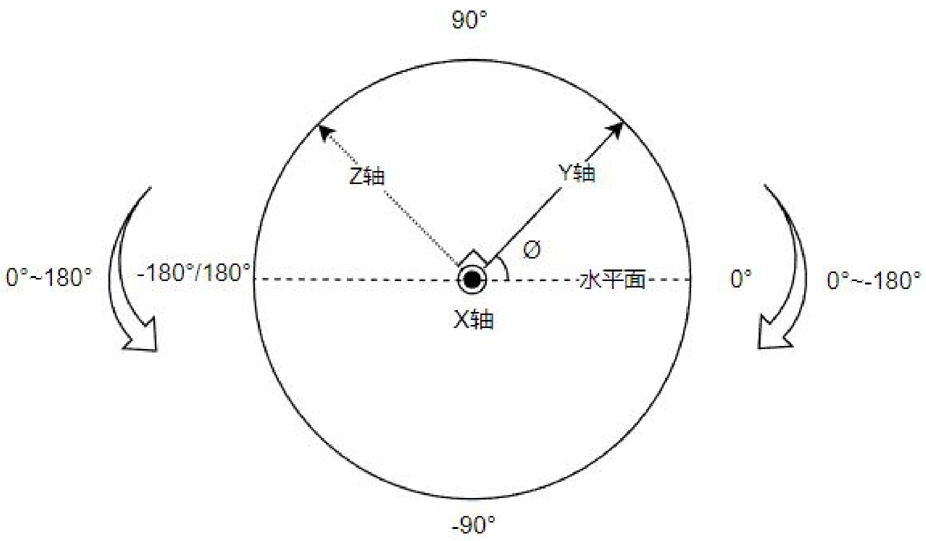
4.1.4. Pitch Angle

The image below shows the disk surface perpendicular to the horizontal plane, with the dashed line representing the horizontal plane. The Y-axis is parallel to the horizontal plane and perpendicular to the document, pointing outwards. The angle between the positive X-axis and the horizontal plane is the pitch angle Ø, ranging from -180° to 180°. Values above the horizontal plane are negative, and values below are positive.



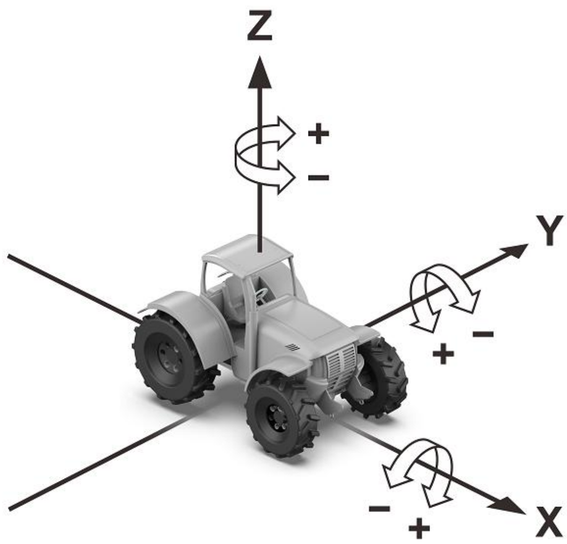
4.1.5. Roll Angle

The image below shows a circular disk perpendicular to the horizontal plane, with the dashed line representing the horizontal plane. The X-axis is parallel to the horizontal plane and extends outwards from the document. The positive Y-axis forms the pitch angle Ø with the horizontal plane, ranging from -180° to 180°. Values above the horizontal plane are positive, and values below are negative.



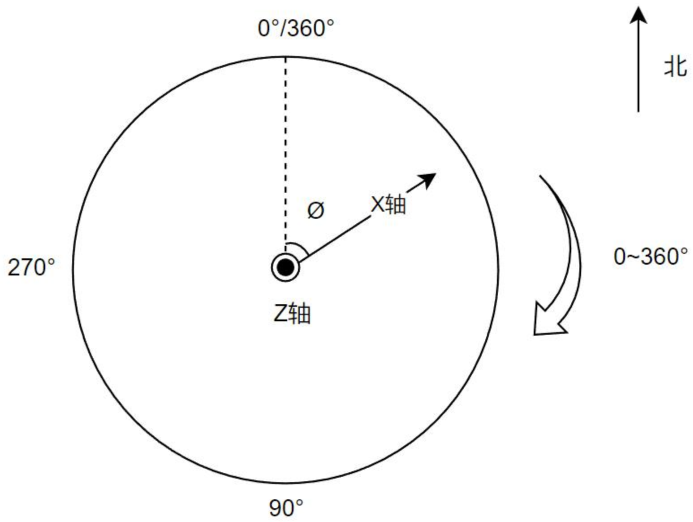
4.2. Vehicle Navigation Axis Description

The front of the vehicle is aligned with the positive X-axis, the roof with the positive Z-axis, and the front is facing forward. The right side is aligned with the positive Y-axis. All three axes rotate clockwise to increase the angle and counter-clockwise to decrease the angle.



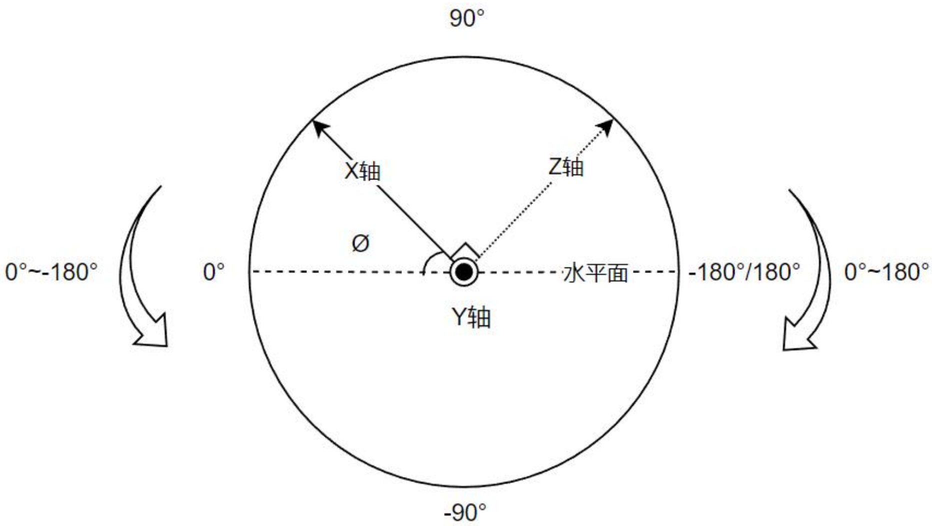
4.2.1. Heading Angle

The diagram below shows a circular disk parallel to the horizontal plane. The dashed lines represent the north-south axis. The Z-axis points upwards and is perpendicular to the horizontal plane, extending outwards from the document. True north corresponds to 360°/0°. The heading angle is the angle Ø between the positive X-axis and true north, ranging from 0° to 360°.



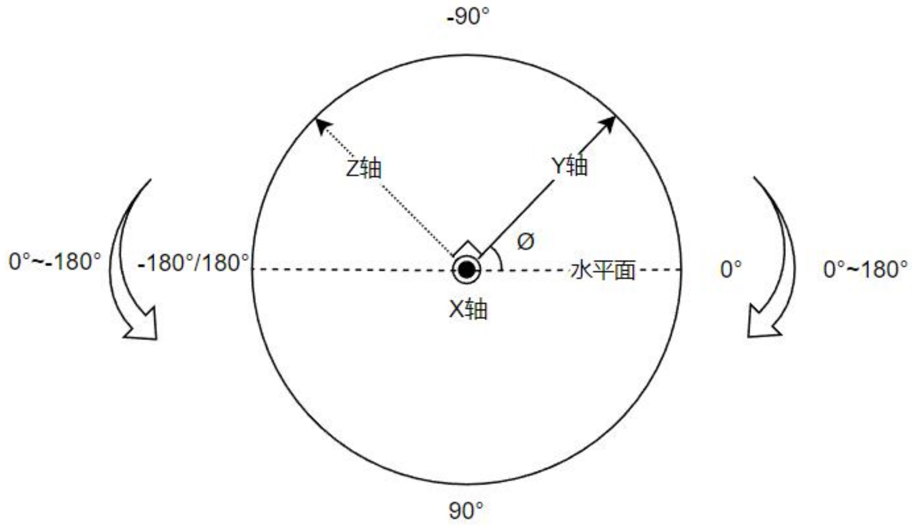
4.2.2. Pitch Angle

The image below shows a circular disk perpendicular to the horizontal plane, with the dashed line representing the horizontal plane. The Y-axis is parallel to the horizontal plane and perpendicular to the document, pointing outwards. The angle between the positive X-axis and the horizontal plane is the pitch angle Ø, ranging from -180° to 180°. Values above the horizontal plane are positive, and values below are negative.



4.2.3. Roll Angle

The image below shows the disk surface perpendicular to the horizontal plane, with the dashed line representing the horizontal plane. The X-axis is parallel to the horizontal plane and extends outwards from the document. The positive Y-axis forms the pitch angle Ø with the horizontal plane, ranging from -180° to 180°. Values above the horizontal plane are negative, and values below are positive.



4.3. Software Configuration

Default GNSS configuration required to run integrated navigation algorithms

The GNSS module needs to provide the following configuration to the IMU module：

LOG COM3 GPGGA ONTIME 0.1
LOG COM3 BESTPOSB ONTIME 0.1
LOG COM3 PSRVELB ONTIME 0.1

4.4. Prerequisites

Prerequisites for the effectiveness of integrated navigation algorithms.

4.4.1. Initialization Completion Requirements

Obtaining accurate heading, roll, and pitch angle values requires certain prerequisites.

- The state solution in GPGGA is a fixed E4 solution.
- The vehicle completes the initialization process by moving forward at a speed of not less

than 1.8 km/h.

5. Chapter 5 GNSS Module

This section only shows some of the main GNSS module configuration commands. Please download for detailed instructions. "Unicore Reference Commands Manual For N4 High Precision Products_V2_EN" View the data interface protocol manual.

5.1. Factory default configuration

The following configuration is the default configuration of the R100 receiver when it leaves the factory.

CONFIG SIGNALGROUP 3 6

CONFIG SIGNALGROUP 3 6

CONFIG SIGNALGROUP 3 6

GPGGA COM2 0.1

GPRMC COM2 0.1

CONFIG NMEA0183 V31

NMEATALKER GP

GPGST COM2 1

GPNTR COM2 1

CONFIG LBAND ENABLE AUTO

5.2. PPP Configuration

This command is used to configure the receiver's PPP positioning-related functions, and is supported on certain versions.

command format:

CONFIG PPP [Parameter 1] [Parameter 2] [Parameter 3 (Optional)]

CONFIG PPP CONVERGE [Parameter 1] [Parameter 2]

命令示例:

CONFIG PPP ENABLE B2b-PPP

CONFIG PPP DISABLE

CONFIG PPP CONVERGE 10 20

Command Header	Function Name	Parameter 1	Parameter 2	Parameter Description
CONFIG	PPP	ENABLE	B2b-PPP	B2b PPP functionality priority
			E6-HAS	E6 HAS Function Priority
			AUTO	Automatically select the appropriate PPP correction number based on the scenario.
			L6MDCPPP	QZSS L6E MADOCA-PPP service priority
		DATUM	WGS84	Reference coordinate system datum WGS84 coordinate system
			PPPORIGINAL	Uses the same coordinate system as PPP services (default).
		TIMEOUT		The value range is 90~180s, with a default of 120s. When the TIMEOUT is configured to be 0, the PPP solution function is turned off.。
		CONVERGE		For details on the PPP positioning accuracy convergence threshold, please refer to the table below.
		DISABLE		PPP function is disabled (default).

Command Header	Function Name	Parameter 1	Parameter 2	Parameter 3 (optional)	Parameter Description
CONFIG	PPP	ENABLE	B2b-PPP	ONLY	Only enable B2b-PPP
			E6-HAS		Enable E6-HAS only
			L6MDCPPP		Enable only QZSS L6E MADOCA-PPP

Command Header	Function Name	Parameter 1	Parameter 2
CONFIG	PPP CONVERGE	HorSTD Horizontal error threshold, in cm	VerSTD Elevation error threshold, in cm

5.3. 5.3. LBAND Configuration

The CONFIG LBAND command configures L-band satellite information.

command format:

CONFIG LBAND [Parameter 1] [Parameter 2] [Parameter 3]

Command Examples:

CONFIG LBAND ENABLE AUTO

Command Header	Function Name	Parameter 1	Parameter 2	Parameter Description	Command Header
CONFIG	LBAND	DISABLE			LBAND is off; this is the default setting.
		ENABLE	AUTO		The tracking lobe bundle and channel are automatically switched according to the strategy module.
			BeamID	ID	BeamID can specify an L-band satellite, which will be used preferentially for PPPAR positioning. This command will not take effect if BeamID is not configured. Value range: Decimal integer 1 to 7.
		DATUM	WGS84		Reference coordinate system datum WGS84 coordinate system(default)
			LBANDORIGINAL		The coordinate system is consistent with that of the service.
		BEAM	Parameter set		The parameter set should include all parameters shown in Table 4-23, which describes the L-band Beam parameter set configuration, with each parameter separated by a single space.

6. Chapter 6 Radio Module

The R100 receiver has a built-in radio module. Before configuring the radio, you need to enter the pass-through radio mode by sending a command via the CONFIG-RS232 serial port. The command is as follows:

SYS CONFIG

SET MODE 0

SET CONCOM 14

The command requirements for entering configuration mode for the radio module are as follows:

Configuration mode:

+++

Send the string "+++" (Note: It must be sent in the following manner: One second before sending the string "+++", no characters can be sent; one second after sending the string "+++", no characters can be sent, otherwise the system will not be able to enter the radio parameter configuration mode; there is no newline character (\r\n) at the end of the string).

Exit configuration mode:

ATA

6.1. Factory default configuration

After establishing initial contact with the radio module, you can send the following command to query the factory settings.

ATP0?	Query the list of operating frequencies already configured for the current radio station. ATP0? Channel Number Tx Frequency(MHZ) Rx Frequency(MHZ) DIR -------------- ----------------- ---------------- --- 00 451.12500 451.12500 Tx&Rx 01 452.12500 452.12500 Tx&Rx 02 453.12500 453.12500 Tx&Rx OK
AT&V	Query current radio station operating parameters AT&V HX-DU2029D-NB400 Harxon Corporation. Soft ver:A038.01.00 S/N:D16000000000 S102=3 Serial Baud Rate S103=5 Wireless Link Rate S108=H Output Power S131=00-451.12500 Current Tx Frequency S132=00-451.12500 Current Rx Frequency S186=25 Protocol Selection S226=0 Compatibility Type S104=4294967295 ID OK

6.2. Configuration Commands

command	value	illustrate
+++	/	Enter configuration mode and send without adding a carriage return or line feed (\r\n).
ATA	/	Exit configuration mode and add a carriage return and line feed (\r\n) when sending.
AT&W	/	The parameter save command requires sending a save instruction after configuration.
ATP0=CH TX RX	TX:410-470MHZ RX:410-470MHZ	The command to configure the working frequency table requires that the frequency point and channel number be separated by a space (only one space character); the frequency point must retain at least one decimal place and at most five decimal places.
ATP0?	/	Query the list of operating frequencies already configured for the current radio station.
AT&V	/	Query current radio station operating parameters
ATS101=value	0:TXONLY 1:DUPLEX 2:RXONLY	Work mode modification
ATS102=value	1:115200 2:57600 3:38400 5:19200 7:9600	The current serial port baud rate has been modified. The baud rate will take effect immediately after sending this command. To save the current configuration parameters, you need to switch the serial port baud rate of the current configuration tool (SET UARTBD 0,baud) and then send the AT&W save command.
ATS103=value	0:4800 2:9600 4:19200 5:11000 6:12000 7:15000 8:18000	The air baud rate has been modified. The LIANSHI and CSS protocols only support air baud rates of 11000, 12000, 15000, and 18000. Other protocols only support 4800, 9600, and 19200.
ATS104=value	0-4294967295	Modify ID parameter
ATS106=value	1-50	Configure the number of network scanning channels.
ATS107=value	0：Disable networking function 1：Enable networking function	Configure network functions
ATS108=value	H：High power M：medium power L：low power	Transmit power modification

ATS131=value	0-63	Current radio station working transmission channel settings
ATS132=value	0-63	Current radio receiver channel settings
ATS186=value	1：TRIMTALK; 2：TRIMMK3; 4：TT450S 5：TRANSEOT 9：SOUTH 13：SATEL 25：LIANSHI 26：CSS	Communication protocol selection
ATS226=value	0：HARXON; 2：SATEL 4：SINO 5：TOPCON	Compatibility mode selection

Notes: 1. Unless otherwise specified, each AT command must be followed by a carriage return and line feed (\r\n); 2. To enable communication between two radios, the following parameters must be consistent: communication protocol, transmit and receive frequencies, and air baud rate.

7. Chapter 7 CAN Bus

CAN bus (Controller Area Network) is a serial communication protocol widely used in automotive and industrial automation, characterized by high reliability and real-time performance.

7.1. Default Configuration

The CAN baud rate is 500K by default and can be configured to 250K via commands. It defaults to outputting heading, roll, and pitch data from the IMU integrated navigation algorithm.

7.2. Configure CAN bus baud rate

SYS CONFIG

SET MODE 0

SET CAN 250 // The system will restart after sending. Please wait for the restart to complete before executing the following commands.

SET MODE 2

SAVE LIST

7.3. AllyNav Messages on CAN

7.3.1. CAN ID

ID	illustrate
0X18FFCA9A	Gyroscope angle data output
0X18FFCB9A	Gyroscope acceleration data output
0X18FFCC9A	Angular rate data output of gyroscope

7.3.2. Angular Velocity Analysis

ID：0X18FFCA9A，Output interval period：200ms

byte.bit	length	Parameter Name		numerical values
1-2	2	The angle value of the X-axis measured by the attitude sensor	ROLL	Location: X-axis angle; Resolution: 0.01°, Offset: 180°; Range: -180° to 180°; Calculation Formula： =(Data[1]+Data[2]<<8)*0.01°-180° 0xFEFF异常 0xFFFF无用
3-4	2	The angle value of the Y-axis measured by the attitude sensor	PITCH	Y-axis angle value; Resolution: 0.01°, offset 180° Range: -180°-180° Calculation formula:=(Data[3]+Data[4]<<8)*0.01° -180° 0xFEFF abnormal 0xFFFF useless
5-6	2	The angle value of the Z-axis measured by	YAW	Z-axis angle value Resolution: 0.01°, offset 180°

		the attitude sensor		Range: -180°-180° Calculation formula:=(Data[5]+Data[6]<<8)*0.01° -180° 0xFEFF abnormal 0xFFFF useless
7	1			0xFF FF：Initialization not completed No FF：Initialization complete
8	1			0xFF

7.3.3. Acceleration Analysis

ID：0X18FFCB9A，Output interval period：50ms

The standard IMU firmware version does not support output; a special version is required.

byte.bit	length	Parameter Name		numerical values
1-2	2	The attitude sensor measures the acceleration along the X-axis.		Acceleration along the X-axis; Resolution: 0.00025g, offset 8g Range: -8g~8g Calculation formula:=(Data[1]+Data[2]<<8)*0.00025-8 g 0xFEFF abnormal 0xFFFF useless
3-4	2	The attitude sensor measures the acceleration along the		Y-axis acceleration; Resolution: 0.00025g, offset 8g Range: -8g~8g Calculation formula:

		Y-axis.		=(Data[3]+Data[4]<<8)*0.00025-8g 0xFEFF abnormal 0xFFFF useless
5-6	2	The attitude sensor measures the acceleration along the Z-axis.		Z-axis acceleration; Resolution: 0.00025g, offset 8g Range: -8g~8g Calculation formula: =(Data[5]+Data[6]<<8)*0.00025-8g 0xFEFF abnormal 0xFFFF useless
7-8	2	reserve		0xFFFF

7.3.4. Angular Rate Analysis

ID： 0X18FFCC9A， Output interval period： 50ms

byte.bit	length	Parameter Name		numerical values
1-2	2	The attitude sensor measures the angular rate along the X-axis.	Gyro_x	Angular velocity along the X-axis; Resolution: 0.02°, offset 640°/s Range: -640°/s ~ 640°/s Calculation formula:=(Data[1]+Data[2]<<8)*0.02-640°/s 0xFEFF abnormal 0xFFFF useless
3-4	2	The attitude sensor measures the angular rate	Gyro_y	Y-axis angular velocity; Resolution: 0.02°, offset 640°/s Range: -640°/s~640°/s

		along the Y-axis.		Calculation formula: =(Data[3]+Data[4]<<8)*0.02-640°/s 0xFEFF abnormal 0xFFFF useless
5-6	2	The attitude sensor measures the angular rate along the Z-axis.	Gyro_z	Z-axis angular velocity; Resolution: 0.02°, offset 640°/s Range: -640°/s~640°/s Calculation formula:=(Data[5]+Data[6]<<8)*0.02-640°/s 0xFEFF abnormal 0xFFFF useless
7-8	2	reserve		0xFFFF

8. Chapter 8 Fault Diagnosis

The diagnostic function is a series of mechanisms that enable self-testing and status monitoring of the receiver during startup, operation, and maintenance. It combines periodic self-testing with event triggering to sample and analyze key hardware parameters such as onboard temperature, voltage, and module status in real time. During initialization, the system performs a comprehensive self-test to ensure all modules are within their normal operating range. During normal operation, the diagnostic program, as an independent thread or process, continuously monitors these parameters and reports any abnormalities to other working units. When a parameter exceeds a preset threshold, the system automatically implements protective measures, such as reducing CPU frequency or shutting down module power. Furthermore, the diagnostic function supports external command queries and can output detailed status reports via serial port or bus interface, facilitating debugging and maintenance.

8.1. Functional Classification

The purpose of creating module or function indexes is to facilitate unified management, improve compatibility, and reduce parsing difficulty by using single numbers instead of strings, such as using 1 to represent "GNSS". The indexes are divided into three categories: the first category represents the physical module, the second category represents the corresponding physical quantity, and the third category represents the diagnostic status. If the equipment has special requirements, the index can be decremented from 255, allowing for differentiated configurations for different devices, depending on the specific functional requirements of the device.

8.1.1. Module Classification Description

Serial Number	Module Description	Remark
0	Reserve	
1	MainBoard	Device motherboard
2	MCU	
3	GNSS	
4	IMU	
5	RADIO	
6	4G	
7	BLUETOOTH	
8	WIFI	
9	POWER1	Power supply (lead-acid/lithium battery)
10	POWER2	Solar energy
…		
253	Custom Module 3	
254	Custom Module2	
255	Custom Module1	

Note: Some definitions are not applicable to R100.

8.1.2. Description of physical quantities

Serial Number	Function Description	Remark
0	Reserve	
1	Temp	
2	Voltage	
3	Current	
4	PWMfreq	
5	PWMduty	
6	CSQ	Signal quality
7	SNR	Signal-to-noise ratio
8	MsgID	Message ID
…		
253	Custom physical	

	quantities 3	
254	Custom physical quantities 2	
255	Custom physical quantities 1	

8.1.3. Diagnostic Status Description

Serial Number	Function Description	Remark
0	Reserve	Reserve
1	OK	normal
2	OverLimit	Exceeding the set threshold limit
3	BelowLimit	Below the set threshold lower limit
4	NoSignal	No waveform or signal detected
5	NoID	No corresponding ID detected
...		
253	Custom status 3	
254	Custom status 2	
255	Custom status 1	

8.2. Print diagnostic text information

[CONFIG-RS232] GET DIAGTXT

The above information is printed via serial port to facilitate troubleshooting by on-site personnel. It includes the following content:

1. Module classification information

2. Physical quantity information

3. Diagnostic status information

4. Information on the reporting interval of the status of each physical quantity

Note: In all the diagnostic information below, 'm' (module) represents the module category number, 'p' (physical quantity) represents the physical quantity, and 's' (status) represents the diagnostic status.

8.3. Configure diagnostic information time intervals by second

[CONFIG-RS232]SYS DIAGTS m,p[,time]

time Optional instruction

1. When the `time` parameter is omitted, it indicates that the host computer is requesting time interval information for a specified module and function from the slave device. The receiver will return the relevant time information immediately upon receiving the instruction.

2. When the `time` parameter is included, it indicates that the host computer sets the diagnostic information reporting interval for the receiver. (Note that before using the setting command, you need to send `SYS CONFIG` to unlock it first.)

time Data types unsigned int, unit s

For example：

1. The host computer automatically reports the temperature diagnostic information obtained from the MCU at intervals.

host computer： SYS DIAGTS 2,1

2. The host computer is configured to report temperature diagnostic information from the MCU at a time interval of 1 second.

host computer： SYS DIAGTS 2,1,1

8.4. Configure diagnostic information time intervals in milliseconds

[CONFIG-RS232] SYS DIAGTMS

Format： SYS DIAGTMS m,p[,time]

time Optional instruction

1. When the `time` parameter is omitted, it indicates that the host computer is requesting time interval information for a specified module and function from the slave device. The receiver will return the relevant time information immediately upon receiving the instruction.

2. When the `time` parameter is included, it indicates that the host computer sets the diagnostic information reporting interval for the receiver. (Note: Before using the setting command, you need to send `SYS CONFIG` to unlock the receiver first.)

time Data types unsigned int, unit s

For example：

1. The host computer automatically reports the temperature diagnostic information obtained

from the MCU at intervals.

host computer：SYS DIAGTMS 2,1

2. The host computer is configured to report temperature diagnostic information from the MCU at a time interval of 1000ms.

host computer：SYS DIAGTMS 2,1,1000

8.5. Configure diagnostic information time intervals by frequency

[CONFIG-RS232] SET DIAGFS m,p[,freq]

freq Optional instruction。

1. When the `freq` parameter is omitted, it indicates that the host computer is requesting frequency information for a specified module and function from the slave device. The receiver will immediately return the relevant frequency information upon receiving the instruction.

2. When the `freq` parameter is included, it indicates that the host computer sets the diagnostic information reporting frequency of the receiver. (Note that before using the setting command, you need to send `SYS CONFIG` to unlock it first.)

freq Data types unsigned int, unit Hz

For example：

1. The host computer obtains the temperature diagnostic information from the MCU and automatically reports the frequency.

host computer：SYS DIAGFS 2,1

2. The host computer is configured to report temperature diagnostic information to the MCU at a time interval of 1Hz.

host computer：SYS DIAGFS 2,1,1

8.6. Real-time access to diagnostic information

[CONFIG-RS232] GET DIAGIF m,p

For host computer operators, when clicking a button or needing to immediately obtain relevant diagnostic information.

The diagnostic information returned by this command will not reset the diagnostic information reporting interval counter mentioned in the previous command. For example, if the interval for reporting a certain diagnostic information is configured to be once per second, and 300ms has passed since the last report, pressing the retrieval button will immediately return a diagnostic information.

However, the interval will continue to count from the 300ms that have already elapsed, and will not be reset to 0ms.

For example：

1. Read the voltage signal of the GNSS module

GET DIAGIF 3,2

2. Read PWM sampling information

GET DIAGIF 1,4

The following is the content reported by the lower-level machine. It is divided into two types.

1． SDH(System Diagnose Human-Readable) It is mainly used by on-site inspectors to read data; the serial port will print the content represented by strings in the table above.

Example: Report GNSS power supply voltage 3.3V

SDH 3,2,3.3

2． SDM(System Diagnose Machine-Parseable) Primarily used for host computer parsing, reducing data volume and improving parsing efficiency. The string reference section categorizes string descriptions.

Example: Report GNSS power supply voltage 3.3V

SDM GNSS,Voltage,3.3

8.7. Report diagnostic information

[CONFIG-RS232] SDH/SDM DIAGIF (m,p,para1,para2···)(···)

Diagnostic content reported by the lower-level machine after being triggered immediately or periodically.

illustrate：

1. The data type of `para` is uniquely determined by the `m` module class, the `p` physical quantity class, and the product requirements. For example, the temperature value of GNSS is of type `float`.

2. The number of parameters para1, para2...parax is uniquely determined by the module class m, the physical quantity class p, and the product requirements.

3. One or more diagnostic records can be uploaded simultaneously; each diagnostic record is called a data set. Data within a group is separated by commas, and multiple groups are separated by commas (without any characters in between).

For example：

1. GNSS 温度值 42.3

SDH DIAGIF 3,1,42.3

SDM DIAGIF GNSS,Temp,42.3

2. GNSS temperature: 42.3°C, voltage: 3.3V

SDH DIAGIF (3,1,42.3)(3,2,3.3)

SDM DIAGIF (GNSS,Temp,42.3)(GNSS,Voltage,3.3)

3. The three temperature points on the motherboard are 40.1, 40.2, and 40.3.

SDH DIAGIF 1,1,40.1,40.2,40.3

SDM DIAGIF Mainboard,Temp, 40.1,40.2,40.3

The following are alarm information reports.

The command header SDE indicates system diagnose error.

8.8. Diagnostic Alarms

[CONFIG-RS232] SDH/M DIAGERR m,s,p

When the downstream device triggers the alarm mechanism, it immediately sends diagnostic alarm information to the upstream device. Simultaneously, the system periodically checks its status; if abnormalities persist, it will periodically report error statuses at configured time intervals. Once the status returns to normal, the device will send a message containing an "OK" status, and the alarm will be cleared.

Example：

1. GNSS temperature exceeded limit

SDH DIAGERR GNSS,Temp,OverLimit

SDM DIAGERR3,1,2

2. CAN bus error, no corresponding IMU ID

SDH DIAGERR IMU,MsgID,NoID

SDM DIAGERR 4,8,5

3. CAN bus fault clearing

SDH DIAGERR IMU,MsgID,OK

SDM DIAGERR 4,8,1

8.9. Set alarm limit

[CONFIG-RS232] SET DIAGEUL m,p,value

This indicates that `diagnos err upper limit` is used to indicate the error rate.

When the program detects that a physical quantity value is higher than the upper limit, it will immediately report it. Afterward, it will report periodically without resolving the status quo.

For example:

Set the GNSS voltage value to no more than 3.5V.

SET DIAGEUL 3,2,3.5

8.10. Set alarm lower limit

[CONFIG-RS232] SET DIAGELL m,p,value

Indicates diagnostics err lower limit

When the program detects that a physical quantity value is below the lower limit, it will immediately report it. Afterward, it will report periodically without resolving the status quo.

For example:

Set the GNSS voltage value to no less than 3.1V.

·SET DIAGELL 3,2,3.1

8.11. Read the upper and lower alarm limits

[CONFIG-RS232] GET DIAGELT m,p

This indicates the diagnose err limit.

Obtain the threshold information of a certain physical quantity

Example: Reading the upper and lower limit alarm thresholds of GNSS voltage.

GET DIAGELT 3,2

8.12. Configure and enable diagnostic alarms

[CONFIG-RS232] SYS DIAGETS m,p[,time]

Enable or disable diagnostic error alarm function

time Optional instruction

1. When the `time` parameter is omitted, it indicates that the host computer is requesting time interval information for a specified module and function from the slave device. The receiver will return the relevant time information immediately upon receiving the instruction.

2. When the `time` parameter is included, it indicates that the host computer sets the reporting interval for diagnostic alarm information from the receiver. A `time` value of 0 (in seconds) indicates that the diagnostic alarm function is disabled. A value greater than 0 indicates the reporting interval after triggering the alarm threshold. (Note: Before using the setting command, you need to send `SYS CONFIG` to unlock the system.)

For example：

1. Disable GNSS voltage diagnostic alarm function

SYS DIAGETS GNSS,Voltage,0

SYS DIAGETS 3,2,0

2. Set the GNSS voltage alarm reporting interval to 1 second.

SYS DIAGETS GNSS,Voltage,1

SYS DIAGETS 3,2,1

illustrate：

Diagnostic status reporting and diagnostic alarm reporting should be distinguished.

To enable/disable status reporting, use the SYS DIAGTS/SYS DIAGTMS/SYS DIAGFS commands.

To enable or disable alarm reporting, use SYS DIAGETS.

8.13. Read all CAN bus message IDs

[CONFIG-RS232] GET CANID [time]

`time` is an optional parameter. The unit is seconds.

When the instruction does not include a time period, the program defaults to detecting all message IDs on the bus within 2 seconds.

When the instruction includes "time", the program will detect all message IDs on the bus within the specified time period.

Return content：@GET CANID n,ID1,ID2···

The returned message ID is displayed in hexadecimal format.

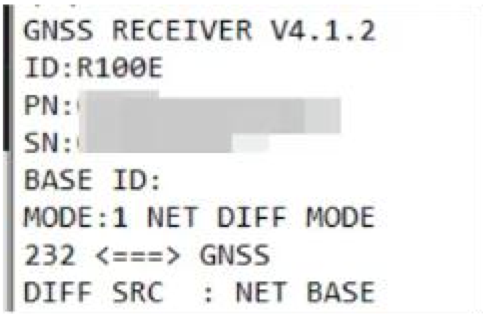
9. Chapter 9 Firmware

9.1. Firmware Updates and Model Upgrades

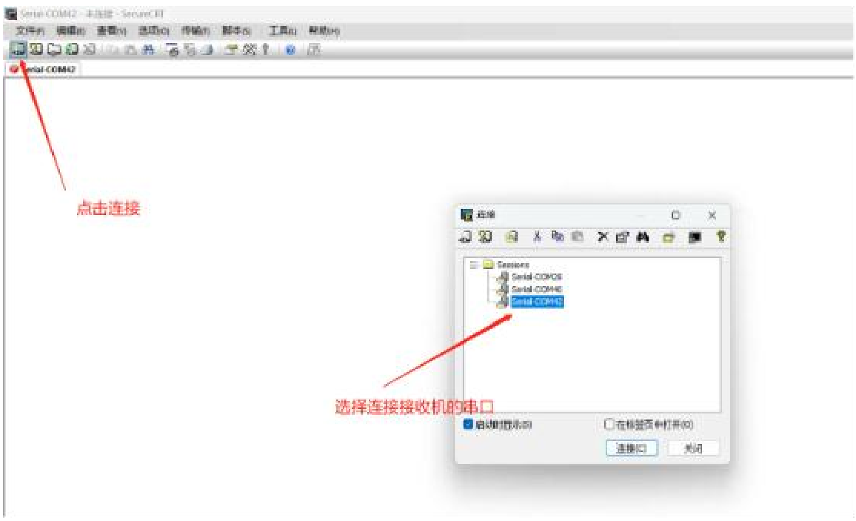
9.1.1. Firmware Update

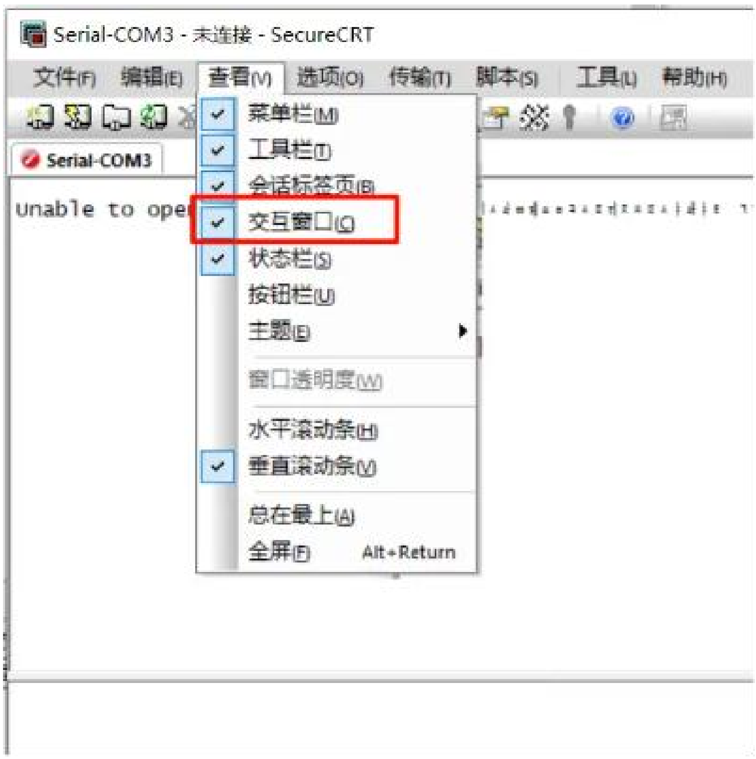
The R100 series receivers support firmware upgrades using common serial port tools such as SecureCRT.

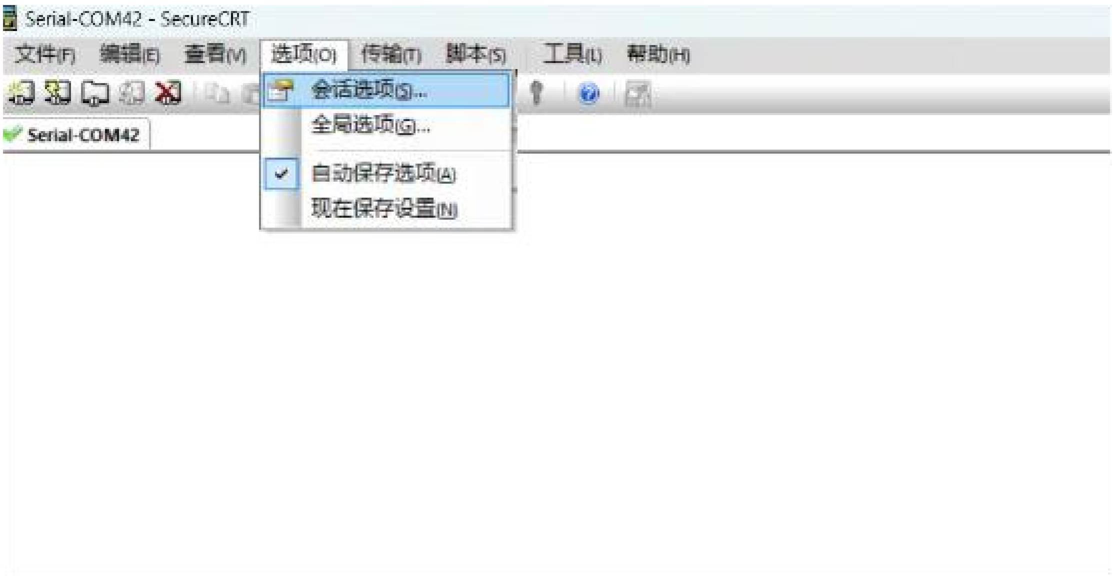
Connect the receiver to CONFIG-RS232 using a DB9 cable, and send SYS SAVE to view the current firmware version V4.1.2.



Open the secureCRT.exe software, select the COM port corresponding to the receiver's serial port, connect, and configure the serial port properties.

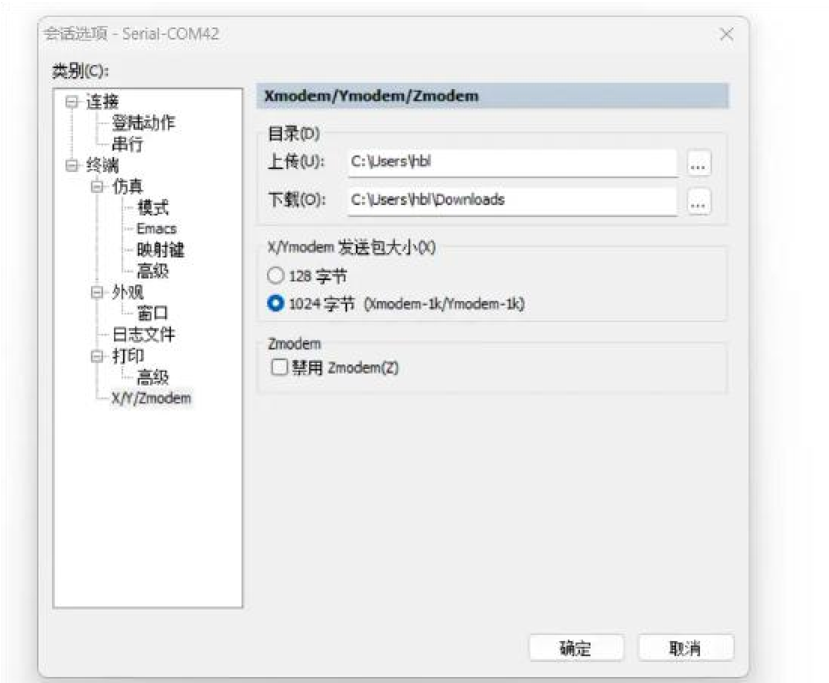



Serial-COM3 - 未连接 - SecureCRT
文件(F) 编辑(E) 查看(V) 选项(O) 传输(T) 脚本(S) 工具(L) 帮助(H)
Serial-COM3
Unable to ope
菜单栏(M)
工具栏(T)
会话标签页(B)
交互窗口(C)
状态栏(S)
按钮栏(U)
主题(E)
窗口透明度(W)
水平滚动条(H)
垂直滚动条(V)
总在最上(A)
全屏(F) Alt+Return


Serial-COM42 - SecureCRT
文件(F) 编辑(E) 查看(V) 选项(O) 传输(T) 脚本(S) 工具(L) 帮助(H)
Serial-COM42
会话选项(S)...
全局选项(G)...
自动保存选项(A)
现在保存设置(N)


会话选项 - Serial-COM42
类别(C):
连接
登陆动作
串行
终端
仿真
模式
Emacs
映射键
高级
外观
窗口
日志文件
打印
高级
X/Y/Zmodem
串行选项
端口(O):
COM42
波特率(B):
115200
数据位(D):
8
奇偶校验(A):
None
停止位(S):
1
流控
DTR/DSR
RTS/CTS
XON/XOFF
串行中断长度(S):
100
毫秒
确定
取消

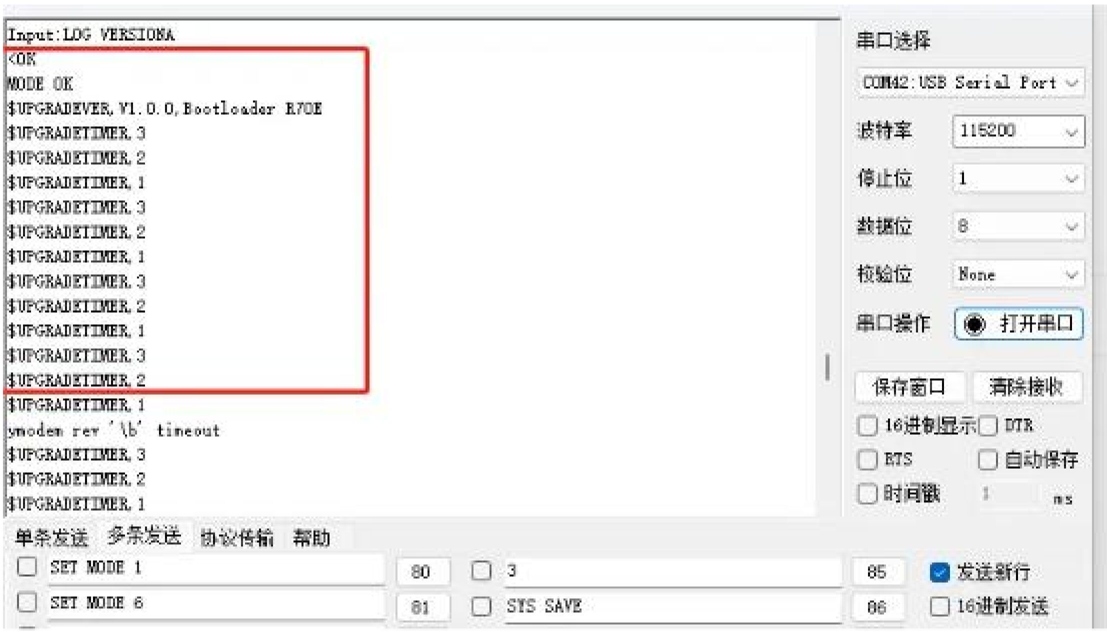

会话选项 - Serial-COM42
类别(C):
连接
登陆动作
串行
终端
仿真
模式
Emacs
映射键
高级
外观
窗口
日志文件
打印
高级
X/Y/Zmodem
仿真模式
初始模式(I)
光标键模式(C)
换行(L)
新行模式(N)
数字小键盘(U)
应用程序键区(A)
当前模式(R)
光标键模式(S)
换行(E)
新行模式(W)
数字小键盘(M)
应用程序键区(P)
模式转换(O)
启用 80/132 列转换(B)
启用光标键模式转换(K)
启用小键盘模式转换(Y)
启用换行模式转换(D)
确定
取消



After clicking OK, enter the following command in the interactive window below and wait for the following image to appear.

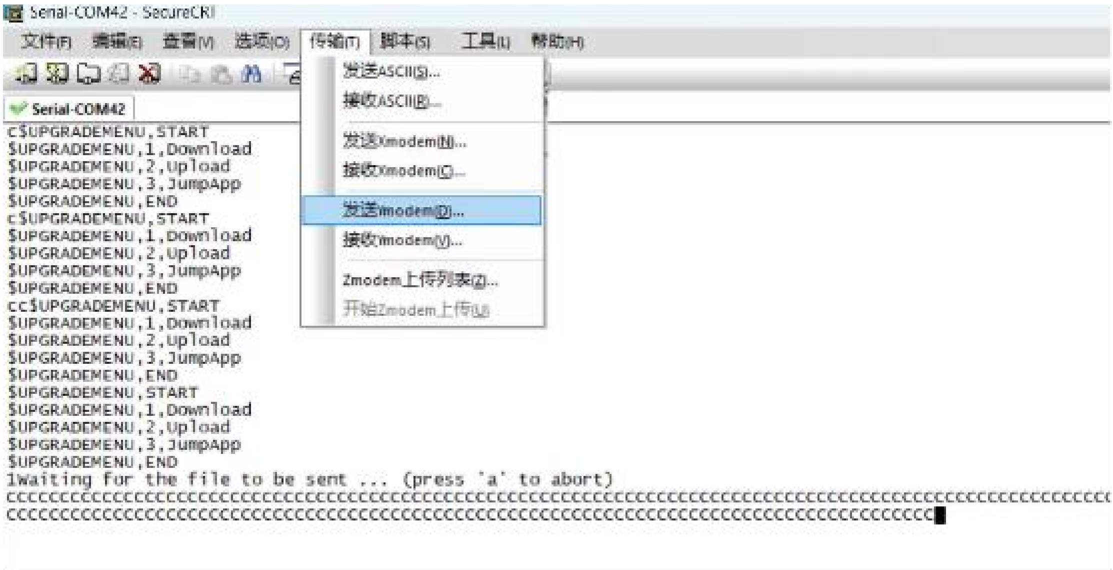
SYS CONFIG

SET MODE 6



Press the backspace key on your keyboard to see the menu list, then send 1 to enter firmware upgrade mode.

The window will then continuously print the character 'C'. Select the transmission option shown in the image below, and then select send (ymodem).



Select the fota.pac file, select "Add A", and select "OK". Sending will then begin. The progress percentage will be displayed on the screen.

9.1.2. Firmware Downgrade

R100 series receivers do not support firmware downgrading.

9.2. Download firmware file

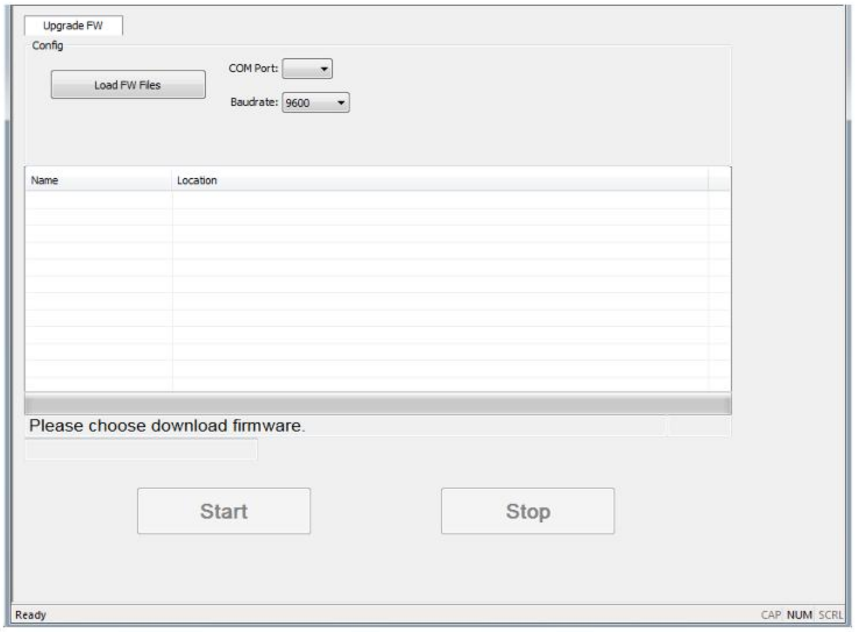
Please contact business or technical support for the latest upgrade files.

9.2.1. Firmware File Format

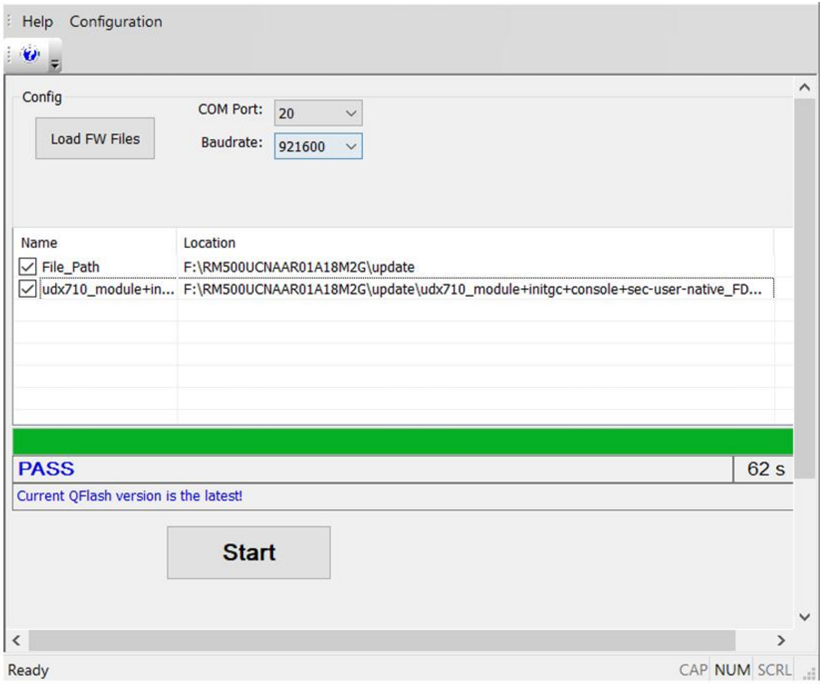
Firmware upgrade files for the R100 series receivers all have the .pac extension.

9.3. Use QFlash to update or upgrade

After launching the QFlash tool, the main interface is shown in the following figure.



Select the serial port corresponding to the Quectel USB AT Port. To find the AT port number, please go to Device Manager on your PC, as shown in the image below.



Appendix A R100 Technical Specifications

A.1 R100 Performance Specifications

GNSS positioning accuracy [1]

Single point positioning (RMS)[2]	flat：1.5 m

	Elevation：2.5 m
DGPS (RMS)[2,3]	flat：0.4 m+1 ppm Elevation：0.8 m+1 ppm
RTK (RMS)[2,3]	flat：0.8 cm+1 ppm Elevation：1.5 cm+1 ppm
PPP (RMS)[4]	flat：5 cm Elevation：10 cm
PPP-AR(RMS)[4]	flat：3 cm @ 5 min Elevation：6 cm @ 5 min
CLAS(RMS)[4]	flat：5 cm @ 1 min Elevation：10 cm @ 1 min
Orientation accuracy (RMS)[7]	0.1 degrees/1 m baseline
PPS 精度(RMS)	20 ns
速度精度(RMS)[5]	0.03 m/s
First positioning time [6]	cold start < 30 s warm start < 4 s
Initialization time [2]	< 5 s (Typical value)
Initial reliability [2]	> 99.9%
Data update rate	Positioning and Orientation 20 Hz 20 HzOriginal observations
Differential data	RTCM 3.X
Data format	NMEA - 0183 Unicore

satellite frequency

aisle	1408 channels, based on Nebulas IV™
constellation	BDS、GPS、GLONASS、Galileo、QZSS
Main antenna frequency	BDS: B1I, B3I, B2a, B2b GPS: L1C/A、L2P (Y)/L2C、L5 GLONASS: G1、G2 Galileo: E1、E5a、E5b、E6 QZSS: L1C/A、L1C/B、L2C、L5、L6 L-Band
From antenna frequency	BDS: B1I, B3I GPS: L1C/A、L2C Galileo: E1、E5b QZSS: L1C/A、L2C

1. This section covers the main antenna performance of the UM982C.

2. Test results are affected by atmospheric conditions, baseline length, GNSS antenna type, multipath propagation, number of visible satellites, and satellite geometry, and may be subject to deviation.

3. Measurements were performed using a 1-kilometer baseline and a receiver with good antenna performance, without

considering possible antenna phase center offset errors.

4. Open sky and undisturbed environment

5. Open sky, unobstructed view, 99% static

6. -130dBm @More than 12 available satellites

7. Laboratory Ideal Environment Test Results

IMU performance parameters

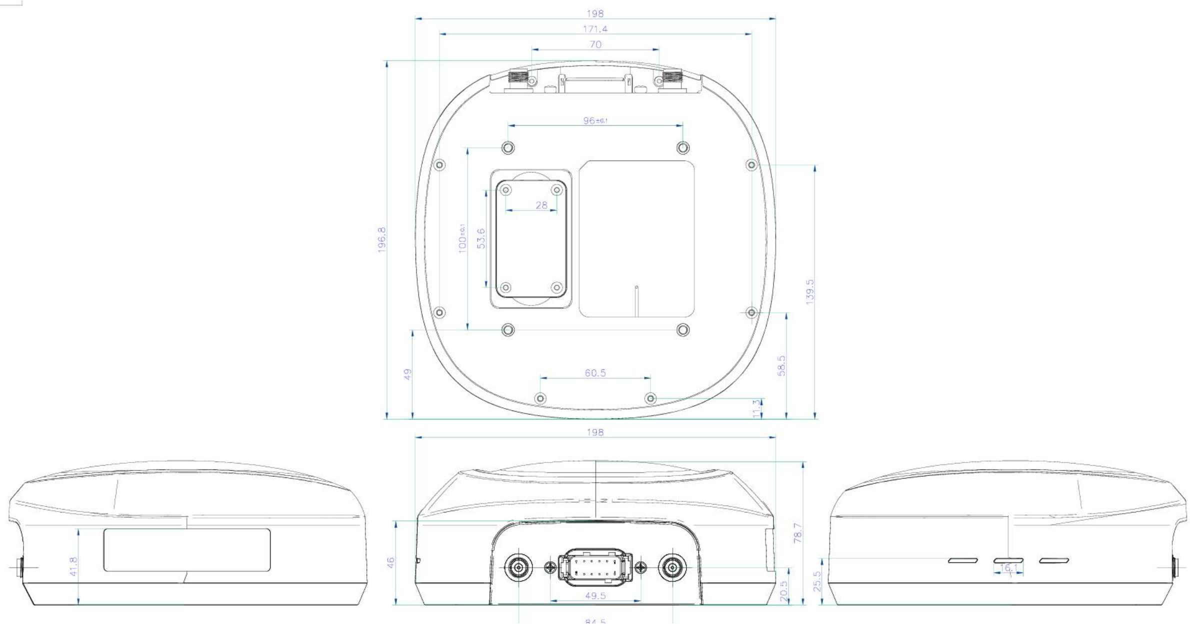
Performance indicators	Attitude accuracy	Roll/Pitch :<0.2° rms Heading:<0.3° rms (Vehicle speed greater than 1km/h, Ackermann steering structure in-vehicle scenario)
	Location estimation accuracy	<2% @1σ (Vehicle-mounted scenario, satellite loss for 30 seconds, no wheel speedometer combination)
	Update rate	100Hz
	Gyroscope range	±500°/s
	Gyroscope zero-bias instability	XY:4°/h Z:3°/h @25℃,ALLAN variance, 1σ
	Accelerometer range	±6g
	Accelerometer zero bias instability	XY:20μg Z:40 μg @25℃,ALLAN variance, 1σ

Radio performance parameters

Frequency range	410-470MHz
Work mode	Single Receiver
Communication Protocol	GFSK model: TRIMTALK、TRANSEOT、TRIMMARK3
	LORA model: LIANSHI、CSST Transmission Protocol
Channel spacing	GFSK model: 12.5KHZ、25KHZ
	LORA model: 250KHz
Modulation method	CSS/GFSK/4FSK
air speed	GFSK model 9600bps、19200bps
	LORA model 18000bps 、 15000bps 、 12000bps、 11000bps
Serial port speed	115200bps 、 38400bps 、 19200bps、9600bps

A.2 R100 Mechanical Specifications

Wireframe diagram (unit: millimeters)



A.3 R100 Environmental and Electrical Specifications

Operating temperature and protection level

User Interaction	indicator lights	POW、SA、LINK
Electrical performance	powered by	9-36V DC
	Power consumption	≤4.0W
physical properties	size	198mm×196.8mm×78.7mm
	weight	＜0.88Kg(No support)
	Material	PC-PBT/ silicone
	Operating temperature	-20℃ ~ +75℃
	Storage temperature	-40℃ ~ +85℃
	Protection level	IP67
	Impact and vibration	A 1m drop, marble

A.4 R100 Data Communication Specification

CONFIG-RS232	
baud rate	115200
Support signal	Sending and receiving
R100 port	12-core Dechi head
COM-RS232	
baud rate	9600, 19200, 38400, 57600, 115200(default), 230400, 460800, 921600

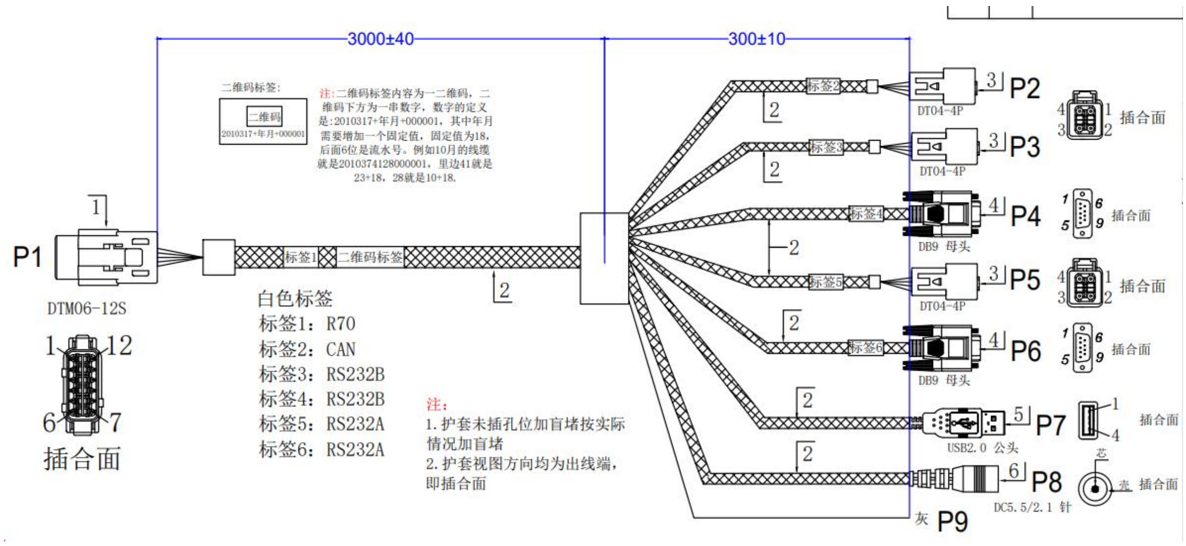
Support signal	Sending and receiving
R100 port	12-core Dechi head
CAN	
Default baud rate	500K
Supported baud rates	250K、500K
R100 port	12-core Dechi head

A.5 R100 Speed Pulse Specification

Signal	Input/Output	illustrate
velocity pulse signal	Output	SET PWMFREQ mode,freq The speed specified in the GPRMC statement is converted into a PWM frequency with a 50% duty cycle according to a specific ratio.

A.6 R100 Antenna Interface Cable (Optional Accessory)

Debugging wire harness



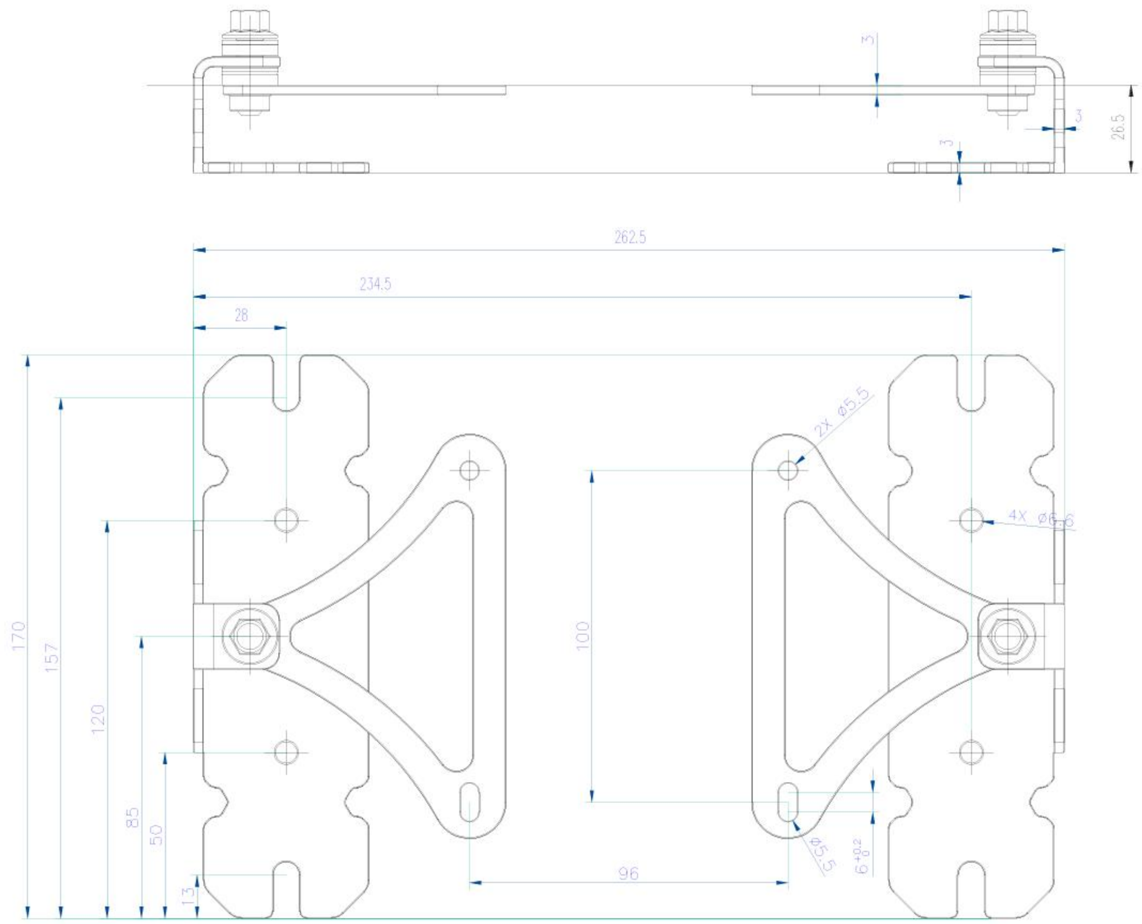
Wiring diagram										
	P1	P2 CAN	P3 CONFIG -RS232	P4 CONFIG -RS232	P5 COM -RS232	P6 COM -RS232	P7 USB	P8 DC	P9 PLS	Core specifications
POW	5 red	1 red						core / red		0.5mm^2
GND	7 black	3 black	3 black	5 black	3 black	5 black	4 black	shell /		0.5mm^2

								black		
CANL	9 Light blue	4 Light blue								$0.5mm^2$ Twisted Pair
CANH	10 orange	2 orange								
232BRX	11 Brown		4 Brown	3 Brown						$0.5mm^2$
232BTX	12 yellow		2 yellow	2 yellow						$0.5mm^2$
232ATX	1 blue				2 blue	2 blue				$0.5mm^2$
232ARX	2 pink				4 pink	3 pink				$0.5mm^2$
USBD+	3 green						3 green			$0.35mm^2$ Twisted Pair
USBD-	4 white						2 white			
PLS	6 Ash								Ash	$0.5mm^2$

A.7 R100 Custom Cable Recommendation

Connection harnesses can be customized to meet specific needs; please contact ALLYNAV's sales manager for consultation.

A.8 R100 Mounting Plate Specifications



This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

-Reorient or relocate the receiving antenna.

-Increase the separation between the equipment and receiver.

-Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

-Consult the dealer or an experienced radio/TV technician for help.

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment.

This equipment should be installed and operated with minimum distance 20cm between the radiator & your body