INSTALLATION AND OPERATION

USER MANUAL

UB4B0

ALL-constellation GNSS
High Precision Board

Revision History

Version	Revision History	Date
Ver. 1.0	First release	Aug. 2017
Ver. 1.1	Update the Dimension of UB4B0	Feb.2019
R1.3	Revise mechanical spec/add HW design notes/remove MEMS info	2019-08-28
R1.4	Add the shield dimension	2019-10-12
R2.0	Align the installation diagram with HW ver3.1	2020-02-20
R2.1	Update Copyright time	2020-04-07
R2.2	Update BDS frequency	2020-06-30
R2.3	Fix typo and update BDS/GPS frequencies	2020-10-22
R2.4	Add the table of absolute maximum rating	2021-04-09
R2.5	Correct the indicating sequence of the LED indictor in Chapter 4	2021-07-06
R2.6	Delete the remaining information about MEMS; Update the maximum value of power supply	2021-08-06

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Foreword

This <User Manual> offers you information in the features of the hardware, the installation, specification and use of UNICORECOMM UB4B0 product.

This manual is a generic version. Please refer to the appropriate part of the manual according to your purchased product configuration, concerning CORS, RTK and Heading.

Readers it applies to

This <User Manual> is applied to the technicists who know GNSS Receiver to some extent but not to the general readers.

Contents

1 Overview

Thanks for purchasing and using UB4B0 GPS/BDS/GLONASS/Galileo All-Constellation All-Frequency High Precision OEM Board. The board employs the new generation all-constellation multi-core high precision SoC—NebulasII (432 channel tracking), which is based on the mature baseband technology, with 55nm low power consumption, in which built the broadband ADC and anti-interference unit, integrating two 600MHz ARM processors and a special high-speed floating-point processor, and providing more powerful satellite navigation signal process ability.

UB4B0 provides millimeter-level carrier-phase observation data and centimeter-level RTK position output, supports advanced multi-path mitigation and low angle tracking; UB4B0 is suitable for high precision surveying and mapping application, especially for geodetic surveying, engineering survey, deformation monitoring, mechanical control, meteorological monitoring, precision agriculture, continuous operation reference station (CORS), advanced instantaneous RTK and long-distance RTK, etc.

Figure 1-1 UB4B0 Board

1.1 Key Features

➢ Based on NebulasII new generation multi-system multi-frequency high-performance SoC

➢ 432 super channels and dedicated fast acquisition engine

➢ Support BDS, GPS, GLONASS, Galileo and QZSS, etc.

➢ Hardware size compatible with current GNSS OEM boards

- ➢ Support GPS/BDS/GLONASS/Galileo single system positioning and multi-system positioning

- ➢ Support advanced multi-path mitigation and low angle tracking

- ➢ Support rover station RTK

- ➢ Millimeter-level carrier-phase observation data

- ➢ High reliability, high stability, suitable for challenging environment

- ➢ Support RS232, Ethernet, 1PPS, external clock input

2 Hardware Design in Considerations

To keep UB4B0 functioning normally, the following signals need to be connected correctly:

- ➢ The module's VCC should be monotonic when powered on, the initial level should be lower than 0.4V, and the undershoot and ringing should be guaranteed within 5% VCC

- ➢ It is recommended to use a power chip with current output capacity greater than 2A to power the board

3 Installation

This section contains the list of the product package and the details of product installation.

3.1 Package Inspection

Please check the contents of the package carefully after receiving the package of UB4B0:

- ➢ UB4B0 board and EVK suite (or evaluation board) (or enclosure)

- ➢ User manual (CD attached)

- ➢ Command manual (CD attached)

- ➢ UPrecise software (CD attached)

- ➢ MMCX antenna cable

- ➢ Cross serial port cable

3.2 ESD Protection

A lot of components on UB4B0 are susceptible to electrostatic damage, which affects IC circuits and other components. Please follow the instructions below for ESD protection before open the plastic package:

➢ Electrostatic discharge (ESD) can damage components. Please use an anti-static work bench, a conductive foam pad, and at the same time, wearing an anti-static wrist strap. If ESD workstation is not available, wear an anti-static wrist strap and attach it to metal parts of your industrial PC in order to obtain protection against static electricity.

➢ Please use the edge of the board, avoiding to touch the components on the board while fetching or putting the boards

➢ Please carefully check for obviously loose or damaged components after removing the package from the boards. If you have any questions, please contact your local dealer.

Please save the package boxes and plastic containers for storage and transport.

3.3 Board Overview
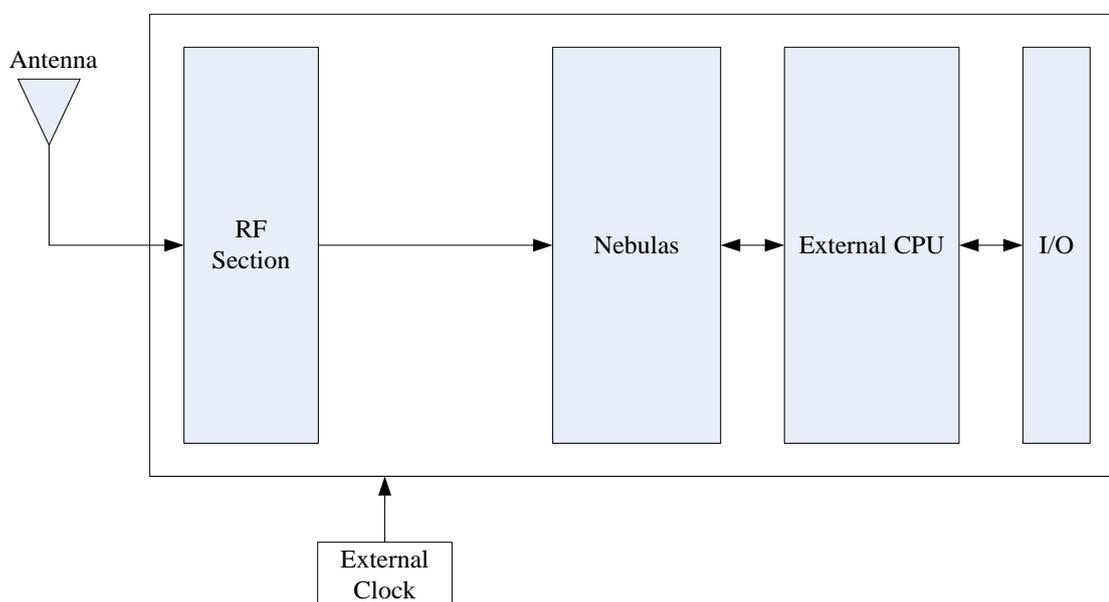
Figure 3-1 Structure Diagram

1. **RF Part**

The receiver gets filtered and enhanced GNSS signals from the antenna via a coaxial cable. The RF part converts the RF input signals into the IF signals, and converts IF analog signals into digital signals required for NebulasII chip (UC4C0).

2. **NebulasII SoC (UC4C0)**

NebulasII (UC4C0) is Unicore's new generation high precision GNSS SoC with 55nm low power design, supports up to 12 digital intermediate frequency or 8 analog intermediate frequency signals, which can track 12 navigation signals with 432 channels.

3. **1PPS**

UB4B0 provides 1 PPS with adjustable pulse width and polarity and 1 output pulse width.

4. **Event[1]**

UB4B0 provides 1 Event Mark Input.

5. **I/O**

Power input, data communication port, pulse trigger, LED etc.

3.4 Installation Guide

UB4B0 is delivered as a board, users can flexibly assemble according to the scenario and the market need. Figure below shows the typical installation of UB4B0 with evaluation kit (EVK), users can also use other enclosures to install receiver, using the same method.

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[1] Supported on customized versions
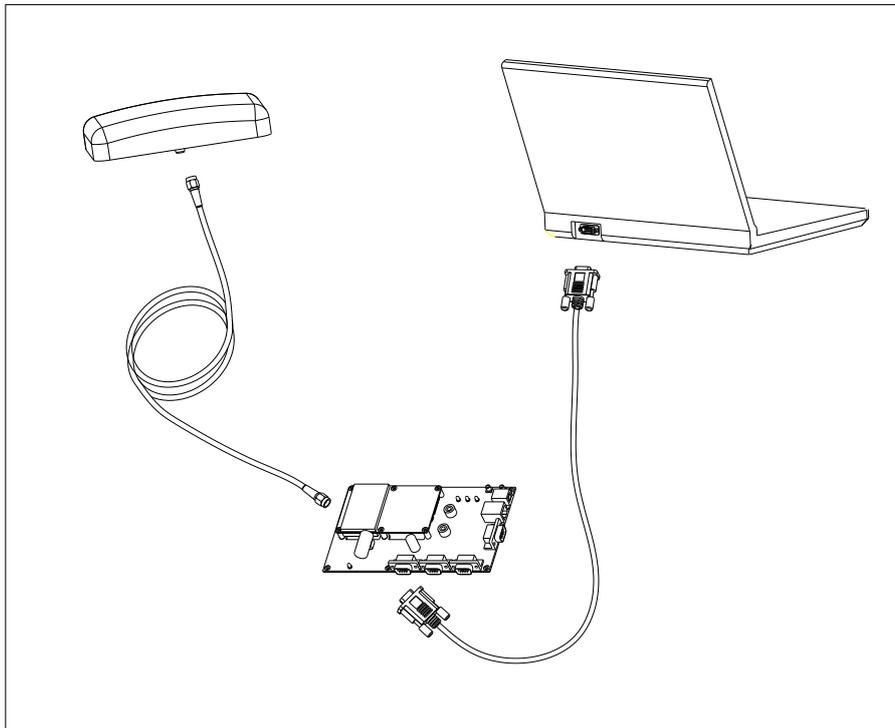
Figure 3-2 UB4B0 Installation

For efficient installation, please prepare the following items before installation:

- ➢ UB4B0 EVK suite (or evaluation board) (or enclosure)

- ➢ User manual

- ➢ Command manual

- ➢ UPrecise software (CD attached)

- ➢ Qualified antenna

- ➢ MMCX antenna cable

- ➢ PC or Laptop with serial ports (Win7 and above), with UPrecise installed

After the above preparation is made, please follow the steps below to install:

Following the steps below to install the device:

1. Align UB4B0 positioning holes and pins with EVK, and fix UB4B0 on the EVK. EVK

    provides power supply and standard communication interface for the board, to

communicate with peripheral devices (such as PC, USB devices[2], and so on).

Figure 3-3 Installation Step 1

2. Select a GNSS antenna with appropriate gain, and mount it in an open sky area. Connect the antenna to J1 MMCX port of UB4B0 via coaxial RF cable.

Antenna RF input

Figure 3-4 Installation Step 2

NOTE: The RF connector on the board is MMCX, please select the appropriate cable. The signal gain to the RF connector should be within 25 to 35dB. The Antenna connector provides 5V DC antenna feed.

3. Connect the PC with EVK through serial ports, or through Ethernet ports.

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[2] Only for manufactory test

Figure 3-5 Installation Step 3

Figure 3-6 Installation Step 3

4. Connect a 12V adapter with the EVK power input, and switch on to power the device

Figure 3-7 Installation Step 4

5.   Start UPRECISE on the PC

6.   Refer to UPRECISE online help to send commands or log data for the receiver

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Note: If the board has not been in use for a long time, or the distance between the last location and the current location is above 1000Km, a slower fix may occur. In that case, please use the FRESET command to clear the older ephemeris and Almanac information (this command will also clear the Board setup information). After the FRESET command is executed, the board will be reset, it will take 15 minutes to collect new ephemeris and Almanac information.

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4   LED Indicators

There is a double color LED indicator on UB4B0, which can indicate the working status of the board.

No	Status		Red	Green	Remark
1	Single Point Positioning	BDS	Off	0.25s	Green Fast Flash
2		Multi-System	0.25s	0.25s	Orange Fast Flash (red and green on)
3	Differential Positioning	BDS	Off	1s	Green Slow Flash
4		Multi-System	1s	1s	Orange Slow Flash (red and green on)
5	Insufficient satellites		1s	Off	Red Slow Flash
6	Status Switch		Blank 1s	Blank 1s	Time interval between two positioning status
7	Abnormal		0.25s	Off	Red Fast Flash, abnormal status other than 1-5

No	Status	Red	Green	Remark
8	Power on	Red Stead on	Off	Switch into other status after starting up.

1. For normal status, the indicating sequence is: power on -> status switch -> insufficient satellites -> status switch······ insufficient satellites -> status switch -> single point positioning -> status switch······single point positioning -> status switch -> differential positioning -> status switch -> differential positioning······

2. If abnormal status occurs on the board, the indicating sequence is: power on -> abnormal, or normal -> abnormal
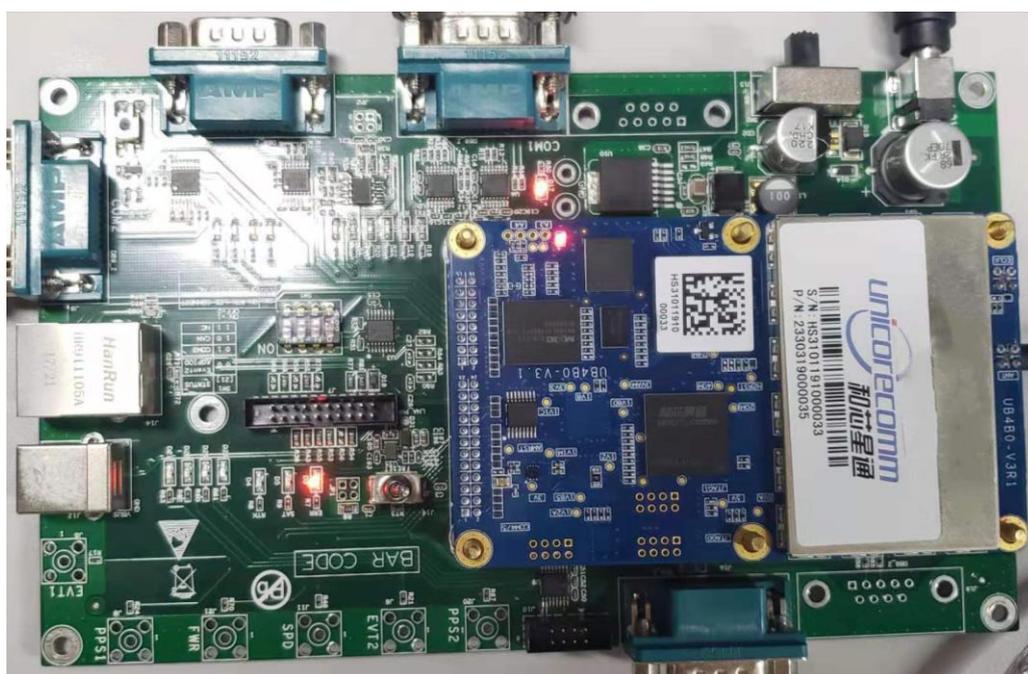
Figure 4-1 LED Indicators

5 PC Utility Configuration (UPrecise)

5.1 Overview

UB4B0 Unicore UPRECISE (Control and Display Tool) provides a user-friendly graphical interface to control and display the operation of your receiver. User can access the

functionality and information just through several clicks.

The following features are included in UPRECISE：

- ➢ Connecting the receiver, configuring the baud rate

- ➢ Graphic window for displaying Position of satellite, PRN, and Signal/Noise Ratio (Constellation View)

- ➢ Displaying the historical and present Trajectory of the receiver, as well as the position, velocity, and time (Trajectory View)

- ➢ Graphic interface for data logging, sending commands to the Receiver (Logging Control View)

- ➢ Console window for sending command to receiver (Console View)

- ➢ Sending commands to the Receiver

- ➢ The trajectory view for displaying the present point and the past point of the Receiver

- ➢ Upgrading the firmware

- ➢ TTFF test

Figure 5-1 UPrecise Overview

5.2 Operation Steps

1. Follow the tutorial to install the board, and turn on the EVK switch

2. Click file -> connect the serial port, set the baud rate, the default baud rate is 115200bps
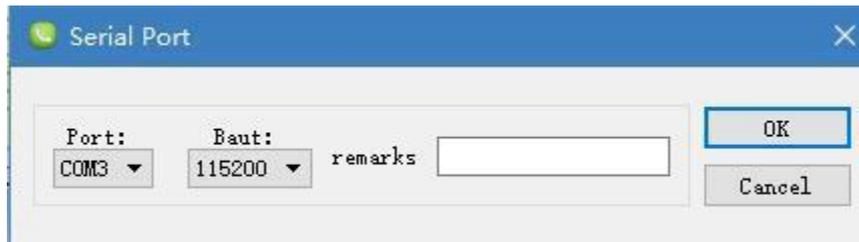
Figure 5-2 Configure Baud Rate

3. Click the receiver settings button to configure the NMEA message output. It is recommended to configure GPGGA, GPGSV, and other messages.
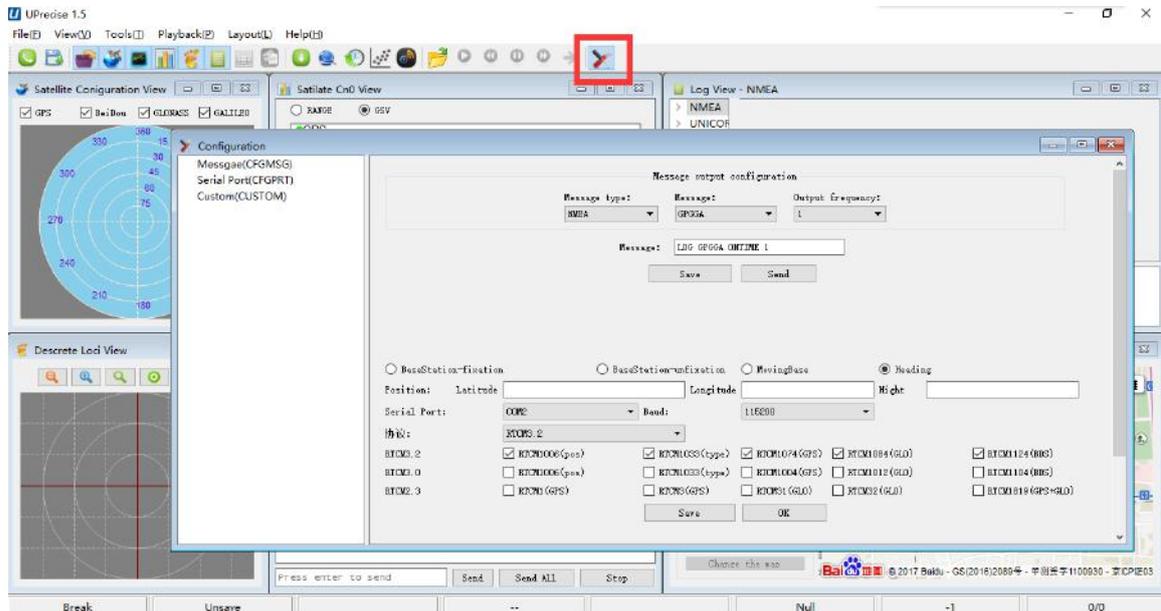
Figure 5-3 Configure NMEA Output

4. Click the receiver settings button, configure the NMEA message output, and click send. It is recommended to configure GPGGA, GPGSV, and other statements. or

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5. In the dialog window, click on "Send all Message" to complete all the NMEA

    message output (update rate 1Hz). Right click in the data session window to

    adjust: output log font size, stop / resume log output, or clear log content

6. Configure or type commands according to requirements in various UPrecise views

6 Firmware Update (WinConfig)

WinConfig (in the attached CD) software is used for the remote update of UB4B0, please

follow the steps below to install the software:

☞ During the firmware update of the board, please stop all the operations to the
device, including the cutoff of the power supply.

Step 1: Click the program icon to run the software:

Figure 6-1 WinConfig Welcome Interface

Step 2: Click "Next" to browse the firmware update package:
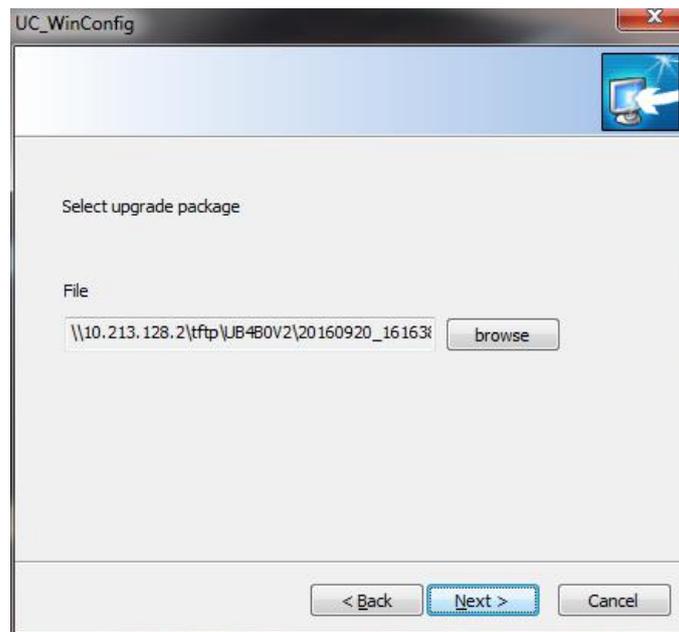
Figure 6-2 Select Firmware Update Package

Step 3: Click "Next" to display the communication type:
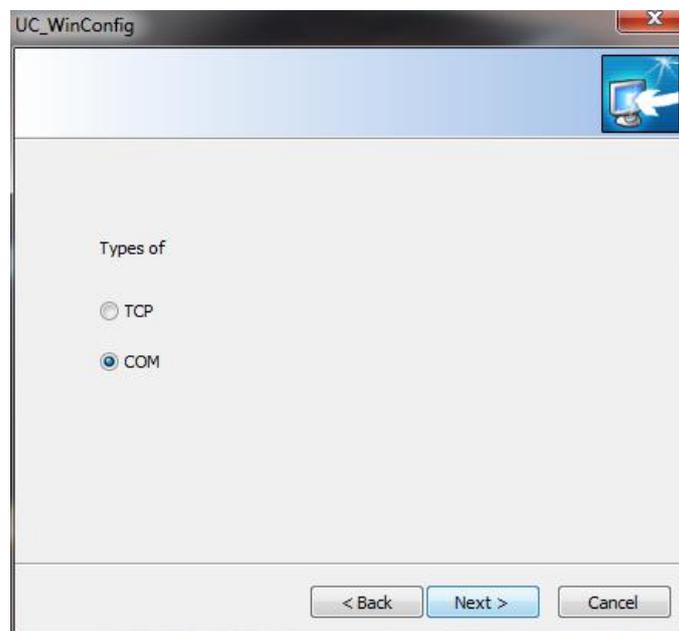
Figure 6-3 Select Communication Type

Step 4: Select the communication type as through Serial Port (COM), click "Next" to
configure:
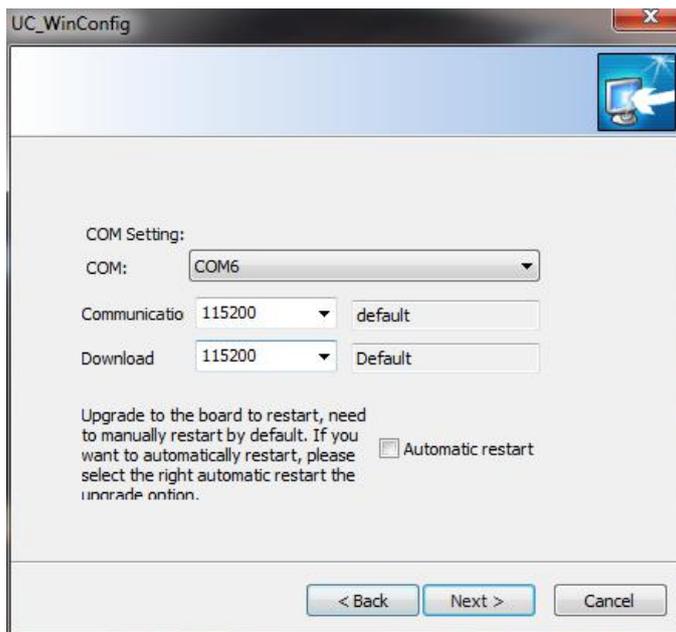
Figure 6-4 Serial Port Communication Configuration

☞ Please use COM1 to update firmware.

Step 5: After the configuration of the COM port, click "Next" to prompt the configuration

summary dialog:
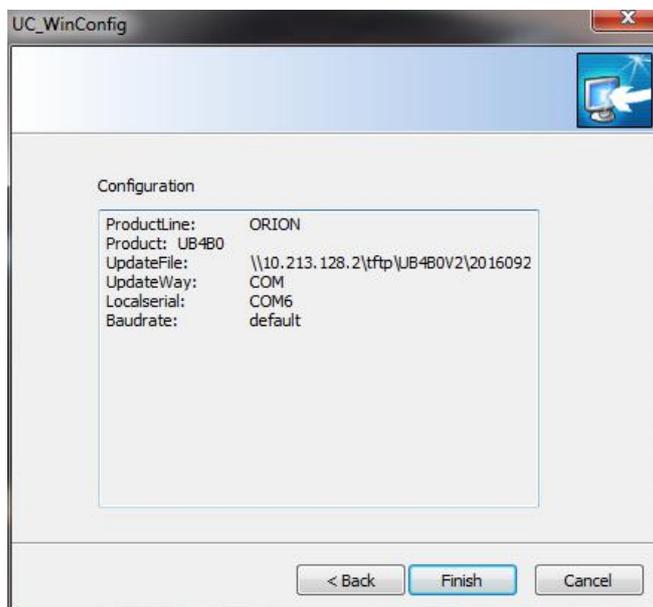
Figure 6-5 Serial Port Upgrade Configuration Summary

Step 6：Check the summary to make sure the receiver is correctly configured, then click

"Finish" to prompt the Upgrade window:
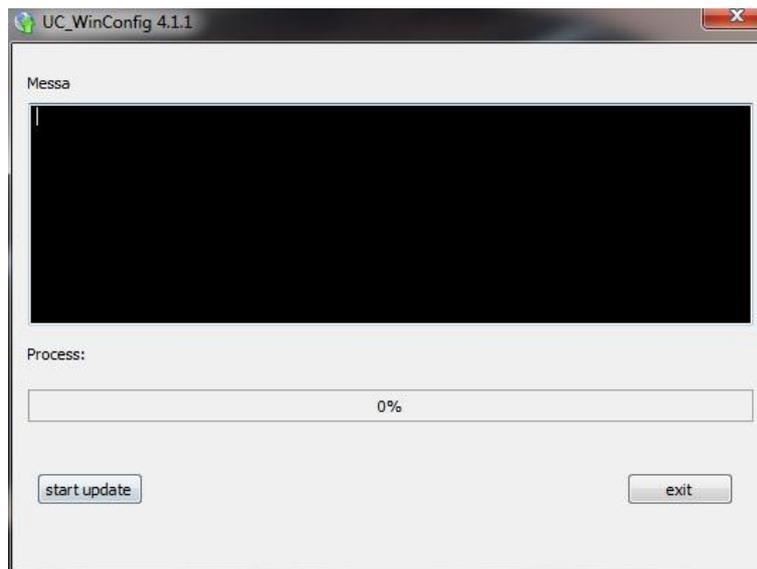
Figure 6-6 Firmware Upgrade Window

Step 7: Click "Upgrade" to start the firmware upgrading process:
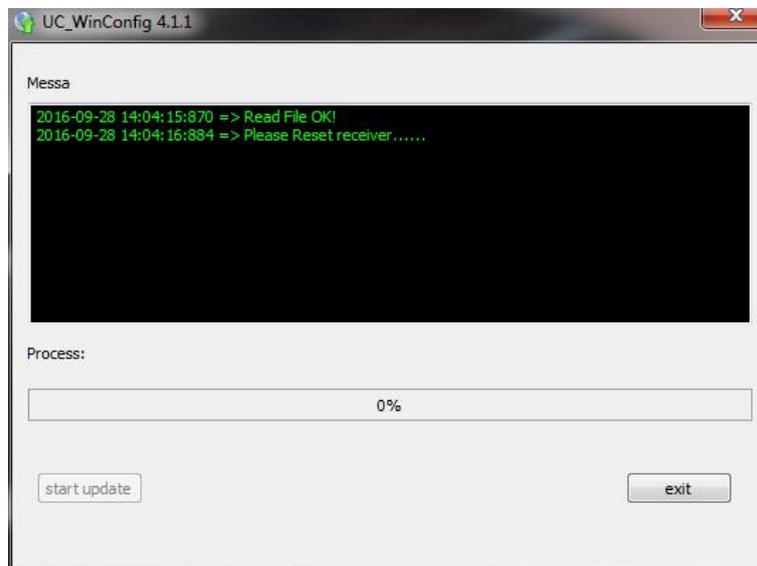
Figure 6-7 Serial Port Upgrade Success

☞ The "Upgrade" button is gray and can't be clicked while the receiver is in the upgrading process, unless the upgrade is complete, or an error occurs during the upgrade process.

Step 8: Check if the firmware upgrading process is finished successfully.

7 Hardware Interface

This chapter is a brief introduction about UB4B0 receiver I/O port and Electrical Characteristics, please connect correctly to avoid unnecessary damage.

7.1 Absolute Maximum Rating

Item	Pin	Min	Max	Unit
Power Supply (VCC)	Vcc	-0.3	3.6	V
VCC Ripple (Rated Max.)	Vrpp	0	50	mV
LVTTL Voltage Input	Vin	-0.3	3.6	V
Antenna RF Input Power Consumption	ANT_IN input power		+15	dBm

7.2 Power Input

Index	Description
Acceptable Velocity Input Range	3.3V +5%/-3%

Note: Please avoid switching power supply frequently, it is recommended that the switching interval is more than 5s.

7.3 RF Input

Index	Description
RF Input	-85 dBm ~ -105 dBm
Signal Input	BDS B1I/B2I/B3I/B1C/B2a/B2b*+GPS L1/L2C/L2P(Y)/L5+GLONASS L1/L2+Galileo E1/E5a/E5b
LNA power supply	+4.75 ~ +5.10 VDC, 0 ~ 100 mA

7.4 External Clock Input

Index	Description
External Clock Input	Frequency: 10 MHz
	Voltage Peak: 1.2V~1.8V
	Frequency Stability: max ± 0.5 ppm
	Waveform: Sine

7.5 Serial Port Access

Index	Description
Baud Rate	115200bps by default

Note: When configuring the serial port, make sure that the baud rate matches the data amount and confirm that the baud rate set by your hardware device is supported. Otherwise, an error may occur.

7.6 Pin Function

UB4B0 provides dual row 2x12 pin (2.0mm pitch) as main interface.

As follows:
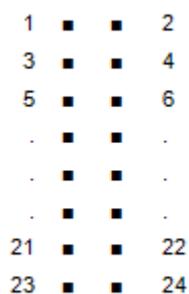
No	Signal	Type	Description	Note
1	GND	Ground	Ground Reference	
2	RTK LED	Output	RTK LED	LVTTL, high level effective
3	Reserved	RSV	RSV	RSV
4	PPS	Output	Time Mark Output	LVTTL
5	VCC	Power	Supply Voltage, +3.3V	+5%/ − 3%
6	VCC	Power	Supply Voltage, +3.3V	+5%/ − 3%
7	Rx3 or Event2	Input	External Event 2 Default: COM3 Receive Data	LVTTL
8	Event1	Input	External Event 1	LVTTL
9	ERROR	Output	Error Detected LED	LVTTL, Low Level effective
10	Satellite LED	Output	Satellite LED	LVTTL, Low Level effective
11	CTS2	Input	COM2 Clear to Send	LVTTL
12	RESETIN	Input	Hardware reset	LVTTL, Low Level effective, duration >5ms
13	RTS2	Output	COM2 Request to Send	LVTTL
14	RxD2	Input	COM2 Receive data	LVTTL
15	CTS1	Input	COM1 Clear to Send	RS-232
16	TxD2	Output	COM2 transmit data	LVTTL
17	RTS1	Output	COM1 Request to Send	RS-232
18	RxD1	Input	COM1 receive data	RS-232

No	Signal	Type	Description	Note
19	TxD3 or GPIO0	Input/Output	General Purpose I/O Default: COM3 Transmit Data	LVTTL
20	TxD1	Output	COM1 transmit data	RS-232
21	USB D (-)	Input/Output	USB D -	
22	USB D (+)	Input/Output	USB D+	
23	GND	Ground	GND	
24	GND	Ground	GND	

In addition, UB4B0 provides a 10/100M Ethernet interface, CAN, Odometer interface, with dual row 2x8 pin (2.0mm pitch).

As follows:
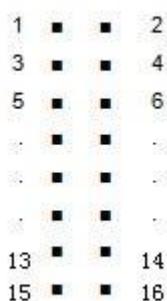
No.	Signal	Function	Description
1	ETH_RD-	Negative electrode of Ethernet receiving data, Differential pair.	Connect to RD-
2	ETH_RD+	Positive electrode of Ethernet receiving data, Differential pair	Connect to RD+
3	CENT_RD	Ethernet interface transformer center receives taps	Connect to RD Center Tap
4	ETH_TD+	Positive electrode of Ethernet receiving data, Differential pair	Connect to TD+
5	ETH_TD-	Negative electrode of Ethernet receiving data, Differential pair.	Connect to TD-
6	CENT_TD	Ethernet interface Transformer center send taps	Connect to TD Center Tap
7	ETH_LINK	Ethernet interface connect indicator light LOW Level: connection building; High Level: ununited;	

No.	Signal	Function	Description
8	ETH_SPD	Ethernet interface network speed indicator LOW Level: 100Mbps High Level: 10Mbps	
9	GND	Ground	GND
10	CAN_TX	CAN bus transmit data	
11	CAN_RX	CAN bus receive data	
12	Reserved	Reserved	Reserved
13	GND	Ground	GND
14	SPEED	Odometer velocity Input[3]	
15	FWR	Odometer direction message Input	
16	GND	Ground	GND

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[3] This will be supported in the future release

Appendix I Mechanical drawing

Parameter	Value	Tolerance
Length	100mm	-0.2mm +0.5mm
Width	60mm	±0.2mm
Height (PCB)	1.6mm	±10%
RF Connector	4.5mm	±0.2mm
Shield	3.1mm	±0.2mm
Pin Height	5.9mm	±0.2mm
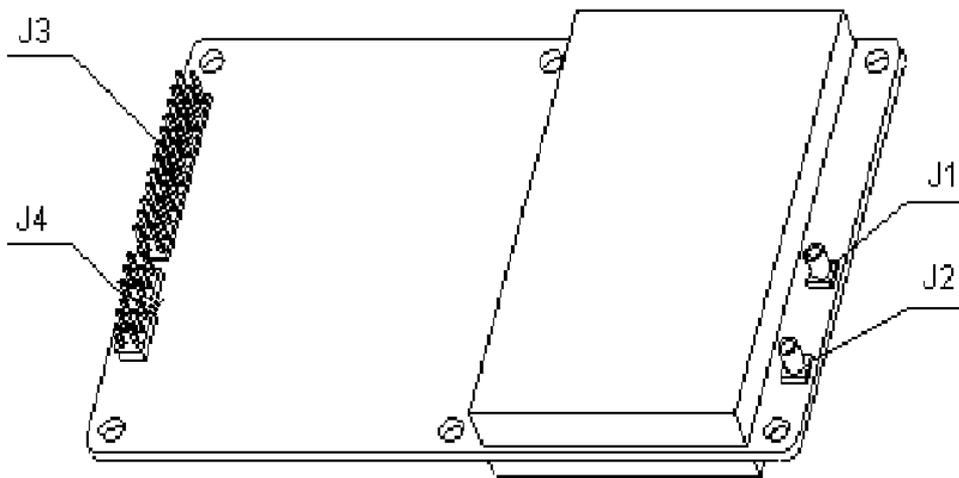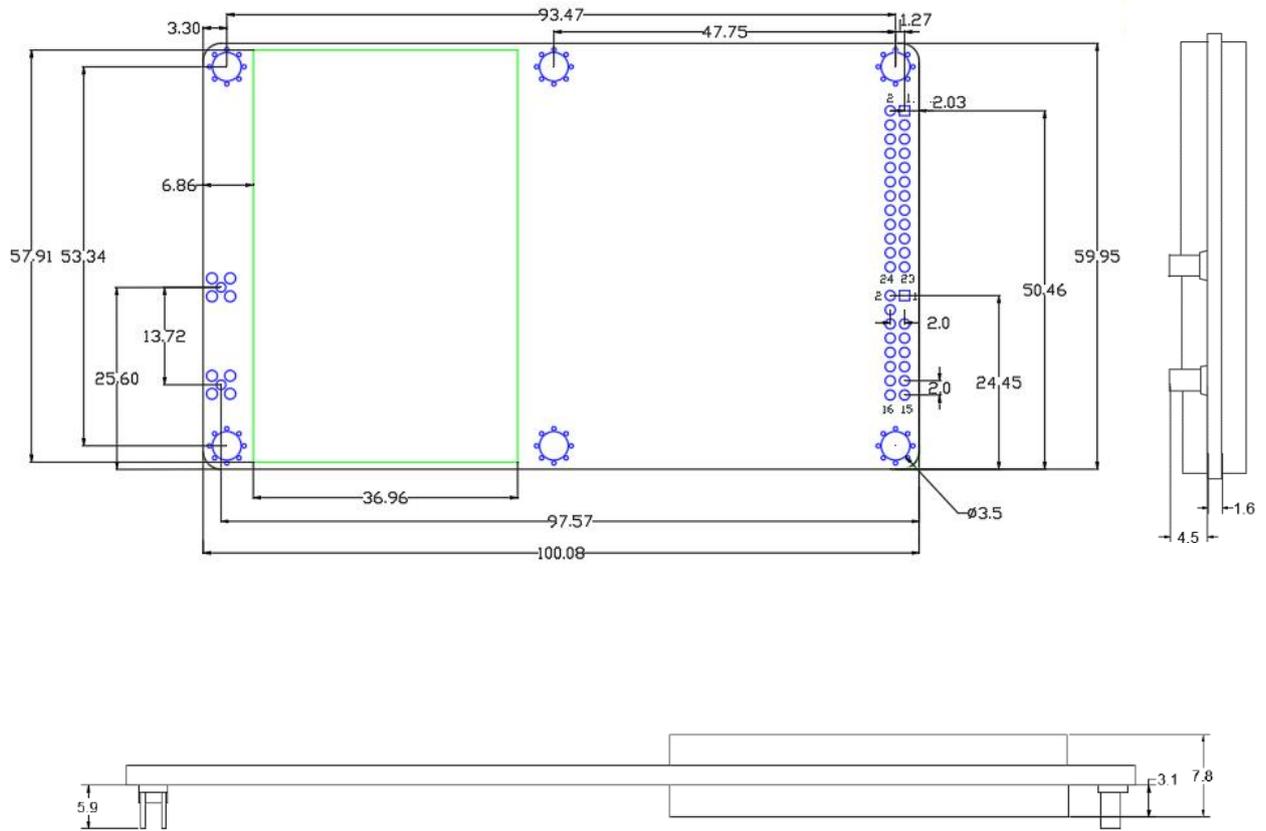
J1: MMCX female, GNSS antenna interface

J2: MMCX female, 10M external clock interface

J3: 2x12 dual row pin (2.0mm pitch）

J4: 2x8 dual row pin (2.0mm pitch)

Appendix II Technical Specifications

Performance Specifications

Channels	432 channels, based on NebulasII SoC	Cold Start	<40s
Frequency	BDS B1I/B2I/B3I/B1C/B2a/B2b* GPS L1/L2C/L2P(Y)/L5 GLONASS L1/L2 Galileo E1/E5a/E5b QZSS L1/L2/L5	Hot Start	<10s
		Re-Acquisition	<1s
		RTK Initialization Time	<5s (Typical)
Single Point Positioning (RMS)	Horizontal: 1.5m Vertical: 2.5m	Initialization Reliability	>99.9%
DGPS (RMS)	Horizontal: 0.4m Vertical: 0.8m		
RTK (RMS)	Horizontal: 1cm+1ppm Vertical: 1.5cm+1ppm	Differential Data	RTCM 3.2/3.0
		Data Formats	NMEA-0183, Unicore
Measurement Precision (RMS)	BDS GPS GLONASS Galileo	Update Rate	20Hz
B1/L1 C/A/E1 code	10cm 10cm 10cm 10cm	Positioning Update Rate	20Hz
B1/L1/E1 Carrier Phase	1mm 1mm 1mm 1mm	Time Accuracy (RMS)	20ns
B2/L2P(Y)/L2C /E5a Code	10cm 10cm 10cm 10cm	Velocity Accuracy (RMS)	0.03m/s
B2/L2P(Y)/L2C /E5a Carrier Phase	1mm 1mm 1mm 1mm	Network Protocol	NTRIP, HTTP, FTP
B3/L5/E5a Code	10cm 10cm 10cm		
B3/L5/E5a Carrier Phase	1mm 1mm 1mm		

 * refers to that B2b is supported with the firmware upgraded

Physical Specifications

Dimension	100×60×11.4 mm
Weight	45g
Operating Temperature	-40℃～+85℃
Storage Temperature	-40℃～+85℃
Humidity	95% non-condensing
I/O Connectors	2x12 Pin 2x8 Pin
Antenna Input	MMCX
External Clock Input	MMCX
Vibration	GJB150.16-2009, MIL-STD-810
Shock	GJB150.18-2009, MIL-STD-810

Electrical Specifications

RTC	3.0~3.3VDC
LNA	4.75~5.10V, 0~100 mA
Voltage Ripple	100mV p-p（max）
Power Consumption	2.8W (typical)

Functional Ports

Serial	1x UART (RS-232), 2 x UART(LV-TTL), 115200bps
Internet Access	1x LAN, 10/100M
1PPS Interface	LV-TTL
USB Interface	1x USB 2.0 Host & Device
CAN Interface	1x CAN
Speedometer	1x wheel pulse 1x heading

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