AK988EU

Dalang Communication Technology Co., Ltd Product Specification

Product Name:	GNSS Receiver
Product Model:	AK988EU
Version Number:	V 1.0
Revision Date:	2024.12.13

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Contents

1 Product Application Scenarios

K988EU is a 4G RTK positioning terminal device that transmits RTK differential base station data to the positioning module through 4G network to achieve RTK accurate positioning. The terminal supports Ntrip communication protocol and supports network base station services such as Qianxun position, CORS station, and self built station. Adopting industry-leading 4G hardware solutions, supporting the network standards of most domestic and European operators, adopting a 9-36V wide power input design, RTK positioning data supports RS232 and BT output. Refer to Figure 1 for details.

Figure 1 Product Application Scenarios

2 Features

In this chapter, we will delve into and comprehensively elaborate on the functionalities and operating principles of the K988EU, detailing how it plays a pivotal role in various applications as follows:

1. Support full constellation multi frequency chip level RTK positioning and dual antenn a heading solutions.

2. Supports BDS, GPS, GLONASS, Galileo, QZSS, and SBAS.

3. The terminal supports Ntrip communication protocol and supports network base stati on services such as Chihiro location, CORS stations, and self built stations.

4. Can be used as a mobile station and heading.

5. Adopt on-board standard 9-36V wide voltage input.

6. Adopt industrial grade 4G network communication module.

3 Structural Characteristic

In this section, we will conduct an in-depth analysis of the product's design details, presenting its aesthetic features and precise interface specifications through detailed structural diagrams. This perspective aims to provide a comprehensive framework, thereby enhancing the understanding and perception of the product's architecture. Refer to Figure 2， Table 1， Figure 3， Table 2， Figure 4。

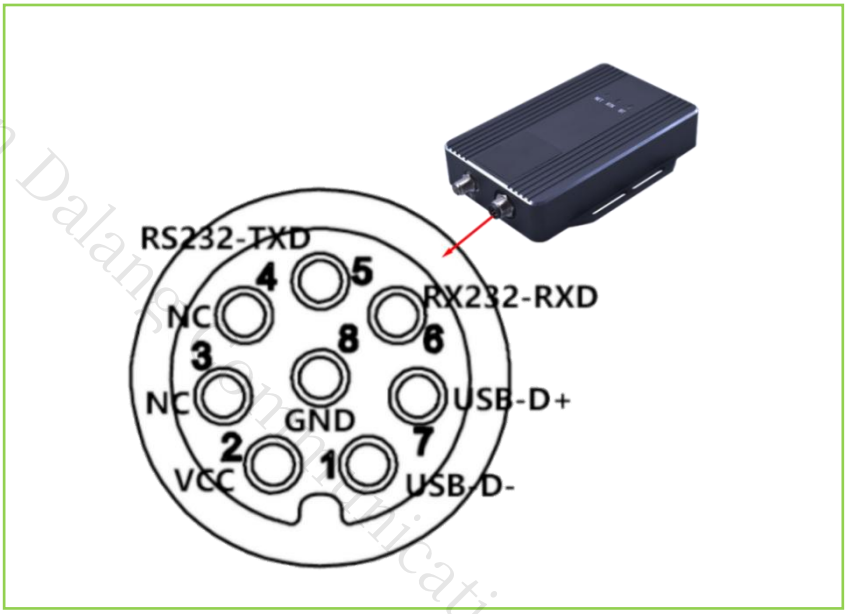


Figure 2 Interface Definition Diagram

Table 1 M8 Interface Definition

Serial Number	Interface Name	Function Introduction
1	USB-D-	Parameter configuration USB interface D-
2	VCC	power input DC9-36V
3	NC	empty
4	NC	empty
5	RS232-TXD	RTK positioning output RS232-TXD
6	RS232-RXD	RTK positioning output RS232-RXD
7	USB-D+	Parameter configuration USB interface D+
8	GND	Grounding
Antenna interface		
1	GNSS	Active positioning antenna, 3.3V, SMA interface
2	NET	4G antenna interface, SMA

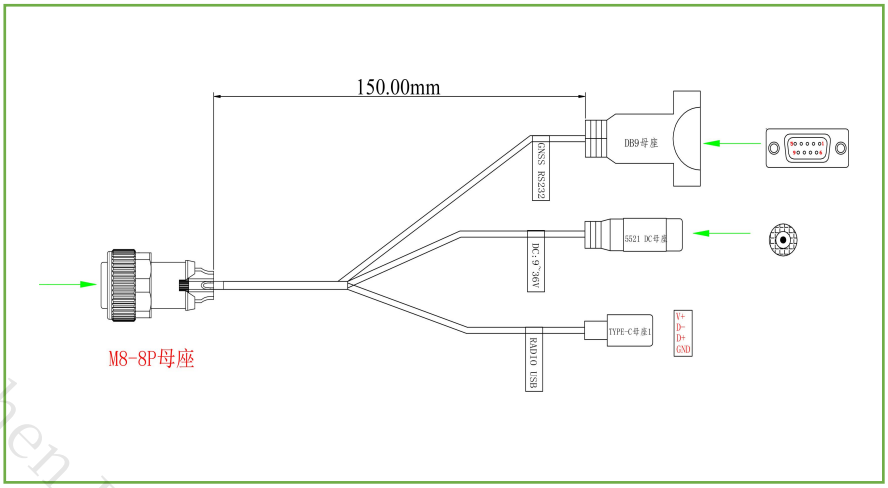


Figure 3 Schematic diagram of connecting wires

Figure 4 Complete K987 Connection Scheme

Table 2 Complete Component Description

Number	Name	Quantity	Remarks
1	AK988EU terminal	1	
2	Connecting line	1	M8 aviation head to type C; DC-DC power supply; DB9 female head
3	GNSS antenna	2	Full system full frequency antenna
4	Coaxial line	2	5mTNC to SMA, 50-3 wires
5	4G antenna	1	

4 Specifications

In this section, we will provide a detailed list and explanation of the product's chip features, sensitivity, accuracy, operating principles, and other technical details, as detailed in Table 3.

Table 3 Product Specifications

Specification parameters						
GNSS module	1	Working mode	BDS: B1I、B2I、B3I GPS: L1C/A、L2P (Y)、L2C、L5 GLONASS: L1、L2 Galileo: E1、E5a、E5b QZSS: L1、L2、L5			
	2	Receiving channel	1408 channel			
	3	Single point positioning (RMS)	Plane: 1.5m			
			Elevation: 2.5m			
	4	DGPS(RMS)	Plane: 0.4m+1ppm			
			Elevation: 0.8m+1ppm			
	5	RTK(RMS)	Flat: 0.008m+1ppm			
			Elevation: 0.015m+1ppm			
	6	Directional accuracy (RMS)	0.2degrees/1m baseline			
	7	Time accuracy (RMS)	20ns			
	8	Speed accuracy (RMS)	0.03m/s			
	9	Observation accuracy (RMS)	BDS	GPS	GLONASS	Galileo
	10	B1I/B1C/L1 C/A/E1/G1 pseudorange	10cm	10cm	10cm	10cm
	11	B1I/B1C/L1 C/A/E1/G1 carrier phase	1mm	1mm	1mm	1mm
	12	B3I/L2P (Y)/L2C/G2 pseudorange	10cm	10cm	10cm	10cm
	13	B3I/L2P (Y)/L2C/G2 carrier phase	1mm	1mm	1mm	1mm
	14	B2I/L5/E5a/E5b pseudorange	10cm	10cm	10cm	10cm
	15	B2I/L5/E5a/E5b carrier phase	1mm	1mm	1mm	1mm
	16	cold boot	＜30s			
	17	Initialization time	<5s (typical value)			
4G module (net	1	LTE FDD	B1/3/7/8/20/28			

work frequency band)	2	LTE TDD	B38/40/42/43
	3	GSM/GPRS/EDGE	NA
4G module (propagation speed)	1	LTE FDD (Mbps)	10.3(DL)/5.1(UL)
	2	LTE TDD (Mbps)	9.1(DL)/3.1(UL)
Bluetooth module	1	Bluetooth version	2.0
	2	Working frequency band	2.4G
	3	Air speed	2Mbps
	4	Reference distance	10m
Data format	1	Differential data	RTCM3.X
	2	output format	NMEA-0183, RTCM3.X
	3	Data update rate	1Hz-20Hz(default 1Hz)
Power supply	1	Voltage	DC +9V~36V
	2	power waste	＜3W
	3	Working current	≤145mA/12V
	4	indicator light	1 NET，1RTK，1BT
Physical parameters	1	size	100mm*61.8mm*18.75mm
	2	weight	180g
	3	Shell material	aluminium
	4	interface	SMA*3/8-core LEMO ports
Environmental Specifications	1	working temperature	-30℃～＋70℃
	2	Storage temperature	-40℃～＋85℃
	3	humidity	95% condensation
	4	Protection grade	IP65
	5	Seismic resistance	Resist the impact of a 1-meter free fall

5 Product Photos

In this chapter, we will showcase real-life images of the product, as shown in Figure 6. These images provide a detailed view of our product from various angles and perspectives. We believe that through authentic representation, we can better convey the value and concept of the product, thereby enhancing your trust and satisfaction.

Figure 6 Product Images

6 status indicator

NET (green) light	Chang Liang	The 4G module is powered on, but PPP dialing is not completed
	flash	PPP dial-up completed
	Slow Flash	Registered RTK NTRIP base station
RTK (blue) light	Chang Liang	Not located
	flash	Positioned but not entered RTK fixed solution
	Slow Flash	RTK fixed solution
BT (blue) light	Chang Liang	Bluetooth connected
	flash	Bluetooth not connected

Note: Slow flashing: on for 400ms, off for 800ms

Flash: on 200ms, off 200ms

7 Common configuration instructions

NO.	Instruction	Describe	Notes
1	AT+set_ntrip_param,140.207.166.210,25001,,,SZ-DL-8KM-RTCM32#	Set ntrip IP, port, username, password, and loading point	Please separate each item with a comma. If there is no username or password, do not write it, but also separate it with a comma
2	AT+get_ntrip_param#	Query ntrip parameters	
3	AT+get_verno#	Versions Query	
4	AT+set_to_bt,NAMEAK987#	Set Bluetooth name	Note that setting the Bluetooth name must be done when the Bluetooth is not connected. When changing it, disconnect the Bluetooth connection first. The AK987 command shows the Bluetooth name displayed after the change, which can be changed according to your own needs
5	AT+set_uart_gps,1#	Enable MCU serial port forwarding of GPS information	This command will be saved in case of power failure, but if the factory reset command is sent, it will default to no output
6	AT+set_uart_gps,0#	Turn off MCU serial port forwarding GPS information	
7	AT+set_gps_rtk_timer,10#	Set 10 seconds to send GGA information to the ntrip server	10 "is 10 seconds, can be changed to 5 seconds or other, default is 10 seconds
8	AT+set_to_gps,log gpgsv ontime 1#	Positioning module outputs gpgsv data	The instructions starting with "AT+set_to-ugps" are forwarded to the positioning module, and the subsequent instructions are the positioning module instructions, which can be modified according to the GPS module instructions
Note: AT commands can be sent from MCU serial port or Bluetooth. When sending commands via Bluetooth on a mobile app, try to edit the text in English as much as possible to avoid text errors			

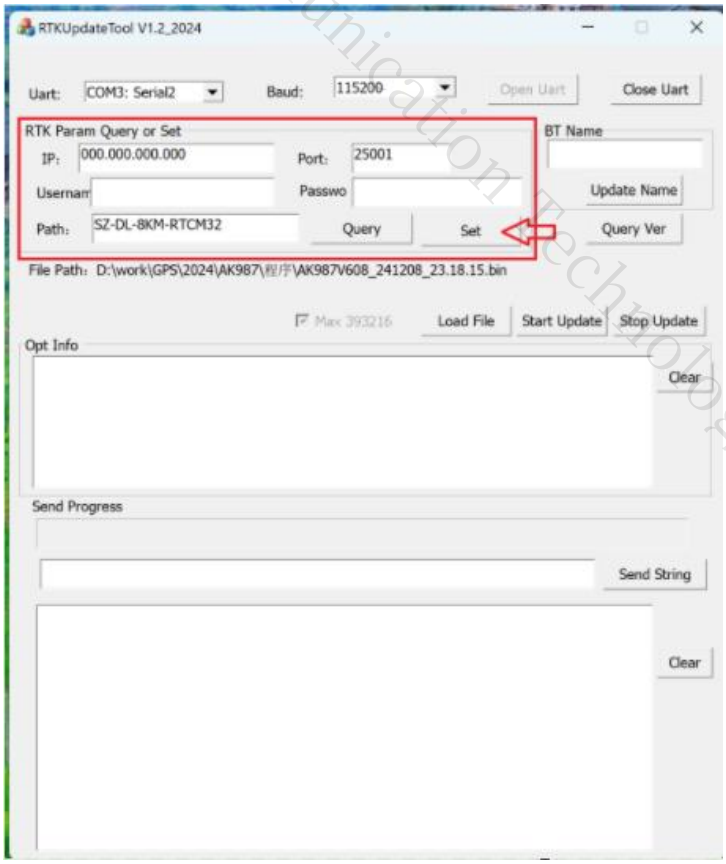
8 4G RTK ROVER instructions

8.1 Preparation work

8.1.1 Connect the AK987/AK988configuration USB cable to the computer USB (Windows 10 and above computer systems will automatically generate serial port numbers, Windows 7 and above computer systems need to install the CH340 serial port driver first) . Open the RTKYu pdateTool_1.1CH.exe configuration tool software on the computer

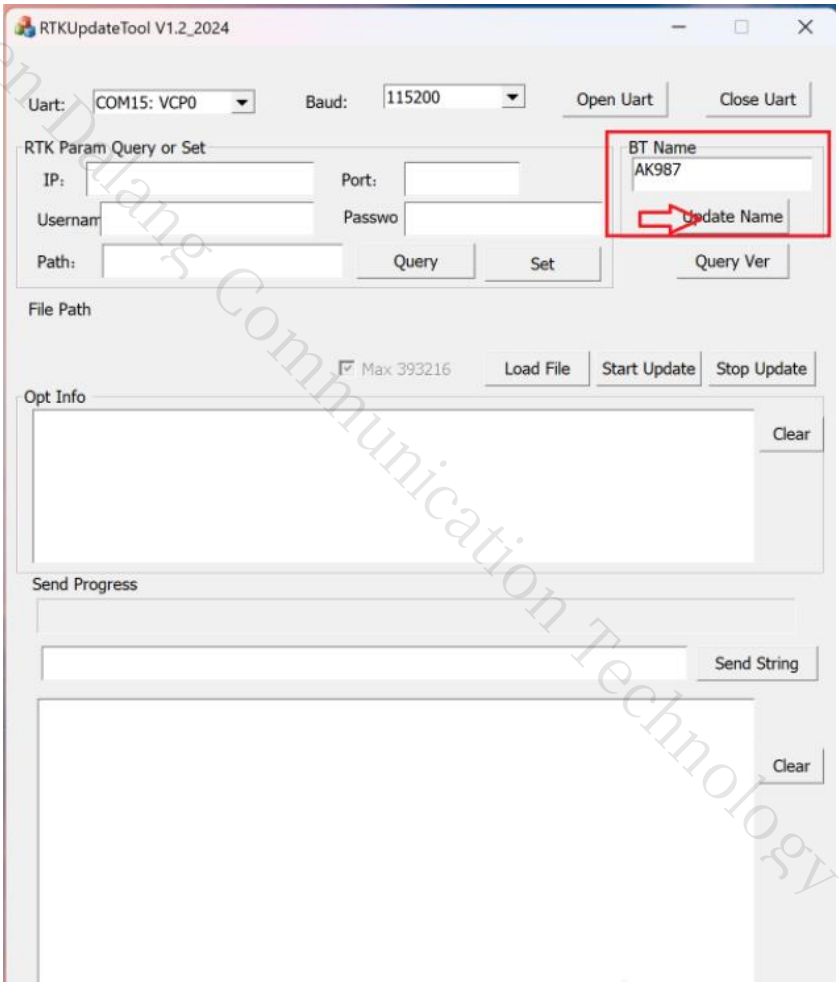
8.2 Parameter configuration

Open the RTKUpdateTool_1 .1CH.exe software and select a good string of slogans, baud rate 115200, click to open the serial port, fill in the IP (or domain name), port, username, password, access point in the corresponding window of the software interface (the IP bar supports enteri ng the domain name, username and password If not, do not fill in), click Settings after all inpu t is completed, and the bottom of the software returns "wait 10s system reset! set_ntrip_param ", 000.000.000.000, 25001, SZ-DL-8KM-RTCM32 ok #indicates that the setting is successful (the content of the underlined part is the IP port and other parameters actually set in, and the a ctual content is consistent with the setting content.



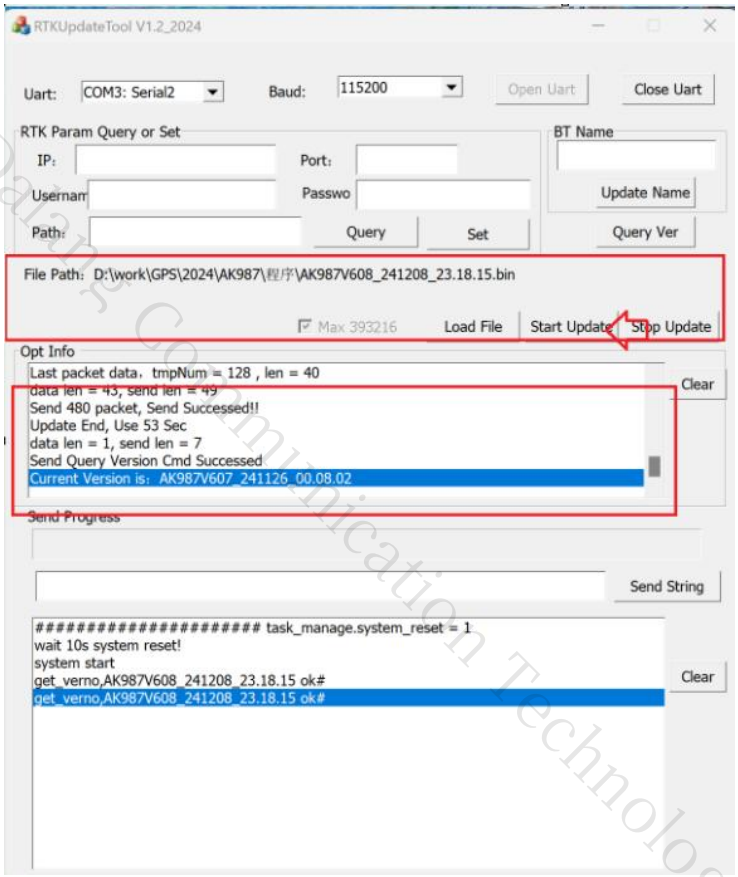
8.3 Change bluetooth name.

AK987/AK988 supports customers to modify the Bluetooth name by themselves. Just fill in the Bluetooth name you want to modify in the Bluetooth name window of the RTKUpdate Tool_1 .1CH.exe tool, and click Modify Name to complete the change. The bottom interface of the software returns set_to_bt, NAMEAK987, ok #(the underlined content is the changed Bluetooth name). It should be noted that the modification of the Bluetooth name must be carried out without a Bluetooth connection, that is, when you see the end point BT indicator flashing, the Bluetooth name must not exceed 16 characters.



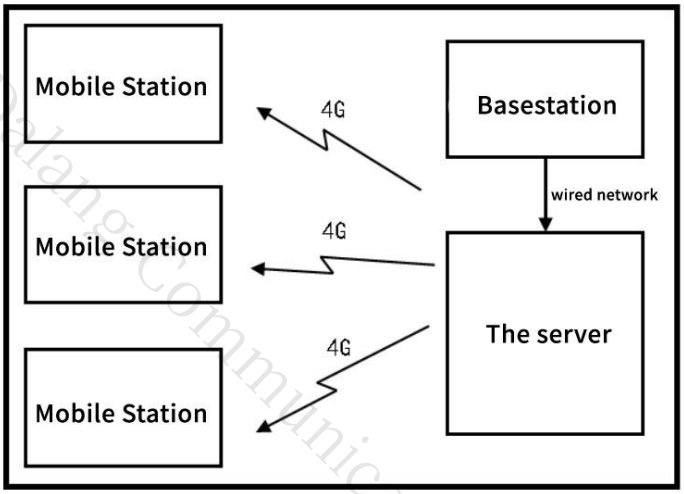
8.4 firmware upgrade

RTKUpdateTool_1 tool software can be AK987/AK988 product firmware upgrade, open the software to select a good serial port, baud rate 115200, click to open the serial port, click t o load the file to select the firmware, and then click to start the upgrade, waiting for the progre ss bar to complete, and the sending window shows the upgrade is complete, the current versio n of the sending window is the version before the upgrade, see the receiving window shows s ystem start that has been upgraded and end point restart, then click the query version button, t he receiving window returns to the upgraded version.

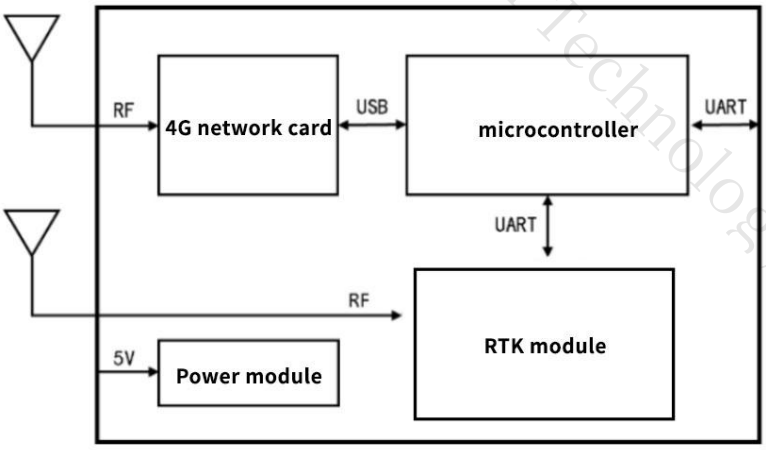


9 Typical applications

9.1 Common data transmission modules are difficult to provide reliable differential data conn ections, resulting in serious packet loss issues. For this purpose, the company provides a soluti on based on 4G network (as shown in the figure below). The benchmark station sends differen tial data to the server through a wired network and is cached by the server. Mobile stations acc ess servers through 4G networks to obtain differential data. This solution can greatly expand t he coverage area of base stations, and mobile stations equipped with 4G network cards can si multaneously transmit positioning results back to designated servers.



The circuit diagram of the mobile station is as follows:



In practical applications, the number of mobile stations that a server can access simultaneousl y is limited only by server performance and is more suitable for a large number of users. Requ irements between the server and the base station: the server can be directly accessed from the public network (with a public IP address), and a network connection can be established betwe en the base station and the server (either through the public network or local area network).

9.2 In high-precision positioning applications without reference stations, the module needs to cooperate with the 4G communication module to obtain differential data. We provide Qianxun with differential data sources nationwide, and users can obtain high-precision positioning results without deploying base stations. The circuit diagram is as follows: