Dalang

AK977U

Dalang Communication Technology Co., Ltd Product Specification

Product Name:	GNSS Receiver
Product Model:	AK977U
Version Number:	V 1.0
Revision Date:	2024.05.23

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1 Product Application Scenarios

The AK977U is a high-precision positioning and orientation GNSS receiver that offers exceptional performance. This integrated unit supports all global GNSS constellations and all frequency bands, allowing simultaneous tracking of BeiDou, GPS, GLONASS, Galileo, QZSS, and SBAS. The K977U receiver's multi-frequency, multi-constellation tracking capability ensures high-precision positioning in various complex environments. This receiver is primarily used in fields such as surveying and mapping, precision agriculture, unmanned aerial vehicles (UAVs), and autonomous robotics. Its high accuracy and reliability make it an ideal choice for professional users in these domains. See Figure 1for 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 AK977U, detailing how it plays a pivotal role in various applications as follows:

1. Built in advanced full system full constellation GNSS module.

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

3. Can be used as a base station or mobile station.

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

5. Adopt industrial grade 2W wireless transmitter 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，

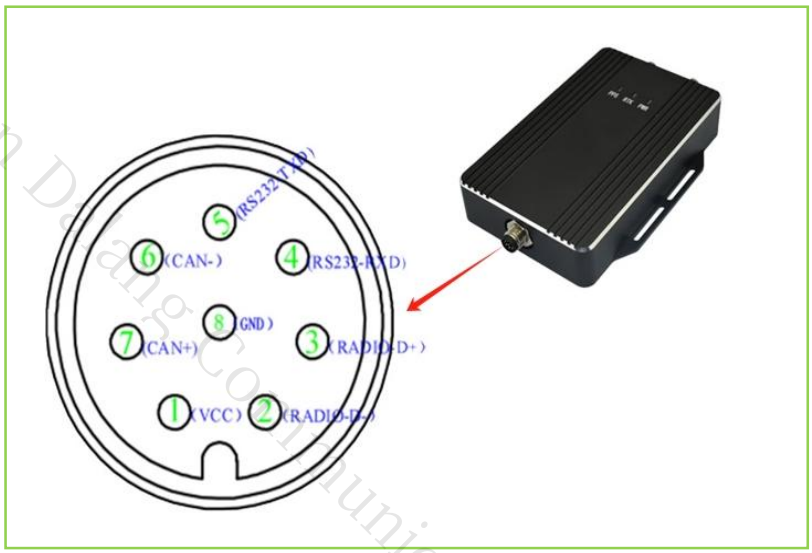


Figure 2 Interface Definition Diagram

Table 1 M8 Interface Definition

M8-8P Male Interface Description		
No.	Interface Name	Function Description
1	VCC	Input voltage 9-36V (typical value 12V), current 3A
2	RADIO-D-	Radio serial port USB D-
3	RADIO-D+	Radio serial port USB D+
4	RS232-RXD	GNSS module RS232 RXD
5	RS232-TXD	GNSS module RS232 TXD
6	CAN-	NC
7	CAN+	NC
8	GND	Mainboard GND
LED Indicator Interaction		
1	PWR	Power indicator, solid red when operating normally
2	RTK	Differential positioning indicator, solid blue in FIX state
3	PPS	Positioning indicator, green light flashes, provides an output pulse per second (1PPS) signal with adjustable pulse width and polarity
Antenna Interface Definition		
1	GNSS Antenna	SMA female, primarily receives GNSS antenna signals, antenna power supply 5V
2	Radio Antenna	SMA male, primarily receives/transmits 410-470MHz antenna signals

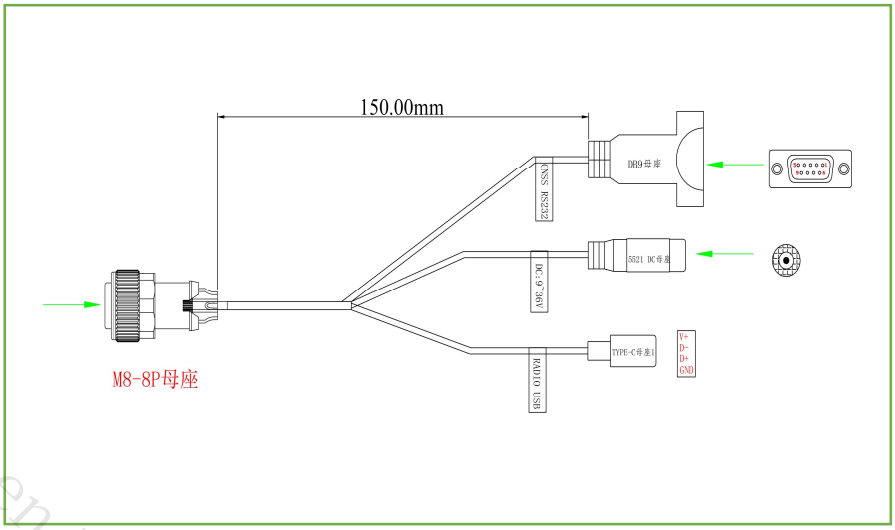


Figure 3 Structural diagram of connecting cables

Figure 4 Complete Solution Connection Diagram

Table 2 Complete Component Description

No.	Product Name	Function Description
1	Connection Cable	8-pin aviation connector to Type-C; DC-DC power DB9 female connector
2	Receiver	Built-in GNSS module and Radio module
3	Radio Antenna	433±20MHz antenna
4	GNSS Antenna	All-system, all-frequency antenna
5	Coaxial Cable	5m TNC to SMA, 50-3 cable

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 frequency	BDS: B1I B2I B3I B1C B2a B2b GPS: L1 C/A L1C L2P (Y) L2C L5 GLONASS: L1 L2 Galileo: E1 E5a E5b E6 QZSS: L1 L2 L5 L6			
	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	Observation accuracy (RMS)	BDS	GPS	GLONASS	Galileo
	7	B1I/B1C/L1C/L1 C/A/E1/G1 pseudo range	10cm	10cm	10cm	10cm
	8	B1I/B1C/L1C/L1 C/A/E1/G1 carrier phase	1mm	1mm	1mm	1mm
	9	B3I/L2P (Y)/L2C/G2 pseudorange	10cm	10cm	10cm	10cm
	10	B3I/L2P(Y)/L2C/G2	1mm	1mm	1mm	1mm
	11	carrier phase	10cm	10cm	10cm	10cm
	12	B2I/B2a/B2b/L5/E5a/E5b pseudorange	1mm	1mm	1mm	1mm
	13	Time accuracy (RMS)	10ns			
	14	Speed accuracy (RMS)	0.03m/s			
	15	cold boot	＜10s			
	16	Initialization time	<5s (typical value)			
	17	Initialize reliability	＞ 99.9%			

Radio module	1	frequency range	410-470MHz
	2	Channel spacing	12.5KHz
	3	Working mode	half-duplex
	4	Frequency stability	1.5ppm
	5	modulation mode	CSS
	6	Airborne baud rate	12Kbps
	7	Protocol type	LoRa
	8	Serial port baud rate	4800/9600/19200/38400/115200bps
	9	Maximum data transmission and reception size per second	1000Byte
	10	Receive current	50mA
	11	Emission current	＜2A
	12	Transmission power	33dBm±1.5dB
Interface	1	Radio interface	SMA ports
	2	GNSS antenna interface	SMA ports
	3	Data/power interface	8-core LEMO ports
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	indicator light	1power，1PPS，1RTK
Physical parameters	1	size	100mm*61.8mm*18.75mm
	2	weight	180g
	3	Shell material	aluminium
Environmental Specifications	1	working temperature	-30℃ ～ +70℃
	2	Storage temperature	-55℃ ～+85℃
	3	humidity	95%condensation
	4	Protection grade	IP66
	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 Operating

6.1.1 Power on

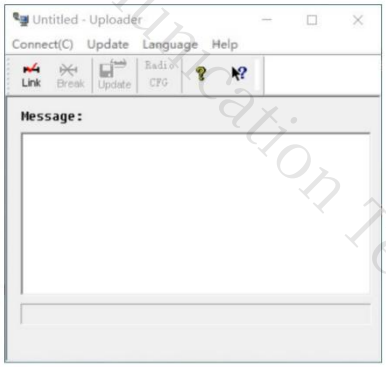
a) Connect to a PC using a serial cable (DB9 to USB). Connect to power(9-36V) and turn on it (the power lamb is OK, when antenna correctly connected the star searching lamb continuo us flashing) automatic online search or manual installation of drivers, viewed in Device Mana ger to confirm the serial port correctly identified.

b) Open the serial port Debugger, select the corresponding serial port connection, the default serial port Baud is 115200, according to the board command Manual, send relevant instructio ns, and check whether the board firmware and serial port communication are normal.

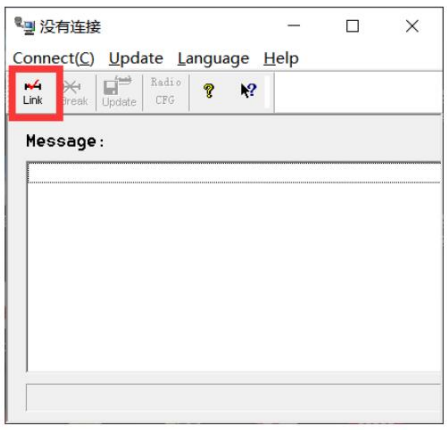
6.2 Radio configuration

Modify the relevant configurations of the base station and mobile station data link modules th rough the data link com1 (After one modification, the subsequent normal use Configuration w ill not change, data link com1 can be used without connection).

1、Open U70_V1.0.3.exe



2. Connect Data Link COM1: Click Connect>Setup>connect your COM>OK>Link



3. Click Radio CFG **c**onfiguration parameter:

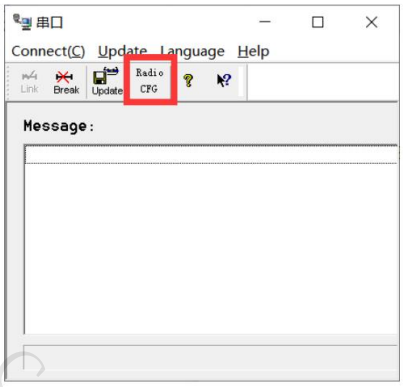
(1) Data Link Protocol

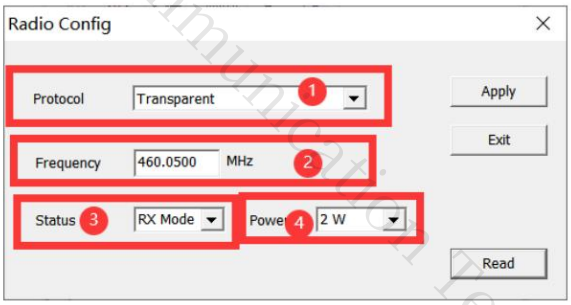
(2) Frequency(410Mhz-470Mhz)

(3) Working mode:RX(Rover) and TX(Base)

(4) Power (0.5W,1W, 2W)

(5) Finished setting up click Apply





※Attention: The frequency between the base station and mobile station must be the same, otherwise communication cannot proceed.

6.3 GNSS module instruction configuration

(1) Base Station

After the Radio module is set up, send the GNSS module to start the base station related instructions on the com1 port of the board at the base station end (where the data link module should be in TX transmission mode):

Fix auto

Log com1 rtcm1005b ontime 5

Log com1 rtcm1033b ontime 10

Log com1 rtcm1074b ontime 1

Log com1 rtcm1084b ontime 1

Log com1 rtcm1094b ontime 1

Log com1 rtcm1114b ontime 1

Log com1 rtcm1124b ontime 1

Saveconfig

Attention: Because the com1 port of GNSS module is connected to the com3 port of the Radio module, the differential data of the board must be from the Com1 output!

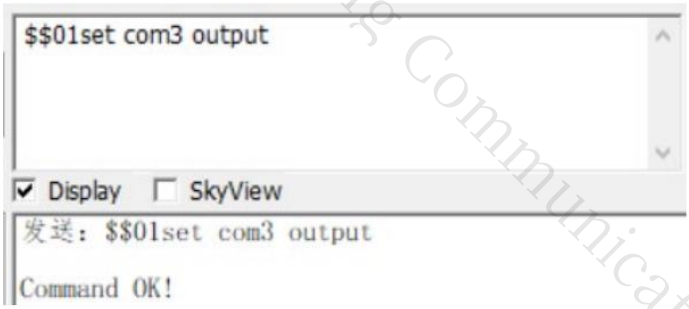
(2) Rover Station

1.Configuration of Rover Station Radio Module

Connect Type C to PC choose COM1 ,send instructions

$$01set com3 output

※Attention: Command OK will be printed after success! (The instruction only needs to be configured on the first use and used later No further modifications are required!)



6.3.1 Rover station output

The corresponding message output can be performed on the board com3 of the mobile station, for example:

Interfacemode com1 auto auto on

Log com3 gpgga ontime 1

Saveconfig

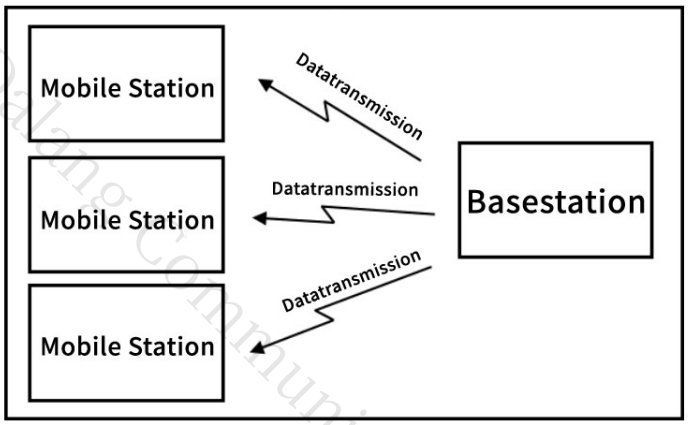
7 Common configuration instructions

NO.	Instruction content	Function Description	notes
1	VERSIONA	Version query	
2	CONFIG	Query receiver configuration	
3	SAVECONFIG	Save configuration	After configuring the receiver, a save command needs to be sent, otherwise the receiver will return to its factory state after being powered on again
4	CONFIG COM1 115200	Configure COM1 baud rate to 115200	
5	UNLOG	Stop all information output from the current serial port	
6	UNLOG COM1	Stop all output from COM1 serial port	This command can be sent on any serial port
7	UNLOG COM2 GPGGA	Stop COM2 serial port output of GPGGA data	If no serial port number is added, it will be the current serial port
8	GPGGA COM1 1	Output GGA data on COM1 serial port	If COM1 (such as GPGGA 1) is not input, it will be the current serial port. If you want to output other data, such as "GSV", simply change the "GGA" in the instruction to "GSV" (the output information includes DTM, GBS, GGA, GLL, GNS, GRS, GSA, GST, GSV, THS, RMC, ROT, VTG, ZDA)
9	GPGGAH 1	Output satellite positioning GGA data calculated from the antenna from the current serial port	UM982 dual antenna module is only supported
10	freset	Restore factory settings	Note: The factory set baud rate is 115200
11	mode base	Set as reference station	
12	mode rover	Set as mobile station	This instruction can switch the receiver from base station mode to mobile station mode
13	gpgga comx 1	Set 1Hz output GGA message	COMX can be specified as COM1 Either COM2 or COM3
14	gpths comx 1	Output current heading information	COMX can be specified as COM1 Either COM2 or COM4
15	freset mode base time 60 1.5 2.5 rtcm1006 comX 10 rtcm1033 comX 10 rtcm1074 comX 1 rtcm1124 comX 1 rtcm1084 comX 1 rtcm1094 comX 1 saveconfig	Configure base station mode	COMX can be specified as COM1 Either COM2 or COM3

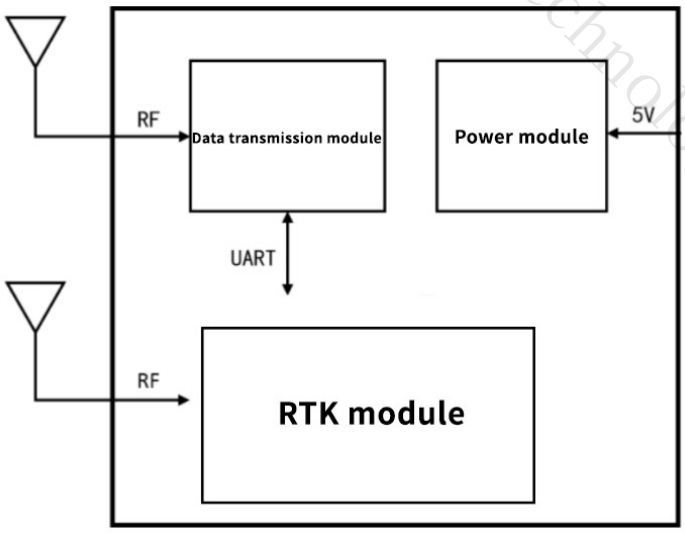
8 Typical applications

Application of high-precision positioning for medium to short distances

In high-precision positioning applications for medium to short distances (<3km), the module can be combined with a data transmission module to form a complete high-precision positioning system with only a small amount of external circuits. It is suitable for applications with a large number of mobile stations in a small range, and the module is fully compatible with other automatic flight control systems such as Pixhawk and APM. The schematic diagram is as follows:



The reference station is stationary and fixed, and differential data is broadcasted to all mobile stations through a data transmission module. The circuit diagrams of the mobile station and the reference station are as follows:



3) If the antenna coordinates have been accurately determined through other surveying methods, please use the # set position command to input the antenna coordinates into the reference station module in latitude, longitude, and altitude format;

4) If the antenna coordinates are unknown, please wait patiently for about 5 minutes. The module will calculate the antenna position as accurately as possible. After the calculation is completed, the differential data port will begin to output data. At this point, the base station has already recorded the coordinates and broadcasted them wirelessly to ensure that the base station does not lose power, as the coordinates will be recalculated after a power outage and the repeatability of the mobile station measurement points cannot be guaranteed;

5) Install the mobile station antenna on the mobile carrier, confirm receipt of differential data, and wait for about 120 seconds to obtain high-precision positioning results.