

TU106 LoRa-RTK Four-in-One Kit

User Manual

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1. product brief Introduction

1.1. Product Brief Introduction

TU106 LoRa-RTK four-in-one module is a highly integrated professional all-in-one kit featuring high-precision positioning and LoRa transmission functions (hereinafter referred to as "this kit"). This kit is equipped with core components such as GNSS antenna, positioning module, LoRa antenna and LoRa data transmission circuit. During operation, the reference station precisely transmits differential data to the mobile station via LoRa communication, achieving high-precision positioning of the mobile station.

This kit is applicable to industries such as lawn mowers and agricultural machinery.

1.2. Product Features

- The GNSS high-precision antenna and module are designed in an integrated manner, supporting all system and all frequency point signals.
- LoRa supports frequency bands in Europe and North America^{Note1} and enables software configuration of the transmission channel and transmission power.
- Support LBT + AFA for rapid frequency hopping anti-interference, RTCM compression and LoRa encryption transmission
- Support LoRa communication method for OTA upgrade of base station and mobile station LoRa, GNSS firmware
- Support for handling low battery alerts, base station movement and tipping over events^{Note2}
- Supports external LED and LoRa antenna
- Support for low-power mode of base station and wake-up function

Note1: It is necessary to select different frequency versions of the LoRa antenna.

Note2: Low battery warning requires the base station to provide a low battery event signal; for base station movement and tipping, an IMU-equipped version needs to be selected.

1.3. Technical Specifications

Table 1 Product technical specifications

Technical Specifications		Parameter Requirement
1	GNSS Indicators	Supported frequency band BDS-2: B1I/B2I/B3I BDS-3: B1I/B3I/B1C/B2a/B2b GPS: L1CA/L1C/L2C/L2P/L5 GLONASS: G1/G2 Galileo: E1/E5a/E5b QZSS: L1/L2/L5
2		Data updating rate GNSS: 10Hz INS: 100Hz ^{Note3}
3		Single-point positioning accuracy Horizontal $\leq 1.5\text{m}$ (1σ) Vertical $\leq 2.5\text{m}$ (1σ)
4		DGNSS positioning accuracy Horizontal $\leq 0.3\text{m} + 10\text{ppm}$ (1σ) Vertical $\leq 0.6\text{m} + 10\text{ppm}$ (1σ)
5		RTK positioning accuracy Horizontal $\leq 1.0\text{mm} + 1\text{ppm}$ (1σ) Vertical $\leq 1.5\text{mm} + 1\text{ppm}$ (1σ)
6		Differential data RTCM3.X
7		Cold start time $\leq 35\text{s}$
8		Recapture time $\leq 1\text{s}$
9		Comprehensive navigation calculation accuracy ^{Note4} $2\% \times \text{operating range}$ (1km or 2min)
10	LoRa Indicators	Supported frequency band Europe 863-870Mhz North America 902-928Mhz
11		Output power Europe ERIP: 14dBm(max) North America ERIP: 22dBm(max)
12		Communication Rate 2.4kbps ~ 26.4kbps
13		Receive sensitivity -123dBm@BER 10^{-5} , 9600bps
14	Antenna Indicators	Antenna Indicators
		Impedance 50 Ω
15		Polarization mode GNSS: Right-Handed Circular Polarization (RHCP) LoRa: Vertical Polarization
16		Antenna axis ratio $\leq 3\text{dB}$
17		Elevation Coverage 360°
18		Output VSWR ≤ 2
19		Peak Gain GNSS $\geq 4\text{dBi}$ LoRa $\geq 0.5\text{dBi}$
20		GNSS Low-noise amplifier specifications
		Gain 30dB $\pm$ 3dB
21		Noise Figure $\leq 2\text{dB}$

Technical Specifications			Parameter Requirement
22		Output VSWR	≤ 2
23		Flatness In Band	$\pm 2\text{dB}$
24	external interface	J1	HY-2.0-AWT-8
25		J3	HY-2.0-AWT-3
26		J5	HY-2.0-AWT-2
27	Host Parameters	Working Voltage	5V~30V DC
28		Power Dissipation	Normal Operation: Average $\leq 1.5\text{W}$ Low Power Consumption: Average $\leq 0.22\text{W}$
29		Size	Main Part $\Phi 122\text{mm} \times 27.5\text{mm} (\pm 1\text{mm})$
30		weight	108g $\pm$ 5g
31	Environmental	Working Temperature	-40°C ~ +85°C
32	Suitability	Storage Temperature	-55°C ~ +95°C

Note3, Note4: It is necessary to select the version with IMU.

2. Hardware Structure

2.1. Electrical

This set of peripheral devices has 4 connector interfaces, located on the back of the kit, as shown in Figure 3. The definitions are as follows.

Table 2 Connection Definition Table

logo	interface type	names	Pin	defined declaration
J1	HY-2.0-AW T-8	VCC	V+	5V~30V DC
		GND	GND	GND
		GNSS_RXD3	RX3	LvTTL, 3.3V, GNSS Debugging usage
		GNSS_TXD3	TX3	LvTTL, 3.3V, GNSS Debugging usage
		LoRa_RX	RX	LvTTL, 3.3V
		LoRa_TX	TX	LvTTL, 3.3V
		EVENT	EVT	High level, event triggered
		PPS	PPS	Positive polarity pulse, with the rising edge aligned to the UTC second boundary, pulse width 10 ms, configurable
J3	HY-2.0-AW T-3	LED_BLUE	LED-R	LvTTL, 3.3V
		GND	GND	GND
		LED_RED	LEB-B	NC
J5	HY-2.0-AW T-2	RELOAD	RELOAD	RELOAD
		GND	GND	GND

2.2. LED

The base station and mobile station positioning can utilize the 5 LED indicator lights included in this kit, which are located on the back of the kit. The meanings of the LED indicator lights are as listed in Table 3.

Table 3 Pilot Lamp meaning

IDX	logo	names	defined declaration
1	PWR	power status	Lighting off : Not powered on Lighting up : The power has been turned on
2	TX	TX status	Lighting off : Untransmitted data in LoRa glint: LoRa transmits data, and the flashing frequency is the same as that of the configuration data transmission frequency.
3	RX	RX status	Lighting off : LoRa failed to receive data glint: LoRa receives data and the flashing frequency is the same as the frequency of the received data.
4	STATE	LoRa connection state	Lighting off : The base station and the mobile station have failed to establish a successful pairing via LoRa. Frequency-hopping mode glint : During the LoRa pairing process Fixed-frequency mode glint: LoRa pairing channel is interfered with Lighting up: The paired channel of LoRa was interfered with. The base station and the mobile station successfully completed the LoRa pairing.
5	RTK	Positioning status	Lighting off /glint: Base station or mobile station positioning is unavailable. Lighting up: Base station or mobile station positioning are available.

3. Install

3.1. Communication Link

- This kit automatically switches the transmission mode (base station) and the reception mode (mobile station) based on the positioning mode;
- Both the base station and the mobile station equipment support full-system and full-frequency-point positioning calculations;

- The base station equipment transmits RTCM data via LoRa;
- The mobile station equipment receives the RTCM data transmitted by the base station through LoRa, thereby achieving high-precision positioning.

3.2. Installation of Product Equipment

(1) installation method

Fix the four mounting holes on the kit with screws. Then connect the terminals of the 8-pin HY 2.0mm connector. Connect the power supply and serial cable. Selectively connect EVENT or PPS according to your actual needs.

(2) installation requirements

- Try to ensure that the receiving surface of the high-precision antenna of the equipment is vertically upward and facing the sky (that is, the front of the kit is vertically upward), so as to guarantee the satellite reception performance of the antenna;
- The equipment serving as the reference station should be placed as high as possible in an open area with no obvious obstructions, in order to achieve the best transmission effect.

3.3. Connect the devices for communication

3.3.1. serial port

(1) This kit provides a 1-channel TTL serial port COM2 for parameter configuration and data output. The default serial port baud rate is 115200. COM2 supports 9600, 19200, 38400, 57600, 115200, 230400 and 460800

3.3.2. Testing cable

(1) The test cables and test boards of this kit are described as follows (not included in the standard package, and are for use only during testing):

Table 4 Connector Description

ID	interface	color	explain
1	8pinHY 2.0mm	red	VCC, 5~30V DC
2		black	GND
3		white	RX3
4		blue	TX3
5		green	RX

ID	interface	color	explain
6		yellow	TX
7		orange	EVT
8		brown	PPS
9	test board	DC Power	5~30V DC
10		SER1	COM2, DB9
11		SER2	COM3, DB9

4. Product rapid usage configuration

When using it for the first time, configuration and saving are required. If there are no modifications to make, you can skip this step.

4.1. Rover station configuration

Table 5 Rover station configuration

step	command	function	remark
1	CSHG MODE ROVER	Configure rover station mode	Send automatic restart
2	CSHG SETLORAADDR SN 1234567890001	Configure LoRa pairing parameters	bts sequence id : 1234567890001
3	CSHG SETLORA 14 AUTO EU868 9600 ON	Configure LoRa communication parameters	transmitted power : 14dB Timed frequency hopping in the EU frequency band baud: 9600 bps
4	CSHG OPEN COM1 GGA ONTIME 1	Configure COM1 to output 1Hz positioning results	Configure protocol output and frequency on demand
	CSHG OPEN COM1 ZDA ONTIME 1	Configure COM1 to output 1Hz time information	
5	SAVECONFIG	Save configuration	

4.2. Base station configuration

If you need to configure the base station parameters through the mobile station, then prefix the following instructions with "LORA", for example: "LORA CSHG SETLORAADDR SN BROADCAST", then the base station LoRa can be configured to broadcast mode.

Table 6 Base station configuration

step	command	function	remark
1	CSHG MODE BASE	Configure the base station mode	Send automatic restart
2	CSHG SETLORAADDR SN BROADCAST	Configure LoRa pairing parameters	Base station broadcasting mode
3	CSHG SETLORA 14 AUTO EU868 9600 ON	Configure LoRa communication parameters	transmitted power : 14dB Timed frequency hopping in the EU frequency band baud: 9600 bps
4	CSHG FIX AUTO AUTO 30 10	Calculate the average value of the 30-second coordinate data after high-quality positioning. If the difference between the average value and the previous coordinates is within 10 meters after the next power-on, use the old coordinates; otherwise, use the new coordinates and update the FLASH.	Range of time values: 0-60s; Range of difference: 1-10m
5	CSHG OPEN LoRa RTCM1074 ONTIME 5 1	Base station output GPS differential data	
6	CSHG OPEN LoRa RTCM1084 ONTIME 5 2	Base station outputs GLO differential data	
7	CSHG OPEN LoRa RTCM1094 ONTIME 5 3	Base station output GAL differential data	
8	CSHG OPEN LoRa RTCM1124 ONTIME 5 4	Base station output: BDS differential data	
9	CSHG OPEN LoRa RTCM1114 ONTIME 5 1	Base station outputs QZSS differential data	
10	CSHG OPEN LoRa RTCM1005 ONTIME 5 0	Output the coordinates of the base station antenna	
11	CSHG OPEN LoRa KITSTAT ONTIME 5	Base station output status information	
12	SAVECONFIG	Save configuration	

FCC Compliance Statement

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.

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

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.

FCC Radiation Exposure statement

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 and your body.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.
