GnssToolKit3 User Manual

GnssToolKit3 is a software to be used with Hangzhou Zhongke Microsatellite Positioning Receiver (hereinafter referred to as the receiver).

It is used to display the output information of the receiver, configure the internal state of the receiver, and do some simple tests on the performance of the receiver.

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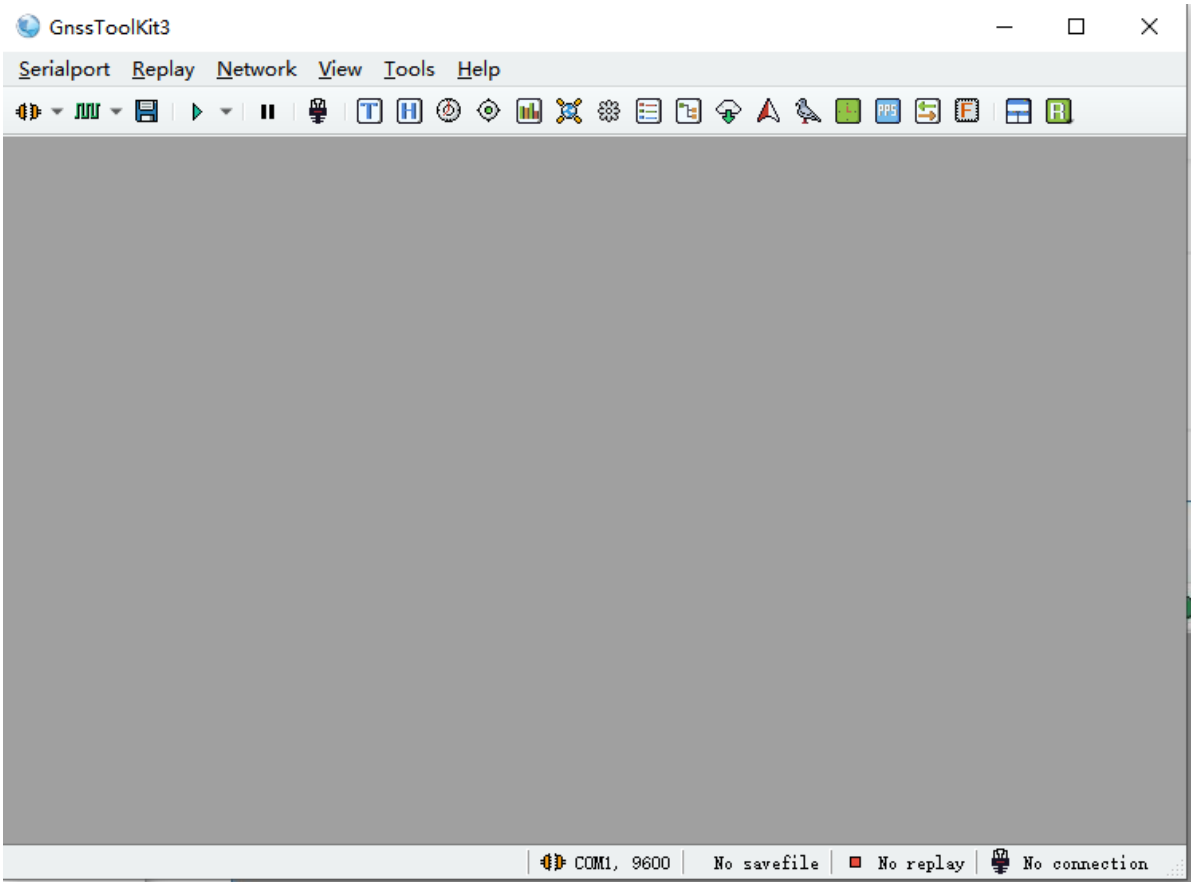
Install

Unzip GnssToolKit3.zip to your computer's local disk

Run

In the GnssToolKit3 folder, double-click GnssToolKit3.exe

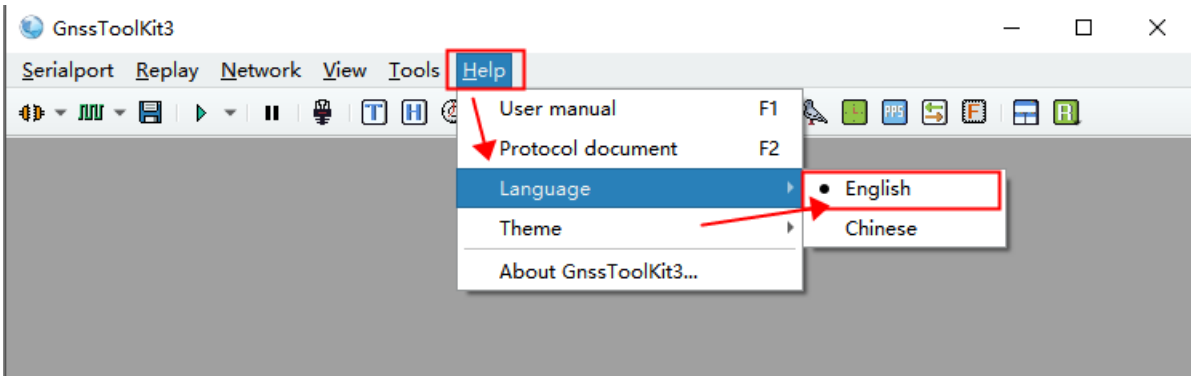


Language selection

In the "**Help**" menu, select the "**Language**" menu item to select the program interface language.

There are two language options: English and Chinese

Changing languages requires restarting the software.



Help and Tips

In the "**Help**" menu, select "**User Manual**" (F1 shortcut key) to open this manual.

In the "**Help**" menu, select "**Agreement Document**" (F1 shortcut key) to open the Zhongweike protocol document.

User manuals and protocol documents are in the doc directory of the software installation directory.

When the mouse moves to the control button, it will prompt information on the left side of the bottom status bar.

Connect the receiver

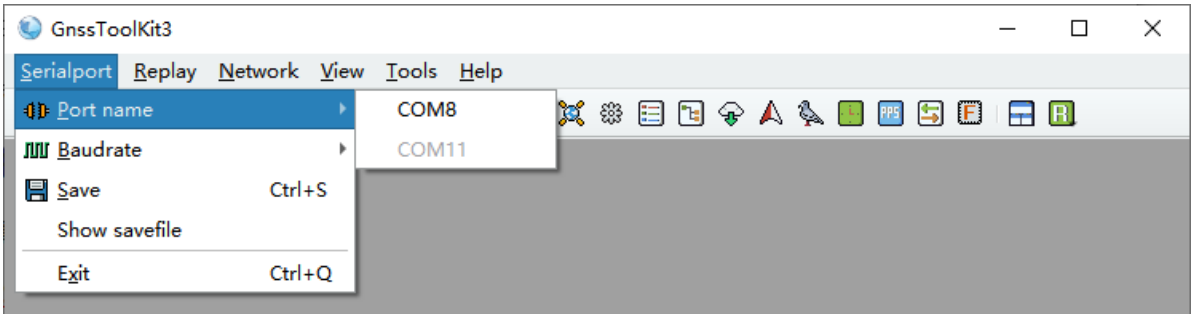
Connect the serial port of the computer and the serial port of the receiver with a serial port cable, and power on the receiver.

When using a USB-to-serial cable, if the mouse jumps randomly. Please disconnect the power supply of the receiver. After using this software to open the USB serial port, and then powering on the receiver and using the PL2302 series USB to serial port chip, you may encounter garbled serial communication. System driver bug.

Serialport settings

Serialport menu

Click the "**Serialport**" menu item on the main menu to open "**Port name**".



Port name setting

Select the "**Port name**" menu item, it will list all serial port numbers in the current system,

If the serial port number font is gray (COM11 in the figure), it means that the serial port device is busy (may be occupied by other processes) and cannot be used by this software.

Click on the serial port number connected to the receiver to enable the software to establish a connection with the receiver.

Baud rate setting

Select the "**Baudrate**" menu item to list the baud rates available to the receiver.

The default baud rate is 9600. The user needs to select the corresponding value according to the actual situation of the receiver.

Only when the baud rate is the same, the software can communicate with the receiver normally.

If you are not sure about the baud rate of the receiver, you can open "**NMEA**" in the "**View**" menu, and then test each baud rate one by one. If there is a "**Mnea View**" A readable navigation text display indicates that the current selection is consistent with the receiver baud rate.

Serial port status

The status bar at the bottom of the software has a serial port status indicator.

The icon indicates that the serial port is open

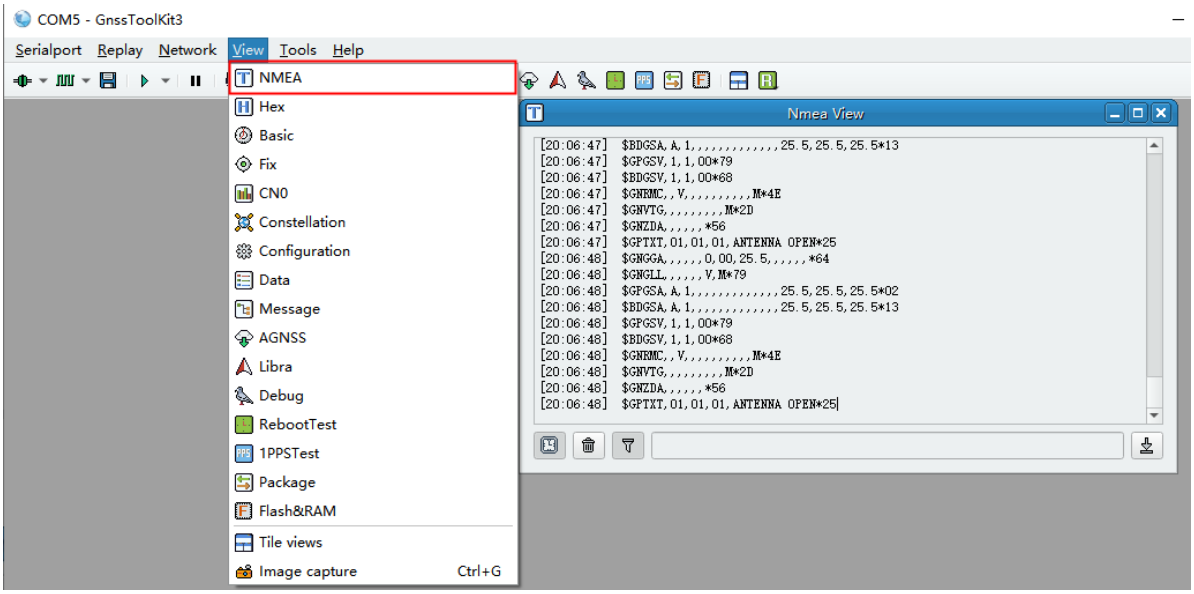
The icon indicates that the serial port is not open.

If the serial port indicator flashes, it means that there is data communication in the serial port.

NMEA navigation message

Nmea View

In the "**View**" menu, select "**NMEA**", open "**Nmea View**"



Nmea View Options

button	Function
	Turn on/off timestamp
	Clear all NMEA text
	En/Disable filter
	Scroll to bottom

NMEA sentence filtering

NMEA can be filtered using regular expressions

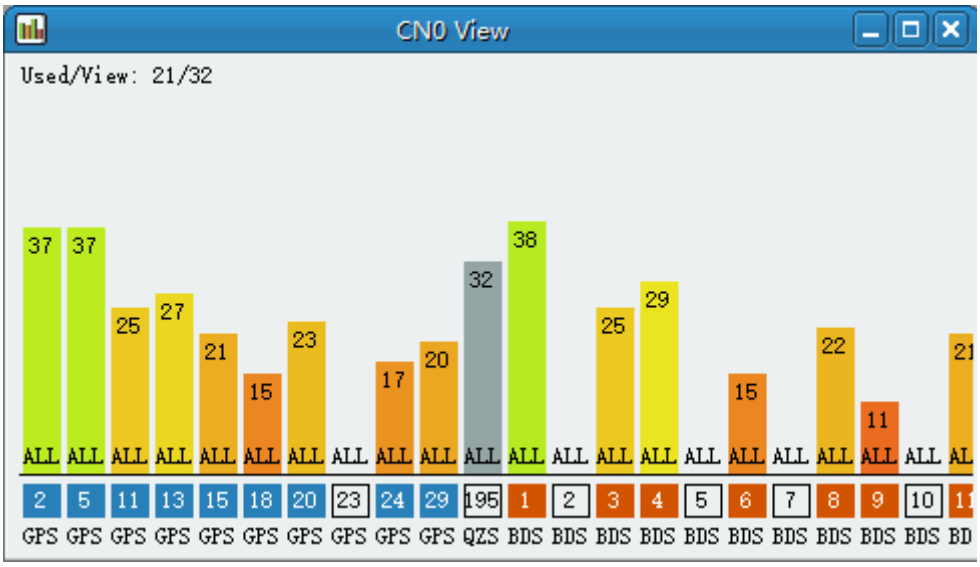
Example:

Filter input	Function
GGA	Only show GGA statements
RMC|GSA|GSV	Only show three statements RMC, GSA and GSV

satellite signal quality

CN0 View

In the "**View**" menu, select "**CN0**" to open the "**CN0 View**"



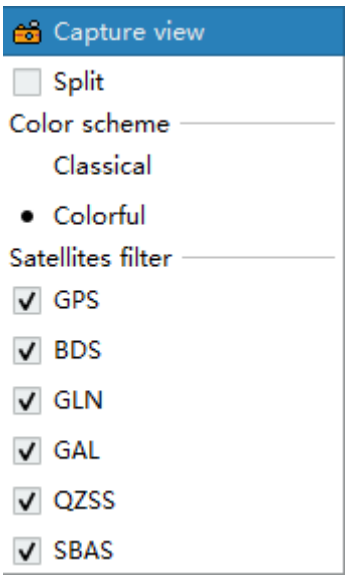
CN0 Histogram

Display the carrier-to-noise ratio of satellites in a bar graph, each bar represents a satellite.

parameter	Location	illustrate
CN0	The value below the bar	C/N(dB),The bar height is proportional to the CN value
Participate in positioning	bar color	Colored means participating in positioning, gray means not participating in positioning.
PRN	Numbers below the bar	The background color indicates the satellite system. If not involved in positioning, the background is transparent.
satellite system	bottom text	3 letters for satellite system

CN0 View Options

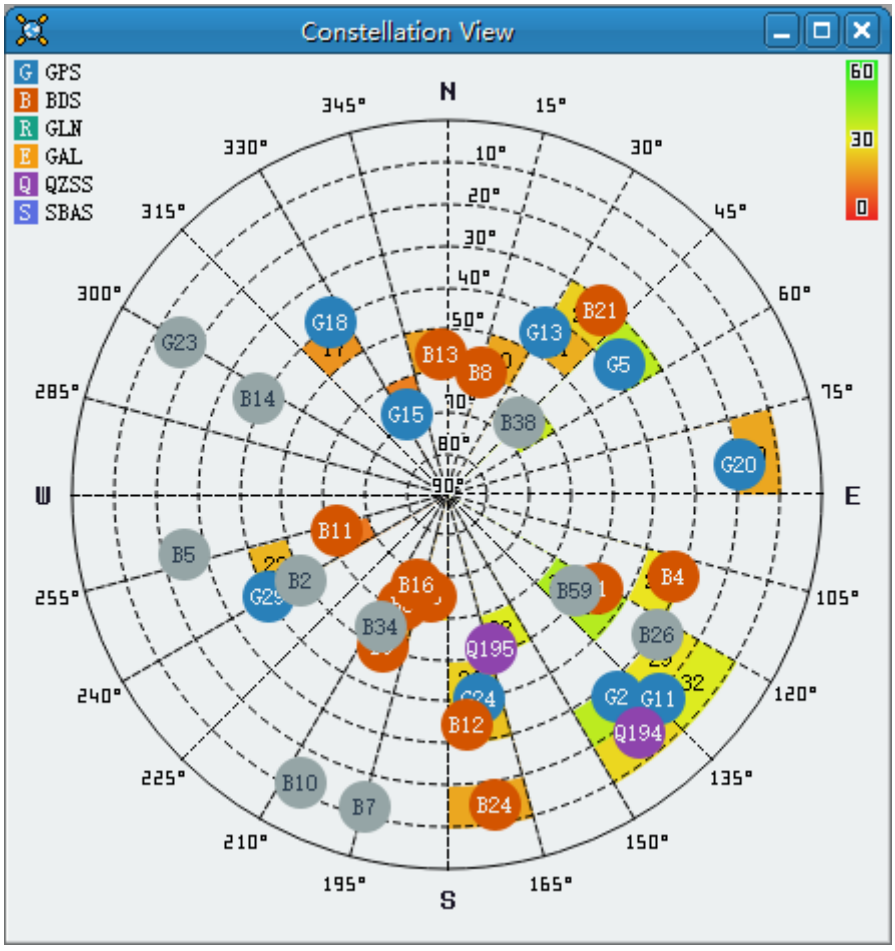
Use the right button to open the configuration menu



Satellite Constellation View

Constellation

In the "**View**" menu, select "**Constellation**" to open the "**Constellation View**".



Constellation View illustrate

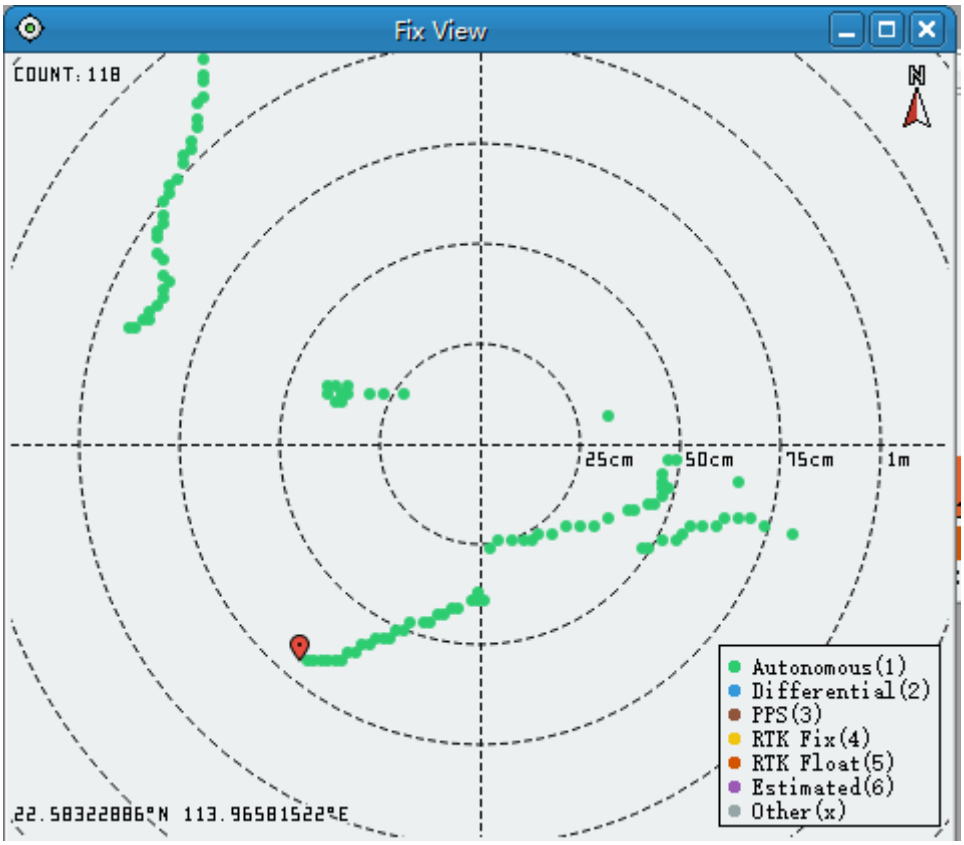
parameter	illustrate
satellite	Each circle represents a satellite.
PRN	The numbers inside the circles represent the PRNs of the satellites.

parameter	illustrate
Elevation angle	The center of the graph is 90 degrees, and the edges of the graph are 0 degrees.
Azimuth	The top is 0 degrees, which means true north. Increase the azimuth clockwise.
Satellite system	Different colors and characters represent different satellite systems.
Participate in positioning	Colored means participating in positioning, grey means not participating in positioning.

FIX

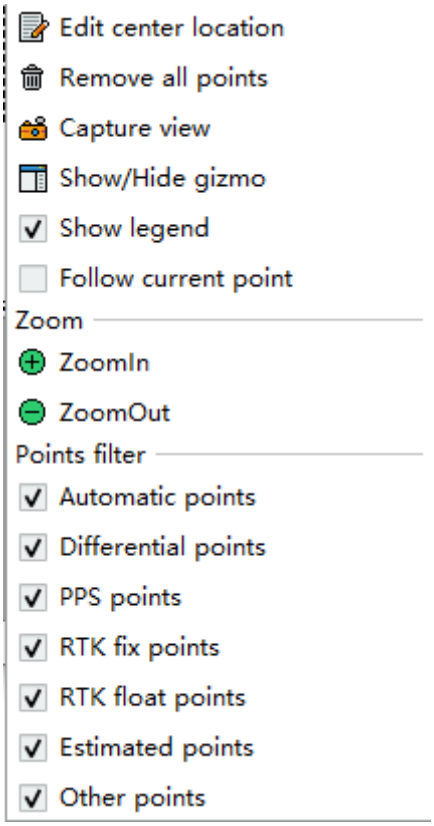
Fix View

In the "**View**" menu, select "**Fix**" to open the "**Fix View**"



Fix View Options

Use the right button to open the "**Fix View Options**" menu.

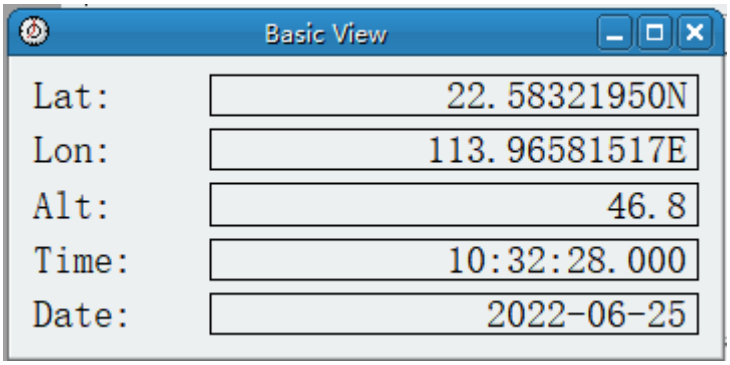


Options	Function
Edit center location	In the dialog box that opens, set the latitude and longitude of the center point of the Fix View.
Remove all points	Deletes all anchor points points in the view
Capture view	Save the Fix View image to the system clipboard.
Show/Hide gizmo	Shows or hides navigation information, a small side window for statistics.
Show legend	Whether to show a legend for the points color-quality.
Follow current point	Whether to automatically set the current anchor point as the view center point.
Zoom	View Zoom function
Points filter	Whether to display anchor points of a certain positioning quality.

Basic Navigation Information

Basic View

In the "**View**" menu, select "**Basic**" to open the "**Basic View**"

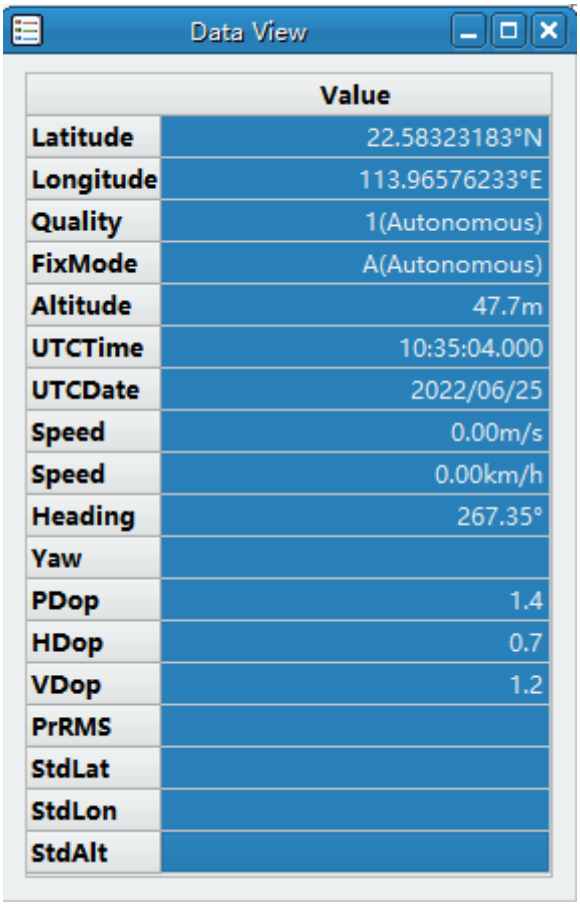


Options	Function
Lat	The latitude of the receiver output.
Lon	The longitude of the receiver output.
Alt	The altitude of the receiver output
Time	The Time of the receiver output
Date	The Date of the receiver output

Detailed navigation information

Data View

In the "**View**" menu, select "**Data**" to open the "**Data View**"



Data View illustrate

parameter	illustrate	Remark
Latitude	Latitude coordinates	degrees
Longitude	Longitude coordinates	degrees
Quality	The positioning quality of the positioning point	-
FixMode	positioning point FixMode	-
Altitude	Altitude height	m
UTCTime	UTCTime	hours:minutes:seconds:milliseconds
UTCDate	UTCDate	year/month/day
Speed	Ground speed	m/s
Heading	Heading	degrees
Yaw	Yaw angle	degrees
PDop	PDop,Position precision factor	-
HDop	HDop,Horizontal precision factor	-
VDop	VDop,Vertical precision factor	-
PrRMS	The value of the pseudorange error callout difference RMS	m
StdLat	Latitude error standard deviation	m
StdLon	Longitude error standard deviation	m
StdAlt	Altitude error standard deviation	m

AGNSS

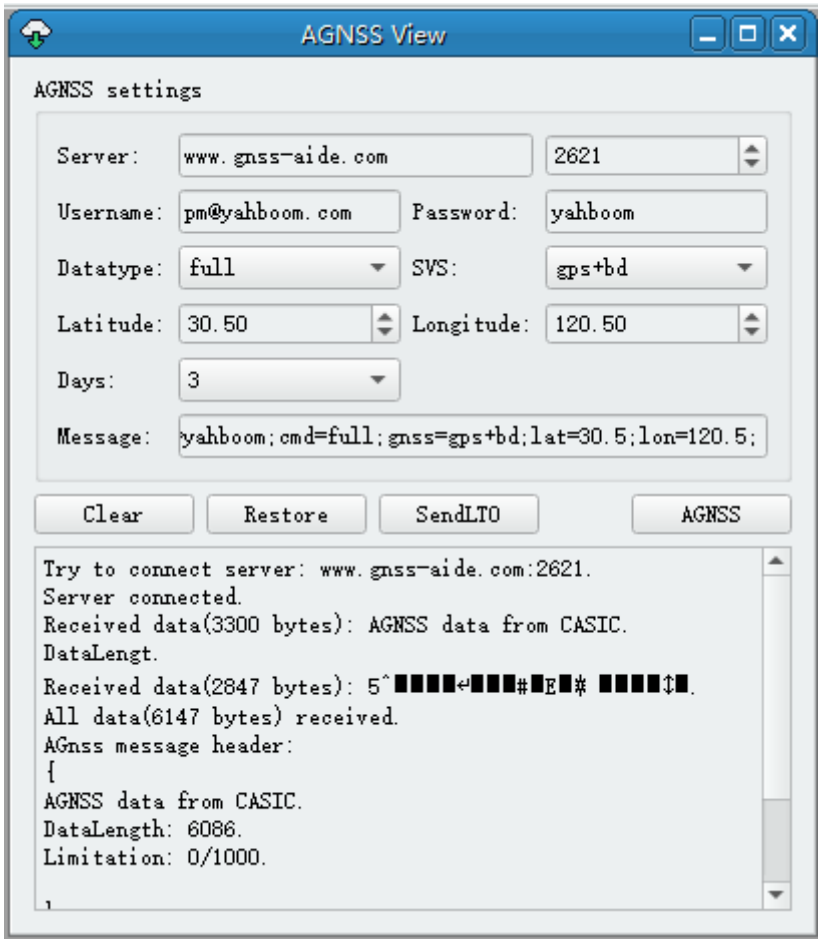
AGNSS-assisted positioning can greatly improve the performance of the receiver's first positioning.

AGNSS View

In the "**View**" menu, select "**AGNSS**" to open the "**AGNSS View**"

The following username and password are required

Username:pm@yahboom.com Password:yahboom



AGNSS Settings

parameter	illustrate	Remark
Server	The address of the server that provides the auxiliary data	The default is ZKMicro AGNSS server
port	AGNSS Services Port	-
Username	registered user name	pm@yahboom.com
Password	Password	yahboom
Datatype	AGNSS Datatype	eph-Ephemeris Aid；aid-time location assistance；full-All auxiliary
SVS	satellite system for auxiliary ephemerisV	GPS,BD
Latitude	rough latitude	unit degree
Longitude	rough longitude	unit degree
Message	A message automatically generated by the above parameters	can be freely modified

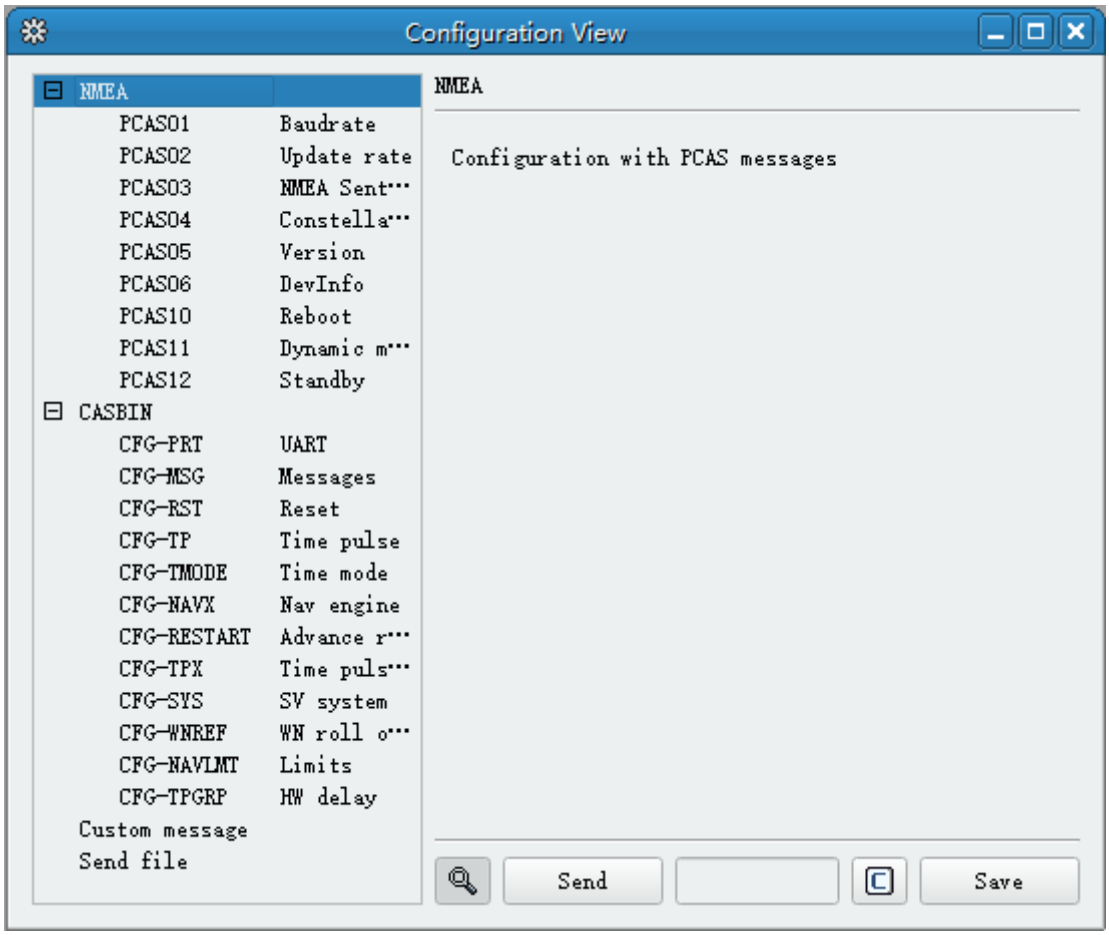
AGNSS assisted positioning

After AGNSS Settings is set, click AGNSS to perform assisted positioning.

Configuration

Configuration View

In the "**View**" menu, select "**Configuration**" to open the "**Configuration View**"



Send Configuration

Use the "Send " button to assign the configuration on the current interface to the receiver.
Configuration not valid after receiver restart

Save Configuration

Save all receiver configuration to Flash.
After saving, the configuration will still take effect after the receiver is restarted.

PCAS configuration

Configure the receiver through PCAS commands in NMEA format.

parameter	illustrate	Remark
Baudrate	The baud rate at which the receiver outputs the navigation information	4800~115200
update rate	The frequency of the receiver output fix	1Hz,2Hz,5Hz,10Hz

parameter	illustrate	Remark
NMEA sentences	Output frequency of each NMEA sentence	0 : no output 1： every 1 seconds 2： every 2 seconds … 9： every 9 seconds blank: leave as is
Constellations	Receiver working system configuration.	Enable or disable GPS, BDS or GLONASS systems
Version	The output NMEA protocol version.	-
Reboot	Reboot receiver	Hot,Cold Or Factory settings
Dynamic model	Dynamic model used by receiver	Not installed yet
Standby	Receiver goes into standby mode	Restart after waiting for a while

BACE configuration

Configure the receiver through BACE commands in HEX format

Parameter	illustrate	Remark
UART	Configure the UART port.	Input and output settings for baud rate and protocol.
Message	Output frequency of each message	0 : no output 1： every 1 seconds 2： every 2 seconds … 65535(0xff):output only once (query)
Time pulse	Timing time pulse setting.	Refer to the CFG->CFG-TP chapter in the CASIC protocol.

Custom message

Users can edit custom messages.
Supports T(NMEA) and H(HEX) modes
Supports automatic addition of headers and checksums.
Log used custom messages.

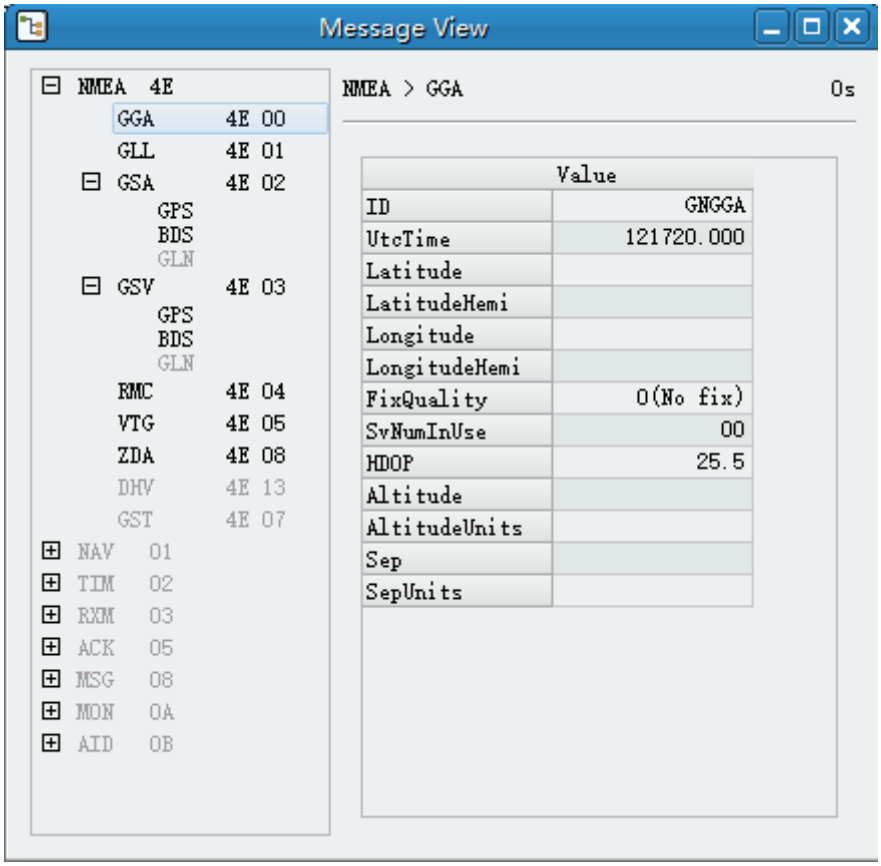
Send file

Select a file to send to the receiver.
File size is limited to 8MB

Message

Message View

In the "**View**" menu, select "**Message**" to open the "**Message View**"



message tree

The message tree lists all supported messages
If a certain message has not been received for a period of time, the branch corresponding to this message will be grayed out.

message control

Options	Function
Turn on	Open the message, output 1 time per second
Turn off	Close this message.
Single shot	The message is output only 1 time.

NMEA message

NMEA format message

message name	message ID	main content
GGA	4E 00	UTC time, latitude and longitude, positioning quality, HDOP, altitude, number of satellites participating in positioning.

message name	message ID	main content
GLL	4E 01	latitude and longitude,UTC time,positioning mode
GSA	4E 02	Participating in the PRN number of the positioning satellite, PDOP, HDOP, VDOP.
GSV	4E 03	Number of visible satellites, satellite PRN number, elevation angle, azimuth angle, carrier-to-noise ratio.
RMC	4E 04	UTC time, latitude and longitude, positioning mode, speed, heading, date.
VTG	4E 05	speed, heading.
ZDA	4E 08	UTC time,UTC date
GST	4E 07	Pseudorange error standard deviation RMS, latitude and longitude height error standard deviation.

NAV message

Navigation Status Messages

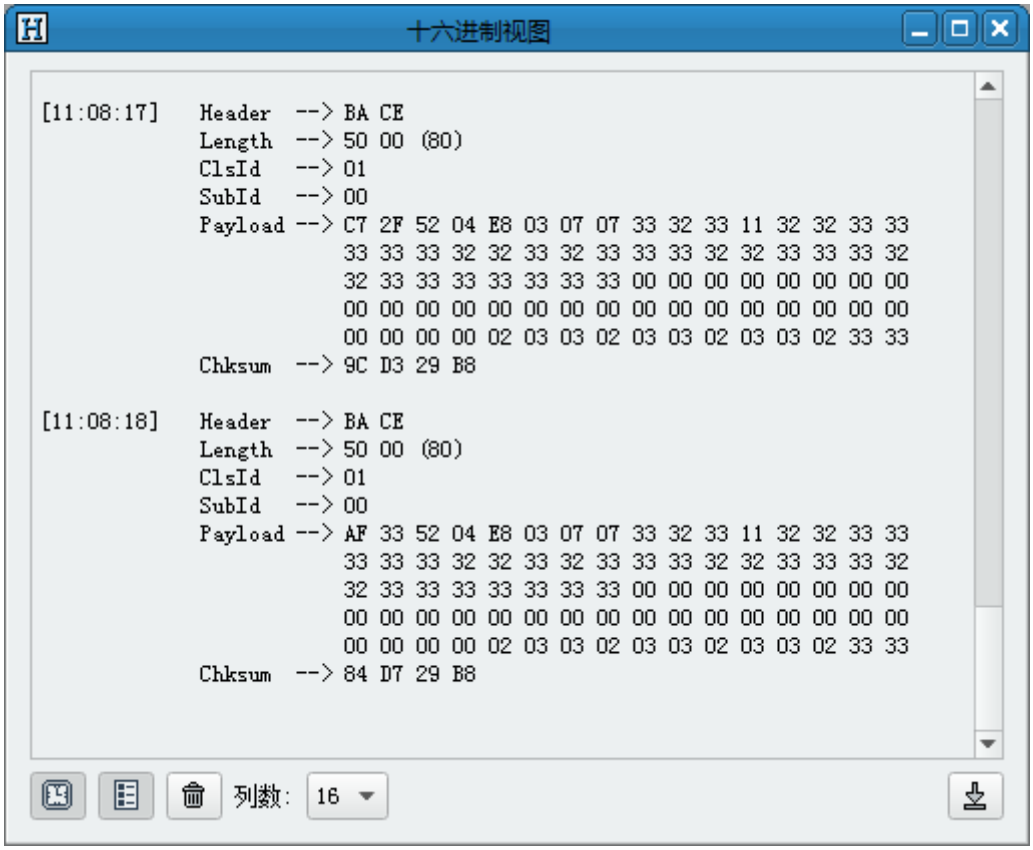
message name	message ID	main content
NAV-STATUS	01 00	Receiver navigation status
NAV-DOP	01 01	Positioning precision factor
NAV-SOL	01 02	PVT navigation information in ECEF coordinate system
NAV-PV	01 03	Position and velocity information in the geodetic coordinate system
NAV-TIMEUTC	01 10	UTC time information
NAV-CLOCK	01 11	Clock settlement information
NAV-GPSINFO	01 20	GPS satellite message
NAV-BDSINFO	01 21	BDS satellite message
NAV-GLNINFO	01 22	GLONASS satellite message

HEX navigation message

The HEX navigation message is a navigation message that conforms to the **CASIC Standard Interface Protocol**.

HEX View

In the "**View**" menu, select "**HEX**" to open the "**HEX View**"



Hex View Options

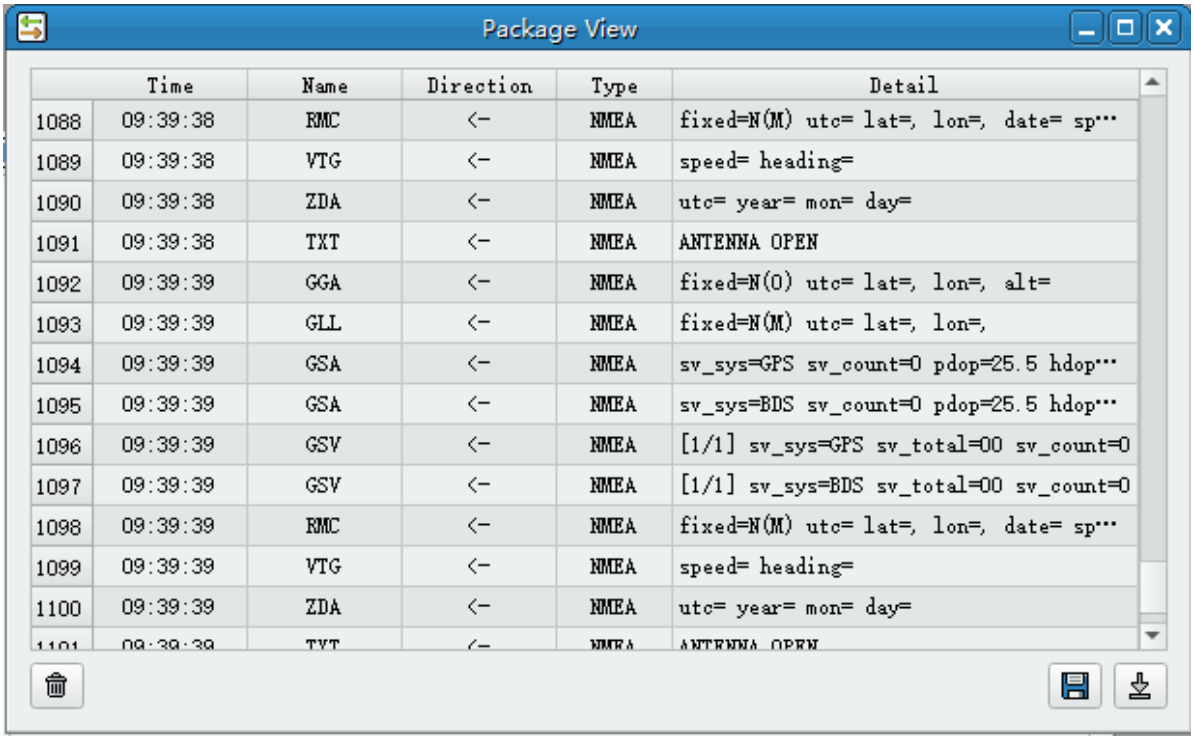
controls	Function Description
	Whether to display the timestamp when the message was received.
	Toggle verbose mode and raw data mode.
	Delete the text in the view.
Column	Set the maximum number of columns for Payload
	Scroll to the bottom.

Package

The packet view displays the packets received or sent by the program. This view consumes CPU and memory, please use it with caution.

Package Options

In the "**View**" menu, select "**Package**" to open the "**Package View**"



packet content

project name	project instruction
Time	The time at which this packet was received or sent.
Name	The name of the packet.
Direction	`<-` Represents the data packets received by the `->` program. Represents the data packets sent by the program.
Type	Packet type, NMEA or binary.
Detailed	The raw data value of the packet.

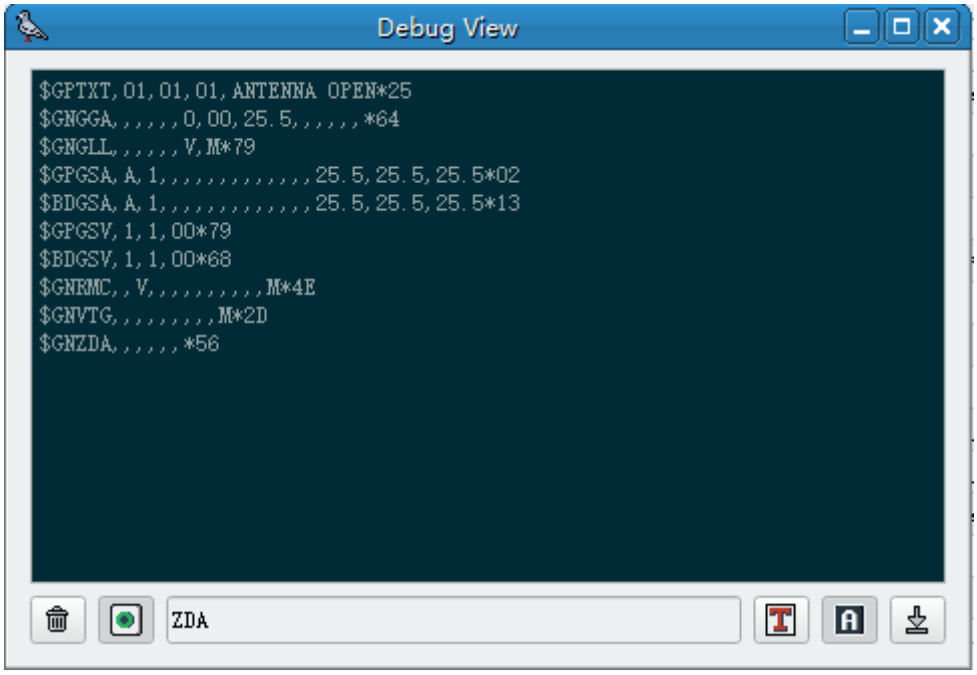
Packet View Options

controls	illustrate
🗑	Clear all packets.
💾	Save the packet.
⤓	Scroll to the bottom.

Debug

Debug view

In the "**View**" menu, select "**Debug** " to open the "**Debug View**"



Debug view options

controls	Function Description
🗑	Clear the text inside the view.
👁	Enable visual mode. In this mode, the output of the receiver is buffered. After receiving a sentence containing keywords (such as:), all buffers are displayed. In this way, the visual effect of the NMEA navigation message is stable, which is convenient for developers to watch for a long time. `ZDA`
👁	Turn off visual mode. Displays the output of the receiver in real time, without any buffering.
T	Set the font of the debug view.
A	Solaried Dark colorway
A	Solaried Light colorway
⬇	scroll text to bottom

Save receiver navigation message

Enter save mode

In the `Serialport` menu, click `Save` (`Ctrl+S`).

After selecting the save path in the pop-up file dialog box, enter Save mode.

The program will automatically generate a save file name according to the serial port name and time.

Below Save mode , all the data in the serial port will be saved to the file.

The Space function does not affect the saving of data.

Pause state

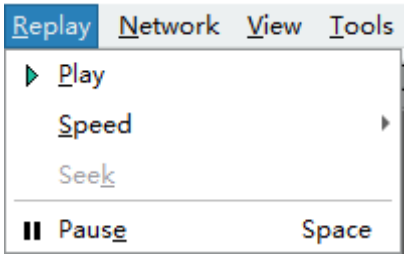
There is a save status indicator in the lower right corner of the program status bar.

Displays the save status and save file name.

A flashing save icon indicates that a data save has occurred.

Replay of receiver navigation messages

In the `Replay` menu, click `Play`.



In the pop-up dialog box, select the file to proceed `Replay`.

- The playback file size is limited to 4GB.
- `Repley` Priority and `Serialport`. During playback, the navigation messages in the serial port will be ignored.
- `Repley` It does not affect serial data `Save`.

Adjust Repley speed

In the `Repley` menu, select `Speed`.

There are currently x0.25, x0.5, x1, x2, x4, x8, x16 and max speed options.

- In x1 mode, playback will try to control one group of navigation messages per second.
- In maximum speed mode, no delay processing is performed on playback.

Pause Repley

In the `Repley` menu, click `Pause` (shortcut `Space`) to enter pause mode.

Pause mode does not affect serial data `Pause`

Resume Repley

In the `Repley` menu, click `Resume` (shortcut `Space`) to exit pause mode.

Repley progress

In `Repley` mode, playback progress is displayed on the taskbar.

`Slider` Control playback progress with mouse movement .

Find and jump

In the `Repley` menu, click `Find`.

In the pop-up dialog box, fill in the search keyword. Generally recommended `Time` (eg: 021223).

Click `OK` the key to search backwards for the keyword from the current playback position.

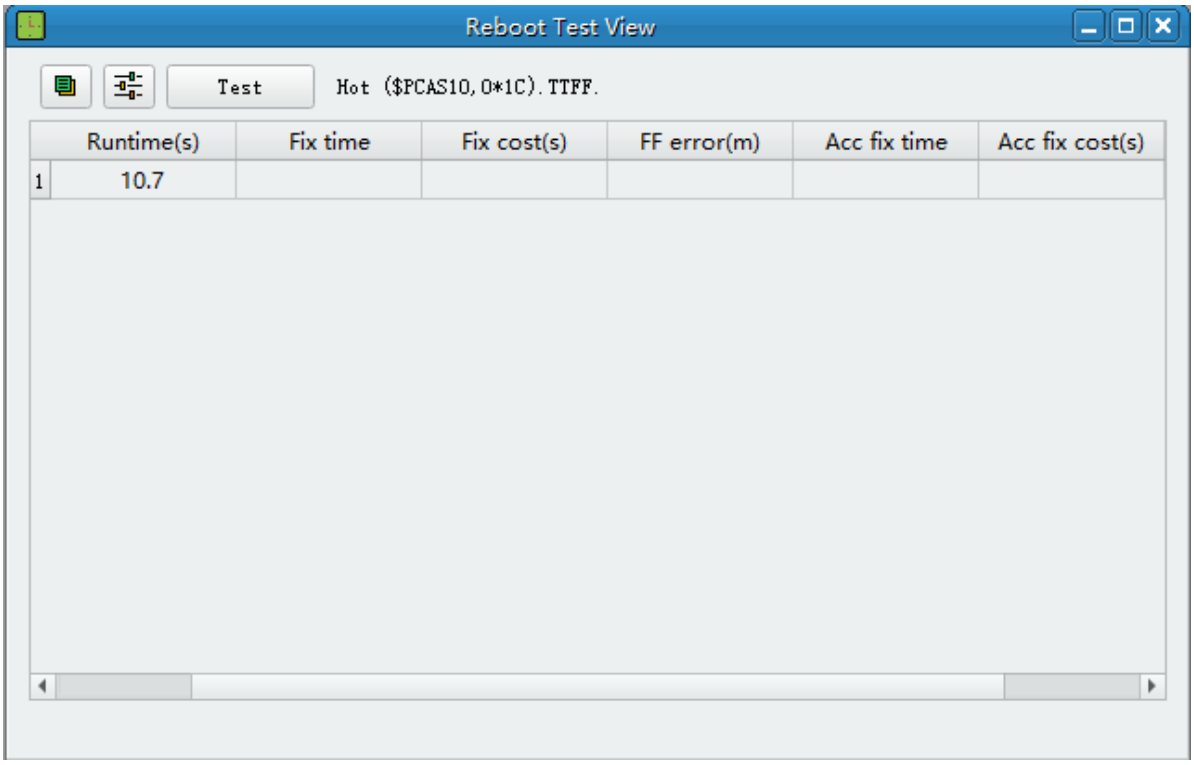
If a keyword is searched, the playback progress will jump to the position of the keyword.

Restart performance test

Time and accuracy of test restarts.

Open the RebootTest View

In the `View` menu, select `RebootTest`, open `RebootTest View`.



Set test option

Before testing, the test parameters need to be configured.

Click the button to `test option` make settings.

Test parameters	illustrate	Remark

Test parameters	illustrate	Remark
Test count	Maximum count for this test	
Min holding	After positioning, the receiver waits for the minimum time for the next restart	second
max holding	After positioning, the maximum time the receiver will wait for the next reboot	second
mode	The mode in which the receiver starts.	Cold, hot, autonomous.
Auto config	In custom mode, edit a custom restart message.	will be recorded in the `History` menu
Accuracy Test setting	Requirements for positioning accuracy. Undetermined positioning: There is no requirement for positioning accuracy. 3D: The 3D error of the positioning point is required to be within the set range. Altitude: The altitude error of the positioning point is required to be within the set range.	-
Fix error	Positioning accuracy error value	Meter
Format	latitude and longitude format	degrees, degrees minutes, degrees minutes seconds
latitude	base latitude value	-
longitude	Base longitude value	-
Altitude	base altitude	Meter

Start testing

Click `Test` the button to start the test.

After the number of tests reaches the set value, it will automatically exit the test.

Stop test

Click `Stop` the button to stop the test.

Test Data

The data generated by the test is as follows

data name	illustrate	Remark
reboot	Timestamp at which the restart command was sent.	-

data name	illustrate	Remark
Runtime	The time the receiver was running.	second
Fix time	Timestamp when the receiver was positioned.	-
Fix cost	The time taken by the receiver from receiving the restart command to positioning again.	second
FF error	The error value of the positioning point at the first positioning.	Meter
Acc fix time	The timestamp of the anchor point whose positioning accuracy meets the requirements.	-
Acc fix cost	The time taken by the receiver from receiving the restart command to accurate positioning again.	second
Fix error	The error value of the current anchor point.	Meter

Export test data

Click the button to copy the test data to `csv` the system clipboard in the format.

Users can paste the data into the spreadsheet software for further analysis and processing.

Test error

- restart time error

  The test uses the time of sending the restart command as the receiver restart time, which may be 0~1 second earlier than the real restart time.

- Sampling frequency error

  The test uses a sampling frequency of 10Hz, and the error of the timer itself is 0.1 seconds.

- restart protection error

  In order to prevent the interference of the buffer output of the receiver, the restart has a critical protection time of 1 second, that is to say, the minimum startup time that can be measured is 1 second.

Generate KML file

Generate KML files based on NMEA navigation messages, used in GoogleEarth.

Opens the Generate NMEA to KML

In the `Tools` menu, click `NMEA to KML`.

Option NMEA to KML

option name	illustrate
Auto open KML	When checked, when the KML generation is completed, GoogleEarth will be automatically called to open the KML, and the dialog box will be closed.
Include satellites	If checked, the satellite information will be listed in the node description of the KML file. The satellite information will take up a lot of googleearth memory space. If there are too many positioning points or insufficient memory, do not select this option.

Add NMEA files

Click `Add NMEA` the button and select the NMEA file in the pop-up dialog box. Supports the selection of multiple files.

In the table, the properties of the KML are displayed.

property name	illustrate
Color	In the KML file, the color of the node, you can choose a preset color.
Tag	In the KML file, the description tag of the node can be edited.
Name	The name of the NMEA file.
Porg	The progress while generating the KML file.

Generate KML

Click `Create` the button to generate KML files in batches.

Upgrade navigation code

Upgrading the navigation code in the navigation module

Select upgrade file

In the `Tools` menu, click `Update GNSS Code`. In the pop-up dialog box, select the UBF format file containing the navigation code to upgrade the code of the navigation module in the serial port connection.

About us

Hangzhou ZKMicro electronics Co., Ltd. is an integrated circuit design enterprise.

The main product directions are Beidou navigation and positioning chips, navigation modules, timing modules, stepping motor drive chips, and analog security chips.

For more information please visit our website .

Appendix A

Checksum for NMEA

The checksum of an NMEA sentence is the XOR sum of all characters between '$' and '*'.

The following code calculates the checksum of NMEA sentences.

```
/*
* Calculate nmea sentence's checksum
* @buf:        nmea sentence
* @return:     checksum
*/
 unsigned char nmea_calc_checksum(const char *buf)
{
        const char *p = buf;
        unsigned char chs = 0;

        while (*p == '$')               // skip '$'
                p++;

        while (*p != '*' && *p != 0)
                chs ^= *p++;

        return chs;
}
```

The following code checks that the checksum of the NMEA sentence is correct.

```
/*
 * Check nmea sentence's checksum
 * @buf:        buffer contains nmea sentence
 * @return:     if checksum is okay return 1, else return 0
 */
int check_nmea(const char *buf) {
        unsigned char chk = 0;
```

```
        const char *p = buf;
        char tmp[4];

        while (*p == '$')
                p++;

        while (*p != '*' && *p != '\0')
                chk  ^ =  * p ++ ;

        if (*p == '*') {
                sprintf(tmp, "%02X", chk);
                return 0 == memcmp(tmp, p + 1, 2);

        }
        return 0;
}
```

Latitude and longitude in NMEA

The latitude and longitude format in NMEA is: ddmm.mmmm.

For example: 12023.4323, which means 120 degrees and 23.4323 minutes.

The following code converts NMEA latitude and longitude strings to degrees.

```
/*
 * Convert ddmm.mmmm format string into degrees
 * @s:          ddmm.mmmm format string in NMEA
 * @return:     degree value
 */
double convert_from_ddmm(const char *s)
{
        double val = strtod(s, NULL);
        int degrees = (int)val / 100;
        double minutes = val - degrees * 100.0;
        return degrees + minutes / 60.0;
}
```

More NMEA parsing

Please refer to the open source project: https://github.com/zxcwhale/NmeaParser