ComNav Technology

# User Guide

K-series OEM Board



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## Trademark notice



SinoGNSS is the official trademark of ComNav Technology Ltd., registered in People's Republic of China, EU, USA and Canada.

## FCC Notice

ComNav Technology OEM boards comply with part 15 of the FCC Rules. Operation is subject to the following two conditions:

1) This device may not cause harmful interference;

2) It must accept any interference received, including interference that may cause undesired operation.



## Copyright Notice



## Technical Assistance

If you have any question and can't find the answer in this manual, please contact your local dealer from which you purchased K-series OEM board. Alternatively, request technical support from ComNav Website: www.comnavtech.com or technical support email: oem.support@comnavtech.com. Your feedback about this Guide will help us to improve it with future revisions. Please email your comments to: oem.support@comnavtech.com.

## Warranty Notice

ComNav Technology warrants K-series OEM board for one (1) year from date of purchase unless otherwise specified.

ComNav Technology only guarantees products that are properly and correctly installed, configured, and operated in accordance with ComNav Technology's K-series OEM board User Guide and Specifications.

# Content

# 1. Introduction

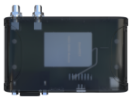
This User Guide provides a brief introduction of K-series OEM board installation, configuration and operation. We recommend that you read this manual carefully even if you have used GNSS products from other brands.

## 1.1 Overview of K-series OEM board

ComNav Technology K-series OEM boards and modules support existing and future constellations, which are widely used in high-accuracy positioning and navigation applications. With Quantum™ technology, it remarkably improves the stability and reliability of positioning accuracy in standalone and RTK modes. Following table on page 7 shows specifications of K-series OEM boards and modules.

## 1.2 Evaluation kit

If you order ComNav Technology OEM board or module evaluation kit, please check carefully when you receive shipping box as the following figure:

| **K-series OEM board Evaluation kit** | | **K8-series OEM module Evaluation kit** | |
|---|---|---|---|
|  | K-Series OEM Board *1 |  | K8-series OEM module *1 |
|  | Interface Board *1 |  | K8-series EVK *1<br>(*K8 Module inside) |
|  | Power Adapter *1 |  | USB Type-C cable *1 |
|  | TNC-K/MCX-K Adapter *1 |  | Serial cable *1 |
|  | Serial Cable *1 |  | SMA-J/TNC-K Adapter<br>(Optional) |
|  | MCX-JW/MCX-J Cable(22cm) *1 |  | GNSS Antenna Cable (Optional) |
|  | GNSS Antenna Cable (Optional) |  | GNSS Antenna (Optional) |
|  | GNSS Antenna (Optional) | | |

## 1.3 Related documents

This document only covered frequently used commands, find further information about command and log information in ***ComNav OEM Board Reference Manual_V1.8***, also for technical specifications of every OEM board model. Please download at:

https://cetest01.ufile.ucloud.com.cn/fsite_1802020370/ComNav_OEM_Board_Reference_Manual_V1.8160 2324480407.pdf

| Model | Signal tracked | Size (L x W x H) | Weight | Position Accuracy | Orientation Accuracy | Position fix update rate | Port type | Power consumption | Internal Memory |
|---|---|---|---|---|---|---|---|---|---|
| **K700** | -GPS: L1<br>-GLONASS: L1<br>-BeiDou: B1<br>-SBAS: WAAS, EGNOS, MSAS, GAGAN, SDCM | 71×41×11 mm | 18g | autonomous <1.5m<br>SBAS <1m<br>DGPS 0.25m+1ppm<br>RTK 8mm+1ppm<br>post processed 2.5mm+1ppm<br>(All values in Horiz,RMS) | Code active | 50Hz PVT<br>100Hz Raw data | 3 ×RS232 | 0.60W | NONE |
| **K708** | -GPS: L1 C/A, L2C, L2P, L5<br>-BeiDou: B1, B2, B3<br>-GLONASS: L1, L2<br>-Galileo E1, E5a, E5b<br>-QZSS<br>-SBAS: WAAS, EGNOS, MSAS, GAGAN | 100×60×9 mm | 45g | autonomous <1.5m<br>SBAS <1m<br>DGPS 0.25m+1ppm<br>RTK 8mm+1ppm<br>post processed 2.5mm+1ppm<br>(All values in Horiz,RMS) | Code active | 50Hz PVT<br>100Hz Raw data | 4×RS232,<br>1 USB,<br>1 LAN Port | 1.70W | 8 GB |
| **K728** | -GPS: L1 C/A, L2C, L2P<br>-BeiDou: B1, B2<br>-GLONASS: L1, L2<br>-SBAS: WAAS, EGNOS, MSAS, GAGAN | 100×60×9 mm | 44.2g | autonomous <1.5m<br>SBAS <1m<br>DGPS 0.25m+1ppm<br>RTK 8mm+1ppm<br>post processed 2.5mm+1ppm<br>(All values in Horiz,RMS) | HDG: (0.2/R)°<br>R/P: (0.4/R*)° | 20Hz PVT<br>20Hz Raw data | 4 ×RS232,<br>1 USB,<br>1 LAN Port | 2.10W | NONE |
| **K706** | -GPS: L1 C/A, L2C, L2P<br>-BeiDou: B1, B2<br>-GLONASS: L1, L2<br>-Galileo, QZSS<br>-SBAS: WAAS, EGNOS, MSAS, GAGAN | 71×46×9m m | 26.6g | autonomous <1.5m<br>SBAS <1m<br>DGPS 0.25m+1ppm<br>RTK 8mm+1ppm<br>post processed 2.5mm+1ppm<br>(All values in Horiz,RMS) | Code active | 50Hz PVT<br>50Hz Raw data | 3 ×RS232,<br>1 USB,<br>1 LAN Port | 1.68W | 8 GB |
| **K726** | -GPS: L1 C/A, L2C, L2P<br>-BeiDou: B1, B2<br>-GLONASS: L1, L2<br>-SBAS: WAAS, EGNOS, MSAS, GAGAN | 71×46×9m m | 27.2g | autonomous <1.5m<br>SBAS <1m<br>DGPS 0.25m+1ppm<br>RTK 8mm+1ppm<br>post processed 2.5mm+1ppm<br>(All values in Horiz,RMS) | HDG: (0.2/R)°<br>R/P: (0.4/R)° | 20Hz PVT<br>50Hz Raw data | 3 ×RS232,<br>1 USB | 1.96W | NONE |
| **K705** | -GPS: L1 C/A, L2C, L2P, L5<br>-BeiDou: B1, B2, B3<br>-BeiDou Global: B1c, B2a<br>-GLONASS: L1, L2<br>-Galileo E1, E5a, E5b<br>-QZSS, IRNSS<br>-SBAS: WAAS, EGNOS, MSAS, GAGAN, SDCM<br>-L-Band | 50×40×9m m | 22g | autonomous <1.5m<br>SBAS <1m<br>DGPS 0.25m+1ppm<br>RTK 8mm+1ppm<br>post processed 2.5mm+1ppm<br>(All values in Horiz,RMS) | Code active | 50Hz PVT<br>50Hz Raw data | 6 ×RS232,<br>1 USB,<br>1 LAN Port | 1.30W | NONE |
| **K803** | -GPS: L1 C/A, L2C, L2P, L5<br>-BeiDou: B1, B2, B3<br>-BeiDou Global: B1c, B2a, B2b<br>-GLONASS: L1, L2<br>-Galileo E1, E5a, E5b<br>-QZSS, IRNSS<br>-SBAS: WAAS, EGNOS, MSAS, GAGAN, SDCM<br>-L-Band | 30×30×3.2 mm | 8g | autonomous <1.5m<br>SBAS <1m<br>DGPS 0.25m+1ppm<br>RTK 8mm+1ppm<br>post processed 2.5mm+1ppm<br>(All values in Horiz,RMS) | Code active | 20Hz PVT<br>50Hz Raw data | 4 ×RS232 | 1.00W | NONE |
| **K823** | -GPS: L1 C/A, L2C, L2P<br>-BeiDou: B1, B3<br>-BeiDou Global: B1c, B2b<br>-GLONASS: L1, L2<br>-Galileo E1, E5b<br>-QZSS, IRNSS<br>-SBAS: WAAS, EGNOS, MSAS, GAGAN, SDCM<br>-L-Band | 30×40×3.2 mm | 10g | autonomous <1.5m<br>SBAS <1m<br>DGPS 0.25m+1ppm<br>RTK 8mm+1ppm<br>post processed 2.5mm+1ppm<br>(All values in Horiz,RMS) | HDG: (0.2/R)°<br>R/P: (0.4/R)° | 20Hz PVT<br>20Hz Raw data | 3 ×RS232 | 1.60W | NONE |

*R(meter) is the baseline length of two GNSS antennas

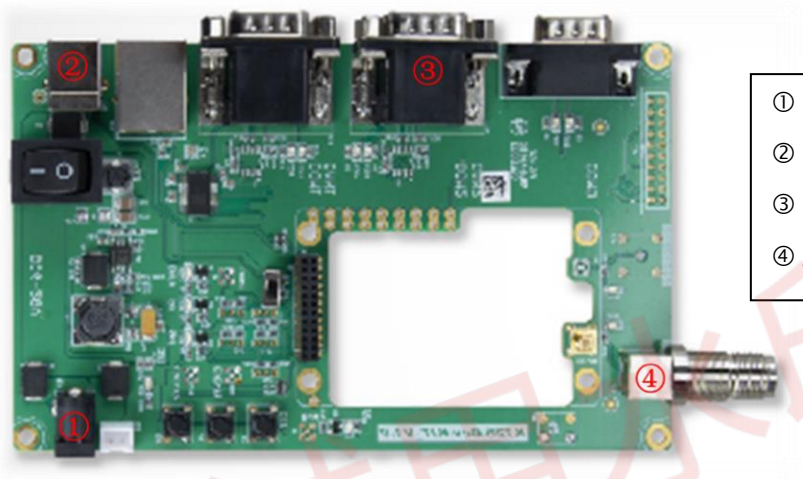
For detailed information about K-family products, refer to the product brochures at http://www.comnavtech.com/product/8/

# 2. Installation of K-series OEM board

This chapter introduces guidelines to install your OEM boards, and check status of K-series OEM board.

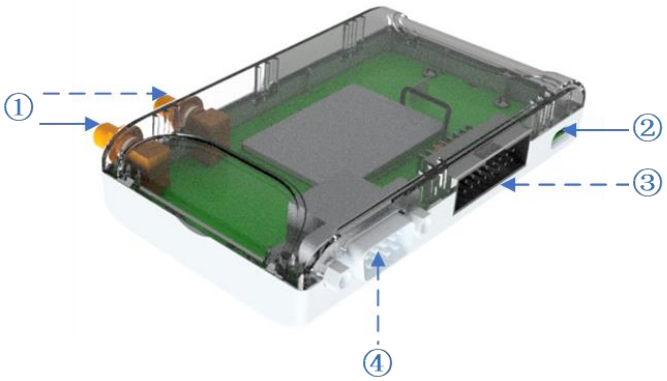
## 2.1 ComNav Technology interface board and EVK

ComNav Technology interface board is a mother board for K-series OEM board and K8 series card version module, and two types interface board are available depending on the size of your OEM board. The following figure shows interface board for small-sized OEM board:




① External DC power supply, 6V-28V
② USB power supply, 5V
③ Serial ports
④ Antenna connector

In addition to card version of K8 series, ComNav Technology also provide EVK of K8 series for users to choose. The following figure shows the EVK of K823 OEM module:






① GNSS RF * 2
② USB Type-C
③ 16-PIN connector
④ DB9 serial port

K823 EVK has a DIP switch, which can control the COM1/2/3 connection of K823 to switch between the 16-pin connector and other interfaces.

The pin definition of the 16-PIN connector is shown in the table below:

| GPIO2 | EVENT2 | PPS | TX_COM3 | TX_COM2 | TX_COM1 | GND | VIN |
|---|---|---|---|---|---|---|---|
| 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| GPIO1 | EVENT1 | GND | RX_COM3 | RX_COM2 | RX_COM1 | GND | VIN |

a. TX/RX_COM1/2/3 supports LVCMOS 3.3V level and is compatible with LVTTL 3.3V level;

b. VIN means power supply, supports 5 - 12 VDC;

c. DB9 serial port support RS232 level;

d. The Type-C interface has a built-in CP2102 USB to UART chip. Windows 10 can automatically identify and install the driver when connected to the Internet. For other OS drivers, please log in to the *website* to download the corresponding driver;

e. The DIP switch defines the connection status of the external interfaces and internal serial ports of OEM module, shown in the following table.

| A | |
|---|---|
| Bluetooth | COM3 |
| USB | COM2 |
| COM | COM1 |

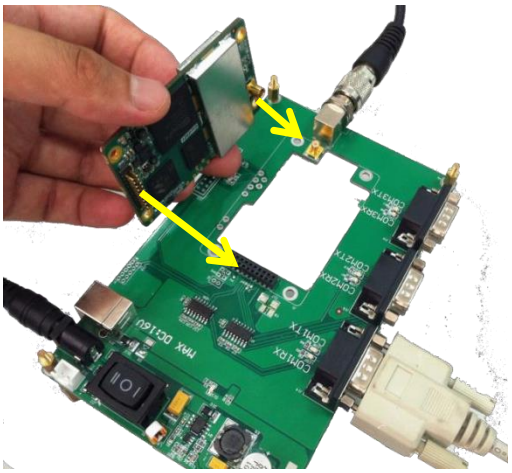
The following sector describes installation guidelines with ComNav Technology interface board. Making self-developing integrated system, please refer to OEM board specifications at

http://www.comnavtech.com/companyfile/7/#c_companyFile_list-15221516507291902-2

## 2.2 Guidelines for installation

1. Install the K-series OEM board and K8 series card version module with ComNav interface board.

   - Fix the PIN and RF connection to the interface board properly
   - Ensure 100% fitting for all connections
   - Firstly, unplug the PIN out when uninstalling the OEM cards (the K501 installation shown in the following figure).



2. Connect the GNSS antenna through a coaxial cable. When mounting the antenna:
   - In the area with a clear view of the sky
   - Far from big power electromagnetic radiation devices
   - On a secure and stable environment
3. Power supply
   - Power on your OEM board through ComNav standard 12 voltage adapter or USB
   - After all components connected, press the power button on the interface board
4. Connect to your PC or data communications equipment as the picture below:




## 2.3 LED behavior

There are LED indicators helping you to check status of K-series OEM board.

① Power indicator of OEM board

② LED indicators of satellites and correction data

- Satellite indicator (R): Flashing N times/5s (N=the number of satellites tracked) Correction data indicator (L): Flashing 1/s to send or receive correction data.

③ LED indicators of serial ports

- TX(R): Flashing when outputting data from OEM board
- RX(L): Flashing when OEM board receiving correction data or commands

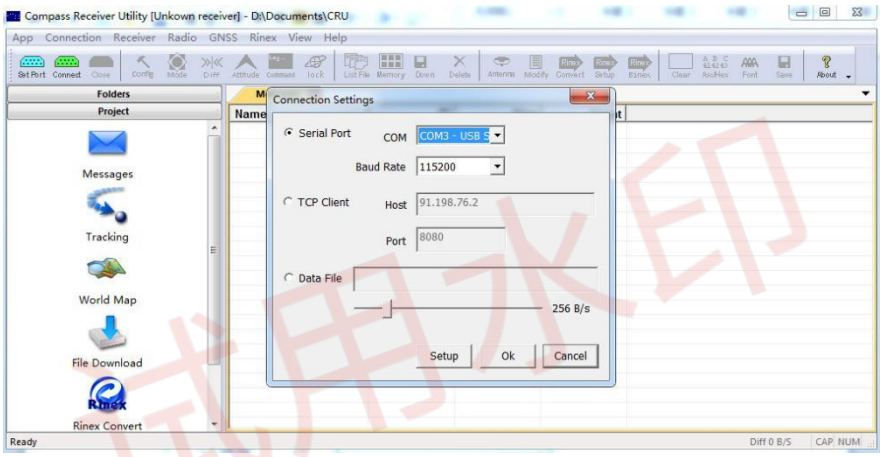
④ Power indicator of Interface board.

# 3. OEM board configuration with CRU software

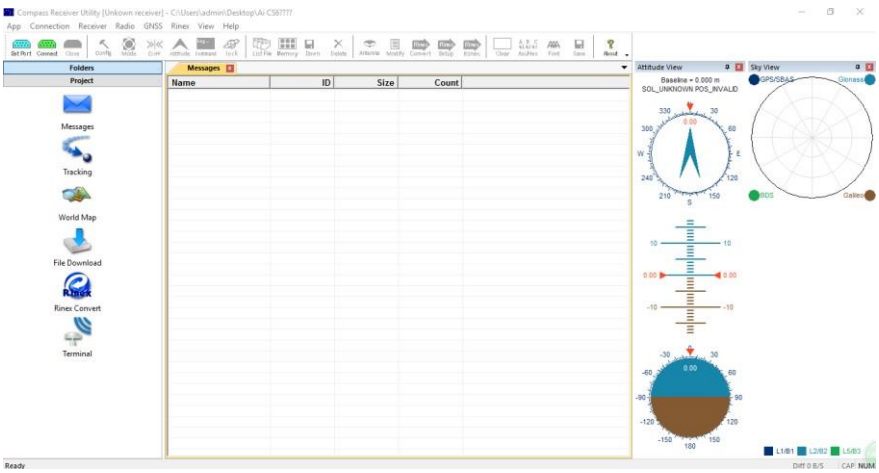
This chapter describes OEM board configuration with ComNav Compass Receiver Utility (CRU) software. With CRU software, you are able to communicate and configure your OEM boards via serial port or Ethernet connection. Download at: http://www.comnavtech.com/companyfile/4/

## 3.1 Connect with OEM boards

For serial port communication, Click **Set Port** -> select COM port -> **OK** to connect (the default baud rate of OEM board is 115200).



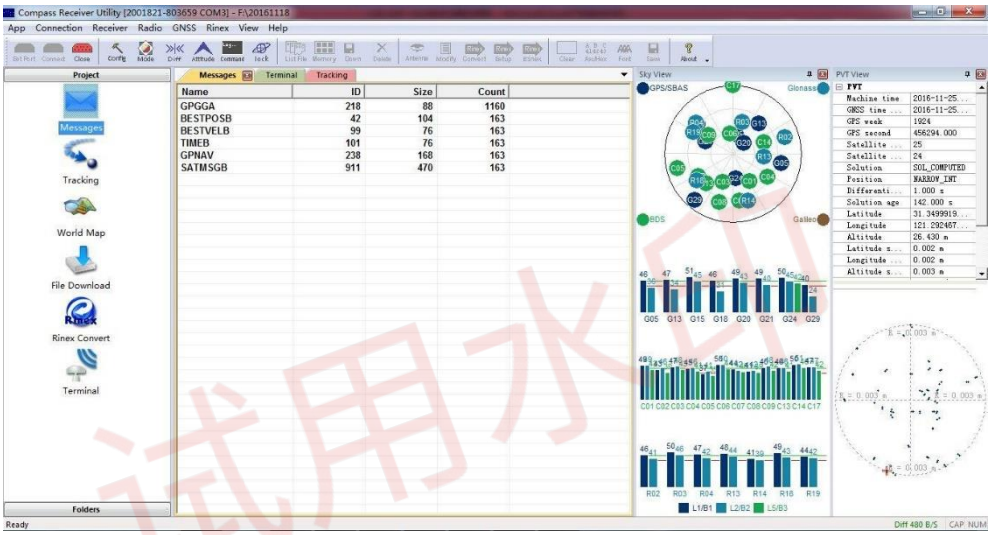

The series number of OEM board will be shown on the title bar if connected successfully, otherwise please check power supply and connections of every components.



## 3.2 Status checking

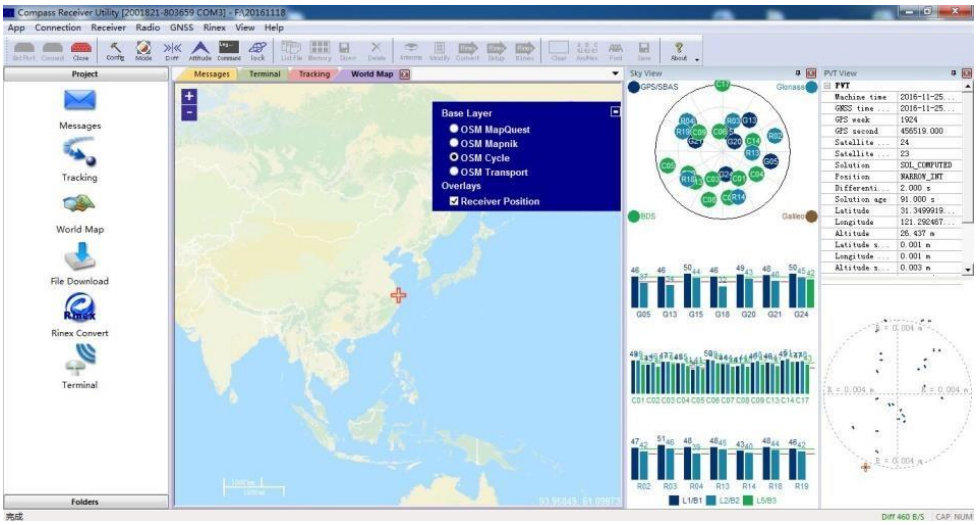
Go to ***Tracking*** to check satellite information such as SNR and elevation, and click ***view*** to display the sky view shown below. Normally the SNR should reach the following values:

- GPS(G): max value for L1: 48-50; max value for L2: 40-42
- Glonass(R): max value for L1: 48-50; max value for L2: 45-48
- BeiDou(C): max value for B1: 45-47; max value for B2: 45-47
- Galileo(E):max value for E1:48-50l max value for E5b: 48-50




Go to ***Message*** to check the output message of receiver.

Ensure your pc internet connected, and go to ***World Map*** -> select proper base layer to check the current position on global map.

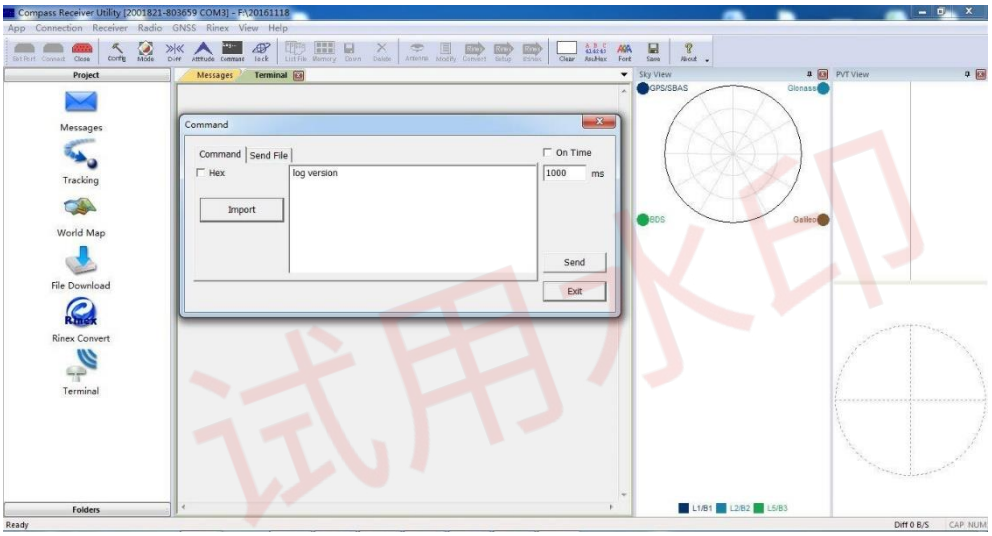


*Tip: After you click on **Tracking**, terminal interface will output binary data that used for request sky view, PTV view. To stop output, please enter command "**Unlogall**" in **command** interface, then enter ASCII commands you need.*

## 3.3 Command Interface

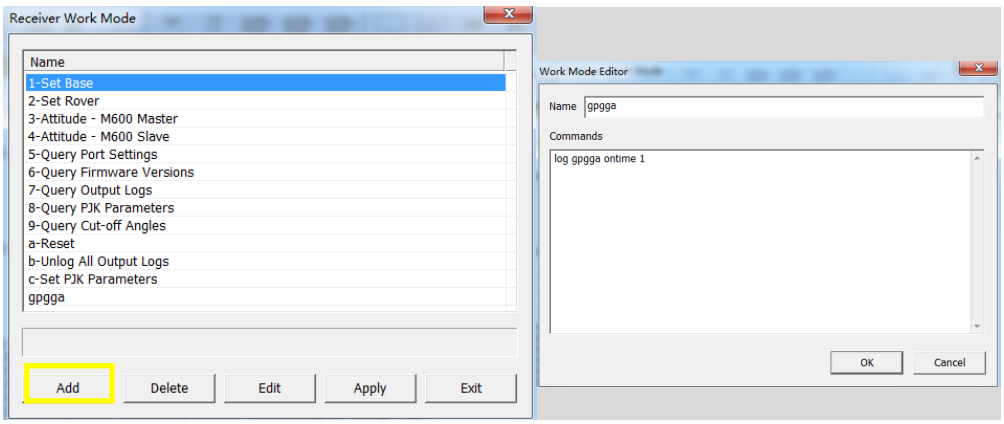
Go to ***Command*** to send ASCII commands to receiver. When inputting commands:

- Select and send proper commands, all commands are case insensitive: Log version=LOG VERSION
- Press ***Enter*** button at the end of every command to check receivers' feedback information or input another command
- For all programmatic commands, please refer to ***ComNav OEM Board Reference Manual_V1.8***



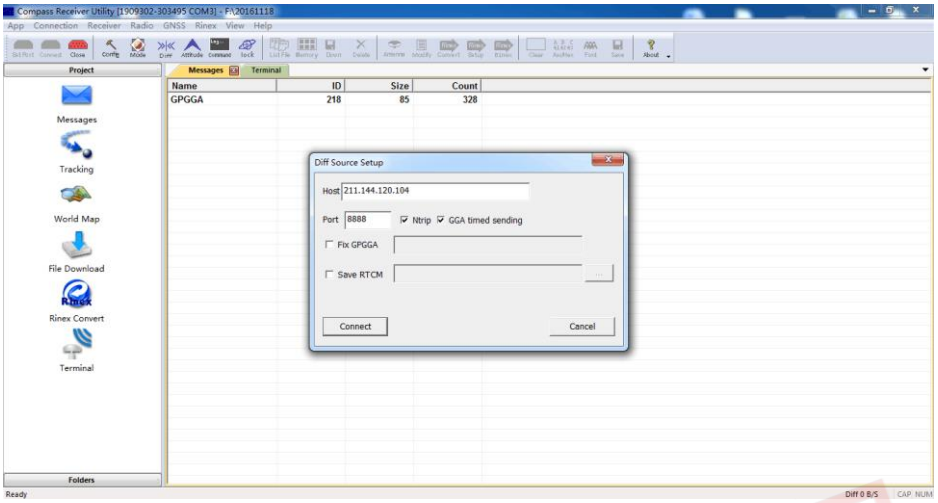

Go to ***Mode*** to check frequently used commands package, and it also supports click

- ***Add*** to add commands you need.

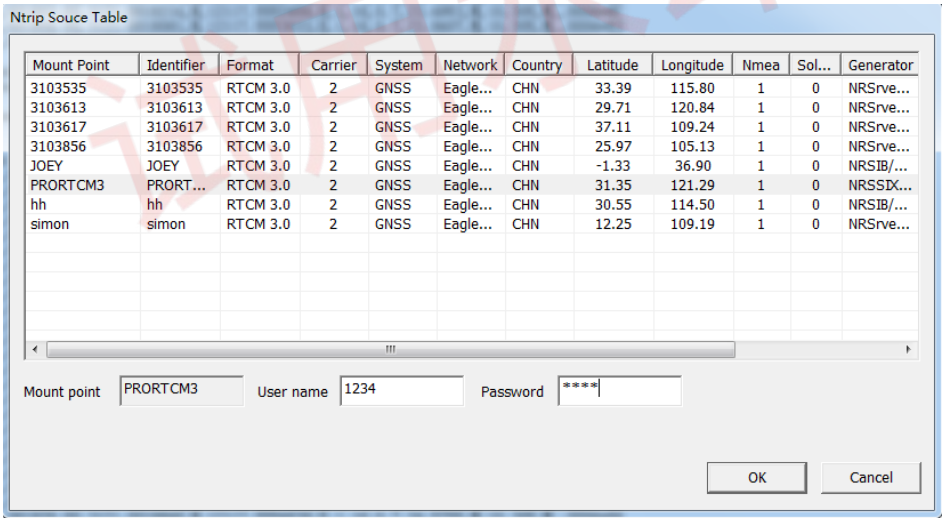


## 3.4 NTRIP configuration

To easily test RTK function through NTRIP protocol, firstly ensure your PC internet connected, then go to ***Diff*** -> enter IP and port -> click ***Ntrip*** -> OK to go to NTRIP source table.

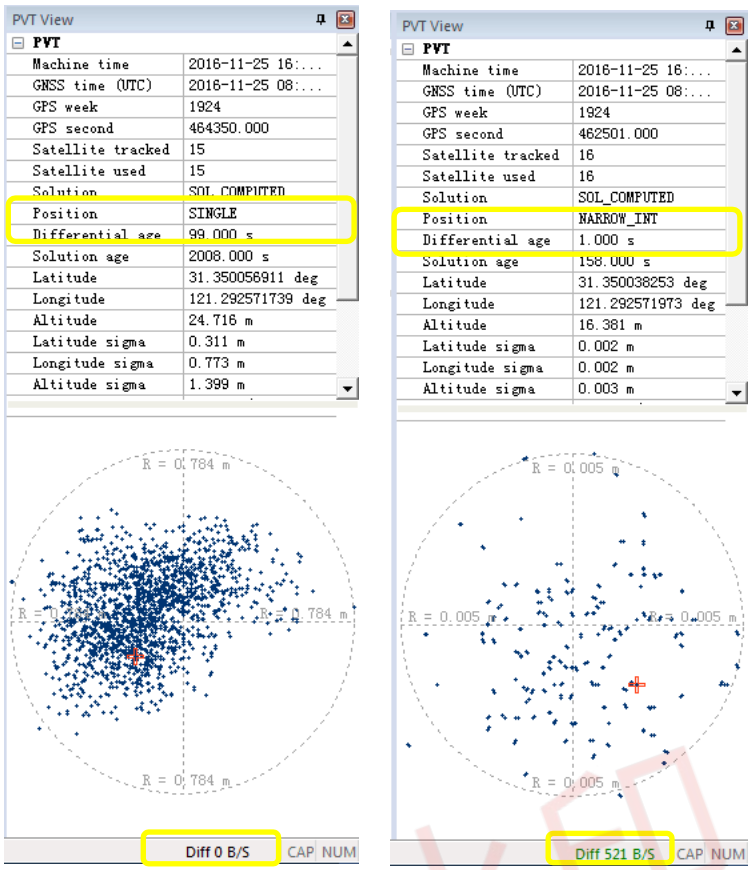



Then select ***Ntrip mount point*** -> enter **Username** and **password** (Anonymous Types)




-> OK.

After receiver received correction data, the receiver will calculate the ambiguity and turn to differential mode. Go to View -> PVT View to check RTK status: 1) Position mode; 2) Differential age: from 1(correction data received) to 99(No correction data received); 3) Diff: Correction data flow.




Be careful that the OEM board is unable to respond to any command when set as the differential mode, it's better to switch to the normal mode by:

1) Go to Diff – click disconnect
2) Or send command: ***Interfacemode compass compass on***

Then you can send commands to OEM board.

## 3.5 Data recording configuration

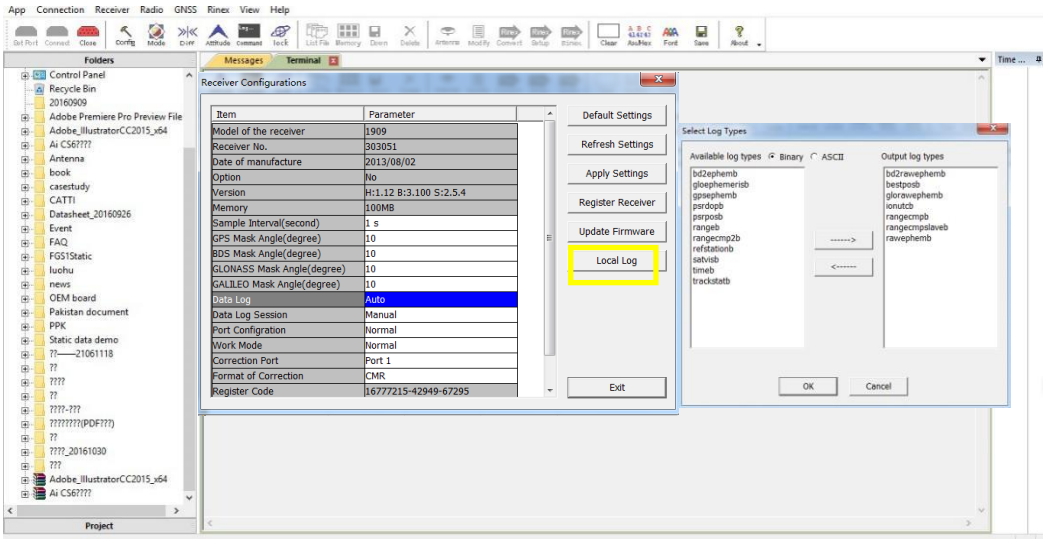
For data recording, it provides two methods to save the raw observation data:

1) To save the raw data in the onboard memory,
   - For K5-series: go to Config -> select Auto Data log -> Apply Settings –> restart your OEM board to activate this setting.
   - For K7-series OEM board (only K706 and K708), it needs to send the following command:

| | |
|---|---|
| ***Set EMMC on*** | *// Open EMMC of OEM board* |
| ***Saveconfig*** | *// Save configuration* |

Then go to ***Config*** -> select Auto Data log -> Apply Settings –> restart your OEM board to activate this setting.

2) To save the raw data in your PC, select the folder path -> go to Config -> click Local Log -> select log types -> OK, the raw data file will be saved in the folder you select.




There are other settings for onboard memory you can change based on your requirements:

- **Sample Interval:** change the sample interval of observations, the maximum data rate is 20Hz, the minimum is one observation per minute.
- **Mask angle:** disable the receiver to track satellites that below the mask angle. You can set mask angle values for different constellations, which can reduce serious multipath influence or low SNR.
- **Data Log Session:** 1) Manual means that the receiver keeps recording data in one file until the receiver is turned off or its memory runs out; 2) if set to 1/2/3/4/12 hours, the data recorded will be saved in to a file every 1/2/3/4/12 hours.
- **Data log:** the default setting is manual mode. To log data in manual mode, send the following commands.

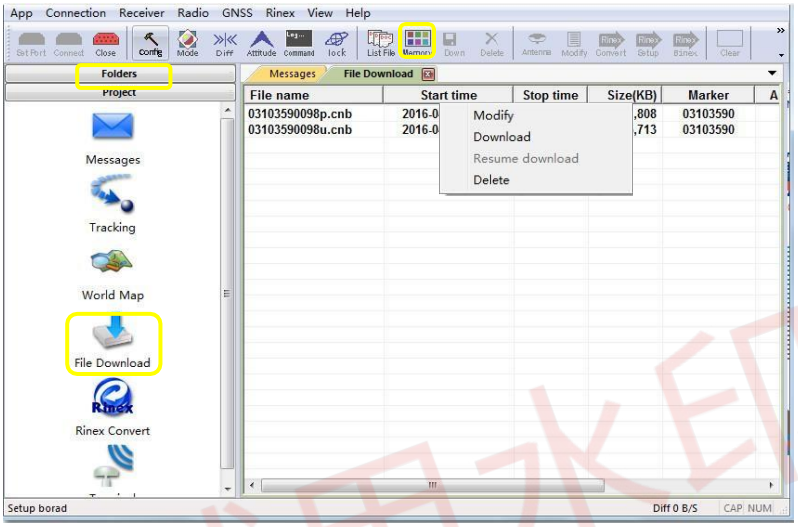
| **For K5-series:** | **For K7-series:** |
|---|---|
| ***Set static on***<br>***Saveconfig*** | ***Set emmc on***<br>***Saveconfig***<br>*// Restart your OEM board*<br>***Set static on***<br>*// Send set static off, if you finish recording* |

## 3.6 Data management

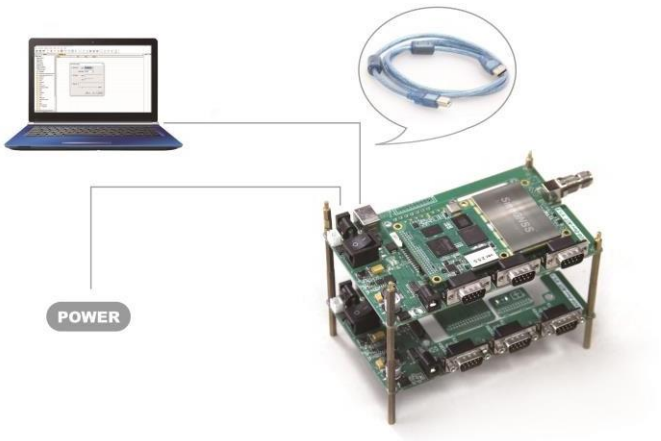
### 3.6.1 Raw Data Download

For K5-series OEM board, download data only from receiver to your PC through serial port in CRU software.

1) Connect the OEM board to your PC as described before (see Chapter 3.1).
2) Click Folders to select download path
3) Click File Download in project menu to check all raw data on main window, or click List File to refresh raw data list.
4) Right-click on the file name to modify, download or delete the raw observation data.




For K7-series OEM board, you only can download raw data through USB cable and raw data will be saved in the file named after its date.

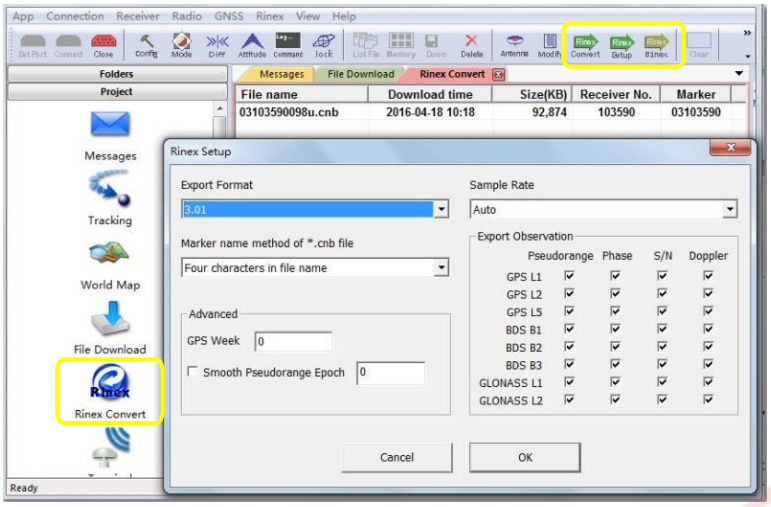



### 3.6.2 Convert to RINEX

After downloading raw observation data to your PC, go to Rinex Convert to convert from ComNav binary format

(*.cnb) to RINEX.

Click  in standard toolbar to change Convert Settings, mainly export format and export observation information. Then click  to convert to RINEX, the RINEX data will be saved in the same path as raw observation data.




*Tip: In some Post Processing software, Beidou observations cannot be processed, you can uncheck Beidou B1, B2, B3 observations.*

# 4. Work mode configuration

This chapter describes the commands for frequently used work mode, which can help you to quick start to use ComNav Technology OEM board and module.

ComNav Technology OEM board set single point positioning as default work mode. However, it also supports various work modes that meet your requirements, including smooth mode, SBAS mode, RTK mode, RTD mode and Moving baseline mode.

*Note: comX shown in the following commands, X is the serial port number*

## 4.1 Smooth mode

In single-point positioning, ComNav Technology have adopted an advanced smoothing filter to enhance pass-to-pass accuracy, which need send commands as:

| | |
|---|---|
| ***Set smoothedpvt on*** | *// activate the smooth mode* |
| ***Saveconfig*** | *// Save configuration* |

With the 20cm pass-to-pass accuracy, positioning with smooth mode is ideal for precision agriculture, fleet management and more.

Output GPGGA message to check if OEM board is in smooth mode, solution status should be" E,1" and differential age value should be "99", shown below.

$GPGGA,000359.00,3125.4999742,N,12136.9969461,E,1,07,2.5,10.4541,M,11.371, M,99,0000*4C

## 4.2 SBAS mode

For ComNav Technology OEM boards, the default setting for SBAS is disabled. You can enable this mode to improve positioning accuracy if receivers in the area covered by certain SBAS satellites. Make sure GNSS antenna is able to track satellites, and send following commands to activate this mode:

| | |
|---|---|
| ***S****et pvtobsmode sbas* | *// activate the SBAS satellite, take MSAS as an example.* |
| *set sbassys* | *// Set sbas satellite based on* |
| *msas/waas/egnos/gagan* | *service coverage* |

*Tip: To disable SBAS, send command "**sbascontrol disable**".*

Output GPGGA message to check if OEM board is in SBAS mode, solution status should be "E,2" (SBAS mode) and base ID should be SBAS satellite's PRN, such as "0129".

$GPGGA,015101.00,3121.0000551,N,12117.5483125,E,2,23,1.1,37.2598,M,0.000,M, 02,0129*58

## 4.3 RTK mode

Generally, RTK mode is a commonly used work mode, which can provide centimeter real-time positioning accuracy. We recommend using RTCM3.0/3.2 as correction data, please refer to following configuration to start RTK mode.

***For the Base***

| **RTCM3.0** | *For the Base* |
|---|---|
| ***Unlogall*** | *// clear previous settings* |
| ***Fix position 31.1744880 121.3878091 44.1287*** | *// fix the coordinate* |
| ***(Fix auto)*** | *// fix auto* |
| ***Log comX rtcm1004b ontime 1*** | *// Extended L1, L2 GPS RTK Observables* |
| ***Log comX rtcm1012b ontime 1*** | *// Extended L1, L2 GLONASS RTK Observables* |
| ***Log comX rtcm1005b ontime 5*** | *// Base station coordinate* |
| ***Log comX rtcm1033b ontime 10*** | *// Base station type* |
| ***Saveconfig*** | *// Save configuration* |

With 9600 baud rate for air link, the limited number of data can be sent out per second in radio mode. Therefore, it's better to set latency time for different constellations if you start base station in radio mode. The following commands show RTCM3.0 as an example, which may be incompatible with rover receiver of other brands.

| ***RTCM3.0 (Radio mode)*** | *For the Base* |
|---|---|
| ***Unlogall*** | *// clear previous settings* |
| ***Fix position 31.1744880 121.3878091 44.1287*** | *// fix the entered coordinate* |
| ***(Fix auto)*** | *// fix the coordinate automatically* |
| ***Log comX rtcm1004b ontime 2*** | *// Extended L1, L2 GPS RTK Observables* |
| ***Log comX rtcm1012b ontime 2 1*** | *// Extended L1, L2 GLONASS RTK Observables* |

| | |
|---|---|
| ***Log comX rtcm1005b ontime 5*** | *// Base station coordinate* |
| ***Log comX rtcm1033b ontime 10*** | *// Base station type* |
| ***Saveconfig*** | *// Save configuration* |

| **RTCM3.2 (MSM4)** | *For the Base* |
|---|---|
| ***Unlogall*** | *// clear previous settings* |
| ***Fix position 31.1744880 121.3878091 44.1287*** | *// fix the entered coordinate* |
| ***(Fix auto)*** | *// fix the coordinate automatically* |
| ***Log comX rtcm1074b ontime 1*** | *// GPS Full PRs and Phase Ranges plus CNR* |
| ***Log comX rtcm1084b ontime 1*** | *// GLONASS Full PRs and Phase Ranges plus CNR* |
| ***Log comX rtcm1094b ontime 1*** | *// GALILEO Full PRs and Phase Ranges plus CNR* |
| ***Log comX rtcm1124b ontime 1*** | *// BeiDou Full PRs and Phase Ranges plus CNR* |
| ***Log comX rtcm1005b ontime 5*** | *// Base station coordinate* |
| ***Log comX rtcm1033b ontime 10*** | *// Base station type* |
| ***Saveconfig*** | *// Save configuration* |

| **RTCM3.2 (MSM5)** | *For the Base* |
|---|---|
| ***Unlogall*** | *// clear previous settings* |
| ***Fix position 31.1744880 121.3878091 44.1287*** | *// fix the entered coordinate* |
| ***(Fix auto)*** | *// fix the coordinate automatically* |
| ***Log comX rtcm1075b ontime 1*** | *// GPS Full PRs and Phase Ranges plus CNR* |
| ***Log comX rtcm1085b ontime 1*** | *// GLONASS Full PRs and Phase Ranges plus CNR* |
| ***Log comX rtcm1095b ontime 1*** | *// GALILEO Full PRs and Phase Ranges plus CNR* |
| ***Log comX rtcm1125b ontime 1*** | *// BeiDou Full PRs and Phase Ranges plus CNR* |
| ***Log comX rtcm1005b ontime 5*** | *// Base station coordinate* |
| ***Log comX rtcm1033b ontime 10*** | *// Base station type* |
| ***Saveconfig*** | *// Save configuration* |

***For the Rover***

| | *For the Rover* |
|---|---|
| ***log comX gpgga ontime 1*** | *//ComX output GPGGA data* |
| ***rtkobsmode 0*** | *//Set the observation mode of rover receiver* |
| ***Interfacemode comX auto auto on*** | *//Config comX to detect RTCM corrections* |
| ***Saveconfig*** | *// Save configuration* |

*Tip: If comX is the serial port used for configuration currently, please replace command* ***saveconfig*** *with* ***interfacemode saveconfig****.*

Output GPGGA message to check if OEM board in RTK mode, solution status should be "E,4".

$GPGGA,015101.00,3121.0000551,N,12117.5483125,E,4,23,1.1,37.2598,M,0.000,M, 02,0004*58

Moreover, the default setting is foot mode, and you also can adjust different dynamic mode in the RTK mode based on your requirements including foot, land, air, auto and static. In different mode, RTK engine treats the observation data in different style to promote the performance of RTK engine. The command is as below:

| | |
|---|---|
| ***Rtkdynamics <mode>*** | *//can be set as land/air/foot/auto/static* |
| ***Saveconfig*** | *//save configuration* |

| Mode | Description |
|---|---|
| **LAND** | Board is in a stable land vehicle with velocity less than 110 km/h |
| **AIR** | Board is in a stable land vehicle or an aircraft with velocity more than 110km/h |
| **FOOT** | Board is being carried by a person with velocity less than 11km/h |
| **AUTO** | Board is in an automatic mode |
| **STATIC** | Board is in static status |

## 4.4 RTD mode

For decimeter-level positioning application, our board can provide DGPS mode. The configuration is as below:

***For the Base:***

| | *For the Base* |
|---|---|
| ***Fix position 31.1744880 121.3878091 44.1287*** | *// fix the entered coordinate* |
| ***(Fix Auto)*** | *// fix the coordinate automatically* |
| ***Log rtcm1b ontime 1*** | *//Differential GPS Corrections* |
| ***Log rtcm31b ontime 1*** | *//Differential GLONASS Corrections* |
| ***Log rtcm59bdsprcb ontime 1*** | */Differential Beidou Corrections* |
| ***Saveconfig*** | *// Save configuration* |

*Tip: RTCM59bdsprcb message is defined by ComNav Technology, which may be incompatible with rover receiver of other brands.*

***For the Rover***

| | *For the Rover* |
|---|---|
| ***log comX gpgga ontime 1*** | *//ComX output GPGGA data* |
| ***rtkobsmode 3*** | *//Set the observation mode of rover receiver* |
| ***Interfacemode comX auto auto on*** | *//Config comX to detect RTCM corrections* |
| ***Saveconfig*** | *// Save configuration* |

*Tip: If comX is the serial port used for configuration currently, please replace command* ***saveconfig*** *with* ***interfacemode saveconfig****.*

Output GPGGA message to check if OEM board is in RTD mode, the solution status should be "E,2".

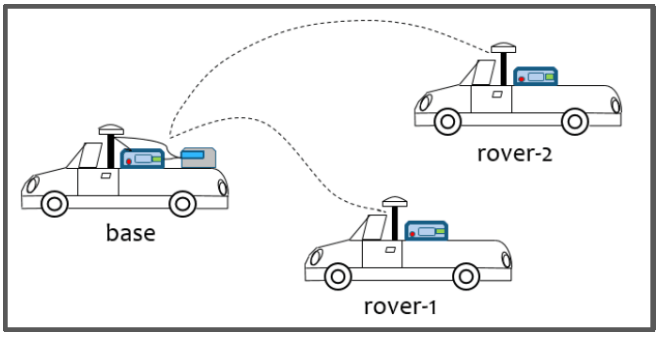
$GPGGA,015101.00,3121.0000551,N,12117.5483125,E,2,23,1.1,37.2598,M,0.000,M, 02,0004*58

## 4.5 Moving base mode

Different from the stationary base station, the moving base station transmits corrections to the rover when it's moving. Therefore, it should set to no fixed position via the "Fix none" command. There are two main types of moving base mode shown below:

### 4.5.1 Moving base station

The moving base function allows you to obtain a centimeter-level xyz baseline estimate when the base station and rover are moving, which means the rover can only get accurate relative position based on the base. In this mode, the rover should be set as synchronous mode due to the latency of the reference station position message. Moreover, the moving base can accept the external high accuracy NMEA input, for example from another GNSS station with absolute high precision; then transmit to the rover, refer to chapter 6.4 in ***ComNav OEM Board Reference Manual_V1.8*** for detailed information.



The configuration is shown below:

***For Moving Base Station***

| | *For Moving Base --Base* |
|---|---|
| ***Fix none*** | *// Undo fix position mode* |
| ***Log comX rtcmcompassb ontime 1*** | *// Differential GPS/GLONASS/Beidou corrections* |
| ***Saveconfig*** | *// Save configuration* |

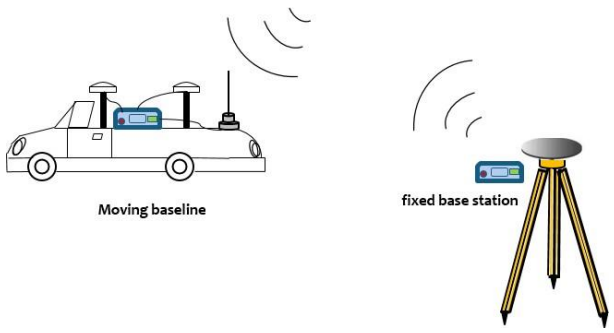
***For the Rover:***

| | *For Moving Base --Rover* |
|---|---|
| ***Interfacemode comX auto auto on*** | *// Set comX in differential mode* |
| ***Set diffmatchmode synch*** | *// Set RTK in synchronous mode* |
| ***Rtkrefmode 1*** | *// Set moving base RTK mode* |
| ***Log comX headinga ontime 1*** | *// Output heading message* |
| ***Saveconfig*** | *// Save configuration* |

### 4.5.2 Moving baseline

In this application case, two OEM boards with two antennae are used and one of the OEM boards is used for the dynamic base station (Master) and the other one is applied as a rover station (Slave). The settings are used to enable or disable a receiver from working with a dynamic base station. In this case, both of the Master and Slave are fixed on the vehicle where the Slave station is static with respect to the Master station.

Moving baseline mode allows the base to do the RTK positioning with the fixed station and also display the attitude information to the user. The rover station is used for attitude determination computation and send the results back to the dynamic base station.




The configuration is shown below:

***For dynamic base***

| | |
|---|---|
| | *For dynamic Base --Base* |
| ***fix none*** | *// Undo fix position mode* |
| ***Interfacemode com2 auto auto on*** | *//Set com2 in differential mode* |
| ***Interfacemode com3 auto auto on*** | *//Set com3 in differential mode* |
| ***log com3 rtcmcompassb ontime 1*** | *//Differential GPS/GLONASS/Beidou corrections* |
| ***log com1 gpgga ontime 1*** | *//Output GPGGA message* |
| ***log com1 headingt ontime 1*** | *//Output heading message* |
| ***saveconfig*** | *// Save configuration* |

***For the rover:***

| | |
|---|---|
| | *For dynamic Base --Rover* |
| ***Interfacemode com3 auto auto on*** | *//Set com3 in differential mode* |
| ***Log com3 rtcmcompass3b ontime 1*** | *// Differential GPS/GLONASS/Beidou corrections* |
| ***log com3 headingp ontime 1*** | *//Transmit heading message to the dynamic base* |
| ***set diffmatchmode synch*** | *//Set RTK in synchronous mode* |
| ***rtkrefmode 1*** | *//Set moving base RTK mode* |
| ***saveconfig*** | *// Save configuration* |

## 4.6 INS mode

The INS (Inertial Navigation System) Mode allows OEM modules to continuously output positioning information through IMU in a short time when losing satellites signal.

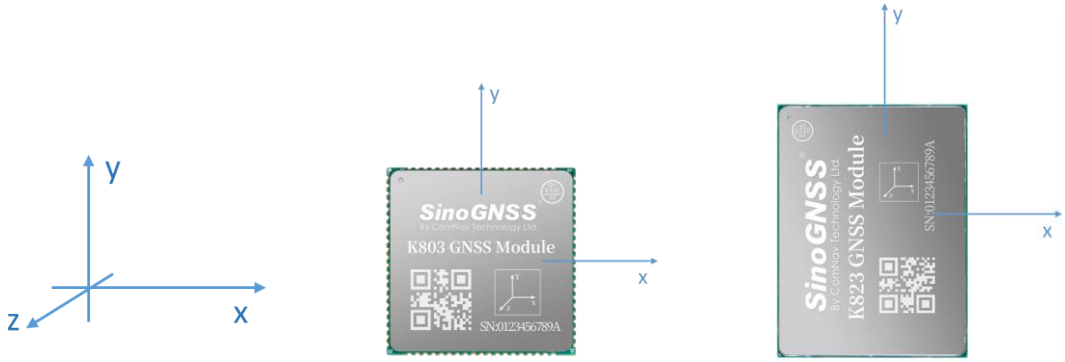
This mode is only valid for K803 and K823 modules which have onboard IMU. It can output INS solution when RTK can't reach fixed solution.

The configuration is shown below.

| | |
|---|---|
| ***Inscontrol enable*** | *//activate INS mode* |
| ***set imuaxestype <axes type>*** | *//Set axes of OEM module* |
| ***set rtkfreq 5*** | *//Set RTK frequency as 5Hz* |
| ***set pvtfreq 5*** | *//Set PVT frequency as 5Hz* |
| ***set smootheddr on*** | *//activate the INS smooth mode* |
| ***saveconfig*** | *// Save configuration* |

*Tips: The INS smooth mode can output INS solution when checking fly points from RTK fixed solution.*

The INS coordinate system is shown in the followed figure and is also shown on the front of K8 module. The y-axis direction is the direction of vehicle movement.




| Axes type | Description |
|---|---|
| **1** | The front of the OEM module faces up, the y-axis faces the front of the vehicle. |
| **2** | Axes 1 rotates 90 degrees counterclockwise horizontally. |
| **3** | Axes 1 rotates 180 degrees counterclockwise horizontally. |
| **4** | Axes 1 rotates 270 degrees counterclockwise horizontally. |
| **5** | The front of the K8 module faces down, the y-axis faces the front of the vehicle. |
| **6** | Axes 5 rotates 90 degrees counterclockwise horizontally. |
| **7** | Axes 5 rotates 180 degrees counterclockwise horizontally. |
| **8** | Axes 5 rotates 270 degrees counterclockwise horizontally. |

After sending above commands, please restart the OEM module. **Notice that once you set the axes type, you need to restart the OEM modules.**

Output GPGGA message to check if OEM module is in INS mode, the solution status should vary between "E,6" (INS solution), "E,4" (RTK fixed solution) and "E,0" (no solution).

$GPGGA,083837.00,3122.2774881,N,12118.3342750,E,6,20,0.6,4.5513,M,10.335,M,01,0004*55

# 5. Frequently used commands

This section describes some frequently used commands for K-series OEM boards, such as version, raw data and NMEA data output. For more programmatic commands, please refer to ***ComNav OEM Board Reference Manual_V1.8***.

## 5.1 Check version information

| | |
|---|---|
| ***Log version*** | *//Version information about the board* |

```
<VERSION COM1 0 60.0 FINESTEERING 2042 455876.900 00000000 0000 1114
<     1<          GPSCARD "S22020K706" "0260370100000000" "CRDK-706AA-TTT-0" "3.8.7-2.056-1" "5.0.0" "2019/Jan/ 7" "14:18:55"!
Command accepted! Port: COM1.
```

## 5.2 Check port information

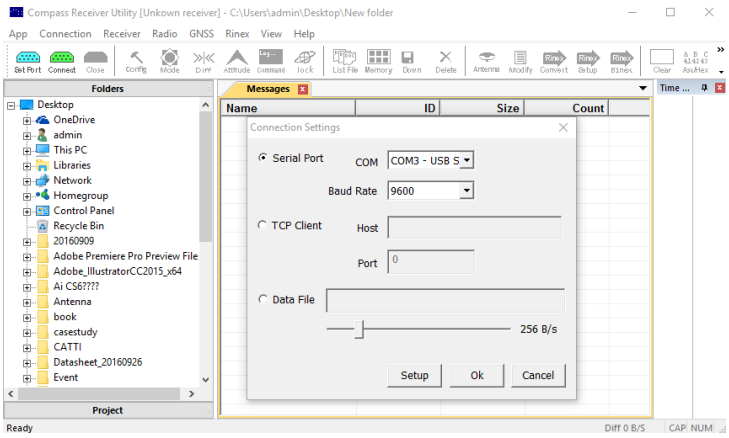
| | |
|---|---|
| ***Log comconfig*** | *//Log Information of the port* |

```
Port| Baud |Parity|Databits|Stopbits|Handshake|Echo|Breaks|RxType|TxType|Response|
COM1|115200|     0|       8|       1|        0|   0|     1|     1|     1|       1|
COM2|115200|     0|       8|       1|        0|   0|     1|    27|    27|       1|
COM3|115200|     0|       8|       1|        0|   0|     1|     0|     0|       1|
COM4|115200|     0|       8|       1|        0|   0|     1|     1|     1|       1|
OK!
Command accepted! Port: COM1.
```

## 5.3 Change the serial port baud rate

| | |
|---|---|
| ***Com comX 9600*** | *//Change the baud rate of comX to 9600* |

*Tip: after changing baud rate of current serial port, you need to reconnect your OEM board.*




## 5.4 Check system information

| | |
|---|---|
| ***Log sysconfig*** | *//log all configuration information* |

## 5.5 Check the output data information

| | |
|---|---|
| ***Log loglista*** | *//List all output Logs* |

## 5.6 Lockout/unlockout satellite system

| | |
|---|---|
| ***(un)lockout bd2*** | *// (un)lockout Beidou system* |
| ***(un)lockout bd3*** | *// (un)lockout Beidou Global system* |
| ***(un)lockout gps*** | *// (un)lockout GPS system* |
| ***(un)lockout glonass*** | *// (un)lockout Glonass system* |
| ***(un)lockout galileo*** | *// (un)lockout Galileo system* |
| ***Unlockoutall*** | *// Unlock all GNSS system* |

## 5.7 NMEA data output

| | |
|---|---|
| ***Log comX gpgga ontime 1*** | *//Output GPGGA* |

| | |
|---|---|
| ***Log comX gpgsv ontime 1*** | *//Output GPGSV* |

*Tip: You can also output GSA, HDT, VHD, ZDA, RMC, GLL and other NMEA-0183 data.*

## 5.8 Heading data output

| | |
|---|---|
| ***Log comX headinga ontime 1*** | *//Output headinga heading information* |

Checking heading solution status from "NARROW_INT" which means integer narrow-lane ambiguity solution, more solution status please refer to page 95 of ***ComNav OEM Board Reference Manual_V1.8***.

#HEADINGA,COM3,0,60.0,FINESTEERING,2120,369117.000,00000000,0000,1114;SOL_COMPUTED,NARROW_INT,0.926589012,67.866401672,3.171051025,0.000000000,0.132969424,0.320492744,"0004",31,25,31,31,0,0,0,123*3256aac8

## 5.9 Check satellites information

| | |
|---|---|
| ***Log testinfor*** | *//Output satellites information* |

## 5.10 Raw data output

| | |
|---|---|
| ***Log comX rawephemb onchanged*** | *//Output GPS ephemeris* |
| ***Log comX glorawephemb onchanged*** | *//Output Glonass ephemeris* |
| ***Log comX bd2rawephemb onchanged*** | *//Output Beidou ephemeris* |
| ***Log comX galephemerisb onchanged*** | *//Output Galileo ephemeris* |
| ***Log comX rangecmpb ontime 1*** | *//Set comX output 1Hz observation data* |

*Tip: Please create file to save the raw data before sending above commands.*

## 5.11 High-frequency data output

| | |
|---|---|
| ***Set pvtfreq 10*** | *//set PVT frequency; take 10Hz as an example* |
| ***Set rtkfreq 10*** | *//set RTK frequency; take 10Hz as an example* |
| ***Log gpgga ontime 0.1*** | *//output GPGGA; take 10Hz as an example* |
| ***saveconfig*** | *//Save configuration* |

*Tip: the default setting supports up to 5Hz, you need to send the above commands if requiring more than 5Hz.*

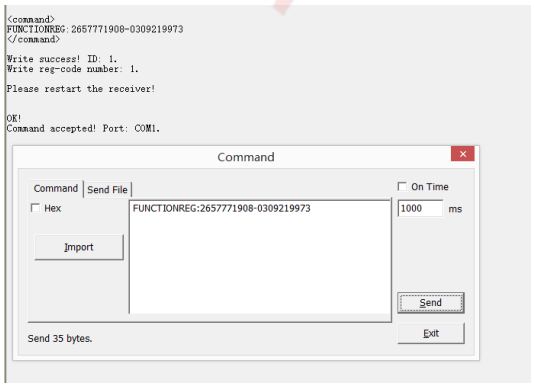
## 5.12 Activate register code

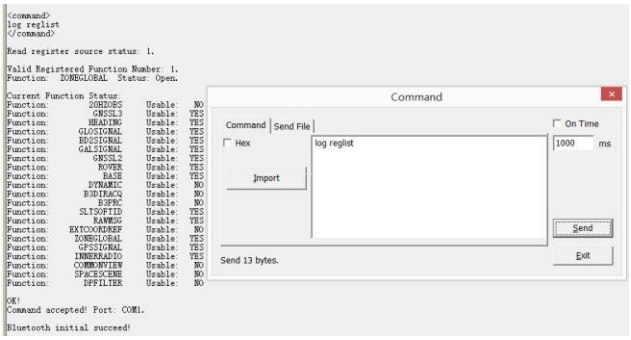
The format of register code: ***FUNCTIONREG: xxxxxxxx***

1) Copy this code to any serial communication software and click ***send.***
2) Send command

| | |
|---|---|
| ***Log reglista*** | *// Check registration information* |

to check the registration status. It will show the number and list of activated functions (**ZONEGLOBAL** function as an example in the following figure)




## 5.13 Event marker

**Format:** *MARKCONTROL <signal> <switch> [polarity] [timebias [timeguard]]*

| | |
|---|---|
| ***markcontrol mark1 enable negative 0 0*** | *//Open Event1 marker* |

| | |
|---|---|
| ***Log marktimea onnew*** | *//Time of mark input event* |
| ***Log markposa onnew*** | *// Position at time of mark input event* |
| ***Saveconfig*** | *//Save configuration* |

**Description**

- <signal> supports the key words “mark1” and “mark2”, K726 and K708 only apply the “mark1”, K706 only apply the “mark2”.
- <switch> supports the key words “enable” and “disable”.
- [polarity] supports the key words “positive” and “negative”, which separately represent “positive pulse” and “negative pulse”.
- [timebias] [timeguard] these two parameters cannot be set by now.

The markcontrol status can be checked by ***log sysconfig*** command.

## 5.14 PPS

**Format:** *PPSCONTROL <switch> <polarity> <period> <pulse-width>*

| | |
|---|---|
| ***ppscontrol enable positive 1 1000*** | *//Set PPS as high level pulse with 1ms width per second* |
| ***Saveconfig*** | *//Save configuration* |

**Description**

- <switch> supports “enable” or “disable”, notice that “disable” is invalid.
- <polarity> supports “positive” and “negative”, “positive” means high level pulse mode and “negative” means low level pulse mode.
- <period> in seconds, the update rate can be up to 10Hz.
- <pulse-width> in microseconds, pulse-width should be less than half of period.

## 5.15 Freset

This command clears data which is stored in non-volatile memory, and set the baud rate to 115200. No data log is outputted.

| | |
|---|---|
| ***Freset*** | *//Reset to the factory default* |

# 6. Firmware update

## 6.1 Auto update

To update firmware of GNSS OEM board, you should follow:

1) Connect your OEM board with your PC.

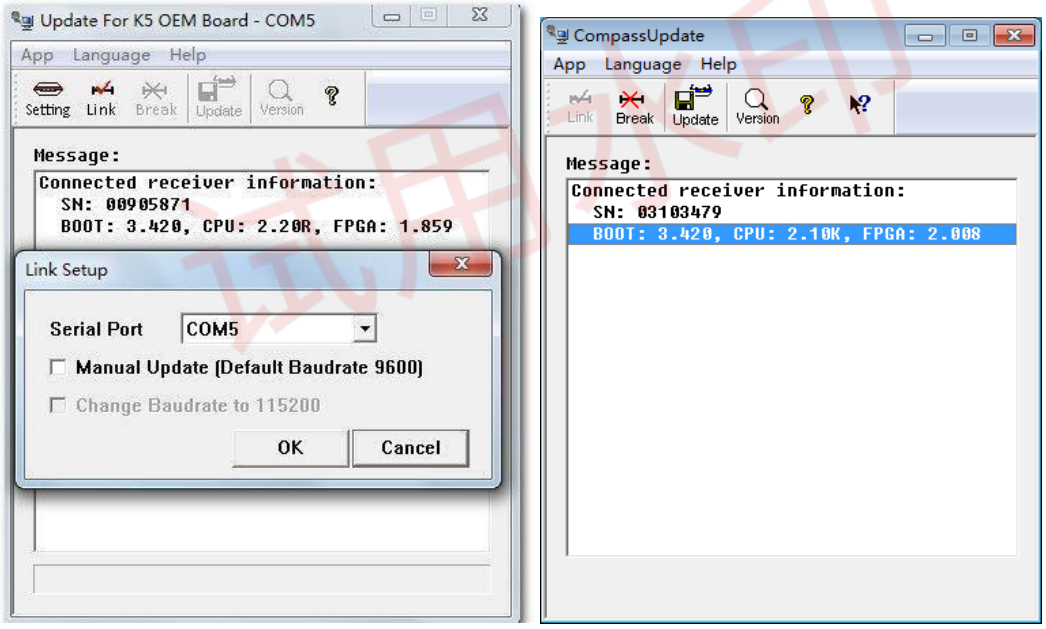
2) Change the baud rate to 115200 in CRU software, enter commands:

***com com1 115200***

3) Open firmware upgrade software, click Break -> Setting -> select serial port and click OK. If Boot message output as below, it means the OEM board is successfully connected; otherwise try FORCE UPDATE.

4) If parameters are incompatible after upgrading, please send command ***Freset*** to clean all previous settings. You can find the latest firmware at

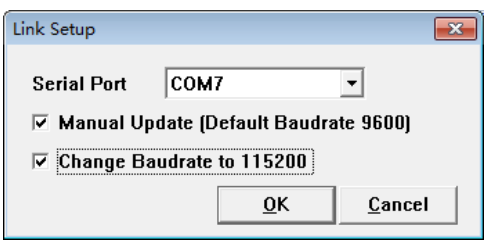
http://www.comnavtech.com/companyfile/5/.



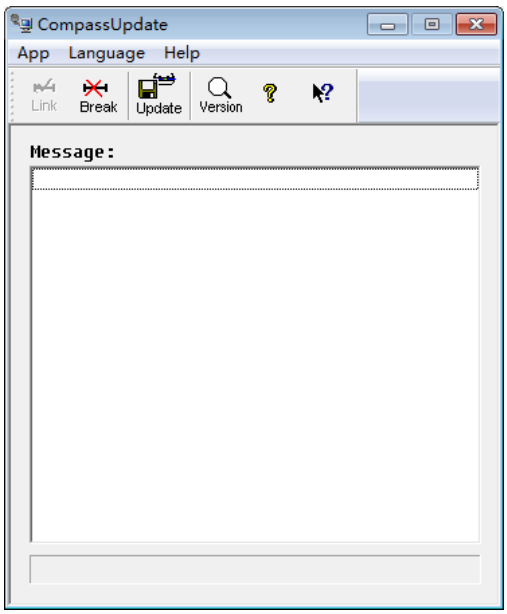

5) Click Link and Update to upgrade OEM board

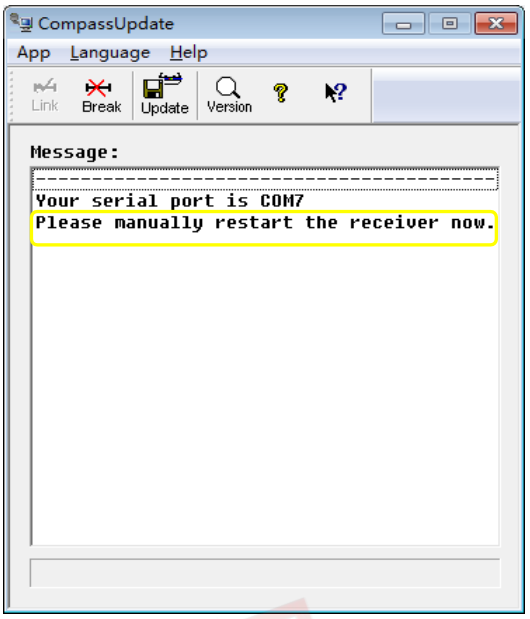
*Note: please don't move your mouse or run other software when updating firmware (5-6 minutes).*

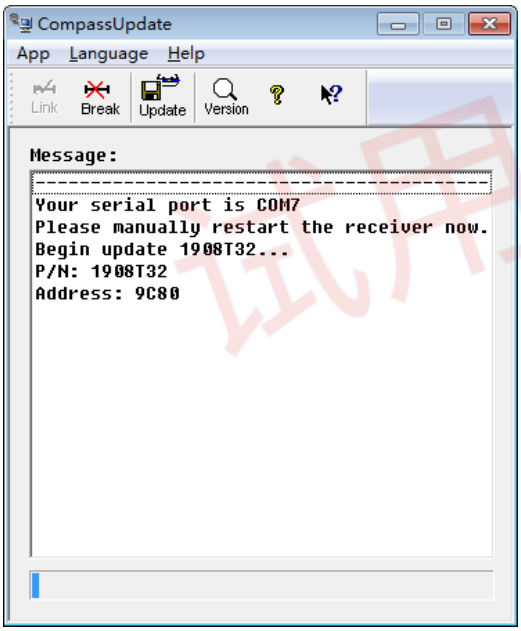
## 6.2 Force update

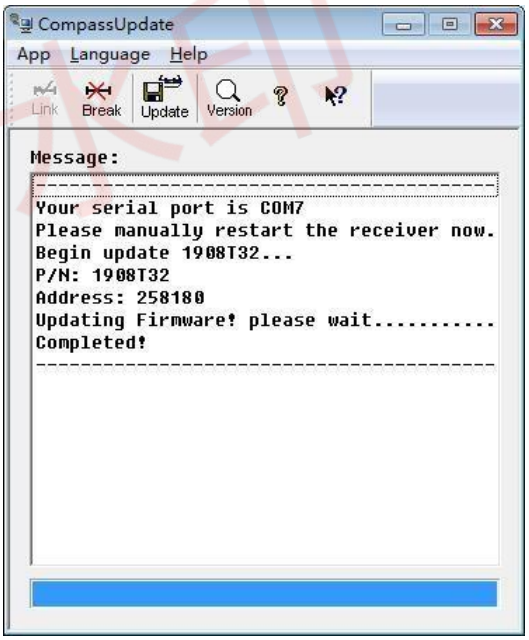


Check the following two options in link setup and update again




*Tip: it's better to use USB to ComNav provided Serial convertor, otherwise it may result a fail identify of serial port.*