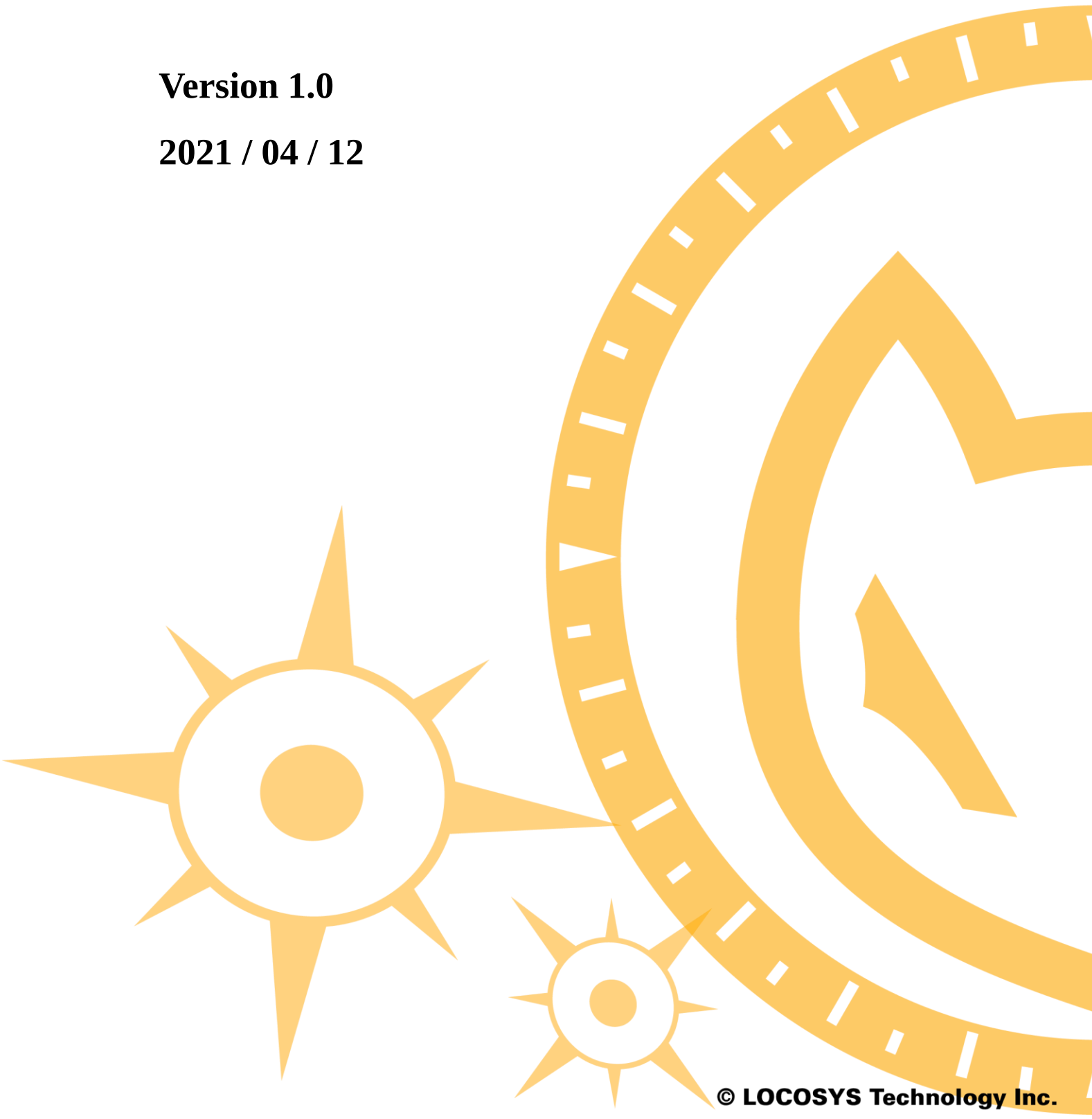
LOCOSYS

GPSFox Quick Guide for ST Series GNSS ADR

Version 1.0

2021 / 04 / 12



About LOCOSYS

LOCOSYS Technology Inc. established in 1995, a company that provide services the scope of which spans from both hardware and software in Global Navigation Satellite System (GNSS), Wireless Communication, Embedded System to Avionics, Automotive and Consumers electronics. LOCOSYS Technology Came from a well-known research organization of information industry, LOCOSYS sustains a strong R&D in Software, Hardware and system integration. Through its self own (International Automotive Task Force, IATF) IATF16949: 2016 / ISO 9001 : 2015 certified production lines in Taiwan and carefully selected sites in China. LOCOSYS is a qualified supplier to tier 1 & tier 2 manufacture in Automotive industry (design house, EMS, OEM, ODM) and be the 2017 best partner of 'Automotive Dead Reckoning' in China automotive industry and provides solutions and services to various market segments. Stay in α-level qualified module designer and supplier in the international market, deal the partnership with more than 20 Well-known distributors overseas, to provide our customers a complete OEM and ODM services.

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For more information about our products, please visit:
https://www.locosystech.com/en/category/Products/index.html

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We will then contact you directly.
https://www.locosystech.com/en/page/Contact-Us/contact-info.html

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1. Introduction

This document is the user guide of GPSFox of ST-1612i-DXX、ST-1612r-DXX LOCOSYS GPS/GNSS DR (Dead Reckoning) products. Before you start reading the below contents, please recognize if your DR products is for ADR (Automotive Dead Reckoning) application.

2. Getting Started

2.1 System Requirements

To use GPSFox on a Windows PC, you must have at least the following:

- Operating System : Windows XP, Windows 7, or Windows 10
- CPU: Celeron 1.6GHz or above
- System Memory (RAM) : 2048 MB RAM and above
- Hard Disk : 50MB free space
- Screen : 800x600, "16-bit High Color" screen
- Internet: 802.11a/b/g/n/ac or Ethernet

2.2 Installation

Make sure the driver for USB has been successfully installed on your host PC/Notebook, and just copy GPSFox.exe to a new empty folder on your hard disk .Create a shortcut on desktop if necessary.
(The USB driver can be downloaded from our website:
http://www.locosystech.com)

2.3 Uninstallation

This program does not add any key to system registry. If you don't want it to keep it no more, just delete the provided files and its shortcut from your hard disk.

3. Launch GPSFox

1. Please open GPSFOX software and then choose a corresponding COMPort.

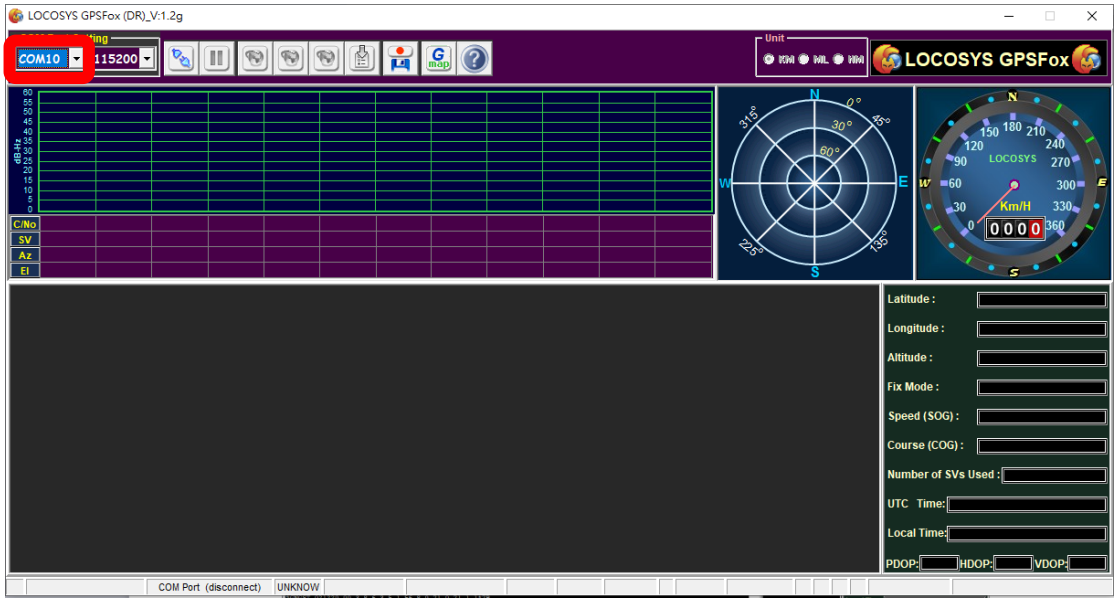


Figure 1: Choose a corresponding

2. Please choose corresponding Baudrate.

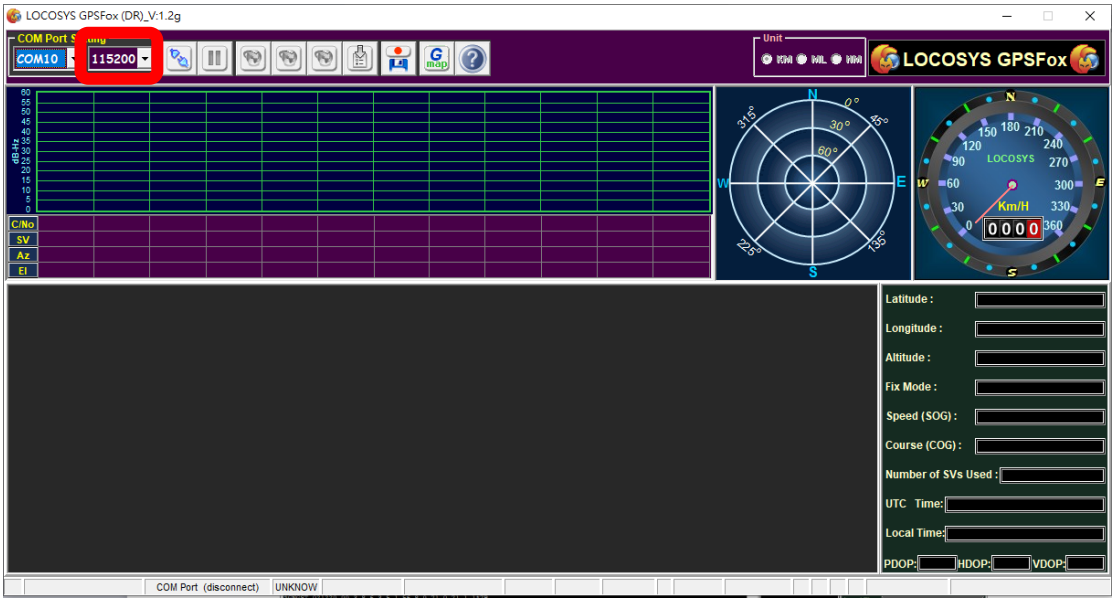


Figure 2: Choose corresponding Baudrate

3. Please press the “Connect to GNSS Receiver” button to connect your GNSS module.

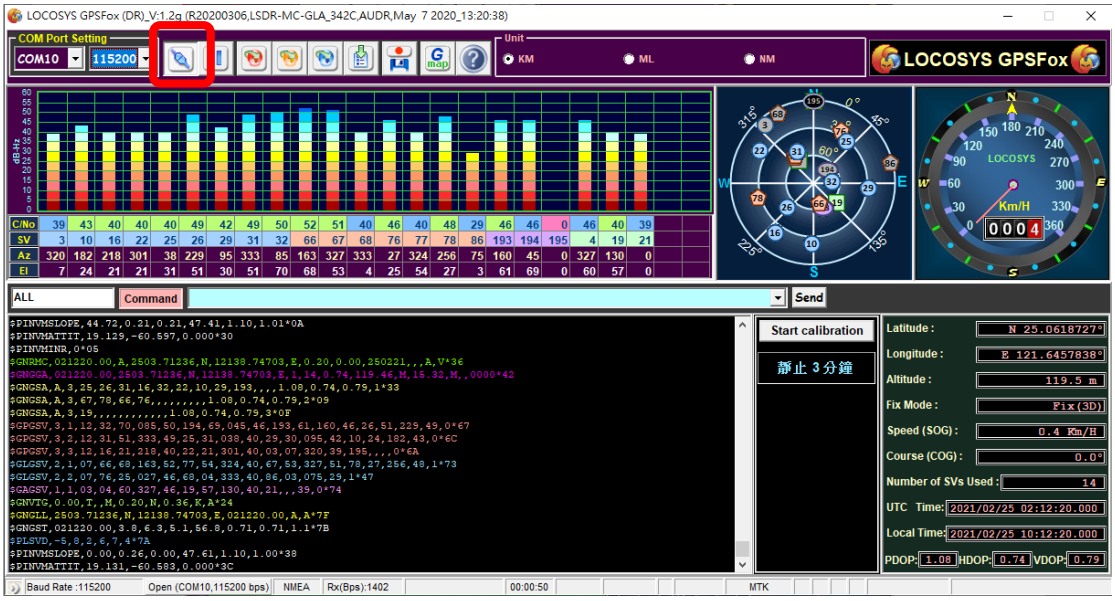


Figure 3: Connect to GNSS Receiver button

4. If you hope to disconnect your connected module, please press “Disconnect” button.

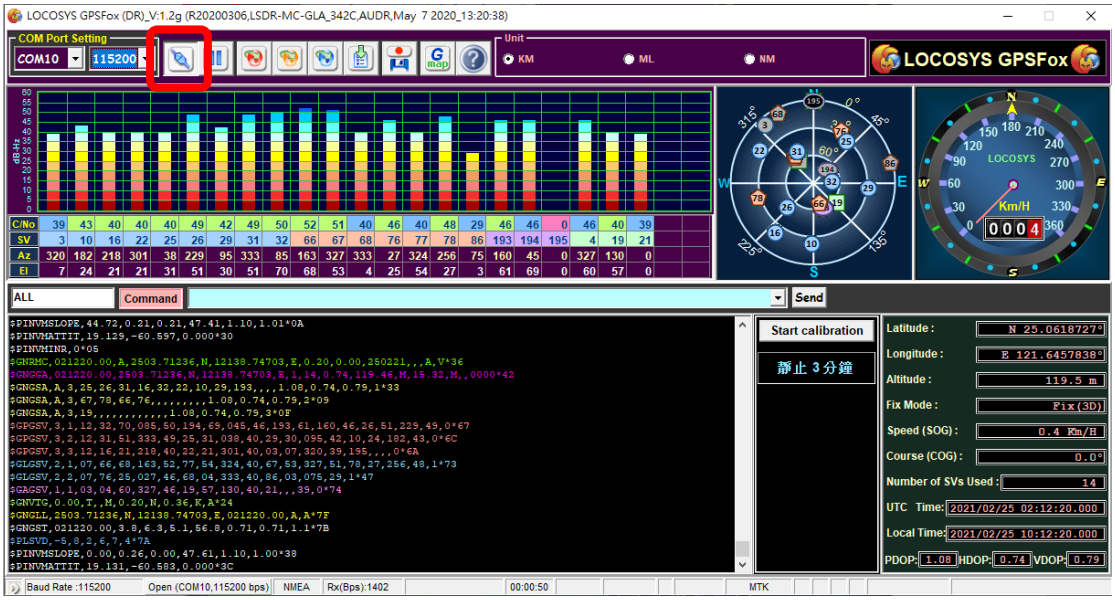


Figure 4: Disconnect button

6. If you want to view NMEA signals, please press “Click to Pause” button to temporarily pause the NMEA signals input, and then you can view its signals.

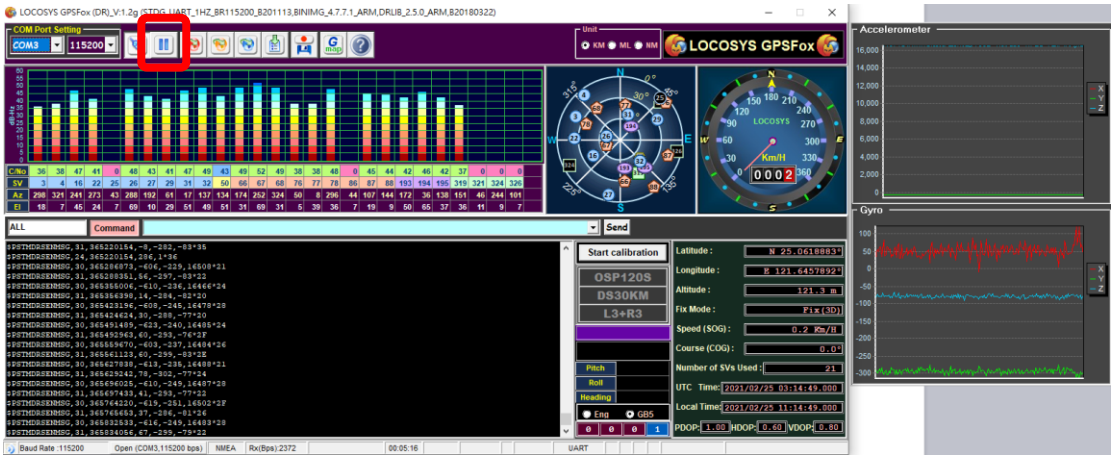


Figure 5: Click to Pause button

7. When you first connect your module, please press “Cold Start” button or “Factory Default” button to clear the original positioning data of the module. Then it can be re-located.

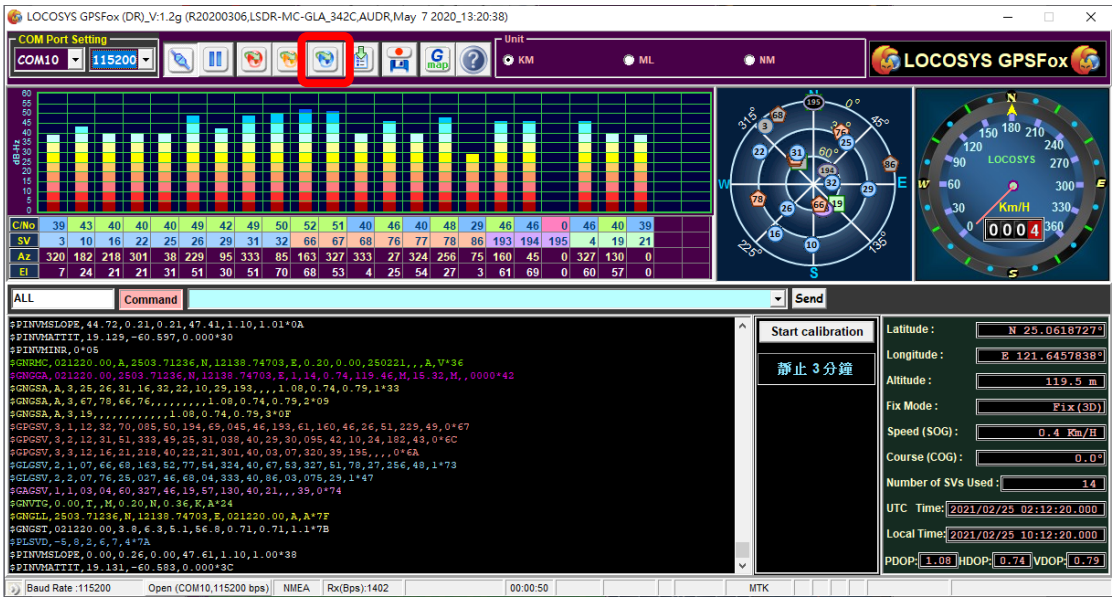


Figure 6-1: Cold Start button

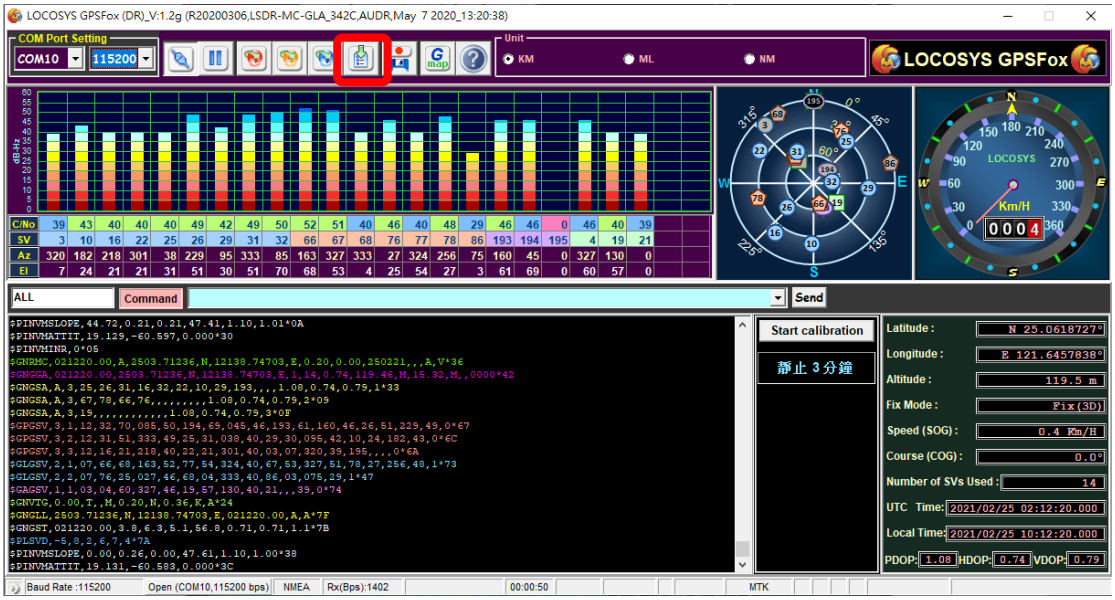


Figure 6-2: Factory Default button

8. Click Start calibration to initiate Calibration Mode, shown as below.

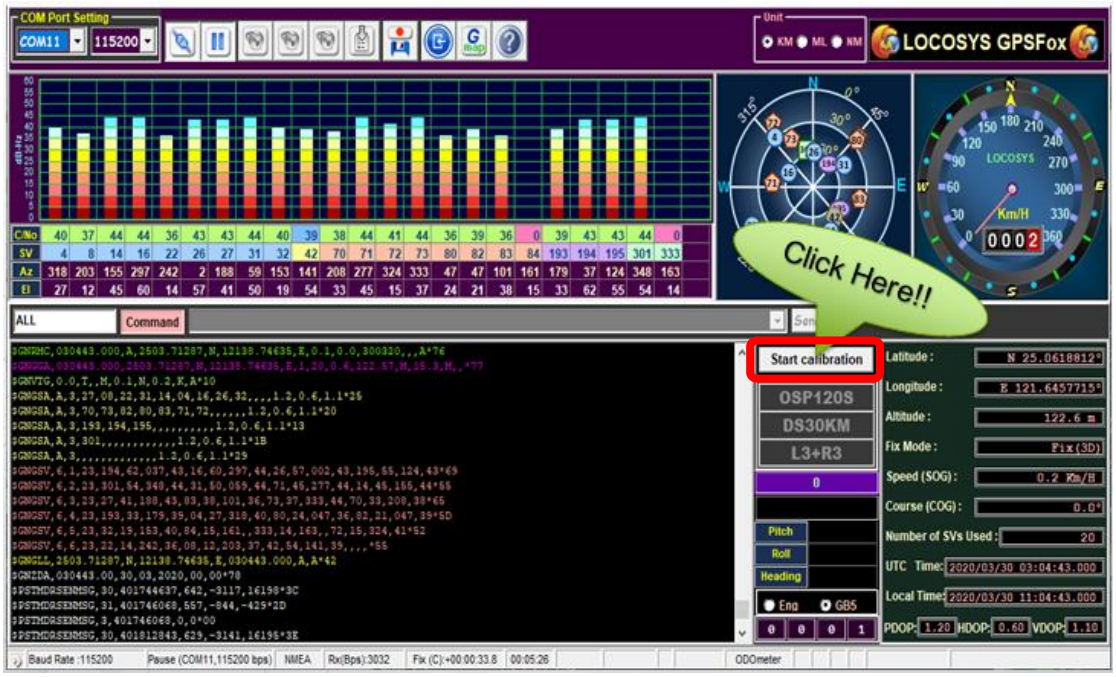


Figure 7: Click to Start Calibration

9. After click Start calibration, you will see a message to have a calibration. If you confirm to do it, please click OK. If don't click Cancel.

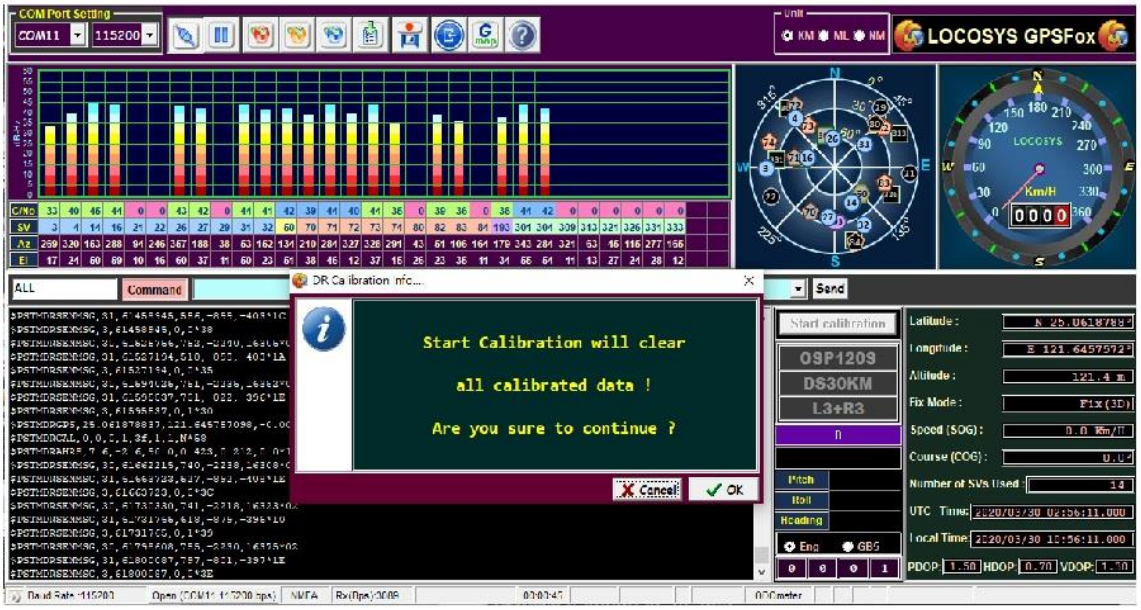


Figure 8: Message to have a calibration

10. Click Start calibration, there will be the information of X, Y, and Z axial information of Accelerometer and Gyro by the GPSFox.

(Note: For ADR MEMS Raw data default 15Hz)

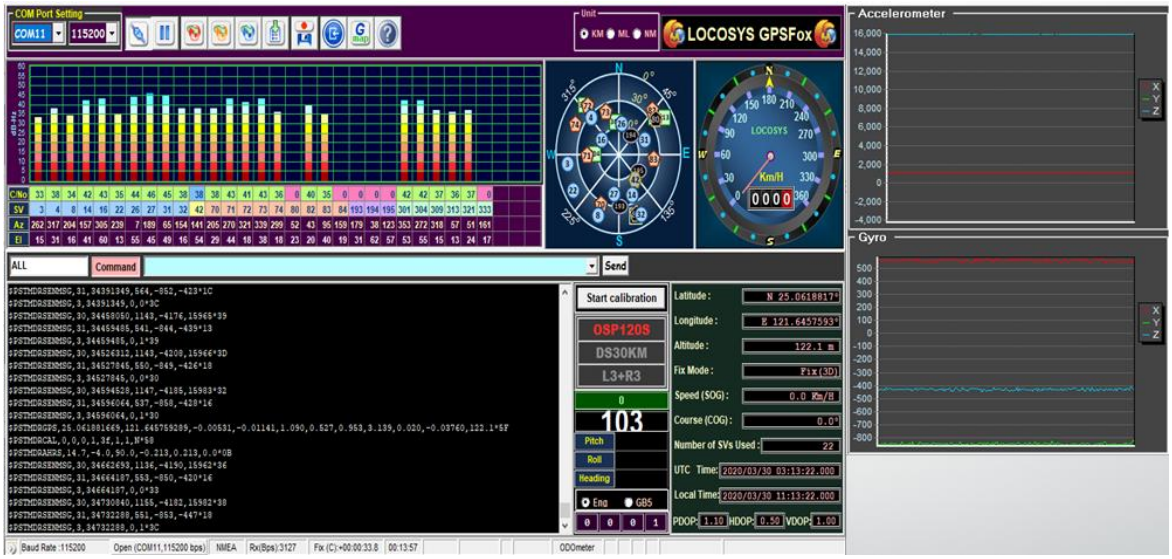


Figure 9: Start Calibration

$PSTMDRSENMSG,30 → for Accelerometer

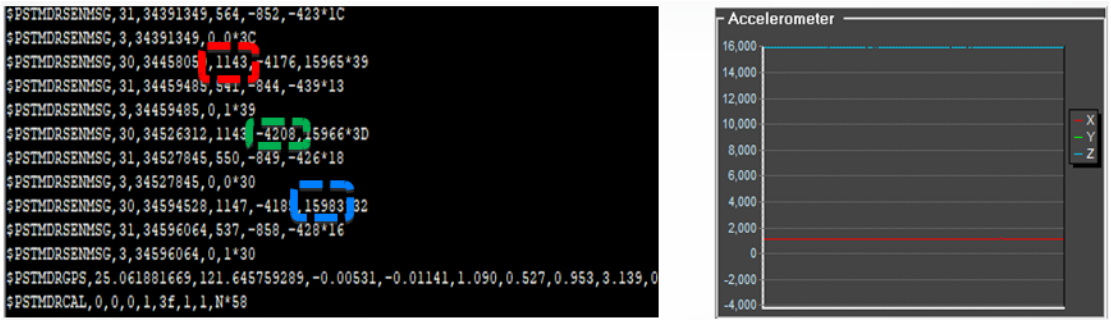


Figure 10: Accelerometer output data

$PSTMDRSENMSG,31 → for Gyro

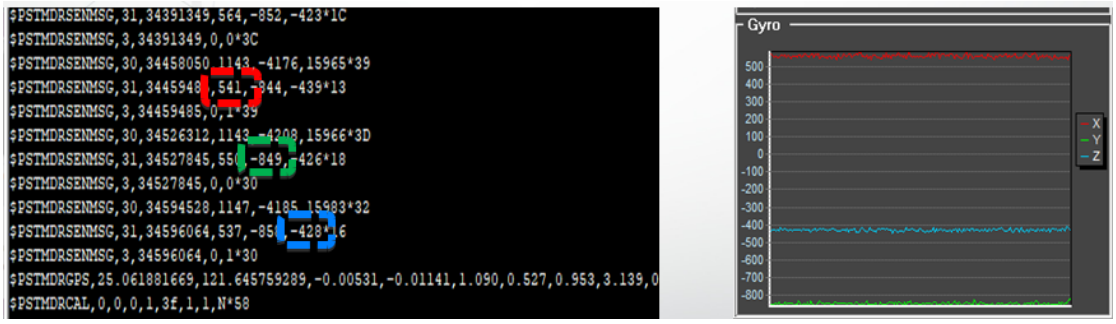


Figure 11: Gyro output data

11. When the cursor move to OSP120S, DS30KM, L3+R3 the pop-up DR calibration info will provide you the instructions.
(Note: The information only show in 10 seconds. To read it again, please move the cursor to the calibration item.)

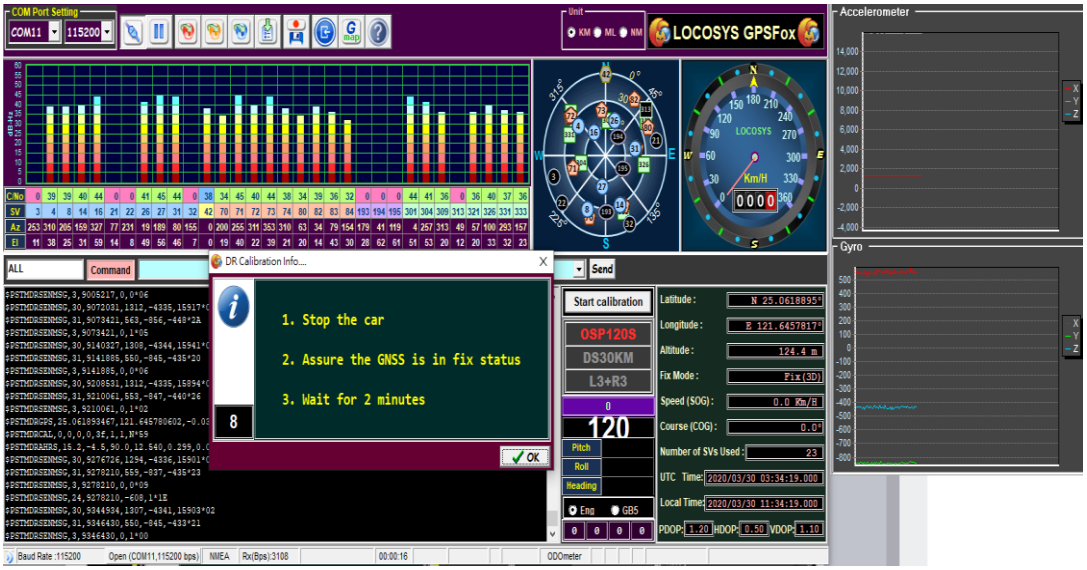


Figure 12: DR Calibration Info

12. In DR Info., there are two languages for users to choose, English (Eng) and Simplified Chinese (GB5).

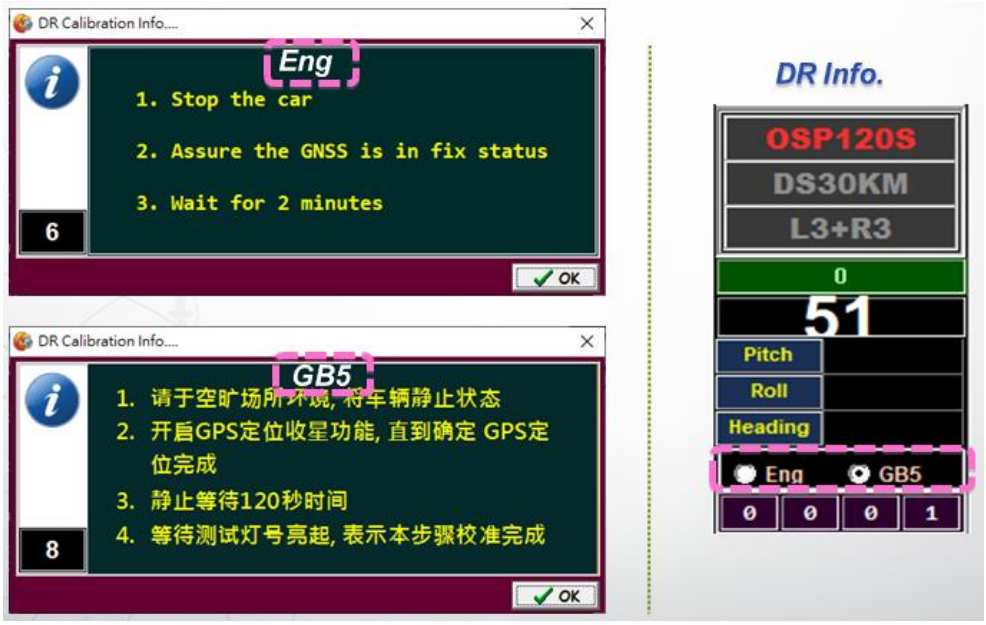
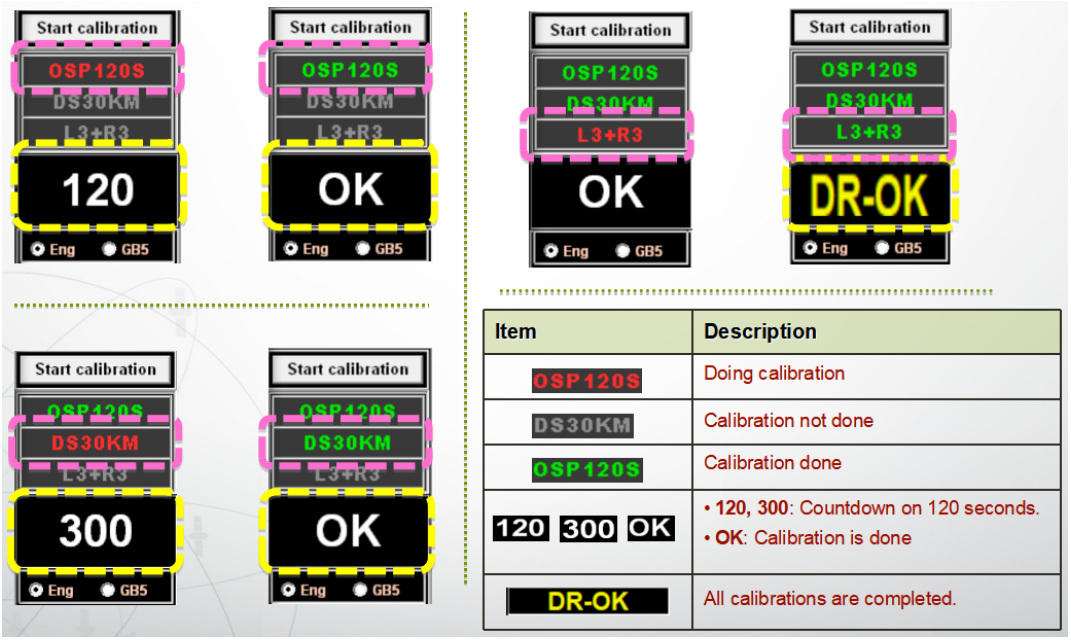


Figure 13: Choose Language of DR Calibration info

13. Calibration Manoeuvres

In DR info., you will see the timer and status while doing each calibration item.



Item	Description
OSP120S	Doing calibration
DS30KM	Calibration not done
OSP120S	Calibration done
120 300 OK	• **120, 300**: Countdown on 120 seconds. • **OK**: Calibration is done
DR-OK	All calibrations are completed.

Figure 14: Timer and Status of DR Info.

14. Calibration Flow Chart

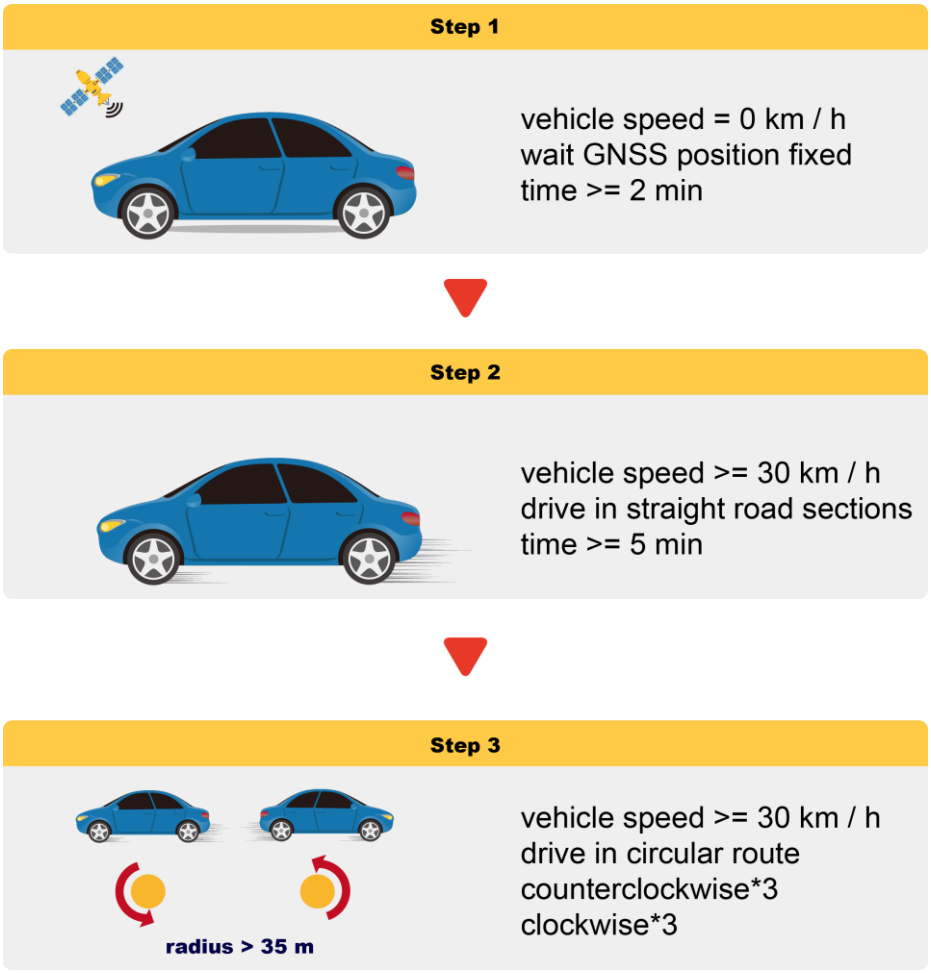


Figure 15: Calibration Flow Chart

➢ **Step 1: Calibration for OSP120S**

Turn vehicle on and stay stopped in a flat section of road with good sky view, wait GNSS position fixed for 2 minutes at least.

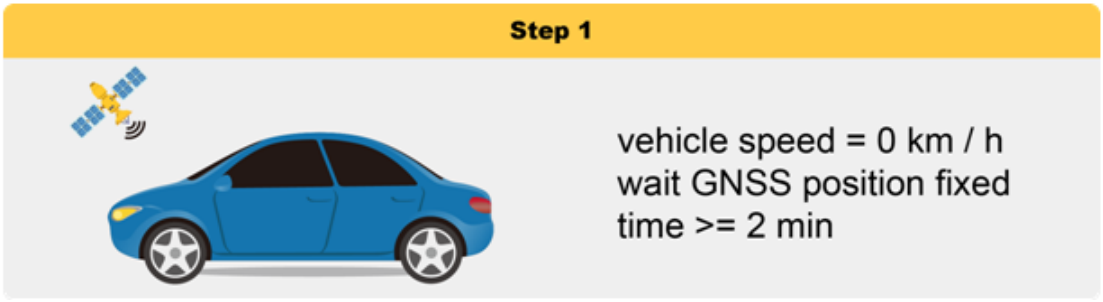


Figure 16: Calibration for OSP120S

You will see in DR Info.

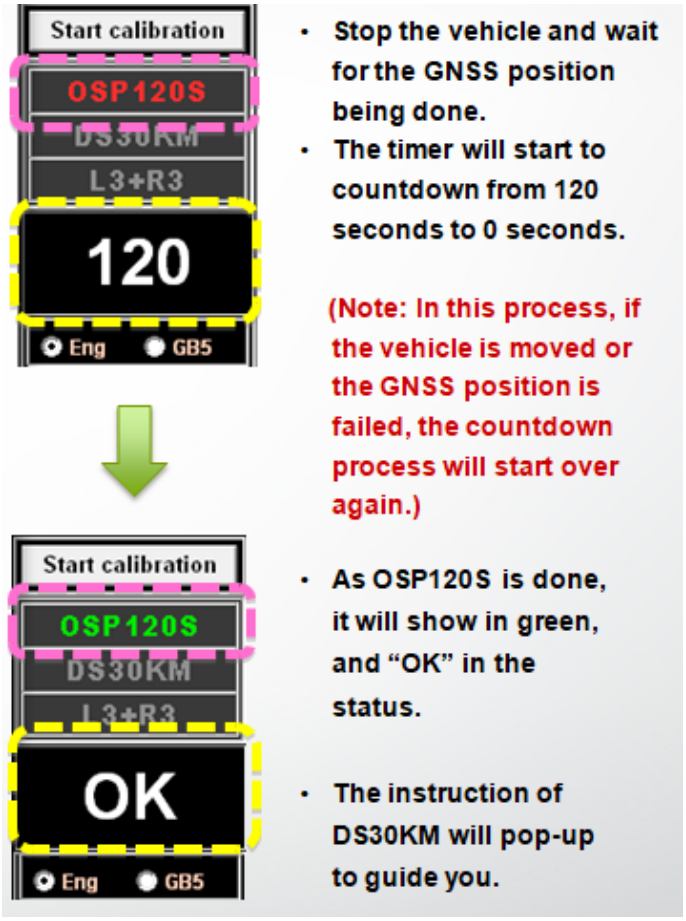


Figure 17: Calibration for OSP120S information

➢ **Step 2: Calibration for DS30KM**

Drive in straight road sections with vehicle speed 30 km/h for 5 minutes at least.

Figure 18: Calibration for DS30KM

You will see in DR Info.

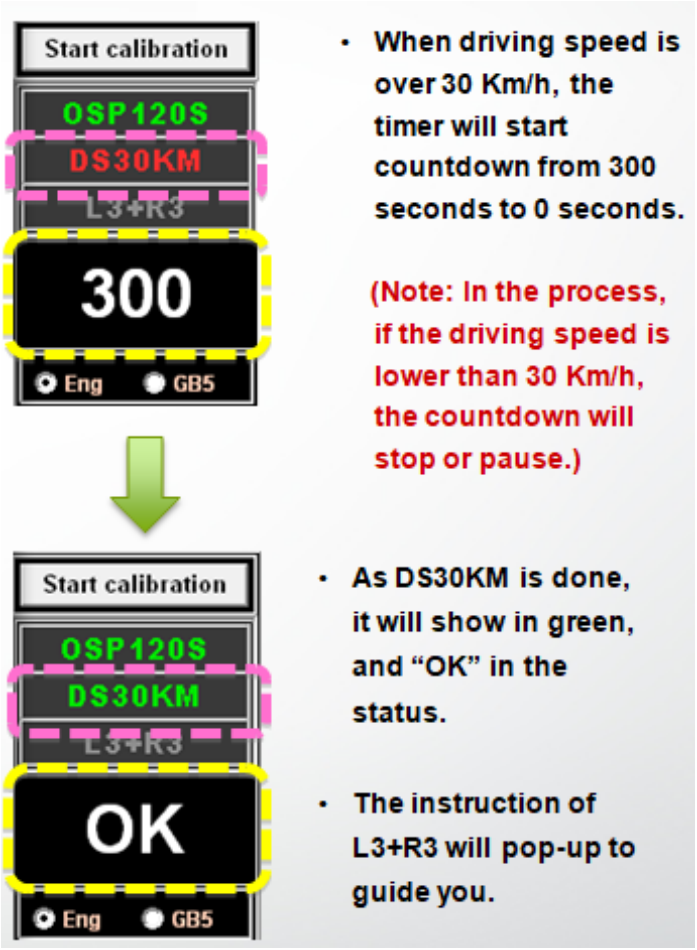


Figure 19: Calibration for DS30KM information

➢ **Step 3:Calibration for L3+R3**

Drive in circular route with its radius over 35 m, take counterclockwise and clockwise circles for three or more times with driving speed over 30 Km/h

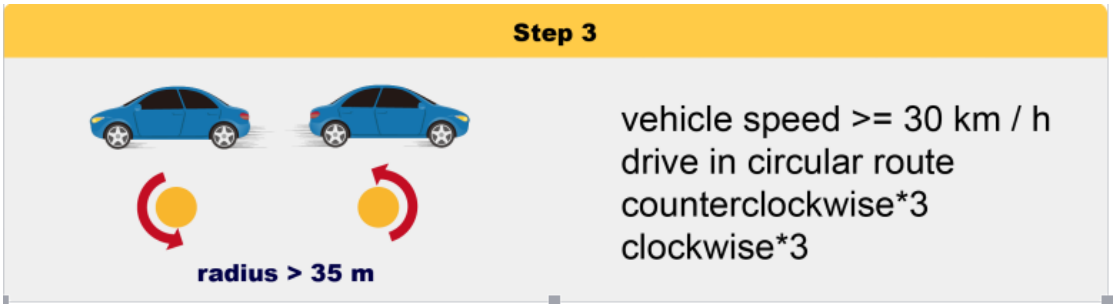


Figure 20: Calibration for L3+R3

Note:

You may have the condition that "L3+R3" calibration to be processed for many times and still fail to complete. If this happened, please does the Step 2 again, drive straightly for 5 to 10 minutes. And then do the Step 3.

Driving in circular routes (counterclockwise and clockwise) for more times will benefit the DR precision.

You will see in DR Info.

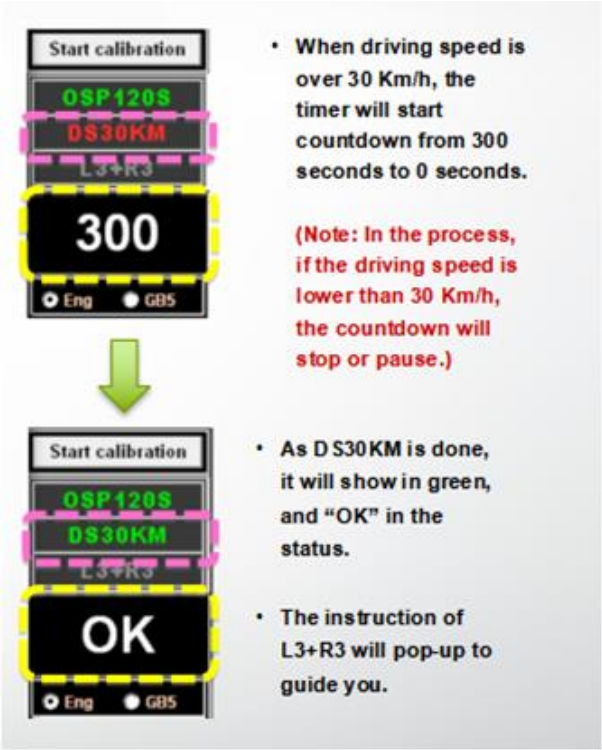


Figure 21: Calibration for L3+R3 information

DR Funsion Status Check

For ADR, the system is fully operational when DR calibrated and System Ready flags are both set. (ST-1612r-DX series need)

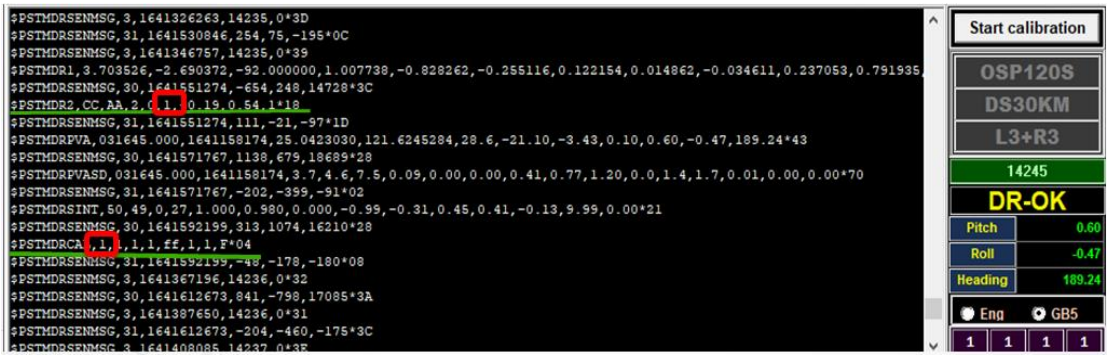


Figure 22: DR Funsion Status

```
$PSTMDRCAL,<DR_calibrated>,<odo_is_calib>,<gyro_sensitivity_is_calib>,
<gyro_bias_is_calib>,<imu_flag>,<gyro_integrity_flag>,<acc_integrity>,
<dr_calib_status>*<checksum><cr><lf>
```

Figure 23: Calibrated flags

```
$PSTMDR2,<IMU_cal>,<AS_cal>,<motion_status>,<err_code>,<System_Ready>,
<res1>,<res2><sa>*<checksum><cr><lf>
```

Figure 24: System Ready flags

Note: The calibration status of ST-1612i-DX series only needs to determine the sentence "PSTMDRCAL".

➢ **Step 4: Turn Off DR Info. and Start DR Function Test**

When completing all the calibrations, GPSFox will turn to NMEA mode. Now you can start to do the DR function test.

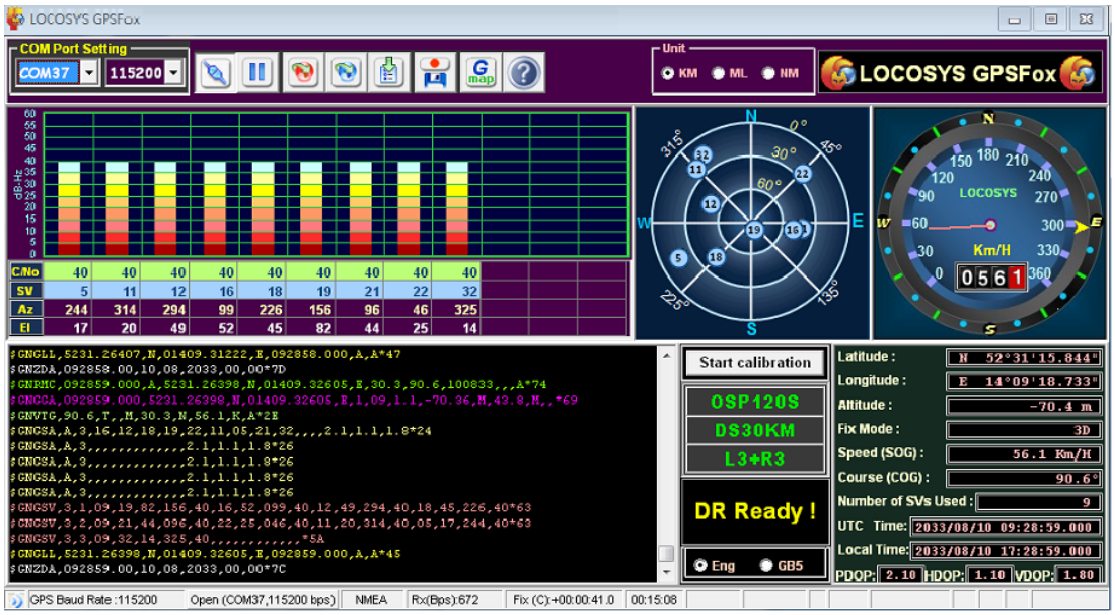


Figure 25: Completing all the calibrations

Note:

The calibration procedure provided above is the fastest and most accurate calibration method for inertial navigation. When the actual customer uses it, INS calibration can be done in normal driving habits.

Inertial navigation has a self-learning function. When the car continues to travel after the basic correction is completed, the inertial navigation will continue to calibrate the learning and converge the divergence of the route, thereby improving the reliability of the inertial navigation.

15. If you want to save the Log file of NMEA data, please press “Start to Log data” button.

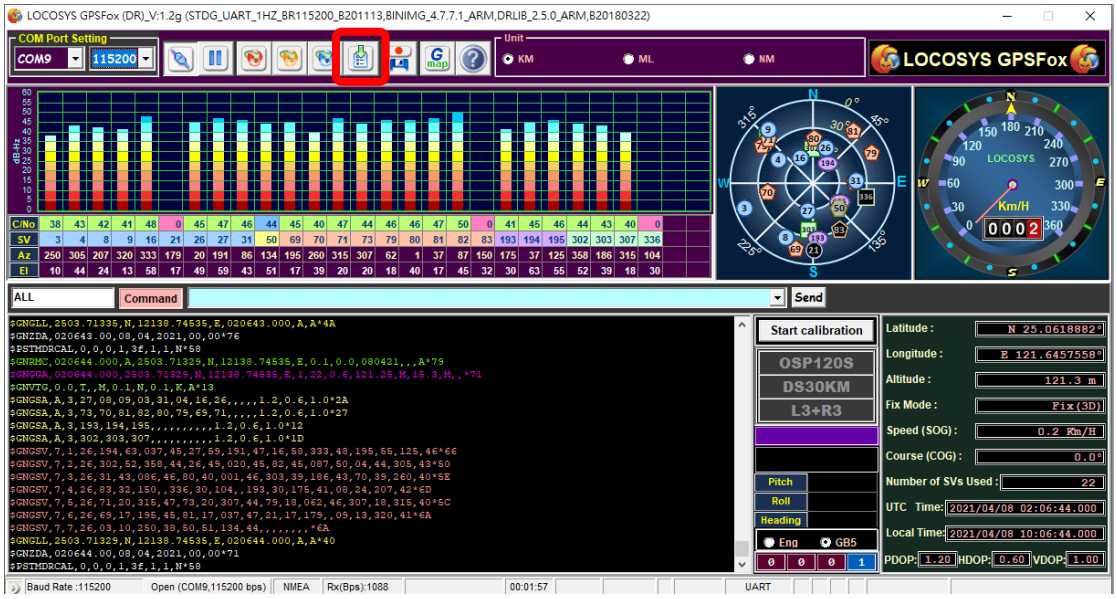


Figure 26: Start to Log data button

16. Please choose the file path where you want to save, and type a file name. Then please press “SAVE” button and it can start recording NMEA LOG Data.

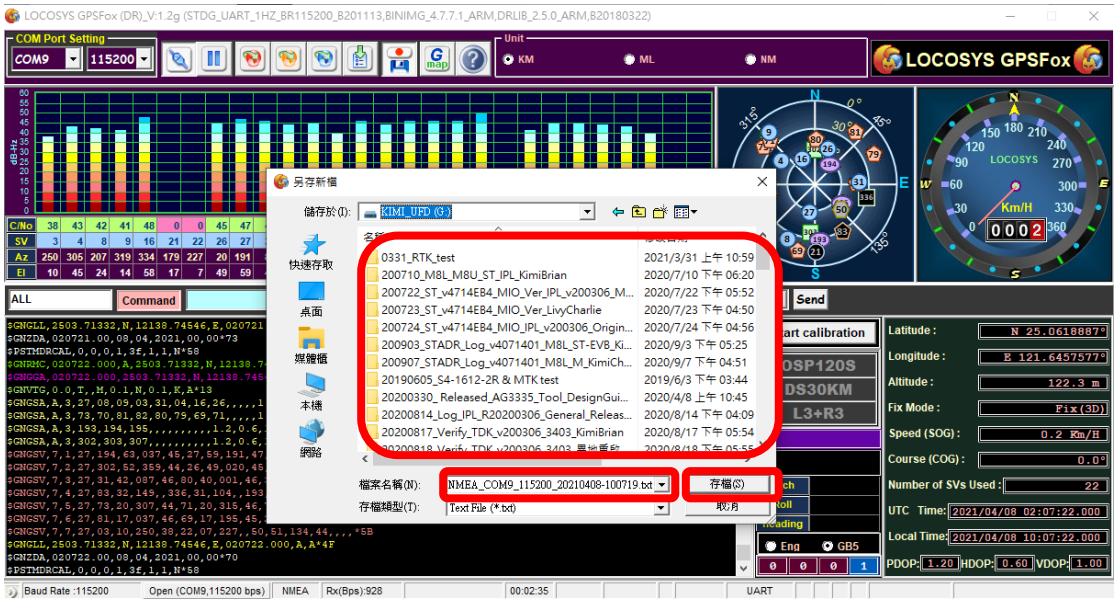
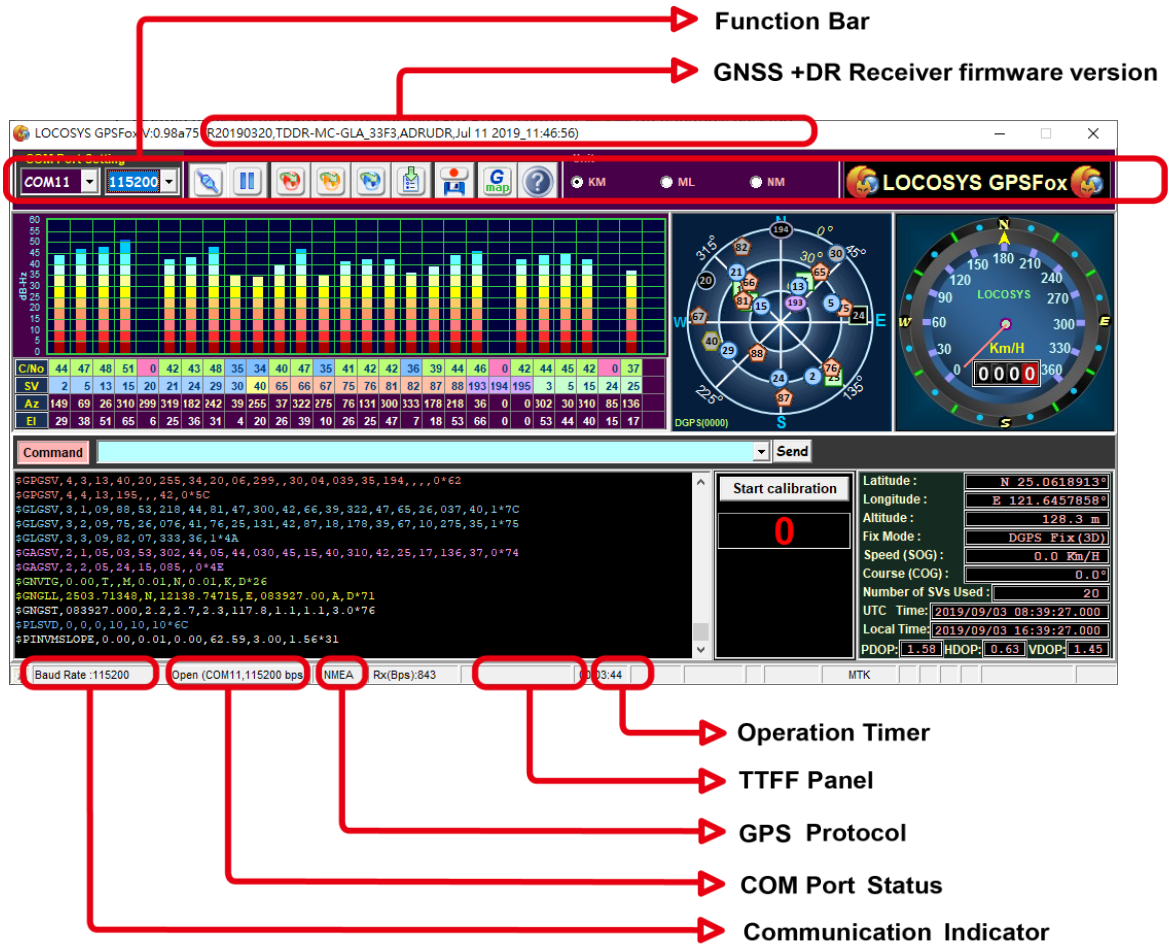


Figure 27: Press SAVE button

4. About the GPSFox

The GPSFox is an easy-to-use utility which can display graphically specific NMEA 0183 message received from GNSS receiver. There are five information areas, one



function bar and some status indicators in the main form.

Figure 28: GPSFox

The **Signal Level View** displays the satellite number(SV), azimuth(Az), elevation(El) of tracked and available satellites in a text form. It also shows the C/No value in both text and graphical forms.

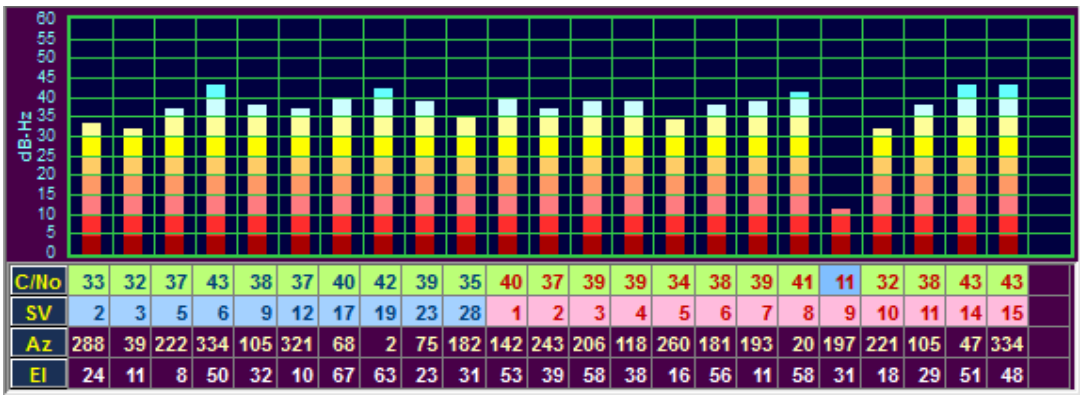
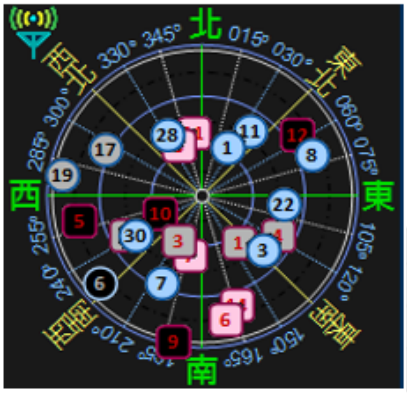


Figure 29: Signal Level View

The **Radar View** displays the azimuth and elevation of tracked and available satellites in a graphical form. The color of the satellite status is:



Type	Description
Solid with Same Color	Satellites being used in the position solution
Solid with Gray Color	Satellites being tracked but not used
Hollow	Satellites that are not tracked and are not used in the position solution

Icon	Description
	Active antenna connected
	Antenna short
	Active antenna not connected

Figure 30: Radar View

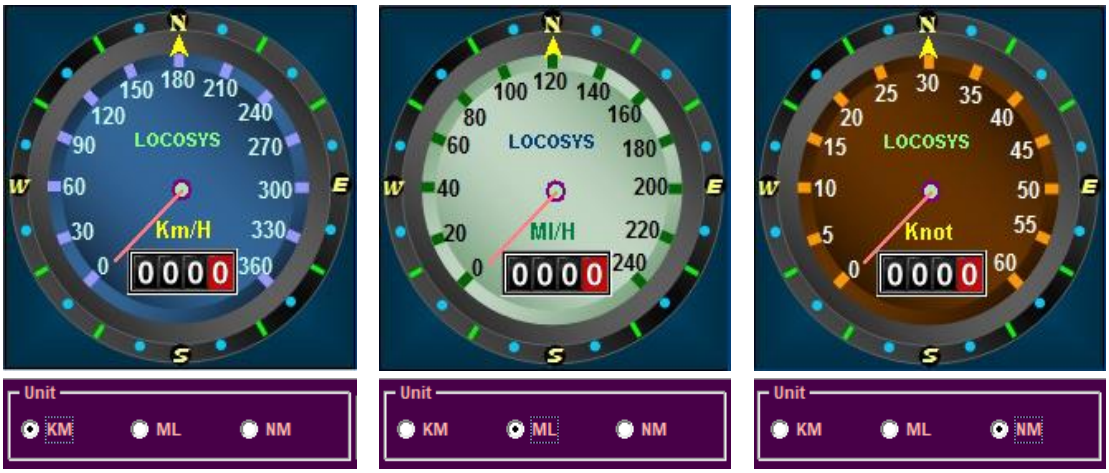


Figure 31: COG&SOG View

The **COG&SOG View** displays the GNSS speed and direction in a graphical form. There are three measurement systems can be shown: Metric (Km), Impearl (Mile) or Nautical Mile (Knot). You can select the unit of measurement in the Unit selection box on ***Function Bar*** by click the item of Km, Mile or Knot.

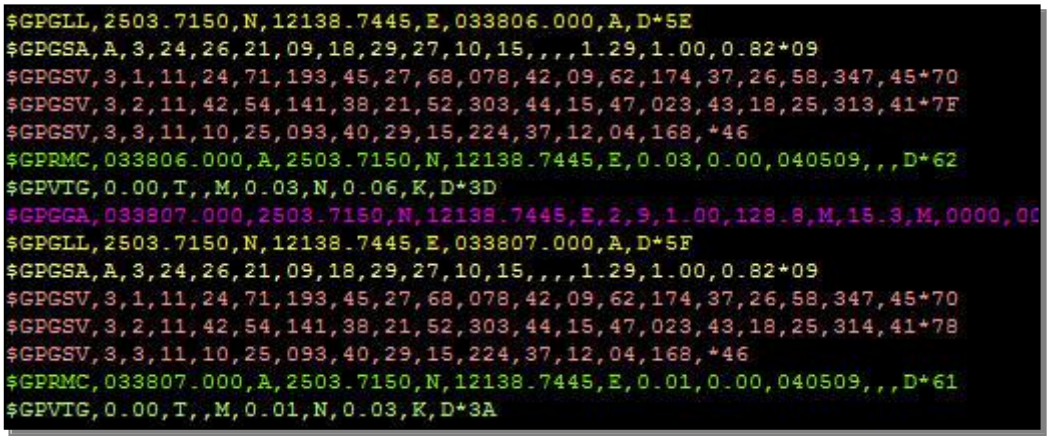
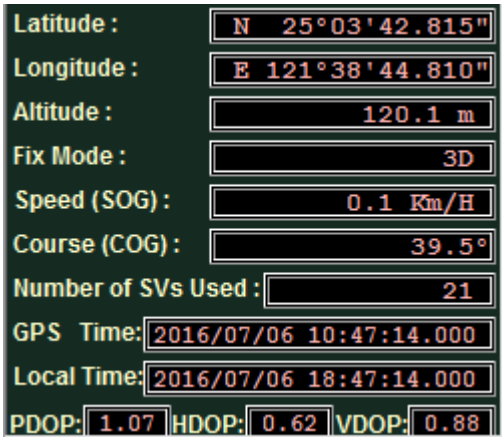


Figure 32: NMEA View

The **NMEA View** displays the original NMEA messages received from GNSS receiver. If you want to clear the content of **NMEA View**, just right-click in **NMEA View** area and click the ***Clear*** item on popup menu.



The **Navigation View** displays the primary navigation information, the units of measurements are determined in the Unit selection box.

Fix Mode	Description
not Fix	Fix not available
2D	2D (<4 SVs used)
3D	3D (>3 SVs used)

Figure 33: Navigation View

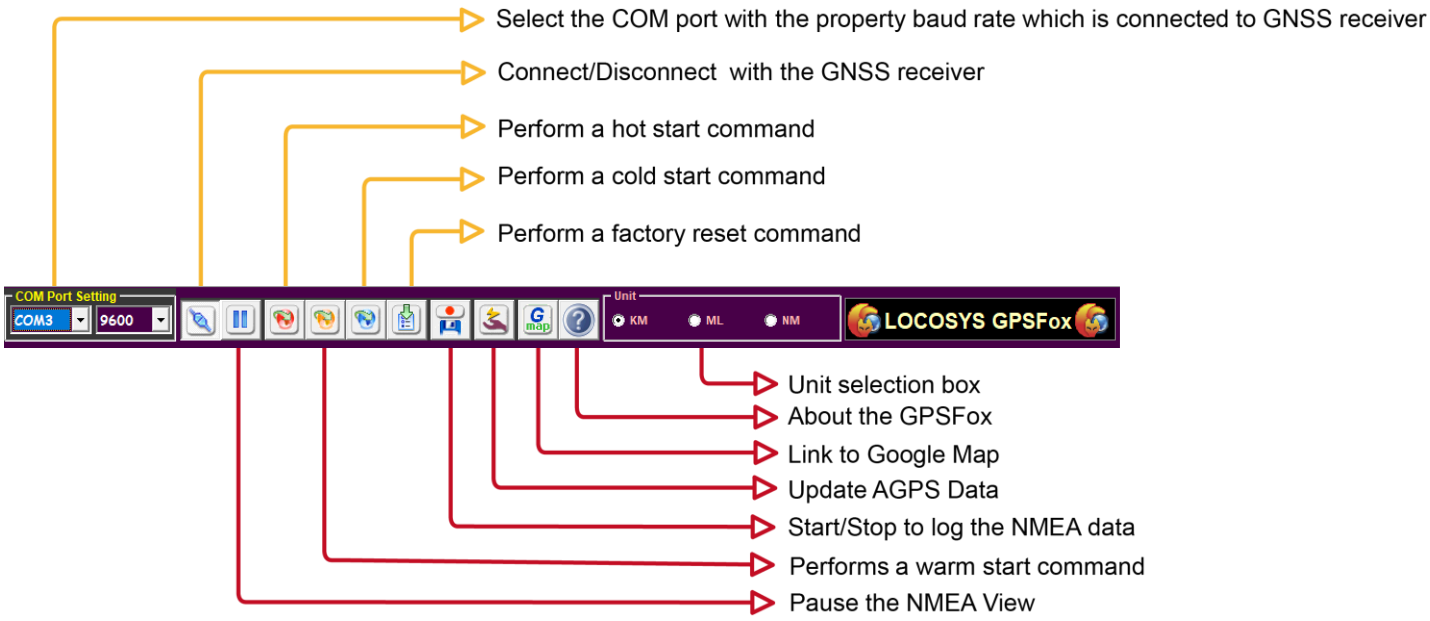


Figure 34: Function Bar

: About the GPSFox

The firmware version can be found after left top LOCOSYS GPSFox's logo & version

Figure 35: About the GPSFox

: Update AGPS data

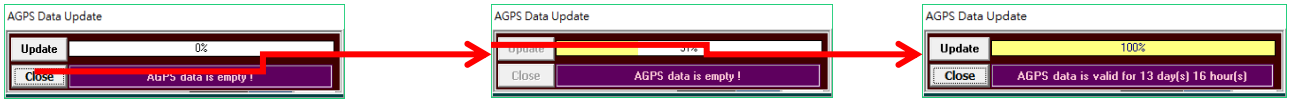


Figure 36: Update AGPS data

Clicks the AGPS button for updating EPO data. If AGPS function is enabled, GPSFox has automatically upload AGPS data to GNSS receiver. Therefore, the TTFF of cold start or warm start with AGPS will faster than them without AGPS aiding.

Desktop or laptop PC needs to connect with Internet when you evaluate the AGPS function.

GNSS Receiver's Firmware version

Figure 37: GNSS Receiver's Firmware version

Command line Support:

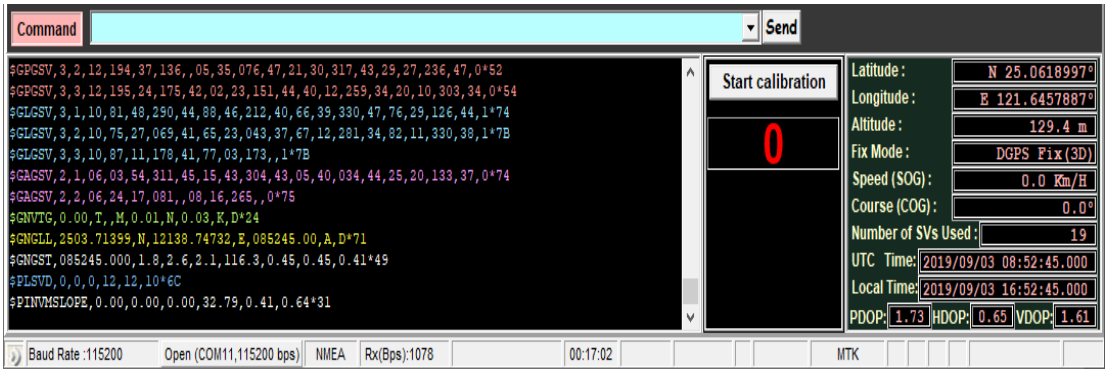


Figure 38: Command line

The version GPSFox can support manual input command. You need to call a hidden command line out. Hold Ctrl key and use mouse to click top right GPSFox logo. An input window will prompt up. Key in "**commandbox"** then clicks okay button. A hidden command line wills come out.

You can use the command line to input HED proprietary binary command. Before you input HED binary command you should key in "**HEXCMD:"** for GPSFox accepting.

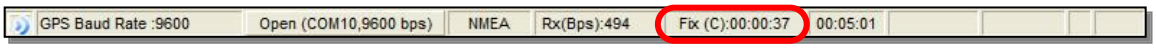


Figure 39: TTFF panel

If you perform a Hot/Warm/Cold Start command, the information of TTFF (Time To First Fix) will display on the TTFF panel.

5. FAQ (Trouble Shooting)

1. Why can't I open the google?

Ans :

(1) Please check if your computer has been connected to the internet or not.

(2) Please check if GNSS has been positioned.

2. Why does the screen only show NMEA messages without any color?

Ans :

It is because GPSFox cannot tell which firmware version of your products is.

(1) For EVK: please unplug and re-plug your USB cable to connect GPSFox.

(2) For GPS/GNSS Module: please check if "the RX pin of GPS/GNSS module" has been connected to "the TX pin of your own systems" already or not.

3. Why is there no "automotive speed"?

Ans :

(1) **Firstly**, it needs to know if the source of the automotive speed is from ODO or UART.

- **ODO Way**:
  1. From the 12V of the original automotive speed cable
  2. Transfer PWM signals via MCU

- **UART Way**: Please use MCU to transfer the sentence output of "**$PSTMDRSENMSG**".

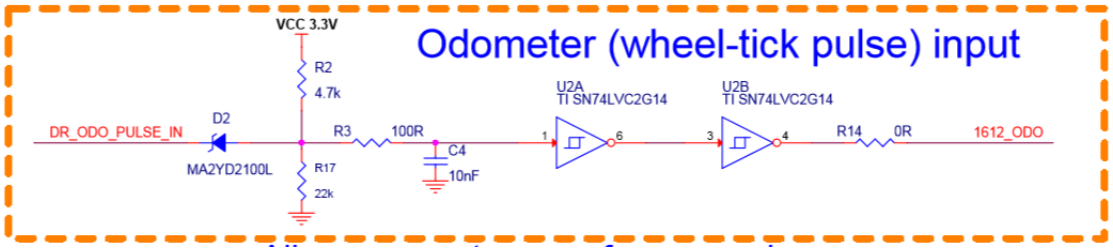
(2) Secondly, If the speed source is confirmed, then we can further check more details below respectively. The circuit diagram can be referred to the its corresponding datasheet.

- **ODO Way**

  From the 12V of the original automotive speed cable:

  Please check the circuit diagram and see if the circuit line has been connected into the module.

  If the automotive speed does not connect to the Module directly via the below circuit line, it would cause Module damaged.



i. Transfer PWM signals via MCU:

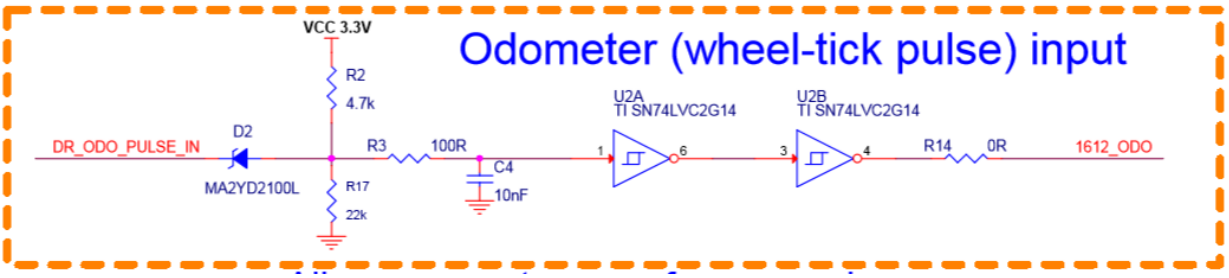
Please check if the program code of MCU has been written completely.

The calculation way of PWN is shown as below.

ii. PWM (HZ) = Automotive Speed (km/h) *4; duty cycle = 50%

iii. **PWN output must be kept in a linear way, such as automotive**

speed:30km/h:PWM=120Hz;60km/h:PWM=240Hz;90km/h:PWM=360Hz.Besides, please also check the circuit diagram and see if this circuit line has been connected into the module.



- **UART Way**
  Please check if the sentence output of "**$PSTMDRSENMSG**" is correct or not.

PSTMDERSENMSG---Sensor data over UART

Customer needs get vehicle speed from the microprocessor and follow the table's data format to input ST-1612i-DXX, ST-1612r-DXX module.

Table 11.2-7 contains the values for the following example:

$PSTMDRSENMSG,14,0,31*16

Table 11.2-7 $ PSTMDRSENMSG Data Format

Name	Example	Units	Description
Message ID	$PSTMDRSENMSG		$PSTMDRSENMSG protocol header
MSG ID	14		Data type
MSG ID	0		Data type
Microprocessor output speed	31	Km/h	Speed over ground in kilometers per hour
Checksum	*16		
<CR> <LF>			End of message termination

Note: Default recommend input up to 5Hz to module pin14.

4. Why does the calibration take so long for some modules?

Ans:

The calibration needs to consider "the set-up way of tested object", "the routes environment of calibration", and "speed". Even if you go the same route with the same speed, the calibration time will be more or less differently according to the environment interference in that period. What we can control is the set-up way and the car-driving way under calibration. As long as you can follow previous provided set-up and calibration way, it can make the calibration of the tested object be completed as soon as possible.

5. How to teach the car owner to calibrate?

Ans:

The above calibration steps are the fastest and the most correct calibration way. When your customers use it, please just follow the usual driving habits, then the dead reckoning calibration can be completed.

6. How to check if Dead Reckoning function works or not?

Ans:

When the calibration of the tested object is completed, please disconnect the signals and observe if the positioning status of GGA sentence is 6. If it is, it means the Dead Reckoning assisted function has already started. Please refer to the below sentence. ($GNGGA,062026.000,2503.52320,N,12137.30974,E,6,18,0.6,038.24,M,15.3,M,,*7A)

7. Why is the evaluation result not good after calibration?

Ans:

Dead Reckoning has automatically learning function. After completing the basic calibration, the Dead Reckoning will continue learning calibration and make the moving trajectory more and more precise. It can raise the reliability of Dead Reckoning. Therefore, when you finish calibration, it will be suggested not to hurry to test and do more calibrations instead. More calibrations will be helpful for your evaluation result.