LOCOSYS

Version 1.0

2021/ 04 / 12

ST Series GNSS ADR

EVK Quick Guide

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 any technical support or others, lease leave a message on below website. We will then contact you directly.
https://www.locosystech.com/en/page/Contact-Us/contact-info.html

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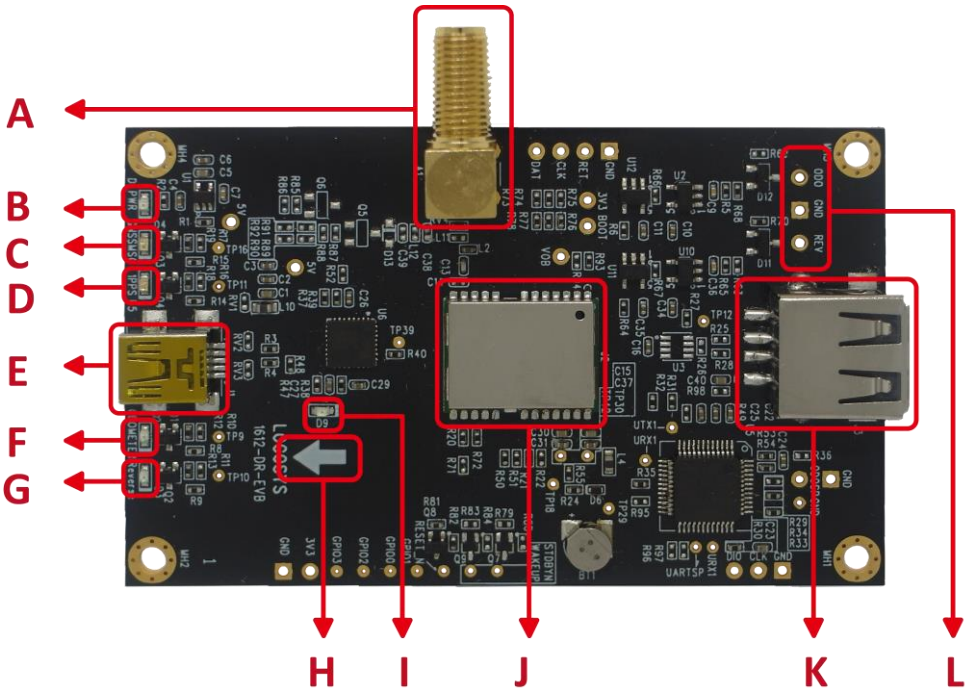
1. Introduction

This document is the user guide of the EVB (Evaluation Board) 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. Introduction to EVK

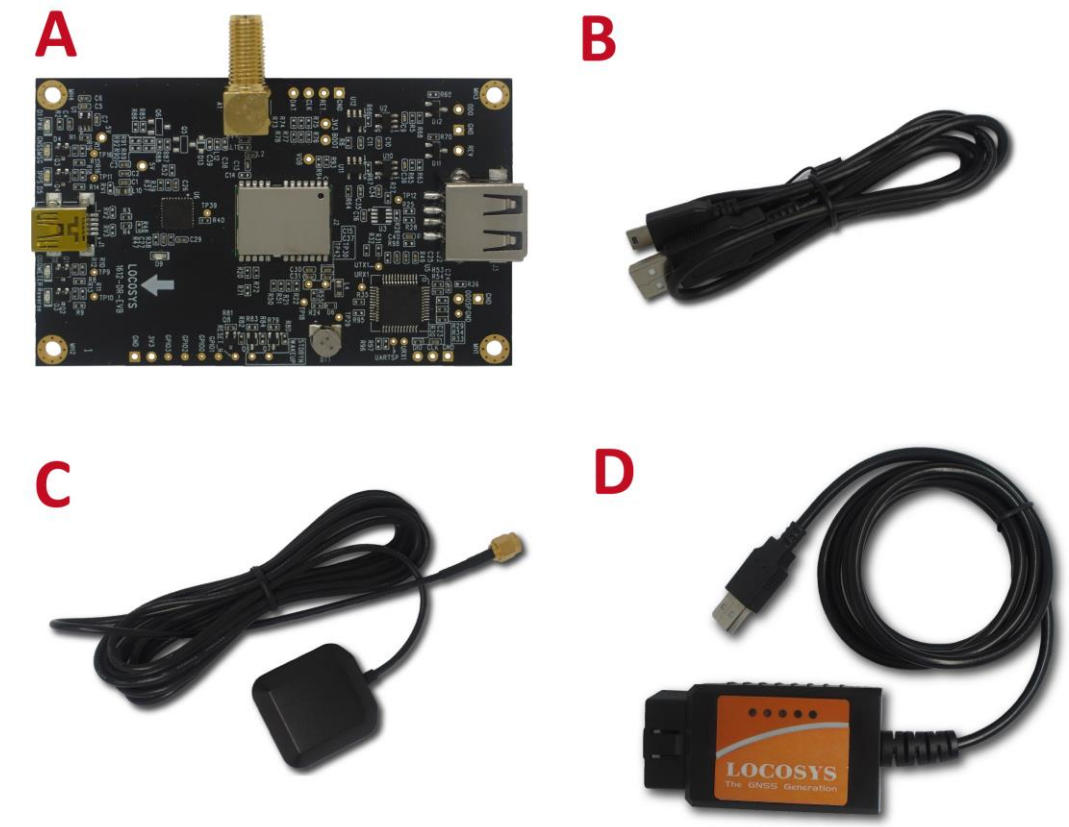
2.1 EVB of ADR



A	RF Connector
B	USB POWER LED (Red) Always On: Normal power supply to USB
C	GNSS TX LEDL (Green) Flash: GNSS works normally Always on: GNSS works abnormally
D	USB POWER(Blue) Flash: GNSS FIX Light Off: GNSS UNFIX
E	MINI USB Connector
F	ODOMETER Signal (Orange) Flash: receive ODO signals input Always on: Do not receive ODO signals input
G	Go Forward/Backward Display (Red) Light Off: The car is going forward. Always on: The car is going backward. This function is required to match ODO signals.
H	EVK Place the direction arrow towards the front of the car
I	Always On : GNSS works abnormally
J	ST-1612i-DGX*/-DBX* (*X : A / B / C / D / E / O / U)
K	UART signals connecting point
L	ODO signals connecting point ODO: Automotive speed signals REV : Go Fforward / Backward signals

Figure 1: ADR EVB TOP View

2.2 Accessories



A	Evaluation Board (EVB) for ADR / ADR+UDR
B	Mini-USB Cable
C	GNSS active antenna (3.3V)
D	OBD-II Cable for ADR / ADR+UDR

Figure 2: Accessories

3. Install Device Driver

If your Windows OS is Windows 7, please install the Device Driver.
Before you connect the EVB with you computer, please check if your computer has installed a Driver already or not. Please go to the following file path and check: "My Computer" > "Computer Management" > "System Tools" > "Device Manager" > "Ports (COM & LPT)" > "USB-Serial Controller D".

If your screen is shown like below one, it means your computer has not installed the Driver yet.

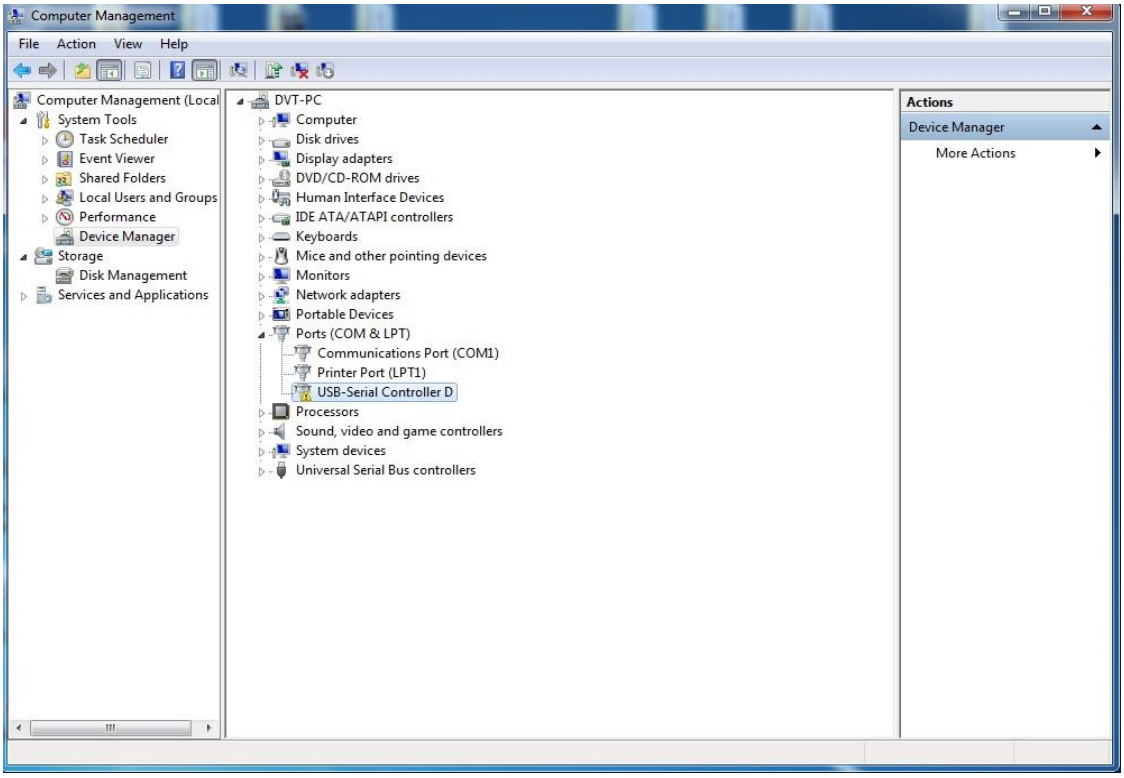


Figure 3: Computer Management

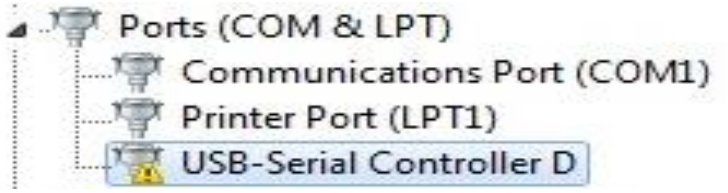


Figure 4: USB-Serial Controller D

Step 1: Please choose the Driver: “pl2303_Prolific_DriverInstaller_v1.8.19” and double click it, then follow up the procedures below.

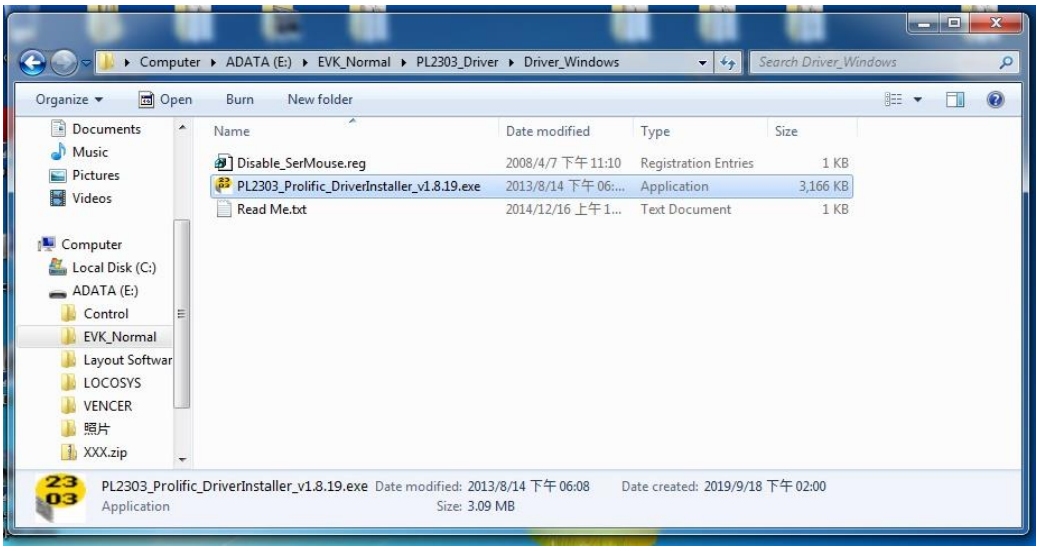


Figure 5: Choose the Driver: “pl2303_Prolific_DriverInstaller_v1.8.19”

Step 2: Please press “Run”.

Figure 6: Open File - Security Warning press “Run”.

Step 3: Please press “Modify”

Figure 7: Modify

Step 4: The Driver has been already installed on your computer. Please restart your computer to complete the whole installation.

Figure 8: Restart your computer to complete the whole installation

Step 5: Then you can see “Prolific USB-to-Serial Comm Port (COM3)” appears under the file path: Ports (COM & LPT) as shown below. It means you indeed install the Driver already.

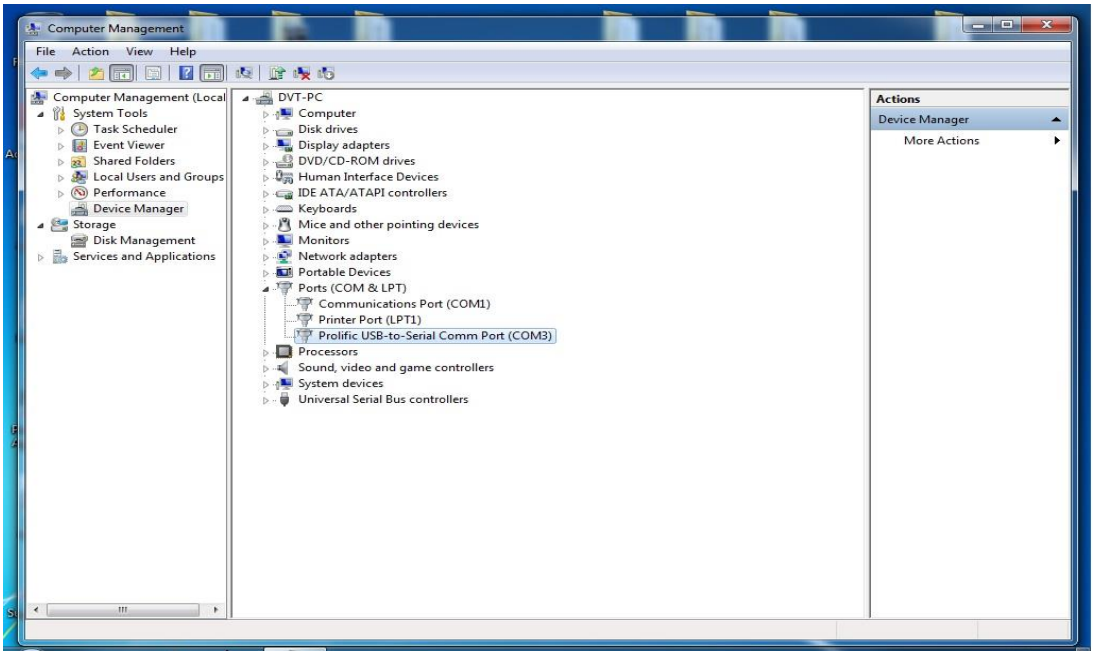


Figure 9: Appears Prolific USB-to-Serial CommPort (COM3)

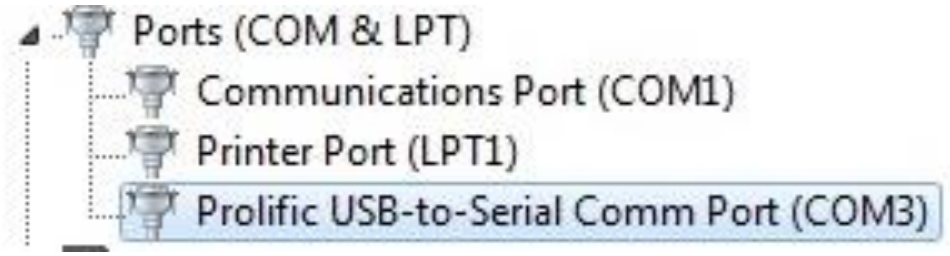


Figure 10: Prolific USB-to-Serial CommPort (COM3)

4. Starting GPS Fox

4.1 Getting Started

4.1.1 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

4.1.2 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)

4.1.3 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.

4.2 Launch GPSFox

1. Please open GPSFOX software and then choose a corresponding COM Port.

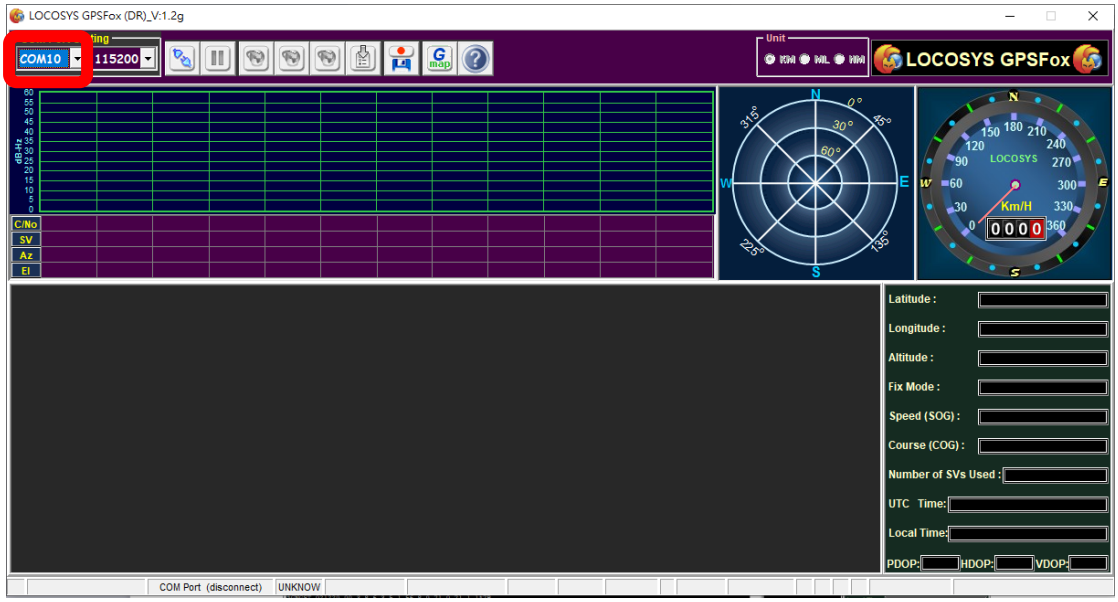


Figure 11: Choose a corresponding

2. Please choose corresponding Baudrate.

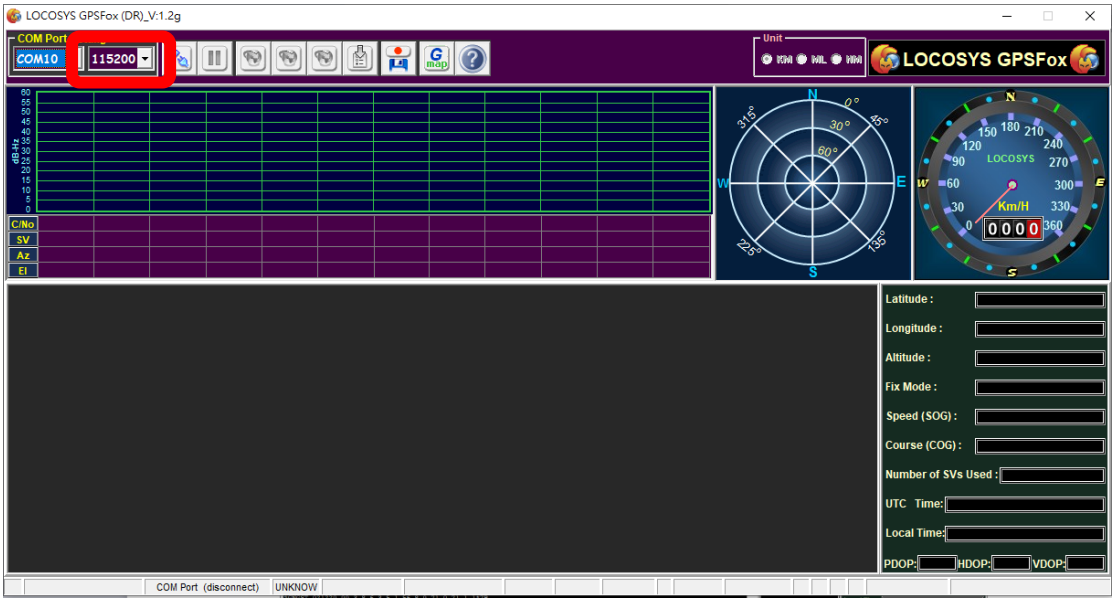


Figure 12: Choose corresponding Baudrate

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

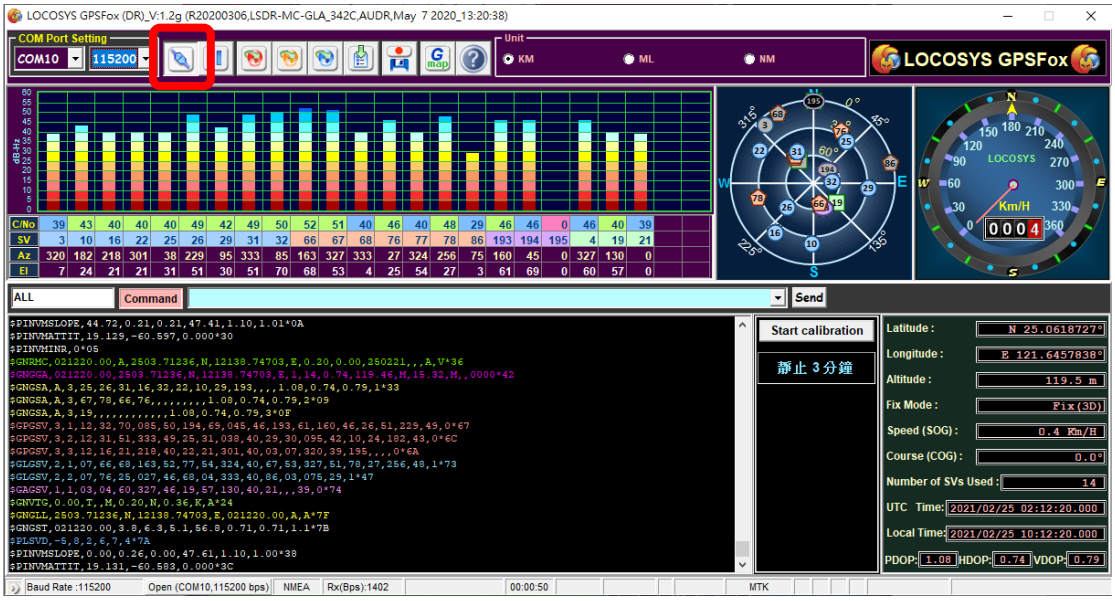


Figure 13: Connect to GNSS Receiver button

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

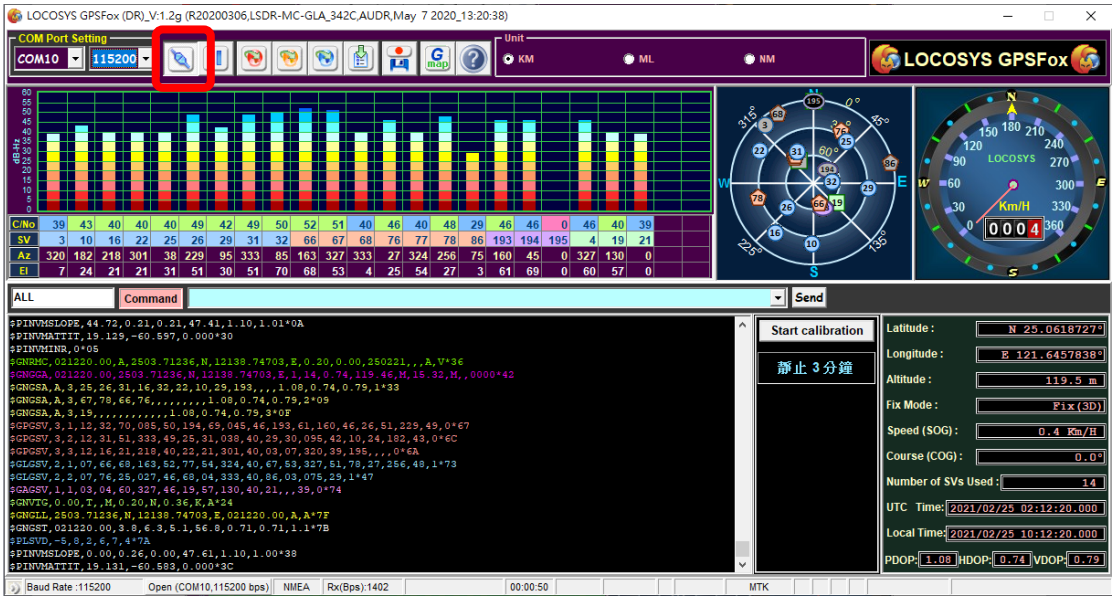


Figure 14: Disconnect button

5. 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.

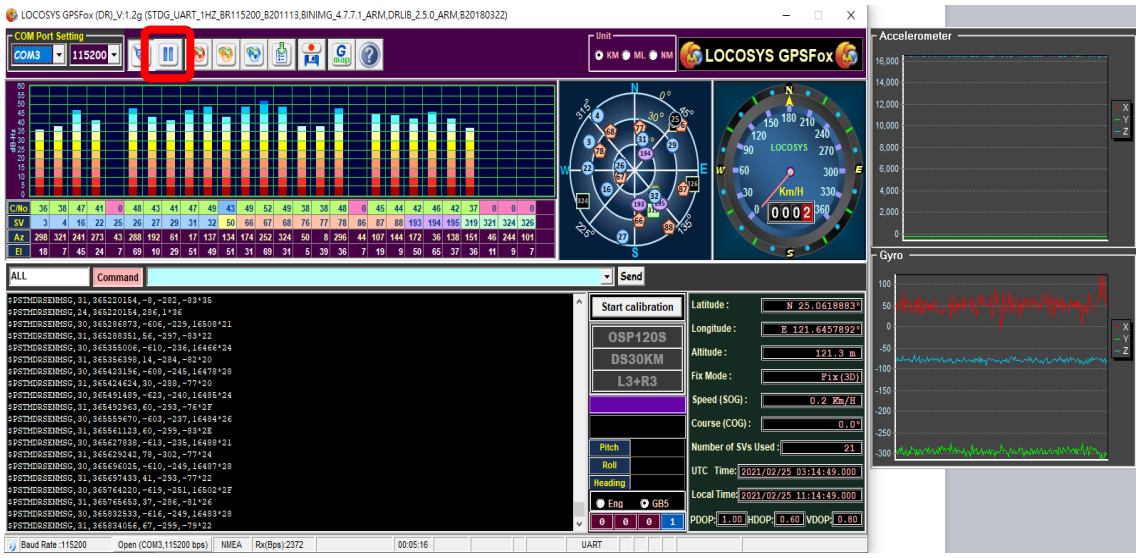


Figure 15: Click to Pause button

6. 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.

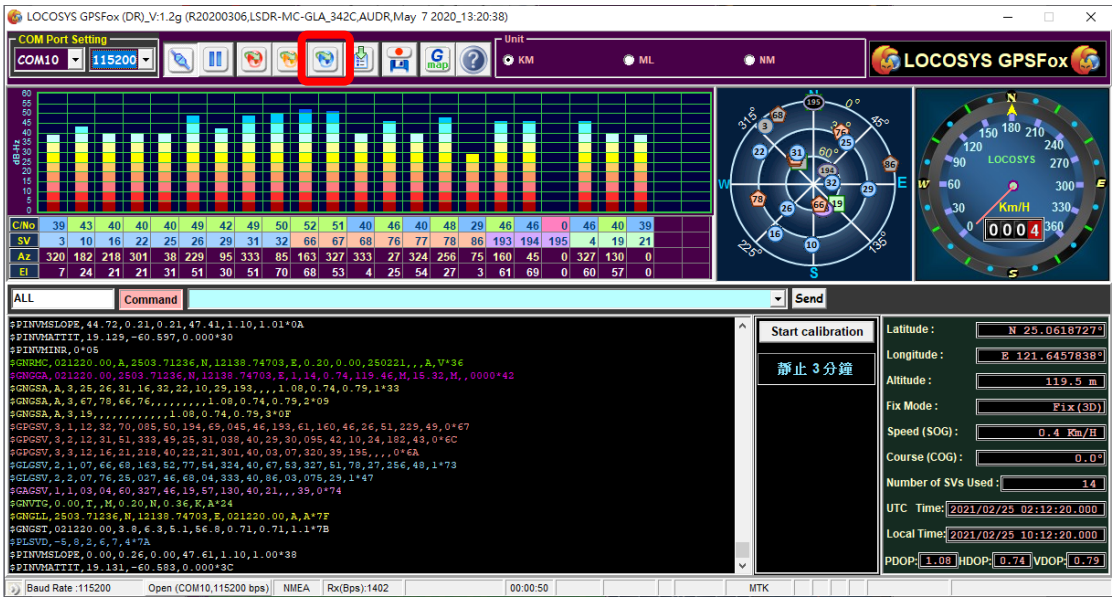


Figure 16: Cold Start button

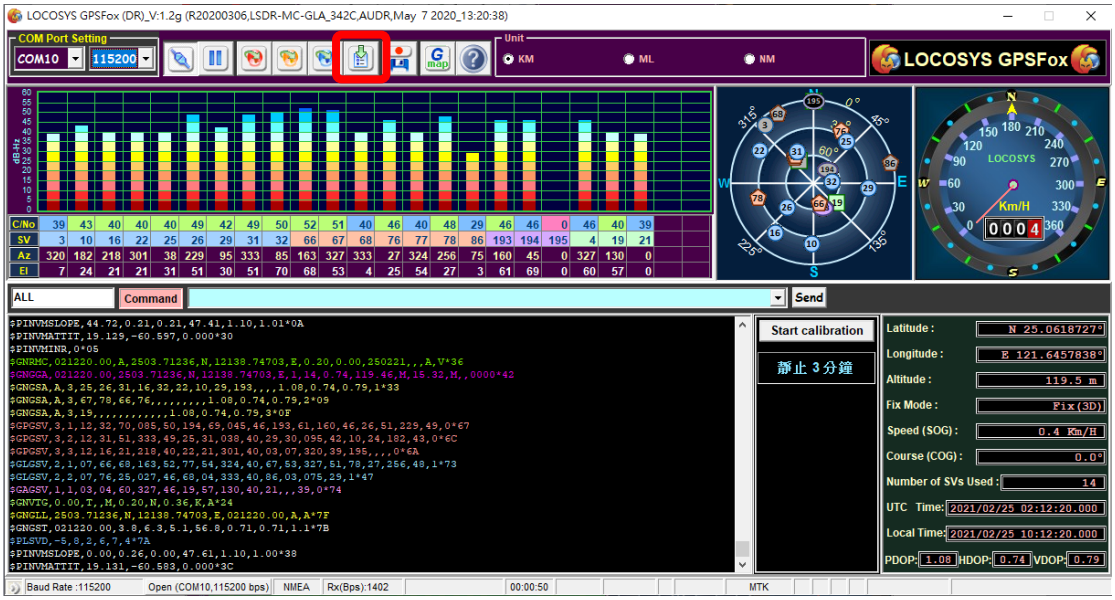
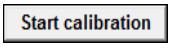


Figure 17: Factory Default button

7. Click  to initiate Calibration Mode, shown as below.

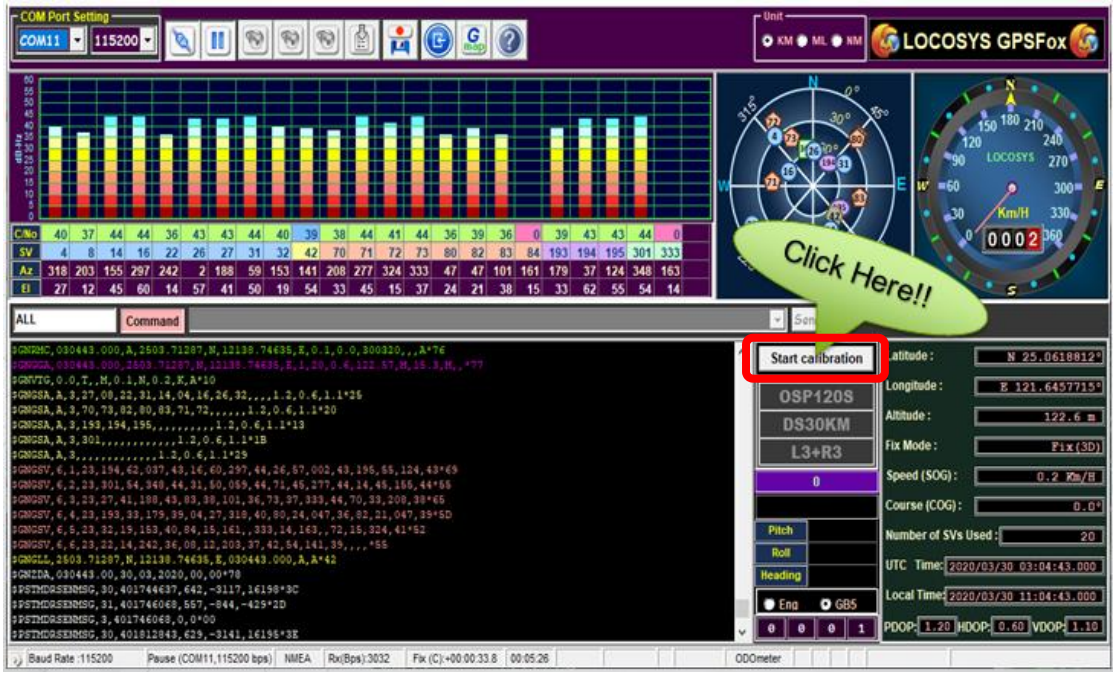
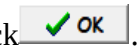


Figure 18: Click to Start Calibration

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

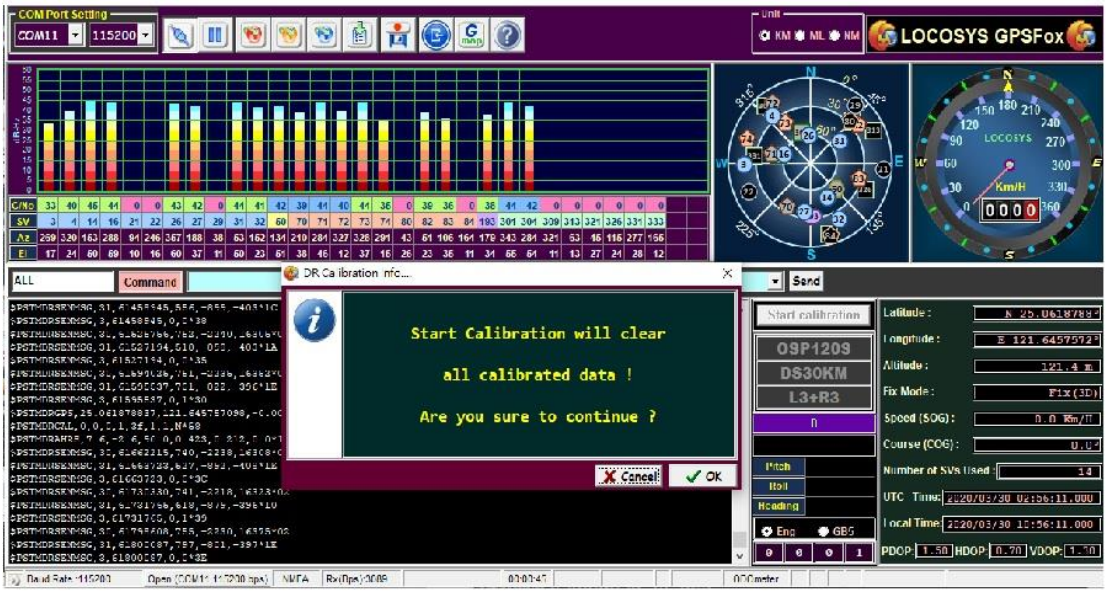


Figure 19: Message to have a calibration

9. 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)

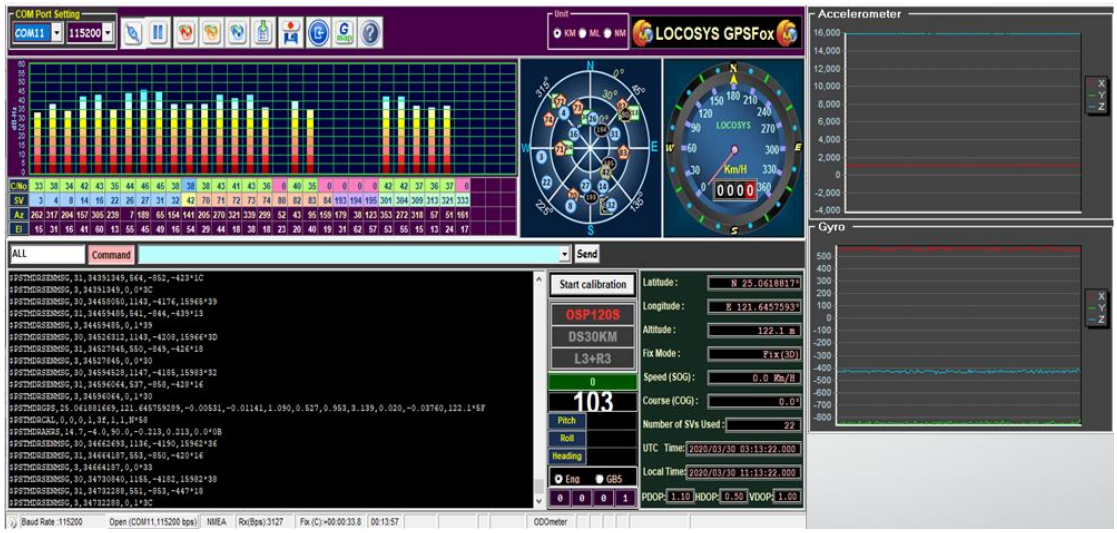


Figure 20: Start Calibration

$PSTMDRSENMSG,30 → for Accelerometer

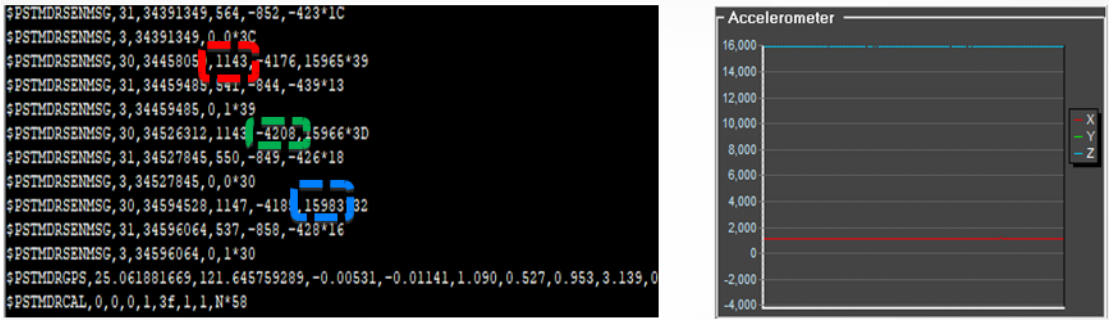


Figure 21: Accelerometer output data

$PSTMDRSENMSG,31 → for Gyro

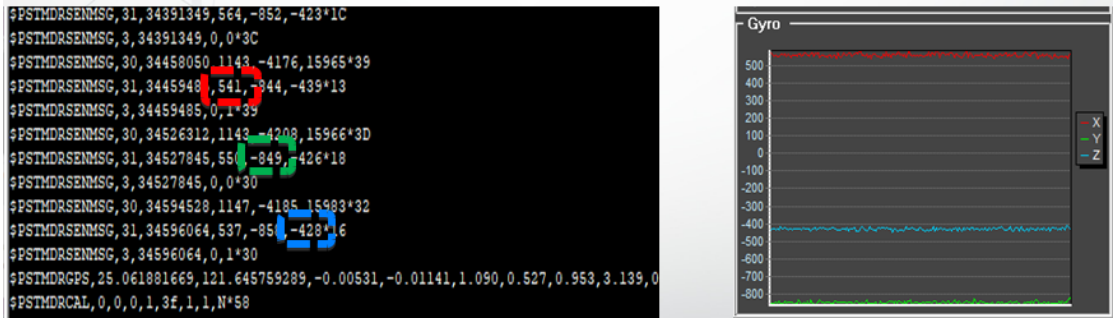


Figure 22: Gyro output data

10. When the cursor move to 

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.)

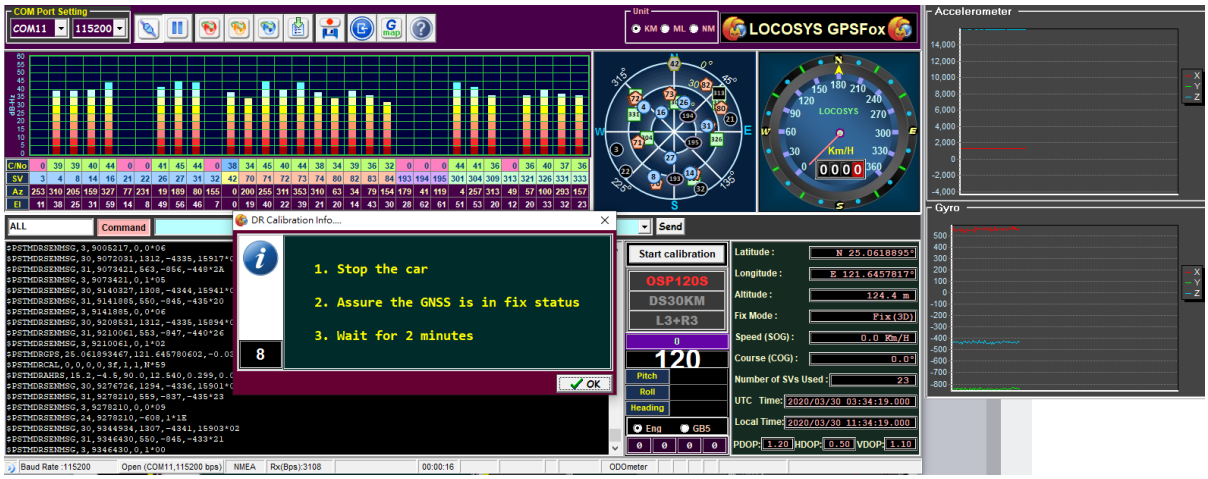


Figure 23: DR Calibration Info

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

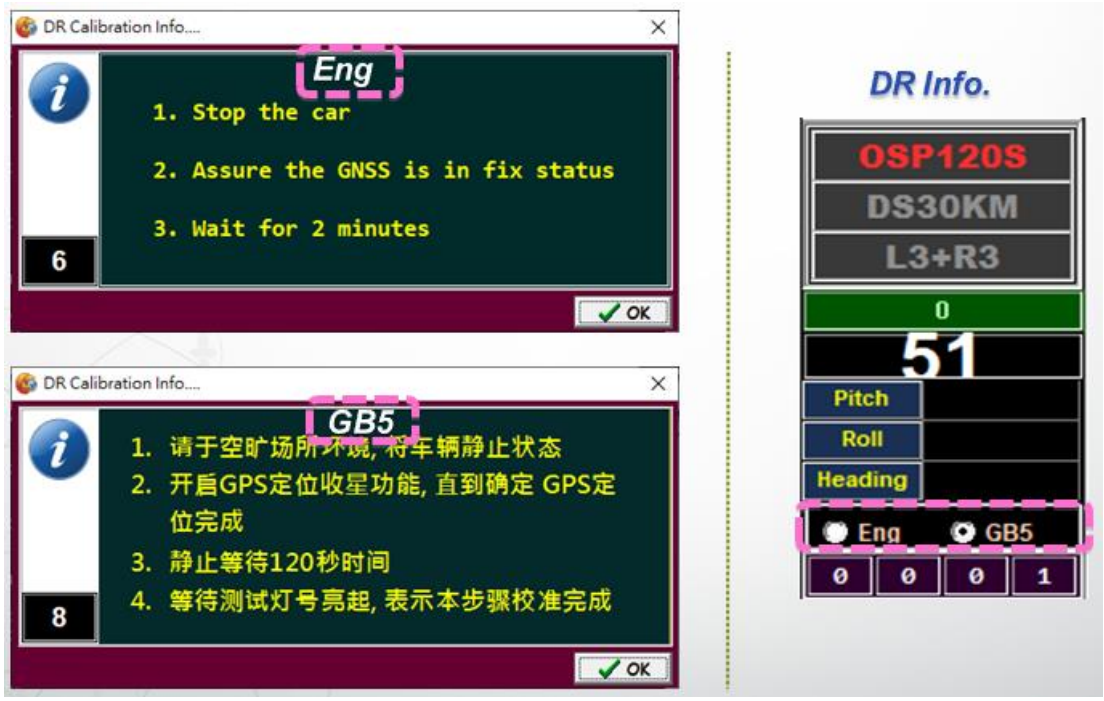
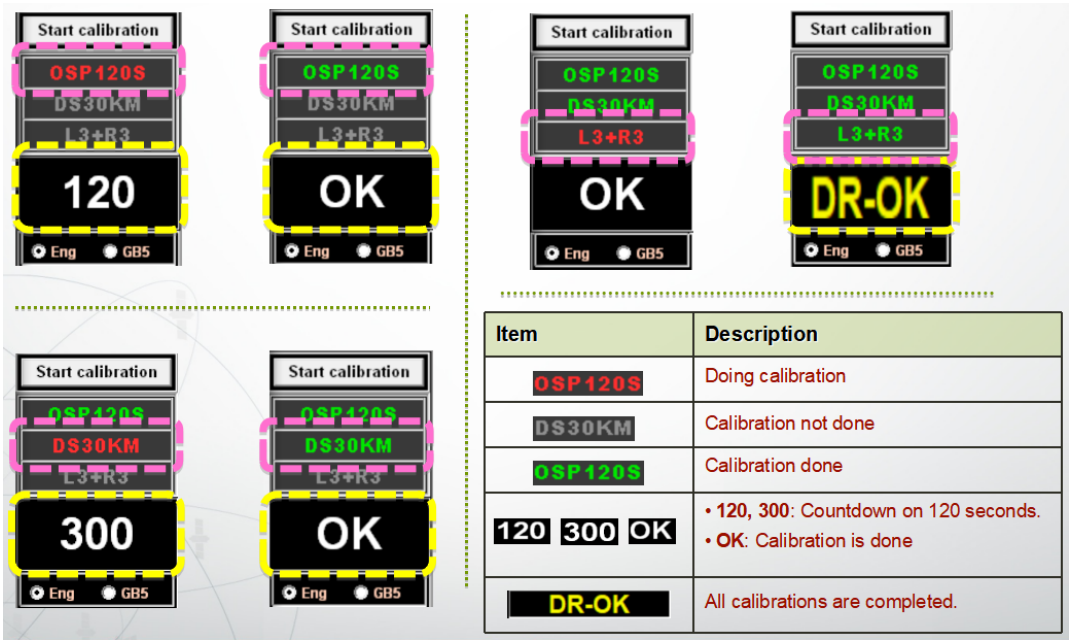


Figure 24: Choose Language of DR Calibration info

12. 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 25: Timer and Status of DR Info.

13. Calibration Flow Chart

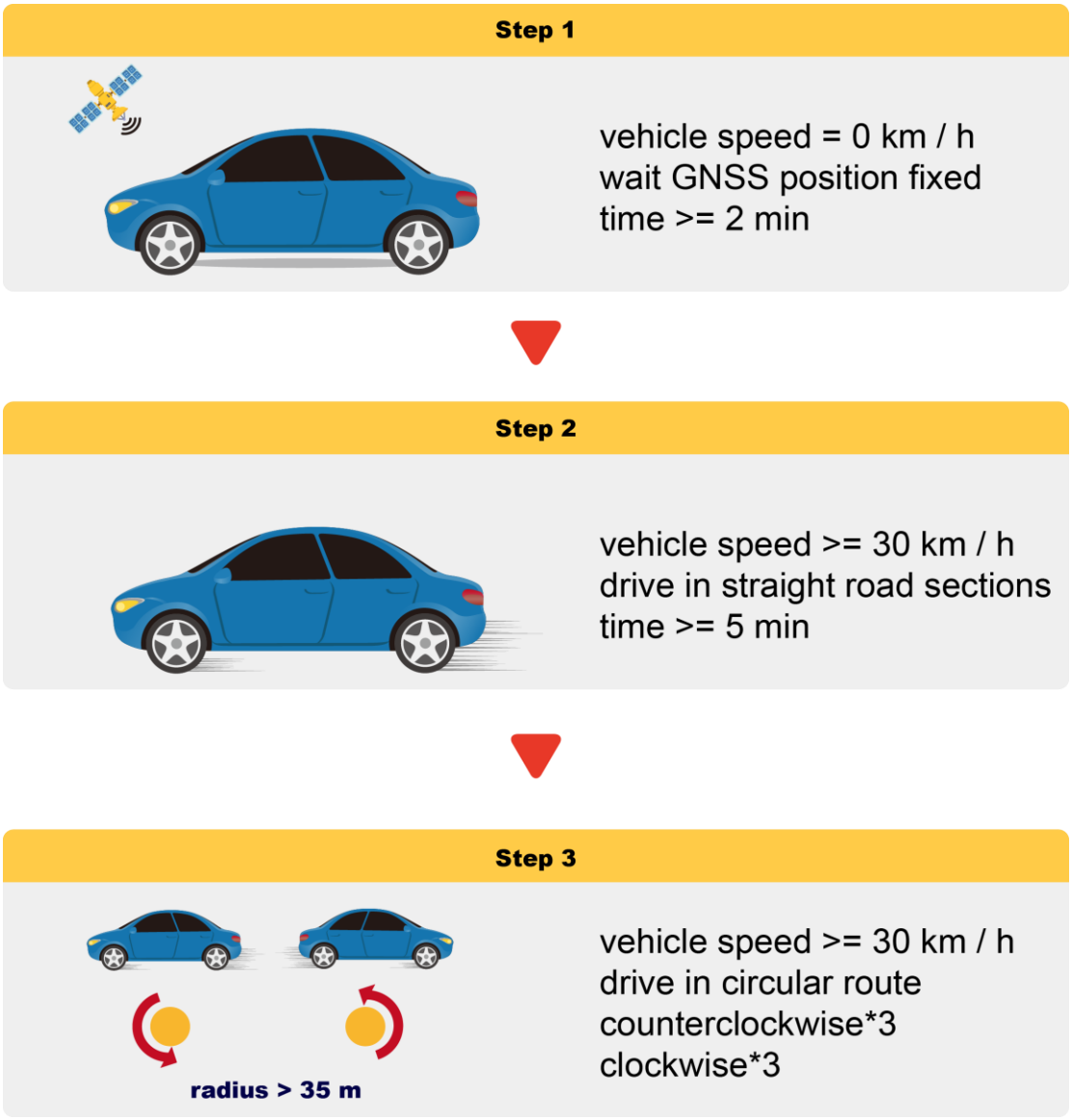


Figure 26: Calibration Flow Chart

➢ **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 27: Calibration for OSP120S

You will see in DR Info.

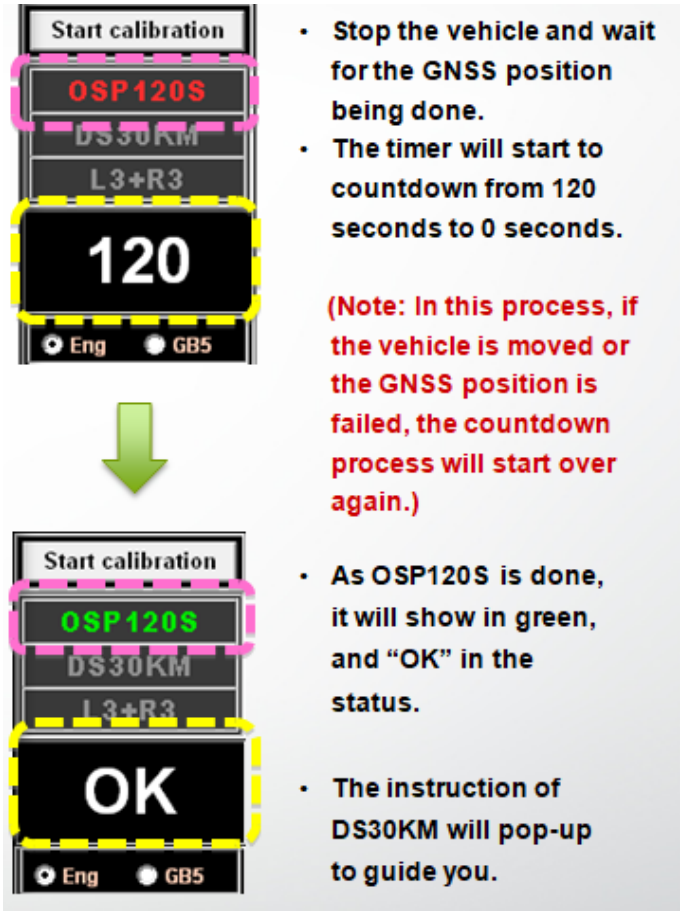


Figure 28: Calibration for OSP120S information

➢ **Step 2: Calibration for DS30KM**

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

Figure 29: Calibration for DS30KM

You will see in DR Info.

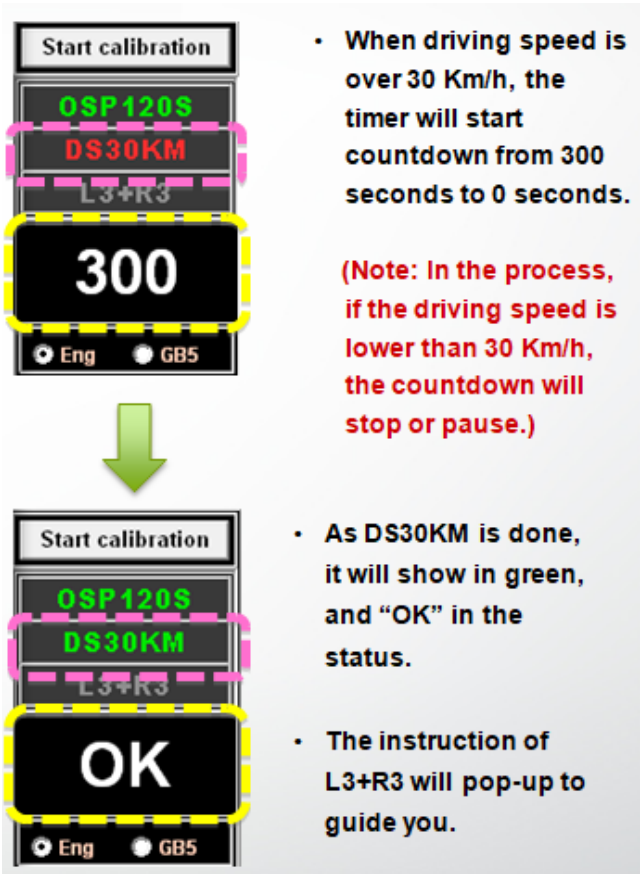


Figure 30: Calibration for DS30KM information

➢ **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

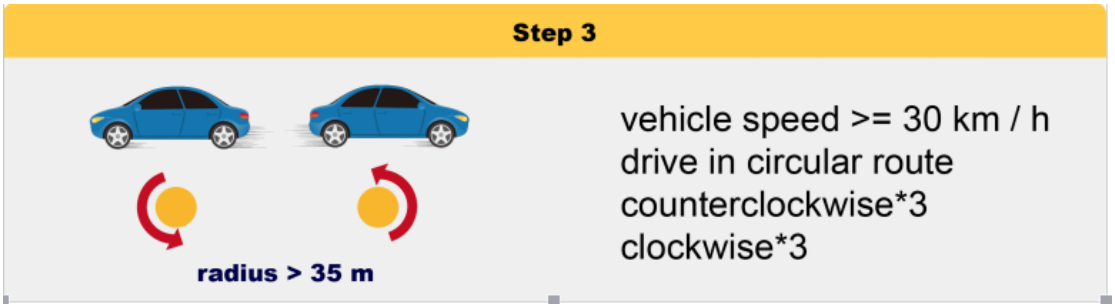


Figure 31: Calibration for L3+R3

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.

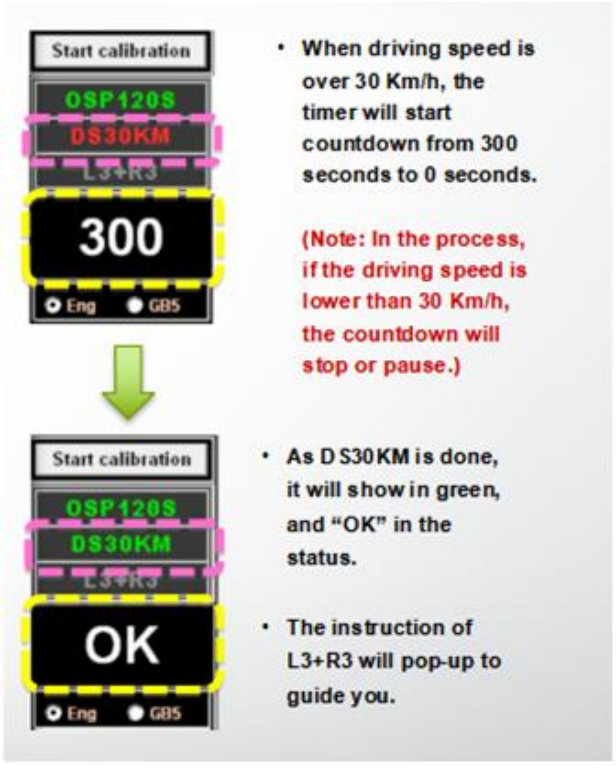


Figure 32: Calibration for L3+R3 information

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)

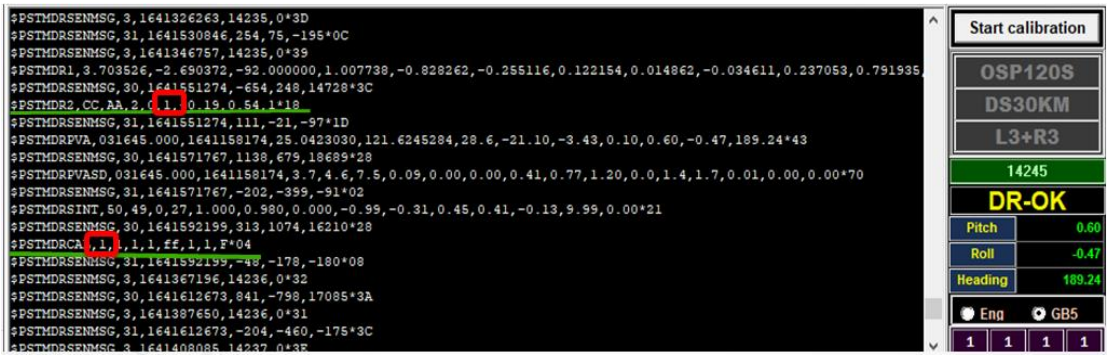


Figure 33: DR Funsion Status

```
$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 34: Calibrated flags

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

Figure 35: 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.

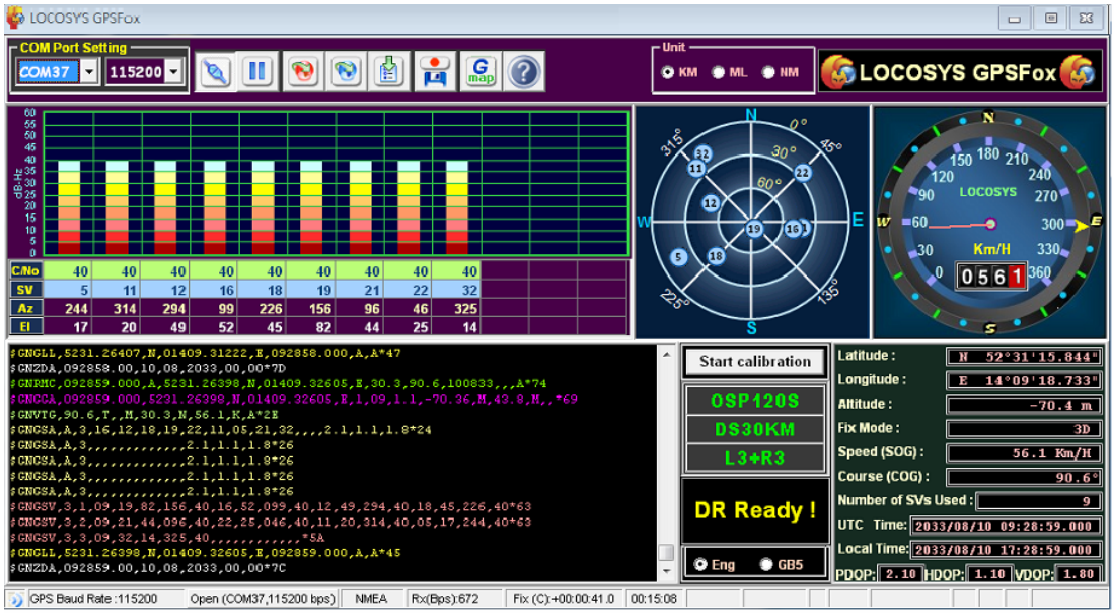


Figure 36: Completing all the calibrations

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.

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

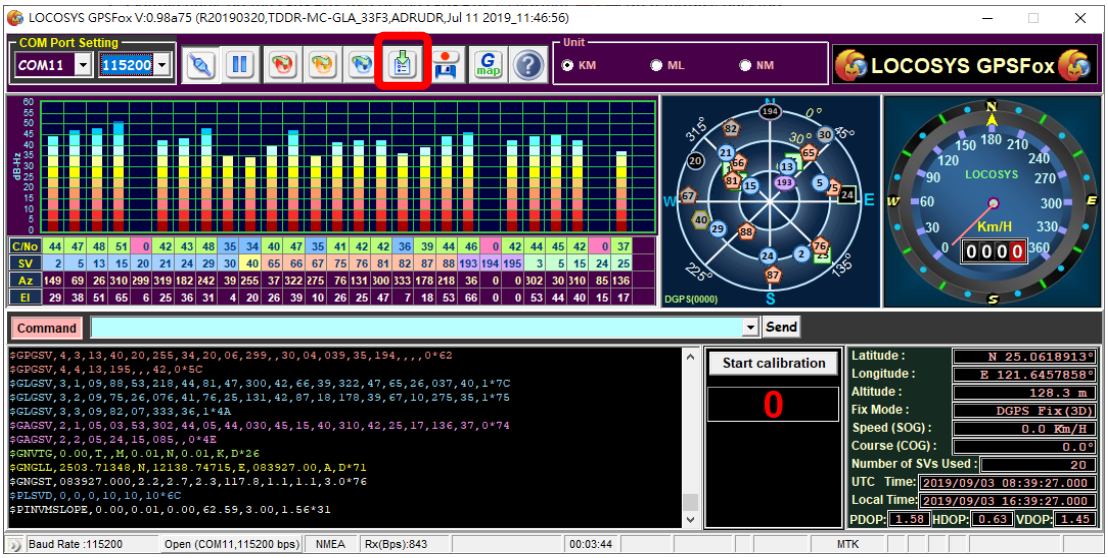


Figure 37: Start to Log data button

15. 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.

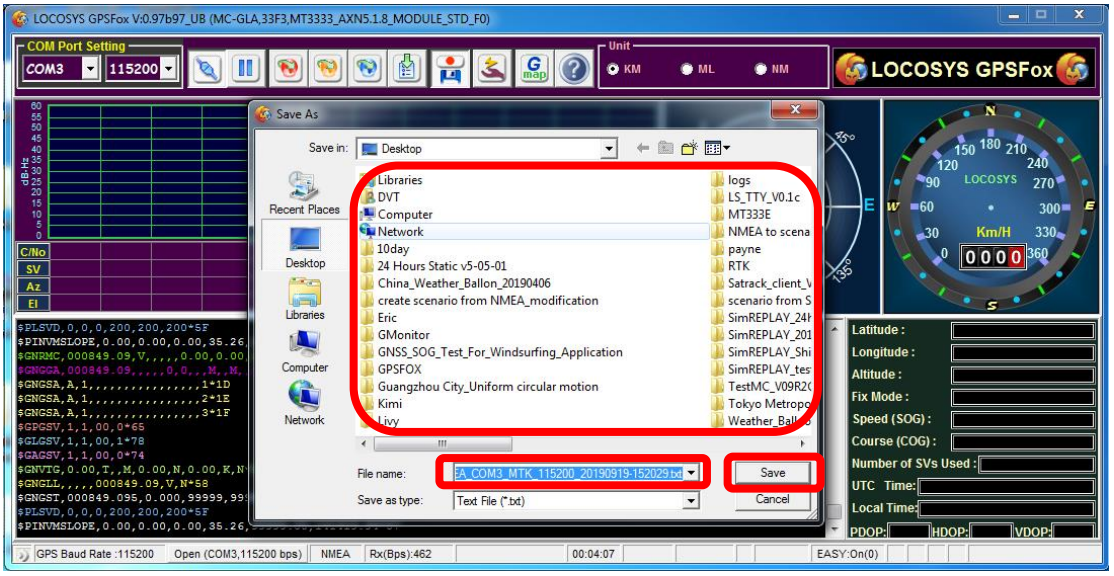


Figure 38: Press SAVE button

4.3 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.

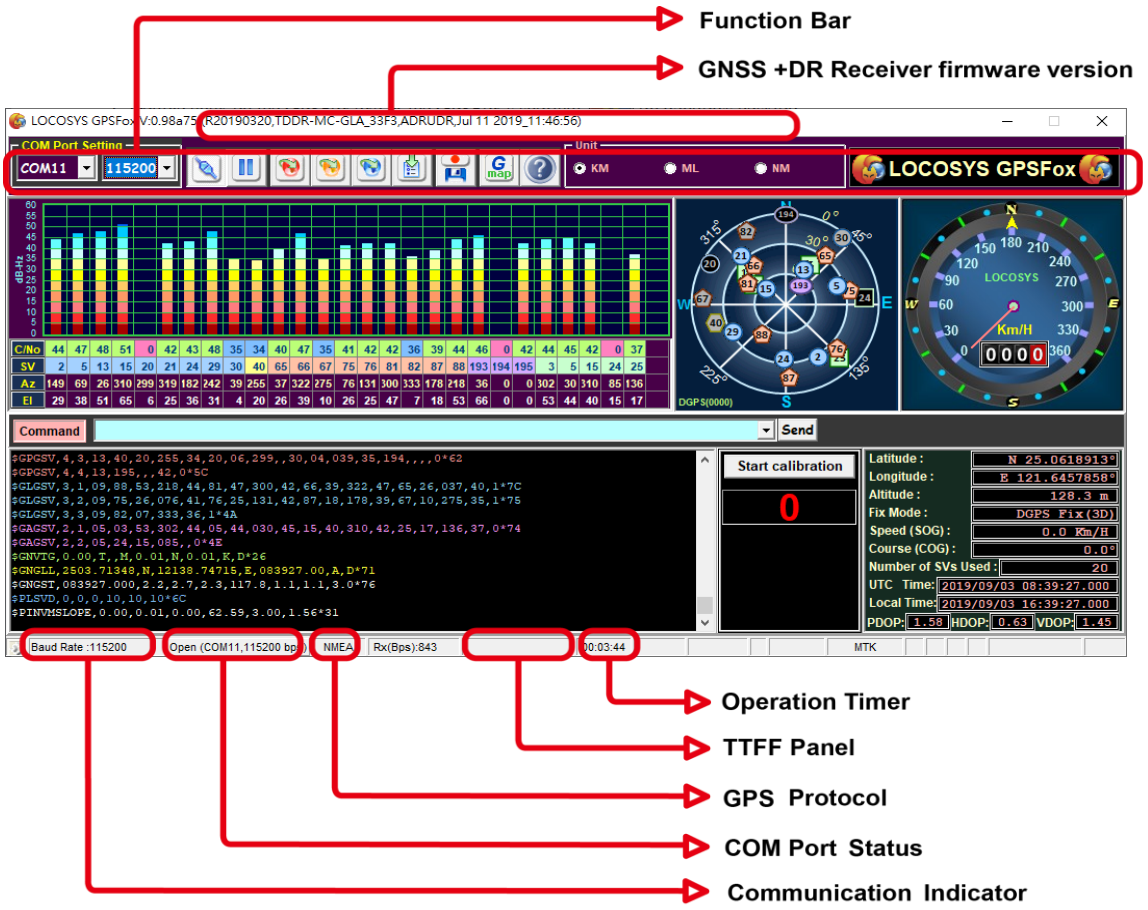
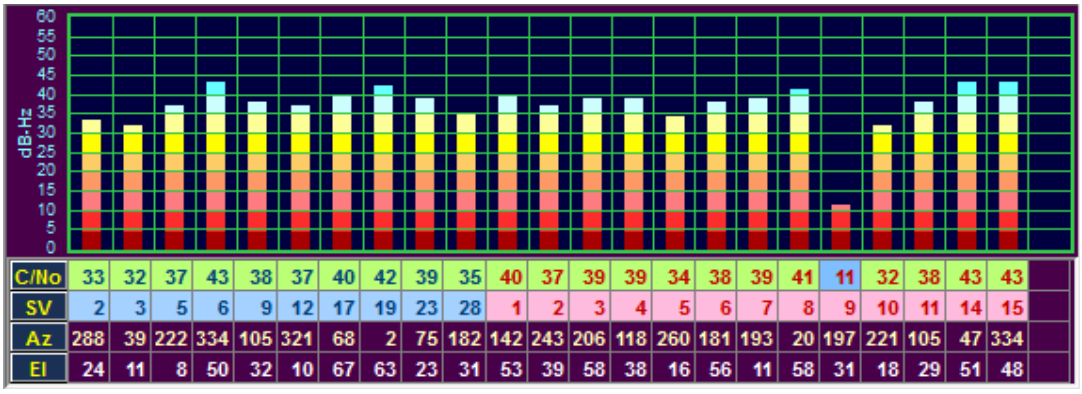


Figure 39: GPSFox

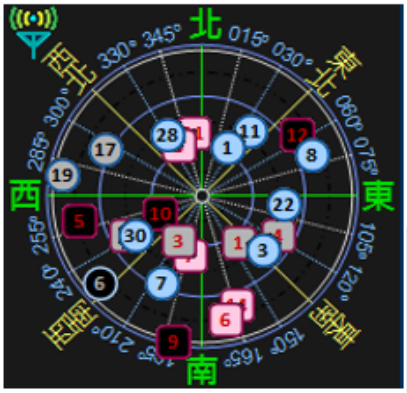
The **Signal Level View** displays the satellite number(SV), azimuth(Az), elevation(El) of tracked and available satellites in a text form. It also shows the C/No value in both text and graphical forms.



C/No	33	32	37	43	38	37	40	42	39	35	40	37	39	39	34	38	39	41	11	32	38	43	43
SV	2	3	5	6	9	12	17	19	23	28	1	2	3	4	5	6	7	8	9	10	11	14	15
Az	288	39	222	334	105	321	68	2	75	182	142	243	206	118	260	181	193	20	197	221	105	47	334
El	24	11	8	50	32	10	67	63	23	31	53	39	58	38	16	56	11	58	31	18	29	51	48

Figure 40: 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 41: Radar View

Figure 42: 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.

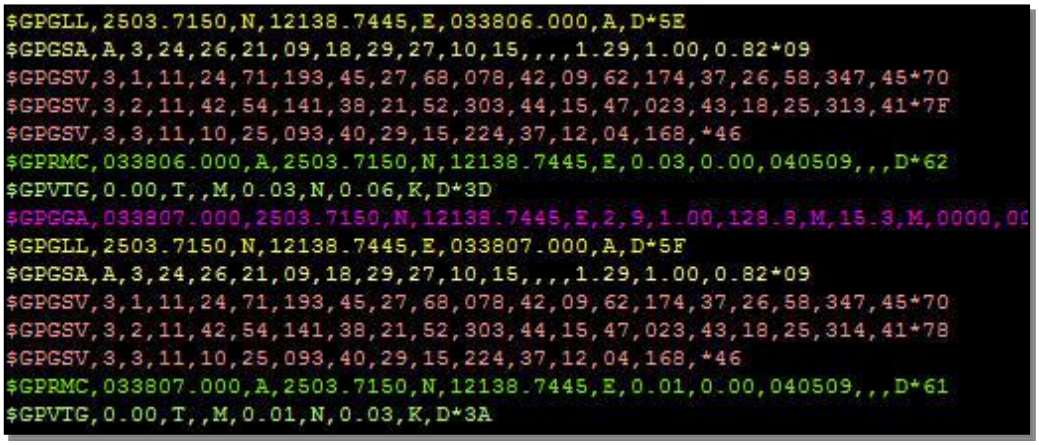
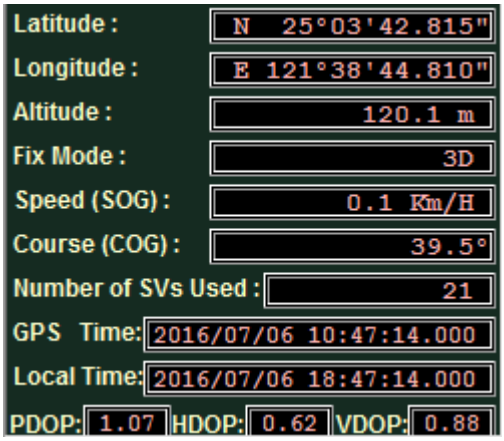


Figure 43: NMEA View

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 44: Navigation View

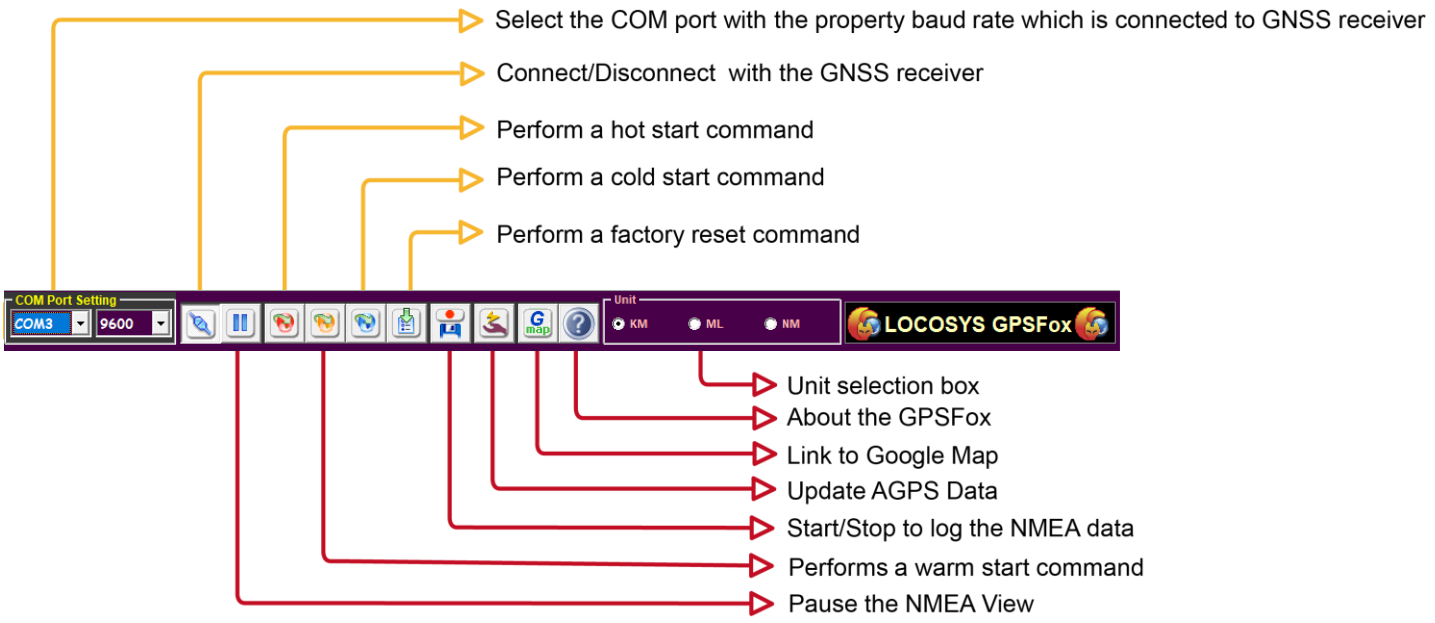


Figure 45: Function Bar

: About the GPSFox

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

Figure 46: About the GPSFox

: Update AGPS data

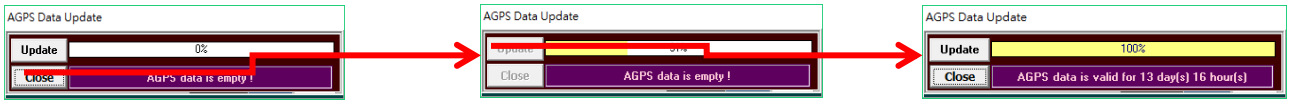


Figure 47: Update AGPS data

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 48: GNSS Receiver's Firmware version

Command line Support:

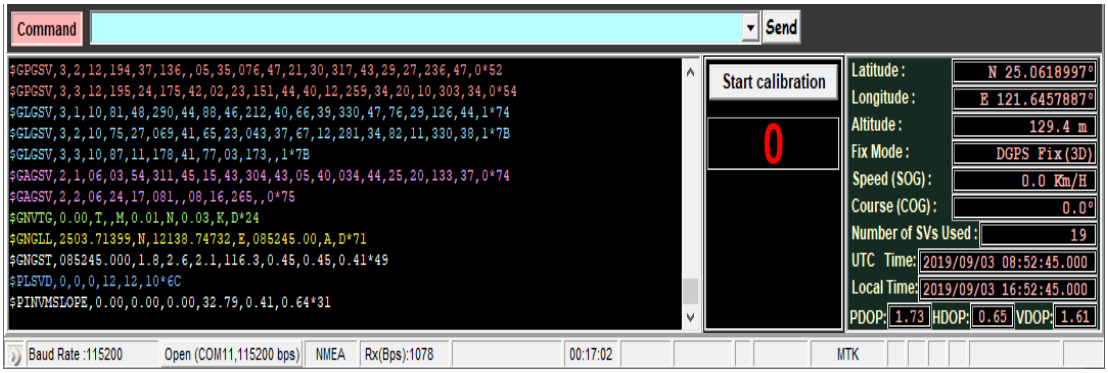


Figure 49: Command line

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.

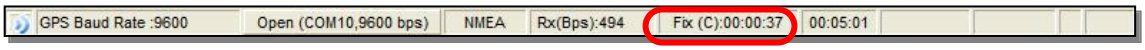


Figure 50: TTFF panel

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 can the signals not be read from "the PPS pin of the EVB"?

Ans :

(1) The locations of PPS Pin in different modules are also different. Please refer to the "Pin Assignment" section of the corresponding datasheet. The PPS Pin of EVB can only support 1612-series

(2) PPS signals will not be output before you get the position..

4. Why can the position not be acquired?

Ans :

The GPS/GNSS part cannot acquire satellites signals. The reason may be due to

(1) Active antenna is problematic

(2) There is no provided voltage for active antenna

(3) The GPS/GNSS product is problematic.

5. 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**”.

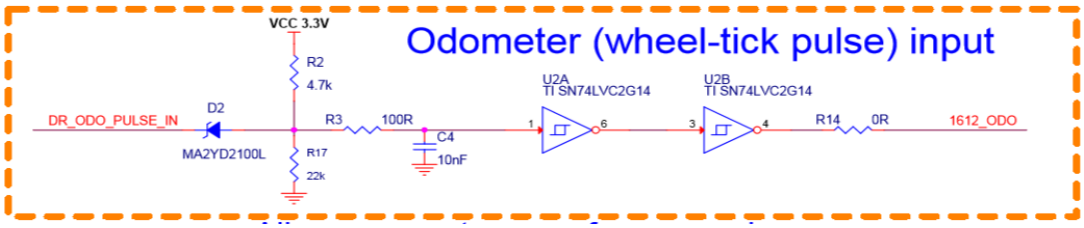
(2) **Secondly**, If the speed source is confirmed, then we can further check more details below respectively. The circuit diagram can be referred to the its corresponding datasheet.

- **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.



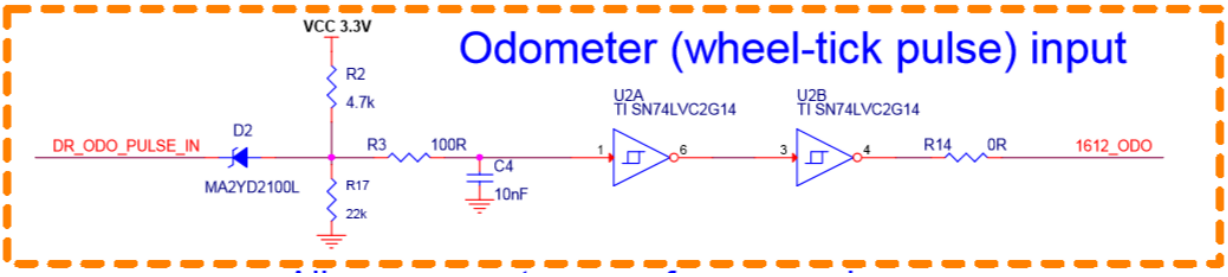
i. **Transfer PWM signals via MCU:**

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.

6. 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.

7. Does each car need to be calibrated?

Ans:

Each car has to complete the calibration initially. After one calibration, the Dead Reckoning will continue automatically learning the calibrating and make the moving trajectory more and more precise.

8. 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.

9. 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)

10. 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.