GP9000/GN190
GNSS Navigator
Operation Manual

Marinelite

NANTONG SAIYANG ELECTRONICS CO.,LTD.

Foreword

Thank you for purchasing the GP9000/GN190 GNSS navigator produced by NANTONG SAIYANG ELECTRONICS CO.,LTD.

This equipment utilized with multi-satellite system technology and advanced speed and heading filtering technology.

Conforms to the IMO (International Maritime Organization) performance standards, which can realize real-time ship spatial positioning, making the data more reliable and stable.

Before attempting to operate this equipment, please read this instruction manual thoroughly to ensure correct and safe operation in accordance with the warning instructions and operation procedures.
You are strongly recommended to store this instruction manual carefully for future reference.
In the event that you have an operational problem or malfunction, this manual will provide useful instructions.

Important Information

Product Function

This product is a set of marine positioning and navigation systems developed based on positioning and navigation systems. Providing accurate location information, speed and heading information for ship-owners, and achieving display and alert of ship movement status information.

Safety Cautions

Warning: Assist Navigation

This product is used to assist navigation, and its accuracy is influenced by many factors, including equipment faults or defects, environmental conditions, and incorrect use. Users have responsibility to make judgment based on their ordinary intelligences, should not rely on this product only.

Warning: Product installation

This product should be installed according to the installation guidelines in this manual. Otherwise, it may lead to a decrease in product performance, causing personal injury, and even damage to ships.

Warning: High Voltage

The main unit of the device contains a high voltage inside. Internal adjustments require qualified technical service with specialized service programs and tools, users are not allowed to disassemble and adjust by themselves, the manufacturer and distributor will not be able to provide warranty services for any damage caused by this case.

Warning: Don’t disassemble or modify the equipment with power on

Turn off the power at the switchboard before beginning the installation.

Operation Tips

There are no customer-serviceable parts inside. Unauthorized inspections and repairs could cause fires and electrical shock hazards. Please call our company or located distributor for inspection and repair services.
Do not disassemble or modify the equipment. Doing so may result in fire, electric shock, or equipment failure.
Do not connect or disconnect the power cord by wet hands, doing so may result in fire, electric shock, or equipment failure.
In case you find smoke, unusual odor or extreme high heat coming from the equipment, turn off the power and breaker immediately. Keeping operation under such condition may cause fire or electric shock.
Do not use this device out of specific voltage (12-36V), Otherwise, a fire, an electrical shock, or a failure may occur.
Do not store or operate the equipment where subject to temperatures more than 55°C or less than -15°C. High temperature may cause failures.
For safety when the equipment is to be left unused for an extended period, turn off the power switch.

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Brief Introduction

The GP9000/GN190/GP9000B/GN190B GNSS navigators contain CCS certificate, which are powerful, highly accurate, easy to operate, with a fashion and beautiful appearance., can be widely used for ship navigation and positioning in oceans, inland rivers, lakes, etc.

Product Features：

- High visibility even in strong light and at night, good performance of high contrast, brightness adjustment.
- Utilized with the multi-GNSS receivers, advanced speed and heading filtering technology, offering higher accuracy, and stable date information.
- Multiple NMEA0183 outputs provide high-precision ship information for navigation equipment such as radar, plotter, autopilots, fish finders, sonar, etc.
- Equipped with a 7-inch or 4.2-inch high-definition color display screen, supporting multiple display modes, making data more intuitive and convenient.
- Excellent industrial product design, fashion appearance, simple installation, maintenance free, not affected by water temperature and salinity, but need to take precautions against strong wind, rainstorm and other complex sea conditions.
- Stable performance, rival with foreign brand products.
- Professional design, beautiful fashion appearance, exquisite and durable, multi-language menu function display.
- Data-rich, integrated with multiple location data outputs, audible and visual alarms and alarm switch interfaces.

1. System Configuration

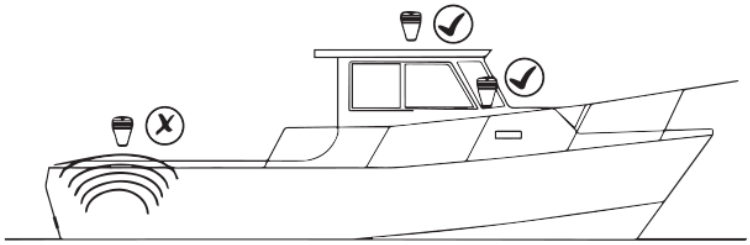
1.1 Antenna Installation

- **Installation Position**

1) The antenna is recommended to be mounted in the highest position on the boat with no obstructions on the satellite signal receiving surface.

2) Keep away from any metal or magnetic surfaces that reflect satellite signals, which may cause some “multipath” of the signal, thus reducing the speed and accuracy of the meter. There should be no metal surfaces above the horizontal plane of the fuselage within a radius of 2m from the center of the antenna.

3) Keep away from RF radiation sources to avoid RF interference. If there are radar systems, satellite stations, etc., please ensure that the antenna is installed out of the range of the radar radiation beam



- **Installation Procedure**

1. Pole Mounting

Notice: Installation of the sensor to pass a cable through a pole, tighten then fix it.

2. **Flash Mounting**

1.2 Display Unit Installation

▪ 7-inch Display Unit Installation

The display unit can be installed in an embedded, suspended, or desktop. For desktop or wall mounted installations, it is recommended to use the original bracket provided by the factory.

Notice: ① The display unit should be avoided from direct sunlight and should be protected from impact and vibration; ② The display unit should be far away from a device that generates electromagnetic radiation, such as an electric motor or generator.

1) Hanging or desktop installation

Installation procedure: Fix the receiver on the bracket with the knob, and then use the screws through the holes to fix the bracket on the flat surface to be installed, and the installation is completed after fixing.

2) Embedded installation

Installation procedure: First in the need to install the plane according to the product size holes, remove the decorative strips, screws through the holes in the corners of the machine to fix the receiver in the plane holes, and then press the decorative strips back to the side of the receiver, fixed and then the installation is complete.

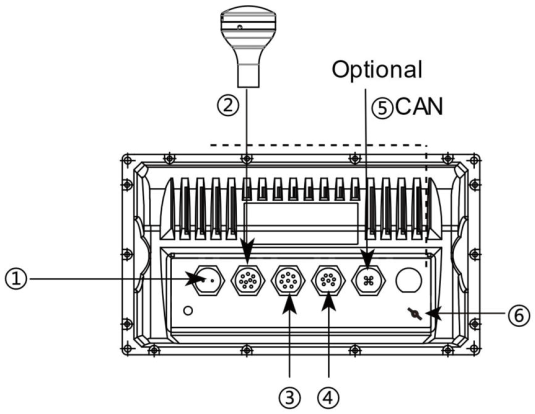
▪ 4.2-inch Display Unit Installation

The display unit supports flush mounting as follows

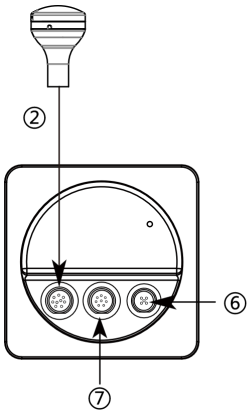
Method 1:
Installation steps: Punch holes in the plane according to the mounting position, and screws through the holes in the plane to fix the receiver on the plane.

Method 2:
Installation steps: After fixing the plug in the monitor with screws, make holes in the plane according to the position of the rubber plug, and then plug the rubber plug into the holes to complete the installation.

1.3 System connection



System with 7-inch display unit



System with 4.2-inch display unit

① Power: 11~36V （1.DC+ 2.DC）；

② Antenna unit: Internal wiring, please use the equipped 20m cable to connect;

③ NMEA 0183 Data: Standard IEC 61162-1 Digital Signal Outputs

（1.COM2 TX+ RS422 2.COM2 TX- RS422 3. COM2 TX+ RS422 4.COM2 TX- RS422）

（5.COM2 TX+ RS422 6.COM2 TX- RS422 7.COM2 RX+ RTCM IN 8.COM2 RX- RTCM IN）

④ Alarm: Alarm digital two-way interaction and normally closed and outputs

（1.COM4 TX+ RS422 2.COM4 TX- RS422 3. COM4 RX+ RS422 4.COM4 RX- RS422）

（5.Alarm COM 6.Alarm N.C 7.GND ）

⑥ Input Power：12V （1.SHIELD 2.12V 3.GND 4.NC 5.NC）

⑦ Digital inputs and outputs with alarms:

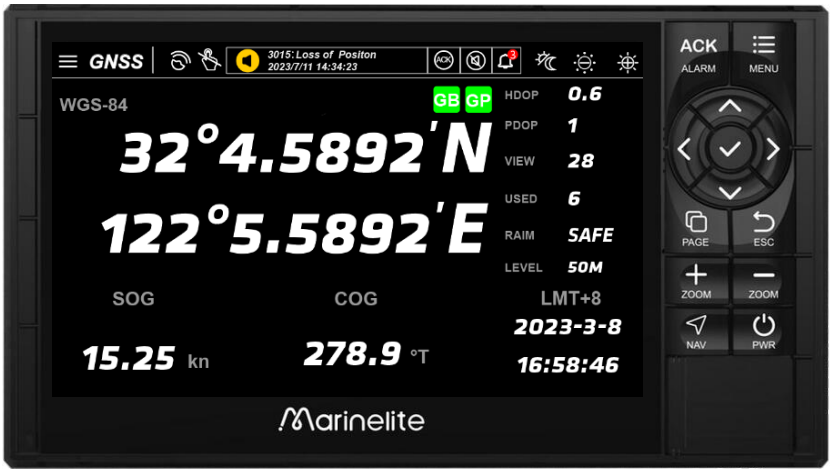
（1.COM4 TX+ RS422 2.COM4 TX- RS422 3. COM2 TX+ RS422 4.COM2 TX- RS422）

（5. COM2 RX+ RTCM IN 6. COM2 RX- RTCM IN 7. Alarm COM 8.Alarm N.C ）

2.Operation Overview

2.1 Key Operation

- **7-inch display unit key operation**



Key instructions are as follows：

Key	Description
ACK ALARM	When an alarm is triggered, the button is used for alarm acknowledgement
☰	Open or close the menu
‹ ˄ ˅ ›	Used for cursor movement to toggle options, long press for fast switching, ✓ Confirm current operation, or save settings
PAGE	Used to switch the main page display
ESC	Cancel the Settings or return to the previous page
+ ZOOM	Brightness +
− ZOOM	Brightness -
NAV	During the development of key functions
PWR	Long press to power on or off.

- **4.2-inch display unit key operation**

Key instructions are as follows：

Key	Description
⮌	Cancel and return to the previous menu on the menu page.
^	Main page, switch pages; menu page, move the cursor up, the value increases;
☰	Under the main page, open the setup menu; under the menu page, select, confirm, save
v	Main page, switch pages; menu page, move the cursor down, the value decreases;
⏻	Long press to turn power on or off

2.2 Power On/Off

Press and hold the button ⏻ for 3 seconds to turn on the device, it will enter the startup display. You can see the version information on the screen.

Press the ⏻ key for 3 seconds to turn off the device.

Note: If the power supply system is turned off during normal operation, the unit will automatically start up next time the power supply system is activated.

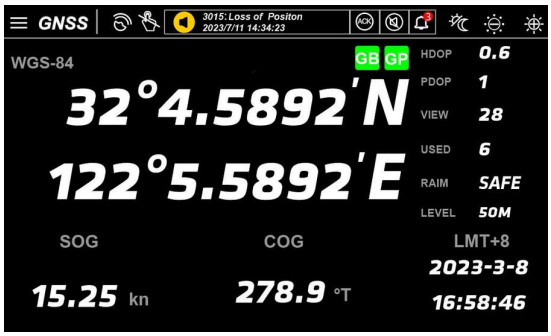
2.3 Brightness Adjustment

Brightness adjustment: Click the button and in the upper right corner of the page or press the ZOOM or ZOOM button to adjust the screen display brightness. Among them, the 4.2-inch display unit only supports touch operation.

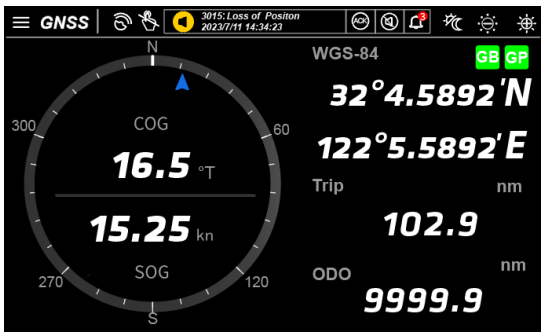
Night mode: Click the button in the upper right corner to switch between day and night modes.

2.4 Display Overview

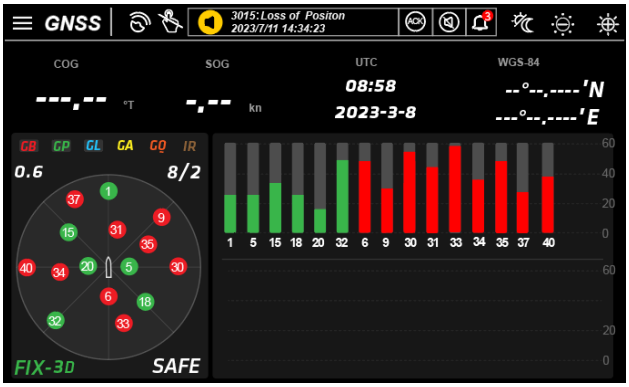
- **Description of 7-inch main display**



Data Page Display

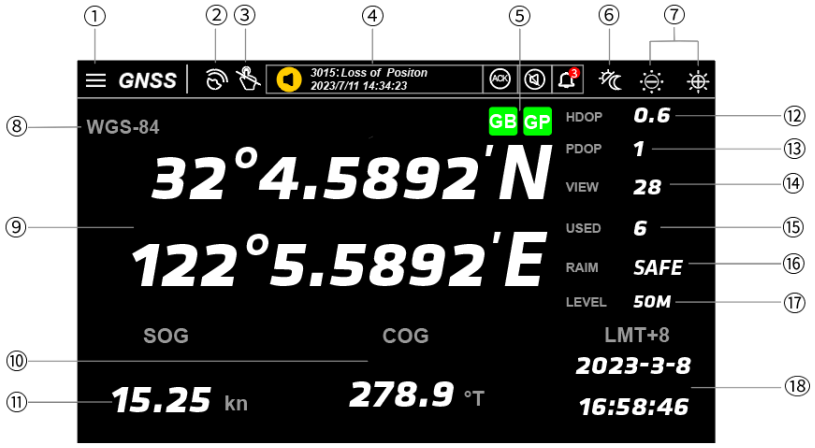


Compass Page Display

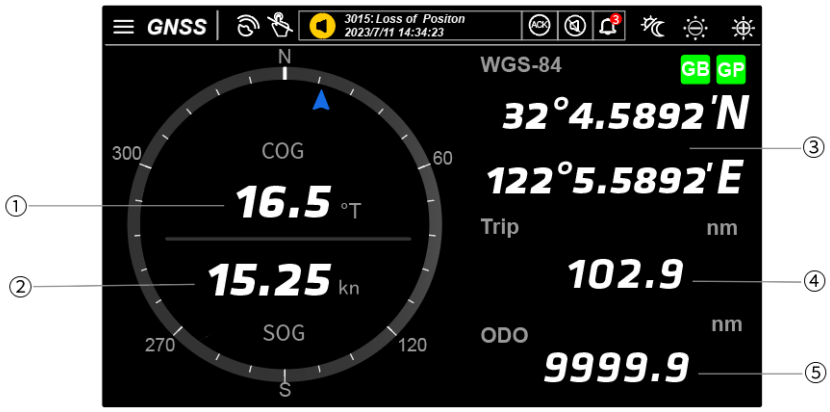


Satellite Page Display

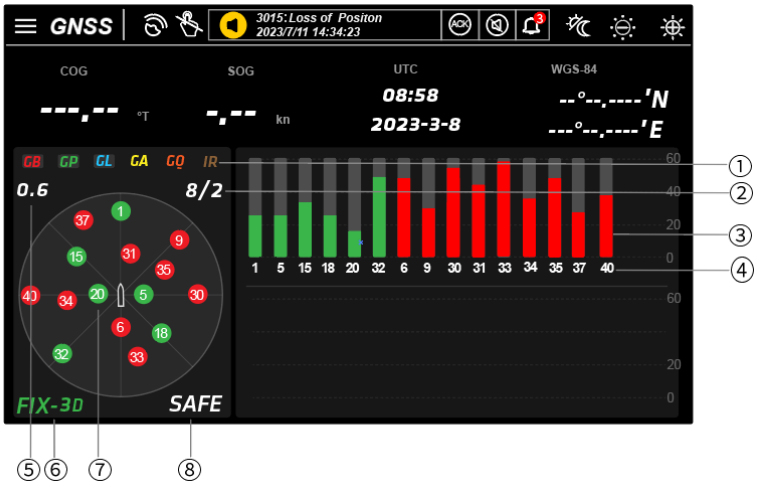
Click the PAGE button to cycle through the numerical value page, compass page and ephemeris page.



NO.	Description	Function
①	On/Off menu	Click to enter the menu
②	Differential Output Indicator	When there is a differential signal input, displays When there is a differential signal but not in use, display Note: Icons are not displayed when there is no input
③	Touch Off	Touch Off Prompt
④	Alarm Alert	When an alarm is triggered, this column displays the alarm status and alarm name.
⑤	Position Type	The type of satellite system used for current positioning
⑥	Day and night mode	For switching day/night mode
⑦	Brightness Adjustment	Used to dim or reduce display brightness
⑧	Reference System	Displays the coordinate system of the positioning reference
⑨	Position	This page show latitude and longitude of the ship's position
⑩	Course	Ship's course over the ground
⑪	Speed	Ship speed over the ground
⑫	HDOP	Horizontal dilution of precision
⑬	PDOP	Position dilution of precision
⑭	Visual satellite quantity	Show available satellite quantity
⑮	Satellite quantity in use	Show satellite quantity in use
⑯	Integrity status	Safe, Caution, Unsafe, ——(Loss of position)
⑰	Position Accuracy	Shows the accuracy of the position
⑱	Date and Time	UTC date and time for the ship



NO.	Descriptio	Function
①	Course	Course over the ground, the compass arrow accord with the date
②	Speed	Speed over the ground
③	Position	The boat positioning's longitude and latitude
④	Voyage	Voyage of the ship
⑤	Mileage	The total distance

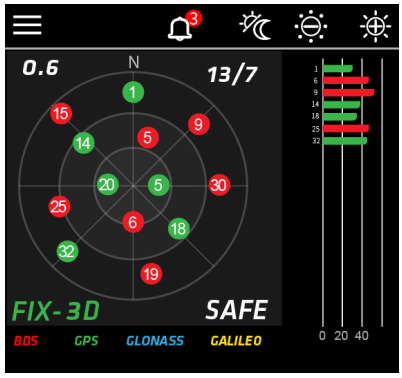


NO.	Description	Function
①	Satellite Type Legend	Category display of satellites
②	Number of Satellites Visible/ Number of Satellites Used	Number of satellites Visible/ number of satellites used for this positioning
③	Satellite Signal-to-Noise Ratio	Satellite signal-to-noise ratio histogram graphic
④	Satellite ID	ID of the satellite used for positioning
⑤	HDOP	Real-time horizontal accuracy values
⑥	Positioning Type	Displays the vessel's position type, including: --, 2D, 3D
⑦	Ephemeris	Distribution of satellite bearings relative to the ship
⑧	Integrity Status	Safe, Caution, Unsafe, ——(Loss of position)

▪ Description of 4.2-inch main display

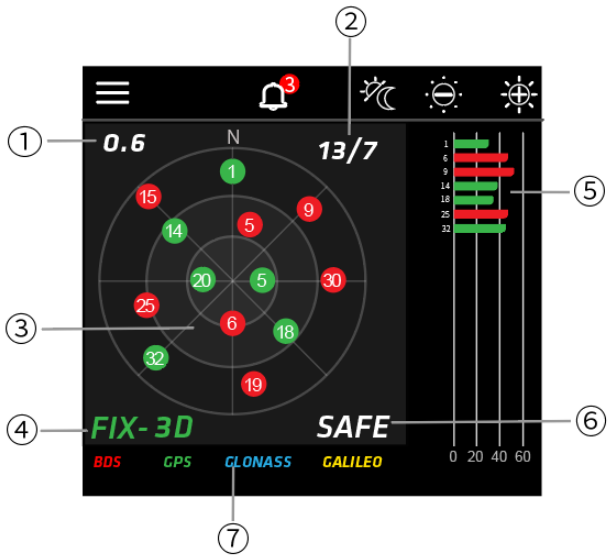
Simple Data Page Display

Full Data Page Display

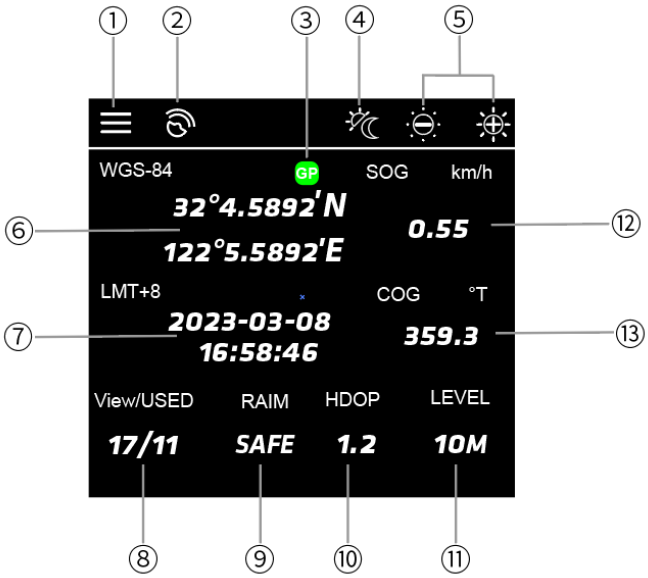


Satellite Page Display

Under the above three display pages, pressing the ^ key can realize switching display.



NO.	Description	Function
①	HDOP	Horizontal Dilution OfPrecision
②	Available Satellite/In Use Satellite	Show available satellite quantity/ In use satellite quantity
③	Ephemeris	Distribution of satellite bearings relative to the ship
④	Positioning Type	Displays the vessel's position type, including: --, 2D, 3D
⑤	Histogram	Satellite signal-to-noise ratio histogram graphic
⑥	Integrity status	Safe, Caution, Unsafe, Loss of position
⑦	Legend of satellite system types	Indication of satellite systems indicated by different colors in ephemeris



NO.	Description	Function
①	Menu	Click to enter the menu
②	Difference Output Indication	When there is a differential signal input, the indicator lights up and displays When there is a differential signal but not in use, display When there is no differential signal, this indicator is not displayed
③	Position Type	Show the boat position type
④	Day and night mode switching	For switching day/night mode
⑤	Brightness Adjustment	For adjusting the brightness of the display
⑥	Position	This page show latitude and longitude of the ship's position
⑦	Date Time	UTC+8 Date & Time
⑧	Number of satellites visible/in use	Number of satellites received/number of satellites used in positioning
⑨	Integrity status	Safe, Caution, Unsafe, ——(Loss of position)
⑩	HDOP	Horizontal dilution of precision
⑪	Position Accuracy	Shows the accuracy of the position
⑫	Speed	The ship speed over the ground, unit: Kn or Km/h
⑬	Course	The ship's course over the ground, unit: °T or °M

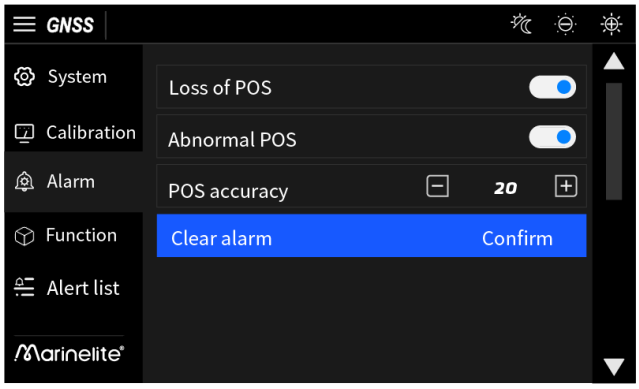
Note: When the antenna unit is lost, the status bar indicates ‘ LOSS SENSOR!!! ’, and retains the last positioning information before the loss.

3. Alarm

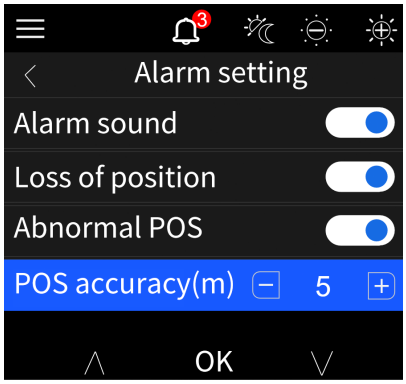
3.1 Alarm Setting

- **Alarm switch and positioning accuracy setting**

Open the menu-Alarm, you can set the position loss switch, position abnormality switch, and positioning accuracy.
Among them, position loss corresponds to 3015, and position abnormality corresponds to 3062, 3055, 3012, 3056 alarms, the specific alarm code corresponding to the alarm description is detailed in the following table.



7 inch display unit



4.2 inch display unit

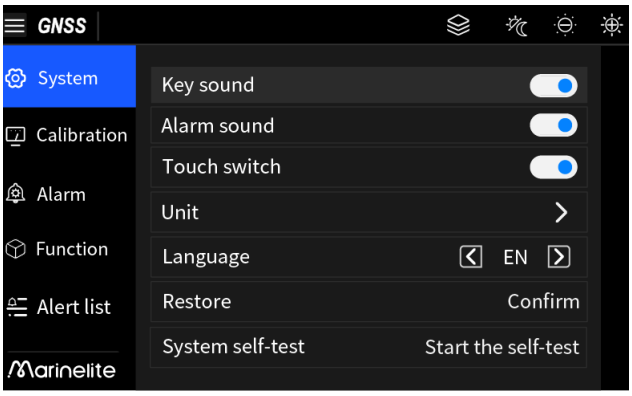
Positioning Accuracy Setting: the default positioning accuracy is 20. when the real-time positioning accuracy is lower than the set positioning accuracy, the position accuracy over limit alarm is triggered.

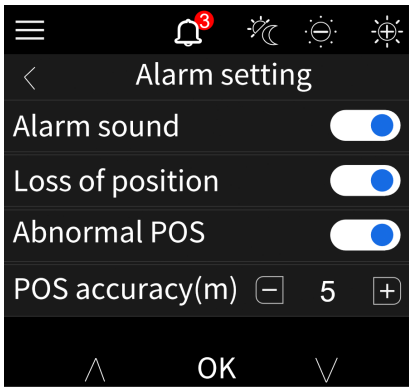
Alarm code instructions

Alarm Name	ID	Instance	Priority	Alarm Condition	Alarm Title
Loss of position	3015	1	W	Position information not received	Loss of position
Positioning anomalies	3062	1	W	Position abnormality over	Alert limit exceeded
Differential corrections not applied	3055	2	W	Differential corrections not applied	Differential corrections not applied
Loss of differential signal	3055	1	W	No differential signal	Loss of differential signal
Differential integrity status	3012	1	W	Navigation status display Unsafe	Differential integrity status
HDOP overrun	3056	1	C	HDOP≥4	HDOP exceeded

▪ Alarm Sound Setting

The 7 inch display unit alarm sound is set in Menu - System- Alarm Sound.
The 4.2 inch display unit alarm sound is set in Menu-Alarm.



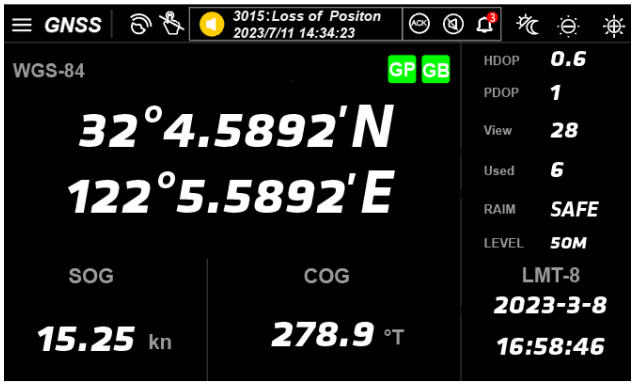


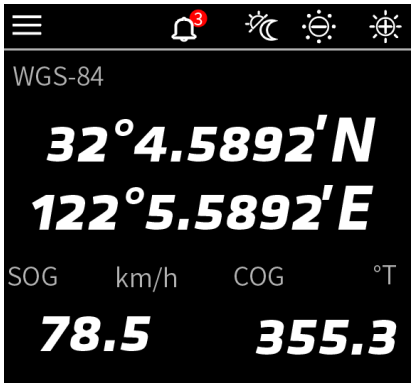
7 inch display unit　　4.2 inch display unit

Note: After the alarm sound is turned off, there will no longer be an audible reminder when the alarm is triggered, so please set it carefully.

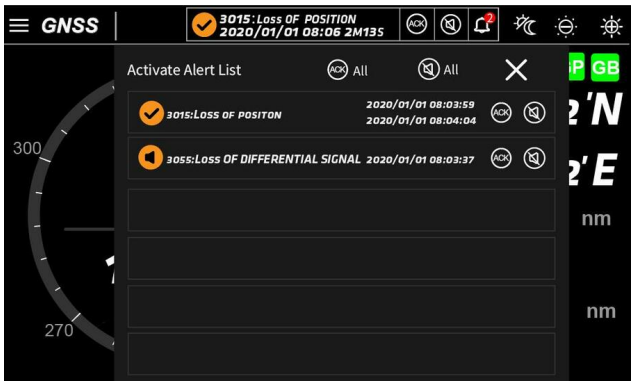
3.2 Alarm Display Description

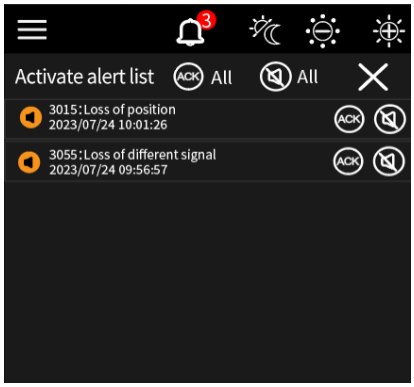
When an alarm is triggered, the status bar increases the alarm status information display, displays the total number of alarms in the current system, and you can view the list of current alarms after clicking it.





7 inch display unit　　4.2 inch display unit





7 inch display unit 4.2 inch display unit

is alarm state, 3015:Loss Of Position is alarm name.

Alarm status detail description as following:

Alarm presentation	Alarm status description
	Warning, Active, alarm sound on
	Warning,Warning,Active - Silenced
	Warning, Active - Acknowledged
	Warning, Active - Responsibility Transferred
	Warning, Alert not unacknowledged and not resolved
	Caution, Active, alarm prompt

3.3 Alarm Interaction

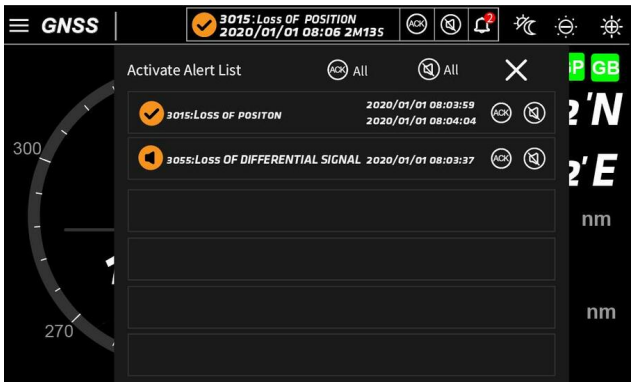
- **Human-machine Interaction**

All alarms acknowledgement:

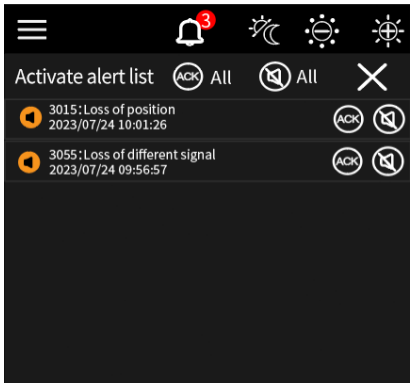
When the alarm is triggered, click the ACK ALARM button (only 7-inch display unit) or ACK in the status bar, or click the status bar alarm list icon 3 to enter the current alarm list page, and then click ACK All to perform all the acknowledgements.

Separate alarm acknowledgement:

When an alarm is triggered, click on the alarm list icon in the status bar to enter the current alarm list page, and click on the target alarm record ACK to realize independent acknowledgement.



7 inch display unit



4.2 inch display unit

All alarms Silence:

When an alarm is triggered, click on the status bar alarm list icon to enter the current alarm list page, and click on All to perform all silences.

Separate alarm Silence:

When an alarm is triggered, click on the status bar (only 7-inch display unit), or click on the status bar alarm list icon to enter the current alarm list page, and click on the target alarm record to execute independent silence.

▪ External Interaction

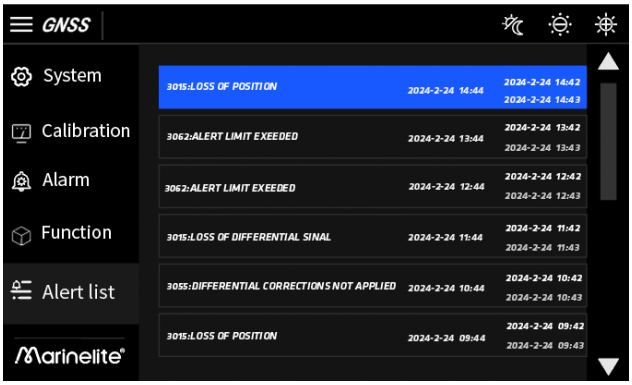
This device supports bi-directional serial communication and outputs alarm information (ALF, ALR, ALC) in COM4 according to the standard IEC 61162-1 Other devices of the bridge system, such as ECDIS, etc., communicate with each other through the NMEA 0183 standard, and perform alarm control such as alarm acknowledgement, silence, or transfer of responsibility by sending a standard ACN statement.

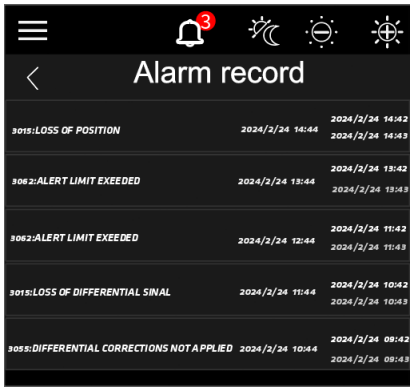
Note: The 7-inch display unit can do two-way interaction through COM4, and the 4.2-inch display unit can receive external interaction through COM2 and output alarm information through COM4.

3.4 Alarm List

- **How to view alarm list**

Open the menu and select Alarm list to view the alarm history.





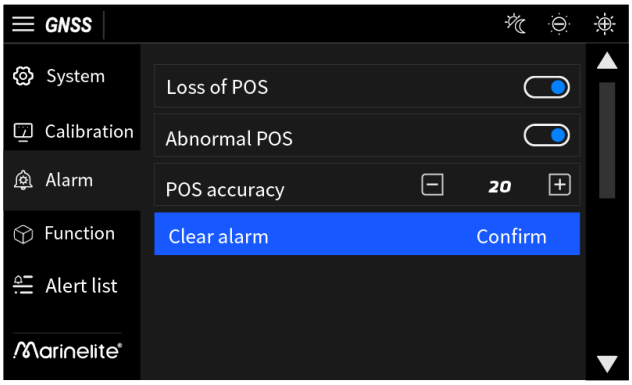
7 inch display unit　　4.2 inch display unit

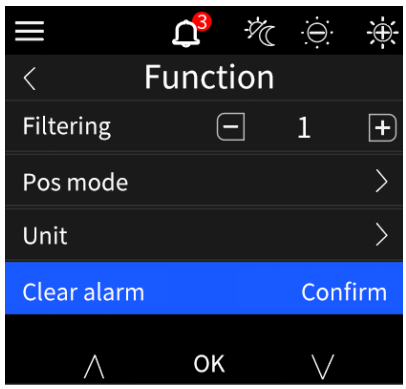
Click on the right scroll bar or press the ∨∧ button to page through.

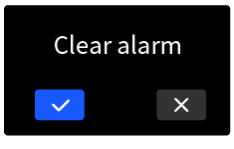
- **How to clear alarm list**

7 inch display unit: open the menu, select Alarm, check Clear Alarm, in the pop-up Clear Confirmation window, select Confirm to complete the clearing.

4.2 inch display unit: open the menu, select Function, check Clear Alarm, in the pop-up Clear Confirmation window, select Confirm to complete the clearing.







7 inch display unit　　4.2 inch display unit　　Clear Confirmation Window

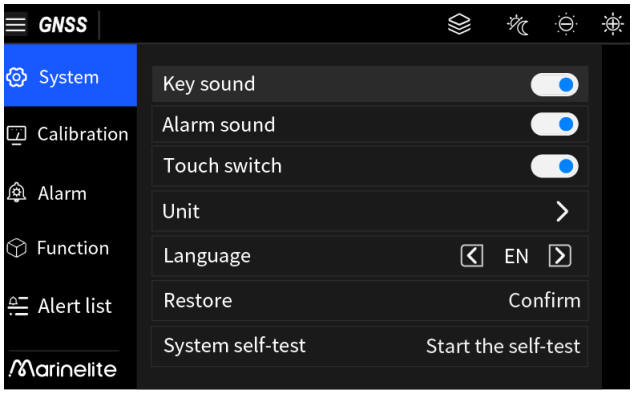
4.Other Settings

4.1 System Setting

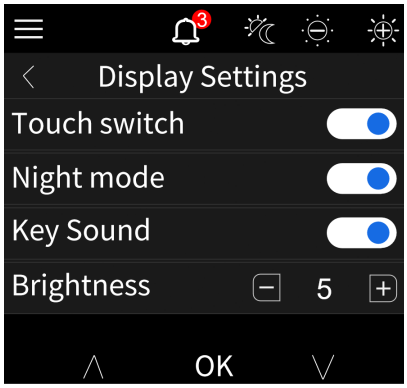
- **How to set key sound**

7-inch display unit: Enter Menu-System Setting, click Key sound

4.2-inch display unit: Enter the menu - Display setting, click key sound



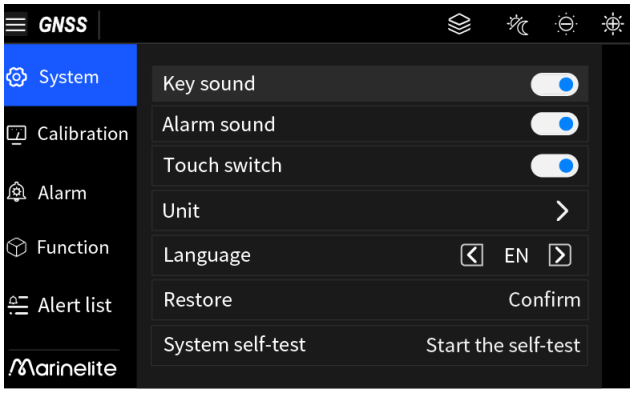
7 inch display unit



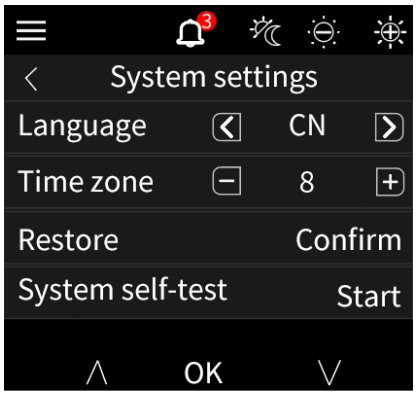
4.2 inch display unit

- **How to do system self-check**

Go to the Menu-System Settings screen and click System Self-Test:



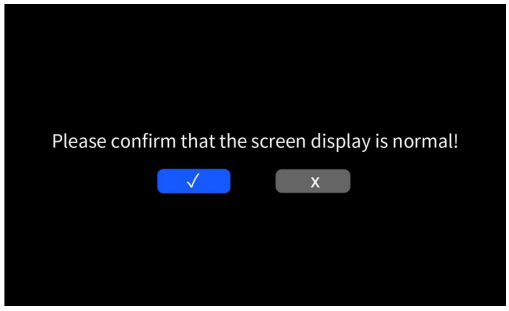
7 inch display unit



4.2 inch display unit

Click to confirm the sequential full-screen display of black, red, blue, yellow, green, rose, after the end of the user according to the actual situation to confirm that the screen display is normal:

After confirming, enter the touch screen self-test process and click as instructed in turn:



When finished, the results of the system self-test are displayed:

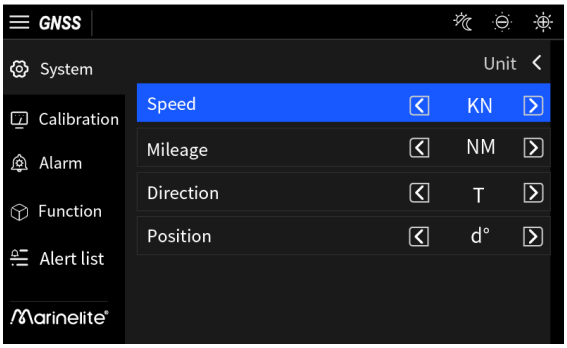
If the sensor connection is faulty or the sensor is damaged, the self-test message sensor shows null and the sensor unit shows empty.

▪ How to set unit

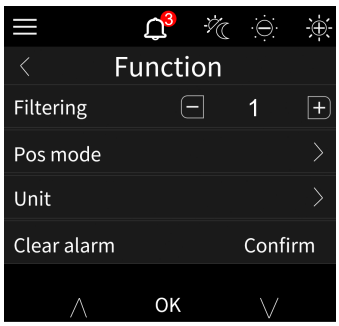
7 inch: open the menu and select System, click Unit to enter the unit setting sub-page.

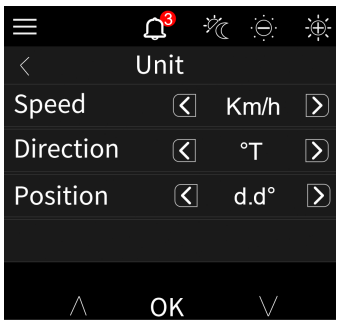
4.2 inch: open the menu, select function, click Unit, enter unit setting sub-page.

You can set unit for boat speed, mileage, direction, position.



7 inch display unit





4.2 inch display unit

- **How to set system language**

Enter Menu-System- Language, then you can set Chinese/English.

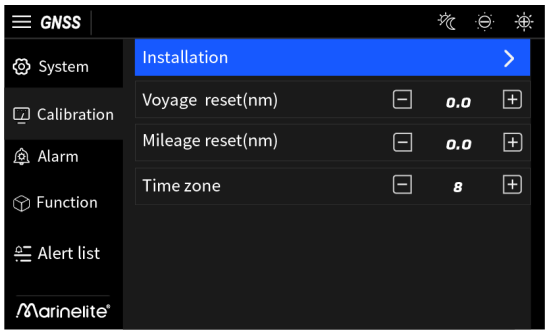
- **How to do restore factory settings**

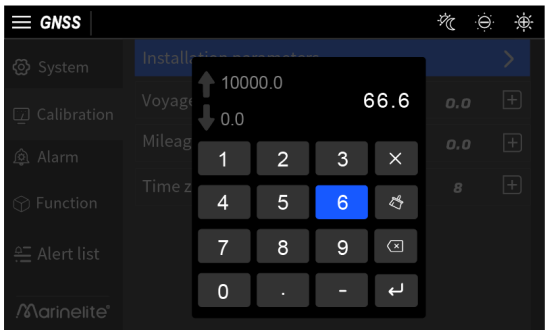
Enter Menu-System-Restore , After clicking confirm, the custom settings will be cleared and the factory settings will be restored. After restoration, it will be restored to the factory state, which will affect the actual use of the results, please be careful!
Note that the system language will not be restored when restoring to factory.

4.2 Calibration setting

- **How to set installation parameters**

Enter menu - Calibration, click the Installation option, After entering the page, you can set customized the parameters for antenna installation. Among them, adjusting the value can be set quickly by clicking on the value area and within the pop-up number pop-up window.
Note: This function only provides setting for 7-inch display unit.





- **How to reset voyage**

Enter Menu-Calibration, click “ Voyage Reset” ⊟⊞ button to reset Voyage value, range: 0-10000.0.

- **How to reset mileage**

Enter Menu-Calibration, click “ Mileage Reset” ⊟⊞ button to reset Mileage value, range: 0-1000.0.

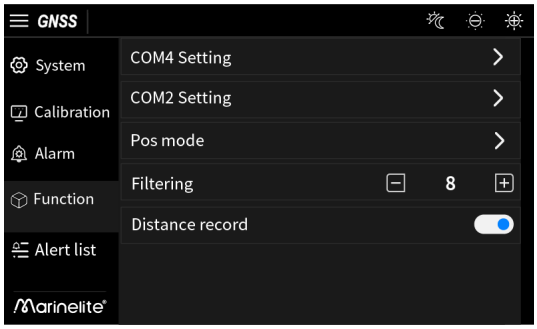
- **How to set time zone**

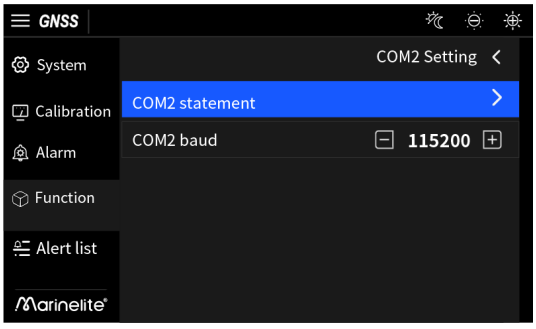
Enter Menu-Calibration, click “ Time zone” ⊟⊞ button to reset time zone, range: -12.0-12.0 .

4.3 Function Setting

▪ How to set output port

The system supports two RS422 outputs inputs, 7” display unit provides setting the specified baud rate and output statements, operate as follows:
Open the menu, select Function, select Output Port Setting, and enter the Output Setting sub-page.





Users can set the serial port baud rate and output statement as needed. The baud rate supports selecting 4800bps, 9600bps, 19200bps, 38400bps, 57600bps, 115200bps.
Note: If you set a low baud rate to match the output of multiple statements, the output will be in order of priority.

Statement output prioritization:
RMC>GNS>ZDA>GBS>GFA>DTM>GRS>GSA>GST>GSV>VTG>GGA>GLL

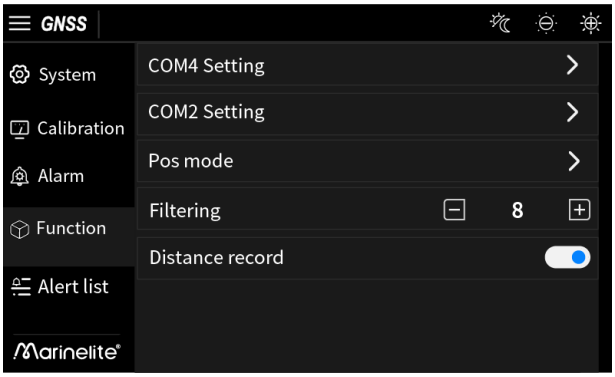
4.2” display unit default COM2 port baud rate is 115200bps, COM4 is 4800bps.

Note: The system only supports RTCM2.X and RTCM3.X inputs, if you use this function, the 7” display unit COM2 baud rate needs to be set to 115200bps.

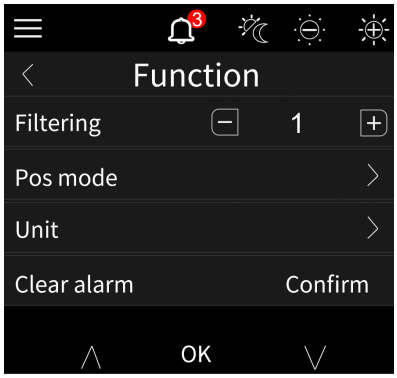
▪ How to set filter

When the speed and heading jumps a lot, especially in bad weather, you can stabilize the speed and heading by setting the speed and heading filter.

Open the menu, select Function Setting, select Speed Heading Filter, click ⊟ and ⊞ numerical value to adjust the filter value.



7 inch display unit



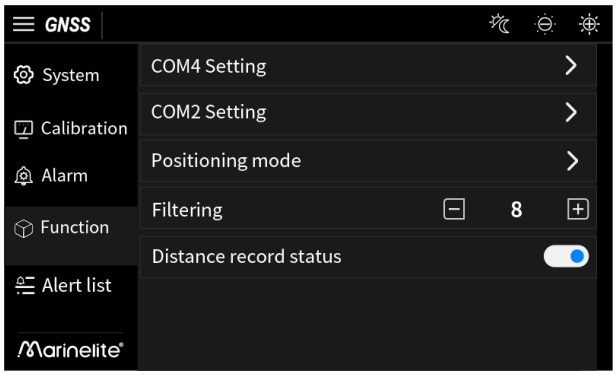
4.2 inch display unit

▪ How to set positioning mode (system)

Go to Menu - Function - Positioning Mode to adjust the type of positioning system.

▪ How to set distance record

Open the menu, select Function, select Distance Record Status, and set Distance Record Status on or off.



Note: The total mileage system is automatically recorded by default, cannot be turned off and can be reset.

5.Maintenance and troubleshooting

Caution
Do not apply paint, anti-corrosive sealant or contact spray to coating or plastic parts of the equipment. These items may contain components that damage plastic components or equipment coatings.

5.1 Maintenance

Regular maintenance is important for product performance. Frequent checking of the following points will help maintain product performance:

- Check if the connectors on the rear panel are tight and free of rust.
- Check the grounding system for rust, tighten the grounding wire, and check if the battery terminals are clean and free of rust.
- Check if the antenna unit is damaged. If damaged, please replace it.
- Use a soft cloth to remove dust or dirt from the cabinet. If necessary, a mild detergent diluted with water can be used. Do not use chemical cleaning agents to clean the display unit; They may remove paint and markings.
- Carefully wipe the LCD with a tissue and LCD cleaner to prevent scratches. To remove dirt or salt deposits, use an LCD cleaner and slowly wipe with a tissue to dissolve the dirt or salt. Regularly replace the paper so that salt or dirt won't scratch the LCD. Do not use solvents such as diluents, acetone, or benzene for cleaning. In addition, do not use degreasers or anti fog solutions as they will peel off the coating on the LCD.
- The lifespan of LCD is approximately 60000 hours. The actual lifespan depends on the ambient temperature and humidity. When the glossiness cannot be fully improved, please request a replacement from the dealer.

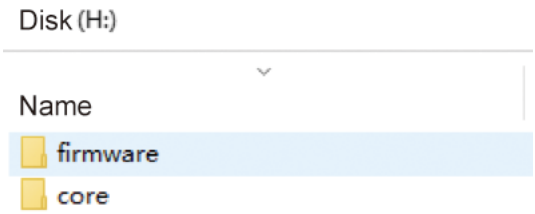
5.2 Troubleshooting

This section provides simple troubleshooting steps that the user can follow to help return the machine to normal. If the machine does not return to normal, do not disassemble the machine in an attempt to inspect the inside of the unit. Any problems should be referred to a company technician for resolution.

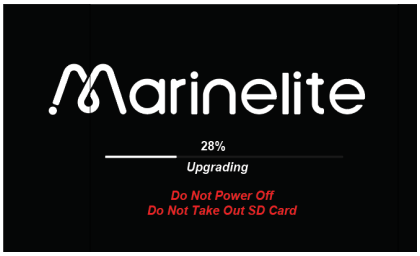
Symptoms	**Troubleshooting**
The power does not turn on.	Check if the bottom cables and connectors are damaged. Check whether the power supply unit cabling is normal. Check if the output voltage of the power cable is normal Check if the fuse connected to the power cable has blown.
Incorrect positioning	Check the screen for the Loss Sensor!!!! prompt, if so, please check if the antenna line connection is tight. Check the number of satellites shown on the ephemeris chart, if less than two, please check the obstacles between the antenna unit and the satellites. Note: Multi-system devices can check the current positioning system type in the system; you can see whether the communication between the current antenna and the main display is normal by self-checking, if it is normal, the antenna model and version information should be displayed.
No response from buttons	Please try to restart the power. If the issue unsolved, please contact our distributor.
The position change is not obvious	Please check if the speed and heading settings in the menu function settings - filtering settings are too large
Incorrect time display	Please check if the menu system settings - time zone settings are correct

5.3 System upgrades

With the power off, insert the SD card in the SD card slot and store the upgrade file in the root directory of the SD card.



Power on the device, enter the upgrade page, the device will automatically shut down and restart after the upgrade progress reaches 100%, at this time, please pull out the SD card before powering on the device, and you will see the program version change on the boot page after the automatic restart.



Appendix 1

IEC 61162-1 2016 standard

- $--RMC,hhmmss.ss,A,llll.ll,a,yyyyy.yy,a,x.x,x.x,xxxxxx,x.x,a,a,a*hh<CR><LF>
  1 2 3 4 5 6 7 8 9 10 11 12 13 14

  1: UTC time
  2: Status
  V: Invalid
  A: Data valid
  3: Latitude
  4: N/S
  5: Longitude
  6: E/W
  7: Speed over ground
  8: Course over ground
  9: UTC date
  10: Magnetic variation
  11: E/W
  12: Mode indicator
  13: Navigational status indicator
  14: Check sum

- $--DTM,ccc,a,x.x,a,x.x,a, x.x,ccc*hh<CR><LF>
  1 2 3 4 5 6 7 8 9

  1: Local datum
  2: Local datum subdivision code
  3: Lat offset, min
  4: Unit: N/S
  5: Lon offset, min (no use)
  6: Unit: E/W
  7: Altitude offset, meters (no use)
  8: Reference datum
  9: Check sum

- $--VTG,x.x,T,x.x,M,x.x,N,x.x,K,a*hh<CR><LF>
  1 2 3 4 5 6 7 8 9 10

  1: Course over ground
  2: T=True(fixed)
  3: Course over ground
  4: M=Magnetic (fixed)
  5: Speed over ground
  6: N=Knots (fixed)
  7: Speed over ground
  8: K=km/h (fixed)
  9: Mode indicator
  10: Check sum

- $--GGA, hhmmss.ss, llll.ll,a,yyyyy.yy,a,x,xx,x.x,x.x,M,x.x,M,x.x,xxxx*hh<CR><LF>
  1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

  1: UTC time
  2: Latitude
  3: N/S
  4: Longitude
  5: E/W
  6: GPS quality indicator
  7: Number of satellite in use
  8: Horizontal dilution of precision
  9: Antenna altitude above/below mean sea level
  10: Unit, m
  11: Geoidal separation
  12: Unit, m
  13: Age of differential GPS data
  14: Differential reference station ID
  15: Check sum

- $--GSA,a,x,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,x.x,x.x,x.x,h*hh<CR><LF>
  1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19

  1: Positioning operation mode
  2: Positioning mode
  3-14: ID number of satellites used in solution
  15: PDOP
  16: HDOP
  17: VDOP
  18: GNSS System ID
  19: Check sum

- $--GSV,x,x,xx,xx,xx,xxx,xx.....,xx,xx,xxx,xx,h*hh<CR><LF>
  1 2 3 4 5 6 7 8-15 16 17 18 19 20 21

  1: Total number of messages
  2: Message number
  3: Total number of satellites in view
  4: Satellite ID number
  5: Elevation, degrees
  6: Azimuth, degrees true
  7: SNR(C/No) (NULL when not tracking)
  8-15: Second and third SV
  16–19: Fourth SV
  20: Signal ID
  21: Check sum

- $--GLL,llll.ll,a,yyyyy.yy,a,hhmmss.ss,A,a*hh<CR><LF>
  1 2 3 4 5 6 7 8

  1: Latitude
  2: N/S
  3: Longitude
  4: E/W
  5: UTC time
  6: Status
  A=valid data V=invalid data
  7: Positioning mode

- $--ZDA, hhmmss.ss, xx, xx, xxxx, xx, xx*hh<CR><LF>
  1 2 3 4 5 6 7

  1: UTC time
  2: Day,1-31
  3: Month,1-12
  4: Year
  5: Local zone, hours
  6: Local zone, minutes
  7: Check sum

- $--GST, hhmmss.ss, x.x, x.x, x.x, x.x, x.x, x.x, x.x*hh<CR><LF>
  1 2 3 4 5 6 7 8 9

1: UTC time of the GGA or GNS fix associated with this sentence
2: RMS value of the standard deviation of the range inputs to the navigation process.
3: Standard deviation of semi-major axis of error ellipse, (m)
4: Standard deviation of semi-minor axis of error ellipse (m)
5: Orientation of semi-major axis of error ellipse (degrees from true north)
6: Standard deviation of latitude error, (m)
7: Standard deviation of longitude error, (m)
8: Standard deviation of altitude error, (m)
9: Check sum

- $--GBS, hhmmss.ss, x.x, x.x, x.x, xx, x.x, x.x, x.x, h, h*hh <CR><LF>
  1 2 3 4 5 6 7 8 9 10 11

1: UTC time
2: Expected error in latitude
3: Expected error in longitude
4: Expected error in altitude (no use)
5: ID number of most likely failed satellite (no use)
6: Probability of missed detection for most likely failed satellite (no use)
7: Estimate of bias in meters on most likely failed satellite (no use)
8: Standard deviation of bias estimate (no use)
9: GNSS System ID
10: GNSS Signal ID
11: Check sum

- $-- GNS, hhmmss.ss,llll.ll,a,yyyyy.yy,a,c--c,xx,x.x,x.x,x.x,x.x,x.x,a*hh<CR><LF>
  1 2 3 4 5 6 7 8 9 10 11 12 13 14

1: UTC time
2: Latitude
3: N/S
4: Longitude
5: E/W
6: Mode indicator
7: Total number of satellites in use
8: HDOP
9: Antenna altitude, meters
10: Geoidal separation
11: Age of differential data
12: Differential reference station ID
13: Navigation status indication
14: Check sum

- $--GRS, hhmmss.ss,x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,h,h*hh<CR><LF>
  1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17

1: UTC time
2: Residual value type
3-14: Range residuals for satellites used in the navigation solution.
Order should match order of satellite ID numbers in GSA.
15: GNSS System ID
16: Signal ID
17: Check sum

- $--GFA,hhmmss.ss,x.x,x.x,x.x,x.x,x.x,x.x,x.x,c--c*hh<CR><LF>
  1 2 3 4 5 6 7 8 9 10

1: UTC time for GNS repair
2: Horizontal protection level (m)
3: Vertical protection level (m)
4: Error ellipse semi major axis standard deviation (m)
5: Error ellipse semi minor axis standard deviation (m)
6: Error ellipse semi major axis direction (degrees)
7: Elevation standard deviation (m)
8: Select accuracy level (m)
9: Integrity status
  V=Unused
  S=Security (when integrity is available and HPL<HAL)
  C=Warning (when integrity is unavailable)
  U=Unsafe (when integrity is available and HPL>HAL)
10: Check sum

- $--GDC,x.x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,h*hh<CR><LF>
  1 2 3 4 5 6 7 8 9 10 11

1: The total number of sentences in this message (1 to 99)
2: Sentence number (1 to 99)
3: Total number of calibration satellites
4: Satellite identification code
5: Pseudorange correction
6: Data publishing
7: The Era Time of GNSS
8: Z-value modification
9: User gap error
10: GNSS signal ID
11: Check sum

- $--ALR,hhmmss.ss,xxx,A, A,c--c*hh<CR><LF>
  1 2 3 4 5 6

  1: UTC time
  2: Unique alarm number (identifier) at alarm source
  3: Alarm condition
  A - threshold exceeded
  V - not exceeded, status normal
  4: Alarm acknowledge state
  A=acknowledged, V=not acknowledged
  5: Alarm description text (alphanumeric)
  6: Check sum

- $--ALF,x,x,x,hhmmss.ss,a,a,a,aaa,x.x,x.x,x.x,x,c---c*hh <CR><LF>
  1 2 3 4 5 6 7 8 9 10 11 12 13 14

  1: The total number of ALF sentences in this message
  2: Sentence number
  3: Sequential message identifier
  4: UTC time
  5: Alarm Category
  6: Alarm priority
  7: Alarm statu
  8: Manufacturer mnemonic code
  9: Alert identifier
  10: Alert instance
  11: Revision counter
  12: Escalation counter
  13: Alert text
  14: Check sum

- $--ARC,hhmmss.ss,aaa,x.x,x.x,c*hh <CR><LF>
  1 2 3 4 5 6

  1: Release time of the Alert Command Refused(UTC)
  2: Used for proprietary alerts, defined by the manufacturer
  3: The alert identifier
  4: The alert instance
  5: Refused Alert Command
  A=acknowledge: A
  Q=request/repeat information
  O=responsibility transfer
  S=Silence
  6: Check sum

■ $--ALC,xx,xx,xx,x.x,aaa,x.x,x.x,x.x,……..,aaa,x.x,x.x,x.x*hh <CR><LF>>
1 2 3 4 5 6 7 8 9 10 11 12 13 14

1: Total number of sentences this message
2: Sentence number
3: Sequential message identifier
4: Number of alert entries
5: Manufacturer mnemonic code
6: Alert identifier
7: Alarm instance
8: Alert instance
9: Other alarm entries composed of manufacturer defined alarm codes, warning identifiers, alarm instances, and revision counters
14: Check sum

Appendix 2

7 inch display unit : Menu tree

Menu Style	Menu Item	Submenu
System	Key sound	
	Alarm sound	
	Touch switch	
	Unit	Speed
		Mileage
		Direction
		Position
	Language	
	Restore	
	System self-test	
Calibration	Installation	Ant to port, m
		Ant to stern, m
		Length，m
		Width，m
	Voyage Reset	
	Mileage Reset	
	Time Zone	
Alarm	Loss of Position	
	Abnormal POS	
	Pos Accuracy	
	Clear alarm	
Function	COM4 Setting	COM4 baud
		COM4 statement
	COM2 Setting	COM2 baud
		COM2 statement
	Pos mode	GPS
		GBS
	Filtering	
	Distance record	
Alert List		

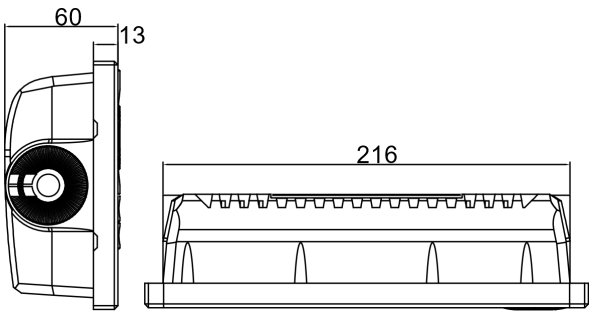
4.2 inch display unit : Menu tree

Menu Style	Menu Item	Submenu
Display	Touch switch	
	Night Mode	
	Key sound	
	Brightness	
System	Language	
	Time Zone	
	Restore	
	System self-test	
Function	Filtering	
	Pos mode	GP
		GB
	Unit	Speed
		Direction
		Position
	Clear alarm	
Alarm	Alarm sound	
	Loss of Position	
	Abnormal POS	
	POS Accuracy(m)	
Alert List		

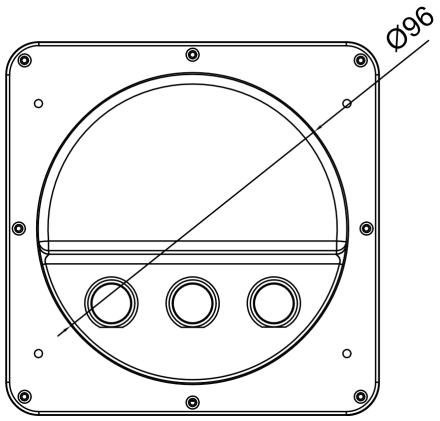
Appendix 3

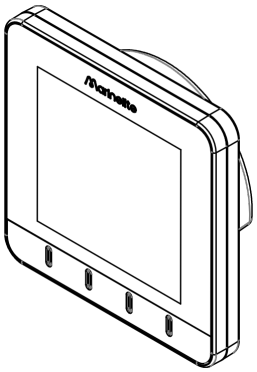
7 inch Display Unit Dimension Diagram

Unit:mm

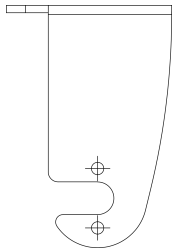


4.2 inch Display Unit Dimension Diagram

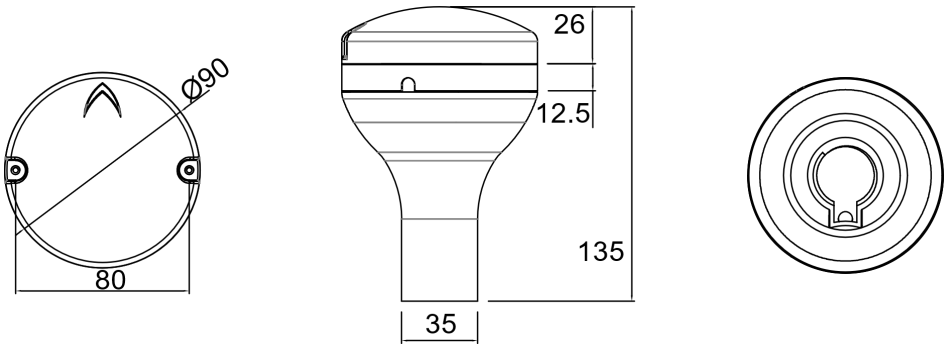




7-inch Display Unit Bracket Dimension Diagram



Antenna Dimension Diagram



Appendix 4

Abbreviation	Meaning	Abbreviation	Meaning
BDS/GB	Bei Dou Navigation Satellite System	GPS/GP	Global Positioning System
GLONASS/GL	Global Navigation Satellite System	COG	Course Over Ground
SOG	Speed Over Ground	UTC	Universal Time Coordinated
PVT	Position Velocity Time	DGPS	Differential GPS
DBDS	Differential Beidou Navigation Satellite System	HDOP	Horizontal dilution of precision
PDOP	Position Dilution of Precision	RAIM	Receiver Autonomous Integrity Monitoring
WGS-84	World Geodetic System 1984	ODO	Odograph
Trip	Trip	VIEW	System Visible Satellite Total
USED	The total number of satellites that the system participated in the location calculation	LEVEL	Targeting level

Sailing Safety With Marinelite

Nantong Saiyang Electronics Co., Ltd.

Marinelite

+86 0513 89129287

+86 0513 81105383

www.ova.com.cn
www.saiyangmarine.com

South Floor 4/5, Building 3, Maipu Technology Park,
Xinsheng Road, Chongchuan District, Nantong City,
Jiangsu Province, China

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