TRELLEBORG

SafePilot CAT XT v5

MANUAL

SafePilot

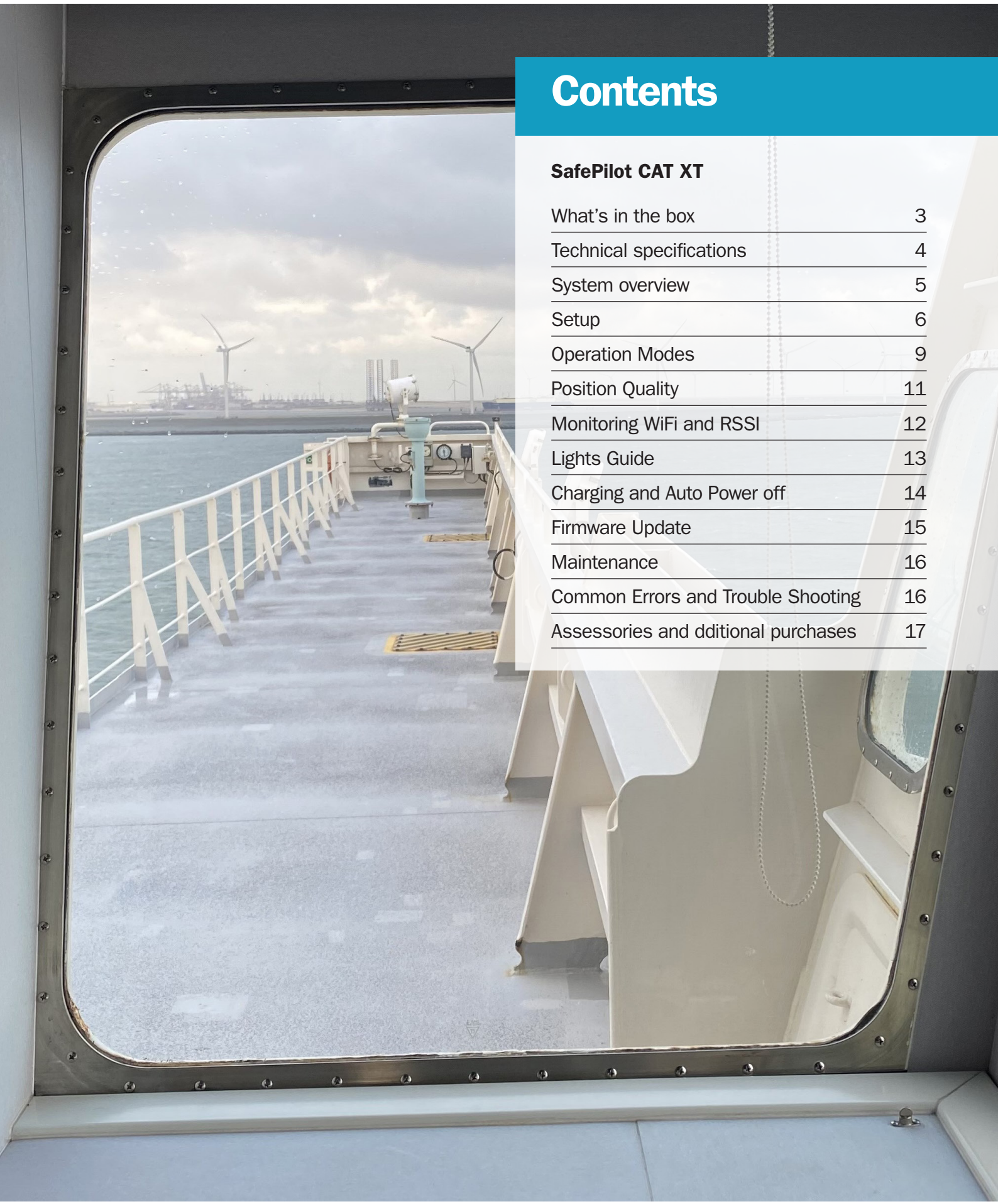
Introduction

To fully utilize the CAT XT v5 navigation system and all its features safely and easily, please read this manual carefully.

The CAT XT v5 facilitates a wireless connection between the AIS pilot plug and a portable piloting display. It benefits from a rate gyro and microprocessor to improve the standard data provided by the AIS pilot plug. In addition to delivering high-quality rate of turn (ROT) data, the system also provides additional decimal degrees for heading information, making it more precise and reliable, especially during critical turns. Gathering independent data on position, speed, and course also enhances the system's usefulness in port and docking operations.

Often, if the position data is derived from the pilot plug, which relies solely on the ship's instrumentation, it can lead to inaccuracies. Sometimes, the offsets entered into the AIS transponder are wrong, or the quality of the GPS receiver is mediocre, which leads to poor reception and, thereby, an unstable showing of the position. The CAT XT is a professional stand-alone Global Navigation Satellite System (GNSS) receiver that utilizes a Satellite-Based Augmentation System (SBAS) used for Differential Global Positioning Systems (DGPS), which supplements and enhances the positional data available from the GNSS. Applying DGPS can significantly increase the accuracy of the GPS data, which may be important in certain operations. For even greater accuracy, the system can offer Real-time Kinematic (RTK) positioning with an accuracy of 0.01m and a speed accuracy of 1cm/sec. It can track all available satellite constellations, ensuring highly precise output data for position and speed.

If the system is used with two CAT XT units, these will be interchangeable. Depending on how long the power button is pressed during startup, the device will function as either an AIS or GPS unit. This allows for a highly flexible system, particularly during long transit pilotage operations, as the unit on the bridge wing can be swapped with the unit charging in the pilot plug. This also means that charging between operations is unnecessary.



Contents

SafePilot CAT XT

What's in the box

1 pcs. CAT XT v5 . . . . . .A

1 pc. Y-cable with USB-C. . . . . .B

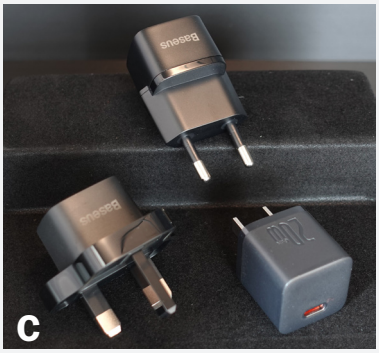
1 pc. USB-C charger with EU, UK, US,
Japan and AUS adapters C

1 pcs. Lanyard . . . . . .D

1 pcs. Quick guide. . . . . .E

A


B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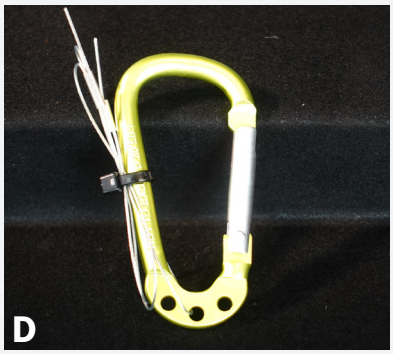

D

E

Technical specifications

CAT XT v.5:

Wi-Fi

- Client for CAT XT Access point: IEEE 802.11 b/g/n with single band
- Access Point: IEEE 802.11 b/g/n with single band
- Number of clients: 8
- Security: WPA2
- Range: 200m line of Sight

GNSS

- Tracked Systems: GPS / QZSS, Galileo, GLONASS, BeiDou.
- Frequencies: L1C/A, L2C, L1OF, L2OF, E1B/C, E5b, B1I, B2I
- Interference Mitigation: Spoofing and Jamming detection
- Position Accuracy: RTK: 0.01m +/ – 1ppm, SBAS: 0.6m +/ – 1ppm, Stand Alone: 3m +/ – 1ppm
- Speed Accuracy: 1 cm/sec

NETWORK DGNSS CORRECTIONS (NTRIP)

- Protocol: Networked Transport of RTCM via Internet Protocol (NTRIP)

PILOT PLUG INTERFACE

- Automatically polarity correction
- Automatically Rx/Tx correction
- Simultaneous pilot plug Connection/Charge
- Heading Accuracy: 0.1 degrees
- Rate of Turn Accuracy: 0.1°/min.

MECHANICAL

- Weight: 400g
- Dimensions: 138 x 100 x 25mm
- Battery Life: 30 hours
- Charge time: 3 hours
- Battery: 3.6V/7AH
- Humidity: 100%
- Temp. range -20 - 50 °C / -4 - 122 °F

System overview

The system consists of one or two CAT XT devices. When used alone, the CAT XT can function as an AIS unit, and when used together, one will serve as an AIS unit, and the other as a GPS unit.

CAT XT AIS gets the Automatic Identification System (AIS) information from the pilot plug but uses its built-in rate gyro to compute the output information about the rate of turn. The rate gyro also adds a decimal to the heading sent out by the pilot plug, but since the AIS message does not support this, a separate heading message is transmitted.

CAT XT GPS provides position, speed, and course independent of the information from the equipment installed on the vessel. The RTK accuracy provided by the CAT XT GPS is possible due to the corrections obtained from the SafePilot software. Two different ways are available to acquire these corrections. A SafePilot server can gather the data from a local reference station installed in the port. Alternatively, the SafePilot software can be linked to an NTRIP server, which then provides the corrections. NTRIP, which stands for Networked Transport of RTCM via Internet Protocol, is a protocol for transmitting real-time GNSS correction data over the Internet, enhancing position accuracy for autonomous navigation.

The TRELLEBORG MARINE SYSTEMS SafePilot systems are designed as a secondary navigational aid and do not relieve the user (pilot, captain, navigator, etc.) of their professional responsibility and navigational skills. Correct use, knowledge, and understanding of the performance and limitations of the SafePilot systems are the sole and only responsibility of the user.

It is important to note that the SafePilot systems and software do not override or substitute the navigation system (charts, ECDIS) installed on board as required by law.

Setup

To fully utilize the CAT XT navigation system and all its features, finding a proper location for the CAT XT GPS unit is of utmost importance. Due to the layout and the extensive amount of equipment found on many vessels, this can sometimes be challenging. To prevent inaccurate readings caused by poor signals, it is essential always to follow the guidelines listed below:

- The CAT XT GPS must have a clear view of the sky, meaning any obstructions cannot be above or near the unit
- Always be cautious not to position the device in areas where multipath reflection may occur. This can happen when the signal bounces off various objects, such as a building or the ship's equipment
- Keep the CAT XT GPS at least 3 meters (10 feet) from vertical obstructions like the wheelhouse
- Maintain a distance of at least 0.5 meters (1½ feet) between the CAT XT GPS and obstacles such as antennas. (If the antenna transmits at high power, it may disrupt satellite tracking!)
- Make sure that nothing is above the CAT XT GPS, such as railings and rain covers made of metal and wood. Most plastics are transparent to GNSS Signals
- Placing the CAT XT GPS directly on a metal floor can cause multipath reflections and degrade Wi-Fi performance. Keep it at least 30 cm (1 foot) above the floor whenever possible, or try finding another location
- Even though the CAT XT GPS has magnets underneath, it is recommended that the mounting brackets be used anyway. The brackets will prevent the CAT XT GPS from sliding even on flat surfaces since the combined magnetic field makes the magnets stick even more

The following section includes images illustrating suitable and unsuitable locations for the CAT XT GPS and directions on connecting the CAT XT AIS to the pilot plug.

This is a very good location for the CAT XT GPS, as the area around the unit is clear and free of obstacles

In the pictures above, a significant portion of the sky is obstructed by the vertical wall and the wheelhouse adjacent to the unit. Moreover, the wall and wheelhouse may cause multipath interference.

Due to the proximity of numerous antennas, this location is not suitable for the CAT XT GPS.

CAT XT AIS, connected to the pilot plug and placed on a horizontal surface.

Operation Modes

The CAT XT v5 have two different operational modes, which can be used depending on conditions and situations requiring their function. The different ways of usage will be rewiewed in the following section:

1. Using CAT XT as Pilot Plug Repeater

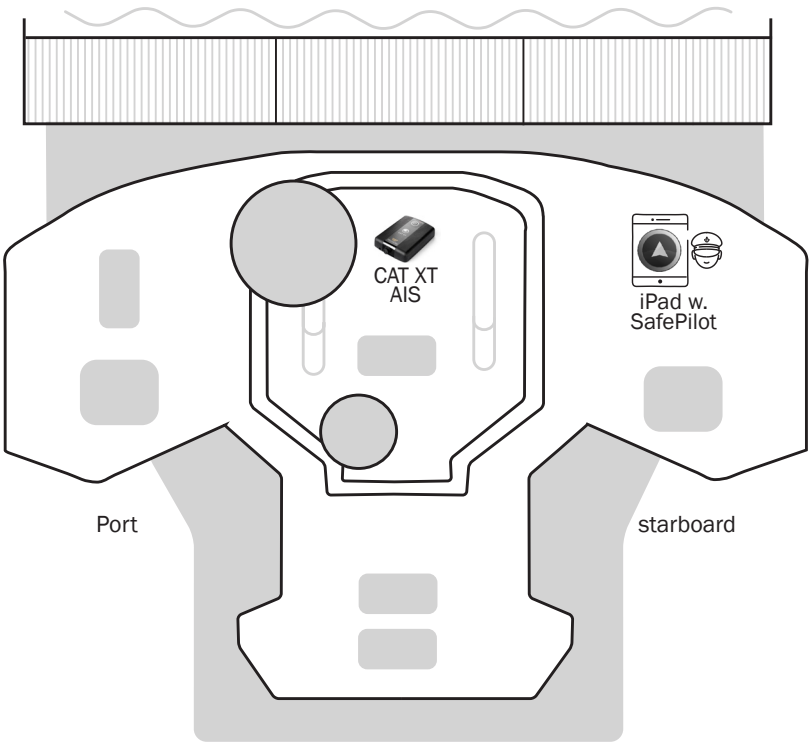
In the simplest use case, the CAT XT will act as a Pilot Plug Repeater. It will overcome the shortcomings of the AIS pilot plug data format by generating an accurate real-time rate of turn and providing the missing decimal readings to the heading data via an integrated rate sensor, intelligent processing, and an advanced Kalman filter integrated into the unit.

Due to frequent inaccuracies, please note that relying solely on the ship's instrumentation may lead to inaccuracies in reading the ship's position and speed. This is why it is recommended that two CAT XT units be utilized for most operations. This way, an independent position, speed, course, heading, and rate of turn is provided.

To use the system in mode 1, please follow the steps below:

- Turn on the CAT XT with a short press of the button on the top of the device
- Connect the CAT XT to the pilot plug with the supplied cable
- Make sure the unit is placed on a horizontal surface to achieve a reliable rate of turn
- Connect an iPad to the network "CAT XT AIS (4-xxxx)" with password "86912255" and open up SafePilot
- To ensure reliability in the Wi-Fi performance, placing the CAT XT AIS, as shown in the layout below, with the arrow pointing towards the bridge wing where the pilot is located during ducking, is important

NOTE: The signal is strongest in the direction of the arrow.



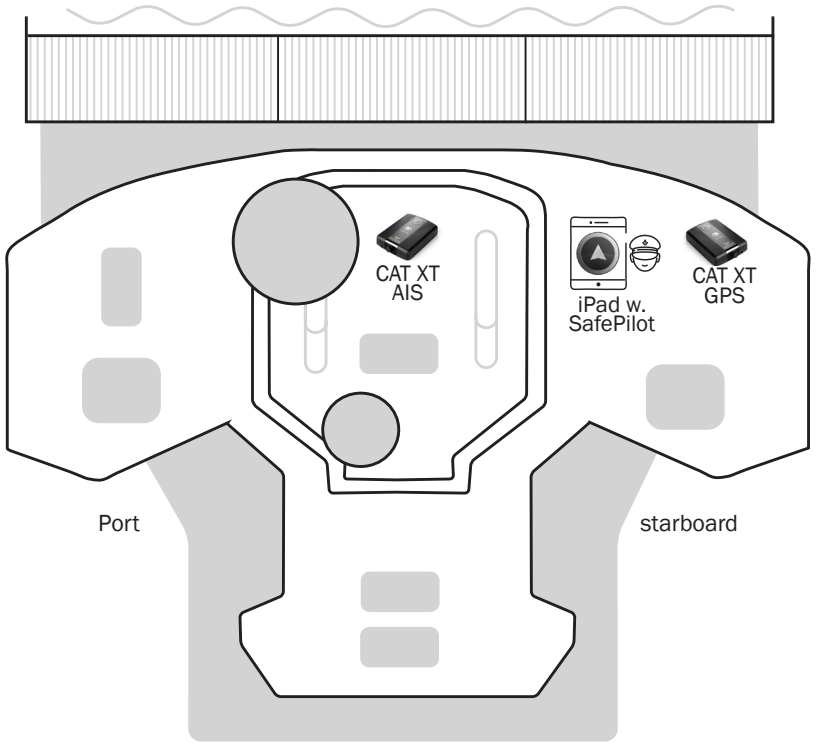
2. Using CAT XT as a stand-alone system

In this mode, two CAT XT devices will work as a pair, with the AIS unit as a Pilot plug repeater and the GPS unit placed outside on the bridge wing. Besides the accuracy in rate of turn that is also provided in mode 1, using the system in this way will provide very accurate data on position, course over ground and speed, independent of the ship's instrumentation.

To use the system in mode 2, please follow the steps below:

- Turn the CAT XT AIS unit on by pressing the button until it flashes blue
- Then turn on the CAT XT GPS unit by pressing the button for 4 seconds until it flashes purple
- Wait a few moments until they both flash green simultaneously. This indicates that they have paired
- Connect the CAT XT AIS to the pilot plug with the supplied cable
- Make sure both units are placed on horizontal surfaces to achieve a reliable rate of turn
- Connect an iPad to the network "CAT XT AIS (4-xxxx)" with password "86912255" and open up SafePilot
- Placing the two CAT XT devices, as shown in the diagram below, is important to ensure a strong and reliable Wi-Fi performance. The arrows should be pointing towards each other, so the arrow on the CAT XT AIS points towards the bridge wing where the CAT XT GPS and the pilot are located during ducking

NOTE: The signal is strongest in the direction of the arrow.



Position Quality

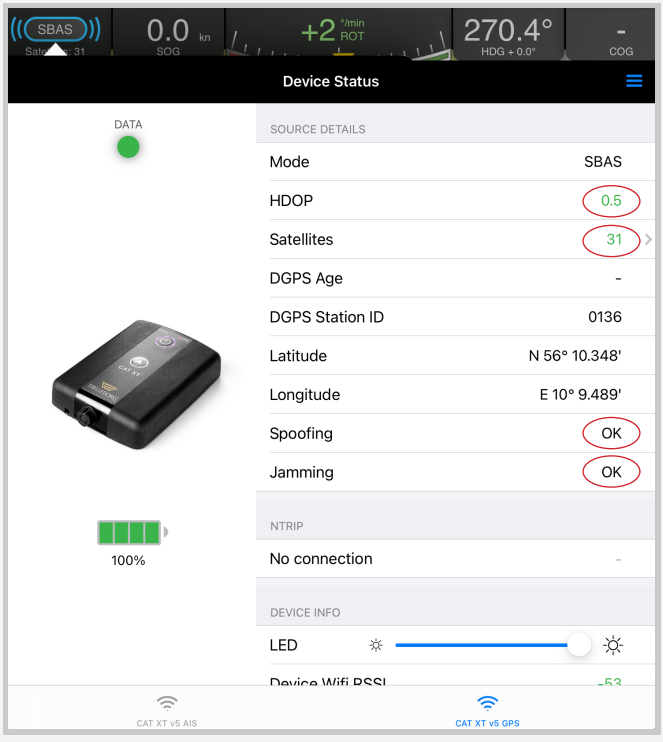
The Device Status window in the SafePilot software provides valuable information about the quality of position, speed, and heading computations. To access it, tap the quality indicator SBAS on the left side of the top bar.

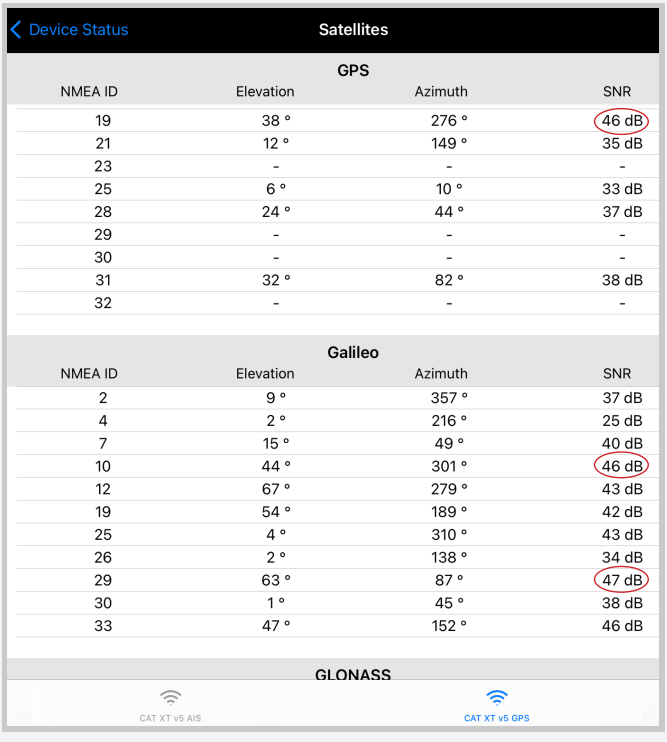
The information from the different units is shown in separate windows. To switch between these, tap either CAT XT AIS or CAT XT GPS CAT XT v5 AIS CAT XT v5 GPS in the bottom bar of the Device Status window. The values displayed in these windows indicate whether the CAT XT GPS is placed appropriately or should be moved to a better location and whether it is in contact with the CAT XT AIS.

When evaluating the placement of each unit, it's important to consider the general guidelines listed in the "Setup" section above.

General Guidelines for the CAT XT GPS unit:

- The unit should be able to connect to more than 20 satellites
- HDOP (horizontal dilution of precision) value must not exceed 1.5
- Both the spoofing and jamming status should be OK
- At least three satellites should have an SNR (signal-to-noise ratio) beyond 45 dB





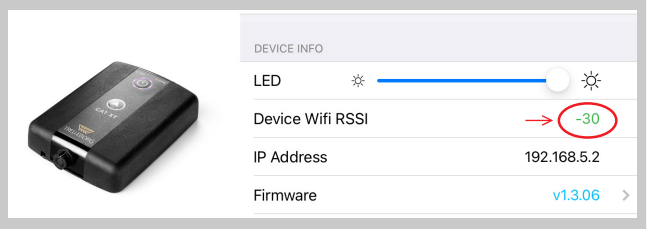
Monitoring WiFi and RSSI

Maintaining a stable WiFi connection between the different units is essential for ensuring reliable and high-quality data reception. The strength of the signal can be monitored in the Device Status window under the "Device WiFi RSSI" point. This reference point will show if the connection is strong or has issues.

The signal quality is categorized into three levels:

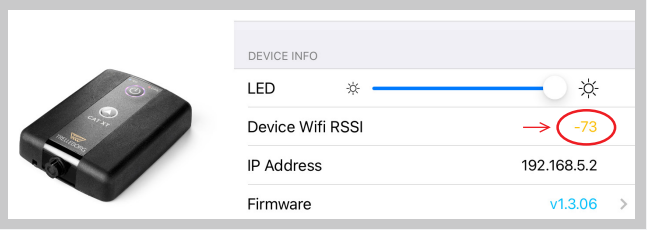
- **Green** (Signal Strength: -60 or better):

  A green indicator signifies a stable connection; no further action is needed



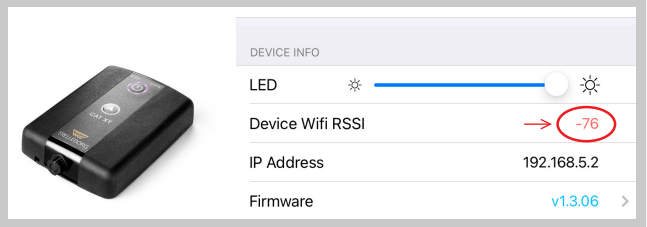
- **Yellow** (Signal Strength: Between -60 and -75):

  A yellow indicator means the connection is weaker than preferred. In such cases, relocating the CAT XT HDG units to a better position for improved WiFi signal strength is advisable.



- **Red** (Signal Strength: Below -75):

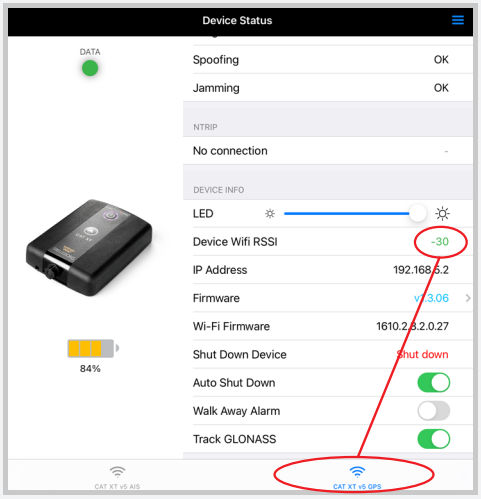
  A red indicator means the WiFi connection is too weak. The units must be relocated to an area with a stronger signal (preferably above -60) for reliable connectivity.



The location of the information to check the signal strength may vary depending on the mode in which the system is being used. However, the key takeaway is that it is essential to monitor the client unit or units closely.

The following provides a brief overview of which unit or units to monitor when used in different modes:

- **Mode 1:** In this mode, the CAT XT unit is directly connected to the pilot plug. This eliminates the need for WiFi and monitoring the connection.
- **Mode 2:** In the second mode, the CAT XT POS unit is the client to the HDG unit which is connected to the pilot plug and provides the signal. In this case, the signal strength can be monitored in the Device Status window when it displays the status for the POS unit, as shown in the screen capture below:



If the signal gets lost, it may be necessary to turn the unit with the lost signal off and on again to regain the connection.

Lights Guide

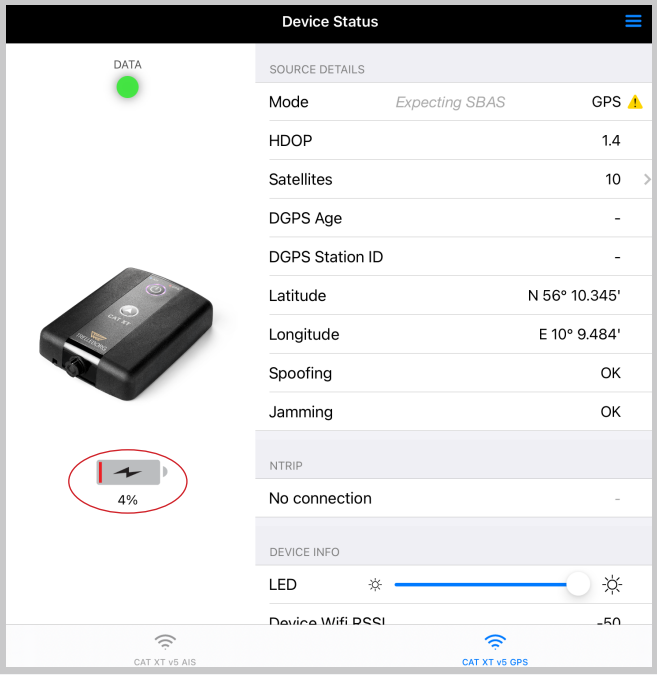
CAT XT:		
	Steady Purple	Position OK
	Fast Flashing Purple	Not Connected to XT access point
	Slow Flashing Purple	No GPS position
	Steady Red	Fully Charged
	Fast Flashing Red	Low Battery
	Slow Flashing Red	Charging
	Simultaneous Flashing Green	Units Paired
	Steady Blue	AIS data OK
	Slow Flashing Blue	No AIS data

Charging and Auto Power off

To offer high flexibility, the CAT XT features two charging options: via cable or with a wireless charge pad.

Cable Charging

The CAT XT flashes red when the charging cable is connected, indicating that charging is in progress. When the unit is fully charged, the light switches from flashing to lighting up in solid red. The SafePilot software displays the current battery level and whether the unit is charging.



The CAT XT is fully functional while charging. It supports up to USB PD 3.0, USB HVDCP, and QuickCharge 3.0. When fast charging is used, the CAT XT battery charges from zero to 100% in approximately 3 hours.

Wireless Charging

Place the CAT XT centred on a wireless charge pad that supports Qi charging. The CAT XT will start flashing red, indicating it is charging. When fully charged, it will flash a solid red.

The units are fully functional while charging, and the progress can be tracked in the SafePilot software. The battery load percentage is shown along with a lightning symbol indicating that the charging is ongoing.

Auto Power off

It is possible to enable/disable the feature, as required, through SafePilot software.

Either of the two CAT XT Units will turn off automatically under certain conditions.

If the following conditions are met, the unit will turn off. This will also occur when the devices are connected to a Pilot Plug or charger.

CAT XT v5 AIS:

- If no heading has been achieved for 30 minutes
- If no clients are registered, on the Wi-Fi Network for 30 minutes

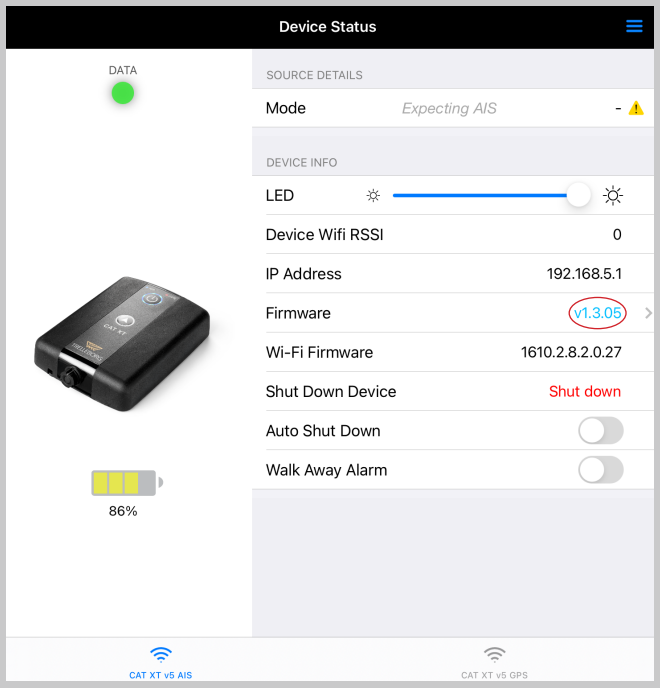
CAT XT v5 GPS:

- If not connected to the CAT XT GPS Unit for 30 minutes
- If no valid position is achieved for 30 minutes

Firmware Update

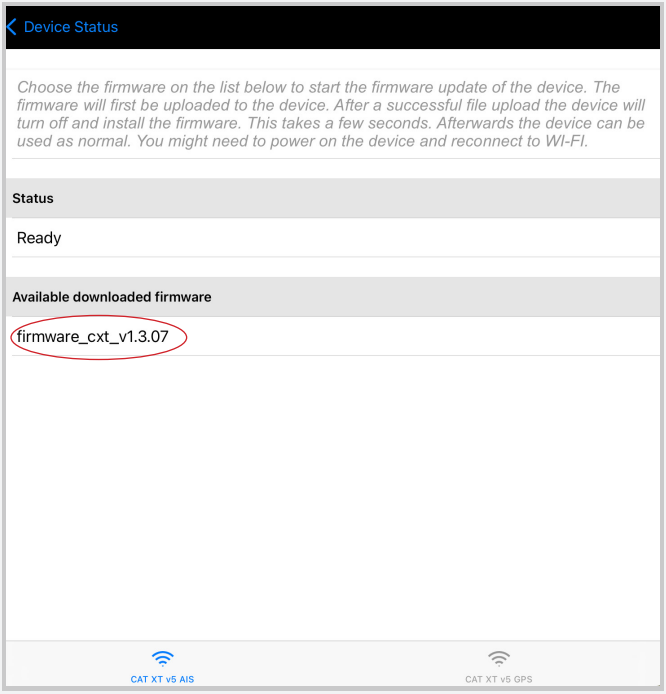
It is recommended that CAT XT devices always be updated to the latest firmware version

When an update is available, it will be displayed in the GPS Status view window, and the version currently installed will be marked blue.

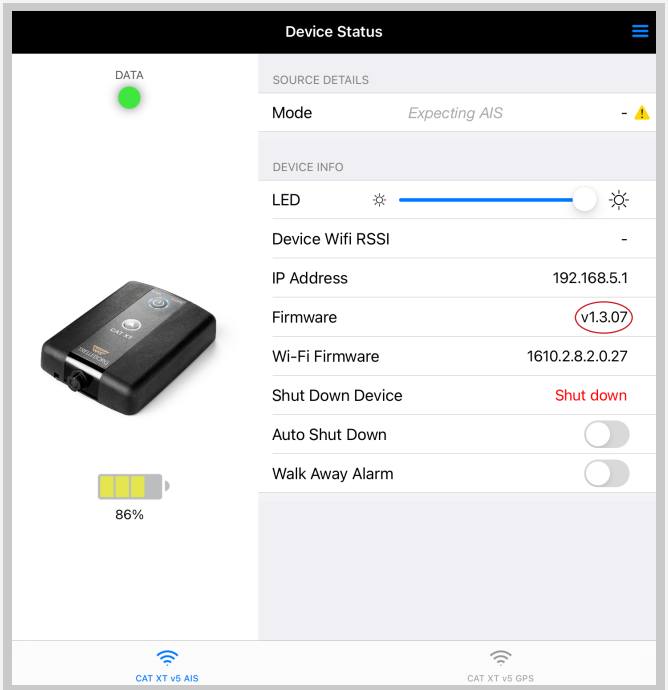


The update can be done Over the Air (OTA) by following the steps below:

- Turn on the CAT XT AIS, and CAT XT GPS.
- Connect to its Wi-Fi and open SafePilot.
- To update the firmware, tap on the firmware field in the GPS Status view window. A new window will appear showing the available firmware.
- Tap on the new firmware version, and the device will start updating



- After completing the update, the unit will restart, and the new firmware version will be displayed in black in the Status view window



Maintenance

To ensure the CAT XT remains in great condition, please keep the following in mind:

- Keep the CAT XT units clean and dry while stored.
- The battery level should be maintained at 50-60% if the device is not used for an extended period of time
- All cables need regular inspection, and the connectors must be checked to ensure they are clean

COMMON ERRORS & TROUBLESHOOTING

No Wi-Fi connection to iPad:

- Do not place the iPad on a metal surface, as this may affect its ability to connect to WiFi.
- Make sure the iPad is placed centrally on the bridge and that there are no obstacles within close proximity of the antenna
- Ensure compliance with the Wi-Fi signal guidelines in the “Operation Mode” section

Units not pairing:

- Turn off all units and place them in close proximity to each other
- Turn on the CAT XT AIS by pressing the power button. It will start flashing blue. Wait 5 seconds until it begins to flash blue more slowly
- Turn on the CAT XT GPS by pressing the power button until it flashes purple. The unit should start flashing green synchronously with the CAT XT AIS within 5 seconds

No position is shown:

- Confirm that the CAT XT GPS is connected to the CAT XT AIS. The CAT XT GPS will be fast flashing purple if not connected
- Make sure the arrows on the two units point towards each other

No RTK position:

- Make sure the NTRIP file is filled in correctly, and ensure that the iPad has a stable connection to the cellular network

Assessories and additional purchases

SafePilot Software

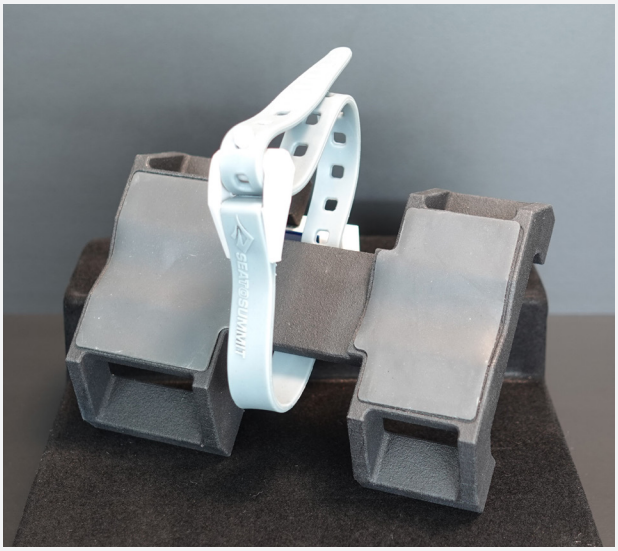
The SafePilot is a user-friendly software available as an app for iPad and Apple Watch. It handles key tasks such as navigation data, planning functions, route and arrival times, recording, chart handling, predictions, and history. Additionally, it offers specialized functions for docking and alignment, lock operations, weather data, and AUKC, among others.

Cat extender

The Cat Extender can be used in conjunction with the Cat XT AIS and Cat XT GPS units. When used together, the Cat Extender will serve as the Wi-Fi access point. If positioned in the center of the ship, the extender will offer robust and dependable Wi-Fi coverage across the entire bridge wing, even on large vessels like ULCVs.

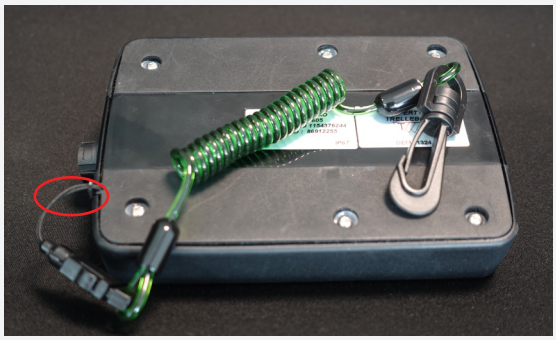
Mounting Bracket

If a suitable flat horizontal surface is not available to place the CAT XT GPS unit, using the mounting brackets designed for it is an easy and efficient way to fit the unit onto a railing or pipe.
When the CAT XT GPS is fitted to the brackets, the combined magnetic fields from the bracket and the CAT XT GPS itself make the magnets stick even more. Because of this, it is also recommended that the brackets be used when the unit is mounted on a flat surface.



Lanyard

The CAT XT GPS features a bottom mounting hole for attaching a safety lanyard, as illustrated in the image below.



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