- An image associated with the machine or system being monitored can be added.
- A company logo can be added.

Only sensor interfaces that are enabled and have transmitted data recently will be displayed on widgets. Any exceptions currently being experienced will be shown in the *Events* widget. Information associated with the selected device such as the model number and firmware version will be shown in the *Device Info* widget.

Note Any alerts, warnings or alarms currently present on the selected device will be shown in the Events widget on the dashboard.

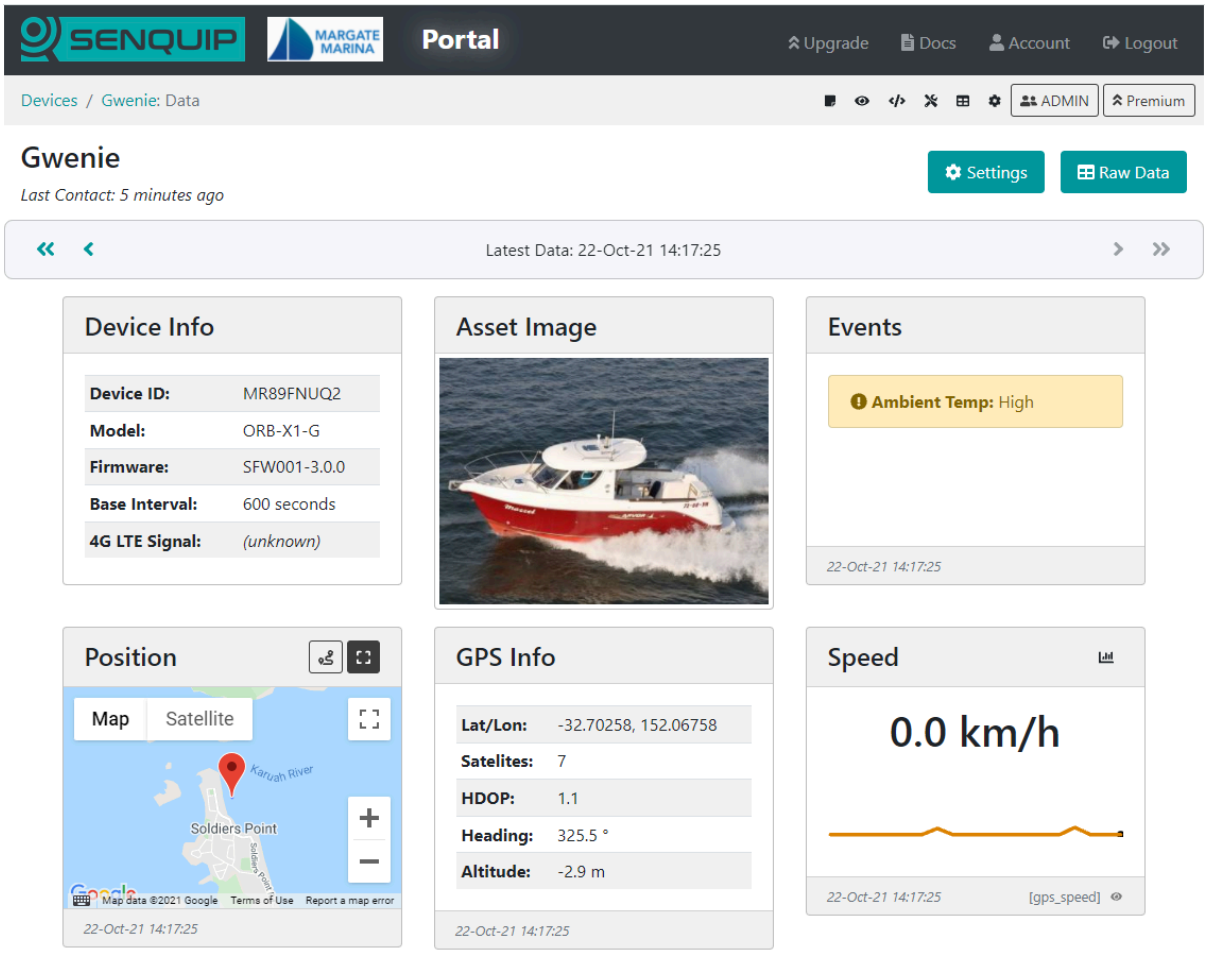


Figure 9.3. Senquip device dashboard

Click on the icon at the top right of each widget to show the data on a graph. Data on the graph can be selected for time periods of an hour, day, week, or custom. Click on a point on the chart to show values at that point.

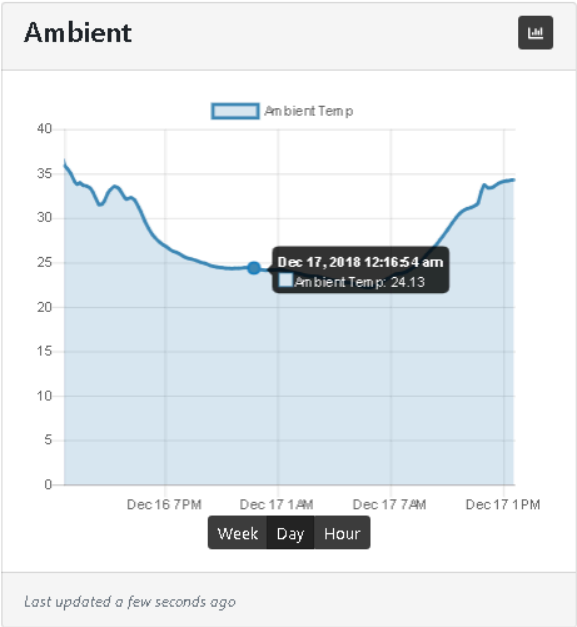


Figure 9.4. Example chart showing the days temperature

Data measured by Senquip devices can be visualised in various formats. To change the format in which data is visualised, press the eye icon on the bottom right of the tile. Formats available are:

- Hidden - Hide the data if it is not relevant to the application
- Trendline - The default graph that facilitates recognition of change. Allows the user to view longer term trends between date ranges.
- Gauge - Useful when representing measurements that must exist within a range. Can be scaled so that the pointer is vertical under normal conditions. Warning and alarm levels can be set.
- Digital - A simple ON or OFF display that shows the status of a measurement. The threshold at which the display switches from ON to OFF can be set.

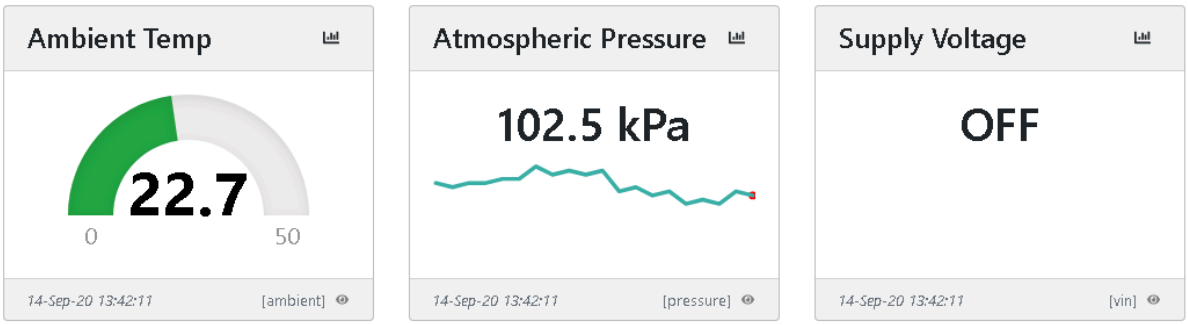


Figure 9.5. Data visualisation in different formats

Buttons can be added to a dashboard that allow user to trigger events on remote devices. When the buttons are pressed, next time the remote device makes contact with the Portal, a user script is triggered to run on the remote device.

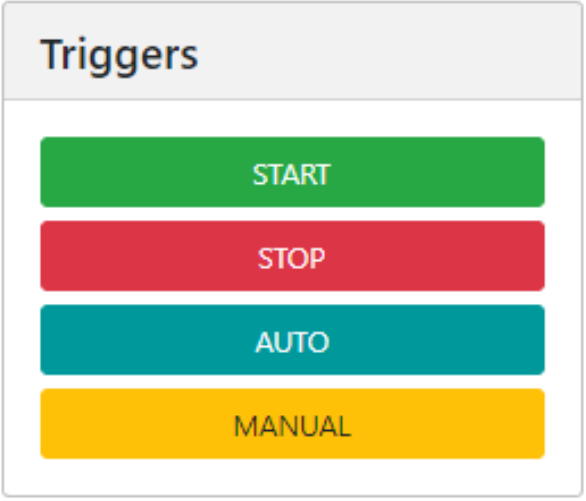


Figure 9.6. Buttons to trigger remote operations

From the device dashboard, the user can navigate to the settings, raw data, display settings and other pages.

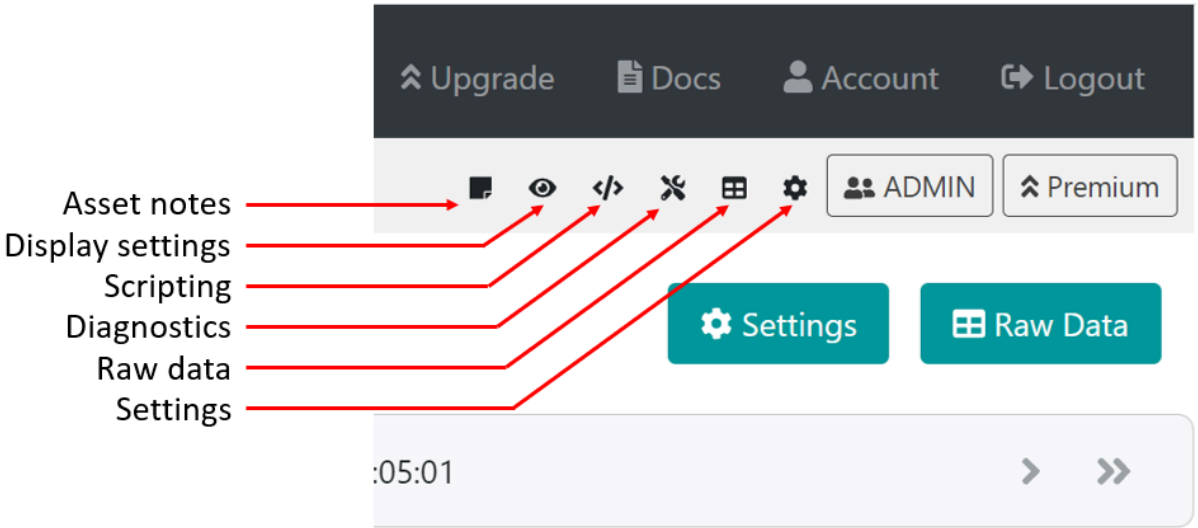


Figure 9.7. Navigate to device configuration pages

Asset notes allows the user to add an image of the system being monitored, add install images, other notes, and a company logo. Display settings allows the user to turn widgets on and off and re-order the widgets. The scripting icon passes the user to the JavaScript editor to enable scripts to be written for Senquip devices. Raw data allows the user to display and then download historic data in csv format. The settings icon takes the user to the device settings pages. Not all of the icons will be available to all users. For instance, the scripting icon will not show up for users who do not have access to scripting.

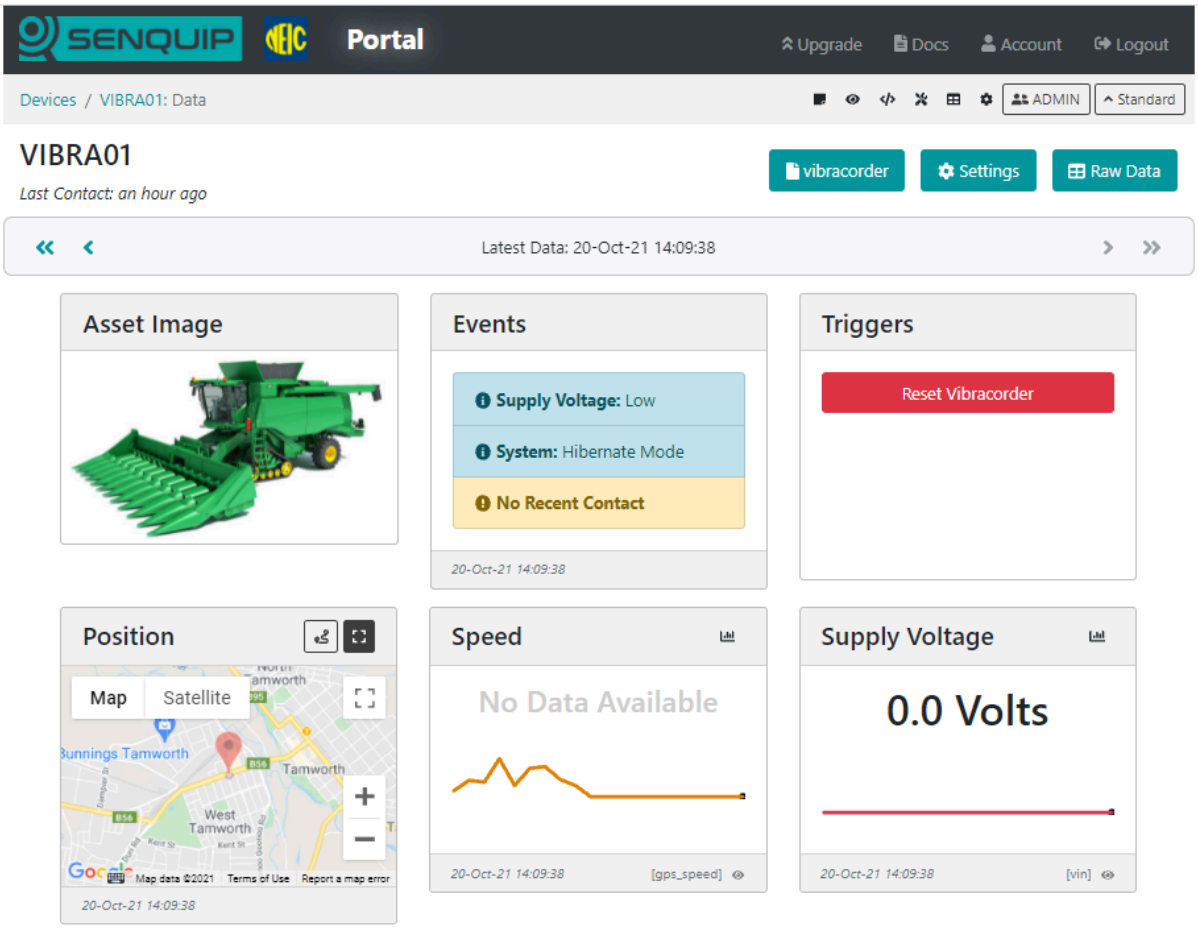
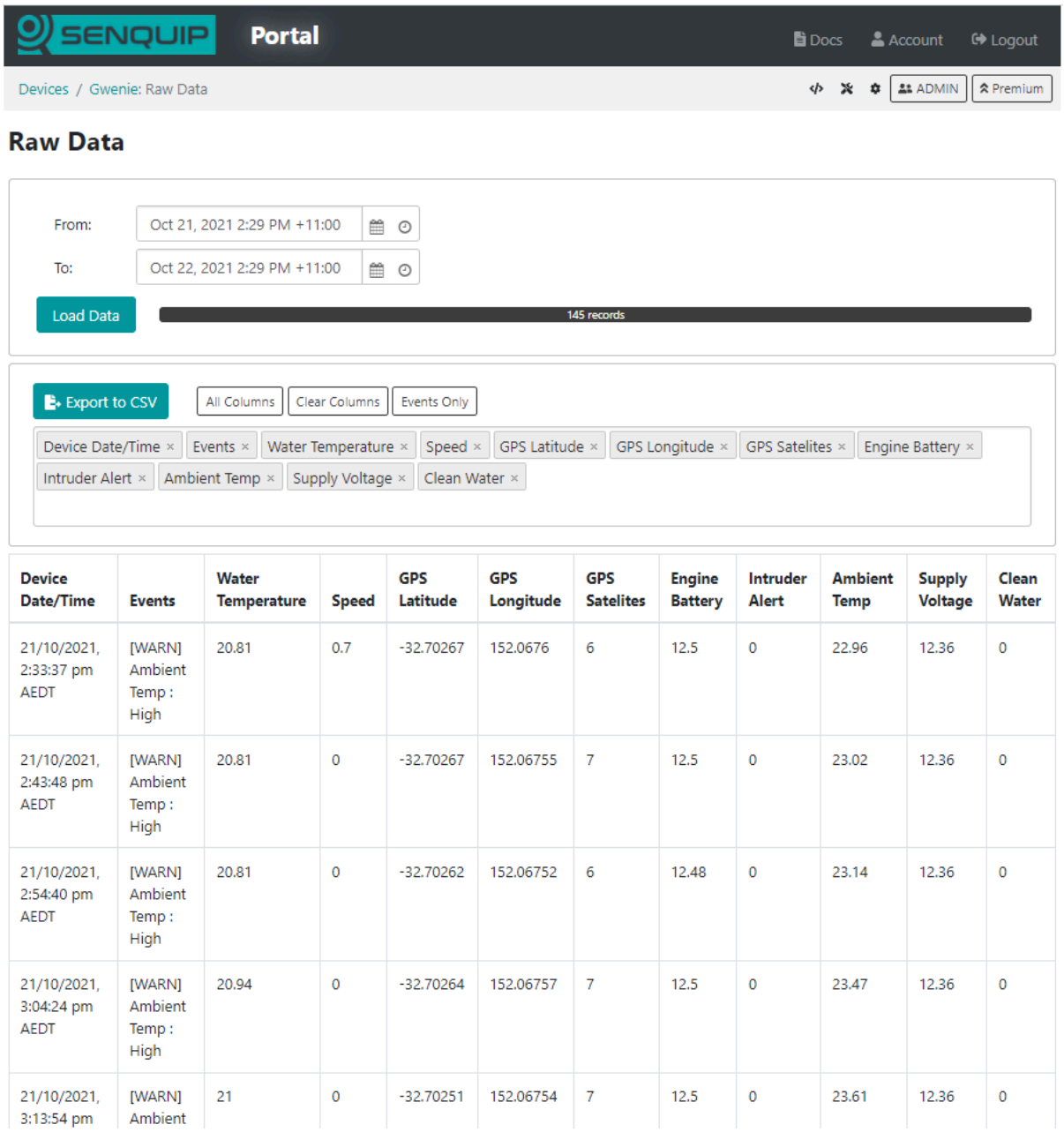


Figure 9.8. Dashboard with an image showing the system being monitored

9.1.4 Historical data

To view or download historical data, press the *Raw Data* button on the top right of the dashboard. A table showing all the data associated with the selected device will be shown. To download the data, press the *Export to CSV* button. The data will be saved to your downloads folder. The downloaded file can be opened and manipulated with any spreadsheet tool.



Device Date/Time	Events	Water Temperature	Speed	GPS Latitude	GPS Longitude	GPS Satelites	Engine Battery	Intruder Alert	Ambient Temp	Supply Voltage	Clean Water
21/10/2021, 2:33:37 pm AEDT	[WARN] Ambient Temp : High	20.81	0.7	-32.70267	152.0676	6	12.5	0	22.96	12.36	0
21/10/2021, 2:43:48 pm AEDT	[WARN] Ambient Temp : High	20.81	0	-32.70267	152.06755	7	12.5	0	23.02	12.36	0
21/10/2021, 2:54:40 pm AEDT	[WARN] Ambient Temp : High	20.81	0	-32.70262	152.06752	6	12.48	0	23.14	12.36	0
21/10/2021, 3:04:24 pm AEDT	[WARN] Ambient Temp : High	20.94	0	-32.70264	152.06757	7	12.5	0	23.47	12.36	0
21/10/2021, 3:13:54 pm	[WARN] Ambient	21	0	-32.70251	152.06754	7	12.5	0	23.61	12.36	0

Figure 9.9. Data associated with the selected device shown in a table

Note The timestamp in the *timestamp* column is in Unix Time; if you would like a GMT date and time field, enable the timestamp setting in endpoint settings.

9.1.5 User administration

Use the *Admin* button to manage the users of each Senquip device. When a device is added to an account using the device ID and password, the user that added the device automatically becomes an admin for that device. Admin users can manage other user rights and have full permissions for the device. The different user types are detailed in the table below:

Allowed Permission	Admin	User	Operator	View
View data	Yes	Yes	Yes	Yes

Trigger device actions	Yes	Yes	Yes	
View users	Yes	Yes		
Change device settings	Yes	Yes		
Add/remove users	Yes			

Warning Anyone who has the device ID and setup password can add the device to their account with Admin permissions.

9.1.6 Configuration via Senquip Portal

Settings associated with a Senquip device can be updated remotely via the Senquip Portal. To change the settings for a selected device, press the *Settings* button on the top right of the dashboard. The selected device settings will be shown and can be changed by clicking in the relevant fields. Once a setting has been changed, press the *Save Settings* button at the bottom of the page.

Senquip devices check for settings changes each time they make a connection to the Senquip Portal. If a device is set to transmit data once an hour, then the settings will be changed up to an hour after the changes have been made on the portal. If quicker changes are required, the device will need to be visited and the changes made via the integrated webserver in setup mode.

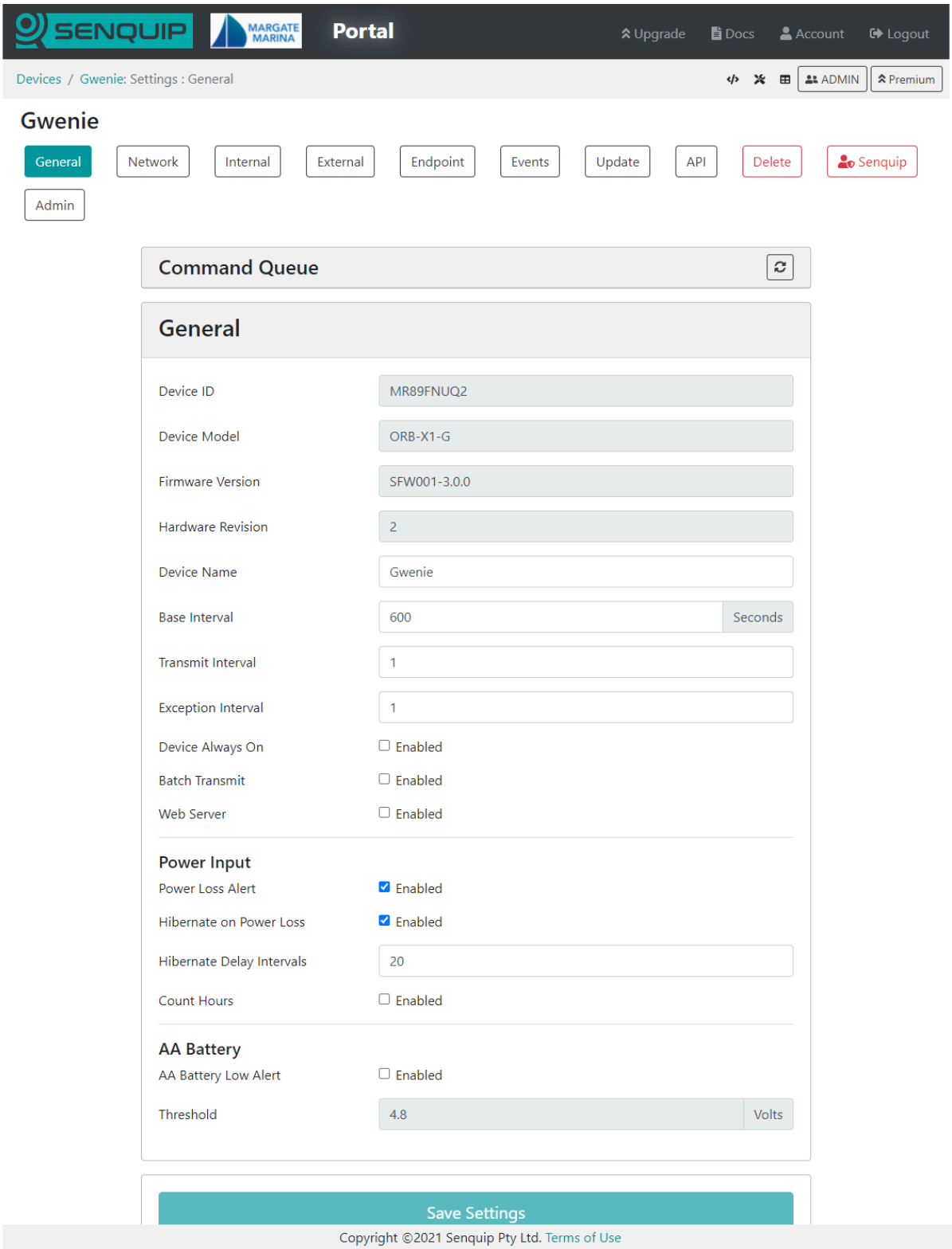


Figure 9.10. Remote update of device settings via the Senquip Portal

Note In applications where power is available, a quicker transmit interval will mean that settings changes can be made more quickly.

9.1.7 Remote firmware updates

Senquip will routinely make firmware updates to enable new features, enhance security and fix bugs.

Device firmware can be updated via the Senquip Portal. To update the firmware, press the *Update* button on the settings page. You will be directed to a page asking for the firmware number. This number can be found in the Device Firmware Changelist on the Senquip website or through your preferred distributor.

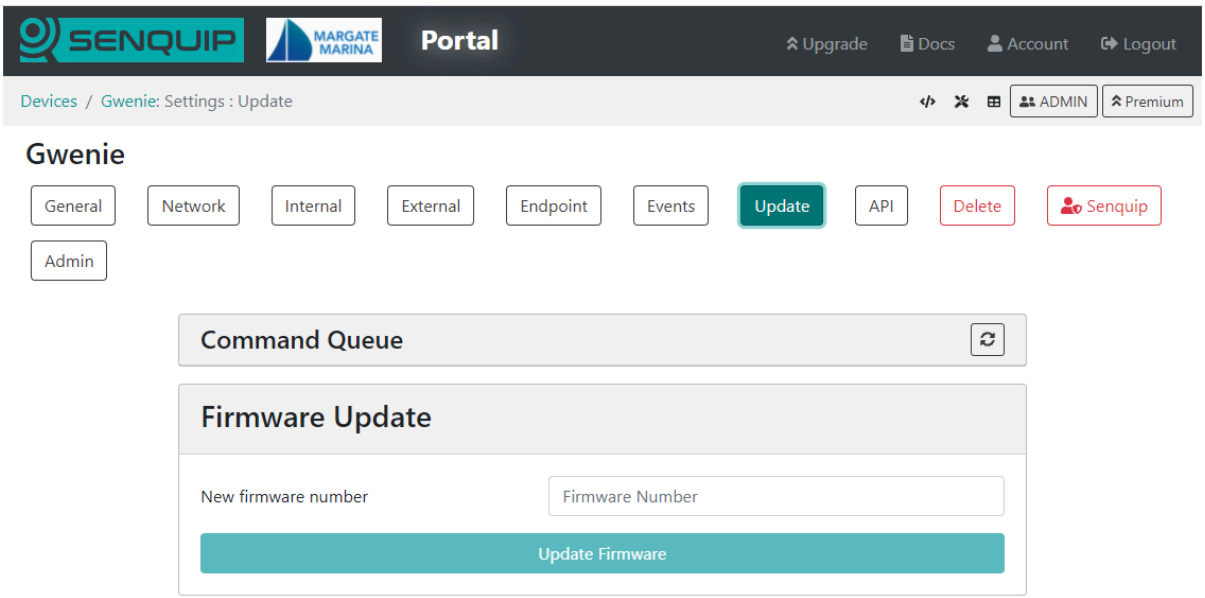


Figure 9.11. Remote firmware updates via the Senquip Portal

A Firmware Update typically takes about 5 minutes on Wi-Fi and 20 minutes on 4G LTE. During the update the green light will be off and the orange light will flash fast. Once the device has received the firmware update and is processing it, the lights may appear to freeze. This is normal behaviour. Please allow plenty of time for the device to finish the update and return to normal operation.

Note There is always a risk that something may go wrong during a firmware update; it is not recommended that firmware be updated unless it is suggested by Senquip or a specific new feature is required.

9.1.8 Event reporting

Use the *Events* page on the Senquip Portal to configure event reporting. Alert, warning and alarm conditions can be forwarded to users via email or as an SMS. Event can be configured to be sent never, once, every 10 minutes, hourly or daily. In all cases except never, the events will be forwarded as the event is reported and then at the period selected.

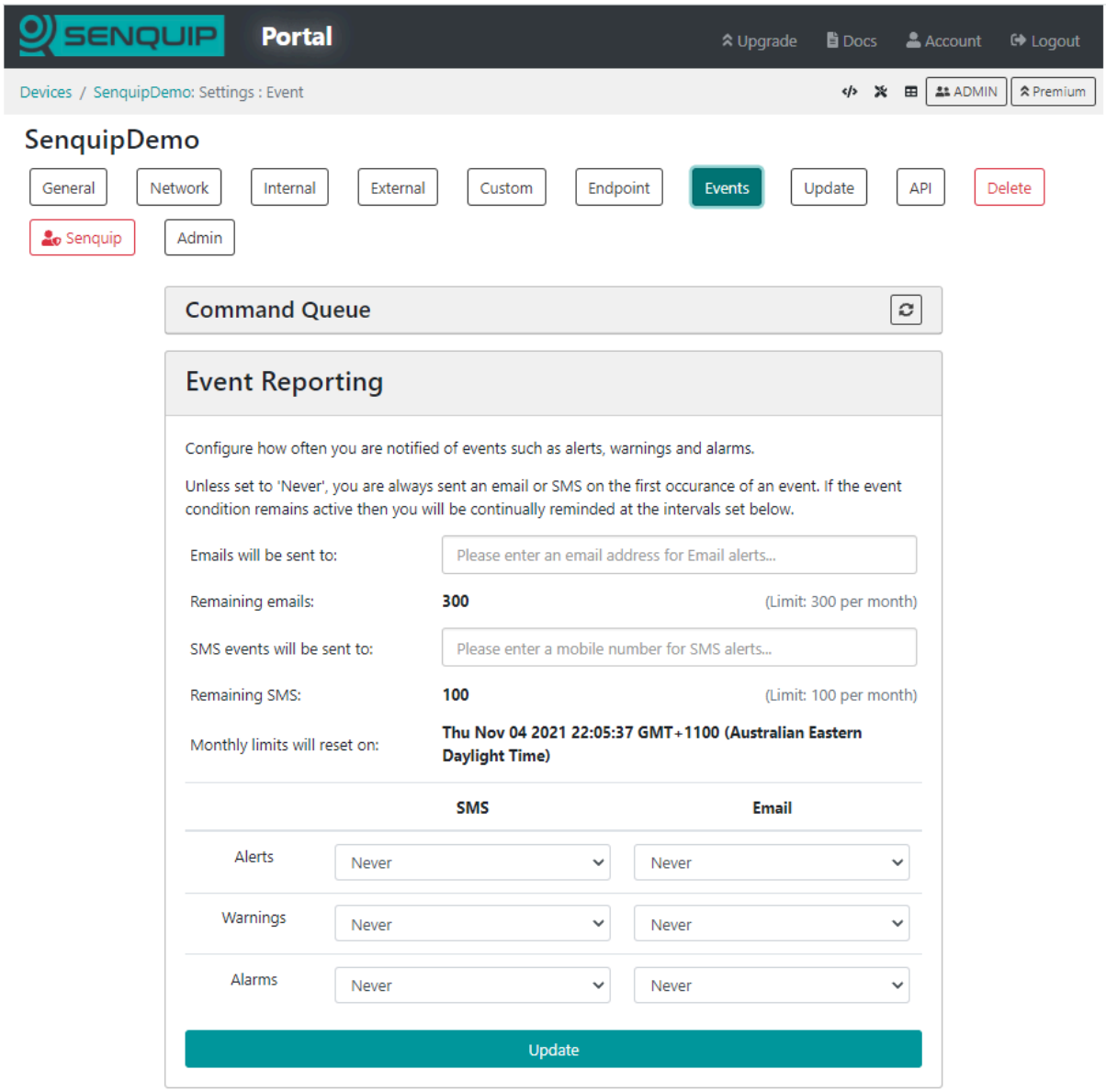


Figure 9.12. Configure event forwarding

9.2 Management and hosting on the Senquip Portal

The Senquip Portal offers hosting of data, a data visualisation dashboard, firmware upgrades, and device management including remote configuration and scripting. Every Senquip device purchased comes with a *managed* plan for the life of the product (10 years). *Managed* plans allow remote configuration and scripting on the Senquip Portal. Users have the option of purchasing a *hosted* plan to enable data hosting and data visualisation on the Senquip Portal. Hosted plans are available on a monthly, yearly, or lifetime basis (10 years), and can be purchased directly off the Senquip Portal or through distributors.

9.2.1 Basic

Managed plans are most suitable for users who are hosting their data on their own server and have their own dashboards. Features of the management plan include:

- Configure devices from the Senquip Portal
- Connection to a private server
- View current data
- 5 Minute updates to the Senquip Portal
- 1 Day of data storage
- Device Scripting
- Access for 3 users
- Firmware updates

9.2.2 Hosted

Hosted plans are for users who will use the Senquip Portal to store and visualise their data. Features of the hosted plan include:

- Configure devices from the Senquip Portal
- Connection to a private server
- View current and historical data
- 5 second data update limit
- 2 years of data storage
- Device scripting
- Senquip Portal access for 20 users
- Firmware updates
- Export raw data
- Trigger remote actions
- 300 email alerts per month
- 100 SMS alerts per month
- Senquip Cloud API access
- AEMP API access

Note Every device includes 90 days of hosted access from the date of activation.

For the most up to date feature list and to purchase a hosted plan, please visit the Senquip Portal or contact your preferred distributor.

Chapter 10

Mechanical Specification

10.1 Mechanical drawings

Critical dimensions for the ORB, mounting plate and mounting hardware are given below. Full three dimensional models are available on request.

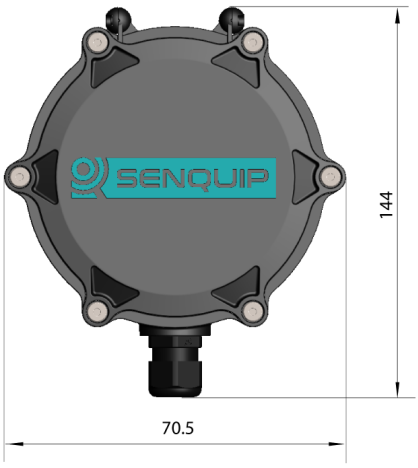


Figure 10.1. Dimensioned front view

Figure 10.2. Dimensioned top view

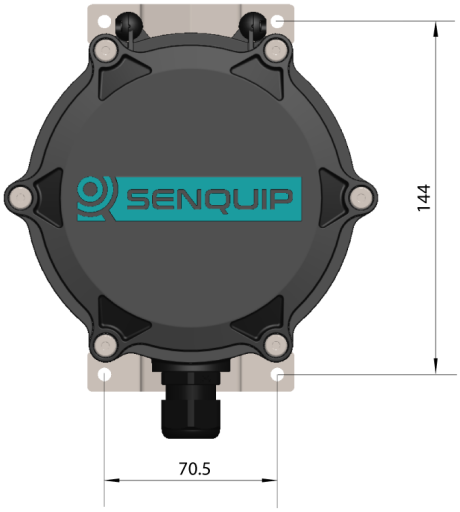


Figure 10.3. Dimensioned front view including mounting brackets

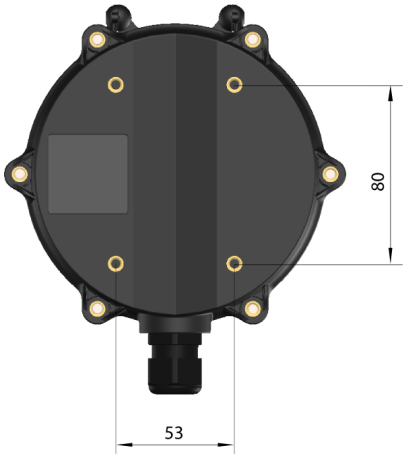


Figure 10.4. Dimensioned rear view

10.2 Mechanical Fittings

The following screws and seals are used on the ORB. Spare parts, if required are available from Senquip.

Location	Size	Length	Max depth	Fastening method
Screws				
Lid attachment	M5	To avoid hinge damage, only captive screws provided by Senquip are to be used.		3mm Allen key
Mounting	M5	8mm	9.5mm	3mm Allen key
PCB mounting	M3	10mm	10mm	T10 Torx key
Gland nut	AF24			
Seals				
O-ring	ID121 x 3mm	To maintaing the IP rating of the enclosure, only use o-rings that have been provided by Senquip.		
Gland	M20 x 1.5	To maintaing the IP rating of the enclosure, only use glands that have been provided by Senquip.		

10.3 Environmental

The ORB is designed for use in harsh outdoor environments and is suitable for use in industrial, mining, fleet and agricultural applications.

The enclosure is rated to IP67, meaning that it is dust tight, with no ingress of dust permitted and watertight against the effects of immersion of up to 1m for 30 minutes. The cable gland, when fitted

with suitable wiring is rated at IP68.

The chart below describes IP ratings and how to interpret them.

Figure 10.5. IP number description

The ORB can be operated in temperatures between -40°C and 85°C however the internal Lithium-Ion-Polymer battery charging will be throttled at temperatures colder than -10°C and higher than 40°C.

An internal gore vent allows for pressure equalisation between the interior of the enclosure and the environment meaning that the ORB can be shipped in non-pressurised environments such as some aircraft.

10.4 Material Specification

The enclosure and all fittings have been chosen to be resistant to salt spray and common industrial chemicals such as petro-carbons. UV stabilised materials have been chosen to allow mounting in direct sunlight.

Component	Material
Enclosure and front cover	Glass filled nylon
Enclosure front cover seal	Nitrile Butadiene Rubber (NBR)
Captive cover screws	Stainless-steel (304)
Cable Gland	Polyamide
Gland insert	Nitrile Butadiene Rubber (NBR)
Optional Mounting plate	Stainless-steel (316)

Chapter 11

Maintenance

The ORB-X1 has been designed to require a minimum of maintenance. The only serviceable item is the internal LiPo backup battery.

11.1 Replacing the LiPo Battery

CAUTION
RISK OF EXPLOSION IF BATTERY IS REPLACED BY AN INCORRECT TYPE.
DISPOSE OF USED BATTERIES ACCORDING TO THE INSTRUCTIONS.

It is expected that the LiPo battery will have an in service life of 5 years. Factors that will reduce the life are:

- Exposure to temperatures above 55°C or below -10°C.
- Unusually high number of charge / discharge cycles.
- Being left in a discharged state for an extended period of time.

Replacement of the LiPo battery should only be performed by suitability trained service personnel. Only LiPo batteries supplied by Senquip should be used. Senquip LiPo batteries contain temperature sensing and protection circuitry to ensure safe operation of the ORB.

Note Use of 3rd party batteries may cause damage to the unit and will void the warranty.

The LiPo battery is located under the battery holder plastics inside the ORB. To replace the LiPo battery, the following steps need to be completed:

- Un-fasten the 6 hex-head screws securing the cover using a 4mm hex bit. The screws are captive and will not fall out when loose. Do not attempt to remove the screws from the lid.
- Open the hinged lid by lifting the bottom of the lid toward yourself and up. When the lid is opened, an internal light detector will recognise the increase in brightness and will enable the LEDs and configuration switches.

Figure 11.1. LEDs and configuration switches.

- Remove the 4 AA batteries and if permanently powered, make sure that power to the ORB is switched off.
- Disconnect all wiring from the header.
- Remove the SIM card.

Figure 11.2. Remove the SIM card before opening.

Warning Failure to remove the SIM card before trying to remove the battery cover could cause mechanical damage to the SIM card holder.

- Remove the battery cover by removing the 4 Torx-head screws using aTorx T10 driver. Note that by removing the battery cover, sensitive electronics may be exposed. The AA battery terminals extend through the battery cover; care should be taken not to damage the terminals when removing the cover.

Figure 11.3. Removing the battery cover.

Warning Make sure that you do not expose the circuit board or components to static electricity.

- The LiPo battery is plugged into a polarised 3 pin JST connector. Gently remove the battery plug by pulling on the 3 wires, ensuring that the direction of pull is in-line with the connector.

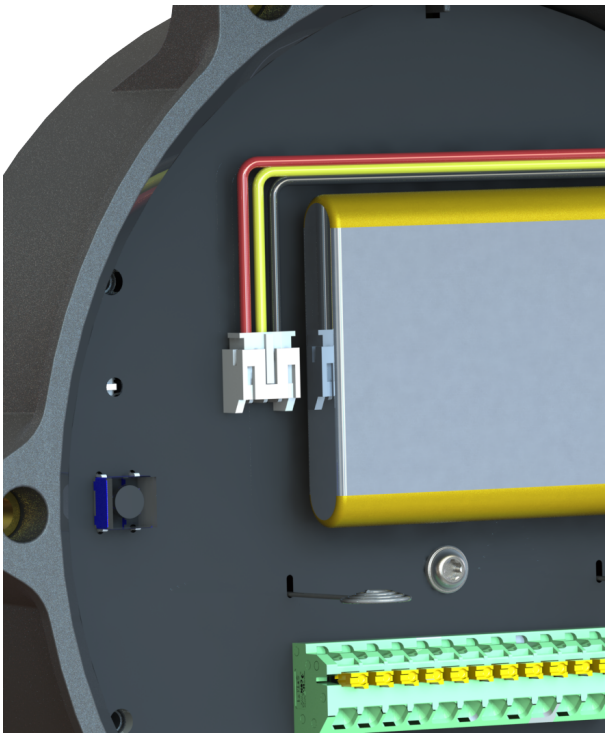


Figure 11.4. Orientation of Lipo Battery.

- Note carefully the polarisation of the 3-way battery plug and be sure to insert the replacement battery with the same polarity.

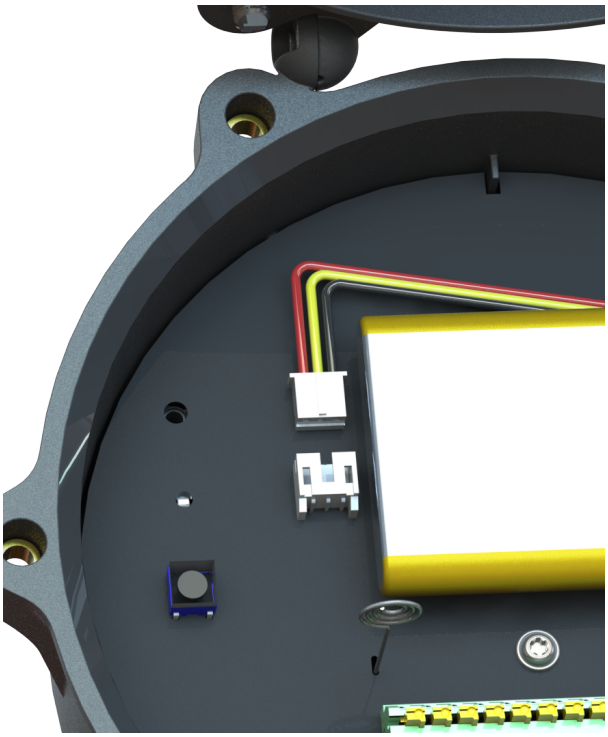


Figure 11.5. Battery plug removed.

- The LiPo battery is secured to the PCB with removable 3M double sided tape. To remove the battery, pull gently, ensuring that you do not damage the battery.
- Remove the old tape; new batteries supplied by Senquip will ship with replacement double sided tape.

Figure 11.6. Remove the old tape.

Note Used LiPo batteries can be dangerous and are harmful to the environment and should only be disposed of using an authorised disposal service.

- Reverse the above procedure to re-assemble the ORB.
- Press the Reset button to restart the ORB.

Chapter 12

Frequently Asked Questions

12.1 Introduction

This document is a collection of responses to questions that are commonly asked by new users of the Senquip telemetry devices. If you cannot find an answer to your question below, please contact us at support@senquip.com. Table of Contents

12.2 Senquip Portal

12.2.1 Do I need a hosted subscription to remotely configure my device?

No. The purchase of a Senquip device entitles the owner to make configuration changes, perform firmware updates and view data using the Senquip Portal for the life of the device.

12.2.2 Do I need a hosted subscription to perform firmware updates?

No. The purchase of a Senquip device entitles the owner to perform firmware updates using the Senquip Portal for the life of the device.

12.2.3 Can I view data on the Senquip Portal for free?

Yes, you can view data on the Senquip Portal on a free basic plan. Updates to the Senquip Portal will be limited to 5 minute intervals and the data will not be stored for more than a day.

12.2.4 I cannot see historical raw data on the Senquip Portal.

If your device is on a free basic plan, Senquip will not store more than 1 day of historical data. Continuous backups of data storage becomes expensive so is feature of hosted plans where data will be saved for 2 years. Updating a device plan to hosted can be done on the Senquip Portal by using the subscriptions facility.

12.2.5 Do I have to use the Senquip Portal to view my data?

Senquip devices can send measured data to any endpoint via UDP, HTTP, and MQTT. Data transfers can be secured through the upload of customer certificates to the device.

12.2.6 Can I completely disconnect from the Senquip Portal?

Yes. To stop sending data to the Senquip Portal, unselect the Send Data to Senquip Portal option in the endpoint settings. To stop configuration settings from the Senquip Portal unselect Configuration via Senquip Portal. Further settings updates will have to be done using the Senquip webserver.

12.2.7 Does Senquip have access to my data?

No. Unless you give a Senquip employee access to a device by giving them view, operator, user, or admin status, Senquip employees will not be able to view your data. Sometimes, you may give a Senquip employee access to your device so that they can assist you in setup. As an administrator, you can remove this access at any time.

12.2.8 Can I secure proprietary scripts?

Yes. You can use the lock feature on the Senquip Portal to lock scripts so that only you can access the content of the script.

12.2.9 I have added a measurement in the settings, but the widget is not showing in the portal.

Browsers typically cache most of the elements in a webpage. Refresh your Chrome or Edge browser by: * Hold down Ctrl and click the Reload button. * Or Hold down Ctrl and press F5. Check that the widget has not been turned off in the portal display settings. To turn on (or off) a widget, press the eye icon on the device page and select which widgets you would like to show, and the order in which you want to show them. Remember to refresh your browser.

12.2.10 There are measurements missing in the data stored on the Senquip Portal.

When a Senquip device tries to connect to a network but cannot, it will retry several times and then discard the measured data and return to sleep. If you would like data to be stored when there is no coverage, select the Offline Buffer option in endpoint settings. If the transmit interval is different to the base interval, the measurement that coincides with the Transmit Interval is the one that will be sent. If you would like the measurements taken on every base interval to be stored, select the Batch Transmit option under general settings.

12.2.11 I have logged into the Senquip Portal but there is no data showing.

Measurements will only show on a device page in the Senquip portal once a device has published measurements to the portal at least once. When you receive a new device, it will be in freight mode, and it will not have published data to the Senquip Portal. Power the device to exit freight mode, configure the network settings and the device will start to publish data at the specified Base Interval.

12.2.12 I have changed a setting on the Senquip Portal, but the Senquip device has not changed behaviour.

When a setting is changed on the Senquip Portal, it is added to a queue that is stored until the device next makes contact. To see if a setting has been applied by a device, press the command queue button at the top of each settings page. Settings changes shown in green have been applied. For remote configuration using the Senquip Portal to be possible, the Configuration via Senquip Portal option must be selected in the endpoint settings.

12.2.13 I have many Senquip devices and I am struggling to identify them.

Once you have many devices installed, it can be difficult to identify which Senquip device is performing which function. It is highly recommended that each device is named using the Device Name setting when first installed and that devices are added to logical groups on the Senquip Portal. If a device has not been named and it needs to be identified, turn the GPS on to determine its location.

The columns on the device summary page can be customised to show key data for a group of assets. You may, for instance want to show fuel level, utilisation and alerts on the summary page.

12.2.14 Is my data secure?

Yes. To ensure the highest levels of security, Senquip devices use a NIST validated, ultra-secure hardware crypto element for key and certificate storage and cryptographic processing. The crypto-element is pre-loaded with certificates for Amazon Web Services (AWS), allowing for immediate, out-of-the box, secure communication with the Senquip Portal. Users can load additional certificates to allow secure communications with other endpoints.

Data stored on Senquip device is encrypted using AES256 encryption.

12.2.15 Can I use symbols and characters as units on the Senquip Portal?

Yes. To use symbols like the degrees symbol (o) as in oC, create the text in an editor such as Microsoft Word or Notepad and copy it into the field in the Senquip Portal. Alternatively, use the alt code for the symbol you need, for instance, ALT 0167 for the o symbol.

12.2.16 I can't add a user to a device.

To add a user to a device, you must have administrator priveledges for that device. For a user to be added to the Senquip Portal, they must have activated an account on the portal. To add a user, from the device page, press the Users icon in the top right. Enter the email address with which the user has signed up to the Senquip Portal. Select the user permissions as Admin, User and Read. If the email address entered is not associated with an activated account on the Senquip Portal, an error will occur, and the user will not be added.

12.2.17 How do I change the payment details for my subscriptions?

You may want to change your payment method when, for instance, your credit card has expired and you need to add an updated version. To change payment details, login to the Senquip Portal and select the *Account* option at the top right to navigate to your account page. Select the *Billing Detail* option and then press the *Edit Billing Detail or View Invoices* banner. This will take you to the secure payment portal from where you can add payment methods by pressing *Add payment method* and delete payment methods by pressing the cross next to each payment method.

12.2.18 Where can I find copies of invoices for subscription payments?

Login to the Senquip Portal and select the *Account* option at the top right to navigate to your account page. Select the *Billing Detail* option and then press the *Edit Billing Detail or View Invoices* banner. This will take you to the secure payment portal where invoice history can be seen at the bottom of the page. Click on an invoice to open the details of that invoice and to download a copy.

12.3 Network

12.3.1 I have inserted a SIM card, but the device is not connecting to the network.

Senquip devices that use 4G networks need to be configured with an Access Point Name (APN). The APN is unique to each mobile service provider and should be known by the provider of the SIM. Sometimes a username and password are also needed for a SIM. To configure SIM settings, use the device network settings page.

Later versions of firmware for Senquip devices include a feature called Auto-APN. With Auto-APN, the Senquip device reads data off the SIM and searches a database to try and find a suitable APN. If successful, the Senquip device will connect directly to the network.

Senquip produces devices for 4G LTE CAT-M1 and 2G, 3G, 4G CAT-1 networks. CAT-M1 is a newer protocol supported by most networks and deliveres extended range from a given 4G tower. Make sure that the 4G network that you are using supports CAT-M1, sometimes referred to CAT-M.

12.3.2 What is Auto-APN?

Later versions of firmware for Senquip devices include a feature called Auto-APN. With Auto-APN, the Senquip device reads data off the SIM and searches a database to try and find a suitable APN. If successful, the Senquip device will connect directly to the network.

12.3.3 My APN is not on the list of Auto-APN options.

If you have a SIM card for which Auto-APN does not work, please contact support@senquip.com to have your service provider details added.

12.3.4 Why does Senquip prefer to operate on the 4G LTE CAT-M1 network?

Senquip supports 2G, 3G, 4G, and 5G LTE networks. We prefer to use the 4G and 5G LTE CAT-M1 service where available.

3G networks are being turned-off in many counties including Australia and New Zealand from 2020. 4G and 5G networks are capable of very high-speed data transfer that is not required for IoT devices. The designers of the networks realized this and introduced IoT specific services NB-IoT and CAT-M1. These services use lower power and achieve extended ranges, meaning longer battery life and better coverage in buildings and remote areas. Senquip prefers 4G and 5G CAT-M1 over NB-IoT as the prior has data rates that allow for in-field updates and the technology allows roaming between towers in mobile applications.

12.3.5 I cannot see my Senquip device on my local Wi-Fi network.

If you know a Senquip device IP address on your local Wi-Fi network, then you can login to the device webserver provided it is active. The webserver will only be active in setup mode unless the *Web Server* option has been selected in general settings.

The webserver will be inactive if the Senquip device is sleeping, to prevent the device sleeping, select the *Device Always On* option in general settings.

The webserver will be disabled if 4G communication options have been chosen as it is a significant security risk to leave the webserver active when operating on an open network.

12.3.6 I am not sure if my Wi-Fi network is reliable enough.

Wi-Fi networks can be affected by the number of transceivers, the geometry of the site and the way in which a Senquip device is mounted. To receive information of the quality of the connection made by a Senquip device, enable the Report Network Info option in endpoint settings. You will be able to map network coverage using this feature.

12.3.7 What SIM card should I use?

Senquip devices use a Micro SIM. The SIM can be either 1.8V or 3.3V. The SIM needs to be for an operator that supports either a CAT-1 (-H devices) or CAT-M1 (-G devices) network.

For volume applications, Senquip can provide devices with SIM cards that are soldered to the PCB during manufacture. Soldered SIMs are more reliable in high vibration environments.

12.3.8 Why does Senquip not allow the webserver to be on when operating on an LTE network?

When a Senquip device is operating on a public LTE network, it will receive an IP address that is open to the internet. If the webserver is enabled, the device may be exposed to malicious attacks by automated *bots* that will try to break the password and gain access to the Senquip device. By turning off the webserver, the risk of attack is eliminated.

12.3.9 I have been using the hotspot on my phone to test Senquip devices and

it is not working anymore.

The Wi-Fi Hotspot feature available on most smartphones is typically limited to between 3 and 5 active device connections. Once this limit is reached, the smartphone will not allow further devices to connect. We note that one some newer smartphones, this limit has been increased to 10. We also note various work arounds to increase this limit.

12.4 GPS / GNSS

12.4.1 Is the Senquip GPS compatible with other GNSS networks?

Yes, the Senquip GPS will receive data from GPS, GLONASS, Bei Dou, Galileo, and QZSS satellites. Senquip uses the term GPS instead of the more correct GNSS because it is more commonly understood.

12.4.2 I have enabled GPS but I am not seeing any GPS data.

To provide GPS data such as position, and speed of satellites, Senquip devices needs to connect to satellite constellations. Ensure that the device is mounted in a location where the device has a clear view of the sky, not through metal. Ensure that the device is mounted with the cable gland down.

In poor reception areas, the device may require additional time to acquire satellite data. Try increasing the GPS Max Time to 240 or even 360 seconds in poor reception areas.

12.4.3 Can I attach a GPS or 4G antenna to my Senquip Senquip device?

No. The Senquip Senquip device has all required antennas internal to the device. This has been done specifically as Senquip Senquip devices are expected to be used in harsh conditions where antennas would be damaged. If you need an external antenna, please use a Senquip QUAD.

12.4.4 How accurate is the GPS on my Senquip device?

With a clear view of the sky, the position accuracy of the GPS is better than 2.5m 50% of the time, and better than 5m 95% of the time.

GPS position accuracy depends on many factors such as the mounting position, orientation, visibility of the sky, weather conditions and time of day. The best position accuracy will always be obtained when the Senquip device is mounted vertically in a position where it has a clear view of the sky. To enhance GPS position accuracy, the Senquip devices track GPS, GLONASS, Bei Dou, Galileo and QZSS satellites.

12.5 Power

12.5.1 Do I need to add AA batteries as a backup in a solar installation?

No. Senquip devices have an internal LiPo battery which, in most solar applications, will be sufficient to power the device during the night and in low sunlight conditions. In low power configurations, the internal LiPo battery can power a Senquip device for months. Use the battery calculator on the Senquip website to estimate how long the internal battery will power your solar setup.

Senquip devices report the internal LiPo battery voltage. It is recommended that the LiPo battery be monitored for a while after a solar install to ensure it is being sufficiently charged by the solar panel.

AA batteries are only required in applications where there is no permanent or solar power available. They can be added as an additional backup when using permanent or solar power.

12.5.2 I am running on solar and am losing data at night and on cloudy days.

It is likely that your solar panel is not supplying enough energy to power your application and charge the Senquip device internal LiPo battery. Monitor the LiPo battery voltage on the Senquip Portal. A charged battery will reach approximately 4.2V. A low battery is below 3.5V.

The simplest way to extend battery life is to increase the Base Interval in general settings.

12.5.3 How can I extend battery life on my Senquip device?

A Senquip Senquip device should be able to last for many years running on AA batteries. To estimate the life of your device, see the battery calculator on the Senquip website. For low power installations such as solar and battery installs, to save energy, consider the following:

- Increase your Base Interval. In applications where measured data is not changing quickly, you may be able to increase the base interval. A longer base interval means that the Senquip device spends more time sleeping between measurement intervals and so saves energy.
- Increase your Transmit Interval. In some applications you may not need every measurement that is taken to be reported but are more interested in receiving an alert when a warning or alarm condition occurs. In these cases, increase the transmit interval so that data is not transmitted on every measurement interval. Once a day measurement may be enough.
- Turn off peripherals that are not needed. If you are not using the serial port, GPS or other peripheral, make sure that they are turned off.
- Reduce the interval of peripherals. A Senquip device mounted on a pole is unlikely to move. One GPS update a day may be sufficient. The GPS, serial and current sources are the most power-hungry peripherals, use them sparingly.
- Consider using voltage sensors instead of current sensors. Sensors like liquid level sensors are often available in current or voltage versions. A 4-20mA sensor will draw 20mA at full scale whereas a voltage version may only draw 1mA. Where using the serial and current sensors, reduce the wait times before measurement and before returning to sleep.
- Make sure that the device is not always on, and that the webserver is off.
- Under endpoint settings, do not send human readable time and network info. The smaller the set of data you send, the lower the power of your device. Send to a single endpoint if possible.
- Senquip is constantly working on code improvements to reduce the power of devices. Make sure that your device is running the most recent firmware version.

12.5.4 I wired my Senquip device incorrectly; have I damaged it?

Senquip devices have protection against the most common wiring faults like reversing the voltage. There are some inputs such as the serial, current sense and thermocouple inputs that can be damaged if connected to supply voltages.

12.5.5 Do I need a fuse in-line with the power supply of my Senquip device?

It is always a good idea to include a fuse in the supply to any electronic device. A 1A fuse would be a suitable size for use with the Senquip device.

12.5.6 I have opened my Senquip device, and the lights are not on.

Your device is most likely sleeping; this is good as it conserves power. The lights will come on when the device next wakes for a measurement cycle. If you want to access the device immediately, press the setup button to access the device webserver or press reset to initiate a re-start that will trigger a measurement cycle. If you want to be able to access your device to make settings changes at any time, select the *Always On* option in the general settings.

12.5.7 The device that I am setting up via the webserver keeps switching off.

The device webserver is activated by pressing the setup button and then connecting to the device Wi-Fi. The device will exit the webserver when settings are saved and it executes a reset, when the lid is closed or when no activity is detected for a few minutes. To ensure that the webserver does not close-down when you are configuring a device, make sure that you do not cover the device light sensor and that you are not inactive for extended periods of time.

12.5.8 Can I use AA NiCd batteries in my Senquip Senquip device?

NiCd batteries are generally rated at 1.2V. Although the Senquip device will operate from 1.2V batteries, they will not last very long. It is recommended to use high quality Alkaline or Lithium batteries. For longest life, use 1.6V or 3.6V lithium batteries.

12.5.9 Can I use 3.6V lithium batteries in my Senquip Senquip device?

Yes. 3.6V Lithium Thionyl Chloride batteries are generally the longest lasting when used with a Senquip Senquip device. The improvement in life is however small when compared with lower cost Lithium Energizer and other brand batteries that are widely available.

12.5.10 How long will the internal LiPo battery in the Senquip device last?

The lithium battery is expected to last 5 years without significant degradation. The life of the battery may be reduced if it is exposed to temperatures above 55°C or below -10°C, if it experienced an unusually high number of charge/discharge cycles or if it is left in a discharged state for an extended time. Spare LiPo batteries can be sourced from Senquip and can be replaced by a qualified technician.

12.5.11 I have received my Senquip device, pressed the setup button and nothing happens.

When Senquip devices are shipped, they are placed in freight-mode to preserve the internal battery and to prevent the device from transmitting when being transported. To exit shipping mode, apply power or insert batteries.

12.5.12 How long can I run my Senquip device off AA batteries?

To achieve maximum life, use high quality Lithium batteries such as Ultimate Lithium from Energiser. Battery life will depend entirely on your application, the rate of measurement, transmissions and the types of sensors attached. As a guide, if your Senquip device was to be left sleeping, it could achieve up to 10 years of life. In a typical battery powered application, where the Senquip device is communicating over GSM, with once per hour updates, the Senquip device can be expected to last 2 years on a set of batteries. The Senquip device can be configured to monitor its batteries and report low battery conditions.

Use the battery calculator available on the Senquip Portal to estimate the battery life of your system.

12.5.13 Why is my AA battery voltage reading lower than I expect?

If you have inserted four 1.5V AA batteries into your Senquip Senquip device, you would expect the battery voltage shown on the portal to be 6V. It may sometimes instead show 5.5V. There is internal resistance in your battery so that when current is drawn from it, the measured voltage drops. If, for instance, the Senquip Senquip device was drawing energy from the AA batteries to charge the internal battery when a measurement was made, the measured battery voltage would be slightly lower than 6V. There is also a small amount of protection circuitry between the battery and the measurement circuit and again, we would expect a small drop across this circuitry.

12.5.14 I haven not used my device for a while, and it is taking a long time to make a first connection.

If you leave a device unpowered for an extended time and you have set the Senquip device in a high-power mode by for instance setting a fast update rate, the internal LiPo battery will have run flat. When the Senquip device first receives power, it evaluates the internal LiPo battery and if it is found to be extremely flat, the Senquip device will pre-condition the LiPo before resuming normal operation. If you open the lid during pre-conditioning, you will see the green light pulsing slowly during pre-conditioning.

12.5.15 How do I make a Senquip device safe for shipping?

Put the device in freight mode. In freight mode, the battery drain is reduced to almost zero and all transmitters are turned off. Enable freight mode via the webserver, on the Senquip Portal in the Admin page, or from setup mode by pressing the setup button 3 times.

The device will exit freight mode when power is applied or batteries are inserted.

12.6 Setup

12.6.1 If I perform a factory reset, will I lose my settings?

Yes. A factory reset will remove all your settings including your network settings. After performing a factory reset, you will need to connect to the device via the internal webserver to re-establish an internet connection.

12.6.2 I performed a factory reset and I cannot remember a setting.

Go to the settings page for the device and open the command queue at the top of the page. You will be able to see a log of previous settings applied to the device.

12.6.3 If I perform a firmware update, will I lose my settings?

No. Performing a firmware update preserves your settings. If the firmware update introduces new settings, these will be set to the default value. Note that updates to major firmware revisions may reset some variables such as non-volatile variables used in scripts and hour meters.

12.6.4 Can I save my settings to a file?

Yes. You can export your settings, scripts and Senquip Portal settings to a file using the export settings option in the admin settings. Before exporting your settings, you will need to use the Request Device Settings option to get the latest settings from the Senquip device.

12.6.5 Can I save settings to another device?

Yes. Use the Import Settings option in the admin settings to import settings from another device.

12.6.6 I have lost my password, what can I do?

If you have lost the original device password, please contact support@senquip.com who will assist you in recovery.

If your device is connected to your Senquip Portal account, you can continue to view device data and make configuration changes. If you have changed your password, and have forgotten your new password, a factory reset will restore the original device password.

12.6.7 How long does a firmware update take?

The time taken to perform a software update depends on the network type chosen and the signal strength of the connection. A typical update over Wi-Fi will take 5 minutes and an LTE update will take 15 minutes. The orange light will flash during the update process. If the upload is interrupted, it will need to be restarted. A failed firmware upgrade will not harm the Senquip device.

12.6.8 If a firmware update fails, will my Senquip device be harmed?

No. If a firmware update fails, your Senquip device will not be harmed. The Firmware update will need to be restarted.

12.6.9 My device is not accepting a firmware update.

In some instances with short base intervals and lots of data being transmitted, the Senquip device may not have the capacity to process a firmware update. In this instance, reduce the base interval to 60 seconds and then apply the firmware update. Once complete and with the device reporting the new firmware version, change the base interval back to the required rate.

12.6.10 How can I force a Senquip device to accept a change made on the Portal if it is sleeping?

Since the device will not contact the Senquip Portal during sleep, no changes can be made until the next transmit interval. To force a device to make immediate contact, press the reset button. After reset, contact is made with the Senquip Portal, and any outstanding settings will load. This is most useful when you have set a long sleep period and want to test a quick change before deployment.

12.7 Operation

12.7.1 Is the time on my Senquip device accurate?

Yes. At boot, the Senquip devices connects to an available network and queries time from an NTP server such as Google NTP. If an NTP server is not available, the device will try to retrieve time from the LTE network and failing that, from the device GPS.

12.7.2 How often is time synchronised on a Senquip device?

Senquip devices renew their time sync every 6 hours. Time between refresh is maintained by a crystal derived source in the device.

12.7.3 Why does the first measurement after a reset take longer?

After a reset, a Senquip device needs to load the operating system into memory, configure itself and load user settings. This can take a few seconds.

12.8 Scripting

12.8.1 Does my script run in the Senquip Portal?

No. Your script will run on the Senquip device in field. This means that your script will continue to execute even if your device loses contact with the network.

12.8.2 How do I get access to scripting?

To request access to scripting, please send a message, using the email address associated with your

Senquip Portal account to support@senquip.com.

12.8.3 I cannot see the scripting icon on the device page.

To request access to scripting, please send a message, using the email address associated with your Senquip Portal account to support@senquip.com.

12.8.4 How can I tell if there is an error in my script?

Limited error detection is available real-time in the scripting page. For feedback on why a script that looks ok in the editor has failed, turn on Send Errors in the scripting window. Errors will show up as script events in the events widget on the device page.

12.8.5 My script looks ok in the editor but is failing to run.

The most common source of problems with scripts is the use of JSON keys that do not exist. If, for instance, GPS speed is used in a script, but the GPS loses satellite lock, the GPS speed key will no longer be available. When the script tries to use GPS speed, the script fails. Use a function like if ((typeof obj.analog1 === "number") to check that a variable exists and is of the correct type before using it.

12.8.6 If my script fails, with my Senquip device fail?

Maybe. In general, if a script fails to end correctly, the script will terminate, and the device will continue to run. Scripting is an advanced feature, and an incorrectly written script can cause a Senquip device to fail or even brick a device. Read the scripting guide carefully before committing a script.

12.8.7 My script looks ok, but I get a calling non-callable error.

Your script may be trying to use a function that is not available in the version of firmware that you are using. Update to the latest firmware version before using scripting.

Chapter 13

Glossary

jubilee-clips

A Jubilee-clip, also known as a hose clamp, is used in conjunction with the supplied brackets when pole mounting the ORB-X1.

certificate-authority

A certificate authority (CA) is a trusted entity that issues digital certificates, which are data files used to cryptographically link an entity with a public key. Certificate authorities are a critical part of the internet's public key infrastructure (PKI) because they issue the Secure Sockets Layer (SSL) certificates that web browsers use to authenticate content sent from web servers.

ASCII

American standard code for information interchange. Developed by American National Standards Institute (ANSI), it is the most common code used by computers to translate text (letters, numbers, and symbols) into a form that can be sent to, and understood by, other computers and devices such as modems and printers.

LTE-M1

LTE Cat M1 is a low-power wide-area (LPWA) air interface that lets you connect IoT and M2M devices with medium data rate requirements (375 kb/s upload and download speeds in half duplex mode). It enables longer battery lifecycles and greater in-building range, as compared to standard cellular technologies such as 2G, 3G, or LTE Cat 1

3G & 4G

3G was the first "high speed" cellular network, and is a name that refers to a number of technologies that meet IMT-2000 standards. 4G is the generation of cellular standards that followed 3G, and is what most people use today for mobile cellular data. You can use 3G and 4G for IoT devices, but the application needs a constant power source or must be able to be recharged regularly.

MODBUS

Modbus RTU is an open, serial (RS-232 or RS-485) protocol derived from the Master/Slave architecture. It is a widely accepted protocol due to its ease of use and reliability. Modbus RTU is widely used within Building Management Systems (BMS) and Industrial Automation Systems (IAS). This wide acceptance is due in large part to MODBUS RTU's ease of use.

JSON

JavaScript Object Notation (JSON) is a standard text-based format for representing structured data based on JavaScript object syntax. It is commonly used for transmitting data in web applications (e.g., sending some data from the server to the client, so it can be displayed on a web page, or vice versa).

NIST

The National Institute of Standards and Technology (NIST) is a physical sciences laboratory, and a non-regulatory agency of the United States Department of Commerce. Its mission is to promote innovation and industrial competitiveness. NIST's activities are organized into laboratory programs that include nanoscale science and technology, engineering, information technology, neutron research, material measurement, and physical measurement.

LiPo

A lithium polymer battery, or more correctly lithium-ion polymer battery (abbreviated as LiPo), is a rechargeable battery of lithium-ion technology using a polymer electrolyte instead of a liquid electrolyte.