Sealite®
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SL-C510 With AIS

Compact 5-9NM Solar Marine Lantern

INSTALLATION & SERVICE MANUAL

V1-3

Version No.	Description	Date	Author	Approved
1.0	Manual Launch	June 2019	J.Ohle / M.Nicholson	M.Nicholson
1.1	Update AIS Battery images	August 2019	M.Dutka	M.Nicholson
1.2	Lantern Data Update	July 2020	M.Dutka	M.Nicholson
1.3	Update to AIS programming procedure	November 2020	M.Dutka	M.Nicholson

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Introduction

Congratulations! By choosing to purchase a Sealite lantern you have become the owner of one of the most advanced LED marine lanterns in the world.

Sealite Pty Ltd has been manufacturing lanterns for over 25 years, and particular care has been taken to ensure your lantern gives years of service.

As a commitment to producing the highest quality products for our customers, Sealite has been independently certified as complying with the requirements of ISO9001:2015 quality management system.

Sealite lanterns comply with requirements of the US Coast Guard in 33 CFR part 66 for Private Aids to Navigation.

By taking a few moments to browse through this booklet, you will become familiar with the versatility of your lantern, and be able to maximise its operating function.

Operating Principle

The solar module of the lantern converts sunlight to an electrical current that is used to charge the battery. The battery provides power to operate the lantern at night.

The flasher unit has very low current requirements. A microprocessor drives multiple ultra-bright LED's (Light Emitting Diodes) through a DC/DC converter, which enables the LED's to operate within the manufacturer's specifications. The battery is protected from over-charging within the circuit to ensure maximum battery life.

On darkness, the microprocessor will initiate a program check and after approximately 1 minute begin flashing to the set Flash Code.

Technology

Sealite is the world's fastest growing manufacturer of marine aids to navigation. We employ leading mechanical, optical, hardware & software engineers to create innovative products to service the needs of our customers worldwide and offer the widest range of solar-powered LED lanterns in the marketplace.

Electronics

Sealite employs leading in-house electronic engineers in the design and development of software and related circuitry. All individual electronic components are sourced directly by Sealite procurement staff ensuring that only the highest quality components are used in our products.

LED Technology

All marine lanterns use the latest advancements in LED technology as a light source. The major advantage of LED's over traditional light sources is well established in that they typically have an operational life in excess of 100,000 hours, resulting in substantial savings to maintenance and servicing costs.

Precision Construction

Commitment to investing in the design and construction of injection-moulded parts including optic lenses, light bases and a range of other components ensures that all Sealite products are of consistent and superior quality.

Optical Performance

Sealite manufactures a range of marine LED lenses moulded from multi-cavity dies. The company has superior in-house lens manufacturing capabilities to support outstanding optical performance.

Award-winning, Patented Technology

Several United States and Australian patent registrations are held on Sealite's range of innovative designs, with other regional patents pending in Canada, United Kingdom and Europe.

SL-C510 With AIS
Compact 5-9NM Solar Marine Lantern

The SL-C510 with AIS is a robust, completely self-contained 5-9NM Solar LED Lantern specifically designed to withstand the tough marine environment to provide years of reliable, low maintenance service. The 3 & 4 hole bolt pattern base fits directly onto existing 200mm bolt pattern industry standard mounts for ease of installation.

The four (4) premium-grade solar modules are integrated into the assembly, and mounted to collect sunlight at all angles. The SL-C510 with AIS has a large power supply consisting of four 8.4-watt panels (33.6 watt total) making this model perfect for use in lower sunlight areas or where more demanding duty cycles are required.

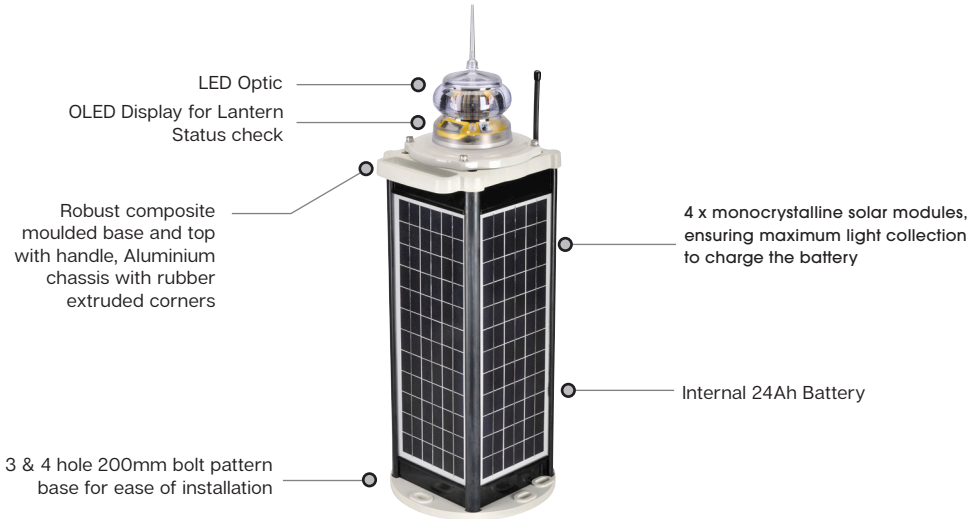
The base and top of the lanterns are made from composite moulded polymer with UV-stabilised rubber corners and gaskets providing a superior IP68 – the best in the industry. A handle is incorporated into the chassis for safe lifting.

The tough, polycarbonate lens is specifically designed for use with LEDs and incorporates an environment-friendly spike to deter unwelcome bird life. The lens design also ensures that vessel operators clearly see the light from above when passing the AtoN. The design incorporates a conveniently located OLED (Organic Light-Emitting Diode) screen with touchpad allowing maintenance personnel to check the diagnostics of the lantern with the touch of a button.

Completely programmable via the new Bluetooth® connected SealitePro® mobile application, the SL-C510 with AIS can be configured and monitored from a distance up to 50 metres. An in-built solar calculator confirms the lanterns ability to operate at the set location, ensuring optimal operating performance.

The SL-C510 with AIS is available with GPS Synchronisation as standard. Two (2) or more lights can be synchronised to flash in unison via an internal GPS module.

The SL-C510 with AIS is backed by Sealite's industry leading 3-year warranty.



Product Components

The following components come as standard with each lantern:

- **SL-LA510 lantern**
- **SL-S2A2 510 Chassis**
- **Quick Start Guide**
- **USB Programming Cable**
- **USB Memory Stick**

Optional

- **IR programmer remote**

These components are securely packaged within protective wrap in a carton and shipped to you.

Please check that ALL of these components are included with your order and contact your Sealite representative as soon as possible if anything is missing.

Installation

Your SL-C510 with AIS is supplied with an internal ON/OFF switch. In the OFF position (as supplied), power is removed from both the AIS module and the lantern. The internal solar charging circuitry will continue to operate normally.

Charging the Battery
New lanterns should be left in the sun with the internal switch in the OFF position for 1-2 days to ensure battery is charged. Alternatively, the external charge port can be used to charge the battery (charger sold separately). Ensure battery voltage is >13V before placing into service.

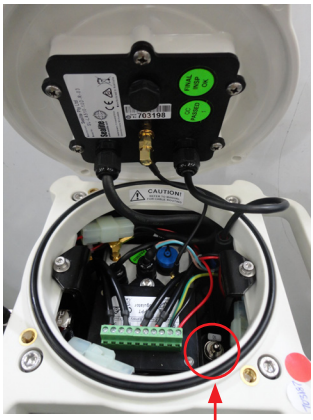
Preferred Installation Location
For best lantern performance, ensure solar modules are not covered and are in clear view of the sky with no shadows.

The AIS should be programmed whilst the unit is in the OFF position. Please refer to the AIS section of this manual for programming.

Lantern Installations Settings
The lantern can be programmed via 2 methods,
1. Bluetooth connectivity via the SealitePro® App (recommended);
2. Via the optional Sealite IR Controller (optional);

The SealitePro® and Sealite IR Controller Instructions are included in this manual.

Lantern Operation
The lantern is activated by switching the internal ON/OFF switch. Flash Codes and Intensity settings need to be set via the SealitePro® App or the Sealite IR Controller.



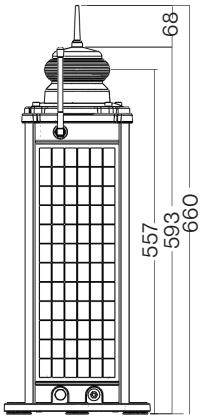
On/Off Switch

1. Remove the four socket-head screws on the top of the lens assembly and lift the SL-C510 with AIS (light head) assembly from the solar chassis. Ensure minimal disturbance or movement of the internal wiring.
2. Switch internal ON/OFF switch to ON.
3. Carefully place the light head assembly back onto the chassis ensuring the O-ring is properly placed.
4. Replace the four (4) socket head screws. Sealite recommends that the light head be tightened onto the solar chassis base using a general purpose “grip tool”, similar in shape to a screwdriver, however with the appropriate hex key head fitted.

   To achieve a satisfactory seal, it is recommended that a torque of 3Nm is applied to the bolts used for holding down the Light Head to the Solar Base and that only the supplied bolts are used.

   Applying a higher torque setting is not recommended and may void warranty. If in doubt, please contact your local Sealite representative.

5. To test, place a dark cover (towel or jacket) on top of the light to activate sensor. The light will come on within thirty seconds.
6. The unit should be bolted to an even, flat surface.
7. Ensure that the earth stud is connected to ground.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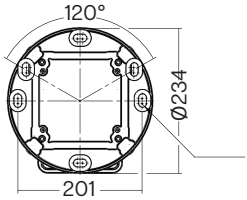

120°
Ø234
201
Slot 12.6 x 21.75
6 Locations

Viewing Lantern Settings

The SL-C510 with AIS models are equipped with a very low power consumption OLED display, providing a quick and easy lantern status and diagnostic checks by maintenance staff.

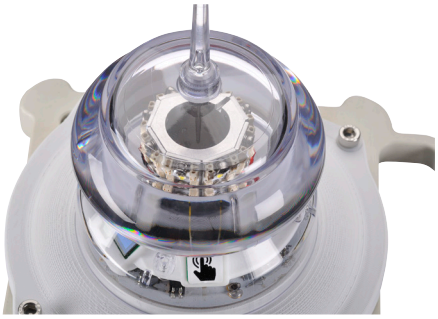
To activate the OLED display simply touch the indicated location. Once activated, the OLED will display in sequence the following information:

- Product Version
- Product Model
- Lantern Operational Mode
- Lantern Flash Character
- Lantern Intensity
- Battery Voltage
- Lantern Status
- Lantern Hibernation Status and settings
- Lantern last accessed date

The OLED system will continue to display the lantern settings/status in a sequential manner unless the Touch Pad is activated for a second time, this action will allow the OLED display to stop on the information showing at the Touch Action. To visualise the remaining information simply “Tap” the Pad again then the system will display the next set of information.

When the Touch Pad device is inactive for more than three minutes the OLED display will enter in sleep mode and can only display the lantern settings/status if the Pad device is activated again.

NOTE – The OLED display and Touch Pad components are designed to provide lantern settings/status readings only, the lantern programming can be achieved by one of the Sealite lantern programming methods, the information is available in this product manual.



Summary of Lantern Status

The following summary indicates the data that can be visualised on the Lantern OLED Display.

Display	Description
Sealite V1.08	Displays the manufacture revision number
Operation Mode Standby	Indicates the lantern current operation mode: Standby - The lantern is configured in a minimum current state; Always on – The daylight sensor is disabled and lantern set to operate day/night time; Dusk till Dawn – The daylight sensor is monitored and the lantern will only operate at night time.
Flash Code:0F4 0.2 1.3	Indicates the lantern current Flash Code. This information provides Sealite's Flash Code in Hex decimal and the on/off flash duration. Please refer to the provided list of Flash Codes included in the appendix.
Range / Intensity High (100%)	Displays the lantern operating intensity in percentage. The SL-C510 can provide four different intensity levels in percentage or with a step size of 3.125% (or 1/32%) nautical miles when set by range. • Low (25%) • Medium (50%) • Medium High (75%) • High (100%)
Battery Voltage 12V	Indicates the lantern real-time battery voltage level.
Status OK	Displays the lantern current operating status. This include the information for: • Battery health conditions; • LED fault
Hibernation Disabled	Indicates if the Hibernation Mode is enabled or disabled. In the case of enabled the unit will indicate the hibernation start and finish dates (day/month).
Last Visit 10 JUL 2018	Indicates the last time the light has been accessed either via touch pad or SealitePro® App.
Test LED Test Off	On first touch test on, or when screen off, the screen will go into Test Mode for 5 seconds.

Programming the Lantern

SealitePro® Bluetooth Guide

The SealitePro® application is used to communicate with Sealite lighting products that have Bluetooth technology fitted. The Bluetooth control offers the following main functionality:

- Lantern Information
- Lantern Status
- Solar Calculations
- Programming Options
- Power Monitoring
- Manufacturing Data
- Advanced Operations

The SealitePro® Application is available on both Android and iOS devices. Most functions between platforms are identical and the majority of the screenshots in this manual where taken showing an iOS device screen. Where the Android device differs, both visual options have been provided.

Bluetooth® Controller Functions

The Sealite SL-C510 with AIS Bluetooth® Control System accessible via the SealitePro® App is divided into seven simple sections as outlined below and displayed on the App home screen;

Lantern Information

- Lantern Identification
- Lantern Type
- Lantern Name
- Bluetooth Authentication
- Lantern Colour
- Lantern Peak Intensity
- Lantern Battery Option

Lantern Status

- Battery Voltage
- Status Flags
- Lantern Geolocation

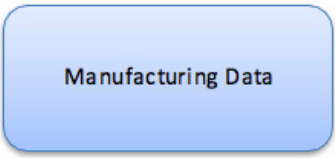
Solar Calculations

- Solar Calculator Options
- Solar Charge
- Autonomy

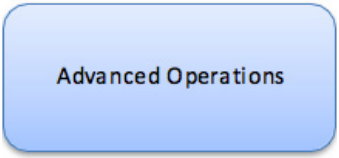
Programming Options

- Operating Mode
- Flash Code
- Intensity
- Sync Offset
- GPS Mode
- Hibernation
- Lux Level
- GSM Power

- Load Current
- Load Current – Last Hour
- Load Current – Yesterday
- Charge Current
- Charge Current – Last Hour
- Charge Current - Yesterday



- Hardware
- Board Serial Number
- Manufacture Date
- Software Version



- Test LED
- Perform Factory Reset

Accessing the SealitePro® App for the first time

Opening the SealitePro® App on an Android or iOS Device

Download the SealitePro® App from Google Play (search for “Sealite” in the store) on an Android Tablet or Smartphone or via the App store on an iOS tablet or phone. Open the App to prompt the Sealite Bluetooth control system.

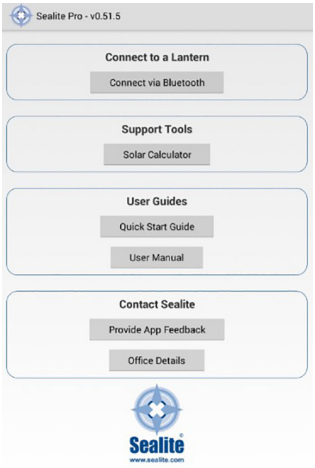
Start Menu

- Connect via Bluetooth - connect to a lantern.
- Support Tools - Solar Calculator to conduct simulations based on lantern settings and locations.

  NOTE – This feature provides lantern simulations only in regard to battery autonomy on solar radiation.

  Changes may be applied through “Connect via Bluetooth” option only.
- User Guides – Quick Start Guide and User Manual

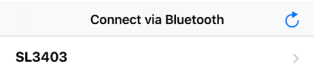
Contact Sealite / Us – Provide product feedback and contact Sealite



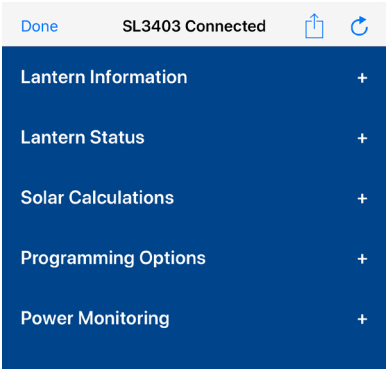
Scan for Lanterns

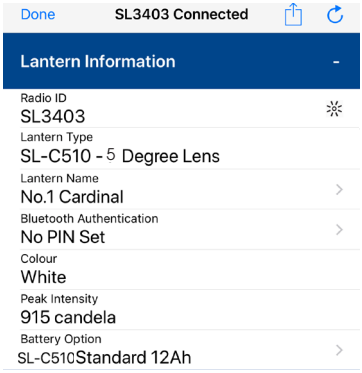
When the “Connect via Bluetooth” option is selected, the App will automatically scan for lanterns equipped with Bluetooth within range.

- Select the lantern which requires setting or verification.



Expand the “Lantern Information” section if collapsed.



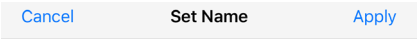


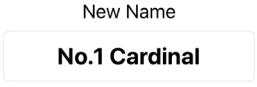
Identify Bluetooth Radio ID

When “Identify” on the Tablet or phone is selected, the connected lantern will flash quickly (10 times). For iOS, identify is represented by a flash / burst icon.

Set the Lantern Name

1. Press “Name” to change the lantern name. A user defined name, comprising up to 16 alpha- numeric characters (and -, $, # @) can be typed into the dialogue box. It is recommended that the lantern be programmed with a unique name.
2. Press apply and then Set to confirm.

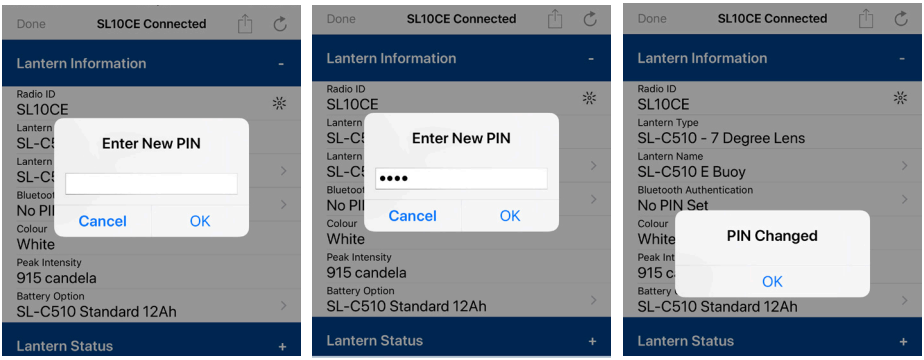




Create Security Access PIN

The factory default does not set the lantern with a Security PIN.

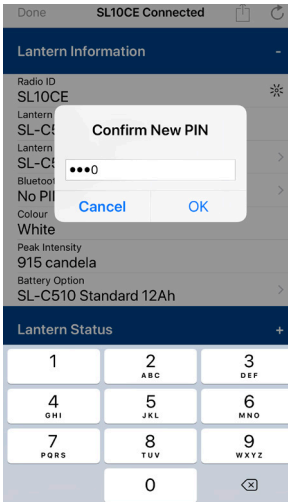
1. To set a PIN, select “Authentication Level” (“Bluetooth Authentication for iOS”) then enter a New PIN and press “OK”. A confirmation of the PIN will be prompted.
2. Re-enter the same PIN and press “OK”.



Modify Current Security Access PIN

1. To set a new Security Access PIN select “Authentication Level” (“Bluetooth Authentication for iOS”) and type the current Security PIN.
2. After validation the App will request for the current PIN to be re-entered. After confirmation enter the new Security PIN then confirm the new PIN.

Note - If the Security PIN is lost, see Password Reset Procedure. Also note that PIN ‘0000’ is reserved and will result in the lantern having no PIN.



SealitePro® Password Reset Procedure

In the event where the password set is unknown the procedure below should be followed:

Step 1 – Disconnect the power supply from the light head:

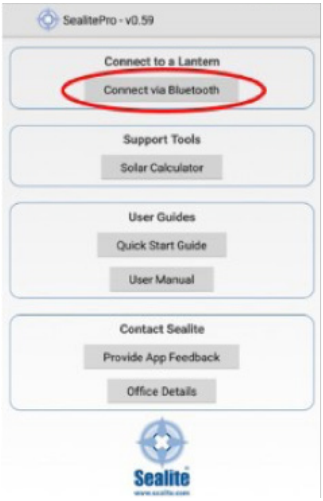
(a). Remove the four socket-head screws on the top of the lens assembly and lift the SL-C510 (lantern head) assembly from the solar chassis.

(b). Disconnect the 4-Pin connector that joins the battery to the light head, then immediately re-connect the battery and the lantern again.

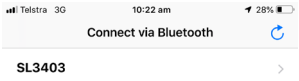
Step 2 – Connect to the lantern using the SealitePro®:

Once the light head and battery are re-connected ensure the following procedure is conducted within one minute. Otherwise the process at step 1 will need to be completed.

(a). Connect to a lantern by pressing "Connect via Bluetooth®"



(b). Select a lantern displayed on the "Connect via Bluetooth" screen.

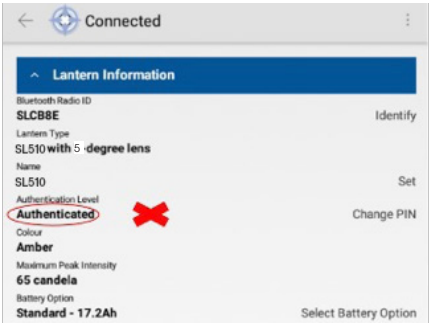


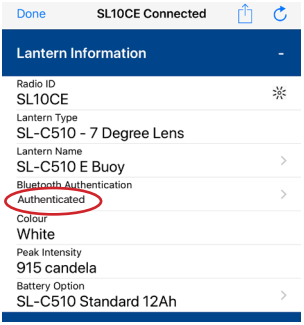
Where examples are identified side by side, the left is applicable to Android devices and the right image to iOS devices.

(c). Expand the “Lantern Information” drop down menu then press select “Authentication Level” (“Bluetooth Authentication for iOS”).

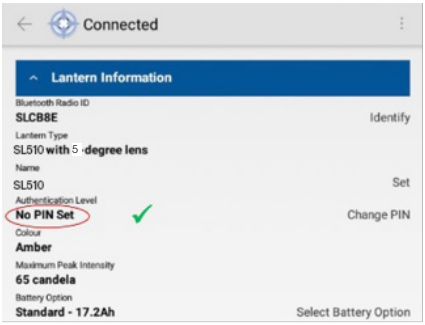
NOTE – If “User Authenticated” under “Authentication Level” or Bluetooth Authentication appears the limited time that allows to modify the PIN has expired.

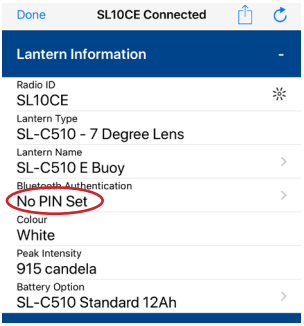
Therefore, start the process again at Step 1;





(d). If “No PIN Set” appears under Authentication Level, please press Change PIN;





(e). Enter a New PIN and press “OK”. A prompt to confirm PIN will appear. Re-enter the same PIN and press “OK”.

(f). One the procedure is complete, ensure the 4 socket head screws are replaced to secure the light head and solar chassis.

- **Colour Menu**

  Displays the lantern colour (White, Red, Green, Blue or Yellow)

- **Peak Intensity Menu**

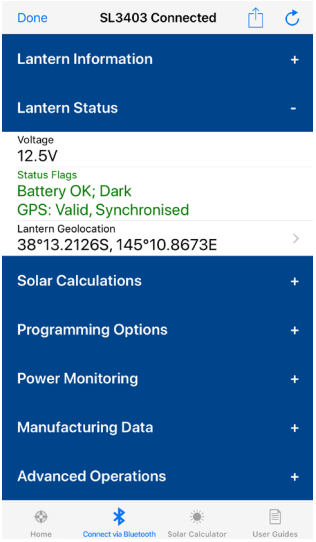
  Displays the Lantern Maximum Intensity in candelas (cd) based on the LED Colour.

- **Battery Option**

  This section displays the battery size capacity in Ampere hour (Ah) and is configurable.

Lantern Status

From the "Lantern Status" section the user can verify the current lantern status

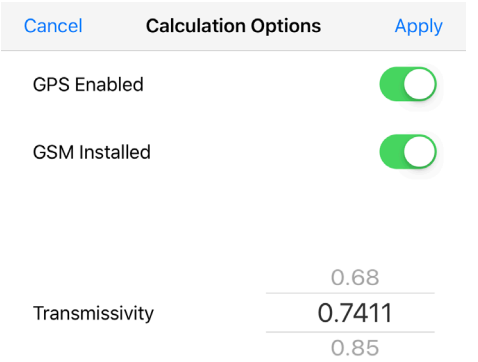


- **Voltage**
  The battery health status.
- **Status**
  Displays the battery health status, the current light sensor state and if the GPS is enabled, synchronised or off station. Any warning states will cause the status to be shown in amber or red.
- **Lantern Geolocation**
  Displays the lantern coordinates and allows the location to be plotted on a map.

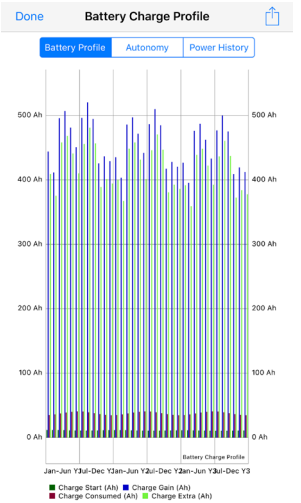
Solar Calculations

This function estimates the lantern autonomy based on the lanterns current settings and geolocation.

- **Solar Calculator Options**
  The SL-C510 with AIS has options to be fitted with Satcoms and GSM modules to allow multiple lanterns synchronisation and monitoring. The SealitePro® App offers the user the option to modify the GPS and GSM by enabling or disabling the operation. In addition, it offers different levels of transmissivity conditions for accurate solar calculations.



- **Solar Charge**
  This function estimates whether the collected solar charge is sufficient to replenish battery consumption and will indicate if the unit is viable for the selected location.

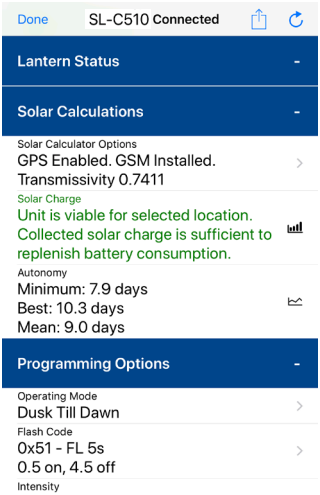


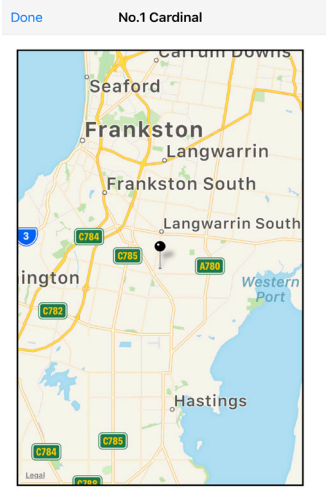
- **Autonomy**

  This function estimates the lantern autonomy based on the lantern settings and geolocation.

- **Option 1**

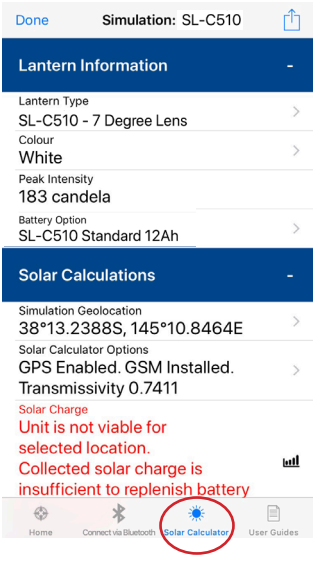
  Use the current GPS location to establish the lantern autonomy.



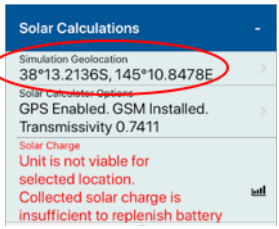


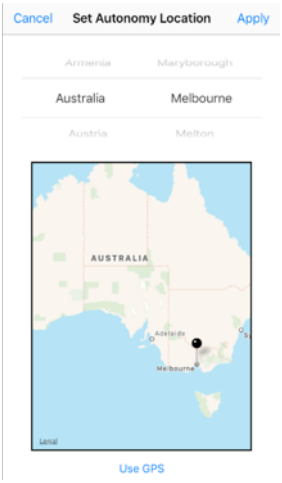
- **Option 2**

  An alternate method for setting the calculator is by using the “Solar calculator” function. Select your product from the option(s) available, then select “Simulation Geolocation”.



Set Autonomy Location - Select a location globally to estimate the lantern autonomy if installed at that location



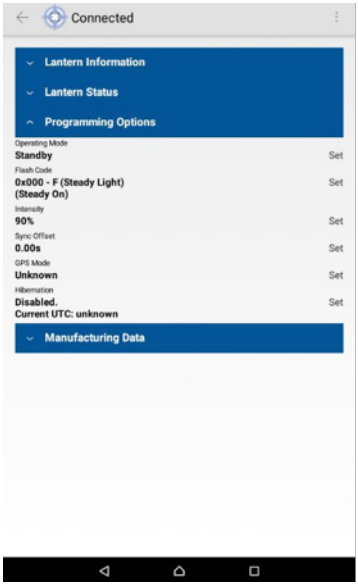


The autonomy will be shown in amber or red if the configuration is not recommended.

Programming Options

Operating Mode:
To change the Operating Mode, press the Operating Mode field and then select one of three available options:
Standby - The lantern is configured in a minimum current state in which the LEDs are always off and the internal GPS is disabled.
Always on – The daylight sensor is disabled, and the lantern operates according to the set flash character and intensity levels.
Dusk till Dawn – The daylight sensor is monitored, and the lantern will only operate at night time.

Once the Operating Mode is selected press “Set / Apply“ to confirm the change. As factory default the lantern is always set to Dusk till Dawn mode.



Flash Code
Sealite marine lanterns may be set to any of the 256 IALA recommended flash characters which are user-adjustable on site.

SEALITE® code reference is listed by the number of flashes. For the latest version of this document visit www.sealite.com or email info@sealite.com

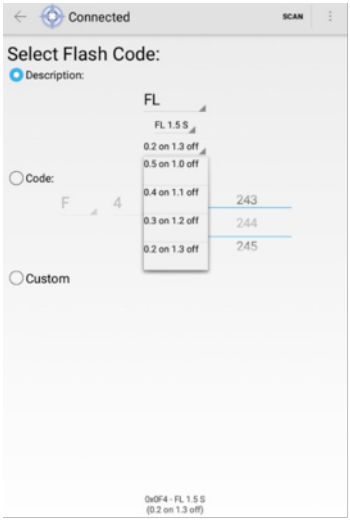
Symbols

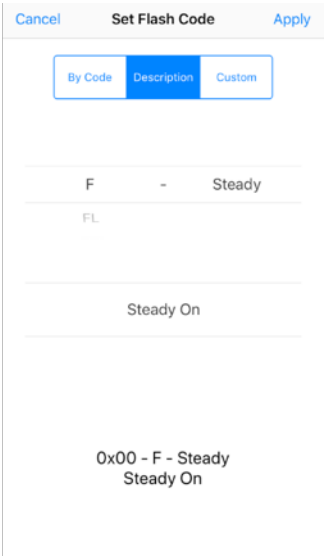
FL	Flash followed by number Eg. Fl 1 S, one flash every second
F	Fixed
Q	Quick Flash
VQ	Very Quick Flash
OC	Occulting; greater period on than off
ISO	Isophase; equal period on and off
LFL	Long Flash Long
MO	Morse code ( ) contains letter

To start the Flash Code settings press on the Flash Code field:
There are three ways to modify the lantern Flash Code:

1. **Description:** Modify the Flash Code by selecting the type and length (on/off) of the flash. Once the Flash Code is established press “Set / Apply” to confirm the change.

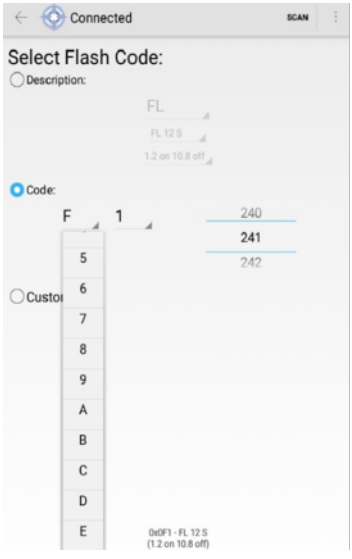
Please Note – The number of flashing combinations are limited, for more information please check the Sealite Flash Code table provided in the Appendix Section.



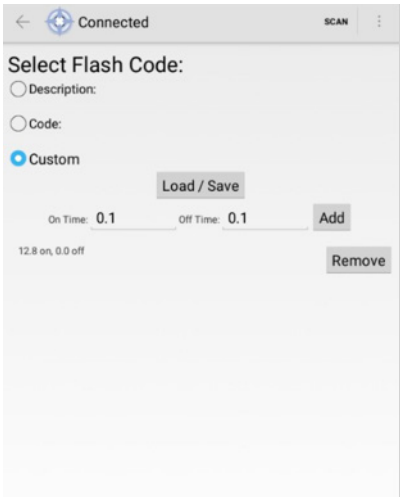


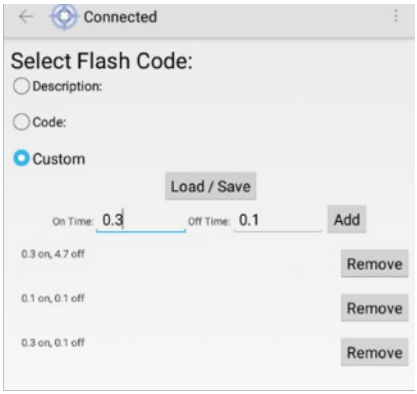
2. **Code –** Select the Flash Code from the Sealite Flash Code table provided in the Appendix section. Once the Flash Code is established press “Set / Apply” to confirm the change.

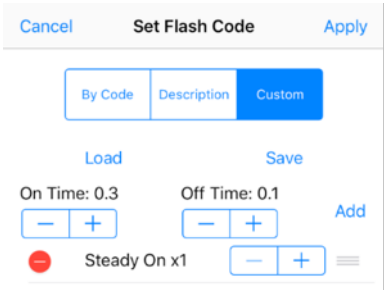
Please Note – The number of flashing combinations are limited. For more information please check the Sealite Flash Code table.



Custom – Create sequences of custom Flash Codes by nominating the on/off times. Once the Flash Code is established press “Set /Apply” to confirm the change. To add multiple flashing configurations, press “add” for each configuration.





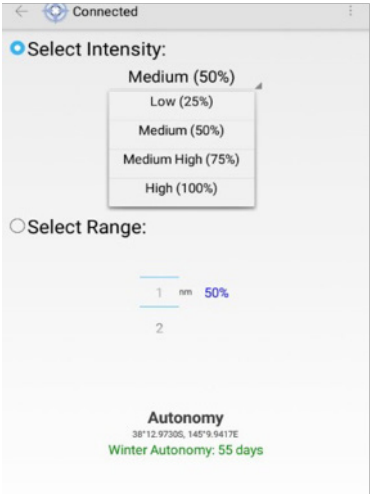


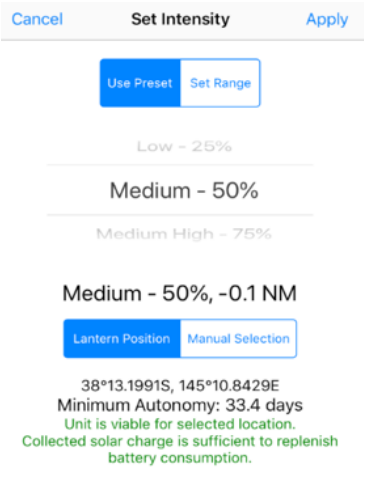
Custom
Steady On

Custom
0.3 on, 0.1 off x3

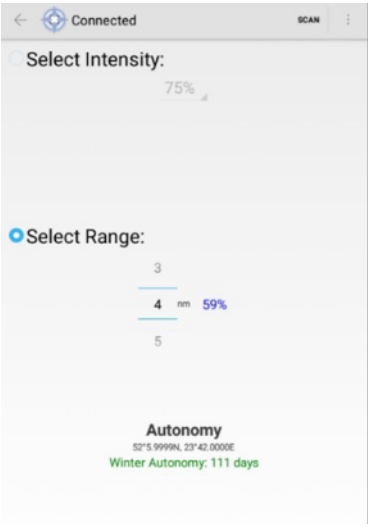
Intensity
The lantern intensity level can be set by either defining the operating range of the lantern (in nautical miles) or by entering the available percentage intensity level.
When Schmidt Clausen is applied, the lantern will automatically adjust the intensity level based on the entered range and Flash Code setting. The intensity level is automatically adjusted each time a new range is set.
NOTE: This does not apply for changing Flash Code - the user must re-set the intensity.

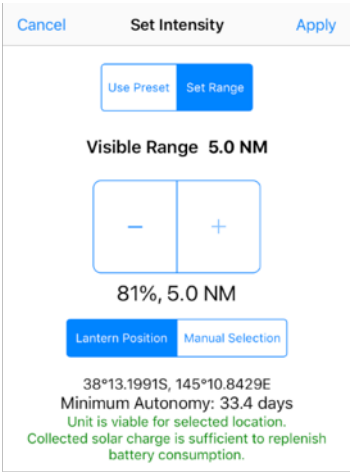
Select Intensity – Choose one of four intensity values - 25%, 50%, 75% or 100%.





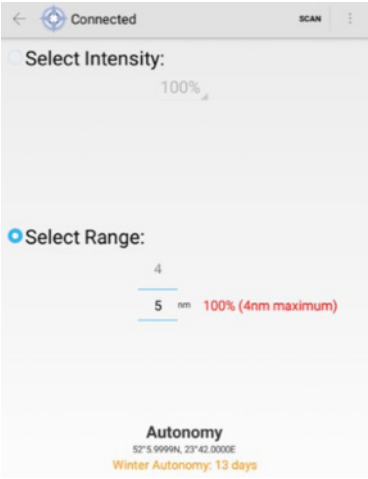
Select Intensity – Choose one of Nautical Miles ranges available.





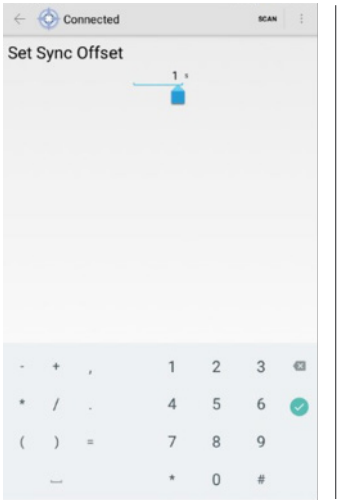
NOTE – If an intensity level is selected that is beyond the specification of the lantern, the entered figure will be displayed in red, with the lantern automatically configuring to the maximum possible of 100%.

In addition, once the intensity is selected the winter autonomy will be recalculated.



Sync Offset
This panel is used to set a Flash Code delay. The built-in GPS receiver and advanced software of the Sealite synchronised lanterns allow for the adoption of Sync Offset channel marking – a unique system that cascades the flash synchronisation of channel lanterns in a uni or bi-directional flash pattern. By default, this figure is set to zero.

Press Sync Offset type a value in seconds and then press “Set / Apply” to confirm the change.



GPS Mode
The lanterns come fitted with a GPS module, and provide the user with the ability to install independently operating lanterns that all flash in Synchronisation. No additional power supplies, aerials or control systems are required and with its microprocessor-based system, the GPS is specifically designed to provide maximum reliability and performance over a wide range of environmental conditions.

On the SealitePro® App the user has the option to modify the GPS mode by selecting to enable or disable the GPS operation.

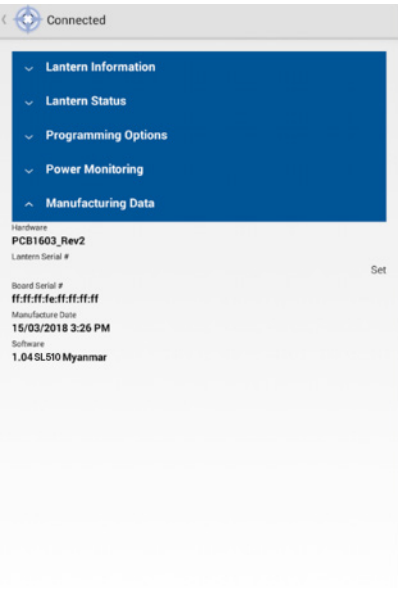
Hibernation

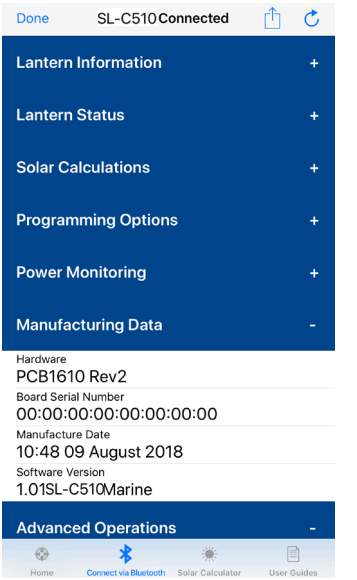
Hibernation Mode maximises conservation of the battery power by disabling the light (will not activate at night) and shutting off the GPS receiver to rely on the internal clock for date checking.

Hibernation Mode can be set by programming a start date and end date via the SealitePro® To enable the Hibernation Mode, tick on the top left box then select the Hibernation start date and Reawaken date. Press “Set / Apply” to confirm the settings.

Manufacturing Data

When connected via Bluetooth, data about the lantern hardware will appear on the “Manufacturing Data” tab. From this drop-down tab the user will be able to verify the information that identifies the lantern’s internal electronic hardware and firmware versions. Moreover, the Lantern Printed Circuit Board Serial number is identified.





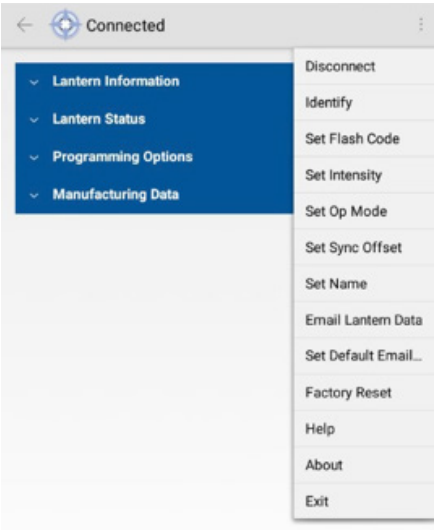
Let's try a practical example

If Bluetooth connection is established, data about the lantern battery charge and load current will appear on the "Power Monitoring" tab. From this drop-down tab the user will be able to verify the amount of battery charge that the lantern was able to capture in the previous 24 hours. In addition, the information of load current through the system can be monitored.

Quick Access Tab

The SealitePro® App also allows a quick access tab offering the user access to the main setting functions of the lantern, applicable to Android devices only.

By touching the menu button, a drop down menu will pop showing the setting functions available.



In addition, the quick access tab offers other additional functions:

- **Disconnect:**

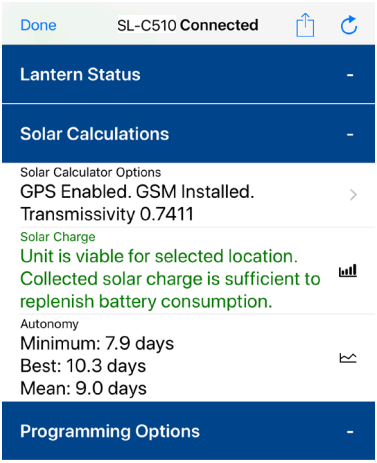
  By touching "Disconnect" it will automatically disconnect the control device from the lantern.

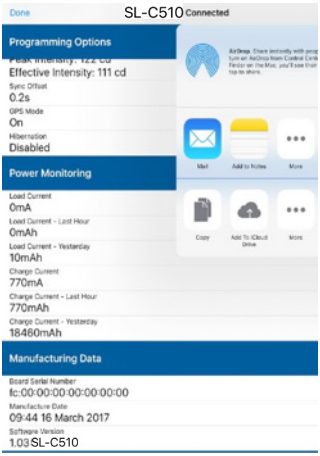
- **Email Lantern Data:**

  This function allows to send the lantern configuration and status via email.

- **Email Lantern Data:**

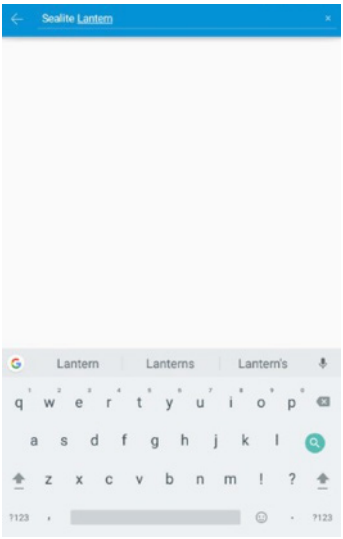
  This function allows to send the lantern configuration and status via email.





- **Set Default Email* Note Android only**

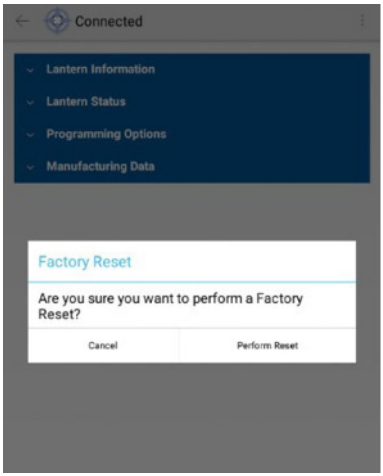
  This option allows to search for an existing contact on the device to use as the default recipient of configuration and status emails.

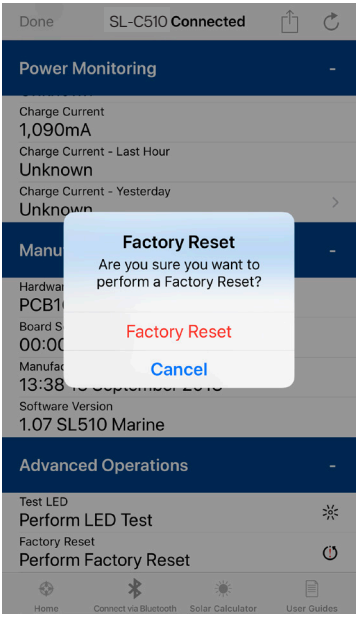


· **Factory Reset:**

This feature will reset automatically all previously lantern settings to a Factory Reset. If the option is selected, a confirmation message will display to confirm. Select “Perform Reset” to confirm the reset.

Please Note – Applying the Factory Reset will also reset the Security Pin if one was set by the user.





SealitePro® Troubleshooting

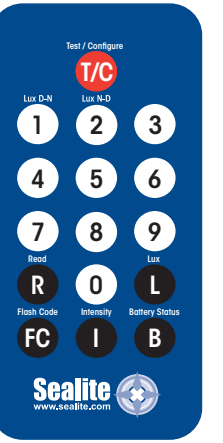
Questions	Answer
I purchased a lantern fitted with a GPS for synchronisation. However, it appears not to work.	If the GPS is not functioning ensure the GPS is enabled. Select “Programming Options” then check under GPS mode. If “off” appears, the GPS is disabled. Tap on “Set”, then select “Normal” to enable the GPS.
Can you use the Solar Calculator under “Support Tool” to verify a Lantern Autonomy then set the lantern configuration from there?	No. The actual lantern settings can only be performed through “Connect via Bluetooth”. Any solar calculation simulation performed under support tools, can be reflected on the actual lantern settings.
Do I need to create a PIN when I first start using the lantern?	No. The lantern will operate without setting a Security PIN. However, it is highly recommended by Sealite for customers to set a unique PIN from the moment the lantern starts to operate.
When I try to download SealitePro® from Google Play, I see the message “Device not compatible”.	SealitePro® may not be installed on an Android device running Ice Cream Sandwich (version 4.0.4) or lower. The Google Play store will stop you from attempting to install SealitePro® if your device is incompatible. SealitePro® requires a device running Android KitKat (version 4.4) to communicate with Sealite Bluetooth lanterns. SealitePro® may be installed on devices running Android Jelly Bean (version 4.1-4.3) however, the ‘Connect via Bluetooth’ option will not be available.
I have installed SealitePro®, but the ‘Connect via Bluetooth’ option is disabled.	SealitePro® requires a device equipped with Bluetooth 4.0 or above. If no Bluetooth device is detected, the ‘Connect via Bluetooth’ option will be disabled. SealitePro® also requires a device running Android KitKat (version 4.4) to communicate with Sealite Bluetooth lanterns. If SealitePro® is installed on a device running Android Jelly Bean (version 4.1-4.3) then the ‘Connect via Bluetooth’ option will not be available.
When I start SealitePro® , I see the message “Bluetooth Permissions Denied. Please enable all permissions. Go to Settings?’	SealitePro® requires permission from Android to access various features of the mobile device, such as use of the Bluetooth module. Some versions of Android enforce these permissions to be granted when SealitePro® is installed. Later versions require the user to manually grant these permissions. If the message above is shown, then the latter scenario has occurred. Please answer ‘Yes’ to the prompt and SealitePro® will attempt to open the ‘Settings’ page. A list of installed Apps should appear. Find SealitePro® in the list and press it. At the bottom of the screen should be an ‘App permissions’ section. Click on this and enable all permissions presented. Then press the ‘Back’ button until SealitePro® reappears. If the above process does not open the ‘Permissions’ settings correctly, this will have to be performed manually. Return to the device home screen, then open the ‘Settings’ App and select ‘Installed Apps’. Select SealitePro® from the list and follow the instructions above. Please consult your device user guide to find out how to access and grant App permissions if the settings cannot be found.

Questions	Answer
When I press 'Connect via Bluetooth', I see the message 'An App/ SealitePro® wants to turn on Bluetooth'.	Connecting to a lantern via Bluetooth requires that the mobile device has Bluetooth turned on. If this message appears it is because the device's Bluetooth module is turned off. Press 'Allow' and SealitePro® will attempt to turn the Bluetooth device on. If required, you may turn Bluetooth off when finished through the device's 'Settings' App. If you press 'Deny' then connection will be cancelled.
When I select 'Connect via Bluetooth', the device performs a scan but tells me that no lanterns were found.	Several conditions may occur that will prevent lanterns from being discovered. 1. Verify that a Bluetooth-equipped Sealite lantern is nearby and powered on. 2. Verify that no other mobile device is connected to the lantern via Bluetooth. Bluetooth supports only one connection at a time, therefore if another device is connected it must be disconnected before the lantern appears in a scan result. 3. Turn the Bluetooth feature of the mobile device off and on again. This may be performed through the Android Notification Bar of some devices or through the Settings App. See your device user manual for full instructions. 4. Some Android devices require Location Services to be enabled before they will 'see' Bluetooth lanterns. Location Services may be enabled through the Android Notification Bar of some devices or through the Settings App. See your device user manual for full instructions. 5. Turn the lantern off and then on again. 6. Ensure your device is within its Bluetooth range. If the problem persists, please contact Sealite for assistance.
I have connected to a lantern via Bluetooth, but the message "Lantern Comms Failure. Retrying..." keeps appearing.	Try disconnecting from the lantern, then rescanning and connecting. It is possible that the lantern is at the edge of the Bluetooth range, or maybe the data connection is unreliable. If the problem persists, please contact Sealite for assistance.

Optional IR Remote Control

The IR programmer is used to communicate with Sealite lighting products that have an IR sensor fitted. The remote control is used for the following functions:

- **Flash Code**: Read the current flash code, configure a new flash code.
- **Lamp Intensity**: Read the current lamp intensity, configure a new intensity level.
- **Ambient Light Thresholds**: Read the current light thresholds, configure new ambient light thresholds.
- **Perform a battery health check**.



On receiving a valid key signal from the IR Programmer, the light will flash once.

The user should wait until the light responds to each keypress before pressing another key. If there is no response to the keypress after 3 seconds, it has not been detected by the light and the key can be pressed again.

If an invalid key is detected, the light will flash quickly 5 times. In this case, the command will have to be restarted.

IR Controller Functions

Test Mode / Configure

Pressing the T/C button up to 5 seconds places the light in Test Mode. The light will flash once in response to the T/C button being pressed and then turn off.

Normal Operation

The light will return to normal operation once it has not detected a valid key press for 30 seconds. The light will flash once to indicate it is returning to normal operation.

Read

Pressing the Read followed by one of the configuration keys shall cause the light to flash the configured value.

Example Key Sequences:

The light flashes the 'IR Remote' number belonging to the currently set Flash Code. Refer to the Flash Code tables to match the 'IR Remote' flash number to the Flash Code.

The light flashes the current intensity setting: 1 flash for 25%, 2 for 50%, 3 for 75% and 4 for 100%.

The light flashes the current battery status.

The light flashes the sunset level in Lux, followed by a 2 second gap, followed by the sunrise level. Levels are in the range of 1 to 5.

Flash Code

This key sets the Flash Code on the light.

Example Key sequence:
This sets the Flash Code to value 123. The light responds by flashing the Flash Code value.

Flash Code Numbers

The lamp flashes numbers as follows: Hundreds, Tens, Ones. A value of 125 will be flashed as: 1 flash, followed by a delay, 2 flashes, followed by a delay, 5 flashes.

The flash for number 0 is one long flash.

For example if the current Flash Code is set to 51 via the AB switches, the lamp will flash number 081. For a Flash Code set to 01, the lamp will flash 001.

Intensity

This function sets the light intensity. Valid intensity values are 1 for 25%, 2 for 50%, 3 for 75% and 4 for 100%.

Example Key sequence:

This sets the light intensity to 25%.

Battery Status

This function reads the battery status. The response from the light is High Voltage: 4 flashes, Good Voltage: 3 flashes, Low Voltage 2 flashes, Cutoff Voltage or below: 1 flash.

Lux

This key sets the ambient light threshold levels.

The format is where 'x' is the desired setting from the table below.

There are 5 programmable lux levels which are set together for the sunset and sunrise transitions.

Level	Sunset (Dusk)	Sunrise (Dawn)
1	65	100
2*	**100**	**150**
3	150	240
4	240	370
5	370	600
6	250	320
*** Default / Factory Preset**		

Example key sequence:

Assume the current Lux settings are at the factory preset values of 2.

This sets the ambient light level to be lower than the default 100 lux. The light will turn on when its surroundings are darker.

The light responds by acknowledgement with a long flash.

Error / Acknowledge Indication

If the key sequence is invalid, or an out of bounds value is attempted to be set, the light flashes 5 times for 1 second. (The command then needs to be sent from the start.)

Example key sequence: (Set the intensity level to 5 – undefined.)

The light flashes 5 times for 1 second.

When a key sequence has been entered successfully the light will respond acknowledgement with a long 1 second flash.

Configuration Settings

The intensity and Flash Codes can be changed using the switches on the lamp circuit board or with the IR Remote Control. The lamp intensity and Flash Code settings are set to the last detected change, carried out with the IR Remote Control or by changing the switch positions.

- **Example #1**: If the intensity is set at 100% with the intensity switches and is then set to 50% using the IR Remote Control, the intensity setting will change to 50%. If the intensity is then set to 75% using the switches, the new intensity value will be 75%.

  In order to change intensity settings using the IR Remoter Control, the lamp must be powered. The lamp can detect a change in switch settings if they are changed while the light is powered down.

- **Example #2**: The Flash Code is set according to the switch settings: A=5, B = 1. The operator changes the Flash Code to 65 (A=4, B=1) using the IR Remote Control. The new flash code is now configured to A=4, B=1. The lamp is powered down and the operator changes the Flash Code switches to A=3, B=1 and powers on the light. The new Flash Code is now A=3, B=1.

  If the Flash Code is read from the light using the IR Remote Control, the lamp will flash 49 which is the corresponding number for switches A=3, B=1.

  Use the IR Remote Control to read the current lamp intensity setting and Flash Code.

Operational Mode (Advanced users)

The lantern has three modes of operation: Always on, Standby Mode and Dusk-to-Dawn mode. These modes can be selected either via the IR Remote Control or via the GSM module (if fitted).

- In Always On mode, the daylight sensor is disabled, and the lantern will remain ON.
- In Standby mode, the lantern is turned off and the daylight sensor is disabled. This mode does not affect the operation of the GSM module.

- In Dusk-to-Dawn, the daylight sensor is enabled.

Always on mode

Standby mode

Dusk-to Dawn mode

Hibernation Mode (Advanced users) – only available for lanterns fitted with GPS

For situations where the lantern is put into storage for a known period, the IR Remote Control can be used to configure the lantern into Hibernation Mode for a user programmable date range.

Hibernation Mode maximises conservation of the battery power by disabling the light (will not activate at night) and shutting off the GPS receiver to rely on the internal clock for date checking. The IR sensor is still monitored in Hibernation Mode. Power consumption is only improved by physically disconnecting the battery supply.

Hibernation Mode is defined by a start date and end date that are programmed into the lantern via the IR Remote Control.

Using the IR Remote Control

The lantern must be in Test Mode prior to pressing any of the following key sequences. However, the lantern will return to Normal Operation if it has not detected a valid key press for a period of 15 seconds. When the lantern exits from Test Mode it will either enter Dusk to Dawn mode, Hibernation Mode, or Storage Mode, if enabled.

Store Hibernation Mode Date Range

The following details the key press sequence that defines the start and end dates of Hibernation Mode:

where ***ddmm*** is the numerical representation of the month (01=January, 08=August) of the start date, and ***DDMM*** is the numerical representation of the end date.
E.g 9th of December is represented by the number sequence 0912. The lantern will acknowledge and respond by flashing a long flash. This operation only stores the start & end dates into the lantern's memory and Hibernation Mode still must be enabled to commence its operation.

Enable Hibernation Mode

Pressing the following key sequence will enable (turn on) Hibernation Mode:

The lantern will respond with a single flash.

The lantern will take a new GPS reading, determine the calendar month, and then enter Hibernation Mode and depending on the current calendar month setting, will either Hibernate or enter Dusk-to Dawn mode.

By default, Hibernation mode is disabled. Note you can only use this command once a valid hibernation start & end date has been stored in the lantern.

Disable Hibernation / Mode

Pressing the following key sequence will disable (turn off) both Hibernation Mode and Seasonal Hibernation:

The lantern will respond with a single long flash.

Momentarily Wake Up from Hibernation Mode

Pressing the T/C button will wake up the lantern, at which point the lantern will remain awake for a further 15 seconds to process other commands from the IR Controller. If no IR commands are received for a period of 15 seconds, the lantern will return to Hibernation Mode.

Read Stored Hibernation Dates

By pressing the following key sequence the lantern will respond with the stored start and end dates for Hibernation:

Read Hibernation

By pressing the following key sequence the lantern will respond with status of Hibernation Mode.

Where:

- A single long flash = Hibernation Mode is Enabled
- Two quick flashes = Hibernation Mode is Disabled.

User Case Example: Configuring the lantern for Hibernation

In this example, we want the lantern to hibernate each year from Dec 10th, through to February 15th, and the lantern is located inside a storage warehouse.

The required key sequence is:

Command	IR Controller Key Press
Store the Hibernation Date Range	
Enable Hibernation	

Storage Mode (Advanced users)

For situations where the lantern is put into storage but with access to daylight, the IR Remote Control can be used to configure the lantern into Storage Mode.

This mode manually forces the lantern to turn off, but with access to daylight it will still charge battery pack. However the lantern will not keep track of the date.

In Storage Mode, the GPS is disabled however the lantern will still respond to IR commands.

The lantern will automatically enter Storage Mode, if it is hibernating and it has not detected any light for 20 hours.

Enter Storage Mode

By pressing the following key sequence the lantern will enter Storage Mode:

The lantern will leave storage mode when exposed to daylight or if the power switch is turned OFF and ON again.

IR Controller Security PIN

The IR Controller allows to create a four-digit numbers security access PIN, this will prevent accessing or modifying the SL-C510 settings. Once the Security PIN is set this it will lock the lantern immediately.

In order to access the light settings, the Unlock PIN command needs to be used, this will allow access to the light settings for 30 minutes then the light will re-lock again. If the entered Security PIN does not match, the lantern will respond with 5 quick flashes indicating the PIN is incorrect.

Pressing the following key sequence will set the light Security PIN:

Where: X = 0 to 9-digit numbers

Pressing the following key sequence will unlock the light for 30 minutes:

Where: X = 0 to 9-digit numbers

Clear or set a new IR Security PIN

To clear the security access PIN the light requires to be switched off then on. The action will allow to enter the following key commands to clear the existing Security PIN:

Once the security access PIN is cleared a new PIN can be entered using the Security PIN set command.

NOTE: The above key command requires to be entered within four minutes, once the time elapses the light will PIN lock again.

GPS Synchronisation

The SL-C510 with AIS lanterns are fitted with GPS and provide the user with the ability to install independently operating lanterns that all flash in synchronisation.

No additional power supplies, aerials or control systems are required, and with its microprocessor-based system, the GPS option is specifically designed to provide maximum reliability and performance over a wide range of environmental conditions.

Operating Principle

Each light operates independently and requires no operator intervention. A minimum of 4 satellites need to be in view for the built-in GPS receiver to collect time data. At dusk, the light sensor will turn the light on. If time data is available, the light will come on synchronised to every other light with the same selected flash code.

Synchronisation is achieved using an internal algorithm based on the highly accurate time base and time data received from the satellites. The satellite data is provided from several earth stations using atomic clocks as the time base. Continuous self-checking ensures that the light will continue to run in synchronisation.

Light Activation

At power-up the microprocessor checks that the internal GPS module is programmed correctly and can provide valid time base and time data.

Once outside with a clear view of the sky, valid data should become available within 20 minutes.

Daylight Operation

During daylight hours the microprocessor is in idle mode to reduce power consumption. Time data continues to be updated once per second. The microprocessor will automatically exit the idle mode as soon as dark conditions are detected.

Dark Operation

When dark conditions are detected the light:

- Checks for valid time data and is turned on after a delay based on the current time and the length of the selected flash code;
- If valid time data is not detected the light will turn on after approximately 10 seconds. This light will not be synchronised;
- If the light turns on unsynchronised it will continually check for valid time data. Once valid data is found the light will automatically synchronise.

Note: Lights will not synchronise if different flash codes are selected.

Lantern Status

Two status LED's on the main printed circuit board provide the operator with an indication of the lantern status. There is one red and one yellow status LED. The red status LED is used to indicate the health of the lantern's power system. The yellow status LED is used to indicate the operational status of the lantern. These indicator LED's can be viewed at the base of the lens.

All Sealite boards are fitted with two Indicator LED's. Use the table below to help determine operational status.

Yellow LED	Lantern Status	Lantern	Comment
OFF	Normal	OFF	Lantern is in Daylight and in Dusk till Dawn mode or in Standby Mode
Flashing ON 0.15 seconds OFF 0.15 seconds	Normal	OFF	Light is activating and will turn on after detecting 30 seconds of continuous darkness.
Flashing 2 x quick flashes every 2 seconds (Heartbeat)	Normal	ON	Lantern is in Normal operating condition. It is not connected to any GPS synchronisation.
Flashing ON 1.5 seconds OFF 1.5 seconds	Normal	ON	Normal operating condition. Lantern is synchronised to GPS-enabled lanterns.
Flashing 1 x quick flash every 2 seconds	Normal	ON	Lantern is 're-syncing' with GPS. The lantern re-sync's with the GPS every 15 minutes.
Flashing 2 x quick flashes every 11 seconds	Normal	ON	Lantern is a Hard Wire Synchronisation Slave.

Red LED	Lantern Status	Lantern	Comment
OFF	Normal	ON	Normal Battery Voltage
Flashing once every 1.6 seconds	Battery Voltage is 12 – 12.5V	ON	Battery Voltage is between 12 – 12.5V
Flashing twice every 2 seconds	Battery Voltage is 11.5 – 12V	ON	Battery Voltage is between 11.5 – 12V
Flashing 3 x times every 2 seconds	Battery Voltage is 10.0 – 11.5V	ON	Battery Voltage is between 10.0 – 11.5V
Flashing 4 x times every 2.5 seconds	Battery Voltage is less than 10.0V	ON	Battery Voltage is at less than 10.0V
Fixed-on	Flat Battery (<10V)	OFF	Flat Battery cut-off is now operational and the lantern will be off. Battery must receive charge (above 12V) and lantern must see daylight for at least 1 minute before resuming normal operation.
Flashing ON 1.5 seconds OFF 1.5 seconds	Battery Voltage is above 13.5V	ON	Battery Voltage is above 13.5V. This may indicate a problem with the solar regulator.

Lantern Thermal Management

The lantern incorporates a dynamic intensity module as part of the thermal management system that ensures it operates within the thermal design window. In practice the thermal management system limits the lanterns average power consumption by automatically adjusting the intensity to prevent overheating.

The Thermal Management system does so by multiplying the flash character duty cycle with the lantern intensity and compares this figure to the Thermal Limit. All the SL-C510 models have the same Thermal limits for all colours. If the figure (called the “multiplier”) is greater than the Thermal Limit the intensity is then adjusted to ensure the Thermal Limit is not exceeded.

This Thermal Limit will come into effect if you select a flash characteristic with a heavy-duty cycle and set a very high intensity. Under these conditions the lantern will automatically reduce its intensity so that it is operating within the thermal design window. Note, this intensity limit will not be reached for the clear majority of applications.

Lantern Data

The following tables detail the electrical power consumption of the SL-C510-5D and 10D lanterns:

SL-C510-5D

	Red	Green	White	Yellow	Blue
Peak Power (W)	10.6	15	13.1	13.1	13.4
Max power at Thermal Limit (%)	40.6	40.6	40.6	40.6	40.6
Max power at Thermal Limit Multiplier* (W)	4.3	6.1	5.3	5.3	5.4
Peak Intensity (cd)	620	690	1150	570	310

SL-C510-10D

	Red	Green	White	Yellow	Blue
Peak Power (W)	10.6	15	13.1	13.1	13.4
Max power at Thermal Limit (%)	40.6	40.6	40.6	40.6	40.6
Max power at Thermal Limit Multiplier* (W)	4.3	6.1	5.3	5.3	5.4
Peak Intensity (cd)	460	440	650	320	200

* See Thermal Limit Operation for full description.

Thermal Limit Operation

Automatically the lantern calculates the MULTIPLIER and compares it to the maximum power Thermal Limit. If the calculated value exceeds maximum power thermal limit, then the intensity is reduced to the highest intensity step to ensure that it is not exceeded.

a) Power is a measure of the rate in which electrical energy is transferred within an electrical circuit and is measured in Watts (W). For DC (Direct Current) electrical circuits it is expressed as:

Power (Watts) = Voltage (Volts, V) x Current (Amps, A) where volts & current are instantaneous values.

b) Peak Power is the maximum power rating of a lantern. In an instant of time, this is the maximum power the lantern will consume. It is determined when all a lantern's features are on and the LEDs intensity is at 100%.

c) Average Power is a measure of Power over a period of time. In raw terms, it expressed as

Average Power (Watts) = Peak power (Watts) x MULTIPLIER (%),

Where the:

MULTIPLIER (%) = Flash Character duty cycle (%) x Intensity level (%)

d) The SL-C510 lantern intensity setting are available in 32 steps from 0% to 100% with a step size of 3.125% (or 1/32%)

Automatic Identification System Programming

The SL-C510 with AIS AtoN is a self contained device supporting both Type 1 (transmit only) and Type 3 (transmit and receive) operations. It is designed for installation in exposed locations on physical AtoN structures.

The AIS AtoN module has an exceptionally low power consumption making it suitable for installation on floating Aids to Navigation with solar charged power systems. The lowest power consumption is achieved when operating as a Type 1 AIS AtoN, transmitting only position information.

Further description of Type 1 and Type 3 operations are provided below.

AIS AtoN Type 1

A Type 1 AIS AtoN is a transmit only device using the FATDMA (Fixed Access Time Division Multiple Access) access scheme. This requires that the AIS AtoN is configured with fixed AIS time slots in which it will transmit AIS messages. Mobile AIS stations operating in the area where a Type 1 AIS AtoN is installed need to be aware of the time slots allocated to the AIS AtoN. The slots allocated to the AIS AtoN are 'reserved' by AIS Base Station transmissions covering the area in which the AIS AtoN is installed.

This mode of operation therefore requires that an AIS base station is operating in the same area as the AIS AtoN and is configured to make the necessary slot reservations.

AIS AtoN Type 3

Type 3 AIS AtoN has transmit and receive capability and can therefore use either the FATDMA or RATDMA (Random Access Time Division Multiple Access) access schemes. The RATDMA scheme allows the AIS AtoN to internally allocate slots for transmission of AIS messages without reservation from an AIS Base Station.

AIS receiving capability also allows a Type 3 AIS AtoN to be configured and queried for it's status via AIS messages sent from a shore station (known as VDL configuration). An extension of VDL configuration is 'Chaining' where configuration and query commands are passed along a 'chain' of AIS AtoN stations to a distant station beyond the range of direct communication with a shore station.

AIS Glossary

Term	Definition
AIS	Automatic Identification System
AtoN	Aid to Navigation
BeiDou	Not supported. Chinese satellite navigation system. Now expanded to BeiDou-3 and is expected to provide global services upon completion in 2020.
BIIT	Built In Integrity Test
DAC	Destination Area Code
FATDMA	Default = 235 (UK & NI) or 250 (ROI) for GLA standard message
FI	Fixed Access Time Division Multiple Access
Frequency	ITU have assigned two channels in the VHF maritime module service band.
Galileo	Not supported. European Union's Navigational System.
GLA	General lighthouse authority
GLA AIS Message 6	Supported by SRT Carbon unit with sensor module. GLA's Application Specific Message,which provides Aids to Navigation monitoring data for the AtoN administration and is specified by ITU.
GLONASS	Option only available upon request from SRT. Global Navigation Satellite System (term specific to the satellite navigation system operated by the Russian Federation)
GNSS	Global Navigation Satellite system (general term used to refer to any satellite navigation system)
GPS	Global Positioning System
IALA	International Association of Lighthouse Authorities (IALA-A126)
IALA A-126	IALA guidelines on the use of AIS Aids to Navigation.
IEC	International Electro-technical commission
ITU	International Telecommunication Union
MMSI	Maritime Mobile Service Identity number. A nine (9) digit number associated with the 'real' AtoN.
NMEA	National Marine Electronics Association
RACON	A radar transponder used to mark navigational hazards.
RATMDA	Random Access Time Division Multiple Access
SART	Search And Rescue Transponder
SOLAS	Safety of Life at Sea
UTC	Coordinated Universal Time
VDL	VHF Data Link. Term to describe the use of VHF radio for the exchange of digital data (VDM)
VDM	VHF Data link Message
VHF	Very High Frequency

Supported AIS Messages

The transceiver supports the following AIS message types.

ITU-R M.1371-4 Message number	Description	Transmitted / Received by AtoN Transceiver	Application
6	Binary addressed message	Transmitted and received	The transceiver uses message 6 to send binary data (relating to connected sensors and systems) to a specific shore station. The transceiver can also receive addressed binary messages for the purpose of configuration and control.
7	Binary acknowledge message	Transmitted and received	This message is transmitted to acknowledge receipt of a binary message. The transceiver can also receive acknowledgements relating to its own addressed binary transmissions.
8	Binary broadcast message	Transmitted	The transceiver uses message 8 to broadcast binary data (relating to connected sensors and systems) to all other AIS stations in range.
12	Addressed safety related message	Transmitted	The transceiver can be configured to transmit an addressed safety related message to a specific shore station to alert the operator to an off position, vessel proximity or built in test failure condition.
13	Acknowledgement of received addressed safety related message	Received	The transceiver receives message 13 in acknowledgement of its transmission of message 12.
14	Safety related broadcast message	Transmitted	The transceiver can be configured to transmit a broadcast safety related message to all AIS stations in range, to warn of an off position, vessel proximity or built in test failure condition.
20	Data link management message	Received	When operating as a Type 3 transceiver slot reservations made by a shore station using message 20 will be observed by the transceiver.
21	Aids to Navigation report	Transmitted	This is the primary message transmitted by the transceiver. It contains the position, identification and status of the transceiver.
25	Single slot binary message	Transmitted and received	This message can be used for remote (over the air) configuration of the transceiver and configuration of a ‘chain’ of transceivers.

Description of the proAtoN Programming Software Tool

The proAtoN PC application is available from the USB memory stick supplied with the lantern. The application provides features for configuration of the transceiver and advises correct operation before deployment.

The main features of the application are:

- Configuration of essential transceiver parameters such as MMSI, name and dimensions
- Configuration of reporting schedules
- Configuration of virtual and/or synthetic AtoN reporting schedules
- Configuration of other messaging features
- GNSS diagnostics
- System diagnostics and alarm display
- Configuration of the source for external equipment status information

The SL-C510 with AIS AtoN supports VDL configuration and chaining. For further information please contact Sealite for support.

Installing the proAtoN PC Software Tool

The proAtoN should be installed from the CD supplied (or USB stick) with the transceiver. The steps to complete the installation are as follows:

1. Insert the CD into your PC
2. Navigate to the proAtoN folder on the CD
3. Double click the 'setup.exe' item to start the installation process
4. Follow on screen instructions to complete the installation

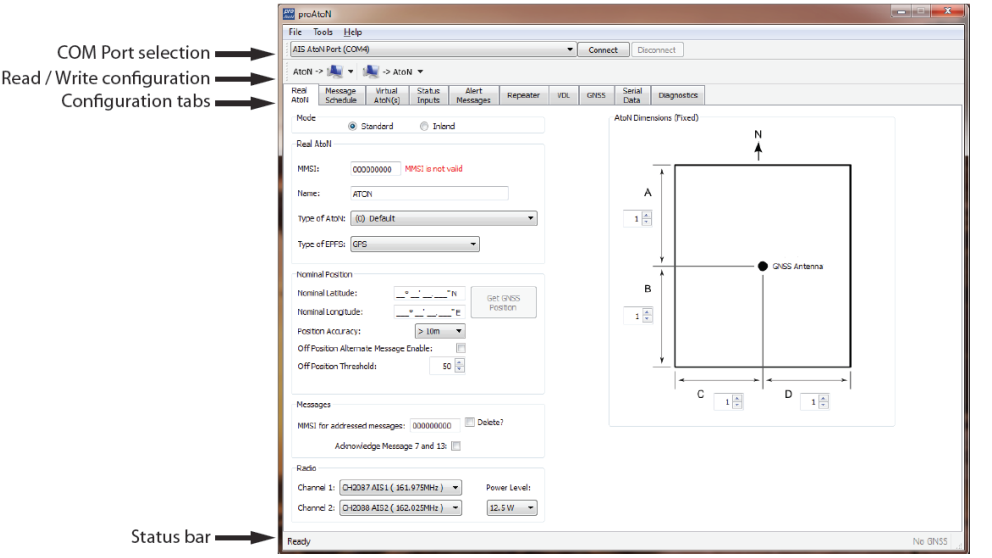
Following successful installation, the application can be launched from the proAtoN folder in the Windows start menu.

USB device drivers for the transceiver are installed automatically during installation of proAtoN.
Note: The transceiver model is powered from the USB Port while connected to the computer.

	**CAUTION**
	Ensure the ON/OFF switch is in the OFF position when configuring the AIS Module. The VHF transmission may damage your computer as a result.

Application layout

The basic layout of the proAtoN application is illustrated in the following figure:



COM Port Selection

When connected via USB the COM port associated with the transceiver will be listed in the selection drop down. To connect to the transceiver select the 'AIS AtoN Port' option from the drop down and click the 'Connect' button.

Read / Write Configuration

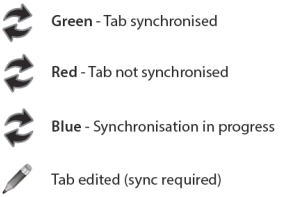
Clicking the left hand button will transfer current configuration information from the transceiver to proAtoN. Clicking the right hand button will configure the transceiver with the information currently displayed in proAtoN. It is possible to select transfer of configuration information relating only to the currently selected tab, or to all tabs by clicking the drop down arrow to the right of each button. The default operation for each button is to read or write data relating to the selected tab only. It is highly recommended that prior to deploying the AtoN the "Send all Configuration" option is used on the write button.

Configuration Tabs

The configuration and status of the transceiver is displayed through a number of tabs:

- Real AtoN tab
  Configuration of AtoN MMSI, name, type, dimensions, position and radio parameters.
- Message schedule tab
  Configuration of FATDMA or RATDMA message schedules.
- Virtual AtoN tab
  Configuration of virtual and/or synthetic AtoN transmissions.
- Status input tab
  Configuration of the source for AtoN status information

When connected to a transceiver a synchronisation status icon is displayed alongside the title of each tab. This icon indicates the current synchronisation status of the information displayed in that tab with the internal configuration of the transceiver. The synchronisation status icons are illustrated as:



Synchronisation is achieved by either writing the configuration displayed in proAtoN to the transceiver (click the write configuration button), or reading the current configuration from the transceiver for display in proAtoN (click the read configuration button).

Status Bar

The status bar displays the current connection status of the application (bottom left) and the current GPS time (if available, bottom right).

Transceiver Configuration

The following sections describe the configuration options available and their effect on the behaviour of the transceiver. Configuration of an AIS AtoN transceiver requires knowledge of the local AIS environment and may require interaction with shore infrastructure. Familiarity with the current IALA guidelines on the use of AIS Aids to Navigation (IALA A-126) is assumed.

Configuration of 'Real' AtoN Parameters

The following parameters associated with the 'real' AIS AtoN transceiver should be configured via the 'Real AtoN' tab:

MMSI

The MMSI number associated with the 'real' AtoN. Typically the MMSI number for a 'real' AtoN station follows the format 99MID1XXX where MID is the appropriate national MID and XXX is a number unique to this station.

Name

The name of the AtoN station as broadcast to other AIS users. Up to 34 characters are available for the name.

Type of AtoN

Select from a list of possible types of AtoN. The types are as defined by IALA in IALA A-126.

Type of EPFS

Select the type of EPFS (Electronic Position Fixing System) used by the transceiver. Note this selection does not affect the hardware configuration, only the contents of the 'Type of EPFS' field transmitted AtoN position reports. The transceiver is equipped with a GPS module by default.

Alternatively, for a fixed or shore based transceiver a surveyed position type can be selected. Note that when the surveyed position is selected, the surveyed position is broadcast to other AIS users and GNSS position information is ignored.

Nominal Position

Enter the nominal or charted position of the AtoN. This is the position transmitted to other AIS users for a fixed AtoN when the 'Surveyed' EPFS type is selected. For all other configurations this position is used to perform 'off position' calculations only; the actual GNSS position is broadcast to other users.

- The application can average the current GNSS position over 5 minutes and use this value for the nominal position. Click the 'Get GNSS position' button to the right of the latitude and longitude fields to begin this process.
- The position accuracy can only be entered when the type of EPFS is set to 'Surveyed'. The accuracy should be set in accordance with the accuracy of the surveyed position.

Off Position Alternate Message Enable

The current GNSS position is compared to the nominal position according to the algorithm defined in IALA A-126 Annex A, Example 1. The off position threshold distance is specified in metres. If the transceiver determines that it is 'off position' then the alternate reporting schedule for message #21 (index 2) is enabled. For example, the alternate reporting schedule could be configured to decrease the reporting interval if the AtoN has drifted off position. The off position flag in message #21 is set when off position regardless of this setting.

The transceiver off position algorithm is always operational and compares the current GPS position to the nominal position of the transceiver.

	CAUTION
CAUTION	It is essential that valid nominal position is entered and that a reasonable off position threshold is entered. If the default nominal position 00° 00' 00.00"N / 000° 00' 00.00"E is left unchanged, then the transceiver will always be 'off position' resulting in the GPS receiver being permanently enabled. This will lead to significantly increased power consumption and the 'off position' flag in the Aids to Navigation report will be set.

MMSI For Addressed Messages

This is the destination MMSI used for all addressed message types generated by the transceiver. This is usually the MMSI of a shore station collecting status information from the transceiver. It is also possible to enable the acknowledgement of received binary messages (via message #7 or #13).

Dimensions

The dimensions of the AtoN should be entered to the nearest metre. Guidance on the appropriate configuration of dimensions for various types of AtoN can be found in IALA A-126.

Radio Channels

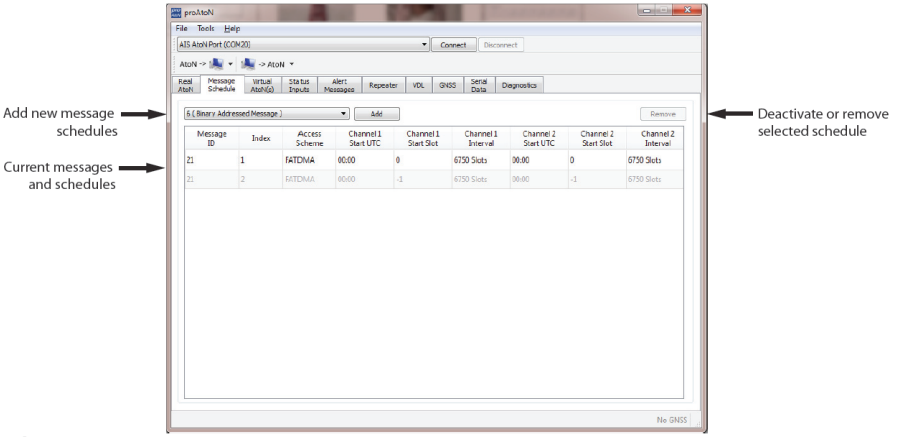
Selection of alternative radio channels for AIS transmission and reception is possible, however in most cases the default channels (AIS1 and AIS2) should be used.

Transmitter Power Level

The transmitter power level for the transceiver can be selected as 1W, 2W, 5W or 12.5W. The default value of 12.5W is appropriate for most scenarios.

AIS Message Schedule Configuration

The layout of the message schedule tab is illustrated below:



Default Messages

An AIS AtoN position report is made using AIS message #21. This message occupies two AIS slots. The default configuration shown in proAtoN includes two message #21 schedule configurations. The first configuration, Index 1, is the primary position reporting schedule for the transceiver. The second, Index 2, is the alternate position reporting schedule selected when the 'off position' monitor is enabled and the AtoN is determined to be off position (see section 7.3.1). If the alternate 'off position' schedule is not required it can be deactivated by selecting the associated row in the message schedule table and clicking the 'Deactivate' button. When deactivated the alternate schedule will be greyed out.

Adding Additional Messages to the Schedule

Additional binary data messages can be added to the schedule table by selecting the required message type from the drop down at the top of this tab, then clicking the 'Add' button. The available message types are:

- **Message #8** - For broadcast of binary data to all other stations in range. The binary data may be provided by the extended sensor interface (if present) or third party equipment connected to the transceiver. See section 8 for further information.
- **Message #6** - For transmission of binary data to an individual destination MMSI. The destination MMSI is set on the 'Real AtoN' tab. The binary data may be provided by the extended sensor interface (if present) or third party equipment connected to the transceiver.
- **Message #12** - For transmission of text messages to an individual destination MMSI. The destination MMSI is set on the 'Real AtoN' tab. This schedule is used for transmission of alert messages.
- **Message #14** - For broadcast of text messages to all other stations in range. This schedule is used for transmission of alert messages.

Up to four separate schedules are available for each binary message type. Each individual schedule has an index from 1 to 4 which is used to identify that schedule (for example, message #8 index 2).

Access Scheme Selection

The access scheme for each message must be selected as either FATDMA or RATDMA. The selection is made by selecting the required row in the schedule table, then clicking on the current access scheme in that row. A drop down menu will then appear in that location allowing selection of the required access scheme.

FATDMA Schedule Configuration

Using the FATDMA (Fixed Access TDMA) access scheme the actual slot for each transmission made by the transceiver is specified. There are 2250 slots per minute (or frame) on each AIS channel. The scheduled slots must be reserved for the transceiver by an AIS base station operating in the same area using AIS message #20. Further information on FATDMA reservations and slot allocation schemes can be found in IALA A-124, Appendix 14.

The parameters required for an FATDMA schedule are as follows:

- **Channel 1 Start UTC**

  This is the hour and minute for transmission on Channel 1. This specifies the AIS frame (minute) within a day in which the start slot for Channel 1 resides.

- **Channel 1 Start Slot**

  This is the slot number for the first transmission on Channel 1. The slot number can range from -1 (transmission disabled on this channel) to 2249. Note that each message #21 transmission occupies two slots and associated base station slot reservations must therefore reserve two slots.

- **Channel 1 Interval**

  This is the interval in slots between transmissions on Channel 1. The interval can range from 0 to 3240000 slots, which equates to an interval of one day. Typically, the interval is set to 13500 slots (6 minutes) on each channel which results in an overall interval of 3 minutes.

- **Channel 2 Start UTC**

  This is the hour and minute for transmission on Channel 2. This specifies the AIS frame (minute) within a day in which the start slot for Channel 2 resides. Typically the Channel 2 start time is offset by 3 minutes from the start time used for Channel 1. With a 6 minute reporting interval on each channel this results in a transmission every 3 minutes on alternating channels.

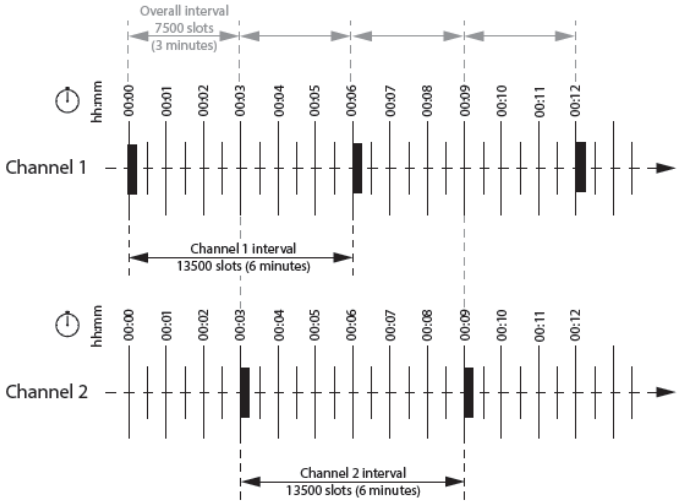
- **Channel 2 Start Slot**

  This is the slot number for the first transmission on Channel 2. The slot number can range from -1 (transmission disabled on this channel) to 2249. Note that each message #21 transmission occupies two slots and associated base station slot reservations must therefore reserve two slots.
- **Channel 2 Interval**

  This is the interval in slots between transmissions on Channel 2. The interval can range from 0 to 3240000 slots, which equates to an interval of one day. Typically the interval is set to 13500 slots (6 minutes) on each channel which results in an overall interval of 3 minutes.

Example FATDMA Schedule

A typical transmission schedule requires that the AIS AtoN transceiver transmits AIS message #21 every three minutes on alternating channels. The transmission schedule is presented diagrammatically in the following figure:



This schedule can be configured using the following values:

- Channel 1 start UTC = 00:00 (the first frame of every hour)
- Channel 1 start slot = 0 (the first slot in the frame, so slots 0 and 1 are used by the message #21 transmission)
- Channel 1 interval = 13500 slots (this equates to a 6 minute interval as there are 2250 slots per minute)
- Channel 2 start UTC = 00:03 (the third frame of every hour)
- Channel 2 start slot = 0 (the first slot in the frame, so slots 0 and 1 are used by the message #21 transmission)
- Channel 2 interval = 13500 slots (this equates to a 6 minute interval as there are 2250 slots per minute)

The transceiver is now configured to report message #21 on channel 1 every 6th minute, and on channel 2 every 6th minute, but offset by three minutes from channel 1. This results in a transmission of message #21 every three minutes on alternating channels. The actual start slot selected for each channel will depend on the FATDMA allocations in the area of operation.

RATDMA Schedule Configuration

Using the RATDMA (Random Access TDMA) access scheme the time for each transmission made by the transceiver is specified. The transceiver will determine the actual slots used for transmission based on internal knowledge of the AIS environment gained from the AIS receivers.

The parameters required for an RATDMA schedule are as follows.

- **Channel 1 Start UTC**

  This is the hour and minute of the frame in which transmission will occur on Channel 1. The slot used within this frame will be determined by the transceiver.
- **Channel 1 Interval**

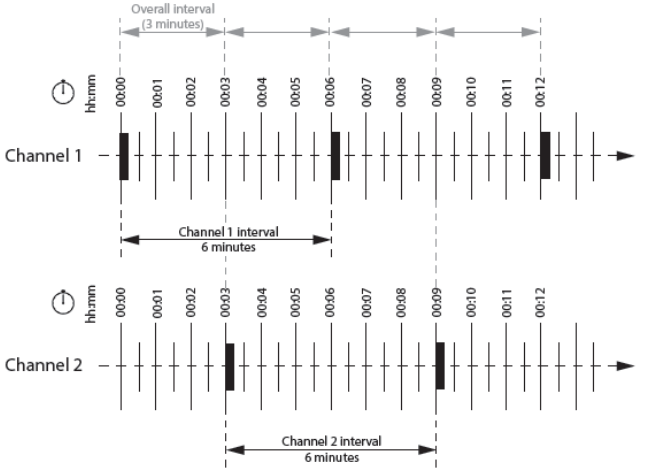
  This is the interval in minutes between transmissions on Channel 1. A typical value is 6 minutes.
- **Channel 2 Start UTC**

  This is the hour and minute of the frame in which transmission will occur on Channel 2. The slot used within this frame will be determined by the transceiver.
- **Channel 2 Interval**

  This is the interval in minutes between transmissions on Channel 1. A typical value is 6 minutes.

Example RATDMA Schedule

A typical transmission schedule requires that the AIS AtoN transceiver transmits AIS message #21 every three minutes on alternating channels. The transmission schedule is presented diagrammatically in the following figure:



This schedule can be configured using the following values:

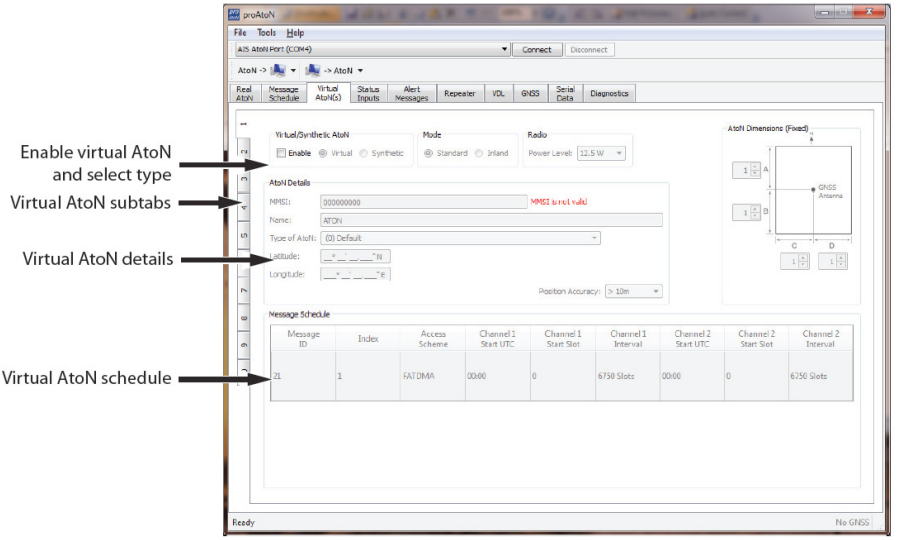
- Channel 1 Start UTC = 00:00 (the first minute of every hour)
- Channel 1 Interval = 6 minutes
- Channel 2 Start UTC = 00:03 (the third minute of every hour)
- Channel 2 Interval = 6 minutes

The transceiver is now configured to report message #21 on Channel 1 every 6th minute and on Channel 2 every 6th minute, but offset by three minutes from Channel 1. This results in a transmission of message #21 every three minutes on alternating channels. The exact timings of the transmissions within the selected minute will vary as the transceiver selects available slots using RATDMA.

Virtual AtoN Configuration

The transceiver can be configured to transmit position reports for up to ten virtual or synthetic Aids to Navigation. This configuration is carried out using the Virtual AtoN(s) tab in proAtoN. Within this tab there are sub-tabs relating to each of the ten virtual or synthetic AtoNs. The sub-tabs are visible at the left hand edge of the window. The layout of the virtual AtoN configuration tab is provided in the following illustration:

	CAUTION
CAUTION	It is not recommended to use this feature as it significantly drains the internal battery. Contact Sealite for additional advice.



Virtual AIS AtoN Configuration

Each virtual AtoN required must be separately enabled by checking the 'Enable' check box. The type of virtual AtoN can then be selected.

- **Virtual AtoN**

  A virtual AtoN is transmission of message #21 for an Aid to Navigation that does not physically exist. A virtual AtoN may be used to mark a temporary hazard to navigation, for example, a wreck. For further information on the use of virtual AtoNs please refer to IALA A-126, IALA O-143 and IALA guideline 1081.

- **Synthetic AtoN**

  A synthetic AtoN is transmission of message #21 from an AIS station located remotely from the physical Aid to Navigation. An example of use is to provide an AIS AtoN target for a buoy or mark that is not capable of supporting AIS AtoN hardware.

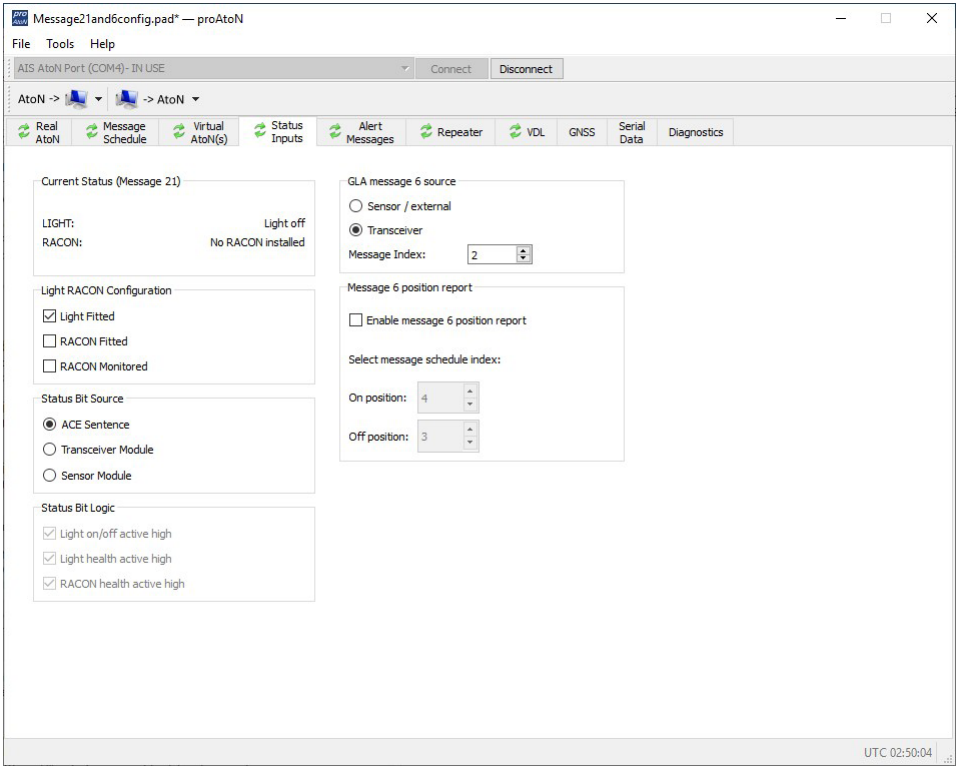
Virtual AIS AtoN Schedule

The transmission schedule for a virtual or synthetic AtoN must be configured in the same way as that for the 'real' AtoN. The TDMA access scheme, start times and intervals must be configured in the virtual AtoN tab.

When an FATDMA schedule is used it is important to ensure the slot allocations used for the virtual and real AtoNs are different in every case. Also note that two consecutive slots are used for each virtual AtoN report.

Status Input Configuration Tab

AIS AtoN position reports (message #21) contain status information encoded as a bit sequence.



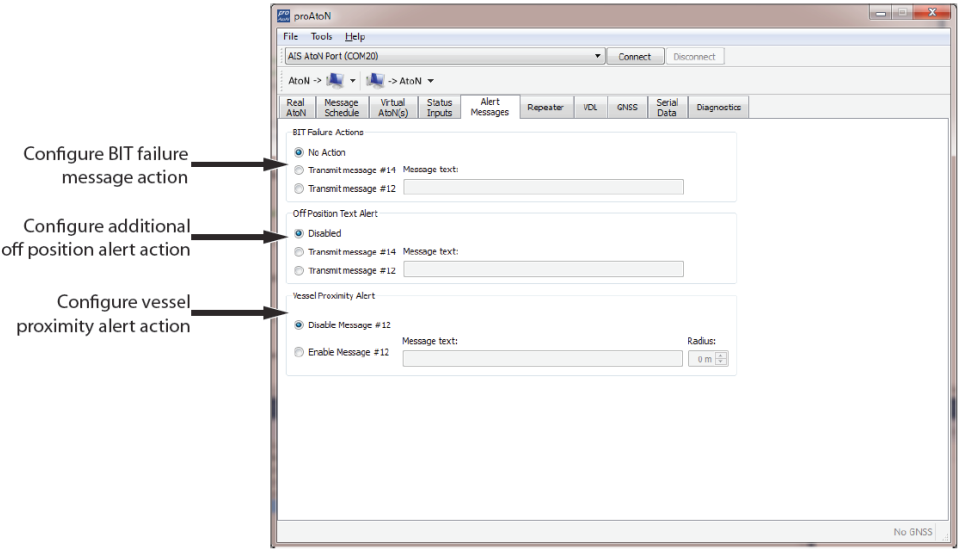
	CAUTION
CAUTION	Do not modify these settings as the AIS AtoN does not support these settings.

Alert Messages Tab

The transceiver can be configured to transmit text messages for three different alert conditions:

- An addressed or broadcast text message can be transmitted when the transceiver detects a Built In Integrity Test (BIIT) failure.
- An addressed text message can be transmitted to an approaching vessel if the vessel comes within a configurable distance of the transceivers location. This function is only available with Type 3 variants and with full time receiver operation.
- An addressed or broadcast text message can be transmitted when the transceiver determines that it is off position. This message is in addition to use of the alternate schedule for off position reporting (if the alternate schedule is enabled) and does not replace that function.

The layout of the alert messages configuration tab is illustrated in the following picture:



BIIT Failure Actions

This section allows configuration of the text message to be transmitted on detection of a Built In Integrity Test failure (BIIT failure). Such a failure may indicate a problem with the transceiver and it may be prudent to warn vessels not to rely on the information provided by the transceiver in this situation. Note that the health of the transceiver is always transmitted as part of the standard Aids to Navigation position report (message #21), however the status contained in that message may not be shown on all display systems. The available actions on BIIT failure are:

- No action - no message is transmitted on detection of a BIIT failure
- Transmit message #14. A broadcast text message is transmitted on detection of a BIIT failure. The text content of the message must be defined in the 'Message text' box.
- Transmit message #12. An addressed text message is transmitted on detection of a BIIT failure.

The destination for the addressed message is configured on the 'Real AtoN' tab.

In addition to configuration of the BIIT failure action, a schedule for the associated message must be configured in the 'Message schedule' tab:

- Message #14 Index 1 must be configured if the message #14 action is selected.
- Message #12 Index 1 must be configured if the message #12 action is selected.

Vessel Proximity Alert

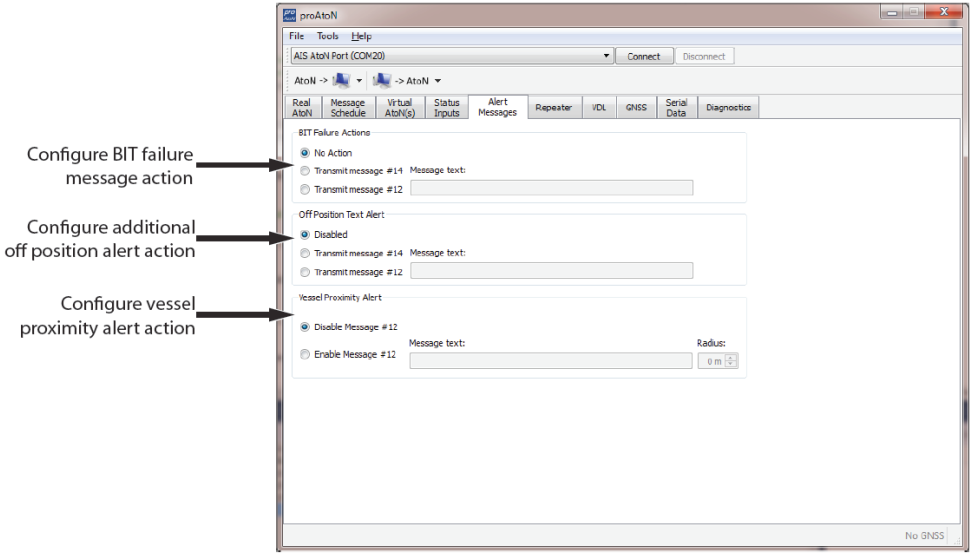
This section allows configuration of the text message to be transmitted on detection of a vessel breaching a defined radius (or guard ring) around the transceiver. This message can be used to warn approaching vessels of potential collision with the AtoN. The addressed message is automatically sent to all vessels that breach the guard ring radius.

The available vessel proximity alert actions are:

- Disable message #12 - The vessel proximity alert function is disabled
- Enable message #12 - The function is enabled and the text content of the message to be transmitted must be defined in the 'Message text' box. The guard ring radius for the proximity alert must also be configured in the 'Radius' box; note that the value is set in metres.

In addition to configuration of the vessel proximity alert a schedule for the associated message must be configured in the 'Message schedule' tab.

- Message #12 Index 2 must be configured if the message #12 action is selected.



Off Position Alert

This section allows configuration of the text message to be transmitted when the transceiver detects that it is off position. The settings for off position detection are made on the 'Real AtoN' tab. The configuration of an alternative off position message #21 reporting schedule is independent of the configuration of this text alert.

The available off position alert actions are:

- Disabled - no text message is transmitted when the transceiver determines that it is off position
- Transmit message #14. A text message is broadcast when the transceiver detects that is off position. The text content of the message must be defined in the 'Message text' box.
- Transmit message #12. An addressed text message is transmitted on detection of an off position condition. The destination for the addressed message is configured on the 'Real AtoN' tab.

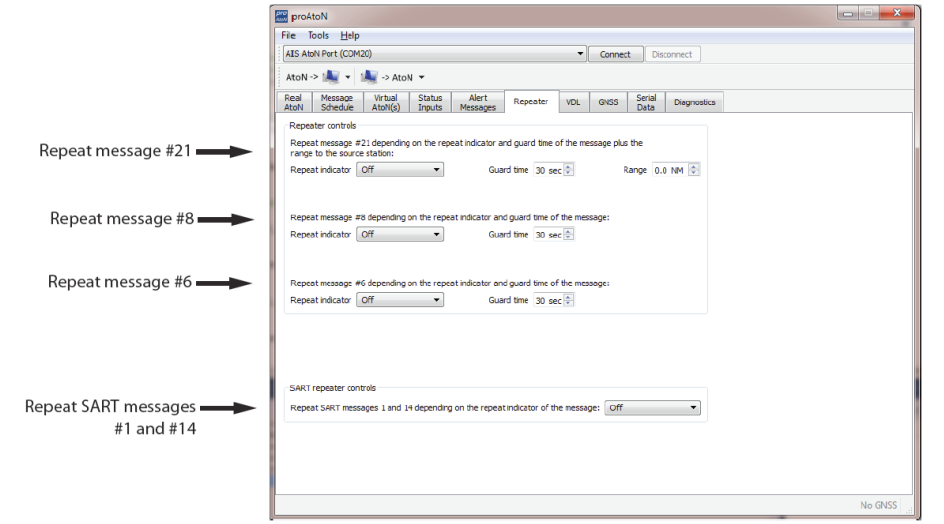
In addition to configuration of the off position alert a schedule for the associated message must be configured in the 'Message schedule' tab.

- Message #14 index 2 must be configured if the message #14 action is selected
- Message #12 index 3 must be configured if the message #12 action is selected

Message Repeater Function

The transceiver can be configured to repeat, or re-transmit, certain messages it receives. Note: messages from virtual AtoN's are not repeated. This feature applies to messages #6, #8, #21 and to SART (Search And Rescue Transponder) specific messages #1 and #14. This feature is turned off by default for all message types but can be enabled and configured using the Repeater tab. The number of messages that are repeated is limited by the number of messages waiting to be repeated and the total number of transmissions made per UTC minute.

	CAUTION
CAUTION	It is not recommended to use this feature as it significantly drains the internal battery. Contact Sealite for additional advice.



For each message type, the repeat function can be disabled - Off - or enabled to repeat received messages with a Repeat Indicator (RI) value equal to or less than 0, 1 or 2. The RI value states how many times the message has already been repeated where 0 means it was transmitted by the source.

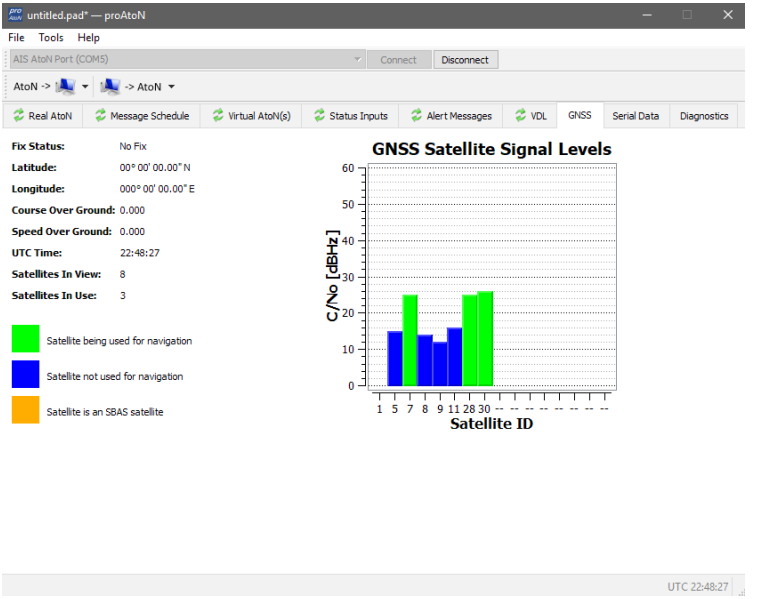
For messages #6, #8 and #21, a Guard Time can be applied. This creates a period after a message is repeated, during which the same message type from the source MMSI will not be repeated again, regardless of the message's RI value.

For example, if a message #6 from MMSI A is repeated then a second message #6 is received from MMSI A within the Guard Time, the second message shall be interpreted and acted upon as necessary but it will not be repeated; however, if a third message #6 from MMSI A is received after the Guard Time has expired, it will be repeated so long as its RI value is less than or equal to that configured for the AtoN. For message #21, a Range constraint can also be applied. Any message #21 that meets the other criteria for repeating, shall be transmitted if the position reported is within the distance specified by the Range value of the receiving AtoN. A Range value of 0 indicates the restriction is disabled.

Transceiver Diagnostics

The proAtoN application provides a number of features to assist with installation of an AIS AtoN and diagnosis of fault conditions. These features are available through the GNSS, Serial Data and Diagnostics tabs in proAtoN. Configuration using proAtoN.

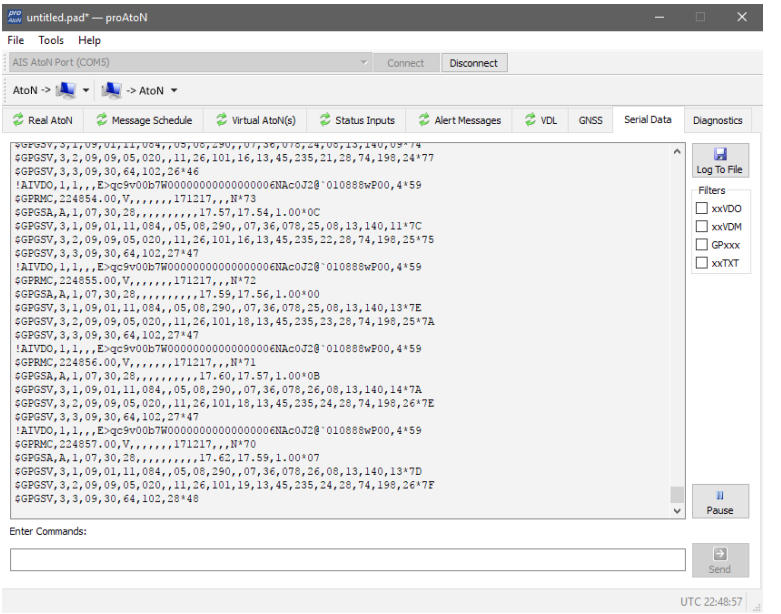
GNSS Tab



The GNSS tab shows the status of the GNSS receiver built into the transceiver. This provides an indication of the quality of the GNSS satellite signals being received along with the current position of the transceiver. At least four satellites with a carrier to noise ratio in excess of 40 dBHz are required for an acceptable position fix. Relocating the transceiver or connecting an external GNSS antenna can help improve the signal quality and resulting position accuracy.

The internal GNSS receiver supports SBAS (Satellite Based Augmentation Service) to enable improved accuracy and integrity of GNSS position fixes. The availability of SBAS depends on the installation location of the transceiver (the WAAS SBAS service covers most of the US and the EGNOS service covers Europe).

Serial Data Tab

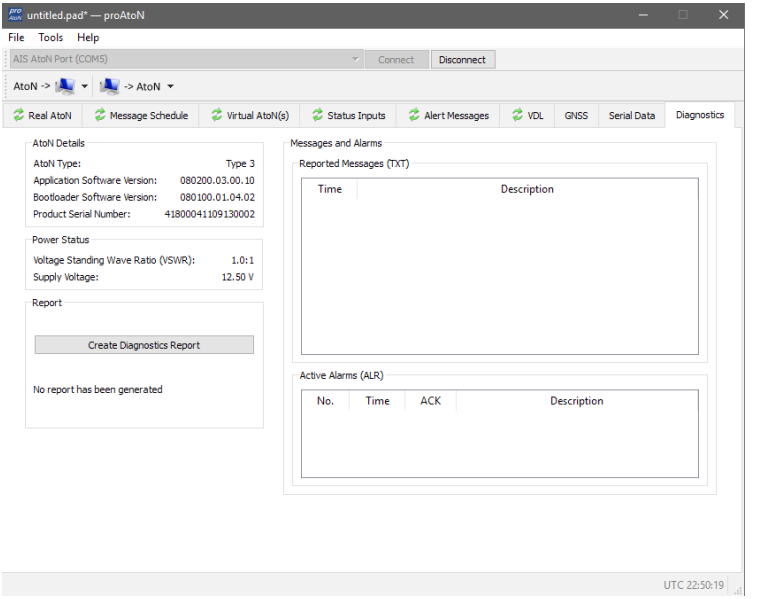


The serial data page shows all data output from the transceiver in NMEA0183 / IEC61162-1 format. It is also possible to send NMEA0183 / IEC61162-1 commands to transceiver if required for technical support or custom configuration. A facility to record the data to a file is provided by clicking the 'Log to File' button.

Certain sentence types can be filtered out of the output window by checking the relevant sentence type in the 'Filters' section of this tab.

Diagnostics Tab

The Diagnostics tab provides system version and status information. This information may be required when requesting technical support for the product.



AtoN Details

- The connected AtoN Type is displayed as Type 1 or Type 3
- The application and boot loader software versions for the connected AtoN are displayed
- The serial number of the connected AtoN and Power status is displayed
- The VHF antenna VSWR (Voltage Standing Wave Ratio) as measured at the last AIS transmission is displayed. This value is for indication only. A value better than 3:1 is expected for a good antenna system. The alarm limit for antenna VSWR is set to 5:1. A perfect antenna would give a VSWR of 1:1.
- The system supply voltage is displayed in volts. The supply voltage must be between 9.6V and 32.6V for correct operation. The supply voltage alarm will activate outside of this supply voltage range.

Report Generation

Clicking the 'Generate' button will produce a full report of the transceiver status. This report may be requested by technical support personnel. After clicking the button select a suitable file name and location for the report file before clicking save.

Reported Messages

During operation the transceiver will output a variety of status messages relating to the current operating state. These messages are for information only and do not represent a fault condition.

Message text	Description / Resolution
TX attempt failed (msg #6 no payload re-broadcast data)	A transmission of message #6 has failed as the payload data required for this message was not provided (by either the extended sensor interface, or an external system). The likely cause is a configuration error relating to data capture.
TX attempt failed (msg #8 no payload re-broadcast data)	A transmission of message #8 has failed as the payload data required for this message was not provided (by either the extended sensor interface, or an external system). The likely cause is a configuration error relating to data capture.
TX attempt failed (msg #12 no payload re-broadcast data)	A transmission of message #12 has failed as the payload data required for this message was not provided (by either the extended sensor interface, or an external system). The likely cause is a configuration error relating to data capture.
TX attempt failed (msg #14 no payload re-broadcast data)	A transmission of message #14 has failed as the payload data required for this message was not provided (by either the extended sensor interface, or an external system). The likely cause is a configuration error relating to data capture.
Standby blocked: Off position algorithm	The transceiver can't enter standby (low power) mode because the 'off position' algorithm has detected an off-position condition. Moving the transceiver within the configured operating radius will resolve this.
Standby Blocked: Acquiring GPS	The transceiver can't enter standby (low power) mode because it is currently acquiring a GNSS position fix. Standby operation will resume when a fix is acquired.
Standby disabled	Standby mode (low power operation) is disabled by configuration.
Standby Blocked: USB connected	The transceiver will not enter standby (low power) mode whilst the USB interface is connected to a PC.
Standby Blocked: Shell running	The transceiver will not enter standby (low power) mode whilst the configuration shell is active.
Standby Blocked: Receivers enabled	The transceiver can't enter standby mode if the current configuration requires that the receivers are active.
Standby Blocked: Repeater enabled	The transceiver cannot enter standby mode if the current configuration has the message repeater function enabled.
Exiting standby	Information only on exit of standby mode.
Entering standby for xx seconds	Information only on entry to standby mode.

Active Alarm

The transceiver incorporates BIIT (Built In Integrity Test) routines which continuously monitor key operating parameters. Should an integrity test fail, the failure will be indicated in the active alarms area.

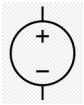
Alarm text	Description / Resolution
Tx Malfunction	A transmitter malfunction has been detected.
Antenna VSWR exceeds limits	Contact your supplier.
Rx Channel 1 malfunction	The VHF antenna VSWR is above the permitted limit. Check the VHF antenna, cable and connections are sound. The VSWR measured at the last transmission is displayed on the proAtoN diagnostics tab.
Rx Channel 2 malfunction	A receiver malfunction has been detected – please contact your supplier.
EPFS failure	A receiver malfunction has been detected – please contact your supplier.
DGNSS input failed	No position is available from the internal GNSS receiver – please contact your supplier.
Supply voltage	No data is available from the external source of differential GNSS correction data. Please check connections, baud rate and equipment configuration.
Low forward power	The transceiver power supply voltage is outside of the permitted range. The measured supply voltage is displayed on the proAtoN diagnostics tab.
Synchronisation lost	The transmitter forward power is below a preset limit - please contact your supplier.

AIS Configuration - Message 21 and Message 6

The process for configuring a SL-C510 with AIS to transmit Sealite Message 21 and Message 6 GLA. It is also applicable to a standalone SL-AIS-C1 or SL-AIS-C3 without sensor board option fitted and not connected to a lantern.

The following tools are required for setup/testing of AIS Ready system:

Power Supply
DC Volts



Digital Multi-meter
Fluke 115
or equivalent

Laptop/Desktop computer with all required software installed

Software

PC to AIS
RS-232 Cable

AIS / VHF Receiver
Dual channel Receiver

	WARNING
	The lantern electronics are not fitted with any reverse voltage/polarity protection circuitry. Not observing correct electrical polarity will result in permanent damage to the electronics.

	CAUTION
	It is essential that electrical power is not applied to the Lantern or AIS Module until instructed to do so.

	CAUTION
	Maintain a minimum distance of 10m between adjacent lanterns if testing 2 or more lanterns at the same time. Otherwise you may permanantly damage either or both the AIS tranceiver.

	CAUTION
	The SL-C510-AIS generates Radio fields. All personal shall be authorised and trained to test this equipment.

	ATTENTION
	It is essential that this procedure is carried out in a safe workspace when powering the RF transmitter. Maintain at least 5m distance from the AIS transponder when in operation.

Reference Documentation

- SL-C510 Installation Manual
- SRT P216 Carbon installation and operation guide

Pre-configuration Information

Prior to commencing this procedure, a number of parameters are required to configure the AIS AtoN. This information maybe be provided to you in the form of:

- "Sealite-Lantern-and-AIS-Setup-Requirements-RevE (2).DOCX"

The details required varies according to whether it is a Type 1 or Type 3 AIS AtoN.

- **Configuration detail required for Type 1**

  For a type 1 AIS AtoN to operate, it relies on being assigned/allocated a specific timing slots typically assigned by a local AIS base station or RF spectrum management authority. All this data fits into the table below:

  The table itself can be broken up into three parts.

  - The essential field is the orange section which is essential regardless of the message type.
  - The blue section represents the date required for Message 21 reporting schedule.
  - The green section represents the date required for Message 6 reporting schedule.

MMSI Number	AIS Broadcast Name	Latitude / AIS AtoN Position	Longitude / AIS AtoN Position	Message Type	Type of AtoN	MMSI Number	Dimension of the AIS Diameter or rectangle	AtoN Slot Msg 21, Channel 1 (A)	Start UTC	Increment/ Interval	AtoN Slot Msg 21, Channel 2 (B)	Start UTC	Increment/ Interval	AtoN Slot Msg 6, Channel 1 (A)	Start UTC	Increment/ Interval	AtoN Slot Msg 6, Channel 2 (B)	Start UTC	Increment/ Interval
Example																			
999999999	FEDCB	54° 17.93' S	124° 57.95' E	Message 21	Real	999999999	3m	445	0	6750	445	3	6750	500	0	6750	1200	3	6750

- **Configuration detail required for Type 3**

  For type 3 AIS AtoN it relies on not being assigned/allocated a specific slot, but instead it utilises its own AIS receiver and listens for free slots and randomly selects a free slot based upon its own slot map.

  For the case of a type 3 configuration, the data to the right is required:

AIS Broadcast Name	Latitude / AIS AtoN Position	Longitude / AIS AtoN	Message Type	Type of AtoN	MMSI Number	Dimension of the AIS Diameter or rectangle	Start UTC	Increment/ Interval	Start UTC	Increment/ Interval	Start UTC	Increment/ Interval	Start UTC	Increment/ Interval
Example														
FEDCB	54° 17.93' S	124° 57.95' E	Message 21	Real	999999999	3m	0	6750	3	6750	0	6750	3	6750

Note that slot timing detail is not required for type 3 AIS AtoN.

- **Character type and lengths limits**

Field	Description limit/type	Range/Type
AIS Broadcast Name	AIS Name, Up to 34 characters	Recommend plain text A..Z, 0..9
Type of AtoN	Refer to Appendix A	0..31
Latitude	AtoN position: degrees, minutes, and seconds	-90-90° 0-59' 59.999
Longitude	AtoN position: degrees, minutes, and seconds	-180-180° 0-59' 59.999
Message type	AIS AtoM, MSG 21 or Binary addressed message, MSG6	21 or 6
MMSI	Maritime mobile service identity, unique 9 digit number	Nine digit, 0-9
Start UTC	This is the hour and minute for transmission on channel 1 or 2	hh:mm format
AtoN Slot	One of 2250 time slots established every 60 seconds	0 to 2249
Interval	Interval in slots between transmissions on channel on particular channel.	0 to 3240000 slots. Typically, 13500slots which equals to a 6minute internal between transmissions.

- **Pre-Start**

1. Remove any DC power from the AIS AtoN, as the AIS module will rely on USB power for configuration.
2. Connect the PC to the AIS AtoN port using the supplied cable.

- **Test Environment Guidance**

Prior to commencing the AIS test procedure, review the following guidance statements:

1. Ideally AIS testing is conducted outdoors or in a RF screen room with transceiver terminated with suitable match loads. Also check for compliance to any local laws or regulations. E.g. FCC
2. Regardless whether testing is performed indoors (inside a building) or outside, the transmitting antenna should ideally be positioned above head height.
3. The distance between the AIS AtoN transmitter antenna and AIS Receiver should be at least 5m (32') especially when transmitting at maximum power of 12.5W.
4. Even at minimum transmitting power of 1W the antenna separation should be at least 2m (16'). Greater is preferred.
5. Separation is required to ensure that two antennas do not interact with each other and that their receivers are not saturated with RF signal.
6. Use a 12VDC battery of at least 24Ah capacity to power a AIS AtoN or a DC 6A , 12VDC PSU as the peak currents when transmitting are at least 3.5A at 12VDC for about 40ms.

A battery is better as most AC/DC power supplies will momentarily lose regulation and briefly trip their internal over current protection with a fast rising, short period peak current draw. A battery will for short periods act as a large capacitor and support high peak current excess of the AtoN's requirements.

7. Keep the AIS AtoN power cable length to a maximum 3m.
8. AIS AtoN modules will only transmit if they received data from at least four GPS satellites.
9. Relocating the transceiver or connecting an external GPS antenna can help improve the signal quality and resulting position accuracy.
10. Ensure that the number of satellites that the AIS AtoN is using is 4 or more by checking the Diagnostic tab of proAtoN.
11. The most cause for a AIS not to transmit are: incorrect configuration, poor supply, no GPS data or poorly match VHF antenna. Refer to the Troubleshooting table for assistance. The following depicts a typical set up:

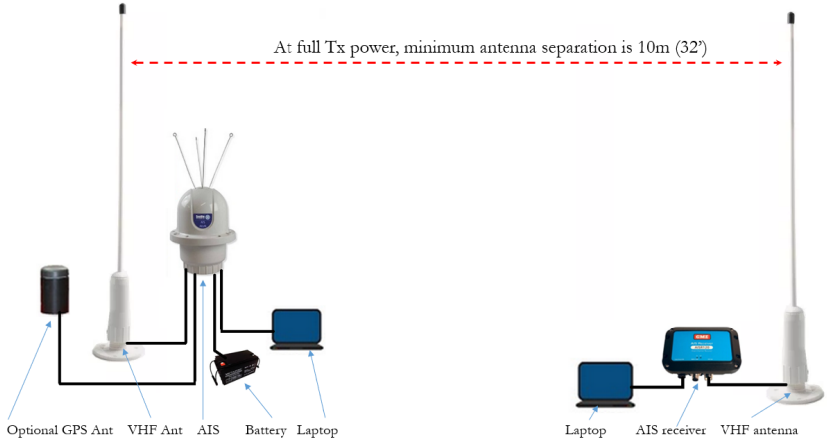


Figure 1

- **Setting up the PC Computer/Laptop**

The following steps install the necessary s/w required to test an AIS AtoN:

1. Install the GME receiver USB drivers
2. Install the proAtoN software : proAtoN v2.01 or later
3. Run the program "Simulator_AIS" and ensure it is not blocked by your computer's anti-virus software.
4. Select the COM port assigned to the AIS receiver and set the BAUD rate as 38400 BAUD.
5. Then click Open Port will change the text colour from red to green.
6. Finally click OK. Now all received AIS messages will be decoded within this window.
7. Connect the AIS receiver to Windows PC/Laptop (Computer)
8. With the DC power removed from the AIS unit, connect the AIS to the Computer via the supplied USB cable.

NOTE: Each AIS AtoN will be allocated by Windows a unique COM port. They are generally never the same COM port.

- **Configuration using 'proAtoN application'**

1. Open 'ProAtoN application 080500.02.01.02 (Apr 4 2018)' or later version if available.
2. The basic layout of the proAtoN application is shown in Figure 2.
3. Select the COM port for the AtoN.

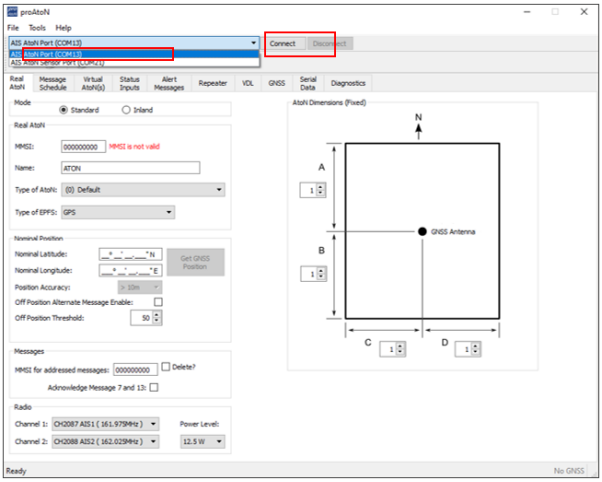


Figure 2

4. When connected via USB port associated with the transceiver will be listed in the selection drop down.
5. To connect to the transceiver, select the 'AIS AtoN Port' option from the drop down and click the 'Connect' button as shown in Figure 3.
6. With reference to your configuration table enter in the highlighted sections and then press the Message Schedule Tab.

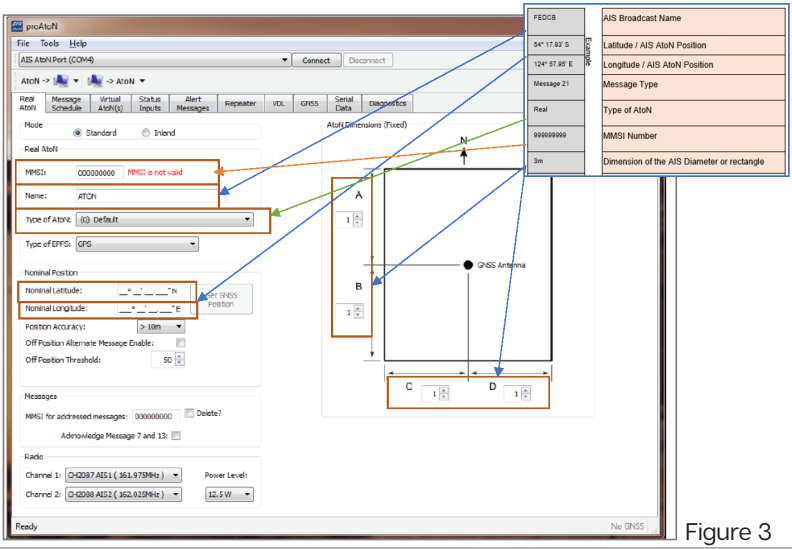


Figure 3

7. Click on the Message schedule tab and input values highlighted. These values will come from the data collected at the beginning of this procedure.

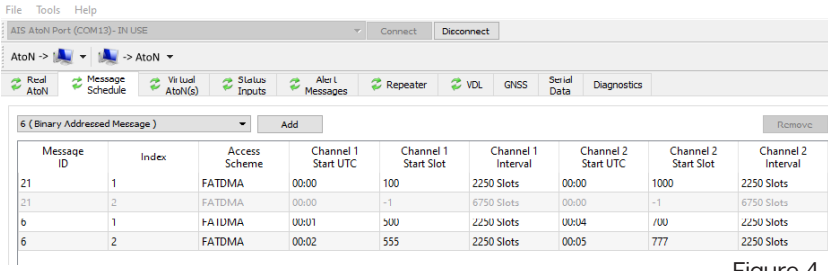


Figure 4

Note: If Message 6 is required, then click on the Add button and new Message schedule will appear and then follow the next step.

8. Click on menu button 'Status Inputs' and tick all the boxes as shown in Figure 5.

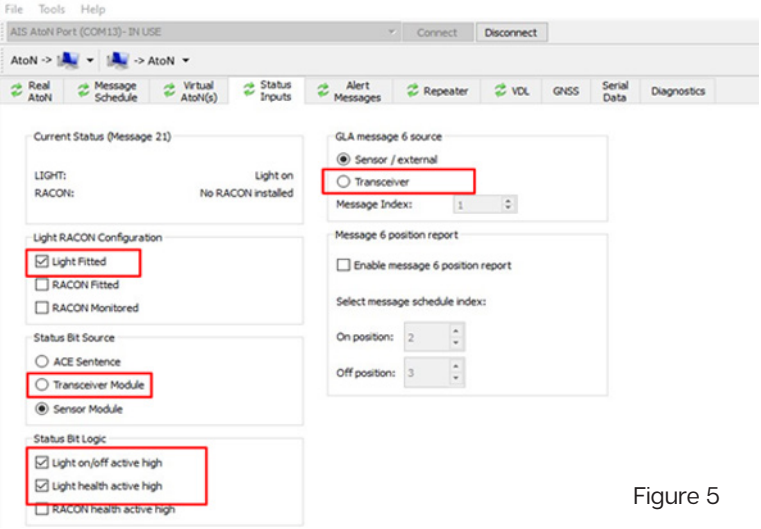


Figure 5

9. Select from 'AtoN' drop down menu 'Send all configuration' as shown in Figure 6.

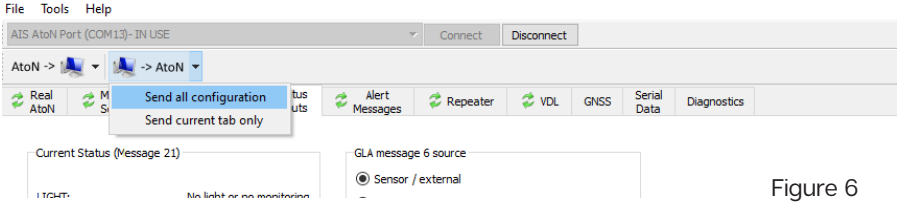


Figure 6

10. If the AIS AtoN is a Type 1 unit then go to the next step titled "AIS type 1 Message Setup" If the AIS AtoN is a Type 3 unit then go to the next step titled "AIS type 3 Message Setup".

Testing the AIS AtoN

11. Attach the grounding wire to the AIS AtoN.
12. Connect the AIS AtoN to DC battery.
13. Leave the unit running until you start to pick up a Message 21.
14. This should occur within 5mins after applying power to the lantern.
15. Leave the AIS AtoN to run for at least 30mins.
16. Every 3mins new data should appear on Simulate_AIS.
17. If you see no transmissions after 15mins, review the possible causes in the Troubleshooting Guide.
18. Review the Message 21 data received by the AIS receiver and displayed within Simulate_AIS PC software.
19. Turn the Light ON by placing it into darkness.
20. Message 21 Light ON format as shown in Figure 7.
21. Ensure Regional Number is 226 (Light ON) as shown in Figure 7.
22. Expose the light to day light and ensure the light turns off.
23. Message 21 Light Off as shown in Figure 8.
24. Ensure Regional Number is 228 (Light OFF) as shown in Figure 8

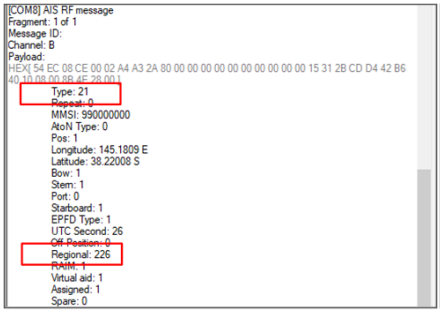


Figure 7.

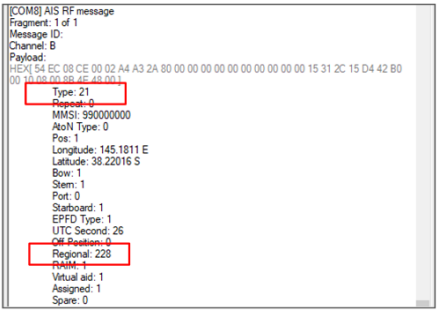


Figure 8.

25. Create Alarm condition by setting input voltage to 11VDC.
26. Message 21 ALARM as shown in Figure 9.
27. Make sure Regional Number is 231 (ALARM) as shown in Figure 9.

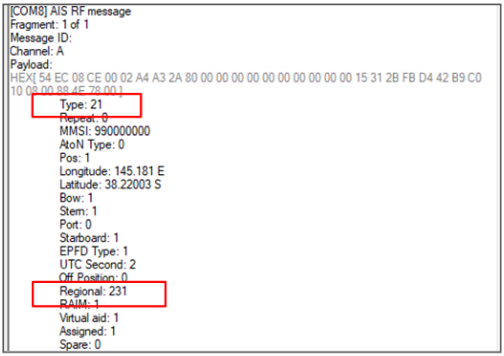


Figure 9.

Additional Test if Message 6 GLA is required

NOTE: Only complete this section if the AIS AtoN has been configured with Message 6 schedule.

28. Adjust input voltage back to 12.6VDC and turn the Light ON.
29. Message 6 GLA Light ON format as shown in Figure 10.
30. Make sure LIGHT ON message is displayed as shown in Figure 10.

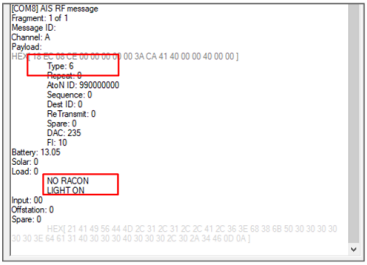


Figure 10.

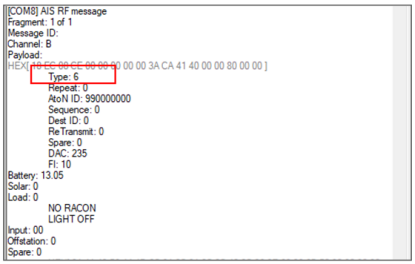


Figure 11.

31. Turn the Light Off.
32. Message 6 GLA Light Off as shown in Figure 11.
33. Make sure LIGHT OFF message is displayed as shown in Figure 11.
34. Create Alarm condition by setting input voltage to 11VDC.
35. Message 6 GLA ALARM as shown in Figure 12.
36. Make sure ALARM message is displayed as shown in Figure 12.

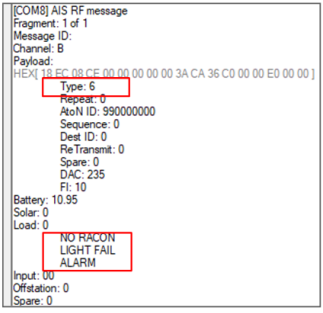


Figure 12.

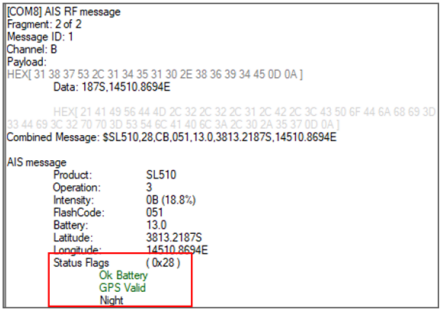


Figure 13.

37. Adjust input voltage back to 12.6VDC and turn the Light ON.
38. Sealite Message Light ON format as shown in Figure 13.
39. Make sure 'Night' message is displayed and Status Flags is (0x28) as shown in Figure 13.
40. Turn the Light Off.
41. Sealite Message Light Off as shown in Figure 14.
42. Make sure 'Night' message is NOT displayed and Status Flags is (0x08) as shown in Figure 14.
43. Create Alarm condition by setting input voltage to 11VDC.

44. Sealite Message 'Flat Battery' as shown in Figure 15.
45. Make sure ALARM message is displayed as shown in Figure 15.

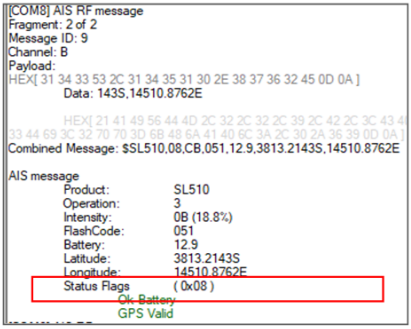


Figure 14.

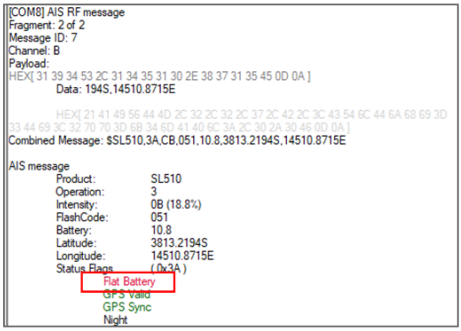
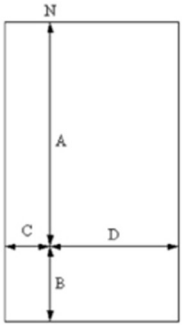
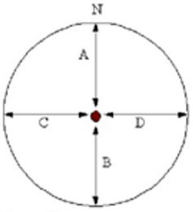


Figure 15.

The table below lists all the codes for type of AtoN defined by IALA:

	Code	Definition	Dimension/ reference for position
	0	Default, Type of AtoN not specified	 Figure 1. Dimensions of a fixed AtoN related to the given reference point.
	1	Reference point	
	2	RACON	
	3	Fixed structure off shore, such as oil platforms, wind farms. (Note: This code should identify an obstruction that is fitted with an Aid-to-Navigation AIS station.)	
	4	Spare, Reserved for future use.	
Fixed AtoN	5	Light, without sectors	
	6	Light, with sectors	
	7	Leading Light Front	
	8	Leading Light Rear	
	9	Beacon, Cardinal N	
	10	Beacon, Cardinal E	
	11	Beacon, Cardinal S	
	12	Beacon, Cardinal W	
	13	Beacon, Port hand	
	14	Beacon, Starboard hand	
	15	Beacon, Preferred Channel port hand	
	16	Beacon, Preferred Channel starboard hand	
	17	Beacon, Safe water	
	18	Beacon, Safe water	
	19	Beacon, Special mark	
Floating AtoN	20	Cardinal Mark N	 Figure 2. Dimensions for a floating AtoN and fixed floating off-shore structures
	21	Cardinal Mark E	
	22	Cardinal Mark S	
	23	Cardinal Mark W	
	24	Port hand Mark	
	25	Starboard hand Mark	
	26	Preferred Channel Port hand	
	27	Preferred Channel Starboard hand	
	28	Isolated danger	
	29	Safe Water	
	30	Special Mark	
	31	Light Vessel / LANBY/Rigs	

Appendix

Flash Codes

The Sealite SL-C510 may be set to any of 256 IALA recommended flash settings which are user adjustable onsite without the need for external devices.

SEALITE® code reference is listed by number of flashes
For the latest version of this document visit www.sealite.com,
or email info@sealite.com

Symbols

FL	Flash followed by number Eg. FL 1 S, one flash every second
F	Fixed
Q	Quick Flash
VQ	Very Quick Flash
OC	Occulting; greater period on than off
ISO	Isophase; equal period on and off
LFL	Long Flash Long
MO	Morse code ( ) contains letter

For example, VQ (6) + LFL 10 S means 6 very quick flashes followed by a long flash, during a 10-second interval.

The amount of power your lantern draws through the night depends on the duty cycle, i.e. the amount of time on as a proportion to the timing cycle. For example, 0.5 seconds on and 4.5 seconds off equals a 10% duty cycle.

It is best to operate at the lowest duty cycle appropriate to the actual needs of the application.

MARK DESCRIPTION	RHYTHM
Port Hand & Starboard Marks:	Any, other than Composite Group Flashing (2+1)
Preferred Channel Starboard:	Composite Group Flashing (2+1)
Preferred Channel Port:	Composite Group Flashing (2+1)
North Cardinal Mark:	Very quick or quick
East Cardinal Mark:	Very quick (3) every 5 seconds or quick (3) every 10 seconds
South Cardinal Mark:	Very quick (6) + long flash every 10 seconds or quick (6) + long flash every 15 seconds
West Cardinal Mark:	Very quick (9) every 10 seconds or quick (9) every 15 seconds
Isolated Danger Mark:	Group flashing (2)
Safe Water Mark:	Isophase, occulting, one long flash every 10 seconds or Morse Code “A”
Special Marks:	Any, other than those described for Cardinal, Isolated Danger or Safe Water Marks

HEX CODE		IR Controller	FLASH CODE	ON	OFF
A	B				
0	0	000	F (Steady light)		
D	3	211	VQ 0.5 S	0.2	0.3
-	-	274	VQ 0.5 S	0.25	0.25
E	3	227	VQ 0.6 S	0.2	0.4
F	3	243	VQ 0.6 S	0.3	0.3
7	3	115	Q 1 S	0.2	0.8
8	3	131	Q 1 S	0.3	0.7
9	3	147	Q 1 S	0.4	0.6
A	3	163	Q 1 S	0.5	0.5
8	4	132	Q 1 S	0.8	0.2
B	3	179	Q 1.2 S	0.3	0.9
-	-	293	FL 1.2 S	0.4	0.8
9	4	148	Q 1.2 S	0.5	0.7
C	3	195	Q 1.2 S	0.6	0.6
F	4	244	FL 1.5 S	0.2	1.3
1	0	16	FL 1.5 S	0.3	1.2
0	5	5	FL 1.5 S	0.4	1.1
0	4	4	FL 1.5 S	0.5	1.0
2	0	32	FL 2 S	0.2	1.8
3	0	48	FL 2 S	0.3	1.7
4	0	64	FL 2 S	0.4	1.6
5	0	80	FL 2 S	0.5	1.5
6	0	96	FL 2 S	0.7	1.3
7	0	112	FL 2 S	0.8	1.2
1	2	18	ISO 2 S	1.0	1.0
8	0	128	FL 2.5 S	0.3	2.2
9	0	144	FL 2.5 S	0.5	2.0
D	6	214	FL 2.5 S	1.0	1.5
1	5	21	FL 3 S	0.2	2.8

HEX CODE		IR Controller	FLASH CODE	ON	OFF
A	B				
A	0	160	FL 3 S	0.3	2.7
2	5	37	FL 3 S	0.4	2.6
B	0	176	FL 3 S	0.5	2.5
3	5	53	FL 3 S	0.6	2.4
C	0	192	FL 3 S	0.7	2.3
D	0	208	FL 3 S	1.0	2.0
2	2	34	ISO 3 S	1.5	1.5
5	4	84	OC 3 S	2.0	1.0
E	2	226	OC 3 S	2.5	0.5
4	6	70	OC 3.5 S	2.5	1.0
4	5	69	FL 4 S	0.2	3.8
5	5	85	FL 4 S	0.3	3.7
E	0	224	FL 4 S	0.4	3.6
F	0	240	FL 4 S	0.5	3.5
6	5	101	FL 4 S	0.6	3.4
0	1	1	FL 4 S	0.8	3.2
1	1	17	FL 4 S	1.0	3.0
2	1	33	FL 4 S	1.5	2.5
3	2	50	ISO 4 S	2.0	2.0
3	6	54	OC 4 S	2.5	1.5
F	2	242	OC 4 S	3.0	1.0
3	1	49	FL 4.3 S	1.3	3.0
8	5	133	FL 5 S	0.2	4.8
4	1	65	FL 5 S	0.3	4.7
-	-	279	FL 5 S	0.4	4.6
5	1	81	FL 5 S	0.5	4.5
9	5	149	FL 5 S	0.9	4.1
6	1	97	FL 5 S	1.0	4.0
7	1	113	FL 5 S	1.5	3.5

HEX CODE		IR Controller	FLASH CODE	ON	OFF
A	B				
4	2	66	ISO 5 S	2.5	2.5
8	2	130	LFL 5 S	2.0	3.0
0	3	3	OC 5 S	3.0	2.0
1	3	19	OC 5 S	4.0	1.0
2	3	35	OC 5 S	4.5	0.5
C	6	198	FL 6 S	0.2	5.8
B	5	181	FL 6 S	0.3	5.7
C	5	197	FL 6 S	0.4	5.6
8	1	129	FL 6 S	0.5	5.5
9	1	145	FL 6 S	0.6	5.4
A	1	161	FL 6 S	1.0	5.0
7	5	117	FL 6 S	1.2	4.8
B	1	177	FL 6 S	1.5	4.5
5	2	82	ISO 6 S	3.0	3.0
9	2	146	LFL 6 S	2.0	4.0
6	4	100	OC 6 S	4.0	2.0
3	3	51	OC 6 S	4.5	1.5
4	3	67	OC 6 S	5.0	1.0
-	-	280	FL 7 S	0.4	6.6
A	4	164	FL 7 S	1.0	6.0
9	6	150	FL 7 S	2.0	5.0
5	6	86	OC 7 S	4.5	2.5
D	5	213	FL 7.5 S	0.5	7.0
C	1	193	FL 7.5 S	0.8	6.7
E	5	229	FL 8 S	0.5	7.5
B	4	180	FL 8 S	1.0	7.0
6	2	98	ISO 8 S	4.0	4.0
A	2	162	LFL 8 S	2.0	6.0
6	6	102	OC 8 S	5.0	3.0

HEX CODE		IR Controller	FLASH CODE	ON	OFF
A	B				
-	-	294	OC 8 S	6.0	2.0
B	2	178	LFL 8 S	3.0	5.0
F	5	245	FL 9 S	0.9	8.1
C	4	196	FL 9 S	1.0	8.0
7	6	118	OC 9 S	6.0	3.0
0	6	6	FL 10 S	0.2	9.8
1	6	22	FL 10 S	0.3	9.7
-	-	281	FL 10 S	0.4	9.6
D	1	209	FL 10 S	0.5	9.5
2	6	38	FL 10 S	0.8	9.2
E	1	225	FL 10 S	1.0	9.0
1	4	20	FL 10 S	1.5	8.5
C	2	194	LFL 10 S	2.0	8.0
D	2	210	LFL 10 S	3.0	7.0
7	2	114	ISO 10 S	5.0	5.0
2	4	36	LFL 10 S	4.0	6.0
8	6	134	OC 10 S	6.0	4.0
5	3	83	OC 10 S	7.0	3.0
6	3	99	OC 10 S	7.5	2.5
-	-	303	FL 11 S	1.0	10.0
-	-	302	FL 12 S	1.0	11.0
F	1	241	FL 12 S	1.2	10.8
D	4	212	FL 12 S	2.5	9.5
3	4	52	LFL 12 S	2.0	10.0
0	2	2	FL 15 S	1.0	14.0
4	4	68	LFL 15 S	4.0	11.0
7	4	116	OC 15 S	10	5.0
A	6	166	LFL 20 S	2.0	18.0
E	4	228	FL 26 S	1.0	25.0

HEX CODE		IR Controller	FLASH CODE	ON	OFF	ON	OFF
A	B						
0	A	10	FL (2) 4 S	0.5	1.0	0.5	2.0
E	B	235	VQ (2) 4 S	0.2	1.0	0.2	2.6
1	A	26	FL (2) 4.5 S	0.3	1.0	0.3	2.9
2	A	42	FL (2) 4.5 S	0.4	1.0	0.4	2.7
3	A	58	FL (2) 4.5 S	0.5	1.0	0.5	2.5
-	-	277	FL (2) 4.6 S	0.3	0.3	0.3	3.7
F	9	249	FL (2) 5 S	0.2	0.8	0.2	3.8
2	C	44	FL (2) 5 S	0.2	1.2	0.2	3.4
4	A	74	FL (2) 5 S	0.4	0.6	0.4	3.6
-	-	282	FL (2) 5 S	0.4	1.1	0.4	3.1
0	7	7	FL (2) 5 S	0.5	1.0	0.5	3.0
1	7	23	FL (2) 5 S	1.0	1.0	1.0	2.0
-	-	257	FL (2) 5 S	0.3	1.0	0.3	3.4
9	B	155	Q (2) 5 S	0.3	0.7	0.3	3.7
2	9	41	Q (2) 5 S	0.5	0.5	0.5	3.5
-	-	305	FL (2) 5 S	0.5	0.7	0.5	3.3
5	A	90	FL (2) 5.5 S	0.4	1.4	0.4	3.3
7	8	120	FL (2) 6 S	0.3	0.6	1.0	4.1
A	A	170	FL (2) 6 S	0.3	0.9	0.3	4.5
6	A	106	FL (2) 6 S	0.3	1.0	0.3	4.4
7	A	122	FL (2) 6 S	0.4	1.0	0.4	4.2
-	-	283	FL (2) 6 S	0.4	1.2	0.4	4.0
9	9	153	FL (2) 6 S	0.5	1.0	0.5	4.0
2	8	40	FL (2) 6 S	0.8	1.2	0.8	3.2
-	-	256	FL (2) 6 S	0.8	0.8	0.8	3.6
3	7	55	FL (2) 6 S	1.0	1.0	1.0	3.0
3	9	57	Q (2) 6 S	0.3	0.7	0.3	4.7
-	-	295	LFL + FL 6 S	3.0	1.0	1.0	1.0
-	-	273	FL (2) 6.5 S	0.5	1.0	0.5	4.5
-	-	283	FL (2) 7 S	0.4	1.2	0.4	5.0
-	-	311	FL (2) 7 S	0.5	1.5	0.5	4.5
A	9	169	FL (2) 7 S	1.0	1.0	1.0	4.0
7	B	123	FL (2) 8 S	0.4	0.6	2.0	5.0
8	A	138	FL (2) 8 S	0.4	1.0	0.4	6.2
-	-	285	FL (2) 8 S	0.4	1.7	0.4	5.5
4	7	71	FL (2) 8 S	0.5	1.0	0.5	6.0
-	-	297	FL (2) 8 S	0.5	0.5	1.5	5.5
8	8	136	FL (2) 8 S	0.8	1.2	2.4	3.6
5	7	87	FL (2) 8 S	1.0	1.0	1.0	5.0
4	C	76	OC (2) 8 S	3.0	2.0	1.0	2.0
5	C	92	OC (2) 8 S	5.0	1.0	1.0	1.0
F	B	251	VQ (2) 8 S	0.2	1.0	0.2	6.6
-	-	286	FL (2) 9 S	0.4	1.7	0.4	6.5
9	A	154	FL (2) 10 S	0.4	1.6	0.4	7.6
-	-	287	FL (2) 10 S	0.4	2.2	0.4	7.0
6	7	103	FL (2) 10 S	0.5	1.0	0.5	8.0
7	7	119	FL (2) 10 S	0.5	1.5	0.5	7.5
6	9	105	FL (2) 10 S	0.5	2.0	0.5	7.0
-	-	298	FL (2) 10 S	0.5	0.5	1.5	7.5
8	7	135	FL (2) 10 S	0.8	1.2	0.8	7.2
B	9	185	FL (2) 10 S	1.0	1.0	1.0	7.0
9	7	151	FL (2) 10 S	1.0	1.5	1.0	6.5
4	9	73	Q (2) 10 S	0.6	0.4	0.6	8.4
B	A	186	FL (2) 12 S	0.4	1.0	0.4	10.2
C	9	201	FL (2) 12 S	0.5	1.0	0.5	10.0
D	9	217	FL (2) 12 S	1.5	2.0	1.5	7.0
A	8	168	FL (2) 15 S	0.5	1.5	2.0	11.0
A	7	167	FL (2) 15 S	1.0	2.0	1.0	11.0

HEX CODE		IR Controller	FLASH CODE	ON	OFF	ON	OFF	ON	OFF
A	B								
7	9	121	Q (3) 5 S	0.5	0.5	0.5	0.5	0.5	2.5
5	9	89	VQ (3) 5 S	0.2	0.3	0.2	0.3	0.2	3.8
0	C	12	VQ (3) 5 S	0.3	0.2	0.3	0.2	0.3	3.7
E	9	233	VQ (3) 5 S	0.3	0.3	0.3	0.3	0.3	3.5
-	-	308	FL (3) 5 S	0.3	0.7	0.3	0.7	0.3	3.7
0.3	3.7	60	FL (3) 6 S	0.5	1.0	0.5	1.0	0.5	2.5
2	B	43	FL (2+1) 6 S	0.3	0.4	0.3	1.2	0.3	3.5
HEX CODE		**IR Controller**	**FLASH CODE**	**ON**	**OFF**	**ON**	**OFF**	**ON**	**OFF**
A	B								
A	B	171	Q (3) 6 S	0.3	0.7	0.3	0.7	0.3	3.7
F	A	250	FL (3) 8 S	0.5	1.0	0.5	1.0	0.5	4.5
-	-	301	FL (3) 8 S	1.5	0.5	0.5	0.5	0.5	4.5
-	-	266	Q (3) 9 S	0.5	0.5	0.5	1.0	0.5	6.0
0	B	11	FL (3) 9 S	0.3	1.0	0.3	1.0	0.3	6.1
-	-	306	FL (3) 9 S	0.5	1.5	0.5	1.5	0.5	4.5
B	7	183	FL (3) 9 S	0.8	1.2	0.8	1.2	0.8	4.2
B	8	184	FL (3) 10 S	0.3	0.7	0.3	0.7	0.9	7.1
C	8	200	FL (3) 10 S	0.4	0.6	0.4	0.6	1.2	6.8
-	-	290	FL (3) 10 S	0.4	0.8	0.4	0.8	0.4	7.2
C	B	203	FL (3) 10 S	0.5	0.5	0.5	0.5	0.5	7.5
C	7	199	FL (3) 10 S	0.5	1.5	0.5	1.5	0.5	5.5
D	B	219	FL (3) 10 S	0.6	0.6	0.6	0.6	0.6	7.0
-	-	278	FL (3) 10 S	0.9	1.1	0.9	1.1	0.9	5.1
D	7	215	FL (3) 10 S	1.0	1.0	1.0	1.0	1.0	5.0
-	-	261	FL (3) 10 S	0.35	0.65	0.35	0.65	0.35	7.65
3	8	56	FL (2+1) 10 S	0.5	0.7	0.5	2.1	0.5	5.7
8	9	137	OC (3) 10 S	5.0	1.0	1.0	1.0	1.0	1.0
B	B	187	Q (3) 10 S	0.3	0.7	0.3	0.7	0.3	7.7
D	8	216	FL (2 + 1) 10 S	0.5	0.5	0.5	0.5	1.5	6.5
-	-	288	FL (3) 12 S	0.4	2.1	0.4	2.1	0.4	6.6
1	B	27	FL (3) 12 S	0.5	1.5	0.5	1.5	0.5	7.5
E	A	234	FL (3) 12 S	0.5	2.0	0.5	2.0	0.5	6.5
E	7	231	FL (3) 12 S	0.8	1.2	0.8	1.2	0.8	7.2
B	6	182	FL (3) 12 S	1.0	1.0	1.0	3.0	1.0	5.0
4	8	72	FL (2+1) 12 S	0.8	1.2	0.8	2.4	0.8	6.0
5	8	88	FL (2+1) 12 S	1.0	1.0	1.0	4.0	1.0	4.0
-	-	272	FL (3) 12.5 S	0.5	1.0	0.5	1.0	0.5	9.0
-	-	289	FL (3) 13 S	0.4	2.1	0.4	2.1	0.4	7.6
-	-	296	LFL + FL(2) 13 S	6.0	1.0	2.0	1.0	2.0	1.0
1	8	24	FL (2+1) 13.5 S	1.0	1.0	1.0	4.0	1.0	5.5
-	-	307	FL (3) 14.5 S	0.5	1.0	1.5	3.0	0.5	9.0
F	7	247	FL (3) 15 S	0.3	1.7	0.3	1.7	0.3	10.7
9	D	157	FL (3) 15 S	0.4	1.0	0.4	1.0	0.4	11.8
0	8	8	FL (3) 15 S	0.5	1.5	0.5	1.5	0.5	10.5
-	-	259	FL (3) 15 S	0.5	2.0	0.5	2.0	0.5	9.5
-	-	260	FL (3) 15 S	1.0	1.0	1.30	1.0	1.0	10.0
F	8	248	FL (2+1) 15 S	0.6	0.3	0.6	0.3	1.4	11.8
0	9	9	FL (2+1) 15 S	0.7	0.5	0.7	0.5	1.9	10.7
1	9	25	FL (2+1) 15 S	0.7	0.7	0.7	0.7	2.1	10.1
6	8	104	FL (2+1) 15 S	1.0	2.0	1.0	5.0	1.0	5.0
-	-	265	FL (2+1) 15 S	1.3	0.7	1.3	0.7	3.3	7.7
-	-	264	FL (2+1) 15.75 S	0.55	0.35	0.55	0.35	1.45	12.5
1	C	28	VQ (3) 15 S	0.1	0.5	0.1	0.5	0.1	13.7
-	-	313	FL (2) + LFL 16 S	2.0	2.0	2.0	2.0	6.0	2.0
4	B	75	FL (3) 20 S	0.5	3.0	0.5	3.0	0.5	12.5
3	B	59	FL (3) 20 S	0.5	1.5	0.5	1.5	0.5	15.5
-	-	263	FL (3) 20 S	0.5	2.0	0.5	2.0	0.5	12.0
5	B	91	FL (3) 20 S	0.8	1.2	0.8	1.2	0.8	15.2
6	B	107	FL (3) 20 S	1.0	1.0	1.0	1.0	1.0	15.0

HEX CODE		IR Controller	FLASH CODE	ON	OFF	ON	OFF	ON	OFF	ON	OFF
A	B										
-	-	271	VQ (4) 2 S	0.10	0.13	0.10	0.13	0.10	0.13	0.10	1.21
B	F	191	VQ (4) 4 S	0.3	0.3	0.3	0.3	0.3	0.3	0.3	2.3
B	D	189	Q (4) 6 S	0.3	0.7	0.3	0.7	0.3	0.7	0.3	2.7
8	D	141	Q (4) 6 S	0.4	0.6	0.4	0.6	0.4	0.6	0.4	2.6
-	-	299	FL (1+3) 8 S	1.5	0.5	0.5	0.5	0.5	0.5	0.5	3.5
-	-	309	FL (4) 7 S	0.3	0.7	0.3	0.7	0.3	0.7	0.3	3.7
1	D	29	FL (4) 10 S	0.5	1.0	0.5	1.0	0.5	1.0	0.5	5.0
2	D	45	FL (4) 10 S	0.8	1.2	0.8	1.2	0.8	1.2	0.8	3.2
F	E	254	Q (4) 10 S	0.3	0.7	0.3	0.7	0.3	0.7	0.3	6.7
-	-	300	FL (4) 10 S	1.5	0.5	0.5	0.5	0.5	0.5	0.5	4.5
-	-	312	FL (4) 11 S	0.5	1.5	0.5	1.5	0.5	1.5	0.5	4.5
B	E	190	FL (4) 12 S	0.3	1.7	0.3	1.7	0.3	1.7	0.3	5.7
4	F	79	FL (4) 12 S	0.5	0.5	0.5	0.5	0.5	0.5	0.5	8.5
C	E	206	FL (4) 12 S	0.5	1.5	0.5	1.5	0.5	1.5	0.5	5.5
3	D	61	FL (4) 12 S	0.8	1.2	0.8	1.2	0.8	1.2	0.8	5.2
A	D	173	Q (4) 12 S	0.3	0.7	0.3	0.7	0.3	0.7	0.3	8.7
4	D	77	FL (4) 15 S	0.5	1.5	0.5	1.5	0.5	1.5	0.5	8.5
8	E	142	FL (4) 15 S	1.0	1.0	1.0	1.0	1.0	1.0	1.0	8.0
7	D	125	FL (4) 15 S	1.5	0.5	0.5	0.5	0.5	0.5	0.5	10.5
D	E	222	FL (4) 16 S	0.5	1.5	0.5	1.5	0.5	1.5	0.5	9.5
-	-	314	FL (3+1) 18 S	1.5	1.5	1.5	1.5	1.5	4.5	1.5	4.5
-	-	304	FL (4) 19 S	0.3	0.7	0.3	0.7	0.3	0.7	0.3	15.7
C	D	205	FL (4) 20 S	0.3	3.0	0.3	3.0	0.3	3.0	0.3	9.8
5	D	93	FL (4) 20 S	0.5	1.5	0.5	1.5	0.5	1.5	0.5	13.5
0	D	13	FL (4) 20 S	0.5	1.5	0.5	1.5	0.5	4.5	0.5	10.5
3	F	63	FL (4) 20 S	1.5	1.5	1.5	1.5	1.5	1.5	1.5	9.5
0	F	15	Q (4) 20 S	0.5	0.5	0.5	0.5	0.5	0.5	0.5	16.5
-	-	263	FL (4) 20 S	0.5	2.0	0.5	2.0	0.5	2.0	0.5	12.0
E	E	238	Q (4) 28 S	0.5	0.5	0.5	0.5	0.5	0.5	0.5	24.5
6	F	111	FL (4) 30 S	0.5	0.5	0.5	0.5	0.5	0.5	0.5	26.5

HEX CODE		IR Controller	FLASH CODE	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF
A	B												
D	D	221	Q (5) 7 S	0.3	0.7	0.3	0.7	0.3	0.7	0.3	0.7	0.3	2.7
-	-	310	Q (5) 9 S	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	4.5
E	D	237	Q (5) 10 S	0.3	0.7	0.3	0.7	0.3	0.7	0.3	0.7	0.3	5.7
E	8	232	FL (5) 12 S	0.5	1.5	0.5	1.5	0.5	1.5	0.5	1.5	0.5	3.5
-	-	276	FL (5) 16 S	0.5	1.5	0.5	1.5	0.5	1.5	0.5	1.5	0.5	7.5
5	F	95	FL (5) 20 S	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	15.5
9	F	159	FL (5) 20 S	0.8	1.2	0.8	1.2	0.8	1.2	0.8	1.2	0.8	11.2
9	E	158	FL (5) 20 S	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	11.0

HEX CODE		IR Controller	FLASH CODE	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF
A	B														
F	D	253	Q (6) 10 S	0.3	0.7	0.3	0.7	0.3	0.7	0.3	0.7	0.3	0.7	0.3	4.7
A	F	175	FL (6) 15 S	0.3	0.7	0.3	0.7	0.3	0.7	0.3	0.7	0.3	0.7	0.3	9.7
7	F	127	FL (6) 15 S	0.5	1.0	0.5	1.0	0.5	1.0	0.5	1.0	0.5	1.0	0.5	7.0

HEX CODE		IR Controller	FLASH CODE	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF
A	B																
6	E	110	VQ (6) + LFL 10 S	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	2.0	5.0
7	E	126	VQ (6) + LFL 10 S	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	2.0	4.4
2	F	47	Q (6) + LFL 15 S	0.2	0.8	0.2	0.8	0.2	0.8	0.2	0.8	0.2	0.8	0.2	0.8	2.0	7.0
2	E	46	Q (6) + LFL 15 S	0.3	0.7	0.3	0.7	0.3	0.7	0.3	0.7	0.3	0.7	0.3	0.7	2.0	7.0
3	E	62	Q (6) + LFL 15 S	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	2.0	5.8
-	-	258	FL (6 + 1) 15 S	0.35	0.65	0.35	0.65	0.35	0.65	0.35	0.65	0.35	0.65	0.35	0.65	1.05	7.95
-	-	292	FL (6) + LFL 15 S	0.4	0.8	0.4	0.8	0.4	0.8	0.4	0.8	0.4	0.8	0.4	0.8	2.0	5.8
-	-	262	FL (6) + LFL 15 S	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	2.0	7.0
8	F	143	VQ (6) + LFL 15 S	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	2.0	9.4

HEX CODE		IR Controller	FLASH CODE	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF
A	B																				
-	-	275	FL (3+5) 12.2 S	0.9	0.3	0.9	1.0	0.9	0.3	0.3	0.3	0.3	1.0	0.3	0.3	0.3	0.3	0.3	4.5	-	-
4	E	78	VQ (9) 10 S	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	5.8
5	E	94	VQ (9) 10 S	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	4.9
1	F	31	Q (9) 15 S	0.2	0.8	0.2	0.8	0.2	0.8	0.2	0.8	0.2	0.8	0.2	0.8	0.2	0.8	0.2	0.8	0.2	6.8
0	E	14	Q (9) 15 S	0.3	0.7	0.3	0.7	0.3	0.7	0.3	0.7	0.3	0.7	0.3	0.7	0.3	0.7	0.3	0.7	0.3	6.7
-	-	267	Q (9) 15 S	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	6.5
1	E	30	Q (9) 15 S	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	4.8
-	-	291	FL (9) 32.92 S	0.4	0.8	0.4	0.8	0.4	0.8	0.4	0.8	0.4	0.8	0.4	0.8	0.4	0.8	0.4	0.8	0.4	22.9

HEX CODE		IR Controller	FLASH CODE	ON	OFF	ON	OFF	ON	OFF	ON	OFF
A	B										
MORSE CODE ( ) INDICATES LETTER											
7	8	120	MO (A) 6 S	0.3	0.6	1.0	4.1				
7	B	123	MO (A) 8 S	0.4	0.6	2.0	5.0				
8	8	136	MO (A) 8 S	0.8	1.2	2.4	3.6				
B	8	184	MO (U) 10 S	0.3	0.7	0.3	0.7	0.9	7.1		
C	8	200	MO (U) 10 S	0.4	0.6	0.4	0.6	1.2	6.8		
D	8	216	MO (U) 10 S	0.5	0.5	0.5	0.5	1.5	6.5		
9	8	152	MO (A) 10 S	0.5	0.5	1.5	7.5				
8	9	137	MO (D) 10 S	5.0	1.0	1.0	1.0	1.0	1.0		
A	8	168	MO (A) 15 S	0.5	1.5	2.0	11.0				
F	8	248	MO (U) 15 S	0.6	0.3	0.6	0.3	1.4	11.8		
0	9	9	MO (U) 15 S	0.7	0.5	0.7	0.5	1.9	10.7		
1	9	25	MO (U) 15 S	0.7	0.7	0.7	0.7	2.1	10.1		
7	D	125	MO (B) 15 S	1.5	0.5	0.5	0.5	0.5	0.5	0.5	10.5

Maintenance & Servicing

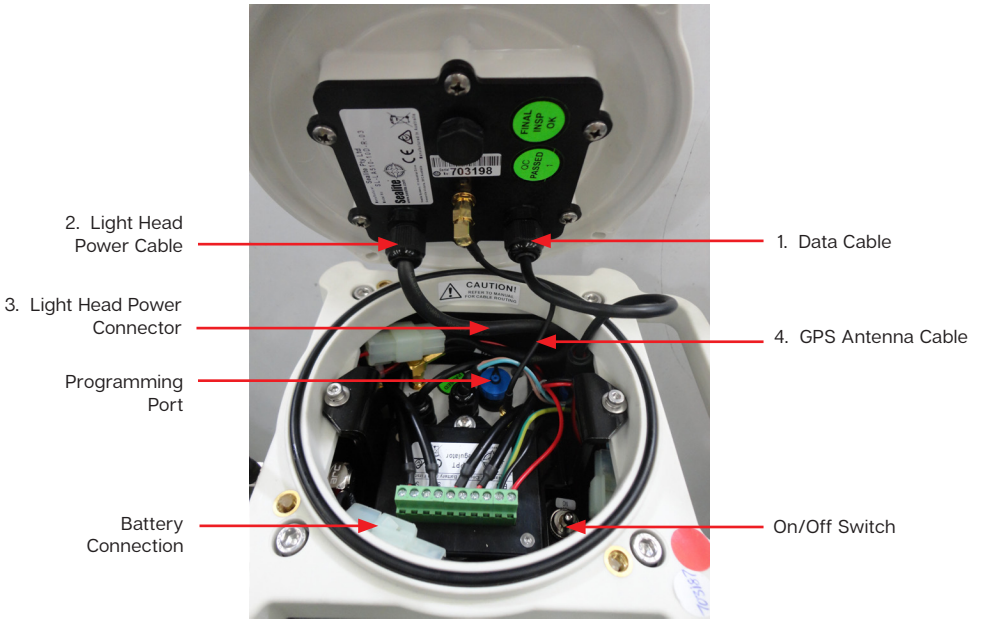
Designed to be almost maintenance-free, the SL-C510 with AIS requires minimal attention, though the following maintenance and servicing information is provided to help ensure the life of your Sealite product.

1. Cleaning Solar Panels- Occasional cleaning of the solar panels may be required. Using a cloth and warm soapy water, wipe off any foreign matter before rinsing the panels with fresh water.
2. Battery Check- Inspection of batteries should be performed every three years (minimum) to ensure that the charger, battery and ancillary electronics are functioning correctly. Using a voltage meter, check that the battery voltage is at least 12 volts under 100mA load and ensure all terminals are clear of foreign matter.
3. O-Ring Check- Inspect the condition of the O-ring for damage, wear or if it is brittle. Replace if necessary. The O-ring should be a rubber texture to ensure a complete and even seal.

Replacing the Battery

The SL-C510 with AIS has an internal battery compartment, which provides the user with the ability to change the battery after years of operation. Contact Sealite should a replacement battery required.

1. Remove the four socket-head screws on the light assembly and separate the SL-C510 with AIS light assembly from the body/base section.
2. Switch the ON/OFF switch to the OFF position.
3. Disconnect the light head, battery cable, data cable and GPS antenna from the light head assembly.



CAUTION	**CAUTION**
	Make sure On / Off switch is in Off position.

4. Remove 2 x M4 cap screws & washers from the top of the chassis.
5. Lift the upper battery bracket out of the SL-C510 with AIS, taking care to avoid the VHF antenna connector.
6. Remove the old battery from the chassis.
7. Discard old battery in a safe manner.
8. Reconnect the new battery.
9. Place battery back inside lantern body, and position the upper battery bracket in the top of the chassis.
10. Secure using 2 x M4 cap screws & washers.
11. Feed all wiring back inside lantern body in the following order:
    i. Data cable (RS-232) should be connected first and Bulgin connection placed into the space at the right-hand corner of the chassis as defined.
    ii. Light Head Power Cable should be connected second.
    iii. Light Head Power Connector placed into the space at the left-hand corner of the chassis (behind VHF antenna connection).
    iv. GPS Antenna connection should be connected last and right-angle SMA connector tightened into the orientation as shown in the figure on the previous page.
    v. Make sure the O-ring is properly placed at the top of the lantern body.
12. Switch the ON/OFF switch to the ON position.
13. Place the top lens assembly back onto the lantern body and replace 4 socket head screws. Half tighten all 4 socket head screws, and then fully tighten each socket head screw to ensure an even seal.

    To achieve a satisfactory seal, it is recommended that a torque of 3Nm is applied to the bolts used for holding down the Light Head to the Solar Base and that only the supplied bolts are used. Applying a higher Torque setting is not recommended and may void warranty. If in doubt, please contact your local Sealite representative.
14. To test, place dark cover (towel or jacket) on top of light to activate sensor, light will come on. Care must be taken to observe the polarity of each wire before they are connected. To ensure waterproofing of the unit, make sure that there is an even seal.

Long Term Battery Storage

If the SL-C510 is to be placed in storage for an extended period please follow the below information. The sealed lead acid batteries inside the lights must always be stored in a fully charged state. Always make sure to disconnect the light head from the solar unit. All batteries will discharge over time and the rate of discharge is dependent on temperature. If the light is being stored in temperatures greater than 40°C the battery will discharge faster. Please check battery regularly and recharge if necessary. Re-connect the light head and battery and place unit in the sun for 2-4 days.

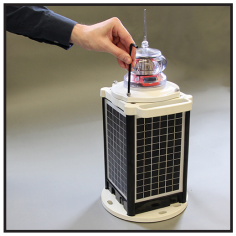
Solar Panel Replacement

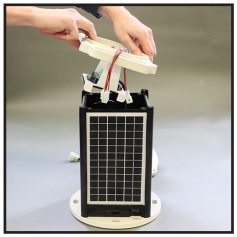
The SL-C510 is built around an internal aluminium chassis. The solar panels can be by the user replaced in the unlikely event that one is broken or damaged during the product's life.

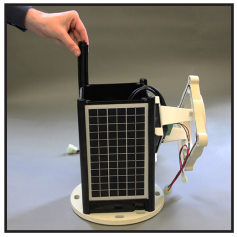
Follow the steps below or contact support@sealite.com for more details:

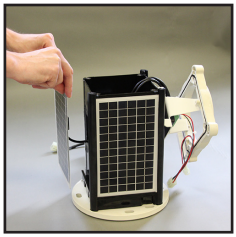
1. Remove 4 x M6 x 20 socket head cap screws and 4 x M6 nylon washers and disconnect the light head from the chassis.
2. Remove the 2 x M4 x 20 socket head cap screws, 2 x M4 spring washers and 2 x M4 penny washers. Remove the upper battery bracket containing regulator.
3. Disconnect the battery.
4. Remove 4 x M6 x 35 socket head cap screws, to remove the top casting from the chassis.

   Note: Be careful not to damage the O-rings on each of these screws. If replacements are required please use standard 6.0x1.0mm O-ring.
5. Slide the rubber corner out of the chassis, it may be necessary to lubricate the edges of the solar panels with grease or oil based lubricant if this is difficult to remove.
6. Unscrew the affected panel wires from the regulator and remove the solar panel from the chassis.
7. Clean any silicon off the chassis from the solar panel junction box hole and add a new seal to ensure the solar panel is watertight when assembled.
8. Repeat the process in the reverse order to replace a new pane.









Note:

Make sure the O-rings on the top casting and 4 x M6 x 35 socket head cap screws are coated in silicon grease before re-assembling. To achieve a satisfactory seal, it is recommended that a torque of 3Nm is applied to the bolts used for holding down the Light Head to the Solar Base and that only the supplied bolts are used.

Applying a higher Torque setting is not recommended and may void warranty. If in doubt, please contact your local Sealite representative.

The replacement of a solar panel should only be performed by a confident technician.

Sealite cannot guarantee the chassis will remain waterproof, if service is not performed by Sealite staff. To test for any leaks remove the gore vent and pressurise the assembled light to 1.5psi.

Note:

Make sure the O-rings on the top casting and 4 x M6 x 35 socket head cap screws are coated in silicon grease before re-assembling. To achieve a satisfactory seal, it is recommended that a torque of 3Nm is applied to the bolts used for holding down the Light Head to the Solar Base and that only the supplied bolts are used.

Applying a higher Torque setting is not recommended and may void warranty. If in doubt, please contact your local Sealite representative.

The replacement of a solar panel should only be performed by a confident technician.

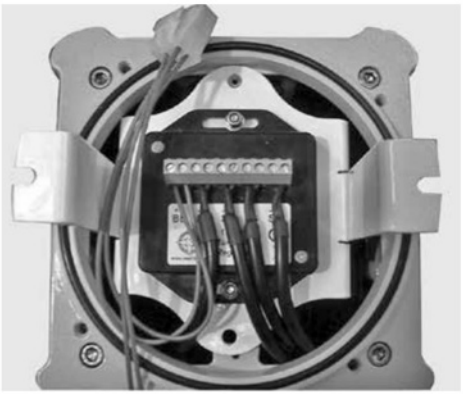
Sealite cannot guarantee the chassis will remain waterproof, if service is not performed by Sealite staff. To test for any leaks remove the gore vent and pressurise the assembled Light to 1.5psi.

How to Change the Regulator

1. Remove the 4 x M6 x 20 socket head cap screws and 4 x M6 nylon washers, then disconnect the light head from the chassis.
2. Remove the 2 x M4 x 20 socket head cap screws, 2 x M4 spring washers and 2 x M4 penny washers then remove the upper battery bracket containing the regulator.
3. Disconnect the battery.
4. Take note of the wire colours and location in the regulator.
5. Disconnect the wires from the regulator.
6. Remove the 2 x M4 CSK screws, 2 x M4 nyloc nuts and 2 x M4 penny washers that retain the regulator to the top battery bracket and remove the regulator.
7. Fit the new regulator using the 2 x M4 CSK screws, 2 x M4 penny washers and 2 x M4 nyloc nuts.
8. Connect the solar positive wires to the S points on the regulator.
9. Connect the solar negative wires to the S points on the regulator.
10. Connect the battery positive wires to the B point on the regulator.
11. Connect the battery negative wire to the B point on the regulator.
12. Reconnect the battery.
13. Refit the battery top bracket into the solar unit using the 2 x M4 x 20 socket head cap screws.
14. Ensure the top O-ring is sitting correctly into the top casting. Refit the light head and tighten the M6 x 20 socket head cap screws with the 4 x M6 nylon washers evenly.

DO NOT OVERTIGHTEN.

Use the label to ensure correct location of wires during assembly



SL10 AMP Regulator shown when correctly fitted

Trouble Shooting

Problem	Remedy
Lantern will not activate.	• Ensure Lantern is in darkness; • Wait at least 60 seconds for the program to initialise in darkness; • Ensure battery terminals are properly connected; • Ensure battery voltage is above 12volts; • Check the status of the LED's on the base of the PCB to determine what type of fault the light is acting (see Lantern Status section of this manual).
Lantern will not operate for the entire night.	• Expose the lantern to direct sunlight and monitor operation for several days. • Sealite products typically require 1.5hours of direct sunlight per day to retain full autonomy. From a discharged state, the lantern may require several days of operational conditions to 'cycle' up to full autonomy; • Reducing the light output intensity or duty cycle (flash code) will reduce current draw on the battery; • Ensure solar module is clean and not covered by shading during the day.

Sealite LED Light Warranty

Refer to Sealite website: www.sealite.com