



SL-155 Series

SL-155-5D/10D Models with Integrated AIS
Marine Lanterns
Installation & Service manual

Introduction.....	4
Operating Principle.....	4
Technology	4
Specifications.....	7
Product Components.....	8
PC Configuration Tool.....	9
Programming the Lantern	9
Info Tab.....	13
Operation Mode Tab	14
Flash Code	16
Intensity.....	17
Sensors	18
AIS Report.....	20
IR Programmer	21
Sealite IR Programmer / Universal Remote Compatibility	21
IR Programmer Functions.....	22
SL-155 Series Lantern	27
Power Consumption	27
Power Basics.....	27
Thermal Management.....	28
Lantern Data	29
Let’s Try a practical Example	30
Power Supply Design Considerations.....	32
Lantern Testing.....	33
Lantern Installation	33
GPS Synchronisation.....	39
Lantern Testing.....	40
Lantern Installation	40
Optional GPS Synchronisation.....	46
AIS System	47
Type 1 AIS AtoN	47
Type 3 AIS AtoN	47
GNSS systems	47
Supported AIS Messages	48
Installation.....	49
Transceiver configuration.....	52
FATDMA Schedule configuration.....	54

RATDMA Schedule configuration	57
Virtual AtoN configuration	58
Status input configuration tab.....	59
Alert messages.....	60
Off position alert	61
SART Relay Mode.....	61
Transceiver diagnostics	61
GNSS tab.....	61
Serial Data tab	62
Report generation	62
Reported messages	63
Active alarms	64
Maintenance & Servicing.....	65
Trouble Shooting	65
Appendix – Flash Codes.....	66
Notes	72
Sealite LED Light Warranty V2.2.....	73
.....	73

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 ISO9001:2008 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

A microprocessor drives an array of ultra-bright LED's through a DC/DC converter, which enables the LED's to operate within the manufacturer's specifications.

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

The flasher unit has a low current requirement to optimise its use with external battery power supply systems.

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 (Light Emitting Diode) 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 a consistent & superior quality.

Optical Performance

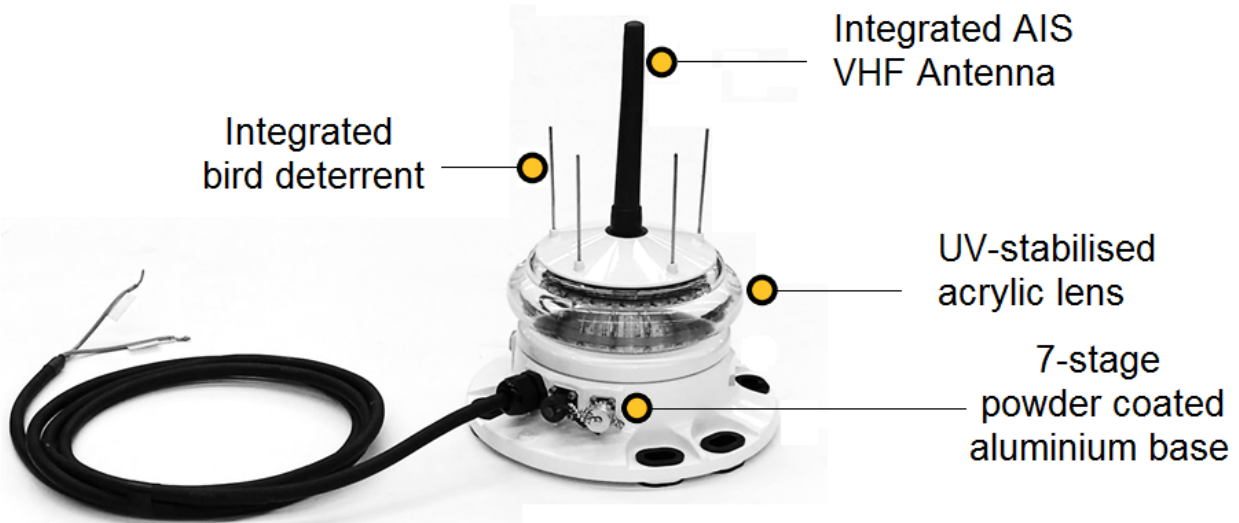
Sealite manufactures a range of marine LED lenses moulded from multi-cavity dies. The company has superior in-house lens manufacturing capabilities to support outstanding optical performance.

Award-winning, Patented Technology

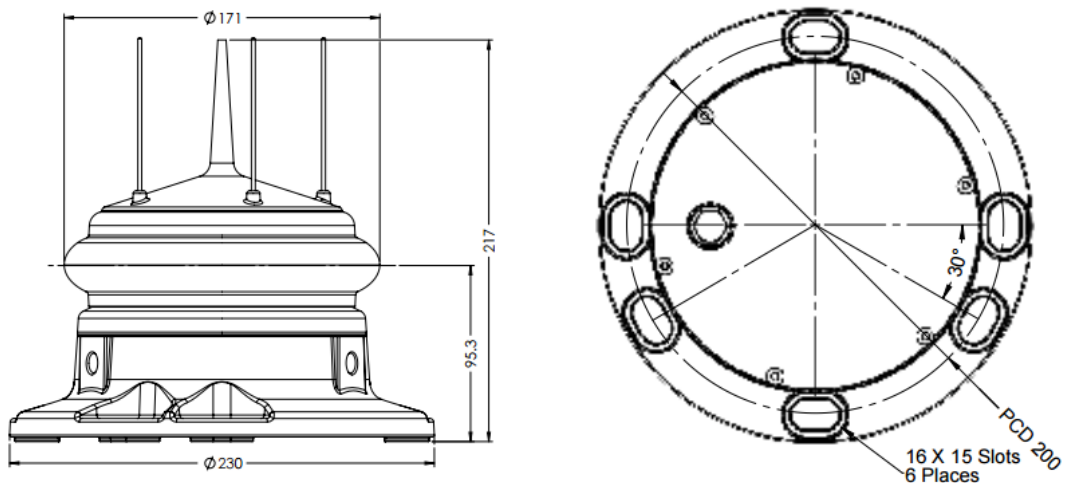
Several United States and Australian patent registrations are held on Sealite's range of innovative designs, with other regional patents pending in Canada, United Kingdom and Europe.

SL-155 Series 6–13NM Marine Lanterns SL-155-5D/10D Models

The SL-155 Complete Lantern Assembly provides a complete solution for visual navigation requirements and is available with remote monitoring and control capabilities allowing the performance of the units to be monitored from remote sites. System status includes battery condition, flash characters, operational configuration, and lantern/buoy position.



SL-155-5D & SL-155-10D Models



Specifications

SPECIFICATIONS * *	
5° & 10° Models	
SL-155-5D & SL-155-10D	
Light Characteristics	
Light Source	High efficiency LEDs
Available Colours	Red, Green, White, Yellow
Maximum Luminous Intensity (cd) †	5 degree model: Red - 2733 Green - 2544 White - 4470 Yellow - 2185 10 degree model: Red - 2368 Green - 2036 White - 3837 Yellow - 1670
Visible Range (NM)	AT @ 0.74: 6–13 AT @ 0.85: 7.8–19.2
Horizontal Output (degrees)	0° - 360°
Vertical Divergence (degrees)	5° or 10°
Available Flash Characteristics	Up to 310 including 256 IALA recommended, & 1 custom
Intensity Adjustments	User adjustable
LED Life Expectancy (hours)	>100,000
Electrical Characteristics	
Average Power (W)	Variable up to 18
Circuit Protection	Polarity protected
Nominal Voltage (VDC)	12–24
Temperature Range	-40 to 80°C
Physical Characteristics	
Body Material	7-stage powder-coated aluminium
Lens Material	UV-stabilised acrylic
Lens Diameter (mm/inches)	171 / 6¾
Lens Design	Multiple LED optic
Mounting	3 & 4 hole 200mm bolt pattern
Height (mm/inches)	217 / 8½
Width (mm/inches)	230 / 9
Mass (kg/lbs)	5 / 11
Product Life Expectancy	Up to 12 years
Environmental Standards	
Shock	MIL-STD-202G Test Condition H, Method 213B 30G vertical and 35G horizontal shock
Vibration	MIL-STD-202G, Test Condition B, Method 204D 5G in all axes
Immersion	MIL-STD-202G, Method 104A
Salt Fog	Rated to withstand continuous exposure to salt water and spray
Ice Loading	Rated to withstand 22kg/m ²
Wind Exposure	Rated to withstand 140knots
Hail Impact	Rated to withstand 25mm diameter ice ball impact at 20m/s
Humidity	0 - 100%, condensing
Driving Rain	at 45° from vertical
Certifications	
CE & Electrical	FCC Part 15 Rules & ICES-003. EN61000-6-1: 2007 (IEC61000-6-1:2005) Part 6-1 Immunity. EN61000-6-3: 2007 (IEC61000-6-3: 2006) Electromagnetic compatibility (EMC) - Part 6-3 Emission. IEC61000-4-2: 2008 Ed 2 Part 4-2 Electrostatic discharge immunity test Level 4. IEC61000-4-3: 2010 Ed 3.2 Part 4-3. Radiated, radio-frequency, electromagnetic field immunity. IEC61000-4-6: 2008 Ed3. , Electromagnetic compatibility (EMC) - Part 4-6 Immunity. Signal colours compliant to IALA E-200-1 ISO9001:2008 IP68
IALA	
Quality Assurance	
Waterproof	
Intellectual Property	
Trademarks	SEALITE® is a registered trademark of Sealite Pty Ltd
Warranty *	3 years
Options Available	<ul style="list-style-type: none"> • GPS Synchronisation • AIS Type 1 or Type 3 • GSM Monitoring & Control System • RS232/422/485 Port • General purpose inputs (2) & outputs (2) • Variety of solar/battery configurations • Serial programming cable • Hard-wire Synchronisation

Product Components

The following components come standard with each lantern:-

- SL-155 lantern
- IR Programmer
- Installation & service manual
- AIS programming Cable
- Lantern programming Cable
- USB Stick containing Lantern and AIS Configuration PC Application

These components are securely packaged within foam in a carton, and shipped to you.

PLEASE NOTE: The programming cable provided is suitable for use with PC's.

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.



Programming the Lantern

PC Configuration Tool

The lantern is pre-programmed to the customer's specific requirements for convenience (eg. flash, intensity setting etc).

The SL-155 Series are extremely intelligent lanterns with a number of features which can be programmed directly via a user-friendly computer program (as supplied on USB drive with every lantern).

To change/update the settings of your lantern, please read the following instructions.

1. Run the Programming Software

The programming software may be run directly from the USB drive provided, or you may copy the software to your computer hard-drive for future use.

Running the Programming Software from the USB Drive

- Connect the USB drive to your computer
- Navigate to the USB drive folder & double-click the file called "LanternConfig.exe". A new window will appear displaying the PC Configuration Tool.

Saving the Programming Software to Computer Hard-Drive

- Connect the USB drive to your computer
- Navigate to the USB drive folder
- Copy the file called "LanternConfig.exe" and the ".dll" files
- Navigate to the hard-drive location where you would like to save this program, and then right-mouse-click and select "paste". A copy of the programming software will now be saved to your computer hard-drive (to add the programmer to your computer desktop for ease of future access, right-mouse-click and select "Send to desktop")
- Double-click the file called "LanternConfig.exe". A new window will appear displaying the PC Configuration Tool

PLEASE NOTE: other documents have been saved on the USB drive for your information & convenience including the latest product specifications sheet and an electronic version of the installation and service manual. You may wish to view these documents to read more about the innovative features and benefits of the SL-155 Series of lanterns.

IMPORTANT: the Sealite PC Configuration Tool is designed for Windows Platforms only.

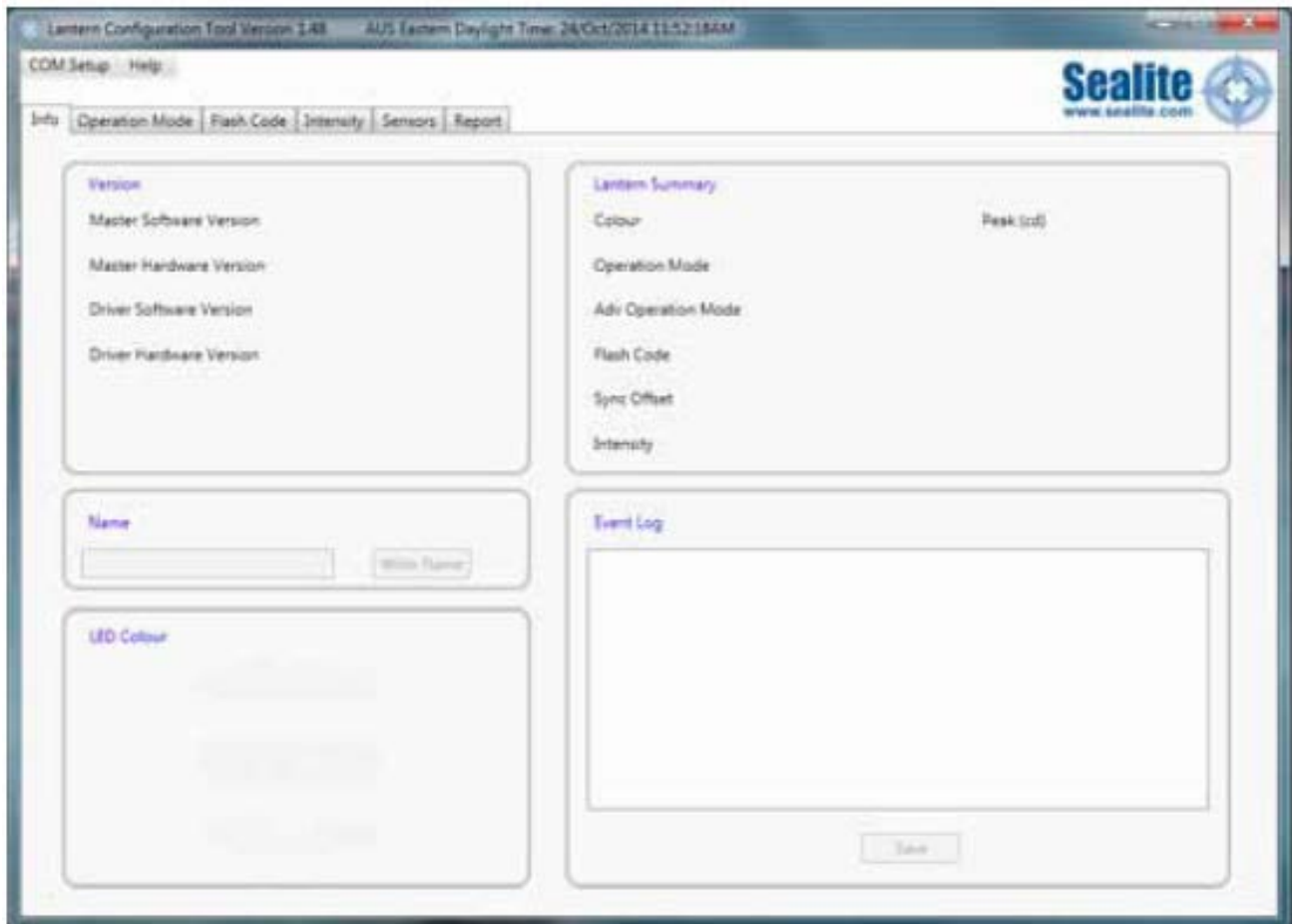


Image 1. Sealite PC Configuration Tool

1. Connect the SL-155 Series Lantern to a Power Source & the Computer

Now that the programming software has been run, you will need to connect the lantern to your computer & power supply so that it can receive programming commands.

Once connection is made, the software automatically determines the colour and preprogrammed settings of the lantern.

Connecting the Lantern to a Power Source

Option 1: Battery

- Connect the blue negative wire of the lantern to the battery negative terminal
- Connect the brown positive wire of the lantern to the battery positive terminal

Option 2: 12V Power Supply

- Connect the blue negative wire of the lantern to the power supply negative terminal
- Connect the brown positive wire of the lantern to the power supply positive terminal



CAUTION: to avoid personal injury do not position the lantern at eye level.

Connecting the Lantern to the Computer

- Plug the Bulgin connector end of the programming cable into the lantern PC Programming Port, and either the serial port end of the cable into your computer serial/communication port (RS232-E) or use the serial port to USB connector if working to a laptop.

3. Establish the Programmer-to-Lantern Computer Connection (COM Port)

Now that the lantern is connected to the computer and the Sealite PC Configuration software has been run, the user must create the programmer-to-lantern connection.

The COM Port is the hardware port which the computer accesses when communicating with the lantern.

- Click the “COM Setup” at the top left of the PC Configuration Tool to open the “Serial Port” dialogue box
- In the “Serial Port” dialogue box select the appropriate COM Port from the drop down field for “Port Name”
- Check the “Open Port” check box to open the port
- Click the “OK” button to initiate the connection

The Sealite PC Configuration Tool will then attempt to connect/interrogate the lantern.

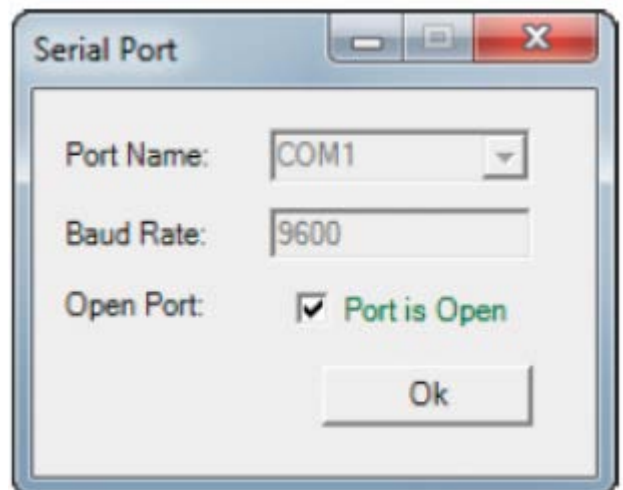


Image 2. Serial Port dialogue box

Correct Connection Established

If the connection is established data about the lantern configuration will appear on the “Info” tab under the headings “Version” & “Lantern Summary” (eg. Lantern Colour, Flash Code, Intensity etc).

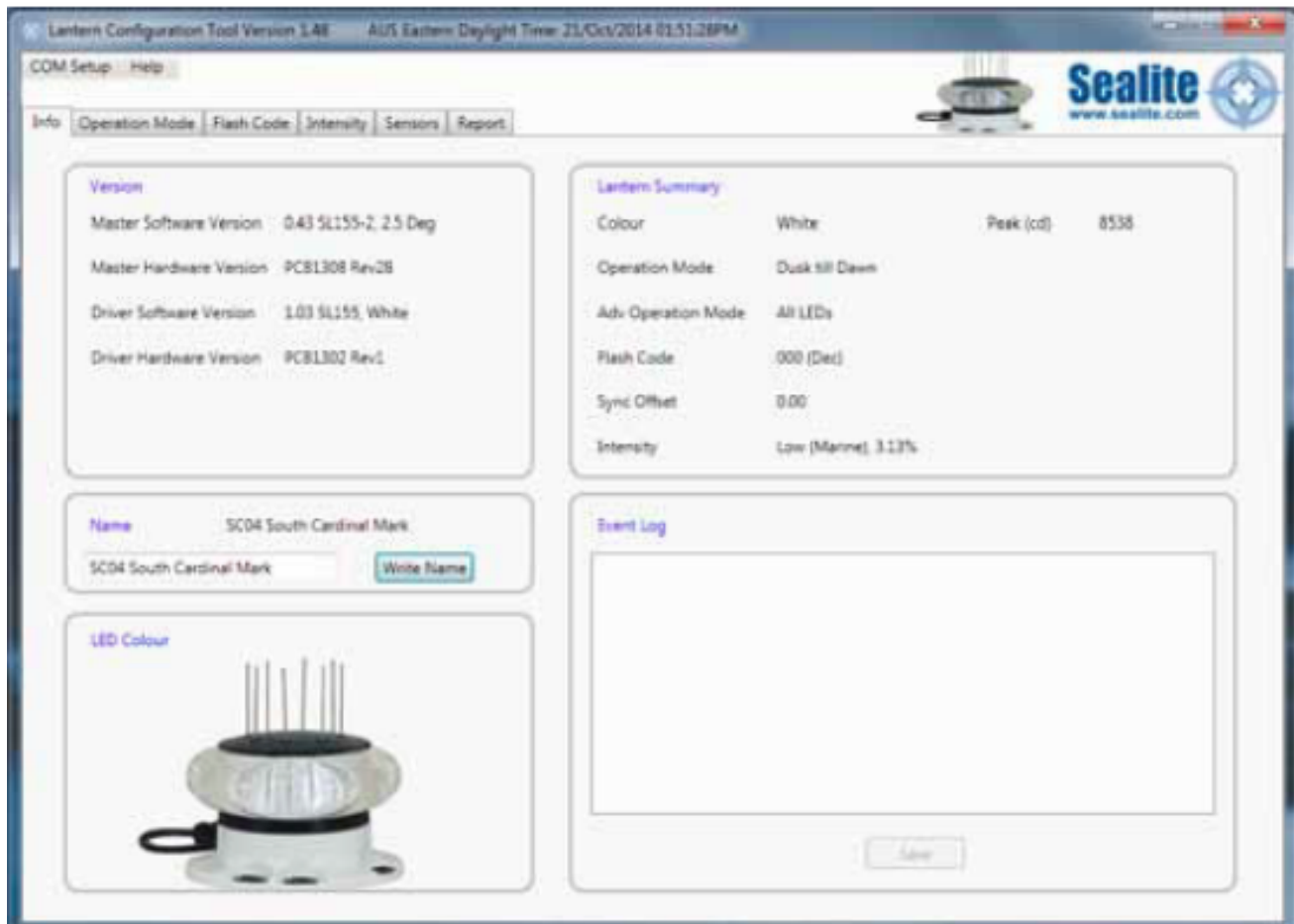


Image 3. Sealite Configuration Tool “Info” tab – showing COM Port connection established, Version & Lantern Summary information

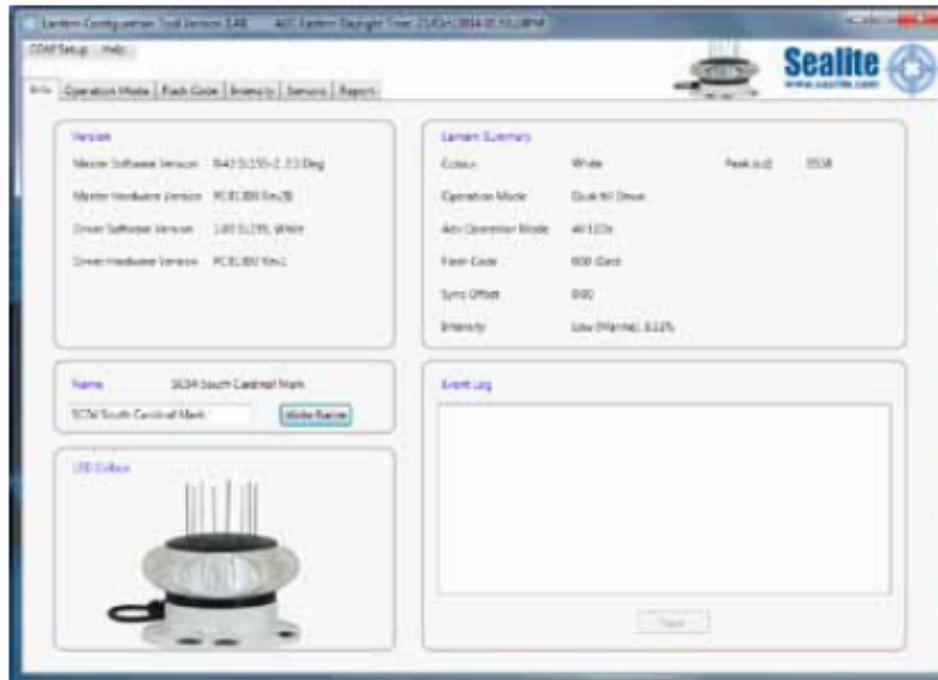
Connection NOT Established

If the connection is not available, the Sealite PC Configuration Tool will not display any lantern specific information under the headings “Version” & “Lantern Summary”. If this error occurs, please check the following:

- Reconnect the lantern to the computer
- Check that the lantern power supply has sufficient charge (eg. battery is charged), and then reconnect it to the lantern
- Re-run the Sealite PC Configuration Tool and follow the information in step 3. The connection should now become established.

The Sealite lantern is now ready to be programmed to your specific requirements.

Info Tab



Provides a summary of the lantern configuration settings, hardware and software versions, and event log.

Version

Is an information panel that identifies the Lantern's internal electronic hardware and firmware versions.

Lantern Summary

Is an information panel that displays a summary of the key lantern settings: colour, operation mode, Peak Intensity setting, Advance Operational Mode, Flash Code, Flash Sync offset and Intensity setting. Refer to the Information, Operation Mode Flash Code, and Intensity Tabs for a description of these parameters.

Name

A user defined name, comprising alphanumeric characters (and -, \$, #, @) can be typed into dialogue box and by pressing and stored within the lantern's non-volatile memory by pressing the 'Write Name' button.

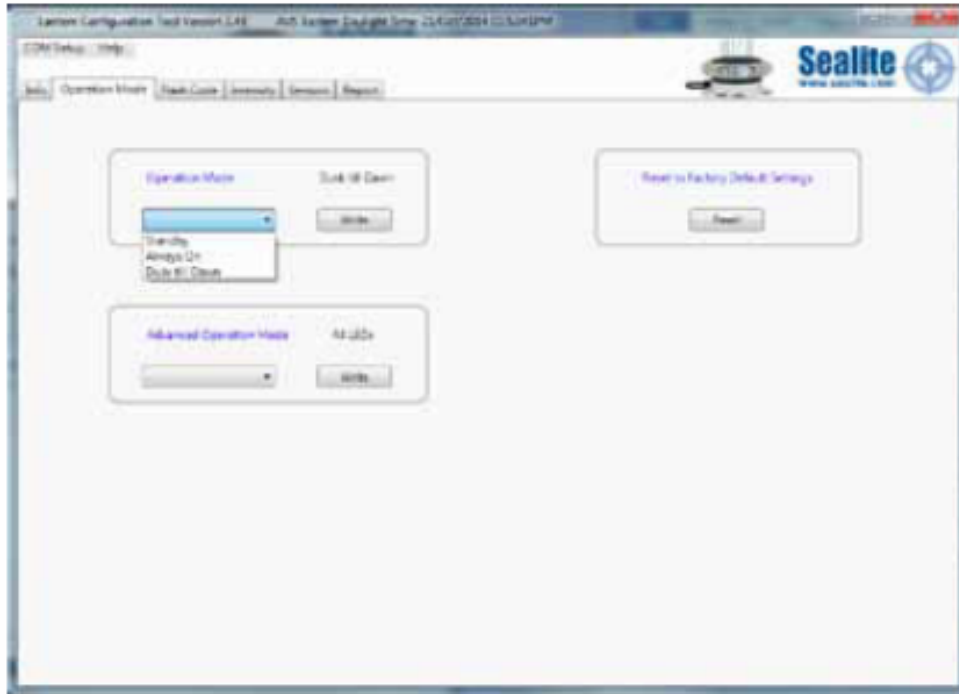
LED Colour

A generic picture of the lantern model and colour that the software tool is communicating with is displayed in this panel.

Event Log

Displays the alarm events recorded by the lantern firmware. Possible alarms (flat battery, low battery, LED failure, high temperature). All alarm events are recorded irrespective of whether the lantern has been configured to respond to an alarm.

Operation Mode Tab



Defines the lanterns mode of operation of which there are four possibilities:

Operational Mode

Standby

The lantern is configured in a minimum current state in which the LEDs are always off and the internal GPS (if installed) 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.

Day and Night

The daylight sensor is monitored and the lantern will operate according to the set flash character and intensity levels for Day, Twilight and Night.

Adv Op Mode

This is an advanced user mode and typically only used if the lantern is to be used as a special navigational aid such as emergency wreck mark.

All

Default on setting. All LEDs are operated in unison and configured by the Operation Mode, Flash Code and Intensity Tabs.

Bank 1 (Visible)

One half (180deg) bank of LEDs are only enabled whilst the other half are disabled.

Bank 2 (IR)

One half (180deg) bank of LEDs are only enabled whilst the other half are disabled.

Alternating

Adjacent LED, alternate their on/off state based upon the intensity and flash character settings. For example, ship wreck marks.

Top tier

Top tier of the lanterns is set to steady on. With the intensity levels selected to be set to either 25% or 50% of the flashing intensity.

Reset

By clicking Reset, the factory et default parameters are restored.

Flash Code



Marine Characteristic Selection

The flash character is defined by first selecting the Mariner code, then the Flash code name and finally timing.

Sealite Code Selection

This is an alternative method to define the lantern flash code by using either the Sealite IR remote control numerical figure or if known the Sealite rotary switch flash character. Refer to the IR remote control section for valid flash characters.

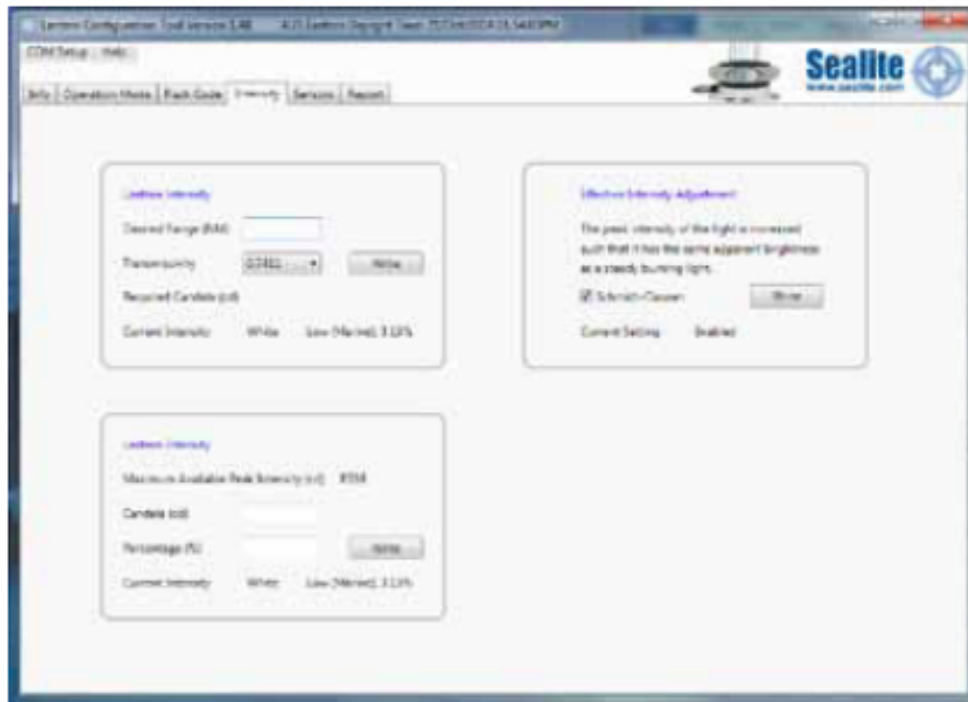
Sync Offset

This panel is used to set a fixed delay to the commencement of the flash character. The built-in GPS receiver and advanced software of the Sealite synchronised lanterns allow for the adoption of SeaFlare™ 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.

Manual Entry Custom Flash Character

In this panel one, custom flash characteristics can be defined with up to 10 individual on/off times.

Intensity



The lantern intensity level can be set by either by defining the operating range of the lantern (in nautical miles) or by entering a desired peak candela or a percentage of maximum peak intensity level.

If Schmidt Clausen is applied is selected, the lantern will automatically adjust the intensity level based up on the entered range and flash character setting. The intensity level is automatically each time a new range (NM) or flash character is written to the lantern.

If an intensity level is selected that is beyond the specification of the lantern, the entered figure will be displayed in in red coloured text, and the lantern will be configured to its maximum.

Note: The lanterns has been designed with a dynamic intensity limit. This limit will come into effect if you select a flash characteristic with a heavy duty cycle ($> 28.125\%$) 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. Thus giving you years of operation without any noticeable degrade in light output. This intensity limit will not be reached for the majority of applications.

The peak power limit for the SL-155-5D and SI-155-10D lanterns has been set to 28.125%. There are 69 flash codes in the base table of 256 that will have an intensity cap.

The peak power limit for the SL155-2 has been set to 34.375%. There are 51 flash codes in the base table of 256 that will have an intensity cap.

Sensors



Battery sensors

The SL-155 series of lantern continuously monitors its input voltage using three finable thresholds.

- For voltages greater than “OK” level, the lantern reports via IR Remote control requests or the GSM that the input voltage is satisfactory.
- For voltages below “low” the lantern can be configured to operate the internal alarm relay and /or reduce the intensity level by 25% as a measure to extend the operation of the lantern until it reaches the “Fail” voltage.
- At “Fail” the lantern shuts down entirely, and turns of the GPS and the mains LEDs. The lantern will only commence operation once the input voltage has exceeds the “OK” voltage level. The three thresholds: Flat, Low and OK are user definable.

Temperature

The SL-155 utilises two temperature sensors. One on contact with the LED heat sink and second that monitors the internal temperature within the lantern.

Each sensor has two user configurable boundaries. At the “low” boundary temperature point, the lantern intensity is reduced by 25% to help reduce the heating of the housing. Reaching this point does not trigger the alarm reply. The second boundary is “high”, where at which point, the lantern turns off and triggers the alarm relay.

LED Sensor

Built into the SL-155 lantern, is a closed loop monitoring system for each LED within the lantern. In the event of a single LED failure, the lantern can be configured to trigger the internal alarm relay which in turn can be connected externally to trigger other devices, such a redundant light source.

Light Sensor

The SL-155 lantern has its own internal light sensor and whose day/twilight/twilight/night thresholds are defined in LUX. These levels can be customised by entering in separate dusk and dawn values as a measure of LUX.

If optional, an external light sensor such as Light dependant resistor or photodiode can be electrically connected to the SL-155.

AIS Report



Lantern Status

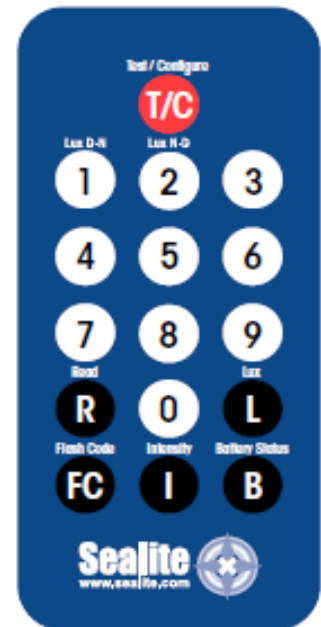
This panel displays the Lantern's AIS message that is output via the serial communications port every 10seconds. Typically this message is processed by an externally installed AIS module, however by itself is a quick summary of the lantern operating status. This detail is also displayed on the INFO tab.

IR Programmer

The IR programmer is used to communicate with Sealite lighting product 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.



Sealite IR Programmer / Universal Remote Compatibility

If you lose your Sealite IR Programmer, the following Universal Remote Controller has been tested for compatibility: RCA Type RCR312WR programmed for Phillips TV Type Code 10054

Sealite Key	Universal Remote Key
T	Power
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
0	0
R	Channel+
L	Mute
FC	Volume+
I	Volume-
B	Channel-



IR Programmer Functions

Test Mode / Configure



Pressing the T/C button for upto 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 x Flash for each Nautical Mile.
Eg 8 x flashes = 8nm



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 and is automatically calculated by user selecting the required operational range of the lantern.



writes the range in nautical miles (0–9) where x represents the range



writes the range in nautical miles (0–32) where x represents the range

A range value from 6 to 13NM is valid however the maximum allowable range is dependent on the lantern's vertical divergence, LED colour and flash character.

Using the selected operational range and current flash character, the lantern uses the Schmidt-Clausen Method, as described in IALA E200-4 to determine the peak intensity.

If the flash character is changed, the peak intensity is automatically adjusted.

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.

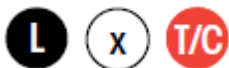
Example Key sequence:



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	Sun- set	Sunri- se
1	64	100
2*	100	150
3	150	240
4	240	370
5	370	600
* 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.)



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 to 10nm via the PC Configuration Tool, and is then set to 8nm using the IR Remote Control, the intensity setting will change to 8nm. If the intensity is then changed via the PC Configuration Tool, eg 7nm, then the intensity will be set to 7nm.

Example #2: The flash code is set using the PC Configuration Tool to 0.5sec ON, 4.5sec OFF. After disconnecting the PC Configuration Tool the operator then can change the flash code using the IR Remote to any three number sequence as found in the manual appendix. The new flash code is now configured to the selected flash code. Eg 163 (0.5sec ON, 0.5sec OFF).

Use the IR Remote to read the flash code and it will flash with the 3 number sequence that matches the flash codes in the Appendix.



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.

B **I** **1** **T/C** Always on mode

B **I** **2** **T/C** Standby mode

B **I** **3** **T/C** Dusk-to-Dawn mode

SL-155 Series Lantern

Power Consumption

Power Basics

- (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:

$$\text{Power (Watts)} = \text{Voltage (Volts, V)} \times \text{Current (Amps, A)}$$

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

$$\text{Average Power (Watts)} = \text{Peak power (Watts)} \times \text{MULTIPLIER (\%)},$$

where the

$$\text{MULTIPLIER (\%)} = \text{Flash Character duty cycle (\%)} \times \text{Intensity level (\%)}$$

- (d) The SL-155 lanterns intensity setting are available in 32 steps from 0% to 100% with a step size of 3.125% (or 1/32%)

Thermal Management

The lanterns incorporate 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. 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 vast majority of applications.

The Thermal Limit for the SL-155-5D and SL-155-10D Series lanterns has been set to 28.125%. The relationship between the Thermal Limit, Intensity and Flash Duty Cycle is illustrated in the following graph:



Lantern Data

The following tables detail the electrical power consumption of the SL-155-5/10D lanterns:

SL-155-5D

	Re	Gree	Whit	Yello
Peak power (W)	48.4	64.2	60.4	60.7
Max power thermal limit %	28.125	28.125	28.125	28.125
Max average power at thermal	13.6	18.1	17.0	17.1
Peak intensity (cd)	2,733	2,544	4,470	2,185
Voltage range (VDC)	12 to	12 to	12 to	12 to

SL-155-10D

	Re	Gree	White	Yello
Peak power (W)	48.4	64.2	60.4	60.7
Max power thermal limit %	28.125	28.125	28.125	28.125
Max average power at thermal	13.6	18.1	17.0	17.1
Peak intensity (cd)	2,368	2,036	3,837	1,670
Voltage range (VDC)	12 to	12 to	12 to	12 to

Electrical Consumption of Control and Flasher Electronics

Parameter	SL-155 Series at		Description
	(mA)	(W)	
I _q , Quiescent	4.8	0.06	Consumption during the day and night time
I _e , Eclipse	16.7	0.20	Consumption between flashes
I _{qps} (average)	2	0.01	Consumption over the entire day
I _{relay}	20	0.24	Consumption when energised

Let's Try a practical Example

Case 1:

SL-155-10D, White, 10NM, Flash Character FI(3+1) 18s
[1.5s on,1.5s off,1.5s on,1.5s off,1.5s on,4.5s off,1.5s on,4.5s off] 33.3%

1. Calculate the Flash Character Duty cycle (%)

$$= (1.5+1.5+1.5+1.5)/(1.5+1.5+1.5+1.5+1.5+4.5+1.5+4.5)*100 = 33.3\%$$
2. With a range of 10NM, use IALA E-200-2 and determine the Effective Intensity (cd)

$$= 1,306\text{cd}$$
3. Using the Method of Modified Allard, determine the Peak Intensity (cd)

$$= 1,481\text{cd}$$
4. Calculate the desired Intensity step setting (0 to 32=100%) based upon the SL-155-10D-W Maximum Peak Intensity (cd)

$$= 1481(\text{cd}) / 3078(\text{cd}) * 32(\text{steps}) = 15 \text{ (rounded up)}$$
5. Calculate the MULTIPLER (%)

$$= 33.3\% * (15/32*100\%) = 16.67\%$$
6. Compare this to the Max Power Thermal Limit for a SL-155-10D

$$= 28.125\%$$

The MULTIPLER < 28.125% is within the Thermal Limit.
7. With an Intensity Step of 25, recalculate the range.
 Peak Intensity = $(15/32) * 3,078\text{cd}$

$$= 1,539\text{cd}$$
8. Using the Modified Allard method in reverse, the new Effective Intensity is

$$= 1,358\text{cd}$$
9. Using IALA E-200-4, the new range is reduced to 10.0NM. (PASS)

Case 2:

SL-155-10D White, 10NM, Flash Character = Occ(3) 16s [2s on, 2s off, 2s on, 2s off, 6s on, 2s off]

1. Calculate the Flash Character Duty cycle (%)
= $(2+2+6)/(2+2+2+2+6+2) * 100 = 62.5\%$
2. With a range of 10NM, use IALA E-200-2 and determine the Effective Intensity (cd)
= 1,306cd
3. Using the Method of Modified Allard, determine the Peak Intensity (cd)
= 1,436cd
4. Calculate the desired Intensity step setting (0 to 32=100%) based upon the SL-155-10D-W Maximum Peak Intensity (cd)
= $1,436(\text{cd}) / 3,078(\text{cd}) * 32(\text{steps}) = 15$ (rounded up)
5. Calculate the MULTIPLIER (%)
= $62.5\% * (15/32 * 100\%) = 29.30\%$
6. Compare this to the Max Power Thermal Limit for a SL-155-10D-W
= 28.125%

The MULTIPLIER > 28.125% and exceeds the Thermal Limit.

As such, go back to Step 5 and reduce the Intensity Step from 15 until the MULTIPLIER is less than Max Power Thermal Limit.

7. In this example, an Intensity Step of 14, results in a MULTIPLIER of
= $62.5\% * (14/32 * 100\%) = 27.34\%$
Which is less than the Max Power Thermal Limit of 28.125%
8. With this reduced intensity step, recalculate the reduced range.
Peak Intensity = $27.34\% * 3,078\text{cd}$
= 1,347cd
9. Using the Modified Allard method in reverse, the new Effective Intensity is
= 1,224cd
10. Using IALA E-200-4, the new range is reduced to 9.8NM. (0.2NM less than desired range of 10NM)



Power Supply Design Considerations

Long range lanterns are designed to operate over a wide operational voltage range and thus the average power consumption will vary accordingly. The lanterns incorporate a dynamic intensity limit as part of the thermal management system that ensures operates within the thermal design window. In practice the thermal management cap limits a lanterns average power to a practical thermal limit of the lantern in order to prevent overheating.

Power Supply Design Considerations

As discussed in IALA Guide 1067-2, there are vast array of power sources that can be utilised for power lanterns. However the vast majority of customer power supplies comprise of either Photovoltaic Power or AC Utility and as such this bulletin will focus on these types and how they apply to the Sealite SL-155 long range lantern.

Contact Sealite for advice when designing your power supply.

(1) PV Power Systems

These systems generally comprise of a 1 or more PV panels, a solar regulator and storage battery. Batteries such as marine grade SLAs are very tolerant of fast switch high peak currents as they electrically behave like a large smoothing capacitors. As detailed in IALA 1067 Solar sizing depends on a number of factors. For Sealite lanterns, pay particular attention to average power consumption and power cable sizing.

(2) Alternating Current (AC) Utility Power

In their simplest form, these systems comprise an AC/DC power supply convertor. Unlike PV Power Systems, AC/DC Power Supplies are limited to their internal storage capacity and as such are not able to maintain voltage regulation to fast switch currents.

As such a lantern's peak current must be determined when selecting an AC/DC power supply. For Sealite's long range lanterns, the peak current can be determined by using the following equation:

$$\text{Peak current (A)} = \text{Peak Power (W)} / (\text{Supply Voltage (Vdc)})$$

Using this method the peak current for the SL-155 Long range lanterns is:

$$\text{SL-155 (2.5/5/10) : Peak Current (A)} = 64 / 12 = 5.3\text{A}$$

As an AC/DC power supply has minimal storage capacity the selected power supply must be capable of delivering a lantern's peak current for all conditions. This is regardless of the lanterns set Flash Duty Cycle or Intensity Settings. Other considerations such as de-rating the AC/DC power supply due to environment and usage.

As an AC/DC power supply has minimal storage capacity the selected power supply must be capable of delivering a lantern's peak current for all conditions. This is regardless of the lanterns set Flash Duty Cycle or Intensity Settings. Other considerations such as de-rating the AC/DC power supply due to environment and usage.

Lantern Testing

Now that the SL-155 has been programmed to suit the project requirements, it's important that the lantern is tested prior to installation, including flash code and intensity settings. To test the SL-155:

- Connect the SL-155 to a 12V power supply or battery
- For lanterns programmed to “Dusk to Dawn” operation setting, cover lantern with a dark cloth or jack in darkness for more than 1 minute. After this time the lantern will activate
- Next, check that the lantern is flashing to the required flash code and intensity
- If the settings are correct, disconnect from the 12V power supply or battery
- If the settings are incorrect, following the Programming Instructions of this manual to re-configure lantern characteristics, and then re-test prior to installation
-

IMPORTANT: when lantern is being programmed using the Sealite PC Configuration Tool software, it is recommended that the operation setting is set to “Always On” for ease of testing/viewing new settings. Once the programming is complete, remember to change the operation mode back to your specific installation requirement (Sealite recommend “Dusk to Dawn” mode).

Lantern Installation

The Sealite SL-155 may be installed with connection to mains power, or as a complete solar powered system (available from Sealite).

IMPORTANT: the SL-155 must be installed appropriately where the lantern is not blocked by buildings, trees or other shadows that may affect the visibility of the lantern or the ambient light.

Option 1: Installation of Lantern to Mains Power

To connect the SL-155 to a 12VDC power supply:

- Connect the blue negative wire of the lantern to the power supply negative terminal
- Connect the brown positive wire of the lantern to the power supply positive terminal

IMPORTANT: it is important that a 15Amp AC-DC power supply is connected between the mains power and the lantern to maximise the life of your product. The AC-DC power supply should be no more than 20m from the lantern

Option 2: Installation of Lantern to Solar Powered System

Sealite has an optional complete solar powered system available to purchase with the standard SL- 155 lantern. Detailed instructions for installation of the solar system are listed as follows.

1. Unpacking Instructions

Unpack all hardware and verify container contents in accordance with Figure 2. Please contact your Sealite representative if there is any hardware missing.

2. Initial Inspection

Inspect all hardware for damage. If there is any damage, please contact your Sealite representative.

3. Installation

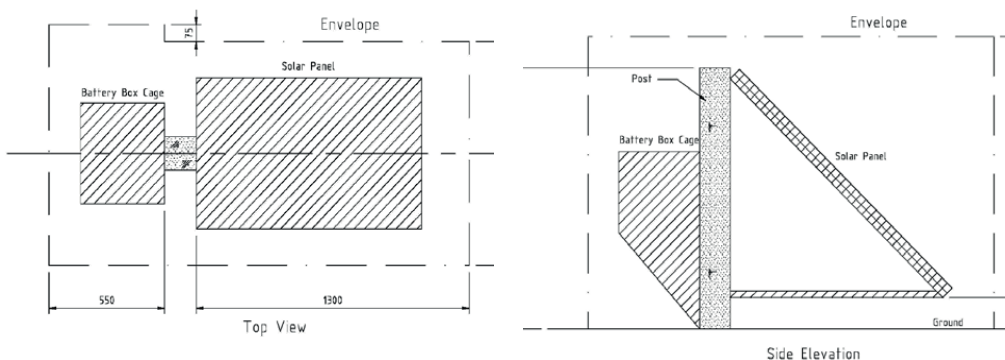
Refer to Figure 1 “Panel & Cage Footprint” and Figure 2 “Installation of Solar Panel & Battery Box Cage” during installation of the panel and cage.

3.1 Installing the Post

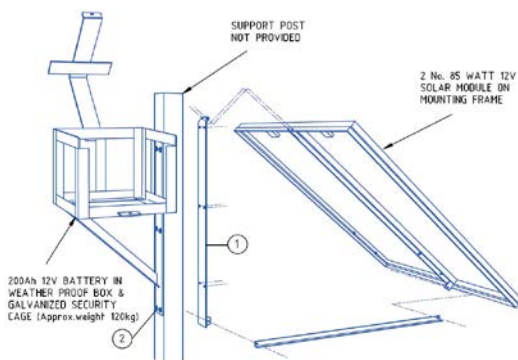
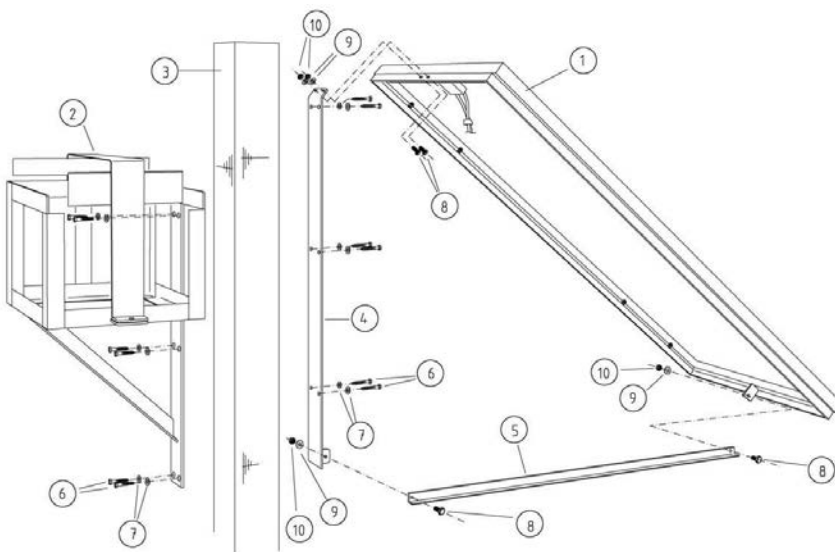
A suitable mounting point for the Solar Panel and Battery Box Cage is to be provided by the client. It is usual to use a purpose installed post.

The following should be observed:-

- The post should be of a durable timber, or other durable material
- Recommended minimum post size is 150mm x 150mm, or larger if the battery box cage needs to be installed immediately beneath the solar panel
- The length of post required is the sum of exposed length (normally 1.25m) plus the required depth into the ground which is dependent on local soil conditions (recommended depth 850 minimum)
- The faces of the post must be aligned with the cardinal points of the compass. This will allow the Solar panel to be aligned with the equator and sun
- The post should not be more than 20m from the lantern, and should not be located so as to place the solar panel in shade for a significant time
- The solar panel is tempered glass, so the post should be located away from any objects which might fall on the installation
- The post and equipment footprint should be at least 300mm clear of any shading under all conditions



Ref No.	Description	No. Required
2.1	140W Solar Panel & Frame	1
2.2	Battery Box Cage	1
2.3	Post, 150x150 minimum	Client Supplied
2.4	Steel Support	1
2.5	Steel Brace	1
2.6	Screw, 12mm x 75	12
2.7	Washer, 12mm	12
2.8	Bolt, 10mm x 25	4
2.9	Washer, 10mm	4
2.10	Self Locking Nut, 10mm	4



Alternative setup, using 2 x 85W panels. Lantern duty cycle and intensity will determine the size and quantity of solar panels and batteries.

Figure 2. Installation of Solar Panel & Battery Box Cage

3.1 Installing the Solar Panel & Battery Box Cage

The battery box cage (Ref 2.2) and the steel support bracket (Ref 2.4) are attached to the post (Ref 2.3) using coach screws and washers (Ref 2.6, 2.7).

- a. Drill the post for the steel support bracket (6 places) and install using supplied screws
IMPORTANT: the Solar Panel must face the equator. Locate the solar panel support bracket accordingly.
- b. Drill the post for the battery box cage (6 places) on the opposite side to the solar panel and install using supplied screws
- c. Install the solar panel and frame (Ref 2.1) and the brace (Ref 2.5) to the steel support bracket using bolts (Ref 2.8), washers (Ref 2.9) and nuts (Ref 2.10)

3.2 Installing the Battery Box

Refer to Figure 3 “Battery and Battery Box” during installation of the battery and battery box.

- a. Open the battery box cage door and place the battery case (Ref 3.1) into the cage with the hinge of the case adjacent to the hinge of the cage
 - b. Open the battery case and lower the battery into the case ensuring the battery terminals are upright
 - c. Insert one bolt (Ref 3.3) with a washer (Ref 3.4) under the head through each of the battery terminals
 - d. Place the red eye connector over the tail of the bolt protruding through the red battery terminal
 - e. Fit a washer (Ref 3.4), spring washer (Ref 3.5) and nut (Ref 3.6) on the terminal bolt. Tighten
 - f. Place the blue eye connector over the tail of the bolt protruding through the black battery terminal. Fit a washer (Ref 3.4), spring washer (Ref 3.5) and nut (Ref 3.6) on the terminal bolt. Tighten
 - g. Insert the end of the cable from the solar panel through one of the cable glands in the back of the battery case. Join bullet connectors, red to red and blue to blue
- Test the lantern. Cover the lantern completely to resemble night time. Allow 60 seconds for the lantern to activate
 - Uncover the lantern and it will turn off after 60seconds

Ref No.	Description	No. Required
3.1	Battery Case, SPC353534	1
3.2	Battery, 12V 70AH or equivalent	1
3.3	Bolt, battery	2
3.4	Washer, battery	4
3.5	Spring Washer, battery	2
3.6	Nut, battery	2

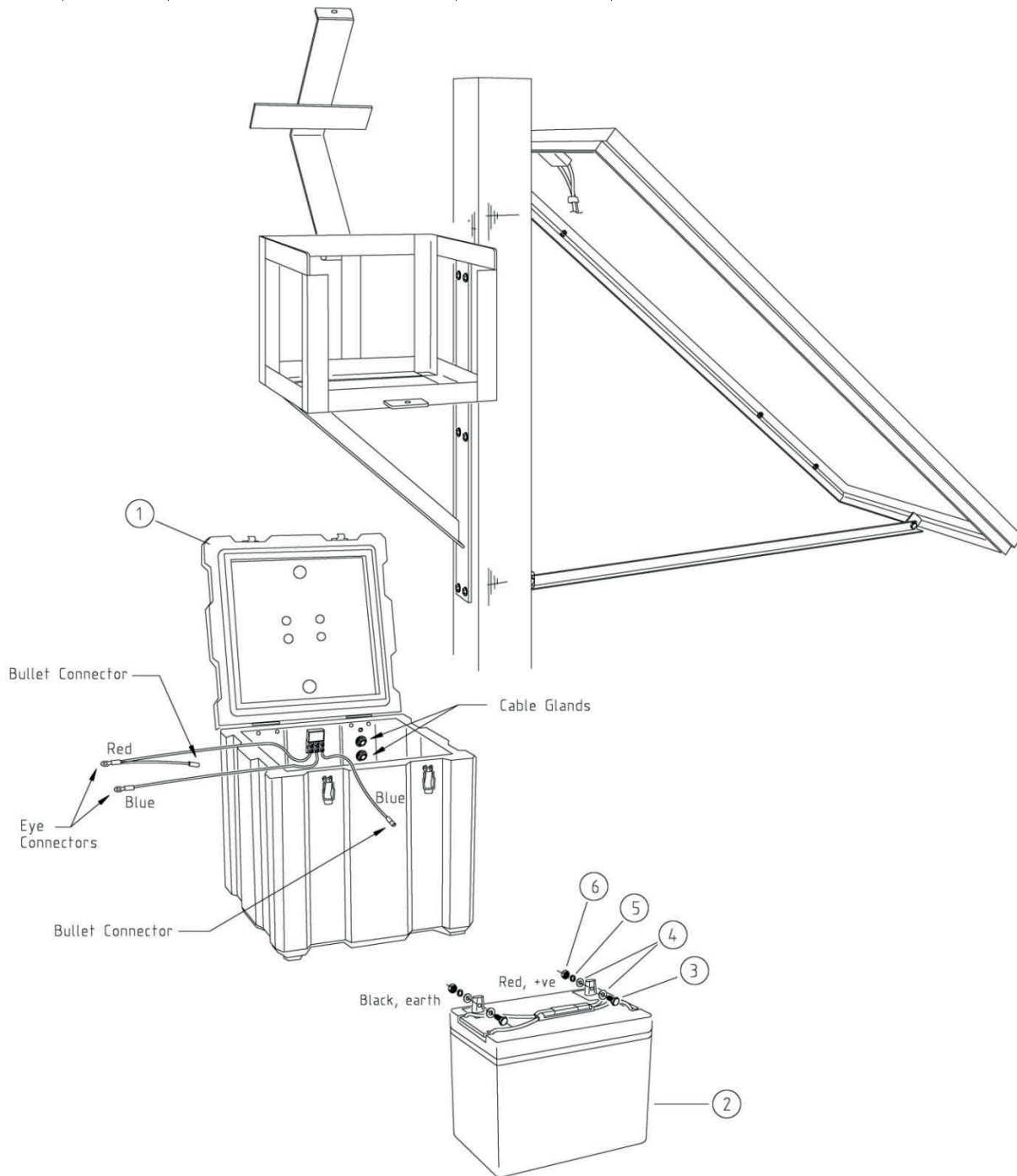


Figure 3. Battery and Battery Box

3.2 Connecting the Lantern

To connect the SL-155 to the solar powered system:

- Connect the blue negative wire of the lantern to the battery negative terminal
- Connect the brown positive wire of the lantern to the battery positive terminal

The lantern must to be connected to a 12VDC power supply.

Please ensure the solar panel array has been installed appropriately. To maximise solar collection, the solar panel array should be installed facing the equator and in a location that ensures it will not be shaded by buildings, trees or other structures. **Solar panels will significantly reduce in efficiency if a small shadow is positioned over the solar panel.**

***IMPORTANT:** it is important to work with the team at Sealite when determining the quantity and size of both batteries and solar panels for this lantern. Duty cycle, intensity and local solar conditions are important factors to take into consideration when building a solar powered battery supply.*

Sealite solar marine lanterns will give years of trouble free service if installed correctly initially.

- Please ensure all connections are tight
- Please ensure that solar panels are always clean and free from bird droppings and shade and that the solar array is pointed toward the sun to maximise solar collection
- Please ensure that battery box covers are latched properly and that cages are secured appropriately, to prevent theft and vandalism

Please contact your Sealite representative if you have any questions regarding the installation and service of the lantern.

GPS Synchronisation

The lanterns are 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 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 a number of 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 is able to 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 Testing

Now that the SL-155 has been programmed to suit the project requirements, it's important that the lantern is tested prior to installation, including flash code and intensity settings.

To test the SL-155:

- Connect the SL-155 to a 12V power supply or battery
- For lanterns programmed to “Dusk to Dawn” operation setting, cover lantern with a dark cloth or jack in darkness for more than 1 minute. After this time the lantern will activate
- Next, check that the lantern is flashing to the required flash code and intensity
- If the settings are correct, disconnect from the 12V power supply or battery
- If the settings are incorrect, following the Programming Instructions of this manual to re-configure lantern characteristics, and then re-test prior to installation

IMPORTANT: *when lantern is being programmed using the Sealite PC Configuration Tool software, it is recommended that the operation setting is set to “Always On” for ease of testing/viewing new settings. Once the programming is complete, remember to change the operation mode back to your specific installation requirement (Sealite recommend “Dusk to Dawn” mode).*

Lantern Installation

The Sealite SL-155 may be installed with connection to mains power, or as a complete solar powered system (available from Sealite).

IMPORTANT: *the SL-155 must be installed appropriately where the lantern is not blocked by buildings, trees or other shadows that may affect the visibility of the lantern or the ambient light.*

Option 1: Installation of Lantern to Mains Power

To connect the SL-155 to a 12VDC power supply:

- Connect the blue negative wire of the lantern to the power supply negative terminal
- Connect the brown positive wire of the lantern to the power supply positive terminal

IMPORTANT: *it is important that a 15Amp AC-DC power supply is connected between the mains power and the lantern to maximise the life of your product. The AC-DC power supply should be no more than 20m from the lantern.*

Option 2: Installation of Lantern to Solar Powered System

Sealite has an optional complete solar powered system available to purchase with the standard SL- 155 lantern. Detailed instructions for installation of the solar system are listed as follows.

1. Unpacking Instructions

Unpack all hardware and verify container contents in accordance with Figure 2. Please contact your Sealite representative if there is any hardware missing.

2. Initial Inspection

Inspect all hardware for damage. If there is any damage, please contact your Sealite representative.

3. Installation

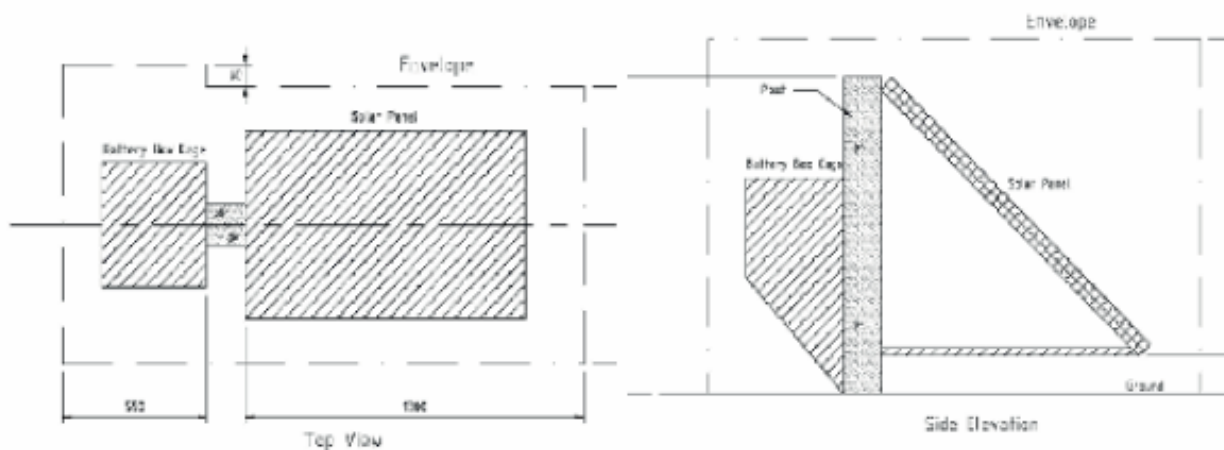
Refer to Figure 1 “Panel & Cage Footprint” and Figure 2 “Installation of Solar Panel & Battery Box Cage” during installation of the panel and cage.

3.1 Installing the Post

A suitable mounting point for the Solar Panel and Battery Box Cage is to be provided by the client. It is usual to use a purpose installed post.

The following should be observed:-

- The post should be of a durable timber, or other durable material
- Recommended minimum post size is 150mm x 150mm, or larger if the battery box cage needs to be installed immediately beneath the solar panel
- The length of post required is the sum of exposed length (normally 1.25m) plus the required depth into the ground which is dependent on local soil conditions (recommended depth 850 minimum)
- The faces of the post must be aligned with the cardinal points of the compass. This will allow the Solar panel to be aligned with the equator and sun
- The post should not be more than 20m from the lantern, and should not be located so as to place the solar panel in shade for a significant time
- The solar panel is tempered glass, so the post should be located away from any objects which might fall on the installation
- The post and equipment footprint should be at least 300mm clear of any shading under all conditions



Ref	Description	No.
2.1	140W Solar Panel & Frame	1
2.2	Battery Box Cage	1
2.3	Post, 150x150 minimum	Client
2.4	Steel Support	1
2.5	Steel Brace	1
2.6	Screw, 12mm x 75	12
2.7	Washer, 12mm	12
2.8	Bolt, 10mm x 25	4
2.9	Washer, 10mm	4
2.10	Self Locking Nut, 10mm	4

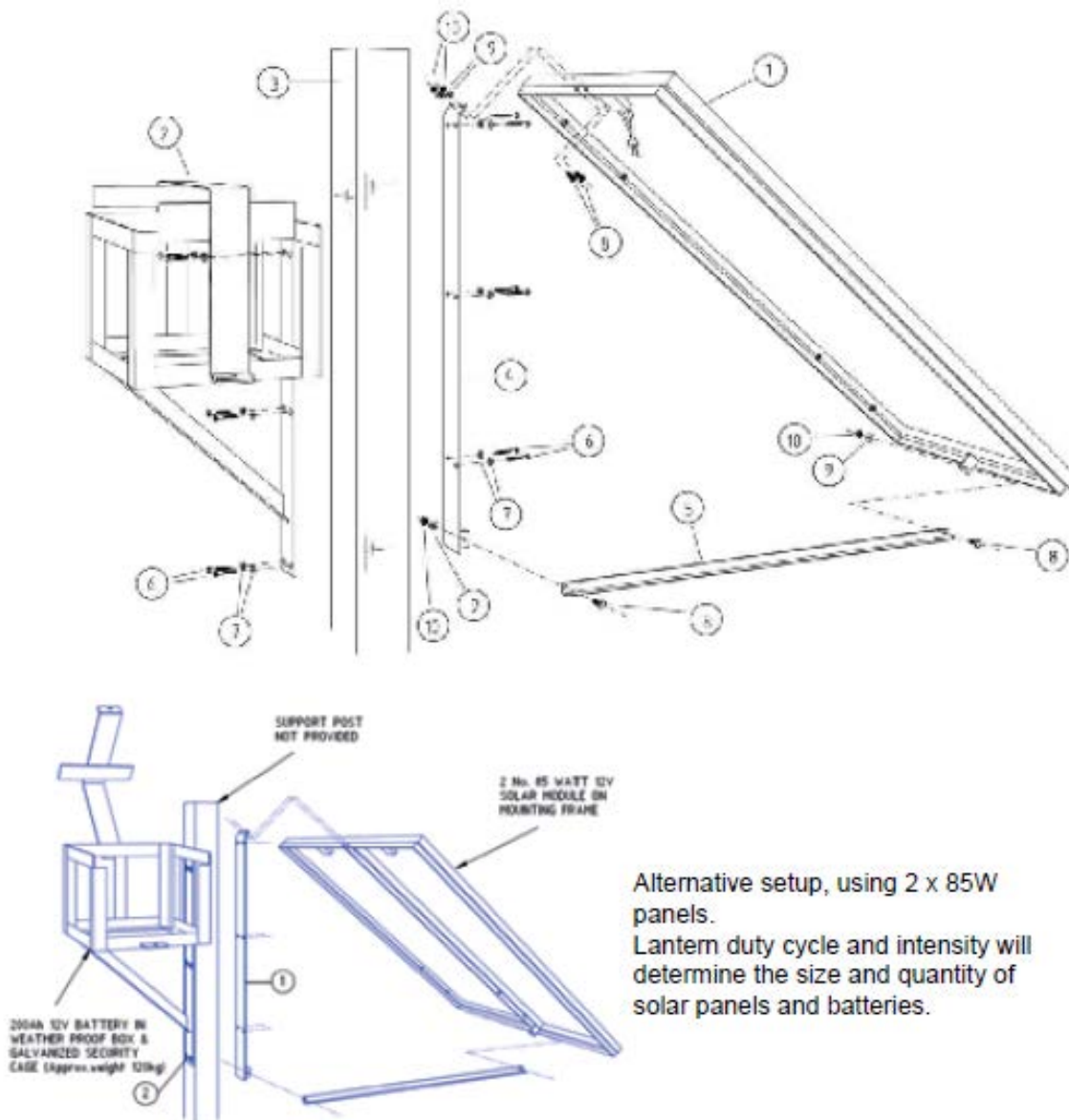


Figure 2. Installation of Solar Panel & Battery Box Cage

3.2 Installing the Solar Panel & Battery Box Cage

The battery box cage (Ref 2.2) and the steel support bracket (Ref 2.4) are attached to the post

(Ref 2.3) using coach screws and washers (Ref 2.6, 2.7).

- a. Drill the post for the steel support bracket (6 places) and install using supplied screws
IMPORTANT: the Solar Panel must face the equator. Locate the solar panel support bracket accordingly.
- b. Drill the post for the battery box cage (6 places) on the opposite side to the solar panel and install using supplied screws
- c. Install the solar panel and frame (Ref 2.1) and the brace (Ref 2.5) to the steel support bracket using bolts (Ref 2.8), washers (Ref 2.9) and nuts (Ref 2.10)

3.3 Installing the Battery Box

Refer to Figure 3 “Battery and Battery Box” during installation of the battery and battery box.

- a. Open the battery box cage door and place the battery case (Ref 3.1) into the cage with the hinge of the case adjacent to the hinge of the cage
 - b. Open the battery case and lower the battery into the case ensuring the battery terminals are upright
 - c. Insert one bolt (Ref 3.3) with a washer (Ref 3.4) under the head through each of the battery terminals
 - d. Place the red eye connector over the tail of the bolt protruding through the red battery terminal
 - e. Fit a washer (Ref 3.4), spring washer (Ref 3.5) and nut (Ref 3.6) on the terminal bolt. Tighten
 - f. Place the blue eye connector over the tail of the bolt protruding through the black battery terminal. Fit a washer (Ref 3.4), spring washer (Ref 3.5) and nut (Ref 3.6) on the terminal bolt. Tighten
 - g. Insert the end of the cable from the solar panel through one of the cable glands in the back of the battery case. Join bullet connectors, red to red and blue to blue
- Test the lantern. Cover the lantern completely to resemble night time. Allow 60 seconds for the lantern to activate
 - Uncover the lantern and it will turn off after 60 seconds

Ref	Description	No.
3.1	Battery Case, SPC353534	1
3.2	Battery, 12V 70AH or	1
3.3	Bolt, battery	2
3.4	Washer, battery	4
3.5	Spring Washer, battery	2
3.6	Nut, battery	2

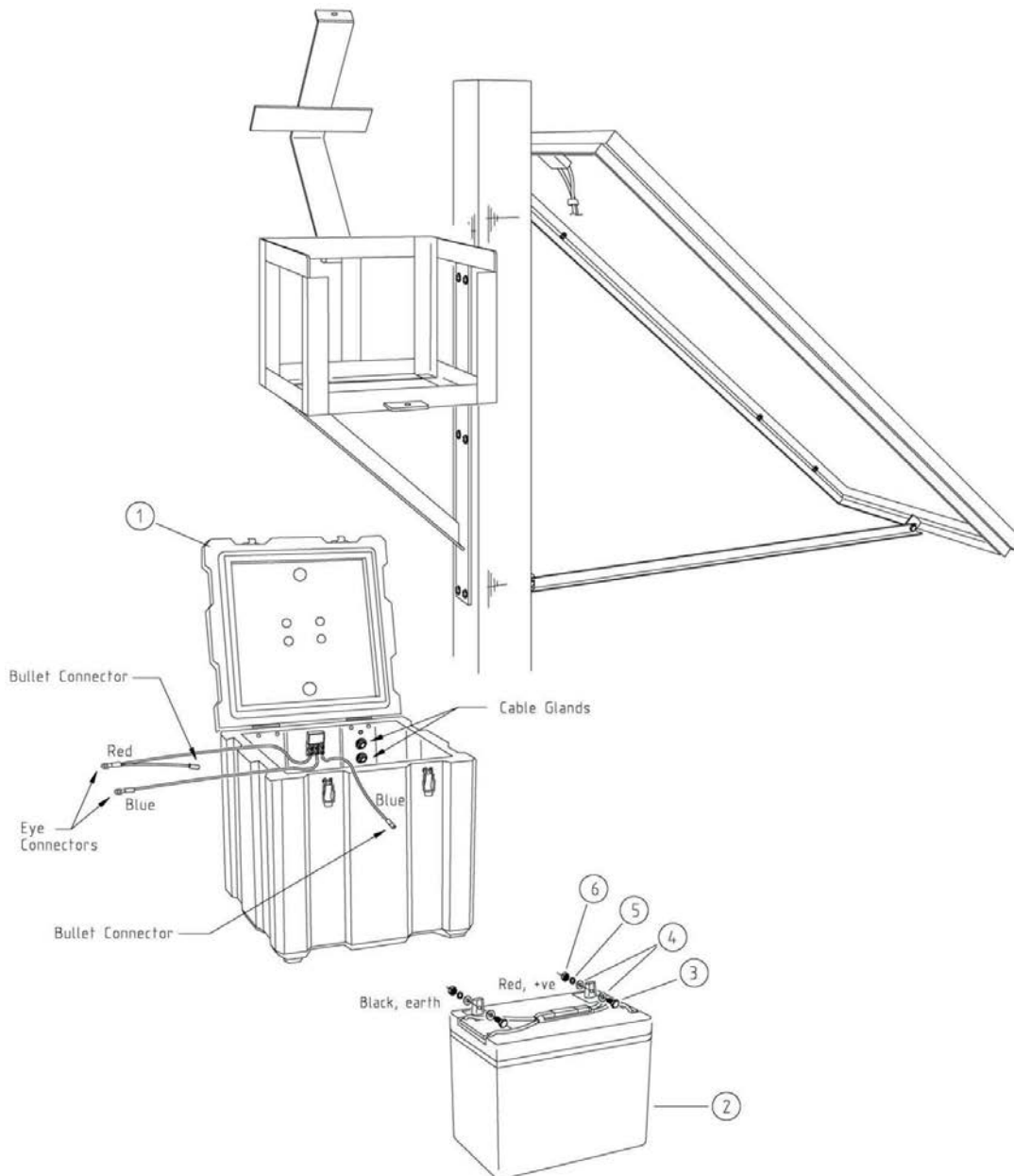


Figure 3. Battery and Battery Box

3.4 Connecting the Lantern

To connect the SL-155 to the solar powered system:

- Connect the blue negative wire of the lantern to the battery negative terminal
- Connect the brown positive wire of the lantern to the battery positive terminal

The lantern must to be connected to a 12VDC power supply.

Please ensure the solar panel array has been installed appropriately. To maximise solar collection, the solar panel array should be installed facing the equator and in a location that ensures it will not be shaded by buildings, trees or other structures. **Solar panels will significantly reduce in efficiency if a small shadow is positioned over the solar panel.**

***IMPORTANT:** it is important to work with the team at Sealite when determining the quantity and size of both batteries and solar panels for this lantern. Duty cycle, intensity and local solar conditions are important factors to take into consideration when building a solar powered battery supply.*

Sealite solar marine lanterns will give years of trouble free service if installed correctly initially.

- Please ensure all connections are tight
- Please ensure that solar panels are always clean and free from bird droppings and shade and that the solar array is pointed toward the sun to maximise solar collection
- Please ensure that battery box covers are latched properly and that cages are secured appropriately, to prevent theft and vandalism

Please contact your Sealite representative if you have any questions regarding the installation and service of the lantern

Optional GPS Synchronisation

The lanterns are 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 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 a number of 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 is able to 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.

AIS System

The SI-155 AIS AtoN is a self contained device supporting both Type 1 (transmit only) and Type 3 (transmit and receive) operation. It is designed for installation in exposed locations on physical AtoN structures. The AIS AtoN can be supplied with an optional sensor interface platform which interfaces to sensors (such as weather instruments) and transmits measured data via AIS messages to surrounding vessels and shore stations.

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 operation is provided below.

Type 1 AIS AtoN

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.

Type 3 AIS AtoN

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 receive capability also allows a Type 3 AIS AtoN to be configured and queried for 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.

GNSS systems

The AIS AtoN includes an internal GNSS receiver supporting the GPS system as standard.

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.

Installation

The main installation and commissioning steps are:

1. Mount the transceiver in a suitable location on the physical Aid to Navigation
2. If using an external VHF antenna, install the VHF antenna according to the manufacturer's instructions
3. Connect any sensor interfaces and light / RACON monitoring signals
4. Connect power to the transceiver
5. Configure and commission the transceiver via USB (note that this step can be carried out on shore prior to installation in a remote location)

Description of the proAtoN Programming Software Tool

The proAtoN PC application is supplied on the CD packaged with the transceiver. The application provides features for configuration of the transceiver and confirming 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-155 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 with the transceiver. The steps to complete the installation are as follows:

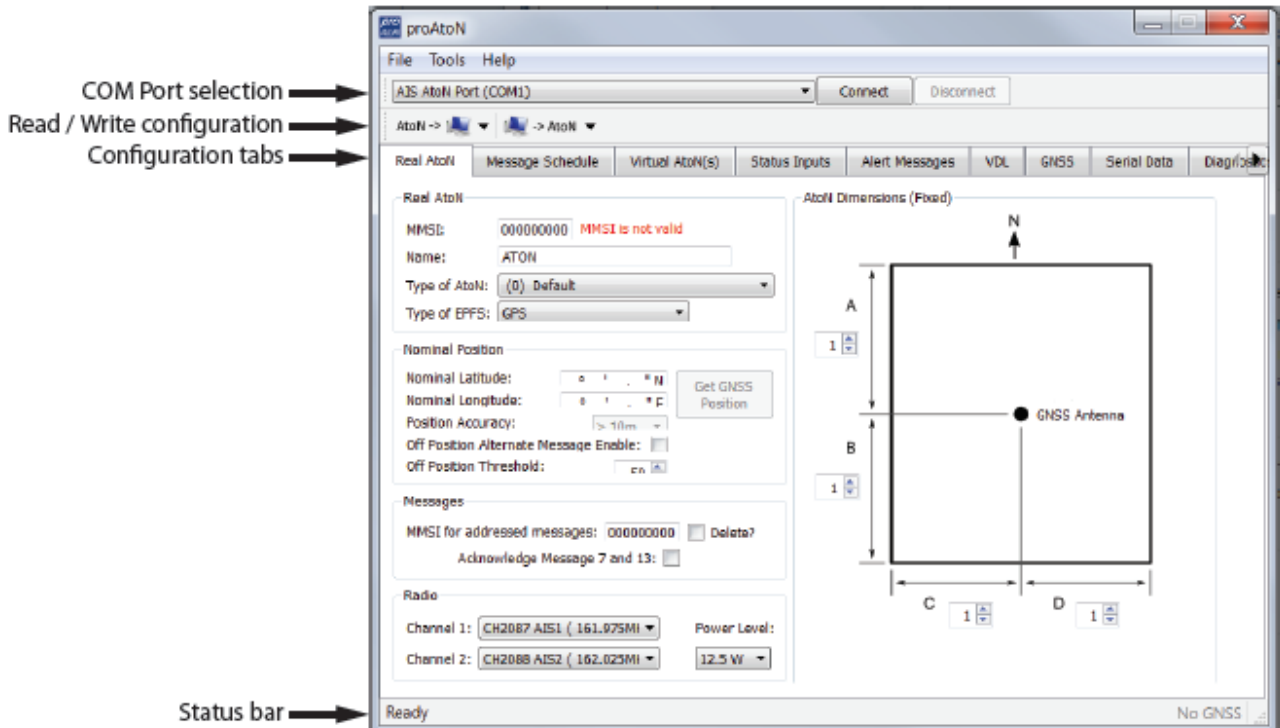
1. Insert the CD into your PC
2. Navigate to the proAtoN folder on the CD
3. Double click the 'setup.exe' item to start the installation process
4. Follow on screen instructions to complete the installation

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.

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.

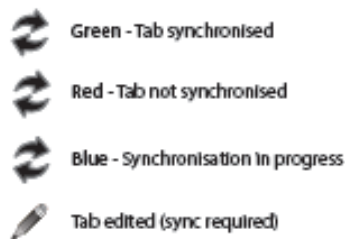
Configuration tabs

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

- **Alert messages tab**
Configuration of non-periodic messages (e.g., vessel proximity alert messages).
- **GNSS**
Displays signal strength and status information for the transceiver GPS receiver.
- **Serial data**
Displays raw IEC61162 (NMEA0183) data output from the transceiver.
- **Diagnostics**
Displays software version information, alarms and other key 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 in 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.



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.

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

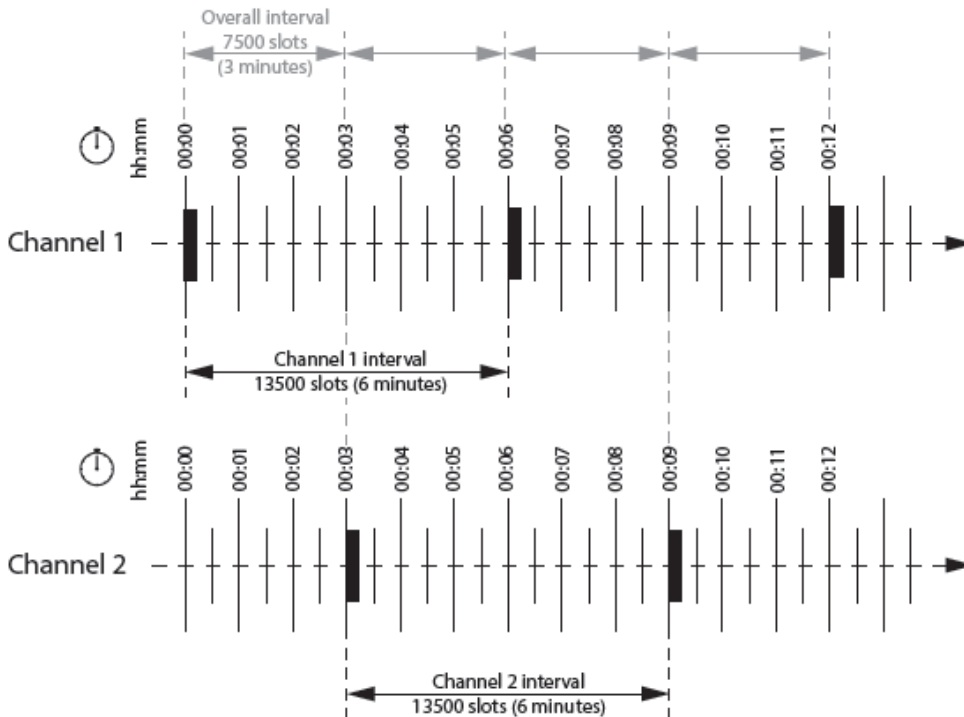
This is the slot number for the first transmission on channel 2. The slot number can range from -1 (transmission disabled on this channel) to 2249. Note that each message #21 transmission occupies two slots and associated base station slot reservations must therefore reserve two slots.

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 transmit 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

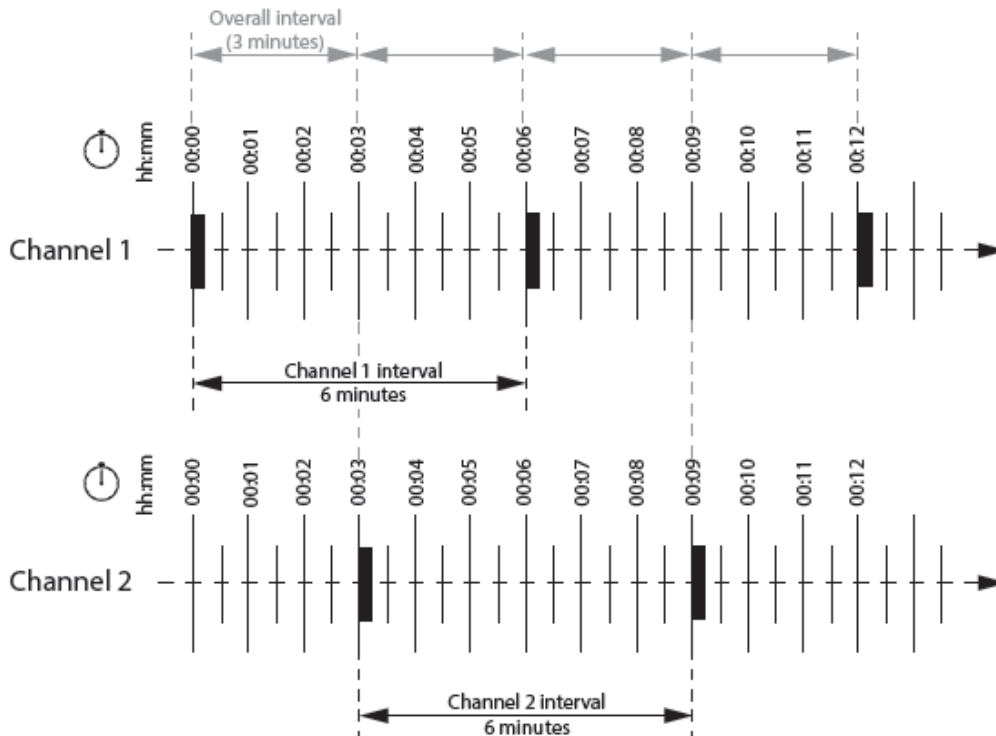
This is the hour and minute of the frame in which transmission will occur on channel 2. The slot used within this frame will be determined by the transceiver.

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 transmit 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 five 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 five 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:

Enable virtual AtoN and select type

Virtual AtoN subtabs

Virtual AtoN details

Virtual AtoN schedule

Message ID	Index	Access Scheme	Channel 1 Start UTC	Channel 1 Start Slot	Channel 1 Interval	Channel 2 Start UTC	Channel 2 Start Slot	Chan Inte
21	1	FATDMA	00:00	0	6750 Slots	00:00	0	6750 5

Virtual / Synthetic AtoN

Each virtual AtoN required must be separately enabled by checking the 'Enable' checkbox. 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, e.g., 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 / Synthetic AtoN Details

The basic configuration of a virtual or synthetic AtoN is comparable to that required for a 'real' AIS AtoN.

Note that the MMSI number format is different:

- A virtual AtoN MMSI has the format 99MID6XXX, where MID is the appropriate national MID and XXX is a number unique to this station.

The position of the virtual or synthetic AtoN must be configured appropriately to the position of the aid. Note that a virtual AtoN has no dimensions whereas the dimensions of a synthetic AtoN should be configured.

Virtual 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. The status bits contain the basic operational state of a connected light and RACON along with the overall health of the transceiver itself. Connection of a light and/or RACON is optional and requires equipment with a suitable health output.

CAUTION : Do not modify these setting as the lantern comes preconfigured for reporting Lantern status in Message 21.



Alert messages

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 provided in
-

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 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**

SART Relay Mode

This control enables or disables the repeating of SART (Search and Rescue Transponder) messages detected by the AIS AtoN. This functionality is only relevant to Type 3 devices as receivers are required to detect the messages.

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 dB Hz 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 bootloader software versions for the connected AtoN are displayed**
- **The serial number of the connected AtoN is displayed Power status**
- **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 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.
Exiting standby	Information only on exit of standby mode.
Entering standby for xx seconds	Information only on entry to standby mode.

Active alarms

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 - please contact your supplier.
Antenna VSWR exceeds limits	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 1 malfunction	A receiver malfunction has been detected - please contact your supplier.
Rx Channel 2 malfunction	A receiver malfunction has been detected - please contact your supplier.
EPFS failure	No position is available from the internal GNSS receiver - please contact your supplier.
DGNSS input failed	No data is available from the external source of differential GNSS correction data. Please check connections, baud rate and equipment configuration.
Supply voltage	The transceiver power supply voltage is outside of the permitted range. The measured supply voltage is displayed on the proAtoN diagnostics tab.
Low forward power	The transmitter forward power is below a preset limit - please contact your supplier.
Synchronisation lost	Timing information is not available from the internal GNSS receiver - please contact your supplier.

Maintenance & Servicing

Designed to be virtually maintenance-free, the SL-155 Series will require minimal attention. However, the following maintenance and servicing information is provided to help ensure the life of your Sealite product.

1. Cleaning Lens - occasional cleaning of the lantern lens may be required. Using a cloth and warm soapy water, wipe off any foreign matter before rinsing the lens with fresh water.
2. Ensure the external vent and programming port are free from foreign material.

Trouble Shooting

Problem	Remedy
Unable to communicate with lantern via USB	<ol style="list-style-type: none"> 1. Connect the USB drive provided by Sealite to the PC and open to view files. 2. Double-click on the file: ???Configx.xx.exe (note, version number may vary) 3. Extract the executable file 4. Connect the lantern to a power source 5. Connect the lantern to the PC 6. Click "COM Setup" 7. Select the appropriate COM Port from the drop down menu in the "Serial Port" dialogue box 8. Ensure the "Open Port" check box is selected and "Port is Open" is displayed 9. Click "Ok" 10. Lantern should be connected and ready for programming
Lantern will not activate.	<ul style="list-style-type: none"> • Ensure lantern is in darkness • Wait at least 60 seconds for the program to initialise in darkness • Ensure battery terminals are properly connected • Ensure lantern is connected to a 12volt power supply
Programming settings will not change	<ul style="list-style-type: none"> • Check programming cable is properly connected to both lantern and computer, and check that the lantern is connected correctly to a power source (and that the power source is charged eg. battery)
Unit will not achieve the desired intensity / range using the PC Configuration Tool	<ul style="list-style-type: none"> • The thermal limit is out of range. Try altering the flash code to reduce the duty cycle. If a flash code has a duty cycle of more than 37.5% the intensity will automatically be reduced to control the lantern temperature.

Appendix – Flash Codes

Sealite marine lanterns 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.

Recommended Rhythm for Flashing Light - IALA Regions A and B

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

IR					IR						
SWITCH		Controller	FLASH CODE	ON	OFF	SWITCH		Controller	FLASH CODE	ON	OFF
A	B					A	B				
0	0	000	F (Steady light)			7	1	113	FL 5 S	1.5	3.5
D	3	211	VQ 0.5 S	0.2	0.3	4	2	66	ISO 5 S	2.5	2.5
E	3	227	VQ 0.6 S	0.2	0.4	8	2	130	LFL 5 S	2.0	3.0
F	3	243	VQ 0.6 S	0.3	0.3	0	3	3	OC 5 S	3.0	2.0
7	3	115	Q 1 S	0.2	0.8	1	3	19	OC 5 S	4.0	1.0
8	3	131	Q 1 S	0.3	0.7	2	3	35	OC 5 S	4.5	0.5
9	3	147	Q 1 S	0.4	0.6	C	6	198	FL 6 S	0.2	5.8
A	3	163	Q 1 S	0.5	0.5	B	5	181	FL 6 S	0.3	5.7
8	4	132	Q 1 S	0.8	0.2	C	5	197	FL 6 S	0.4	5.6
B	3	179	Q 1.2 S	0.3	0.9	8	1	129	FL 6 S	0.5	5.5
9	4	148	Q 1.2 S	0.5	0.7	9	1	145	FL 6 S	0.6	5.4
C	3	195	Q 1.2 S	0.6	0.6	A	1	161	FL 6 S	1.0	5.0
F	4	244	FL 1.5 S	0.2	1.3	7	5	117	FL 6 S	1.2	4.8
1	0	16	FL 1.5 S	0.3	1.2	B	1	177	FL 6 S	1.5	4.5
0	5	5	FL 1.5 S	0.4	1.1	5	2	82	ISO 6 S	3.0	3.0
0	4	4	FL 1.5 S	0.5	1.0	9	2	146	LFL 6 S	2.0	4.0
2	0	32	FL 2 S	0.2	1.8	6	4	100	OC 6 S	4.0	2.0
3	0	48	FL 2 S	0.3	1.7	3	3	51	OC 6 S	4.5	1.5
4	0	64	FL 2 S	0.4	1.6	4	3	67	OC 6 S	5.0	1.0
5	0	80	FL 2 S	0.5	1.5	A	4	164	FL 7 S	1.0	6.0
6	0	96	FL 2 S	0.7	1.3	9	6	150	FL 7 S	2.0	5.0
7	0	112	FL 2 S	0.8	1.2	5	6	86	OC 7 S	4.5	2.5
1	2	18	ISO 2 S	1.0	1.0	D	5	213	FL 7.5 S	0.5	7.0
8	0	128	FL 2.5 S	0.3	2.2	C	1	193	FL 7.5 S	0.8	6.7
9	0	144	FL 2.5 S	0.5	2.0	E	5	229	FL 8 S	0.5	7.5
D	6	214	FL 2.5 S	1.0	1.5	B	4	180	FL 8 S	1.0	7.0
1	5	21	FL 3 S	0.2	2.8	6	2	98	ISO 8 S	4.0	4.0
A	0	160	FL 3 S	0.3	2.7	A	2	162	LFL 8 S	2.0	6.0
2	5	37	FL 3 S	0.4	2.6	6	6	102	OC 8 S	5.0	3.0
B	0	176	FL 3 S	0.5	2.5	B	2	178	LFL 8 S	3.0	5.0
3	5	53	FL 3 S	0.6	2.4	F	5	245	FL 9 S	0.9	8.1
C	0	192	FL 3 S	0.7	2.3	C	4	196	FL 9 S	1.0	8.0
D	0	208	FL 3 S	1.0	2.0	7	6	118	OC 9 S	6.0	3.0
2	2	34	ISO 3 S	1.5	1.5	0	6	6	FL 10 S	0.2	9.8
5	4	84	OC 3 S	2.0	1.0	1	6	22	FL 10 S	0.3	9.7
E	2	226	OC 3 S	2.5	0.5	D	1	209	FL 10 S	0.5	9.5
4	6	70	OC 3.5 S	2.5	1.0	2	6	38	FL 10 S	0.8	9.2
4	5	69	FL 4 S	0.2	3.8	E	1	225	FL 10 S	1.0	9.0
5	5	85	FL 4 S	0.3	3.7	1	4	20	FL 10 S	1.5	8.5
E	0	224	FL 4 S	0.4	3.6	C	2	194	LFL 10 S	2.0	8.0
F	0	240	FL 4 S	0.5	3.5	D	2	210	LFL 10 S	3.0	7.0
6	5	101	FL 4 S	0.6	3.4	7	2	114	ISO 10 S	5.0	5.0
0	1	1	FL 4 S	0.8	3.2	2	4	36	LFL 10 S	4.0	6.0
1	1	17	FL 4 S	1.0	3.0	8	6	134	OC 10 S	6.0	4.0
2	1	33	FL 4 S	1.5	2.5	5	3	83	OC 10 S	7.0	3.0
3	2	50	ISO 4 S	2.0	2.0	6	3	99	OC 10 S	7.5	2.5
3	6	54	OC 4 S	2.5	1.5	F	1	241	FL 12 S	1.2	10.8
F	2	242	OC 4 S	3.0	1.0	D	4	212	FL 12 S	2.5	9.5
3	1	49	FL 4.3 S	1.3	3.0	3	4	52	LFL 12 S	2.0	10.0
8	5	133	FL 5 S	0.2	4.8	0	2	2	FL 15 S	1.0	14.0
4	1	65	FL 5 S	0.3	4.7	4	4	68	LFL 15 S	4.0	11.0
5	1	81	FL 5 S	0.5	4.5	7	4	116	OC 15 S	10	5.0
9	5	149	FL 5 S	0.9	4.1	A	6	166	LFL 20 S	2.0	18.0
6	1	97	FL 5 S	1.0	4.0	E	4	228	FL 26 S	1.0	25.0

SWITCH		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
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
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
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
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
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
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
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
4	7	71	FL (2) 8 S	0.5	1.0	0.5	6.0
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
9	A	154	FL (2) 10 S	0.4	1.6	0.4	7.6
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
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
8	B	139	Q (2) 15 S	0.2	0.8	0.2	13.8
C	A	202	FL (2) 20 S	1.0	3.0	1.0	15.0
D	A	218	FL (2) 25 S	1.0	1.0	1.0	22.0

SWITCH		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
3	C	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

SWITCH		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
0	B	11	FL (3) 9 S	0.3	1.0	0.3	1.0	0.3	6.1
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
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
D	7	215	FL (3) 10 S	1.0	1.0	1.0	1.0	1.0	5.0
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
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
1	8	24	FL (2+1) 13.5 S	1.0	1.0	1.0	4.0	1.0	5.5
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
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
1	C	28	VQ (3) 15 S	0.1	0.5	0.1	0.5	0.1	13.7
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
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

SWITCH		IR Controller	FLASH CODE	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF
A	B												
B	F	191	VQ (4) 4 S	0.3	0.3	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	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	0.6	0.4	2.6
1	D	29	FL (4) 10 S	0.5	1.0	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	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	0.7	0.3	6.7
B	E	190	FL (4) 12 S	0.3	1.7	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	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	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	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	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	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	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	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	1.5	0.5	9.5
C	D	205	FL (4) 20 S	0.3	3.0	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	1.5	0.5	13.5
0	D	13	FL (4) 20 S	0.5	1.5	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	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	0.5	0.5	16.5
E	E	238	Q (4) 28 S	0.5	0.5	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	0.5	0.5	26.5

SWITCH		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
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
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

SWITCH		IR Controller	FLASH CODE	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	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	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	7.0

SWITCH	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
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

SWITCH	IR Controller	FLASH CODE	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	
A	B																		
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	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	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	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	6.7
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	4.8

SWITCH		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

Notes

Sealite LED Light Warranty V2.2

Upon purchase, the Sealite Pty Ltd warranty must be activated for recognition of future claims. To do this you need to register on-line. Please complete the Online Registration Form at:

www.sealite.com

Sealite Pty Ltd will repair or replace your LED light in the event of electronic failure for a period of up to three years from the date of purchase, as per the terms & conditions below.

Sealite Pty Ltd will repair or replace any ancillary or accessory products in the event of failure for a period of up to one year from the date of purchase, as per the terms & conditions below.

The unit(s) must be returned to Sealite freight prepaid.

Warranty Terms

1. Sealite Pty Ltd warrants that any Sealite marine products fitted with telemetry equipment including but not limited to AIS, GSM, GPS or RF (“Telemetry Products”) will be free from defective materials and workmanship under normal and intended use, subject to the conditions hereinafter set forth, for a period of twelve (12) months from the date of purchase by the original purchaser.
2. Sealite Pty Ltd warrants that any BargeSafe™ Series of LED barge light products (“BargeSafe™ Products”) will be free from defective materials and workmanship under normal and intended use, subject to the conditions hereinafter set forth, for a period of twelve (12) months from the date of purchase by the original purchaser.
3. Sealite Pty Ltd warrants that any LED area lighting products (“Area Lighting Products”) but not including sign lighting products will be free from defective materials and workmanship under normal and intended use, subject to the conditions hereinafter set forth, for a period of twelve (12) months from the date of purchase by the original purchaser.
4. Sealite Pty Ltd warrants that any ancillary products and accessories, not mentioned in other clauses in this section, will be free from defective materials and workmanship under normal and intended use, subject to the conditions hereinafter set forth, for a period of twelve (12) months from the date of purchase by the original purchaser.
5. Sealite Pty Ltd warrants that any LED sign lighting products (“Sign Lighting Products”) will be free from defective materials and workmanship under normal and intended use, subject to the conditions hereinafter set forth, for a period of three (3) years from the date of purchase by the original purchaser.
6. Sealite Pty Ltd warrants that any Sealite marine lighting products other than the Telemetry Products, BargeSafe™ Products, and Area Lighting Products (“Sealite Products”) will be free from defective materials and workmanship under normal and intended use, subject to the conditions hereinafter set forth, for a period of three (3) years from the date of purchase by the original purchaser.
7. Sealite Pty Ltd will repair or replace, at Sealite’s sole discretion, any Telemetry Products, BargeSafe™ Products, Area Lighting Products or Sealite Products found to be defective in material and workmanship in the relevant warranty period so long as the Warranty Conditions (set out below) are satisfied.
8. If any Telemetry Products, BargeSafe™ Products, Area Lighting Products or Sealite Products are fitted with a rechargeable battery, Sealite Pty Ltd warrants the battery will be free from defect for a period of one (1) year when used within original manufacturer’s specifications and instructions.
9. Buoy products are covered by a separate ‘Sealite Buoy Warranty’.

Warranty Conditions

This Warranty is subject to the following conditions and limitations;

1. The warranty is applicable to lanterns manufactured from 1/1/2009.
2. The warranty is void and inapplicable if:
 - a. the product has been used or handled other than in accordance with the instructions in the owner’s manual and any other information or instructions provided to the customer by Sealite;
 - b. the product has been deliberately abused, or misused, damaged by accident or neglect or in being transported; or
 - c. the defect is due to the product being repaired or tampered with by anyone other than Sealite or

authorised Sealite repair personnel.

3. The customer must give Sealite Pty Ltd notice of any defect with the product within 30 days of the customer becoming aware of the defect.
4. Rechargeable batteries have a limited number of charge cycles and may eventually need to be replaced. Typical battery replacement period is 3-4 years. Long term exposure to high temperatures will shorten the battery life. Batteries used or stored in a manner inconsistent with the manufacturer's specifications and instructions shall not be covered by this warranty.
5. No modifications to the original specifications determined by Sealite shall be made without written approval of Sealite Pty Ltd.
6. Sealite lights can be fitted with 3rd party power supplies and accessories but are covered by the 3rd party warranty terms and conditions.
7. The product must be packed and returned to Sealite Pty Ltd by the customer at his or her sole expense. Sealite Pty Ltd will pay return freight of its choice. A returned product must be accompanied by a written description of the defect and a photocopy of the original purchase receipt. This receipt must clearly list model and serial number, the date of purchase, the name and address of the purchaser and authorised dealer and the price paid by the purchaser. On receipt of the product, Sealite Pty Ltd will assess the product and advise the customer as to whether the claimed defect is covered by this warranty.
8. Sealite Pty Ltd reserves the right to modify the design of any product without obligation to purchasers of previously manufactured products and to change the prices or specifications of any product without notice or obligation to any person.
9. Input voltage shall not exceed those recommended for the product.
10. Warranty does not cover damage caused by the incorrect replacement of battery in solar lantern models.
11. This warranty does not cover any damage or defect caused to any product as a result of water flooding or any other acts of nature.
12. There are no representations or warranties of any kind by Sealite or any other person who is an agent, employee, or other representative or affiliate of Sealite, express or implied, with respect to condition of performance of any product, their merchantability, or fitness for a particular purpose, or with respect to any other matter relating to any products.

Limitation of Liability

To the extent permitted by acts and regulations applicable in the country of manufacture, the liability of Sealite Pty Ltd under this Warranty will be, at the option of Sealite Pty Ltd, limited to either the replacement or repair of any defective product covered by this Warranty. Sealite will not be liable to Buyer for consequential damages resulting from any defect or deficiencies.

Limited to Original Purchaser

This Warranty is for the sole benefit of the original purchaser of the covered product and shall not extend to any subsequent purchaser of the product.

Miscellaneous

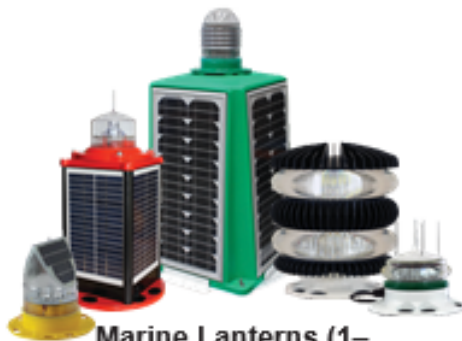
Apart from the specific warranties provided under this warranty, all other express or implied warranties relating to the above product is hereby excluded to the fullest extent allowable under law. The warranty does not extend to any lost profits, loss of good will or any indirect, incidental or consequential costs or damages or losses incurred by the purchaser as a result of any defect with the covered product.

Warrantor

Sealite Pty Ltd has authorised distribution in many countries of the world. In each country, the authorised importing distributor has accepted the responsibility for warranty of products sold by distributor. Warranty service should normally be obtained from the importing distributor from whom you purchased your product. In the event of service required beyond the capability of the importer, Sealite Pty Ltd will fulfil the conditions of the warranty. Such product must be returned at the owner's expense to the Sealite Pty Ltd factory, together with a photocopy of the bill of sale for that product, a detailed description of the problem, and any information necessary for return shipment.

Information in this manual is subject to change without notice and does not represent a commitment on the part of the vendor.
Sealite products are subject to certain Australian and worldwide patent applications.

Other Sealite Products Available



Marine Lanterns (1–19NM)



Monitoring & Control Systems



Bridge & Barge Lights



**Marine Buoys
(up to 3mt in diameter)**



Area Lighting



Mooring Systems & Accessories



AUSTRALIA
t: +61 (0)3 5977 6128

USA
t: +1 (603) 737 1311

UNITED KINGDOM
t: +44 (0) 1502 588026



e: info@sealite.com

We believe technology improves navigation™