VEGA INDUSTRIES LIMITED

VLB-5X LED Beacon

AIS-Compatible

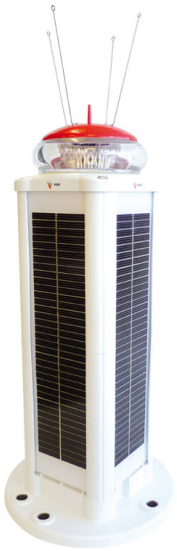
Installation and Operation Manual

STAND ALONE & SELF CONTAINED

- Marine Beacon
- Bridge Light
- Aircraft Hazard Light

VLB-5X-SA-Stand Alone

VLB-5X-SS-Standard Solar



VLB-5X-LS-Large Solar

VLB-5X Product Manual	
Available colour range	Red, Green, White, Yellow or Blue
Available models	SA-Stand Alone (No Solar panels) SS-Standard Solar 8W with 12Ah battery LS1-Large Solar 16W with 12Ah Battery LS2-Large Solar 16W with 24Ah Battery
Vertical divergence	7° Marine Beacon, Obstacle Light and Wreck Light
Options	Internal GPS for synchronising RS232 Data port (RS485 optional) Sync and monitor wire AIS-compatible
Product Version	1.00
Software version:	8.11
Manual version:	1.2
Date released:	Aug 2017

Manual revision history

Manual Version	Released	Description of Change	Software version	VLB-5X Serial number
1.0.0	Dec 2016	• First issue.	800	67-00050000
1.1	Jul 2017	• Added CSQ query command	810	67-00050000+
1.2	Aug 2017	• Add coms protocol compatibility section	811	67-00050964+

Serial Communications Protocol Compatibility

VLB5X beacons with software versions lower than 811 (or 722 for Lead-Acid Battery variants) may not communicate correctly over the serial interface with a Vega AIS device. Please contact Vega Industries to arrange a software update.

VLB-5X LED Versions by colour, release date and serial number

RED LED		
LED Version	**Release Date**	**VLB-5X Serial Number**
Vega 116	Dec 2009	
Vega 163	Aug 2011	67-50000

GREEN LED		
LED Version	**Release Date**	**VLB-5X Serial Number**
Vega 223	Dec 2009	
Vega 263	Aug 2011	67-50000

WHITE LED		
LED Version	**Release Date**	**VLB-5X Serial Number**
Vega 422	Dec 2009	
Vega 423	May 2011	
Vega 463	July 2013	67-50000

YELLOW LED		
LED Version	**Release Date**	**VLB-5X Serial Number**
Vega 320	Dec 2009	67-50000

BLUE LED		
LED Version	**Release Date**	**VLB-5X Serial Number**
Vega 525	Dec 2009	67-50000

VEGA INDUSTRIES LIMITED
21 Heriot Drive, Porirua 5022, New Zealand
Tel: +64 4 238 0200; Fax: +64 4 237 4392
E-mail: sales@vega.co.nz Web: http://www.vega-navigation.com

Product Warranty

Vega warrants that all products supplied are free from labour and material defects, and will repair or replace (at its option) the whole or any part of the products found to be faulty. Vega is not liable for any charge beyond the point of delivery, including installation, alignment or testing. To claim under warranty the product must be returned to the manufacturer.

To view Vega's warranty terms and conditions please visit http://www.vega.co.nz/terms-and-conditions/.

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SECTION 1 OVERVIEW OF THE VLB-5X LED BEACON

1.0 Introduction to the VLB-5X LED Beacon

The VLB-5X (next generationVLB-67/VLB-5) includes a new robust battery technology and an increased optical range. The benefits of the new Lead Crystal® Battery (LCB) include improved lifetime in hot climates, improved capacity in cold climates and better tolerance to running flat.

The user can also program many features using the TVIR remote programmer. If it is uncertain how the beacon has been programmed, the VLB-5X can be reset to the factory default settings. The procedure to do this is detailed in Section 4, Clause 5.6

For the self-contained solar powered models of the VLB-5X beacon it is critical that the solar irradiation for the location where the beacon is to be used is checked to ensure that there is enough energy available to support the intended range, and flash character. Vega provides an online calculator for the VLB-5X on www.vega-navigation.com to assist in the correct usage of the VLB-5X. Please note that reducing the range and the duty cycle of the beacon can lower the power requirement.

1.1 Options Available

There are three lens options for the VLB-5X beacon.

- The 7° divergence (±3.5°) symmetrical lens provides a horizontal fan beam for marine beacon applications.
- The obstacle lens is an asymmetrical lens with the peak intensity occurring at +8° above the horizontal and is designed to provide the beacon profile required for aircraft hazard lights for ICAO Type A and Type B and for use as bridge marking lights.
- The FAA lens is made to meet the FAA 810 optical requirements.

The VLB-5X 7° marine beacon can be programmed for an operating range at:

- 2 to 5.5NM at 0.74T visibility and
- 2.25 to 7NM at 0.85T visibility

The VLB-5X obstacle light can be programmed between 1 and 54 candela effective intensity, measured at +6 and +10 degrees from the horizontal. ICAO Aircraft hazard light requires the following intensity at these angles:

- Type A hazard light 10 candela
- Type B hazard light 32 candela

The VLB-5X wreck light is IALA-compliant and offers a yellow and blue alternating light.

- Flash character: Blue 1.0s + 0.5s + Yellow 1.0s + 0.5s = 3.0s
- Hard-wired and GPS sync options

For the VLB-5X, there are five LED colours available: red, green, white, yellow, and blue. Each colour has a different power requirement to achieve any particular intensity. Detail on power consumption is provided in appendix B.

The Vega VLB-5X beacon is available in four models.

Body size	Solar Panel Capacity	Battery Capacity
SA=Stand Alone	Nil	Nil
SS=Standard Solar	8Watt (4x 2W panels)	12Ah
LS1=Large Solar	16Watt (4x 4W panels)	12Ah
LS2=Large Solar`	16Watt (4x 4W panels)	2x12Ah

The self-contained solar power models use a 12VDC long life lead crystal battery that can operate down to low temperatures. Only use a Vega VLB-5X replacement battery (EBAT-LCB-12V-12AH).

The Standard Solar (SS) unit will cover most self-contained applications. The large solar LS models are available for use in higher latitude and/or high duty applications.

For bridge marking application (VLB-5X-SAP and VPP-5X), the VLB-5X obstacle lens is mounted separately from the solar power pack. This allows the light head to be mounted under a bridge while locating the power pack where it can receive solar energy. The separate components consist of the stand-alone (SAP) light head and VPP-5X power pack. Note that the solar power regulator is located in the lantern and not in the VPP-5X power pack. In applications requiring more solar power, the solar power pack can be substituted with the larger capacity VPP-5X.

The VLB-5X is designed with many features to allow the user to customise the beacon for any application. Programming is done using the Vega Remote-02 infrared programmer, which needs to be ordered separately.

1.2 Additional Factory Options

Additional Factory options for the VLB-5X:

- GPS synchronising.
- Data Plug incorporating RS232 or RS422 data connection, alarm/monitor wire, and sync wire
- External charging plug and sync wire for self-contained models SS and LS
- Alarm/Monitor output (beacon healthy)

Note: Hard wire synchronisation is provided as standard on the SA model

1.3 Approvals

The VLB-5X (approved under the former name of VLB-67) LED beacon has been approved under US Coast Guard regulations CFR33 part 67 for use as a Class B or C light for artificial islands and structures in the Gulf of Mexico (USCG District 8).

2.0 Range and Power

2.1 Effective Intensity Settings

Effective intensity is the intensity required to see a continuously “on” light (fixed character) at a certain distance. For example 37 Candela is required to see a fixed “on” light at 4 NM when the atmospheric visibility is 10 miles (0.74T).

The VLB-5X beacon supports a number of effective candela settings.

Appendix B of the manual provides the following information:

- The effective intensity settings available for each colour
- The current the beacon will use at each intensity
- The peak candela and peak current of each colour

While the VLB-5X is normally only used at night it is possible to operate the beacon during the day using a different intensity setting than is used at night.

2.2 Automatic Schmidt Clausen Correction

When a light is flashed, the intensity must be increased to maintain the lights visibility at the required distance. This increase of intensity is the “peak” intensity for the flash character. The VLB-5X automatically handles this process according to the Schmidt Clausen multiplier for LED lights: (Flash period in seconds+0.2)/Flash period in seconds

The VLB-5X beacon will not operate above its maximum candela capability. When programming a flash character the user should check that the peak candela required for a flash character at the required range is below the maximum intensity. The VLB-5X will cap the intensity at the maximum candela allowed, reducing the range of the light.

3.0 Mechanical Description

3.1 Construction

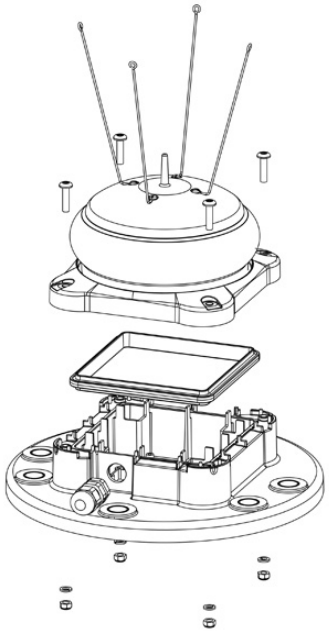
The common parts of the VLB-5X are the beacon head, the base, and the connecting seal.

The stand-alone (SA) model consists of these 3 parts and has a 1.5 metre 3 core cable fitted to provide the power connection for the beacon. This cable also contains the wire for the sync signal.

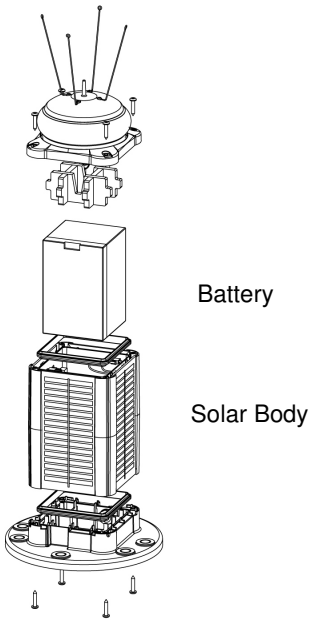
The standard solar (SS) and large solar (LS1 and LS2) self-contained models have the solar power system consisting of solar panel assembly and battery.

The plastic body and base of the VLB-5X beacon is made from nylon and has a 30 percent glass fill. The coloured top of the beacon is made from ASA plastic. The lens is moulded from optical grade acrylic.

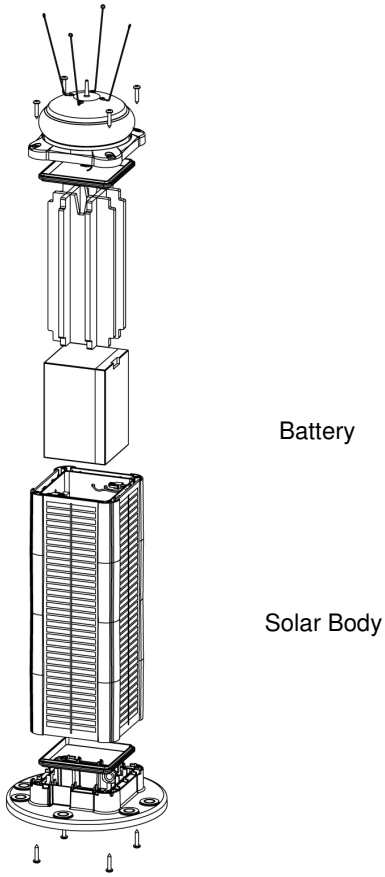
The VLB-5X LED beacon is assembled and sealed using self-tapping fasteners into the glass filled nylon parts. This assembly method is not designed for frequent disassembly and reassembly of the beacon. There should be no need to disassemble the beacon other than to change the battery once or twice during the beacon's lifetime. Disassembly of the beacon should be kept to a minimum to ensure the proper sealing.



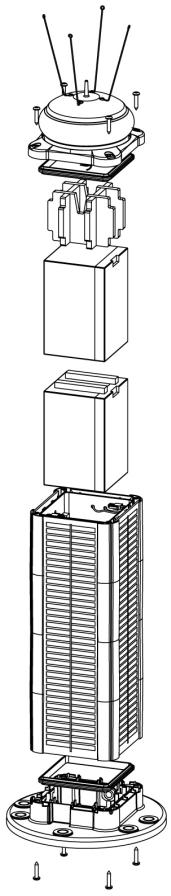
VLB-5X-SA Stand Alone



VLB-5X-SS Standard Solar



VLB-5X-LS1 Large Solar



VLB-5X-LS2 Large Solar

3.2 Solar Body Breather Vent

The solar body has been fitted with a membrane vent to allow pressure equalization, and to release any hydrogen gas that may build up from the battery. The membrane vent is located at the top of the body behind one of the solar panels. The vent should not be tampered with as any damage may cause water to enter the battery compartment.

3.3 Sealing

The beacon is sealed against the ingress of moisture, dust, insects and other environmental contaminants. Because the beacon does not need to be opened for programming, these seals can remain undisturbed for extended periods. If the power pack is opened for inspection or to change the battery, do not let any water accumulate in the battery compartment.

4.0 Electrical

4.1 Electrical Connections

There are four connectors at the bottom of the VLB-5X lantern. These are used to connect the battery/power supply, solar panels, data port, sync wire, and monitor wire. What connectors are used on any VLB-5X Beacon will depend on the options ordered.

There should be no need for the user to access these connections other than when a battery is being replaced on the self-contained units.

Details of the electrical connections are provided in Appendix F.

5.0 Battery Charging on VLB-5X SS and LS Beacons

The solar charger in the VLB-5X beacon monitors the temperature and the voltage and will charge the batteries when the voltage level at the solar panels exceeds the voltage of the battery. Protection is provided to prevent the overcharging of the battery.

The solar charger is designed for the lead crystal battery. The battery on the VLB-5X has been specifically designed for the mounting configuration used in the VLB-5X. If a replacement battery is required please obtain the correct battery from Vega or one of Vega's distributors. Other batteries may cause damage to the beacon.

SECTION 2 SETTING UP AND USING THE VLB-5X BEACON

1.0 Getting Started

- If using a self-contained model check there is sufficient solar energy at the location to support the range and flash character (see Appendix E). Alternatively use the selector program on the Vega website www.vega-navigation.com under "Calculators"
- For self-contained models change the operating mode from "storage" to "normal"
- Program the beacon (Section 4).
- Fit the bird deterrents (Clause 7)
- Install the VLB-5X LED marine beacon (Clause 7)
- Check the beacon is working (Section 3)

2.0 Solar Calculations

If the solar calculations are being done manually, it is necessary to determine the energy contribution for each solar panel taking into account the azimuth and inclination angles. Examples

for the solar calculations are provided in appendix E. The solar panels should provide more energy than the beacon uses during the worst solar month of the year.

The 4 solar panels on the VLB-5X beacon are mounted 90 degrees apart from each other in azimuth. The inclination of the solar panels is 90 degrees from the horizontal.

3.0 Shipping of the VLB-5X

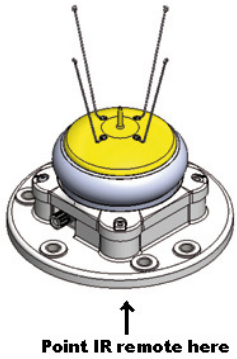
3.1 From the Factory

The VLB-5X beacon will be delivered with factory default settings. The default settings are detailed in appendix A. Please note the following defaults:

- TVIR Remote-02 programming only. *The IRDA port will need to be enabled to program the beacon with a Computer.*
- Self-contained units will be shipped in storage mode in order to maintain the battery charge. *The operating mode will need to be changed to "normal" in order to get the beacon operating*

4.0 Infra-red Programming

The infrared receiver for programming the beacon is located behind the LED ring. To program the beacon, point the Vega TVIR programmer or the Vega IRDA sensor at the lens. Best results can be achieved by using the programmers at the position indicated in the diagram.



5.0 The Initial Power Up

5.1 Stand Alone Model

At power-on when a battery is first connected, the beacon will remain inactive for about 30 seconds then start in night mode with the beacon flashing with the programmed flash character.

- After a further 16 to 20 seconds the beacon will begin to monitor the ambient light level. If day is detected and the beacon is set for night operation only the beacon will turn off.
- After a further 14 seconds the beacon will begin to monitor the voltage for the low level threshold (factory setting 11 Volts). If the threshold is reached the beacon will turn off. The beacon will not return to normal operation until the voltage is above high voltage threshold (factory setting 12.8 volts).

If the battery terminals (+ / -) are connected in reverse the beacon will not power up. No damage will be caused by reverse connecting the beacon.

5.2 Self Contained Model

The self-contained models of the VLB-5X beacons are shipped from the factory in "storage mode" and must be changed to "normal mode" to operate.

When in "storage mode", the TVIR receiver in the beacon only looks for the programmer every 60 seconds. To get the self-contained unit into "normal mode":

- Hold the red button down for up to 60 seconds until the VLB-5X flashes four times to indicate the beacon is in program mode.
- Enter 15000 ensuring the beacon flashes between each key entry from the programmer.
- The VLB-5X will flash when each key of the programmer is pressed
- The VLB-5X will then flash back the complete code 15000 in a series of flashes
- If no other programming instructions are done the beacon will respond with 2 quick flashes followed by as space then two more quick flashes and leave the programming mode.

See Section 4 on how the Beacon responds on entering and leaving the program mode.

6.0 Programming

The VLB-5X beacon has many program options and settings. It is important that the user understands the programming syntax and the options available. It is suggested the user works through the programming examples provided in Section 4 and the description on the various options and features before deciding the setup of the Beacon for a particular application

7.0 Installing the VLB-5X Beacon

7.1 Bird Spikes

The beacon is supplied with 4 stainless steel bird spikes.

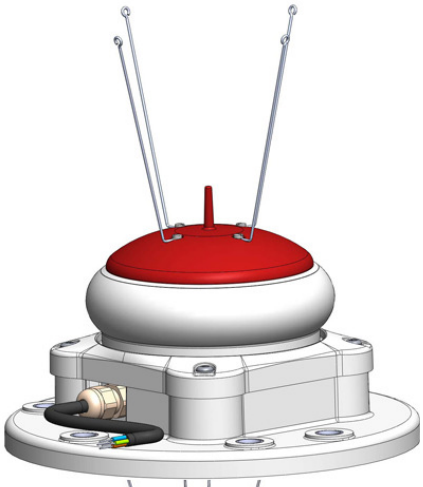
Each spike is attached to the lid by a 4 gauge x ¼" (6mm) stainless steel s e loop on the end of the wire. It is important that only the Vega supplied s s purpose as longer or larger diameter screws may puncture the lid and e beacon.

7.2 Wiring from VLB-5X-SA & SAP Stand Alone Beacon

The power and synchronizing connections are provided in a 1.5-meter ler.gth of 3 core 0.75mm² cable. Wiring identification is as follows:

		SA Unit	SAP Unit
Brown	+12 Volts	Battery positive	Battery positive
Blue	0 Volts	Battery negative	Battery negative
Green	Sync	Do not connect to battery negative unless using advanced sync functions	N/A
White	Solar Power	N/A	For connecting to VPP-5X Solar Power Pack

The VLB-5X SA Beacon is a sealed unit. If shortening the power cable the user must tin each cable core and reseal both external sheath and internal cores with heat shrink and marine sealant.



7.2.1 VLB-5X Base Compartment

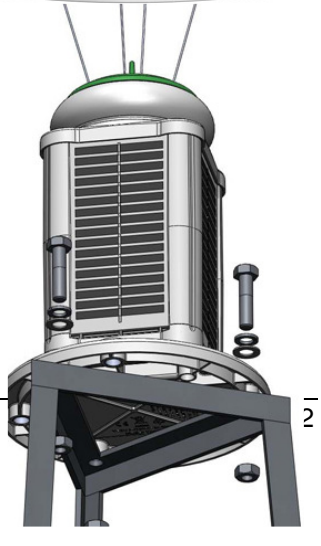
The base of the VLB-5X beacon is designed to provide space to fit a AC to DC switch-mode power supply to allow the VLB-5X-SA Stand Alone model to be mains powered. Vega will only supply the stand alone model as a 12VDC unit and if a mains supply is required the needs to be done by the user.

The user has the responsibility to ensure the mains power conversion meets the local electrical regulation requirements.

The base is fitted with mounting points to accept a TRACO AC/DC converter. This unit can be purchased from RS Components (www.RS-Online.com) part number #RS 3221840.

The space in the base can also be used for other user equipment such as for a monitoring interface or for sync signal conversion.

The VLB-5X beacon is a sealed unit. Where any item is fitted into the base of the beacon extreme care should be taken to ensure the sealed integrity of the beacon is maintained.



7.3 Mounting the VLB-5X Beacon

The base of the VLB-5X beacon has been designed for 3 or 4 holes mounting on a 200mm diameter PCD. The base has through holes sized to take 316 Stainless steel M12 (1/2" UNC) bolts or rod. The mounting holes are fitted with stainless inserts to prevent compression of the plastic base when the fasteners are tightened.

7.3.1 Levelling the Beacon

The mounting surface needs to be level to ensure the VLB-5X has a horizontal beam. This can be checked by placing a builder's level on the mounting surface then moving the level 90 degrees at a time checking the surface is level in at least two directions. If the mounting surface is not level take appropriate measures to ensure it is level before permanently installing the beacon.

Alternative levelling mechanisms can be used, such as adjustable rods. If the mounting surface cannot provide 3 or 4 holes mounting on a 200mm PCD an adapter plate would be required.

When the beacon is mounted on a floating structure (buoy), the beacon needs be level when the buoy is floating freely in calm air and water.

7.3.2 Mounting Structure

Movement of the mounting structure needs to be constrained to a level where the VLB-5X beacon can be visible to the intended user. This includes the sway on a fixed structure and the roll of a buoy.

The vertical divergence of the VLB-5X beacon is 7 degrees. At ± 3.5°the intensity is at 50%, and at ± 7.0°the intensity is approximately 10% of the peak intensity

8.0 VLB-5X Factory Options

All options are factory installed and must be included in the purchase order. None of the options can be fitted in the field after the VLB-5X beacon has been manufactured.

8.1 Hardwire Synchronization

The VLB-5X-SA stand alone beacon comes with the hardwire sync wire included in the power cable. Because of the nature of the self-contained beacon no external wiring is supplied with the standard option.

The Vega hardwire sync operates as a positive to negative transition. The start of the flash character can be delayed between 0 and 9.9 seconds should it be desirable to have a different start time to other beacons connected to the synchronising wire.

The sync wire can provide additional control such as turning the beacon off when grounded. This can be useful when a standby light option is required. Refer to section 4 clause 5.5.1.

Other beacon manufacturers may not use a negative transition signal and will not be able to synchronise with Vega beacons. If there is a requirement to synchronise with beacons with a positive transition signal it may be possible to use the signal inverter module (Vega 167-600). The VLB-5X beacon will only operate in Slave Sync mode when connected to the signal inverter module.

8.2 Internal GPS Synchronization

It is necessary to take into account the power consumption of the GPS unit in any power calculations. The GPS sync unit only operates when the beacon is programmed to run (night or day/night). The clock is updated from the GPS satellites every 20 minutes and the typical acquisition time is around 2 minutes. The GPS current is detailed in Appendix B

If GPS synchronisation is required for a number of beacons that are in close proximity it is possible to fit only one GPS unit and to connect the other beacons using hardwire synchronising.

8.3 Alarm Monitor wire

The alarm monitor wire is used to provide an indication when the VLB-5X is not working. This alarm monitors the current of the beacon and the supply voltage.

Output is connected to ground when

- No voltage or low voltage is present.
- No LED current or low current is detected when the VLB-5X beacon should be on.
- Alarm is being tested using Operation mode 1-5-007 (Section 4 Clause 5.6)

The monitor output operates as an electronic relay with one side connected to ground (battery negative). A 0 to 20VDC can be applied to the alarm/monitor output. The maximum current the monitor output can handle is 400mA DC. Do not connect to battery positive. For additional details refer to the specification section.

8.4 Data Port

The RS232/RS485 data port can operate continuously or “on demand. The “on demand” mode uses less power than the continuous mode. When the data port is used the additional power must be taken into account when calculating the overall power requirement if the VLB-5X.

The data port shares common circuitry with the IRDA port that is used for programming the VLB-5X from a computer. Only one data port can be used by the VLB-5X at any time. Operation of the data ports is selectable using the Vega Remote TVIR programmer.

Details of the data port protocol and the beacon parameters available are contained in Appendix G

SECTION 3 MAINTENANCE

1.0 Maintenance Cleaning

Vega LED beacons require little to no maintenance.

Solar panels on the VLB-5X SS and LS models should be inspected and cleaned occasionally to ensure maximum solar energy capture. Use warm soapy water to wash the outside of the beacon and rinse off with clean water. Do not use any solvent-based cleaner.

2.0 Inspection Check

Periodically check that the beacon remains firmly secured and level, and the mounting fasteners are still in good condition. Investigate any corrosion and take appropriate preventive action.

The beacon can be tested by programming for the “test “mode or if daytime covering the lens briefly to simulate night time operation. When the light is flashing, check it is displaying the correct flash character.

Remember to remove any lens cover before leaving the site.

3.0 Changing the Battery on Self Contained Models

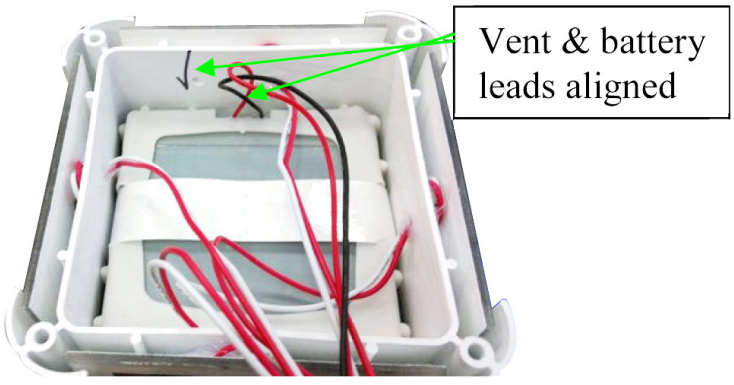
Ensure the correct replacement battery is being used. This should be an EBAT-LCB-12V-12AH available from Vega or a Vega distributor.

It is recommended that the O-rings on the solar body seals be replaced at the same time as the battery. The replacement battery will be shipped with two O-rings for the seal where the solar body is opened. If additional O-rings are required, the part number for ordering is **Oring130EPDM**. When new O-rings are fitted ensure they have a coating of silicon grease before reassembly.

To change the battery on the self-contained models of the VLB-5X:

- Unscrew the four screws holding the lantern head to the solar body.
- Lift off the lantern head ensuring the head seal with the two O-rings remains attached to the lantern head.
- Unplug the battery cable and solar cables from the lantern head and set the lantern head aside.
- Remove the battery and the foam packing.
- Unscrew the battery cable from the old battery and attach to the new battery.
- Fit the new charged battery as shown in the photo with the battery leads next to the solar body vent and refit the foam packing making sure the vent is not blocked.
- Push the square foam packer between the battery (next to the screw terminals) and the side wall of the beacon body.
- With the sealing ring containing the two O-rings attached to the lantern head, reconnect the battery and solar cables to the lantern head. Arrange the cables inside the solar body and under the foam packing so that the cables cannot interfere with the sealing ring.
- Carefully replace the lantern head onto the solar body keeping the lantern head as horizontal as possible. Hold the cables and connectors in place with one hand as the lantern head is put in place on the solar body with the other hand. Once the lantern head is in place apply some pressure and check that it feels properly in place. If there is any doubt about the position of the cables or connectors under the head, lift the lantern head and repeat this step.
- Reattach the lantern head using the original 4 screws. The torque value for the assembly screws is 2.2 to 2.4Nm. Using torque above this value will cause damage and prevent the VLB-5X beacon from sealing properly.
- Visually check the beacon from all four sides to ensure the lantern head is level relative to the base.

The self-contained versions of the VLB-5X LED Marine Beacon are assembled and sealed using self-tapping fasteners into the glass filled nylon parts. This assembly method is not designed for frequent disassembly and reassembly of the lantern. There should be no need to disassemble the beacon other than to change the battery once or twice during the life of the product. Disassembly of the beacon should be kept to a minimum to ensure the proper sealing.



SECTION 4 PROGRAMMING

1.0 Programming Methods

There are two methods of programming the VLB-5X Beacon.

- Using the Vega remote TVIR programmer (Remote-02)
- Using a computer with the VLB-5X Programming Kit (Prog-01)

The beacon will be shipped with a default setting for programming with the remote TVIR programmer. The programming mode will have to be changed to allow computer programming.

1.1 Using the Vega Remote TVIR Programmer

During programming the VLB-5X the beacon will provide visual feedback by flashing as the keys are operated on the IR programmer. On completion of a program option the beacon will provide visual feedback by repeating the code of the programmed function by a series of flashes.

IMPORTANT

Before attempting to use the programmer for the first time, please pull the plastic insulating strip out of the battery holder – you do not need to remove the battery holder to do this.

The programmer will not work if the plastic strip is left in place.

Red standby key, used to enter programming mode.

Numeric keypad, used to configure the programmable features of the light.

1.2 Using a Computer

Two-way IRDA communication to the beacon is provided via a USB to IR adapter plugged into a computer. All programming options for the VLB-5X will be displayed on the screen. The program settings can be sent to or read from the VLB-5X beacon. Copies of the program settings can also be saved or recalled from memory.

For computer programming please refer to the PROG-01 instruction manual. The programming described in the rest of this manual relates to the infrared TVIR programmer only.

Computer programming of the VLB-5X is more straightforward than using the remote TVIR programmer as all features of the beacon can be set at once and or can be verified by down loading the settings from the beacon.

The VLB-5X has two data ports, IRDA and the RS232/RS485. The RS232/RS485 port is only fitted if requested at time of order. The VLB-5X can only operate with one of the data ports at any time. The port being used is selectable using the programming mode options. The IRDA data port is required to be enabled to allow programming to occur from a computer.

When either the IRDA or RS232/RS485 port is enabled the VLB-5X will use more power. When programming is finished the IRDA should be turned off before the Beacon is installed in order to reduce the power consumption.

2.0 Default Settings

The VLB-5X beacon is delivered from the Factory with default settings. These settings are detailed in Appendix A. If there is a need to return the light to the default settings use the option to allow this in the in the “operating mode”.

3.0 Programming Syntax

All programming of uses the syntax of: OPERATION_FEATURE_VALUE

There are six OPERATION items

Programming	Operation 1
Creating a Custom Character	Operation 2
System Information	Operation 3
Calendar Control	Operation 4
Optional PIN code	Operation 7
Read settings	Operation 9

FEATURE items represent the features of the light such as flash character and intensity.

VALUES are the actual settings or value of the various features.

Appendix A of this manual provides a Table for the programming features of the VLB-5X beacon. Please take the time to become familiar with the table before continuing.

4.0 Visual Feedback when using the TVIR Programmer

The VLB-5X will provide visual feedback of the programming instructions it receives from the TVIR programmer. It is important to understand the feedback that is provided to ensure the light will be programmed correctly.

Programmer Keys	Light response
Enter Programming Mode By pressing red standby key for 5 seconds	4 quick flashes (0.1sec on 0.1sec off) *If the VLB-5X has been programmed for Calendar or auto storage mode the flash response will be different.*
Numeric key when programming	1 flash for each key pressed
When programming code recognised	The 3 or 4 digit value code is repeated using a series of flashes of 0.1sec on and 0.1 sec off with a gap of 0.5 sec between each number of the code. A zero is represented by a 2 second on flash. Proper termination of custom character programming: the feedback code will be 000
When programming code **is not** recognised	3 quick flashes (0.1sec on 0.1sec off) The light will remain in programming mode waiting for a new programming instruction.
Exiting Programming mode **No programming activity for 10 Seconds**	The light will give two quick flashes followed by a short pause followed by another two quick flashes. *If the VLB-5X has been programmed for Calendar or auto storage mode, the flash response will be different.* After this, the beacon will resume normal operation. The light will flash its character for 16 seconds while it checks the day/night settings. If it is daytime and the light is set to operate at night only the light will turn off.

The flash sequence for entering and exiting the programming mode is adjusted if the VLB-5X has been programmed to use calendar or Auto Storage. This has been done in order to provide an indication that the VLB-5X has been programmed in either of these modes. The background power consumption of the VLB-5X will be higher if these functions are used. Flash sequence when entering and leaving the program mode is as follows:

Action	Flash Sequence
Entering TVIR Mode Normal	4 quick flashes (0.1sec on 0.1sec off)
When Calendar or Auto Storage is being used	2 slow flashes (0.3sec on 0.3sec off) 2 quick flashes (0.1sec on 0.1sec off) 2 slow flashes (0.1sec on 0.1sec off)
Exiting TVIR Mode Normal	2 quick flashes (0.1sec on 0.1sec off) 1 gap of (0.3 sec) 2 quick flashes (0.1sec on 0.1sec off)
When Calendar or Auto Storage is being used	2 quick flashes (0.1sec on 0.1sec off) 1 gap of (0.3 sec) 2 slow flashes (0.3sec on 0.3sec off)

4.1 The VLB-5X Will Not Enter Programming Mode

If you find the VLB-5X will not enter the programming mode it will be caused by one of 4 reasons:

- The battery in the TVIR programmer is missing, or the plastic battery insulator has not been removed, or the battery has low voltage.
- There is no 12VDC supply connected to the light.
- The light has been set to storage or calendar mode and is hibernating. In this case the red button may have to be held for 60 seconds in order for the VLB-5X to see the TVIR programmer. Once in programming mode the operating or calendar settings can be checked or reprogrammed. Refer Clause 5.6 for the operating modes and clause 5.11 for the calendar settings.
- Beacon needs a security PIN to allow programming. Refer clause 5.10.

4.2 Becoming Familiar with the Syntax and Flash Feedback

If you have not used the Vega TVIR Programmer before, spend some time learning how the light will respond to the various programming actions. Make sure the light is connected to a 12VDC supply and experiment with the following.

Enter and Exit Program mode

1. Enter program mode Press the red standby button for 5 seconds	The light will give 4 quick flashes to indicate it has entered programming mode *If the VLB-5X has been programmed for Calendar or auto storage mode, the flash response will be different.*
2. Exit program mode Leave the programmer idle for 10 seconds	The light will give two quick flashes followed by a short pause followed by another two quick flashes. *If the VLB-5X has been programmed for Calendar or auto storage mode, the flash response will be different.* After this it will resume normal operation. The light will flash its character for 16 seconds while it checks the day/night settings. If it is daytime and the light is set to operate at night only the light will turn off.

Program a Flash Character with a flash character of Q 1s 0.4. (0.4 “on” 0.6 “off”)
To program this Flash Character, find the three-digit code from Appendix K, “Flash character table with program codes”. (Flash Q 1s 0.4 = code 602). Determine the programming Syntax from Appendix A for the setting:

Operation	=Programming	=1
Feature	=Flash Character	=0
Value	=Code	=602

The programming sequence to enter this flash character is 10602

1. Enter programming mode Press the red standby button for 5 seconds	The light will give 4 quick flashes to indicate it has entered programming mode *If the VLB-5X has been programmed for Calendar or auto storage mode, the flash response will be different.*
2. Enter the programming sequence for the flash character (10602)	The light will flash once each time a key on the programmer is operated. When the sequence is completed and accepted the light will repeat the value 602 in a series of flashes. Six quick flashes followed by a 0.5sec gap followed by a 2 second flash (for a zero) followed by a 0.5 second gap followed by two quick flashes
3. Exit programming mode Leave the programmer idle for 10 seconds	The light will give two quick flashes followed by a short pause followed by another two quick flashes. *If the VLB-5X has been programmed for Calendar or auto storage mode, the flash response will be different.* After this it will resume normal operation. The light will flash its character for 16 seconds while it checks the day/night settings. If it is daytime and the light is set to operate at night only the light will turn off.

<u>Create a programming error by attempting to enter an invalid Operation Mode code 003</u>

Determine the programming Syntax from Appendix A for the setting:

Operation	=Programming	=1
Feature	=Operation Mode	=5
Value	=Code	=003

The programming sequence to enter this Operation Mode is 15003

• **Enter programming mode** Press the red standby button for 5 seconds	The light will give 4 quick flashes to indicate it has entered programming mode *If the VLB-5X has been programmed for Calendar or auto storage mode, the flash response will be different.*
• Enter the programming sequence for the Operation Mode (15003)	The light will flash once each time a key on the programmer is operated. When the sequence is completed the value will be rejected and an error indicated by 3 quick flashes. The beacon will then return to programming mode and is ready for a new instruction.
• **Exit programming mode** Leave the programmer idle for 10 seconds	The light will give two quick flashes followed by a short pause followed by another two quick flashes. *If the VLB-5X has been programmed for Calendar or auto storage mode, the flash response will be different.* After this it will resume normal operation. The light will flash its character for 16 to 20 seconds while it checks the day/night settings. If it is daytime and the light is set to operate at night only the light will turn off.

Read System Information

To read the current level of the battery or 12VDC supply, determine the Syntax from Appendix A:

Operation =System Checks =3
Feature =Battery Voltage =1

The programming sequence to get the information is 31

1. Enter programming mode Press the red standby button for 5 seconds	The light will give 4 quick flashes to indicate it has entered programming mode *If the VLB-5X has been programmed for Calendar or auto storage mode, the flash response will be different.*
2. Enter the programming sequence for the information (31)	The light will flash once each time a key on the programmer is operated. When the sequence is completed and accepted the light will provide the voltage level in a series of flashes (13.2VDC). One quick flash followed by a 0.5sec gap followed by 3 quick flashes followed by a 0.5 second gap followed by two quick flashes.
3. Exit programming mode Leave the programmer idle for 10 seconds	The light will give two quick flashes followed by a short pause followed by another two quick flashes. *If the VLB-5X has been programmed for Calendar or auto storage mode, the flash response will be different.* After this it will resume normal operation. The light will flash its character for 16 to 20 seconds while it checks the day/night settings. If it is daytime and the light is set to operate at night only the light will turn off.

4.3 Deciding what Settings are required

Appendix D contains tables for noting the program settings of the VLB-5X.

As the VLB-5X is delivered from the factory with default settings and it is only necessary to program the settings that need to be changed. The “Read Settings” feature can be used to note the values already programmed.

Once the required settings are known use the second table in Appendix D to note the correct syntax and programming code from programming tables in Appendix A.

4.3.1 Programming or Reading Multiple Settings

Each feature can be programmed one at a time, as done in the examples given in Clause 4, by entering and exiting the program mode each time a feature is programmed. However, this can be time consuming to enter multiple settings, as it is necessary to wait for the VLB-5X to flash its response and return to normal operation before entering the programming mode again.

To avoid this difficulty the various settings can be programmed sequentially. Once the VLB-5X has accepted a program sequence and has flashed back the value code, the next program sequence can be entered. If there is a delay of more than 10 seconds after the confirmation flashes before entering the next program sequence the VLB-5X will exit the program mode.

The use of the table in Appendix D will allow all the programming sequences to be pre-determined and allow for a quick entry of the program settings without the need to exit the programming mode.

5.0 Programming Features

(Refer to Appendix A for the full list).

5.1 Flash Character

Vega lights are pre-programmed with 246 standard characters represented by a 3-digit code XYY. The first digit of the code represents a flash type such as 1YY for Isophase characters. If flash characters are required that are not included in the standard set these can be loaded as a custom

set if advised to Vega at the time of order. These would then be available for programming under Custom character type 9YY.

Operation	=Program (or read)	=1 (or 9)
Feature	=Flash character	=0
Value	=Select from Appendix K	=XYY

5.2 Custom Flash Character.

When programmed, the flash character code for the custom character is 999.

To program the custom character, the details of the on and off periods of the flash character has to be recorded.

The programming a custom character has its own syntax and this needs to be followed correctly to be able to program the character successfully.

Operation	=Custom Character	=2
Value	=Code for the character	

The code is entered in a series of 3 digit values representing an on period or off period. Each 3-digit value is a multiple of 0.05 seconds. The 3-digit code for a 1 second on or off period would be 020 (20 multiplied by 0.05 seconds is 1 second).

The following restrictions apply:

- The minimum period that can be programmed is 0.1 second or the code of 002.
- The maximum period that can be programmed is 12.75 seconds or the code of 255. For longer periods than 12.75 seconds an ADD code can be entered

There are two special codes used as part of the custom character programming

- The ADD code to get on or off periods greater than 12.75 seconds = 001
- The termination code when the programming of the custom character is finished = 000

Appendix C provides a work sheet, and an example, for programming a Custom Character

If an error occurs when entering a custom character the VLB-5X will flash the error code of 3 quick flashes.

Programming a custom character creates a flash character with code 999. To get the VLB-5X to use the custom character the value of 999 must be entered as the flash character.

5.3 Day/Night Use of the Light

The VLB-5X is capable of operation at night only or both day and night. The default setting when the beacon is shipped is to operate at night only.

How the VLB-5X transitions from day to night mode and vice versa is determined by the programmed day and night Lux levels. There are 12 different day/night transition light levels allowing for a shorter or longer night.

Operation	=Program (or read)	=1 (or 9)
Feature	=Day/Night Control	=4
Value	=Select from Appendix A	=XYY

The first digit of the Day/Night Control value programs Day or Day/Night operation.

- 0YY allows night time operation only
- 1YY allows day and night operation

The YY digits of the Day/Night Control Value determine when the Day/Night transition occurs. The Lux levels of the 12 settings are detailed in Appendix A. The accuracy of the light sensor is ±10%.

5.4 Intensity Settings

A different effective intensity can be programmed for both day and night operation. By having different intensity settings the lights can be dimmed during the night. The programmable effective intensity settings for the VLB-5X are provided in Appendix B.

It is the effective intensity of the VLB-5X that is programmed. The peak intensity is controlled automatically according to the flash character (Schmidt-Clausen correction) to maintain the required effective intensity.

Operation	=Program (or read)	=1 (or 9)
Feature	=Intensity	=1 for night intensity, 2 for day intensity
Value	=Select from Appendix B	=XXX or XXXX

5.5 Synchronising Options

The synchronisation options available are as follows:

Product	Hard wired	GPS
VLB-5X Self Contained LED beacon	Factory Option	Internal GPS option or External GPS using Vega VSU-29 If sync wire available on beacon
VLB-5X Stand Alone beacon	Yes	Internal GPS option or External GPS using Vega VSU29 If sync wire available on beacon

For Vega LED products, the sync pulse has a positive to negative transition.

The sync pulse will occur at the start of the flash character. Where the lights connected are all masters the first light to send a sync pulse will control the other lights.

Each light can be set to be a sync master or sync slave. As a slave the VLB-5X will not operate unless receiving sync pulses, however the slave will still generate a sync pulse when operating.

In slave mode, the VLB-5X will operate on the basis of the sync pulses received and will stop operating after a programmed number of flash cycles after the sync pulse is lost.

Operation	=Program (or read)	=1 (or 9)
Feature	=Synchronisation	=3
Value		=XYY (999 disables synchronisation)

X determines if the light is a master or slave unit.

- 0YY Master
- 1YY Slave

YY allows for the start of the flash character to be delayed from 0.0 seconds to 9.9 seconds in 0.1second increments. For example: YY=25 would provide a delay of 2.5 seconds.

Where an internal GPS unit is used, the flash character will always synchronise to the GPS time pulse. The GPS synchronisation will not be accurate until the GPS has acquired a valid time signal. When using GPS, synchronising the VLB-5X must be set for Sync Master (0YY)

When an external GPS sync unit is used, such as the VSU-29, refer to the manual for this device.

5.5.1 Additional Sync Options

To program a slave VLB-5X beacon unit to keep running for a number of flash cycles after the loss of the master sync pulse.

Operation	=Program (or read)	=1 (or 9)
Feature	=Flash count on Loss of Sync	=7
Value		=0YY where YY is the number of flashes (999 = never stops flashing)

To program the VLB-5X beacon to use the sync wire to turn the beacon off when the sync wire is grounded.

Operation	=Program (or read)	=1 (or 9)
Feature	=Flash count on Loss of Sync	=7
Value		=998

5.6 Operation Mode

The Operation Mode provides control of how the VLB-5X will operate.

- Normal (000) Allows general operation with no advanced options
- Storage (009) Allows operation in low power mode (asleep). A TVIR programmer is required to put the VLB-5X in and out of this mode. The VLB-5X self-contained units are shipped from the factory in storage mode in order to preserve the battery charge. Storage mode should always be used when storing the self-contained beacons in a place where they are likely to see daylight.
- Auto Leave Storage Allows the VLB-5X to automatically revert from "Storage" to "Normal" after the beacon sees daylight for a predetermined period. This allows the VLB-5X to be programmed, put in storage mode, then automatically return to normal operation without the need to use a TVIR programmer.
- Auto Storage Allows the VLB-5X to automatically enter "Storage" mode if daylight is not seen for 24hours. The beacon reverts back to "Normal" in the same manner as "Auto Leave Storage". This allows the beacon to be stored and redeployed without the need to use the TVIR programmer.
- Test (007) Allows the testing of the Alarm/Monitor option on the VLB-5X. If connected to a VSM-222, the beacon will flash back the CSQ value (network signal strength) received from the VSM-222.
- Reset (999) Allows the beacon to be reset to the factory default settings. The calendar "on/off" dates are not altered during the reset.

To change the mode from Storage to Normal the red standby key on the TVIR programmer must be held down for the time necessary for the VLB-5X to recognise the programmer. This could take up to 1 minute. Once in programming mode the Operation Mode of the light can be changed to Normal operation by pressing 15000.

Operation	=Program (or read)	=1 (or 9)
Feature	=Operation Mode	=5
Value		=YYY where 000 is normal mode. (Refer to Appendix A for other codes)

5.6.1 Auto Leave Storage

Operation	=Program (or read)	=1 (or 9)
Feature	=Operation Mode	=5
Value		=1N9

N determines how long the VLB-5X has to see daylight before switching from "Storage" to "Normal" mode. N can be set from 0 to 9. Each increment increases the time the VLB-5X has to see daylight before switching by 10 minutes.

- N=0 Switch time is 2 minutes of daylight
- N=1 Switch time is 12 minutes of daylight
- N=3 Switch time is 22 minutes of daylight
- Etc

Once the Auto Leave Storage mode is programmed the VLB-5X must see 2 minute of darkness before the mode is activated.

5.6.2 Auto Storage

Operation	=Program (or read)	=1 (or 9)
Feature	=Operation Mode	=5
Value		=2NY

The VLB-5X will go into storage mode when daylight is not seen for 24hours.

N determines how long the VLB-5X has to see daylight before switching from “Storage” to “Normal” mode. N can be set from 0 to 9. Each increment increases the time the VLB-5X has to see daylight before switching by 10 minutes.

- N=0 Switch time is 2 minutes of daylight
- N=1 Switch time is 12 minutes of daylight
- N=3 Switch time is 22 minutes of daylight
- etc.

Y determines how the VLB will activate the Auto Store mode.

- Y=0 VLB-5X will turn off when no daylight seen for 24 hours
- Y=9 VLB-5X goes immediately to Storage mode. After the beacon sees 1 minute of darkness it remains in Storage and reverts to Y=0.

5.7 Programming Mode

Programming Mode controls the operation of the IRDA and RS232/RS485 data ports. Only one of the ports can be used at any time. When in use the background power consumption of the VLB-5X will be higher and this must be taken into account when calculating the power usage of the beacon.

The IRDA port is used for computer programming of the VLB-5X. To begin using a computer for programming the IRDA port will need to be turned on using the TVIR remote programmer.

Information on the IRDA operation is provided in the supplementary programming manual (PROG-01). Remember to turn the IRDA port off before the VLB-5X is installed to reduce the background power consumption of the beacon.

Monitoring using the IRDA or RS232/RS485 port can be continuous or on demand when data is requested by an external device. The on demand option will use less power.

Protocol for the RS232/RS485 port is provided in Appendix G

Operation	=Program (or read)	=1 (or 9)
Feature	=Operation Mode	=6
Value		=000 has both IRDA and RS232 port disabled. See Appendix A for other settings

5.8 Battery Thresholds

The VLB-5X has programmable battery threshold settings designed to protect a battery from damage by being over discharged. If the low threshold is reached the beacon will turn off until the battery voltage is above the high voltage threshold. Where no batteries are used the low voltage threshold can be disabled.

Operation	=Program (or read)	=1 (or 9)
Feature	=Operation Mode	=8 Low battery threshold (9 High battery threshold)
Value		=YYY in tenths of Volts

The value range for the low threshold is 000 to 119 (999 disables the Low voltage threshold).

The value range for the high threshold is 080 to 138 (999 sets the default setting 12.8VDC).

Take care in setting the high threshold to ensure the voltage of the battery will reach this voltage during charging. If the high threshold is set too high, the light may not resume operation after a low voltage threshold shutdown. Disconnecting and reconnecting the battery or putting the light into TVIR programming mode will reset the high voltage threshold restart.

5.9 System Checks

The VLB-5X beacon contains details of manufacture including calibration details, firmware version, and LED type used. This information is useful should there either be a problem with the VLB-5X or where it is necessary to locate the correct manual for the serial number of the beacon.

The supply voltage to the VLB-5X can also be read as a quick means of checking battery voltage.

Operation	=Read Only	=3
Feature	=Operation Mode	=1 for battery voltage, (see Appendix A for others)
Value		=Series of flashes providing the requested value.

All information is in numeric format and represented by a series of flashes 0.1 sec on, 0.1 sec off, separated by 0.5 sec gap between numbers. The voltage level is provided in tenths of a volt.

5.10 Security PIN Number

The VLB-5X is shipped from the factory without any security protection. If there is concern about unauthorised programming, it is possible to have a 3 digit PIN number for security access. Use of the PIN code is only necessary to change settings. It is possible to read settings without using the PIN code

For setting a Security PIN

Enter TVIR programming mode by operating the standby button for 5 seconds.

Operation	=7	=PIN
Feature	=1	=Set PIN
Value	=XXX	=PIN Code (Value 000 no PIN)

The VLB-5X will then flash back the three numbers in a series of flashes.

To change settings when a Security PIN is used.

Enter TVIR programming mode by operating the standby button for 5 seconds.

Operation	=7	=PIN
Feature	=7	=Check PIN
Value	=XXX	=PIN Code

The VLB-5X will flash back the number using a series of flashes. You can then continue onto programming your beacon.

In contrast, the VLB-5X wreck light is set with security PIN numbers, directly from the factory. The PIN number for each colour (blue and yellow) is provided on the Test Sheet when the product is shipped. Refer to the test sheet for these numbers.

Note: Where a PIN has been set, and a user attempts to change a setting, an error message will be generated and no changes will occur. If you lose your PIN, please contact Vega.

5.11 Calendar

The VLB-5X allows the programming of 5 pairs of calendar dates where the beacon will turn off at the first date, hibernate, and then return to “Normal” operation on the second date. Because the calendar operation continues when the beacon is in hibernation the background power is higher than if the VLB-5X was in storage mode.

The default setting for the calendar is “disabled” and the feature must be turned “on” and the current date and time set in order to enable the function. The VLB-5X handles the programmed on and off dates in a sequential manner and care needs to be taken that the off periods are not overlapped. Overlapped the off periods may result in operation that is not as expected. A setting of 0000 will disable the ON or OFF date and all ON/OFF dates can be disabled by using Feature 50 and entering 0000.

Enter TVIR programming mode by operating the standby button for 5 seconds.

Operation	=4	=Calendar
Feature	=See table below	
Value	=See table below	

Program and reading of settings are done using a different feature code.

The calendar in the VLB-5X does not support daylight savings. All date settings are referenced to the real time that is entered. If this is standard time then all the on and off dates must be programmed in standard time.

The day of the month is a number between 01 and 31. The VLB-5X does not check the days entered against a particular month. The 31st of February for example would be seen by the VLB-5X as the 3rd of March.

Feature		Value	Flash response from VLB-5X
00	Calendar Enable/Disable	000 Disable 001 Enable	000 Disable 001 Enable 011 Enabled and Hibernating
01	Read Enable/Disable		000 Disable 001 Enable 011 Enabled and Hibernating
10	Set Year	YYYY (i.e. 2010)	YYYY (i.e. 2010)
11	Read Year		YYYY (i.e. 2010)
20	Set Month/Day/Hour/Minute	MMDDHHMM MM is month (01 to 12) DD is day (01 to 31) HH is hour (00 to 23) MM is minute (00 to 59) *Take care with day setting. 31 Feb will be 3rd of March.*	MMDDHHMM MM is month (01 to 12) DD is day (01 to 31) HH is hour (00 to 23) MM is minute (00 to 59)
21	Read Month/Day/Hour/Minute		MMDDHHMM MM is month (01 to 12) DD is day (01 to 31) HH is hour (00 to 23) MM is minute (00 to 59)
30	Set 1st OFF date	MMDD (0000 Disables) MM is month (01 to 12) DD is day (01 to 31) *Daylight saving is not supported by the Calendar Feature. All dates must be programmed relative to the real time programmed in Feature 10 and 20*	MMDD MM is month (01 to 12) DD is day (01 to 31)
40	Read 1st OFF date		MMDD MM is month (01 to 12) DD is day (01 to 31)
31	Set 1st ON date	MMDD (0000 Disables) MM is month (01 to 12) DD is day (01 to 31)	MMDD MM is month (01 to 12) DD is day (01 to 31)
41	Read 1st ON date		MMDD MM is month (01 to 12) DD is day (01 to 31)
32	Set 2nd OFF date		
42	Read 2nd OFF date		
33	Set 2nd ON date		
43	Read 2nd ON date		
34	Set 3rd OFF date		
44	Read 3rd OFF date		
35	Set 3rd ON date		
45	Read 3rd ON date		
36	Set 4th OFF date		
46	Read 4th OFF date		
37	Set 4th ON date		
47	Read 4th ON date		
38	Set 5th OFF date		
48	Read 5th OFF date		
39	Set 5th ON date		
49	Read 5th ON date		
50	Clear All ON/OFF dates	0000 Disable	0000

User Notes

APPENDIX A PROGRAMMING TABLE

Operation	Feature	Value
1 = Program Mode 9 = Read Settings	0 = Flash Character Default 601 QFL 1sec (0.3 on)	000 – Fixed character 1YY – Isophase (ISO) 2YY – Occulting (OC) 3YY – Flash (Fl) 4YY - Multiple Flash (Fl(x)) 5YY - Very Quick (VQ) 6YY - Quick (Q) 7YY – Long (LF) 8YY – Morse (MO) 9YY – Custom (CCG Codes)
	1 = Night Effective Intensity Default 0025 25 candela effective	Four Digit Value – Enter value as a number 0000 to 9999. 0000 Sets minimum allowed value. 9999 sets maximum allowed value.
	2 = Day Effective Intensity Default 0025 25 candela effective	Four Digit Value – Enter value as a number 0000 to 9999. 0000 Sets minimum allowed value. 9999 sets maximum allowed value.
	3 = Synchronisation Default 000 Master sync no delay	999 – Disable Synchronisation 998 – Beacon activated by holding sync low. Synchronization not possible since sync line used. 0YY Light in normal mode 1YY Light operates only when sync pulse present YY=sync delay seconds (0.0 to 9.9 seconds)
	4 = Day/Night Control Default 005 Night operation IALA recommended transition	0YY Light operates night only 1YY Light operates day and night YY= Day/Night transition Lux Level Night Lux. Day Lux YY=01 40 100 shortest night YY=02 50 150 YY=03 75 100 CCG YY=04 75 150 YY=05 75 175 IALA suggested YY=06 100 175 YY=07 100 200 YY=08 150 250 YY=09 250 320 longest night USCG YY=10 15 40 shortest night YY=11 30 50 YY=12 15 60

<table>
<tr><th>Operation</th><th>Feature</th><th>Value</th></tr>
<tr><td>1 = Program Mode

9 = Read Settings</td><td>5 = Operation Mode

Default 000
Normal

Note:
Self Contained units are shipped from the Factory in Storage Mode 009</td><td>000 – Normal, also cancel Auto Storage/ Auto Leave Storage mode.
007 – Test Alarm signal output (Alarm operates until beacon leaves programming mode). Returns CSQ if connected to VSM-222 (0 = unknown, 999 = no SIM card).
009 – Storage Mode, also cancel Auto Storage/ Auto Leave Storage mode.
999 – Reset beacon to Factory Default – All changes will be lost. Auto Storage/Leave Storage cancelled.
1N9 – Auto Leave Storage on day light and place beacon in storage mode. N is proportional to minutes of light required to leave storage mode and reactivate (see table below). Beacon must be placed in dark for at least 1 minute to activate the Auto Leave function.
2N0 – Auto Storage Mode on dark/Auto Leave Storage on day. 24 hours of darkness will force beacon into storage mode. N is proportional to minutes of light that will cause beacon to leave storage mode and reactivate (see table below).
2N9 – Same as 2N0 except beacon is immediately placed in storage mode upon exit from programming.

Where N is 0-9

<table>
<tr><td>N = 0</td><td>~2 minutes of light releases beacon from storage</td></tr>
<tr><td>N = 1</td><td>~12 minutes of light releases beacon from storage</td></tr>
<tr><td>N = 2</td><td>~22 minutes of light releases beacon from storage</td></tr>
<tr><td></td><td>…</td></tr>
<tr><td>N = 9</td><td>~92 minutes of light releases beacon from storage</td></tr>
</table>

Read Settings are a combination of the activated modes:
119: Auto Leave Storage 12 minutes, Storage Mode on exit.
220: Auto Storage Mode activated, 22 minute leave storage, Normal Operation on exit.
009: Storage Mode Only
000: Normal mode only
149: Auto Leave 41 minute, and Storage Mode on exit.
209: Auto Storage, Auto Leave 1 minute and Storage Mode on exit.</td></tr>
</table>

Operation	Feature	Value
1 = Program Mode 9 = Read Settings	6 = Programming Mode/ RS232/ IRDA Default 000 (Data Ports Disabled)	000 – Disable IRDA and RS232, No Monitoring 001 – Enable IRDA, No Monitoring 002 – Enable IRDA, Monitoring on Demand 003 – Enable IRDA, Monitoring Free Running 004 – Enable RS232, Monitoring on Demand 005 – Enable RS232, Monitoring, 1s Free Running 006 – Enable RS232, No Monitoring 007 – Enable RS232, Monitoring, 60s Free Running (AIS) 008 – Enable RS232, Monitoring, 60s Free running (AIS), 38400 baud (i.e. includes command 8-7-005)
	7 = Slave Mode Flash count on loss of sync Default 001 (1 Character cycle)	0YY– Continue "Y" number of cycles (0-99) 998 – Beacon deactivated by holding sync low. 999 – Disabled, never stop flashing
	8 = Set Low battery threshold Default 110 (11.0 Volts)	YYY – Battery low threshold. (00.0 to11.9VDC) 999 – Disabled, No battery low cut off
	9 = Set High battery threshold Default 128 (12.8 Volts)	YYY – Battery high threshold. (08.0 to 13.8VDC) 999 – Default setting (12.8VDC)

Operation	Feature	Value
2 – Custom Character Setting	Custom flash character segments Default ISO 1 sec	Up to 9 On/Off pairs. Comma Separated, 50 millisecond units. Numbers 002 to 255 are permitted in the On/Off pairs. 001 is a special case indicating continuation (connect the two values on either side of 001) 002 to 255: 100 milliseconds to 12.75 seconds 001 - Extend an on or off period). 000 – End command Examples: a: 010 020 015 020 200 001 200 020 000 b: 006 012 006 012 000 c: 125 125 000 Illegal: a: 020 001 001 020 000 (repeated connecting character) b: 010 020 015 000 (no off period after 015) c: 020 010 020 010 (no terminating 000)

Operation	Feature	Value
3 – System Checks	0 = Software version	Version Y.Y.Y (i.e. 3.0.2)
	1 – Battery voltage	YY.Y Volts (i.e. 11.7 volts) Last voltage prior to entering programming mode
	2 – Temp sensor reading	Temperature in degrees Kelvin (C+273).
	3 – Current adjustment	Percentage output adjust (080% to 120%)
	4 – Serial Number	Displays beacon serial number as a series of flashes
	5 – LED version number	Displays LED version number identifier
	6 – Characterisation number	Displays LED characterisation identifier
	7 – GPS Present	001 if GPS present bit is set, 000 if bit not set

Operation	Feature	Value
7 – Pin	1 – Set PIN	XXX (000 clears the PIN)
	7 – Enter PIN	XXX

Operation	Feature	Value
8 – Special Options	1 – Comms Mode Reset	001 – AIS comms reset (includes commands 8-7-005 & 1-6-007)
	7 – Set RS232 Baud Rate	000 – Default 115200 Baud
		001 – 4800 Baud
		002 – 9600 Baud
		003 – 14400 Baud
		004 – 19200 Baud
		005 – 38400 Baud (AIS)
		006 – 57600 Baud
	9 – Reset to Bootloader	XXX – Any code starts beacon in bootloader mode

Operation	Feature	Value	Response
4 – Calendar Control (Rev 4.00 or greater)	0-0: Enable/Disable Calendar Control Default 000 Disabled	000 – Disable 001 - Enable	000 – Disabled 001 – Enabled 011 – Enabled and hibernating during off period
	0-1: Read Enable State		000 – Disabled 001 – Enabled 011 – Enabled and hibernating during off period
	1-0: Set Year	YYYY where YYYY is the year (ie.; 2010)	YYYY where YYYY is the year (i.e.; 2010)
	1-1: Read Year	YYYY where YYYY is the year (i.e.; 2010)	YYYY where YYYY is the year (i.e.; 2010)
	2-0: Set Month/Day/Hour/Minute	MMDDHHmm where MM is month of the year (01-12) DD is day of the month (01-31) HH is the hour (00-23) mm is the minute (00-59)	MMDDHHmm where MM is month of the year (01-12) DD is day of the month (01-31) HH is the hour (00-23) mm is the minute (00-59)
	2-1: Read Month/Day/ Hour/Minute	Note: Day Light Savings time is not calculated, so depending on when the hour and minute was originally set, there may be an apparent one hour error in the current time.	MMDDHHmm where MM is month of the year (01-12) DD is day of the month (01-31) HH is the hour (00-23) mm is the minute (00-59)
	3-0: Set 1st OFF Date (Off dates are even numbered)	MMDD where MM is month of the year (01-12) DD is day of the month (01-31) If month is zero in either OFF date/time or corresponding ON date/time, OFF date/time pair is ignored.	MMDD where MM is month of the year (1-12) DD is day of the month (01-31)
	4-0: Read 1st OFF Date		MMDD where MM is month of the year (1-12) DD is day of the month (01-31)
	3-1: Set 1st ON Date (On dates are odd numbered)	MMDD where MM is month of the year (01-12) DD is day of the month (01-31) 1st OFF date/time will not be acted upon unless 1st ON month is non-zero.	MMDD where MM is month of the year (1-12) DD is day of the month (01-31)
	4-1: Read 1st ON Date		MMDD where MM is month of the year (1-12) DD is day of the month (01-31)
	3-E: Set E(even) OFF Date (E = 0,2,4,6,8)	MMDD where MM is month of the year (01-12) DD is day of the month (01-31) If month is zero in either OFF date/time or corresponding ON date/time, OFF date/time pair is ignored.	MMDD where MM is month of the year (1-12) DD is day of the month (01-31)
	4-E: Read E(even) OFF Date (E = 0,2,4,6,8)		MMDD where MM is month of the year (1-12) DD is day of the month (01-31)
	3-D: Set D(odd) ON Date (D = 1,3,5,7,9)	MMDD where MM is month of the year (01-12) DD is day of the month (01-31) 1st OFF date/time will not be acted upon unless 1st ON month is non-zero.	MMDD where MM is month of the year (1-12) DD is day of the month (01-31)
	4-D: Read D(odd) ON Date (D = 1,3,5,7,9)		MMDD where MM is month of the year (1-12) DD is day of the month (01-31)
	5-0: Clear All On/Off Periods	0000	Value 0000 Clears all On/Off Periods

APPENDIX B VLB-5X INTENSITY SETTINGS AND CURRENTS

Table 1 7° (±3.5°) Divergence Marine Lens

Last update: 28/10/2016

Range (NM @ 0.74T)	Range (NM @ 0.85T)	Effective Luminous Intensity (cd)	Program Code	Current (mA) @ 20ºC				
				Red	Green	White	Yellow	Blue
				168	263	466	366	562
6.3	8.2	177	-	*240*	*255*	*245*	-	-
5.7	7.5	128	-	*175*	*185*	*180*	*215*	-
5.5	7	106	**0106**	**145**	**155**	**150**	*180*	-
5.3	6.8	94	**0094**	**130**	**135**	**135**	**160**	-
5.0	6.3	77	**0077**	**105**	**115**	**110**	**130**	-
4.5	5.6	54	**0054**	**75**	**75**	**80**	**95**	-
4.0	4.9	37	**0037**	**55**	**50**	**55**	**65**	*184*
	4.5	29	**0029**	**45**	**40**	**45**	**55**	**145**
USCG Class B		25	**0025**	**40**	**35**	**40**	**45**	**125**
3.5		24	**0024**	**35**	**35**	**40**	**45**	**120**
3.0	3.5	15	**0015**	**25**	**20**	**25**	**30**	**75**
	3.0	10	**0010**	**20**	**15**	**20**	**20**	**55**
2.0		5	**0005**	**10**	**10**	**10**	**15**	**30**
1.5		2.4	**0002**				**10**	
1.0		1.0	**0001**				**5**	
Max Peak Candela (cd)				**177**	**177**	**177**	**157**	**50**
Max Peak Current (mA)				**240**	**255**	**245**	**265**	**246**
Max Fixed/Effective Candela (cd)				**106**	**106**	**106**	**94**	**30**
Max Fixed/Effective Current (mA)				**145**	**155**	**150**	**160**	**150**
Night current (mA)				**2.5**				
Night current with GPS (mA)				**4.5**				
Day off current/transport modes/storage mode with calendar disabled (mA)				**0.3**				
Day off current/transport modes/storage mode with calendar enabled (mA)				**1.2**				
Current consumption data for VLB-5X Options (add to day and night currents)								
IRDA enabled current (mA)				**0.3**				
RS232 enabled & externally connected current (mA)				**1**				
Monitor alarm current excluding external load (mA)				**0.075**				

Notes:

- Only currents shown in **BOLD** can be programmed.
- Currents are based on 12V supply voltage.
- Currents are based on ambient temperature of 20ºC and represent upper bounds with +10% tolerances.
- Currents are temperature-dependent.

Table 2 VLB-5X Obstacle Lens

Last update: 14 September 2015

Range (NM @ 0.74T)	Range (NM @ 0.85T)	Effective Luminous Intensity (cd)	Program Code	Current (mA) @ 20ºC				
				Red	Green	White	Yellow	Blue
				163	263	463	363	562
4.5	5.6	54.0	**-**	*270*	*240*	*235*	*270*	
4.3		46.0	**-**	*220*	*205*	*200*	*225*	
TYPE B ICAO 32CD	4.6	32.0	**0032**	**155**	**140**	**125**	**165**	
3.5		24.0	**0024**	**115**	**100**	**90**	**125**	
3.0	3.5	15.0	**0015**	**65**	**60**	**60**	**80**	*186*
TYPE A ICAO 10CD	3.0	10.0	**0010**	**40**	**35**	**35**	**55**	**124**
2.0		5.0	**0005**	**20**	**15**	**15**	**25**	**62**
1.5		2.4	**0003**	**10**	**10**	**10**	**15**	**30**
1.0		1.0	**0001**	**5**	**5**	**5**	**10**	**12**
Measured / Estimated (mm/yyyy)				07/2013	07/2013	07/2013	Est.	09/2015
Max Candela (cd)				**60**	**60**	**60**	**60**	**21**
Max Current (mA)				**300**	**265**	**260**	**275**	**260**
Night current (mA)				**2.5**				
Night current with GPS (mA)				**4.5**				
Day off current/transport modes/storage mode with calendar disabled (mA)				**0.3**				
Day off current/transport modes/storage mode with calendar enabled (mA)				**1.2**				

Notes:

- Only currents shown in BOLD can be programmed
- Currents are based on 12V supply voltage
- Currents are based on ambient temperature of 20°C and represent upper bounds with +10% tolerances.
- Intensities are measured at the lowest point between 6° and 10° above the horizontal.
- Maximum currents for Schmidt-Clausen corrected flashes need to be checked by calculation.

Table 3 VLB-5X FAA Hazard Light

Last update: 13 May 2014

Range (NM @ 0.74T)	Range (NM @ 0.85T)	Effective Luminous Intensity (cd)	Program Code	Current (mA) @ Red 165
4.5	5.7	54.0	-	150
4.3		45.0	-	120
FAA	4.6	32.5	**0032**	**85**
3.3		20.0	**0020**	**50**
3.0	3.5	15.0	**0015**	**40**
	3.0	10.0	**0010**	**30**
2.0		5.0	**0005**	**15**
	1.5	2.0	**0002**	**10**
Max Candela (cd)				**106**
Max Current (mA)				**300**
Night current (mA)				**2.5**
Night current with GPS (mA)				**4.5**
Day off current/transport modes/storage mode with calendar disabled (mA)				**0.3**
Day off current/transport modes/storage mode with calendar enabled (mA)				**1.2**

Notes:

- Only currents shown in BOLD can be programmed
- Currents are based on 12V supply voltage
- Currents are based on ambient temperature of 20°C and represent upper bounds with +10% tolerances.
- Intensities are measured at the peak between 6° and 10° above the horizontal.
- Maximum currents for Schmidt-Clausen corrected flashes need to be checked by calculation.

Using the tables:

1. The VLB-5X beacon is programmed for the effective intensity required. For example; a 4NM light at 0.74T has an effective candela of 37 candelas. Program code 0037
2. The bold numbers in the current tables indicate the effective candela settings that can be programmed for a particular colour. For example; the highest effective candela that a red beacon can be programmed is 106 candela.
3. The VLB-5X beacon has automatic Schmidt Clausen correction to maintain the effective intensity for short flash periods. For example; to achieve an effective candela of 37 Candela (4NM) for a 0.3 flash period the peak intensity required is 62 Candela (37Candela*(flash period+0.2)/flash period).
4. The maximum candela the beacon can output for each colour is shown at the bottom of the table together with the peak current. For example: the maximum output for the red marine beacon is 177 candela, at a current of 240mA.
5. The beacon is unable to output more than the maximum candela. The user should check that the beacon is able to reach the peak candela required after the Schmidt Clausen correction. In the example above, the peak candela for the 0.3 flash is 62 candela and below the maximum of 140 for the red marine beacon. The beacon will therefore support the flash for the required range of 4NM.
6. To determine the on current of a flash it is necessary to determine the peak candela required. Using the example of the 0.3-second flash for a red beacon. The peak candela is 62. The currents for settings bordering this value can be obtained from reading across from the effective candela column, 155mA for 77 Candela, and 95mA for 54 Candela. The option is to use the higher of the 2 currents (155mA) or carry out a linear approximation between the two values, (116mA=95mA+(155mA-95mA)/(77Cd-54Cd) *(62Cd-54Cd).
7. The off current of the beacon between flashes and the base current when the beacon is not operating (switched off during daytime) are provided at the bottom of the table.

APPENDIX C WORKSHEET FOR A CUSTOM CHARACTER

Fill out the table below for the values required to program a custom character.
The steps to program a custom character is as follows
Example given for Fl (2) 38.5sec (0.5sec on 2sec off 16sec on 20sec off)

Step		Example	Required Character
Enter programming mode	The light will flash 4 times to indicate it is in programming mode	Press standby button for 5 seconds	Press standby button for 5 seconds
Enter Operation and Class syntax	Light will flash each time button is pressed	**2**	**2**
Enter ON time. If greater than 12.75 seconds, use ADD code 001	Value is multiple of 0.05 seconds, max value 255	On time of 0.5 sec **010**	
Enter OFF time. If greater than 12.75 seconds, use ADD code 001	Value is multiple of 0.05 seconds, max value 255	Off time of 2 sec **040**	
Enter ON time. If greater than 12.75 seconds use ADD code 001		On time 16 seconds. Need to program 8 sec, plus 8 sec using ADD **160 001 160**	
Enter OFF time. If greater than 12.75 seconds, use ADD code 001		Off time 20 seconds Need to program 10 sec, plus 10 sec using ADD **200 001 200**	
Enter ON time. If greater than 12.75 seconds use ADD code 001			
Enter OFF time. If greater than 12.75 seconds use ADD code 001			
FINISHED code	Light will flash 3 long flashes to indicate the instruction has been accepted	**000**	**000**

When the light exits the programming mode it will flash the character that is currently selected. To use the custom character, you must select character 999 (enter programming mode then press 1 0 999).

If an error is made when programming the custom character, the light will flash 3 times and exit the programming mode

APPENDIX D VLB-5X SETTINGS

Complete the table for the required settings. It is only necessary to program the specific settings where they are different to the settings already programmed.

The programming can be done sequentially without leaving the program mode. After the light has flashed back the setting, enter the next setting within 10 seconds or the light will exit programming mode.

To read the settings already programmed

Setting	Key sequence	Value
Flash Character	**90**	
Night Effective Intensity	**91**	
Day Effective Intensity	**92**	
Synchronisation	**93**	
Day/Night Control	**94**	
Operation mode	**95**	
Programming mode	**96**	
Slave Mode Flash count on loss of sync	**97**	
Battery Low Threshold	**98**	
Battery High Threshold	**99**	

To enter new settings

Setting	Default		Settings required
Flash Character	QFL 1sec (0.3s on)	1-0-601	**10**_____
Night Effective Intensity	25 Candela	1-1-0025	**11**_____
Day Effective Intensity	25 Candela	1-2-0025	**12**_____
Synchronisation	Master, no delay	1_3_000	**13**_____
Day/Night Control	Night, IALA setting	1_4_005	**14**_____
Operation mode	Normal	1_5_000	**15**_____
Programming mode	Data Ports off	1_6_000	**16**_____
Slave Mode Flash count on loss of sync	1 Character cycle	1_7_001	**17**_____
Battery Low Threshold	11.0 Volts	1_8_110	**18**_____
Battery High Threshold	12.8 Volts	1_9_128	**19**_____

APPENDIX E VLB-5X SOLAR POWER CALCULATION EXAMPLE

DETERMINE THE POWER CONSUMPTION FOR A VLB-5X FOR A SPECIFIED RANGE AND FLASH CHARACTER

To determine the power requirement of the VLB-5X the following information is required.

1. The flash character
2. Colour of light
3. The range of the light in NM
4. Whether GPS synchronization is used
5. The longest period in hours the light will operate.

Lowering the energy requirement can be done by:

- Lowering the range of the light and
- Lowering the duty cycle of the flash character.

Only night operation is considered in the calculation examples provided below.

Step 1 Calculate the Power Consumption of the VLB-5X

Note: The effective intensity is the intensity the user programs into the light and corresponds to the nominal range of the light. This is the intensity required for a "fixed on" light to be seen at that distance. The peak intensity is the intensity required to see a flashing light at the same distance. The peak intensity increases the shorter the flash. The VLB-5X is programmed in effective intensity and performs automatic Schmidt Clausen correction for the programmed flash Character to increase the peak intensity depending on the duration of the flash

Example 1: Calculate the peak intensity and the power consumption for a red VLB-5X operating at night, fitted with an internal GPS pulse sync unit. The calculation is made for the longest night to determine the highest energy needs of the light

- Night range = 4.0NM at 0.74T
- Flash character = Fl 5s 0.3 (on for 0.3 sec off for 4.7 sec)
- Operating hours at night (longest) = 14 hours

Determine the peak intensity requirement for night

Atmospheric transmissivity	0.74	
Range required	4NM	
Night effective intensity (Appendix B)	37Cd	**= A**
Character period in seconds	5 sec	**= B**
Flash duration in seconds	0.3 sec	**= C1**
Duty Cycle = C1/B	0.06	**= D1**
Schmidt Clausen Factor = ((C1+0.2)/C1)	1.667	**= E**
Peak intensity = A*E	62Cd	**= F1**

Note: If the character has a multiple flash the peak intensity will need to be calculated for each of the flash periods. C1, C2…D1, D2…F1,F2 etc

Determine the power consumption for each flash

For the peak intensity F1 find the current in Appendix A for the intensity value above and below the value of F1	77Cd 155mA 54Cd 95mA	**= G**
Difference in current values in G	60mA	**= H**
Difference in Candela values in G	23Cd	**= I**
Lowest Candela value in G	54Cd	**= J**
Difference between F and J	8Cd	**= K**
Lowest current in G	95mA	**= L**
Current at F1 Candela =L+K*H/I	115.9mA	**= M**
Average current in Character period=M*D1	6.95mA	**= N1**

Note: If the character has a multiple flash, repeat this calculation for each flash (N1, N2, N3 etc)

Determine energy need of light

Average current in Character period=N1+N2 etc	6.95mA	**=O**
Night Off current with GPS (Appendix B)	4.5mA	**=P**
Time when light is off =B-(C1+C2 etc)	4.7 sec	**=Q**
Average current=O+P*Q/B	11.18mA	**=R**
Longest operating hours	14 hours	**=S**
Night energy usage=R*S/1000	0.157Ah	**=T**
Day current from Appendix B	0.3mA	**=U**
Day Energy Usage=(24-S)*U/1000	.003Ah	**=V**
Total energy used by light=T+V	0.16Ah	**=Y**

For VLB-5X-SA Stand Alone unit the power source supplying the Beacon must be able to support the load of the beacon as calculated above.

For VLB-5X-SS/LS Solar Powered beacons it is necessary to ensure the Solar-energy available and the battery capacity is sufficient to support the load of the Beacon.

Step 2 Determine the energy available from the solar panels at the location the beacon

Now that the worst-case load is determined for the beacon it is necessary to determine what size solar body is required to support the beacon. It is usually the case that when the beacon needs the most energy (longest night). This is also the shortest day with least solar energy. The solar calculation should be done for the month with the lowest solar energy.

Because of the shape of the VLB-5X solar pack it is necessary to have the solar energy figures for each of the solar panels. This means a different azimuth for each panel (90 degrees apart). The inclination of the panels is 90 degrees from the horizontal.

Example: The lowest month for sunshine in Lisbon Portugal (Northern Hemisphere) is December.

Solar radiation for December	Panel 1 Panel 2 Panel 3 Panel 4 **Total**	104 kWh/sqm 40 kWh/sqm 40 kWh/sqm 17 kWh/sqm **201 kWh/sqm**	Data source Meteonorm
Solar Panel Size	SS LS	2 Watt 4 Watt	
Energy collected per day 31 Days in December	SS LS	12.97 Wh/day 25.94 Wh/day	(month solar radiation)* (panel size)/(days in month)
Convert to Amp Hours Battery at 12 Volt	SS LS	1.08 Ah/day 2.16 Ah/day	(Energy per day)/12
Allow for efficiency factors	Panel fouling Charge efficiency **Overall efficiency**	10% 20% **70%**	
Amp hour available per day After efficiency	SS LS	0.756 Ah/day 1.51 Ah/day	(Amp hours)*(0.7)

For the flash character and range of the beacon the load calculated in step 1 was 0.16Ah per day with GPS. From the calculations above all solar sizes can support the Beacon load.

Step 3 Battery Autonomy

The standard battery sizing for the VLB-5X self-contained beacons are as follows

SS	12Ah
LS1	12Ah
LS2	24Ah

To calculate the battery sizing properly the technical specification of the battery should be consulted to adjust the available battery capacity for various factors including minimum temperature, capacity retention with age, capacity retention on standby duty etc.

Factors to decide for the battery are:

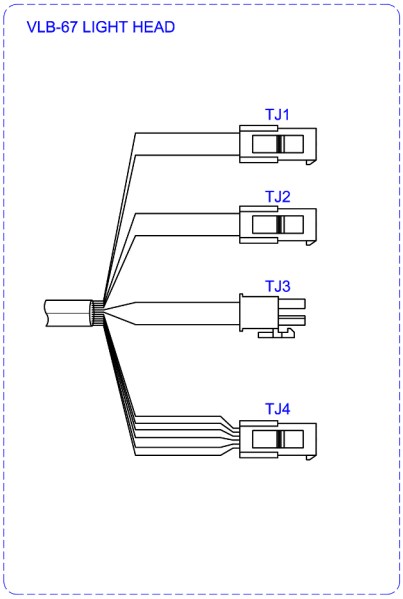
- Degree of discharge allowed (80% - end of life capacity)
- Days of autonomy required (10 days)

Battery Capacity available to minimum discharge level	SS LS1 LS2	9.6 Ah 9.6 Ah 19.2Ah
Beacon load to be supported (Red, Fl 5s 0.3, GPS, 4NM)	0.1432 Ah per day	
Battery capacity required for the 10 autonomy days	1.432 Ah	

From the solar panel and battery capacity calculations the VLB-5X-SS self-contained unit is capable of supporting a red Fl 5s 0.3 character at a 4NM range with GPS fitted at Lisbon Portugal

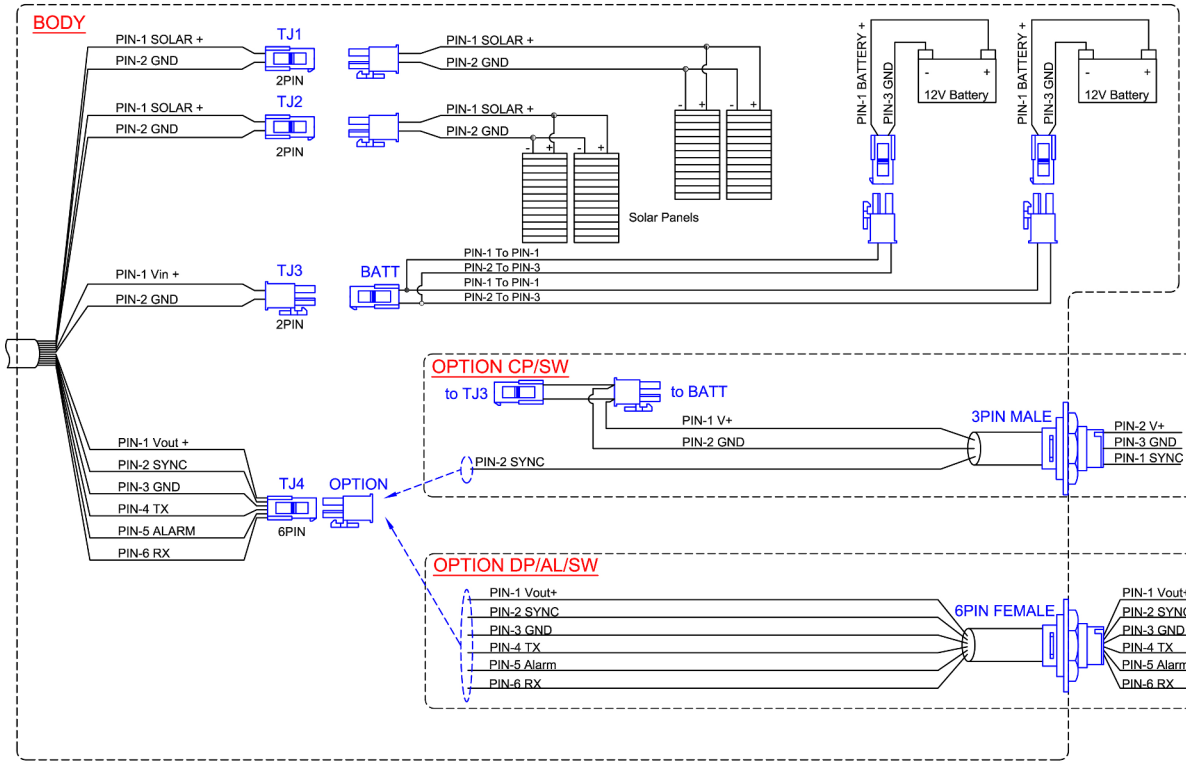
APPENDIX F ELECTRICAL CONNECTIONS TO VLB-5X BEACON

Connections will vary with VLB-5X Model and Options ordered

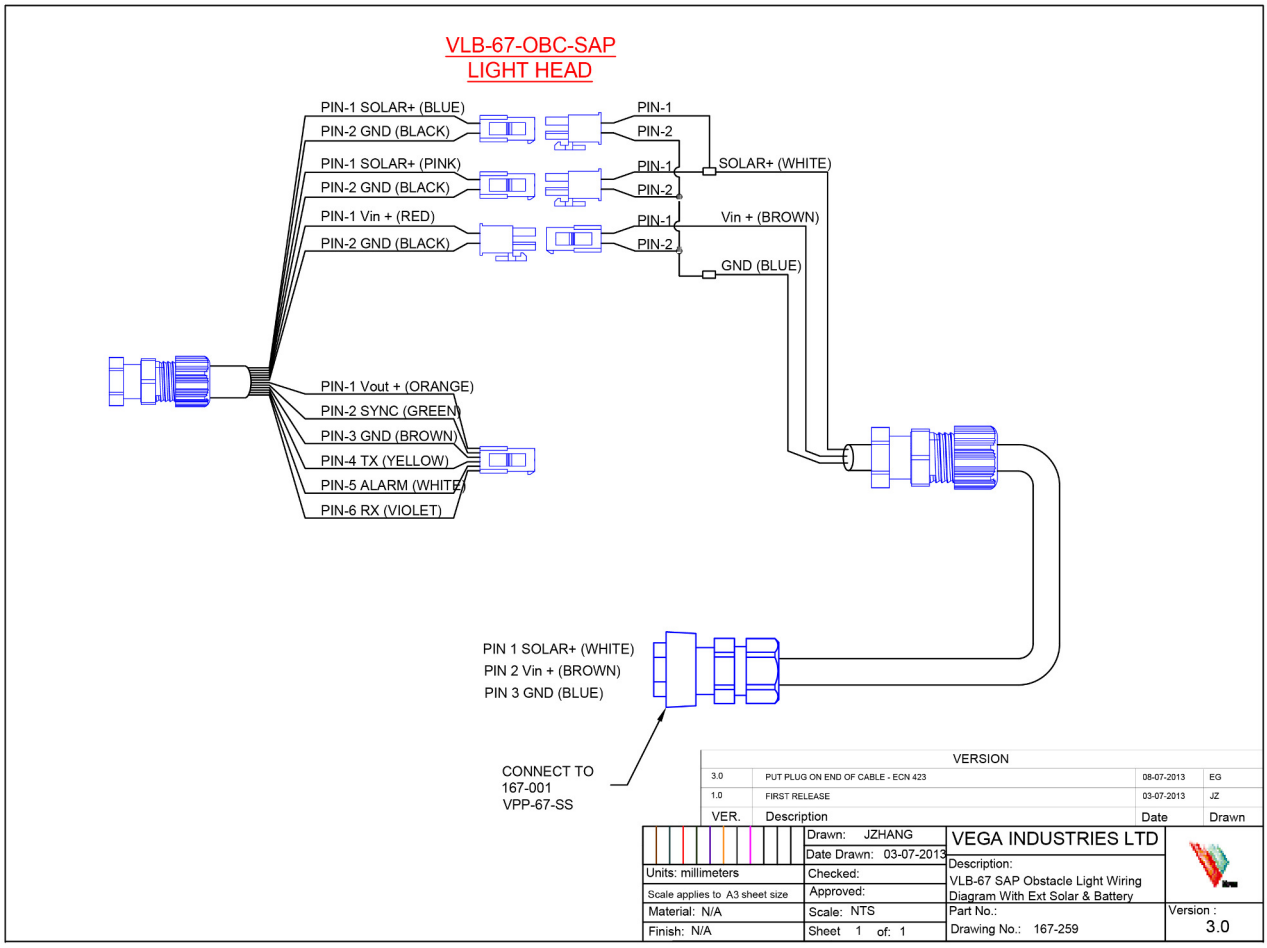


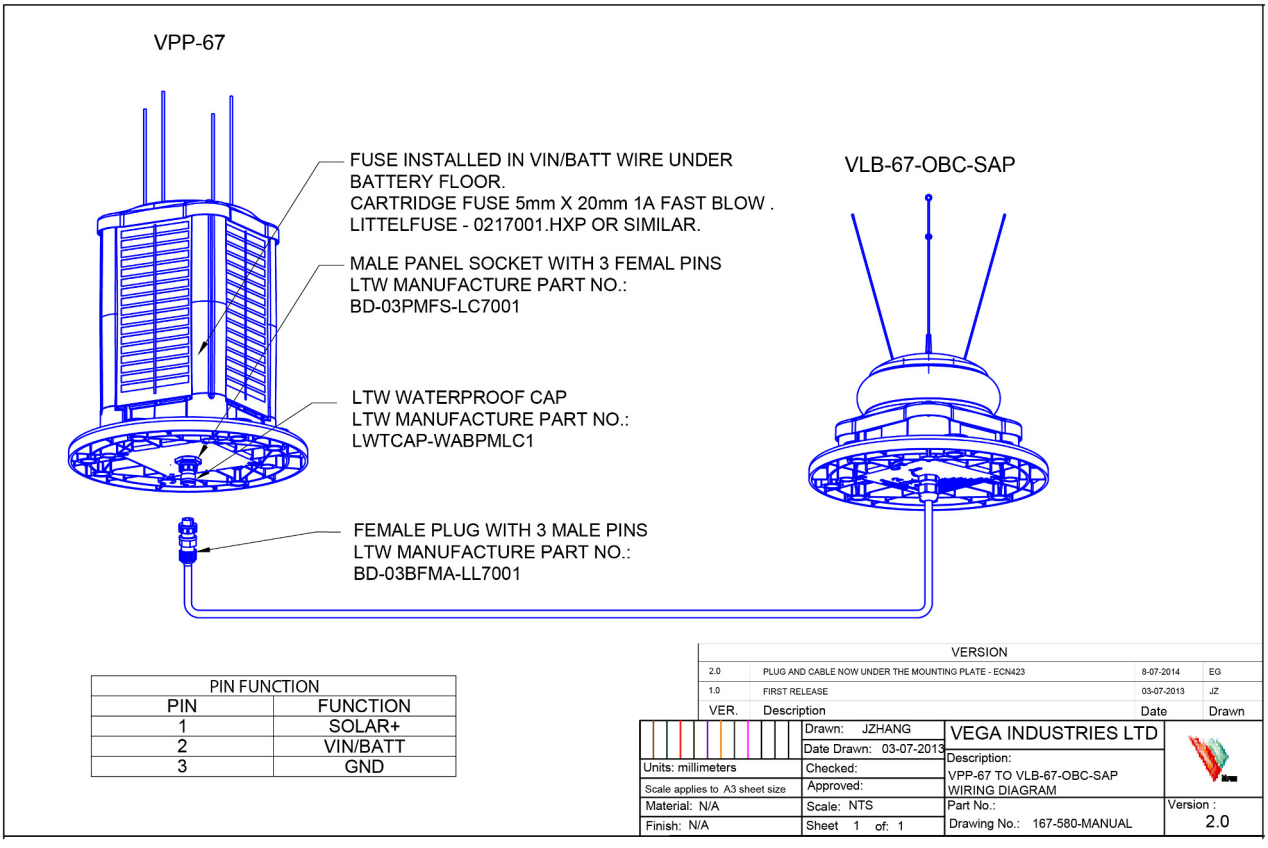
CONNECTOR	PIN	FUNCTION
TJ1 SOLAR CONNECTOR	1	SOLAR +
	2	GND
TJ2 SOLAR CONNECTOR	1	SOLAR +
	2	GND
TJ3 POWER CONNECTOR	1	Vin +
	2	GND
TJ4 OPTION CONNECTOR	1	Vout+
	2	SYNC
	3	GND
	4	TX
	5	ALARM
	6	RX

Third Angle Projection	Drawn: JZhang	VEGA INDUSTRIES LTD	
	Date Drawn: 23/11/09	Description: VLB67 Head Wiring Map	
Units: millimeters	Checked: JBrook		
Scale applies to A3 sheet size	Approved: JBrook		
Material: N/A	Scale: NTS	Part No.: 167-291	Version : 1.5
Finish: N/A	Sheet 1 of: 1	Drawing No.: 167-291	

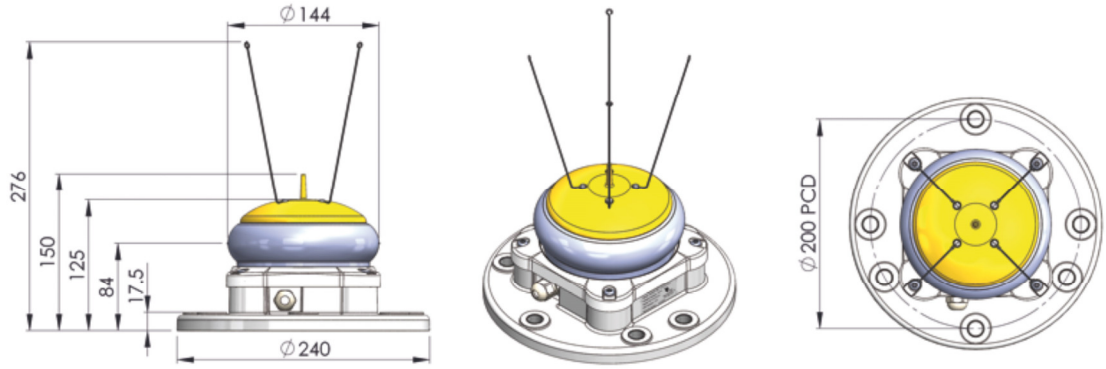


Third Angle Projection	Drawn: JZhang	VEGA INDUSTRIES LTD	
	Date Drawn: 26/11/09	Description: VLB67 Large Self-contained Cabling With Option Cable	
Units: millimeters	Checked: JBrook		
Scale applies to A3 sheet size	Approved: JBrook		
Material: N/A	Scale: NTS	Part No.: 167-298	Version : 1.1
Finish: N/A	Sheet 1 of: 1	Drawing No.: 167-298	

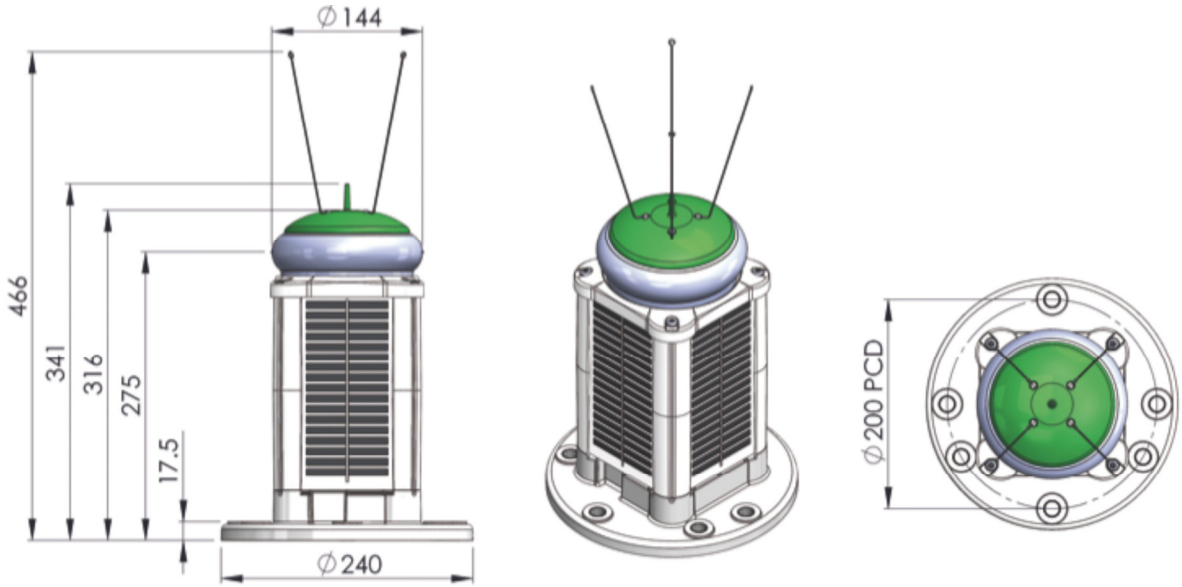

VLB-67-OBC-SAP
LIGHT HEAD
PIN-1 SOLAR+ (BLUE)
PIN-2 GND (BLACK)
PIN-1 SOLAR+ (PINK)
PIN-2 GND (BLACK)
PIN-1 Vin + (RED)
PIN-2 GND (BLACK)
PIN-1
PIN-2
PIN-1
PIN-2
PIN-1
PIN-2
SOLAR+ (WHITE)
Vin + (BROWN)
GND (BLUE)
PIN-1 Vout + (ORANGE)
PIN-2 SYNC (GREEN)
PIN-3 GND (BROWN)
PIN-4 TX (YELLOW)
PIN-5 ALARM (WHITE)
PIN-6 RX (VIOLET)
PIN 1 SOLAR+ (WHITE)
PIN 2 Vin + (BROWN)
PIN 3 GND (BLUE)
CONNECT TO
167-001
VPP-67-SS
VERSION
3.0 PUT PLUG ON END OF CABLE - ECN 423 08-07-2013 EG
1.0 FIRST RELEASE 03-07-2013 JZ
VER. Description Date Drawn
Drawn: JZHANG
Date Drawn: 03-07-2013
Units: millimeters
Checked:
Scale applies to A3 sheet size
Approved:
Material: N/A
Scale: NTS
Finish: N/A
Sheet 1 of: 1
VEGA INDUSTRIES LTD
Description:
VLB-67 SAP Obstacle Light Wiring Diagram With Ext Solar & Battery
Part No.:
Drawing No.: 167-259
Version :
3.0


VPP-67
FUSE INSTALLED IN VIN/BATT WIRE UNDER BATTERY FLOOR.
CARTRIDGE FUSE 5mm X 20mm 1A FAST BLOW .
LITTELFUSE - 0217001.HXP OR SIMILAR.
MALE PANEL SOCKET WITH 3 FEMAL PINS
LTW MANUFACTURE PART NO.:
BD-03PMFS-LC7001
LTW WATERPROOF CAP
LTW MANUFACTURE PART NO.:
LWTCAP-WABPMLC1
FEMALE PLUG WITH 3 MALE PINS
LTW MANUFACTURE PART NO.:
BD-03BFMA-LL7001
VLB-67-OBC-SAP
PIN FUNCTION
PIN FUNCTION
1 SOLAR+
2 VIN/BATT
3 GND
VERSION
2.0 PLUG AND CABLE NOW UNDER THE MOUNTING PLATE - ECN423 8-07-2014 EG
1.0 FIRST RELEASE 03-07-2013 JZ
VER. Description Date Drawn
Drawn: JZHANG
Date Drawn: 03-07-2013
Units: millimeters
Checked:
Scale applies to A3 sheet size
Approved:
Material: N/A
Scale: NTS
Finish: N/A
Sheet 1 of: 1
VEGA INDUSTRIES LTD
Description:
VPP-67 TO VLB-67-OBC-SAP WIRING DIAGRAM
Part No.:
Drawing No.: 167-580-MANUAL
Version :
2.0

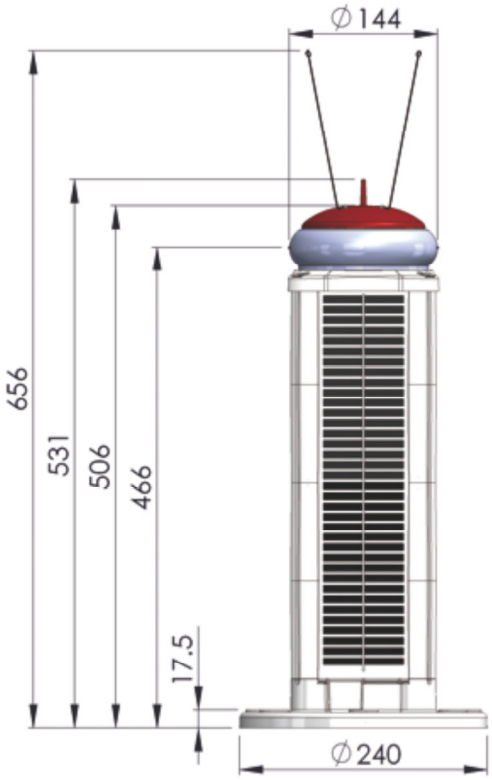
APPENDIX G VLB-5X BEACON DIMENSIONS

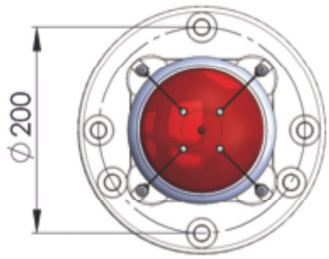


Standalone Beacon

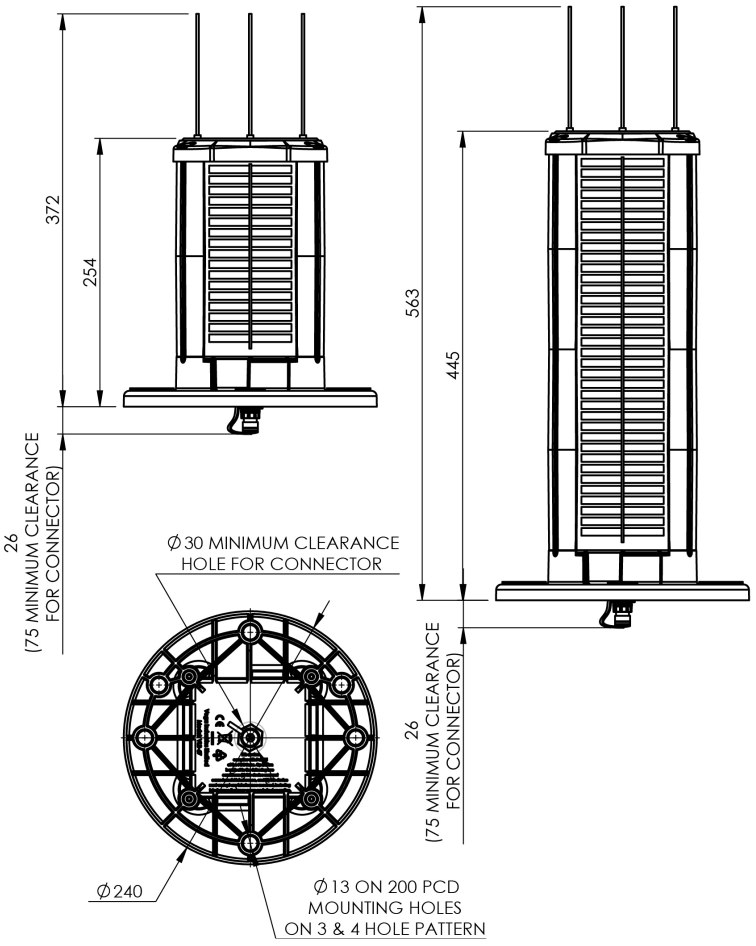


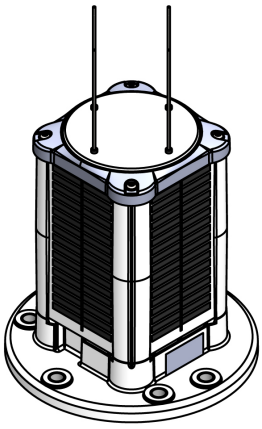
Standard Self Contained Beacon





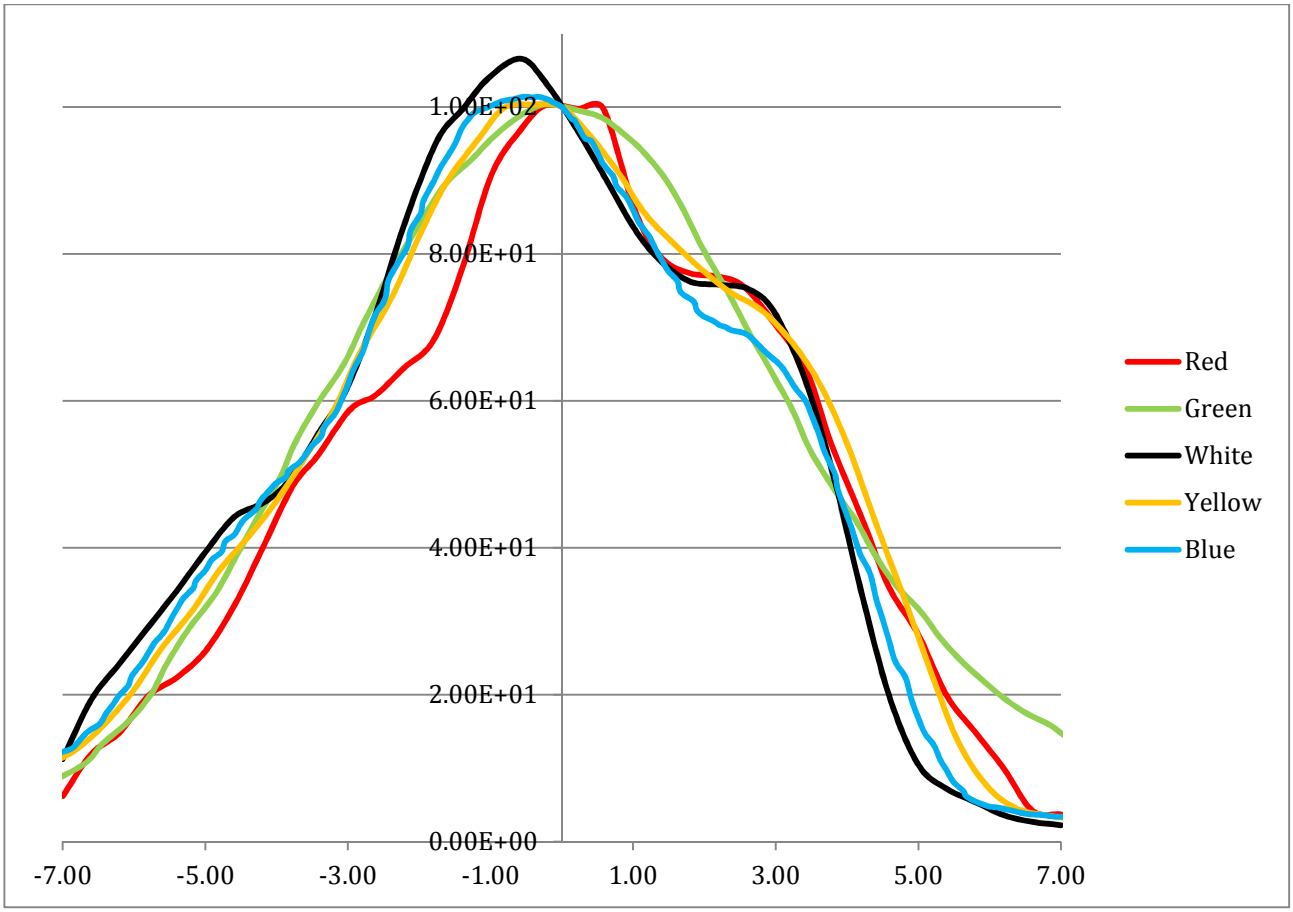
Large Self Contained Beacon

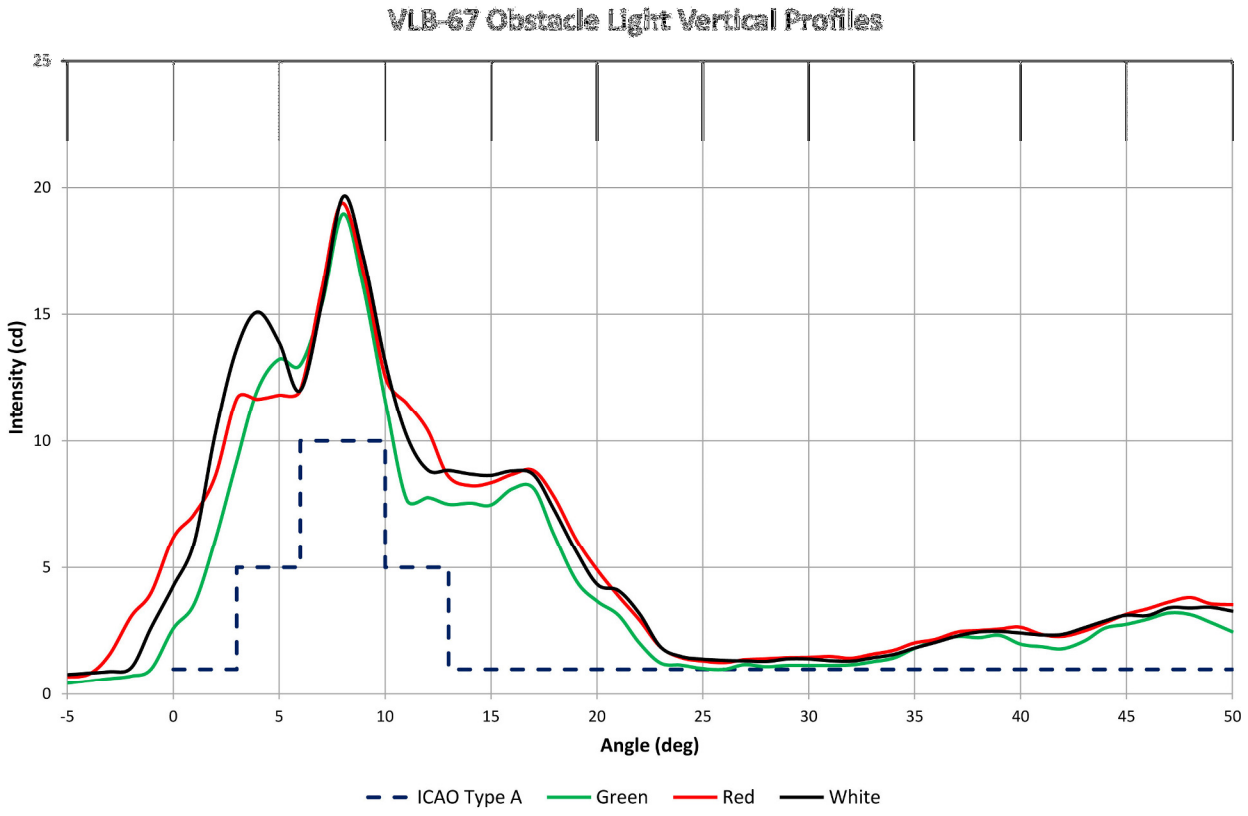




VPP-67 SS VPP-67 LS

APPENDIX H 7° MARINE LIGHT VERTICAL DIVERGENCE PROFILES





APPENDIX I SPECIFICATIONS OF VLB-5X BEACON

Optical

Light Source	High-Intensity Light-Emitting Diodes Operating temperature controlled to protect LEDs
Colours Available	Red, Green, White, Yellow, Blue IALA Recommendation E-200-1 part1
Intensity	See Appendix A IALA Recommendation E-122(2001) & E-200-3 Part 3 (2008)
Effective Intensity Settings	Multiple levels for both day and night operation
Peak Intensity	Automatic Schmidt Clausen correction up to beacon max intensity
Flash Characters	256 standard characters plus one custom character 20 factory set custom characters if required
Vertical Divergence	Marine beacon ± 3.5°, measured at 50% Obstacle light 10°, measured at 50%, programmed intensity occurring at 6° and 10°
Chromaticity Co-ordinates	Red 0.68<x<0.71, 0.29<y<0.32 White 0.28<x<0.36, 0.25<y<0.39 Green 0.09<x<0.20, 0.53<y<0.75 Yellow 0.56<x<0.60, 0.40<y<0.43 Blue 0.09<x<0.17, 0.02<y<0.10

Synchronisation

Wire Synchronisation	Standard on SA model, factory option on SS and LS models Negative transition signal at start of flash character Max sink-current 1.6mA @18V positive supply
GPS Synchronisation	Factory option internal GPS module. Operates only when VLB-5X beacon is running.
Synchronising Delay	Synch pulse delay settable from 0 to 9.9 seconds

Electrical

Voltage	9 to 18 VDC, nominal 12.0 VDC 12Ah battery in SS and LS1 model (2 batteries in LS2 model)
Low Voltage Cut Out	Programmable low voltage cut off threshold
Solar Charger	On SS and LS models Consumes 12mW max while charging battery, plus overcharge protection
Solar Panel	4 x 2 Watt panels on SS model and 4 x 4 Watt on LS model Mono-crystalline, 90° to horizontal, 90° apart in azimuth
Light-On Current	See Appendix A
Current between Flashes	3.0 mA (without GPS module)
Current by Day	0.25 mA
Day / Night Transition	Photo sensor located inside lens Nine program settings for the day/night transition Accuracy of sensor $\pm$20 lux
Calendar Clock Accuracy	Better than 6 hours per year over full operating temperature range
Optional GPS Current	Average current when operating is 1mA 10mA when acquiring signal. 0mA when not acquiring signal. Nominally acquires for 2 minutes every 20 minutes.
Optional Monitor Output	Voltage 0 to 20 VDC Current to Ground 400mA max Leakage current to ground 5 micro Amp Max Voltage during alarm: 1VDC@ 400mA. 0.2VDC @ 100mA
Optional Data Port	RS232, 2-wire, half-duplex serial interface, HW handshaking and SW flow control not supported. Buffer auto-detects external RS232 Tx connection. Current when enabled and connected is 1mA.

	RS485 2-wire differential, bidirectional half-duplex serial interface, custom protocol.

Materials for Beacon

Lens	Moulded acrylic (PMMA)
Top	Moulded UV stabilised ASA plastic with central bird spike
Body	Injection Moulded UV Stabilised Nylon 6/6 with 30% glass fill
Additional Bird Spikes	4 spikes, 316 Stainless steel.
Sealing	Lens glued in position. Other parts sealed using O rings

Environment

Temperature	-40°C to +50°C
Intrusion Protection	IP68 1 hour immersion at 1.5 metre
Design Icing Load	25 kg/square metre on external surface
Design Wind Speed	140 knots (280 kph)
Ultra-Violet Radiation	All external materials are UV resistant
Shock	MIL-STD-202G, Method 213B, Cond H. 75g
Vibration	MIL-STD-202G, Method 204D Cond B, peak value of 5g in all directions
Electromagnetic Interference	EN55015:2006 radiated and conducted emissions EN61000-4-2:2001 Electrostatic Discharge Immunity, Level 4 EN61000-4-3: 2002 Radiated Immunity, Class 1 EN6100-4.5:1995 Class 3 Surge Immunity, 0.5kV lead-to-lead FCC 47 CFR Section15 Class A
Programming	Vega Remote02 Infra-red programmer By Computer using Prog-01 kit
Design Life	12 years excluding battery
Warranty	3 years. See Vega warranty terms

Weights and Dimensions

Mounting Holes	3 or 4-hole mounting**.** Holes to take ½ inch or M12 bolts 200 mm pitch circle diam. 200PCD 316 stainless steel anti compression sleaves

	SA Model	SS Model	LS Model	VPP-SS	VPP-LS
Base Diameter	240mm	240mm	240mm	240mm	240mm
Overall height (no bird spikes)	150mm	341mm	531mm	252mm	443mm
Focal plane height	85mm	275mm	465mm	-	-
Weight	1kg	6kg	7.5kg LS1 11kg LS2	5.75kg	7.0kg LS1 10.75kg LS2
Shipping Weight	1.5kg	7kg	8.5kg LS1 12kg LS2	6.75kg	8.0kg LS1 11.75kg LS2

TVIR Programmer

Coding Scheme: RC5 code with centre frequency 36.7 kHz
Dimensions: 87mm x 41mm x 6.5mm
Weight: 18gms
Power Supply: 1 x 3V lithium coin cell battery, CR2025 type

Battery Replacement on TVIR Programmer

Place the remote face down, and push the latch on the battery holder towards the centre of the programmer case, while at the same time levering the slot on the battery holder outward as shown in the illustration below.

Pull the battery holder out of the case.

Remove the old battery and insert a new one, ensuring that the + side of the battery is facing upwards as shown.

Insert the battery holder into the programmer case, and press it until the latch clicks into place.

APPENDIX J FLASH CHARACTER TABLE WITH PROGRAMMING CODES

FIXED	DETAIL
000 Fixed	On

ISO	DETAIL
100 ISO 2s	1.0s, 1.0s
101 ISO 3s	1.5s, 1.5s
102 ISO 4s	2.0s, 2.0s
103 ISO 5s	2.5s, 2.5s
104 ISO 6s	3.0s, 3.0s
105 ISO 8s	4.0s, 4.0s
106 ISO 10s	5.0s, 5.0s

OCCULT	DETAIL
200 OC 1.25s 0.75	0.75s, 0.5s
201 OC 3s 2.0	2s, 1s
202 OC 3s 2.5	2.5s, 0.5s
203 OC 3.5s 2.5	2.5s, 1s
204 OC 4s 2.5	2.5s, 1.5s
205 OC 4s 3.0	3s, 1s
206 OC 5s 3.0	3s, 2s
207 OC 5s 4.0	4s, 1s
208 OC 5s 4.5	4.5s, 0.5s
209 OC 6s 4.0	4.0s, 2s
210 OC 6s 4.5	4.5s, 1.5s
211 OC 6s 5.0	5s,1s
212 OC 7s 4.5	4.5s, 2.5s
213 OC 8s 5.0	5s, 3s
214 OC 8s 6.0	6s, 2s
215 OC 9s 6.0	6s, 3s
216 OC 10s 6.0	6s, 4s
217 OC 10s 7.0	7s, 3s
218 OC 10s 7.5	7.5s, 2.5s
219 OC 12s 8.0	8.0s, 4s
220 OC 15s 10.0	10s, 5s
221 OC(2) 8s 3.0 2.0	3.0s, 2.0s, 1.0s, 2.0s
222 OC(2) 8s 5.0 1.0	5s, 1s, 1s, 1s

FLASH	DETAIL
300 FL 1.5s 0.2	0.2s, 1.3s
301 FL 1.5s 0.3	0.3s, 1.2s
302 FL 1.5s 0.4	0.4s, 1.1s
303 FL 1.5s 0.5	0.5s, 1s
304 FL 2s 0.2	0.2s, 1.8s
305 FL 2s 0.3	0.3s, 1.7s

FLASH	DETAIL
306 FL 2s 0.4	0.4s, 1.6s
307 FL 2s 0.5	0.5s, 1.5s
308 FL 2s 0.7	0.7s, 1.3s
309 FL 2s 0.8	0.8s, 1.2s
310 FL 2.5s 0.3	0.3s, 2.2s
311 FL 2.5s 0.5	0.5s, 2s
312 FL 2.5s 1.0	1s, 1.5s
313 FL 3s 0.2	0.2s, 2.8s
314 FL 3s 0.3	0.3s, 2.7s
315 FL 3s 0.4	0.4s, 2.6s
316 FL 3s 0.5	0.5s, 2.5s
317 FL 3s 0.6	0.6s, 2.4s
318 FL 3s 1.0	1s, 2s
319 FL 4s 0.2	0.2s, 3.8s
320 FL 4s 0.3	0.3s, 3.7s
321 FL 4s 0.4	0.4s, 3.6s
322 FL 4s 0.5	0.5s, 3.5s
323 FL 4s 0.6	0.6s, 3.4s
324 FL 4s 0.8	0.8s, 3.2s
325 FL 4s 1.0	1s, 3s
326 FL 4s 1.5	1.5s, 2.5s
327 FL 5s 0.2	0.2s, 4.8s
328 FL 5s 0.3	0.3s. 4.7s
329 FL 5s 0.5	0.5s, 4.5s
330 FL 5s 0.9	0.9s, 4.1s
331 FL 5s 1.0	1s, 4s
332 FL 5s 1.5	1.5s, 3.5s
333 FL 6s 0.2	0.2s, 5.8s
334 FL 6s 0.3	0.3s, 5.7s
335 FL 6s 0.4	0.4s, 5.6s
336 FL 6s 0.5	0.5s, 5.5s
337 FL 6s 0.6	0.6s, 5.4s
338 FL 6s 1.0	1s, 5s
339 FL 6s 1.5	1.5s, 4.5s
340 FL 7s 1.0	1s, 6s
341 FL 7s 2.0	2s, 5s
342 FL 7.5s 0.5	0.5s, 7s
343 FL 7.5s 0.8	0.8s, 6.7s
344 FL 8s 0.5	0.5s, 7.5s
345 FL 9s 0.9	0.9s, 8.1s
346 FL 10s 0.2	0.2s, 9.8s
347 FL 10s 0.3	0.3s, 9.7s
348 FL 10s 0.5	0.5s, 9.5s

FLASH	DETAIL
349 FL 10s 0.8	0.8s, 9.2s
350 FL 10s 1.0	1s, 9s
351 FL 10s 1.5	1.5s, 8.5s
352 FL 12s 1.2	1.2s, 10.8s
353 FL 12s 2.5	2.5s, 9.5s
354 FL 15s1.0	1s, 14s

MULTI FLASH	DETAIL
400 Fl(2) 4s 0.5	0.5s, 1s, 0.5s, 2s
401 Fl(2) 4.5s 0.3	0.3s, 1s, 0.3s, 2.9s
402 Fl(2) 4.5s 0.4	0.4s, 1s, 0.4s, 2.7s
403 Fl(2) 4.5s 0.5	0.5s, 1s, 0.5s, 2.5s
404 Fl(2) 5s 0.2 0.8	0.2s, 0.8s, 0.2s, 3.8s
405 Fl(2) 5s 0.2 1.2	0.2s, 1.2s, 0.2s, 3.4s
406 Fl(2) 5s 0.4	0.4s, 0.6s, 0.4s, 3.6s
407 Fl(2) 5s 0.5	0.5s, 1s, 0.5s, 3s
408 Fl(2) 5s 1.0	1s, 1s, 1s, 2s
409 Fl(2) 5.5s 0.4	0.4s, 1.4s, 0.4s, 3.3s
410 Fl(2) 6s 0.2 1.4	0.2s, 1.4s, 0.2s, 4.2s
411 Fl(2) 6s 0.3	0.3s, 1s, 0.3s, 4.4s
412 Fl(2) 6s 0.4	0.4s, 1s, 0.4s, 4.2s
413 Fl(2) 6s 0.5	0.5s, 1s, 0.5s, 4s
414 Fl(2) 6s 0.5 1.5	0.5s, 1.5s, 0.5s, 3.5s
415 Fl(2) 6s 0.8	0.8s, 1.2s, 0.8s, 3.2s
416 Fl(2) 6s 1.0	1s, 1s, 1s, 3s
417 Fl(2) 6s 3.0	3s, 1s, 1s, 1s
418 Fl(2) 7s 1.0	1s, 1s, 1s, 4s
419 Fl(2) 8s 0.4	0.4s, 1s, 0.4s, 6.2s
420 Fl(2) 8s 0.5	0.5s, 1s, 0.5s, 6s
421 Fl(2) 8s 1.0	1s, 1s, 1s, 5s
422 Fl(2) 10s 0.4	0.4s, 1.6s, 0.4s, 7.6s
423 Fl(2) 10s 0.5 1.0	0.5s, 1s, 0.5s, 8s
424 Fl(2) 10s 0.5 1.5	0.5s, 1.5s, 0.5s, 7.5s
425 Fl(2) 10s 0.5 2.0	0.5s, 2s, 0.5s, 7s
426 Fl(2) 10s 0.6 2.4	0.6s, 2.4s, 0.6s, 6.4s
427 Fl(2) 10s 0.8 1.2	0.8s, 1.2s, 0.8s, 7.2s
428 Fl(2) 10s 1.0 1.0	1s, 1s, 1s, 7s
429 Fl(2) 10s 1.0 1.5	1 s, 1.5s, 1s, 6.5s
430 Fl(2) 10s 3.0 1.0	3s, 1s, 5s, 1s
431 Fl(2) 12s 0.4 1.0	0.4s, 1s, 0.4s, 10.2s
432 Fl(2) 12s 0.5 1.0	0.5s, 1s, 0.5s, 10s
433 Fl(2) 12s 1.0 2.0	1s, 2s, 1s, 8s
434 Fl(2) 12s 1.5 2.0	1.5s, 2s, 1.5s, 7s
435 Fl(2) 15s 1.0 2.0	1s, 2s, 1s, 11s

MULTI FLASH	DETAIL
436 Fl(2) 20s 1.0 3.0	1s, 3s, 1s, 15s
437 Fl(2) 25s 1.0 1.0	1s, 1s, 1s, 22s
438 Fl(3) 6s 0.5	0.5s, 1s, 0.5s, 1s, 0.5s, 2.5s
439 Fl(3) 6.1s 0.4	0.4s, 1s, 0.4s, 1s, 0.4s, 2.9s
440 Fl(3) 8s 0.5	0.5s, 1s, 0.5s, 1s, 0.5s, 4.5s
441 Fl(3) 9s 0.3	0.3s, 1s, 0.3s, 1s, 0.3s, 6.1s
442 Fl(3) 9s 0.8	0.8s, 1.2s, 0.8s, 1.2s, 0.8s, 4.2s
443 Fl(3) 10s 0.5	0.5s, 1.5s, 0.5s, 1.5s, 0.5s, 5.5s
444 Fl(3) 10s 1.0	1s, 1s, 1s, 1s, 1s, 5s
445 Fl(3) 12s 0.5 1.5	0.5s, 1.5s, 0.5s, 1.5s, 0.5s, 7.5s
446 Fl(3) 12s 0.5 2.0	0.5s, 2s, 0.5s, 2s, 0.5s, 6.5s
447 Fl(3) 12s 0.8 1.2	0.8s, 1.2s, 0.8s, 1.2s, 0.8s, 7.2s
448 Fl(3) 12s 1.0 2.0	1s, 2s, 1s, 2s, 1s, 5s
449 Fl(3) 15s 0.3	0.3s, 1.7s, 0.3s, 1.7s, 0.3s, 10.7s
450 Fl(3) 15s 0.4	0.4s, 1s, 0.4s, 1s, 0.4s, 11.8s
451 Fl(3) 15s 0.5	0.5s, 1.5s, 0.5s, 1.5s, 0.5s, 10.5s
452 Fl(3) 20s 0.5 1.5	0.5s, 1.5s, 0.5s, 1.5s, 0.5s, 15.5s
453 Fl(3) 20s 0.5 3.0	0.5s, 3s, 0.5s, 3s, 0.5s, 12.5s
454 Fl(3) 20s 0.8 1.2	0.8s, 1.2s, 0.8s, 1.2s, 0.8s, 15.2s
455 Fl(3) 20s 1.0 1.0	1s, 1s, 1s, 1s, 1s, 15s
456 Fl(3) 30s 1.0 4.0	1s, 4s, 1s, 4s, 1s, 19s
457 Fl(4) 10s 0.5 1.0	0.5s, 1s, 0.5s, 1s, 0.5s, 1s, 0.5s, 5s
458 Fl(4) 10s 0.5 0.5	0.5s, 0.5s, 0.5s, 0.5s, 0.5s, 0.5s, 0.5s, 6.5s
459 Fl(4) 10s 0.8	0.8s, 1.2s, 0.8s, 1.2s, 0.8s, 1.2s, 0.8s, 3.2s
460 Fl(4) 12s 0.3	0.3s, 1.7s, 0.3s, 1.7s, 0.3s, 1.7s, 0.3s, 5.7s
461 Fl(4) 12s 0.5	0.5s, 1.5s, 0.5s, 1.5s, 0.5s, 1.5s, 0.5s, 5.5s
462 Fl(4) 12s 0.8	0.8s, 1.2s, 0.8s, 1.2s, 0.8s, 1.2s, 0.8s, 5.2s
463 Fl(4) 15s 0.5	0.5s, 1.5s, 0.5s, 1.5s, 0.5s, 1.5s, 0.5s, 8.5s
464 Fl(4) 15s 1.0	1s, 1s, 1s, 1s, 1s, 1s, 1s, 8s
465 Fl(4) 16s 0.5	0.5s, 1.5s, 0.5s, 1.5s, 0.5s, 1.5s, 0.5s, 9.5s
466 Fl(4) 20s 0.3	0.3s, 3s, 0.3s, 3s, 0.3s, 3s, 0.3s, 9.8s
467 Fl(4) 20s 0.5	0.5s, 1.5s, 0.5s, 1.5s, 0.5s, 1.5s, 0.5s, 13.5s
468 Fl(4) 20s 1.5	1.5s, 1.5s, 1.5s, 1.5s, 1.5s, 1.5s, 1.5s, 9.5s
469 Fl(4) 30s 0.5	0.5s, 0.5s, 0.5s, 0.5s, 0.5s, 0.5s, 0.5s, 26.5s
470 Fl(5) 20s 0.5 1.5	0.5s, 1.5s, [x 4], 0.5s, 11.5s
471 Fl(5) 20s 0.80	0.8s, 1.2s, [x 4], 0.8s, 11.2s
472 Fl(2+1) 6s 0.3	0.3s, 0.4s, 0.3s, 1.2s, 0.3s, 3.5s
473 Fl(2+1) 10s 0.5	0.5s, 0.7s, 0.5s, 2.1s, 0.5s, 5.7s
474 Fl(2+1) 12s 0.8	0.8s, 1.2s, 0.8s, 2.4s, 0.8s, 6s
475 Fl(2+1) 12s 1.0	1s, 1s, 1s, 4s, 1s, 4s
476 Fl(2+1) 15s 1.0	1s, 2s, 1s, 5s, 1s, 5s

VERY QUICK	DETAIL
500 VQ 0.5s 0.15	0.15s, 0.35s

VERY QUICK	DETAIL
501 VQ 0.5s 0.20	0.2s, 0.3s
502 VQ 0.6s 0.20	0.2s, 0.4s
503 VQ 0.6s 0.30	0.3s, 0.3s
504 VQ(2) 4s 0.20	0.2s, 1s, 0.2s, 2.6s
505 VQ(2) 8s 0.20	0.2s, 1s, 0.2s, 6.6s
506 VQ(3) 5s 0.15	0.15s, 0.35s, 0.15s, 0.35s, 0.15s, 3.85s
507 VQ(3) 5s 0.20	0.2s, 0.3s, 0.2s, 0.3s, 0.2s, 3.8s
508 VQ(3) 5s 0.3 0.2	0.3s, 0.2s, 0.3s, 0.2s, 0.3s, 3.7s
509 VQ(3) 5s 0.3 0.3	0.3s, 0.3s, 0.3s, 0.3s, 0.3s, 3.5s
510 VQ(3) 15s 0.10	0.1s, 0.5s, 0.1s, 0.5s, 0.1s, 13.7s
511 VQ(9) 10s 0.15	0.15s, 0.35s, [x 8], 0.15s, 5.85s
512 VQ(9) 10s 0.20	0.2s, 0.3s, [x 8], 0.2s, 5.8s
513 VQ(9) 10s 0.30	0.3s, 0.3s, [x 8], 0.3s, 4.9s
514 VQ(6)+LFl 10s 0.15	0.15s, 0.35s, [x 6], 2s, 5s
515 VQ(6)+LFl 10s 0.2	0.2s, 0.3s, [x 6]s, 2s, 5s
516 VQ(6)+LFl 10s 0.3	0.3s, 0.3s, [x 6], 2s, 4.4s

QUICK	DETAIL
600 Q 1s 0.2	0.2s, 0.8s
601 Q 1s 0.3	0.3s, 0.7s
602 Q 1s 0.4	0.4s, 0.6s
603 Q 1s 0.5	0.5s, 0.5s
604 Q 1s 0.8	0.8s, 0.2s
605 Q 1.2s 0.3	0.3s, 0.9s
606 Q 1.2s 0.5	0.5s, 0.7s
607 Q 1.2s 0.6	0.6s, 0.6s
608 Q(2) 5s 0.3	0.3s, 0.7s, 0.3s, 3.7s
609 Q(2) 5s 0.5	0.5s, 0.5s, 0.5s, 3.5s
610 Q(2) 6s 0.30	0.3s, 0.7s, 0.3s, 4.7s
611 Q(2) 6s 0.35	0.35s, 0.7s, 0.35s, 4.6s
612 Q(2) 10s 0.6	0.6s, 0.4s, 0.6s, 8.4s
613 Q(2) 15s 0.2	0.2s, 0.8s, 0.2s, 13.8s
614 Q(3) 5s 0.5	0.5s, 0.5s, 0.5s, 0.5s, 0.5s, 2.5s
615 Q(3) 6s 0.3	0.3s, 0.7s, 0.3s, 0.7s, 0.3s, 3.7s
616 Q(3) 10s 0.30	0.3s, 0.7s, 0.3s, 0.7s, 0.3s, 7.7s
617 Q(3) 10s 0.35	0.35s, 0.65s, 0.35s, 0.65s, 0.35s, 7.65s
618 Q(3) 10s 0.50	0.5s, 0.5s, 0.5s, 0.5s, 0.5s, 7.5s
619 Q(3) 10s 0.60	0.6s, 0.6s, 0.6s, 0.6s, 0.6s, 7s
620 Q(3) 30s 0.4	0.4s, 4.6s, 0.4s, 4.6s, 0.4s, 19.6s
621 Q(4) 6s 0.3	0.3s, 0.7s, 0.3s, 0.7s, 0.3s, 0.7s, 0.3s, 2.7s
622 Q(4) 6s 0.4	0.4s, 0.6s, 0.4s, 0.6s, 0.4s, 0.6s, 0.4s, 2.6s
623 Q(4) 10s 0.3	0.3s, 0.7s, 0.3s, 0.7s, 0.3s, 0.7s, 0.3s, 6.7s
624 Q(4) 12s 0.3	0.3s, 0.7s, 0.3s, 0.7s, 0.3s, 0.7s, 0.3s, 8.7s
625 Q(4) 15s 0.35	0.35s, 0.7s, 0.35s, 0.7s, 0.35s, 0.7s, 0.35s, 11.5s

QUICK	DETAIL
626 Q(4) 20s 0.5	0.5s, 0.5s, 0.5s, 0.5s, 0.5s, 0.5s, 0.5s, 16.5s
627 Q(9) 15s 0.3	0.3s, 0.7s, [x 8], 0.3s, 6.7s
628 Q(9) 15s 0.35	0.35s, 0.65s, [x 8], 0.35s, 6.65s
629 Q(9) 15s 0.6	0.6s, 0.6s, [x 8], 0.6s, 4.8s
630 Q(6)+LFl 15s 0.2	0.2s, 0.8s, [x 6], 2s, 7s
631 Q(6)+LFl 15s 0.3	0.3s, 0.7s, [x 6], 2s, 7s
632 Q(6)+LFl 15s 0.35	0.35s, 0.65s, [x 6], 1.05s, 7.95s
633 Q(6)+LFl 15s 0.6	0.6s, 0.6s, [x 6], 2s, 5.8s

LONG FLASH	DETAIL
700 LFl 5s 2.0	2s, 3s
701 LFl 6s 2.0	2s, 4s
702 LFl 8s 2.0	2s, 6s
703 LFl 8s 3.0	3s, 5s
704 LFl 10s 2.0	2s, 8s
705 LFl 10s 3.0	3s, 7s
706 LFl 10s 4.0	4s, 6s
707 LFl 12s 2.0	2s, 10s
708 LFl 15s 4.0	4s, 11s

MORSE	DETAIL
800 MO(A) 6s 0.3	0.3s, 0.6s, 1s, 4.1s
801 MO(A) 8s 0.4	0.4s, 0.6s, 2s, 5s
802 MO(A) 8s 0.8	0.8s, 1.2s, 2.4s, 3.6s
803 MO(A) 10s 0.5	0.5s, 0.5s, 1.5s, 7.5s
804 MO(A) 12s	1s, 1s, 3s, 7s
805 MO(A) 15s 0.5	0.5s, 1.5s, 2s, 11s
806 MO(B) 15s 1.5	1.5s, 0.5s, 0.5s, 0.5s, 0.5s, 0.5s, 0.5s, 10.5s
807 MO(D) 10s 5.0	5s, 1s, 1s, 1s, 1s, 1s
808 MO(N) 8s 5.0	5s, 1s, 1s, 1s
809 MO(U) 10s 0.2	0.2s, 0.8s, 0.2s, 0.8s, 0.6s, 7.4s
810 MO(U) 10s 0.3	0.3s, 0.7s, 0.3s, 0.7s, 0.9s, 7.1s
811 MO(U) 10s 0.4	0.4s, 0.6s, 0.4s, 0.6s, 1.2s, 6.8s
812 MO(U) 10s 0.5	0.5s, 0.5s, 0.5s, 0.5s, 1.5s, 6.5s
813 MO(U) 15s	0.4s, 0.5s, 0.4s, 0.5s, 1.2s, 12s
814 MO(U) 15s 0.45	0.45s, 0.45s, 0.45s, 0.45s, 1.35s, 11.85s
815 MO(U) 15s 0.50	0.5s, 0.5s, 0.5s, 0.5s, 1.5s, 11.5s
816 MO(U) 15s 0.55	0.55s, 0.35s, 0.55s, 0.35s, 1.45s, 11.75s
817 MO(U) 15s 0.60	0.6s, 0.3s, 0.6s, 0.3s, 1.4s, 11.8s
818 MO(U) 15s 0.7 0.5	0.7s, 0.5s, 0.7s, 0.5s, 1.9s, 10.7s
819 MO(U) 15s 0.7 0.7	0.7s, 0.7s, 0.7s, 0.7s, 2.1s, 10.1s
820 MO(U) 15s 0.75 0.15	0.75s, 0.15s, 0.75s, 0.15s, 1.65s, 11.55s
821 MO(U) 15s 0.75 0.45	0.75s, 0.45s, 0.75s, 0.45s, 2s, 10.6s
822 MO(U) 15s 1.15	1.15s, 0.75s, 1.15s, 0.75s, 3s, 8.2s

MORSE	DETAIL
823 MO(U) 15s 1.30	1.3s, 0.7s, 1.3s, 0.7s, 3.3s, 7.7s

SPECIAL	DETAIL
900 Fl 3s	0.45s, 2.55s
901 Fl 4s	0.55s, 3.45s
902 Fl 5s	0.55s, 4.45s
903 Fl 6s	0.65s, 5.35s
904 Fl 9s	0.65s, 8.35s
905 Fl 10s	0.65s, 9.35s
906 Fl 15s	0.6s, 14.4s
907 Fl (2) 8s	0.55s, 1.45s, 0.55s, 5.45s
908 Fl (2) 10s	0.65s, 1.35s, 0.65s, 7.35s
909 Fl (2) 12s	0.65s, 1.35s, 0.65s, 9.35s
910 Fl (2) 15s	0.65s, 1.35s, 0.65s, 12.35s
911 Fl (3) 10s	2 x (0.65s, 1.35s), 0.65s, 5.35s
912 Fl (3) 15s	2 x (0.65s, 1.35s), 0.65s, 10.35s
913 Fl (3) 18s	2 x (0.65s, 1.85s), 0.65s, 12.35s

SPECIAL	DETAIL
914 Fl (4) 10s	3 x (0.4s, 1.2s), 0.4s, 4.8s
915 LFl 10s	2.15s, 7.85s
916 MO (A) 5s	0.45s, 0.25s, 1.45s, 2.85s
917 Q 15s	1s, 14s
918 Fl (5) 30s	4 x (1s, 1s), 1s, 21s
919 Fl (5) 30s	4 x (1s, 1.5s), 1s, 19s
920 OC 3.5s	3.2s, 0.3s
921 OC 4s	2.4s, 1.6s
922 OC 4s	3.5s, 0.5s
923 MO (F) 4.2s	2 x (0.3s, 0.3s), 0.5s, 0.3s, 0.3s, 1.9s
924 MO (U) 20s	2 x (0.5s, 3s), 5s, 8s
925 Q 15s	0.5s, 14.5s
926 OC 15s	9s, 6s
927 LF1 (2) 12s	2s, 2s, 2s, 6s
928 Fl (04) 10s	4 x (1s, 1.5s)
929 Fl (04) 20s	3 x (1s, 1.5s), 1s, 11.5s

APPENDIX K VLB-5X BEACON PRODUCT CODES

Self Contained solar powered TVIR programmable LED beacon

VLB-5X LED Marine Beacon VLB-5X-c07-YY
VLB-5X LED Obstacle Light VLB-5X-OBc-YY
VLB-5X LED Wreck Light VLB-5X-WRECK-YY
VLB-5X LED FAA Light VLB-5X-FAA-YY

Options
- GPS Synchronisation add "-GS"
- Data port, Alarm/Monitor, and Sync Wire add "-DP/AL/SW"
- Charging Plug and Sync Wire (SS, LS and SAP model) add "CP/SW"

VPP-5X Solar Power Pack (with no optical head or solar regulator) VPP-5X-YY

Note: c is colour (G, R, W, Y, B), YY is size: SA (Standalone), SAP (Standalone used with VPP-5X), SS (Standard Solar), LS1 (Large Solar Single 12AH Battery), LS2 (Large Solar Two 12AH Battery)

Related Parts
- Replacement Battery Kit VLB-5X LCB Battery Kit
  (Kit includes LCB, EPDM O-rings, plug adaptor cable, battery retainers)
- Software Upgrade kit (kit includes USB, cable) VLB-67/5 LCB Software upgrade Kit
  only one kit required for multiple unit upgrades
- Battery Spare Part EBAT-LCB-12V-12AH
- Sync Signal Inverter Module 167-600
- Vega TVIR Programmer Remote-02