VLB-44X Marine LED Beacon
(With Extended I/O Option)

Product Manual

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1. Introduction to the VLB-44X Marine LED Beacon

1.1. Overview

The Vega VLB-44X LED beacon is an energy-efficient marine beacon that is available in a wide range of configurations. The number of tiers can range from 1 to 3, with each tier having a vertical divergence of 2.5, 5.0 or 10 degrees. An obstacle lens is also available, which has a vertical divergence greater than 10 degrees.

To accommodate different mounting arrangements the beacon can be pole-mounted or mounted on a horizontal surface.

Three LED colours available are red, green, white, yellow. The peak light intensity and power requirement is different for each colour and this needs to be taken into account when calculating for the power requirements for a particular beacon.

The beacons are designed to operate using a 12 VDC power supply and have a maximum voltage capability of 18 VDC. Reverse polarity protection is provided. The beacon is supplied with a 1.75m length of neoprene 3-core cable for the power and hard wire synchronizing connections. The size of wire is 1.5mm^2.

The beacon can optionally be supplied with a 1.75m length of 12-core cable containing additional I/O signals. These include the day/night, flash/fixed and on/off inputs that allow this beacon to be manually controlled when in "traffic light" mode. Also included are an alarm output RS232/485 Rx and Tx and an additional sync connection.

The VLB-44X has been designed with many features to allow the user to set up the required operation for a specific site. These features are programmable using the Vega infra-red programmer. This programmer is provided with the beacon and is also available separately. The beacon will be delivered with factory default settings. Details on how to reprogram the VLB-44X are provided in the Vega IR Programmer instruction manual.

While the VLB-44X beacon is capable of various ranges and can handle a multitude of flash characters, the power requirement must be able to be supported by the power supply connected to the beacon, especially where it is solar / battery powered. Increasing the range or the duty cycle of the beacon will require a larger solar panel and battery capacity. Information is provided in this manual on how to calculate the beacon power consumption. Vega or the local Vega Distributor can assist with the calculation if required.

The VLB-44X beacons are fitted with hard wire synchronization, which can be used to synchronize the flash character with other Vega beacons that are within wiring distance. GPS synchronization can be provided to allow synchronization with more remote beacons by fitting the optional VSU-29 GPS Synch Unit.

When using the optional VSU-29 GPS unit, ensure the power requirements of this device is included in any overall power calculation for the beacon.

To begin using the VLB-44X beacon the power will need to be connected, and the unit programmed for the flash character, effective intensity, and any other features required.

The VLB-44X beacon has a 10-year design life.

1.2. The initial power-up

Upon first powering-up the beacon will start in night mode. If the beacon is in the default sync-master mode then it will be operating with the programmed flash character.
- After 10 seconds the beacon will begin to monitor the ambient light level. If day is detected and the beacon is set for night-only operation then the beacon will be turned off.
- After 14 seconds the beacon will begin to monitor for the low battery threshold (factory setting 11 Volts). If the input voltage is below the threshold then the beacon will be turned off. The beacon will not return to normal operation again until the battery charges to above the high voltage reset voltage (factory setting 13.0 volts) and daylight is detected.

Note: If the beacon does not flash when power is connected.
- The power connection might be reversed. Check that the power connection is correct. The beacon is protected from damage for reverse-polarity connection.
- The beacon may be programmed for Storage Mode. Refer to the Vega IR Programming Manual on how to return the beacon to Operating Mode.
- The beacon might be set to sync-slave mode. Either provide an external hard-wire sync source or program the beacon to sync-master mode to enable it to operate.

- The beacon might be set to Traffic Light mode. Either apply the appropriate voltage to the On input or send the TVIR programming command to set the beacon into Normal mode, instead.

1.3. Infra-red programming

The infrared receiver for programming the beacon is located on the base of the beacon. For best results when programming direct the IR remote at this part of the beacon. Refer to the separate instruction manual for operating the Vega IR Programmer.

1.4. Automatic Schmidt Clausen/Modified Allard Correction

The VLB-44X beacon is programmed for the required effective intensity. This is the intensity needed to see a light that is continuously "on" at a certain distance. For example, 77 Candela is required to see a fixed on light at 5NM at a transmissivity of 0.74T. When a light is flashed the intensity must be increased to maintain the visibility of the light at the required distance. The VLB-44X automatically maintains the effective range of the light by increasing the intensity to compensate for shorter flash periods. This is done according to the Schmidt Clausen multiplier.

The desired Schmidt-Clausen multiplier is selectable according to which IALA Recommendation is preferred, E-200-4 2017 or 2008 (refer to the programming table in Appendix A).

1.5. VLB-44X Intensity Performance

The effective candela settings and the maximum candela capability for the different versions of the VLB-44X are provided in Appendix B. The beacon can only achieve the maximum peak candela value in the tables when flashing at a 30% duty cycle or less.

A beacon cannot output an intensity above its maximum peak candela capability. When programming a flash character the user should check that the peak candela needed for the required effective candela is below the maximum peak intensity of the beacon. If higher peak intensity is required than what the VLB-44X can produce then the beacon will not have the required range. Should this be the case the choice to achieve the desired range would be to:
- Increase the flash "on" period (select a different flash character) or
- Use a VLB-44X beacon with additional tiers.

1.6. Beacon On Override

The VLB-44X may be forced on by activating the On/Off input. This input is not capable of turning the beacon off. For example, if the beacon were configured in night only mode, setting the on/off input high during the day would cause the beacon to come on for as long as that input is held high. If the on/off input is low or open circuit (i.e. inactive) then the beacon will operate normally, sensing day/night and switching automatically in the normal way.

- On/Off input - if this input is high (≥7V) the beacon will turn on; if this input is open-circuit or low (<6V) then the beacon operates automatically according to its settings, sync input and day/night detection.
- Flash/Fixed & Day/Night inputs are inert.
- Refer also to the table in the next section.

1.7. Traffic Light Mode

The VLB-44X may be configured to run in "traffic light" mode using the TVIR programmer. Traffic light mode refers to a method of remotely-controlling the VLB-44X. This mode is available regardless of the optical variant of the VLB-44X.

When in traffic light mode the beacon is completely controlled by the three traffic light inputs as shown below:
- On/Off input - if this input is low or open circuit the beacon will turn off; if this input is high the beacon will turn on.
- Day/Night input - if this input is low or open circuit the beacon will use the programmed night time intensity; if this input is high the beacon will use the programmed day time intensity.
- Flash/Fixed input - if this input is low or open circuit the beacon will operate with a fixed flash character; if this input is high the beacon will operate with the programmed flash character.

This allows the VLB-44X to be controlled by an external controller so it may be used, for example, to direct shipping traffic.

Note – when operating in traffic light mode, the normal mode day/night switching based on the measured light level is inhibited.

This behaviour is summarized in the following table:

Input State			Beacon Operating Mode	
On/Off	Day/Night	Flash/Fixed	Traffic Light	Normal
Low or open	X	X	Off	X
High	Low or open	Low or open	Night intensity Fixed character	Override On*
High	Low or open	High	Night intensity Flash character	Override On*
High	High	Low or open	Day intensity Fixed character	Override On*
High	High	High	Day intensity Flash character	Override On*

X = no effect.
* When override is on, the intensity and flash character will depend on the programmed settings and ambient light level.

2.   Getting Started

From knowing the flash character, colour, and range required (effective candela)

  i.   Determine the number of tiers required and the power requirement (Appendix D)
 ii.   Connect power to the VLB-44X and any I/O signals that are required.
iii.   Program the beacon for the required flash character, effective candela, and other features (Section 3 and Appendices A & B.)
 iv.   Install the VLB-44X beacon (Section 4 and 5)
  v.   Set synchronization options (Section 6)
 vi.   Check that the beacon is working (Section 7)
vii.   Routine maintenance and inspection (Section 7)

3. TVIR Remote02 Programming Procedures & Options

For detailed programming instructions refer to Appendix A. The programming codes for the effective intensity settings of the VLB-44X beacon are provided in the performance tables of Appendix B of this manual.

During programming the VLB-44X beacon will flash each time a button is 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.

3.1. Programming overview

3.1.1. Introduction

Red standby key, used to enter programming

IMPORTANT

Before attempting to use the Programmer for the first time, please pull the insulating strip of plastic 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.

The TVIR Programmer allows the user to program a wide range of Vega LED Aids to Navigation products.

The VLB-44X beacon is shipped from Vega with default settings. The Vega Remote02 TVIR Programmer allows the user to set up the product for a particular application and to interrogate the product to find out what settings are already programmed. Most of the features of the VLB-44X beacon are the same as found in other Vega LED products.

Numeric key pad, used to configure the programmable features of the beacon.

To use the programmer you will need to consult Appendices A & B obtain the codes for setting the intensity of the beacon and other features.

3.1.2. Programming Syntax

All programming of the VLB-44X uses a syntax of:

OPERATION_FEATURE_VALUE

There are five OPERATION items

- Programming settings   Operation 1
- Creating a Custom Character   Operation 2
- System Checks   Operation 3
- Special settings   Operation 7
- Read settings   Operation 9

The FEATURE items represent the features of the beacon such as flash character and intensity. A feature parameter must always be entered after an operation parameter.

The VALUES are the actual settings or value of the various features. A value parameter is either entered or read back, depending on the operation and feature combination selected.

The valid combinations of operation, feature and value are listed in Appendix A.
The valid beacon intensity settings can be found in Appendix B for the relevant beacon model.

Please take the time to familiarise yourself with the tables in Appendices A & B before continuing.

3.1.3. Visual feedback

The VLB-44X 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 that the beacon will be programmed correctly.

Programmer Keys	Beacon response
Enter Programming Mode By pressing red standby key for 5 seconds	4 quick flashes (0.1sec on 0.1sec off)
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 beacon will remain in programming mode waiting for a new programming instruction.
Exiting Programming mode **No programming activity for 10 Seconds**	The beacon will give two quick flashes followed by a short pause followed by another two quick flashes. After this it will resume normal operation. The beacon will flash its character for 16 seconds while it checks the day/night settings. If it is day time and the beacon is set to operate at night only the beacon will turn off.

3.1.4. Troubleshooting TVIR Programming

If you find that the beacon will not enter the programming mode it will be caused by one of 4 reasons (ensure first that the Remote02 TVIR programmer is pointed directly at the light sensor window on the base of the VLB-44X):

- If there is no response to the Remote02 then the battery in the IR Programmer could be missing, or the plastic battery insulator might not have been removed, or the battery might have a low voltage.

- If there is no response to the Remote02 and the beacon is not operating then there might be no 12VDC supply connected to the beacon.

- If there is no response to the Remote02 then the beacon might have been set to storage mode, in which case it will initially be very slow to respond to the Remote02 request to enter programming mode.

- If the beacon responds and enters programming mode but rejects (triple-flash) any programming operations then the beacon needs a security PIN to allow programming.

3.1.5. Remote02 TVIR Programming Tutorial

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

3.1.5.1 Enter and Exit Program mode

1. **Enter program mode**

Press the red standby button for 5 seconds	The beacon will give 4 quick flashes to indicate it has entered programming mode
2. Exit program mode	
Leave the programmer idle for 10 seconds	The beacon will give two quick flashes followed by a short pause followed by another two quick flashes.
	After this it will resume normal operation. The beacon will flash its character for 16 seconds while it checks the day/night settings. If it is day time and the beacon is set to operate at night only the beacon will turn off.

3.1.5.2 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 ?, "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   1-0-602

(The '-' character in the above sequence is inserted only to provide clarity for the reader and has no meaning in the programming input sequence.)

0. Enter programming mode	
Press the red standby button for 5 seconds	The beacon will give 4 quick flashes to indicate it has entered programming mode
2. Enter the programming sequence for the flash character (10602)	The beacon will flash once each time a key on the programmer is operated.
	When the sequence is completed and accepted the beacon 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
1. Exit programming mode	
Leave the programmer idle for 10 seconds	The beacon will give two quick flashes followed by a short pause followed by another two quick flashes.
	After this it will resume normal operation. The beacon will flash its character for 16 seconds while it checks the day/night settings. If it is day time and the beacon is set to operate at night only the beacon will turn off.

3.1.5.3 Create a programming error by attempting to enter an invalid Operation Mode code 003

Determine the programming Syntax from Appendix A for the setting:

Operation = Programming = 1
Feature = Operation Mode = 5
Value = Code = 002

Note: The programming sequence to enter this Operation Mode is 1-5-002.

1. Enter programming mode	
Press the red standby button for 5 seconds	The beacon will give 4 quick flashes to indicate it has entered programming mode
2. Enter the programming sequence for the Operation Mode (15002)	The beacon 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.
3. Exit programming mode Leave the programmer idle for 10 seconds	The beacon will give two quick flashes followed by a short pause followed by another two quick flashes.
	After this it will resume normal operation. The beacon will flash its character for 16 seconds while it checks the day/night settings. If it is day time and the beacon is set to operate at night only the beacon will turn off.

3.1.5.4 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 3-1

1. Enter programming mode Press the red standby button for 5 seconds	The beacon will give 4 quick flashes to indicate it has entered programming mode
2. Enter the programming sequence for the information (31)	The beacon will flash once each time a key on the programmer is operated.
	When the sequence is completed and accepted the beacon will provide the voltage level in a series of flashes. 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 beacon will give two quick flashes followed by a short pause followed by another two quick flashes.
	After this it will resume normal operation. The beacon will flash its character for 16 to 20 seconds while it checks the day/night settings. If it is day time and the beacon is set to operate at night only the beacon will turn off.

3.1.5.5 Programming or Reading Multiple Settings

Each feature can be programmed one at a time as done in the examples above, however it can be extremely time consuming to enter multiple settings in this manner. Alternatively, and more conveniently, various settings can be programmed sequentially in the same programming session. Once the beacon has accepted a program sequence and has flashed back the value code, the next program sequence can be entered. If you delay more than 10 seconds after the confirmation flashes before entering the next program sequence the beacon will exit the program mode. One way to hold the beacon in programming mode is to press the Standby (red) button on the Remote02 periodically.

3.2.   Programming Features

3.2.1. Flash character

(Factory set default 1-0-100 <ISO 2s (1.0s on 1.0s off)>)

Vega beacons 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 a customer uses a set of flash characters which are not included in the standard set these can be included if advised at time of ordering the beacons. These would then be available for programming under type 9YY (Special characters).

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

3.2.2. Custom Flash Character

Vega beacons allow the user to create one custom character. When programmed the flash character code for the custom character is 999. To program the non-standard character the details of the on and off periods of the flash character have to be entered into the beacon.

The method of 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	= The custom codes for the character	

These custom codes are 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 three digit code for a 1 second on or off period would be 020 (20 multiplied by 0.05 seconds is 1 second). Each code must comprise exactly three digits so leading zeroes must be included.

The following restrictions apply:

- The minimum on or off period that can be programmed is 0.1 second or the code of 002.

- The maximum on or off period that can be programmed in one code 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 to let the beacon know that the programming sequence is finished = 000

For assistance Appendix G provides a work sheet, and an example, for programming a Custom Character. It is best to prepare the character code sequence and write it down ready for programming. If an error occurs when entering a custom character the beacon will flash the error code of 3 quick flashes. If there is an error detected then the custom character programming must be restarted from the beginning (it can be restarted within the same programming session).

Please note: Programming a custom character creates a flash character with code 999. To get the beacon to use the custom character the value of 999 must be entered as the flash character for the beacon: 1-0-999.

3.2.3. Day / Night control

(Factory set default 1-4-005 <night only, 75Lux sunset, 175Lux sunrise>)

The user has the ability to program when the beacon will recognize sunset and sunrise from a choice of nine available settings. The daylight sensor is located on the base of the beacon. The beacon can be set for night-only operation or for both day and night (24 hour) operation. The default setting when the beacon is shipped from the factory is to operate at night only.

To program the selected lux setting:

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

How the beacon operates is controlled by the first digit of the Day/Night Control value.

- 0YY   enables night-only operation

- 1YY   enables day and night operation

When the beacon changes from day to night operation is determined by the last two digits of the Day/Night Control Value. The lux level of each of the 9 settings is detailed in Appendix A. The default setting is YY=05 which is the IALA suggested setting. The accuracy of the light sensor is ±10%.

The Day/Night transition can be synchronised between multiple beacons when the sync wires of the beacons are connected. This synchronization scheme overcomes the difference in the accuracy of the light sensor in each beacon or their slightly different location. The synchronization works as follows for beacons that are sync masters:

- The first beacon to see night sets all beacons to night mode.
- The last beacon to see day sets all beacons to day mode.

If the beacons are set to night-only mode then day mode is equivalent to off. If the beacons are set to day/night mode then day mode is equivalent to on at the day intensity. Night mode is always equivalent to on at the night intensity.

If some beacons are set to sync slave mode then these beacons do not participate in the collective day/night detection. Sync slaves only obey the external sync signal. For example, if a sync slave is set to night only then it will only illuminate when it receives a night sync signal. The absence of a night sync signal means that the sync-slaved beacon will turn off after a user-preset number of flash periods. A sync-slave beacon that is set to day/night mode will switch between day and night only according to the sync information that it receives via its hard-wire sync connection.

3.2.4. Effective intensity

(Factory default is Maximum for both day and night, 1-1-999999, 1-1-999999)
The VLB-44X is able to have a different intensity setting for each of day and night operation. If the beacon has been programmed for night operation only the beacon will be off during the day, irrespective of the day intensity setting. All intensity settings are available (in 1 Cd steps) between the minimum and maximum intensity settings shown in the relevant performance table in Appendix B.

It should be noted that it is the effective intensity of the beacon that is programmed. The peak intensity is controlled automatically according to the flash character (Schmidt-Clausen correction) in order to maintain the effective intensity for a flashing beacon.

Six digits are required to set the intensity, including leading zeroes. This is because the VLB-44X has an extremely wide intensity range across all models. The six-digit code will often be displayed with a middle space – this is for clarity only and has no meaning during the programming procedure.

Some intensity VALUES that will have special effect
- 000 001 Will set the minimum legal intensity value (this value is never 1 Cd).
- 999 999 Will set the maximum programmable intensity.

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

The Schmidt-Clausen flash compensation formula can be adjusted by the user according to the desired IALA Recommendation. IALA E-200-4 2017 defines the Modified Allard parameter a (which for rectangular flash characters is analogous to the Schmidt-Clausen parameter c) to be 0.1s for all signal colours except blue at night. The VLB-44X adopts this setting for effective intensity by default. This setting can be changed to the previous value under E-200-4 2008 of c = 0.2s, if desired, as follows:

Operation	= Special	= 7
Feature	= Set PIN	= 2 (for Set, or 3 for Read)
Value		= XXX

Where:
- 000 (default): Sets the E-200-4 2017 flash compensation value;
- 002: Sets the E-200-4 2008 flash compensation value.

The flash compensation value is used by the VLB-44X both during day and night operation. The blue models' flash compensation value is always 0.2, regardless of the user's setting.

3.2.5. Beacon synchronization

(Factory settings:
1-3-000 <sync-master with zero time delay>;

1-7-001 <Normal sync operation with 1 continued flash cycle after loss of sync if a slave>)

Hard wire synchronization is standard for the VLB-44X beacon.

Programming options allow the beacon to be set as a sync-master or as a sync-slave. The start of the flash character can be delayed from 0 to 9.9 seconds.

Further, detailed information on how the synchronization operates are detailed in Sections 3.2.3 and 6.

Some VALUES for the Synchronisation command (1-3-) that will have special effect:

- 999   Disable synchronization – the hardwire sync will be inoperative for both send and receive. The beacon must be in sync-master mode when this feature is enabled, otherwise it will never turn on.

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

The first digit of the Value determines if the beacon is a master or slave unit. Master is the usual setting and is essential for a beacon that is not connected to any source of sync. If a GPS source is used, such as a VSU-29 then the beacon must also be set as a sync master since the GPS source cannot make day/night decisions and the beacon must be enabled to do so.

- 0YY   Master

- 1YY   Slave

The second two digits of the value YY allows for the start of the flash character to be delayed from 0.0 seconds to 9.9 seconds in 0.1 second increments. For example, YY=25 would provide a delay of 2.5 seconds. This feature allows behaviours such as a string of beacons to create a runway flash sequence, or to allow two beacons to generate alternating flashes.

To program a slave beacon to keep running for a number of flash cycles after the loss of a master sync pulse:
Operation   = Program (or read)   = 1 (or 9)
Feature   = Slave mode flash count   = 7
Value   = 0YY where YY is the number of flashes (min 001, max 099)

The VLB-44X beacon has additional sync functions to allow the beacon to be used for specific applications such as a standby beacon. These features are also accessible in the Slave mode flash count feature.
- **Force off on sync low**: The ability to turn the VLB-44X off when the sync wire is grounded. All other sync features operate when the sync wire is not grounded (Value 998)
- **Force fixed character on sync low**: The ability to set the VLB-44X into FIXED character. All other sync features are disabled (including generating sync pulses).
- **Cancel special sync feature**: Value 999 in feature 7 resets the above special sync modes and returns the beacon back to normal sync operation (master or slave depending on the Synchronisation feature's setting).

3.2.6. Operation mode

(Factory setting 1-5-001 <normal operation>)
The VLB-44X beacon can be set to one of three operating modes.
- "Test Alarm" (007), this temporary mode sets the alarm output to active until the beacon exits the TVIR programming mode. This Test Alarm mode is temporary and does not change the last selected operating mode.
- "Storage Mode" (009), this forces the beacon into a very low power drain state and will remain out of operation until the beacon has been reprogrammed for normal operation.
- "Normal Operation Mode" (001). The beacon has to be programmed to this mode to recover from the storage mode. This mode puts the beacon into automatic operation according to its programmed settings and the ambient light level.
- "Traffic Light Mode" (003). In this mode the beacon is remotely controllable. Its operation depends on the states of the three external inputs, internal settings and sync wire.

An example of setting or reading the operation mode of a beacon:
Operation   = Program (or read)   = 1 (or 9)
Feature   = Operation Mode   = 5

| Value | | = 001 is normal operation mode |

Note - it is not possible to switch directly from Traffic Light mode to Storage mode. It is first necessary to switch to Normal mode from Traffic Light mode and then the beacon may be switched to Storage mode. It is however possible to switch from storage mode into any other mode – including traffic light mode.

3.2.7. Programming mode

(Factory setting 1-6-006 <Enable RS232, no monitoring>)
This mode controls the state of the RS232 port:
- Disable RS232 (000);
- Enable RS232 with monitoring on-demand (004): Input commands are received and processed; a monitoring data packet is output if a '/' character is received at the input.
- Enable RS232 with monitoring free-running (005): Input commands are received and processed; monitoring data is output continuously.
- Enable RS232, no monitoring (006): Input commands are received and processed. This is the default.

To set or read the programming mode:
Operation	= Program (or read)	= 1 (or 9)
Feature	= Operation Mode	= 6
Value		= XXX

3.2.8. Battery Thresholds

(Factory default low threshold default 1-8-110 <11.0 Volts>;
Factory default high threshold default 1-9-128<12.8 Volts)

The VLB-44X beacon monitors the power supply for low voltage and will switch off when the programmed low threshold is reached. This feature can be disabled if not required by setting value 000. Normal operation will resume once a daylight transition is detected and the voltage reading exceeds the high threshold setting. When normal operation is restored after a low voltage condition, the beacon switches on for ten seconds before making a determination of day or night.

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

The value range for the Low Threshold is 000 to 119 (i.e. 00.0 to 11.9V). 999 disables the Low voltage check.
The value range for the High Threshold is 121 to 998 (12.1V to 99.8V). 999 sets the default setting of 12.8V.

Note: Take care in setting the high threshold to ensure that the charge voltage of an ageing battery will reach this threshold during charging. If the threshold set too high, the beacon might not resume operation after a low voltage threshold shutdown.

Note: The high voltage threshold shutdown can be manually bypassed by either disconnecting and reconnecting the battery or by putting the beacon into programming mode while the battery voltage is greater than the low voltage threshold value.

3.2.9. System Checks

Vega LED beacons contain details of their manufacture including calibration/characterisation details, firmware version, and LED type used. This information is useful should there either be a problem with the beacon or where it is necessary to locate the correct manual for the product.

To perform a system check:
| Operation | = Read Only | = 3 |
| Feature | | = X |

Use the System Check options to access:
- Software version (0);
- Battery voltage (1);

- Beacon internal temperature (2);
- Factory current adjustment (3);
- Serial number (4);
- LED type (5);
- Calibration/Characterisation (6);
- Aux Driver to Primary Driver Current Ratio (9).

3.2.10. PIN Code Option

(Factory setting 000 <no PIN code>)

If the user is concerned about unauthorized programming of the beacon then a 3-digit PIN code can be set. Once a PIN is set, programmed settings can be read back but cannot be set unless a PIN is first entered. Make sure that the PIN code is recorded, as programming access will not be possible without the PIN once this option has been set.

<u>For setting a Security PIN</u>
Enter programming mode by operating the standby button for 5 seconds.

Operation	= Special	= 7
Feature	= Set PIN	= 1
Value	= PIN Code	= XXX (Value 000 will disable the need for a PIN.

The beacon will then flash back the three numbers in a series of flashes.

If a PIN is already set and it is desirable to change it then the old PIN must first be entered, as below, before the new one is programmed, as above.

<u>To change settings when a Security PIN is used.</u>
Enter programming mode by operating the standby button for 5 seconds.

Operation	= Special	= 7
Feature	= Enter PIN	= 7
Value	= PIN Code	= XXX (the currently valid PIN code stored in the beacon)

If the PIN is correct then the beacon will flash back the number using a series of flashes. If the PIN is incorrect then the beacon will flash back the triple-flash error code.

If a correct PIN is entered and accepted in programming mode then the user will have full access to change any beacon settings while the current programming session is active.

If the PIN number is lost then please contact Vega for assistance.

4. Installing the VLB-44X Beacon

4.1. The Mounting Structure

Any movement of the mounting structure will affect how the intended user will see the beacon. The amount of sway that can occur needs to be limited to ensure that the beacon will remain visible. This includes the sway on a fixed structure and the degree of roll on a buoy. The vertical divergence of the beacon is the point where the intensity is at 50% of the peak intensity. For example, the VLB-44X-10D has 50% of the peak intensity 5° above and below the focal plane of the beacon. At twice the vertical divergence (±10°) the intensity will be approximately 10% of the peak intensity. Narrowing the vertical divergence of the beacon increases the intensity of the light produced and increases the range for a fixed power consumption.

- The VLB-44X-2.5D (±1.25°) has been designed for rigid, fixed structures
- The VLB-44X-5D (±2.5°) has been designed primarily for use on fixed structures, and can also be used on a stable floating buoy where the vertical divergence limits are acceptable for the expected heeling angles.
- The VLB-44X-10D (±5°) has been designed primarily for use on a floating buoy.

4.2. Mounting

The VLB-44X beacon should be carefully levelled to ensure that the focal plane of the beacon is horizontal. The focal plane of the beacon is parallel with the base. This levelling can be done by placing a builder's level across the mounting surface of the structure, then moving the level 90 degrees to check 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 fixing the beacon.

An alternative option is to use a levelling mechanism, such as adjustable rods to level the base of the beacon.

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

4.2.1. Base Mounting

The VLB-44X supports both 3- and 4-hole base mounting.

The holes on the base are Ø14mm in diameter and located on a 200mm PCD. The beacon can be secured using M12 (or 1/2" UNC) 316-grade stainless steel bolts or threaded rod.

Plastic isolation bushes have been fitted in the mounting holes to prevent bi-metallic corrosion occurring. Please ensure that these bushes remain in place and that the mounting bolts are **not over-tightened** as this may cause the base to make contact with the mounting surface and defeat the purpose for having the bushes fitted.

The beacon can be levelled using adjustable rods. Fit the mounting rods firmly in place on the mounting surface; place one nut and washer on each stud. Slip the beacon (with corrosion isolation bushes in place) over the studs, and adjust the nuts by hand until the beacon is level. Then add the top washers and locking nuts and tighten.

A	M12 Stainless Steel Stud
B	Locking Nut
C	Stainless Flat Washer (2)
D	Plastic Bush (2)
E	Beacon Base
F	Plain Nut
G	Mounting Base plate
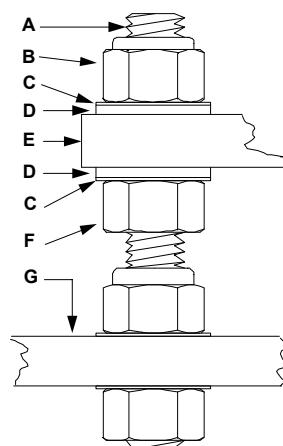
4.2.2. Central Pole Mounting

The Ø88mm hole through the centre of the VLB-44X beacon provides an alternative mounting option.

A	Secure Head Fastener
B	Top view of fastener
C	Aluminium tube
D	Base Mounting Plate with Taper-Lock collar.
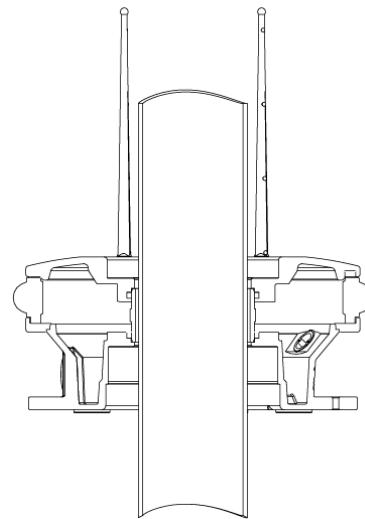
4.3.   Bird Spikes

The beacon is supplied with four plastic bird spikes. To install the bird spikes simply screw them by hand into the threaded holes in the beacons lid.

Screw bird spikes in firmly
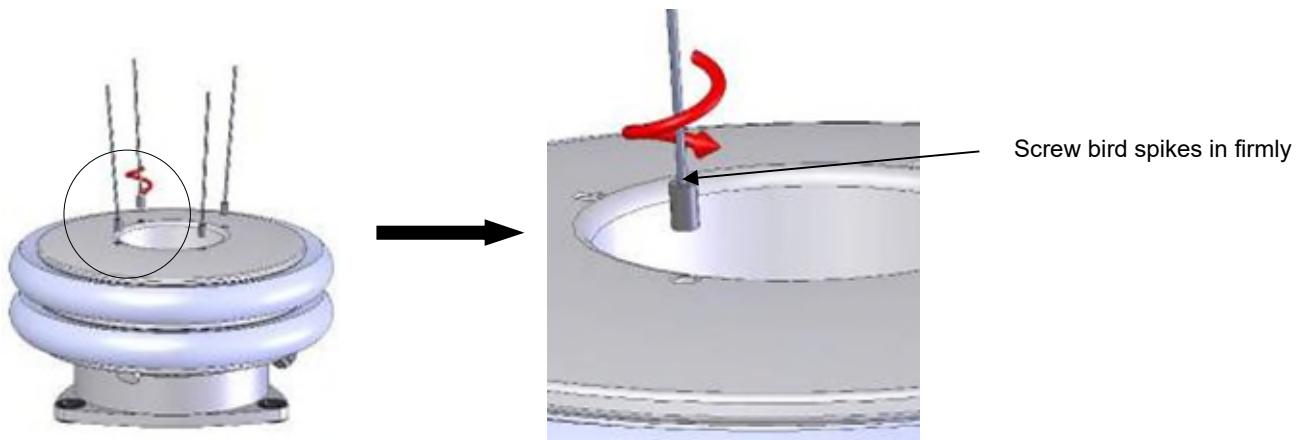
4.4.   Mounting the VSU-29 Pulse Sync unit

The internal diameter of the centre hole allows for the fitting of the VSU-29 GPS Sync Unit and mounting ring.

Alternatively, the VSU-29 can be separately mounted.

Refer to the VSU-29 GPS Sync Unit manual for mounting instructions

5. Power Supply & I/O Connections

5.1. Power Supply Requirements

Supply voltage is nominally 12 VDC, with an operating range of 9.0 – 18.0 VDC. Normal operating voltage should not exceed 18.0V. Reverse polarity and internal transient voltage protection are provided.

A low and high voltage threshold is programmable and the beacon will switch off if the low threshold is reached. This feature is provided to prevent the total discharge of a battery if it is being used as the power source. The default low voltage threshold is 11 Volts. Refer to section 3.4 for details.

Where possible do not earth any of the supply wiring such as the battery negative. This precaution may avoid setting up additional electrical current paths that could cause metallic corrosion.

5.2. Power Supply Connection

Colour	Voltage	Polarity
Black (+)	+12 Volts	Battery positive
Black (-)	0 Volts	Battery negative
Black (SYNC)	Sync	If required

The VLB-44X is supplied with a 2 metre length of neoprene 3-core 2.5mm^2 cable already sealed into the cable gland. If there is a need to shorten the power cable, ensure that the cable is resealed using heat shrink and marine sealant at the cut to prevent any moisture being able to enter the beacon.

5.3. Beacon Input / Output

The VLB-44X Extended I/O model is supplied with a 2m length of 12-core cable sealed into a cable gland on the beacon housing. This cable contains these I/O signals:

Colour	Signal	Description
Grey	Do not connect	Do not connect to this wire.
Black & Blue	Signal Ground	Use only as signal ground, not power ground. May be connected to power ground at the power supply. Max current 100mA.
Pink	n/c	
Green	Sync input/output	Hard wired sync line – see synchronization section below
White	Alarm output	Normal operation=open; Fail condition=closed to Signal Ground.
Red/Blue	Beacon On Out	Beacon On = Active Low output; Beacon off = high impedance
Yellow	RS232 Tx	RS232 Transmit output
Grey/Pink	Flash/Fixed input	Low / open circuit = fixed character. High = flash character. On threshold >= 7VDC.
Purple	RS232 Rx	RS232 Receive input
Red	Day/Night input	Low / open circuit = night. High = day. On threshold >= 7VDC.
Brown	On/Off input	Low / open circuit = off. High = on. On threshold >= 7VDC.

See Appendix G Beacon Specifications for I/O hardware specs.

The Day/Night input is only active in traffic light mode. If this input is low or open circuit the beacon will use the programmed night time intensity; if this input is high the beacon will use the programmed day time intensity.

The Flash/Fixed input is also only active in traffic light mode. If this input is low or open circuit the beacon will operate with a fixed character; if this input is high the beacon will operate with the programmed flash character.

The On/Off input is active in traffic light and normal modes. In traffic light mode if this input is low or open circuit the beacon will turn off; if this input is high the beacon will turn on. In normal mode setting if this input is high it will turn the beacon on if it is not already on. If the beacon is already on, changing this input will keep the beacon on. When this input is low or open circuit in normal mode, the beacon operates normally, switching on and off based on the light sensor readings.

5.4. Digital I/O Connection to VegaAIS

The following connection table provides both VLB-44X I/O and serial interface monitoring inputs to the VegaAIS.

VLB-44X Data Port Cable		AIS Beacon Cable	
Signal	**Colour**	**Colour**	**Signal**
Do not connect	Grey	-	-
Signal Ground	Black & Blue	Black	Beacon -ve
n/c	Pink	-	-
Sync input/output	Green	Green	Sync
Alarm output	White	White	Light OK/Fail
Beacon On Out	Cyan	Grey	Light On/Off
RS232 Tx	Yellow	Violet	RX/A
Flash/Fixed input	Orange	-	-
RS232 Rx	Purple	Yellow	TX/B
Day/Night input	Red	-	-
On/Off input	Brown	-	-

If it is desirable to control the beacon's on/off state from a VegaAIS Type 3 then the AIS Beacon Enable Contacts can be connected to enable the VLB-44X in either of two arrangements:

- Connect one of the Beacon Enable contacts to the VLB-44X beacon +ve supply and the other Beacon Enable contact to the VLB-44X On/Off Input. When the VegaAIS beacon control output is active the VLB-44X will turn on. This method can be used in standard or traffic light operating modes, or;
- Connect one of the Beacon Enable contacts to VLB-44X Signal Ground and connect the other Beacon Enable contact to the sync input of the VLB-44X. Program the VLB-44X beacon for off-on-sync-low operation. The VegaAIS beacon control output will then activate the beacon when the output is open-circuit (i.e. inactive). Therefore, the VegaAIS might need to be programmed so that its beacon control output is inverted.

6. Synchronization with Other Beacons

Note – Synchronization is disabled when in traffic light mode.

6.1. Hard-wire synchronization option

The VLB-44X beacon comes with a sync wire to allow synchronizing with other beacons that are within a reasonable wiring distance. For convenience the sync wire is present in both the power and the I/O cables. When using one of the sync connections leave the other unconnected.

When synchronizing, the start of the flash character can be delayed between 0 and 9.9 seconds after the sync pulse. Refer to Appendix A for further details. The day/night transition will be synchronized and occur within 20 seconds for all of the beacons that are connected together with the sync wire.

Using hard-wire synchronizing will not increase the power requirement of the beacon.

6.2. External GPS synchronization option

The VLB-44X beacon can operate with an external GPS sync pulse unit (VSU-29) and will allow the beacon to synchronize with other beacons being controlled by a GPS sync pulse. The negative sync signal from the VSU-29 should be connected to the sync wire of the beacon. Refer to the VSU-29 product manual for details of installation and connection.

On synchronization the start of the flash character can be delayed between 0 and 9.9 seconds from the time the sync signal from the VSU-29 is received. Refer Appendix A for further details.

The VSU-29 GPS sync unit has two mounting options. The unit can be mounted in the centre hole of the beacon or can be mounted separate from the beacon. The mounting arrangement must be defined when ordering the VSU-29 unit.

It is necessary to take into account the power consumption of the VSU-29 GPS Sync Pulse Unit in any power load calculations for the beacon installation. The GPS sync unit runs continuously whether or not the VLB-44X is operating. The VSU-29 updates its clock periodically as programmed by the user (factory setting is every 30 minutes). The update takes approximately 2 minutes. The highest power usage is when the VSU-29 is updating the clock. Increasing the period between updates will reduce the overall power requirements. Refer to the VSU-29 manual for details on how to calculate the power requirements.

7.   Serial Interface

The VLB-44X RS232 serial interface accepts commands and queries as well as generating monitoring data. The default state of the serial interface is active (115200 baud, 8N1) and receiving commands and queries with monitoring output deactivated.

7.1.   Monitoring Output

The monitoring output can be delivered in a variety of ways:
- On-demand sends one or two data tags on receipt of a '/' character;
- Free-running sends a regular stream of tags at a rate dependent on the state of the beacon (see below);
- AIS mode sends a burst of tags once every minute following a preamble sequence.

When the beacon is active (i.e. the light is on or flashing), the monitoring data is sent in bursts of a few tags at typically one second intervals. When the beacon is inactive, e.g. in an alarm state or off during the day, or off in traffic light mode then the entire monitoring stream tag set is sent at four second intervals.

The monitoring output stream comprises this information:
- <BAT>[Integer voltage value in tens of millivolts]/, e.g. <BAT>1330/ means 13.30V.
- <LIT>[Integer, normalized daylight level]/, high values around 2000 mean very bright and low values around 30 mean very dark.
- <TMP>[Integer temperature in deciKelvin]/, e.g. <TMP>3003/ means 300.3°K or (300.3-273.15)=27.15°C.
- <GUD>[Binary value]/, 1 = no alarm, 0 = alarm.
- <AON>[Binary value]/, 1 = beacon light is on, 0 = beacon light is off.
- <DAY>[Binary value]/, 1 = day detected, 0 = night detected.
- <TYV>8/, Unique identifier for the VLB-44X model.
- <TYP>VLB-44X/, unique, human-friendly identifier for the VLB-44X model.
- <TLS>[Integer traffic light state]/, is only output in traffic light mode. See the following table for decoding this status.

When in traffic light mode, the VLB-44X outputs the TLS tag, which information describes the state of the beacon as follows:

Bit 2	Bit 1	Bit 0
On (value 4)	Day (value 2)	Flashing (value 1)

Here are some examples:

Example	ON (4)	DAY (2)	FLASHING (1)	Total
Beacon on, day mode and flashing	Yes	Yes	Yes	7
Beacon on, day mode and fixed	Yes	Yes	No	6
Beacon on, night mode and flashing	Yes	No	Yes	5
Beacon on, night mode and fixed	Yes	No	No	4
Beacon off (other states don't matter)	Yes	X	X	0, 1, 2 or 3

7.2.   Command and Query Input

The VLB-44X accepts a large number of commands and queries. The commands are provided for convenient setting of standard features.

A list of commands and their syntax is provided in Appendix J. Commands will only be accepted when the beacon is active. i.e. when the light is flashing. Please only enter those commands listed in Appendix J.

Command syntax involves an XML-style tag followed by a parameter or query symbol ('?') and a terminating slash character '/'. Whitespace should not be used inside this sequence and it is ignored outside this sequence.

e.g. the query <VER>?/ returns the string <VER>408/
An unrecognized command or query returns no response.

Most commands only have an effect on the beacon when followed by a restart. A restart can be initiated by any of these methods:

- Sending command <RST>1/ ;
- Exiting TVIR programming mode;
- Cycling the beacon power;

A string of any number of queries and/or commands can be entered, followed by a <RST>1/ command which will then restart the beacon with all of the changes created by the list of commands.

8. Routine Maintenance

8.1. Maintenance cleaning

This LED beacon requires little to no maintenance other than the occasional cleaning with warm soapy water. Rinse off with clean water. Do not use any solvent-based cleaner.

If the beacon is solar powered, panels should be inspected and cleaned occasionally to ensure maximum solar energy capture. Battery capacity should also be monitored.

8.1.1. Inspection check

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

The beacon can be tested by programming the "test" mode or if daytime covering the daylight sensor briefly to simulate night time operation. When the beacon is flashing check it is displaying the correct flash character. Remember to remove any daylight sensor cover before leaving the site.

The beacon must be properly monitored and maintained to ensure its continuous functioning. A non-working AtoN may result in severe consequences up to loss of life at seas.

User Notes

Appendix A   VLB-44X TVIR Programming Syntax Table

For most TVIR commands in the following table, the corresponding serial interface command or related serial commands are shown in `Courier New` font. All serial interface commands can accept a question mark, '?' as a parameter and will return the current settings after the receipt of the trailing forward slash '/'. (Parameter 'B' in various commands represents a binary value, '0' or '1'.) Commands require a beacon restart ('`<RST>1/`') before they will affect beacon operation.

Operation	Feature	Value
1 = Program Mode 9 = Read Settings	0 = Flash Character `<FID>XYY/`	000 – Fixed character 1YY – Iso phase (ISO) 2YY – Occulting (OC) 3YY – Flash (FI) 4YY - Multiple Flash (FI(x)) 5YY - Very Quick (VQ) 6YY - Quick (Q) 7YY – Long (LF) 8YY – Morse (MO) 9YY – Custom (CCG Codes)
	1 = Night Effective Intensity `<NRG>XXXXXX/`	YYYYYY (Six-digit intensity value) Refer to Appendix B for the specific beacon. Includes automatic Schmidt Clausen correction
	2 = Day Effective Intensity `<DRG>XXXXXX/`	YYYYYY (Six-digit intensity value) Refer to Appendix B for the specific beacon. Includes automatic Schmidt Clausen correction

	3 = Synchronisation
	
	`<OSO>B/`
	`<SYD>YY/`
	`<SDA>B/`
		999 – Disable Synchronisation Functions
		0YY Beacon in master mode
		1YY Beacon in slave mode
		YY=sync delay seconds (0.0 to 9.9 seconds)

1 = Program Mode
 	
9 = Read Settings
	4 = Day/Night Control
	This function does not operate in Traffic Light mode.
	
	`<DNT>0YY/`
	`<ODD>b/ (b=0 for night only, 1 for day/night)`
		0YY Beacon operates night only
		1YY Beacon operates day and night
		YY= Day/Night transition Lux Level
		
		        <u>Night Lux.</u> <u>Day Lux</u>
		YY=10 15 40 shortest night
		YY=12 15 60
		YY=11 30 50
		YY=01 40 100
		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

	5 = Operation Mode
	
	`<OPM>XXX/`
	`<TST>B/`
		001 – Normal, also cancel Auto Storage/ Auto Leave Storage mode.
		003 – Traffic Light Mode
		007 – Test Alarm signal output (Alarm operates until beacon leaves programming mode).
		009 – Storage Mode

Operation	Feature	Value

	6 = Program Mode
	
	`<MON>b/`
	`<MFR>b/`
	`b = 0 or 1`
	
	`<R2B>x/`
	`x = baud rate`
		000 – Disable RS232, No Monitoring
		004 – Enable RS232, Monitoring on Demand
		005 – Enable RS232, Monitoring Free Running (suitable for Vegaweb monitoring)
		006 – Enable RS232, No Monitoring (default setting)
		007 –Enable RS232, Monitoring, 60s Free Running
		008 – Enable RS232, Monitoring, 60s Free running (suitable for AIS monitoring), 38400 baud (i.e. includes command 8-7-005)

1 = Program Mode
 	
9 = Read Settings
	7 = Slave Mode Flash count on loss of sync
	
	`<SSF>YY/`
	`<ODS>b/`
		0YY– Continue "Y" number of cycles (1-99), clear Force Fixed on Sync Low setting.
		999 – Clear Forced Off and Forced Fix on Sync Low settings.
		998 – Force Off on Sync Low enabled - normal sync functions continue to operate. (Not supported in Traffic light Mode).
		987 – Force to Fixed character on sync low enabled - other sync functions disabled. Will activate even if off during the day. (Not support in Traffic light Mode)

	8 = Low battery threshold `<BLW>YYY/`	YYY – Battery low threshold. (00.0 to11.9VDC) 999 – Disabled, No battery low cut off
	9 = High battery threshold `<BHI>YYY/`	YYY – Battery high threshold. (12.0 to 18.0VDC) 999 – Default setting (12.8VDC)

Operation	Feature	Value
2 – Custom Character Setting	Custom flash character segments `<SPC>.../`	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 (read only)	0 = Software version `<VER>?/`	Version Y.Y.Y (i.e. 1.9.2 or 1.7)
	1 – Supply voltage (`<BAT>` monitoring only)	YY.Y Volts (i.e. 11.7 volts) Last voltage prior to entering programming mode
	2 – Beacon Temperature (`<TMP>` monitoring only)	YYY in degrees Kelvin. Subtract 273 to obtain the temperature in °C. (e.g. 298°K is 25°C).
	3 – Current adjustment (`<ADC>` monitoring only)	Displays the percentage output adjust (060% to 140%)
	4 – Serial Number `<SER>?/`	Displays the beacon 8-digit serial number as a series of flashes
	5 – LED version number `<LED>?/`	Displays the 4-digit LED version number identifier (refer to Appendix B performance tables)
	6 – Characterisation number `<CAR>?/`	Displays the 3-digit Characterisation number (refer to Appendix B performance tables)
	9 - Auxiliary to Primary current ratio	0.YYY ratio of auxiliary LED current to main LED current
7 - Special	1 – Set PIN `<PIN>XXX/`	XXX (000 clears the PIN)
	2 – Set Effective Intensity Mode `<FCM>x/`	000 (Default) – Sets effective intensity flash compensation to be conformant with IALA E-200-4 2017. (SC constant c = MA constant a = 0.1s for day and night flash operation except for blue beacons). 002 – Sets effective intensity flash compensation to be conformant with IALA E-200-4 2008. (SC constant c = 0.2s for day and night flash operation, which is always true for blue beacons).
	3 – Read Effective Intensity Mode `<FCM>?/`	YYY (Reads back the effective intensity mode)
	7 – Enter PIN `<PIN>XXX/`	XXX (Enter XXX PIN value to obtain access to program settings in the current programming session)
8 – Special Options	7 – Set RS232 Baud Rate `<R2B>x/` `x = baud rate`	000 – Default 115200 Baud (suitable for Vegaweb monitoring) 001 – 4800 Baud 002 – 9600 Baud 003 – 14400 Baud 004 – 19200 Baud 005 – 38400 Baud (suitable for AIS monitoring) 006 – 57600 Baud

Appendix B   VLB-44X Performance Tables

Using the Programming and current tables

Performance tables are provided for each vertical divergence and for each colour of the VLB-44X beacon. Each table details the effective intensity settings that can be programmed and the current that the beacon will draw.

Currents in bold font indicate fixed character operation (100% duty) capability.

Currents in blue, italicised font indicate 30% duty capability. These intensities cannot be programmed directly but result from Schmidt-Clausen correction.

All currents should have a 10% margin added to them.

In general, currents will increase with increasing ambient temperature or solar heating.
Any intensity value from the minimum shown in the table to the maximum fixed intensity for that number of tiers can be programmed (i.e. not limited to the examples in the table).

Appendix B.1 VLB-44X-2.5 White

Range (NM @ 0.74T)	Range (NM @ 0.85T)	Effective Candela (cd)	Prog code	White 2.5 Degree Beacon Nominal Current (mA) @12V, 25C Ambient		
				Tiers		
				1	2	3
15		14130			7870	7870
	22.5	13450			7490	7490
	22	11900	011 900	6630	6630	6630
14.5		11400	011 400	6350	6350	6350
	21.5	10400	010 400	5790	5790	5770
14	21	9180	009 180	5110	5110	5070
	20.5	8070	008 070	4490	4490	4430
13.5		7280	007 280	4050	4050	3970
	20	7080	007 080	3940	3940	3860
	19.5	6200	006 200	3450	3430	3380
13		5810	005 810	3240	3210	3160
	19	5430	005 430	3020	2990	2950
	18.5	4750	004 750	2640	2600	2580
12.5		4620	004 620	2570	2530	2510
	18	4140	004 140	2310	2250	2240
12	17.5	3660	003 660	2040	1980	1980
	17	3140	003 140	1750	1700	1700
11.5		2890	002 890	1620	1570	1570
	16.5	2720	002 720	1520	1480	1480
	16	2360	002 360	1330	1290	1290
11		2280	002 280	1280	1250	1250
	15.5	2040	002 040	1150	1120	1120
10.5	15	1790	001 790	1010	990	990
	14.5	1520	001 520	870	850	850
10		1390	001 390	800	780	780
	14	1310	001 310	750	740	740
	13.5	1120	001 120	650	640	640
9.5		1080	001 080	630	610	610
	13	959	000 959	560	550	550
9	12.5	835	000 835	490	480	480
	12	695	000 695	410	400	400
8.5		641	000 641	380	370	370
	11.5	588	000 588	350	350	350
8	11	496	000 496	300	300	300
	10.5	417	000 417	260	250	
7.5		369	000 369	230	230	
	10	348	000 348	220	210	
7	9.5	290	000 290	190		
	9	240	000 240	160		
6.5	8.5	205	000 205	140		
	8	161	000 161	110		
6		150	000 150			
	7.5	131	000 131			
5.5	7	109	000 109			
Measured / Estimated (mm/yy)				Jun-18	Jun-18	Jun-18
Characterisation number				003	003	003
Maximum Fixed Candela				3730	7460	11190
Maximum Fixed Current (mA)				2080	4150	6230
Maximum Peak Candela (30% duty max)				11990	14490	14490
Maximum Peak Current (mA)				6680	8070	8070
Night off current (mA)				4	4	4
Day current (mA)				0.5	0.5	0.5

- Currents in **bold** font indicate fixed character operation (100% duty). Currents in *blue, italicised* font indicate 30% duty capability and cannot be programmed directly but result from Schmidt-Clausen correction.
- All currents should have a 10% margin added to them and will increase with increasing ambient temperature.
- Any intensity value from the minimum shown in the table to the maximum fixed intensity for that number of tiers can be programmed (i.e. not limited to the examples in the table).

Appendix B.1 VLB-44X-2.5 Red

Range (NM @ 0.74T)	Range (NM @ 0.85T)	Effective Candela (cd)	Prog code	Red 2.5 Degree Beacon Nominal Current (mA) @12V, 25C Ambient		
				Tiers		
				1	2	3
15		14130				
	22.5	13450				
	22	11900				
14.5		11400				
	21.5	10400				10200
14	21	9180			9000	9000
	20.5	8070	008 070		7920	7920
13.5		7280	007 280		7140	7140
	20	7080	007 080		6940	6940
	19.5	6200	006 200		6080	6080
13		5810	005 810		5700	5680
	19	5430	005 430		5330	5280
	18.5	4750	004 750	4660	4660	4580
12.5		4620	004 620	4530	4530	4440
	18	4140	004 140	4060	4060	3940
12	17.5	3660	003 660	3590	3580	3480
	17	3140	003 140	3080	3050	2990
11.5		2890	002 890	2830	2800	2750
	16.5	2720	002 720	2670	2630	2590
	16	2360	002 360	2310	2260	2250
11		2280	002 280	2240	2180	2170
	15.5	2040	002 040	2000	1940	1940
10.5	15	1790	001 790	1750	1700	1700
	14.5	1520	001 520	1480	1450	1450
10		1390	001 390	1350	1320	1320
	14	1310	001 310	1270	1250	1250
	13.5	1120	001 120	1070	1070	1070
9.5		1080	001 080	1030	1030	1030
	13	959	000 959	910	910	910
9	12.5	835	000 835	800	800	800
	12	695	000 695	670	670	670
8.5		641	000 641	620	620	620
	11.5	588	000 588	570	570	570
8	11	496	000 496	490	490	490
	10.5	417	000 417	410	410	410
7.5		369	000 369	370	370	
	10	348	000 348	350	350	
7	9.5	290	000 290	300	300	
	9	240	000 240	250		
6.5	8.5	205	000 205	220		
	8	161	000 161	180		
6		150	000 150	170		
	7.5	131	000 131	150		
Measured / Estimated (mm/yy)				Jun-18	Jun-18	Jun-18
Characterisation number				001	001	001
Maximum Fixed Candela				2060	4120	6180
Maximum Fixed Current (mA)				2020	4040	6060
Maximum Peak Candela (30% duty max)				4840	9670	10520
Maximum Peak Current (mA)				4750	9490	10320
Night off current (mA)				4	4	4
Day current (mA)				0.5	0.5	0.5

- Currents in **bold** font indicate fixed character operation (100% duty). Currents in *blue, italicised* font indicate 30% duty capability and cannot be programmed directly but result from Schmidt-Clausen correction.
- All currents should have a 10% margin added to them and will increase with increasing ambient temperature.
- Any intensity value from the minimum shown in the table to the maximum fixed intensity for that number of tiers can be programmed (i.e. not limited to the examples in the table).

Appendix B.1 VLB-44X-2.5 Green

Range (NM @ 0.74T)	Range (NM @ 0.85T)	Effective Candela (cd)	Prog code	Green 2.5 Degree Beacon Nominal Current (mA) @12V, 25C Ambient		
				Tiers		
				1	2	3
	22	11900				
14.5		11400				
	21.5	10400				
14	21	9180			*7280*	*7280*
	20.5	8070	**008 070**	*6400*	*6400*	*6400*
13.5		7280	**007 280**	*5770*	*5770*	**5740**
	20	7080	**007 080**	*5620*	*5620*	**5570**
	19.5	6200	**006 200**	*4920*	*4920*	**4820**
13		5810	**005 810**	*4610*	*4610*	**4480**
	19	5430	**005 430**	*4310*	*4310*	**4160**
	18.5	4750	**004 750**	*3770*	**3750**	**3610**
12.5		4620	**004 620**	*3660*	**3650**	**3510**
	18	4140	**004 140**	*3280*	**3250**	**3140**
12	17.5	3660	**003 660**	*2900*	**2860**	**2770**
	17	3140	**003 140**	*2490*	**2430**	**2360**
11.5		2890	**002 890**	*2290*	**2220**	**2170**
	16.5	2720	**002 720**	*2160*	**2080**	**2040**
	16	2360	**002 360**	**1870**	**1800**	**1770**
11		2280	**002 280**	**1810**	**1740**	**1710**
	15.5	2040	**002 040**	**1620**	**1570**	**1540**
10.5	15	1790	**001 790**	**1420**	**1380**	**1360**
	14.5	1520	**001 520**	**1210**	**1180**	**1160**
10		1390	**001 390**	**1110**	**1080**	**1070**
	14	1310	**001 310**	**1040**	**1020**	**1010**
	13.5	1120	**001 120**	**890**	**880**	**880**
9.5		1080	**001 080**	**860**	**850**	**850**
	13	959	**000 959**	**770**	**760**	**760**
9	12.5	835	**000 835**	**670**	**660**	**660**
	12	695	**000 695**	**560**	**560**	**560**
8.5		641	**000 641**	**520**	**520**	**520**
	11.5	588	**000 588**	**480**	**480**	**480**
8	11	496	**000 496**	**410**	**410**	**410**
	10.5	417	**000 417**	**350**	**340**	**340**
7.5		369	**000 369**	**310**	**310**	
	10	348	**000 348**	**290**	**290**	
7	9.5	290	**000 290**	**250**	**250**	
	9	240	**000 240**	**210**		
6.5	8.5	205	**000 205**	**180**		
	8	161	**000 161**	**150**		
6		150	**000 150**	**140**		
	7.5	131	**000 131**	**130**		
Measured / Estimated (mm/yy)				Jun-18	Jun-18	Jun-18
Characterisation number				002	002	002
Maximum Fixed Candela				**2610**	**5220**	**7830**
Maximum Fixed Current (mA)				**2070**	**4140**	**6210**
Maximum Peak Candela (30% duty max)				*8210*	*9920*	*9920*
Maximum Peak Current (mA)				*6510*	*7870*	*7870*
Night off current (mA)				4	4	4
Day current (mA)				0.5	0.5	0.5

- Currents in **bold** font indicate fixed character operation (100% duty). Currents in *blue, italicised* font indicate 30% duty capability and cannot be programmed directly but result from Schmidt-Clausen correction.

- All currents should have a 10% margin added to them and will increase with increasing ambient temperature.
- Any intensity value from the minimum shown in the table to the maximum fixed intensity for that number of tiers can be programmed (i.e. not limited to the examples in the table).

Appendix B.1 VLB-44X-2.5 Yellow

Range (NM @ 0.74T)	Range (NM @ 0.85T)	Effective Candela (cd)	Prog code	Yellow 2.5 Degree Beacon Nominal Current (mA) @12V, 25C Ambient		
				Tiers		
				1	**2**	**3**
14.51	21.85	11400				
14.5	21.8	11260				
	21.5	10400				
14	21	9180				
	20.5	8070				
13.5		7280			*7090*	*7090*
	20	7080			*6890*	*6890*
	19.5	6200	**006 200**	*6040*	*6040*	6030
13		5810	**005 810**	*5660*	*5660*	5640
	19	5430	**005 430**	*5290*	*5290*	5260
	18.5	4750	**004 750**	*4620*	*4620*	4590
12.5		4620	**004 620**	*4500*	*4500*	4460
	18	4140	**004 140**	*4030*	4030	3990
12	17.5	3660	**003 660**	*3560*	3550	3520
	17	3140	**003 140**	*3060*	3030	3020
11.5		2890	**002 890**	*2810*	2790	2770
	16.5	2720	**002 720**	*2650*	2620	2610
	16	2360	**002 360**	*2300*	2260	2260
11		2280	**002 280**	*2220*	2180	2180
	15.5	2040	**002 040**	1990	1950	1950
10.5	15	1790	**001 790**	1760	1730	1730
	14.5	1520	**001 520**	1500	1480	1480
10		1390	**001 390**	1380	1360	1360
	14	1310	**001 310**	1310	1290	1290
	13.5	1120	**001 120**	1130	1110	1110
9.5		1080	**001 080**	1090	1080	1080
	13	959	**000 959**	980	970	970
9	12.5	835	**000 835**	860	860	860
	12	695	**000 695**	730	720	720
8.5		641	**000 641**	670	670	670
	11.5	588	**000 588**	620	610	610
8	11	496	**000 496**	530	520	520
	10.5	417	**000 417**	450	450	450
7.5		369	**000 369**	400	400	400
	10	348	**000 348**	380	380	380
7	9.5	290	**000 290**	330	320	
	9	240	**000 240**	280	270	
6.5	8.5	205	**000 205**	240		
	8	161	**000 161**	200		
6		150	**000 150**	190		
	7.5	131	**000 131**	170		
5.5	7	109	**000 109**	150		
Measured / Estimated (mm/yy)				Jun-18	Jun-18	Jun-18
Characterisation number				003	003	003

Maximum Fixed Candela	**2190**	**4380**	**6570**
Maximum Fixed Current (mA)	**2130**	**4260**	**6400**
Maximum Peak Candela (30% duty max)	*6570*	*7940*	*7940*
Maximum Peak Current (mA)	*6400*	*7730*	*7730*
Night off current (mA)	4	4	4
Day current (mA)	0.5	0.5	0.5

- Currents in **bold** font indicate fixed character operation (100% duty). Currents in *blue, italicised* font indicate 30% duty capability and cannot be programmed directly but result from Schmidt-Clausen correction.
- All currents should have a 10% margin added to them and will increase with increasing ambient temperature.
- Any intensity value from the minimum shown in the table to the maximum fixed intensity for that number of tiers can be programmed (i.e. not limited to the examples in the table).

Appendix B.2 VLB-44X-5 White

Range (NM @ 0.74T)	Range (NM @ 0.85T)	Effective Candela (cd)	Prog code	White 5 Degree Beacon Nominal Current (mA) @12V, 25C Ambient		
				Tiers		
				1	2	3
	21.5	10400				
14	21	9180			7310	7310
	20.5	8070	008 070	6420	6420	6420
13.5		7280	007 280	5790	5790	5780
	20	7080	007 080	5640	5640	5610
	19.5	6200	006 200	4930	4930	4880
13		5810	005 810	4620	4620	4560
	19	5430	005 430	4320	4320	4250
	18.5	4750	004 750	3780	3770	3700
12.5		4620	004 620	3680	3660	3600
	18	4140	004 140	3300	3270	3220
12	17.5	3660	003 660	2910	2880	2840
	17	3140	003 140	2500	2450	2440
11.5		2890	002 890	2300	2250	2240
	16.5	2720	002 720	2160	2110	2100
	16	2360	002 360	1880	1830	1830
11		2280	002 280	1820	1770	1770
	15.5	2040	002 040	1630	1590	1590
10.5	15	1790	001 790	1440	1400	1400
	14.5	1520	001 520	1230	1200	1200
10		1390	001 390	1130	1100	1100
	14	1310	001 310	1060	1040	1040
	13.5	1120	001 120	920	890	890
9.5		1080	001 080	890	860	860
	13	959	000 959	790	770	770
9	12.5	835	000 835	690	680	680
	12	695	000 695	590	570	570
8.5		641	000 641	540	530	530
	11.5	588	000 588	500	490	490
8	11	496	000 496	430	420	420
	10.5	417	000 417	370	360	360
7.5		369	000 369	330	330	330
	10	348	000 348	310	310	310
7	9.5	290	000 290	270	270	270
	9	240	000 240	230	230	230
6.5	8.5	205	000 205	200	200	
	8	161	000 161	170	170	
6		150	000 150	160		
	7.5	131	000 131	150		
5.5	7	109	000 109	130		
	6.5	83	000 083	110		
5		77	000 077	100		
Measured / Estimated (mm/yy)				Jun-18	Jun-18	Jun-18
Characterisation number				001	001	001
Maximum Fixed Candela				2610	5220	7830
Maximum Fixed Current (mA)				2080	4150	6230
Maximum Peak Candela (30% duty max)				8390	10140	10140
Maximum Peak Current (mA)				6680	8070	8070
Night off current (mA)				4	4	4
Day current (mA)				0.5	0.5	0.5

- Currents in **bold** font indicate fixed character operation (100% duty). Currents in *blue, italicised* font indicate 30% duty capability and cannot be programmed directly but result from Schmidt-Clausen correction.
- All currents should have a 10% margin added to them and will increase with increasing ambient temperature.
- Any intensity value from the minimum shown in the table to the maximum fixed intensity for that number of tiers can be programmed (i.e. not limited to the examples in the table).

Appendix B.2 VLB-44X-5 Red

Range (NM @ 0.74T)	Range (NM @ 0.85T)	Effective Candela (cd)	Prog code	Red 5 Degree Beacon Nominal Current (mA) @12V, 25C Ambient		
				Tiers		
				1	2	3
	20.5	8070				
13.5		7280				
	20	7080				10220
	19.5	6200			8950	8950
13		5810	**005 810**		8390	8390
	19	5430	**005 430**		7840	7840
	18.5	4750	**004 750**		6860	6860
12.5		4620	**004 620**		6670	6670
	18	4140	**004 140**		5980	5970
12	17.5	3660	**003 660**		5280	5240
	17	3140	**003 140**	4530	4530	4440
11.5		2890	**002 890**	4170	4170	4060
	16.5	2720	**002 720**	3930	3920	3810
	16	2360	**002 360**	3410	3390	3300
11		2280	**002 280**	3290	3270	3190
	15.5	2040	**002 040**	2940	2910	2860
10.5	15	1790	**001 790**	2580	2540	2510
	14.5	1520	**001 520**	2190	2140	2130
10		1390	**001 390**	2010	1950	1950
	14	1310	**001 310**	1890	1830	1830
	13.5	1120	**001 120**	1610	1570	1570
9.5		1080	**001 080**	1550	1510	1510
	13	959	**000 959**	1370	1340	1340
9	12.5	835	**000 835**	1190	1170	1170
	12	695	**000 695**	980	970	970
8.5		641	**000 641**	900	900	900
	11.5	588	**000 588**	820	820	820
8	11	496	**000 496**	700	700	700
	10.5	417	**000 417**	600	600	590
7.5		369	**000 369**	540	530	530
	10	348	**000 348**	510	500	500
7	9.5	290	**000 290**	430	430	430
	9	240	**000 240**	370	360	360
6.5	8.5	205	**000 205**	320	310	310
	8	161	**000 161**	260	260	
6		150	**000 150**	250	240	
	7.5	131	**000 131**	220		
5.5	7	109	**000 109**	190		
	6.5	83	**000 083**	160		
5		77	**000 077**	150		
	6	66	**000 066**	140		
Measured / Estimated (mm/yy)				Jun-18	Jun-18	Jun-18
Characterisation number				002	002	002
Maximum Fixed Candela				1400	2800	4200
Maximum Fixed Current (mA)				2020	4040	6060
Maximum Peak Candela (30% duty max)				3290	6570	7150
Maximum Peak Current (mA)				4750	9480	10320
Night off current (mA)				4	4	4
Day current (mA)				0.5	0.5	0.5

- Currents in **bold** font indicate fixed character operation (100% duty). Currents in *blue, italicised* font indicate 30% duty capability and cannot be programmed directly but result from Schmidt-Clausen correction.
- All currents should have a 10% margin added to them and will increase with increasing ambient temperature.
- Any intensity value from the minimum shown in the table to the maximum fixed intensity for that number of tiers can be programmed (i.e. not limited to the examples in the table).

Appendix B.2 VLB-44X-5 Green

Range (NM @ 0.74T)	Range (NM @ 0.85T)	Effective Candela (cd)	Prog code	Green 5 Degree Beacon Nominal Current (mA) @12V, 25C Ambient		
				Tiers		
				1	2	3
	20	7080				
	19.5	6200			*7130*	*7130*
13		5810			*6680*	*6680*
	19	5430	005 430	*6250*	*6250*	*6250*
	18.5	4750	004 750	*5460*	*5460*	5430
12.5		4620	004 620	*5310*	*5310*	5280
	18	4140	004 140	*4760*	*4760*	4710
12	17.5	3660	003 660	*4210*	*4210*	4130
	17	3140	003 140	*3610*	3590	3530
11.5		2890	002 890	*3320*	3290	3240
	16.5	2720	002 720	*3130*	3090	3050
	16	2360	002 360	*2710*	2660	2630
11		2280	002 280	*2620*	2560	2540
	15.5	2040	002 040	*2350*	2280	2270
10.5	15	1790	001 790	2060	1980	1980
	14.5	1520	001 520	1750	1680	1680
10		1390	001 390	1600	1540	1540
	14	1310	001 310	1510	1450	1450
	13.5	1120	001 120	1290	1250	1250
9.5		1080	001 080	1240	1200	1200
	13	959	000 959	1100	1070	1070
9	12.5	835	000 835	960	930	930
	12	695	000 695	800	780	780
8.5		641	000 641	730	720	720
	11.5	588	000 588	670	660	660
8	11	496	000 496	570	560	560
	10.5	417	000 417	480	480	480
7.5		369	000 369	430	430	430
	10	348	000 348	410	410	410
7	9.5	290	000 290	350	350	350
	9	240	000 240	300	290	290
6.5	8.5	205	000 205	260	260	260
	8	161	000 161	210	210	
6		150	000 150	200	200	
	7.5	131	000 131	180	180	
5.5	7	109	000 109	160	160	
	6.5	83	000 083	130		
5		77	000 077	130		
	6	66	000 066	110		
4.5		54	000 054	100		
Measured / Estimated (mm/yy)				Jun-18	Jun-18	Jun-18
Characterisation number				002	002	002
Maximum Fixed Candela				1800	3600	5400
Maximum Fixed Current (mA)				2070	4140	6210
Maximum Peak Candela (30% duty max)				*5660*	*6840*	*6840*
Maximum Peak Current (mA)				*6510*	*7870*	*7870*
Night off current (mA)				4	4	4
Day current (mA)				0.5	0.5	0.5

- Currents in **bold** font indicate fixed character operation (100% duty). Currents in *blue, italicised* font indicate 30% duty capability and cannot be programmed directly but result from Schmidt-Clausen correction.
- All currents should have a 10% margin added to them and will increase with increasing ambient temperature.
- Any intensity value from the minimum shown in the table to the maximum fixed intensity for that number of tiers can be programmed (i.e. not limited to the examples in the table).

Appendix B.2 VLB-44X-5 Yellow

Range (NM @ 0.74T)	Range (NM @ 0.85T)	Effective Candela (cd)	Prog code	Yellow 5 Degree Beacon Nominal Current (mA) @12V, 25C Ambient		
				Tiers		
				1	2	3
	19	5430			*7720*	*7720*
	18.5	4750			*6750*	*6750*
12.5		4620			*6570*	*6570*
	18	4140	**004 140**	*5880*	*5880*	**5870**
12	17.5	3660	**003 660**	*5200*	*5200*	**5180**
	17	3140	**003 140**	*4460*	*4460*	**4430**
11.5		2890	**002 890**	*4110*	**4100**	**4070**
	16.5	2720	**002 720**	*3870*	**3860**	**3820**
	16	2360	**002 360**	*3350*	**3340**	**3310**
11		2280	**002 280**	*3240*	**3220**	**3200**
	15.5	2040	**002 040**	*2900*	**2870**	**2860**
10.5	15	1790	**001 790**	*2540*	**2510**	**2500**
	14.5	1520	**001 520**	*2160*	**2120**	**2120**
10		1390	**001 390**	**1980**	**1950**	**1950**
	14	1310	**001 310**	**1870**	**1840**	**1840**
	13.5	1120	**001 120**	**1620**	**1590**	**1590**
9.5		1080	**001 080**	**1560**	**1540**	**1540**
	13	959	**000 959**	**1400**	**1380**	**1380**
9	12.5	835	**000 835**	**1230**	**1210**	**1210**
	12	695	**000 695**	**1040**	**1030**	**1030**
8.5		641	**000 641**	**970**	**950**	**950**
	11.5	588	**000 588**	**900**	**880**	**880**
8	11	496	**000 496**	**770**	**760**	**760**
	10.5	417	**000 417**	**670**	**660**	**660**
7.5		369	**000 369**	**600**	**590**	**590**
	10	348	**000 348**	**570**	**570**	**570**
7	9.5	290	**000 290**	**490**	**480**	**480**
	9	240	**000 240**	**420**	**410**	**410**
6.5	8.5	205	**000 205**	**370**	**370**	**370**
	8	161	**000 161**	**310**	**300**	**300**
6		150	**000 150**	**290**	**290**	**290**
	7.5	131	**000 131**	**260**	**260**	**260**
5.5	7	109	**000 109**	**230**	**230**	**230**
	6.5	83	**000 083**	**200**	**200**	
5		77	**000 077**	**190**	**190**	
	6	66	**000 066**	**170**	**170**	
4.5		54	**000 054**	**160**		
4	5	39	**000 039**	**140**		
3.5	4.5	29	**000 029**	**120**		
Measured / Estimated (mm/yy)				Jun-18	Jun-18	Jun-18
Characterisation number				002	002	002
Maximum Fixed Candela				**1500**	**3000**	**4500**
Maximum Fixed Current (mA)				**2130**	**4260**	**6400**
Maximum Peak Candela (30% duty max)				*4500*	*5440*	*5440*

Maximum Peak Current (mA)	*6400*	*7730*	*7730*
Night off current (mA)	4	4	4
Day current (mA)	0.5	0.5	0.5

- Currents in **bold** font indicate fixed character operation (100% duty). Currents in *blue, italicised* font indicate 30% duty capability and cannot be programmed directly but result from Schmidt-Clausen correction.
- All currents should have a 10% margin added to them and will increase with increasing ambient temperature.
- Any intensity value from the minimum shown in the table to the maximum fixed intensity for that number of tiers can be programmed (i.e. not limited to the examples in the table).

Appendix B.3 VLB-44X-10 White

Range (NM @ 0.74T)	Range (NM @ 0.85T)	Effective Candela (cd)	Prog code	White 10 Degree Beacon Nominal Current (mA) @12V, 25C Ambient		
				Tiers		
				1	**2**	**3**
	20	7080				
	19.5	6200			*7820*	*7820*
13		5810			*7330*	*7330*
	19	5430			*6850*	*6850*
	18.5	4750	**004 750**	*5990*	*5990*	5980
12.5		4620	**004 620**	*5830*	*5830*	5810
	18	4140	**004 140**	*5220*	*5220*	5180
12	17.5	3660	**003 660**	*4610*	*4610*	4550
	17	3140	**003 140**	*3960*	3950	3880
11.5		2890	**002 890**	*3640*	3630	3570
	16.5	2720	**002 720**	*3430*	3410	3360
	16	2360	**002 360**	*2980*	2940	2910
11		2280	**002 280**	*2870*	2840	2810
	15.5	2040	**002 040**	*2570*	2530	2510
10.5	15	1790	**001 790**	*2260*	2200	2200
	14.5	1520	**001 520**	1920	1870	1870
10		1390	**001 390**	1760	1710	1710
	14	1310	**001 310**	1670	1620	1620
	13.5	1120	**001 120**	1430	1400	1400
9.5		1080	**001 080**	1390	1350	1350
	13	959	**000 959**	1240	1210	1210
9	12.5	835	**000 835**	1090	1060	1060
	12	695	**000 695**	920	890	890
8.5		641	**000 641**	850	830	830
	11.5	588	**000 588**	790	770	770
8	11	496	**000 496**	670	660	660
	10.5	417	**000 417**	580	570	570
7.5		369	**000 369**	520	510	510
	10	348	**000 348**	490	480	480
7	9.5	290	**000 290**	430	420	420
	9	240	**000 240**	370	360	360
6.5	8.5	205	**000 205**	330	320	320
	8	161	**000 161**	280	270	270
6		150	**000 150**	270	260	260
	7.5	131	**000 131**	250	240	240
5.5	7	109	**000 109**	220	220	220
	6.5	83	**000 083**	190	190	190
5		77	**000 077**	180	180	180
	6	66	**000 066**	170	170	170
4.5		54	**000 054**	160	150	
4	5	39	**000 039**	140		
	4.5	29	**000 029**	130		
	4	21	**000 021**	120		
Measured / Estimated (mm/yy)				Jun-18	Jun-18	Jun-18
Characterisation number				002	002	002
Maximum Fixed Candela				**1650**	**3300**	**4950**
Maximum Fixed Current (mA)				**2080**	**4160**	**6240**
Maximum Peak Candela (30% duty max)				*5300*	*6410*	*6410*
Maximum Peak Current (mA)				*6680*	*8080*	*8080*
Night off current (mA)				4	4	4
Day current (mA)				0.5	0.5	0.5

- Currents in **bold** font indicate fixed character operation (100% duty). Currents in *blue, italicised* font indicate 30% duty capability and cannot be programmed directly but result from Schmidt-Clausen correction.
- All currents should have a 10% margin added to them and will increase with increasing ambient temperature.
- Any intensity value from the minimum shown in the table to the maximum fixed intensity for that number of tiers can be programmed (i.e. not limited to the examples in the table).

Range (NM @ 0.74T)	Range (NM @ 0.85T)	Effective Candela (cd)	Prog code	Red 10 Degree Beacon Nominal Current (mA) @12V, 25C Ambient		
				Tiers		
				1	2	3
	20	7080				
	19.5	6200				
13		5810				
	19	5430				
	18.5	4750				
12.5		4620				10150
	18	4140			9090	9090
12	17.5	3660	003 660		8040	8040
	17	3140	003 140		6900	6900
11.5		2890	002 890		6350	6350
	16.5	2720	002 720		5970	5970
	16	2360	002 360		5180	5130
11		2280	002 280		5010	4940
	15.5	2040	002 040	4480	4480	4390
10.5	15	1790	001 790	3930	3930	3810
	14.5	1520	001 520	3340	3320	3240
10		1390	001 390	3050	3020	2960
	14	1310	001 310	2880	2840	2790
	13.5	1120	001 120	2460	2410	2390
9.5		1080	001 080	2370	2320	2300
	13	959	000 959	2110	2050	2040
9	12.5	835	000 835	1830	1780	1780
	12	695	000 695	1520	1480	1480
8.5		641	000 641	1400	1370	1370
	11.5	588	000 588	1280	1250	1250
8	11	496	000 496	1070	1060	1060
	10.5	417	000 417	900	890	890
7.5		369	000 369	790	790	790
	10	348	000 348	740	740	740
7	9.5	290	000 290	640	640	640
	9	240	000 240	550	550	550
6.5	8.5	205	000 205	480	480	480
	8	161	000 161	400	400	400
6		150	000 150	380	380	380
	7.5	131	000 131	350	350	350
5.5	7	109	000 109	310	310	310
	6.5	83	000 083	260	260	260
5		77	000 077	250	250	250
	6	66	000 066	230	230	230
4.5		54	000 054	210	210	
4	5	39	000 039	180		
	4.5	29	000 029	160		
	4	21	000 021	150		
Measured / Estimated (mm/yy)				Jun-18	Jun-18	Jun-18
Characterisation number				002	002	002
Maximum Fixed Candela				920	1840	2760
Maximum Fixed Current (mA)				2020	4040	6060
Maximum Peak Candela (30% duty max)				2160	4320	4700
Maximum Peak Current (mA)				4740	9490	10320
Night off current (mA)				4	4	4
Day current (mA)				0.5	0.5	0.5

- Currents in **bold** font indicate fixed character operation (100% duty). Currents in *blue, italicised* font indicate 30% duty capability and cannot be programmed directly but result from Schmidt-Clausen correction.
- All currents should have a 10% margin added to them and will increase with increasing ambient temperature.
- Any intensity value from the minimum shown in the table to the maximum fixed intensity for that number of tiers can be programmed (i.e. not limited to the examples in the table).

Appendix B.3 VLB-44X-10Green

Range (NM @ 0.74T)	Range (NM @ 0.85T)	Effective Candela (cd)	Prog code	Green 10 Degree Beacon Nominal Current (mA) @12V, 25C Ambient		
				Tiers		
				1	**2**	**3**
	18.5	4750			*7560*	*7560*
12.5		4620			*7360*	*7360*
	18	4140			*6590*	*6590*
12	17.5	3660	**003 660**	*5830*	*5830*	**5800**
	17	3140	**003 140**	*5000*	*5000*	**4910**
11.5		2890	**002 890**	*4600*	*4600*	**4480**
	16.5	2720	**002 720**	*4330*	*4330*	**4190**
	16	2360	**002 360**	*3760*	**3740**	**3610**
11		2280	**002 280**	*3630*	**3610**	**3480**
	15.5	2040	**002 040**	*3250*	**3210**	**3110**
10.5	15	1790	**001 790**	*2850*	**2800**	**2720**
	14.5	1520	**001 520**	*2420*	**2350**	**2300**
10		1390	**001 390**	*2210*	**2140**	**2090**
	14	1310	**001 310**	*2090*	**2010**	**1970**
	13.5	1120	**001 120**	**1790**	**1720**	**1690**
9.5		1080	**001 080**	**1730**	**1660**	**1630**
	13	959	**000 959**	**1540**	**1480**	**1460**
9	12.5	835	**000 835**	**1340**	**1300**	**1280**
	12	695	**000 695**	**1120**	**1090**	**1080**
8.5		641	**000 641**	**1040**	**1010**	**1000**
	11.5	588	**000 588**	**960**	**930**	**920**
8	11	496	**000 496**	**810**	**800**	**790**
	10.5	417	**000 417**	**690**	**680**	**670**
7.5		369	**000 369**	**610**	**610**	**600**
	10	348	**000 348**	**580**	**580**	**570**
7	9.5	290	**000 290**	**490**	**490**	**490**
	9	240	**000 240**	**420**	**420**	**420**
6.5	8.5	205	**000 205**	**370**	**370**	**370**
	8	161	**000 161**	**300**	**300**	**300**
6		150	**000 150**	**290**	**290**	**290**
	7.5	131	**000 131**	**260**	**260**	**260**
5.5	7	109	**000 109**	**230**	**230**	**230**
	6.5	83	**000 083**	**190**	**190**	**190**
5		77	**000 077**	**180**	**180**	**180**
	6	66	**000 066**	**170**	**170**	**170**
4.5		54	**000 054**	**150**	**150**	
4	5	39	**000 039**	**130**		
	4.5	29	**000 029**	**110**		
	4	21	**000 021**	**100**		
Measured / Estimated (mm/yy)				Jun-18	Jun-18	Jun-18
Characterisation number				002	002	002
Maximum Fixed Candela				**1300**	**2600**	**3900**
Maximum Fixed Current (mA)				**2070**	**4140**	**6210**
Maximum Peak Candela (30% duty max)				*4090*	*4940*	*4940*
Maximum Peak Current (mA)				*6510*	*7870*	*7870*
Night off current (mA)				4	4	4
Day current (mA)				0.5	0.5	0.5

- Currents in **bold** font indicate fixed character operation (100% duty). Currents in *blue, italicised* font indicate 30% duty capability and cannot be programmed directly but result from Schmidt-Clausen correction.
- All currents should have a 10% margin added to them and will increase with increasing ambient temperature.

- Any intensity value from the minimum shown in the table to the maximum fixed intensity for that number of tiers can be programmed (i.e. not limited to the examples in the table).

Appendix B.3 VLB-44X-10 Yellow

Range (NM @ 0.74T)	Range (NM @ 0.85T)	Effective Candela (cd)	Prog code	Yellow 10 Degree Beacon Nominal Current (mA) @12V, 25C Ambient		
				Tiers		
				1	2	3
	18	4140				
12	17.5	3660			7430	7430
	17	3140	003 140	6380	6380	6380
11.5		2890	002 890	5870	5870	5860
	16.5	2720	002 720	5520	5520	5510
	16	2360	002 360	4790	4790	4760
11		2280	002 280	4630	4630	4600
	15.5	2040	002 040	4140	4140	4100
10.5	15	1790	001 790	3630	3620	3590
	14.5	1520	001 520	3090	3060	3050
10		1390	001 390	2820	2790	2780
	14	1310	001 310	2660	2630	2620
	13.5	1120	001 120	2270	2240	2230
9.5		1080	001 080	2190	2150	2150
	13	959	000 959	1950	1920	1920
9	12.5	835	000 835	1710	1680	1680
	12	695	000 695	1430	1410	1410
8.5		641	000 641	1330	1310	1310
	11.5	588	000 588	1220	1200	1200
8	11	496	000 496	1040	1030	1030
	10.5	417	000 417	890	880	880
7.5		369	000 369	790	780	780
	10	348	000 348	750	740	740
7	9.5	290	000 290	640	630	630
	9	240	000 240	540	540	540
6.5	8.5	205	000 205	470	470	470
	8	161	000 161	390	390	390
6		150	000 150	370	360	360
	7.5	131	000 131	330	330	330
5.5	7	109	000 109	290	290	290
	6.5	83	000 083	240	240	240
5		77	000 077	230	230	230
	6	66	000 066	210	210	210
4.5		54	000 054	180	180	
4	5	39	000 039	160		
3.5	4.5	29	000 029	140		
	4	21	000 021	120		
Measured / Estimated (mm/yy)				Jun-18	Jun-18	Jun-18
Characterisation number				002	002	002
Maximum Fixed Candela				1050	2100	3150
Maximum Fixed Current (mA)				2130	4260	6400
Maximum Peak Candela (30% duty max)				3150	3810	3810

Maximum Peak Current (mA)	*6400*	*7730*	*7730*
Night off current (mA)	4	4	4
Day current (mA)	0.5	0.5	0.5

- Currents in **bold** font indicate fixed character operation (100% duty). Currents in *blue, italicised* font indicate 30% duty capability and cannot be programmed directly but result from Schmidt-Clausen correction.
- All currents should have a 10% margin added to them and will increase with increasing ambient temperature.
- Any intensity value from the minimum shown in the table to the maximum fixed intensity for that number of tiers can be programmed (i.e. not limited to the examples in the table).

Appendix B.4 VLB-44X-OBS White

Range (NM @ 0.74T)	Range (NM @ 0.85T)	Effective Candela (cd)	Prog code	White OBS Beacon Nominal Current (mA) @12V, 25C Ambient		
				Tiers		
				1	**2**	**3**
11		2280				
	15.5	2040			*7710*	*7710*
10.5	15	1790			*6770*	*6770*
	14.5	1520	**001 520**	*5750*	*5750*	**5740**
10		1390	**001 390**	*5260*	*5260*	**5240**
	14	1310	**001 310**	*4950*	*4950*	**4930**
	13.5	1120	**001 120**	*4240*	*4240*	**4200**
9.5		1080	**001 080**	*4080*	**4080**	**4040**
	13	959	**000 959**	*3630*	**3620**	**3580**
9	12.5	835	**000 835**	*3160*	**3150**	**3110**
	12	695	**000 695**	*2630*	**2610**	**2570**
8.5		641	**000 641**	*2420*	**2410**	**2370**
	11.5	588	**000 588**	*2220*	**2210**	**2170**
8	11	496	**000 496**	**1880**	**1860**	**1830**
	10.5	417	**000 417**	**1590**	**1570**	**1540**
7.5		369	**000 369**	**1410**	**1400**	**1370**
	10	348	**000 348**	**1330**	**1320**	**1300**
7	9.5	290	**000 290**	**1120**	**1110**	**1090**
	9	240	**000 240**	**930**	**920**	**910**
6.5	8.5	205	**000 205**	**800**	**790**	**780**
	8	161	**000 161**	**640**	**630**	**630**
6		150	**000 150**	**600**	**590**	**590**
	7.5	131	**000 131**	**530**	**520**	**520**
5.5	7	109	**000 109**	**450**	**440**	**440**
	6.5	83	**000 083**	**350**	**350**	**350**
5		77	**000 077**	**330**	**330**	**330**
	6	66	**000 066**	**300**	**290**	**290**
4.5		54	**000 054**	**250**	**250**	**250**
4	5	39	**000 039**	**200**	**200**	
3.8		32	**000 032**	**180**	**180**	
	4.5	29	**000 029**	**170**		
	4	21	**000 021**	**140**		
3	3.5	15	**000 015**	**120**		
Measured / Estimated (mm/yy)				Jun-18	Jun-18	Jun-18
Characterisation number				001	001	001
Maximum Fixed Candela				**550**	**1100**	**1650**
Maximum Fixed Current (mA)				**2080**	**4160**	**6240**
Maximum Peak Candela (30% duty max)				*1770*	*2140*	*2140*
Maximum Peak Current (mA)				*6690*	*8080*	*8080*
Night off current (mA)				4	4	4
Day current (mA)				0.5	0.5	0.5

- Currents in **bold** font indicate fixed character operation (100% duty). Currents in *blue, italicised* font indicate 30% duty capability and cannot be programmed directly but result from Schmidt-Clausen correction.
- All currents should have a 10% margin added to them and will increase with increasing ambient temperature.
- Any intensity value from the minimum shown in the table to the maximum fixed intensity for that number of tiers can be programmed (i.e. not limited to the examples in the table).

Appendix B.4 VLB-44X-OBS Red

Range (NM @ 0.74T)	Range (NM @ 0.85T)	Effective Candela (cd)	Prog code	Red OBS Beacon Nominal Current (mA) @12V, 25C Ambient		
				Tiers		
				1	2	3
	18.5	4750				
12.5		4620				
	18	4140				
12	17.5	3660				
	17	3140				
11.5		2890				
	16.5	2720				
	16	2360				
11		2280				
	15.5	2040				
10.5	15	1790				
	14.5	1520				9600
10		1390			8780	8780
	14	1310	001 310		8270	8270
	13.5	1120	001 120		7070	7070
9.5		1080	001 080		6820	6820
	13	959	000 959		6060	6060
9	12.5	835	000 835		5270	5230
	12	695	000 695	4390	4390	4290
8.5		641	000 641	4050	4050	3930
	11.5	588	000 588	3710	3700	3600
8	11	496	000 496	3130	3100	3040
	10.5	417	000 417	2630	2590	2550
7.5		369	000 369	2330	2280	2260
	10	348	000 348	2200	2140	2130
7	9.5	290	000 290	1830	1780	1780
	9	240	000 240	1510	1470	1470
6.5	8.5	205	000 205	1280	1260	1260
	8	161	000 161	1000	990	990
6		150	000 150	930	920	920
	7.5	131	000 131	810	800	800
5.5	7	109	000 109	670	670	670
	6.5	83	000 083	520	520	520
5		77	000 077	490	490	490
	6	66	000 066	430	430	430
4.5		54	000 054	370	370	370
4	5	39	000 039	280	280	
	4.5	29	000 029	230		
	4	21	000 021	190		
3	3.5	15	000 015	150		
Measured / Estimated (mm/yy)				Jun-18	Jun-18	Jun-18
Characterisation number				002	002	002
Maximum Fixed Candela				320	640	960
Maximum Fixed Current (mA)				2020	4040	6060
Maximum Peak Candela (30% duty max)				750	1500	1630
Maximum Peak Current (mA)				4740	9470	10290
Night off current (mA)				4	4	4

Day current (mA)	0.5	0.5	0.5

- Currents in **bold** font indicate fixed character operation (100% duty). Currents in *blue, italicised* font indicate 30% duty capability and cannot be programmed directly but result from Schmidt-Clausen correction.
- All currents should have a 10% margin added to them and will increase with increasing ambient temperature.
- Any intensity value from the minimum shown in the table to the maximum fixed intensity for that number of tiers can be programmed (i.e. not limited to the examples in the table).

Appendix B.4 VLB-44X-OBS Green

Range (NM @ 0.74T)	Range (NM @ 0.85T)	Effective Candela (cd)	Prog code	Green OBS Beacon Nominal Current (mA) @12V, 25C Ambient		
				Tiers		
				1	**2**	**3**
	14.5	1520				
10		1390			*7290*	*7290*
	14	1310			*6870*	*6870*
	13.5	1120	**001 120**	*5870*	*5870*	**5850**
9.5		1080	**001 080**	*5660*	*5660*	**5620**
	13	959	**000 959**	*5030*	*5030*	**4940**
9	12.5	835	**000 835**	*4380*	*4380*	**4240**
	12	695	**000 695**	*3640*	**3620**	**3490**
8.5		641	**000 641**	*3360*	**3330**	**3220**
	11.5	588	**000 588**	*3080*	**3040**	**2940**
8	11	496	**000 496**	*2600*	**2540**	**2470**
	10.5	417	**000 417**	*2190*	**2110**	**2070**
7.5		369	**000 369**	**1940**	**1860**	**1830**
	10	348	**000 348**	**1830**	**1760**	**1730**
7	9.5	290	**000 290**	**1530**	**1480**	**1450**
	9	240	**000 240**	**1270**	**1230**	**1210**
6.5	8.5	205	**000 205**	**1090**	**1060**	**1040**
	8	161	**000 161**	**860**	**840**	**830**
6		150	**000 150**	**810**	**790**	**780**
	7.5	131	**000 131**	**710**	**700**	**690**
5.5	7	109	**000 109**	**590**	**590**	**580**
	6.5	83	**000 083**	**460**	**460**	**460**
5		77	**000 077**	**430**	**430**	**430**
	6	66	**000 066**	**370**	**370**	**370**
4.5		54	**000 054**	**310**	**310**	**310**
4	5	39	**000 039**	**230**	**230**	
3.8		32	**000 032**	**190**	**190**	
	4.5	29	**000 029**	**180**		
	4	21	**000 021**	**140**		
3	3.5	15	**000 015**	**100**		
Measured / Estimated (mm/yy)				Jun-18	Jun-18	Jun-18
Characterisation number				001	001	001
Maximum Fixed Candela				**395**	**790**	**1185**
Maximum Fixed Current (mA)				**2070**	**4140**	**6210**
Maximum Peak Candela (30% duty max)				*1240*	*1500*	*1500*
Maximum Peak Current (mA)				*6500*	*7860*	*7860*
Night off current (mA)				4	4	4
Day current (mA)				0.5	0.5	0.5

- Currents in **bold** font indicate fixed character operation (100% duty). Currents in *blue, italicised* font indicate 30% duty capability and cannot be programmed directly but result from Schmidt-Clausen correction.
- All currents should have a 10% margin added to them and will increase with increasing ambient temperature.
- Any intensity value from the minimum shown in the table to the maximum fixed intensity for that number of tiers can be programmed (i.e. not limited to the examples in the table).

Appendix B.4 VLB-44X-OBS Yellow

| Range (NM @ 0.74T)	Range (NM @ 0.85T)	Effective Candela (cd)	Prog code	Yellow OBS Beacon Nominal Current (mA) @12V, 25C Ambient		
				Tiers		
				1	2	3
10		1390				
	14	1310			*7450*	*7450*
	13.5	1120	**001 120**	*6370*	*6370*	**6370**
9.5		1080	**001 080**	*6140*	*6140*	**6140**
	13	959	**000 959**	*5450*	*5450*	**5430**
9	12.5	835	**000 835**	*4750*	*4750*	**4720**
	12	695	**000 695**	*3950*	**3950**	**3910**
8.5		641	**000 641**	*3640*	**3630**	**3600**
	11.5	588	**000 588**	*3340*	**3330**	**3300**
8	11	496	**000 496**	*2820*	**2790**	**2780**
	10.5	417	**000 417**	*2370*	**2330**	**2330**
7.5		369	**000 369**	**2100**	**2060**	**2060**
	10	348	**000 348**	**1980**	**1950**	**1950**
7	9.5	290	**000 290**	**1660**	**1630**	**1630**
	9	240	**000 240**	**1390**	**1360**	**1360**
6.5	8.5	205	**000 205**	**1190**	**1170**	**1170**
	8	161	**000 161**	**950**	**940**	**940**
6		150	**000 150**	**890**	**880**	**880**
	7.5	131	**000 131**	**790**	**780**	**780**
5.5	7	109	**000 109**	**670**	**660**	**660**
	6.5	83	**000 083**	**520**	**520**	**520**
5		77	**000 077**	**490**	**480**	**480**
	6	66	**000 066**	**420**	**420**	**420**
4.5		54	**000 054**	**350**	**350**	**350**
4	5	39	**000 039**	**270**	**260**	
3.5	4.5	29	**000 029**	**210**		
	4	21	**000 021**	**160**		
3	3.5	15	**000 015**	**130**		
Measured / Estimated (mm/yy)				Jun-18	Jun-18	Jun-18
Characterisation number				002	002	002
Maximum Fixed Candela				**375**	**750**	**1125**
Maximum Fixed Current (mA)				**2130**	**4260**	**6400**
Maximum Peak Candela (30% duty max)				*1130*	*1360*	*1360*
Maximum Peak Current (mA)				*6420*	*7730*	*7730*
Night off current (mA)				4	4	4
Day current (mA)				0.5	0.5	0.5

- Currents in **bold** font indicate fixed character operation (100% duty). Currents in *blue, italicised* font indicate 30% duty capability and cannot be programmed directly but result from Schmidt-Clausen correction.
- All currents should have a 10% margin added to them and will increase with increasing ambient temperature.
- Any intensity value from the minimum shown in the table to the maximum fixed intensity for that number of tiers can be programmed (i.e. not limited to the examples in the table).

Appendix B.5 Sample Vertical Divergence Profiles

VLB-44X 2.5D Normalised Vertical Divergence Beam Shapes
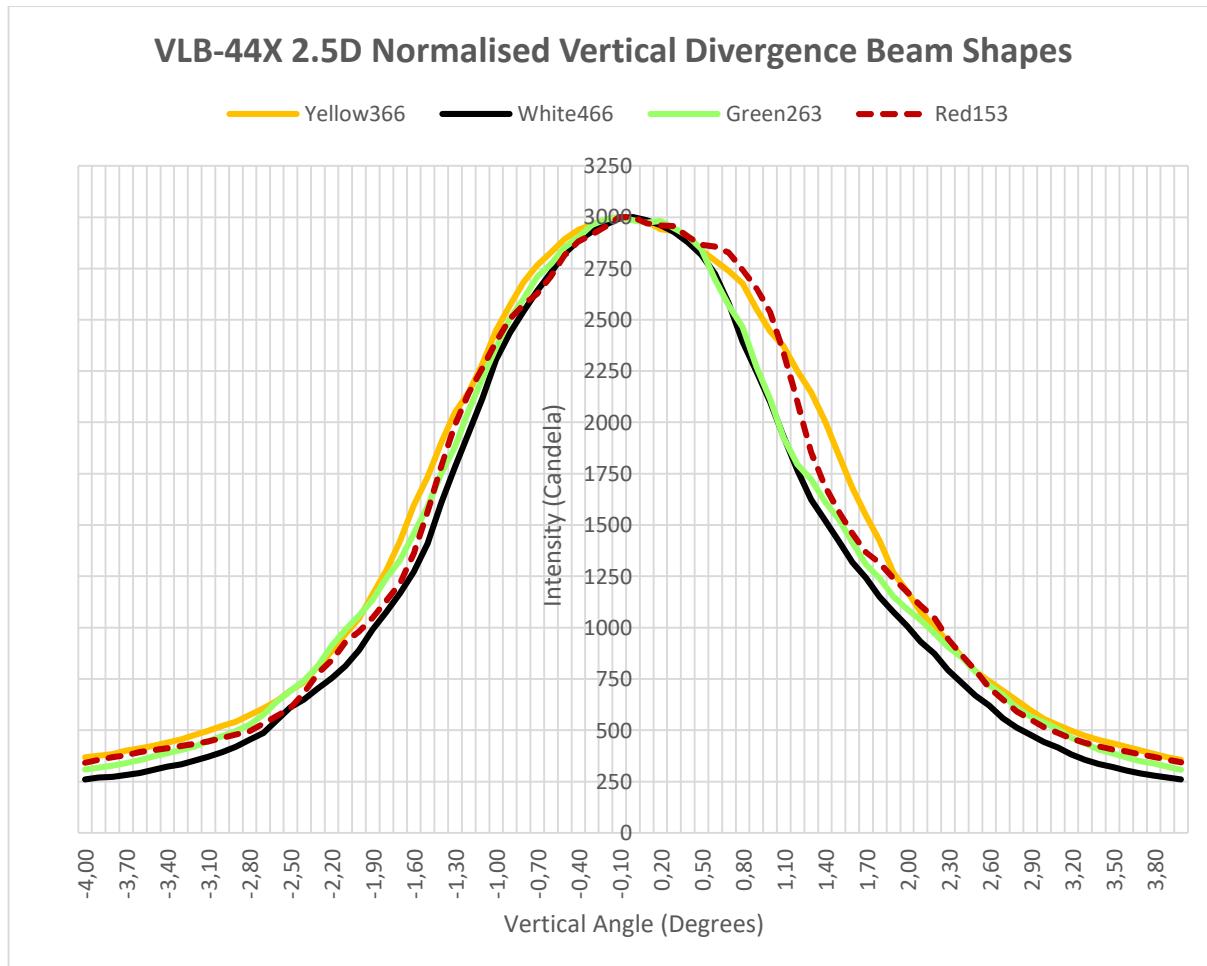
Day Range Table

Night Range Table

Day-Time Range in Nautical Miles for 0.74T assuming background light intensity of 10,000cd/M^3	
NM	**cd**
0.1	35
0.2	146
0.3	338
0.4	620
0.5	998
0.6	1,480
0.7	2,080
0.8	2,800
0.9	3,650
1.0	4,640
1.1	5,790
1.2	7,100
1.3	8,580
1.4	10,300
1.5	12,100
1.6	14,200
1.7	16,600
1.8	19,100

Night-Time Range in Nautical Miles assuming no background light at 0.74T and 0.85T								
	0.74	0.85		0.74	0.85		0.74	0.85
NM	**cd**	**cd**	**NM**	**cd**	**cd**	**NM**	**cd**	**cd**
0.5	0.2	0.2	4.0	37	21	9.0	836	240
0.6	0.3	0.3	4.1	40	22	9.2	928	259
0.7	0.4	0.4	4.2	43	24	9.4	1,030	280
0.8	0.6	0.5	4.3	46	26	9.6	1,140	301
0.9	0.7	0.6	4.4	50	27	9.8	1,260	324
1.0	0.9	0.8	4.5	54	29	10.0	1,390	349
1.1	1.2	1.0	4.6	58	31	10.2	1,540	375
1.2	1.4	1.2	4.7	62	33	10.4	1,700	403
1.3	1.7	1.4	4.8	67	35	10.6	1,880	432
1.4	2.1	1.7	4.9	72	37	10.8	2,070	463
1.5	2.4	2.0	5.0	77	39	11.0	2,280	497
1.6	2.8	2.3	5.1	83	41	11.2	2,510	532
1.7	3.3	2.6	5.2	89	43	11.4	2,760	569
1.8	3.8	3.0	5.3	95	46	11.6	3,040	609
1.9	4.4	3.4	5.4	102	48	11.8	3,340	651
2.0	5.0	3.8	5.5	109	51	12.0	3,670	695
2.1	5.7	4.3	5.6	116	54	12.5	4,630	818
2.2	6.4	4.8	5.7	124	56	13.0	5,820	960
2.3	7.3	5.3	5.8	132	59	13.5	7,290	1,120
2.4	8.1	5.8	5.9	141	62	14.0	9,120	1,310
2.5	9.1	6.4	6.0	151	66	14.5	11,400	1,520
2.6	10.2	7.1	6.2	171	72	15.0	14,100	1,770
2.7	11.3	7.8	6.4	193	80	15.5	17,600	2,050
2.8	12.5	8.5	6.6	218	87	16.0	21,700	2,370
2.9	13.8	9.3	6.8	246	96	16.5	26,900	2,730
3.0	15.3	10.1	7.0	277	105	17.0	33,200	3,150
3.1	16.8	10.9	7.2	311	115	17.5	40,900	3,620
3.2	18.4	11.8	7.4	349	125	18.0	50,300	4,150
3.3	20.2	12.8	7.6	391	136	19.0	75,700	5,440
3.4	22.1	13.8	7.8	438	148	20.0	113,000	7,090
3.5	24.1	14.9	8.0	489	161	22.0	250,000	11,900
3.6	26.3	16.0	8.2	545	175	24.0	544,000	19,600

Appendix D   Beacon Dimensions

NUMBER OF TIERS	BEACON HEIGHT [A] (mm)*	FOCAL HEIGHT (mm)*	BEACON WEIGHT (Kg)
1	110	80	4.5
N	110+((N-1)x40)	80+((N-1)x20)	4.5+((N-1)x2.7)

* Includes mounting bush
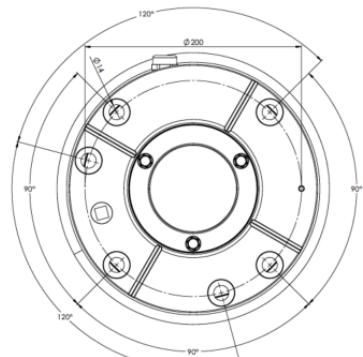
BOTTOM VIEW
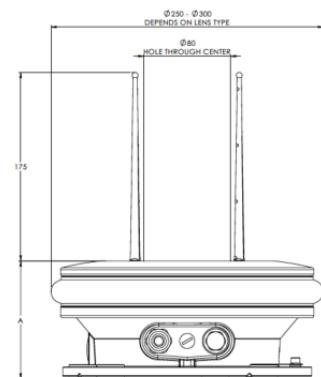
SIDE VIEW

Appendix E   Product Codes

Marine LED beacon with IR programmer

VLB-44X-xT-cddd

c =	Beacon colours, RED, WHT, GRN, YEL.
ddd =	Vertical divergence 2.5, 05, 10 degrees and OBS
x =	Number of tiers

Mounting studs required:

3 or 4 M12 Bolts, nuts, washers, lock nuts (or 1/2")

3 or 4 M12 Threaded rod, nuts, washers, locking nuts (1/2")

Mounting bolt separation 200mm PCD

Appendix F   Specifications of VLB-44X Beacon

Optical

Light Source	High-Intensity Light-Emitting Diodes
	Output temperature controlled to protect LEDs
Colours Available	Red, White, Green and Yellow
Intensity	See Appendix B
Effective intensity settings	Up to 15 levels for both day and night operation
Peak Intensity	Automatic Schmidt-Clausen correction up to beacon max intensity
Flash Characters	246 standard characters plus one custom character
	20 factory set custom characters if required
Vertical Divergence	VLB44X-2.5 ±1.25° at 50% centre-peak
	VLB44X-5 ±2.5° at 50% centre-peak
	VLB44X-10 ±5° at 50% centre-peak
Synchronization	Wired sync standard, delay up to 9.9 seconds in 0.1 second steps.
	Optional external VSU-29 GPS sync pulse unit (beacon top-mount available)

Electrical

Voltage	Nominal 12.0VDC (9VDC to 18VDC)
	Programmable low voltage cut off threshold
Beacon on current	See Appendix B
Current between flashes	See Appendix B
Current by day	See Appendix B
Day/Night transition.	Photo-sensor located in base. Nine program settings for the day/night transition. Accuracy of sensor +20 lux
Reverse Polarity	Internally protected against reverse polarity connection
Traffic Light Inputs	Flash/Fixed, Day/Night and On/Off inputs.
	On Threshold >= 7VDC, off threshold <= 5.5VDC
	Max sink current 0.3mA @ 12VDC supply, rated to 24VDC max
Alarm Output	Open drain FET, max current 100mA, max 50VDC
Data Port	RS232, 2 wire, half-duplex serial interface; HW handshaking and SW flow control not supported.

Material for Beacon

Lens	Optical grade acrylic
Top	Marine grade aluminum (AlSi12), anodized to 25 microns, powder coated
Center Tube	Marine grade aluminum (6082-T6), electroless Ni
Body	Marine grade aluminum (AlSi12), anodized to 25 microns, powder coated
Additional Bird Spikes	4 bird spikes, PC-ABS blend.
Sealing	O-rings

Environment

Temperature	-30°C to +50°C
Design Wind speed	Rated to withstand winds to 100+ knots
Immersion	MIL-STD-202G Method 104A, Cond A IP68, 1.5m for 60 minutes
Ultra-Violet Radiation	All external materials are UV resistant
Vibration	MIL-STD-202G Method 204D, Cond B
	1G (5Hz to 40.8Hz, xyz axis, 1 octave/min)
	5G (40.85Hz to 2000Hz, xyz axis, 1 octave/min)
Shock	MIL-STD-202G Method 213B, Cond H 75G, xyz axis
Electrical	47 CFR FCC Part 15 Subpart B: 2009
	EN 55015:2006+A2:2009 (Disturbance voltages)
	EN 61547:1995+A1:2000 (Radiated disturbance 30MHz to 300MHz)
	IEC 61000-4-2: 2008, Level 3 (Electrostatic discharge immunity)
	IEC 61000-4-3: 2006+A1:2007, 3V/m (Radiated, radio frequency, electric field immunity)
	IEC 61000-4-5: 2005 (Surge immunity)

Programming	Vega Infra Red programmer
Design Life	>10 years depending on flash character and duty cycle
Weights and Dimensions	
Mounting holes	Three corrosion-insulated holes, Ø14 mm, on 200 (7-7/8") PCD
Overall Height	See Appendix D
Focal plane	See Appendix D
Beacon diameter	See Appendix D
Centre Hole	Single tier Ø92mm, 2-8 tier Ø88mm.
Power Connection	2m length of neoprene 3-core 2.5mm^2 cable
Signal Connection	2m length of 12 core 0.2mm^2 wire
Weight	See Appendix D

Appendix G   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 are as follows

Example given for Fl (2) 38.5sec (0.5sec on <u>2sec off</u> 16sec on <u>20sec off</u>)

Step		Example	Required Character
Enter programming mode	The beacon 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, Colour/Units, Feature and Feature syntax	Beacon will flash each time button is pressed	20	20
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	Beacon will flash 3 long flashes to indicate the instruction has been accepted	000	000

When the beacon 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 0 999).

If an error is made when programming the custom character, the beacon will flash 3 times.

Appendix H   Flash Character Table with Programming Codes

Code	Description	Duty Cycle	On	Off	On	Off	On	Off	On	Off
FIXED CHARACTER CODE										
000	Fixed	1.00								
00Y	Fixed – 0.Y sec SC Correction	*FOR LAB TESTING ONLY – DO NOT USE IN THE FIELD*								
ISOPHASE CODES										
100	ISO 2s	0.50	1.00	1.00						
101	ISO 3s	0.50	1.50	1.50						
102	ISO 4s	0.50	2.00	2.00						
103	ISO 5s	0.50	2.50	2.50						
104	ISO 6s	0.50	3.00	3.00						
105	ISO 8s	0.50	4.00	4.00						
106	ISO 10s	0.50	5.00	5.00						
OCCULTING CODES										
200	OC 1.25s 0.75	0.60	0.75	0.50						
201	OC 3s 2.0	0.67	2.00	1.00						
202	OC 3s 2.5	0.83	2.50	0.50						
203	OC 3.5s 2.5	0.71	2.50	1.00						
204	OC 4s 2.5	0.63	2.50	1.50						
205	OC 4s 3.0	0.75	3.00	1.00						
206	OC 5s 3.0	0.60	3.00	2.00						
207	OC 5s 4.0	0.80	4.00	1.00						
208	OC 5s 4.5	0.90	4.50	0.50						
209	OC 6s 4.0	0.67	4.00	2.00						
210	OC 6s 4.5	0.75	4.50	1.50						
211	OC 6s 5.0	0.83	5.00	1.00						
212	OC 7s 4.5	0.64	4.50	2.50						
213	OC 8s 5.0	0.63	5.00	3.00						
214	OC 8s 6.0	0.75	6.00	2.00						
215	OC 9s 6.0	0.67	6.00	3.00						
216	OC 10s 6.0	0.60	6.00	4.00						
217	OC 10s 7.0	0.70	7.00	3.00						
218	OC 10s 7.5	0.75	7.50	2.50						
219	OC 12s 8.0	0.67	8.00	4.00						
220	OC 15s 10.0	0.67	10.00	5.00						
221	OC(2) 8s 3.0 2.0	0.50	3.00	2.00	1.00	2.00				
222	OC(2) 8s 5.0 1.0	0.75	5.00	1.00	1.00	1.00				
FLASH CODES										
300	Fl 1.5s 0.2	0.13	0.20	1.30						
301	Fl 1.5s 0.3	0.20	0.30	1.20						
302	Fl 1.5s 0.4	0.27	0.40	1.10						
303	Fl 1.5s 0.5	0.33	0.50	1.00						
304	Fl 2s 0.2	0.10	0.20	1.80						
305	Fl 2s 0.3	0.15	0.30	1.70						
306	Fl 2s 0.4	0.20	0.40	1.60						
307	Fl 2s 0.5	0.25	0.50	1.50						
308	Fl 2s 0.7	0.35	0.70	1.30						
309	Fl 2s 0.8	0.40	0.80	1.20						
310	Fl 2.5s 0.3	0.12	0.30	2.20						
311	Fl 2.5s 0.5	0.20	0.50	2.00						
312	Fl 2.5s 1.0	0.40	1.00	1.50						
313	Fl 3s 0.2	0.07	0.20	2.80						
314	Fl 3s 0.3	0.10	0.30	2.70						
315	Fl 3s 0.4	0.13	0.40	2.60						

Code	Description	Duty Cycle	On	Off	On	Off	On	Off	On	Off
316	Fl 3s 0.5	0.17	0.50	2.50						
317	Fl 3s 0.6	0.20	0.60	2.40						
318	Fl 3s 1.0	0.33	1.00	2.00						
319	Fl 4s 0.2	0.05	0.20	3.80						
320	Fl 4s 0.3	0.08	0.30	3.70						
321	Fl 4s 0.4	0.10	0.40	3.60						
322	Fl 4s 0.5	0.13	0.50	3.50						
323	Fl 4s 0.6	0.15	0.60	3.40						
324	Fl 4s 0.8	0.20	0.80	3.20						
325	Fl 4s 1.0	0.25	1.00	3.00						
326	Fl 4s 1.5	0.38	1.50	2.50						
327	Fl 5s 0.2	0.04	0.20	4.80						
328	Fl 5s 0.3	0.06	0.30	4.70						
329	Fl 5s 0.5	0.10	0.50	4.50						
330	Fl 5s 0.9	0.18	0.90	4.10						
331	Fl 5s 1.0	0.20	1.00	4.00						
332	Fl 5s 1.5	0.30	1.50	3.50						
333	Fl 6s 0.2	0.03	0.20	5.80						
334	Fl 6s 0.3	0.05	0.30	5.70						
335	Fl 6s 0.4	0.07	0.40	5.60						
336	Fl 6s 0.5	0.08	0.50	5.50						
337	Fl 6s 0.6	0.10	0.60	5.40						
338	Fl 6s 1.0	0.17	1.00	5.00						
339	Fl 6s 1.5	0.25	1.50	4.50						
340	Fl 7s 1.0	0.14	1.00	6.00						
341	Fl 7s 2.0	0.29	2.00	5.00						
342	Fl 7.5s 0.5	0.07	0.50	7.00						
343	Fl 7.5s 0.8	0.11	0.80	6.70						
344	Fl 8s 0.5	0.06	0.50	7.50						
345	Fl 9s 0.9	0.10	0.90	8.10						
346	Fl 10s 0.2	0.02	0.20	9.80						
347	Fl 10s 0.3	0.03	0.30	9.70						
348	Fl 10s 0.5	0.05	0.50	9.50						
349	Fl 10s 0.8	0.08	0.80	9.20						
350	Fl 10s 1.0	0.10	1.00	9.00						
351	Fl 10s 1.5	0.15	1.50	8.50						
352	Fl 12s 1.2	0.10	1.20	10.80						
353	Fl 12s 2.5	0.21	2.50	9.50						
354	Fl 15s 1.0	0.07	1.00	14.00						
MULTIPLE FLASH CODES										
400	Fl(2) 4s 0.5	0.25	0.50	1.00	0.50	2.00				
401	Fl(2) 4.5s 0.3	0.13	0.30	1.00	0.30	2.90				
402	Fl(2) 4.5s 0.4	0.18	0.40	1.00	0.40	2.70				
403	Fl(2) 4.5s 0.5	0.22	0.50	1.00	0.50	2.50				
404	Fl(2) 5s 0.2 0.8	0.08	0.20	0.80	0.20	3.80				
405	Fl(2) 5s 0.2 1.2	0.08	0.20	1.20	0.20	3.40				
406	Fl(2) 5s 0.4	0.16	0.40	0.60	0.40	3.60				
407	Fl(2) 5s 0.5	0.20	0.50	1.00	0.50	3.00				
408	Fl(2) 5s 1.0	0.40	1.00	1.00	1.00	2.00				
409	Fl(2) 5.5s 0.4	0.15	0.40	1.40	0.40	3.30				
410	Fl(2) 6s 0.2 1.4	0.07	0.20	1.40	0.20	4.20				
411	Fl(2) 6s 0.3	0.10	0.30	1.00	0.30	4.40				
412	Fl(2) 6s 0.4	0.13	0.40	1.00	0.40	4.20				
413	Fl(2) 6s 0.5	0.17	0.50	1.00	0.50	4.00				

Code	Description	Duty Cycle	On	Off	On	Off	On	Off	On	Off
414	Fl(2) 6s 0.5 1.5	0.17	0.50	1.50	0.50	3.50				
415	Fl(2) 6s 0.8	0.27	0.80	1.20	0.80	3.20				
416	Fl(2) 6s 1.0	0.33	1.00	1.00	1.00	3.00				
417	Fl(2) 6s 3.0	0.67	3.00	1.00	1.00	1.00				
418	Fl(2) 7s 1.0	0.29	1.00	1.00	1.00	4.00				
419	Fl(2) 8s 0.4	0.10	0.40	1.00	0.40	6.20				
420	Fl(2) 8s 0.5	0.13	0.50	1.00	0.50	6.00				
421	Fl(2) 8s 1.0	0.25	1.00	1.00	1.00	5.00				
422	Fl(2) 10s 0.4	0.08	0.40	1.60	0.40	7.60				
423	Fl(2) 10s 0.5 1.0	0.10	0.50	1.00	0.50	8.00				
424	Fl(2) 10s 0.5 1.5	0.10	0.50	1.50	0.50	7.50				
425	Fl(2) 10s 0.5 2.0	0.10	0.50	2.00	0.50	7.00				
426	Fl(2) 10s 0.6 2.4	0.12	0.60	2.40	0.60	6.40				
427	Fl(2) 10s 0.8 1.2	0.16	0.80	1.20	0.80	7.20				
428	Fl(2) 10s 1.0 1.0	0.20	1.00	1.00	1.00	7.00				
429	Fl(2) 10s 1.0 1.5	0.20	1.00	1.50	1.00	6.50				
430	Fl(2) 10s 3.0 1.0	0.80	3.00	1.00	5.00	1.00				
431	Fl(2) 12s 0.4 1.0	0.07	0.40	1.00	0.40	10.20				
432	Fl(2) 12s 0.5 1.0	0.08	0.50	1.00	0.50	10.00				
433	Fl(2) 12s 1.0 2.0	0.17	1.00	2.00	1.00	8.00				
434	Fl(2) 12s 1.5 2.0	0.25	1.50	2.00	1.50	7.00				
435	Fl(2) 15s 1.0 2.0	0.13	1.00	2.00	1.00	11.00				
436	Fl(2) 20s 1.0 3.0	0.10	1.00	3.00	1.00	15.00				
437	Fl(2) 25s 1.0 1.0	0.08	1.00	1.00	1.00	22.00				
438	Fl(3) 6s 0.5	0.25	0.50	1.00	0.50	1.00	0.50	2.50		
439	Fl(3) 6.1s 0.4	0.20	0.40	1.00	0.40	1.00	0.40	2.90		
440	Fl(3) 8s 0.5	0.19	0.50	1.00	0.50	1.00	0.50	4.50		
441	Fl(3) 9s 0.3	0.10	0.30	1.00	0.30	1.00	0.30	6.10		
442	Fl(3) 9s 0.8	0.27	0.80	1.20	0.80	1.20	0.80	4.20		
443	Fl(3) 10s 0.5	0.15	0.50	1.50	0.50	1.50	0.50	5.50		
444	Fl(3) 10s 1.0	0.30	1.00	1.00	1.00	1.00	1.00	5.00		
445	Fl(3) 12s 0.5 1.5	0.13	0.50	1.50	0.50	1.50	0.50	7.50		
446	Fl(3) 12s 0.5 2.0	0.13	0.50	2.00	0.50	2.00	0.50	6.50		
447	Fl(3) 12s 0.8 1.2	0.20	0.80	1.20	0.80	1.20	0.80	7.20		
448	Fl(3) 12s 1.0 2.0	0.25	1.00	2.00	1.00	2.00	1.00	5.00		
449	Fl(3) 15s 0.3	0.06	0.30	1.70	0.30	1.70	0.30	10.70		
450	Fl(3) 15s 0.4	0.08	0.40	1.00	0.40	1.00	0.40	11.80		
451	Fl(3) 15s 0.5	0.10	0.50	1.50	0.50	1.50	0.50	10.50		
452	Fl(3) 20s 0.5 1.5	0.08	0.50	1.50	0.50	1.50	0.50	15.50		
453	Fl(3) 20s 0.5 3.0	0.08	0.50	3.00	0.50	3.00	0.50	12.50		
454	Fl(3) 20s 0.8 1.2	0.12	0.80	1.20	0.80	1.20	0.80	15.20		
455	Fl(3) 20s 1.0 1.0	0.15	1.00	1.00	1.00	1.00	1.00	15.00		
456	Fl(3) 30s 1.0 4.0	0.10	1.00	4.00	1.00	4.00	1.00	19.00		
457	Fl(4) 10s 0.5 1.0	0.20	0.50	1.00	0.50	1.00	0.50	1.00	0.50	5.00
458	Fl(4) 10s 0.5 0.5	0.20	0.50	0.50	0.50	0.50	0.50	0.50	0.50	6.50
459	Fl(4) 10s 0.8	0.32	0.80	1.20	0.80	1.20	0.80	1.20	0.80	3.20
460	Fl(4) 12s 0.3	0.10	0.30	1.70	0.30	1.70	0.30	1.70	0.30	5.70
461	Fl(4) 12s 0.5	0.17	0.50	1.50	0.50	1.50	0.50	1.50	0.50	5.50
462	Fl(4) 12s 0.8	0.27	0.80	1.20	0.80	1.20	0.80	1.20	0.80	5.20
463	Fl(4) 15s 0.5	0.13	0.50	1.50	0.50	1.50	0.50	1.50	0.50	8.50
464	Fl(4) 15s 1.0	0.27	1.00	1.00	1.00	1.00	1.00	1.00	1.00	8.00
465	Fl(4) 16s 0.5	0.13	0.50	1.50	0.50	1.50	0.50	1.50	0.50	9.50
466	Fl(4) 20s 0.3	0.06	0.30	3.00	0.30	3.00	0.30	3.00	0.30	9.80
467	Fl(4) 20s 0.5	0.10	0.50	1.50	0.50	1.50	0.50	1.50	0.50	13.5

Code	Description	Duty Cycle	On	Off	On	Off	On	Off	On	Off
468	Fl(4) 20s 1.5	0.30	1.50	1.50	1.50	1.50	1.50	1.50	1.50	9.50
469	Fl(4) 30s 0.5	0.07	0.50	0.50	0.50	0.50	0.50	0.50	0.50	26.5
470	Fl(5) 20s 0.5 1.5	0.13	0.50	1.50	**[x 4]**				0.50	11.5
471	Fl(5) 20s 0.80	0.20	0.80	1.20	**[x 4]**				0.80	11.2
472	Fl(2+1) 6s 0.3	0.15	0.30	0.40	0.30	1.20	0.30	3.50		
473	Fl(2+1) 10s 0.5	0.15	0.50	0.70	0.50	2.10	0.50	5.70		
474	Fl(2+1) 12s 0.8	0.20	0.80	1.20	0.80	2.40	0.80	6.00		
475	Fl(2+1) 12s 1.0	0.25	1.00	1.00	1.00	4.00	1.00	4.00		
476	Fl(2+1) 15s 1.0	0.20	1.00	2.00	1.00	5.00	1.00	5.00		
VERY QUICK CODES										
500	VQ 0.5s 0.15	0.30	0.15	0.35						
501	VQ 0.5s 0.20	0.40	0.20	0.30						
502	VQ 0.6s 0.20	0.33	0.20	0.40						
503	VQ 0.6s 0.30	0.50	0.30	0.30						
504	VQ(2) 4s 0.20	0.10	0.20	1.00	0.20	2.60				
505	VQ(2) 8s 0.20	0.05	0.20	1.00	0.20	6.60				
506	VQ(3) 5s 0.15	0.09	0.15	0.35	0.15	0.35	0.15	3.85		
507	VQ(3) 5s 0.20	0.12	0.20	0.30	0.20	0.30	0.20	3.80		
508	VQ(3) 5s 0.3 0.2	0.18	0.30	0.20	0.30	0.20	0.30	3.70		
509	VQ(3) 5s 0.3 0.3	0.18	0.30	0.30	0.30	0.30	0.30	3.50		
510	VQ(3) 15s 0.10	0.02	0.10	0.50	0.10	0.50	0.10	13.70		
511	VQ(9) 10s 0.15	0.14	0.15	0.35	**[x 8]**				0.15	5.85
512	VQ(9) 10s 0.20	0.18	0.20	0.30	**[x 8]**				0.20	5.80
513	VQ(9) 10s 0.30	0.27	0.30	0.30	**[x 8]**				0.30	4.90
514	VQ(6)+LFl 10s 0.15	0.29	0.15	0.35	**[x 6]**				2.00	5.00
515	VQ(6)+LFl 10s 0.2	0.32	0.20	0.30	**[x 6]**				2.00	5.00
516	VQ(6)+LFl 10s 0.3	0.38	0.30	0.30	**[x 6]**				2.00	4.40
QUICK CODES										
600	Q 1s 0.2	0.20	0.20	0.80						
601	Q 1s 0.3	0.30	0.30	0.70						
602	Q 1s 0.4	0.40	0.40	0.60						
603	Q 1s 0.5	0.50	0.50	0.50						
604	Q 1s 0.8	0.80	0.80	0.20						
605	Q 1.2s 0.3	0.25	0.30	0.90						
606	Q 1.2s 0.5	0.42	0.50	0.70						
607	Q 1.2s 0.6	0.50	0.60	0.60						
608	Q(2) 5s 0.3	0.12	0.30	0.70	0.30	3.70				
609	Q(2) 5s 0.5	0.20	0.50	0.50	0.50	3.50				
610	Q(2) 6s 0.30	0.10	0.30	0.70	0.30	4.70				
611	Q(2) 6s 0.35	0.12	0.35	0.70	0.35	4.60				
612	Q(2) 10s 0.6	0.12	0.60	0.40	0.60	8.40				
613	Q(2) 15s 0.2	0.03	0.20	0.80	0.20	13.80				
614	Q(3) 5s 0.5	0.30	0.50	0.50	0.50	0.50	0.50	2.50		
615	Q(3) 6s 0.3	0.15	0.30	0.70	0.30	0.70	0.30	3.70		
616	Q(3) 10s 0.30	0.09	0.30	0.70	0.30	0.70	0.30	7.70		
617	Q(3) 10s 0.35	0.11	0.35	0.65	0.35	0.65	0.35	7.65		
618	Q(3) 10s 0.50	0.15	0.50	0.50	0.50	0.50	0.50	7.50		
619	Q(3) 10s 0.60	0.18	0.60	0.60	0.60	0.60	0.60	7.00		
620	Q(3) 30s 0.4	0.04	0.40	4.60	0.40	4.60	0.40	19.6		
621	Q(4) 6s 0.3	0.20	0.30	0.70	0.30	0.70	0.30	0.70	0.30	2.70
622	Q(4) 6s 0.4	0.27	0.40	0.60	0.40	0.60	0.40	0.60	0.40	2.60
623	Q(4) 10s 0.3	0.12	0.30	0.70	0.30	0.70	0.30	0.70	0.30	6.70
624	Q(4) 12s 0.3	0.10	0.30	0.70	0.30	0.70	0.30	0.70	0.30	8.70
625	Q(4) 15s 0.35	0.09	0.35	0.70	0.35	0.70	0.35	0.70	0.35	11.5

Code	Description	Duty Cycle	On	Off	On	Off	On	Off	On	Off
626	Q(4) 20s 0.5	0.10	0.50	0.50	0.50	0.50	0.50	0.50	0.50	16.5
627	Q(9) 15s 0.3	0.18	0.30	0.70	[x 8]				0.30	6.70
628	Q(9) 15s 0.35	0.21	0.35	0.65	[x 8]				0.35	6.65
629	Q(9) 15s 0.6	0.36	0.60	0.60	[x 8]				0.60	4.80
630	Q(6)+LFl 15s 0.2	0.21	0.20	0.80	[x 6]				2.00	7.00
631	Q(6)+LFl 15s 0.3	0.25	0.30	0.70	[x 6]				2.00	7.00
632	Q(6)+LFl 15s 0.35	0.21	0.35	0.65	[x 6]				1.05	7.95
633	Q(6)+LFl 15s 0.6	0.37	0.60	0.60	[x 6]				2.00	5.80

LONG FLASH CODES

Code	Description	Duty Cycle	On	Off	On	Off	On	Off	On	Off
700	LFl 5s 2.0	0.40	2.00	3.00						
701	LFl 6s 2.0	0.33	2.00	4.00						
702	LFl 8s 2.0	0.25	2.00	6.00						
703	LFl 8s 3.0	0.38	3.00	5.00						
704	LFl 10s 2.0	0.20	2.00	8.00						
705	LFl 10s 3.0	0.30	3.00	7.00						
706	LFl 10s 4.0	0.40	4.00	6.00						
707	LFl 12s 2.0	0.17	2.00	10.00						
708	LFl 15s 4.0	0.27	4.00	11.00						

MORSE CODES

Code	Description	Duty Cycle	On	Off	On	Off	On	Off	On	Off
800	MO(A) 6s 0.3	0.22	0.30	0.60	1.00	4.10				
801	MO(A) 8s 0.4	0.30	0.40	0.60	2.00	5.00				
802	MO(A) 8s 0.8	0.40	0.80	1.20	2.40	3.60				
803	MO(A) 10s 0.5	0.20	0.50	0.50	1.50	7.50				
804	MO(A) 12s	0.33	1.00	1.00	3.00	7.00				
805	MO(A) 15s 0.5	0.17	0.50	1.50	2.00	11.00				
806	MO(B) 15s 1.5	0.20	1.50	0.50	0.50	0.50	0.50	0.50	0.50	10.5
807	MO(D) 10s 5.0	0.70	5.00	1.00	1.00	1.00	1.00	1.00		
808	MO(N) 8s 5.0	0.75	5.00	1.00	1.00	1.00				
809	MO(U) 10s 0.2	0.10	0.20	0.80	0.20	0.80	0.60	7.40		
810	MO(U) 10s 0.3	0.15	0.30	0.70	0.30	0.70	0.90	7.10		
811	MO(U) 10s 0.4	0.20	0.40	0.60	0.40	0.60	1.20	6.80		
812	MO(U) 10s 0.5	0.25	0.50	0.50	0.50	0.50	1.50	6.50		
813	MO(U) 15s	0.13	0.40	0.50	0.40	0.50	1.20	12.00		
814	MO(U) 15s 0.45	0.15	0.45	0.45	0.45	0.45	1.35	11.85		
815	MO(U) 15s 0.50	0.17	0.50	0.50	0.50	0.50	1.50	11.50		
816	MO(U) 15s 0.55	0.17	0.55	0.35	0.55	0.35	1.45	11.75		
817	MO(U) 15s 0.60	0.17	0.60	0.30	0.60	0.30	1.40	11.80		
818	MO(U) 15s 0.7 0.5	0.22	0.70	0.50	0.70	0.50	1.90	10.70		
819	MO(U) 15s 0.7 0.7	0.23	0.70	0.70	0.70	0.70	2.10	10.10		
820	MO(U) 15s 0.75 0.15	0.21	0.75	0.15	0.75	0.15	1.65	11.55		
821	MO(U) 15s 0.75 0.45	0.23	0.75	0.45	0.75	0.45	2.00	10.60		
822	MO(U) 15s 1.15	0.35	1.15	0.75	1.15	0.75	3.00	8.20		
823	MO(U) 15s 1.30	0.39	1.30	0.70	1.30	0.70	3.30	7.70		

CUSTOM & SPECIAL CODES

900…	Can be inserted at factory at time of order (up to 50, memory-limited)
	See next page if special characters have been added.

999	Custom flash character programmed by user

Code	Custom Character Description	Duty Cycle	On	Off	On	Off	On	Off	On	Off
SPECIAL CHARACTER CODE										
900	Fl 3s, 0.45	0.15	0.45	2.55						
901	Fl 4s, 0.55	0.138	0.55	3.45						
902	Fl 5s, 0.55	0.11	0.55	4.45						
903	Fl 6s, 0.65	0.108	0.65	5.35						
904	Fl 9s, 0.65	0.072	0.65	8.35						
905	Fl 10s, 0.65	0.065	0.65	9.35						
906	Fl 15s, 0.6	0.04	0.6	14.4						
907	Fl (2) 8s, 0.55	0.138	0.55	1.45	0.55	5.45				
908	Fl (2) 10s, 0.65	0.13	0.65	1.35	0.65	7.35				
909	Fl (2) 12s, 0.65	0.108	0.65	1.35	0.65	9.35				
910	Fl (2) 15s, 0.65	0.087	0.65	1.35	0.65	12.35				
911	Fl (3) 10s, 0.65	0.195	0.65	1.35	0.65	1.35	0.65	5.35		
912	Fl (3) 15s, 0.65	0.13	0.65	1.35	0.65	1.35	0.65	10.35		
913	Fl (3) 18s, 0.65	0.108	0.65	1.85	0.65	1.85	0.65	12.35		
914	Fl (4) 10s, 0.4	0.16	0.4	1.2	0.4	1.2	0.4	1.2	0.4	4.8
915	LFl 10s, 2.15	0.215	2.15	7.85						
916	MO (A) 5s, 0.45	0.38	0.45	0.25	1.45	2.85				
917	Q 15s, 1	0.067	1	14						
918	Fl (5) 30s, 1	0.167	1	1	**[x4]**				1	21
919	Fl (5) 30s, 1	0.167	1	1.5	**[x4]**				1	19
920	OC 3.5s, 3.2	0.914	3.2	0.3						
921	OC 4s, 2.4	0.6	2.4	1.6						
922	OC 4s, 3.5	0.875	3.5	0.5						
923	MO (F) 4.2s, 0.3	0.33	0.3	0.3	0.3	0.3	0.5	0.3	0.3	1.9
924	MO (U) 20s, 0.5	0.3	0.5	3	0.5	3	5	8		
925	Q 15s, 0.5	0.033	0.5	14.5						
926	OC 15s, 9	0.6	9	6						
927	LF1 (2) 12s, 2	0.33	2	2	2	6				
928	Fl (4) 10s, 1.5	0.4	1	1.5	1	1.5	1	1.5	1	1.5
929	Fl (4) 20s, 1.5	0.2	1	1.5	1	1.5	1	1.5	1	11.5
930	Fl(2+1) 9s	0.167	0.5	0.5	0.5	1	0.5	6		
931	Q(6)+LFl 15s, 0.5s	0.333	0.5	0.5	**[x6]**	2	7			
932	Q(9) 15s, 0.5s	0.3	0.5	0.5	**[x8]**	0.5	6.5			

Appendix ITVIR Remote02 Specifications & Battery Replacement

Coding Scheme: RC5 code with centre frequency 36.7 kHz

Programming options:

- Flash Character

- Individual day / night Intensity

- Synchronisation

- Day / Night sensitivity control

- Operation mode

- Battery low threshold

- Slave sync flash cycle disable count

- Custom flash character

Dimensions: 87mm x 41mm x 6.5mm

Weight: 18g

Power Supply: 1 x 3V lithium coin cell battery, CR2025 type

Part Number: Remote 02

Battery Replacement:

- The programmer requires one 3V lithium battery type CR2025.

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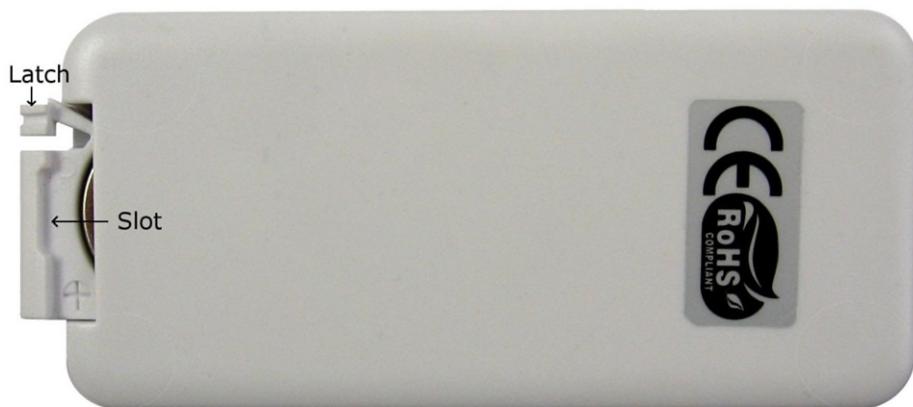
- Remove the old battery and insert a new one, ensuring that the + side of the battery is facing upwards as shown.

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

Appendix J Serial Interface Commands

The VLB-44X beacon offers a serial interface control and monitoring capability if the data-port option is fitted.
Many of these commands can be found in Appendix A as annotations to their related TVIR commands.
Any command can be turned into a query by inserting a question-mark character, '?' instead of the standard parameter. The consequent read-back format is the same as the command format, including the pseudo-XML tag.

The serial interface defaults to 115.2kbaud, 8 bits, no parity, 1 stop bit (8N1).

Command (Pseudo-XML Tag)	Command or Query Name	Legal Parameter Range & Unit	Acts Immediately or Requires Restart	Description
`<NRG>X/`	Night Range	X = 0 to 999999 Candela	Restart required	Sets night intensity in Candela. Any intensity below the minimum is clipped to the minimum value allowable. 999999 or any value greater than or equal to the maximum intensity specification for the beacon sets the maximum intensity value.
`<DRG>X/`	Day Range	X = 0 to 999999 Candela	Restart required	Sets day intensity in Candela. Any intensity below the minimum is clipped to the minimum value allowable. 999999 or any value greater than or equal to the maximum intensity specification for the beacon sets the maximum intensity value.
`<SYD>YY/`	Sync Delay	YY = 0 to 99 tenths of a second	Restart required	Sets flash sync delay.
`<OSO>B/`	On Sync Only	B = 0 for sync-master or B = 1 for sync-slave	Restart required	Sets sync master/slave mode.
`<DNT>0YY/`	Day/Night Threshold	YY = 01 through 12 thresholds	Restart required	Sets day/night thresholds.
`<ODD>B/`	On During Day	B = 0: Night-only operation B = 1: Day and night operation	Restart required	Defines whether the beacon operates during the night only or during both day and night.
`<OPM>X/`	Operation Mode	X = 0/1: Normal mode, traffic light mode is disabled. 3: Traffic light mode is enabled (same effect as <TRF>1/). 7: Brief test of alarm output. 9: Storage mode only if traffic light mode is not enabled, otherwise no effect.	Restart required	Sets beacon main operation mode. Used for enabling/disabling traffic light mode; running a test or putting the beacon into or out of storage mode.

Command (Pseudo-XML Tag)	Command or Query Name	Legal Parameter Range & Unit	Acts Immediately or Requires Restart	Description
`<TRF>B`	Traffic Light Mode	1: Enable traffic light mode (and remove beacon from storage mode as a side effect); 0: Disable traffic light mode (does not affect storage mode).	Restart required	Enables or disables traffic light mode.
`<BLW>YYY/`	Low battery threshold	YYY: Threshold in tenths of a volt or disable code 999.	Restart required	Refer to Appendix A.
`<BHI>YYY/`	High battery threshold	YYY: Threshold in tenths of a volt or reset code 999.	Restart required	Refer to Appendix A.
`<VER>?/`	Software version query	Only '?' allowed	Immediate	Queries software version as per system command section of Appendix A.
`<LED>?/`	LED version query	Only '?' allowed	Immediate	Queries LED version as per system command section of Appendix A.
`<CAR>?/`	Characterisation version query	Only '?' allowed	Immediate	Queries optic characterisation version as per system command section of Appendix A.
`<ADC>?/`	Current adjustment query	Only '?' allowed	Immediate	Queries factory LED driver current adjustment.
`<FID>XYY/`	Flash Character Index	XYY = 0 through 999 as per valid characters in Appendix F. '999' represents the Custom character that is manually entered.	Restart required	Defines the flash character.
`<SPC>…/`	Special (Custom) Character	A sequence of comma-separated on/off pairs terminated with a '0' as last parameter, as per the definition in Appendix A.	Restart required	Defines the manually-entered custom character. This custom character can be selected by <FID> and/or <AID> by using index parameter 999.
`<SER>?/`	Serial number query	Only '?' allowed	Immediate	Queries beacon serial number as per system command section of Appendix A. Note! Entering a numerical value will overwrite the serial number.
`<SDA>B/`	Sync disabled	B = 0: Sync pulse generation enabled B = 1: Sync pulse generation disabled.	Restart required	Enables or disables sync pulse generation.

Command (Pseudo-XML Tag)	Command or Query Name	Legal Parameter Range & Unit	Acts Immediately or Requires Restart	Description
`<REB>1/`	Reboot command	Value doesn't matter	Immediate	Causes a reboot from the bootloader, which has a startup delay before the beacon application is entered. Intended to allow updating of beacon application software through the bootloader.
`<MON>B/`	Monitoring function	B = 0: disable monitoring B = 1: enable monitoring	Restart required	Enables monitoring the output stream over the serial interface. The stream can be set to free-running or on demand with the <MFR> command.
`<MFR>B/`	Monitoring free-run	B = 0: On-demand monitoring enabled B = 1: Free-running monitoring	Restart required	Enables free-running monitoring in which a semi-continuous stream of data is output. On-demand monitoring sends one or more data packets on receipt of a '/' character.
`<ODS>B/`	On-demand sync	B = 0: Disables On-demand sync behaviour (default, normal operation) B = 1: Enables on-demand sync behaviour	Restart required	When set the beacon turns off when sync is low and operates normally when sync is open-circuit or high.
`<SSF>YY/`	Slave sync flash count	YY = 002 to 099	Restart required	Sets the number of cycles that a beacon will continue to flash after loss of sync.
`<RST>1/`	Restart the beacon	Any value	This is the restart command	This command must be sent after any command or sequence of commands that are listed as requiring a restart. It causes the beacon application software to restart without waiting in the bootloader. A restart causes the non-volatile settings information to be copied into volatile, operational memory in the beacon.
`<FCM>X/`	Flash compensation mode	X = 0: (Default) Effective intensity mode as per IALA E-200-4 2017; X = 2: Effective intensity mode as per IALA E-200-4 2008;	Restart required	Sets the flash compensation mode. Refer to Appendix A for more information.
`<R2B>X/`	Set baud rate	X: Standard baud rates: 0 (i.e. 115200 default), 4800, 9600, 14400, 19200, 38400 (AIS), 57600, 115200 (default & Vegaweb).	Restart required	Sets the command & monitoring serial interface to the required baud rate.
`<RS2>B/`	Enable/ disable RS232	B = 0: disable RS232	Restart required	If disabled, RS232 can only be re-enabled using the TVIR command (see Appendix A).

Command (Pseudo-XML Tag)	Command or Query Name	Legal Parameter Range & Unit	Acts Immediately or Requires Restart	Description
`<AIM>B/`	AIS Monitoring function	B = 0: disable AIS monitoring B = 1: enable AIS monitoring	Restart required	Enables/disables the specific AIS output monitoring stream format comprising one-per-minute bursts of all monitoring data after a preamble. Does not change the baud rate. For the AIS format to be output correctly, when enabled, the <MON> and <MFR> commands also must be enabled. When <AIM> is disabled, it leaves monitoring in the state defined by <MON> and <MFR>.