SABIK

VLL-43 LED Linear Lead Light

Installation and Operation Manual with Infra-red Programmer

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1.0 Introduction to the VLL-43 Marine LED Linear Lead Light

1.1 Overview

The Vega VLL-43 LED Linear lead light is an energy efficient marine light that has been designed for use as range lights or for marking the edges of channels or obstacles. The VLL-43 can be used as a single unit or multiple units to increase the range of the light. For example a single green light has a range of 11NM at 0.074T and 15.5NM for 8 lights.

The light can be mounted horizontally or vertically giving quite a different horizontal and vertical divergence profile. The divergence at 50% intensity across the Lead Light is 8.5 degrees. The divergence along the length of the light varies depending on the colour. (Refer section 4.0 and Specifications Appendix F)

Five LED colours are available red, green, white, yellow, and blue. 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 Linear lead Lights are designed to operate using 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 4-core 0.75mm^2 cable for the power and hard wire synchronizing connections.

The VLL-43 has been designed with many features to allow the user to set up the operation for a specific site. These features are programmable using the Vega Remote02 infrared programmer. The programmer needs to be ordered as a separate item. The lead light will be delivered with factory default settings. Details on how to reprogram the VLL-43 are available in the Vega IR Programmer instruction manual.

While the VLL-43 light 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 lead light, especially where it is solar / battery powered. Increasing the range or the duty cycle of the light will require larger solar panel and battery capacity. Information is provided in this manual to calculate the Lead Light power consumption. Vega or the local Vega Distributor can assist with the calculation if required.

The VLL-43 Lead Light is fitted with hard wire synchronization, which can be used to synchronize the light with other beacons that are within wiring distance. To allow synchronization with more remote beacons GPS synchronization can be provided by fitting the optional VSU-29 GPS Synch Unit.

By using the optional Mini VegaWeb monitoring unit the operation of the VLL-43 Lead Light can be monitored, and if required have on demand control.

If using the optional VSU-29 GPS Sync or VegaWeb monitoring unit, ensure the power requirements of these devices are included in any overall power calculation for the Lead Light application.

To begin using the VLL-43 Lead Light the power will need to be connected, and the unit programmed for the flash character, effective intensity, and any other features required. Where multiple VLL43 lights are being used these will need to connected together and programmed individually.

The VLL-43 Linear Lead Light has a 10-year design life.

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1.2 Additional Factory Options

Additional factory options for the VLL-43:

- Alarm/Monitor output (Beacon Healthy)
- Plug and socket option for connecting multiple units supplied with a 3 pin plug fitted to the 1.75m cable and a corresponding 3 pin socket to allow another VLL-43 to be daisy chained.

1.3 The initial power up

At power-on when power is first connected, the VLL-43 will start in night mode with the light on, operating with the programmed flash character.

- After 10 seconds the VLL-43 will begin to monitor the ambient light level. If day is detected the light will be turned off.
- After 14 seconds the VLL-43 will begin to monitor for the low battery threshold (factory setting 11 Volts). If the threshold is reached the light will be turned off. The VLL-43 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 VLL-43 does not flash when power is connected.

- The power connection may be in reversed. Check that the power connection is correct. The Lead Light is protected for reverse polarity connection.
- The VLL-43 may be programmed for Storage Mode. Refer to the VegaIR Programming Manual on how to return the beacon to Operating Mode.

1.4 Infra-red programming

The infrared receiver for programming the light is located on the under side of the circuit board directly below the optical lens of each light. For best results when programming, direct the IR remote at the side of the plastic base where two cable glands are fitted. Refer to the separate instruction manual for operating the VegaIR Programmer.

1.5 Automatic Schmidt Clausen correction

The VLL-43 Linear Lead Light is programmed for the required effective intensity. This is the intensity required 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 0.74. When a light is flashed the intensity must be increased to maintain the visibility of the light at the required distance. The VLL-43 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.

- (flash period in seconds+0.2)/ flash period in seconds

For example if a 0.3 second flash was required for a range of 5NM at an atmospheric transmissivity of 0.74T:

- The effective intensity would be programmed at 77 Candela (5NM)
- The flash character would be programmed such as QFl (0.3 sec on)
- The automatic Schmidt Clausen correction would result in the light producing 77*(0.3+0.2)/0.3 or 128.33 Candela

1.6 Candela capability of the VLL-43

The effective candela settings and the maximum candela capability for the different versions of the VLL-43 are provided in Appendix A. The beacon can only achieve the maximum candela value when flashing.

A VLL-43 cannot go above its maximum 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 intensity of the beacon. If higher peak intensity is required than what the VLL-43 can produce the light 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 additional VLL-43 units.

2.0 Getting started

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

i. Determine the number of VLL-43 Lead Lights required and the power requirement (Appendix D)
ii. Program the light for the required flash character, effective candela, and other features (Section 3 and the VegaIR instruction Manual.)
iii. Install the VLL-43 Lead Light (Section 4 and 5)
iv. Synchronization options (Section 6)

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v. Check the light is working (Section 8)
vi. Routine maintenance and inspection (Section 8)

3.0 Programming options

For detailed programming instructions refer to the VegaIR Instruction manual. The programming codes for the effective intensity settings of the VLL-43 are provided in Appendix A of this manual.

During programming the VLL-43 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 Flash character

(Factory set default 104 <ISO 6s (3.0 on 3.0 off)>)
The user can program either one custom flash character or select one of 256 preprogrammed flash characters.

3.2 Day / Night control

(Factory set default 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 VLL-43 can be set for night or for both day and night (24 hour) operation.

In applications where day only operation is required in the VLL-43 Linear Lead Light should be set for day and night operation and the night intensity set to zero (0000).

3.3 Effective intensity

(Factory set default is the maximum effective intensity)
The VLL-43 is able to have a different intensity setting for day and night operation. If the Light has been programmed for night operation only the VLL-43 will be off during the day. There are up to 15 effective candela settings for both day and night operation.

The effective intensity program steps and their programming codes are detailed in Appendix A of this manual.

3.4 Battery settings

(Factory low threshold default 110 <11.0 Volts>, high threshold default 130<13.0 Volts, unless otherwise indicated on the test sheet)
The VLL-43 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. If the beacon detects three consecutive voltage readings less than the programmed low threshold the Light will turn off. 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 VLL-43 switches on for ten seconds before making a determination of day or night (refer section 1.3).

3.5 VLL-43 synchronization

(Factory setting 000 <enabled and zero time delay>)
Two options are available for synchronization on the VLL-43 Linear Lead Light.

- Hard wire synchronization or by using the
- Optional VSU-29 GPS synchronizing unit

Hard wire synchronization can be used where the other beacons to be synchronized are within a practical wiring distance. With GPS synchronization, all the beacons being synchronized will need to be fitted with a GPS unit

Program options allow the VLL-43 to be set as a master (will send and receive sync pulses) or as a slave (receive pulses only). The start of the flash character can be delayed from 0 to 9.9 seconds

Details how the synchronization functions are detailed in Section 6 and in the IR Programming manual.

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3.6 Operation mode

(Factory setting 000 <normal operation>)
The VLL-43 can be set to one of three operating modes.

- "Test Mode", this displays the programmed flash character for approx 4 minutes after which time reverting back to normal operation mode.
- "Storage Mode", this forces the light into a very low power drain state and will remain out of operation until the light has been reprogrammed for normal operation.
- "Normal Operation Mode". The light is programmed with this mode to recover it from storage mode.

3.7 PIN Code Option

(Factory setting 000 <no PIN code>)
If the user is concerned about unauthorized programming of the VLL-43 a 3digit PIN code can be set. Where a PIN code is required it is recommended the same code for all the users installed beacons. Make sure the PIN code is recorded, as programming access will not be possible without the PIN once this option has been set.

3.8 Reading settings

The user can "read" any setting that is programmed in the VLL-43. When a setting is requested the Light will respond with a series of flash groups resembling the program code of that particular feature, i.e. flash character, day or night intensity, software version etc.

3.9 System Checks

Use the System Check options to access:

- The software version and the LED type used in the VLL-43, and
- The battery voltage.

The information is read from the light as a series of flash groups.

4.0 Installing the VLL-43 linear lead light.

4.1 The mounting Structure

Depending on the application the VLL-43 can be mounted vertically or horizontally. As with any navigation light, consideration should be given to the amount of movement (sway and twist) that can occur on the mounting structure and how this may change how the light will be seen by the user. The divergence of the VLL43 lead light results in the intensity being:

- 50% of the peak intensity at ±4.25° and 10% of the peak intensity at ±7.5° across the focal plane and

- 50% of the peak intensity along the focal plane varies by colour

Red	Green	White	Yellow	Blue
±20°	±15°	±7.5°	±20°	±15°

As the focal plane for the VLL-43 is perpendicular to the base of the light the mounting surface needs to be vertical.

4.2 Mounting

When using multiple lights to increase the intensity and range, mount the lights as close as possible so that the lights appear as a single unit.

If the plug and socket option has been ordered the VLL-43 units can be mounted before connecting the individual VLL-43 unit together. The plug and socket option can support up to 8 VLL-43 units linked together.

For the standard VLL-43 unit provided with a 1.75m cable and a second cable gland the wiring between multiple units will need to be completed prior to mounting as access to the wiring is from the rear of the VLL-43.

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Where the VSU-29 GPS sync pulse unit is to be used this can be connected after the last VLL-43 in the chain of a multiple Lead Light application.

4.3 Alignment of the light

The VLL-43 should be carefully aligned to ensure that the focal plane of the light operates as intended. The light should be mounted on a vertical surface that is perpendicular to the intended direction of the light. Depending on the orientation of the VLL43 it should be mounted either horizontally or vertically on the mounting surface. Use a builder's level against the mounting surface of the structure and the VLL-43 checking the mounting surface is vertical and the light orientation is correct. If the mounting surface or the position of the light is not correct take appropriate measures to ensure it is before permanently fixing the light in place.

4.4 Mounting Stud Detail

The mounting holes for the VLL-43 light is located at the base of the light, each hole has a diameter of Ø6.1mm, and pitched on a 54mm x 280mm bolt pattern. To secure the light in place use 4 x 316 stainless steel M6 bolts or threaded studs.

When fitting the light ensure that the four stainless sleeve bushes are inserted into each mounting hole to prevent the plastic base material distorting when tightening the bolts.

1	M6 Stainless socket head cap screw
2	M6 Stainless flat washer
3	Plastic foot of VLL-43
4	Stainless foot bush of VLL-43
5	Mounting plate for the light
6	M6 Stainless flat washer
7	M6 Stainless spring washer
8	M6 Stainless nut

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5.0 Power Supply

5.1 VLL-43

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 is provided.

A low and high voltage threshold is programmable and the VLL-43 will switch off if the low threshold is reached. This feature is provided to prevent the total discharge of a battery if this is being used as the power source. The default low voltage threshold is 11 Volts unless specified on the test sheet (usually listed as “Low Battery Disconnect”). Refer to section 3.4 for details.

5.2 Identification and Termination of Wires to a Junction Box

Access to the terminals is achieved by removing the cover on the back of the VLL-43 Lead Light. When replacing the cover take care not to over tighten the screws as this could cause damage to the threads in the plastic base

Colour	Voltage	Polarity
Brown	+12 Volts	Battery positive
Blue	0 Volts	Battery negative
Green/yellow	Sync	Synchronising wire
White	Alarm/Monitor	Only available if Alarm/Monitor option has been selected at time of order. Do not connect to battery positive or damage will occur

The VLL-43 is supplied complete with a 1.75meter length of 3 or 4-core 0.75mm2 cable (if alarm/monitor option ordered) already sealed into the cable gland. If shortening the power cable, ensure that the cable is resealed using heat shrink and marine sealant at the end of the cable to prevent any moisture being able to enter the light.

Where the plug and socket option has been ordered the 1.75m cable will be terminated to a 3 pin plug.

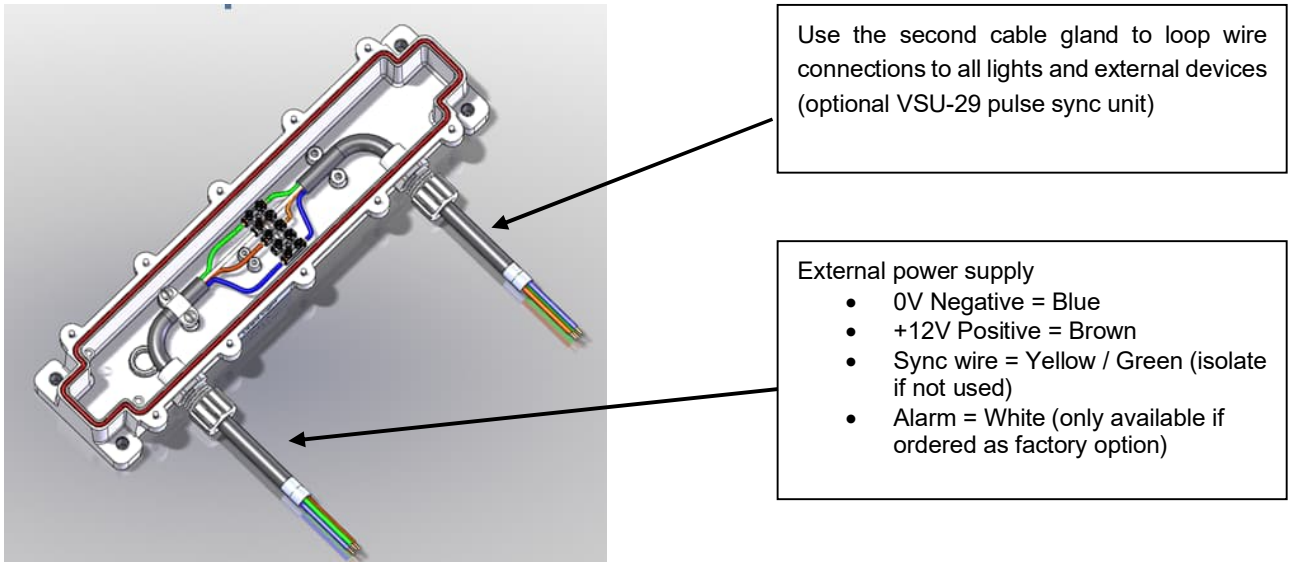
5.3 Multiple leading lights

The user can mount multiple VLL-43’s one above the other to increase the intensity and range of the installation.

5.3.1 Standard VLL-43 unit

The standard VLL-43 is supplied with double cable glands to allow the wiring to be looped from one VLL-43 to another. As access to the wiring is from the rear of the unit the wiring must be completed before mounting the VLL-43 unit.

The double cable glands on the VLL-43 allow the wiring to be looped from one VLL-43 to another. Wiring identification is as follows:



VLL-43 viewed without lens assembly fitted.

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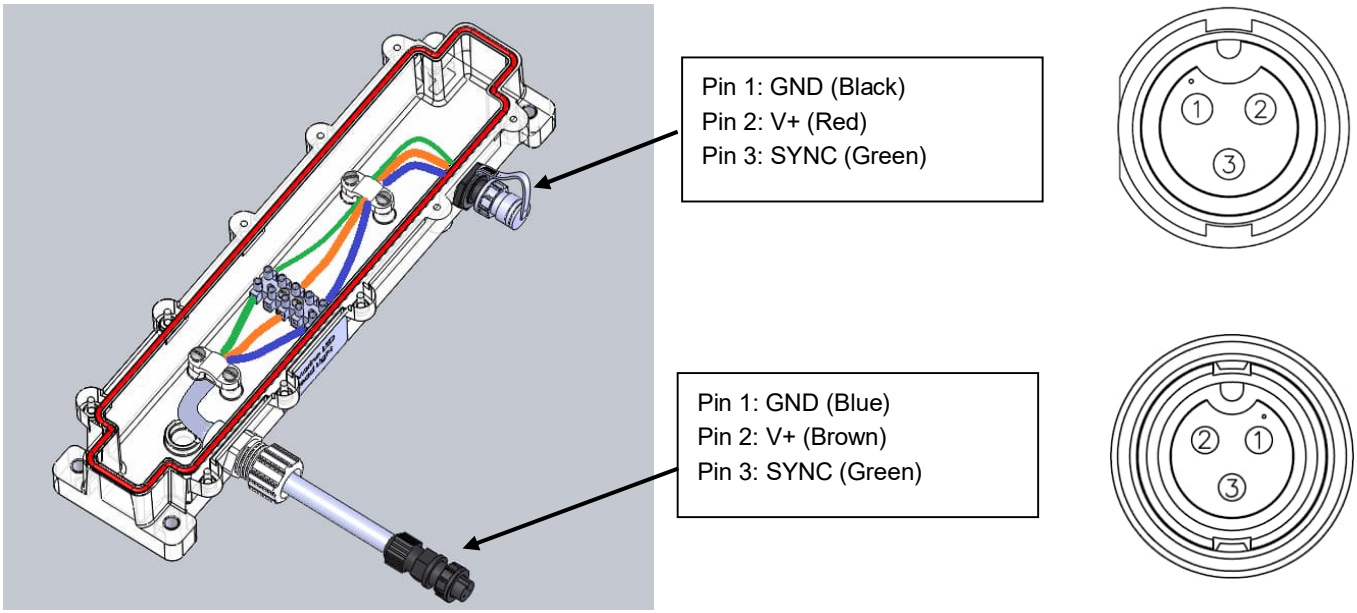
The power cable size is the only thing that limits how many VLL-43 Lead Lights that can be connected together. In selecting the correct cable size check what voltage drop will occur with the load of the VLL-43 units connected.

5.3.2 Plug and socket factory option

With the plug and socket option a 3 pin plug is fitted to the 1.75m cable and the second gland is replaced by a 3 pin socket. This allows VLL-43 unit to be linked together without opening up the unit. It also allows the VLL-43 unit to be mounted prior to being interconnected.

Up to 8 VLL-43 units can be linked together using the plug and socket option.



5.3.3 Connection of Synchronizing wire

Connection of the synchronizing wire between multiple units allows the flash character on all the VLL-43 units to be synchronized.

6.0 Synchronization with other lights

6.1 Hard wire synchronization option

The VLL-43 Lead Light comes with a sync wire (Green / Yellow) for synchronizing with other beacons that are within wiring distance. Vega lights use a negative transition sync pulse.

The start of the flash character can be delayed between 0 and 9.9 seconds after the sync pulse. The day/night transition for each beacon will be synchronised and this occurs within 20 seconds for all of the beacons connected together. Refer to the VegaIR programming manual for further details.

Hard wire synchronizing does not increase the power requirement of the VLL-43.

6.2 GPS synchronization option

The VLL-43 Lead Light can operate with an external GPS sync pulse unit (VSU-29) and will allow the beacon to synchronize with other lights being controlled by a GPS sync pulse. The sync signal from the VSU-29 connects to the sync wire of the VLL-43. 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 to the VegaIR programming manual for further details.

It is necessary to take into account the power consumption of the VSU-29 GPS Sync Pulse Unit in any power load calculation for the Lead Light installation. The GPS sync unit runs continuously whether or not the VLL-43 is operating.

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The VSU-29 updates its clock on a 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 time between updates will reduce the overall power requirements. Refer to the VSU-29 manual for details on how to calculate power requirements.

7.0 Alarm Monitor Wire (Factory Option)

The alarm monitor wire (White) is used to provide an indication when the VLL-43 is not working. This alarm monitors the beacon current and the supply voltage.

Output is connected to ground when:

- No voltage is present.
- No LED current is detected when the VLL-43 should be operating.
- Alarm is being tested using Operation Mode (IR remote code 1-5-007).
- VLL-43 is in storage mode.

The alarm monitor output operates as an electronic relay with one side connected to ground (battery negative). Voltages in the range 0 to 20VDC may be applied to the alarm monitor output. The maximum current the alarm monitor output can handle is 400mA DC.

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8.0 Routine Maintenance

8.1 Maintenance cleaning

This Lead Light 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 VLL-43 is solar powered, panels should be inspected and cleaned occasionally to ensure maximum solar energy capture. Battery capacity should also be monitored.

8.2 Inspection check

Periodically check that the VLL-43 Lead Light remains firmly secured and the orientation of the light is correct (mounting surface vertical etc), and that the mounting fasteners are still in good condition. Investigate any corrosion and take appropriate preventive action.

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

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9.0 User notes

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Appendix A VLL-43 programming and current figures

Using the Programming and current tables

Tables are provided for each color of the VLL-43 Lead Light. The table details of the effective intensity settings that can be programmed and the current the Lead Light will draw at that setting.

Where multiple VLL-43 units are being used calculate the current for a single Lead Light then multiply by the number of units being used

The example given below is based on the VLL-43 WHITE Lead Light

1. The VLL-43 is programmed for the effective candela required. For example a 10NM light at 0.74T has an effective candela of 1390 Candela. Program code 1390
2. The bold numbers in the current tables indicate the effective Candela settings that can be programmed for a particular colour. For example the highest effective candela that a white VLL-43 can be programmed is 2360 Candela.
3. The VLL-43 has automatic Schmidt Clausen correction to maintain the effective Candela for short flash periods. For example to achieve an effective candela of 1390 Candela (10NM) for a 0.3 flash period the peak intensity required is 2317 Candela (1390Candela*(flash period+0.2)/flash period)
4. The Maximum Candela the light can output for each colour is shown at the bottom of the table together with the peak current. For example the maximum output for the white is 3120 Candela at a current of 700mA.
5. The light is unable to output more than the maximum candela. The user should check that the light is able to reach the peak candela required after the Schmidt Clausen correction. In the example above the peak candela for the 0.3 flash is 2317 Candela and below the maximum of 3120 candela for the white VLL-43. The light will therefore support the flash for the required range of 10NM
6. To determine the on current of a flash it is necessary to determine the peak candela required. Using the example of the 0.3-second flash for a white light. The peak candela is 2317. The currents for settings bordering this value can be obtained from reading across from the effective candela column, 420mA for 2360 Candela, and 400mA for 2280 Candela. The option is to use the higher of the 2 currents (420mA) or carry out a linear approximation between the two values, (409mA=400mA+(420mA-400mA)*(2317Cd-2280Cd)/(2360Cd-2280Cd)
7. The off current of the light between flashes and the base current when the light is not operating (switched off during daytime) are provided at the bottom of the table.
8. The current figures are based on a 12 Volt Supply at 20 degrees Celsius.

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VLL-43/8 – 8.5º Programming and Currents

Last update: 17 July 2015

Range (NM @ 0.74T)	Range (NM @ 0.85T)	Effective Candela (cd)	Prog code	Current (mA)				
				Red (122)	Green (222)	Yellow (321)	White (424)	Blue (525)
		2890			750		590	
		2720			650		530	
	16.0	**2360**	2360		**490**		**420**	
11.0		**2280**	2280		**460**		**400**	
	15.5	**2040**	2040		**390**		**340**	
10.5	15.0	**1790**	1790		**320**		**290**	
	14.5	**1520**	1520	670	**250**		**230**	
10.0		**1390**	1390	**580**	**220**		**210**	
	14.0	**1310**	1310	**520**	**210**		**190**	
	13.5	**1120**	1120	**420**	**170**		**160**	
9.5		**1080**	1080	**400**	**160**	760	**150**	
	13.0	**959**	0959	**340**	**130**	**550**	**130**	
9.0	12.5	**835**	0835	**290**	**110**	**400**	**110**	
	12.0	**695**	0695	**240**	**90**	**290**	**90**	
8.5		**641**	0641	**220**	**80**	**260**	**80**	
	11.5	**588**	0588	**200**	**70**	**230**	**70**	470
8.0	11.0	**496**	0496	**160**	**60**	**190**	**60**	**380**
	10.5	**417**	0417	**140**		**160**		**280**
7.5		**369**	0369	**120**		**140**		**240**
	10.0	**348**	0348	**110**		**130**		**220**
7.0	9.5	**290**	0290	**90**		**110**		**170**
	9.0	**240**	0240	**80**		**90**		**130**
6.5	8.5	**205**	0205			**80**		**110**
	8.0	**161**	0161			**70**		**80**
6.0		**150**	0150			**60**		**70**
	7.5	**131**	0131			**50**		**60**
5.5	7.0	**109**	0109					**50**
	6.5	**83**	0083					**40**
5.0		**77**	0077					**30**
	6.0	**66**	0066					**30**
4.5	5.5	**54**	0054					**20**
Date characterised / Estimated				0218	0507	0218	0507	0613
Characterisation Number				14	15	12	15	16
Maximum Candela				1740	2900	1120	3120	600
Maximum current (mA)				900	760	860	700	480
Night off current (mA)				4	4	4	4	4
Day current (mA)				0.5	0.5	0.5	0.5	0.5

- Only currents shown in **BOLD** can be programmed
- Currents are based on 12V supply voltage
- Currents are based on ambient temperature of 20ºC
- Maximum currents for Schmidt-Clausen corrected flashes need to be checked by calculation
- To operate light during day only select day + night operation and program the night intensity for zero (0000)

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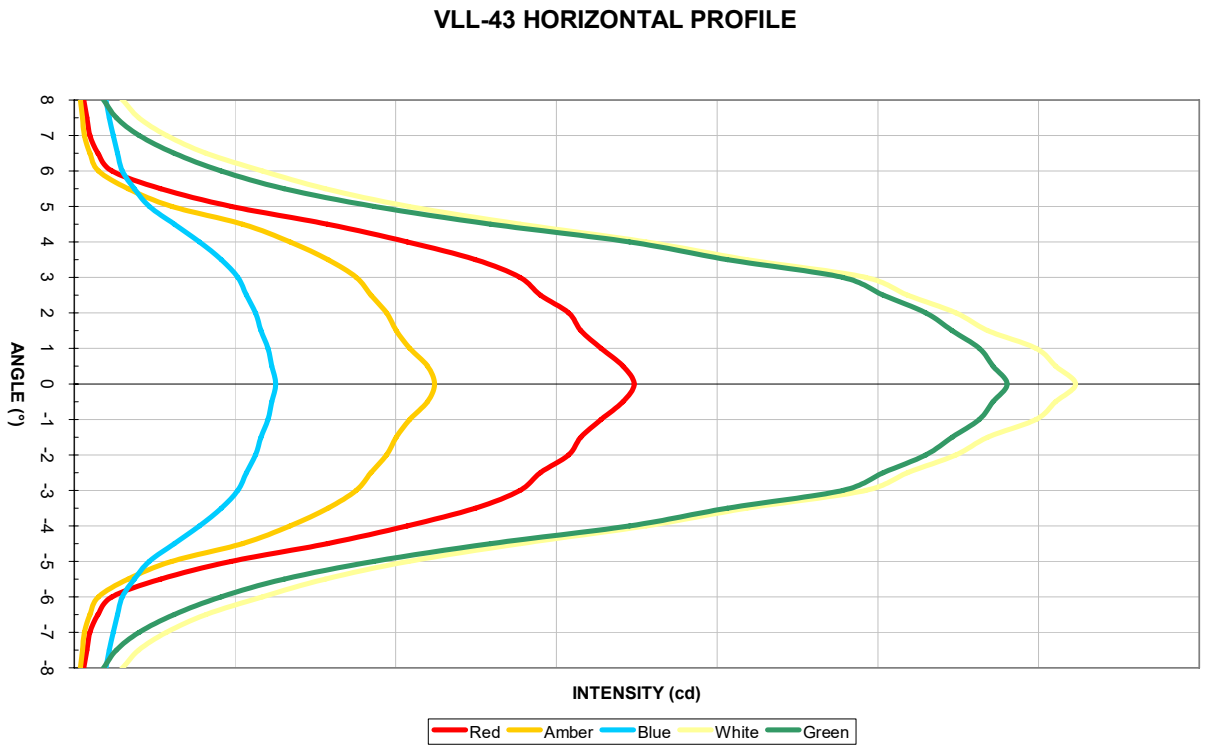
GPS pulse sync unit, current figures

The clock sync data update from the satellite is programmed to occur every 30 minutes for a typical duration of 2 minutes regardless of the beacons programmed flash character.

Internal GPS pulse sync unit	Operating current (mA) at 25°C and 12VDC
"On" current, update from satellite	17
Base current, between updates	5
Sync off	0

Appendix B Sample Horizontal divergence profile for the VLL-43



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Appendix C Day and Night intensity and range tables

Day 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
1.9	22,000
2.0	25,100

Night Range Table

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
3.7	28.6	17.2	8.4	608	190	26.0	1,170,000	31,800
3.8	31.1	18.4	8.6	677	206	28.0	2,470,000	51,000
3.9	33.8	19.7	8.8	753	222	30.0	5,180,000	81,000

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Appendix D Calculation example

DETERMINE THE POWER REQUIREMENT FOR A VLL-43 LINEAR LEAD LIGHT FOR A PARTICULAR LOCATION AND FLASH CHARACTER.

To determine what size power supply is required for a particular application the following information is required.

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

If you require assistance with the selection of the correct unit, contact Vega directly or one of the Vega distributors.

Lowering the energy requirement can reduce the size of the power supply. This is especially important in solar power applications. This can be done by:

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

It is likely the VLL-43 will also be used by day. If this is the case and the intensity of the light during the day is likely to be higher than the night intensity the load calculation should be done for the longest day (not longest night) as this will the highest energy need of the application. For day and night operation it is necessary to calculate the night load and the day load and add the energy requirements.

Only night operation is considered in the calculation examples provided below

Step 1 Calculate the Power Consumption of the VLL-43 Linear Lead light

Note: The **effective intensity** is the intensity the user programs into the Lead Light and corresponds to the required range in nautical miles. This is the intensity required from a fixed “on” light to be seen at that distance. The **peak intensity** is the intensity required to see a flashing light at the same distance. This value of peak intensity increases the shorter the flash becomes.

The VLL-43 is programmed in effective intensity and performs automatic Schmidt Clausen correction for the programmed flash Character to increase the peak intensity depending on the duration of the flash.

Example 1: Calculate the peak intensity and the power consumption for a red VLL-43 operating at night fitted with an external GPS pulse sync unit (VSU-29). The calculation is made for the longest night to determine the highest energy needs of the lead light.

- Night range = 8.0NM at 0.74T
- Flash character = Fl 5s 0.3 (on for 0.3 sec off for 4.7 sec)
- Operating hours at night (longest) = 14 hours

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Determine the peak intensity requirement for night

Atmospheric transmissivity	0.74	
Range required	8NM	
Night effective intensity (Appendix A)	496Cd	**= A**
Character period in seconds	5 sec	**= B**
Flash duration in seconds	0.3 sec	**= C1**
Duty Cycle = C1/B	0.06	**= D1**
Schmidt Clausen Factor = ((C1+0.2)/C1)	1.67	**= E1**
Peak intensity = A*E1	828.3Cd	**= F1**

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

Determine the power consumption for each flash

For the peak intensity F1 find the current in Appendix A for the intensity value above and below the value of F1	835Cd 290mA 695Cd…240mA	**= G**
Difference in current values in G	50mA	**= H**
Difference in Candela values in G	140Cd	**= I**
Lowest Candela value in G	695Cd	**= J**
Difference between F1 and J	133.3Cd	**= K**
Lowest current in G	240mA	**= L**
Current at F1 Candela =L+K*H/I	287.6mA	**= M**
Average current in Character period=M*D1	17.26mA	**= N1**

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

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Determine energy need of beacon

Average current in Character period=N1+N2 etc	17.26mA	**=O**
Night Off current from Appendix A	4.0mA	**=P**
Time when light is off =B-(C1+C2 etc)	4.7 sec	**=Q**
Average current=O+P*Q/B	21mA	**=R**
Longest operating hours	14 hours	**=S**
Night energy usage=R*S/1000	0.294Ah	**=T**
Day current from Appendix A	0.5mA	**=U**
Day Energy Usage=(24-S)*U/1000	.005Ah	**=V**
Total energy used by beacon=T+V	0.299Ah	**=Y**

Note: If multiple lead lights are being used this calculation is needed for each light, (Y1, Y2, Y3 etc)

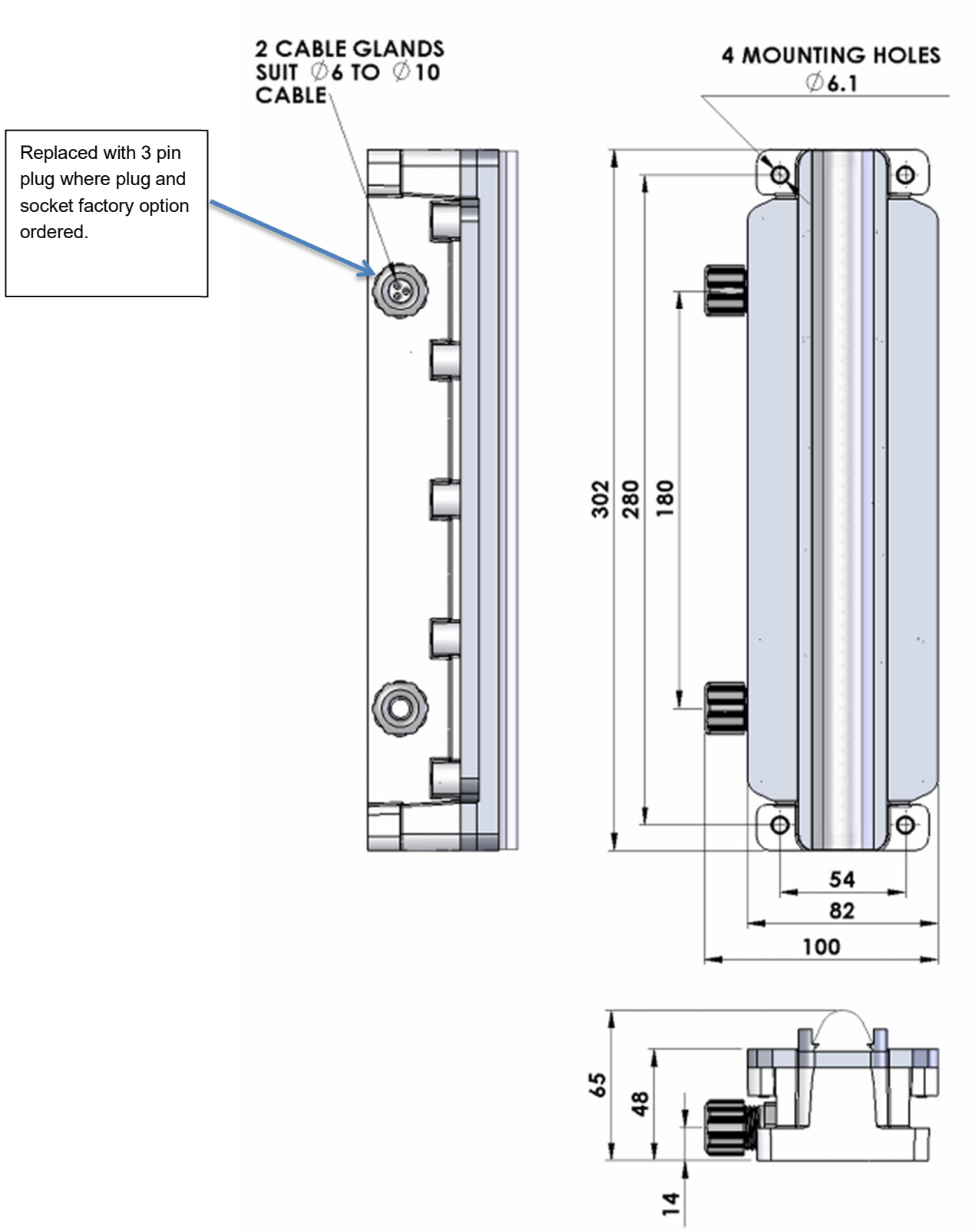
Determine the power consumption of the GPS pulse sync unit (data from Appendix A)

Update period	30min	**= AA**
Typical update duration	2min	**= AB**
On current	17mA	**= AC**
Base current, between updates	5mA	**= AD**
Duty cycle =AB/AA	0.07	**= AE**
Average current = (AC*AE)+((1-AE)*AD)	5.84mA	**= AF**
Ah/day = (AF*24)/1000	0.140Ah	**= AG**

Total power consumption for night operation with GPS

Power consumption for night operation=Y1 + Y2 + Y3 etc	0.299Ah/day
Power consumption for GPS	0.140Ah/day
Total Ah/day	0.439Ah/day

Appendix E Dimensions of the VLL-43



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Appendix F Specifications of VLL-43 Linear lead light

Optical

Light Source	High-Intensity Light-Emitting Diodes Output temperature controlled to protect LED's
Colours Available	Red, White, Green, Yellow and Blue
Intensity	See Appendix A
Effective intensity settings	Up to 15 levels for both day and night operation
Peak Intensity	Automatic Schmidt Clausen correction up to max intensity of colour
Flash Characters	246 standard characters plus one custom character 20 factory set custom characters if required
Divergence along focal plane	Red ±20° at 50% peak intensity Green ±15° at 50% peak intensity Yellow ±20° at 50% peak intensity White ±7.5° at 50% peak intensity Blue ±15° at 50% peak intensity
Divergence across focal plane	±4.25° at 50% peak intensity
Chromaticity	All meet IALA recommendations for signal colours: Red 0.68<x<0.71, 0.29<y<0.31 Green 0.09<x<0.13, 0.53<y<0.65 White x=0.31, y=0.32 Yellow x=0.57, y=0.43 Blue 0.09<x<0.17, 0.02<y<0.15
Synchronization	Wired sync standard, delay up to 9.9 seconds in 0.1 second steps. Optional external VSU-29 GPS sync pulse unit

Electrical

Voltage	Nominal 12.0VDC (9VDC to 18VDC) Programmable low voltage cut off threshold
Light on current	See Appendix A
Current between flashes	See Appendix A
Current by day	See Appendix A
Day/Night transition.	Photo sensor located inside base. Nine program settings for the day/night transition. Accuracy of sensor ±20 lux
Optional GPS current.	17mA when acquiring signal. 5mA when not acquiring signal. Nominally 2 minute every 30 minutes.
Reverse Polarity	Internally protected against reverse polarity connection
Optional Alarm/Monitor	Voltage 0-20VDC Current to ground 400mA max Leakage current to ground 5 micro Amp Max voltage during alarm 1VDC @ 400mA. 0.2VDC @ 100mA
Plug (when used)	Brand: LTW; part #: LTWBB-03BFFA-LL7001
Socket (when used)	Brand: LTW; part #: LTWBB-03PMMS-LC7001
Socket Cap (when used)	Brand: LTW; part #: LTWCAP-WABPML-C1

Material for Beacon

Lens	Optical grade impact modified acrylic
Lens retainer	Marine grade aluminium (DT5008), anodized to 25 microns
Body	Injection molded plastic, GE xylex
Sealing	O-ring

Environment

Temperature	-30°C to +60°C
Design Wind speed	Rated to withstand winds to 100+ knots
Immersion	Rated for continuous exposure to salt water and spray depth
Ultra-Violet Radiation	All external materials are UV resistant
Acceleration	Rated to 40g in all directions

Programming	Vega Remote01 Infra Red programmer
Design Life	10 years
Warranty	1 year. See Vega warranty terms

Weights and Dimensions

Mounting holes	Four Ø6 mm holes, pitch pattern 54mm x 280mm

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Length x Width x Height	302mm x 82mm (100mm with electrical glands fitted) x 65mm
Connection	1.75m length of neoprene 4-core 0.75mm^2 open connection
Weight	1.3Kg
Packaging weight	.079Kg
Shipping Dimensions	345 x 120 x 90mm
shipping weight	1.4kg

Appendix G Product Codes

IR programmable marine LED Linear Lead Light

VLL-43-ccc	ccc = Light colour code, Red, Wht, Grn, Yel and Blue
Options	
- Alarm / Monitor output	Add “-AL to the product code
- Plug/Socket connection	Add “-PL” to the product code
For Example:	To order a white VLL-43
Order code:	VLL-43-Wht

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Document revision history

Manual Revision	Description of Change	Date manual released	Software version	PEL-4 Serial number
1.0	Original issue	Jul- 07	1.9.0 to	VLL-43 = 43-0500 to 43-0625
1.1	Pin code function to prevent tampering Battery high/low level setting enabled Double sync pulse function (day/night communication) Day/night transition sync	Feb-08	2.0.4	43-0626 to
1.2	Removed unwanted flash during day/night transition of "sync on only" (slave mode) beacons.	19 November 2008	2.0.6	
1.3	Changed the White421 LED version to White420, but the LED part remains same. Changed the Amber313 LED version to Amber310, but the LED part remains same. The characterization data remains no change.	27 May 2009	2.0.6	43-752 on
1.4	Updated software version number in manual	7 December 2010	3.0.5	43-752 to 43-0946 inclusive
1.5	Updated for status monitoring Firmware update to 3.06	16 January 2012	3.0.6	43-1003 on (s/n 42-0947 to 43-1002 reserved for TIR version)
1.6	Updated additional factory options • Plug and socket option	19 April 2013	3.0.6	
1.7	Added note about the default low battery threshold being specified on the test sheet.	20 May 2013	3.0.8	
1.8	Changed to Blue 525 LED	12 September 2013	3.0.9	43-1928 on
1.9	Changed to White 424 LED	17 July 2015	3.0.9	
2.0	Updated Product Warranty	July		
2.1	Updated red & yellow LEDs. Performance unchanged.	February 2018	3.0.9	43-2449
2.2	Graphic Update	January 2021		

VLL-43 Product Manual	
Available colour range	Red, Green, White, Yellow or Blue
Vertical divergence	30 degrees
Horizontal divergence	8.5 degrees
This manual applies from serial #:	43-2449
Software version:	3.0.9
Manual version:	2.1
Date released:	16 February 2018
Status:	Released by JCB

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