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HEMS-Star®
FEC Battery LED Helipad Lights
Type: FEC - HP0678/6
User Manual – Specification – Diagnostics

HEMS-Star® Battery LED Helipad Light displaying Green

This device emits Infra-Red radiation
Never stare at the IR emitters as this may cause eye damage
Read this manual before operating the unit

Issue: 1.1   17th March 2016

Powered by eAGLe Light Engines

® Interleader Limited

Document Revision Sheet

Issue	Date	Changes
1.0	21/02/2016	New Document
1.1	17/03/2016	Corrected UHF figures

HEMS-Star$^®$ in alternative case colours

The *eAGLe* logo and HEMS-Star name are copyright of Interleader Limited 2016

Contents

1. Compliance Statements

USA

FCC Compliance WARNING

Changes or modifications to the transmitter not expressly approved by the manufacturer could void the user's authority to operate this RF device.

FCC Compliance Statement

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause interference, and

2. This device must accept any interference, including interference that may cause undesired operation of the device.

USA-Federal Communications Commission (FCC)

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy. If not installed and used in accordance with the instructions, it may cause harmful interference to radio communications. However, there is no ensured specification that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by tuning the equipment off and on, the user is encouraged to try and correct the interference by one or more of the following measures:

• Reorient or relocate the receiving antenna.

• Increase the distance between the equipment and the receiver.

• Connect the equipment to outlet on a circuit different from that to which the receiver is connected.

• Consult the dealer or an experienced radio/TV technician for help.

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Europe

This device carries the CE marking showing it has been tested and shown to be in compliance with:

R&TTE Type Testing EN 300 220-1v2.4.1 & EN 300 220-2v2.4.1

EMC Type Testing EN 301 489-1v1.9.2 & EN 301 489-3v1.6.1

CE

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2. Overview

The HEMS-Star® Battery LED Helipad Lights (In this manual referred to as the light or lights) are an advanced battery powered, microprocessor controlled helipad light designed for rapid deployment in temporary and emergency situations to provide safe and effective marking. In steady light mode, constant light level is achieved for up to 15 hours before recharging. In flashing mode running time is significantly extended.

Part Number

FEC - HP0678/6

- 4 colours + IR – White, Green, Blue, Red and Infra-Red

Model Characteristics

The lights use advanced LED and microelectronics to provide a safe and effective lighting solution for temporary and emergency situations.

The lights are manufactured in robust ABS and acrylic enclosures with stainless steel fittings for durability and long life. The lights use magnetic switches, cord-less charging and are sealed to IP65 rating.

The lights have a number of operating modes: steady visible or infra-red, steady visible and infra-red and a number of flash patterns in the above combinations.

Configurations of colours, flash patterns and operating modes are stored as 5 selectable programs and groups of lights can be wirelessly controlled.

In steady mode the LEDs provide continuous and constant light output for between 3.75 and 15 hours depending on the colour and intensity level selected.

In flashing modes there are 5 selectable flash patterns to choose from. Once selected, the pattern will output each time flash mode is selected.

The lights are supplied as a set of up to 8 in a robust Nanuk case which incorporates a mains power supply to simultaneously charge all fitted lights.

The power source may be 110/230V AC or 12-24VDC or a 12V nominal solar panel with cables supplied and connected for both and stored in the case.

The lights have 6mm stainless steel bases with rubber anti-skid bottoms.

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3.   The HEMS-Star

A HEMS-Star is shown in the picture below.

The units are completely self-contained and incorporate; microprocessor main controller, magnetic control switches, advanced LED driver units, visible and infra-red LEDs, Li-Ion battery, advanced battery charging control and monitoring system, charging studs, USB port for field upgrade of the software and a UHF wireless interface for programming, monitoring and controlling the light from either: a Remote Lighting Controller, a PC with the provided wireless 'dongle' or an optional Key Fob Controller (KFC).

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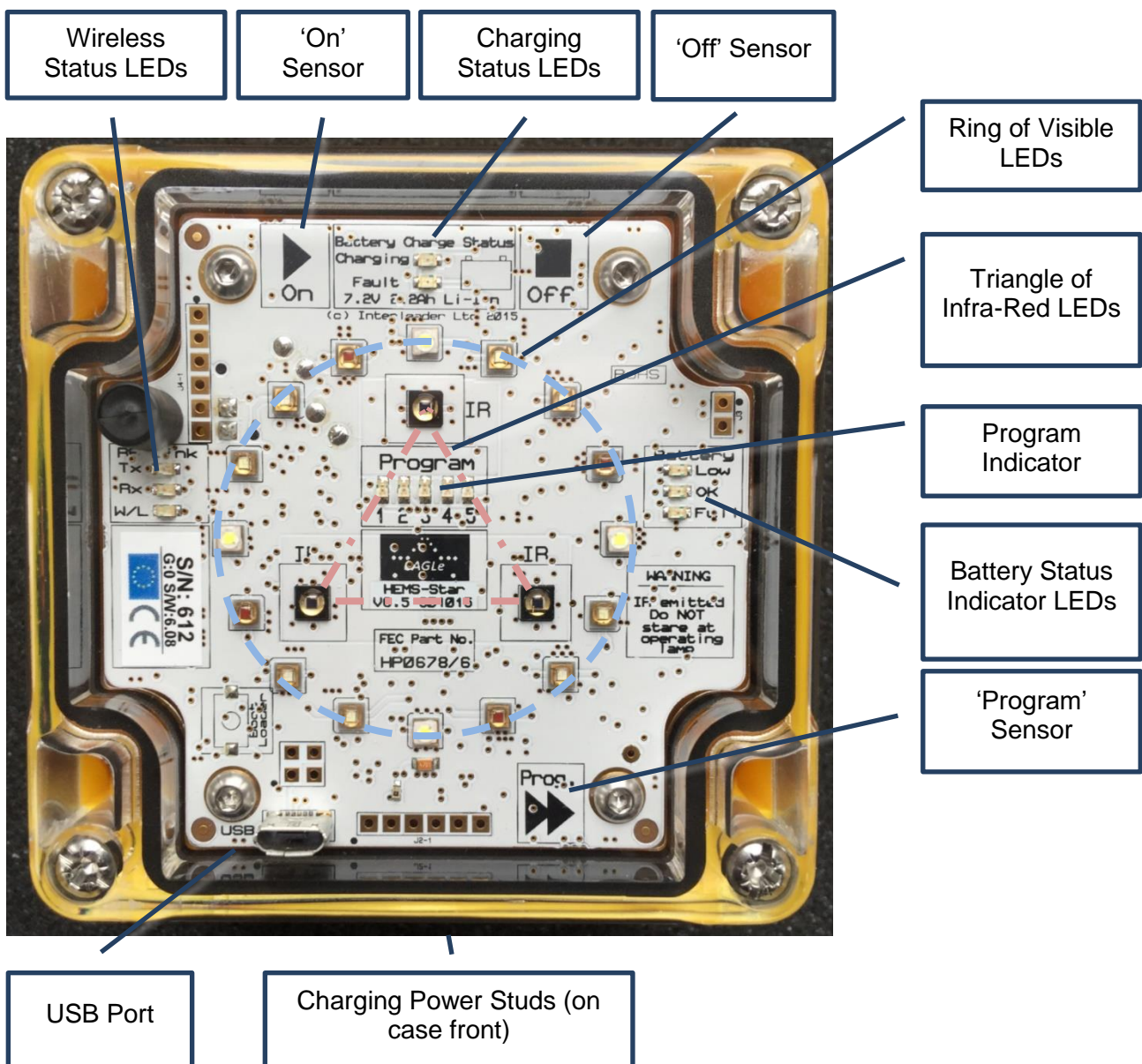
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4. HEMS-Star Capabilities

The HEMS-Star lights incorporate an advanced microcontroller to provide very flexible and programmable operation. The HEMS-Star has 5 pre-set Programs which can have any of the following attributes set:

Colours (Single Mode)

HEMS-Stars are fitted with White, Green, Red and Blue visible and Infra-Red (IR) LEDs.

Colours + IR (Dual Mode)

There may be instances where pilots require both visible light and infra-red lights in the pattern of light so that they can either use normal vision or augmentation through the use of Night Vision Goggles (NVG). Any colour + IR can be selected for Dual Mode

Levels (Brightness)

The LED output Level is set to 20%, 40%, 60%, 80% or 100% of maximum output level. In Dual mode the ratio of the IR level to the visible LED level can be set at 10%, 20%, 30%, 40% and 50% of the output level of the visible LEDs. Note that as this is a ratio, as the level of the visible LEDs is changed, the IR level tracks it at the desired ratio.

Steady/Flashing Modes

HEMS-Stars can be set to operate in Steady mode (where the LEDs are maintained at constant brightness) or Flashing mode (where the LEDs are flashed at the desired flash pattern – see later section).

Automatic Switching

HEMS-Stars incorporate a light detector and can be set to switch in Normal mode (On/Off action solely controlled by the magnetic or wireless switches) or in Sunset mode where they will automatically come on at Sunset and off at Sunrise.

Stealth

Where it is undesirable to have any status lights showing, Stealth mode provides the facility to turn off the status LEDs after an initial confirmation period (5 seconds).

Lead-In Lights

A group of HEMS-Stars can operate as a string of sequenced flashing lead-in lights. In this mode each HEMS-Star is programmed with a 'Light Number' and, on the receipt of a Flash command, will flash at the right point in the lead-in sequence

Basic Switching

HEMS-Stars are turned On, Off and have the required Program selected by using a magnet to activate magnetic switches inside the case (Basic Operation – next section)

Wireless Switching

Once turned on, HEMS-Stars can be controlled by a wireless Remote Lighting Controller or wireless Key Fob Controller (optional extra). See later sections for details.

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5.   Basic Operation

Basic On/Off/Program selection of the HEMS-Star is achieved by activating magnetic sensors inside the unit using a small magnet (supplied).
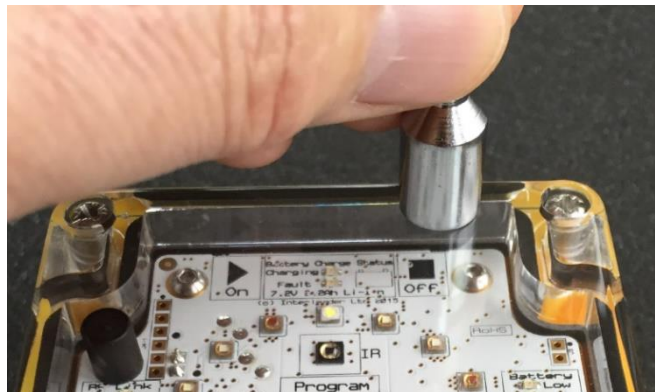
Turn HEMS-Star On

To turn a HEMS-Star on, momentarily bring the Magnetic Key Controller (MKC) in line with the 'On' sensor on the unit's top panel (picture top right).
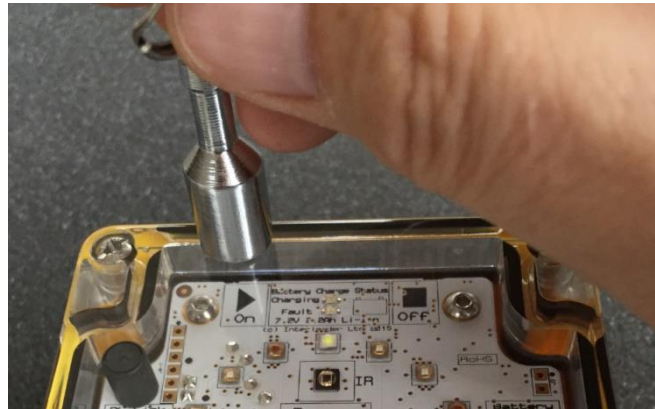
Turn HEMS-Star Off

To turn a HEMS-Star off, momentarily bring the Magnetic Key Controller (MKC) in line with the 'Off' sensor on the unit's top panel (picture middle right).

If the unit is off, bringing the MKC in line with the 'Off' sensor, displays the current Program and battery status (useful for a quick check without having to turn the unit on)

Advance HEMS-Star Program

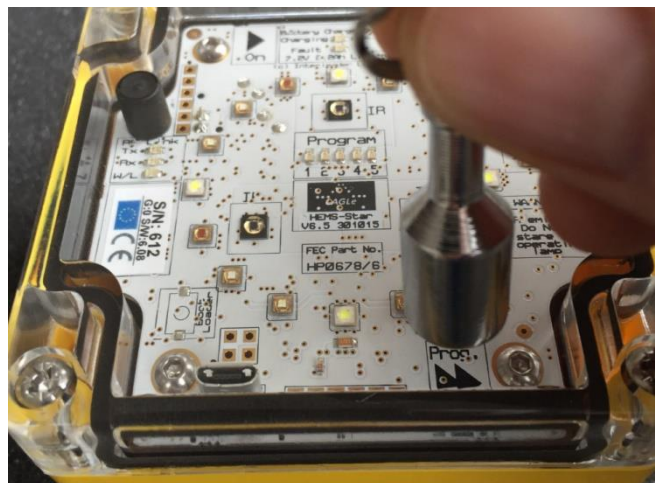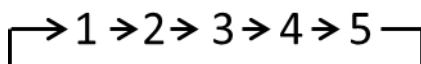To advance the HEMS-Star to the next Program, momentarily bring the Magnetic Key Controller (MKC) in line with the 'Program' sensor on the unit's top panel (picture lower right). Program advance is:

$$1 \rightarrow 2 \rightarrow 3 \rightarrow 4 \rightarrow 5$$

The Program can also be advanced with the unit off in which case the current Program is briefly shown and then the Program advances by one.

6.   Program Setting

The HEMS-Star has 5 programs, each of which can be set to control such attributes as colour, brightness (level), flash patterns etc.

The full list of attributes and the options for each is shown below:

Item	Attribute	Options	Comment
1	Colour	W = White G = Green B = Blue R = Red I = Infra-Red (IR)	
2	Level	1 = 20% 2 = 40% 3 = 60% 4 = 80% 5 = 100%	Percentage of Maximum output
3	Single/Dual	S = Single Colour (including IR) D = Dual: Any visible colour + Infra-Red	IR + IR not allowed
4	Dual Ratio	1 = 10% 2 = 20% 3 = 30% 4 = 40% 5 = 50%	IR power level as a percentage of the visible LED power level
5	Mode	S = Steady F = Flashing	
6	Flash Pattern	Flash, Identification and Morse Code Patterns – see section 7 for details of timing	
7	Normal/Sunset Switching	N = Normal: On when commanded, or S = Sunset: Automatically On at Sunset, Off at Sunrise	Sunset is defined as 400lux. Sunrise is defined as Sunset + 100lux to avoid 'hunting'
8	Stealth	N = Normal: Display LEDs On S = Stealth: Display LEDs Off	Battery Exhausted warning LED always flashes

Note that every permutation of attributes is allowed except those that are illogical (e.g. Colour = IR and Dual mode). Users should ensure that they are clear about the attributes required before programming the unit.

7. Default Program Settings

The default program settings are:

Program	1	2	3	4	5
Colour	Green	Green	Green	Red	White
Level	60%	60%	60%	80%	100%
Single/Dual	Single	Single	Dual	Single	Single
Dual Ratio	30%	30%	50%	30%	30%
Mode	Steady	Steady	Steady	Flash	Flash
Flash Pattern	1:3	ID Single	ID Dual	ID Dual	Morse 'H'
Normal/Sunset Switching	Normal	Sunset	Normal	Normal	Normal
Stealth	Normal	Normal	Normal	Normal	Normal
Comment	Shipping setting		**Warning IR Emitted**		

Note that greyed-out figures above mean that these are set in the program memory but ignored because of the other settings. e.g. in program 1 the dual ratio is set at 30% but is ignored because program 1 is set to Single Mode.

8. Flash Patterns

The following flash patterns are available:

Mode	Description	Timing	Flash Rate
0	1:1 Mark:Space Ratio	On – 250mS Off - 250ms	120 Flashes / Minute
1	!:3 Mark:Space Ratio	On - 250mS Off - 750mS	60 Flashes / Minute
2	Identification Beacon Single Flash	On – 250mS Off – 1750mS	30 Flashes / Minute
3	Identification Beacon Double Flash	On – 250mS Off – 100mS On – 250mS Off – 1400mS	30 Frames (of two flashes) / Minute
4	Morse Character 'X'	On – 300mS Off – 100mS On – 100mS Off – 100mS On – 100mS Off – 100mS On – 300mS Off – 900mS	30 Characters / Minute
5	Morse Character 'H'	On – 100mS Off – 100mS On – 100mS Off – 100mS On – 100mS Off – 100mS On – 100mS Off – 1300mS	30 Characters / Minute
6	Reserved #1		
7	Reserved #2		
8	Reserved #3		
9	Reserved #4		

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9.   Sunset/Sunrise Switching

Every program can be set to automatically switch the lights on at sunset and off again at sunrise.

When switched to this mode in daylight, the Battery Capacity LEDs will light as normal but the main LEDs will be off until the light level becomes less than 400 Lux (the level of light at sunset on a clear day) at which point they will turn on. In a pattern of, for example, 8 lights it is to be expected that it may take up to 5 minutes for all lights to come on due to internal differences in their light readings.

Note that it is the light level that turns the lights on and off, not the time of day. Very overcast conditions causing a dark sky may cause light levels to drop significantly below 400 Lux even though the time is not at sunset. This will cause the lights to come on (see test results below).

The units monitor light level continuously and if the 'sunrise' light level of 500 Lux is exceeded, the lights will go off again. This may lead to a situation where if the lights are set to automatic and before sunset a large black cloud causes the lights to turn on, but then moves away, they may go back off again (as happened in the test below).

The graph below shows the drop in light level from 60 minutes before sunset to sunset. The green bars indicate the actual time the test set of lights came on.
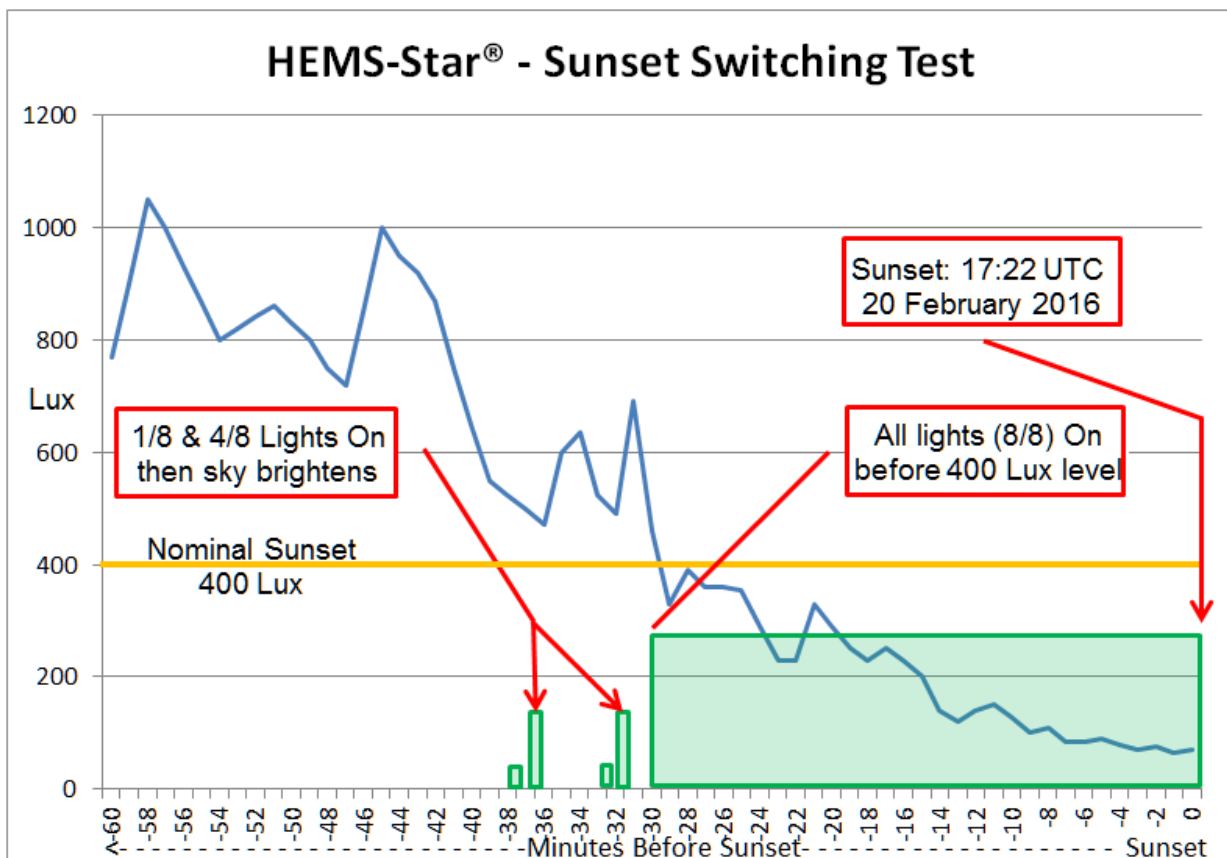
Meteorological conditions at time of test:

Metar from nearby Stansted Airport (EGSS) at 17:20 Zulu, 20th February 2016:
Overcast clouds at 1400 feet (recent rain and drizzle). Temp. 11C, Dewpoint 9C, RH 87% 1006hPa.

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10.   Run Time in Steady Mode

The following are computed run times of lights in 'Steady Mode' (on constantly assuming a fully charged battery) referenced[#] to actual readings from 8 lights on Green 60%. Figures rounded down to nearest 0.25 hour.

Single Colour	Level	Estimated Run-time (hours)	Dual Mode Colour + IR	Colour Level *	Estimated Run-time (hours)
White	20%	18.00	White + IR	20%	14.75
	40%	11.00		40%	8.50
	60%	7.75		60%	5.75
	80%	6.00		80%	4.25
	100%	5.00		100%	3.59
Green	20%	16.50	Green + IR	20%	13.50
	40%	9.50		40%	7.75
	60%	7.00[#]		60%	5.25
	80%	5.25		80%	4.00
	100%	4.50		100%	3.00
Blue	20%	17.00	Blue + IR	20%	14.0
	40%	10.25		40%	8.00
	60%	7.25		60%	5.50
	80%	5.25		80%	4.00
	100%	4.25		100%	3.25
Red	20%	17.00	Red + IR	20%	16.75
	40%	10.25		40%	10.25
	60%	7.25		60%	7.25
	80%	5.50		80%	5.25
	100%	4.50		100%	4.25
Infra-Red	20%	20.75			
	40%	13.25			
	60%	9.50			
	80%	7.50			
	100%	6.25			

* Assumes IR:Visible Ratio of 50% (i.e. maximum IR level).

[#] Program 1 shipped setting – Reference measurement form basis of computed values based on actual light current consumption.

Important Notes

1) These figures have been obtained from new units with fully charged batteries.
2) Battery performance will degrade slowly over time and with charge cycles.
3) This is a guide only and should be validated by the operator prior to use.
4) There will be variation of run times between lights of the same set.
5) Lights will remain at full brightness until the battery is exhausted and then suddenly go out.

11.   Run Time in Flashing Mode

The run time in Flashing mode will be longer than in Steady mode on a like-for-like basis.

Run times in Flashing Mode are a function of the Colour, Intensity, IR:Visible Ratio (in Dual mode) and the Flash Pattern set.

The following is a guide to determining the expected run times for any given Colour, Intensity, IR:Visible Ratio combination.

To determine the approximate run time, multiply the relevant time from the table in section above by the factor shown below:

Mode	Description	Multiply Steady Time by
0	1:1 Mark:Space Ratio	2.0
1	!:3 Mark:Space Ratio	4.0
2	Identification Beacon Single Flash	6.0
3	Identification Beacon Double Flash	4.0
4	Morse Character 'X'	1.5
5	Morse Character 'H'	4.0

As an example, to determine the approximate run time of a light set to Green, 60%, Single mode when in Identification Beacon Single Flash, multiply the Steady run time by 6 up to a maximum of 50 hours.

7 Hours * 6 = 42 Hours

This is a guide only – remember points on previous page.

12.   Standby Time

When the HEMS-Star has been set to Standby in Wireless mode the main processor and wireless interface are still running (indicated by the flashing blue 'Wireless' status LED) waiting for the next wireless command.

In this state the light will reduce the battery to half charge in 30 hours. If the lights are to be left in this state for more than 2 days they need to be regularly re-charged.

13.   Off Time

When 'Off', HEMS-Stars are actually in 'sleep mode' waiting for an activation of the magnetic switches. In this condition most of the systems are shut down to conserve power but the microcontroller and sensors are still drawing a small current.

This constant small drain will reduce the battery to half charge in 9 months.

It is essential that the batteries are checked and charged at least every 6 months (see next sections).

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14. Battery Capacity 'Traffic Light' LED indicators

All the time that the unit is switched on (either steady mode or flashing/special function mode) the on-board microprocessor monitors the battery voltage to ensure that operation remains within the safe working limits of the battery and to ensure its maximum life.

In all modes, except 'stealth mode', when the light is turned on the battery voltage/capacity is indicated via the three 'traffic light' LEDs.
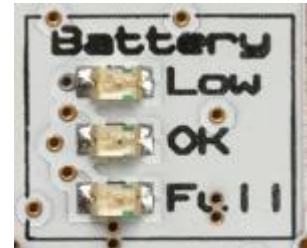
Their status may be interpreted as follows:

LED Status	Battery Voltage	Meaning
Red flash every 10s	<6.00V	Battery exhausted – Switch off & Recharge
Flashing Red every 1s	6.00V - 6.25V	Battery nearing exhaustion. Switch off & Recharge
Solid Red	6.25V – 6.80V	Battery low (<20% remaining).
Solid Orange	6.80V – 7.50V	Battery OK (between 20% and 80% capacity)
Solid Green	>7.50V	Battery Full (>80% capacity)

In practice the green LED will not remain lit for much of the total running time. Most of the running time is spent with the orange LED on. This is totally normal and to be expected.

Also note that at the transition point between, for example, orange and red, the LEDs may display alternate orange/red at a rate of 1 second per colour. This is perfectly normal.

If the light has been run continuously until the battery is nearly exhausted and then turned off, the battery voltage may 'recover' a little. If turned back on, this may show as either the red or orange light coming on briefly but the light quickly indicating a low battery and shutting down.

Stealth Mode

When the light is first switched on in Stealth Mode, the Battery Capacity LEDs will light for 5 seconds to indicate the battery capacity. After this initial period, the Battery Capacity LEDs will turn off and the IR LEDs switch on.

If a low IR intensity has been selected the light may appear to be neither on nor emitting any light (see later section on how to check this).

The IR LEDs will continue at constant intensity until the battery voltage gets to just above the exhausted state (about 5% left), at which point the red Battery Capacity LED will start to flash as it would in any other mode.

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15. Charging

Do NOT Charge from mains with the Case Lid Shut

The lights are charged in their carrying case using the integrated mains Power Supply Unit (PSU) or connection to a nominal 12V or 24V DC supply (e.g. car or truck) or directly from a 12V (nominal) PV Solar Panel.

Connections:

- First ensure that the mains PSU and 12-24V supplies are disconnected.
- Ensure that all of the lights are fitted into the case properly (lenses facing left as picture above) with the Power Studs down
- Either:
    - Connect the PSU to the mains and switch on, or
    - Connect DC connector to a 12V – 24V DC source

Charging Limits:

The mains PSU is capable of charging 8 lights from fully exhausted to fully charged in about 3.5 hours (max 4) if the case of the PSU is below 40C (104F). If the ambient temperature is very high and the case temperature is above this, only 4 lights can be charged simultaneously. If the case/PSU temperature is above $50^{o}C$ ($122^{0}F$) the PSU must not be used.

If charging 8 fully exhausted lights from a vehicle's 12V supply the total load will be 4 Amps. The cable and connector (with 5 Amp fuse fitted) are capable of supporting this load.

Be aware that many vehicle supply sockets may be unable to support this load or that the vehicle's socket (and then the cable connector) may get hot. This could present a fire hazard. This is particularly likely with an old, used socket. If in doubt, reduce the number of lights being charged simultaneously. Also be aware that this load will take charge from the vehicle battery.

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Battery Status LEDs:

- When power is first applied to the lights, the internal charging circuit first determines the state of the battery, only going to full charge if the battery passes the initial test. If there is a problem with the battery the red Fault LED will be lit. See later section on action to take.
- The charger is an intelligent dual-rate charger and, after the initial battery check, will determine exactly how long to charge the battery and at what rate, switching off automatically at the end of the main charge. During the initial high charge rate the Charging LED will be lit. This will extinguish once the battery is fully charged.
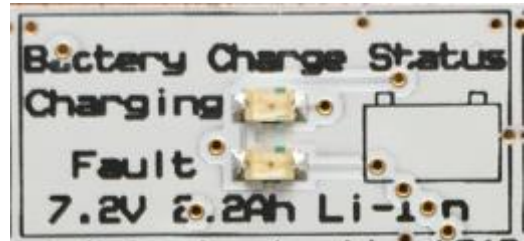
After Charging:

- Once fully charged (and with the charger still connected and switched on) all LEDs will be off. **At this point turn off the charger.**
- Li-Ion batteries have a very low self-discharge current and neither need nor benefit from trickle charging.
- A refresh cycle should be performed once every 6 month (more frequently in very hot conditions – see table below) to maintain full charge and best battery condition and life.

Temperature	Remaining Capacity	After
23°C / 73°F	➢ 95%	6 months
45°C / 113°F	➢ 80%	3 months
60°C / 140°F	➢ 80%	1 month

Dis-Connection:

- To disconnect the charger, switch off the mains supply and remove the power cord or disconnect the DC power cable
- Re-store the cable

Good Practice:

- Never charge batteries from the mains power supply with the case lid shut
- DO NOT leave charger connected and 'trickle charging'
- Always isolate from the mains before connecting/disconnecting
- Only charge batteries indoors in dry conditions
- Keep batteries away from sources of heat and direct sunlight
- Routinely recycle as outlined above
- Never charge a battery that appears damaged
- Never use a power cord that is damaged in any way

**If in doubt – have it checked out**

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16. Wireless Controller

All lights are shipped in manual mode and will operate at the colour and intensity selected by default Program 1 (Green, 60% of max) when first turned on.

Manual and Wireless Modes

All lights will come on in manual mode and the blue Wireless LED will be off.

Wireless LED (Blue)
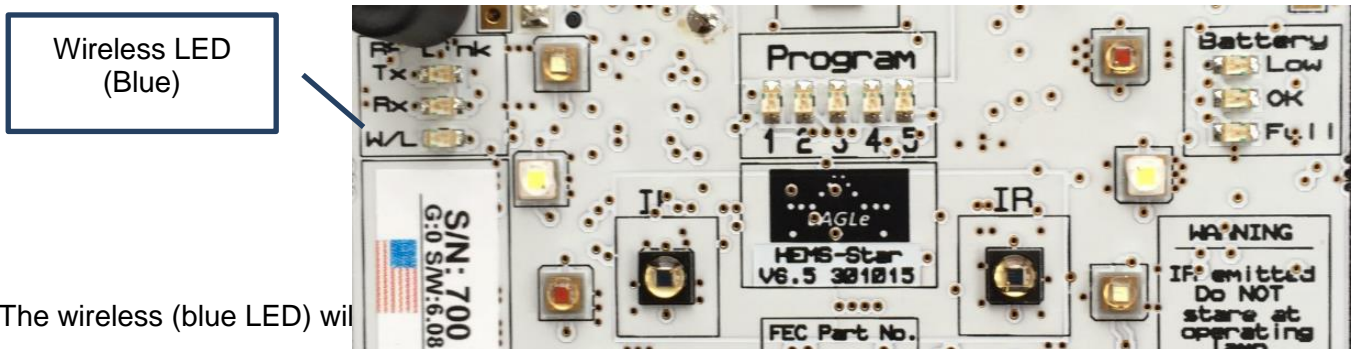
The wireless (blue LED) wil

Wireless Groups

To enable control of a specific group of lights in a situation where multiple groups are deployed (for example, multiple adjacent pads), all lights belong to a 'Group'.

Groups of lights will then respond to Wireless PC Controller or Remote Lighting Controllers (RLC) set to that group number. Lights are shipped set at Group 0 (as is the RLC default settings).

If multiple groups of lights are to be controlled then each set needs to have their Group set using the wireless PC Controller software.

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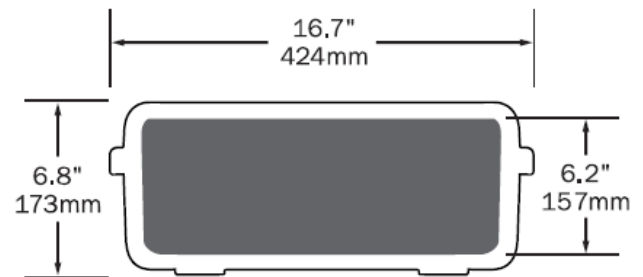Designed, Manufactured and Installed...we do it all.

17. Dimensions

Lights (each)

| Dimension	Value (mm/inches)	Comment
Width	84mm / 3.31 inches	
Length	83mm / 3.26 inches	Including Power Studs
Height	65mm / 2.56 inches	Including 6mm base – Standard product

Case (without packaging)

Dimension	Value (mm/inches)
Width	424mm / 16.7 inches
Length	340mm / 13.4 inches
Height	173mm / 6.8 inches

Case (with shipping packaging)

Dimension	Value (mm/inches)
Width	430mm / 16.9 inches
Length	360mm / 14.2 inches
Height	185mm / 7.3 inches
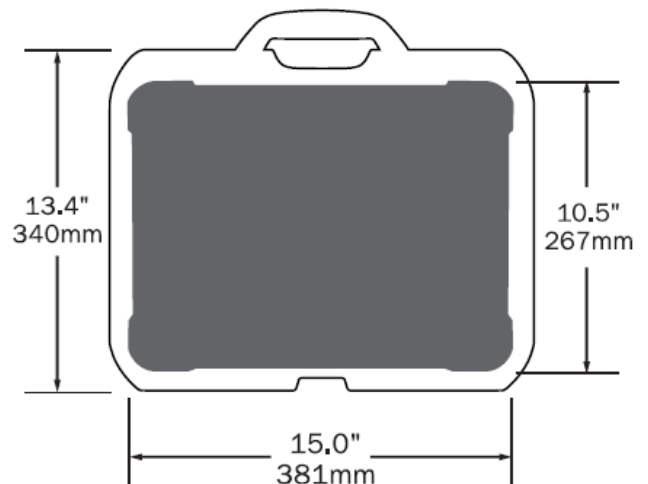
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18. Weight

The weight of the individual lights and complete sets (8 lights, case, charger and mains and DC cables) are as follows:

Item	Weight (kilograms)	Weight (US pounds)	Comment
Single Battery LED Helipad Light (6mm Stainless Steel base)	0.73kg	1.61lb	6mm Standard base
Case – Empty (including power supply and mains and DC cables)	4.76kg	10.49lb	
System: 8 Helipad Lights in Case (including power supply and mains and DC cables)	10.60kg	23.37lb	Operational system weight
System packed for Shipping	TBC	TBC	As above but with outer foam and shipping box

19. Environmental (Lights)

- Degree of protection IP65
- HEMS-Star Operating temperature: -25°C to +40°C
- Charging temperature: -25°C to +40°C
- System Storage temperature: -25°C to +50°C
- Shock – TBC
- Fully ROHC Compliant

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20. Electrical Specification (Lights)

Parameter	Value
Operating voltage (nominal):	7.5V DC
Absolute voltage range:	6.0V – 8.4V DC
Charger input voltage range:	12.5V – 28.0V DC
Running power consumption:	5.0 watts (maximum with steady light)
LED power consumption (total):	4.6 watts (maximum with steady light)
Power rating of LEDs	30% of manufacturers maxima
On-board fuses:	2 * 1 Amp (self re-setting type)
Reverse voltage protection:	Polarity protected on charger
LED controllers (2off):	Under voltage, short circuit and overvoltage protected
LED Lifetime (projected):	>50,00 hours
Battery:	Li Ion Battery Pack
Battery Manufacturer:	Enix
Battery Type:	MGL2807
Nominal Voltage:	7.5V
Nominal Capacity:	2.2Ah
Nominal Energy:	16.5Wh
Battery Protection:	Internal self-resetting fuse

21. Electrical Specification (DC Charging Cable/Connector)

Parameter	Value
Connector Type:	Fused Lighter Plug
Connector Rating:	12V 10A maximum rating
Manufacturer:	TruConnect
Contact Resistance:	100mΩ Max.
Operating Temperature:	-20C ~ +65C (-4F ~ 149F)
Fuse:	5A 32mm / 1 1/4inch
Cable Type:	3182Y 0.75mm PVC 300/500V, HO5VV-F2
Manufacturer:	AVSL
Manufacturer's Part Code:	804.332 UK
Approvals:	BSI approved to BS6500, VDE approved.
Current Rating:	6Amp

All specifications are manufacturer's data

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22. UHF Radio Modem Specification

The same UHF Radio Modem is used in the HEMS-Stars and FEC Remote Lighting Controller (RLC).

The Modem has the following specification.

Parameter	Value	
	UK/EU/ROW 868 MHz	USAA 915MHz
Manufacturer:	RF Solutions Ltd. UK	RF Solutions Ltd. UK
Modem Type:	ZULU-2-M868-SO	ZULU-2-M915-SO
Nominal Frequency Band:	868MHz	915MHz
Frequency Options:	868.400, 868.900, **869.450**, 869.600 and 869.800 MHz	915.00, 915.09, 915.18 & 915.27 MHz
Frequency Set to:	869.450MHz	915.00 - 915.27 MHz
Bandwidth per Channel:	100kHz	90kHz
Deviation:	45kHz	45kHz
Power Output Set	100mW (20dBm)	0.74mW (-1.3dBm)
Receiver sensitivity:	Max –121dBm (-102dBm (Max) to -109dBM (Min) at 56kbps)	Max –121dBm (-102dBm (Max) to -109dBM (Min) at 56kbps)
RLC & PC Controller Range:	Up to 2km depending on RLC aerial positioning and terrain	TBC
Addressing:	24bit secure data protocol	24bit secure data protocol
Addressing Schema:	One to Many	One to Many
RF Baud Rate:	56kbps	56kbps
Modem Data Rate:	19.2kbps	19.2kbps
Modulation:	Frequency Shift Keying (FSK)	Frequency Shift Keying (FSK)
Operating Temperature:	-40C to +85C	-40C to +85C
Compliance:	CE (see table below)	Compliance for FCC is to 47 CFR part 15.249

RF Channel Selection
The EU standard sets maximum power transmission limits dependent on frequency, bandwidth and application. A rough guidance applicable to the ZULU channel numbers is given below

Channel Number	Frequency Centre (MHz)	EU Power Allowance mW/dBm	Notes
0	868.400	25/14	Applicable standard - EN300-220
1	868.900	25/14	
2	**869.450**	**100/20**	
3	869.600	100/20	
4	869.800	25/14	

All specifications are manufacturer's data

23. Electrical Specification (Mains Power Supply Unit)

The Mains PSU fitted is a 60 watt unit identified on the PSU enclosure.

Parameter	Value (60 watt unit)
PSU Type:	Universal AC input / Full range
Rating:	15.0V 4A 60W max rating
Manufacturer:	Meanwell
Type:	LPV-60-TF15
Mains electrical connector:	2 pole AC via flying leads
Protections:	Short circuit / Overload / Over voltage / Over temperature
Case:	Fully enclosed plastic
Safety:	IP67
Earthing:	None – Double Insulated – PSU casing has earth bonding
No-load power consumption:	<0.5W
Compliance:	EMC Emission: EN55022 Class B, EN61000-3-2 Class A EMC Immunity: EN61000-4-2,2,4,5,6,8,11 EN55024 light industry level, criteria A
Absolute Input voltage range:	90V – 264V AC 47- 63Hz 127V – 370V DC
Operating Input Voltage Range:	100V – 240V AC
Absolute Operating Temperature Range:	-30C to +70C -13F to +158F
Operating Temperature Limits: 8 lights on full charge: 4 lights on full charge:	PSU Casing Temperature: 40C 104F Max 50C 122F Max
Meantime Between Failures (MTBF):	732,000hours MIL-HDBK-217F (25C)
Efficiency:	83%

All specifications are manufacturer's data

□ IP67 CE

24.   Electrical Specification (Power Cord Sets)

All power cord sets are approx 2m/6 feet long unless otherwise noted.

The following power cord sets are supplied for the defined markets:

North Americal Power Cord Set	
UL Approved Rated 125V AC 10A	

UK Power Cord Set	
VDE Approved Rated 250V AC 10A Fused 10A Length 1.8m	

European Schuko Power Cord Set	
CE, VDE and KEMA Approved Rated 250V AC 10A	

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Electrical Specification (Power Cord Sets) Continued

The following power cord sets are available as additional cost options:

Australia & New Zealand Power Cord Set	
SAA(13389), IMQ, SEV, VDE, KEMA, SEMKO, DEMKO, NEMKO, FIMKO Approved Rated 250V AC 10A	

Danish Power Cord Set	
DEMKO, SEV, SAA(13389), VDE, KEMA, SEMKO, NEMKO, FIMKO Approved Rated 250V AC 10A	

Italian Power Cord Set	
IMQ, SEV, SAA(13389), VDE, KEMA, SEMKO, DEMKO, NEMKO, FIMKO and other approvals Rated 250V AC 10A	

Contact your FEC representative for details of other options.

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25. LED Colour Characteristics

- White   6000°K/6500°K 'Cool White'
- Green   528nm
- Blue   470nm
- Red   625nm
- Infra-Red   940nm

Options

At additional cost and subject to a Minimum Order Quantity (MOQ), units can be supplied with a range of colour LEDs including:

- Deep Blue   455nm
- Yellow   590nm
- Red-Orange   617nm
- Hyper Red   656nm

26. LED Light Intensity – Approximate

The following gives an indication of the measured light level obtained from the units at different vertical angles and with different colour LEDs.

Colour	White			Green			Blue			Red		
Angle of Elevation	20%	60%	100%	20%	60%	100%	20%	60%	100%	20%	60%	100%
-5												
0												
5												
10												
15												
20												
25												
30												
45												
90												

New Figures to be used

As standard, lights are delivered set to Program 1: Green, 60% max output

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27. Special Orders

Software Features

At additional cost, units can be programmed to perform non-standard functions including:

- Different string lengths of Morse Code
- Alternative flash patterns
- Customer specified timing or operation

Please contact your FEC sales representative to discuss your particular requirements.

28. Spare Parts

The Li-Ion battery is a user changeable item.

There are no other user serviceable parts.

Items requiring repair need to be returned to FEC

29. Support Documentation

Documentation, including this manual, is contained on the USB memory stick in the case (colour of USB stick will vary).

Also on the USB memory stick are short video clips that demonstrate various aspects of setting up and using the lights and charger. Updates may also be posted on the FEC website.

Material on the USB Stick:

There are a number of folders on the USB Memory Stick containing:

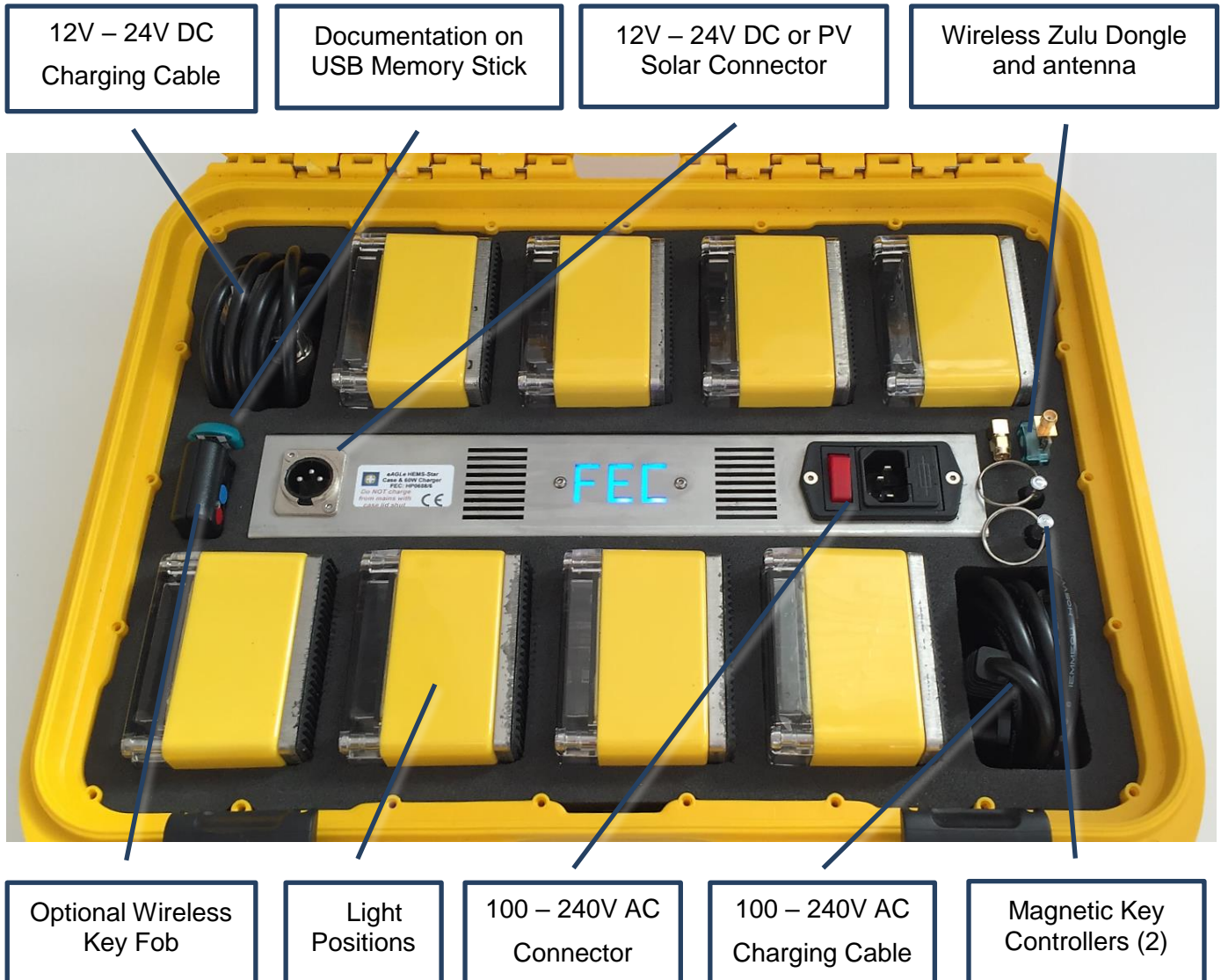|	
Application Files	PC Controller Software
Battery Data	Manufacturers declaration about the battery
HEMS-Star Software	Software running the lights
KFC Software	Software for the optional Key Fob Controller
Labels	Battery shipping labels
Manuals	HEMS-Star summary (flier in case) HEMS-Star manual (this document) HEMS-Star PC Controller manual Key Fob Controller manual
Videos	Short videos showing basic operations
HEMS-Star PC Controller V1.0	HEMS-Star PC Controller software
Setup	Setup file for PC Controller Software

Name
- Application Files
- Battery Data
- HEMS-Star Software
- KFC Software
- Labels
- Manuals
- Videos
- HEMS-Star PC Controller v1.0.application
- setup.exe

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30.   The Carrying and Charging Case

The carrying case can accommodate up to 8 lights, has an integrated 100-240V AC Power Supply Unit (PSU) and leads for connection to either the mains supply (for the PSU) or a vehicle nominal 12-24V DC supply. Note – Non-standard light cases shown.

12V – 24V DC Charging Cable	Documentation on USB Memory Stick	12V – 24V DC or PV Solar Connector	Wireless Zulu Dongle and antenna

Optional Wireless Key Fob	Light Positions	100 – 240V AC Connector	100 – 240V AC Charging Cable	Magnetic Key Controllers (2)

Always charge lights from the mains with the case lid fully open

Lights and PSU may overheat causing fire risk and permanent damage if lid is closed during charging

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31. Diagnostics and Fault Finding

The following are the range of simple tests that an end-user of the light can perform – to be carried out in the order given.

Warning

- The lights emit high brightness light pulses and/or Infra-Red. Do not look directly at the LED arrays or near reflections of the light.

Basic Visual Checks – Ensure that:

- The unit is properly mounted, secure and appears physically undamaged
- **There are no signs of overheating or leakage (could indicate a split battery)**

Basic Operational Checks – Ensure that:

- The magnetic switches operates correctly
- If the unit comes on but:
    1. In steady mode – the light flashes briefly and then goes out (indicates an exhausted battery), or
    2. In flash mode the correct sequence is not followed,

Check the charge state of the battery

- If the unit does not come on at all, go to next step
- If unsure of the charge state of the battery, connect to the charger and ensure that the charge cycle is as follows:
    1. There may be a brief period before the Green 'Charging' LED comes on (charger controller is checking the state of the battery)
    2. The Green 'Charging' LED comes on an stays on for up to 4 hours (indicates bulk charge cycle)
    3. The Green 'Charging' LED then goes off (indicates that the charger has entered the trickle charge phase).
- If at any time during charging the Red 'Fault' LED comes on it indicates a fault has been detected by the charger circuit – most likely with the battery.
    1. The first time this happens, disconnect the power and wait 5 minutes before trying again as the fault may clear
    2. Repeated display of the Red 'Fault' LED indicates a serious fault and the light should be returned to FEC for rectification

Returning the Light:

Defective Li-Ion batteries are not permitted to be air transported.

- Turn off the light
- Securely wrap the light in protective foam or similar
- Send the light to FEC for repair – by a permitted carrier (see next section)

32.   Transportation

Defective Li-Ion batteries are not permitted to be air transported.

Batteries are subject to special conditions when transported, particularly by air. The relevant ICAO/IATA documents make the following Provision (A67):

IATA-ICAO Provision A67 for the carriage of Batteries

A67   Non-spillable batteries meeting the requirements of Packing Instruction 872 are not subject to these Regulations if, at a temperature of 55ºC (131ºF), the electrolyte will not flow from a ruptured or cracked case. The battery must not contain any free or unabsorbed liquid. Any electrical battery or battery powered device, equipment or vehicle having the potential of dangerous evolution of heat must be prepared for transport so as to prevent:

(a)   a short circuit (e.g. in the case of batteries, by the effective insulation of exposed terminals; or in the case of equipment, by disconnection of the battery and protection of exposed terminals); and

(b)   unintentional activation

The words "Not Restricted" and the Special Provision number must be included in the description of the substance on the Air Waybill as required by 8.2.6, when an Air Waybill is issued.

The batteries used in the FEC HEMS-Star have been qualified by the manufacturer to be compliant with this provision.

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33. Packaging and Labelling

Repack the lights in the case and fit the case into its original cardboard box. Attach a warning label to the inner box.

Fit the inner box into the outer protective cardboard box with foam liner. Attach another warning label to the outer box.

A sample label is included on the memory stick for you to enter your contact details onto.

CAUTION!

IF DAMAGED

Lithium-ion Batteries
DO NOT LOAD OR TRANSPORT PACKAGE IF DAMAGED

For more information, call
Your Company Name Here
Your Telephone Number Here

34. Software Updater - HEMS-Stars

The HEMS-Star can be updated with new software by users. Software updates are available as downloads from the FEC website. Two formats are supported; executable (.exe) and self-extracting zip files. If your PC firewall prevents downloading of the .exe file, download and extract the zip file version.

To update the software requires a Windows PC and a USB cable with type 'A' plug one end and **Micro** type 'B' the other. The installer requires neither software nor drivers to be installed on your PC – the standard Windows HID drivers already installed are used.

To update the software:

1) Turn the HEMS-Star unit off

2) Open the enclosure as described in earlier section

3) Connect the USB cable to the PC (not yet to HEMS-Star)

4) Double click on the update file and a screen similar to that to the top-right will appear

5) Hold the Magnetic Key to the 'Off' position – all of the program LEDs will flash – keep holding until they all come on solid. Take away the magnetic key.

6) Insert the micro USB plug into the socket on the HEMS-Star

7) The screen on the PC should now advise that the system is connected and the Install button will have changed from greyed-out to active.

   - If screen does not confirm it is ready to install, remove the cable from the HEMS-Star and repeat from instruction 6

8) Click Install and the software will be automatically uploaded to the HEMS-Star

9) A screen (right) confirms the update in progress

10) When complete:

   - All of the HEMS-Star Program LEDs will extinguish
   - The PC Window will advise it is finished – click finish and the window will close

11) If Windows asks if the programme installed ok – click yes

12) Disconnect the USB cable

13) Reassemble the controller and turn on in the usual way with the magnetic key.

14) The HEMS-Star will now be running the new software

Note that the serial number and wireless type are retained during an upgrade but all other settings revert to factory defaults.
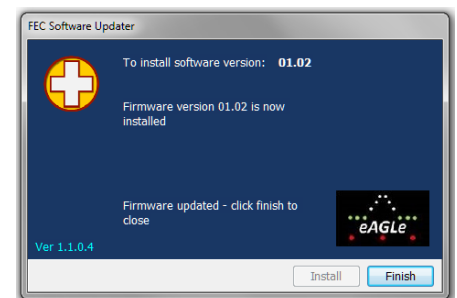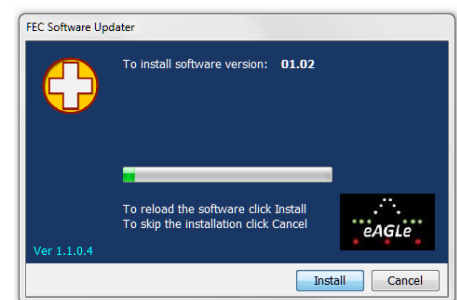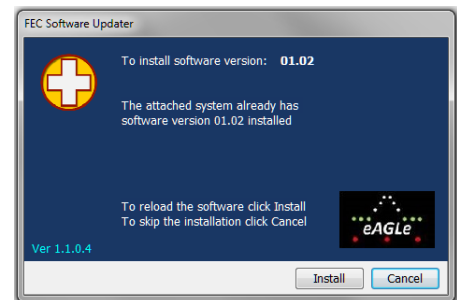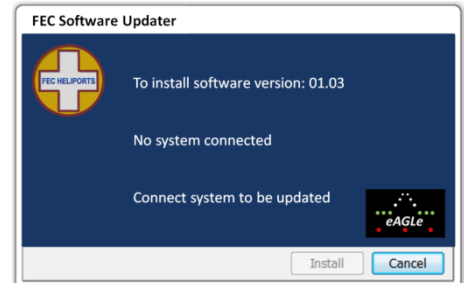
35.   Wireless Command Mode

Using the Wireless interface and a PC with HEMS-Star PC controller software it is possible to access the wireless lights directly and perform a range of control, testing and configuration tasks.

The HEMS-Star PC Controller has a separate manual – Please read carefully before attempting to install or run the software.

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36.   Changing the Battery

If the battery needs changing, proceed as follows:

1) Remove the top cover

Align the HEMS-Star as shown in the photo to the right.

Turn the unit off with the magnetic key and remove the top cover using a number 2 Pozi-drive screwdriver.

The screws are 'captive' so only need to be slackened off sufficiently to release from the base.

Keep the cover top-side up to avoid it getting scratched.

2) Remove the top cover

Remove the four 4mm M3 socket screws which hold the main circuit board in the case with an Allen key or driver (shown).

Note that a small amount of thread locking compound was used during manufacture to ensure these screws do not come loose.

Some initial resistance to turning will therefore be felt. This is normal and to be expected.

3) Fold the circuit board open

Carefully rotate the circuit board open to the right as shown. This exposes the delicate electronic components and should be done with care.

Locate the battery isolation switch (ringed in red) and slide it to the Off position (direction of red arrow).

Note that the exact position of the switch may vary.

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4) Cut the cable Tie

With a pair of small jaw diagonal cutters, cut through the cable tie ensuring that the wires and sleeving are not damaged.
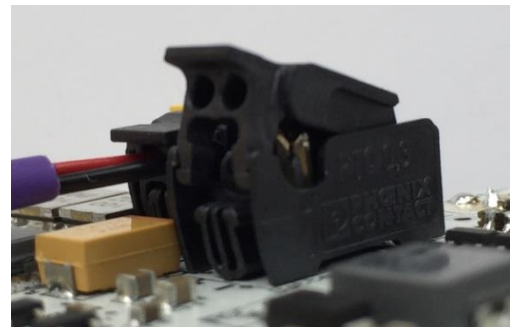
Discard the tie wrap. A new replacement is supplied with the replacement battery.

5) Release the battery connector

With a small flat-bladed screwdriver, raise the battery Insulation Displacement Connector (IDC) to the position shown and withdraw the battery wires.

Ensure no insulation remains in the connector and remove it if it does.

6) Release the battery

The Tie Wrap used to hold the battery in place is a reusable type and **must not** be cut through.

Insert a small flat-bladed screwdriver between the locking tab and the tie as shown.

Open the tie wrap and leave in place.

The battery may now be released from the case base leaving the wrap tie in place.

7) Fit the new battery

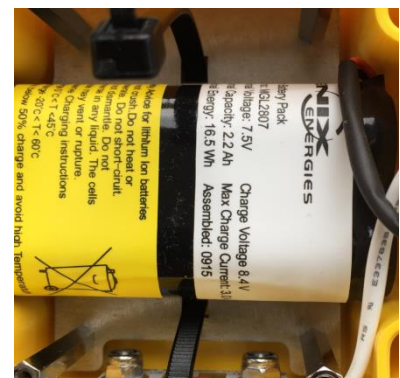Fit the new battery in the exact position of the old one

Re-fit the wrap tie and ensure it is secure (not too tight)

Re-fit the cable ends into the IDC and when checked that they are correct polarity and fully home, squeeze the connector shut

Turn the battery isolator on and observe that the light comes on (turn off with magnetic key)

Carefully fold the wiring into the case ensure it does not foul anything and re-fit the PCB

Re-fit the lid and test that the light is operating as expected

End of Document