Pad-Star® Lighting Controller (PLC)
FEC Type: HP0719
User Manual – Specification - Diagnostics

PLC Version 3 Issue: 1   10th October 2020

Note that this manual relates to

PLC V3.0, Software V4.01 and SMS V7.1 onwards

Table of Contents

Document Revision Sheet

Version - Issue	Date	Changes
4 - 1	10th October 2020	New Document for PLC V3 based on ULC system core

Notes

1)	this manual covers all commands available to the Manager and User. Additional commands available to FEC, System and the OEM are contained in separate documents.
2)	Optionally, the Controller contains either
     a. A Cellular Radio. Refered to as the 'Cell' in this document.
     b. A Local Area Network interface. Refered to as the 'LAN' in this document.

1 Compliance Statement - 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.

2   Compliance Statement – Europe

EU Declarations of Conformity for the Bluetooth and Cellular radio modules are included in the appendix.

This product has been marked with the CE mark to show it is compliant with the relevant standards.

3 Overview

FEC's Pad-Star® Lighting Controller (PLC) V3 is an all new, fully digital design that combines ease of installation and use with sophisticated yet simple and secure configuration via the IP65 rated keypad and LCD display or via a Bluetooth (or optional cellular radio) link to a PC running FEC's Systems Management Software (SMS) Version 7.

This manual relates to the PLC Version 3 and in this manual is referred to as the Controller.

3.1 Key Features

- Traditional VHF Pilot Controlled Lighting configuration
- Simple 25kHz/8.33kHz frequency setting through front panel – no fiddly switches
- Defined number of presses to activate Channels 1, 2 or 3
- Programmable timeout for VHF, keypad and Cellular/LAN activation
- Each channel has fully independent time-out (10 seconds to 60 minutes)
- VHF and Cellular operation can be remotely enabled/disabled for extra security
- FCC/EU approved, Integrated Bluetooth module for local SMS control
- Optional FCC/EU approved universal Cellular Radio Module for remote SMS control
- Optional LAN interface
- Secure PIN code protected SMS commands to monitor and control your installation
- Secure status reporting – check out your installation before taking off
- Remotely activate Channels 1, 2 or 3
- 3 Status relay contact outputs for BMS interface
- 4 Auxiliary and 1 BMS input for switching or BMS control of VHF receiver
- Local and remote test and diagnostics integrated into the unit
- Very low power consumption – Approx. 3W (idle) and less than 30W max. (including internal winter heater)
- Operates from 110-240V AC 50-60Hz or 12V DC (ideal for solar and batteries)
- Weather station interface for meteorological information from your helipad
- Simple helipad cabling – two core cable taken to each light.
- Smart installation, setup, control and monitoring – communication over the data cable to intelligent light drivers via a Bluetooth (or optional cellular radio/LAN) link to FEC's SMS
- ICAO plus additional light levels for both visible and infra-red LEDs

3.2 Part Numbers

FEC Part Number	Device	Comment
HP0719	Pad-Star® Lighting Controller with VHF Airband radio and internal 480W Power Supply Unit	Single unit enclosed in an ABS enclosure for smaller installations

FEC and Interleader Ltd have a policy of continuous product improvement and reserve the right to change specifications of products. See website for latest details.

4 Architecture of Pad-Star Lighting Controller V3

Effective operator or pilot control of Helipad Lighting is critical to the safe operation of an installation. Traditional radio Pilot Controlled Lighting (PCL) solutions using the VHF radio is a tried and trusted method.

Now there is a new way to control your lighting and peripheral circuits using FEC's new Controller which integrates both traditional VHF PCL and adds Systems Management Software (SMS) control and monitoring with the option of automatic weather reporting (wind speed/direction, temperature, dew point and pressure) right from your helipad.

FEC's Controller sits at the heart of a monitoring and control capability bringing together for the first time remote lighting control, helipad weather and system reporting.

The architecture can be used simply to control lights or, with additional meterological sensors, to provide richer monitoring and reporting both by helipad operators and other agencies.

All of these features are under the full and secure control of the owner/operator and are the basic building blocks on which future FEC developments will be built.
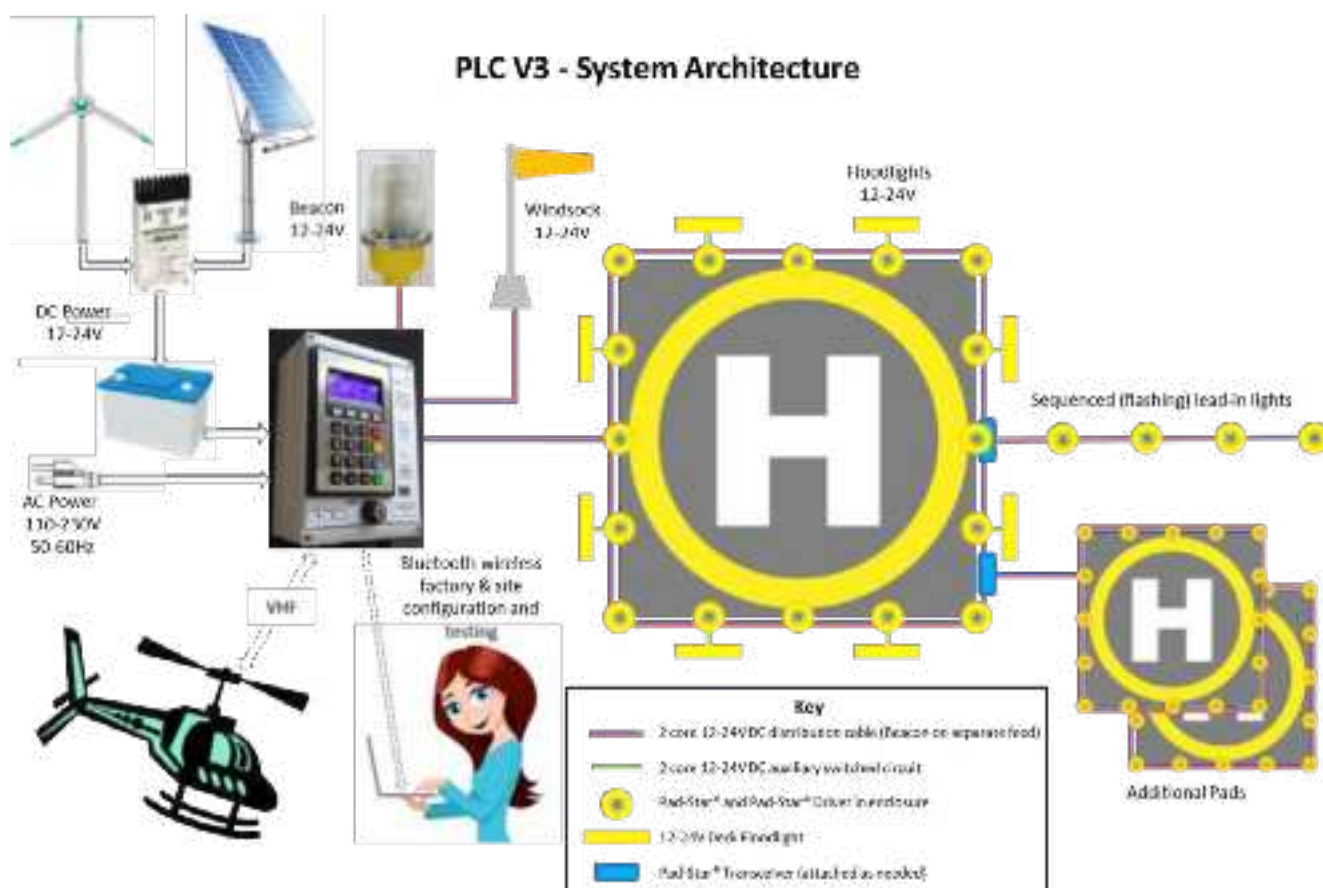
5   Principles of Operation

5.1   Keypad and LCD Display - Overview

The FEC Controller is basically configurable via the front panel keypad and screen.

Setup, test and monitoring of the controller is carried out via the front panel keypad and LCD display. There are no controls inside the case.

The menus are arranged in a hierarchical structure with a consistent presentation format and key operation. Extensive use is made of the 4 'Function Keys' above the main 16 key keypad and, in conjunction with changing legends on the screen, intuitively guide the user through the various steps.

The key features of the interface are shown left.

LCD Screen Common Layout

Line 1 indicates the menu level

Line 2 provides instruction

Line 3 Indicates the 'Function Keys' function

Line 4 identifies the keys and their status

Function Keys 1-4 (left to Right)

Data Entry Keypad

Note that in some menus the boxes in the 4th line also give the current status of that function. For example, in the Power setup the LCD mode, the square changes from open to solid to indicate the changed setting.

Note that in some menus more information is provided and hence the exact layout above not followed. The approach is the same and where there are differences instructions provided.

F4, usually marked 'Exit', returns to the previous level in the menu and in many screens accepts the conditions set in that menu. If Marked 'Quit' then that screen is discarded before return.

Repeatedly pressing F4 will bring you back to the main menu.

5.2 Systems Management Software – Overview

All FEC products can be configured, tested, controlled and monitored with the Systems Management Software (SMS) via either a Bluetooth (included in all products) or Cellular Radio Module (Optional extra) or LAN (Optional extra) link.

SMS is run on any PC, Laptop or Tablet running MS Windows 10 and which supports Bluetooth LE (V4.X). The main menu displays the products supported:

Select the link type ⬭ (default is Bluetooth) and SMS will find all of the FEC products in range and turned on. In this case it has found device serial number 70000 which is a PLC.

Click on the PLC image ☐ and SMS will connect to the desired device:
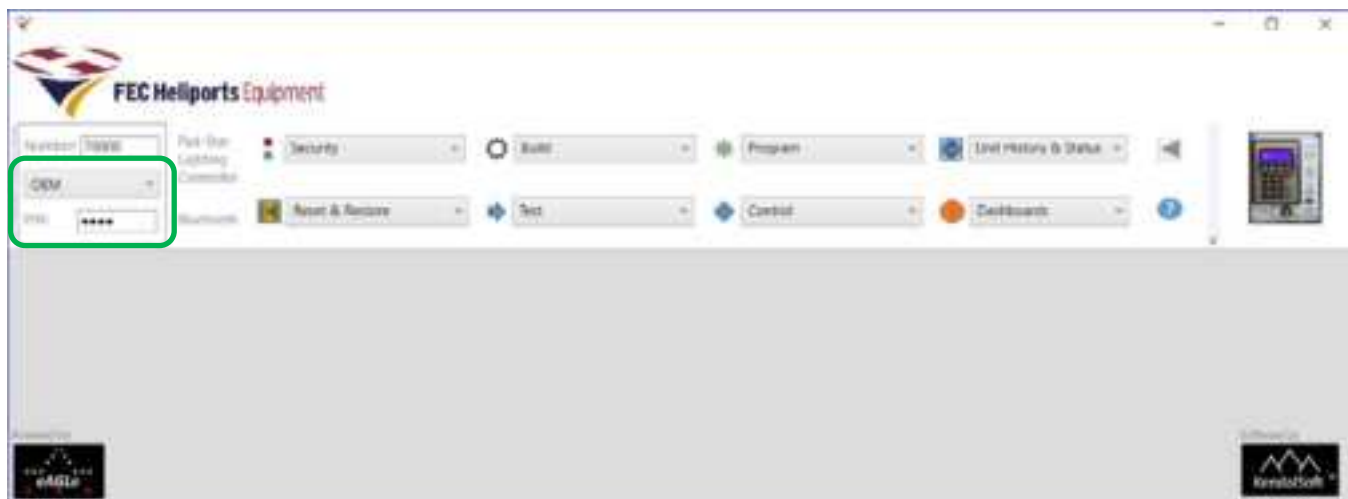
This is the main Controller Menu. To access the device through the menus, select your User Type (example is Manager) and the relevant PIN ☐ . The Sub-menus are covered in later sections.

5.3   User Types

Users of the system are classified by User Type. For security, each User Type has a unique PIN code associated with it and different levels of access. User Types and their basic attributes are:

User – This is generally the pilot who has been given permission to use the system.

Manager – This is the owner or operator of the facility.

FEC – FEC have defined access to certain options (e.g. reset the Operators PIN).

System – Machine to Machine system interface for data logging

OEM – The Original Equipment Manufacturer has defined access to perform diagnostic and support options.

Each type of user has a PIN access code and are arranged in an hierarchical manner – User has the fewest privileges, OEM the most, to perform a variety of tasks on the system.

5.4   Modes of Operation

After the initial start-up sequence, when the system checks out its sub-systems, the Controller enters its operational state continuously monitoring all of the triggers that can activate channels or provide responses to either the Bluetooth or Cellular Radio Module interfaces.

The exception to this is when a user enters the menu mode from the keypad to perform setup or testing operations. During this access all other inputs are ignored.

To avoid the Controller becoming 'stuck' in this state, after 10 minutes the Controller will return to its main operational state. As an additional security measure, if PINs are not entered within 5 seconds of each other, the screen times out and returns to the main menu. Also, if the wrong code is given this is advised and a return made to the main programme.

Warning - Once the Menu Mode is selected, the system no longer monitors the VHF or Cell receivers and will not respond to remote commands. All setups should be performed when it is known that no movements requiring the lighting controller are required

5.5   Channels

The Controller uses the concept of 'Channels'. Channels are activated via Start-Up, Inputs, the Keypad, VHF or SMS. Channels are then mapped to control which relays are activated.

The default settings are as follows:

Keypad Action [1]	VHF Action	SMS	Default Relay Activated
Function Key # 1 Pressed	3 'clicks'	Channel 1	Relay 1 activated
Function Key # 2 Pressed	5 'clicks'	Channel 2	Relay 2 activated
Function Key # 3 Pressed	7 'clicks'	Channel 3	Relay 3 activated
<CAN> Manager only	6 or 8 'clicks'	Channels Off	All relays de-activated

Notes:

1) 3, 5 & 7 clicks are the default but can be changed to any desired unique number per channel
2) Any combination of relays can be activated instead of the defaults (see later section)
3) If Timeout Alert is active, The Winsock is flashed according to the parameters set through SMS (default 10 minutes).

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[1] By default, no PIN is required to activate channels via the keypad. This can be changed via SMS

5.6 Activation Options

There are five ways to activate channels:

- *Start-up* and *Wired Inputs* trigger channels to stay on until turned off, and
- *Keypad, VHF* and *SMS* all start timers to de-activate the channel after a defined period for each channel.

1) **Start-up** The Controller can be configured so that at start-up (or after a power-cut) a specified channel is activated.

   The Controller remains in this state until another trigger. This is a 'fail-safe' option of operation. Start-up channels are inactive by default and are configured via SMS.

2) **Wired Inputs** The Controller has 3 inputs (which can be activated by a switch or relay) which turn on the channels with no time-out.

   Wired Inputs have the highest priority of all triggers and once set cannot be cancelled unless the switch/relay is opened.

3) **Keypad** All channels can be triggered by selecting Fn1 – Fn3 keys. The relevant channel will be activated with the time-out timer running.

   By default no PIN is required to activate channels via the keypad but this is configurable via SMS.

4) **VHF** All channels can be activated by a pilot using a series of 'Clicks' - pressing the Push To Talk (PTT) transmit switch in the aircraft. The relevant channel is activated with the time-out timer running.

   Each of the channels 1 -3 have a default number of clicks of 3, 5 & 7 respectively. The number of clicks, including the option to cancel via VHF, are configured via SMS

5) **SMS** Channels can be controlled On (with timer running) or Off via SMS and either the Bluetooth or Cellular Radio links.

As well as activating the 3 channels, both the Windsock and Beacon interfaces are activated by default.

How channels control these, including a Windsock Alert is configurable via SMS.

Note that in this version of software channels are activated sequentially and only one channel can be active at a time (although it can control up to 3 relays).

For example, if channel 1 is active and channel 3 is triggered, channel 1 will be immediately cancelled and channel 3 activated.

6 Setup through the Keypad and LCD Screen

The top menu is not really a menu but rather the main status display page with two main options:

1) Select the menu, or
2) Directly activate a Channel.

If neither a Cellular Radio nor LAN interface is fitted to the Controller then the start-up checks are skipped. The screen will appear as shown right. No Network device (Cellular Radio or LAN) is fitted.

```
VHF:   ■  On  122.800MHz
Net:   □  None
CH1      CH2     CH3     Menu
 □        □       □       ■
```

If a LAN interface is fitted then after the start-up checks the screen will appear as shown on the right. The LAN interface needs to be tested by using SMS to confirm connection.

```
VHF:   ■  On  122.800MHz
Net:   ■  LAN
CH1      CH2     CH3     Menu
 □        □       □       ■
```

If a cellular radio module is fitted the start-up process includes checking, configuring and connecting to the network. There are more start-up screens showing this progress and it takes 10 seconds. once the system has performed its start-up checks the screen will appear as shown right. A Cell Module is fitted, the receiver is ON - shown by both the filled box and the word 'On'.

```
VHF:   ■  On  122.800MHz
Cell:■  On
CH1      CH2     CH3     Menu
 □        □       □       ■
```

If a cellular radio module is fitted but a network connection has not been made at start-up then the screen will appear as shown right. N/C is short for No Connection. No communication will be possible with the unit in this state. Check all connections, particularly the antenna and re-cycle the power.

```
VHF:   ■  On  122.800MHz
Cell:□  N/C
CH1      CH2     CH3     Menu
 □        □       □       ■
```

The screen provides the essential information to show the status of the system. Including:

Line 1: The VHF receiver is ON – shown by both the filled box and the word 'On' and the operating frequency is shown – in this example a US UNICOM frequency.

Line 2: LAN or Cell Radio Module status.

Line 3: Is the legend and functional description of the function keys

Line 4: Indicates the status of the channels. In this example, none are active (open boxes) and the Menu is available via the Function Key 4 below it. The Menu box will flash open/solid every second.

By default, the screen remains back-lit all of the time.

To save power (particularly useful in battery powered installations) the LCD screen back-light can be set to 'Auto' in which case it goes out 30 seconds after the last key was pressed or the screen was refreshed. To re-activate the backlight, simply momentarily touch any key and the screen will light up for another 30 seconds.

During an Active Period (when the controller has been activated to turn on the lights) the screen is regularly updated with a down-count to the end of the Active Period and so the screen remains on. See section on SMS system setup.

6.1 Entering Menu Mode

To enter the Menu mode, simply press the function key (F4).
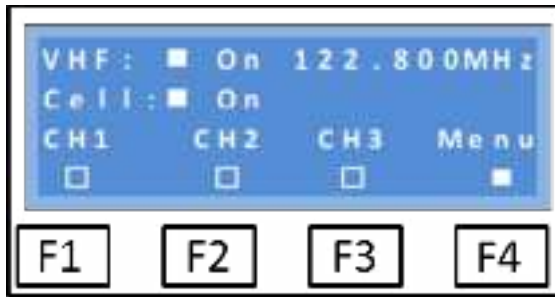
In this paper all live options are shown
Solid: [   ],
inactive buttons/screens greyed out: [   ]

Keypad entry is shown:

Note that the function key representation above is used consistently throughout the manual.

On pressing F4 (for the main menu) you will be taken immediately to the PIN challenge screen to enter your security PIN. If successful, the Setup Control Unit menu will be displayed.

Level 1 – Main Screen
Main screen shows VHF and Cellular radio status
VHF is On with Frequency 122.800MHz set
Cellular radio is On
All of the 'soft keys' are active:
F1, F2 or F3 select a channel to be activated
F4 selects the main menu

Note
When channels have been activated the legend changes
To show which are on
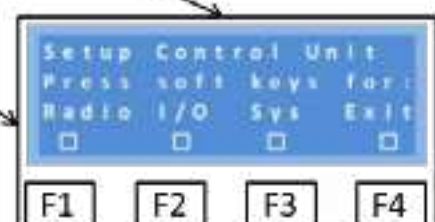
6.2 Setup Control Unit

The Setup Control Menu gives access to basic Radio, Input & Output and system settings. All of these basic functions and many more sophisticated functions are also available via SMS which is the advised method of system configuration and testing.
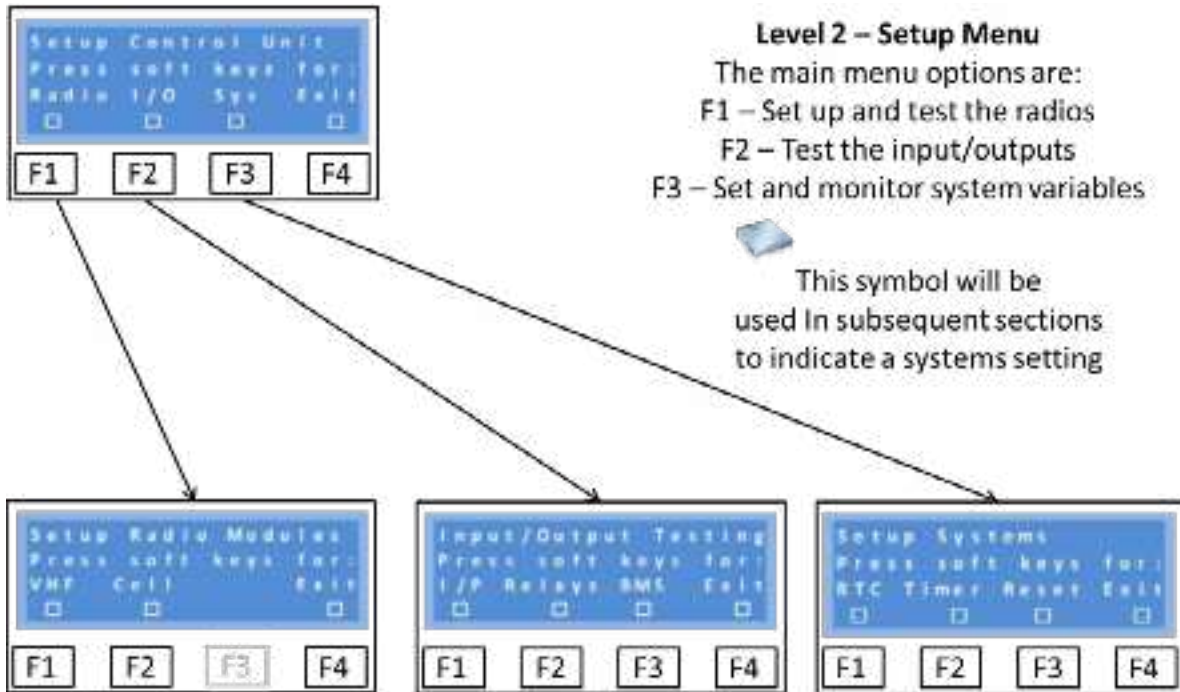
6.2.1 Radio

The Radio menu gives access to the VHF receiver and Cellular Radio module.

6.2.1.1 VHF Receiver
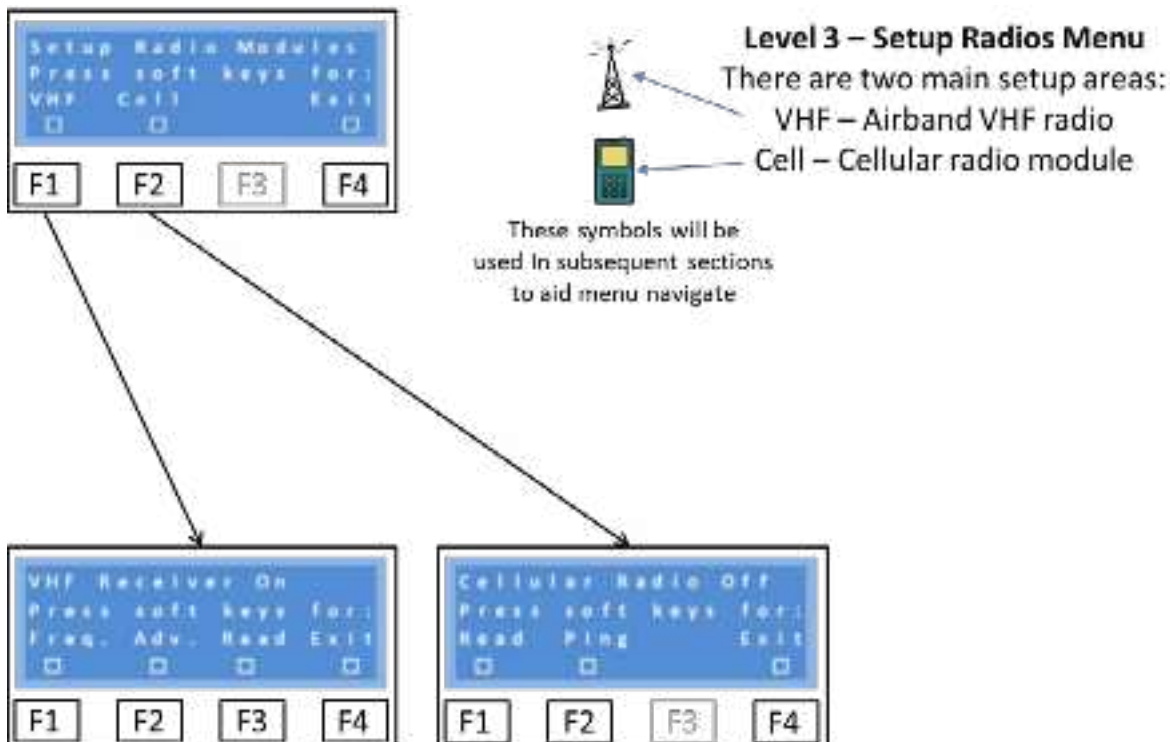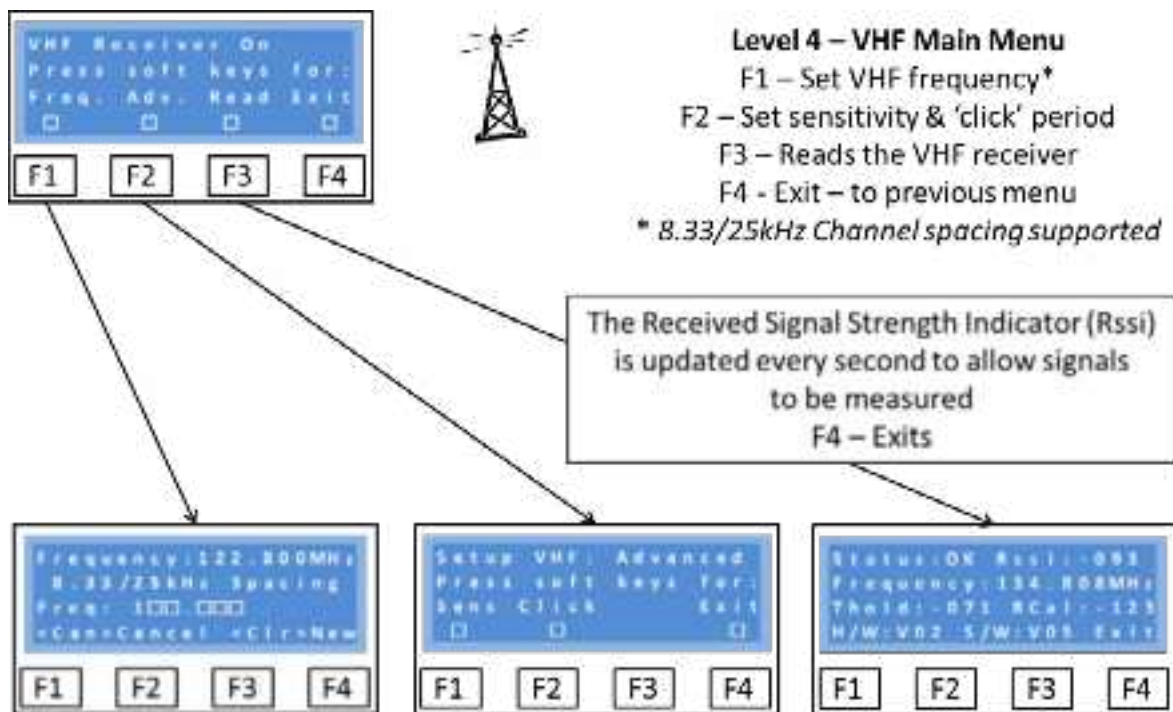

6.2.1.2 VHF Frequency Setting

The international channel convention of 8.33kHz provides 16 channels per 100kHz of bandwidth and as a consequence not all frequencies are available. For example, 134.810 is valid but 134.815 is not.

Frequency reading

Note that in the screen (over the page) the frequency is displayed as 134.808MHz even though the channel selected is 134.810. This is because the channels are a simplified and rounded (down or up) representation of the frequency used.

A table showing the first 16 channels versus their frequency is shown below. The user does not need to know any of this detail.

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
118.000	*118.0000*	*118.025*	*118.0250*	*118.050*	*118.0500*	*118.075*	*118.0750*
118.005	118.0000	118.030	118.0250	118.055	118.0500	118.080	118.0750
118.010	118.0083	118.035	118.0333	118.060	118.0583	118.085	118.0833
118.015	118.0166	118.040	118.0416	118.065	118.0666	118.090	118.0916

Note that the 25kHz spacing channels (italics) are an exact frequency but that the 8.33kHz channels are not.

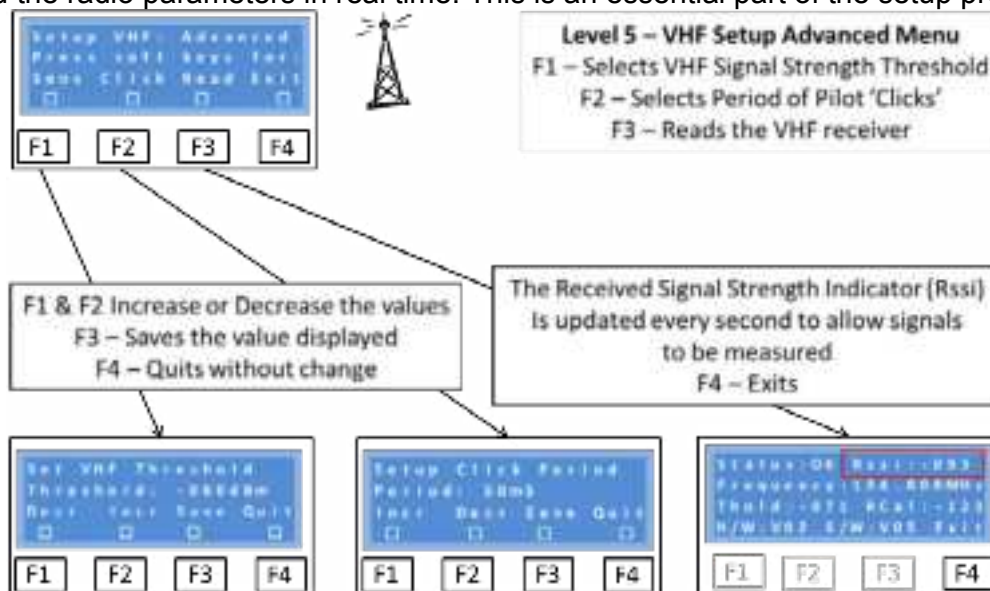This pattern is repeated every 100kHz for all 3,040 channels.
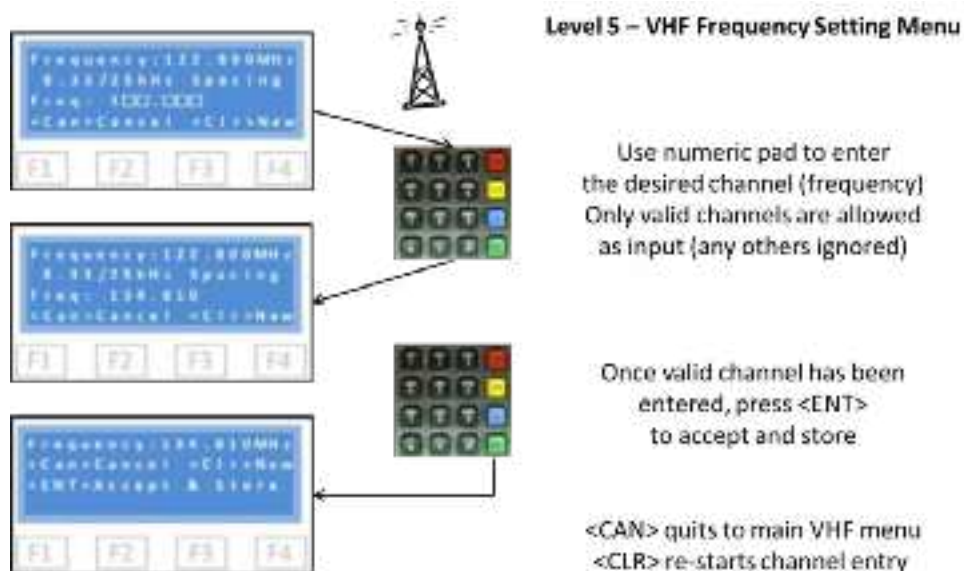
Frequency (Channel) Setting – as each number is entered it is checked to ensure that the frequency (channel) is valid. If valid the number entered is displayed and the cursor moves to the next space. Any invalid entries are ignored, nothing is displayed and the cursor does not move.

Once all numbers have been entered the system has ensured a correct and unique channel. The full frequency is displayed (screen 3) and confirmation requested (<ENT>).

6.2.1.3 Setup VHF Receiver – Advanced

There are currently three menu options to:

1) Set the sensitivity of the VHF receiver threshold detection level (this is analogous to a 'squelch' on earlier systems)

2) Set the minimum period of the Pilot 'Clicks' (presses of the Push To Talk – PTT button), which will trigger the system, and

3) Read the radio parameters in real time. This is an essential part of the setup process.

Level 5 – VHF Setup Advanced Menu
F1 – Selects VHF Signal Strength Threshold
F2 – Selects Period of Pilot 'Clicks'
F4 - Exit

F1 & F2 Increase or Decrease the values
F3 – Saves the value displayed
F4 – Quits without change
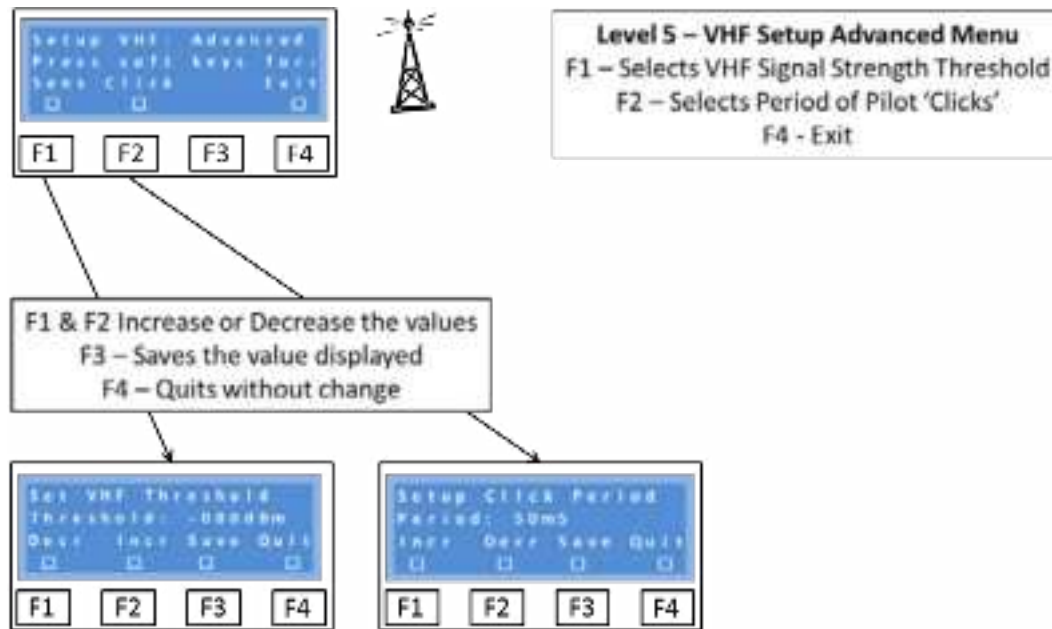
Sensitivity – Setting the threshold

The Threshold is the level of Received Signal Strength at which the receiver is set to detect the carrier signal (so called Carrier Detect) and is expressed as the power at the aerial socket.

By default it is set to -75dBm and can be varied between 0dBm and -125dBm (where 0dBm is the highest level and -125dBm the lowest).

Great care should be exercised in setting the threshold too low (less than -80dBm) as noise may cause false triggers. Equally if very high signal levels are experienced, an attenuator may need to be introduced to the aerial feed.

Before changing the threshold level, read the section about the display of RSSI (Read command below) as this will give good information about the local conditions.

Click – Setting the minimum PTT press period

As well as setting the signal level at which the system will trigger, the minimum length of time that the Push To Talk (PTT) switch is activated can also be set.

This 'Click' period helps mitigate against the effects of 'noisy' switches which can otherwise cause problems of false activations.

The system employs digital filtering of the received signal and waits for the signal to be stable above the threshold level for the 'Click' time before it counts as a genuine PTT press.

Each click is counted in a 5 second period and if 3, 5 or 7 clicks successfully received, channels 1, 2 or 3 are set (see later section on mapping of channels to relays).

The default setting for Click is 100ms (100 milliseconds) and can be set between 1 and 250mS. Some experimentation may be necessary to ensure correct operation in any particular installation.

Reading the VHF receiver status

Selecting 'Read' retrieves and displays all of the relevant status registers from the VHF receiver.

Of importance to the operator are:

1) That the status is OK
2) The Rssi level of the received signal
3) That the Frequency is as set and expected
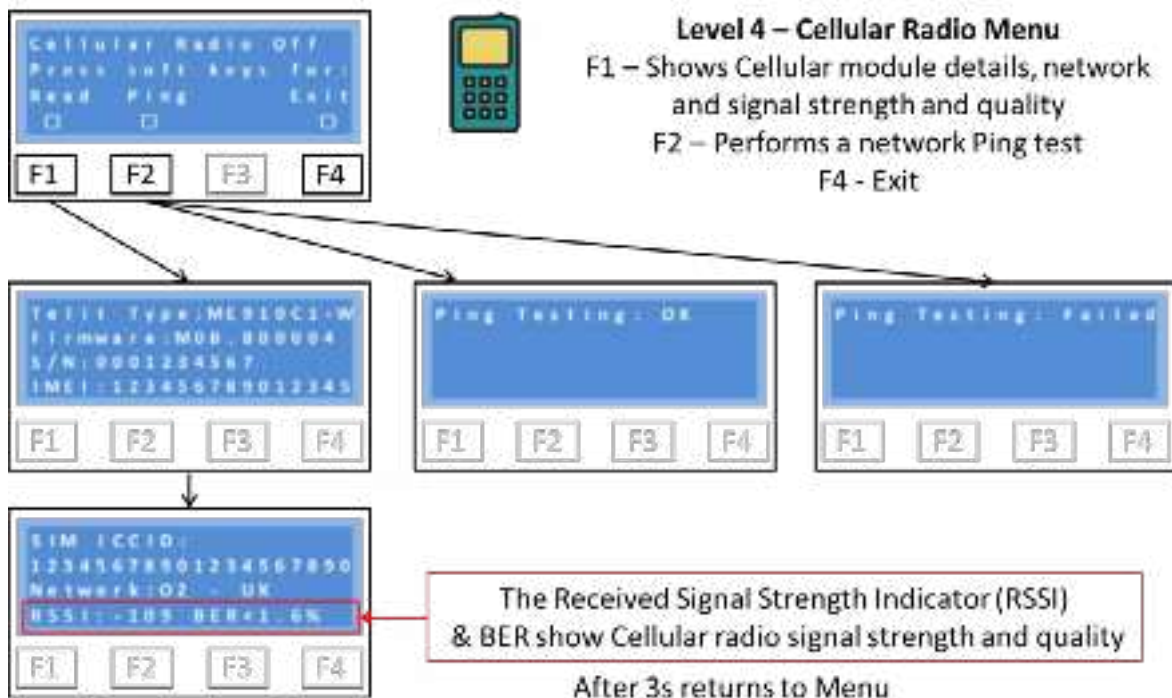4) That the Threshold level is as set and expected

Once this command is invoked, the receiver will be continuously re-read every 1 second and the Rssi figure will be updated. This is extremely useful in checking the installation (aerials, down-feed etc.) and setting up the receiver.

6.2.2 Cellular Radio

If a cellular module is fitted the basic module details, signal strength and quality can be obtained and a network 'ping' to test the network connection are available.

These simple routines are useful in fault finding and diagnostics.

Level 4 – Cellular Radio Menu
F1 – Shows Cellular module details, network and signal strength and quality
F2 – Performs a network Ping test
F4 - Exit

The Received Signal Strength Indicator (RSSI) & BER show Cellular radio signal strength and quality

After 3s returns to Menu

Read returns the basic information about the module and the network characteristics. In the example above the module is attached to the UK O2 network with a reasonable signal strength and low Bit Error Rate (BER) which is a measure of network quality.

Ping performs a network access ping to the service provider network. This test will take a few seconds to complete.

6.3 Input and Output Testing Menu

The 4 inputs, BMS input and 3 relays, 3 channel, Windsock and Beacon relays can all be tested through the Input/Output Testing menu.

These tests are extremely useful during installation to check that all of the interface
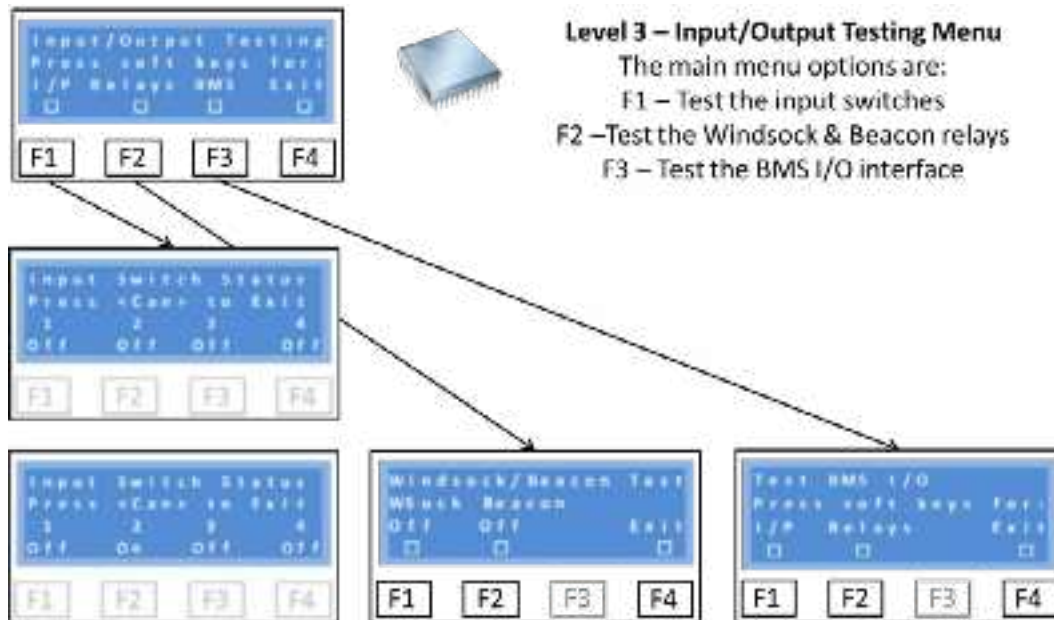
In the lower left screen above input 1 has been made active and is shown in line 4 as 'On'.

6.3.1 Test Inputs

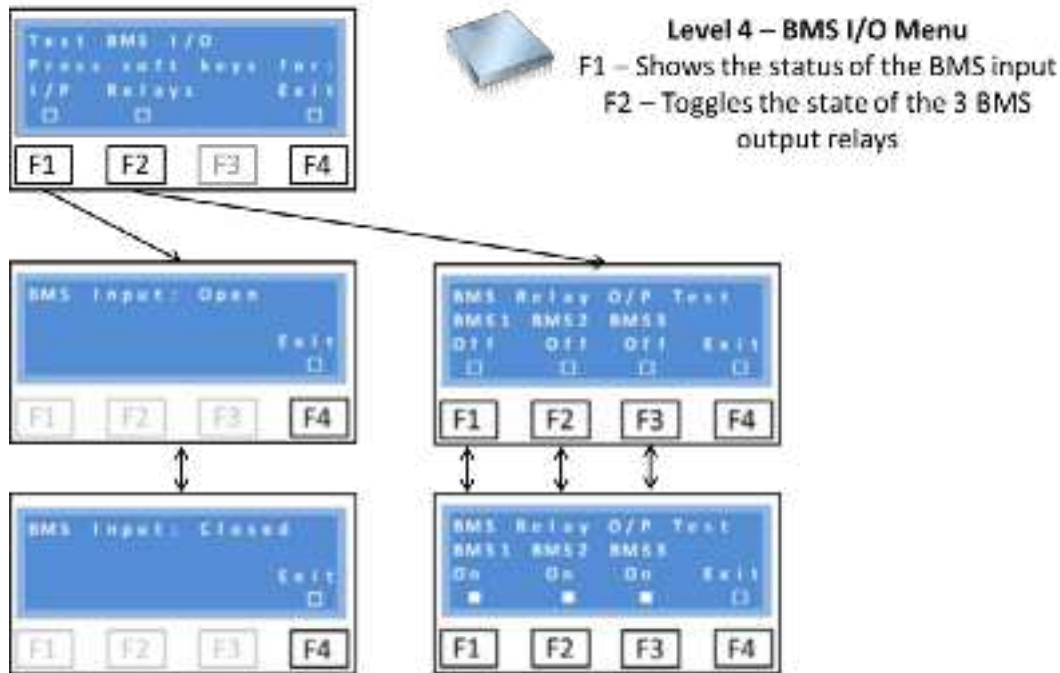The status of the Inputs are displayed.

6.3.2 Test Windsock & Beacon Relays

The windsock and beacon relays are tested in the same manner as the channel relays. Note that the coil currents are not measured for these relays.
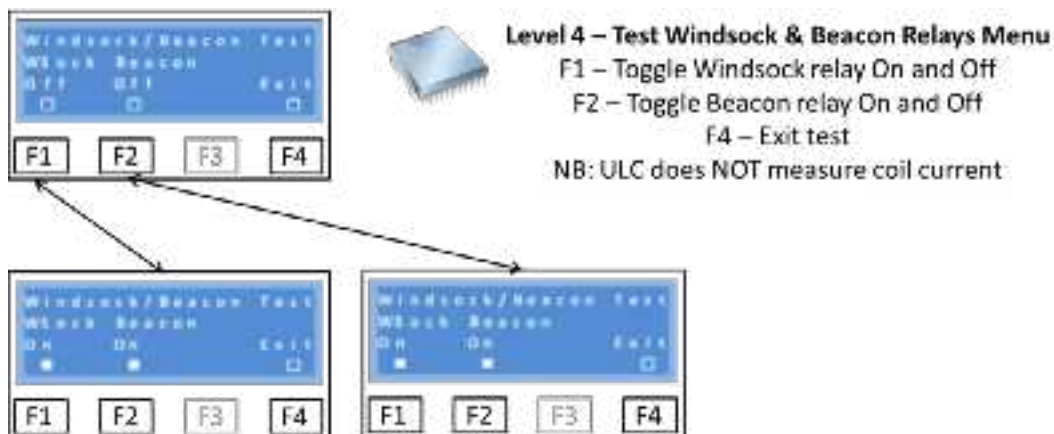
6.3.3 BMS Input and Output Tests

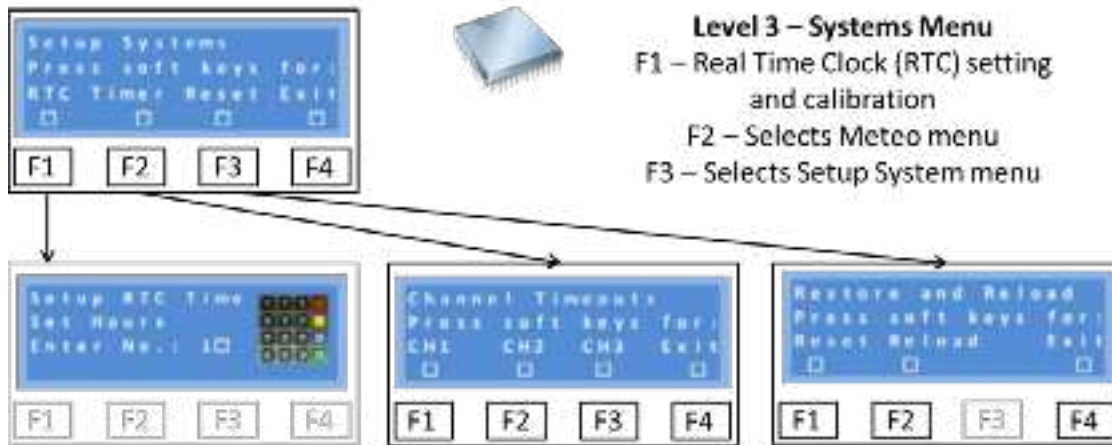The BMS input and three BMS output relays can be tested.

Selecting input monitors the state of the input and displays it. Press F4 to exit.
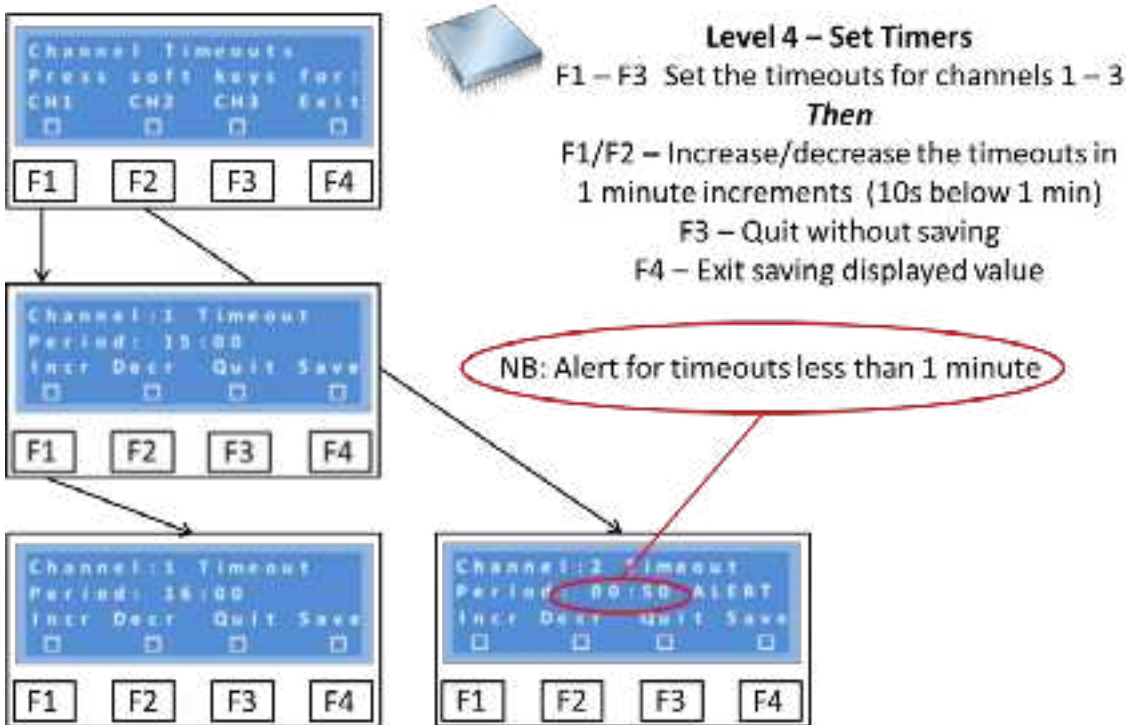
Each of the 3 BMS relays can be tested by using F1-3 which toggles them on and off. Unlike the power relays, these are small signal relays are inaudible in operation. Use a circuit tester across their output contacts to test action. Schematics are shown in the Appendix.

6.4   Setup Systems

Level 3 – Systems Menu
F1 – Real Time Clock (RTC) setting and calibration
F2 – Selects Meteo menu
F3 – Selects Setup System menu

6.4.1   Set Channel Timeouts

Level 4 – Set Timers
F1 – F3 Set the timeouts for channels 1 – 3
Then
F1/F2 – Increase/decrease the timeouts in 1 minute increments (10s below 1 min)
F3 – Quit without saving
F4 – Exit saving displayed value

NB: Alert for timeouts less than 1 minute

The time-out period for each **channel** to be set in the range (default 15 minutes):

a) 10 seconds to 1 minute (in 10 second intervals), and
b) 1 to 60 minutes (in 1 minute intervals)

Changes are made simply using the F1 & F2 keys and then either quitting or saving when happy with the new value.

NB: The provision of very short time-out periods is to allow the driving of latching infrastructure (either direct contactor switching or a BMS, for example). Such short periods would not normally be used to drive lighting circuits directly.

When using Windsock alert (as required in certain territories) ensure that the channel timeout chosen is longer than the windsock alert period (default 10 minutes).

6.4.2 Set Real Time Clocks

Selecting RTC from the previous menus starts the clock setting process:
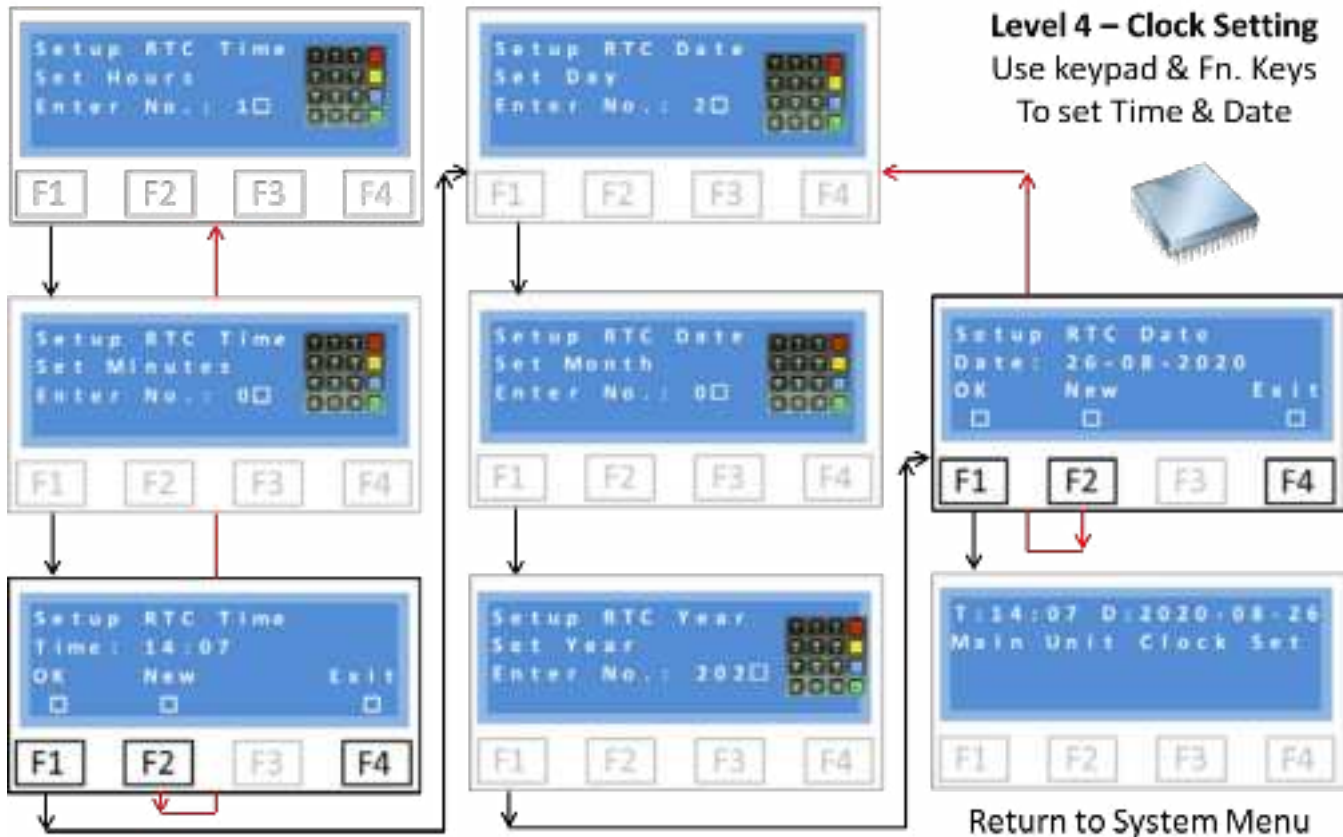
The first screen requests the hour. This must be entered in 24 hour format and as a two digit number. For example, 9 o'clock in the morning would be entered '09' and 5 o'clock in the afternoon '17'.

Immediately that the two numbers for the hours have been entered you are prompted to enter minutes. Again, this is as a two digit number.

Immediately the minutes have been entered the time is shown (bottom left screen) which you can accept (F1 -OK) or reject and start over (F2-New).

Once the time has been correctly entered, the day of the month is prompted for. Again this is in a two digit format. The number is checked to be in the range 01-31 but does not check against the month which is entered in the same way, again being checked to be in a valid range of 01-12.

Once the month has been correctly entered you are prompted for the year. The system pre-fills the Century (20) and accepts all years from 15 - 99.

On completion of the above there is a screen to confirm the date with the same options as before. Pressing F1 accepts the date/time and sets the clocks.

Confirmation that the clocks have been set is displayed for a short period before returning to the main menu.

The clock can also be set via SMS.

6.4.3 Reset and Reload (Software)
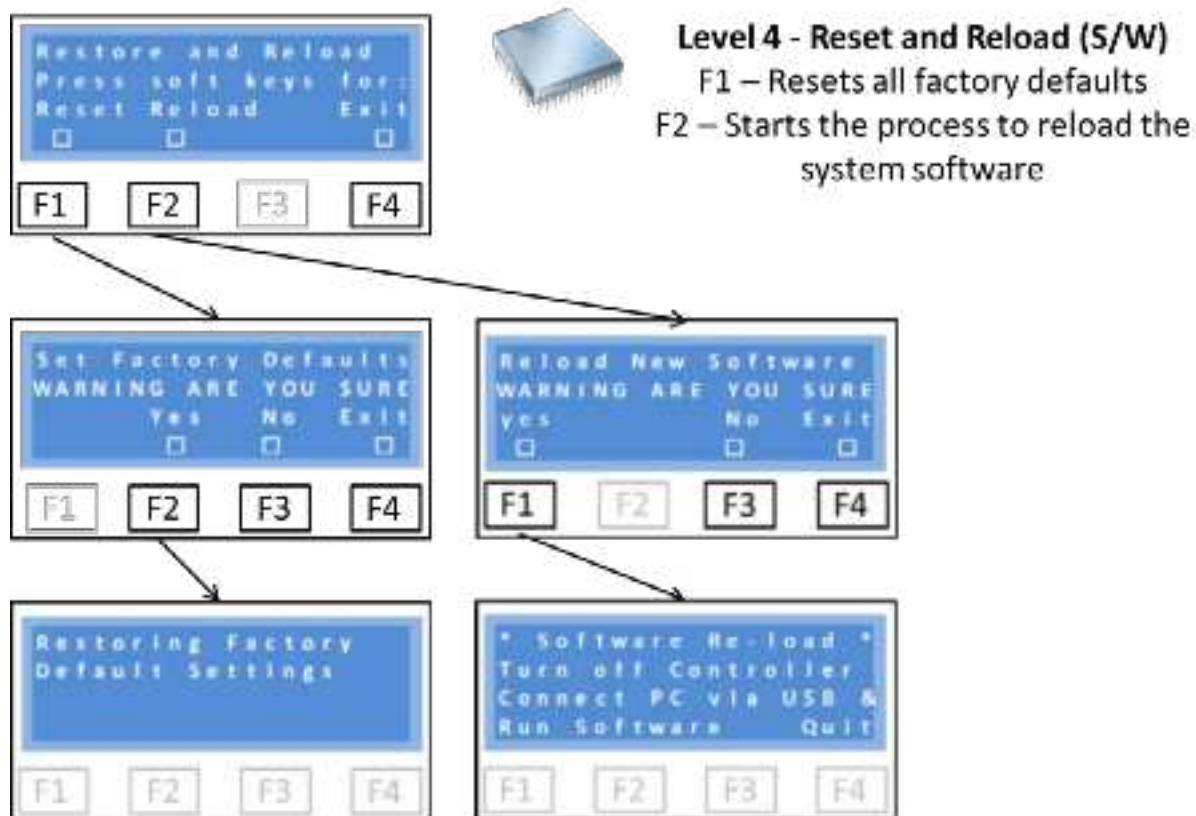
The variables such as VHF frequency and Channel timeouts can be reset to the factory default settings (see Factory Default Settings section later in this manual). Note that all settings are taken back to their factory default state and all user configuration will be lost.

New software can loaded into the controller either via the USB port (the method shown above and in the Appendix) or via a wireless link (Bluetooth or Cellular Radio/LAN if fitted).

7 Operation

In normal operational mode the channels are activated from 5 sources:

1) **Start-up** – On first power-up of the unit (or after a power cut)
2) **Wired Inputs** – Either switch or relay contacts

    Channels triggered via 1 and 2 have no timeouts and stay on until turned off

3) **Keypad**
4) **VHF**
5) **SMS**

    Channels triggered via 3, 4 and 5 have timeouts and stay on until:

1) Turned off by timeout
2) They are turned off by the Manager, or
3) A new channel is triggered

By default, activating any channel will turn on both the Windsock and Relay.

In this version of SMS the Beacon trigger channels can be set and in future versions the Windsock will have the same options.

In some territories it is necessary to flash the windsock a defined period before the main lighting circuit times-out. e.g.

CASA MoS Part 139 compliance (Australian Civil Aviation) requires:

9.3.1.5 *Ten minutes before the aerodrome lighting system is due to turn OFF, the PAL must cause the lights of at least the primary Illuminated Wind Direction Indicator (IWDI), in accordance with Paragraph 9.6.1.10, to commence to flash at approximately 50 cycles per minute (approximately 0.6 seconds ON and 0.6 seconds OFF), and continue to flash until either:*

(a) the PAL system switches OFF, and all aerodrome lighting, including the IWDI lights, is extinguished; or

(b) the PAL system has been reset for another ON period.

This requirement is fully supported by the Controller and is setup via SMS. Once active, the Windsock relay can be heard engaging and dropping out and the windsock indicator on the LCD will flash.

7.1 Activated via Start-Up

If a channel is selected to be on at Start-up, at power-up that channel will come on and remain on until a further command is given, either to turn it off or to select another channel.

```
Access Via:  Start-up
Set on By:   Unknown
CH1    CH2    CH3    W&B
On     Off    Off    ■  ■
```

The LCD screen will show the channel that is on, the access route (Start-up) and who turned it on (Unknown – since no User Type PIN in entered). Note that legends W&B refer to the Windsock and Beacon respectively.

In this example both have come on with channel 1 (default).

7.2 Activated by Input

If a channel is activated via the wired inputs (e.g. switch or relay) it will immediately cancel any other input and set the desired channel. Inputs have priority over every other route. The LCD screen will show the channel that is on, the access route (Input) and who turned it on (Unknown). Again, both the Windsock and Beacon have come on with channel 2.

```
Access Via:     Input
Set  on By:     Unknown
CH1      CH2      CH3    W&B
Off      On       Off     ■  ■
```

Once the input is de-activated the screen will show that the channels are off. The route (Input) and who turned it off (Unknown) are also shown. This will be displayed for 1 minute after which the screen will change to the main screen.

```
Access Via:     Inputs
Set Off By:     Anyone
CH1      CH2      CH3    Menu
 □        □        □       ■
```

7.3 Activated by keypad

A channel can be directly turned on or off via the function keys on the keypad. By default no PIN is required to achieve this but this can be changed via SMS.
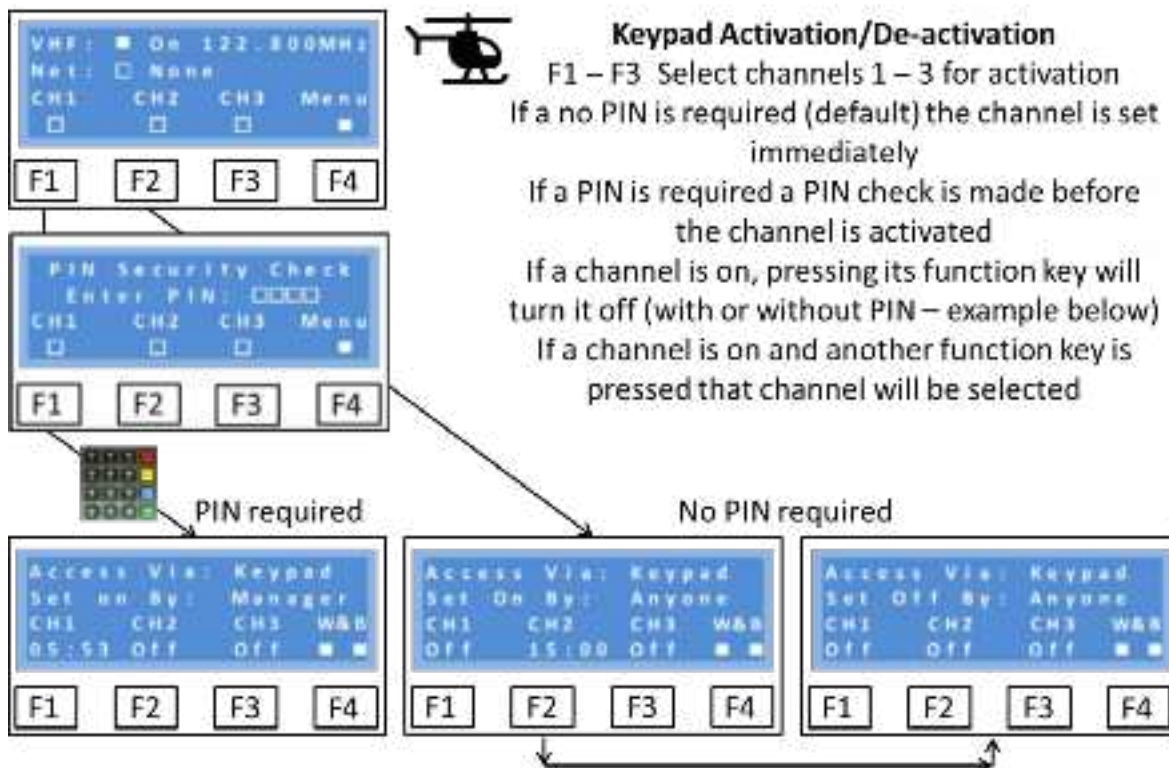
In the example above to turn on channel 1, If a PIN is required, then after pressing F1 the PIN check screen is presented. If the correct PIN is entered the channel is activated and the screen shows who activated it. If F1 is pressed again to turn the channel off, again a valid PIN is required before the channel is de-activated.

If no PIN required, for example to turn on channel 2, pressing F2 will immediately activate channel 2. Pressing F2 again will immediately de-activate it. Pressing F1 or F3 will select those channels.

The keypad Cancel key <CAN> can also be used to deactivate all channels. This always requires a Manager PIN or above to action.

7.4 Activated by VHF

If VHF is 'Active' then the controller will be activated if 3, 5 or 7 (default) presses of the aircraft microphone switch (PTT) are made in a 5 second period by an approaching pilot on frequency.

```
VHF:  ■ On  122.800MHz
Cell:■ On    CD #:  1
CH1     CH2    CH3    Menu
  □       □      □      ■
```

As the 'clicks' are received the CD (Carrier Detect) counter will be displayed on the screen:

This will turn on the relevant channel for the periods previously set by the operator (default 15 minutes).

```
Access Via:  VHF
Set on By:   Pilot
CH1     CH2    CH3    W&B
15:00    □      □      ■ ■
```

There is no restriction as to who can use the VHF part of the controller. If it is active and someone is on frequency, then they can operate it. The screen will appear:

During this period the 'Menu' option is not available but alternative channels can be activated by pressing the microphone switch again – including re-activating the same channel. Each time a channel is set the timeout period restarts.

This is a useful feature if, for example, a landing is delayed and the lights are approaching turning off (indicated by the flashing windsock if implemented. The pilot simply re-keys the required clicks for the channel and the timer re-starts.

```
Access Via:  Unit
Set Off By:  Timeout
CH1     CH2    CH3  Menu
  □       □      □      ■
```

At the end of the time-out period the channel is de-activated and the display shows that the unit has timed-out. This will be displayed for 1 minute after which the screen will change to the main screen.

```
Access Via:  VHF
Set Off By:  Pilot
CH1     CH2    CH3  Menu
  □       □      □      ■
```

The Manager can set 6 or 8 'clicks' to de-activate all channels/relays. If setup this way, the pilot can de-activate the channel with number of clicks.

7.5 Activated by SMS

Channels can be activated, deactivated and monitored via SMS. With a cellular radio module or LAN module fitted this enables truly remote management of the lighting.

```
Access Via:  SMS
Set on By:   User
CH1     CH2    CH3    W&B
  □       □     03:39■  ■
```

Once activated by SMS the screen will show which channel is active and the timeout period left to run. Note that all of the other options to deactivate or change the channel remain active.

Channels can also be de-activated via SMS and the display shows that the unit has been turned off. This will be displayed for 1 minute after which the screen will change to the main screen.

```
Access Via:  SMS
Set Off By:  User
CH1     CH2    CH3  Menu
  □       □      □      ■
```

7.6   System Management Software (SMS)

Using a Bluetooth wireless interface and a PC with the FEC Systems Management Software (Version 7.1 onwards) it is possible to access the Controller directly and perform a range of control, testing and configuration tasks. This option requires that the PC/Laptop/Tablet has an embedded Bluetooth module or an adaptor that acts like one.

The relevant commands are in the following sections – Please read carefully before attempting to install or run the software.

7.7   Preparing for Installation

Before beginning installation make sure:

1) The Controller is powered
2) You have a PC with Windows 10 (has been shown to work on Windows 7 or later but will not run on any earlier version of Windows, or on Apple iOS or Android devices)
3) Access to the internet with a fast connection

7.8   Materials on the Supplied Media (USB or CD)

There are a number of folders and files on the USB Memory Stick/CD typically containing:

Application Files	Systems Management Software
Software	Software running the Controller
Manuals	PLC User Installation and Operational Manual
Systems Management Software	Systems Management Software (SMS)
Setup	Setup file for SMS

It is recommended that you copy all of the files on the USB memory stick

However you organise the copied files, ensure that the following are all together, at the same level, in the same directory (C:\Downloads recommended):

Folder: Application Files

Manifest File: Systems Management Software V7.X

Setup File: Setup.exe

7.9   Installing Systems Management Software (SMS)

The software uses Microsoft .Net Framework v4.6 components which are included with Windows 10.

If you are running an earlier version of Windows, at the time of installation, these components may download automatically but if not, you will need to download them manually. Note that this is a large download and even with a fast internet connection will take some tens of minutes and will require a re-start of the PC to take effect.

To install the software:

1) Shut down all other applications running on your PC
2) Uninstall any previous installation of the same version of the SMS
   a. Select: Windows key, All apps, double click on FEC SMS and select uninstall
3) switch on the Controller
4) You may need to switch off protection virus software such as Avast, McAfee completely
5) Run the setup.exe file
   a. This can either be from the memory stick or the location you copied the files to
   b. If you get a screen displayed saying this is risky software and a 'Don't install' button then select 'More Info' and then press 'Install anyway'.
6) A 'Publisher cannot be verified' screen will be displayed – select 'Install'.
7) The software will install and appear thus:

If it does not appear at all, repeat the process above ensuring that all steps are followed exactly. On narrower screens, the menu area may appear truncated from the right (for example the Help area may not be visible). This is quite normal and is managed by use of the drop-down menus (see later sections).

Operational Note:

Check that you have the correct product (e.g. PLC) serial number, the power is applied and the unit switched on before running the software or you will receive various failure and time-out messages.

.

7.10 Selecting the Communication Channel and Device

Communication Selection

SMS supports a range of communication options but only Bluetooth (default) and Cellular Radio (if fitted) for an Controller.

Device Selection

The serial number of all FEC devices that are in range will be found and available to select from the drop down menu. In this example it is device 70000.

Product Selection

The Systems Management Software is capable of configuring and controlling a number of FEC lighting products - simply click on the product that you wish to establish communication with. The software will automatically check the device and product selected and show the menu.

<div align="center">NB – The Product and Serial Number must match</div>

Potential Communication Issues

If you are unable to communicate with the chosen device, check that it is properly powered up, you have identified the correct serial number and that the PC and Controller are within a few meters of each other and there is no wireless obstruction (e.g. metal structures) between them.

SMS will scan for devices with a default scan period of 40 seconds. This can be increased if required to give the PC longer to find all devices.
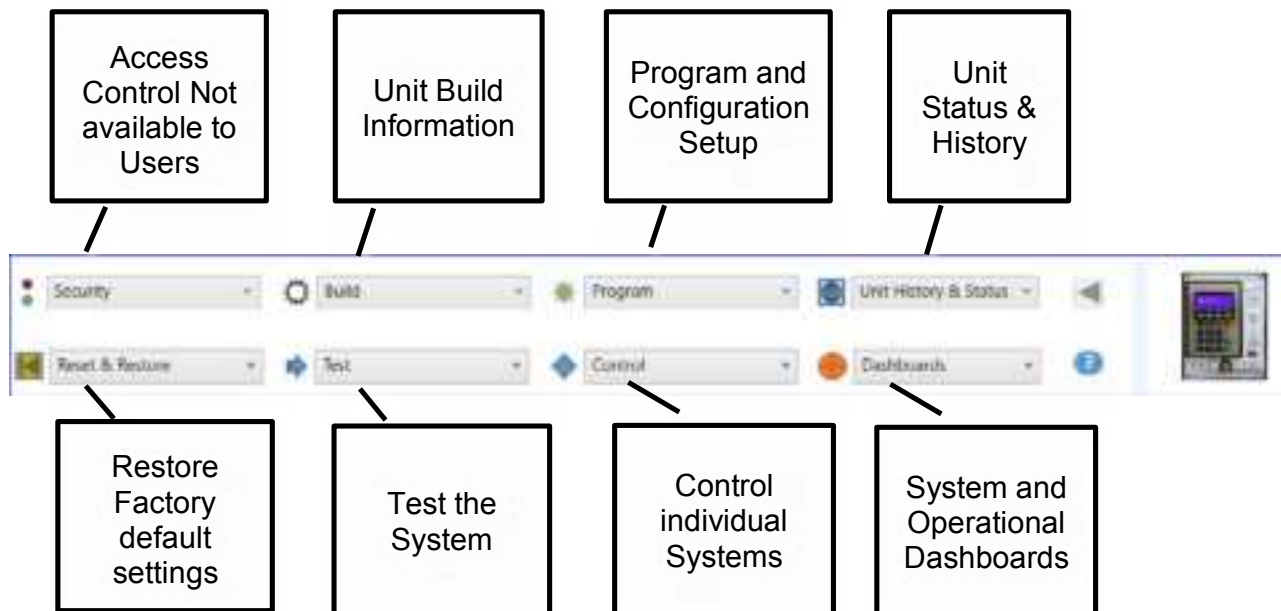
7.11 Product Menu

The menu for a Controller appears as follows:
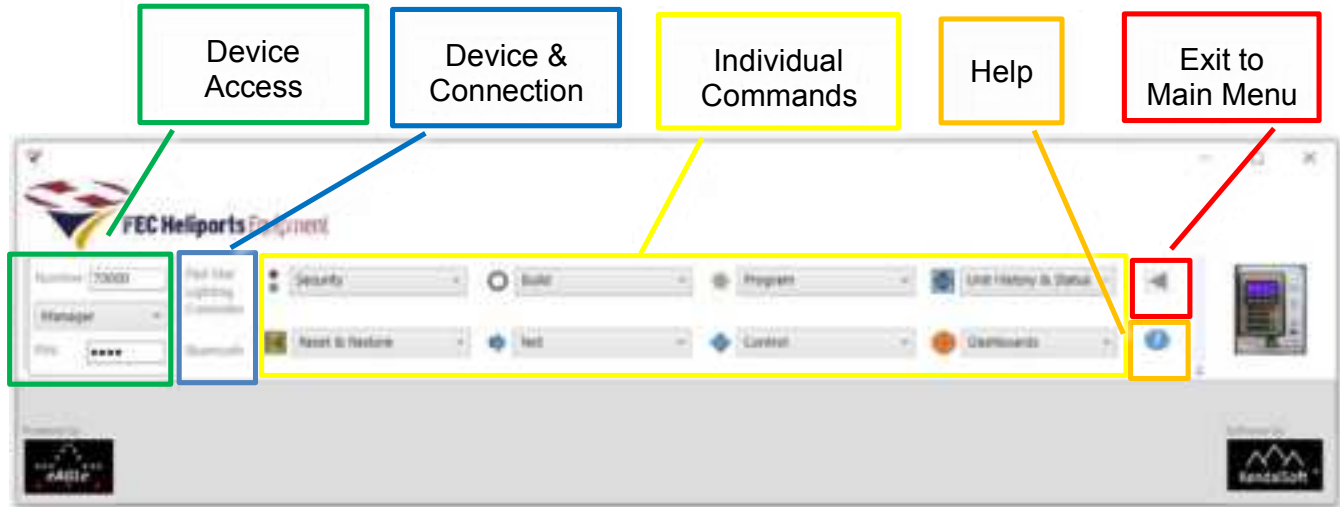
The commands that can be performed are grouped as follows (details in later sections):

The 'look and feel' of the commands is similar across all menus making it easier to navigate and be productive.

Help

Pressing the Help key brings up simple text-based help.

This will be expanded in subsequent releases of the software.

7.12 Security

The Security menu options are:

1) Display PINS – PINs displayed are a function of User Type
2) Update PIN - PINs can be changed depending on User Type
3) Keypad PIN – Define whether direct keypad input to set or unset channels requires a PIN or not.

Display & Update PINs

A Manager will see current PINs (left). Pressing Change brings up a screen to allow a new PIN to be entered. Once successfully applied the screen will appear as right.

a) Any attempt to change a PIN of higher authority will be rejected (e.g. Manager tries to change FEC PIN), and
b) A Manager may change their own PIN. Be careful to make a note of it as you could lock yourself out of your own product!

Keypad PIN

Dy default no PIN is required to set or unset a channel via the F1 (Channel 1), F2 (channel 2) or F3 (channel 3) function keys.

To require that a PIN is entered to perform these actions, select PIN required from the drop-down menu and the Update.

7.13 Unit Build Commands

User Commands

Only the Build Data is available to the User.

Manager Commands

The options available to Managers are:

1. Build Data option - returns details of the unit
2. VHF Version – Check HW & SW version of receiver
3. Download Program file – download new Controller software
4. Update Device Software – install new Controller software
5. ULC Type and Setup – Enables the LCD backlight and internal heater to be configured – important for battery installations – and if a Cellular radio is retro-fitted to enable it. Fuller instructions are supplied with the module.
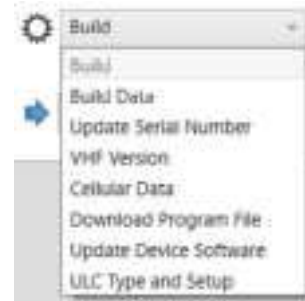
FEC Commands

As for Manager.

OEM Only Commands

Update Serial Number: The serial number entered will be stored immediately allowing other commands to be entered.

The LAN is a factory fit open and only available to the OEM.

Download Program File

New software can be downloaded from the manufacturer's website. Select Download Program File and SMS will automatically search the relevant download area for software. Select the required file and then download and the software will be downloaded. Confirmation of download is shown on successful completion.
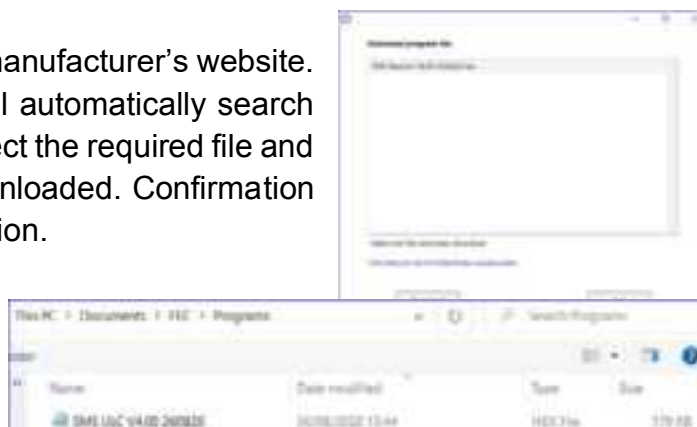
The software (.hex) will be stored in:

This PC>Documents>FEC>Programs.

Update Device Software

Select Update Device Software and the previously downloaded file will be found.

Select the required file and open.

Program File Information

Information about the software will open. Read carefully and ensure that it is the version you want to install and then press Next.

Devices

Enter the device serial number that is to be programmed into the starting serial number box and press Add. The serial number will be transferred to the Defined serial numbers box. If correct, press Next, otherwise clear the list and start over.

SMS will get the current version of software from the Controller and confirm if it is a previous, current or new version.

Device Status

Normally the software will be the next version but there may be a need to either regress to a previous version of the software or reload the current version. All options are possible.

Select the desired software and press update software to continue or back, refresh or quit as appropriate.

Update Software

The software updater automatically builds a report file of the software update including date, time, versions and, if entered, the name of the person performing the update.

If there is a suspected issue with updating, then also check the diagnostic report which will be useful to FEC in diagnosing any issues.

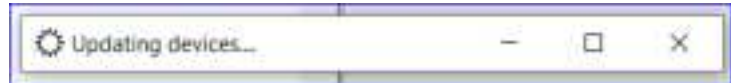Once ready, click Start Update.

Final Warning

A final warning is given that once started the process must run to completion and that if it does not the Controller will need to be updated via the USB port (later section). If happy to proceed, click Yes

Update Software

SMS will then show that the software is updating.

At the same time the LCD display will confirm progress.

```
Loader V01.20 310720
W/L Started:Erased
■■■■■■■
Code Address:0DB30
```

On completion SMS will confirm the update and also run the new program.

Clicking Verify update will show the version now installed. Same screen as Device Status above.

View Report

Click View report for the details of the update process.

```
RLC software update report 260820 160433 - Notepad
File  Edit  Format  View  Help
RLC

Conducted by: John Doe
SMS version: 7.1
Report file name: C:\Users\malco\Documents\FEC\Programs\RLC software update report 260820 160433.txt
Date and time of run: 26/08/2020 16:04:33
Device type: RLC

Serial number: 70002
--------------------
Software updated successfully: the device is now in command mode

Run time: 175.84 secs
End of report
```

7.14 Program

The Program menu provides access to:

Unit Configuration - To check and make changes to the configuration settings which are common to all programs
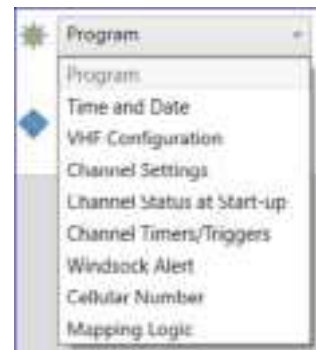
Time and Date

When Time and Date is selected, the Real Time Clock/Calendar (RTC) in the Controller is read and the current time and date displayed (right).

Select Change to update (far right).
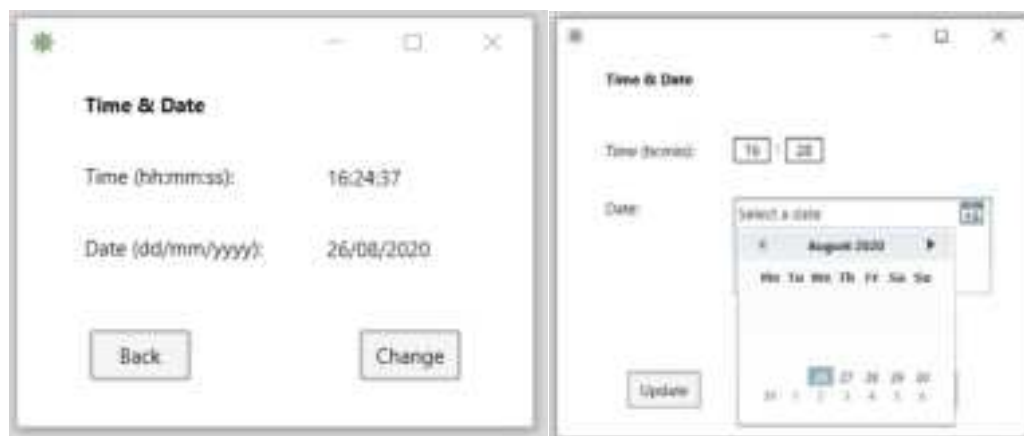
VHF Configuration

The VHF Configuration menu provides similar functions as provided through the keypad menus.

The VHF frequency, activation threshold and 'Click' period can all be set.

Depending on customer demand, the capability to set Sequential or Concurrent channel activation may also be made available.

Channel Settings

Each Pad-Star channel is capable of controlling up to three Groups of lights.

This flexibility allows, for example, channel 1 to turn on the main pad lights and a set of approach lights and channel two to turn on the main pad and a different set of approach lights.

To configure what each channel does, first select the channel then define up to three actions for that channel. Note that each action must act on a different Group.

In the example to the right, Action 1 is to turn on Group 1 lights at a steady (non-flash) setting with the visible LEDs set at 50% of maximum and the IR LEDs off.

Channel Status at Start-up

The controller can be programmed to immediately activate a channel on start-up and keep the channel active until commanded to do otherwise (off or activate another channel). This is a very useful feature where it is desired, for example, for the system to come on following a power cut.

Select the desired channel to come on at start up and press 'Set'. Note that only one channel can be set as the start-up channel but that channel can control up to three relays.

Channel Timers & Triggers

Selecting Channel Configuration shows the current channel timeouts and whether or not each channel also triggers the Beacon.

Channel timeouts can be set in whole minutes above 1 minute or 10 seconds below 1 minute.

Warnings are issued for erroneous values.

To make changes, simply enter the desired values and press Update.

Winsock Alert

In some territories it is necessary to flash the windsock a defined period before the main lighting circuit times-out. e.g.

CASA MoS Part 139 compliance (Australian Civil Aviation) requires:

9.3.1.5 *Ten minutes before the aerodrome lighting system is due to turn OFF, the PAL must cause the lights of at least the primary Illuminated Wind Direction Indicator (IWDI), in accordance with Paragraph 9.6.1.10, to commence to flash at approximately 50 cycles per minute (approximately 0.6 seconds ON and 0.6 seconds OFF), and continue to flash until either:*

(a) the PAL system switches OFF, and all aerodrome lighting, including the IWDI lights, is extinguished; or

(b) the PAL system has been reset for another ON period.

Select whether the Windsock Alert is on or off, the channel which will trigger the alert and the period of the alert.

Cellular Numbers

For future product development and for units fitted with Cellular Radios, cellular radio numbers can be stored in the Controller.

Mapping Logic

Clicks to Activate

Each of the channels can be activated by a programmable number of 'clicks' from the pilot's PTT switch on their VHF Radio . By default these are:

Channel 1 – 3 clicks

Channel 2 – 5 clicks, and

Channel 3 – 7 clicks

The number of clicks to activate each channel can be changed using the drop-down menus. The constraints on this are:

1) No two channel can have the same number of clicks assigned (SMS blocks this), and
2) 6 and 8 clicks are reserved for the cancel function

Input Switch to Channel Mapping

There are 3 wired inputs that can be connected to switches or relays (see appendix for sample wiring schematics). By default these are mapped as follows:

Input 1 – Channel 1
Input 2 – Channel 2
Input 3 – Channel 3

Inputs can be mapped to any channel without restriction. If an input is set to channel 0 then that input is ignored.

Clicks to Cancel Channels

It is possible to cancel all channels by selecting either 6 or 8 clicks from the drop- down menu.

This function is off by default (clicks = 0) and should only be used if the operator and pilots are all conversant with the setup.

7.15 Unit History and Status

Unit History & Status provides:

Unit History – Maxima and minima

Unit Status – Current status of: VHF Radio, Wired Interface (Inputs), Cellular Radio (if fitted), Weather Reports (if optional MetPak is fitted), and Controller activity.

UHF Radio Setup

Non-standard product to special order. Will normally report 'Not Fitted'

VHF Status

The VHF status command reads the VHF receiver parameters. The frequency, threshold, click period and space/mark ratio are all as set in the Program menu.

Also displayed is the Received Signal Strength. This is a very useful way, in conjunction with the refresh button, of understanding the performance of the radio and is a vital aid to setup, testing and subsequent validation.

Wired Interface Status

This menu shows the status of the Inputs (switch or relay circuits) and again is extremely useful during installation and testing as well as monitoring the satus of the inputs.

Press refresh to get the current status.

Cellular Radio Status

The basic network information for the Cellular Radio can be read (if fitted).

Do not use this command if no cellular radio is fitted.

Weather Report

If a MetPak is fitted to the Controller, basic weather information is available.

The MetPak reports the current parameters every second and these are buffered by the Controller.

The default units are those shown (right) and can be changed to using the radio buttons to the desired local units.

NB: The altitude of the weather station must be entered (and is stored in SMS) in order for the reported barometric pressure to be properly reported, corrected for the installation altitude of the MetPak.

Pressing Refresh re-reads the data from the MetPak/Controller.

Depending on customer demand, additional processing of the data may be possible to provide trending, max and min and gusting for example.

GPS Report

Not implemented in this version of SMS.

Solar Status

Not implemented in this version of SMS.

Controller Status

The Controller Status screen shows the current unit temperature and voltage and the status of the channels, windsock and beacon.

In the example to the right, Channel 2 is active with 13 minutes 21 seconds left to run on the timeout. Both the Windsock and Beacon are active.

Press Refresh to get an updated status.

Note that the Windsock shows the instantaneous status of the windsock relay. If Windsock Alert has been set, Windsock may show as active or inactive depending on exactly when the status was obtained.

7.16 Reset & Restore

Of the menu options, only the Reset Factory Defaults option is available to Managers but not to Users.
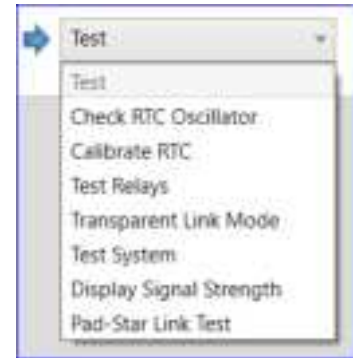

The program and/or channel settings along with all of the configuration and calibration data are re-loaded with the product default values. All user settings are lost.

7.17 Test

Of the menu options, Managers can access:

- Test Relays
- Enter Link Test Mode, and
- Display (Bluetooth) Signal Strength.

Check RTC Oscillator

Only available to OEM for testing and setting up.

Calibrate RTC

Only available to OEM for testing and setting up.

Test Relays

Both the Windsock and Beacon relays can be tested.

For technical reasons neither the Winsock nor Beacon relays have their coil currents measured.

To test, select the required relay and the on radio button and press Test. Quitting the menu turns the relays off.

Transparent Link Mode

OEM and FEC only. This mode is used during diagnostic sessions with Pad-Stars and enables the communication channel to be cleared for that activity.

When in Transparent Link Mode the Controller does not update the Pad-Stars every second as it would normally and although it will accept any input commands it will not action them.
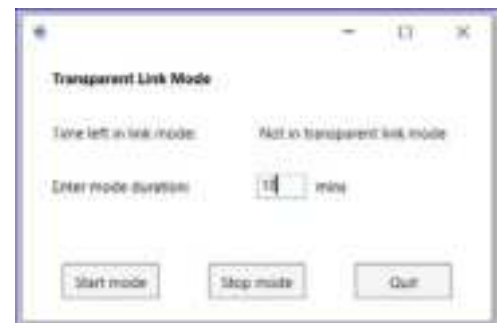
Test System

Not available to managers

Display Signal Strength

An assessment of the performance of the Bluetooth radio link can be made.

Note that this is the signal strength measured at the time of connection.

Pad-Star Link Test

Not implemented this version.

7.18 Control

It is possible to directly control the Controller channels and switch radio on and off.

Set Channel

Select the required channel to turn on or off and press update.
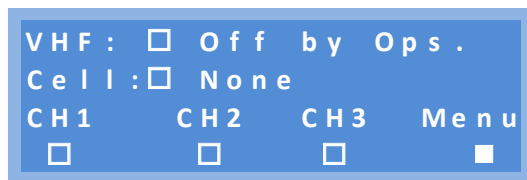

Set Radio

The VHF, Cellular and UHF (if fitted) radios can be switched on and off.

Strictly speaking they are logically not physically turned on and off.

This is too support operational needs to, for example, block false activations due to interference.

The LCD screen will display


```
VHF:  □  Off  by  Ops.
Cell:□  None
CH1      CH2     CH3     Menu
  □        □       □        ■
```

7.19 Dashboards

All previous commands are structured as a single command-response transaction with the option via a 'Refresh' button to repeat the command. Dashboards provide automated windows of commonly accessed data which is continuously polled and refreshed without further user action. There are two dashboard: Systems and Operational.

Systems Dashboard

The dashboard below has been accessed by a Manager and hence the Manager and User PINs are visible. Pressing any of the Change buttons closes the dashboard and takes the user directly to that area to affect the required changes.

Operational Dashboard

The dashboard below provides access to the operational (status) data.

In this example Input 1 is on (closed) and has activated Channel 1 which, because it is an Input, has no time-out. Both the Beacon and Windsock are active and because a weather station is fitted and the elevation entered, weather data is available.

In addition to the screen output, every time a channel changes state (e.g. non-active to active) the PC's bell is sounded to alert the operator to the change.

Operational Dashboard

Program

Time and date: 16:38:45 10/10/2020

[Change]

History

Battery volatge

Maximum:	23.7 V
Minimum:	3.3 V

Temperature

Maximum:	+34 C
Minimum:	+26 C
No. of activations:	0
Run time:	0 hr 0 mins

Status: Wired Interface

Input 1:	On
Input 2:	Off
Input 3:	Off
Input 4 (Aux):	Off

Controller Status

System voltage: 23.6 V

Temperature: +34 C

Channel	Timeout
1 - Active	00:00
2 - Not active	
3 - Not active	
Beacon:	Active
Windsock:	Active

Weather

Wind direction:	30 degrees
Wind speed:	12 kts
Pressure:	1022 hPa/mbar
Humidity:	55 %
Temperature:	+20 C
Dew point:	+15 C

[Change Units]

Weather data is not provided from an official source: you are advised to validate it against a national weather service

[Back]

8   Installation

Installation of the FEC Pad-Star Lighting Controller must be carried out by a suitably qualified electrician with full authority to undertake work in the safety critical environment of a helipad.

It is recommended that a formal Statement of Works, Standard Operating Procedure or similar is created and used for the initial installation and testing and all subsequent test and maintenance activities to ensure the safety of the installation and personnel.

8.1   Locating the Controller

The controller should be located in a secure location that is easy for operational staff to access the keypad and screen and appropriate for the antenna, mains and circuit wiring.

The enclosure is intended for wall mounting and, with suitable rails or adaptors, can be frame or pole mounted. Appendix 6 has a full-size template for the mounting holes.

Although the enclosure is IP65 rated, a sheltered location is recommended.

Keep in mind that the controller will need mains electricity supply and connection to the circuits to be controlled

8.2   Things you will need

Before starting the installation ensure that you have at least the following items in addition to those required for the rest of the installation:

1) A No.2 Philips (PH2) or No. 2 Pozidrive (PZ2) screwdriver to open the main enclosure.
2) Fixing screws and wall plugs as required.

8.3 Preparing for Installation – HP0719

Lay the controller on its back on a clean soft surface at least twice the width of the unit and undo the four corner retaining screws (they are 'captive' and do not need to be fully removed).

Gently lift the front of the enclosure away from the base and lay face down to the left of the base unit. Be careful not to strain the cables as this could cause permanent damage.

Disconnect the main power and controller ribbon cable.

8.4 Installing the Base Unit – HP0719

Either by measurement or using the template in Appendix 1, mark out and drill (and plug) the surface to which the controller is to be fixed.
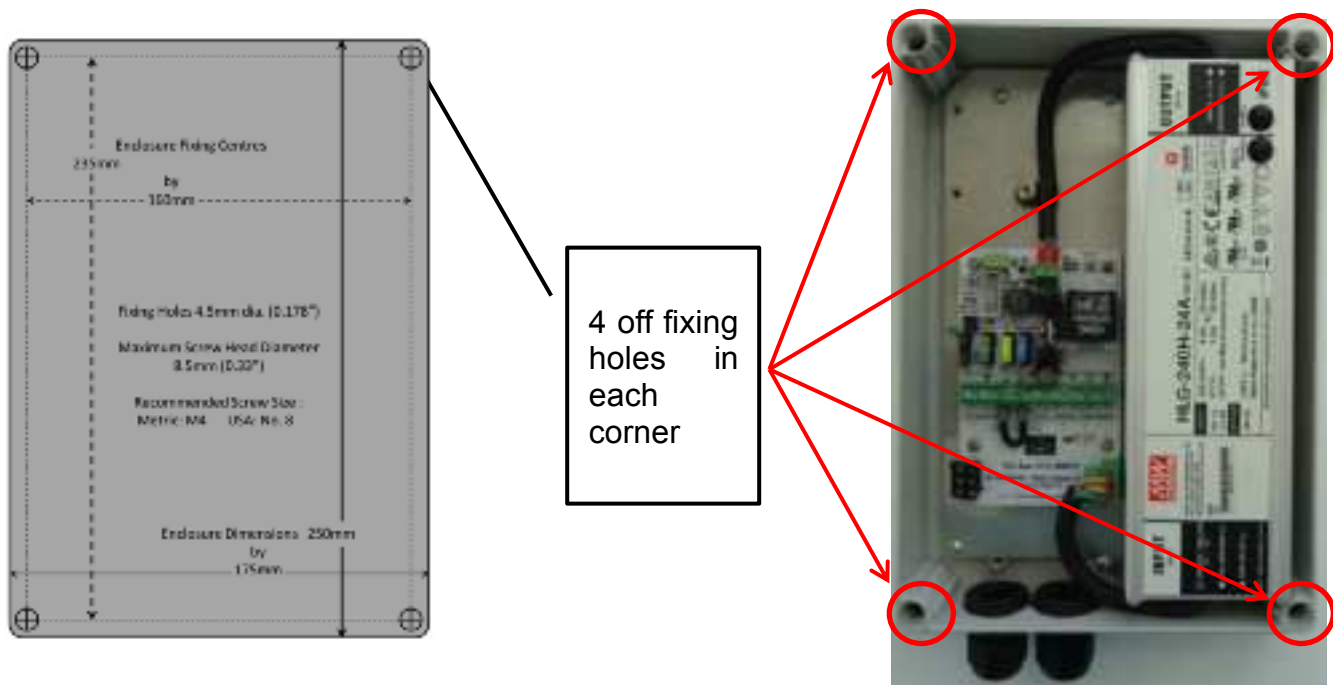
4 off fixing holes in each corner

If the fixing screws are not in a convenient position for the surface on which the controller is to be fixed then the use of rails, frames or battens is recommended.

DO NOT DRILL HOLES THROUGH THE ENCLOSURE BASE

The fixing screws are in the same position as the top cover screws. The maximum screw diameter is 4.5mm (0.178") and maximum head diameter 8.5mm (0.33"). Recommended screw sizes are Metric M4 or USA No. 8 of a suitable length and type for the surface.

Mount the base of the enclosure and ensure that the fixing screws are secure but do not over-tighten as this could damage the enclosure and compromise the IP65 rating.

Once the base is fitted, the unit can be wired up (later section). Take particular care not to damage the Power Supply Unit during the installation of cables.

As many installations will only require two cables to be fitted, one of the cable glands is fitted with a nylon plug to ensure integrity of the enclosure. To use this gland, simply remove the plug. If replacing, do not over-tighten as this may permanently damage the gasket.

8.5   Preparing for Installation – HP0719

With the controller upright on its base, push out the plugs fitted into the four corner fixing holes.

If water ingress to the cabinet or severe condensation is likely, also push out the drain plug situated at the front left of the base of the cabinet. An insect-proof plug should be fitted.

If required, the inner base plate can be removed complete with the controller and Power Supply Unit (PSU) to aid installation. To do this, use a socket spanner

8.6   Installing the Base Unit – HP0719

Based on the diagram in Appendix 3 mark out and drill (and plug) the surface to which the controller is to be fixed.
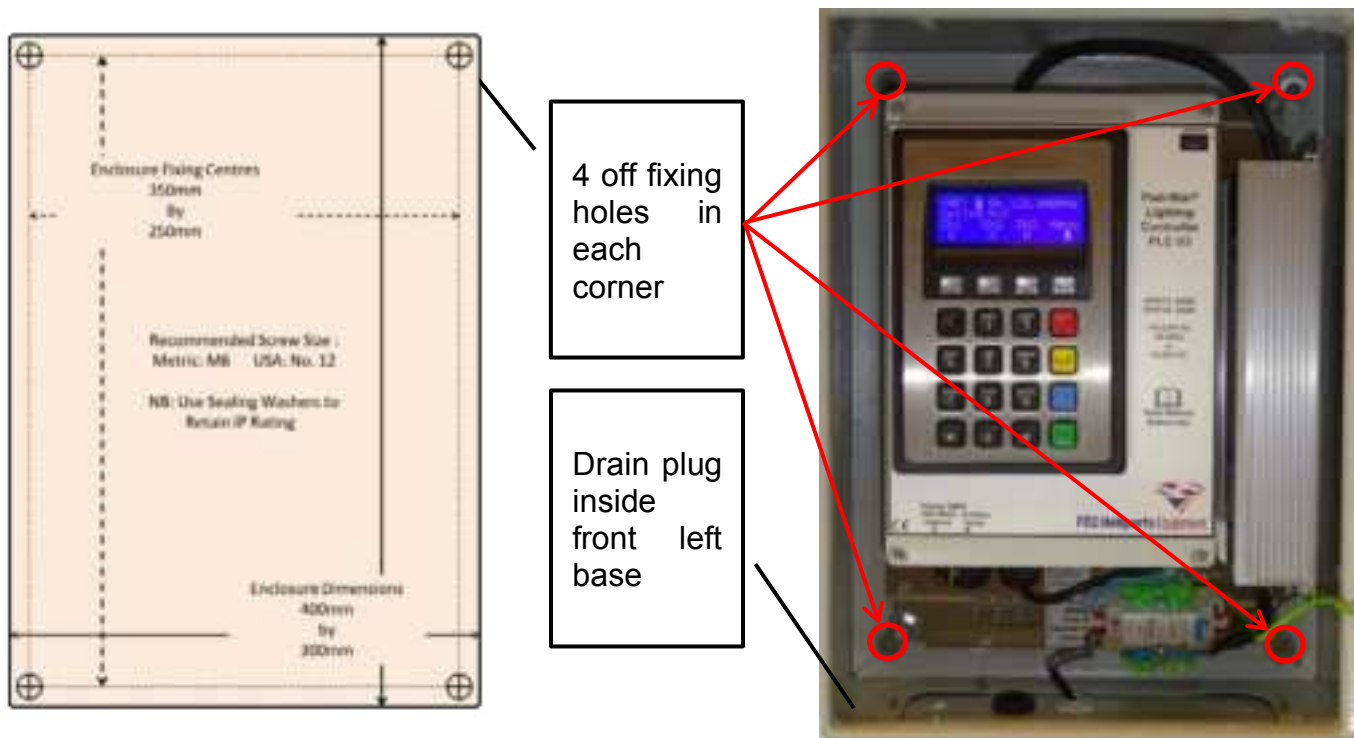
4 off fixing holes in each corner

Drain plug inside front left base

If the fixing screws are not in a convenient position for the surface on which the controller is to be fixed then the use of rails, frames or battens is recommended.

DO NOT DRILL ADDITIONAL HOLES IN THE ENCLOSURE BASE

Recommended screw sizes are Metric M6 or USA No. 12 of a suitable length and type for the surface.

To retain the IP rating of the enclosure, suitable waterproof washers (such as nylon or butyl rubber) must be used.

Mount the base of the enclosure and ensure that the fixing screws are secure but do not over-tighten as this could damage the enclosure and compromise the IP rating.

8.7   Mains Electrical Installation - HP0719

It is recommended that mains cables are fixed first to avoid damage to aerial or signal cables.

If the Controller is to be operated from a mains power supply it must be connected to the supply using a fused double pole isolator.

The controller has a maximum power consumption of 480watts and a 5 Amp fuse should be used.

A power cord is supplied with the unit appropriate to the territory it is shipped to.

8.8   Main Electrical Installation – HP0719

The arrangement of the mains connections in the base unit is shown below:

	Live connection fitted with 5A 20mm fuse
	Neutral connection
	Earth connection
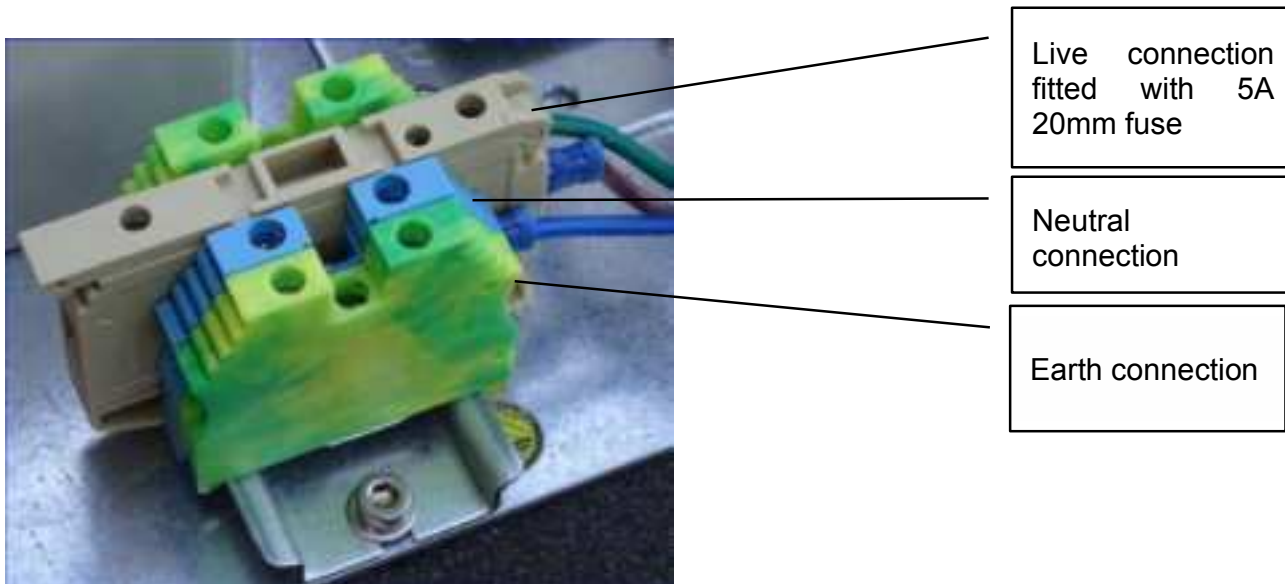
Notes:
1) Live (Brown), Neutral (Blue) and Earth (Green/Yellow) 4mm IMO DIN rail mounted connector strips are provided for customer wiring.
2) Additional connectors can be added by the customer but pay particular attention to:
   a. Such connectors are often open on one side. Care must be taken to ensure that the open side is always covered by its neighbour or end plate.
   b. The earth connector is fixed and grounded to the DIN rail by a central screw. To move this connector, slacken the central screw, move as required and re-tighten.
   c. The Earth connector provides the earth bonding connection to the controller.
   d. The connectors must be gently pushed tight against the PSU and Relay Interface Board to ensure that these items are prevented from sliding on the rail.

NB – Ensure that no live connections are exposed by the insertion of additional connectors.

8.9   Basic 24V DC Connections

Only FEC Pad-Star components can be connected to the DC output circuit to the Helipad as they are specifically designed to support the Power Line Communication (PLC) technology used to control the system.

Attaching other devices will stop the system working

Version 3.X PSU PCB

The DC input and Outputs to the unit is via a 9 way terminal strip. The connections are:

1	2	3	4	5	6	7	8	9
+	−	+	+	−	+	−	+	−
Windsock		Power Out	In	Com	Beacon		Pad-Stars	

All Controllers use the same base unit but only HP0717 has the mains interconnected via the PCB as per the photo (right).

Connect the pad feed cable positive wire to the terminal marked Pad-Stars + (8) and the pad feed cable negative wire to Pad-Stars – (9).

The Controller Base PCB requires a link to be fitted on the terminal strip if the unit is powered from the internal mains PSU: Power + Out (3) to PSU Power + In (4). The link is fitted as shipped.

To use an external power source, discard the link and feed external power to Power + In (4) and Power - Com (5).

An FEC Programmable Beacon is connected directly to the output terminals Beacon + (6) and Beacon – (7). The output voltage is same as the supply voltage: 24V DC from the internal PSU and 12V or 24V if from an external source. Maximum load is 150W.

The Windsock output can be either:
a) the same as the feed voltage
b) 12V if the feed voltage is 24V

The feed voltage is selected by inserting the 2A windsock fuse into fuse holder 1.

If the feed voltage is 24V and the windsock is 12V, fit the 2A windsock fuse in fuse holder 2 (as shown). Max windsock load is: 24V = 48W, 12V = 20W.

8.10 Basic Circuit Wiring

The wiring of the Pad-Star Lighting Controllers and Pad-Star Drivers is extremely simple because all of the control signals are carried over the power wiring.

The wiring should be sized to carry a maximum of at least 10A (@24V) for an HP0717 and at least 15A (@24V) for an HP0718. Consideration of voltage drops should also be made for long feeder cables.

The Basic wiring schematic is as below:
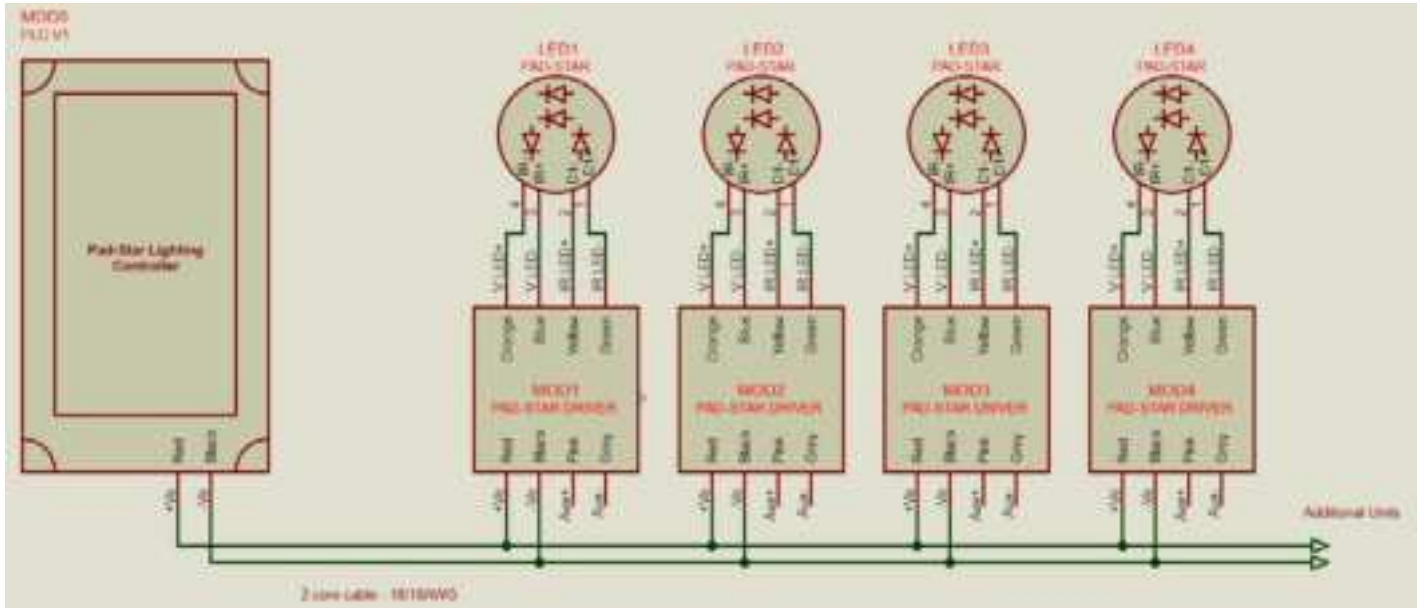
The circuit topology can be linear, branched or a loop (ring circuit) to suit the specific installation.

The recommended maximum number of Pad-Star drivers that can be connected to single 'bus' is 30. Please refer to FEC to discuss the installation, design and sizing.

Systems larger than this need to be divided up into a primary bus and a number of spur secondary busses. See next section on Transceivers

Auxiliary Circuit

If an auxiliary light is to be driven from one of the Pad-Star Drivers (must be a /A variant) it is connected as shown on the right.:
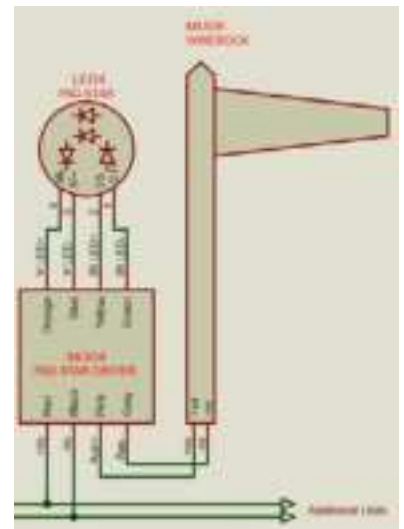
8.11 Pad-Star Transceivers

Where a large number of lights are to be connected it is important to split them across a number of 'Spur' secondary busses.

The Pad-Star Transceiver is designed to perform this function allowing up to ~ 20 Pad-Star Drivers to be connected per Spur secondary circuit.
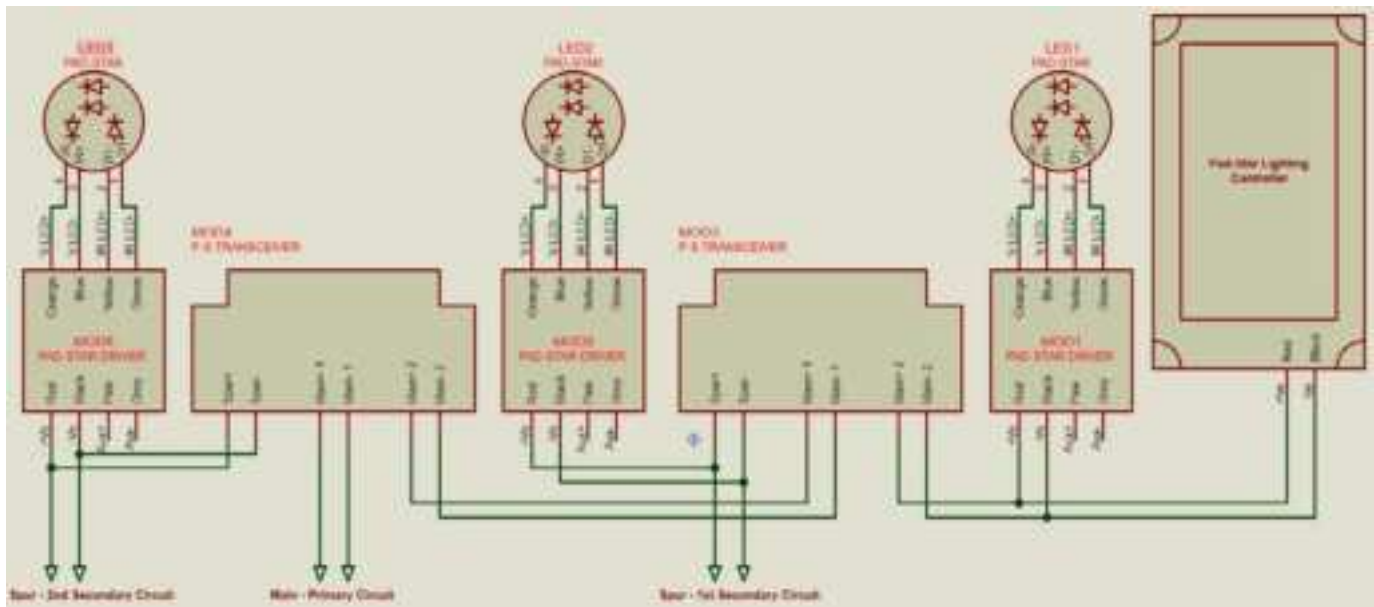
The general arrangement is as below:

.

9   Summary Specification

- Controller modes: 5: Start-up, Switches, Keypad, VHF, Wireless control from PC

- Degree of protection: IP65 (general)
- LCD and Keypad protection: IP65 and 'vandal resistant'
- Unit operating temperature: -25ºC to +50ºC
- System Storage temperature: -25ºC to +80ºC
- Compliance: ROHC Compliant except exempt items (radios)
- Operating voltage (AC source): 100-240V AC 50-60Hz
- Operating voltage (DC source): 12V – 24VDC
- Max voltage range (DC):   10V – 28V DC
- Electrical Protection (HP0713/4) 5A 20mm Fuse
- Max power consumption: DC/AC: 300 watts (including optional winter heater)
- Cable Entry (Mains):   2 off M20 Cable glands – 10mm max cable diameter
- Enclosure material: ABS
- Size: Height - 11" (280mm)

    Depth - 6.5" (165mm)

    Width - 7" (180mm)

- Package Dimensions: Length: 350mm, Width: 320mm Height: 240mm
- Weight: 3.0kg 6.6lbs
- Packed Weight: 4.0kg 8.8lbs (Incl. CD, leads & antenna)
- Warranty: 2 years return to FEC

10 Spare Parts

There are no user serviceable parts.

Items requiring repair need to be returned to FEC.

11 Factory Default Settings

The following are the Factory default settings:

Item	Default Setting	Comment
Start-up status	All Channels Off	Channel 1 or 2 or 3 On
LCD Backlight	Auto	Option = On
Backlight timeout period	1 minute	Cannot be changed
In-Menu timeout period	10 minutes	Cannot be changed
Heater Enable	Off	Option = Auto
User PIN	0000	
Manager PIN	1111	
Unit ID	Set to Unit Serial Number	Cannot be set by Operator
Aux Inputs (4)	On	Always active except in menu setup
VHF Frequency	122.800MHz	Any valid 8.33kHz channel
VHF Threshold	-75dBm	Range 0dBm -110dBm
'Click' period	100mS	Range 1 – 250mS
Channel Timers	3	1 per Channel
Timeout Period (all)	15 minutes	Range: 10 seconds – 60 minutes
Windsock Alert	Off	Option = On
Windsock Alert Period	10 minutes	Range: 1 – 60 minutes

12 Diagnostics and Fault Finding

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

Warning

If the controller is mains powered, the controller box will contain dangerous voltages.

A qualified electrician must perform all of the necessary safety checks on the unit prior to any other tests being carried out.

Basic Visual Checks – Ensure that:

- The unit is properly mounted, secure and appears physically undamaged
- There are no signs of overheating
- The wiring, switches and fuses that power the unit are all working as expected

Basic Operational Checks – Ensure that:

- The Controller Base Status LED is lit indicating power to the system.

13 Appendix 1 – Software Updater

The Controller can be updated with new software in situ.

To update the software requires a Windows PC and a USB cable with type 'A' plug one end and 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.

Software updates can be emailed to you as a self-extracting zip file.

Controller screens are shown next page.

To update the software (initiated through the Boot-loader Switch):

The following is the simplest way of initiating the uploading of new software.

1) Turn the unit off and disconnect from the normal power source
2) Open the enclosure as described in earlier sections (open carefully and disconnect aerial and connecting cable and earth wire)
3) Lay the controller front panel face down on a protective flat surface
4) Double click on the update file and a screen similar to that to the top-right will appear
5) Connect the USB cable to the PC
6) Hold down the Boot-loader switch at the same time as connecting to the USB port on the rear of the controller (image right) – this will power the controller from the PC
7) The screen on the PC should now advise that the system is connected and the Install button will changed from greyed-out to active.
8) Click Install and the software will be automatically uploaded to the controller checked
9) A screen (right) confirms the update in progress
10) When complete – 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
14) The controller will now be running the new software (Version and build date displayed on the LCD screen at start-up and via SMS)

Controller Software Update Screens

Below is the sequence of screens that the Controller will display as the new software is loaded indicating progress.

DO NOT interrupt the process once started. If the process needs to be repeated, start from beginning of the process.
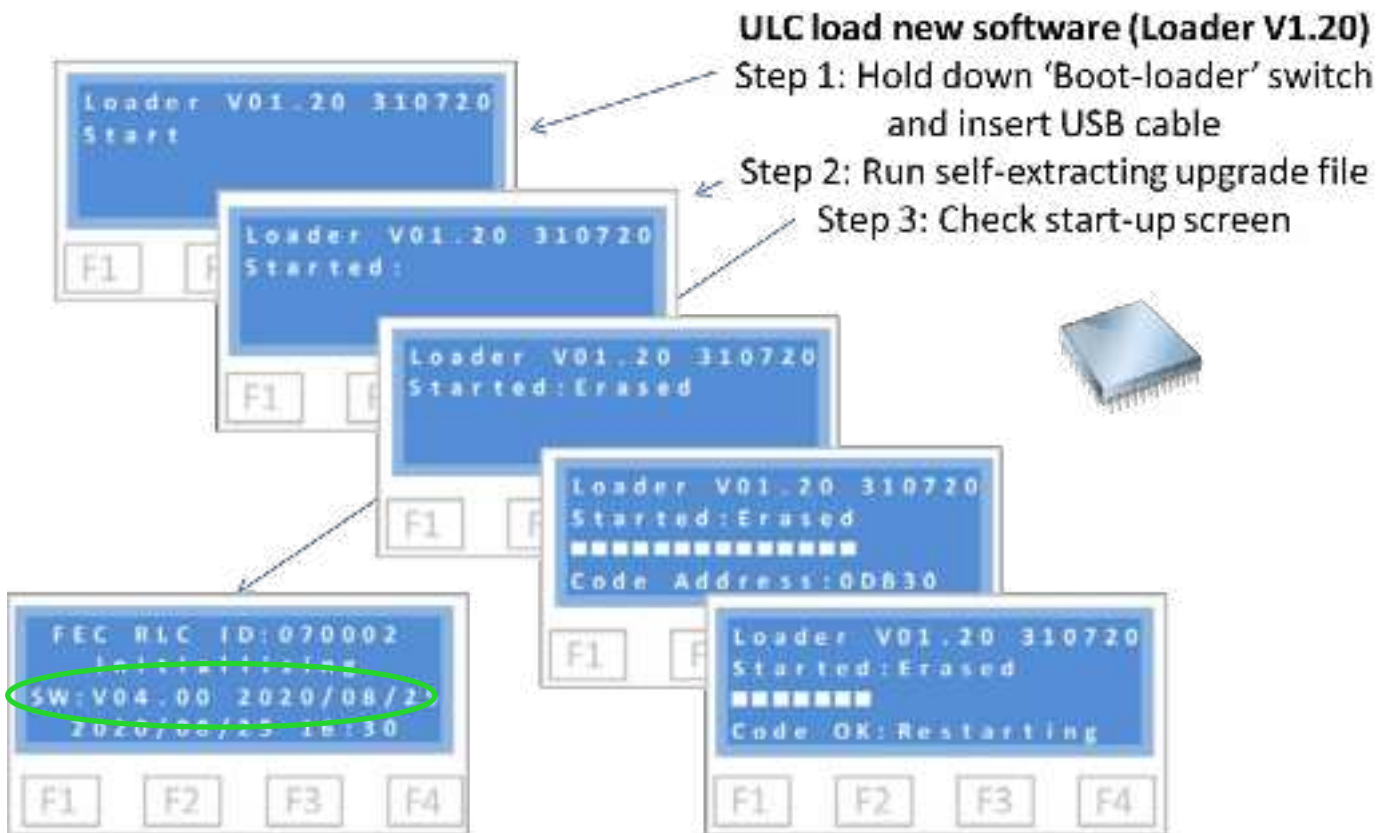
The first time that the Controller is started after a software update pay attention to the initialisation screens and con firm version of software is as expected. Repeat with the correct version if not.
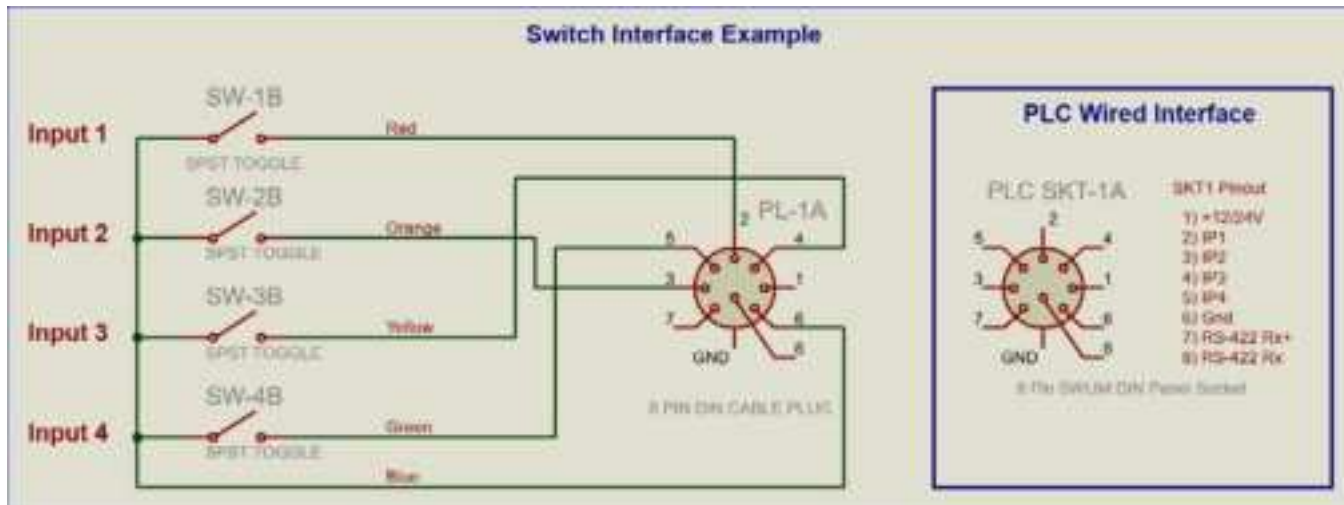
14 Appendix 2 – External Switch/Relay Wiring Schematic

Below are the schematics for connecting external switches or relays (or both) to the Controller. The circuits must be 'voltage free' (i.e. do not use solid state relays). Do not make any connections to pins 1, 7 and 8.

The plug is an 8 way IP rated, locking DIN type. Lumberg part number: 0332 08-1 (shown right).

14.1 Switch Inputs

14.2 FEC Controller Inputs

Auxiliary Inputs

Below are a few options for controlling the Aux Inputs:

1) Relay contact
a. An instrument relay can be used
b. Ensure that there are no high voltages >12V DC present

2) Transistor (Open Collector/Drain)
a. Either a junction transistor (NPN shown) or an FET can be used
b. Aux Input has internal pull-up
c. Device must be rated >12V

3) Simple Switch
a. Could be any good quality switch. Examples include: micro-switch, instrument switch.

MetPak Interface

Covered in the separate MetPak manual

14.3 Example Switch – Twilight Switch

The following is an example of the wiring for a standard, low voltage light level switch. The example shown (with cover removed) is a Danlers 'Twilight' switch which has been suitably modified to work with the RLC.

This switch should be mounted externally, protected from the weather and not pointing at any light source, particularly the lights it will control.

Connection to the RLC is via 4 core 0.75mm^2 (21AWG) instrument cable (Beldon CYSC04 or similar).

The wiring is connected as follows:

8 Way Male DIN Connector	Cable Core	Twilight Switch
Pin 1	Brown wire	12V
Pin 2	Grey wire	O/P (Output from switch)
Pin 6	Black and Green/Yellow wires	0V
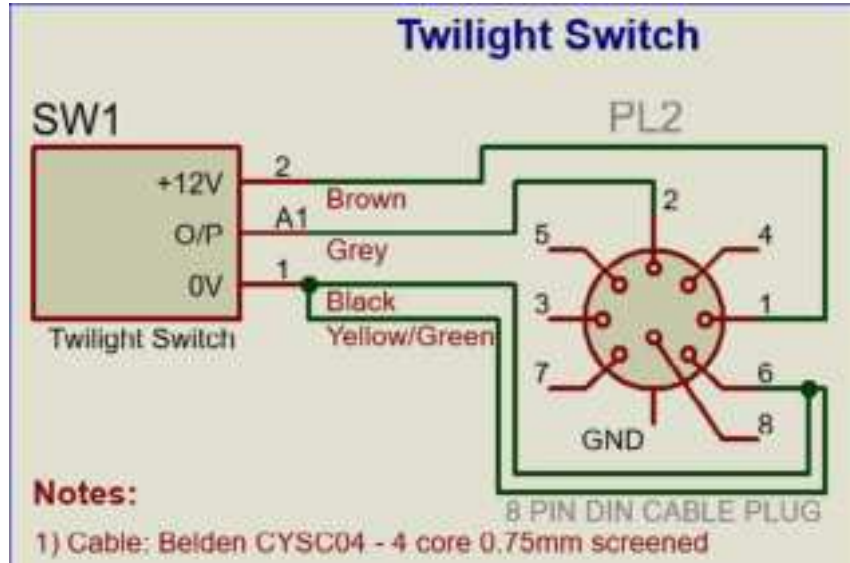
Control for adjusting light level at which switch will come on.

Use a small screw driver to make small adjustments, waiting for 10 seconds each time to confirm the change.

Once installed use the Aux input screens to confirm that the switch is closing.

Note that the switch has a time-delay of many seconds to avoid false triggers. Ensure you take this into account when testing the switch.

15 Appendix 3 – Antenna and Cables

15.1 Mains Cables, Switches and Fuses

No external mains cables, switches or fuses are supplied with the Controller. It is the responsibility of the owner/installer to ensure that the installation is carried out in such a manner as to ensure the safety of the installation and that it meets all of the relevant local regulations.

15.2 VHF Aerial

The Controller is not supplied with any of the VHF aerial components required.

Inventory

For installations with good signal strength a simple mag-mount whip antenna (example upper right: Aviator-2 WSM-225) maybe all that is required.

It is recommended that a higher gain antenna is used. A pole mounted air-band aerial (example lower right: Diamond D-777).

This should be specified and installed by an experienced aerial installer.

You are strongly recommended to fit a Static Surge Protector into the down-feed (example: SP-350V).

A typical installation would need:

1) 1 off aerial type e.g. D-777
2) 1 off aerial mounting bracket
3) 1 off Static Surge Protector e.g. type SP-350V
4) 1 off link cable (between aerial and SP-350V) fitted with PL-259 plugs each end
5) 50ohm down-cable (length/type to suit installation – see over)
6) 1 off PL-259 plug to connect to SP-350V, and
7) 50ohm BNC Plug to connect to Controller.

VHF Cable

For a long run you may want to use RG213 cable (this has an outside diameter of 10.3mm).

For a short run you may want to use RG58 cable (this has an outside diameter of 4.99mm).

At the controller end you will need to terminate in a BNC plug which are available for both of the above.

When installing cable it is not just the diameter of the trunking but two areas are critical and the contractor should be aware:

1) All cables are specified with a Minimum Bending Radius (MBR). Check the data sheet but this is usually a minimum of 10 times the diameter so for the RG213 above is 103mm (4")

2) Kinking or twisting of the cable must be avoided. If a cable is 'bent', even when straightened out again, the internal core will be permanently damaged and cause additional loss and unwanted signal reflections in the cable.

Customers are advised to make sure that:

1) Their contractor is experienced in installing and terminating such cables

2) The cable-ways, ducts, trunking etc. allow for easy bends that exceed the MBR and provide good support

3) The installation work is closely monitored

4) Their installer performs a TDR (Time Domain Reflectometry) test and presents this as part of his certification of installation (the TDR test will both demonstrate that the cable has not been damaged and provide you with a reference document for future audits or checks).

Installation

The diagram to the right gives a suggested general layout for an aerial installation.

Your installer will be able to advise on the details specific to your installation.
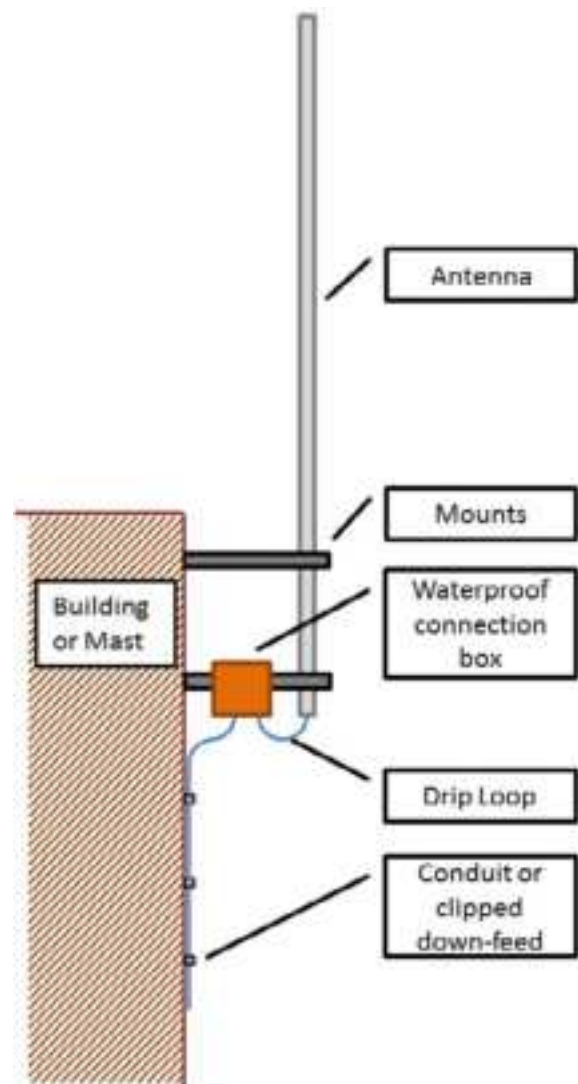
Multiple Antennas

Where a Controller is to be installed at a facility with other Airband VHF transmitting devices a separate aerial **must** be used for the Controller.

To avoid interference or damage to the Controller, the Controller and other device's aerials should be either:
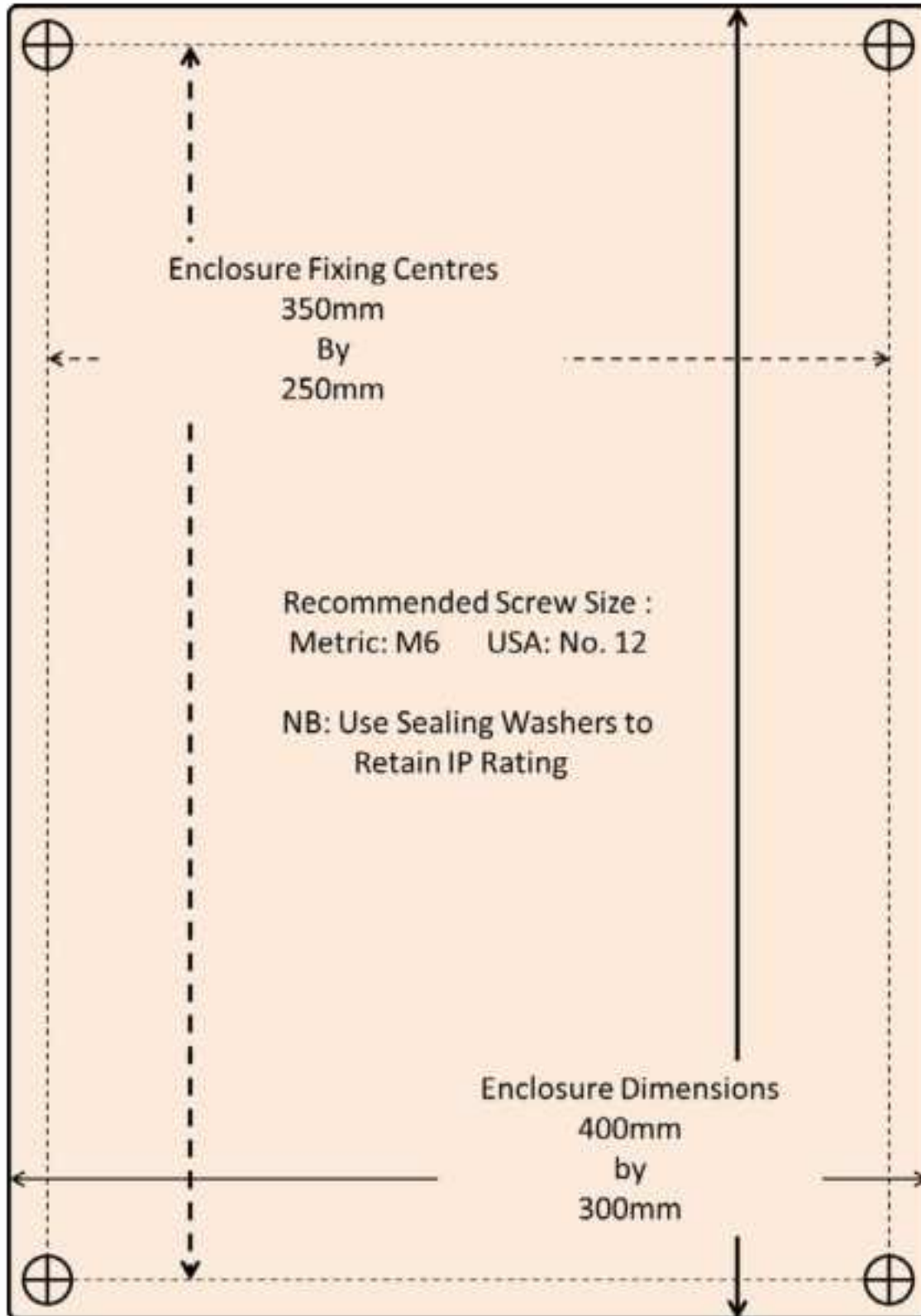
1) Located some distance apart horizontally (greater than 10 meters), or
2) If located on the same mast, aligned vertically one above the other with an ideal separation of at least 2 meters.

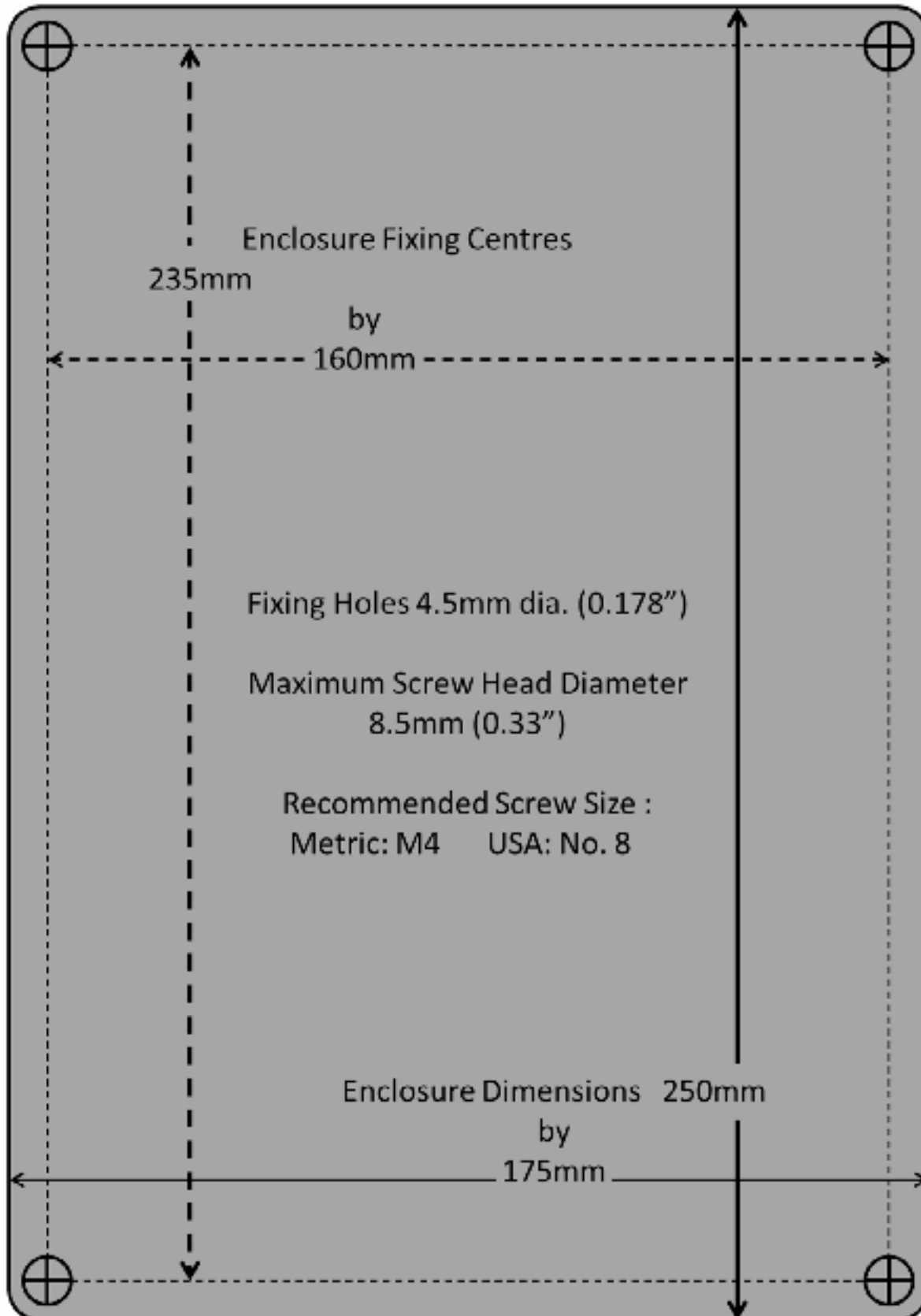The drawing below gives the general layout:
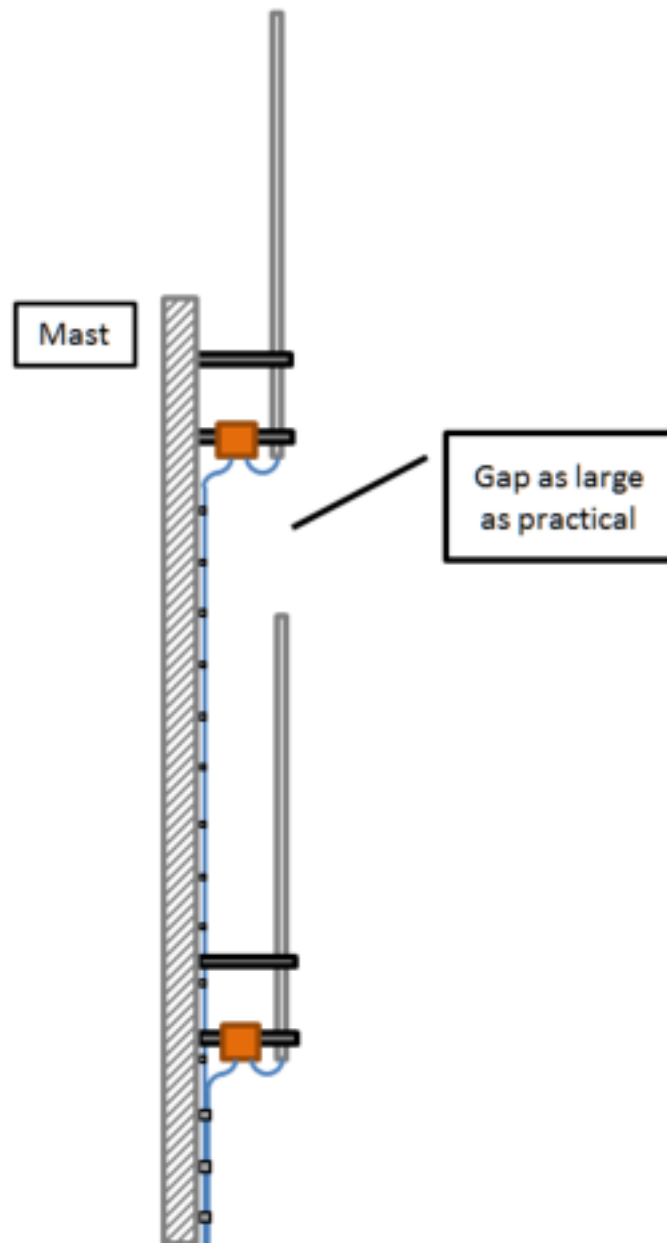
16 Appendix 4 – Mounting Details – HP0717

NB This diagram is not to scale and is not a template.

17 Appendix 4 – Mounting Template – HP0717

The template below is at a scale of 1:1 if this document is printed on A4 paper or US Letter and no scaling options are used e.g. do NOT use the printing option 'scale to fit'.

Enclosure Fixing Centres

235mm

by
160mm

Fixing Holes 4.5mm dia. (0.178")

Maximum Screw Head Diameter
8.5mm (0.33")

Recommended Screw Size :
Metric: M4   USA: No. 8

Enclosure Dimensions   250mm
by
175mm

End of Document