

# AUTOMATIC BACKUP “LOW VOLTAGE” LIGHTING SYSTEM

Software Version 1.2



## **DESCRIPTION**

The system described here is processor controlled and designed to provide low voltage battery operated lighting as a "power fail" backup to the usual light source within an area. It can assist an emergency lighting system but does not replace the need for regulation egress lighting as specified by building regulations. These regulations are quite specific regarding location, luminance, maintenance, testing and length of run time.

This system will supply low voltage power for backup lighting in a power fail situation and can light an area until the battery has no usable energy left or can be selected by an option switch to run only until the battery voltage falls to a level that will possibly harm the battery if it were to keep discharging.

To keep operation simple, only one button and one Light Emitting Diode (LED) are used for control of the system.

## **FEATURES**

Three separately fused lighting circuits give optimum protection in the event of damage to one or more cables.

Lights can be automatically switched by power failure or manually switched on at the controller or by an external trigger input such as push button or alarm system.

Easy to change switch selectable programming options for flexibility of use.

One single control for all functions.

Easy to connect to building low voltage lighting wiring via screw connector plugs.

No adjustments required.

Can easily be software upgraded for future enhancements.

Can be optioned to self test the battery every 30 or 90 days or just alert that a test is required.

Will alert if battery test fails.

Can be wired to an alarm system to trigger an emergency event in the controller which will switch the lights on and stay on until the battery has run totally flat unless cancelled at the controller.

An external beeper can be connected so that alerts can be heard in another area.

## **OPERATION**

There is no main power switch apart from the AC charger plug pack. This reduces the chance of accidentally leaving the system switched off. If it is necessary to disable the system, the AC charger plug pack should be switched off first; then within 10 seconds the battery should be unplugged from the rear of the controller. If longer than 10 seconds before unplugging the battery, the system will switch to POWER FAIL mode and unplugging the battery would be done under load which may cause sparking and burning of the connection contacts.

Normal system operation is indicated by the Green LED flashing regularly at one second intervals and no beeps are heard. This is MONITOR mode. **The following can be done after waiting an initial time of 5 minutes after startup to allow the battery to gain some charge.**

Press and Hold the button for 3 seconds when in MONITOR mode to put the system into TEST mode.

Press and Hold the button for 3 seconds when in TEST mode to put the system back into MONITOR mode.

Press and Hold the button in POWER FAIL mode (lights on) to put system back into MONITOR mode even if the power has still failed. The system will not switch back to POWER FAIL mode until the power has resumed for at least 20 seconds before another power failure occurs.

If a POWER FAIL mode has been cancelled, it can be restarted by pressing and holding the button for 3 seconds.

If the system is in TEST mode when the power fails, the system will automatically switch to POWER FAIL mode and cancel the TEST mode.

If POWER FAIL mode is triggered by an alarm system or push button, the system will switch directly to POWER FAIL mode and can only be switched back to MONITOR mode by pressing and holding the button for 3 seconds.

### **POWER FAIL mode**

If the AC mains power fails, the system will wait for 10 seconds before switching to POWER FAIL mode as it could be a short interruption to power only. When the power has failed for more than 10 seconds, the LED will flash RED and the backup lights will illuminate.

If the “Confirm” option has been selected by DIP Switch 2 - ON, the button must be pressed within 15 minutes of the power failing to confirm that the lighting is required. If not, the system will automatically return to MONITOR mode. When the button is pressed, the system will emit 2 short beeps to confirm the button press. The system will then stay in POWER FAIL mode until the power has resumed for at least 20 seconds or the battery has insufficient voltage to continue. If this option is not selected, the button does not need to be pressed and the system will stay in POWER FAIL mode until either the power resumes for at least 20 seconds or the button is pressed and held for 3 seconds to cancel the mode. If the “Run Till Flat” option is also selected by DIP Switch 1- ON, the system will remain in POWER FAIL mode until the battery is too flat to supply current to operate the lights. If this option is not selected, the system will switch back to MONITOR mode when the battery voltage falls below 11v thereby saving the battery from being damaged by being flattened completely. For a critical type installation, the “Run Till Flat” option should be selected to give maximum time as battery condition is not relevant. For this type of installation, the “Confirm” option should be disabled (DIP Switch 2 – OFF), so that POWER FAIL mode will remain invoked without pressing the button within the 15 minute timeout period. In domestic situations where the system might be used as backup lighting only, the “Confirm” option allows a 15 minute window of time to escape a situation or if no one is in attendance, will prevent the battery from being flattened if the power does not resume for a long time. This also assumes that the “Run Till Flat” option is also selected. However if not selected, even though the system will switch back to MONITOR mode when the battery voltage falls below a usable level, the battery life will be shortened due to the constant charge and discharge each time a power failure occurs.

If the POWER FAIL mode is cancelled by pressing the button, the system will not switch back to this mode automatically unless the power has resumed for at least 20 seconds before failing again. To switch the lights on during a power failure if the Confirm Timer has expired or if it has been cancelled by the button, press and hold the button for 3 seconds. If the “Confirm” option is selected, the button will need to be pressed to confirm the mode

before the Confirm Timer expires (15 minutes). If 5 beeps in quick succession are heard, the battery requires charging for at least 5 minutes before this mode can be invoked. If the “Run Till Flat” option is selected by DIP Switch 1- ON the system will switch the lights ON regardless of the battery condition, however there may not be sufficient charge in the battery to operate the lights.

When the system is in POWER FAIL mode with the lights ON, and the Beep ON option is selected (DIP Switch 5 – ON), a beep will be heard each 60 seconds to alert people of the system status.

When the power resumes, the system will remain in POWER FAIL mode for 20 seconds in case the power has not stabilised.

If a power failure occurs and 5 short beeps are heard plus the lights do not switch on, the system is indicating that the battery is considered flat either because the power has not been on long enough to charge the battery after a previous power fail which has caused the battery to fall below a usable level or possibly that the battery needs replacing. The battery will require at least 5 minutes of charging.

If a POWER FAIL mode has been cancelled and the power has not resumed for at least 20 seconds, the LED will continue to flash RED.

### **EMERGENCY mode**

This mode can be invoked by a separate trigger input which will override all other operations within the system and go directly to POWER FAIL mode. This EMERGENCY mode can only be cancelled by pressing and holding the button for at least 3 seconds. The trigger could be an alarm system or fire panel with output contacts which may be programmed to operate in the event of a fire alarm or similar event. It could also be a push button switch mounted within an area so that in the event of a lighting failure but not a general power failure, the lights can be switched on manually. In this mode, the lights will remain ON until the battery is totally flat or is cancelled at the controller.

EMERGENCY mode will be triggered even if the power is ON. The LED will flash RED whilst in this mode.

If a normal POWER FAIL mode has been previously cancelled by the button, this trigger will override that also.

If an Emergency mode is cancelled the system reverts to normal operation in MONITOR mode.

If the “Run Till Flat” option is not selected (DIP Switch 1- OFF), the EMERGENCY mode will cancel if the battery has insufficient energy to power the lights.

When the controller is in EMERGENCY mode, and the Beep ON option is selected (DIP Switch 5 – ON), a beep will be heard each 60 seconds to alert people of the system status.

If an EMERGENCY mode has been cancelled and the power has not resumed for at least 20 seconds, the LED will continue to flash RED.

### **TEST REMINDER ALERT**

If the “Test Alert” option is selected by DIP Switch 3 - ON, the controller will count the approximate number of days and alert users that a test is required. This alert is in the form of a series of 8 short beeps emitted by the controller every two minutes. The LED will flash BLUE also. The alert will only be emitted when in MONITOR mode. This alert will be cancelled as soon as TEST mode is invoked.

It is suggested that this option remain selected as it forces tests to be performed regularly which can highlight faults in the system.

Another option switch – DIP Switch 4 can select between 30 day alert periods or 90 day alert periods.

### **TEST mode**

TEST mode will allow the lights to be on for 15 minutes to allow the tester to check the lighting in all areas to ensure it is working correctly. This also tests the condition of the battery and its ability to maintain lighting for that amount of time. To switch to TEST mode when in MONITOR mode, press and hold the button for 3 seconds. A beep will be heard and the lights will switch on for 15 minutes after which the controller will revert to MONITOR mode. If more test time is required, the button can be pressed again as previously. If 5 beeps in quick succession are heard, the battery requires at least 5 minutes of charging before TEST mode can be invoked. Wait 5 minutes then try again. The system will continuously emit 3 beeps in quick succession during the last minute of the test.

The LED will blink GREEN while in TEST mode.

If during the TEST mode the battery voltage falls below a predetermined level, an alert will sound to show that the battery may not have sufficient charge to perform adequately or that the battery may be failing or the lighting load may be too great for the size of battery installed.

An erratic flashing of the LED accompanied by continuous beeping indicates that a flat battery has been sensed during TEST mode. This alert will continue until cancelled by a short button press. If the battery has been tested as flat, neither TEST mode nor POWER FAIL mode can be invoked unless the power has resumed for at least 5 minutes to sufficiently charge the battery for use. If the power has resumed for at least 5 minutes, the battery is no longer considered to be flat but will not be fully charged. Unpredictable results may be obtained at this time. A totally flattened battery may take up to 24 hours to be considered fully charged. Depending on the load (number and type of lights) being powered by the system will dictate the amount of discharge that may have occurred during last use. If after a full charge, the TEST mode fails the battery test, the battery may need replacing or the load may be too great for the battery capacity. If the controller has been in POWER FAIL mode, the TEST reminder alert and AUTOTEST timer will be extended by an additional 24 hours.

### **AUTO TEST mode**

If AUTO TEST mode has been selected by DIP Switch 3 – OFF, the system will self test either every 30 or 90 days depending on DIP Switch 4. (30 or 90 days) This will automatically test the battery by switching into TEST mode for 15 minutes. However even though the battery can be tested, the lights cannot be, therefore a visual inspection should be initiated on a regular basis as well.

The LED will blink flash GREEN while in AUTOTEST mode. If the controller has been in POWER FAIL mode, the AUTOTEST function reminder timer will be extended by an additional 24 hours. During the last one minute of TEST mode, the beeper will sound triple beeps.

### **BATTERY REPLACEMENT**

Battery replacement should be done by a qualified tradesperson, as correct installation of the connection terminals is critical if proper operation of this potentially lifesaving system is expected. Switch off the plug pack charger first. Then with 10 seconds, unplug the battery from the rear of the controller. If longer than 10 seconds before unplugging the battery, the system will switch to POWER FAIL mode and unplugging the battery would be done under load which may cause sparking and burning of the connection contacts. Correct selection of the replacement battery is critical to allow the system to function correctly. Only 12 Volt batteries can be used.

The plug pack charger should be OFF at this stage. When a new battery is installed, a controller reset is required before normal timer operation is realised. To do this, press and hold the button at the same time as connecting battery power. Continue to hold the button for 5 seconds. A beep will be heard when the controller has reset. Release the button and wait at least 5 seconds when the controller will switch to POWER FAIL mode if the battery has sufficient charge. Now switch on the plug pack charger. The controller will revert to MONITOR mode after 20 seconds.

Note that the system is designed for the plug pack charger which has been supplied. Other chargers may not be compatible with this system and may cause damage to the controller or the battery or both.

## **INSTALLATION**

### **CONSIDERATIONS**

Installation in an area where critical lighting is the main aim requires a suitably qualified tradesperson to install and maintain this system to ensure it is reliable. Homeowners should only attempt installation if they fully understand the operation and wiring used, so that maximum benefit can be realised in the event of a power failure.

The controller should be mounted where it will not be interfered with, but where the beeper can be heard during normal people movement. A power point is required for the charging plug pack and sufficient space is required for the battery. The type of battery for this purpose is designed for inside use. Installation of the low voltage lighting does not require an electrician but best wiring practices should be followed to ensure reliability and prevent future damage to the cables.

Although the voltages used by this system are low (12v) the current can be quite high (tens of Amps). Therefore a danger exists if batteries or cables connected to them are short circuited. Wiring can overheat and cause a fire or can cause serious burns to the installer or user.

If the coverage area is large, it is probably better to use multiple systems rather than overload one system.

### **LIGHTING**

LED down lights are amongst the best solution for this type of light as are 12 volt fluorescent lights. LED lighting technology is getting better daily and 12v LED down lights are commonly available. Lights utilising halogen globes should be avoided due to the higher current required to provide adequate lighting.

When considering where to mount the lights, if possible one of the lights should illuminate the location where the controller has been installed so that it can be controlled if required.

A Manual Trigger button, if installed, can be mounted anywhere within easy reach when needed. It should be suitably signed.

### **WIRING**

Three individual lighting circuits are used to give greater protection in the event that one or more of the cables is damaged. Three separately switched circuits also allows for a smaller load to be switched by each circuit. Each coverage area should have a separate cable from each of the supply circuits to ensure the best protection from the system. An example wiring diagram is shown at the end of this manual. This however requires additional cabling which therefore will add expense to the installation. If such a high level of protection is not required, a cable for each circuit can be installed to a separate coverage area. The lighting load should be distributed over the three circuits as the system components are designed to safely switch a maximum of 5 Amps each. (Approximately 60 watts of lighting at 12 Volts)

Do not attempt to connect to existing down lights as special circuits are required to allow both systems to be co connected. This should only be done by a suitably qualified person, if at all, and can only be done in conjunction with 12 Volt lighting such as down lights. (CAUTION: SOME DOWNLIGHTS LOOK LIKE LOW VOLTAGE TYPES BUT ARE ACTUALLY 240v OPERATED)

Testing of co-connected lights cannot be done if the lights are powered by the mains (unless they can be switched off) so special consideration must be given if this method is chosen.

The size and type of cable to use for the lighting will be determined by the lighting load to be operated. In most cases twin core cable (RED / RED BLACK designated 24/0.20) as sold by electronics stores is suitable however once again a qualified installer will calculate the correct size cable to use. Never use 240v power cable of any type or size or figure 8 cable as used in public address systems. These cables are designed for other uses and may overheat causing a fire or damage to the system.

The size and type of cable used to connect between the battery and the controller will be determined by the amount of current to be supplied in POWER FAIL mode. The total load should be calculated and a suitable cable used for the connection. If supplying the maximum amount of lighting that is specified for this system, cable type (RED / RED BLACK designated 32/0.20) capable of handling 20 Amps at 12 Volts should be used.

## **CONNECTIONS**

Screw terminated plug in type connectors are provided for easy termination of cables. Observe the polarity of all wiring as damage can result from incorrect terminations. The connectors are designated as follows:

**Battery Input:** Terminate the cable from the battery. RED is positive and BLACK is negative.

**Charger Input:** Terminate the cable from the battery charger. This is polarity conscious.

**Lights 1:** Terminate the cable from lights on circuit 1. This connection is polarity conscious for LED type lights.

**Lights 2:** Terminate the cable from lights on circuit 2. This connection is polarity conscious for LED type lights.

**Lights 3:** Terminate the cable from lights on circuit 3. This connection is polarity conscious for LED type lights.

**Alarm Trigger Input:** A wired connection from an alarm system, press button or fire panel providing a brief short circuit to this input will trigger the "Emergency" mode. The lights will switch On and will stay ON until cancelled at the controller or the battery goes totally flat. This option could be configured to operate in the event of a fire or similar. Switch selectable options are ignored in this mode.

**External Beeper Output:** A 5v Piezo beeper can be connected to this output to provide alerts remote to the controller. These beepers are low volume and are polarity conscious. This output is protected by a current limiting series resistor.



**Emergency Trigger Input:** This is an input to the controller which will force it into POWER FAIL mode when a momentary short circuit is placed across the terminals marked Trig A and B. This could be a trigger from an alarm system with fire / smoke sensors. When triggered, the controller will switch to POWER FAIL mode as per when the power fails. The controller will stay in POWER FAIL mode even if mains power is on. The controller can only be reset by pressing and holding the button for 3 seconds. The “Confirm” option is bypassed when triggered by this method.

### **SWITCHING the System ON or OFF**

To switch the system ON, first connect the plug pack charger BUT LEAVE IT SWITCHED OFF AT THE WALL OUTLET. Connect the battery. When the green light begins to flash and within 10 seconds, switch ON the wall outlet for the plug pack charger. If the wall outlet is switched ON after 10 seconds, the controller will switch to POWER FAIL mode.

To switch the system OFF, switch OFF the wall outlet for the plug pack charger and within 10 seconds, disconnect the battery.

### **BATTERY size and type**

The type of battery for this type of system is the 12 Volt - Sealed Lead Acid (SLA) type which is commonly available in a variety of sizes. The size will be determined by the lighting load that will be required to operate under power fail conditions and the amount of time the lights will be expected to give adequate lighting. Too big a battery will not be able to be charged by the compact plug pack charger.

Too small a battery will not be able to supply the current to operate the lights for a long enough time when the power fails. The lighting load should be calculated by a qualified installer and a suitable battery chosen for the length of time this load will be supplied.

Therefore the formula below is a fair indication of the size of battery that should be chosen. Note that due to battery design and efficiency, the amount of time that a battery can supply a larger load is reduced as the load is increased.

Current Required (Amps or Amperes) = Load Wattage / 12

Battery Size Required (in Ampere Hours or AH) = Current Required (from above) X Time to Run (in hours)

For example if 3 globes consuming 20watts each were to run for 2 hours would need:

$3 \times 20 / 12 = 5 \text{ Amps} \times 2 \text{ hours} = 10 \text{ AH (12 Volt) battery.}$

Another Example - Halogen down lights are 50watts each, so to run 6 of them for 1 hour would require:

$6 \times 50 / 12 = 25 \text{ Amps} \times 1 \text{ hour} = 25 \text{ AH (12 Volt) battery.}$

## **BATTERY Charger**

The Plug Pack charger supplied with the system is suitable for this system and **MUST NOT** be replaced with a higher rated unit to charge bigger batteries. If more lighting is required, additional systems should be installed and will give better overall protection should one system fail. If a battery is totally discharged, the plug pack may not charge it. This may be because the battery is no longer serviceable.

If you experience software problems with this unit, please send an email to:

[office@hubbatech.com.au](mailto:office@hubbatech.com.au)

describing the problem with as much detail as possible.

**OPTIONS:**

Underneath the control unit are 6 switches in a recessed compartment. The function of these switches is as per the following table:

<b>SWITCH</b>	<b>IF SWITCH IS "ON"</b>	<b>IF SWITCH IS "OFF"</b>
1	Run Till Flat option = ON	Run Till Flat option = OFF
2	Confirm Power Fail option = ON	Confirm Power Fail option = OFF
3	Test Alert option = ON	Auto Test at DIP Switch 4 interval
4	Test or Alert each 90 Days	Test or Alert each 30 Days
5	Power Fail Beep = ON	Power Fail Beep = OFF
6	No Function	No Function

These switches may be changed while the system is operating. Switch 6 is presently unused.

**MAINTENANCE:**

Fuses:

There are 4 fuses protecting the controller. Fuse 1 protects the circuitry that performs the decision making.

Fuse 2 protects Lighting Circuit 1

Fuse 3 protects Lighting Circuit 2

Fuse 4 protects Lighting Circuit 3

Fuses 2 , 3 and 4 each have an LED beside the fuse which will light if that fuse is blown. Replace the fuses with the same type only from the specifications list.

If a buzzing noise is heard from the plug pack charger, this may indicate that the battery is either not connected or is too flat to charge. The battery may no longer be serviceable for use in this system or may require precharging from another source prior to connecting to this system.

**SPECIFICATIONS:**

Load capacity per output circuit: 5 Amps

Load Lighting Voltage: 12 Volts nominal

Maximum suggested Battery capacity: 20 AH

Load Lighting Time: depends on load and Battery capacity.

Fuse 1 = 100 mAmp (M205 type)

Fuse 2 ,3 and 4 = 5 Amp (M205 type)