Battery & Link Monitor

General layout

Failsafe Output (pins)
(C)

Setup Button
(E)

Input Signal Lead
(B)

4x Battery Charge Status LEDs
(D)

Power Lead
(A)

100%   75%   50%   25%
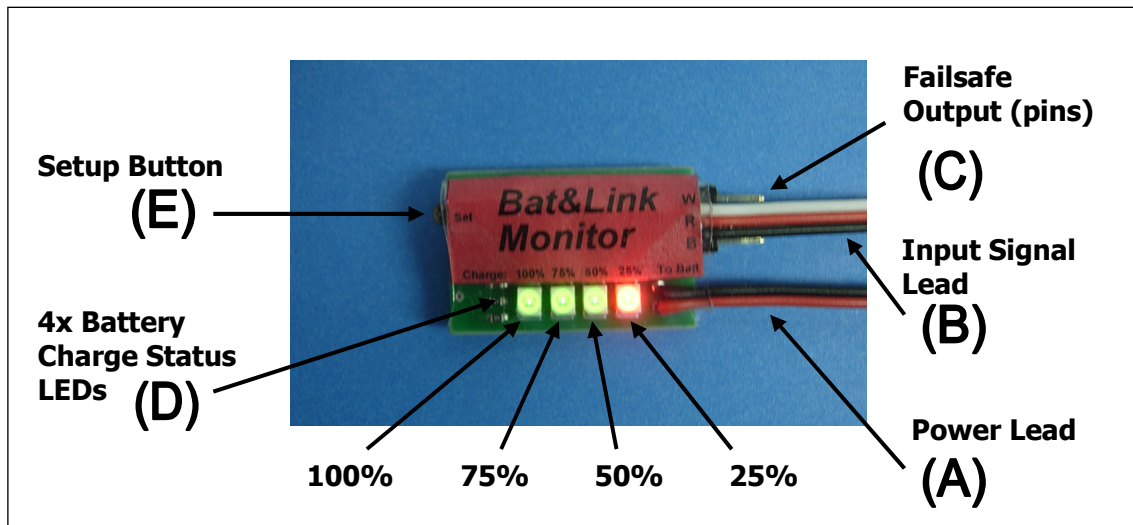
Quick Setup Guide

1. Connect the **Power Lead (A)** to your power bus (battery connection), red to positive, black to negative.
2. Plug the **Input Signal Lead (B)** into the ballast channel of your receiver.
3. Plug the ballast control servo (or other) lead into the **Failsafe Output (C)** receptacle taking note of the correct polarity.
4. Observe the charge state of the battery on the four **Battery Charge Status LEDs (D)**.
5. Use the **Setup Button (E)** to enter setup mode and configure the three failsafe positions, failsafe durations, and battery type.

Features

- Intuitive four LED "gas gauge" gives an instant indication of charge level.
- Helps protect batteries from damage due to over-discharge by triggering the failsafe sequence when Low battery condition is detected.
- Link monitor keeps a running count of "lost signal events" to advise you of the quality of your radio link.
- Features 3-stage failsafe program with fully user configurable failsafe positions and durations.
- Compatible with receivers with built-in failsafe.
- Configurable to help protect 2S/3S LiPos, 6V/12V lead-acid, or 5/6/7/8 cell NiCd/NiMh battery packs.
- Failsafe Output is powered from the battery bus instead of receiver power to guard against ESC/BEC failure.

Device Description

The BLM is a multi-purpose device which combines a battery "charge state" indicator with an advanced radio link monitor and missing pulse/commanded failsafe. The link monitor keeps a constant watch on the signal coming in from your receiver and will command a connected device through a 3-stage pre-programmed failsafe sequence if the input signal is lost. The duration of stages 1 and 2, as well as the commanded position for each of the 3 stages of the failsafe program are configured in the setup routine. The BLM can also be used with receivers which already have a built-in failsafe: By setting the receiver's built-in failsafe to command a position that is outside of the normal use range the BLM can be configured to recognize this "not normal" command as a lost-signal event and behave as if the signal were missing. The total number of lost signal events for each run are logged and displayed using a blink-pattern on the LEDs.

The BLM also continuously checks and reports on the condition of your battery. It can be configured to monitor 2S or 3S LiPo, 5-cell through 8 cell NiCd/NiMh, as well as 6V and 12V Pb chemistries. When the battery voltage falls below the minimum safe value the BLM will automatically initiate the programmed failsafe sequence. (The "minimum safe voltage" is preset to 3.3V per cell for LiPo, 1.05V per cell for NiCd/NiMh, 6V/12V for Pb.)

LED Display

The display consists of four LEDs: The leftmost LED (identified within this manual as the "100% LED") is green. The second from leftmost LED (identified within this manual as the "75% LED") is green. The second from rightmost LED (identified within this manual as the "50% LED") is green. The rightmost LED (identified within this manual as the "25% LED") is red.

During normal operation the LEDs on the BLM display the battery charge state:
- All four LEDs illuminate when the charge state is between 100% and 76%.
- The 75% LED, 50% LED and 25% LED illuminate when the charge state is between 75% and 51%.
- The 50% LED and 25% LED illuminate when the charge state is between 50% and 26%.
- Only the 25% LED illuminates when the charge state is between 25% and 1% of charge.
- When the battery is depleted the 100% LED and 50% LED will illuminate. (This condition is easily identified because it's the only "non-sequential" light pattern to be displayed.)

If lost signal events have been logged the display will alternate between displaying the charge state and the number of lost signal events. Lost signal events are displayed using blink-codes:
- The 100% LED will flash to show the number of hundreds of lost frames.
- The 75% LED will flash to show the number of tens of lost frames.
- The 50% LED will flash to show the number of ones of lost frames.

(12 lost frames would be shown with 1-blink of the 50% LED followed by 2 blinks on the 25% LED.)

BLM Setup

Setup mode allows the BLM to learn the desired Failsafe Output positions and durations to command should signal loss occur, as well as what battery type is being used. To enter setup mode turn on your transmitter, press and hold the setup button on the BLM, then apply power to your battery bus. All four of the status LEDs will illuminate to indicate that you've entered Setup mode. (You may now release the Setup button.) When you release the Setup button the illuminated LED will sweep from side to side, then stop with only the 25% LED on. You are now at the first-level setup menu level. From here you may now choose which sub-function you wish to setup by moving the transmitter stick that's driving the failsafe channel and observing the illuminated LED pattern, then pressing the setup button to make your selection:

25% LED	Exit setup
100% LED	Set failsafe command for receivers with built-in failsafe
75% LED	Set failsafe position for stage 1, 2, and 3
100% LED + 75% LED	Set failsafe duration for stage 1 and 2
50% LED	Set battery type and cell count

Exit Setup Mode
Selecting this option will terminate the setup routine and return the BLM to normal operation.

Forced Failsafe Setup
The BLM can be configured to operate correctly with receivers which output no signal during a lost signal event (missing pulse) as well as those which generate an output (failsafe) during signal loss. Generally speaking, simple PPM receivers do not have a built-in failsafe feature where advanced PPM and PCM receivers will. Some receivers which do support a built in failsafe have a setting that will allow you to turn the failsafe off, where others will only allow you to set it to HOLD the last known good setting. When using the BLM it is preferred to have a receiver that does not have an internal failsafe, or have the internal failsafe switched off. BLM can be made to work with the receivers internal failsafe ON, but it must not be used with a receiver that HOLDs the last known good position.

If you will be using the BLM with a failsafe receiver it is essential that you set up the receiver's failsafe position to be outside the "normal use" range. (It is recommended that you set the position to be full-blow on the stick with full trim in the same direction and the ATV set to the maximum setting the transmitter will allow.) When the BLM sees this position command it will understand that a failsafe event has occurred and begin executing the "failsafe routine", so it's important that the programmed "failsafe" position in your receiver is not one that you would accidentally command from your transmitter during normal running. (It will also substitute the servo command for one that you will programme so it's OK if the receiver's failsafe command tries to drive the servo beyond what the linkages will allow as it will never see this command.)

From the first-level setup menu press and hold the setup button while the "Forced Failsafe setup" (100% LED) option is displayed to configure the BLM for use with receivers with a built-in failsafe.

1. The forced failsafe selection menu is confirmed by the 100% LED being illuminated solid and 25% LED blinking. The 25% LED will show a single-blink pattern to configure the BLM for use with for a non-failsafe receiver (missing pulse), or a two-blink pattern for use with a receiver with a built-in failsafe. To change the selection between "missing pulse" and "built-in failsafe" hold the transmitter stick at the extreme end of travel - When the blink pattern completes if the transmitter stick is at the end of travel the blink count will be increased by one on the next pattern. When the 25% LED is showing the desired blink pattern press and hold the setup button until the LED stops blinking. You may now release the setup button – this will save your selection and return you to the main setup menu if your selection was "missing pulse", otherwise you will proceed to step 2 for "built-in failsafe".

2. You will only enter this step if you have selected the "Use receiver **with built-in failsafe**" option. This second step will tell the BLM what command position the receiver will generate when a loss of signal event occurs. (Note: The receiver's failsafe position must be set before you begin this step, and should be set to a position beyond the blow position if possible so that a normal command is not interpreted by the BLM as a failsafe event.) The forced failsafe position menu is confirmed by the 100% LED and the 75% LED being illuminated solid. (The 25% LED will also be blinking.) Once you have entered this step turn your transmitter OFF, wait a few seconds until the receiver switches to it's failsafe command, then press and hold the setup button until the 25% LED stops blinking. You may now release the setup button – this will save the forced failsafe command setting and move you back to the main setup menu. (Turn your transmitter back on again so you can finish setting up the remaining configuration options.)

Failsafe Position Setup

This setup section will define the positions that the BLM will command during the first, second and third stages of failsafe.

From the first-level setup menu press and hold the setup button while the "Failsafe Position setup" (75% LED) option is displayed:

1. The 1st failsafe position menu is confirmed by 100% LED being illuminated solid. (The 25% LED will also be blinking.) With your transmitter commanding the desired 1st failsafe position (typically neutral) press and hold the setup button until the red LED stops blinking. You may now release the setup button – this will save the first failsafe command setting and move to the second failsafe position setup.

2. The 2nd failsafe position menu is confirmed by 100% LED and 75% LED being illuminated solid. (The 25% LED will also be blinking.) With your transmitter commanding the desired 2nd failsafe position (typically blow ballast) press and hold the setup button until the red LED stops blinking. You may now release the setup button – this will save the second failsafe command setting and move to the third failsafe position setup.

3. The 3rd failsafe position menu is confirmed by 100% LED, 75% LED and 50% LED being illuminated solid. (The 25% LED will also be blinking.) With your transmitter commanding the desired 3rd failsafe position (typically blow ballast or neutral) press and hold the setup button until the red LED stops blinking. You may now release the setup button – this will save the third failsafe command setting and move you back to the main setup menu.

Failsafe Duration Setup

This submenu allows you to configure the length of time that Failsafe Position 1 and Failsafe Position 2 will be held for before moving to the next step in the failsafe sequence.

From the first-level setup menu press and hold the setup button while the "Failsafe Duration setup" (100% LED + 75% LED) option is displayed:

1. The 1st failsafe duration menu is confirmed by 100% LED being illuminated solid. The 25% LED will also be blinking to indicate the number of seconds the first failsafe position will be held for. (One second of delay for every blink.) To increase the count hold the transmitter stick at the extreme end of travel – When the blink pattern completes if the transmitter stick is at the end of travel the blink count will be increased by one on the next pattern. When the 25% LED is blinking the desired number of seconds press and hold the setup button until the LED stops blinking. You may now release the setup button – this will save the first failsafe command setting and move to the second failsafe position setup.

2. The 2nd failsafe duration menu is confirmed by 100% LED and 75% LED being illuminated solid. The 25% LED will also be blinking to indicate the number of seconds the second failsafe position will be held for. (One second of delay for every blink.) To increase the count hold the transmitter stick at the extreme end of travel – When the blink pattern completes if the transmitter stick is at the end of travel the blink count will be increased by one on the next pattern. When the 25% LED is blinking the desired number of seconds press and hold the setup button until the LED stops blinking. You may now release the setup button – this will save the second failsafe duration and move you back to the main setup menu.

Battery Setup

The BLM must be programmed for the battery type that it's connected to so it knows how to map the current battery voltage to the "charge status" LEDs, as well as what voltage to use to trigger the low voltage warning.

From the first-level setup menu press and hold the setup button while the "Battery setup" (50% LED) option is displayed:

1. Entry into the Set Battery Type selection is confirmed by 100% LED being illuminated solid and the 25% LED blinking. The 25% LED will be blinking with a pattern to indicate the battery type: 1 = Lead Acid, 2 = LiPo, 3 = NiCd/NiMh. To change the selection between battery types hold the transmitter stick at the extreme end of travel at the end of the blink pattern. When the 25% LED is showing the desired blink pattern press and hold the setup button until the red LED stops blinking. You may now release the setup button.
2. Entry into the Set Cell Count selection is confirmed by the 75% LED being illuminated solid and the 25% LED blinking. The 25% LED will be blinking with a pattern to indicate the battery cell count. (Make your selection according to the table below based on the battery chemistry you have already selected and the battery type you have.) To change the selection/blink pattern hold the transmitter stick at the extreme end of travel. When the 25% LED is showing the desired blink pattern press and hold the setup button until the red LED stops blinking. You may now release the setup button.

Blink count	Batt Voltage/Cell Count
1 (Lead Acid)	6V
2 (Lead Acid)	12V
1 (LiPo)	2S/7.4V
2 (LiPo)	3S/11.1V
1 (NiCd/NiMh)	5 cell / 6V
2 (NiCd/NiMh)	6 cell / 7.2V
3 (NiCd/NiMh)	7 cell / 8.4V
4 (NiCd/NiMh)	8 cell / 9.6V

BLM Operation

When power is applied the BLM it immediately enters its running mode. The current charge state is displayed using the four LEDs. The display will go blank every few seconds, then return to show the charge state. When the battery is depleted below the programmed minimum voltage level the 100% LED and 50% LED will turn on to show an "empty battery" condition.

If a lost signal event (or commanded failsafe event) is recorded the display will alternate between displaying the charge state of the battery and the number of lost signal events. The count of lost frames is indicated with a sequence of coded flashes: Each flash of 100% LED indicates 100 lost frames. Each flash of 75% LED indicates 10 lost frames. Each flash of 50% LED indicates one lost frame. The lost frame count is held until power down.

General Notes

▪ Once a low voltage condition is detected power must be removed from the BLM to reset it.
▪ The BLM maintains galvanic isolation between the battery connection return and the input servo connection return so noise-causing ground loops are not created.
▪ The onboard BEC is capable of delivering about 500mA at 5V, plenty of power for a single servo.
▪ BLM can also be used with dynamic diving "pool" subs- Insert the BLM between the receiver and the ESC and your throttle will be disabled when it's time for a recharge. (Not recommend for running beyond the reach of a retrieval net.)
▪ If you also have an ADF or ADF2 **do not** use the BLM as the input to the ADF's failsafe channel.
▪ Some customers have reported compatibility issues with *very* old Futaba and Sombra Labs Shadow 7 type receivers. If you have an early model Futaba or Shadow 7 receiver (and seem to be having issues at start-up) please contact us at the email address below for assistance.

Questions?

▪ If you have questions or concerns about your BLM please contact Kevin McLeod by email at KevinMc.Electronics@gmail.com