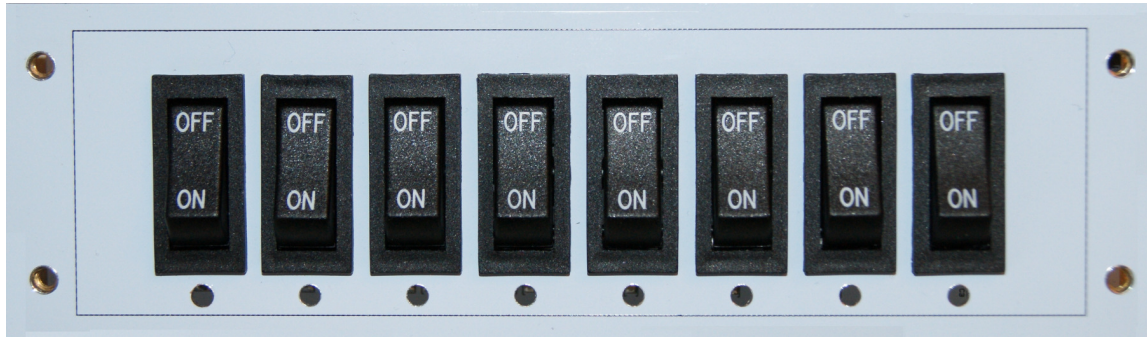


Ztron Labs ZL-BP8X User Guide



Introduction

ZL-BP8X

The ZL-BP8X is an extremely simple, load power switching and protection device, yet is a precision instrument.

Replacing eight conventional switches and circuit breakers, in less space for about the same cost.

These units use advanced microprocessor circuitry to provide the highest accuracy and greatest flexibility in the industry.

Comprising eight individual channels of power monitoring and control in a single, all solid-state unit.

These units can be reprogrammed to different current settings via serial PC interface or EIFS (if it supports it).

There are no fancy or required installation extras, just four 5/32" holes for mounting bolts and a small 1.5"x5.5" rectangular cutout in your instrument panel.

Because these units are solid-state and do not pass any current through the rocker switches, there are no arc current wear-out mechanisms!

Simplifies power wiring and lets you decide on the protection level needed after installation.

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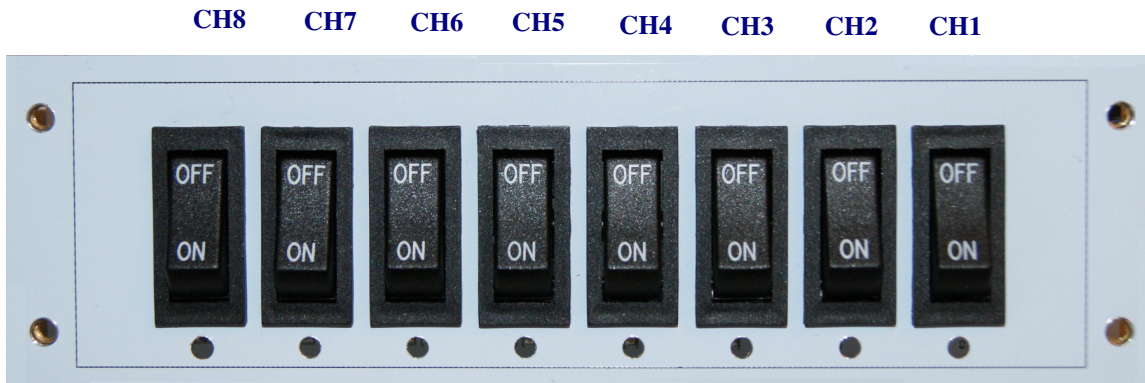
Power Channels

The ZL-BP8X is an eight channel electronic power-switching device, which also monitors and controls the current into each of these channels. All channels are equivalent, but for discussion purposes we will identify them as Channels CH8 through CH1, left to right on the front side and CH1 through CH8 on the back side.

Each channel can switch up to 15 Amps from the supply input through to its attached load. Each channel can be switched On or Off manually by its corresponding rocker switch, and each channel will be switched Off automatically if excessive current is drawn. A channel that is intended to handle 15 amps **must** have a trip point reasonably above this value. Because there are **very few** 15 Amp load types that do not have a transient/ turn-on current much higher the user should always set such a channel to have a 20 amp trip point.

The current threshold at which any channel will trip off is selectable by the user (see the programming section). When we ship the ZL-BP8X, each unit is preset with all channel having 10 Amp trip thresholds.

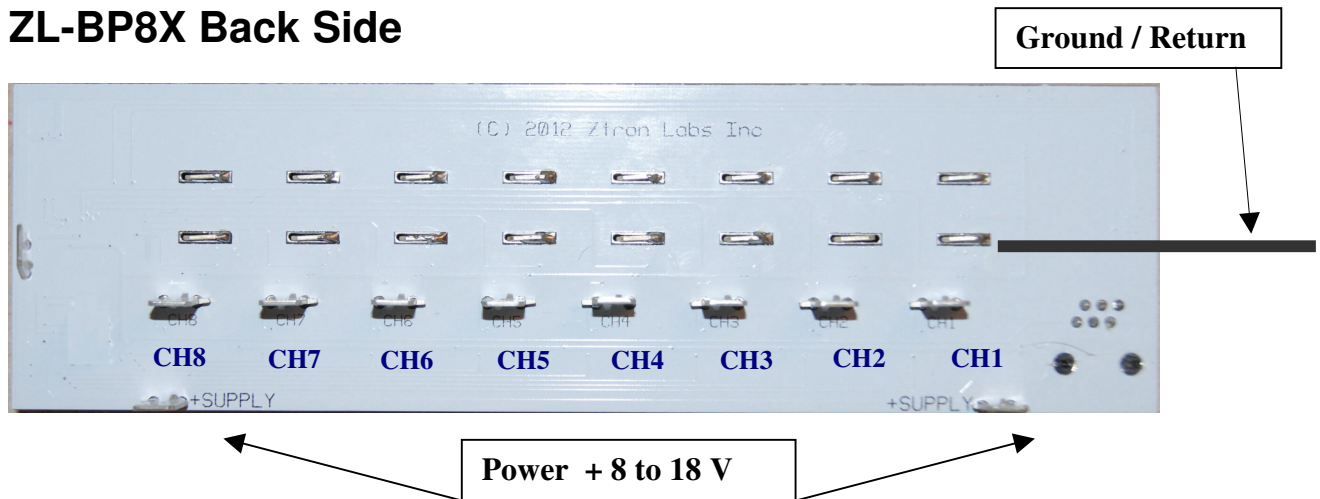
ZL-BP8X Front Side



The rocker switches are clearly marked as Off if the upper “**OFF**” portion is depressed, and On if the lower “**ON**” portion has been depressed. The position of these switches directly and immediately control a channel’s power status.

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ZL-BP8X Back Side



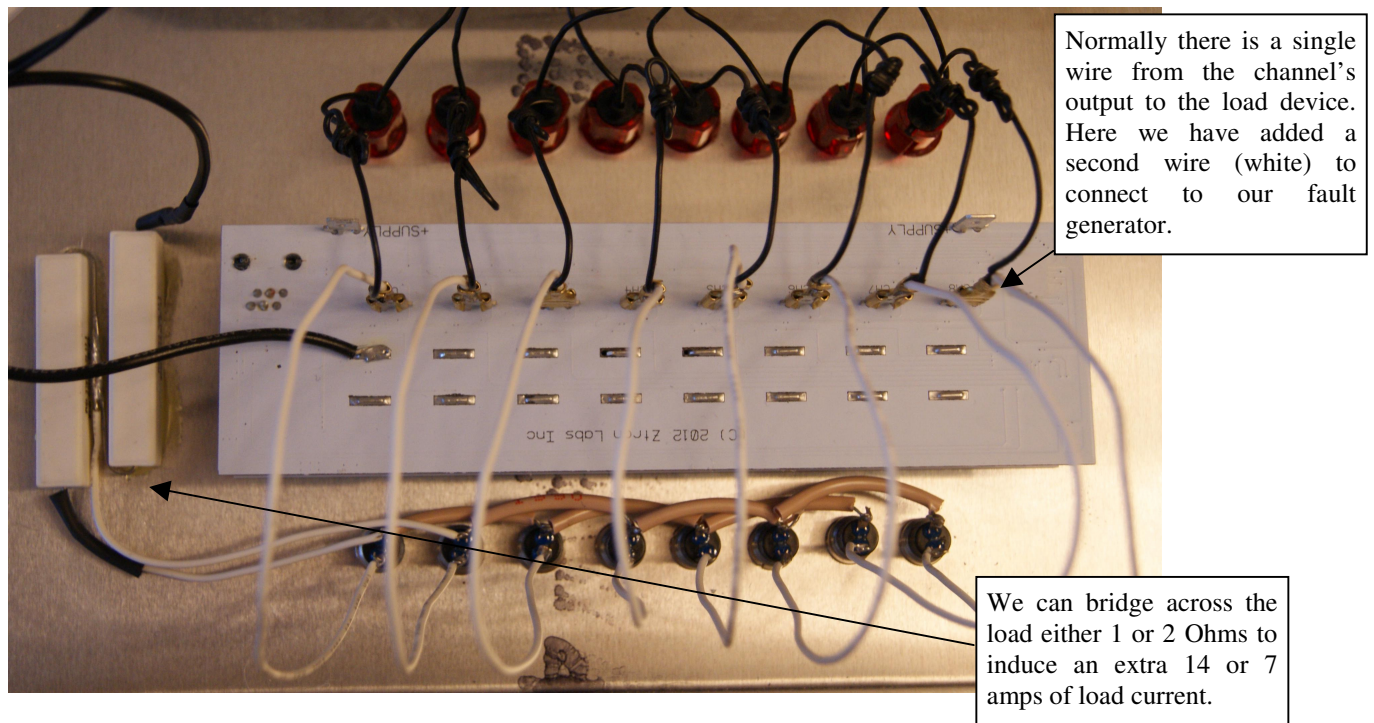
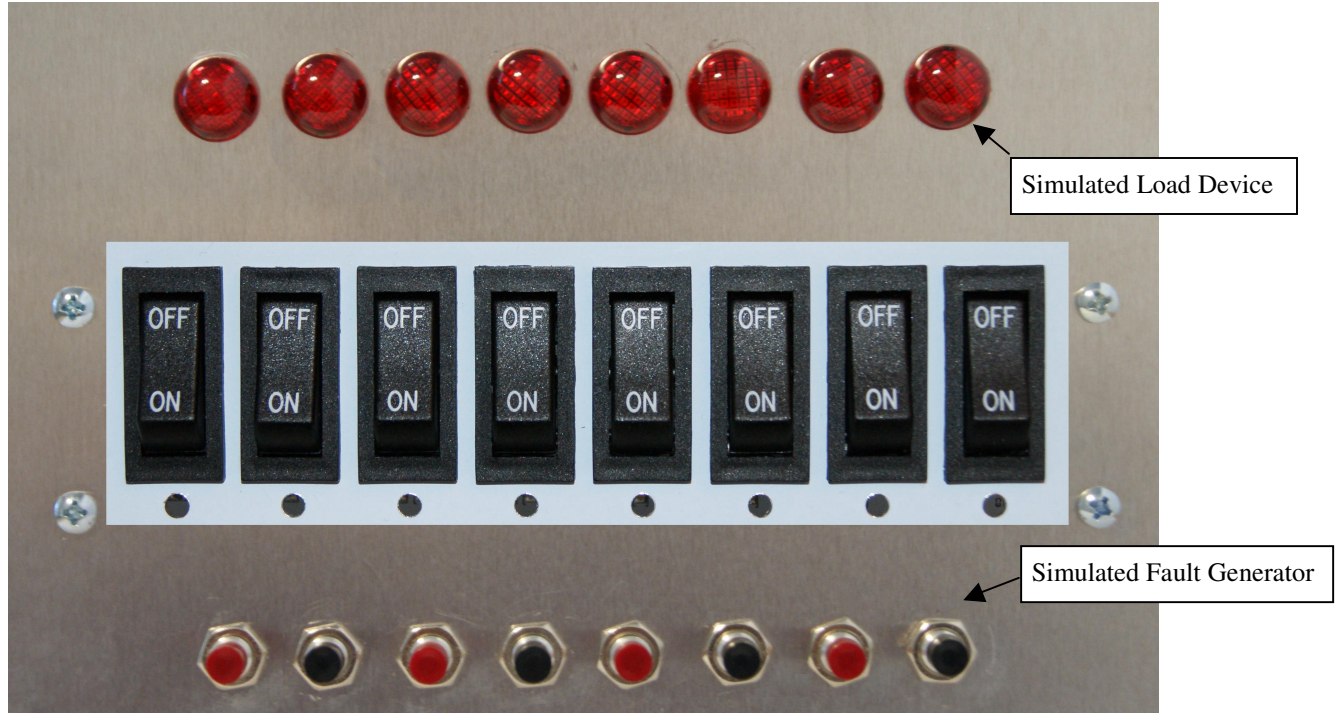
The positive power input is identified as the lower supply spades on the back. While the negative power input (ground or return) is identified as the far right side spade. The eight channel load ports are along the bottom.

Recommendation: The Power input should use wire rated for 50 Amps, such as 10 AWG while the individual channels can use 16 down to 26 AWG depending on the load. The Ground / Return line only has this units current flowing (30 mA) and can be as small as 26 AWG.

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Demo Panel

To demonstrate the ZL-BP8X we installed a unit into a demo-panel for our Videos.



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Indicator LEDs

There is one indicator LEDs for each channel: a Red status indicator at the bottom. When the units is first powered on or if the unit resets from extremely low voltage (see specifications) these 8 LEDs will blink four times as a visual check of each channels initial operational readiness.

When a channel is switched on with the rocker switch, after being off, the LED for that channel will blink rapidly for ½ second **if** the channel is drawing > 0.2 Amps. If the channel is drawing excessive current it will trip with the LED steady on. The initial blinking is visual indication that there is a Non-Open load attached. If the LED does not blink then it may indicate that the attached wiring is Open!

Channel States

Each channel can be in one of several states. The normal state for a channel is on, supplying power to its load. Unless a channel has faulted from excessive current or you the user have turned it off, this will be the state of the channel. The channel LED is not lit in this state.

The user can override a channel and turn it off. The load is disconnected from the Supply and no current flows or is monitored. A rocker switches in the off position always turns the channel off.

If for some reason the current flowing into the load of a channel exceeds the user selected current threshold, the channel will go into the Fault state. The channel's power will be cut off, and the Red Fault indicator LED will light steadily. The rocker switch will still be in the on position. Switching the rocker to the off position will clear the fault indication, and allow a retry when it is switched back on.

Current Overload and Faulting

Every channel that is on, has its load current continuously measured. This current is averaged and filtered and then checked against the channels preset trip threshold. If the current exceeds the trip value the channel may fault off. The ZL-BP8X looks for transient current overloads and reacts differently if the fault results in steady over-current.

Each channel can have its response time configured (see software). This time parameter is the maximum time the channel is allowed to be above its trip. Additionally if the current exceeds 40 amps, this fault condition may only persist for $\frac{1}{30}$ th this time parameter.

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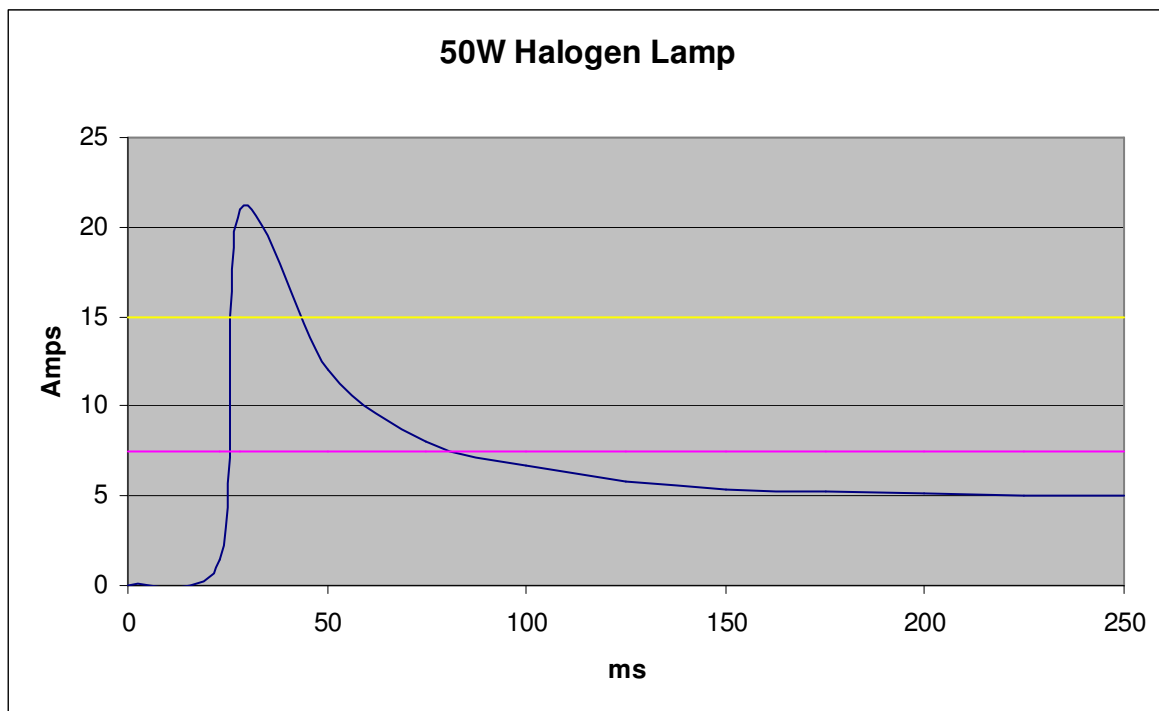
The default 10 ms response time allows repeatable current spikes to come and go, so long as none remain excessive for longer than this 10 ms.

Unfortunately, some loads in an aircraft have very large peak current demands, and it may require the configuration of the channel's response time so as to not fault prematurely. The default for each channel is 10 ms, for which most loads will settle within. Many incandescent lamps will require a larger value, while most LED lighting is well behaved.

Using too large of a time constant can cause your wiring to overheat during a short fault, if it is too small a gauge. A 3 foot 24 AWG wire with a dead short at its end will be destroyed within 100 ms.

Standard circuit breakers have trip times in the minutes to hours for less than 2X overload. The ZL-BP8X ultra fast response is very useful if one is trying to protect aircraft wiring. However, it can be an annoyance with some avionics loads that have exceeding high peak to average current consumption AND the user has set too low a trip threshold. Be sure to read the specifications for each load device attached.

The figure below shows a typical turn on characteristic of a 50 W halogen bulb, as might be found in a conventional landing lamp.



If the ZL-BP8X trip point associated with this channel is 7 Amps, then the current is in excessive of the trip for 55 ms. Using a 75 ms response time parameter with a 7 A

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trip setting would be appropriate. Raising the trip to 15 A, reduces the response time requirement to 25 ms. The PC application software will guide the user in the proper selection of response times.

It is recommended that the fastest response time be used whenever possible. Heating leading to possible failure of the wiring connecting to the load increases the longer the fault is allowed to persist.

Note: that a conventional hard short will probably results in a constant excessive current greater than 2X of any trip point. It is for these types of faults that one wants to shut down the channel as soon as possible.

Note: 16 AWG 10 feet long will result in a 313 Amp fault,
24 AWG 10 feet long will yield a 49 Amp fault.

Important point: For most common sized wires (greater than 28 AWG) a short at its end will probably result in much more than 15 amps of current flowing. Whenever possible to protect the wire, use 10 amps or greater trip point and 10 ms or less response time. This will provide good protection for the wire. See Appendix 1 for details.

A channel (with a problem load) that is switched on is treated differently from a channel that is on and a load problem develops later on:

- 1) When a channel is initially switched on, the BP8X will allow an excessive current ($I > 40A$) for a time that is proportional to the response time setting. The scale factor is 1/33: a 10ms Response Time setting will allow a 300 us excessive current event. Such events can happen when an EFIS or Radio is initially switched on (any electronic device with very large supply capacitors).

If the surge current decreases below 40Amps, the Response Time filter will then be applied (the 10ms case will allow the surge to persist for a maximum of 10ms),

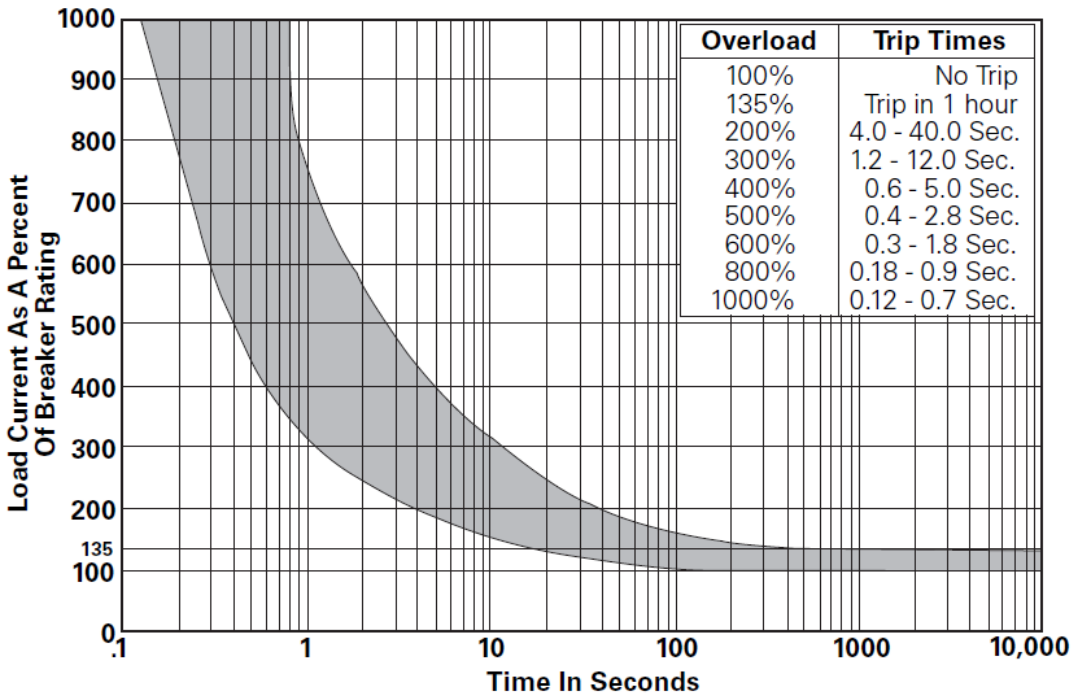
- 2) If a channel sees a nominally small load that is less than the trip current, and then the load current suddenly jumps greater than 40A; the BP8X assumes this is a problem, and will fault immediately. If the load current only jumps to a value less than 40A then the Response Time filter will be used (10 ms allowed time between trip and 40A).
- 3) If a channel is on and sees no load, then suddenly jumps greater than 40A (excessive current), this will be handled exactly like in case 1.

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Conventional Circuit breakers

Lets examine an exert from a conventional circuit breaker's datasheet.

Time vs. Current Trip Curve @ +25°C



At 2 times the rated load, a conventional circuit breaker will require from 4 to 40 seconds to trip. This is a huge variation in performance. These things are designed to be useful, when a 1000% overload occurs, in which case the response time is under 700 ms. Even so, damage to small gauge wiring can result within these time frames. The BP8X provides precise and rapid response times without needing massively excess current to sense and react to a fault.

Important: A channels trip threshold should always be set well above the maximum rated current of the instruments attached as a load. There are always random and systematic fluctuations in the current being drawn by load devices and sufficient margin for these fluctuations needs to be accounted for. *It is not the load that is being protected; it is the wires that run from the breakers to the load.*

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Programming

A free PC application is available from our Web Site for use in configuring the ZL-BP8X. Each channel and its parameters are readily available for modification. A 3' serial (RS232) cable is provided for connection between an EFIS's or PC's serial port and the ZL-BP8X (see Appendix 3).

The ZL-BP8X must be powered on during the configuration phase. Its power consumption is small (< 10 mA) during this operation; a small 9V battery is sufficient to provide power.

Low Voltage

The ZL-BP8X has been designed to function correctly when the main-bus voltage is greater than 8V. A lower voltage than this implies that there is a problem in your electrical system. These units will retain their last state when the voltage drops below 8 V.

When the bus-voltage drops below 6V the unit will reset / reboot and restore previous settings. This behavior will ensure its correct operation when and if your main bus power ever recovers. If the unit resets, there will be a momentary time in which all loads are turned off! Such conditions may happen to happen during engine cranking!

Installation

Appendix 1 shows the hole/cutout pattern to mount a ZL-BP8. Four 5/32 drill holes for the mounting bolts (included) and a single rectangular cutout to expose the key pads.

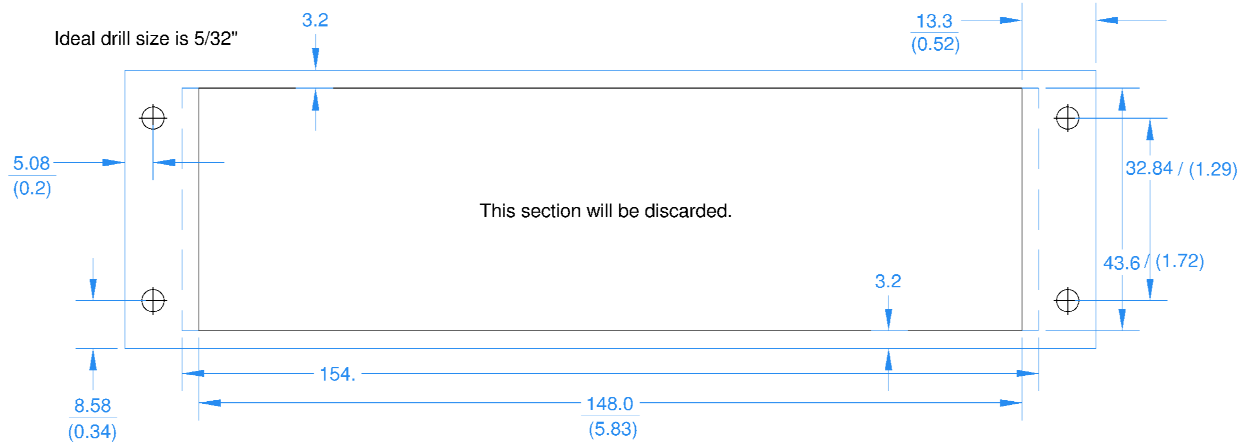
The unit is intended to be mounted behind a thin flat panel such as a standard instrument panel. **Do not** install the unit in front of the panel! The reason for this should be obvious, so we apologize for this disclaimer.

The power into the unit will come from your main-bus switch, such as provided by our ZL-MB50 main-bus contactor.

The female terminal connector that attaches to each of the 10 sites on the back of the ZL-BP8X is a 0.25" x 0.05" standard spade terminal, which can be found at all home improvement stores or any electronics distributor.

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Panel Cutouts



Dimensions are in mm (inches)

The inner rectangle is the recommended cutout window for the BP8.

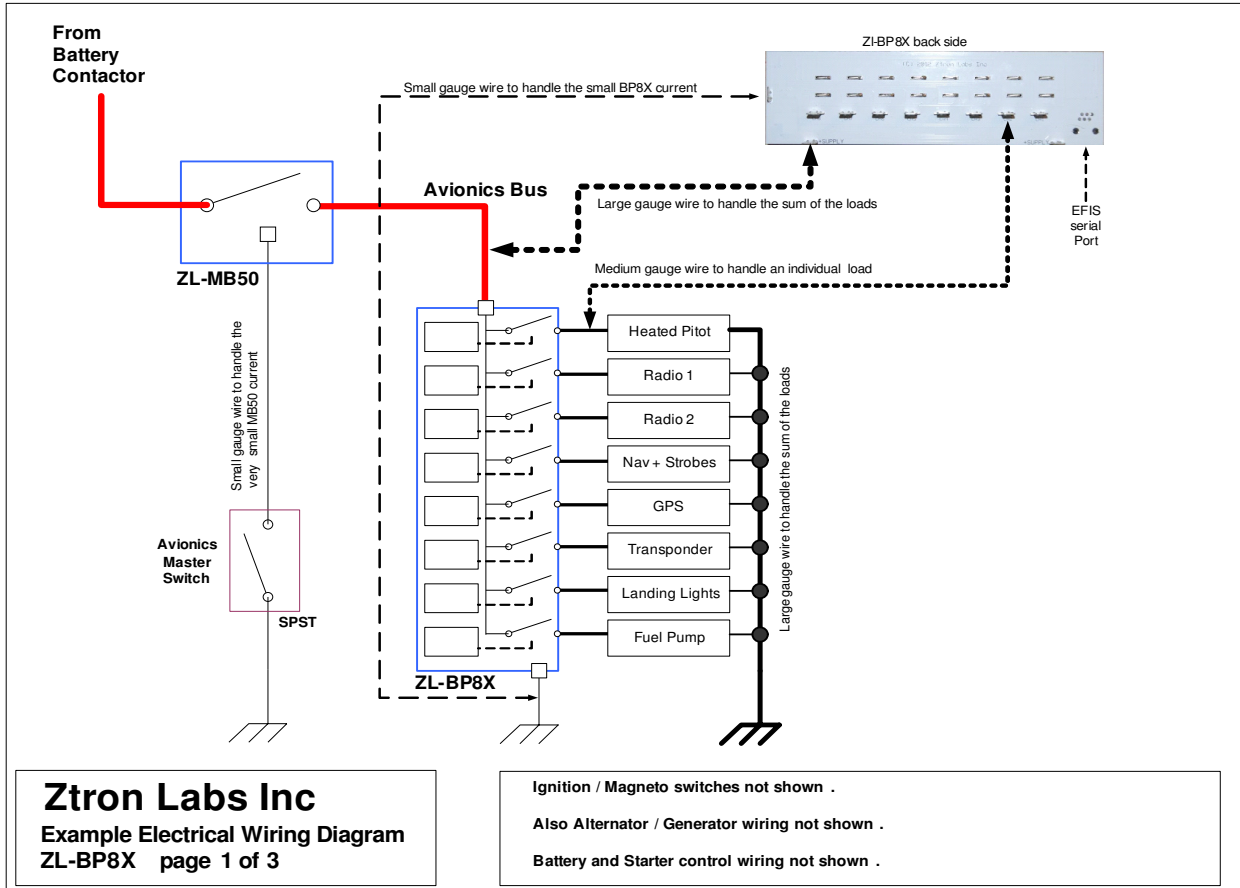
You may print and use this page as a template.

ZL-BP8X

Note: Above is not to scale. Look on our web product page for a printable to-scale version.

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The following diagram shows an example wiring. *Do not connect the return from the various loads to the connector, which is the ZL-BP8X return.* A small gauge wire should connect from the ZL-BP8X's return to a common bus return point in your instrument panel.



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ZL-BP8X Specifications

Dimensions	6.84"x 2.0 "x 1.25" (174 x 50 x 30 mm)
Weight	7 oz (200 grams)
Input Voltage	8-18 V DC
Current Draw	40mA maximum
Power	0.4 Watts maximum
Total Operating Capacity	50 Amps maximum ¹
Individual channel capacity	15 Amps maximum
Operating voltage	8 – 18 V ² 6 – 18V ³
Current trip accuracy	5 %
Trip speed	1 to 100 ms (programmable) 10 ms default
Current trip resolution	0.1 Amp internally 1 to 20 Amps, in 1 A steps
Warranty	3 years

Notes: **1** Sum of operating current flowing through all channels
 2 Supply voltage range for current monitoring to be accurate
 3 Supply voltage range for switching function to deliver power to loads.

Watch our breakers in action; look for our video at www.ZtronLabs.com/Products

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Appendix 1: Useful properties of copper wire, in 13.8 V systems.

AWG	Ohms / 1K ft	Max Current	Fusing Current	Current / 10 ft (short circuit)	Voltage Drop / 10 ft * 10 A
	(Ohms)	(Amps)	(5 seconds)	(Amps)	(Volts)
6	0.3951	101	668.0	3442.2 A	0.04
7	0.4982	89.	561.0	2729.8	0.05
8	0.6282	73.	472.0	2164.9	0.06
9	0.7921	64.	396.0	1717.0	0.08
10	0.9989	55.	333.0	1361.5	0.10
11	1.260	47.	280.0	1079.4	0.13
12	1.588	41.	235.0	856.4	0.16
13	2.003	35.	197.0	679.0	0.20
14	2.525	32.	166.0	538.6	0.25
15	3.184	28.	140.0	427.1	0.32
16	4.016	22.	117.0	338.6	0.40
17	5.064	19.	98.4	268.6	0.51
18	6.385	16.	82.9	213.0	0.64
19	8.051	14.	69.7	168.9	0.81
20	10.15	11.	58.4	134.0	1.02
21	12.8	9.0		106.3	1.28
22	16.14	7.0	41.2	84.3	1.61
23	20.36	4.7		66.8	2.04
24	25.67	3.5	29.2	53.0	2.57
25	32.37	2.7		42.0	3.24
26	40.81	2.2	20.5	33.3	4.08
27	51.47	1.7		26.4	5.15
28	64.9	1.4	14.4	21.0	6.49
29	81.83	1.2		16.6	8.18
30	103.2	0.9	10.2	13.2	10.32

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Appendix 2 EFIS Interface

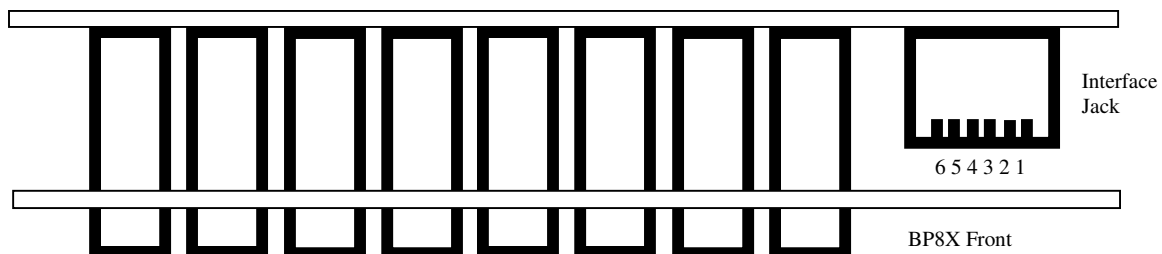
The ZL-BP8X supports a limited sub-set of the Vertical Power VPX command set. There are 8 generic devices that can be addressed. These correspond to devices with identifier numbers 1 through 8 in the VPX nomenclature (device 0 is not supported).

Serial Interface

The serial port uses just the Transmit and Receive RS232 lines. The baud rate is fixed at 19,200 Baud, 8 bits, No parity, 1 stop bit.



Supplied serial cable: 9-pin female to RJ25 male connector.



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RJ25 pin out

Pin 1: Shield (ground)
Pin 2: Ground
Pin 3: RS232 Receive from PC/EFIS
Pin4: RS232 Transmit to PC/EFIS
Pin5: not used
Pin 6: not used

Status

The all devices status message is sent to the EFIS/PC at a once per second rate. Only the status information for the first 9 devices (0 is empty, 1 → 8) is sent. This status has the following information:

Channel/device fault/trip status
Channel/device current consumption (in units of $\frac{1}{10}$ th Amp).

Channel Naming

Each channel can be named by the customer to have an arbitrary name, with up to 16 characters in length. By default they are “Channels1” → “Channels8”

Trip Value

Each channel can be set to trip at a current value from 1 to 20 Amps in 1-amp increments.

Trip Speed

Each channel can be set to trip within 1 to 100 ms, in 1 ms increments.

Enable

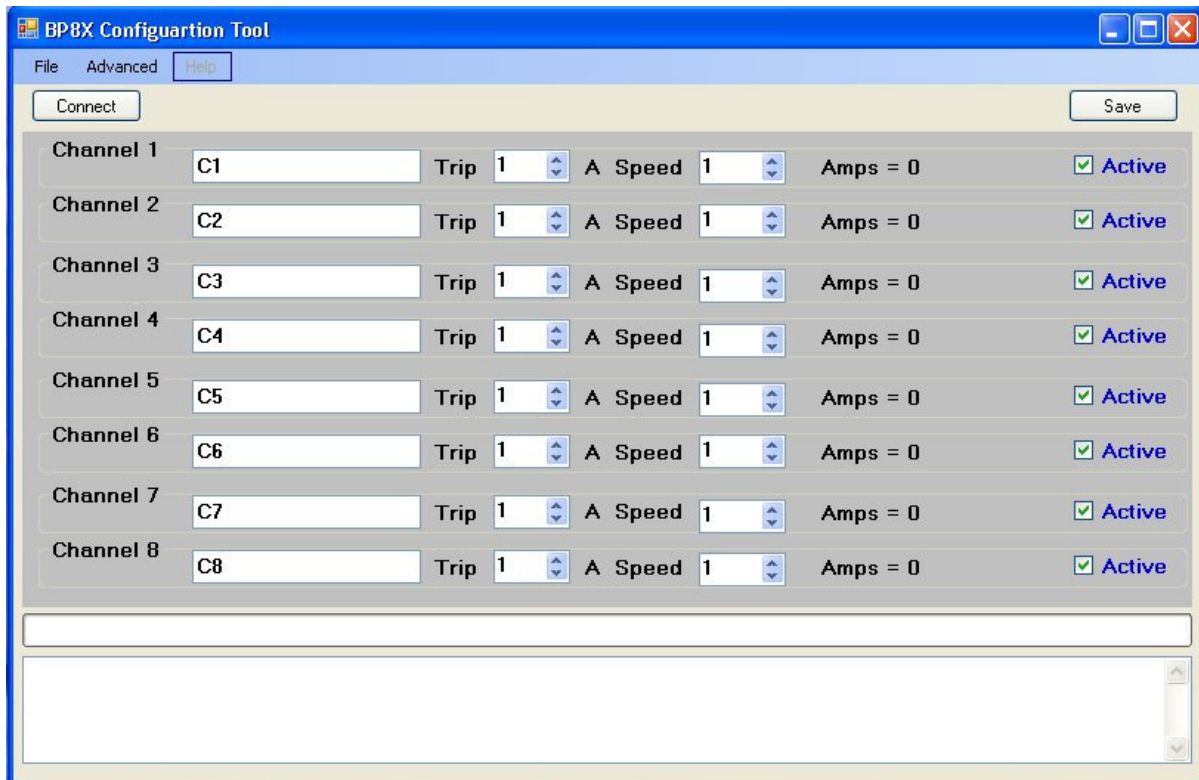
Each channel can be disabled or enabled. A disabled channel will not respond to rocker switch control.

Disclaimer: Ztron Labs Inc is not responsible for the correct functioning of our ZL-BP8X when connected to any third party EFIS. We will work with the customer and EFIS vendor to try to resolve any incompatible issues, but do not guarantee to be successful.

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Appendix 3 PC Application

The PC Application (Windows XP or Windows 7) is called BP8X.exe. The main window is illustrated bellow.



The primary function of this utility is to allow the customer to change the internal settings on a ZL-BP8X.

The {Connect} button will change from “Connect” to “Connected” after a powered ZL-BP8X has been successfully interfaced with this application.

Pushing the {Connected} button will load from a connected ZL-BP8X all of its channel settings into this windows.

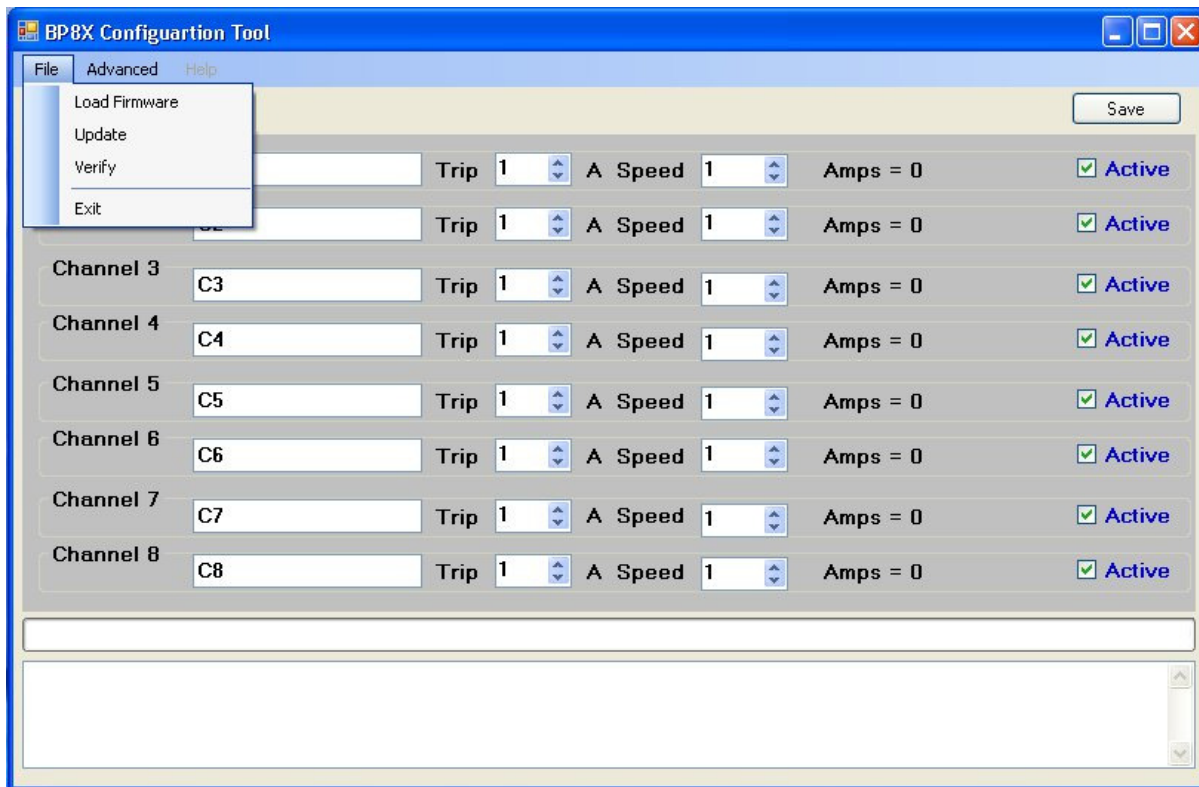
The user can editing these settings and save them back into the ZL-BP8X by pressing the {Save} button.

Right clicking in the Trip or Speed controls will bring up suggested settings based on the type of loads one might attach.

Toggling the Active checkbox within each channel group can disable a Channel. There is no fundamental reason that a channel needs to be disabled if the customer is not going to attach a load to that channels’ power port. However, if a load has been attached to a channel AND

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the user does not want the ability to turn on that device then he should disable make inactive that channel.



The File menu allows new firmware to be loaded into an attached ZL-BP8X. This should only be necessary if a required upgrade notice has been sent to the user. Optionally, Ztron Labs may introduce new features, which the customer may choose to add.