VoltMagic RADIO CONTROL SYSTEM MONITOR VM2R

INSTALLATION

www.VoltMagic.com

VoltMagic lets you custom configure the monitor for your setup. During normal operation the 8 LEDs indicate the current average battery voltage or voltage regulator output. LED 5-8 blink to record abnormal peak low voltages (PLV) or over voltage (OV). LED 1 blinks to count radio glitches. The objective of proper installation is for the LEDs to reflect the status of your system as follows:

RED (blinking or solid) = Warning — voltage low.
YELLOW (blinking or solid) = Caution — voltage lower than normal.
GREEN LED5 blinking = PLV values approaching the yellow level, or Over Voltage with voltage regulators (ranges 5-8).
GREEN LED1 blinking = Glitch or Failsafe count
GREEN solid = Normal (voltage displayed).

CAUTION: Do not connect to over 8.7 volts—damage may result.

1. **Connect the attached lead**, just like a servo, to the receiver. (Wire colors: brown is equivalent to black, and orange is equivalent to white.) A "Y" harness may be used if there is not a spare channel on the receiver. If a "Y" harness is used, connect it to a channel with low current draw. When configuring VoltMagic for failsafe detection on PCM receivers, using a separate channel is advised since its failsafe position will be adjusted for VoltMagic. VoltMagic can also be plugged into a socket that does not have a channel signal (such as one for a DSC) or connected directly to a battery (such as a 7.4v LiPoly). Naturally, if VoltMagic is connected without a channel signal, glitch/failsafe detection is disabled and you will have to plug it somewhere with a channel signal temporarily to change the configuration (in step 3).
2. **Set Glitch or PCM Failsafe Detection:** Glitch detection checks if signals from the receiver fall outside the normal range of pulse widths. Failsafe detection (for PCM receivers only) checks if the signals from the receiver are at maximum high or low, which is the failsafe position to set for the channel connected to VoltMagic. The receiver will apply this failsafe position signal when the radio signal is lost. As a side note, we recommend that you check that the throttle channel failsafe is set to idle. See your transmitter manual for specific procedures to set failsafe positions.
   - Proceed to the **CONFIGURATION GUIDE** and begin at the top of the configuration flow chart.
3. **Set Voltage Range:** See **Table 1** and choose a voltage range. The fourth column in **Table 1** shows the LEDs that are lit during configuration when that particular range is selected. To enter configuration, your transmitter ATVs for the channel connected to VoltMagic should be about 85% (or more if not using PCM failsafe detection).
   - Proceed to the **CONFIGURATION GUIDE** and start at the SET VOLTAGE RANGE block.
4. **To test glitch or failsafe detection**, turn on the transmitter and receiver for **longer than one minute** to enable glitch (or failsafe) counting, then turn the transmitter off and back on. Green LED 1 should blink (see the Operation Guide). (If PCM failsafe detection doesn't work at first, try setting the failsafe again to the opposite extreme.)
5. **Mount VoltMagic** by applying double-stick tape to the back. Mount away from engine exhaust, preferably where it can be seen in a hover or slow fly-by. For mounting inside a fuselage, cut a slot for viewing the LEDs.
6. See the **OPERATION GUIDE** for specifics on reading the LEDs.

TABLE 1: Voltage Ranges + Glitch or Failsafe Mode -- In order of appearance during configuration.

Range	Ranges for LED's 1-8 * Glitch Mode (last two choices)	PLV or OV Range	Configuration LED Display	Applications **
1	5.3 – 4.6 volts	PLV 4.4 – 3.8	Green LED 5	4 cell Ni
2	5.4 – 4.7 volts	PLV 4.4 – 3.8	Greed LED 4	4 cell Ni
3	5.5 – 4.8 volts	PLV 4.4 – 3.8	Green LED 3	4 cell Ni (Default)
4	5.6 – 4.9 volts	PLV 4.4 – 3.8	Green LED 2	4 cell Ni
5	5.5 – 4.8 volts	OV 5.8 PLV 4.2 – 3.8	Green LED 4 + Green LED 5	5.4 to 5.1 Regulators
6	5.7 – 5.0 volts	OV 6.0 PLV 4.2 – 3.8	Green LED 3 + Green LED 4	5.6 to 5.3 Regulators
7	5.9 – 5.2 volts	OV 6.2 PLV 4.2 – 3.8	Green LED 2 + Green LED 3	5.8 to 5.5 Regulators
8	6.1 – 5.4 volts	OV 6.4 PLV 4.4 – 4.0	Green LED 2 + Green LED 5	6.0 to 5.7 Regulators
9	6.5 – 5.8 volts	PLV 5.4 – 4.8	Green LED 5 + Yellow LED 6	5 cell Ni
10	6.6 – 5.9 volts	PLV 5.4 – 4.8	Green LED 4 + Yellow LED 6	5 cell Ni
11	6.7 – 6.0 volts	PLV 5.4 – 4.8	Green LED 3 + Yellow LED 6	5 cell Ni
12	6.8 – 6.1 volts	PLV 5.4 – 4.8	Green LED 2 + Yellow LED 6	5 cell Ni
13	7.7 – 7.0 volts	PLV 6.4 – 5.8	Green LED 5 + Red LED 7	7.4v Li
14	7.8 – 7.1 volts	PLV 6.4 – 5.8	Green LED 4 + Red LED 7	7.4v Li
15	7.9 – 7.2 volts	PLV 6.4 – 5.8	Green LED 3 + Red LED 7	7.4v Li
16	8.0 – 7.3 volts	PLV 6.4 – 5.8	Green LED 2 + Red LED 7	7.4v Li
	Glitch (Default)		Saved voltage range + **Red LED 8 OFF**	FM / PPM
	Failsafe		Saved voltage range + **Red LED 8 ON**	PCM

* The 8 LEDs each represent a 0.1 volt increment of the range. Voltage listed is the median. For example, in the first range, Red LED 8 is on with less than 4.65 volts. Red LED 7 is on between 4.65 and 4.75, Yellow LED 6 is on between 4.75 and 4.85 and so on. A deadband dampens changes between LEDs.

** Ni = Nickel (NiCd or NiMh) Li = Lithium (LiPo, Li-ion, LiMn)

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TIPS and TROUBLESHOOTING

VoltMagic 2R Features

Voltage Indication — Filtered and averaged. 16 accurate range selections for the LEDs.
Peak Low Voltage (PLV) — Captures momentary low voltages, samples hundreds of times each second.
Over Voltage (OV) — For use with Voltage Regulators
Glitch and Failsafe Counting — Selectable PPM glitch or PCM failsafe counting.
Data Logger — PLV / OV and Glitches / Failsafes play back after power off.
Application — Battery types: 4 or 5-cell NiMh / NiCd, 7.4v Lithium, or monitoring of Voltage Regulators.
Connector — Universal (Futaba, JR, Z)
High Accuracy — Calibrated within 0.015 vdc

Voltage Ranges: There is a lot of personal preference in choosing a voltage range for your battery. When to charge a battery will depend on battery characteristics, amperage, flight duration, etc. If you want to see yellow at a different voltage, just select a different range. Using battery load, discharge, or capacity test instruments, in addition to VoltMagic, is always good practice. With its 7.4v Lithium ranges, VoltMagic is ready for the future as more servos, receivers, and gyros are capable of running from a 7.4 Li pack directly. For monitoring voltage regulators, ranges 5 through 8 are ideal. Select a range that displays the regulator output in the green band, but below the highest green LED.

Troubleshooting: When VoltMagic is connected to the receiver, it looks at the entire electrical system, including radio glitches. Often batteries check out fine, yet there are problems with the system as a whole under real flight conditions. Problems can start small and go unnoticed – VoltMagic tries to detect these problems early, before the safety margin is used up. Even momentary low voltage due to switches, servos and wiring can be detected, as well as low voltage due to the battery or high voltage from a regulator. Generally, voltage below 4.2 vdc is not good practice, and peak lows below 1.05 volts per cell with NiCd or NiMh are not normal. Check your radio manual or contact the manufacturer for specifics. (For example, at www.futabarc.com/faq/faq-receivers.html, Futaba says that 4.0 vdc is the minimum, with performance degraded as voltage falls under 4.3 - April, 2005).

Low PLV: With a non-voltage regulator setup, it is often normal to have PLV in the green or yellow zone when the battery is due for charging. However, if the battery charge is normal and the PLV is low, the problem may be with the battery, switch, servos, wiring, connections, etc. Cold temperatures can also degrade battery performance resulting in low PLV. Note that high current (digital) servos require a suitable battery and switch harness to avoid severe peak low voltages.

Unfortunately, readily available digital servos draw more current than ever, **but high impedance batteries with undersize connectors and small switches are still common.** First, try plugging the battery directly into the receiver and wiggle the sticks quickly. If the problem goes away, or is significantly better, it's likely that the switch harness is part of the problem. If not, the battery and/or its connecter can't keep up with the servo load. You can also unplug individual servos and quickly wiggle the sticks to see the effect of lowering servo load on PLV. Most servos typically draw a lot of current with a sudden reversal, but you can also add some load with your hand as a further test. Also note that typical R/C connecters can be marginal when a single connecter has to feed 4+ high output digital servos.

Generally, the recommendation is to use whatever works and keeps the voltage within a normal band, but here are some specific suggestions: If you don't really need a high output digital servo for the throttle, don't use one. If you are going to use high output digital servos and a Ni based battery, it should have low impedance (designed for high discharge rates) and capacity for at least three flights plus reserve. Use a high current switch with two poles (e.g. Futaba's heavy duty switch). Either use a battery with twin leads (or dual batteries) and install two redundant switches both feeding the receiver, **or** replace the connecter between the battery and switch with a Power Pole type. To further lower voltage drop and add redundancy with a single switch setup, replace the single output lead of the switch harness with two leads to feed the receiver. This can be done with another Power Pole connecter with the side going to the receiver forming a Y with two leads and R/C connecters. Use the Power Pole contacts for smaller wire and crimp them carefully. Add heat-shrink over the crimp as a strain relief. All of the wire should be 20 gage (or larger).

Voltage regulators can also benefit from spreading the load between two R/C connecters at the receiver. Low PLV with a voltage regulator may be caused by the regulator itself, poor connections, excessive servo load, or the supply battery (possibly from internal voltage drop, cold temperatures or low charge). Depending on regulator design and servo load, high discharge (20C) Li batteries may be required to keep the voltage up. You can unplug individual servos and quickly wiggle the sticks to see the effect of lowering servo load on PLV. Normally, the output of a regulator shouldn't change as the battery discharges. However, the voltage at the receiver will still change with load, especially sudden changes. OV (over voltage) is always caused by the regulator, or by selecting the wrong range.

Glitches or Failsafes: If there are excessive glitches or failsafes, it may be helpful to use VoltMagic as a diagnostic tool on the ground while range checking. Problems with the transmitter, receiver, or antenna usually can be detected without the engine or motor running. When glitches only occur with an engine or motor running, look for something related such as bearings or faulty motor noise suppression.

LIABILITY EXCLUSION AND SAFETY

Never turn off your brain and rely solely on this device. Observe safe practices concerning your particular model. Always perform an appropriate pre-flight check. As manufacturers, we are not in a position to ensure the proper methods of operation when installing, testing, or using this product, nor can we assure the fitness of this product for your particular application. For these reasons, the manufacturer does not accept any liability for loss, damage, or injury connected with this product. By using VoltMagic, you agree to this.