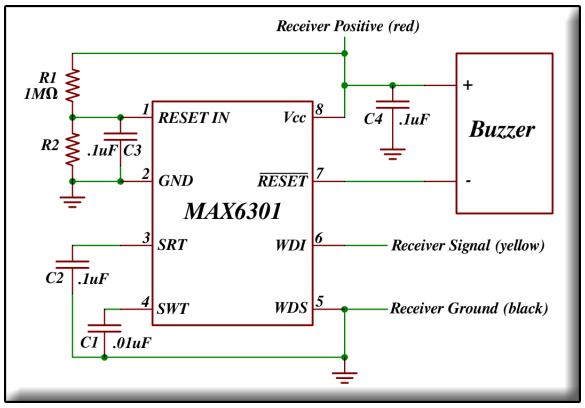
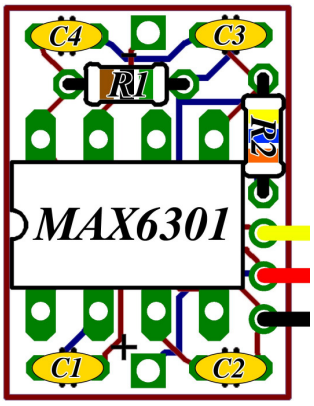


V SENTRY Schematic Diagram



PCB Diagram

Thanks for purchasing this ***V SENTRY Flight Monitor Kit***! Please make sure you have everything:

- V SENTRY pcb	(1)	- MAX6301 chip	(1)	- .1uF capacitor **C2**, **C4**, **C5**	(3)
- 0.01uF capacitor **C1**	(1)	- 270KΩ resistor **R2**	(1)	- 360KΩ resister **R2**	(1)
- 1MΩ resistor **R1**	(1)	- 8" servo lead	(1)	- 1/2" heat shrink	(1)
- 3/16" heat shrink	(1)	- 8" solder		- piezo buzzer (supplied separately)	

Circuit explanation:

The **MAX6301** is a microprocessor supervisory chip. It is designed to monitor a voltage level and a signal line which makes it perfect for a receiver flight monitor. For detailed information and graphs (referred to below) please visit www.maxim-ic.com and search for "**MAX6301**" to view the data sheet.

The **MAX6301** has a voltage comparator that compares the **RESET IN** (pin 1) voltage to an internal **1.22V** reference. If the **RESET IN** voltage is less than **1.22V** it will turn the buzzer on (pull pin 7 low to allow current flow through the buzzer) and keep it on until the voltage rises above **1.22V**. By the time your batteries got this low you'd already be in the dirt, so we have to divide the supply (receiver battery) voltage to give a more reasonable comparison. We can do this with two resistors in series. A big **1MΩ** (**R1**) is chosen along with another value (**R2**) which we have to calculate. The voltage across **R2** (V_{R2}) is equal to the supply voltage times the ratio of **R2** to that of the total series resistance:

$$\frac{R2}{(R1 + R2)}(V_{supply}) = V_{R2}$$

Moving things around:

$$R2 = \frac{(V_{R2})(R1)/V_{supply}}{1 - V_{R2}/V_{supply}}$$

We arbitrarily chose **R1** to be **1MΩ** and we know what voltage V_{R2} needs to be to make the buzzer turn on, so we can plug these in:

$$R2 = \frac{(1.22)(1M\Omega)/V_{supply}}{1 - 1.22/V_{supply}}$$

Now we simply select the supply voltage that we want the ***V SENTRY*** to alarm at. Selecting **4.6V** as our V_{supply} we get a **R2** value of **360,947Ω** and choose the closest available resistor – **360kΩ**. The buzzer will turn on whenever the supply voltage drops below **4.6V**. Now you can select any alarm voltage you want for your application (be careful - the **MAX6301** can only take up to **7V** for its **Vcc**).

When a receiver is getting a good signal, it pulses to each servo every **20ms**. If the receiver isn't getting a clear signal (if your transmitter is off) then is will fail to pulse consistently. The **MAX6301** has a **Watchdog Timer** that is settable with an external capacitor. Using the **Watchdog Timeout Period** graph on the **MAX6301** data sheet, a **0.01uF** capacitor (**C1**) was selected for a timeout period of **30ms**. This means that as long as the receiver is pulsing normally, it will reset the **Watchdog Timer** before it times out. If the **Watchdog Timer** does

time out then it will turn on the buzzer. Using the graph on the **MAX6301** datasheet, you can easily change the timeout period for any application.

There is also a capacitor selectable **Reset** timeout period. Using the **Reset Timeout Period** graph, a **0.1uF** capacitor (**C2**) was selected for a **300ms** timeout. When the **Reset Timer** times out it turns the buzzer off. If the receiver is not pulsing consistently then the **Watchdog Timer** will turn the buzzer back on right away (after **30ms**), and the **Reset Timer** will turn it off after another **300ms**. This back and forth causes the pulsed tone you hear when you turn off your transmitter.

Assembly instructions:

Use the printed circuit board (pcb) layout diagram above as well as the images below to place and solder your components. If you're new to soldering, many good tutorials can be found online. It is recommended that you solder the **MAX6301** chip first, and then move on to the resistors and capacitors. For five cell operation replace the **360KΩ (yellow, blue, orange)** resistor shown to the left with the supplied **270KΩ (red, violet, orange)** resistor – this will set the alarm voltage to **5.7V**. Neither the resistors nor the capacitors have any special orientation/polarity. Make sure the **0.01uF** capacitor (reads "**103**" on the side) is placed where **C1** is indicated; the rest of the capacitors are the same and are marked "**104**". Clip off the component leads as you go. If you're using a pinned buzzer then you should slide the 3/16" heat shrink over the servo wire now – do not shrink yet. Solder the servo lead in place taking note of the orientation. If you like, you can clean the flux off of the pcb using isopropyl alcohol and a brush.

After all the other components are soldered in place (and leads clipped flush to the board) you can solder the buzzer in place. If using a pinned buzzer, first check over your circuit to make sure there aren't any bridged connections or misplaced components - access to the back of the pcb will be difficult later on. Pay special attention to the orientation of the buzzer – the pcb has markings on it showing "+" and "-". The buzzers we supply have either black and red wires (negative and positive, respectively), or are marked "+/-" on the casing. The buzzer pins or wires should come up from the bottom of the pcb (opposite of all the other components) as shown below.

Test your circuit by plugging into a powered receiver with your transmitter turned off. If it doesn't start beeping then something is not working correctly and you should unplug it immediately and recheck for mistakes. To test that the voltage monitoring portion of the circuit is working you can either use a variable power supply, power it with a 3 cell battery (or 4 cell if built for 5 cell operation), or simply run down your receiver battery until a low voltage condition causes the ***V SENTRY*** to beep.

After you're satisfied that everything is working correctly, you can protect the circuit with the supplied heat shrink tubing. If you're using a pinned buzzer then we recommend you use 3/16" heat shrink on the servo wire where it meets the pcb – this will help stiffen the wire around the solder joint where it is most prone to breaking. If you're using a wired buzzer then we recommend you route the wires as shown and cover the circuit with 1/2" heat shrink. The wires will be clamped down among the pcb, components, and heat shrink to prevent strain on the solder joints.

Operating Instructions:

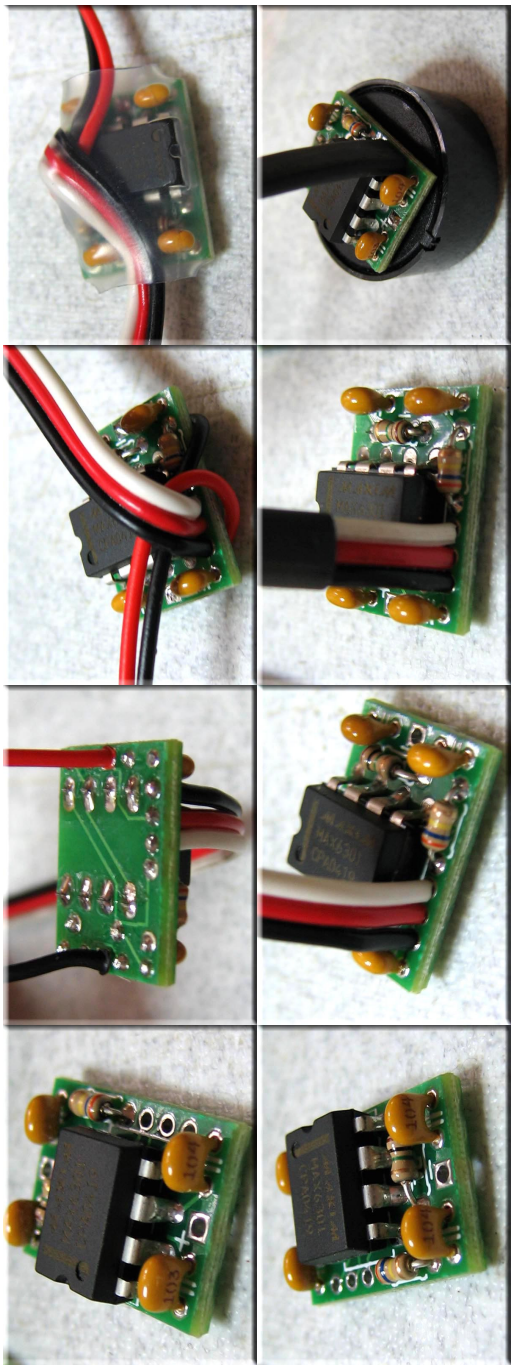
The buzzer on your ***V SENTRY*** is best located over a small hole on the side of your plane's fuselage opposite the muffler, or pointing towards the tail for helicopters. Use hot glue, or double-sided tape for a less-permanent attachment.

Plug your ***V SENTRY*** into an extra channel on your receiver or use a Y-connector if you don't have a spare channel (it can share a channel with a servo), making sure that the plug orientation is correct. Turn on your transmitter, then your receiver. Turning off your transmitter will cause the ***V SENTRY*** to emit a **pulsed tone**, helping you find your lost plane, or notifying you that you've forgotten to turn off the receiver power. If the receiver battery voltage drops below **4.6v** (four cell version) or **5.7v** (five cell version) the ***V SENTRY*** will emit a **continuous tone**.

Note: If the voltage drops below **4.6v** momentarily then you will only hear a short chirp – this may happen if several servos move at one time. If your ***V SENTRY*** starts to chirp then you're probably safe for another **10-30 minutes**. If you get a continuous tone with little or no servo movement then you should seriously consider replacing your receiver battery. **All systems are different** (battery size, number of servos, etc…) so

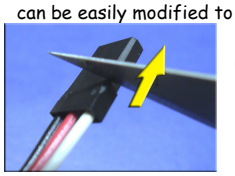
you should test yours with your ***V SENTRY*** to see how much safe flying time you have left, and when you really need to replace your battery.

Attention: Some receivers have the ability to move servos to a preset position when the transmitter signal is lost, like Futaba's "**FailSafe**" system. If your receiver has this type of feature enabled, then the ***V SENTRY*** will not sound when you turn your transmitter off. This isn't an issue for most people.



Modifying Connector Housings:

This product contains a standard receiver connector with a rectangular end (no keys or bevels to denote orientation). Some receivers only accept "universal" type connectors with beveled edges. The included connector housing can be easily modified to fit these receivers.



Simply take a sharp hobby knife and hold the blade perpendicular to one edge of the housing. Then scrape outwards, taking off layer by layer until the bevel is deep enough to fit your receiver. Do this to both of the bottom edges on the housing.

If you have any questions or comments about this kit please email chris@hansenhobbies.com.