

## FEATURES

- Loud 102dB @2' beeper allows over 100m range to help locate lost aircraft
- Standalone module functions independent of crashed A/C
- Self contained LiPo 2S 180mAh battery for over 24 hours of beeping
- Battery status monitor beeps on power up
- Shutdown below 20% battery capacity
- Beeper triggered from programmed delay timeout or spare receiver channel
- User programmed delay in multiples of 20 minutes up to 24 hours
- Programmable delay using spare receiver channel
- 1 second on, 10 seconds off beeper duty cycle to prolong battery life
- Standard JST/Molex connector for LiPo battery charging
- Use same beacon in different aircraft
- Conformally coated electronics
- 30g, 1.6"L 1.6"H 1.1"W

## DESCRIPTION

The E2452 is a standalone lost RC aircraft beacon module which produces a loud beeping sound after a programmed time delay has elapsed or when triggered from a spare receiver channel. The programmed time delay varies between 1 to 72 times 20 minutes after being powered. This allows aircraft to be flown for regular flights before being reset unless the aircraft does not return in time such as due to a crash. Alternatively, the beeper can be enabled using a spare receiver channel prior to the time delay elapsing. Unlike other lost aircraft beepers, the E2452 module does not depend on a possibly non-functional receiver to power

the beeper after a crash. The E2452 module instead uses a self-contained battery to sound a beeper for 1 second on and 10 seconds off to prolong battery life for over 24 hours while a search is in progress. A battery monitor beeps between one and five times to indicate battery strength. The modular form also minimizes the chance for damage after a crash. The beeper is very loud thus increasing the chances of recovering an aircraft in dense bush. The module can be attached and transferred to any aircraft.

## APPLICATIONS

- Helps locate lost R/C aircraft

**Table 1. Electrical Characteristics**Test Conditions: Supply Voltage  $V_{dd} = +8.4V$ ,  $T_{ambient} = 25^{\circ}C$ , unless otherwise specified

Symbol	Parameter	Min.	Typ.	Max.	Unit
$V_{dd}$	Supply voltage	7.4		8.4	V
$I_{avg}$	Average supply current beeper on		4.6		mA
$I_{shd}$	Average supply current after shutdown		0.13		mA
$V_{shd}$	Shutdown voltage at 20% capacity		7.28		V
$T_{thrh}$	Receiver channel switch or stick high threshold	1.55			msec
$T_{thrl}$	Receiver channel switch or stick low threshold			1.45	msec
$T_{operate}$	Operating temperature	-10		+30	$^{\circ}C$
$T_{delay}$	Delay time from power on	20		1440 (24 hrs)	minutes
$T_{duty}$	Duty cycle		~1/11		sec/sec
$T_{duration}$	Beeper cycle duration once triggered after 20 minutes		~24		Hrs
SPL	Beeper sound intensity @10cm		104		dBA
$R_{open}$	Open field range, sound port up		~100		meters

**General Precautions**

The beeper is very loud up close! Place a piece of tape over the beeper opening during testing.

Charged devices and circuit boards can discharge without warning. Proper ESD precautions should be followed to avoid failure.

This device is not authorized for use in any product where the failure or malfunction of the product can reasonably be expected to cause failure in a life support system or to significantly affect its operation.

Locus Engineering Inc. reserves the right to make changes at any time without notice to improve product features or reliability.

Information is provided by Locus Engineering Inc. with the best of intentions without any warranty expressed or implied. As such Locus Engineering Inc. disclaims all liabilities or responsibilities for any use of the information, any inaccuracies or fitness for a particular purpose.

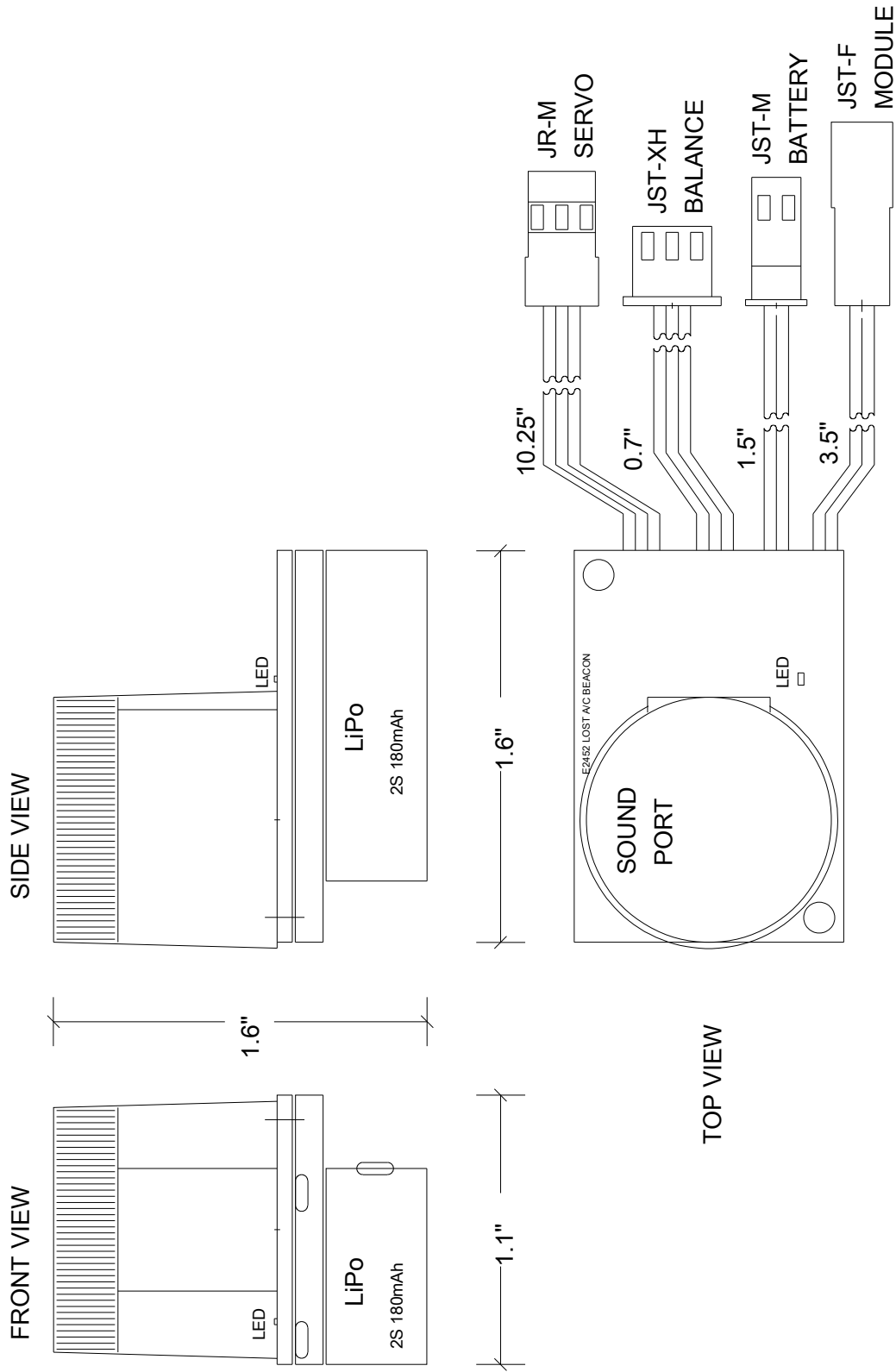


Figure 1. Module Dimensions

## Installation

The module should be placed with the beeper port exposed outside the aircraft, either facing upwards or backwards. This increases the chances of the beeper facing skyward or towards the searcher in the event of a crash so it can be heard from the greatest distance. The module may be attached using VELCRO® Brand hook and loop tape or equivalent, #4 or 3mm screws, or tie-wrapped. The module should be placed away from sharp corners so the battery won't be punctured in the event of a crash. Using hook and loop tape allows the module to be removed for charging or placed in another aircraft. If the module is fixed to the aircraft, an extension cable may be necessary to charge the battery.

## Battery Status

The E2452 includes a 2S 7.4V 180mAh LiPo battery. The battery should be charged before use. Turn the module on by connected the battery JST connector to the module JST connector.

The module first does a low battery capacity check and if detected will shut itself off to protect the battery from further discharge. If the battery is below 20% capacity (<7.42V, the module will flash the onboard led rapidly for several seconds followed by entry into a low power shutdown mode to protect the battery from further discharge. Note that there remains a minuscule current being drawn from the battery in shutdown mode.

Following the low battery capacity check, the module will beep between one (60%) and five(100%) times to indicate the battery capacity.

**Table 2. Battery Capacity vs. Beep Count**

Battery Capacity (%)	Battery Voltage (V)	Beep Count
100	8.40	5
90	8.26	4
80	8.12	3
70	7.98	2
60	7.84	1

If the module does not beep on power up, the battery needs recharging as it is between 50% and 20% capacity, and should not be relied on to perform its lost aircraft beacon function.

The battery should be recharged prior to the flying day for maximum beeper endurance in the event of a lost aircraft. The module beeper time will typically run for 24 hours.

The beeper will continue to sound until the battery reaches the 20% capacity point or until the aircraft is found and the module turned off. Note that cold winter temperatures will reduce the capacity of the battery.

## Program & Run Modes

After the battery capacity indication, the module will check for either program or run mode. If the delay count needs to be changed, connect a spare receiver channel to the JR connector, and set the associated switch or stick high. If the channel state is high (corresponding to a pulse width  $>1.55\text{msec}$ ) for more than three seconds, the onboard LED will light indicating program mode. If the channel state is low ( $<1.45\text{msec}$ ) or not connected, the module goes to run mode. Once in program mode, cycle the switch or stick to low then high for each delay increment. Both the LED and beeper will quickly flash and beep for every delay increment. The total delay equals 20 minutes times the delay count for up to 72 counts or 24 hours. When done, leave the switch or stick inactive for three seconds at which point the delay count is played back using the LED. The programmed delay will be saved in memory until the program mode is entered into again. Set the switch or stick back to low, otherwise the module will be triggered to beep immediately.

## Delay Count Playback

The delay count playback is simplified by playing back the tens count as  $1/2$  second flashes, and the units count as  $1/10$  second flashes. Thus for a delay count of 15 corresponding to  $15 \times 20 = 300$  minutes, the LED will flash once for  $1/2$  second, then five short  $1/10$  second flashes.

Set the delay according to the type of flying expected. Most flying times are less than 20 minutes, so the factory default setting of 20 minutes is sufficient. For longer flights such as gliders that may stay up for hours, set the delay period accordingly. Keep in mind that if the delay period is several hours and the aircraft disappears soon after takeoff, the beacon won't be heard unless activated by a connected receiver channel.

## Timeout & Servo Triggering

After the delay count playback, the module will start the delay, and at the end of the delay period will sound the beeper for a one second period followed by a ten second off period. The module can also be triggered by a spare receiver channel up to the end of the timeout period. Once the timeout period has ended, the beeper will continue to cycle on and off independent of the servo channel state. After each flight the module should be disconnected from its battery to reset the delay otherwise the beeper may sound in flight.

## Additional Notes

Note that the beeper is very loud up close; cover the beeper opening with tape when testing. If the module gets wet, disconnect the battery to prevent electro-chemical corrosion. Ensure module is dry before reconnecting the battery.

### Quick Procedure

1. Ensure module battery is charged prior to flight.
2. Place module in aircraft, and program delay count if necessary.
3. Prior to launch, connect module battery, check for battery state and delay count.
4. Launch aircraft.
5. On aircraft return, disconnect module battery.
6. Remember to reconnect the module battery for the next flight
7. On aircraft loss, start listening for beacon beeps once the timeout period has ended.
8. At end of day ensure module battery is unplugged.

### Battery Charging

The battery is a 2S (7.4V) 180mAh LiPo type with JST type connector for the discharge and a JST-XH connector for the balance charge. The battery should be charged at a 180mA rate using a LiPo charger prior to the day's flight. Note that a fully charged battery with 100% capacity will measure 8.4V and a 30% capacity remaining battery will measure 7.4V. Disconnect the module to turn it off when not in use otherwise it will beep after the timeout completes. It is possible that the battery may have discharged below 3.3V per cell, i.e. 6.6V total if the beeper has been on too long by the time the aircraft is found. Depending on the state of discharge, the battery may or may not be recoverable. Replacement batteries are not expensive and are recommended in the case of deep discharge. To change the battery, cut the heatshrink lengthwise on one side, open it and replace the battery with a similar one. Keep the battery clear of the mounting holes and with the label showing. The heatshrink can be taped afterwards to secure the module.

### Expected Range

The beeper used in the E2452 has a very high sound output of 104dBA @10cm. Sound is typically measured in decibels or dBs which is the logarithm of the ratio of the measured quantity to a reference. There is a 6dB decrease in sound intensity for every doubling of the distance between the beeper and the listener. Put another way, there is a 20dB decrease for every 10x the distance between the beeper and the listener. The effective distance of the beeper is when the sound pressure level reaches 5dB above the background noise. Wind, vehicle traffic, etc. all contribute to the background noise. If the aircraft has landed in dense bush or snow, the sound will also be reduced due to blockages and absorption. The direction of the sound port will also affect the effective range. In short, distance, background noise, obstructions, and the sound port direction will limit the listening distance, but on a quiet day the beacon can be heard from about 100 meters.

There is normally some idea of the area and direction an aircraft has crashed in, so walking in that direction will usually bring the searcher within range of the beeper. A useful exercise is to test the beeper by turning it on and walking away to get an idea of what it sounds like and the expected range.