

# A3 MINI

## User Manual

Revision 2023-06-14



Thank you for purchasing our products. A3 Mini is a high-performance and functional 6-axis mini gyro system designed for R/C airplanes. The smaller size and more compact design make it more suitable for the small electric airplanes. With the new feature of multi-protocol serial receiver support, it could be compatible with most single line mini receivers on the market. In order for you to make the best use of your gyro and to fly safely, please read this manual carefully and set up the device as described below.

## IMPORTANT NOTES



Radio controlled (R/C) models are not toys! The propellers rotate at high speed and pose potential risk. They may cause severe injury due to improper usage. It is necessary to observe common safety rules for R/C models and the local law. Read the following instructions thoroughly before the first use of your gyros and setup the gyro carefully according to this manual. We also recommend that you seek the assistance of an experienced pilot before attempting to fly with our gyros for the first time.



After power on, A3 Mini needs to perform an accurate gyroscope calibration, keep the airplane stationary after power on and wait while the LED flashes blue. The LED will stay solid blue if a slight movement is detected and the calibration will not start until you stop moving the airplane, however, making the airplane level is NOT required during the initialization.



A stick centering is also required following the gyroscope calibration. Always put all the sticks center (the throttle stick in the lowest position) before power on the airplane, and do not move the sticks until the initialization is done. The stick centering only applies to *Aileron*, *Elevator*, *Rudder*, *Aileron 2* and *Throttle* channels.



Make sure to check the gyro direction of *Aileron*, *Elevator* and *Rudder* after installation and always perform a test of them before each flight. An opposite reaction of the gyro could lead to losing control or even crash!

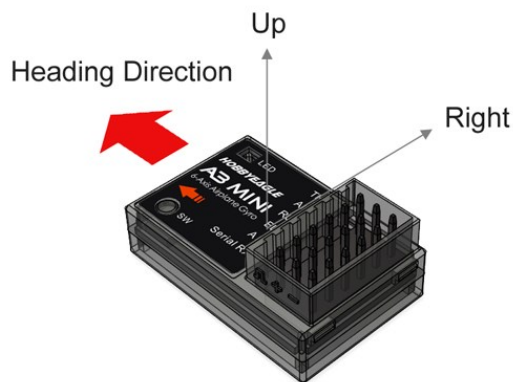
# INSTALLATION

## ⚠ NOTES

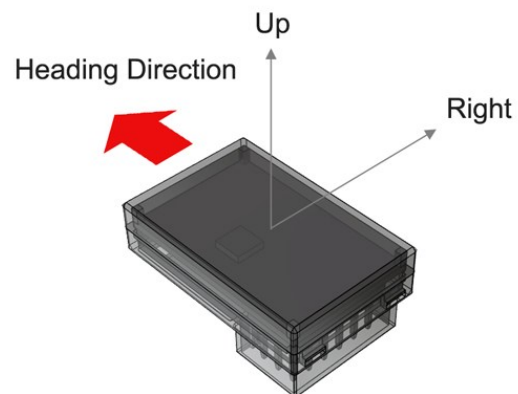
- Never use the hot-melt glue or nylon ties to fix the gyro onto the airplane!
- You need only one piece of the double-sided tapes each time, a mounting type that is too soft or too thick can affect performance of the gyro.
- The gyro is a sensing device, please make enough space around it and keep as far away from other electronic devices or wires as possible.

## MOUNTING ORIENTATION

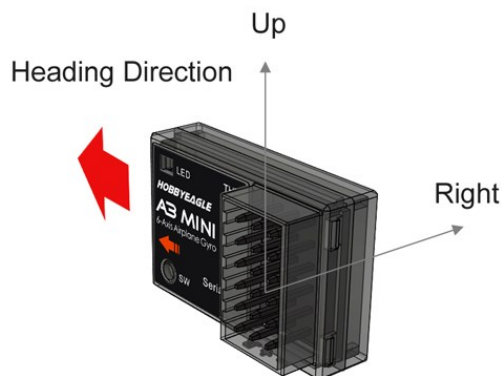
Use one of the supplied double-sided tapes to attach the gyro to the airplane firmly. For best performance, the gyro should be mounted as close to the C.G. as possible, and the housing edges must be aligned exactly parallel to all three rotation axes of the airplane. The gyro can be attached flat or upright, and even upside down, however, you must ensure the arrow on the sticker always point to the heading direction, otherwise the gyro will not work normally in *ANGLE*, *LEVEL* and *HOVER* modes.



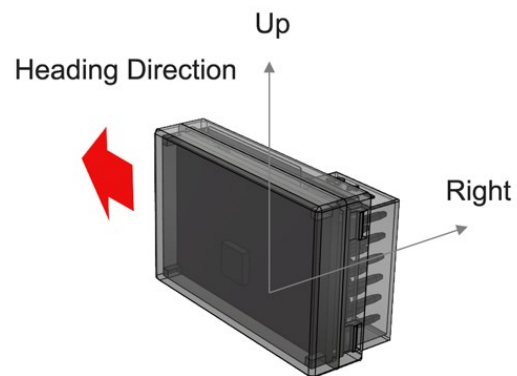
① Flat, face up



② Flat, face down



③ Upright, button down



④ Upright Inverted, button up

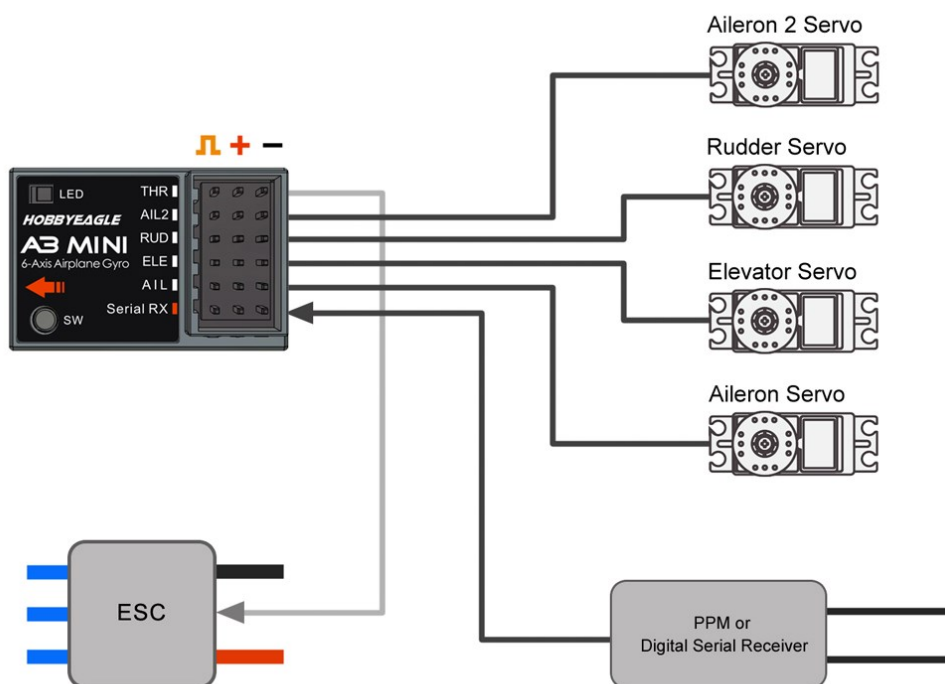
# CONNECTION

## RECEIVER CONNECTION

A3 Mini supports PPM and multi-protocol digital serial receivers which allows you to connect the receiver to the gyro with one single wire on the slot [Serial RX]. When operating in single-line mode, the gyro uses the preset channel assignment to recognize the channels from the receiver. Please check if the current channel mapping matches the channel order of your transmitter via the configurator or programming card. After each time you have changed the receiver type, you can choose either to reset the channels, or to keep existing settings. Choose “None” for those channels you do not use.

**Table 1: Serial Receiver Protocols Supported and Default Channel Assignment**

Serial Protocol Supported	AIL	ELE	RUD	AIL2	MODE	GAIN	THR
PPM Receiver	CH1	CH2	CH4	CH6	CH5	None	CH3
SBus - Futaba/WFLY WBus	CH1	CH2	CH4	CH6	CH5	None	CH3
SBus - FrSky/RadioLink/JETI/TBS	CH1	CH2	CH4	CH6	CH5	None	CH3
Spektrum DSM2/X 1024 Satellite	CH2	CH3	CH4	CH6	CH5	None	CH1
Spektrum DSM2/X 2048 Satellite	CH2	CH3	CH4	CH6	CH5	None	CH1
Spektrum SRXL	CH2	CH3	CH4	CH6	CH5	None	CH1
Multiplex SRXL/JR XBUS Mode B	CH2	CH3	CH4	CH6	CH5	None	CH1
Graupner SUMD	CH2	CH3	CH4	CH6	CH5	None	CH1
FlySky iBUS	CH1	CH2	CH4	CH6	CH5	None	CH3
JETI EXBus (F/W V1.2 or later required)	CH2	CH4	CH5	CH3	CH6	None	CH1
TBS/ELRS CRSF (F/W V1.6 required)	CH1	CH2	CH4	CH6	CH5	None	CH3



## ! NOTES

- Please note that the *GAIN* channel is disabled by default. To enable the remote master gain, you need to specify a channel number for it via the configurator or the programming card.
- Pay attention to the polarity of the plugs. The orange or white signal line must always be on the inner side of the gyro.
- A special optional adapter or converter is required if you want to use a Spektrum satellite (remote) receiver or a SRXL2 remote receiver.

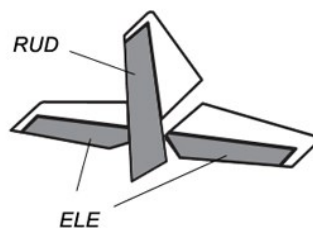
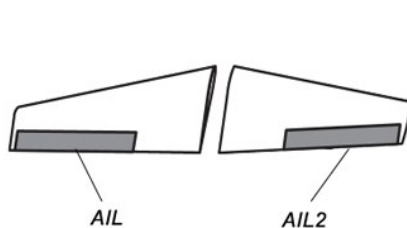
## ? About Failsafe

- **Receiver Failsafe** Most receivers will enter Failsafe mode in case of signal loss from the transmitter. In such conditions the gyro will benefit from the native Failsafe/Hold functions of the receiver. Always ensure that the Failsafe settings are properly set in the transmitter.
- **Gyro Failsafe** The gyro also provides the gyro-level Failsafe function when the connection fails from the receiver. When the function is activated, the LED will keep flashing Red slowly and all servos will move to their initial positions at startup, including the *THR* channel, gyro will switch to *Normal* mode automatically and remote master gain will be disabled.

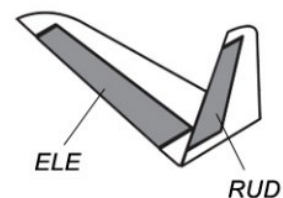
## WING TYPE AND SERVO CONNECTION

A3 Mini supports Standard Fixed-wing, Flying-wing (Delta-wing) and V-Tail. **Always turn off the mixing function of delta-wing or v-tail in the transmitter because the gyro will provide such mixing features by itself.** Check the *Servo Monitor* of the transmitter and verify that each stick controls only one channel.

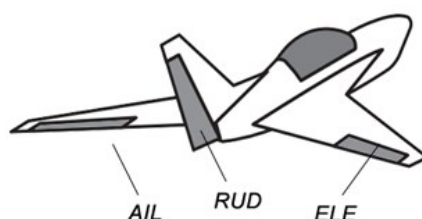
Standard Fixed-wing



V-tail



Flying-wing (Delta)



## ? Single / Dual Aileron Control

- The gyro works in single aileron control mode when there is only one aileron input connected. Both output channels of *A/L* and *A/L2* issue the same signal for the aileron servos, just like what a Y-extended lead works.
- The gyro works in dual aileron control mode if both aileron inputs are connected, in this mode, output channels of *A/L* and *A/L2* are operated separately.

## FLIGHT MODES

A3 Mini provides 6 flight modes which can be switched by using a 3-position switch of the transmitter during flight. The expected flight mode associated to each position of the switch can be specified via the configurator or the programming card. The default setting is **OFF - NORMAL – LEVEL**. The color of the LED shows the current flight mode of the gyro while in use.

**Table 2: LED Colors of Flight Mode**

	Solid Red	GYRO OFF Mode
	Solid Blue	NORMAL Mode
	Blue, Flashing	LOCK Mode
	Solid Violet	ANGLE Mode
	Violet, Flashing	LEVEL Mode
	Violet, Fast Flashing	HOVER Mode

### 1. GYRO OFF MODE

When operating in *GYRO OFF* mode the gyro will be deactivated completely, and the airplane will be completely under the control of your transmitter as it was before installing the gyro. This mode is usually used for testing purpose only.

### 2. NORMAL MODE

The *NORMAL* mode, also known as the '*Rate mode*', is the most basic function of the gyro. It works based on the rotation rate control of each axis of the airplane. When operating in this mode, the gyro will only correct currently occurring rotational movements, a momentary reaction will be applied to the servos when the airplane rotating on corresponding axis, the servos will move back to their neutral position as soon as the airplane stops rotating. The *NORMAL* mode can be used with nearly any size and type of airplanes. It can effectively improve the stability and precision of the airplane and reduce the stall point specially.

### 3. LOCK MODE

The *LOCK* mode is also known as the '*Attitude Lock mode*', '*3D mode*' or '*AVCS mode*'. Different from *NORMAL* mode, the gyro will perform a permanent correction for rotational movements on each axis constantly. That is when you release the sticks the airplane will stop and lock its current position immediately. This mode is well suited for practicing basic 3D maneuvers such as hovering or knife edge. Since it can help you to lock the attitude of the airplane, it is also helpful for landing.

### 4. ANGLE MODE (FORMER TRAINER MODE)

The *ANGLE* mode, also known as the '*Trainer mode*' or '*Attitude mode*', will limit the maximum angle of the airplane on both roll and pitch axes. Roll and loop are not allowed in this mode, the airplane will be stabilized all the time, independent of any stick input. This prevents the airplane from being tilted into a larger angle that may cause a danger. As soon as the sticks are released, the airplane will be brought back to horizontal position automatically. You can use this mode as emergency rescue, or in other applications, e.g., to have a training for new beginners or to use for FPV. The maximum allowed angle of this mode can be specified via the configurator or programming card.

### 5. LEVEL MODE

The *LEVEL* mode is also known as the '*Auto-Level mode*', '*Auto-Balance mode*' or '*Horizon mode*'. When operating in this mode, the airplane will be brought to horizontal position automatically when releasing the sticks. Different from the *ANGLE* mode, there is no maximum angle limitation in this mode and the airplane will be stabilized only when there is no specific control input from aileron and elevator sticks. This mode can be used if the pilot becomes disoriented and would like to save the airplane from crashing.

### 6. HOVER MODE

The *HOVER* mode, also known as the '*Auto-Hover mode*', provides the same functionality as the *LEVEL* mode. The only difference is that when you release the sticks, the airplane will be brought to vertical position (nose up) and keeps hovering. This mode is designed to help you to learn hovering maneuver and reduce the probability of crashing.

## GAIN ADJUSTMENT

### BASIC GAIN

A3 Mini provides separate adjustment of basic gain on aileron, elevator and rudder. Basic gain determines the reaction strength of the gyro. In general, the higher the gain the harder the airplane will stop after rotation and the more stable and precise the airplane will fly. But if the gain is too high the airplane will tend to oscillate at high frequency on the corresponding axis. If too small, the operation and stability will not be so good, and the airplane does not stop precisely and overshoots. The gyro will be deactivated completely if you set the basic gain to 0%.

For the first flight test it is recommended to start with a lower basic gain setting (e.g., 30%) and switch

the gyro to *NORMAL* mode. In case the airplane starts to oscillate then reduce the gain of the corresponding axis. If the control feels weak and imprecise and does not hold position when stopping then increase the gain, according to this approach, fine tune the basic gain until you get the best performance.

## MODE GAIN

Furthermore, the gyro gain of each axis can also be adjusted separately for each flight mode, including *Lock Gain*, *Angle Gain*, *Level Gain* and *Hover Gain*, these gains are normally used after the basic gain has been properly set and will only work with the corresponding flight mode.

## REMOTE MASTER GAIN

The remote master gain is used to change the basic gain of aileron, elevator and rudder at the same time in flight. By using a slide lever on the transmitter, the rate of the gain can be decreased linearly from 100% to 0%, you can also use a 3-position switch to get a 3 rates selection of the gain. Remote master gain will always default to 100% if you do not connect this channel.

## GYRO DIRECTION

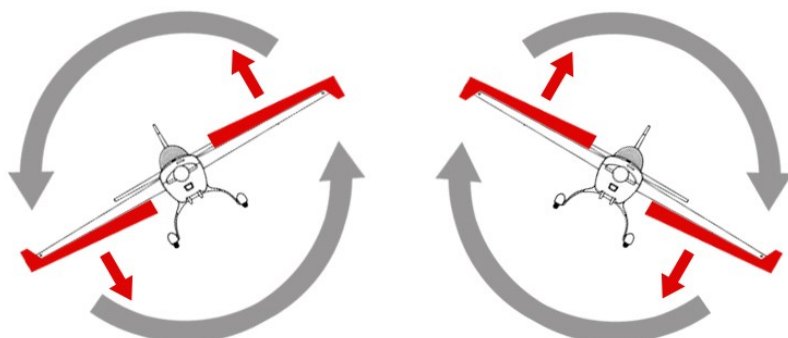
After installation, lift the airplane up and make it quickly rotate around the roll, pitch and yaw axes respectively. Make sure all the control surfaces react in the correct directions referring to the figures below.

### **VERY IMPORTANT!**

It is extremely important to make sure that the gyro reacts in the correct direction for each channel before flight. An opposite reaction of the gyro could lead to losing control or even crash!

### Check the gyro direction for Aileron

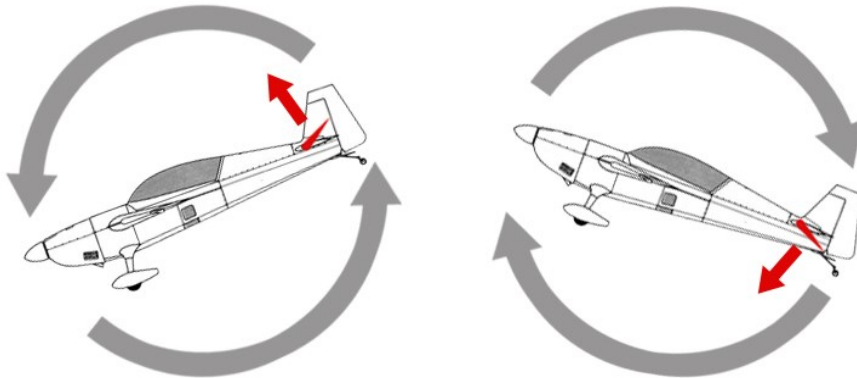
Quickly rotate the airplane left or right around the roll axis, the ailerons should react in the expected directions as shown below.





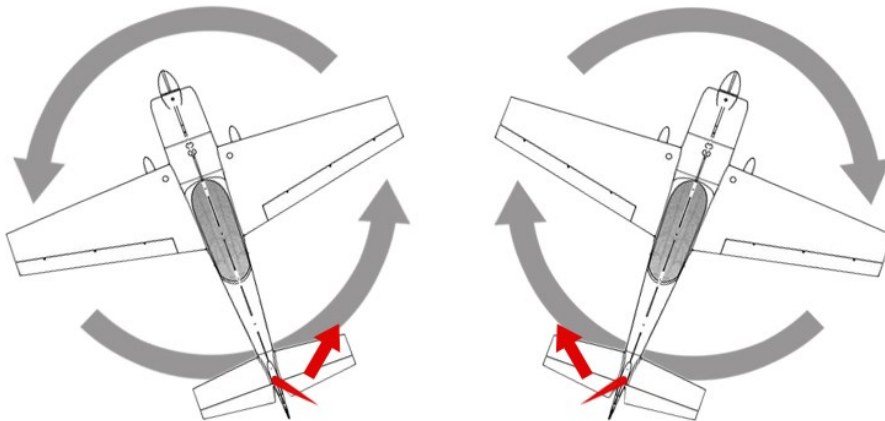
## Check the gyro direction for Elevator

Quickly rotate the airplane up or down around the pitch axis, the elevator should react in the expected direction as shown below.



## Check the gyro direction for Rudder

Quickly rotate the airplane left or right around the yaw axis, the rudder should react in the expected direction as shown below.



## QUICK GYRO REVERSING

A3 Mini also provides you a quick approach to reverse the gyro direction without connecting it to a PC or a programming card. For example, to reverse the gyro direction of Aileron, press and hold the button while moving and holding the Aileron stick right or left for about 2 seconds, release both the button and the stick when the LED flashes White once, indicating that the gyro direction of Aileron has been reversed and saved. Similarly, move the Elevator stick up or down for Elevator channel and move the Rudder stick right or left for Rudder channel while long pressing the button until the LED starts to flash White once.

# LEVEL AND HOVER CALIBRATION

When flying in *ANGLE* mode or *LEVEL* mode, gyro needs to know the angle of the airplane in both roll and pitch directions, this is achieved by calculating the attitude of its own. A small angle deviation caused by installation can lead to an unexpected behavior when flying in *ANGLE* mode or *LEVEL* mode. For this reason, a level calibration is recommended to offset the error caused by installation and to establish a proper level reference of the airplane after installing the gyro.

## Step 1

Before calibrating, the airplane should be placed on the horizontal ground and make the wing parallel to the ground. Make the airplane slightly nose-up because a certain elevation angle is usually required to maintain level flight for most airplanes.

## Step 2

Click the *Level Calibration* button on the *Sensor* tab of the configurator to start the calibration. The whole calibration process will take you several seconds and the LED will blink blue rapidly during calibrating. Do not move the airplane until the calibration is done.

## Step 3

After a successful calibration, the result will be saved and displayed on the screen, you can adjust them manually in the future. If you get a rapid red blinking during calibration, this means the result exceeds the maximum permissible value (i.e.  $\pm 25\text{deg}$ ), in this case, you have to re-install the gyro to reduce the deviation caused by installation.

As a same reason, a hover calibration is recommended to perform after installation if you want to fly with *HOVER* mode. The procedure is quite similar to that of level calibration. The only difference is that the airplane should be lifted vertically to the ground instead of putting it on the ground in Step 1.

## QUICK CALIBRATION

After finishing the first step, you can also perform the calibration using the button without connecting the gyro to a PC or a programming card.

- To start the level calibration, press and hold the button for about 2 seconds, release the button once the LED turns solid White.
- To start the hover calibration, press and hold the button more than 4 seconds until the LED starts to flash White continuously.

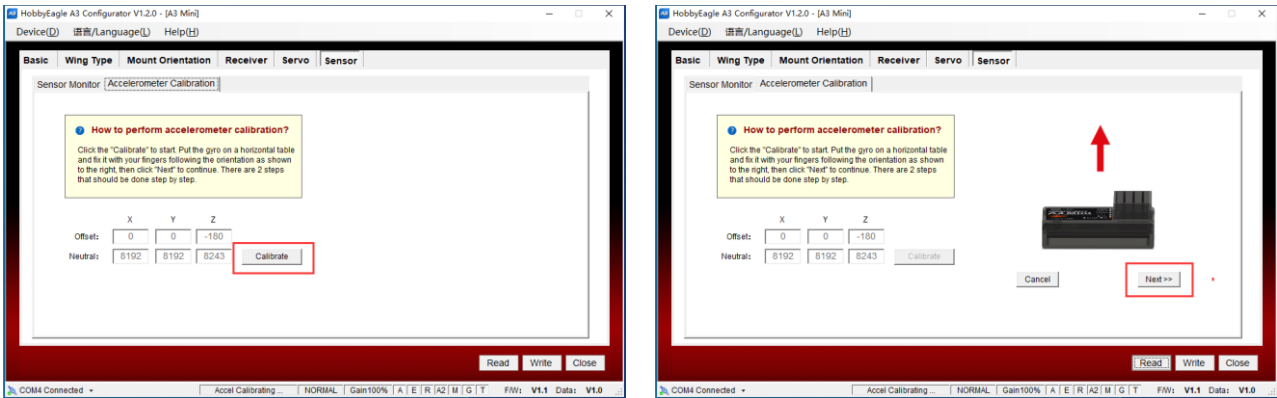
# ACCELEROMETER CALIBRATION

Each gyro has been carefully tested and calibrated before leaving the factory. Usually, you do not need to perform a calibration for the accelerometer again. However, in some specific cases, we would suggest you re-calibrate the accelerometer to obtain better performance, these include temperature changes those will probably cause the mechanical characteristics changes of the sensor, or replacement of a new sensor, etc. The calibration should be done on a horizontal desktop and the gyro needs to be removed from the airplane first.

## Calibration Procedure

Connect the gyro to the PC and wait until the initialization is done. Open the configurator and go to the *Sensor* -> *Accelerometer Calibration* tab, click the *Calibrate* button. Follow the prompts and complete the

next 2 steps corresponding to both side of Z axis of the unit, do not move the gyro while calibrating at each step.



## OTHER SETTINGS

### STICK DEADBAND

The stick dead band is the range around the very center of the sticks at where the gyro will not react. Some transmitters have the problem that when the sticks are brought back after an input, they are not exactly at the same center position as before which may generate a deviation on the corresponding function, in this condition, you can increase the setting of stick dead band to fix it. The adjustment range of the dead band is 0% to 20%, the default 5% is fit for most radios without modification.

### SERVO FREQUENCY

Set the working frequency for the servos. The analog servos can only work with 50Hz, a high frequency may cause damage of the servos. Check the servo specifications before increasing the setting, if you don't know what the maximum update rate that is tolerated by your servos never use more than 50Hz. In theory, the higher the working frequency of the servos the better performance of the gyro can be obtained, but it may increase the power consumption and cause heating of the servos. This setting will affect all output channels including *THR*.

### GAIN LEVEL

Change the level of the basic gain, the default "Medium" is fit for most airplanes.

### CONTROL BEHAVIOR

After installing the gyro, the airplane will become more stable but less responsive because of the correction of the gyro. To improve we need to reduce the correction strength of the gyro on the desired direction dynamically when there is an input of the sticks. This function allows you to change the control behavior by choosing different curves of the gain attenuation.

# PROGRAMMING

To setup the gyro, download and install the latest *HobbyEagle A3 Configurator* and the *USB driver* from our website at <https://www.hobbyeagle.com/a3-configurator/>



- The software supports Windows XP, Windows 7, Windows 8 and Windows 10 (32 or 64 bit).
- If the installation fails, please download and install *Microsoft .NET Framework 4* first.
- Install the USB driver (CP210X\_VCP) before connecting the gyro to the PC.

## Related Documents

*Installation Guide*

[https://www.hobbyeagle.com/a3-configurator/docs/installation\\_guide\\_en.pdf](https://www.hobbyeagle.com/a3-configurator/docs/installation_guide_en.pdf)

*USB Driver Installation Guide*

[https://www.hobbyeagle.com/a3-configurator/docs/usb\\_installation\\_guide\\_en.pdf](https://www.hobbyeagle.com/a3-configurator/docs/usb_installation_guide_en.pdf)

*Quick Start Guide*

[https://www.hobbyeagle.com/a3-configurator/docs/quick\\_start\\_guide\\_en.pdf](https://www.hobbyeagle.com/a3-configurator/docs/quick_start_guide_en.pdf)

*Firmware Update Guide*

[https://www.hobbyeagle.com/a3-configurator/docs/firmware\\_update\\_guide\\_en.pdf](https://www.hobbyeagle.com/a3-configurator/docs/firmware_update_guide_en.pdf)



## VERY IMPORTANT!

- **ALWAYS** use the special USB adapter and data cable included in the package while connecting the gyro to a PC or the programming card. The common USB cables for mobile phones or other products will not work with our gyros!
- It is recommended to use the new *Program Card X* for A3 Mini and keep the firmware update to the latest version.

# SPECIFICATIONS

<b>Main Controller:</b>	32-bit MCU
<b>Sensors:</b>	High-precision 3-axis gyroscope and 3-axis accelerometer
<b>Gyroscope Scale Range:</b>	± 2000dps
<b>Accelerometer Scale Range:</b>	± 4g
<b>PWM:</b>	800 ~ 2220uS, Neutral 1500/1520uS, 50Hz ~ 333Hz
<b>Input Voltage:</b>	DC 3.6V ~ 8.4V
<b>Operating Temperature:</b>	-10°C ~ 50°C
<b>Size:</b>	30 × 19.5 × 7.5mm
<b>Weight:</b>	4.8g (excluding wires)