

# A3 SUPER 4

## User Manual

V1.1 Apr, 2022 Revision



Thank you for purchasing our products. A3 Super 4 is a high-performance and functional 6-axis gyro and stabilizer designed for R/C airplanes. For you to make the best use of the gyro and to fly safely, please read this instruction 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, the gyro 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 *Elevator 2* 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!



It is recommended to use the supplied 3300uF/16V capacitor to get a more stable and secure working voltage after installing the gyro. The capacitor can be plugged onto any one of the free connectors of the gyro or the receiver.

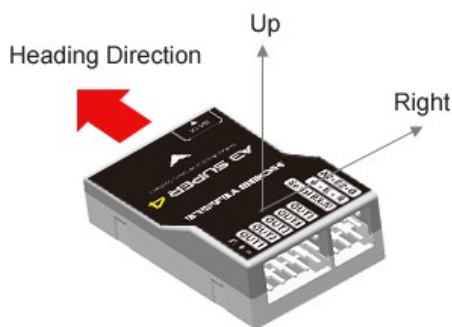
# INSTALLATION

## ⚠ NOTES

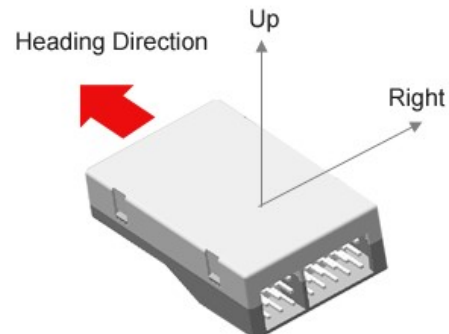
- Never use the hot-melt glue or nylon ties to fix the gyro onto the airplane!
- You need only one piece of the double-sided tapes each time, a mounting type that is too soft or too thick can affect performance of the gyro.
- The gyro is a sensing device, please make enough space around the gyro and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

## MOUNTING ORIENTATION

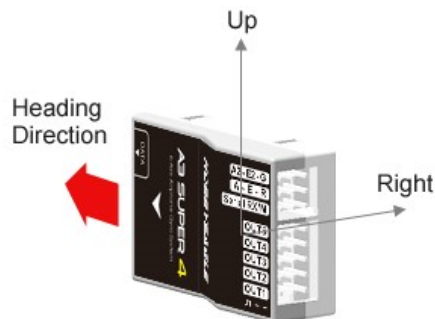
Use one of the supplied double-sided tapes to attach the gyro to the airplane firmly. For best performance, the gyro should be mounted as close to the C.G. as possible, and the housing edges must be aligned exactly parallel to all three rotation axes of the airplane. The gyro can be attached flat or 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.



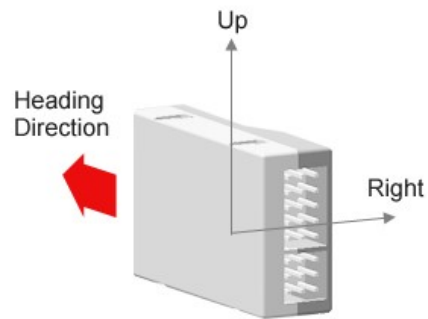
① Flat, face up



② Flat, face down



③ Upright, [DATA] up



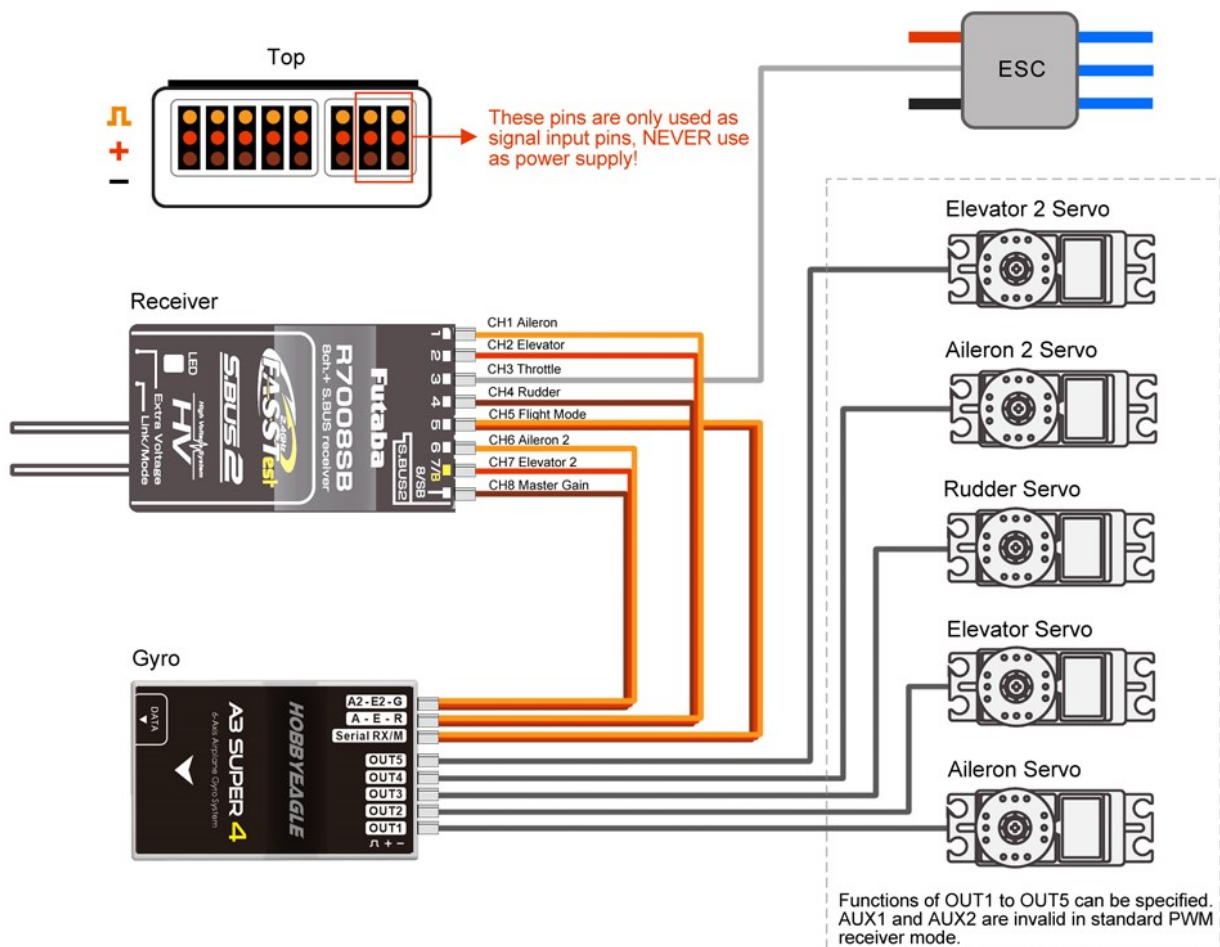
④ Upright Inverted, [DATA] down

# RECEIVER CONNECTION

## STANDARD PWM RECEIVER

When using a standard PWM receiver, A3S4 has 7 input channels in which at least one channel should be connected to the receiver in *Aileron (A)*, *Elevator (E)* and *Rudder (R)*, or the gyro will enter the receiver timeout mode (Red Slow Flashing). The descriptions of input channels are shown in the following table.

A	E	R	A2	E2	G	Serial RX/M
AIL	ELE	RUD	AIL2	ELE2	Remote Master Gain	Serial RX Input / Flight Mode



### NOTES

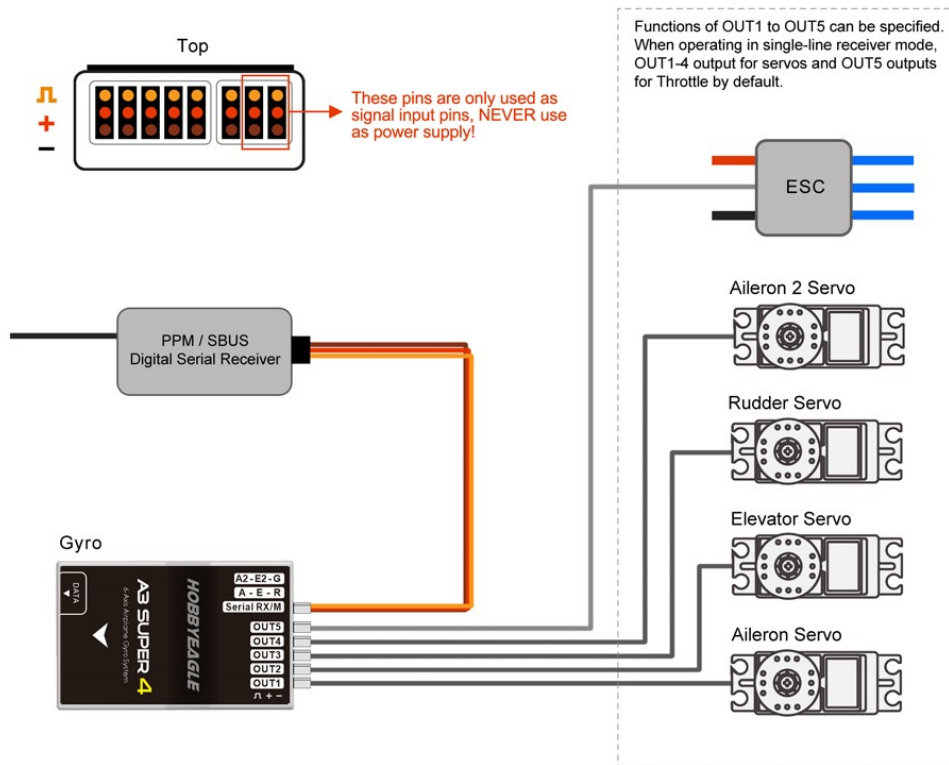
- [Serial RX/M] is used for flight mode switching, use a 3-position switch of the transmitter to switch the flight mode during flight.
- [G] is used for remote master gain control, a slide lever or a switch of the transmitter can be used to tune or change the master gain during flight.
- Connect the ESC or the throttle servo to the receiver directly without passing through the gyro.
- Pins on slot [A-E-R] and [A2-E2-G] are only used as signal input pins, NEVER connect a power source on these pins.
- Pay attention to the polarity of the plugs. The orange signal line must always be on the top and the brown on the bottom.

# SINGLE-LINE RECEIVER

A3S4 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/M]. When using single-line receivers, 2 auxiliary pass-through channels (AUX1 and AUX2) are available which can be used to output the expected channels of the receiver directly. By default, AUX1 is always assigned to Throttle and applies to OUT5, while AUX2 is disabled. 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	ELE2	MODE	GAIN	AUX1	AUX2
PPM Receiver	CH1	CH2	CH4	CH6	None	CH5	None	CH3	None
Futaba S.Bus / WFLY WBus	CH1	CH2	CH4	CH6	None	CH5	None	CH3	None
FrSky / RadioLink / JETI SBus	CH1	CH2	CH4	CH6	None	CH5	None	CH3	None
Spektrum DSM2/X 1024 Satellite	CH2	CH3	CH4	CH6	None	CH5	None	CH1	None
Spektrum DSM2/X 2048 Satellite	CH2	CH3	CH4	CH6	None	CH5	None	CH1	None
Spektrum SRXL	CH2	CH3	CH4	CH6	None	CH5	None	CH1	None
Multiplex SRXL/JR XBUS Mode B	CH2	CH3	CH4	CH6	None	CH5	None	CH1	None
Graupner SUMD	CH2	CH3	CH4	CH6	None	CH5	None	CH1	None
FlySky iBUS	CH1	CH2	CH4	CH6	None	CH5	None	CH3	None
JETI EXBus (F/W V1.1 required)	CH2	CH4	CH5	CH3	None	CH6	None	CH1	None

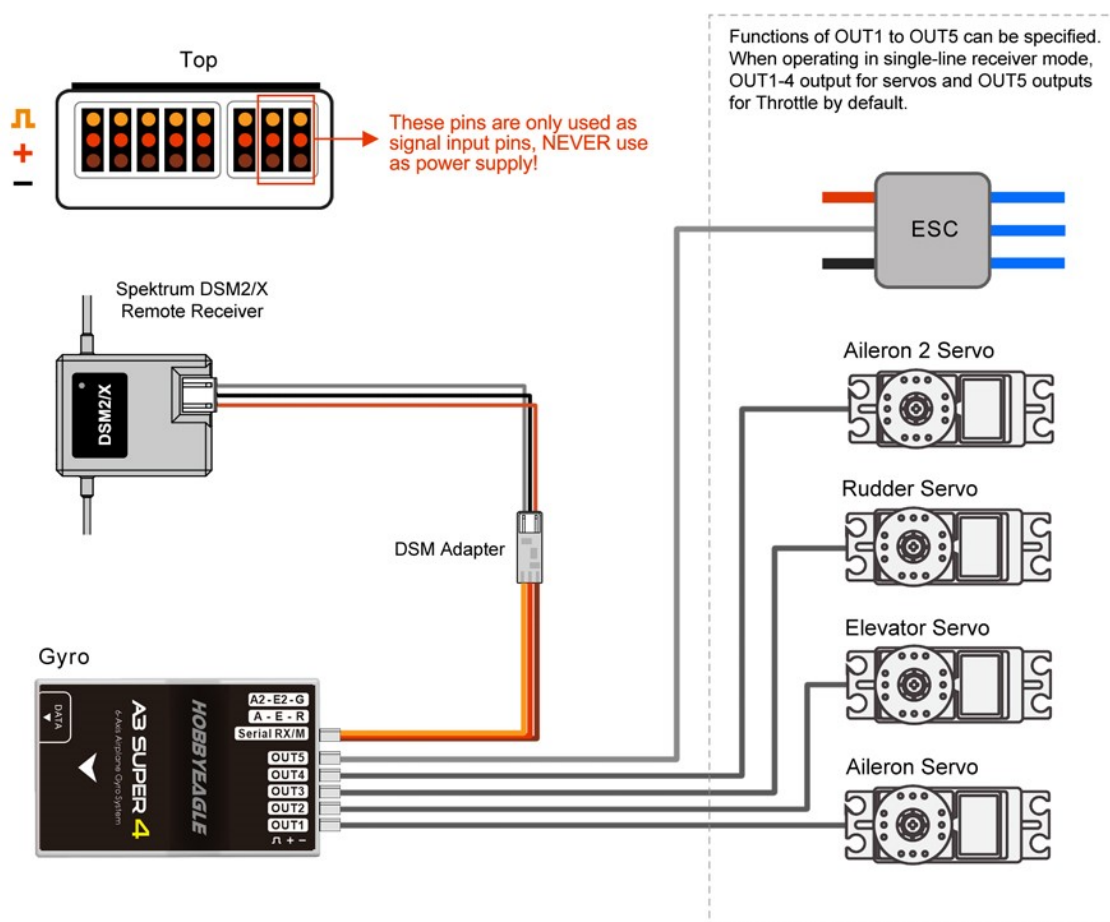


## NOTES

- Please note that input channels of *ELE2*, *GAIN* and *AUX2* are disabled in single line mode by default. To enable these channels, you need to specify channel numbers for them via the configurator or the programming card.
- Pay attention to the polarity of the plugs. The orange signal line must always be on the top and the brown on the bottom.
- A special optional adapter or converter is required if you want to use a Spektrum satellite (remote) receiver or a SRXL2 remote receiver.

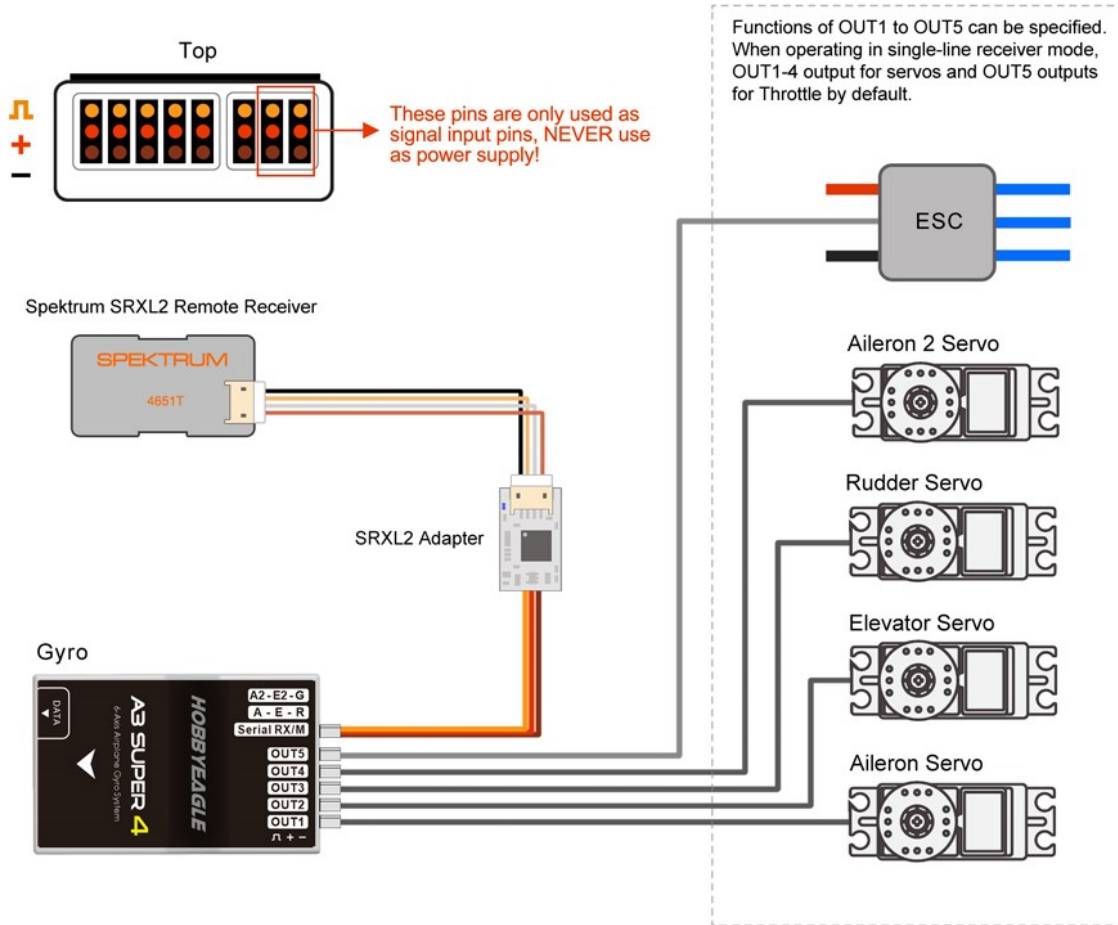
## SPEKTRUM DSM2/X SATELLITE RECEIVER

By using the DSM Adapter, a Spektrum satellite (remote) receiver can be connected directly to the gyro.



## SPEKTRUM SRXL2 RECEIVER

By using the SRXL2 Adapter, A3S4 supports the latest SRXL2 serial receivers of Spektrum, such as SPM4651T, SPMAR8020T, etc. Please note that the receiver type of the gyro must be set to *SBUS* mode when using the SRXL2 Adapter.



## ? 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 *AUX1* and *AUX2* channels, gyro will switch to *Normal* mode automatically and remote master gain will be disabled.

# OUTPUT CONNECTION

## OUTPUT FUNCTIONS

A3S4 provides 5 customized PWM output channels, including OUT1 to OUT5, of which the function can be specified by user. The available functions are shown in the table below.



**Table 2: Output Functions**

Function	OUT1	OUT2	OUT3	OUT4	OUT5	Description
INH						Output Disabled
AIL	•					Output for Aileron Servo
ELE		•				Output for Elevator Servo
RUD			•			Output for Rudder Servo
AIL2				•		Output for Aileron 2 Servo
ELE2					•	Output for Elevator 2 Servo
AUX1						Output for AUX1 Channel
AUX2						Output for AUX2 Channel

**Notes:** • are the default settings of standard PWM receiver mode. *AUX1* and *AUX2* are both invalid in standard PWM receiver mode. *OUT5* is always preset to output the *AUX1* channel in PPM or serial receiver mode by default.

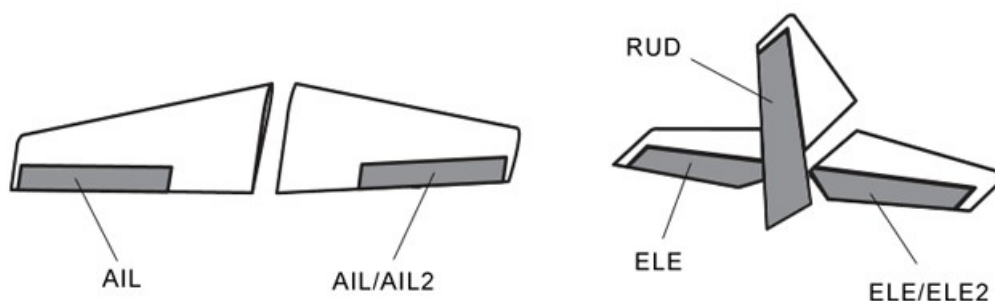
## SERVO REVERSE

The *Servo Reverse* function is designed to use for reverse servos, for example, when operating the gyro in single aileron control mode with two aileron servos connected, it will be impossible to reverse the servos separately if a reverse servo is being used on one side of the wing. In this case, the *Servo Reverse* function provided by the gyro makes it easy to change the direction of one of the servos. The same also applies to such applications as two elevator servos, two wing servos of a delta wing or two tail servos of a v-tail airplane.

## WING TYPE AND SERVO CONNECTION

A3S4 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.

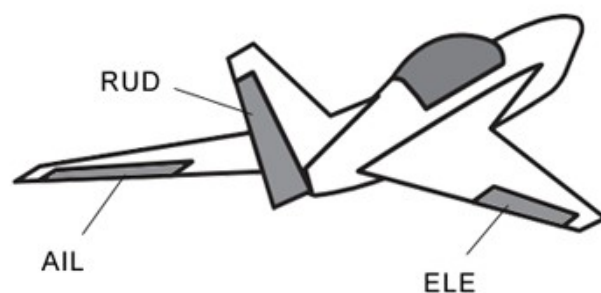
### Standard Fixed Wing



- When using single aileron input, set the output function of the two aileron servos to “*AIL+AIL*” or “*AIL+AIL2*”. If a reverse servo is being used on one side of the wing, reverse it with the *Servo Reverse* function of the gyro.
- When using dual aileron input, set the output function of the two aileron servos to “*AIL+AIL2*”.
- The same applies to the elevator servos connection.

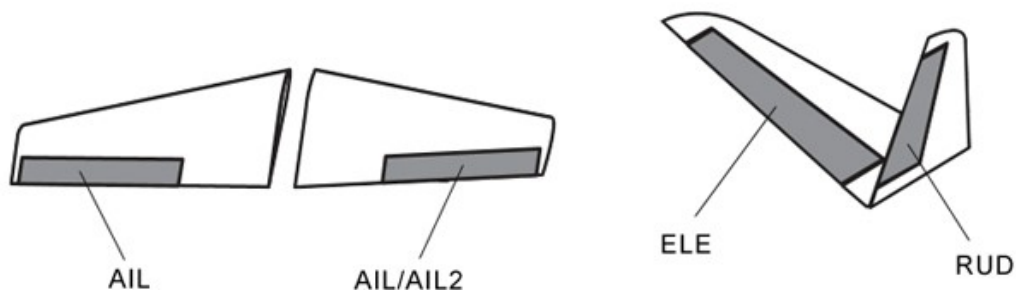


## Flying Wing (Delta Wing)



- Set the output function of the two servos to "AIL+ELE". If a reverse servo is being used on one side of the wing, reverse it with the *Servo Reverse* function of the gyro.
- Functions "AIL2" and "ELE2" are controlled separately which can be used for Canards or other purposes.

## V-Tail



- When using single aileron input, set the output function of the two aileron servos to "AIL+AIL" or "AIL+AIL2". If a reverse servo is being used on one side of the wing, reverse it with the *Servo Reverse* function of the gyro. When using dual aileron input, set the output function of the two aileron servos to "AIL+AIL2".
- Set the output function of the two tail servos to "ELE+RUD", if a reverse servo is being used on one side of the tail, reverse it with the *Servo Reverse* function of the gyro.
- Function "ELE2" is controlled separately which can be used for Canards or other purposes.

### ? Single / Dual Aileron (Elevator) Control

- The gyro works in single aileron control mode when there is only one aileron input connected. Both output channels of *AIL* and *AIL2* issue the same signal for the aileron servos, just like what a Y-extended lead works. The function *Servo Reverse* provided by the gyro can be used to reverse the servo when a reverse servo is being used.
- The gyro works in dual aileron control mode if both aileron inputs are connected, in this mode, output channels of *AIL* and *AIL2* are operated separately.
- The same applies to elevators.

# FLIGHT MODES

A3S4 provides 6 flight modes which can be switched in 3-position mode (or 6-position mode) 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** in 3-position mode. The color of the LED shows the current flight mode of the gyro while in use.

**Table 3: 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 hold 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 you release 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

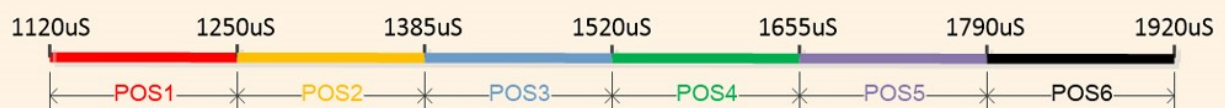
The *HOVER* mode, also known as the '*Auto-Hover mode*', provides the same functionality as the *LEVEL* mode. The only difference is that when you release the sticks, the airplane will be brought to vertical position (nose up) and keeps hovering. This mode is designed to help you to learn hovering maneuver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

### ? Setup of Flight Mode Switch

You can use any 3-position switch of the transmitter to switch the flight mode. The simplest way is to use the *Gear Channel* and connect it to the [*Serial RX/M*] slot of the gyro. To make the gyro possible to identify the correct positions the PWM input must meet the requirement of range as shown below:



A3S4 also supports 6-position flight mode switching, which allows you to switch all flight modes in flight. To do this, a mixing function of one 2-position switch and one 3-position switch is required on your transmitter. To make the gyro possible to identify the correct positions the PWM input must meet the requirement of range as shown below:



To achieve a 6-position logic switch, your transmitter needs to support program mixing functions, most advanced radios provide you such features. Please refer to our website for examples on how to setup the mixing for some popular radios.

# GAIN ADJUSTMENT

## BASIC GAIN

A3S4 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

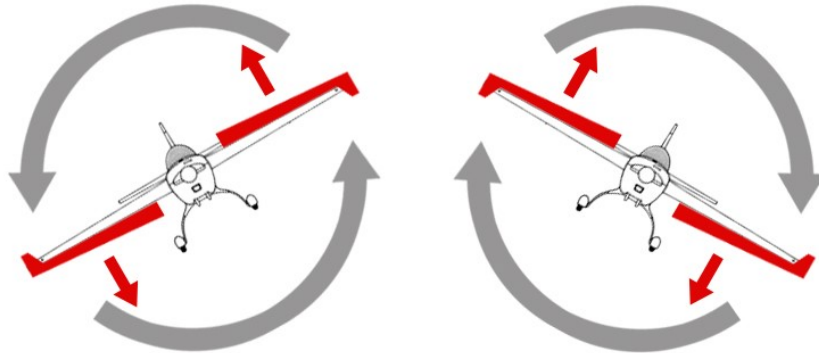
After installation, lift the airplane up and make it quickly rotate around the roll, pitch and yaw axes respectively. Make sure all the control surfaces react in the correct directions referring to the figures below.

### **VERY IMPORTANT!**

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

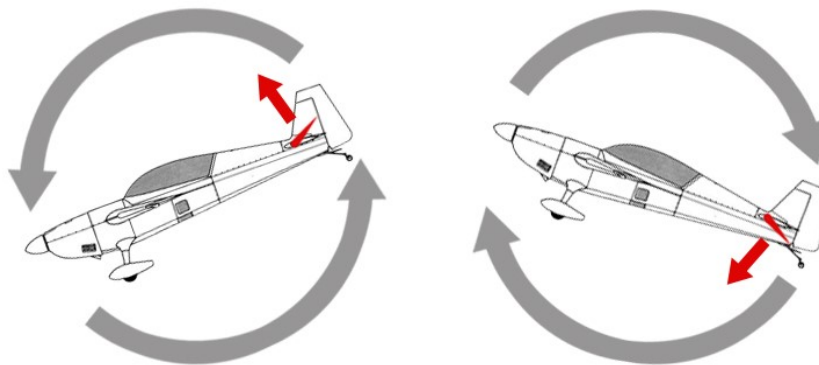
### Check the gyro direction for Aileron

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



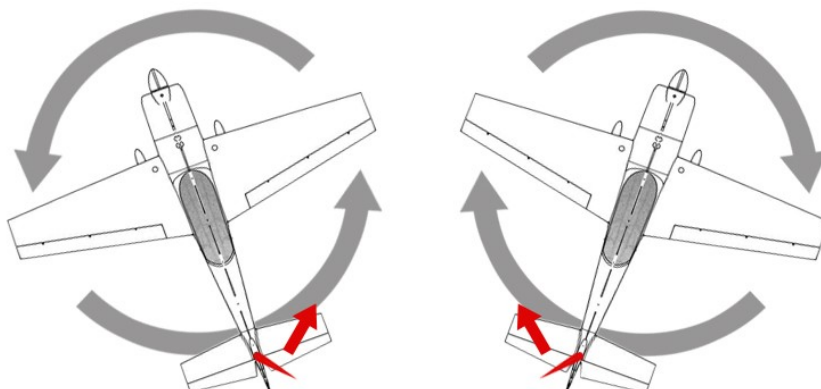
### Check the gyro direction for Elevator

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.



# 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.

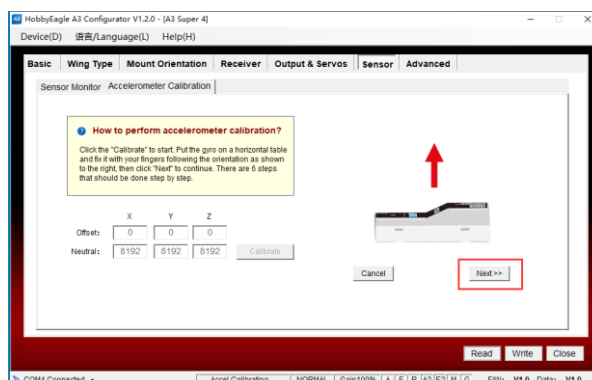
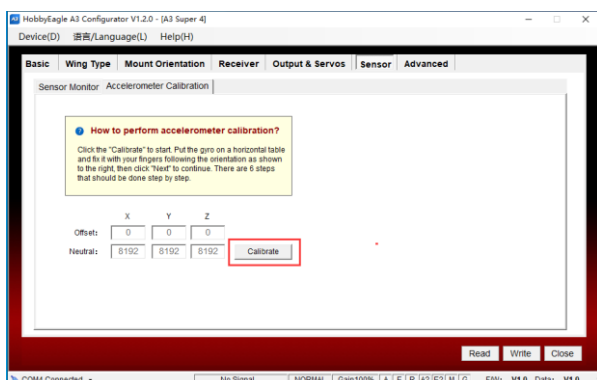
As a same reason, a hover calibration is recommended to perform after installation if you want to fly with *HOVER* mode. The procedure is quite similar to that of level calibration. The only difference is that the airplane should be lifted vertically to the ground instead of putting it on the ground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

# 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 6 steps, do not move the gyro while calibrating at each step.



# ADVANCED 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 AUX1 and AUX2.

## 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.

## GYRO DIGITAL FILTER

This function is used to setup the cut-off frequency of the hardware low pass filter of the gyro. Reducing the frequency can significantly reduce the interference of the vibration from the fuselage. By testing, the default setting DLPF\_20Hz is fit for most electric airplanes. Appropriately decrease it when the vibration is strong, it is recommended to choose DLPF\_5Hz when using the gyro on a nitro or gasoline airplane. Please note that a high cut-off frequency setting may increase the power consumption and cause heating of the servos.



# 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

<i>Installation Guide</i>	<a href="https://www.hobbyeagle.com/a3-configurator/docs/installation_guide_en.pdf">https://www.hobbyeagle.com/a3-configurator/docs/installation_guide_en.pdf</a>
<i>USB Driver Installation Guide</i>	<a href="https://www.hobbyeagle.com/a3-configurator/docs/usb_installation_guide_en.pdf">https://www.hobbyeagle.com/a3-configurator/docs/usb_installation_guide_en.pdf</a>
<i>Quick Start Guide</i>	<a href="https://www.hobbyeagle.com/a3-configurator/docs/quick_start_guide_en.pdf">https://www.hobbyeagle.com/a3-configurator/docs/quick_start_guide_en.pdf</a>
<i>Firmware Update Guide</i>	<a href="https://www.hobbyeagle.com/a3-configurator/docs/firmware_update_guide_en.pdf">https://www.hobbyeagle.com/a3-configurator/docs/firmware_update_guide_en.pdf</a>

### **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 Super 4 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>	4.8V ~ 8.4V
<b>Operating Temperature:</b>	-10°C ~ 50°C
<b>Size:</b>	43 × 27 × 14mm
<b>Weight:</b>	10g (excluding wires)