KDS Helicopter Balancer User Manual

Foreword

Thank you for choose KDS Helicopter Balancer, it is an high performance intelligent device. The balancer is suitable for beginner, it can help you to keep the helicopter hovering and flying, made flying easy.

To gain the best effect, you should configure your balancer according to your own condition, because the working of balancer relates to mechanism of helicopter. Before using balancer, we suppose you have know your helicopter well (such as movement of swash plate), if you are not sure about these, it is recommend to find an old hand to help you.

***Attention: The software may be different from this manual because upgrading of the software. Please base on the software you are using, and refer to this manual.**

Caution

It is necessary to learn proper technology for assemble and operate model. Be careful when operating. Improper mounting may cause serious damage or injury!
KDS balancer is designed for civil model using only, please confirm it will not used on manned flyer or other device! The balancer provides an auxiliary control for model, you can not depend on it completely.

1. Summary

1.1 Introduce

The balancer is consist of three modules, Controller, Sensor and CCD. See Diagram1.1.1.

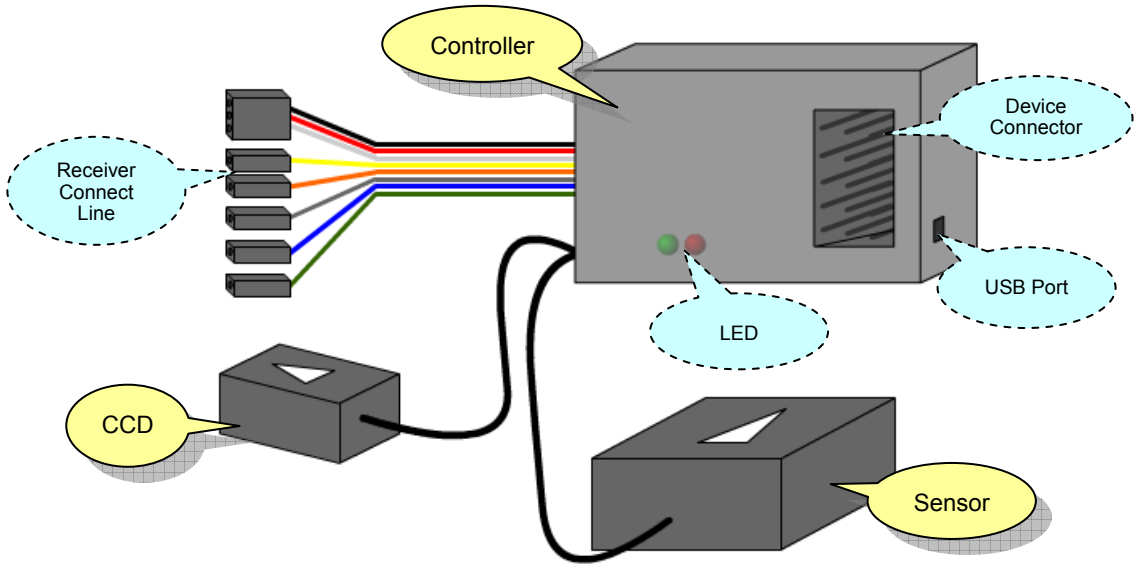

Diagram1.1.1 Balancer modules

- **Controller: i**t is kernel of balancer, take charge of balance calculating and servos controlling. The Receiver Connect Line used to link receiver to obtain signal. The Device Connector used to link servos to control them.
- **Sensor:** used to induce the position of helicopter, and transform the signal to controller. Sensor must be mount on suitable place. Usually, the Sensor should be mount on the place which the gyro should be.
- **CCD:** used to 'see' ground to avoid drifting. To see ground effective, CCD should be mount on suitable place, and lens must face to ground, and CCD must 'see' ground well without any obstruction.

KDS balancer has following functions:

- Control all movement, include attitude stabilization, speed control, position locking.
- CCD sensor to capture picture of ground, comparing pictures to avoid drifting.
- Switch working mode (horizontal mode and position mode) through AUX channel.
- Integrating head locking gyro and swash plate mixer.
- Control sense and mode of internal gyro through GEAR channel.
- Support swash 3S 120º, 3S 140º, 4S 90º, 4S 90º+45º
- Keep balance in inverted flight.
- Configure by computer through USB.
- If you are using FM/PPM remote control device, when losing control of transmitter, the balancer will set aileron, elevator, rudder to neutral, keep pitch, switch to position mode, and set position sense to 70%.

1.2 Spec

- Voltage: 4.8-6.0V
- Current: 55mA (under 5V)
- Size: ？？mm×？？mm×？？mm
- Weight: ？？
- Temperature: 0℃~ +40℃
- Maximum allows rotate speed:

✓ Aileron and Elevator: ≤200°/ s

✓ Tail turning (if using external gyro): ≤360°/ s

1.3 Attentions

It is very easy to configure and use balancer, but if you are a beginner, it is recommend to find an old hand pilot for help because of the complex adjusting of mechanism.

During adjusting, please be careful about following:

- It is recommended to make electronic connection between tail pipe, motor shell and helicopter base for earth connection. If the tail drive structure is belt, you should pay more attention to this issue. Attrition between belt and metal will produce static electricity, and it will disturb other electronic device of helicopter.

- Confirm all part of balancer have been mount on helicopter firmly, and the lens of CCD can 'see' ground, and you should keep the lens clean.
- The sensor of balancer (gyro) must be mounting horizontal.
- The balancer should keep away from engine and vent-pipe, because the vibration of engine will disturb sensor of balancer and the smoke from vent-pipe will cover lens of CCD.
- You may add magnetic ring on wires between controller, sensor and CCD to reduce electronic disturb. The wire should twist magnetic ring for three circles at least.
- Channels of aileron, elevator and pitch must be connected with receiver. Connections of gear and aux is optional.
- Wires which is unused should be locked to prevent unexpected affection.
- Slot of controller which is unused should be covered to prevent oil stain or oxidation.
- The maximum turning speed should not exceed 360°/s, otherwise the balancer may work abnormally.

1.4 LED status

There are two LED in controller to indicate status of balancer, see following table:

LED shine map		Balancer status	Comment
⊙ ⊙ ⊙ ⊙ ⊙	Red fast blink	No signal from receiver	
⊙ ⊙ ⊙	Red slow blink	Balancer initial failed	Balancer may be move during initial
———	Red shine	Under manual control	Manual control, balancer not working
——— ———	Red and Green shine	Horizontal mode on	Under horizontal mode, no anti-drifting
———	Green shine	Position mode on	Under position mode, horizontal with anti-drifting
⊙ ⊙ ⊙ ⊙ ⊙	Green blink	Position mode failed	CCD can not obtain enough contrast, can not switch to position mode, balancer working on balance mode automatically.

***Attention: please refer to section 4.2.1 for detail of working mode**

1.5 Using flow

The using flow of balancer is shown as diagram1.4.1. You can divide them into two stages, 'Mounting stage' and 'Flying stage'.

In 'Mounting stage', you should complete the mounting of all device, then make all basic configuration so that the balancer can work normally. These basic parameters are called 'Mounting parameters'.

In 'Flying stage', you may adjust some advance parameters according to the result of flight-test, to reach best status you stratify. These advance parameters are called 'Flying parameters'.

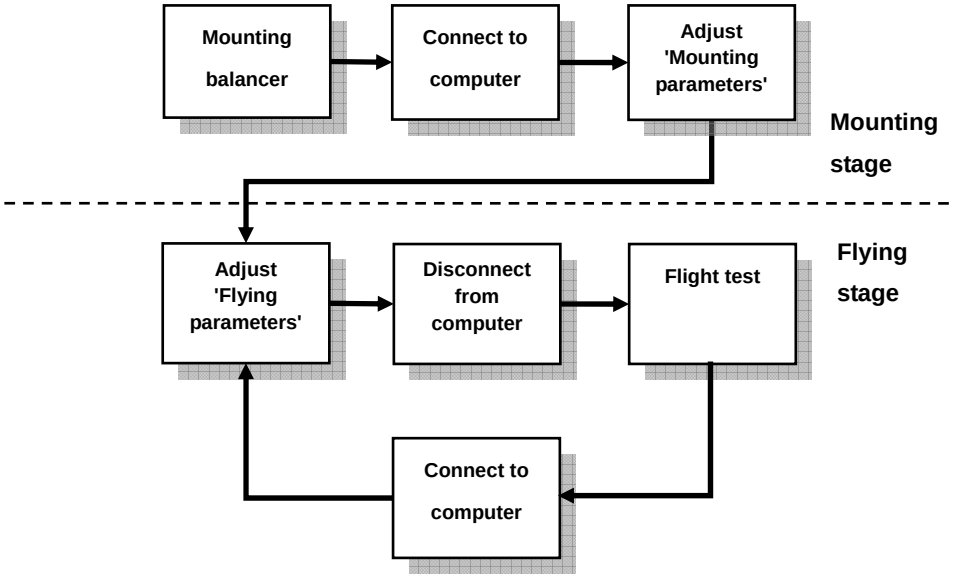

Diagram1.5.1 Using flow of balancer

2. Connect to computer

2.1 Install driver

Configuring balancer must use a computer, you should take a computer with USB port and mouse, and it must has Microsoft Windows OS(Windows XP/Vista/Windows2000).

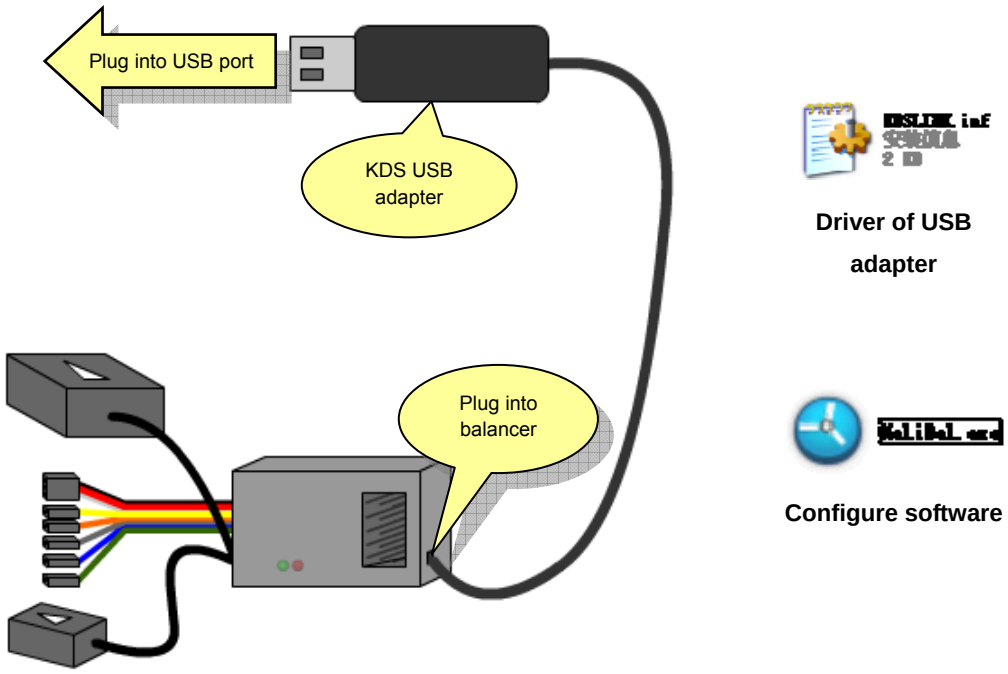

Diagram2.1.1 Connect balancer with computer

At first, please plug the USB adapter into balancer, then plug USB, refer to diagram2.1.1. When the computer notify you find new hardware and need driver, choose the KDSLINK.INF. After a while, the adapter will install properly.

Then run HeliBal.exe , you will see the main interface of the configure software like diagram2.1.2.

Diagram2.1.2 Configure software

At beginning, the software will search KDS USB adapter automaticly, if it not found, a

balloon will show as diagram2.1.3. If so, please confirm the adapter was connected properly then click 'Retry'. If the apapter can not be found at all times, please contact your distributor.

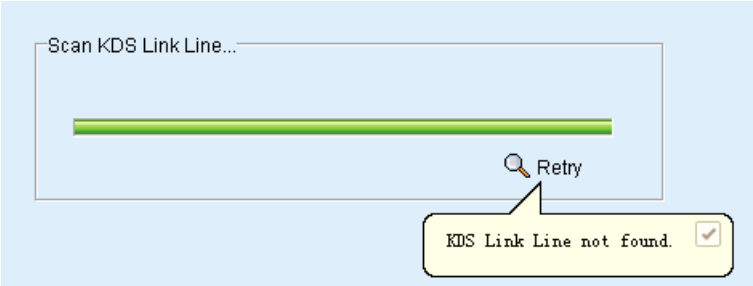

Diagram2.1.3 Adapter not found

After adapter found, the software will try to communicate with balancer. If the balancer not power on, you will see 'No device' on status bar. Otherwise it will show 'Connected' after few seconds, shown as diagram2.1.4.

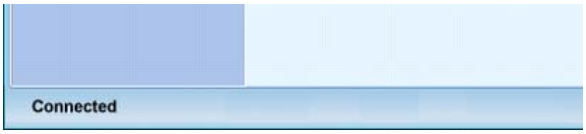

Diagram2.1.4 Balancer connected

***Attention: don't power up balancer before adapter found.**

2.2 Adjustment and Saving

Normally, you should read parameters from balancer before adjust, then change and saving. After balancer connected, click 'Read' button, see diagram2.2.1.

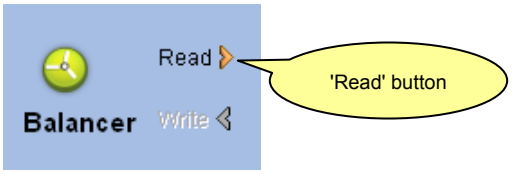

Diagram2.2.1 Read parameters

After reading, you will see configure page on the right side of the software, like diagram2.2.2. You can use mouse to drag them for fast tune or use keyboard (left or right) for find tune.

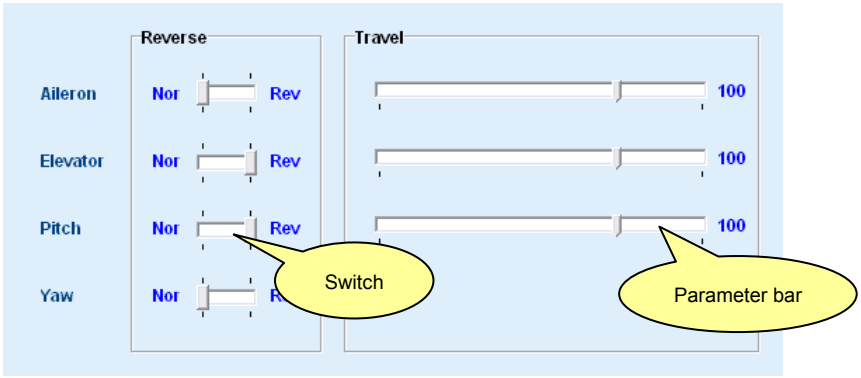

Diagram2.2.2 Sample configure page

When adjust done, click 'Write' button (see diagram2.2.3) to save parameters.

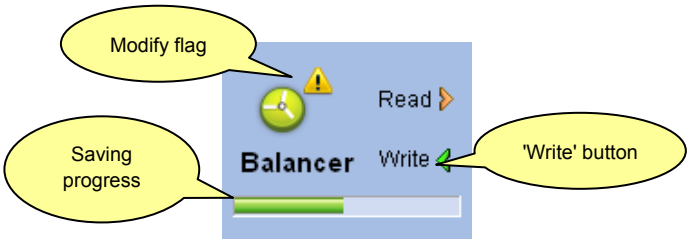

Diagram2.2.3 Saving changes

The saving will cost few seconds, during saving, a bar will show to indicate the progress. If the 'Write' button is gray (disabled), it means the parameters you set is equal to parameters in balancer, and no necessary to write. If they are not equal, a exclamatory mark will show to notify you.

3. Mounting stage

3.1 Setup transmitter

Normally, the transmitter of helicopter model might has mixer, but KDS balancer has internal mixer, so you must disable the mixer of transmitter, otherwise the balancer can not work properly.

All mixer relate to swash plate must be disable, and travel of aileron and elevator should be 100% (you may set some EXP to make better feel), the signal should be set to 1.5ms neutral. If you are using the internal gyro of balancer, all mixer relate to rudder must be disable.

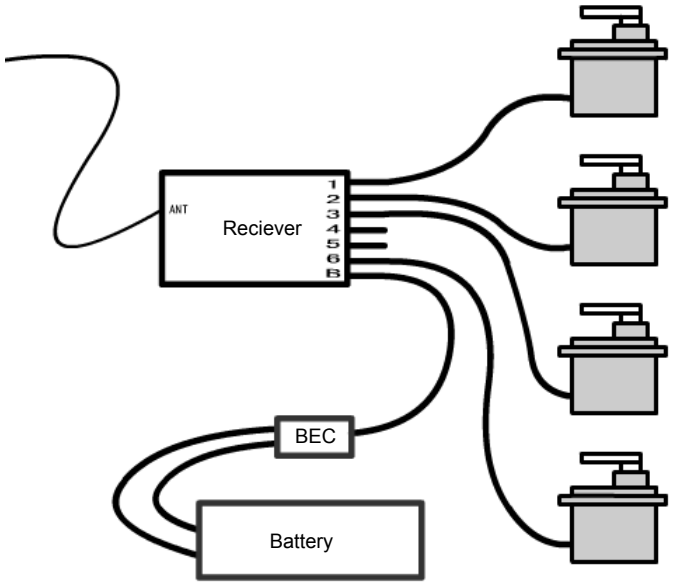

Diagram3.1.1 Ensure no mixer

***Attention: it is FUTABA remote system, if you are using JR remote system, please link servo to 2/3/4/6 channel.**

To ensure you have disable all mixer properly, you should make a test system like diagram3.1.1. After power up, move the stick on transmitter, if each direction of each stick affects only one servo, that prove the mixers are all disabled successfully.

Please read manual of transmitter carefully before make the operation.

3.2 Mounting Balancer

Firstly you should find a suitable place to mount balancer. The lens of CCD should face to ground, and the Sensor should be mount on the place which the gyro should be, see diagram3.2.1 for example. The controller can be mount in any place you want.

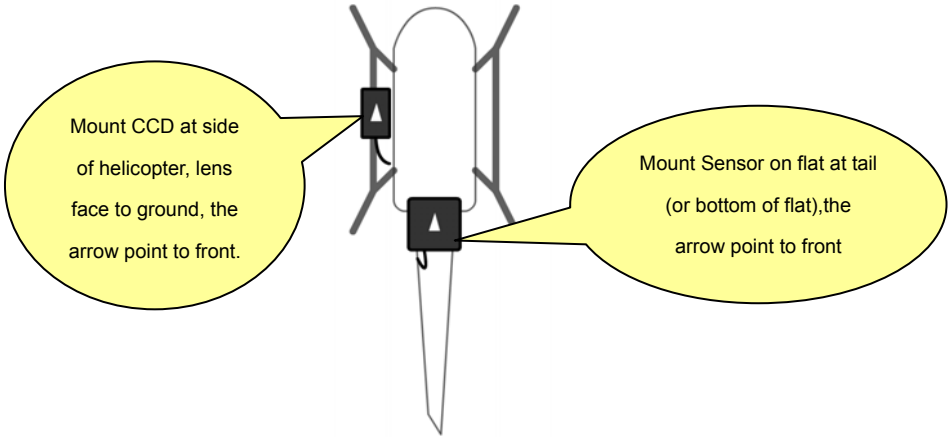

Diagram3.2.1 An mounting example

***Attention: the arrow on CCD and the arrow on Sensor must point to same direction**

After mounting of balancer, all electronic device should be connected. There is a internal gyro in balancer, so additional gyro is not necessary. Diagram3.2.2 is an example, the connection between receiver and controller should refer to following table.

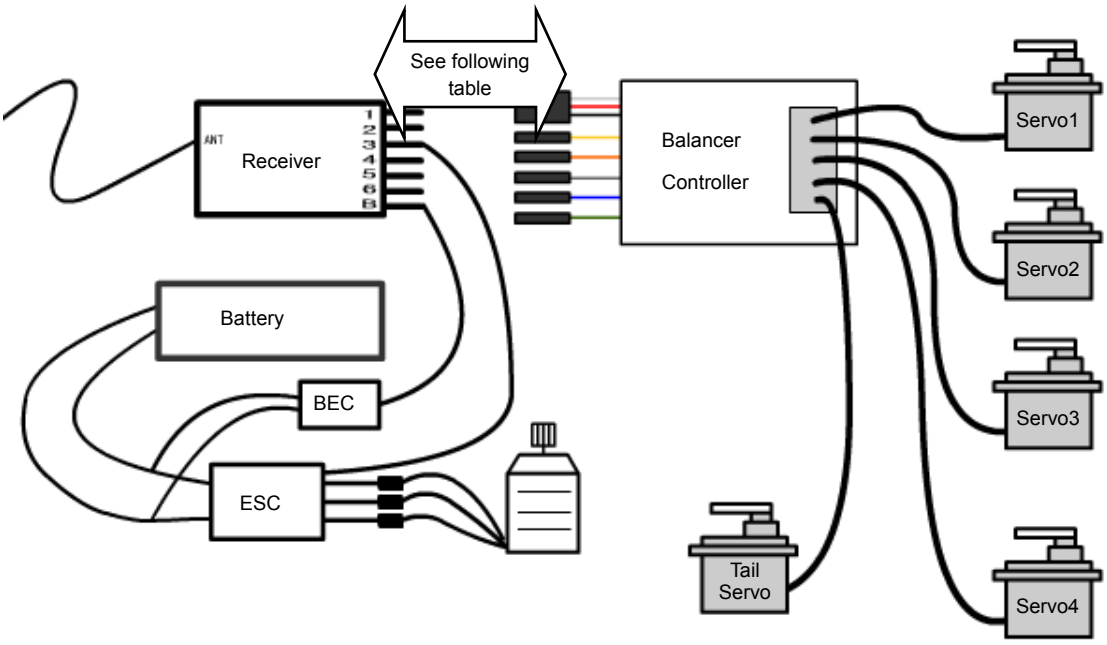

Diagram3.2.2 Electronic connection

Balancer Connector	Connector Name	FUTABA Receiver	JR Receiver	Comment
Black/Red/White Three pin	Aileron/Power connector	Channel 1	Channel 2	Must connected
Yellow solo pin	Elevator connector	Channel 2	Channel 3	Must connected
Orange solo pin	Pitch connector	Channel 6	Channel 6	Must connected
Gray solo pin	Rudder connector	Channel 4	Channel 4	Must connected

Blue solo pin	Gyro sense connector	Channel 5	Channel 5	Optional, see 4.1.1
Green solo pin	Balancer sense connector	Channel 7	Channel 7	Optional, see 4.2.2

3.3 Adjust 'Mounting parameters'

The page 'Mounting' is some basic parameters relate to mechanism, they must be configure correctly so that balancer can work. The interface is shown as diagram3.3.1, there are three categories: mounting direction, rotor direction, swash plate type.

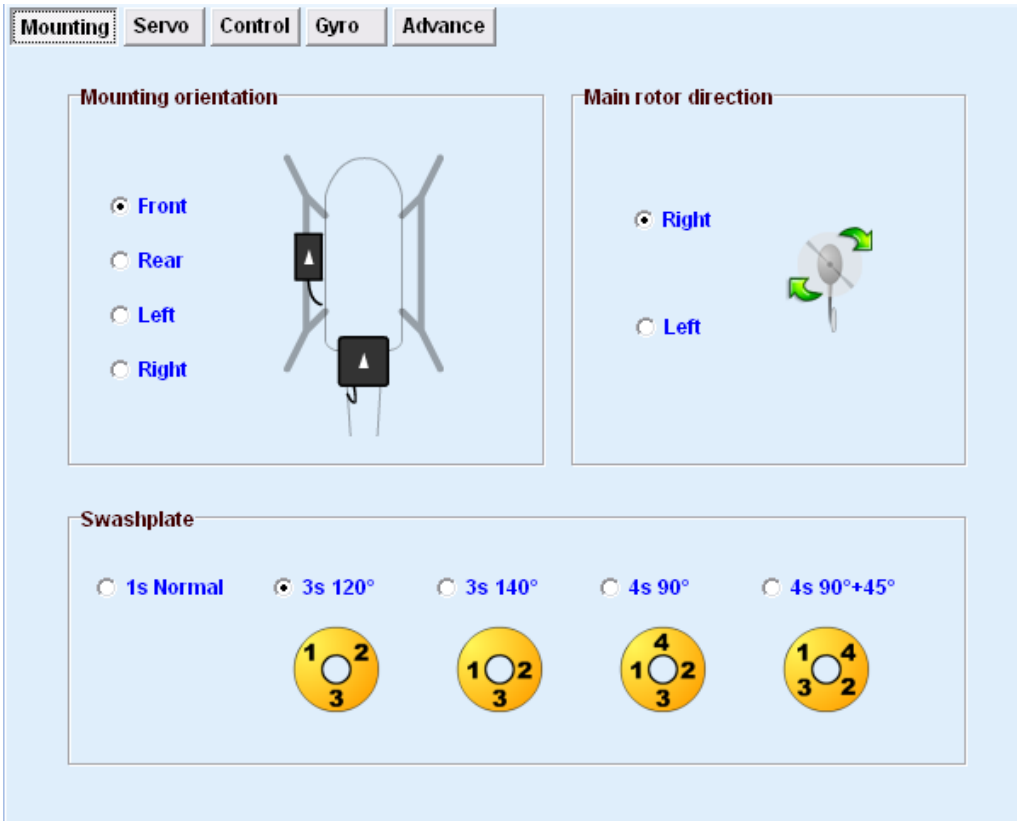

Diagram3.3.1 'Mounting' page

1) Mounting orientation

There is an arrow print on Sensor and CCD of the balancer. You can point the arrow to any direction when mounting, but the two arrows must point to same direction (and lens of CCD must face to ground). Normally, the arrows is point to front (helicopter head). After mounting, you should set this parameter according to the arrows.

2) Main rotor direction

You can look in your rotor, record the rotate direction (clockwise or counter clockwise), and set this parameter.

3) Swash plate type

Select your swash plate type here.

***Attention: Please refer to chapter 2 for computer connection and parameters adjustment.**

3.4 Adjust 'Servos parameters'

The page set servo reverse and neutral. See diagram3.4.1. The parameter about servo4, will only enable under four servo swash mode.

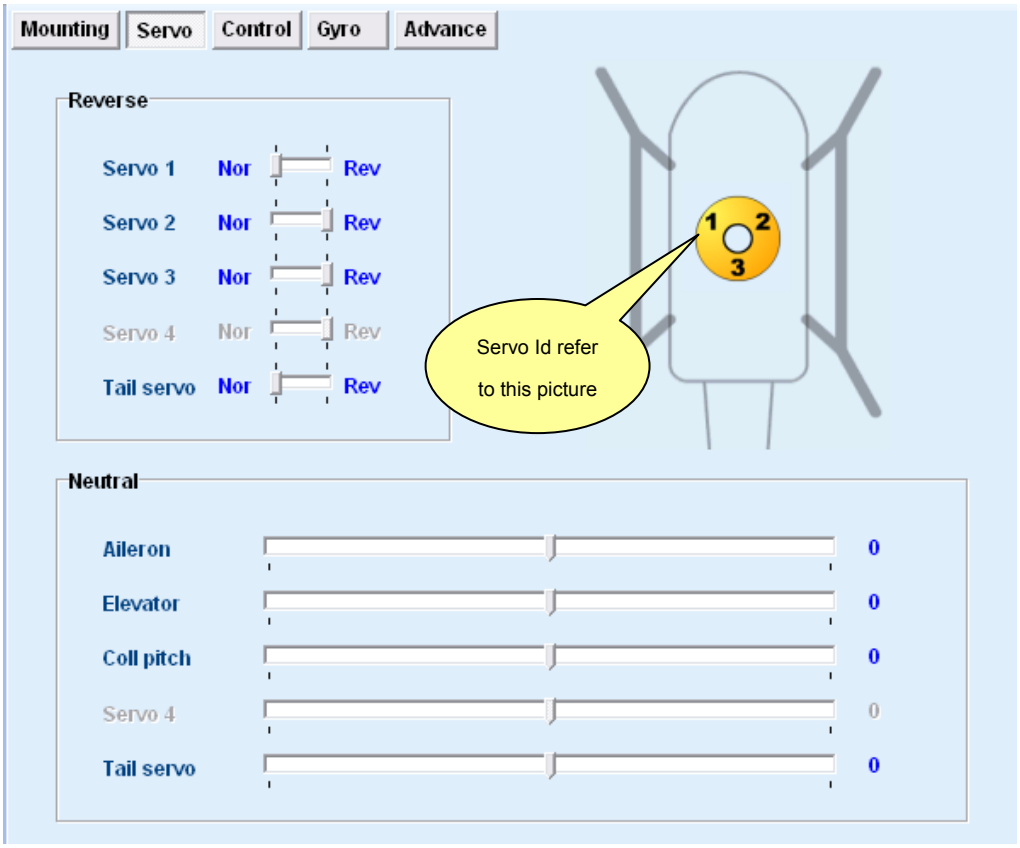

Diagram3.4.1 'Servo' page

***Attention: to avoid injury, please unmount rotary wing or shut off motor wires!**

3.4.1 Servo Reverse

You must set reverse before adjust neutral. It is a little different from adjusting helicopter without balancer, the adjust should be done in balancer, not in transmitter!

Please do it as following step:

1）Ensure balancer is mount ok, and all electronic device have been connected successful.

2）Turn on transmitter, ensure throttle stick on lowest position.

3）Place helicopter on a horizontal surface, power up.

4）Wait for balancer initialization finished.

5）Lean helicopter to one side, look in the reaction of swash plate. If servo reverse

setting is correct, the balancer will control swash plate to the opposite side. That means when helicopter lean to left, the swash should lean to right (relative to main axis), when helicopter lean to front, the swash should lean to rear, etc. See diagram3.4.2.

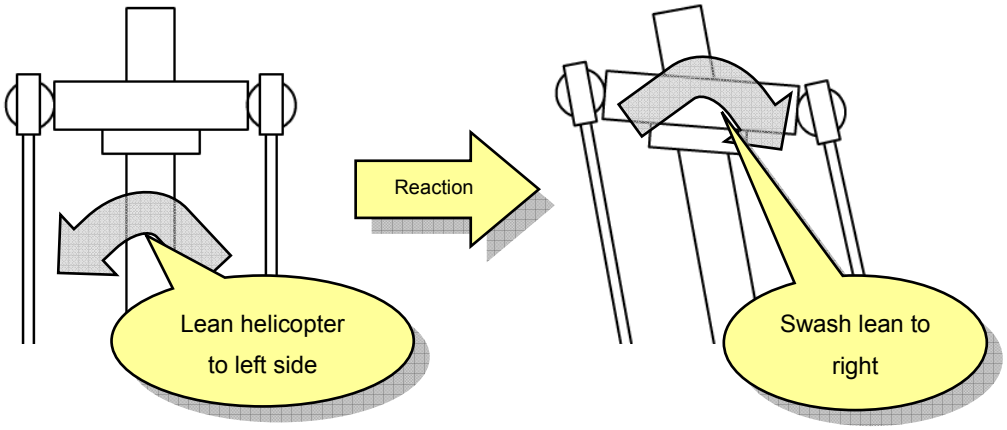

Diagram3.4.2 Correct balancer reaction

6）If the reaction is wrong, connect balancer with computer, change reverse setting and save. (You can keep connection when do Lean-testing)

7）Repeat step 4 5 until reactions of all directions is correct.

***Attention: to avoid injury, please unmount rotary wing or shut off motor wires!**

3.4.2 Servo neutral

Servo neutral should be set after reverse is set ok. You should adjust neutral to make the rocker at suitable position. Normally, the position means angle between rocker and pole is 90°, like diagram3.4.3.

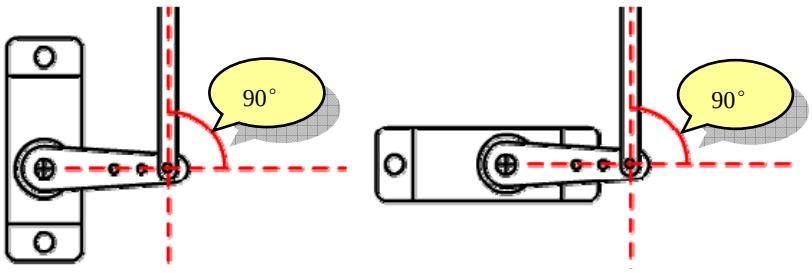

Diagram3.4.3 Servo neutral

Before adjust neutral, you should make the neutral of mechanism on approximate position, then use software for find tune.

You should aware that the neutral is mixed neutral, for example, when we adjust the aileron neutral of CCPM120°, servo1 and servo2 will wiggle at the same time (opposite

direction). So you should adjust neutrals by following steps, suppose your swash is CCPM120°:

1）Adjust aileron neutral, make servo1 and servo2 same height. Don't care if the height is enough.

2）Adjust elevator neutral, make servo1,servo2 and servo3 same height (swash plate was horizontal).

3）Adjust pitch neutral, make the swash at proper height.

Adjusting of tail servo and servo4 are independent, you should adjust servo4 after aileron, elevator and pitch.

***Attention: to avoid injury, please unmount rotary wing or shut off motor wires!**

3.5 Adjust 'Control parameters'

The page set balancer to fit the signal of transmitter. There are two categories in the page, stick reverse and stick travel, see diagram 3.5.1. In fact, these setting can also be set in transmitter, you can choose a way you like.

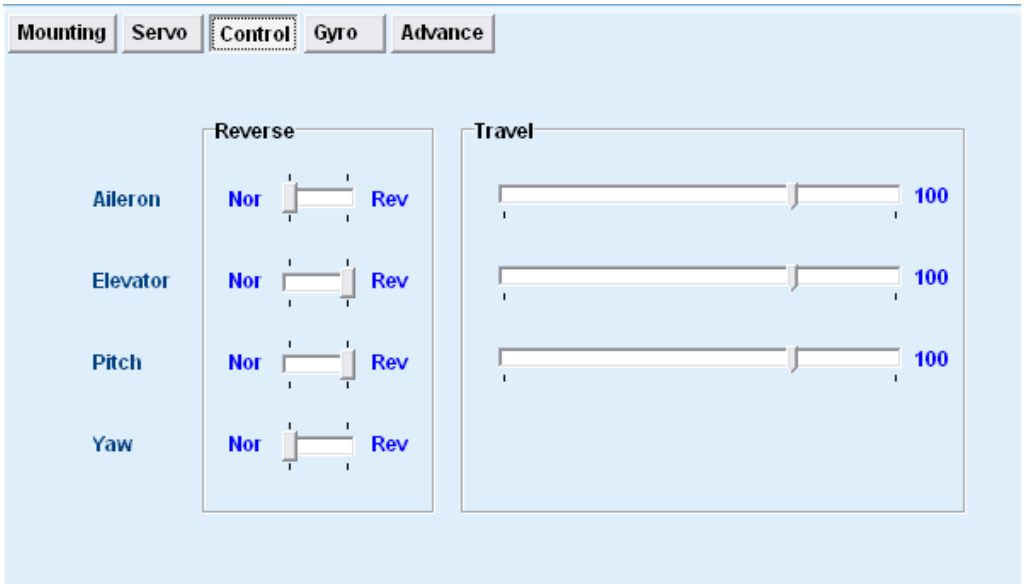

Diagram3.5.1 Control page

***Attention: to avoid injury, please unmount rotary wing or shut off motor wires!**

3.5.1 Stick reverse

Set stick reverse as following steps:

1）Ensure balancer is mount ok, and all electronic device have been connected successful.

2）Turn on transmitter, ensure throttle stick on lowest position.

3）Place helicopter on a horizontal surface, power up.

4）Wait for balancer initialization finished.

5）Move each stick, record the reaction of swash plate.

8）If the reaction is wrong, connect balancer with computer, change reverse setting and save. (You can keep connection when do sticks-testing)

6）Repeat step 5 6 until all reactions is correct.

***Attention: to avoid injury, please unmount rotary wing or shut off motor wires!**

3.5.2 Stick reverse

Set stick reverse as following steps:

1) Ensure balancer is mount ok, and all electronic device have been connected successful.
2) Turn on transmitter, ensure throttle stick on lowest position.
3) Place helicopter on a horizontal surface, power up.
4) Wait for balancer initialization finished.
5) Move each stick to its extreme position, record the move range of swash plate.
6) If the range is not suitable, connect balancer with computer, change reverse setting and save. (You can keep connection when do travel-testing)
7) Repeat step 5 6 until all reactions is correct.

***Attention: to avoid injury, please unmount rotary wing or shut off motor wires!**

4.Flight Testing Stage

Normally, the default settings can be use for flight. But if you want better effect, you should adjust the 'Flying parameters'. This chapter will tell you how to adjust these parameters.

4.1 Adjust 'Gyro parameters'

There is a gyro in balancer, this page used to configure the gyro. You may use the default setting for mostly flying, but for advance user, it is necessary to make some adjusting to achieve better performance.

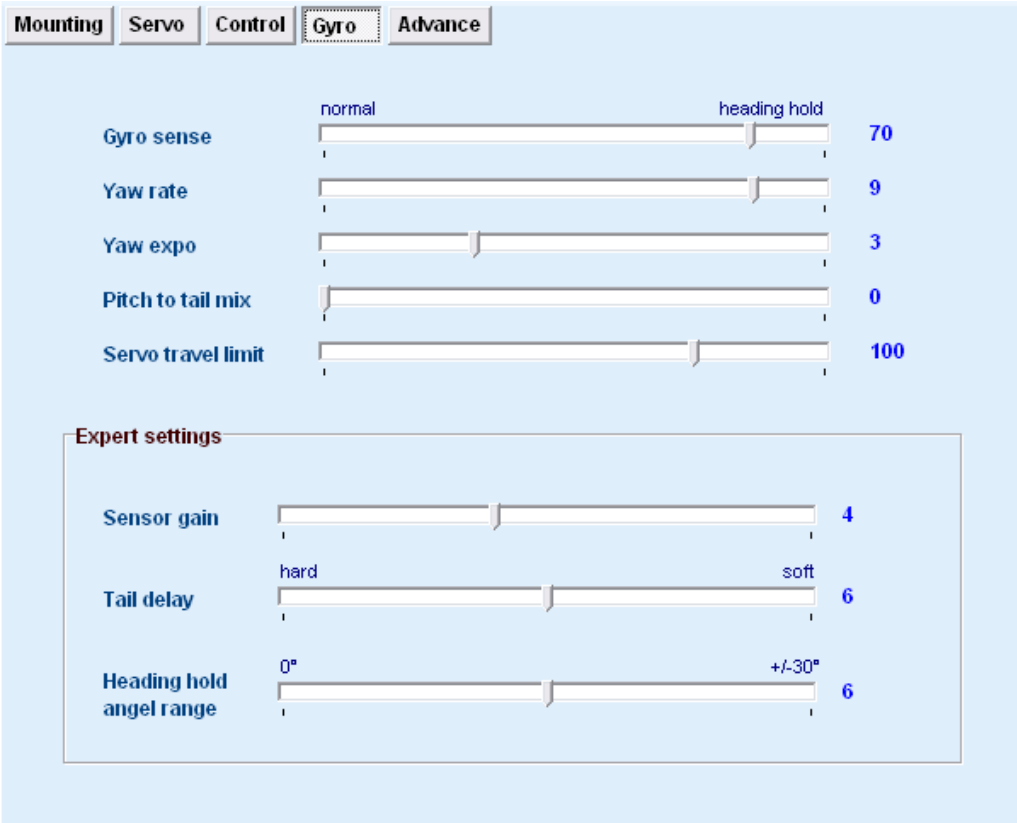

Diagram4.1.1 Gyro page

4.1.1 Gyro settings

1）Gyro sense

The sense of gyro can be set between -100 and +100. The positive value means the gyro working under 'heading hold' mode, negative value means the gyro working under 'normal mode'. It is recommended to using 'heading hold' mode. Same as other gyro, the sense should be as large as possible until the tail swing.

If balancer has connected the sense channel of receiver, the setting in this page will be disabled, the gyro of balancer will use the signal from receiver as sense value. If you do not want to modify sense value frequently, you can keep the sense channel empty (the blue line), then the channel on receiver can be use for other using.

2）Yaw rate

This parameter controls the changing speed of direction. Normally, the value should be set to maximum, but if you do not like fast changing of direction, you may adjust it as you want.

3）Yaw expo

This parameter controls the exponent of rudder. Little value will cause fine response in slim motion of stick. You may adjust it as you want.

4）Pitch to tail mix

This mix can improve effect when pitch changing. You can choose a suitable value, to

make better response of gyro to pitch changing.

5）Servo travel limit

This parameter controls the signal for tail servo, to avoid mechanical conflict of tail pitch structure .

4.1.2 Gyro Expert Setting

1）Sensor gain

The parameter controls the gain of signal amplifier, you may not modify it in most case.

2）Tail delay

The parameter used to fit feature of tail servo. The response speed of tail servo is more slow, the parameter should be more large. If some high quality servo are used, you should set a little value, such as 0.

3）Head holding angle range

The parameter controls the inertia of turning. The inertia means the extra rotation when you make a direction turning.

When you begin moving the rudder stick, it will cause a rotation (head direction changing of the helicopter), when you stop moving the rudder stick, the helicopter will not stop rotation immediately because of the inertia, it will rotate an extra angle before stopping. The parameter controls the angle.

4.2 Adjust 'Advance parameters'

The page controls working mode of balancer. It is strongly recommended keep them as factory setting when you do not know them well.

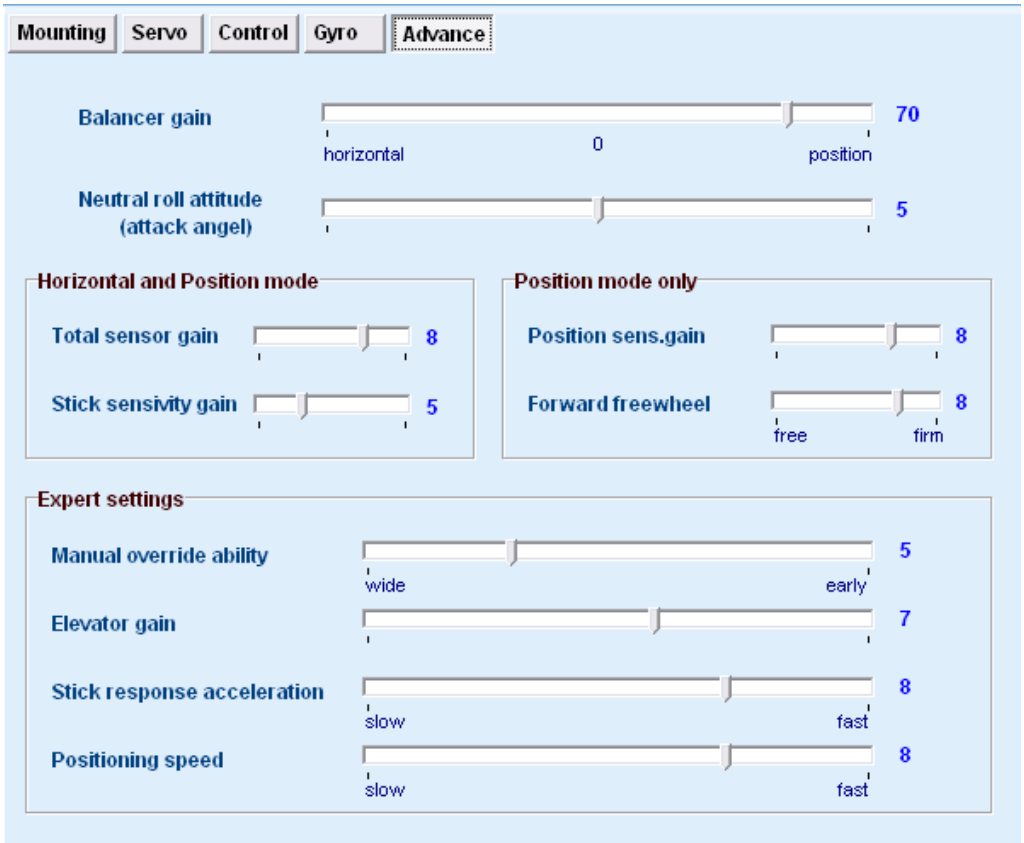

Diagram4.2.1 Advance page

4.2.1 Working mode

The balancer has two working mode: **horizontal mode** and **position mode**. See section 4.2.2 for details of mode switching.

1）Horizontal mode

Make helicopter horizontal automatically. In this mode, helicopter can keep horizontal flying, do not affected by illumination or temperature, but ground effect and airflow are still affect helicopter. It is recommended when indoor flying.

2）Position mode

Make helicopter horizontal and keep its position automatically. The mode can make helicopter hovers on a fixed point automatically, the valid height (relative to ground) is 0.3~3 meters.

When hovering, you can release aileron and elevator sticks of the transmitter, the balancer can make helicopter hovers on a fixed point automatically. Lack of illumination or changing of temperature will affect position. But even if the position affected by environment, you can still fix the drifting easily.

When you are making a air route under position mode, there are only two things you need to do: control elevator stick for forward or backward, control rudder stick for direction.

4.2.2 Basic parameters

1）Balancer sense

The parameter controls sense of attitude changing of helicopter. Negative value make balancer enter horizontal mode, positive value make balancer enter position mode. **Zero value will shutdown balancer, in the time the helicopter is controlled by pilot at all.**

If AUX channel is connected to receiver, the parameter here will be disabled. Balancer will decide working mode and sense by the signal output by receiver.

2）Neutral roll attitude

The parameter controls attack angle when stick on neutral position. It is recommended to keep default value for fresh pilot.

***Attention: It is recommended to choose a three-status-switch for balancer sense (AUX channel). By set negative,positive and zero value relative to the three status, you can switch working mode between horizontal mode, position mode and manual mode. And it is very important to control the helicopter yourself when switching!**

4.2.3 Mode parameters

1）Total sensor gain

The parameter controls gain of signal amplifier for internal gyro. Keep default value in most case.

2）Stick sensitivity gain

The parameter controls gain of signal amplifier for receiver. Keep default value in most case.

3）Position sens. gain

The parameter controls gain of signal amplifier for CCD. Keep default value in most case.

4）Forward freewheel

When using position mode, balancer will try to move helicopter to a place. After helicopter arrived the place, it will keep moving a little distance because of inertia. This parameter controls the affection of inertia, 'free' means large inertia, 'firm' means little inertia.

4.2.4 Expert settings

Parameters in this section is designed for old hand. For a newer, it is recommended to keep default value.

1）Manual override ability

Because pilot and balancer are controlling helicopter at same time, so balancer must mix the two control signals. This parameter controls scale of mixer. Large value means more manual controlling.

2）Elevator gain

The parameter controls gain of signal amplifier for sensor of pitching axis. Keep default value in most case.

3）Stick response acceleration

The parameter controls response speed of balancer for stick motion. Keep default value in most case.

4）Positioning speed

The parameter controls location speed. Large value means faster control, and helicopter will arrive the place more quickly.

5. Usage of Config file

Config file can be using for multiple helicopter. You can export parameters to a cfg file after adjustment with one helicopter, then you can mount balancer on other helicopter and change settings for it. When you want to use balancer on the old one, you can import parameters from the cfg file.

5.1 Export to Cfg file

Click 'Save' button, then choose the file location, name it, all the settings will be exported into the file.

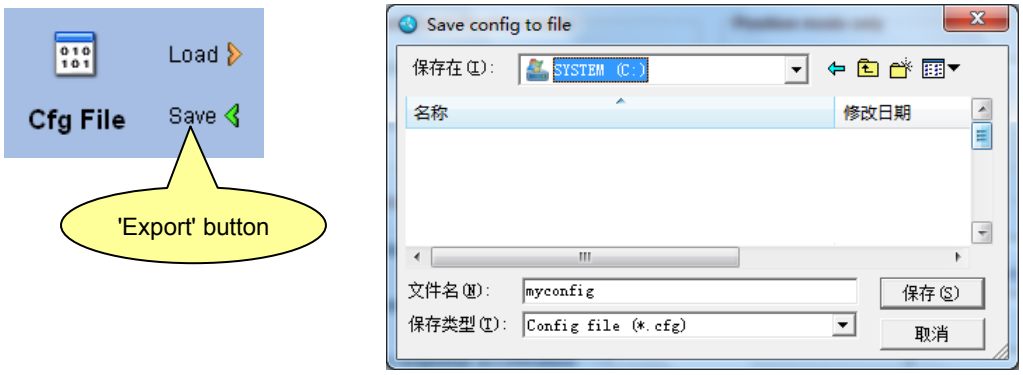

Diagram 5.1.1 Export config file

In fact, the parameters be exported is parameters in the software interface, not parameters in balancer. So if you want to export parameters in balancer, you must execute a 'Read' operation without any modification before exporting.

5.2 Import from cfg file

Click 'Load' button, then choose the file, settings will be import from the file without any other notification.

Diagram 5.2.1 Import config file

After importing, you must click 'Write' button to save them into balancer, because the importing only load parameters to the pages for adjusting.

***Attention: the exporting and importing of config file is all base on the software interface. In another words, when importing, the software loads parameters from config file and updates the elements on the pages, when exporting, the software makes parameters from pages then store them into config file.**

6. Restore factory settings

After many times modification, the effect of balancer may be terrible, then you can use this function to restore balancer to factory settings.
Click 'Reset' button, settings on screen will restore to factory default value, then click 'Write' button, settings will be save into balancer after progress bar shows finished.

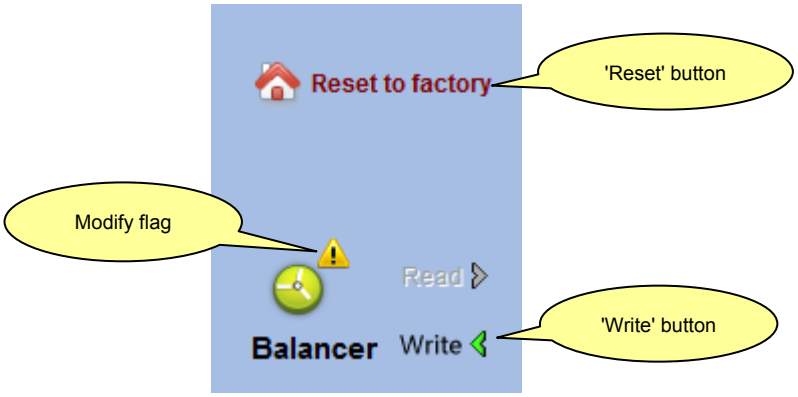

Diagram 6.1 Reset to factory settings

***Attention: if 'Write' function did not be execute, the factory setting would not be save into balancer.**

7. FAQ

Q: Servos has no action
A: Refer to section 1.4, make sure the balancer is working properly.

Q: Helicopter dithering under position mode, especially when flying near ground.
A: Check following items

- ✓ Decrease balancer sense, see section 4.2.1. If AUX channel is using, modify sense in transmitter, if not, modify it in software.
- ✓ The mounting place of CCD may be too lower, you may try to mount it higher.
- ✓ Try to increase the travel of aileron and elevator.
- ✓ May be there are something enter eye shot of CCD.
- ✓ May be some plants swing under helicopter and they are in eye shot of CCD. If then, you should switch to horizontal mode.

Q: Flight is not stable, especially when flying in upper air
A: Clean lens of CCD frequently, and the lens should keep away from vent-pipe.

Q: How to fly above low contrast environment? such as snow ground, water surface ...
A: Position mode can not be used in these environment, you must switch to horizontal mode.

Q: How to modify balancer sense?
A: If AUX channel is using, modify sense in transmitter, if not, modify it in software through PC. It is recommended to keep AUX empty because balancer sense may not be adjust frequently.

Q: There are thick smoke in eye shot of lens, what can I do?
A: Don't let engine rich oil, and keep lens away from vent.

Q: Flight is not stable under horizontal mode and position mode both
A: May be vibration cause balancer working abnormality (especially when use oil engine), you can try to add sponge between balancer and helicopter.

Q: The swash actions when open/close balancer
A: Because balancer need a few seconds to make sync with helicopter when the working mode is changed. See 4.2.2 for more details, and see following items

- ✓ Balancer will take effect in several seconds by degrees after helicopter take off.
- ✓ The environment temperature may change sharply (for example, from your car to ground), please leave helicopter and balancer in the flying environment for five minutes at least before power on.
- ✓ Serious vibration may exists, refer to previous question.

Q: There are drifting after turning

A: Check following items

- ✓ The sensor may not be mount horizontal,
- ✓ You are flying a helicopter with large attack angle rotor
- ✓ Confirm the neutral signal of transmitter is 1.5ms
- ✓ Keep helicopter static, check the tail pitch is fixed. If the tail pitch is moving when helicopter static, make fine tune of rudder to stop it.

Q: There are drifting when changing between hover and invert hover

A: Check following items

- ✓ Try adjusting parameters of '**Neutral roll attitude**'
- ✓ The speed of rotation of helicopter may exceed 360°/ s
- ✓ You may execute a serial aerobatic flight.