

INSTRUCTION MANUAL

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Preface

Congratulations to your new FBL-3X Flybarless System and thank you for choosing FBL-3X.



FBL-3X is a Flybarless System that is equally suited for beginners and advanced pilots due to its simple handling and high performance.

No matter what level of prior knowledge you have or for which model helicopter you would like to use FBL-3X, this manual will guide you through a quick and easy assembly and set-up.

In order to enjoy this kind of flying experience in its full quality it is essential that you are very careful and accurate with the assembly and set-up of your system.

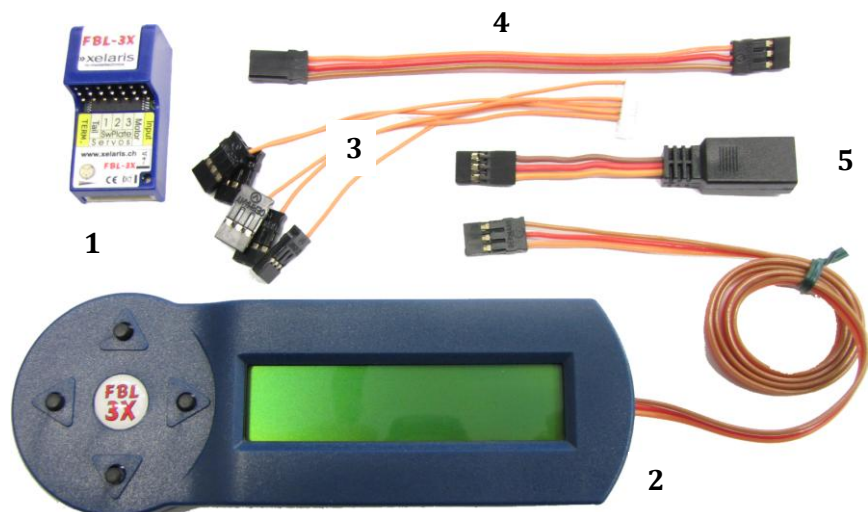
We therefore recommend you study this manual minutely even if you already have some experience with Flybarless Systems.

System components / extent of delivery

The FBL-3X system consists of the FBL-3X central unit and a Terminal unit. The central unit contains the electronic stabilization control computer with the three gyroscopes. In order to optimally fit the controlling unit to a helicopter system several values need to be adjustable. This is where the Terminal comes into action. With the Terminal you can display, adjust and save all of these adjustable values.

Extent of delivery:

- 1 Central unit
- 2 Terminal unit
- 3 Standard receiver adapter
- 4 Patch cable
- 5 Y-adapter cable
- 6 Adhesive tape (not shown)



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List of abbreviations

FBL system	= Flybarless system, electronic system for stabilization of a Flybarless rotor head
FBL-3X	= XELARIS FBL-3X central unit
Terminal	= XELARIS Terminal with four buttons and a 2*16 characters LCD (display)
Gyro	= gyroscope
→ ← ↑ ↓-button	= Terminal buttons right, left, up, down
Rigid-head	= rotor head without fly bar or fly bar stabilization
SwPl	= swash plate

Information for English native speakers

This manual is a translation from the German original. In order to make it easy to read for non native speakers, “simple” English is used in this manual.

In helicopters we have the controls collective pitch, cyclic pitch, aileron and yaw. As both, collective pitch and cyclic pitch can be abbreviated as CPitch, and the available space for characters in the Terminal display is restricted, we decided to use “elevation” or “elevator” instead of cyclic pitch and the word “pitch” or also “CPitch” for collective pitch. Instead of yaw the word “tail” is use in any case.

Characteristics of FBL-3X

FBL-3X combines several functions in the smallest space. Beside the main function, the stabilization of a flybarless rotor head, it includes a high end tail gyro and all set-up options like mixers and travel for he connected servos. As input signals FBL-3X accepts nearly all available receiver systems. All functions are discussed in detail later; let’s start with an overview.

- comfortable and easy setup using the menu system in clear text and in several languages
- 3 axis gyro system with sophisticated control for model helicopter
- can be used as a pure tail gyro
- all types of receivers can be connected directly
- mechanical, 90°, 120°, 135° and 140° SwPl mix (CCCP)
- servo centers for set-up purposes available
- servos set-to-center function for set-up purposes
- virtual swash plate rotation for multi-blade systems
- automatic hold function when receiving signal failure
- FailSafe programmable with variable response
- effective pirouette compensation
- variable mounting positions

Operation

Once the Terminal is connected to the FBL-3X you can use the four buttons to navigate through the menus and adjust the parameters. After connecting the Terminal and switching FBL-3X on you see the welcome screen.



```
FBL-3X      v4.3
Select Function↑
```

Press the ↑ ↓-buttons to scroll through the main menu items. To enter a sub menu item press the → button. You can find an overview of the menu structure in the appendix.

Many of the main menu items have more than one parameter that can be adjusted. If there is more than one parameter to adjust, press the →-button repeatedly to select the one you would like to adjust. Pressing the ←-button or the →-button repeatedly navigates back to the main menu. As soon as the parameter you want to adjust is displayed its value can be changed using the ↑ ↓-buttons.

Changed parameters immediately become valid, however they are not saved permanently and will reset to their previous value when the supply voltage is disconnected. Without any hassle it is therefore possible to try different values in a test flight and discard them afterwards by disconnecting FBL-3X

the supply voltage or save them using the Terminal.

For permanently saving a changed value there are two options, saving via menu and Quick save. After saving using either method "ALL PARAMETERS SAVED" is displayed to show the operation was successful.

Saving via menu

Select the main menu item "Miscellaneous Settings". Enter the submenu until the below text is shown and save the values by pressing the ↓ button.



```
← To Save All →  
Banks use ↓
```

Quick save

The more convenient way however is to enter a main menu and press and hold the ← button then press the → button in addition. This so called "Quick save" can be used in any main menu except for the "Channel Monitoring" menu.

For flight operation the Terminal must always be disconnected as the communication between FBL-3X and the Terminal can cause reaction delays!

TIP: If your FBL-3X system is mounted in an inaccessible location, use a servo extension cable to connect the Terminal. If you do not need the included Y-adapter, this may well be used as such.

How to change the menu language

The menu system of FBL-3X supports English, German and French. When delivered FBL-3X is set to English language menu. If you want to change the menu language, proceed as follows:

- Connect the Terminal to FBL-3X (slot TERM).
- Supply FBL-3X with 4-9 volts (for example: BEC at slot Servo or Motor connector).
- Press the ↑ button twice.
- Press the → button three times.
- Choose desired language with the ↑ or the ↓ button.
- Press the ← button three times.
- Press and hold the ← button and press the → button in addition.
- The display shows a message that all values have been saved. Now you can proceed further in your selected language.

Change installation position

The normal mounting position of FBL-3X is with the FBL-3X mounted lengthwise to the flight direction. Should that not be possible with your helicopter, then proceed as follows:

- Connect the Terminal to FBL-3X (slot TERM).
- Supply FBL-3X with 4-9 volts (for example: BEC at slot Servo or Motor).
- Press the ↑ button twice.
- Press the → button once.
- Switch the installation position with the button ↑ or ↓.
- Press the ← button once.
- Press and hold the ← button and press the → button in addition.
- The display shows a message that all values have been saved. Now you can attach your FBL-3X rotated by 90 degrees.

For more information, see the chapter **Adjusting FBL-3X**.

Part 1 Assembly and connection

Mechanical preparation of your helicopter and requirements

In order to use the FBL-3X to stabilize the swash plate function you need to remove your helicopter's flybar and make some adjustments if required (using the FBL-3X in the Tail Rotor only mode is covered later). In case there is a rigid-head conversion kit offered by the manufacturer of your helicopter we recommend you use it as often times the servo ranges are already adjusted in these.

Note that for a rigid-head rotor considerably higher forces act upon the servos. You must use the proper servos for the function, the size and the type of helicopter you are flying. It is therefore advisable to use digital servos with higher torque and holding torque than you would for a flybarred helicopter.

Please note: FBL-3X needs digital servos for tail and swash plate! For the first adjustments do not mount any servo arms! Also the servos used for the swash plate should be of the same type to help insure equal speed and response.

It is very important to use a power source capable of supplying the required power / current for the servos being used!

Power supply

The power supply for FBL-3X and the receiver can be implemented as follows:

Power source Receiver type	ESC with BEC	ESC without BEC	Throttle servo with receiver battery
Sum signal receiver	Power supply via BEC at Motor connector of FBL-3X	Y-cable at any servo connector or the Motor connector of FBL-3X	Y-cable at any servo connector or the Motor connector of FBL-3X
Spektrum satellites	Power supply via BEC at Motor connector of FBL-3X	Power supply at FBL-3X "Input"	Power supply at FBL-3X "Input"
Futaba S-Bus, Multiplex SRXL, act SX	Power supply via BEC at Motor connector of FBL-3X	Y-cable at any servo connector or the Motor connector of FBL-3X	Y-cable at any servo connector or the Motor connector of FBL-3X
Standard receiver	Power supply via BEC at Motor connector of FBL-3X	Power supply at receiver or Y-cable at any servo connector	Power supply at receiver or Y-cable at any servo connector

FBL-3X assembly and connection

For mounting the central unit, choose a position that is easy to reach and low on vibrations. It should also not be placed next to any pieces that might be electro statically chargeable such as for example a tail drive belt and FBL-3X should not be exposed to any exhaust fumes.

Use the enclosed double sided foam sticky tape for mounting FBL-3X. Use the enclosed tape and not just any other tape as it is adjusted to FBL-3X in its thickness and stability. Only in rare cases, mainly if you can't get rid of vibrations, it is necessary to use a stiffer or softer tape. There is no need for mounting an additional steel plate for FBL-3X as it already has the steel plate integrated in its base. Make sure that all adherence surfaces are oil and dust free!

You can mount FBL-3X to a standing or hanging position. When positioning FBL-3X it is essential that you are extremely careful and patient as the three integrated sensors will later only measure the difference in the very movement they are supposed to. Askew or rotated mounting will lead to clearly worsened flying and controlling characteristics. Therefore please take your time here! Later on if the helicopter drifts away heavily when doing pirouettes the reason is mostly askew positioning of the central unit.

Connecting the receiver

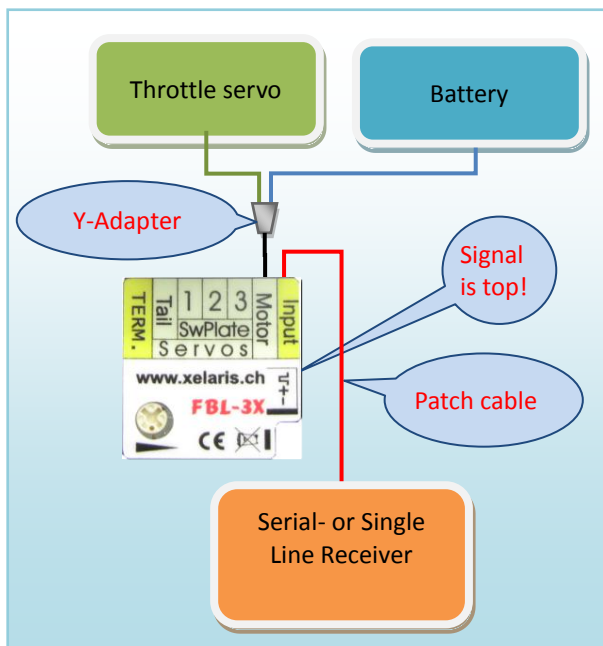
FBL-3X supports all kinds of receivers directly. The transmission frequency (30/40/72MHz or 2.4 GHz) is not important.

Receiver types

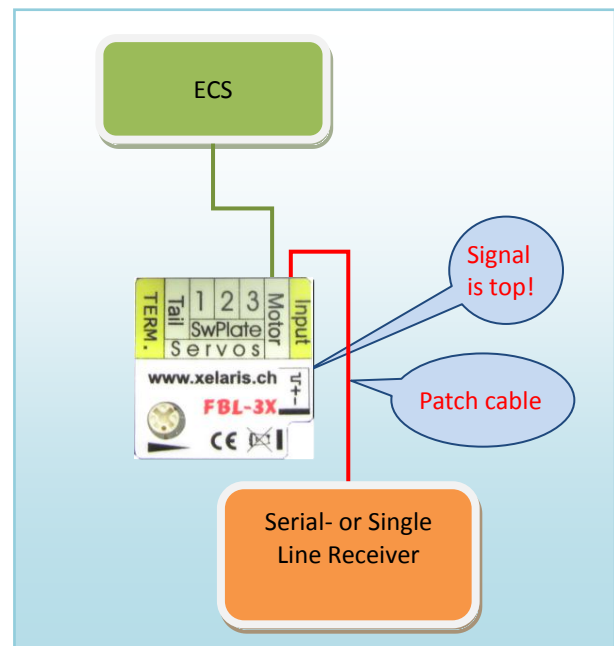
- **Standard receiver:** Standard receivers where each receiver channel is brought out separately via 3-pin connectors.
- **Single-line receivers:** Special receivers where all received channels are brought out together on one 3-pin connector. In this case, the channels are transferred in the so-called serial PPS mode. Such receivers are available from Futaba and Jeti.
- **Serial signal receiver:** Special receivers where all received channels are brought out together on one 3-pin connector. In this case, the channels are transferred in a proprietary serial protocol. Examples are Futaba S-Bus, Multiplex SRXL, ACT SX.
- **Spectrum satellite:** Special receivers where all received channels are brought out together on one 3-pin connector. In this case, the channels are transferred in a proprietary serial protocol. These receivers are called Satellite because they are normally attached as additional receiver (satellite) to a standard receiver.

Serial signal and single line receivers

To connect a serial signal receiver as well as for connecting a single line receiver the patch cable must be connected to the FBL-3X slot "Input" and the receiver.



Connection diagram gas powered



Connection diagram electric version

Spektrum satellites

You can chose to connect one or two Spektrum satellite receivers to the 9-pin plug connector at the front side of FBL-3X. Make sure that these plugs are connected at the far right or far left side! Some pins in the middle will remain empty. If you only use one satellite you can chose freely between the far right or far left side.

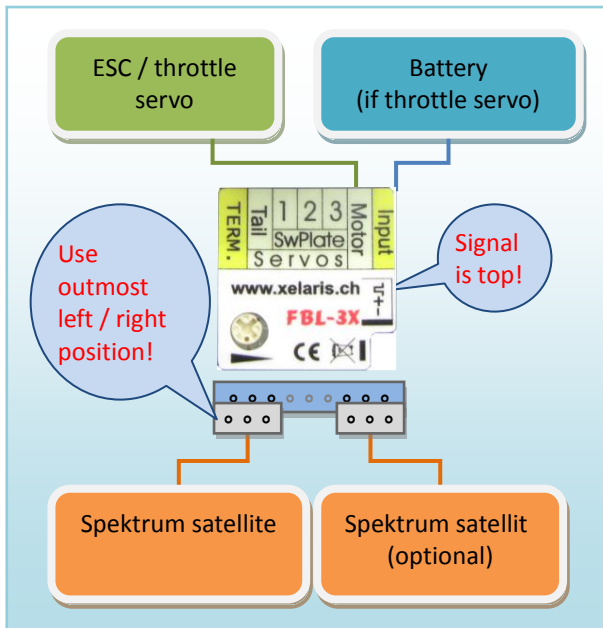
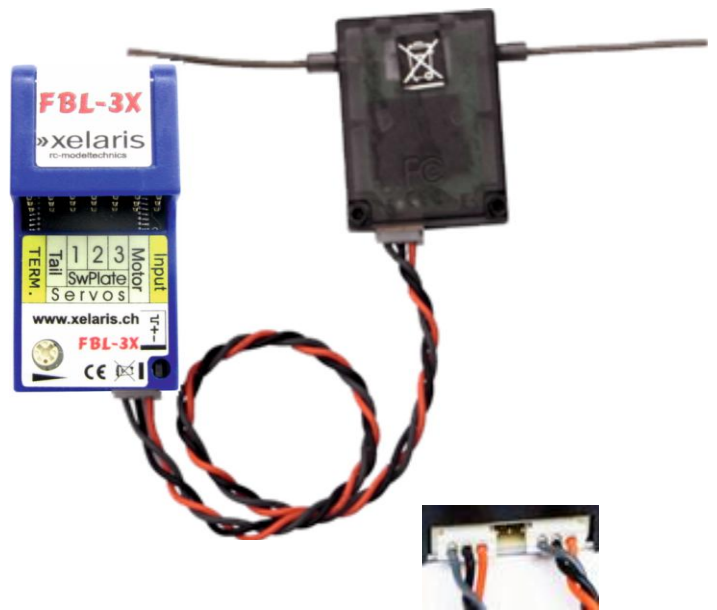


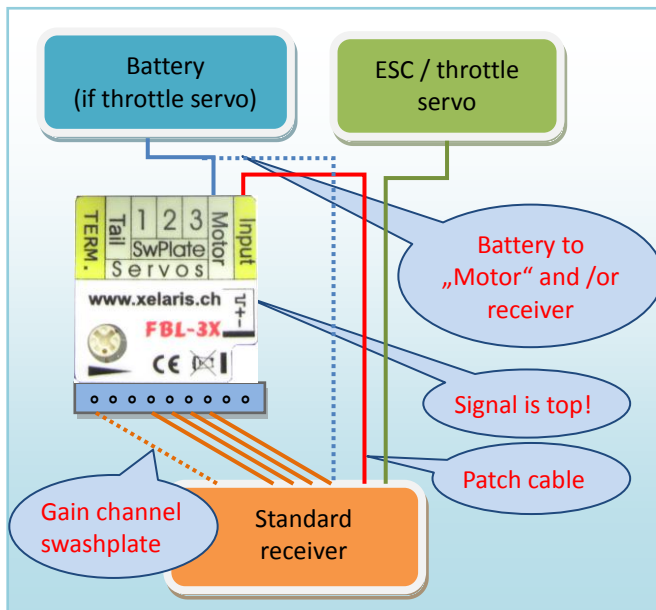
Diagram for Spektrum satellite receivers



Connection of the Spektrum satellite receivers

Standard receiver

A standard receiver is connected through the included adapter cable **and** the patch cable. It does not matter which plug of the adapter is plugged into which channel. The channel assignment is always done in the FBL-3X menu. Of course, this may only be receiver outputs, which also have a relevant function for FBL-3X. In general this is pitch, yaw, aileron, elevation and the tail gain.



Connection diagram standard receivers



Picture does not show the power supply

Connecting the servos

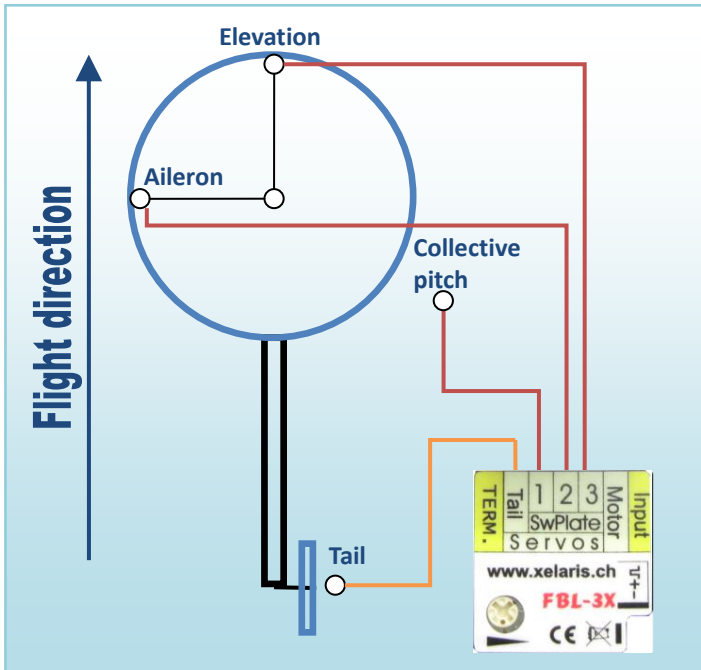
Tail servo

The tail rotor servo is always connected to the "Tail" connector on FBL-3X.

Swash plate servos

FBL-3X supports all swash plate types which operate with three servos. For the different swash plate types, there are differences in meaning and connection details. **Please note: FBL-3X supports only the use of digital servos!**

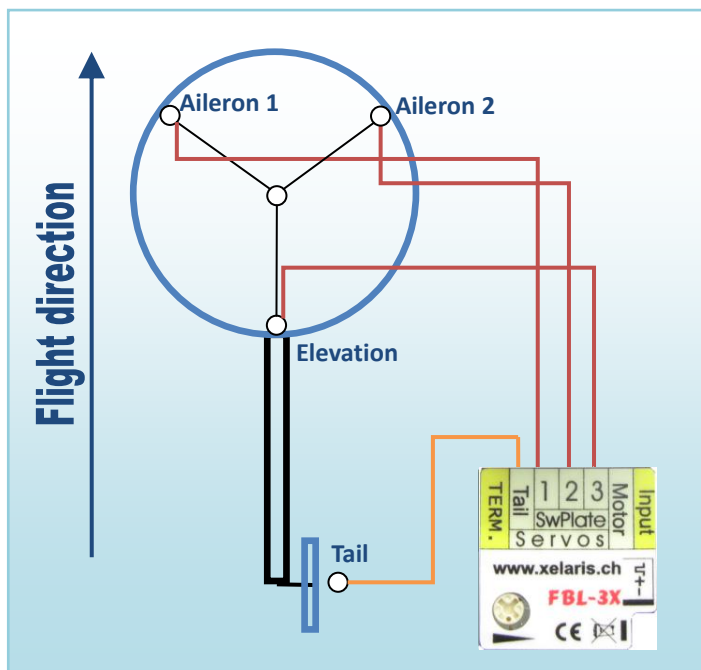
Connection diagram for mechanical swash plate mixing



FBL-3X	Servo
SWASHPL. 1	Collective Pitch
SWASHPL. 2	Aileron
SWASHPL. 3	Elevation

Mechanical swash plate mixing means when the mechanism is designed so that each servo is responsible for a separate function. In this case Pitch, Elevation and Aileron are not mixed in the FBL-3X but issued separately.

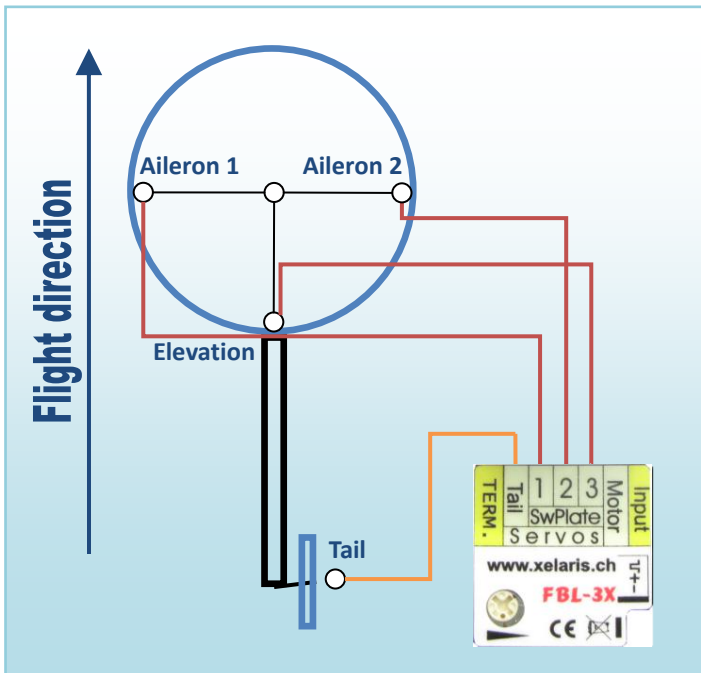
Connection diagram for electronic 120°/135°/ 140° swash plate mixing



FBL-3X	Servo
SWASHPL. 1	Aileron servo 1
SWASHPL. 2	Aileron servo 2
SWASHPL. 3	Elevation servo

In a mixed electronic swash plate all three servos are controlled in a specific ratio. Depending on the function, all three servos move in the same or partly in opposite directions. It is no problem if the two aileron servos are at the back and the elevator servo is in the front of your swash plate. It is only important that the elevator servo is connected properly. If the aileron servos may be reversed you need to correct this on the transmitter later.

Connecting diagram for electronic 90° swash plate mixing



FBL-3X	Servo
SWASHPL. 1	Aileron servo 1
SWASHPL. 2	Aileron servo 2
SWASHPL. 3	Elevation servo

Part 2 Set-up

FBL-3X is distinguished by the fact that apart from the mechanical settings such as servo positions and ranges or the movement directions of servos and gyroscopes, only the tail and swash plate gain have to be set-up. Therefore and even without the knowledge of control engineering specialties of a flybarless system a new model can be set up in only a few minutes. The following chapters will guide you through the set-up and optimization of your system step by step.

Programming the transmitter

In your transmitter choose the model type “helicopter with mechanical swash plate control”. This is very important because FBL-3X needs to receive all control function inputs independently for each control function - **All mixing is done in FBL-3X as needed.** Deactivate **all** mixers that might be pre-set in your transmitter such as for example the static DMA mixer for the tail and check the result on the servo display of your transmitter.

Depending on the transmitter's manufacturer the 100% display for the transmitter does not correlate to the same servo travel. It is therefore advisable that you set your transmitter values as FBL-3X “sees” them. In order to do so, connect the Terminal to FBL-3X and switch on the transmitter and the receiver. It is not necessary to connect the servos yet. Use the ↓-button to switch to “Channel Monitoring” and press the →-button to display all channels.



In this menu you can see what FBL-3X determined the values to be. This way you can easily adjust the previously mentioned channels. The abbreviations are: T = Tail, CP = Collective Pitch, E = Elevation and A = Aileron. The small τ and small H on the top line represent the gain for Tail and swash plate. At the small τ is also a visible up or down arrow. This is shown in what mode you are. Down arrow means FBL-3X

"limited heading hold" up arrow means "full heading hold".

Initially limit the travel for your transmitter as follows:

Elevation and aileron: **E+/-100 A+/-100** Tail servo: **T+/-100** Collective pitch: **CP+/-100**

A FBL-3X stabilized helicopter can reach enormous turn rates depending on its set-up. To make sure the first flight does not end in nasty surprises and with too high yaw rates, we strongly recommend starting of with the reduced servo travels. Later on it is easy to increase them via the transmitter.

Use of the gain channels

The object of the regulator in a FBL system is to implement only deliberate control commands to move the model. Undesired movement of the model, i.e. motion without pilot input or in other words a disturbance should be suppressed. The gain value determines how hard or how sensitive the controller reacts on such disturbances. The higher this value is set, the stronger the response of the regulator. This has nothing to do with the control sensitivity, which is set outside of the controller, in the case of FBL-3X this is done by the servo travel in the transmitter.

To allow a set-up of a model as fast as possible, FBL-3X already supports values for the gain of tail and swash plate. These are referred to as 100% (= factory values). Different values, so for example 80% or 140% will correspond to a reduction by 20% or an increase of 40% from the factory value of 100%. Adjustable values are between 5% and 200%. Because a transmitter can only transmit signals between 0 and 100%, whereas FBL-3X is adjustable from 5% to 200%, the transmitter signal is doubled internally by FBL-3X, so that, depending on the transmitter manufacturer, 35 to 55% of the channel travel means 100% to FBL-3X. This applies to the tail gain and the swash plate gain.

Tail gain set-up

For most tail gyro systems the value of a channel defines the gain and the sign of this value defines the mode. Transmitter values between 0 to +100% define the gain for AVCS mode (heading hold mode) and values between 0 to -100 define the gain for standard mode. The tail gyro in FBL-3X is controlled in exactly the same way. The difference is that there is no standard mode, but instead a "limited heading hold mode" instead. It is recommended to attach the gain channel to a 2-way switch on the transmitter. For the initial set-up, please set the switch position 1 to +50% and position 2 to -50%. This refers to 100% in the Channel Monitoring menu of FBL-3X. With such a set-up, we can switch between the modes. The selected mode can be recognized by the arrow up or down at the small τ in the menu "Channel Monitoring". (See chapter "Transmitter set-up")

Swash plate gain set-up

Same as for the tail, also the gain for the swash plate needs to be adjusted to the model. For the set-up of the swash plate gain, there are three sources to select from. These are:

- A transmitter channel.
- The FBL-3X potentiometer.
- A fixed gain value, which is adjusted with the Terminal.

As the factory default setting **the potentiometer** is selected as source for the swash plate gain.

Which source is suitable for you depends on your habits or also on the installation position of the FBL-3X in the helicopter. There is no right or wrong. If the FBL-3X is installed in a way that the potentiometer is easy to reach, then the default setting where the potentiometer is used as source for the gain set-up can be kept. The gain of the swash plate is usually set once. This value must not be changed often. However, if you have enough free channels on the transmitter and you like to be able to change the gain value while the helicopter is airborne, then a channel from the transmitter should be chosen as source for the gain. In the event that you do not use the potentiometer, or it is unavailable and you do not use a separate channel do not have one available, there is still the option of the fixed value by the Terminal.

To start the setup, set the gain to 100%. Now **set collective pitch to center and check the cyclic pitch with full aileron right**. You should see a cyclic pitch of about 6-8°. If not so, adjust the gain value to lower values for less cyclic pitch or to higher values for more cyclic pitch. In case you finally have a value below 70 or above 130 we recommend to make changes in the mechanical setup e.g. change the

length of the servo arms. For multi blade heads the maximum cyclic pitch should be around 4° and not exceed 5°.

Adjusting FBL-3X

After you have mounted FBL-3X and programmed your transmitter accordingly, all that is left to do is to set up the gyro reverses as well as the servo reverses and travels before you can start off to your first flight. FBL-3X's main menu is set up in a way that you can follow it step by step for the first set-up. Therefore we will follow this same principle here and explain each step one after the other.

During the set-up, we recommend you detach all linkages from the servos so that no mechanical restriction can occur while they move for example when servo travels are far too big.

Now switch on your helicopter. The LED in FBL-3X will start flashing red for a few seconds then it will start to light up continuously. Directly after the switch on, FBL-3X will try to calibrate the sensors and initialize the system. During this time, the FBL-3X is learning the reference position, so do not move the helicopter or the control sticks. If the helicopter or the sticks are moved in anyway calibration of the sensors is not possible and the LED will not change to light up continuously which means the system will not be ready for use. In this case the change will only take place if the helicopter was not moved for at least a few seconds. The successful end of the initialization is indicated by a short movement of all servos. In case of an electronically mixed swash plate this looks like the swash plate is dancing

If you have not yet connected the Terminal go ahead and do so now. The Terminal display will show the following message:

```
FBL-3X      v4.3
Select Function↓
```

As soon as the FBL-3X menu is visible press the ↓ button in order to navigate to the first menu item.

Receiver Assignments

We start with the selection of the receiver type. Press the →-button to navigate to the sub menu „RX Type”.

RX Type

Choose the receiver you use. **Important: Go back to the main menu afterwards and save the setting!** (← button and then “Quick save”) **Turn the FBL-3X OFF and then ON again.**

Spektrum

Use this value if you have connected one or two Spektrum satellite receivers. For this type of receiver the input channels of FBL-3X are assigned to functions automatically according to the standard of Spektrum. Only if the assignment is incorrect, you have to assign the FBL-3X channels to their functions as described further below.

SingleLine

Use this value if you have connected a receiver of the type Single Line. For this type of receiver the input channels of FBL-3X have to be assigned to their functions as described further below

Futaba S-Bus

Multiplex SRXL

ACT S3D SX

Use this value if you have connected a receiver of the type Futaba S-Bus, Multiplex SRXL or ACT SX. For this type of receiver the input channels of FBL-3X are assigned to functions automatically according to the Futaba standard. Only if the assignment is incorrect, you have to assign the FBL-3X channels to their functions as described further below.

Standard

Use this value if you have connected a receiver of the type Single Line. For this type of receiver the input channels of FBL-3X have to be assigned to their functions as described further below

Start Binding with ↓

This menu item only appears, if Spektrum is selected as receiver type. Start Binding by pressing the ↓ button. Afterwards the menu "CONNECT RECEIVER" appears. In case the Spektrum satellite(s) is already connected, disconnect it and then reconnect it again.

The receiver LED indicates the binding readiness by short blinking. You can repeat this procedure as often as you like, unless FBL-3X is not switched off, a newly connected Spektrum satellite will always be set in binding mode. Also two satellites can be bound together. Once the receiver(s) is ready for binding, set the transmitter also in binding mode. Binding is completed when the LED is lit permanently.

Note: FBL-3X can only set-up the receiver in binding mode. The binding itself is a process between transmitter and receiver. You can instead connect the satellite to a standard receiver and do the binding process in this way. Once transmitter and receiver are bound, the operation with FBL-3X is possible..

So far the FBL-3X software supports only the Spektrum mode DSM2. The new DSMX mode will be available in a later version.

Channel / Function assignment

As learned in the chapter transmitter set-up, FBL-3X expects all functions without any mixer on separate channels. Hence, the output channels of a receiver directly represent the functions Pitch, Tail, Elevator, Aileron and gain. To set FBL-3X in a position to correctly process the functions, one has to inform FBL-3X, which function is fed into FBL-3X on which input channel. In some cases this is done by the proprietary sequence of the manufacturer (see above). In case of standard receivers and for Single Line receivers, there is no such sequence, it has to be assigned individually. To do so, go ahead as follows.

Channel assignment checklist

- Connect receiver according to this manual.
- Select main menu item "Receiver Assignments".
- With button → move to sub menu "Pitch". In the display you now can read "Pitch" in the top line and "Channel1" combined with a numerical value in the lower line.
- Move the collective pitch stick and observe the numerical value. If the numerical value follows the stick movement, the assigning of "Pitch" is already correct, if not hit the ↑ button once.
- In the lower line of the display you now can read "Channel2". Move the collective pitch stick again and observe the numerical value. Repeat the procedure -button ↑, move collective pitch stick, observe numerical value -, until you found the "Pitch" channel.
- Select the next function ("Tail") with the → button and repeat the procedure as above until you found the related channel.
- Repeat this for all functions.
- Perform a "Quick save" once all functions have been assigned.

Channel Monitoring

The Channel Monitoring is used to check the function assignment and the travel settings of your transmitter. Here you can check if the receiver was recognized correctly and if all functions have been assigned.

Hint: You can reach this menu directly by pressing the ⓧ button after connecting the Terminal

Tail Settings

Servo Timing

Here you choose the control frequency of your tail servo. **CAUTION: An incorrect setting of the pulse center can destroy the tail servo and does not improve the tail rotor performance!**

1520µs	Digital servos (standard)
760µs	Applies to servo type as: S9251, S9256, BLS251

CPitch → Tail

There is the option to set a mixer for the function Pitch to Tail in FBL-3X. This is needed when the tail gyro is not able to hold the tail by itself for fast pitch changes even after the tail gain has been adjusted to the maximal possible value. Typical values are between 10 and 40. Depending on the tail assembly, positive or negative values can be set-up. To test the function, give a short collective pitch pulse and watch the tail blades. The tail pitch should increase for a short moment for correct operation.

Servo Type

The factory setup „Standard“ is good for most servo types. In case your tail shows a slow wagging which can not be eliminated by tail gain adjust, please try the „Special“ value.

Swashplate Configuration

SwPI Config

Here you can choose your swash plate type. The following options are available:

- 120 °: The most common option of the SwPI mixture.
- 135 °: Less common option of the SwPI mixture, elevator and aileron arms are of equal length.
- 140 °: Less common option of the SwPI mixture, elevator and aileron arms are of equal length.
- 90 °: Option in which the elevator and aileron arms stand at right angles to each other.
- Mechanical: For all helicopters with mechanical SwPI mixing.

Servo Reverse

Tail Servo, SwPI Servo 1-3

Move the sticks and check if all servos move in the right direction. To do so, attach the servo arms to the servos, but don't fix them yet. In case a whole function is inverted, invert this function in the transmitter. Else, invert the related servo with the help of this menu items.

For the following settings the maximum servo ranges are always set automatically. The servos are set to the appropriate positions by FBL-3X whilst you do not have to touch the transmitter sticks, FBL-3X does this for you.

Servo Center Check + Adjust

Tail Side 1-2, SwPI Side1-3

After choosing the function „Servo Center Check“ all servos are set to their center position.

Hint: You can reach this menu directly by pressing the ← button after connecting the Terminal

Now mount the swash plate servo arms horizontally and the tail servo arm 90° to the servo body. Due to the spines on the servo output and the servo arm, the position may not be exact. Try to find the best possible position by rotating the servo arm. To fine tune the position, go to the submenus and adjust each servo arm into the best position. Adjust the swash plate linkages or the servo levers in a way that the swash plate is perpendicular to the rotor shaft and that **collective pitch is set to 0 degrees**. Adjust the tail servo in a way that the tail blades show about 3-4° positive pitch if servo is centered.

This basic setting is important for balanced flight behavior.

Tail / SwPI Ranges

Tip: To make sure that there is no mechanical restriction, don't attach the servo rods yet, but take each rod by hand in the position to which it would be brought by the servo arm. Only when it is certain that this position is mechanical OK, the linkage is hooked up.

Tail Side 1-2 (Setting tail servo endpoint limits)

This submenu is used to adapt the mechanical servo travels. As soon as you switch from the main

menu in the first submenu with the → button, the tail servo moves slowly in the first end position. Adjust the end point using the ↑ ↓ buttons. Set your end points so there is no restriction in movement causing the servo to stall and there is nothing restricting servo movement. With the → button you enter the menu for the end position 2 of the tail rotor.

CPitch Side 1-2 (Setting collective pitch end point limits, symmetry)

In the submenu "CPitch Side 1 ", the swash plate moves automatically to the first end position. Check with a pitch gauge whether the pitch angle suits your needs. In the submenu "CPitch Side 2 ", the swash plate moves automatically to the second end position. Go here also as described above. Please set-up both end positions to symmetrical pitch values (e.g. + / - 10 degrees). If desired, an unbalanced pitch curve can be set later in the transmitter.

Gyro Reverse

This gives you the ability to set the gyro respond direction of each gyro axis. In this menu the tail and swash plate control has an increased sensitivity so that the impact is easy to see, this is not the response rate in normal operation. Please check for the gyro reverse as follows:

Hold your helicopter horizontally. Now tip it about 45 degrees forward. The swash plate should tilt backwards. This means that FBL-3X performs the exact steering movement that the pilot would use to stabilize the model. Please check all axes in this way and please be very precise when doing so. An incorrect gyro reverse makes the model uncontrollable and will certainly lead to a crash. At this point also check the reverses of your control sticks. Please note that the rigid-head alteration can invert the collective pitch. Increasing collective pitch must show a higher pitch at the rotor blades. The swash plate can indeed move downwards in the process!

Dynamic SwPI Settings

Dynamic SwPI

This function compensates exterior influences (wind, unbalanced chassis,...) in pirouettes. It's also called pirouette compensation. As almost no helicopter is 100% balanced and completely immune against wind, this function should be switched ON in any case!

Dyn. SwPI Dir.

Use this menu item to set the compensation direction. In order to make these settings the swash plate moves to an elevation or aileron end position. Look at the swash plate from the side and turn your helicopter's nose left and right repeatedly. Thereby observe the swash plate movement. The direction is set correctly when the swash plate holds its position in space. The big amplitude movement during programming is only used in order to make the check easier.

If this approach seems too complex just switch on the dynamic swash plate rotation and perform a pirouette later on. If the helicopter is thereby quiet (without swash plate control input!) the direction is correct. If the helicopter wobbles invert the direction. If the compensation direction is set incorrectly the result will simply be unclean pirouettes, there is no danger.

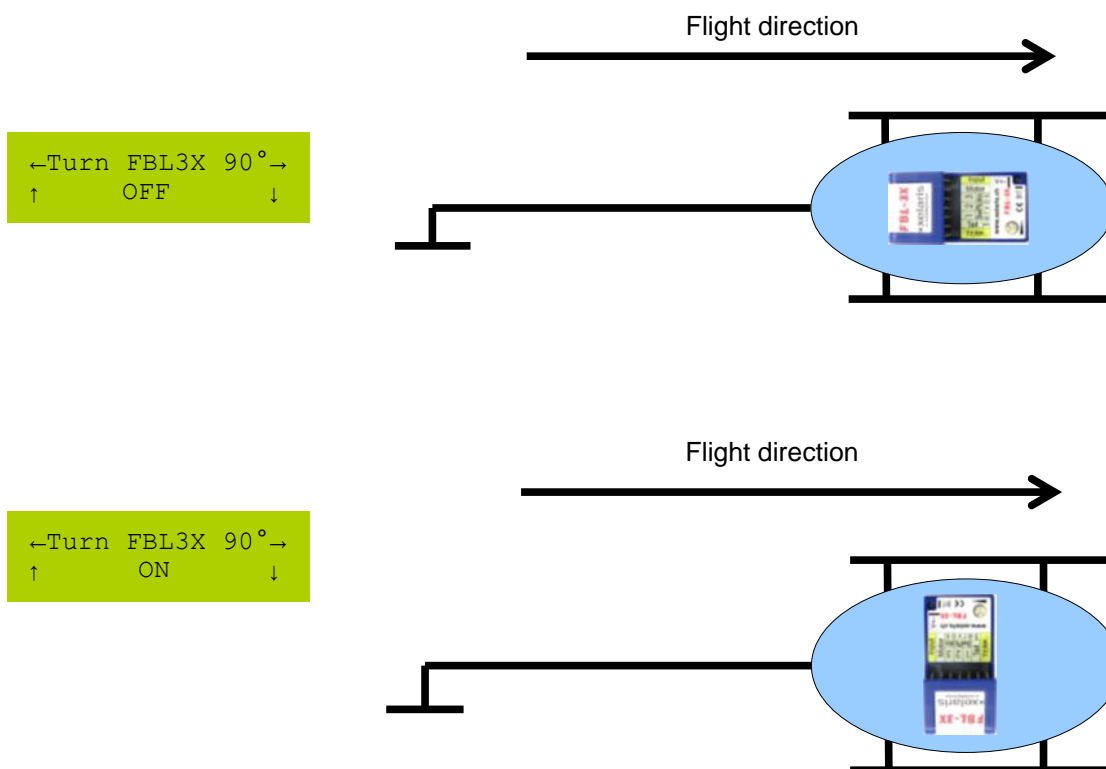
Miscellaneous Settings

These are optional settings that are not necessary for the basic set-up.

Turn FBL3X 90°

Ex factory FBL-3X is programmed in a way that the long side of the housing has to be mounted in flight direction. If it is necessary for mechanical reasons FBL-3X can also be rotated by 90 degrees. This can be activated in the turn FBL-3X 90° menu. It does not matter if the FBL-3X is rotated left or right.

In every case it is necessary that you check the gyro reverses after the rotation and correct them if needed.



V-SwPI Twist

This is a static virtual swash plate twist as it is known from various transmitters. This feature is needed mainly for multi blade rotor heads. This is also known as swash plate phasing.

Language

Here you can choose the display language for the Terminal. All settings and configuration values are retained when the language is changed.

Tail Gyro Mode (FBL-3X is used as a standard Tail Gyro)

Attention: The change to the tail gyro mode means a mode change which is similar to a memory bank change. Therefore FOR SAFETY, make sure before changing that the motor leads and the servo links are disconnected! After the change to the tail gyro mode all settings including the receiver selection must be entered again.

If this option is enabled (ON), then the FBL-3X works as a pure tail gyro, as on a helicopter with flybar. Some settings are then pre-set for this mode already and the unneeded menus are hidden. Pure tail gyro here means that the control system for the swash plate is turned OFF. The servo control and the mixers for the swash plate servos are however active and can be used. So a helicopter can be controlled by a simple transmitter with no mixing functions and all receivers can be used. If you intend to later use the FBL operation of FBL-3X, then it is advisable, even when operating on a standard receiver to connect the swashplate servos from the beginning to the FBL-3X. Basically with a standard receiver you have the opportunity to connect the swash plate servos directly to the receiver and to use FBL-3X as the pure tail gyro. If the swash plate servos are connected to FBL-3X, the swash plate mixing is made either by the transmitter or by FBL-3X. Note however, that the mixture only in either the transmitter or FBL-3X is enabled. If the mixing is done in the transmitter, the swash plate configuration in the FBL-3X must be set to "Mechanical".

If you later change to the FBL operation, just switch off the tail gyro mode and perform a complete setup.

FailSafe

If the connected receiver supplies no signal to FBL-3X, then FBL-3X freezes the last received channel information. It's as if the pilot holds all sticks in a certain position (namely the last received position) and does not control any more. The regulation of FBL-3X is of course still actively working to stabilize your helicopter. This condition is known as Hold.

FailSafe is referred to as the possibility of the servos to move into predefined positions if the received signal is lost. If the connected receiver has an own FailSafe mode, the FailSafe in FBL-3X can stay switched OFF. Otherwise, you can choose to use the Hold mode, or the FailSafe of FBL-3X.

For the FailSafe mode you first need to decide which positions the servos should move to, in the case of FailSafe. Go to the submenu "FailSafe" and press the ↓ button until you can read "FailSafe OFF". Now move all sticks on the transmitter so that all servos have the desired position. E.g. swash plate stick in center position, tail stick in center position and motor (in case of connected to FBL-3X) to motor OFF position. Now press button ↓ to save these positions. It briefly appears the message "FAILSAFE VALUES LEARNED". Now press the ↑ button to activate FailSafe. Because FailSafe should only move the servos to the desired position when the receiver definitely is no longer safe, you now have the opportunity to set a waiting time in 0.25 second steps up to 3 seconds. This waiting time elapses from the time "no longer recognized the receiver", to enable the FailSafe. In between Hold is active.

Bank

There are 4 memory banks (locations to store FBL-3X set-up data). It is for example possible to use one bank for a functioning set-up and another one for testing purposes. When FBL-3X is switched on it automatically loads the bank that was last saved. **Note: When changing a memory bank, the new parameter values become valid immediately. Hence for SAFETY, change a memory banks ONLY when the motor is not connected to the system!**

To Save All Banks Use ↓

After you press the ↓-button all current settings are saved to the currently active memory bank.

Reset Selected Banks With ↓

Here all settings for the current memory bank set in FBL-3X can be reset to the factory settings.

SwPI Gain Settings

Fixed Value

This menu only appears, if the source for swash plate gain is "Fixed Value" (see next menu item). Here you can set-up the swash plate gain directly in numerical values.

SwPI Gain

In this submenu you select the source for the swash plate gain. You have the options: "TX" (transmitter), "Trimmer" (potentiometer on the FBL-3X) and "Fixed Value". See also chapter "Swash plate gain set-up".

**Congratulations, at this point all basic settings are completed!
Remember to save your set-up.**

As you probably noticed, only the mechanical settings of the servos and the gain for swash plate and tail were addressed during all adjustments. Of course, a FBL system requires much more setting to be able to precisely control. All these parameter values were determined in the development of FBL-3X by many pilots and on different models and stored in the so-called professional menu. This means that almost all helicopters with no further changes can be operated safely. The professional menu is not part of the normal menu system, but it can be accessed through key combinations. If you happen to get into the professional menu, then go with the ↑ button to the display "Basic Settings" and then leave this area with the button →. Another way to leave this menu area is to switch FBL-3X off and back on. Do not change values in this area! Should this happen accidentally, then go in the standard menu in the "Miscellaneous Settings" menu to "Reset Selected Bank with ↓" and thus set all values back to factory settings.

The first flights

- Before the first take off we strongly recommend you closely check the following points:
- Are all control function directions set correctly?
- Are the gyro reverse settings (tail, elevator, aileron) correct?
- Is the Gain channel set to 100%?
- Is the center of gravity positioned at the rotor axis?

With the basic setting the helicopter will hover stable and safe. In order to further increase the flight behavior, please follow the matrix below:

Flight behavior	Optimization by FBL-3X Terminal	Optimization by transmitter / or at the Potentiometer if activated
Helicopter has indirect behavior to cyclic inputs		Increase the function's servo ranges / dual rate
Helicopter too responsive	Reduce maximum cyclic range	Reduce servo ranges / dual rate use the transmitter EXPO
Helicopter feels too soft	Increase swash plate gain	
Tail oscillates		Reduce tail gain on transmitter
Tail not inherently stable		Increase tail gain on transmitter
Tail rotation rate too low		Increase the servo range / dual rate
Pirouettes wobble	Turn on "Dynamic SwPl" and /or change direction	
Helicopter shakes on swash plate	Reduce swash plate gain	Reduce gain swash plate gain
LED flashes fast constantly		No receiver recognized. Check receiver type and connection. Transmitter on? Binding done?
LED flashes constantly		Don't shake or move helicopter

If your tail rotor does not stop evenly on both directions, FBL-3X has the possibility to learn a hovering offset. Thereby the tail rotor control is learned and stopping will be considerably smoother in both directions.

In order to learn this offset value, bring your helicopter to a quiet hovering flight and switch (toggle) the sensitivity channel Gain1 quickly four times in a row. Whilst doing that and even about five seconds afterwards you should not move the tail control at all if possible and the helicopter's nose should, if it is not completely calm, turn towards the wind. If the learning was successful FBL-3X will confirm with a slight tail twitch.

The pirouette stopping characteristics should now be the same on both directions. In order to save the learned value you must connect the display to FBL-3X after landing. Instead of the usual welcome menu a special menu will appear where you can save the learned value by pressing the **↓** button. Pressing any other button discards the learned value. The range in which this offset can be set by FBL-3X is limited. If, after connecting the terminal, you see the message "Out of Range", the value is off limits and FBL-3X could not set the offset value. In this case it is often sufficient to give the tail rotor a slight positive pitch. You can reach this by changing the leverage length between the tail servo and the tail linkage. After that, repeat the learning process for the hovering offset. You can delete the hovering offset by switching tail gain quickly four times in a row while the Terminal is connected. A menu will then offer you to delete the value.

Attachment

FBL-3X menu structure

FBL-3X v4.3					
Select Function↓					
Receiver ↑	← RX Type →	←Start Binding →	← Coll. Pitch →	← Tail →	← Elevator →
Assignments →	↑ ↓	with ↓	↑ ↓	↑ ↓	↑ ↓
cont.:	← Aileron →	← Tail Gain →	← SwPl Gain →	← Throttle →	
	↑ ↓	↑ ↓	↑ ↓	↑ ↓	
Channel ↑	←T+000T%100H%100				
Monitoring →	CP-100E+000A+000				
Tail ↑	← Servo Timing →	← CPitch→Tail →	← Servo Type →		
Settings →	↑ ↓	↑ ↓	↑ ↓		
Swashplate ↑	← SwPl Config. →				
Configuration →	↑ ↓				
Servo Reverse ↑	← Tail Servo →	← SwPl Servo 1 →	← SwPl Servo 2 →	← SwPl Servo 3 →	
→	↑ ↓	↑ ↓	↑ ↓	↑ ↓	
Servo Center ↑	← Servo →	← Tail Servo →	← SwPl Servo 1 →	← SwPl Servo 2 →	← SwPl Servo 3 →
Check + Adjust →	Center Check	↑ ↓	↑ ↓	↑ ↓	↑ ↓
Tail / SwPl ↑	← Tail Side 1 →	← Tail Side 2 →	← CPitch Side1 →	← CPitch Side2 →	
Ranges →	↑ ↓	↑ ↓	↑ ↓	↑ ↓	
Gyro Reverse ↑	← Tail Gyro →	←Elevator Gyro →	← Aileron Gyro →		
→	↑ ↓	↑ ↓	↑ ↓		
Dynamic SwPl ↑	← Dynamic SwPl →	← Dyn.SwPl Dir.→			
Settings →	↑ ↓	↑ ↓			
Miscellaneous ↑	←Turn FBL3X 90°→	← V-SwPl Twist →	← Language →	←Tail Gyro Mode→	← FailSafe →
Settings →	↑ ↓	↑ ↓	↑ English ↓	↑ ↓	↑ OFF Learn↓
cont.:	← Bank →	← To Save All →	← Reset Selected→		
	↑ ↓	Banks Use ↓	Bank with ↓		
Swashplate Gain↑	← Fixed Value →	← SwPl Gain →			
Settings →	↑ ↓	↑ ↓			

Specifications

Area of application: Model helicopters that are not subject to authorisation
Supply voltage range: VCC = 4 – 9 Volts, ~50 mA
Temperature range: -20 - +70°C (Even SMM sensors are not completely free of drift. When operating in a highly fluctuating ambient temperature, you need to expect a higher drift)

Relative air humidity over 90% or contact with humidity or water is not acceptable.

Measurements

FBL-3X: 39 * 18,5 * 20 mm
Terminal: 132 * 50 * 19mm
Weight FBL-3X: 14g (including steel plate for vibration attenuation)

Input signals receiver:

Pulse range: 1,520 ms +- 400µs
Repetition rate: ~ 20 ms
Logic High: > 3V
Logic Low: < 1V
Charging: > 10k

Servo output:

Pulse range swash plate: 1,520 ms +- 400µs, repetition rate 3,6 ms
Pulse range tail: 1,520 ms +- 400µs, repetition rate 3,6 ms
760µs +- 400µs, repetition rate 3,6 ms
Logic High: > 4V
Logic Low: < 1V
Inner resistance: 220 Ohm

The outlet “Term.“ may only be used for the Terminal!

Technology:

Three precision sensors in Silicon Micro Machine (SMM) technology.

Controlled yaw rate up to 500°/s, 12 bit resolution.

C-MOS micro processor 56 MHz.

LCD-Display for optimal readability even in bright light..

Content of delivery:

FBL-3X, Terminal, patch cable, standard receiver adaptor cable, Y-adaptor cable.

XELARIS FBL-3X and Terminal are conform to RoHS after EG-Richtlinie 2002/95/EG

Disclaimer

A model helicopter that is equipped with FBL-3X always has to be used in a way that neither people nor objects can be endangered or damaged.

FBL-3X is solely designed for the use in model helicopters and it may not be mounted to any aircraft that carries humans.

Vibrations, static discharge, dirt, petrol residuals and humidity can cause fault in FBL-3X's functions and should therefore be kept away. In particular, high-frequency vibrations generated by turbines, for example, can interfere with the electronics. Although FBL-3X has been tested in all kind of helicopters, due to high frequency vibration or unknown vibration pattern in helicopters driven by turbine or scale helicopters, the operation of FBL-3X in such helicopters is for safety reason generally not recommended. As XELARIS has no control whatsoever over the appropriate handling or the set-up of FBL-3X, XELARIS cannot take any liability for the use of FBL-3X unless the cause can be established to be of reckless action on the part of XELARIS.