X-3D-BL Scientific User's Manual

Ascending Technologies GmbH

x-base x-3d x-ecc x-csm

Inhaltsverzeichnis

1 Introduction

Thank you for purchasing the X-3D-BL Scientific. Please read this manual carefully before you start to work with your new vehicle.

WARNING!

A motorized model aircraft is not a toy! It should only be flown by adults. Improper assembly or operating can lead to severe injuries and / or damages. Trouble with your remote control due to interferences can occur any time without prior notice. Sometimes, a model aircraft can suddenly become uncontrollable due to a failure of any component, including mechanical parts and electronics. In this case, the model can rapidly move towards any direction. Make sure you always keep a safe distance to people, animals, obstacles or things of any kind, traffic roads, etc.. There are country-specific laws regulating the operation of model aircrafts that definitely have to be obeyed. Furthermore, we strongly recommend to effect a liability insurance for model aircrafts. The manufacturer and your dealer of the X-3D-BL do not have any influence on, nor can they monitor the correct assembly and proper operation of your model aircraft. Always be aware of the dangers mentioned above and act accordingly. There is no liability of the manufacturer nor the retailer at all, as far as legally approved.

Our products are designed for the civil market only. It is strictly forbidden to use them in any military environment or to retail them to any military or military related organization. Using any of our components for larger scale flying objects is also not allowed.

SUBJECT TO CHANGE WITHOUT NOTICE.

1.1 System overview

In this section you find some information about the subsystems used in the X-3D-BL Scientific. These components are also used in the hobbyist version of the X-3D-BL, however, the X-3D-BL Scientific onboard software is different.

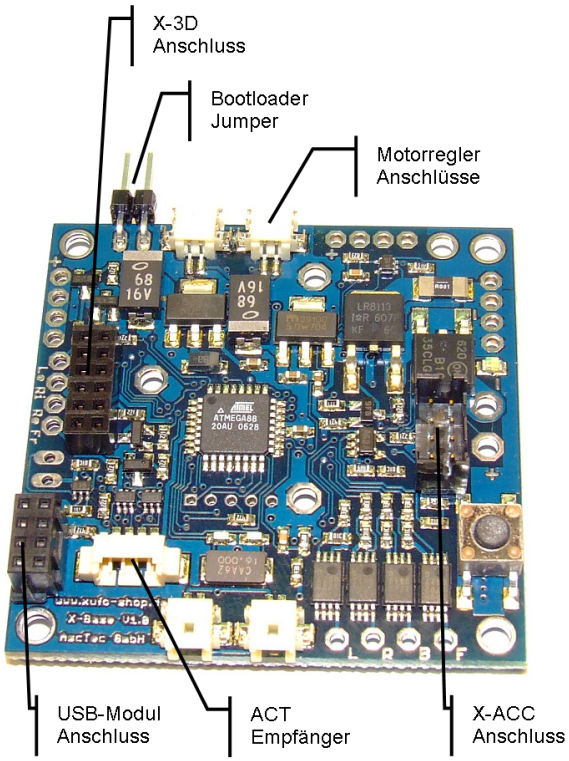
1.1.1 X-CSM

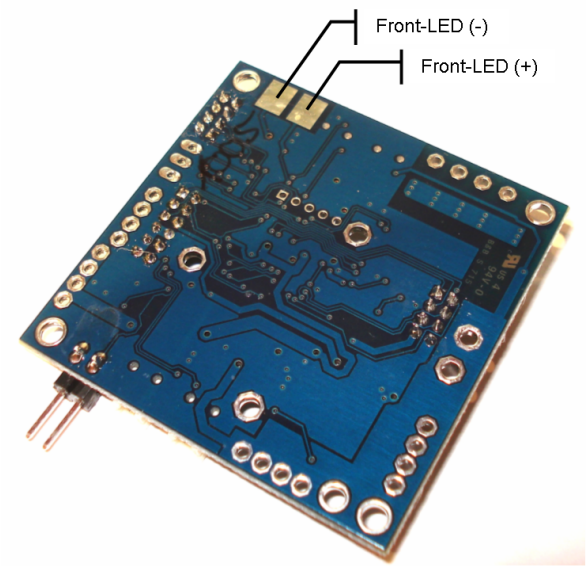
The X-CSM is the mechanical frame of the X-3D-BL UFO. The booms, which are made of a rigid carbon fiber-balsa wood sandwich material, can be replaced individually. The central unit of the frame called the "X-CSM Core" is made of light weight laser-cut magnesium parts. Being built out of these state-of-the-art materials the X-CSM is a very robust high-tech basis for your quadrotor aircraft.

1.1.2 X-Base

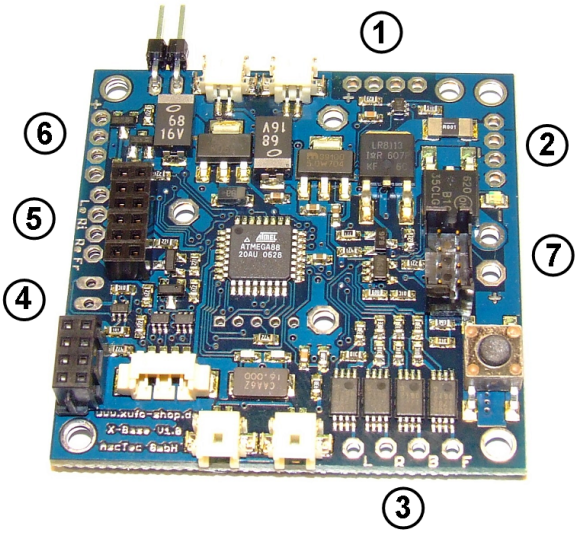
The X-Base is the central control unit which is connected to and communicates with all active elements of the X-3D-BL. Next to the battery, the motor controllers, the X-3D gyro and the receiver

you can also connect several LEDs to the X-Base to give your X-3D-BL a unique fancy look.





An LED connected to the "Front-LED" Pads on the bottom side of the X-Base will always be on as long as the X-3D-BL is turned on. Such an LED can be mounted to the very front of your vehicle to make it easier for the pilot to know where the front side is.



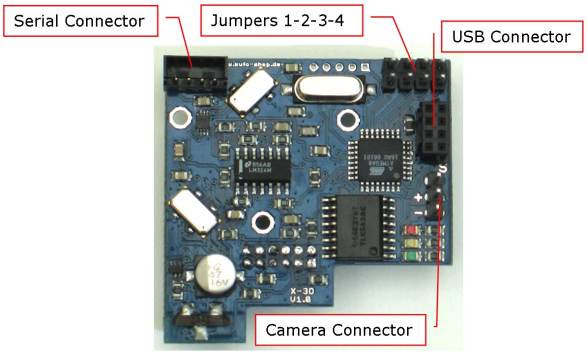
1 BL-controllers / brushed motors (+)
2 BL-controllers (-)
3 Brushed motors (-) **L**eft/**R**ight/**B**ack/**F**ront
4 PPM-Receiver Input (-) (+) Signal (from lower to upper connector)
5 LEDs (-) **Le**ft/**Ri**ght/**Re**ar/**Fr**ont
6 LEDs (+) 5V
7 Power connector, (+) and (-) marked on the upper side of the board

The key below the power connector (7) turns the X-3D-BL on and off. A short press is enough to turn the vehicle on. To turn it off the key has to be pressed for at least 200ms.

The "brushed motors" connectors of the X-Base (3) are not required as the brushless motors are driven by independent controllers, and thus the connectors can be used to drive peripherals like for instance a night-flight kit. Connector "L" is switched on and off by R/C channel 5, connector "R" by R/C channel 6. The connectors can sink currents up to 5A if they're enabled. That means that the (-)-input of a peripheral has to be connected to the "L" or "R" pad and the (+)-input has to be connected to (+) (connector (1)). Be aware that in this configuration your peripheral will be supplied the whole battery voltage. If this not what you need make sure you use a suitable voltage regulator.

1.1.3 X-3D

The X-3D is the sensor unit of the X-3D-BL. With three piezo-gyros and highly optimized control loops it does the actual flight/attitude control. All parameters influencing the in-flight behavior can be tuned by connecting the X-3D to a PC using the USB adapter that came with your X-3D-BL. Once you are on the field for flying you can select four different parameter sets using two jumpers.

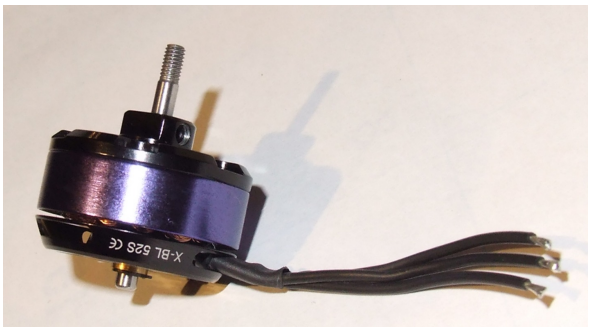


LED patterns shown by the X-3D

- **red blinking:** Initializing or at least one motor not detected
- **yellow+green:** No reception or playing startup-melody
- **green:** Ready to fly

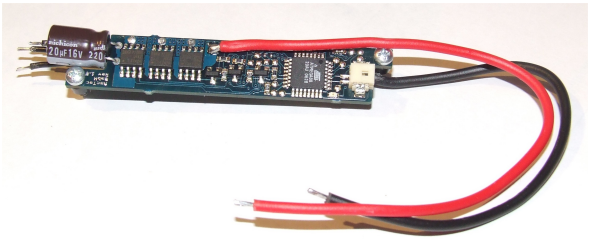
1.1.4 Motors

The X-BL-52s motors by HACKER Motors Germany are custom-built for the X-3D-BL. The motors are perfectly suited for the application in this vehicle.



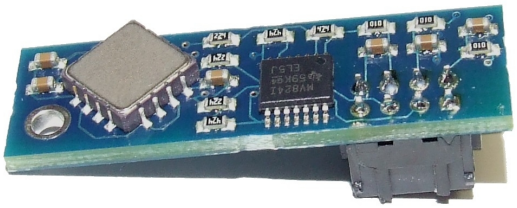
1.1.5 X-BLDC brushless motor controllers

Every motor is controlled by an independent X-BLDC brushless motor controller. The controllers are highly optimized for the X-BL-52s motors and thus ensure the highest efficiency possible. Please note that for this reason the controllers might not work with a different motor type.



1.1.6 X-ACC

The X-ACC is a tiny add-on module comprising a triaxial accelerometer.



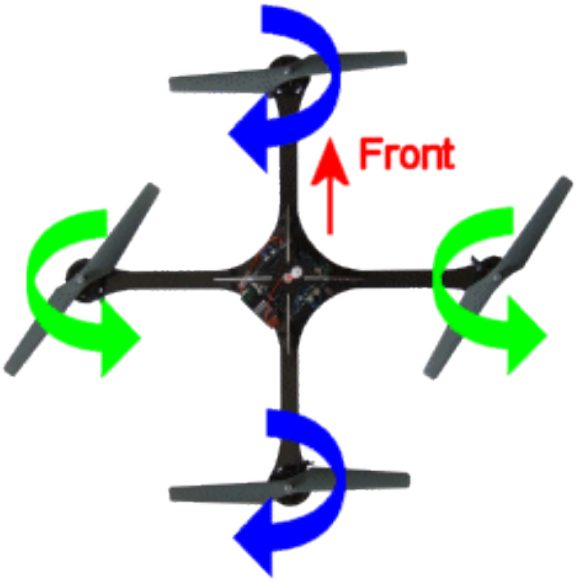
Using the acceleration data the X-3D can compute the absolute orientation of the vehicle in pitch and roll. The datafusion is done with an update rate of 1kHz to guarantee good stability. As a consequence, the helicopter is able to come back to a horizontal orientation on its own. In the X-ACC mode the pilot - or your own add-on electronics - command an absolute angle. The further you push the pitch or roll stick, the bigger the tilt-angle of the X-3D-BL. If you leave the stick centered the helicopter will come back to horizontal. In this mode you are not able to do loops or flips, however, hovering and all 2D-maneuvers are much easier to do. The X-ACC is also a great help for beginners! In addition, the vehicle can be position stabilized by a simple PD-Loop.

1.2 Transmitter

Any five or more channels R/C transmitter can be used to operate the X-3D-BL scientific. Even if it is controlled autonomously by your own controller board, the transmitter is required as a backup. As a safety measure the X-3D-BL scientific is not able to launch without a valid signal from the R/C transmitter.

2 Things to do before the first flight

The X-3D-BL is shipped completely assembled and tested. You only have to do the following steps to make it work with in combination with your equipment.



2.1 Mounting the propellers

The propellers can be slid over the axles and be fastened using a plastic nut. Do not fasten the nut too tight, as this would bend the propellers.

Please note that there are two types of propellers: One pair of propellers is spinning clockwise, the other pair is spinning counterclockwise. The propellers spinning clockwise must be mounted to the front and the rear motor, whereas the counterclockwise rotating propellers must be mounted to the left and to the right motor.

To improve the durability of the propellers during a crash you can optionally add a cable tie (e.g. 2.5 x 100 mm) as seen in the following picture.

2.2 Preparing your own battery

You need a 3s (three cells, 11.1V) Lithium Polymer (LiPo) Battery. We recommend capacities between 1500 and 2100 mAh. With a state-of-the-art 2100

mAh battery the vehicle is able to hover up to 23 minutes without any payload, and up to 12 minutes with 200 g of payload.

Make sure you mount your battery such that it can definitely not get damaged by hitting the frame, even in a crash. Otherwise the battery could explode! Here is an example of how to mount a battery correctly:

The black foam on both sides hinders it from being hurt by the magnesium parts of the frame. The woodden plate on the bottom makes it stick to the screw holding the bottom plate of the frame. Of course, there are many different ways to prepare your battery for a safe operation. This is only an example.

Lithium Polymer Batteries (LiPo) can be very dangerous if not handled correctly. Please read and follow the instructions of the battery and charger manufacturers! Do never short circuit a LiPo battery and use safe connectors!

2.3 Teach-in of your transmitter

If you want to use your own transmitter which you did not purchase bundled with the X-3D-BL Scientific, please follow these steps:

First of all, you need to install the X-Control PC-Software. If you didn't receive a copy of it please contact us by e-mail. Connect the USB adapter to your PC and to the X-Base, turn on your UFO, open the X-Control software and click on "X-Base" and then on "Connect". Then choose "Receiver setup" and "Automatic calibration"and follow the instructions given by the software.

You can freely choose a stick on your R/C for every function. If you are used to a certain configuration you should definitely continue using this one. If you haven't flown other model aircrafts before we recommend the following configuration ("Mode 2"):

The X-3D-BL scientific works with any R/C with at least five channels. Make sure that all channels work independently and that no mixers are active in your remote.

Please make sure you assign a switch on your R/C transmitter to the SW1-function, as you will need this channel to activete the serial interface onboard your X-3D-BL Scientific.

3 Operating the X-3D-BL Scientific

3.1 Important things to keep in mind

- Directly after turning the X-3D-BL on the motors produce a short beep. It is perfectly normal that the propellers move slightly during that tone.
- Keep the X-3D-BL totally still after turning it on until the X-3D shows the yellow+green (no reception) or green (ready to fly) light pattern. Otherwise the sensors can not be calibrated correctly and the vehicle might go crazy after turning on the motors. If you accidentally moved the system during startup simply turn it off and on again.
- If only the green LED at the X-3D board is on the vehicle is ready to fly. A yellow+green light pattern means "no reception". In this case please check that your remote control is turned on and fully functional, that the receiver crystal is installed in the receiver and that the receiver is connected correctly.
- After the startup phase the motors are still turned off and secured. To turn them on you have to move the yaw stick to the very left or to the very right while your throttle stick is in zero position. The motors will then start and keep running at their minimum speed. To turn the motors off you have to do the same procedure again: Move the yaw stick to the very left or to the very right while your throttle stick is in zero position. There is no flight maneuver where one would use this control input and thus you will not accidentally turn off your motors during flight. For safety reasons you should turn off the motors immediately if one of the propellers touches the ground or any other obstacle and hence the X-3D-BL Scientific is not able to take off.
- There is a battery warning implemented in your X-3D-BL. A low battery is signalized by a periodic, simultaneous tremor of all motors. This is hard to see but it can be heard. Depending on the battery you use there is about a minute of flight time left after the low-battery warning is activated. Lithium Polymer (LiPo) batteries are very vulnerable to deep discharge. That is why the X-3D-BL turns off completely if the voltage drops under a programmable threshold. You can adjust the thresholds for the low-battery warning and the low-battery shut down using the X-Control software. Therefor you have to connect the X-Base to your PC using the USB adapter and click on "X-Base", "Connect" and then on "Parameters".
- If the ambient temperature changes rapidly, for instance when you leave a warm room, the angles estimated by the datafusion algorithms might not be totally correct. As a consequence your vehicle would be tilted a bit, even with a neutral pitch and roll command. In this case we recommend to wait a few minutes, until all sensors have adopted to the ambient temperature.

3.2 First flight

We recommend to do the first flights on some big grassland, as the soft ground will soften possible crashes. If you have never controlled an R/C aircraft before you will have to practice a bit until you're able to fly inside your lab.

Make sure that the battery is fully charged, connected and mounted correctly. Switch on the vehicle and be *really* careful during the startup phase. The vehicle must NOT be moved during startup as the gyro sensors are being initialized! If the vehicle was moved during startup simply turn it off and on again.

The startup sequence is completed once the motors start playing the preprogrammed music. Please be aware, that the first "beep" after turning the vehicle on is part of the startup process. Once the music has been played the X-3D will light the green and yellow LEDs if the transmitter is turned off and only green if a valid signal is detected. Now the vehicle is ready to fly.

To start the motors you have to move the left stick to the very left or right whilst holding throttle in zero position.
If it is the first flight after a while or the first flight at all hold your X-3D-BL Scientific down to the floor. You can grab the center part of the frame, but make sure that you don't touch any of the rotors.
In case it tries to tilt in any direction and one or more of the propellers are going crazy: Please read the troubleshooting section of this manual.

Angle stabilization in pitch and roll is active even when the propellers are running idle. Use this feature as you hold the vehicle from below and tilt it carefully to check that everything works. As you tilt it to one direction you must feel some counterforce from the motors if everything is o.k.. You can also try to steer the pitch and roll axis and see that you can directly steer the angles. Please check if the vehicle is leveled in your hand with the pitch and roll stick in neutral position. If not, correct any undesired tilt with the pitch and roll trimmers.

Now, give a little throttle and the vehicle should hover. Try hovering in a height of about 1m and concentrate on the red marking which is the front of your vehicle. Try to compensate for any movement in yaw by moving the yaw-stick in the opposite direction. It is much easier to control the vehicle if red is facing away from you, as in this case it will move away from you if you push your pitch/roll stick away. It is perfectly normal that the vehicle drifts slowly in all directions. As long as you have not installed any external tracking for position control, you have to compensate for these movements manually. After a few battery charges you will able to fly in any room, and with some more practice you can even fly in small spaces and land on tables etc.. Good luck!

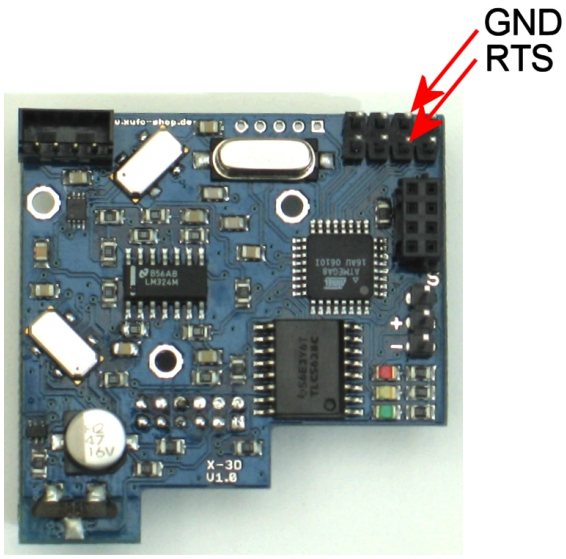
4 On-Board serial interface

4.1 Physical interface

The interface is a serial uart link with 5V TTL levels at 38400 baud, 8 bits, one startbit, one stopbit. To connect a PC, a bluetooth link or a high level processor to the X-3D you can use the black DF3 3-pin connector.

Pin 1 (the inner pin)	GND
Pin 2	RXD (input)
Pin 3 (the outer pin)	TXD (output)

You can set a jumper to permanently enable the data output.



Alternatively, you can use the pin as an input for a radio modem's RTS (Request To Send) pin. The X-3D-BL Scientific will only send data if the RTS pin is pulled low by the connected device. It will stop sending data if the Pin is pulled high by the modem to prevent data loss during the transmission.

4.2 Data protocol

4.2.1 Data output

The X-3D sends the following data packet with an update rate of 100Hz whenever the RTS pin is low (either forced always low by a jumper or pulled low by e.g. a bluetooth module whenever it is ready to send).

The data packet sent starts with two startbytes and ends with two stopbytes:
startbyte 1: 'P'
startbyte 2: 'I'
stopbyte 1: 'E'
stopbyte 2: 'Z'

In between these characters the following structure is sent:

```
struct DATA
{
   unsigned char ident;
   short angvel_pitch;
   short angvel_roll;
   short angvel_yaw;
   short acc_x;
   short acc_y;
   short acc_z;
   long angle_pitch;
   long angle_roll;
   unsigned char pitch;
   unsigned char roll;
   unsigned char thrust;
   unsigned char yaw;
   unsigned char voltage;
   unsigned char command_status;
   unsigned short timeStamp;
   unsigned char chkSum;
};
```

Explanation of the data packet:

- *ident:* Packet identifier; must always be 'd'.
- *angvel_pitch, angvel_roll, angvel_yaw:* Angular velocities. Range: 0..1023, 512 = neutral, 1 LSB = 0.304 deg/s
- *acc_x, acc_y, acc_y:* Accelerations in 1/1000th g, with g being the acceleration of gravity.
- *angle_pitch, angle_roll:* Angle estimates in pitch and roll in 1/10th of a degree.
- *pitch, roll, yaw, thrust:* Commands received from the R/C transmitter.
- *voltage:* Battery voltage in 0.1V
- *command_status:* bit 0: pitch, bit 1: roll, bit 2: yaw, bit 3: thrust If a bit is set (1) the associated channel is controlled by the serial interface, otherwise (bit=0) by the R/C transmitter. bit 4: 1 → command interface enabled by a switch on your R/C transmitter 0 → command interface disabled bit 5: 1 → channel 6 > 0 0 → channel 6 < 0 bit 6: 1 → cmd packet received during the last 250ms 0 → no cmd packet received during the last 250ms bits 7: reserved.
- *timeStamp:* 16 bit counter, incremented with every data packet.
- *chkSum* = SUM(ident..timeStamp) % 0x100

4.2.2 Command input

With the command protocol a single or all control channels can be taken over by the serial interface. Therefore the X-3D-BL Scientific must receive the following command data packet with an update rate of 10Hz to 20Hz over the serial link:

startbyte 1: 'U'
startbyte 2: 'F'
startbyte 3: 'O'
no stopbyte!

```
struct COMMANDDATA
{
  unsigned char ident;
  unsigned char channels[4];
  unsigned char channel_select;
  unsigned char chkSum;
};
```

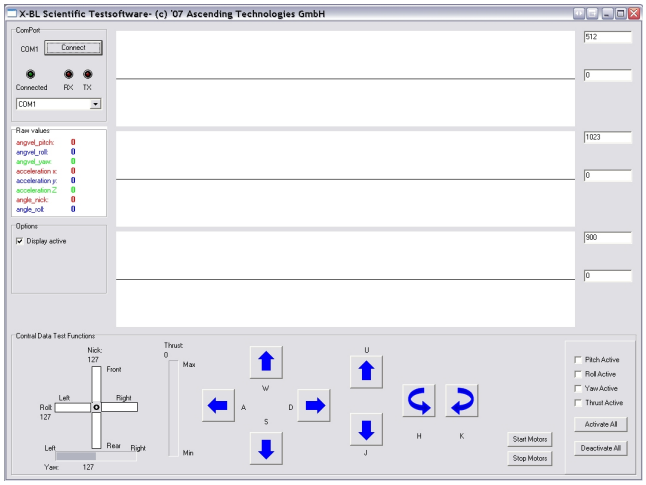
Explanation of the command packet:

- *ident:* Packet identifier; must always be 'C'.
- *channels[4]:* Control inputs for the individual channels. channel[0]: pitch axis channel[1]: roll axis channel[3]: yaw axis possible values: 0..255, neutral = 127 channel[2]: thrust, 0(min)..255(max)
- *channel_select:* Control-byte to determine which channel is controlled by the R/C transmitter, and which one is controlled by the serial interface. bit 0: pitch, bit 1: roll, bit 2: thrust, bit 3: yaw, bits 4..7: reserved. If a bit is set (1) the associated channel is controlled by the serial interface, otherwise (bit=0) by the R/C transmitter. Default is 0x00.
- *chkSum:* (pitch+roll+yaw+thrust+channel_select) % 0x100

As a safety precaution the vehicle will switch back to the transmitter and thus manual control after 100ms not receiving data from the serial link.

4.3 Test software

There is a graphical user interface (X-3D-BL_Scientific_Testsoftware.exe) to visualize the data packets described above. You can use this program to better understand the serial interface and to check if everything is working correctly.



If you did not receive a copy of this software please contact us by e-mail.

4.4 General hints for using the serial interface

To enable the command interface, the vehicle must have a stable link to a normal RC transmitter (green light on the X-3D!) and the SW1 function (see "Receiver Setup" in the X-Control software with the X-Base connected) must be >128 to activate the commands from the interface. This is a safety function as well. A skilled pilot should always be ready to take over by setting the SW1 function back to 0 (e.g. with a switch) to take control, if your high level control is not functioning as desired. The pilot also has to steer all functions that are not activated in the channel_select byte. Consequently you can activate one function after another, which makes setting up and tuning high-level control loops much easier.

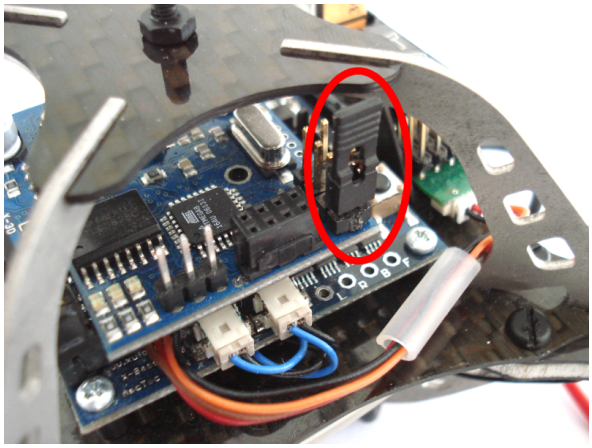
5 Software updates and system configuration changes

The X-3D-BL is shipped with a fully functional firmware installed on all components. Please do not upload any code from our public servers, as these versions do not offer the additional features of your X-3D-BL Scientific. You only need to do a software update if you receive a new version from us.

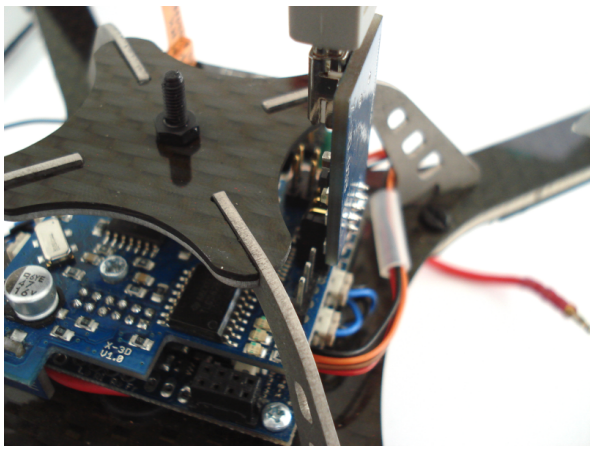
To perform a software update you need the X-Control PC-software. If you did not receive a copy of it, please contact us via e-mail.

5.1 Software update of the X-3D

Disconnect the battery from the X-3D-BL. You need a jumper to activate the so called bootloader. Set the jumper to the following position:



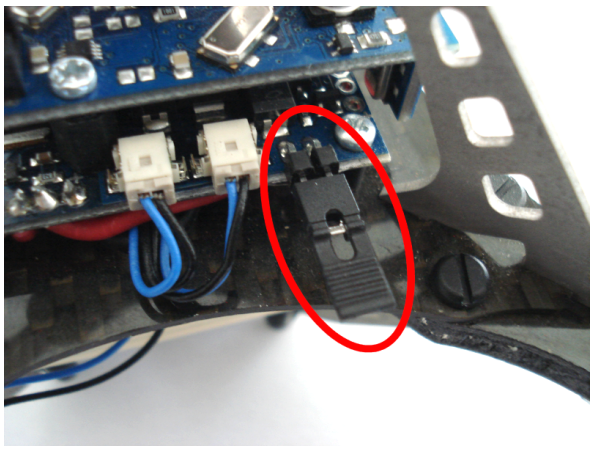
Connect the USB-adapter to your computer. Open the X-Control software, click on "X-3D" and on the left hand side on " X3D firmware upgrade". Then, connect the X-3D to the USB adapter as seen in the following picture.



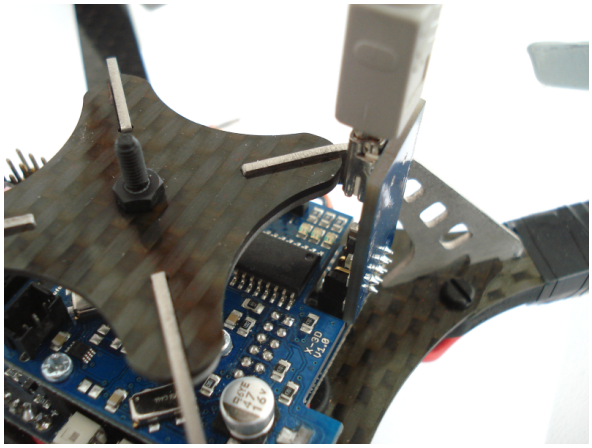
Choose the serial port (normally "Autoselect: COMxx") and click on "connect". Click on "select firmware" and select the firmware file "*.ufc" you received from us. Then click on "Upload", wait for the upload to be completed, disconnect the USB adapter from the X-3D, remove the bootloader jumper and click on "Finished". The X-3D software update is now completed.

5.2 Software update of the X-Base

Again, you need a jumper to activate the so called bootloader. Set the jumper as seen in the following picture.



Open the X-Control software, click on "X-Base" and then on "X-Base firmware Upgrade" on the left hand side. Turn on the X-Base (In this case the battery has to be connected to the vehicle!) and connect the USB adapter to the X-Base.

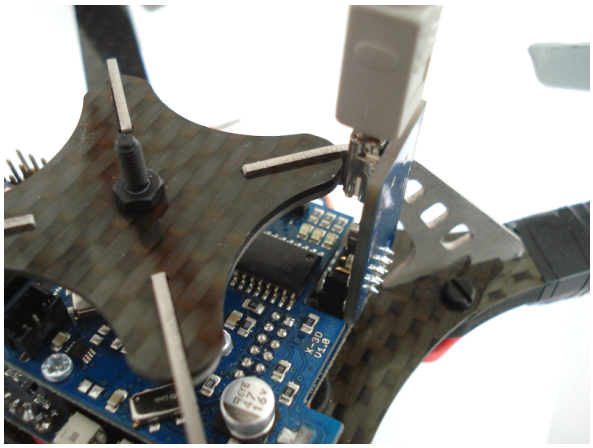


Choose the serial port (normally "Autoselect: COMxx") and click on "connect". Select the "* ACT receiver.xbs" firmware file if you are using an ACT receiver (35 or 40 MHz) or select the "* PPM receiver.xbs" if you are using a different receiver. Then click on "Upload", wait for the upload to be completed, disconnect the USB adapter from the X-Base, remove the bootloader jumper and click on "Finished". The X-Base software update is now completed.

5.3 Setting up the X-BLDC brushless motor controllers

The X-Base will not recognize all motors before they have been set up correctly. This is absolutely normal! Not until a successful configuration the X-Base will recognize all X-BLDC controllers and the X-3D-BL UFO will signal "ready to fly".

Connect the battery to the X-3D-BL, turn it on and connect the USB adapter with your computer and then with the X-Base.



Open the X-Control software and click on "X-Base". Choose the correct COM-Port (normally "Autoselect: COMxx") and click on "Connect". Chose "X-BL Setup" and click on "start search". After several seconds four brushless controllers with different serial numbers should appear in the list. If less than four controllers appear, turn of your X-3D-BL, check all solderings and connectors and repeat the previous steps.

If all four controllers have been found, click on "config" and follow the instructions given by the software in order to tell each controller its own position and the appropriate turning direction. After that, click on "Disconnect" to complete the controller setup.

Optionally a startup melody can be installed using the X-BL update function. A detailed description of how to do this can be found in appendix B.

5.4 X-3D Parameters

If you connect the X-3D to the X-Control software without the bootloader jumper set, you can change all parameters influencing the system behaviour. You can also save a set of parameters to port it to a second vehicle, or you can upload a set of parameters which you received from us.

5.5 Calibration of the acceleration sensors

The X-3D-BL Scientific comes fully calibrated. However, if something goes really wrong and for some reason you need to recalibrate the accelerometers, here is what you have to do.
Connect the X-Base with the X-Control software, open the X-ACC setup and follow the instructions given by the wizard. To achieve the best performance it is very important that the calibration is done very precise. Please check that after the calibration the X- and Y-outputs are roughly zero and the Z-output is roughly -1000 if the X-3D-BL is standing in a horizontal orientation. The automatic calibration gives usable results, but sometimes the values can still be optimized manually. Please also check the scale factors, i.e. see, if all sensor outputs are about ± 1000 if you hold the vehicle with the respective axis in a vertical orientation. If everything seems o.k. you can finalize the calibration by clicking on "Finished" and on "Transmit and disconnect".

6 Contact Information

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A Troubleshooting

This chapter holds solutions to problems which might occur during the operation of your X-3D-BL UFO.

A.1 Slight tilt in pitch/roll with the pitch/roll stick in neutral position

Due to unavoidable measurement errors it is perfectly normal, that your X-3D-BL is not always flying exactly leveled in the X-ACC mode. However, a slight tilt can easily be compensated by the trimmers on your remote control.

A.2 Considerable tilt in pitch or roll

There are some situations where the measured angle can considerably differ from the real angle, which results in big tilt-angles in pitch and/or roll while the pitch/roll stick on your remote is centered. This can have the following reasons:

- *Shaking during initialization:* In the X-ACC mode it is particularly important that the vehicle is not moved at all during the initialization. Calibration errors caused by shaking during startup will influence the performance much more than in the heading-hold mode. If the vehicle tilts more and more after starting the motors it is very likely that it was moved during the initialization. In this case, please turn it off and on again and make sure that it is not moved until the X-3D displays the green+yellow or green light pattern.
- *Teach-in of your transmitter was not correct*: To check if your transmitter was taught-in correctly, please connect the X-Base to your PC using the USB adapter and open the X-Control software to check if all channels are detected as centered if the sticks on the R/C are centered. If this is not the case repeat the teach-in of your R/C following the instructions given by the software.
- *Faulty calibration of the accelerometers:* If after restarting the X-3D-BL the unwanted tilt is still there and cannot be compensated using the trimmers on your remote, please check the calibration of your X-ACC (cf. 5.5).
- *Rapid change of the ambient temperature:* If you notice a considerable tilt in pitch or roll directly after you leave a warm room in winter or an air-conditioned room in summer, please wait a few minutes, until all sensors have adopted to the new ambient temperature. Alternatively, you can use the Heading-Hold mode during that period, as this mode behaves much more robust during fast temperature changes.
- *Extremely fast maneuvers:* Also fast maneuvers, which result in high accelerations interacting with your aircraft, can cause faulty measurements. If you fly several circles in a row in high speeds it can happen, that the measured angle differs several degrees from the real angle. If this is the case, you simply have to fly gently or hover for a few seconds until the unwanted tilt is gone.

A.3 Bad reception during flight

If the X-3D-BL does not react while it is airborne, please check if someone else uses the same channel. Make sure your TX battery is fully charged and that the antenna is fully extended. If you are still having trouble you can to the following test to check the range of your R/C system:

During the range check all other transmitters should be switched off. The best location to do the test is a big open field, as metallic objects like cars or wire fences could influence the result. You need a helper who holds your transmitter with the antenna as close to vertical as possible. Turn the X-3D-BL on and wait until only the green LED on the X-3D is on signalizing "ready to fly". Then walk away from the transmitter until the yellow LED starts flickering. At this point you should be at least 100 m away from your TX. Repeat the whole procedure with the motors running at minimum throttle. If at a distance of about 100 m the signal is still o.k. (i.e. only the green is LED on), your reception is totally fine. Due to the size of the aircraft and the associated visibility you will never fly any further away than that. If the yellow LED comes up randomly at shorter distances your TX/RX combination is to weak. In this case you can try extending the antenna of the X-3D-BL by using a longer plastic tube or stick which holds the antenna. A fully extended antenna works definitely better than one which is wound around a stick as described in this manual. If you use a stub antenna at your TX this could also be the reason for a bad reception, as such antennas do not transmit the full power. In this case try using a standard telescopic antenna instead.

A.4 The red LED on the X-3D keeps blinking after the startup

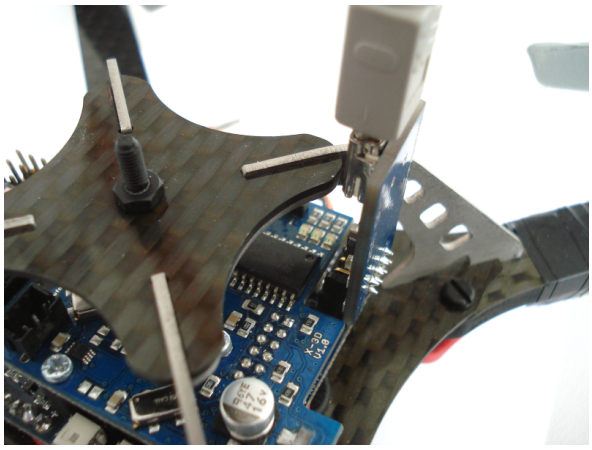
If you have not configured your X-3D-BL using the X-Control software as described above this behavior is normal. In this case please follow the instructions given in **??**. If the configuration of your vehicle was completed successfully the blinking red LED means that one of the motor controllers or motors was not detected. Please check if all four cables in black and blue color between the X-Base and the motor controllers are connected correctly. If all connections are o.k. please verify that all motors produce a short beep directly after you turn the X-3D-BL on. If one of them does not play the sound check the power connection of the affected motor controller. Are all wires o.k.? Are all soldering points clean and correct? If you connect the X-Base to the X-Control software it will show you which of the motors is not working correctly.

A.5 The X-3D-BL turns itself off during flight

Please make sure that the current limit of your X-Base is set to 35 A. To do so, please connect the X-Base to the X-Control software and click on "parameters". The value of the edit-field designated with "Current:" must be 35. Once you are done click on "Finished" and then on "Transmit and disconnect".

B User-programmable startup melodies

The X-3D-BL Scientific is capable of playing preprogrammed melodies directly after the initialization. To upload a melody please connect the battery to the X-3D-BL, turn it on and connect the USB adapter with your computer and then with the X-Base.



Open the X-Control software and click on "X-Base". Choose the correct COM-Port (normally "Autoselect: COMxx") and click on "Connect". Chose "X-BL Setup" and click on "start search". After several seconds four brushless controllers with different serial numbers should appear in the list. If all four controllers have been found, click on "Firmware upgrade", then on "Select all controllers" and open the "Select firmware" dialog. Select "X-BL Startup melody (.snd)" on the lower right of the window and open any *.snd file you like, for instance from the subdirectory "X-BL Sounds" in the X-3D-BL software package. Then press "Upload".
After the upload is completed click on "Finished" and turn your X-3D-BL off and on again. After initializing it should play the new sound. Enjoy it! :-)