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THE NEXT LEVEL!
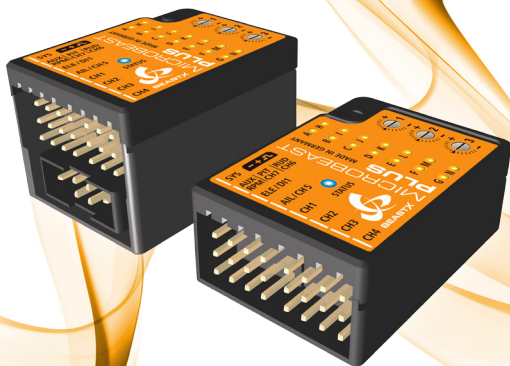
MICROBEAST **PLUS**

6-AXIS MEMS SENSOR SYSTEM FOR RC-MODELS

PRO-EDITION

ADDON MANUAL

PRO-EDITION
Addon manual

CONTENTS

GENERAL INFORMATION

Please note that these instructions are only valid for the MICROBEAST PLUS firmware version 4.x.x with Pro-Edition upgrade !

The firmware version can be detected by connecting the unit to a computer by using the USB2SYS interface together with the StudioX software bundle. Also you can directly read on the MICROBEAST PLUS unit during the initialization phase what firmware version your MICROBEAST PLUS is running:

MICROBEAST PLUS first carries out a brief LED test by lighting up all Menu-LEDs simultaneously, and cycling the Status-LED color (red->blue->purple). Then for about 3 seconds, the Status-LED lights red while the Menu-LEDs Ⓐ - Ⓖ display the first digit of the firmware version, and the LEDs Ⓗ - Ⓝ the second digit of the firmware version.
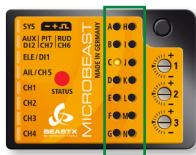
Firmware version 4.0.x:

In the left row menu LED Ⓖ shows the mayor version „4".
In the row from LEDs Ⓗ to Ⓝ nothing lights up. So minor version is „0".

By briefly pushing the button you can get more version informations displayed. In respect to the manual this information is not important. You will get more information about the version display in chapter 11.

SAFETY NOTES

⚠ Radio controlled (R/C) helicopters are not toys! The rotor blades rotate at high speed and pose potential risk. They may cause severe injury due to improper usage. It is necessary to observe common safety rules for R/C models and the local law. You can gather information from your local R/C model club or from your national modelers association.

⚠ Pay attention to your own safety and the safety of other people and property in your vicinity when using our product. Always fly in areas away from other people. Never use R/C models in close proximity to housing areas or crowds of people. R/C models may malfunction or crash due to several reasons like piloting mistakes or radio interference, and cause severe accidents. Pilots are fully responsible for their actions, and for damage or injuries caused by the usage of their models.

⚠ Please read the following instructions thoroughly before the first use of your MICROBEAST PLUS and setup the system carefully according to this manual. Allow sufficient time for the setup procedure and check each step carefully. Watch for a mechanically clean and proper build of your helicopter. A wrong system setup can lead to a serious accident and damage to the model.

⚠ Radio controlled (R/C) models consist of several electrical components. It is therefore necessary to protect the model from moisture and other foreign subtances. If the model is exposed to moisture this may lead to a malfunction which may cause damage to the model or a crash. Never fly in the rain or extremely high humidity.

⚠ When operating the helicopter with a MICROBEAST PLUS ensure there is a sufficiently large and stable receiver power supply. Because of the direct coupling of the rotor blades to the servos, without the use of a flybar mixer, the servos are exposed to increased actuating forces. In addition, because of the intermediary electronic gyro system, the servos are driven more often than with traditional use. These factors can make the power consumption increase a lot compared to a flybar helicopter. When the supply voltage falls below 3,5 volts for a short amount a of time, the system will power off and reboot. In this case a crash of the helicopter is unavoidable.

⚠ Do not expose the MICROBEAST PLUS system to extreme variations in temperature. Before powering up the system, wait some time so that the electronics can acclimatize and any accumulated condensation is able to evaporate.

⚠ The sensors of MICROBEAST PLUS consist of highly sensitive electomechanical components. These can be damaged due to moisture or mechanical or electrical impact. Do not continue using this product, if it hase been exposed to such influences, e.g. dure to a crash of the model or due to overvoltage caused by a defective receiver power supply. Otherwise a failure may happen any time.

⚠ When operating electric helicopters make sure that the electric motor cannot start inadvertently during the setup procedure. Particularly pay attention if using a single-line receiver and if the ESC is connected directly to the MICROBEAST PLUS. We recommend disconnecting the electric motor from the ESC during the setup procedure. Prior the first usage please slide the motor/pinion away from the main gear, then check that the motor does not to start inadvertently when the receiver is switched on.

⚠ When operating the RPM Governor feature of MICROBEAST PLUS Pro-Edition it is essential to ensure that the motor cannot start by accident when making adjustment or performing preparations to start the engine. Carefully read this manual and make sure you fully understand how the RPM Governor feature is operated before making any adjustments. Also make sure the motor does not start when the radio link is interrupted or when you switch on the transmitter initially. With electric driven models do not dock the motor to the main gear unless all necessary adjustment procedures have been finished. Always maintain sufficient safety distance to the motor and other rapidly rotating components of the helicopter.

⚠ MICROBEAST PLUS with AttitudeControl can be used as a flying aid for beginners as the reaction of the helicopter to stick inputs can be limited and as an electronic control circuit can help to stabilize the helicopter. However, this does not provide that the helicopter can always be flown safely! By incorrect control inputs the helicopter still may crash or be placed in a position in which the pilot becomes disoriented even when using AttitudeControl. In addition, the helicopter can drift due to external

influences and it is not guaranteed that the artificial horizon of the device can stabilize the helicopter at any time and recover from any orientation. Influences such as temperature fluctuations or vibrations may cause incorrect results and distort the position calculation of the system in consequence. There is no guarantee that the system will always work correctly. Only the pilot is responsible for the control of the helicopter and thus also for the use of the system. You must always be able to turn off the system immediately and be able to take over full control of the helicopter.

⚠ We suggest you to seek the support of an experienced helicopter pilot before you undertake the first flight of your model. Additionally, flight training with a R/C simulator can help make flying easier and more enjoyable. Ask your local dealer if you need technical support or if you observe problems during the usage of our system.

⚠ AttitudeControl can help to facilitate flying of model helicopters by briefly passing over control to the system if the pilot becomes disoriented. By using the built-in artificial horizon the helicopter can be brought to a nearly horizontal position so that the pilot gains time to reorient. Thus there can be no assurance that the model is saved from a crash in general. Depending on the current attitude and the speed of the model and depending on how fast the AttitudeControl is activated, the model may crash before or while the system tries to recover. In addition, the helicopter can drift due to external influences and it is not guaranteed that the artificial horizon of the device can stabilize the helicopter at any time and recover from any orientation. Influences such as temperature fluctuations or vibrations may cause incorrect results and distort the position calculation of the system in consequence. Strictly observe the general safety rules for dealing with RC models and do not totally rely on the system. The pilot is responsible for the control of the helicopter and thus also for the use of the system. You must always be able to turn off the system immediately and be able to take over full control of the helicopter.

1. INTRODUCTION

Dear customer,

With MICROBEAST PLUS you have purchased an electronic control system that continuously detects and controls the attitude of your helicopter and the control commands from the pilot. As a result the system is constantly aware of how the drive system will be burdened. The Pro-Edition features a RPM Governor system that uses this advantage to control the motor rpm. Contrary to conventional motor control systems that only monitor the engine speed, MICROBEAST PLUS can thus react sooner to speed changes. A separate engine governor system is no longer required for nitro helicopters and electric models can be used with a simple (cheap) speed controller without additional features such as soft start or governor mode. The desired rotor speed is specified via the remote control transmitter and MICROBEAST PLUS controls the throttle servo or speed controller accordingly, so that the predetermined head speed is maintained from takeoff to landing. MICROBEAST PLUS offers an integrated soft start for spooling up the rotor before takeoff and a quick start to regain head speed in a controlled manner when practicing autorotation maneuvers. The system is suitable both for electric and nitro/gas helicopters. Using the proven „Easy Setup" concept no additional equipment is required for programming (apart from your remote control system) and the initial setup is done within minutes.

Further more the Pro-Edition has an integrated artificial horizon. This ensures that MICROBEAST PLUS can determine the absolute position in space of the helicopter on the roll and pitch axis, regardless of the position in which the helicopter is currently located. At the moment this so-called AttitudeControl can be used with five different modes:

- Bail out rescue mode (with/without collective pitch)
- 3D – Mode (with/without collective pitch)
- Flight trainer mode

AttitudeControl helps you to learn new maneuvers and reduces the probability of crashing significantly. If AttitudeControl is switched on in flight the helicopter will be oriented horizontally, depending on the selected mode always in normal or also in inverted flight position. So the helicopter can be brought in a save position by the press of a button, i. e. if the pilot becomes disoriented. Beginners can use

AttitudeControl permanently (preferably in the „Flight trainer mode"), whereby the helicopter loses the peculiarity of having to be constantly controlled by the pilot. When AttitudeControl is switched on the pilot can simply release the sticks and the helicopter will be held almost horizontally without external control commands.

We thank you for your confidence and wish you fun and great flights
with **MICROBEAST** PLUS Pro-Edition.

Your BEASTX-Team

WWW.BEASTX.COM

2. PREPARATIONS FOR GOVERNOR USAGE

To use the Governor function of MICROBEAST PLUS it is necessary that MICROBEAST PLUS is able to measure the motor speed. Therefor see the separate purchase of a motor rpm sensor is required. Additionally you need the adapter cable BXA76401 to connect the sensor to your MICROBEAST PLUS unit. When using an electric helicopter it is possible that your speed controller has a rpm signal output. In this case no additional accessories are required. For more information please see chapter 6.

When using a nitro helicopter remove the servo horn of to the throttle servo before powering up the system or do not connect the throttle servo linkage yet, in order to avoid blocking and in consequence damage of the servo due to incorrect setting.

Using an electric model ensure that the speed controller is programmed correctly and that the travels for the throttle channel have been adjusted in the transmitter if necessary. Note that the speed controller itself must not be operated in a (heli specific) governor mode, but must be operated in a simple motor control mode that allows to control the motor rpm as direct as possible. The throttle signal must not be filtered and should be processed as linear as possible. This ensures that the control loop of MICROBEAST PLUS can govern the motor rpm optimally. For this purpose some electric speed controllers offer a special „External control mode" or „Flybarless mode" on. If your motor controller does not have such a mode, we recommend to select a mode that typically offers such behavior, like a some mode for fixed wing aircraft. Note, however, that no brake function (which is required for electric gliders) must be active and that the throttle response should be set to maximum speed, if such a feature is provided.

> ⚠ Pay attention to your own safety and the safety of other people and property in your vicinity when using our product. When using helicopters with nitro/gas engines make sure that the motor will not start when making adjustments to the system. When using a gas engine always keep the ignition system deactivated!
>
> ⚠ For electric helicopters remove the motor pinion from the main gear during initial setup. Warning! Risk of injury! Never touch the motor when it's running. Always keep a save distance to all rotating parts of the helicopter.

3. OPERATING PRINCIPLES OF ATTITUDECONTROL

When the term „AttitudeControl" is used in the further course, in general reference is made to the function of the artificial horizon, irrespective of a particular operating mode such as „Bail out rescue mode", „3D – Mode" or „Flight trainer mode".

AttitudeControl itself can be enabled or disabled via Parameter menu point ❶ by selecting one of the operating modes as mentioned above. Only if AttitudeControl is enabled, i.e. one of the five operating modes is selected, then AttitudeControl can be activated in operation via the remote control transmitter. **Enable/Disable and activate/deactivate are therefore to separate conceptually!**

For the use of AttitudeControl it is strongly recommended to use a single-line receiver, since for activating AttitudeControl in flight an additional control channel is needed. Almost every manufacturer of remote control systems offers such a receiver for his system and MICROBEAST PLUS supports almost all types of single-line protocols. The additional control channel allows to activate AttitudeControl before, during and after the flight via the remote control transmitter, so that the helicopter is stabilized depending on the selected operating mode if required. As long as AttitudeControl is deactived the helicopter can be flown as usual, so MICROBEAST PLUS only works as flybarless stabilization system. Preferably use a switch or push button on the transmitter that actuates the proper channel for activation/deactivation and that is safe and easy to reach.

Alternatively, the already existing channel for the tail gyro gain can be used to additionally switch AttitudeControl on and off, e.g. if a standard receiver is used (here only 5 channels can be plugged into MICROBEAST PLUS) or a transmitter with only six channels is used. This alternative, however, is far less convenient as it may require some complex programming of the transmitter, especially if several flight modes are programmed with different tail gyro sensitivity settings on the transmitter.

For more information on the individual receiver types, wiring and receiver settings, see the MICROBEAST PLUS instruction manual chapters 4 and 5. The following chapter 4 amends these instructions specifically for the use of RPM Governor and AttitudeControl

4. RECEIVER SETUP MENU

When selecting a specific type of single-line receiver the appropriate type of receiver channel allocation will be preset in MICROBEAST PLUS. Please refer to the tables below and check if your radio transmits the channels in the correct order. If this is not the case, you have to assign the channel order step by step through the menu points **Ⓑ** - **Ⓞ** (for this see section 5.2.2 of the MICROBEAST PLUS manual). **To know the channel assignment of your transmitter you can check the user manual of the transmitter or look at the servo monitor of the transmitter (if it has this feature). If in doubt ask the manufacturer of your transmitter.**

> ⚠ **After updating MICROBEAST PLUS to the** Pro-Edition **firmware you must perform the receiver setup once, independant of which receiver type you use.** Otherwise you will not be able to activate/deactivate the new features.
>
> Note that for safety reason, the settings in Receiver setup menu will be saved only, if the menu is passed through until the end (reached after button press at menu point **Ⓝ**).

4.1 Preset channel assignment

When using the preset channel assignment the RPM Governor function for **nitro/gas helicopters** will use an auxiliary channel (channel 8) to set the rotor rpm and to activate/deactivate the RPM Governor. So you can control the throttle servo as usual by using the thrust stick and throttle curves of your transmitter and the RPM Governor will be switched by using an extra channel on your transmitter. In addition there is the possibility to control both functions (manual throttle control and switching the RPM Governor) only by the throttle channel, e.g. if the transmitter does not have a sufficient number of control channels. For this purpose it is necessary that no additional channel for the RPM Governor is assigned. This can be done by teaching a custom channel order (see next section).

Using the RPM Governor in combination with an **electric helicopter**, then this is generally controlled by the throttle channel only. The specific allocation of an auxiliary control channel for the RPM Governor has no effect here.

For using AttitudeControl also some actuator is needed that can be used to activate/deactivate AttitudeControl during takeoff, landing and in flight. This switch controls a free channel on the transmitter, which is taught in the Receiver setup menu of MICROBEAST PLUS at menu point **Ⓙ** or which corresponds to the standard assignment of the selected receiver type (see next page).

Transmitter channel	Spektrum® satellite	Futaba® S-BUS	PPM composite signal
	Function	Function	Function
channel 1	Throttle (CH5)	Aileron	Collective pitch
channel 2	Aileron	Elevator	Aileron
channel 3	Elevator	Throttle (CH5)	Elevator
channel 4	Rudder	Rudder	Rudder
channel 5	Tail gyro gain	Tail gyro gain	AttitudeControl
channel 6	Collective pitch	Collective pitch	Throttle (CH5)
channel 7	AttitudeControl	AttitudeControl	Tail gyro gain
channel 8	RPM Governor*	RPM Governor*	RPM Governor*
channel 9	Auxiliary (CH6)	Auxiliary (CH6)	Auxiliary (CH6)

Transmitter channel	SRXL			
	BEASTRX®	Multiplex® SRXL JR® X.Bus Mode B JETI® UDI	Graupner® SUMD	Spektrum® SRXL
	Function	Function	Function	Function
channel 1	Aileron	Aileron	Collective pitch	Throttle (CH5)
channel 2	Elevator	Elevator	Aileron	Aileron
channel 3	Throttle (CH5)	Heck	Elevator	Elevator
channel 4	Rudder	Collective pitch	Rudder	Rudder
channel 5	Tail gyro gain	Throttle (CH5)	AttitudeControl	Tail gyro gain
channel 6	Collective pitch	Tail gyro gain	Throttle (CH5)	Collective pitch
channel 7	AttitudeControl	AttitudeControl	Tail gyro gain	AttitudeControl
channel 8	RPM Governor*	RPM Governor*	RPM Governor*	RPM Governor*
channel 9	Auxiliary (CH6)	Auxiliary (CH6)	Auxiliary (CH6)	Auxiliary (CH6)

When using SRXL the preset channel assignment is based on the receiver's protocol version. MICROBEAST PLUS will detect automatically which brand of receiver is used and will choose the appropriate channel assignment accordingly.

* assignment only used for nitro helicopters

4.2 Einlernen einer geänderten Kanalreihenfolge

If you need a customized channel order, please first prepare your transmitter as described in sections 3.2 and 5.2.2 of the MICROBEAST PLUS instruction manual (if not already done). In the following nine menu points **ⓑ** - **ⓙ** you can assign different functions by simply actuating the appropriate channel function on your transmitter. A blue flash of the Status-LED indicates that a channel has been detected. Press the button after learning each function to save the assignment and to go to the next function. The assignment of the auxiliary channel **[CH6]** can be skipped by pressing the button without teaching a channel for this function. Likewise, the assignment of the channel for nitro RPM Governor can be skipped in case it is not needed or if you don't want to control the RPM Governor by a separate channel, e. g. if your transmitter does not provide enough free channels. By skipping the assignment the RPM Governor function will use a different operating mode that allows to control it via the throttle channel (set at menu point **ⓖ**) if you like. When used in an electric model the RPM Governor generally is controlled via the throttle channel (set at menu point **ⓖ**). In this case the assignment at menu point **ⓘ** can be skipped anyway, as an assignment will have no effect.

Finally at menu point **ⓙ** you have to assign the channel that is used to activate/deactivate the AttitudeControl. Also this can be skipped if not needed or of you don't want to use a separate channel. AttitudeControl can still be used then. In this case the channel for the tail gyro sensitivity (set at menu point **ⓕ**) is also used for AttitudeControl (if it is enabled in Parameter menu point **ⓛ** later).

Menu LED	Function
ⓑ	Collective pitch
ⓒ	Aileron
ⓓ	Elevator
ⓔ	Rudder
ⓕ	Tail gyro gain
ⓖ	Throttle (CH5)
ⓗ	Auxiliary (CH6)*
ⓘ	RPM Governor (only for nitro)*
ⓙ	AttitudeControl*

* optional

5. SETUP MENU

Due to the new functionality some basic settings in the Setup menu have been changed in comparison to previous versions (MICROBEAST PLUS firmware versions 3.2.x and below). The affected menu points are described below. **Check and change these settings after updating your MICROBEAST PLUS to Version 4.x.x in any case, even if the functions of AttitudeControl and/or RPM Governor are not (yet) used! Do not attempt to fly the helicopter, as long as these items were not checked and setup correctly. Otherwise the model is guaranteed to crash!!**

⚠ If you are unsure that all the steps were followed correctly, perform a factory reset after the update process and setup the model from scratch. All of the settings (Setup menu points) not named here are setup as described in chapter 7 of the MICROBEAST PLUS instruction manual.

Factory reset:
To reset MICROBEAST PLUS to factory settings, **at any Setup menu point** push down the button for at least 10 seconds until the LEDs Ⓐ - Ⓝ quickly blink one after the other to confirm the reset.

Please note that any previous configuration is now deleted. Do not attempt to fly the helicopter without doing the complete setup procedure again. Otherwise you will crash your helicopter! Please also note that all servo settings are lost. Therefore you should unplug the servos and remove the servo horns before resetting MICROBEAST PLUS.

The receiver type settings (see chapter 6 of the MICROBEAST PLUS instruction manual) are not affected by the reset! Conversely, if you change the receiver type in Receiver setup menu, the parameters of Setup menu and Parameter menu are not affected. However, you have to redo all the receiver-specific settings (channel assignment and fail-safe, see sections 5.2 to 5.3 of the MICROBEAST PLUS instruction manual).

Ⓐ Mounting orientation of MICROBEAST PLUS

Instead of the previous selection „horizontal" or „vertical" at Setup menu point Ⓐ you now must selected the exact mounting position of the MICROBEAST PLUS unit. This results in eight possible settings for Setup menu point Ⓐ:

Status-LED	Mounting orientation
off	flat, sticker on top side, socket points in flight direction*
flashing purple	vertical, button is on the top, socket points in flight direction
purple	flat inverted, sticker on bottom side, socket points in flight direction
flashing red	vertical inverted, button is on the bottom, socket points in flight direction
red	flat, sticker on top side, socket points to the tail boom
flashing blue	vertical, button is on the top, socket points to the tail boom
blue	flat inverted, sticker on bottom side, socket points to the tail boom
red/blue	vertical inverted, button is on the bottom, socket points to the tail boom

Factory Setting

Flight direction

Status-LED: **red**

Status-LED: **off**

Fig. 1

Flight direction

Status-LED: flashing **purple**

Status-LED: flashing **blue**

Fig. 2

Status-LED: **purple**

Status-LED: **blue**

Fig. 3

Status-LED: **red**/**blue**

Status-LED: flashing **red**

Fig. 4

You can switch between the options by moving the rudder stick to one or other direction (see section 6.3 of the MICROBEAST PLUS instruction manual). The Status-LED will change the color according to the selected orientation.

Briefly push the button to save the configuration and to proceed to Setup menu point Ⓑ.

Ⓚ Collective pitch range and endpoints

In contrast to MICROBEAST PLUS firmware versions 3.2.x and below adjusting the collective pitch at Setup menu point Ⓚ now is done by moving the aileron stick, similar as adjustment of cyclic pitch range is done at Setup menu point Ⓙ!

Moving the rudder stick serves for a different task now: By moving the rudder stick you can reverse the internal collective pitch directions. The current pitch direction is indicated by the color of the Status-LED at Setup menu point Ⓚ. When the thrust stick is set to positive collective pitch, the Status-LED must light up in blue color, when the stick is set to negative pitch the Status-LED must light in red. **The crucial factor is the actual pitch angle of the rotor blades, not the position of the thrust stick!** If the display of colors is inversed, i.e. the Status-LED lights blue when pitch is negative and lights red if pitch is positive, the directions can be interchanged by moving the rudder stick once into any direction. Check this setting several times and very conscientious. The setting is very important for proper function of AttitudeControl.

Besides setting the control direction, **after the first update to firmware 4.x.x it is essential to set the collective pitch angles for both positive and negative direction (again)**! This will ensure that the internally stored values are adjusted to the new firmware. So push the thrust stick on your transmitter all the way forward to the maximum deflection. By moving the aileron stick left or right increase or reduce the collective pitch angle so that it corresponds to the desired maximum angle. Make sure the thrust stick stays all the way forward when adjusting the pitch! To confirm that the new value has been set, the Status-LED will flash in the appropriate color.

If you have set the maximum (or minimum) collective pitch angle, move the thrust stick all the way to the back and again adjust the collective pitch to the desired pitch angle by using the aileron stick, this time keeping the thrust stick all the way back.

> ⚠ Don't use any pitch curves in your transmitter **while doing these adjustments**. Later on for the flights, you can adjust your pitch curves as you like and are used to. Setup menu point Ⓚ solely serves to teach MICROBEAST PLUS the maximum pitch range and the endpoints of the thrust stick.

Push the button to save the configuration and to proceed to Setup menu point Ⓛ.

Ⓛ Cyclic swashplate limit

Regarding Setup menu point Ⓛ there are no changes compared to previous versions. Anyhow, after readjusting the maximum pitch angles at Setup menu point Ⓚ, the swashplate cyclic limit at Setup menu point Ⓛ should also be checked and readjusted in case there have been made changes to the pitch angles. How exactly the adjustment at Setup menu point Ⓛ is performed, you can read in the MICROBEAST PLUS instruction manual at chapter 7.

Push the button to save the configuration and to proceed to Setup menu point Ⓜ.

Ⓜ Swashplate sensor directions

The approach to this Setup menu point was not changed compared to previous versions. **However, after updating to firmware version 4.x.x it is very important to check the sensor directions again and set them correctly, even if the helicopter was previously flown. Because of the new architecture it can not be excluded that the sensor directions changed due to the update!**

⚠️ When tilting the helicopter forward the swashplate has to move backwards, when tilting the helicopter to the back, the swashplate has to compensate forward. Same thing applies to the roll axis, when you roll the helicopter to the left the swashplate has to steer right and vice versa. Basically the swashplate has to remain horizontal while banking the helicopter.

If this is not correct, you can reverse the sensor directions by moving the rudder stick in one direction. For confirmation you will see that the Status-LED changes color. Repeat this step until **both sensors** are working in the correct manner.

There are four possible displays for control to choose from, one will be correct.

	Sensor directions	
Status-LED	**Elevator**	**Aileron**
off	reversed *	reversed *
purple	reversed	normal
red	normal	reversed
blue	normal	normal

* Factory Setting

When you press the button now, you will proceed to adjustment of the RPM Governor operation mode at Setup menu point Ⓝ in case you operate MICROBEAST PLUS with a single-line receiver. Otherwise you will exit the Setup menu and MICROBEAST PLUS is ready for operation again. The RPM Governor function is not applicable when a Standard receiver is used!

Ⓝ RPM Governor - Operation modes

At menu point Ⓝ you can choose between three different options:

- **deactivated** - the RPM Governor is not used. All control commands on the throttle channel will be passed to **[CH5]** output directly.

- **electric** - select this option if your helicopter is powered by an electric motor and an electric speed controller is plugged into **[CH5]** output of MICROBEAST PLUS. MICROBEAST PLUS reads the rpm signal from the speed controller or a phase sensor and controls the rotor speed accordingly. Note that the controller itself must not be operated in a (heli specific) governor mode. The speed controller must process the incomming throttle signals and control the motor as direct and unfiltered as possible (see chapter 2).

- **nitro** - with this option MICROBEAST PLUS can govern the rotor rpm of a helicopter with nitro or gas engine. For this MICROBEAST PLUS controls the throttle servo which is connected to **[CH5]** output and that controls the carburetor of the engine. The motor rpm will be read from a magnetic or optical sensor that captures the rpm from the crankshaft of the motor, the clutch bell or the main gear.

The choice is done by moving the rudder stick in one direction until the LED indicates the desired color and state.

Status-LED	Operation mode
off	deactivated*
red	electric
blue	nitro

* Factory setting

If the RPM Governor is „deactivated" MICROBEAST PLUS will exit the Setup menu if you briefly press the button. Otherwise pressing the button will lead to Governor menu point Ⓐ!

6. GOVERNOR MENU

If the RPM Governor was activated at Setup menu point **N** (setting „electric" or „nitro") then you can access the Governor menu immediately afterwards. Here various helicopter-specific information must be provided which is necessary so that the RPM Governor can function correctly. Moreover, the transmitter will be prepared for the use with the RPM Governor function and at menu point **A** a function test for the rpm sensor is performed.

> ⚠ Pay attention to your own safety and the safety of other people and property in your vicinity when using our product. When using helicopters with nitro/gas engines make sure that the motor will not start when making adjustments to the system. When using a gas engine always keep the ignition system deactivated!
>
> ⚠ For electric helicopters remove the motor pinion from the main gear during initial setup. Warning! Risk of injury! The following function test for the rpm sensor and adjusting the throttle range require the motor to be started. Never touch the motor when it's running. Always keep a save distance to all rotating parts of the helicopter.

A Function test for rpm sensor

Thus the RPM Governor of MICROBEAST PLUS can be used, the system must be able to detect the motor speed. This is done with the help of a rpm sensor that must be attached to the sensor input of MICROBEAST PLUS. For models with nitro/gas engines usually sensors are used that determine the speed signal magnetically or optically. These sensors are mounted next to the crankshaft or clutch bell and register the number of engine revolutions here.

For electric motors the motor speed can be determined electronically. For this purpose a phase sensor (e.g. BXA76013) is connected to one or two of the motor phases. Some electric speed controllers also offer a direct signal output for the rpm signal, so that no additional sensor is required.

To see how the sensor is mounted in detail please refer to the instruction manual from the sensor or from the helicopter. The wire with the rpm signal is connected to sensor input pin at the sideport of MICROBEAST PLUS by using the optional adapter cable BXA76401. This sideboard also powers the sensor with the supply voltage, if necessary. Note that the height of the supply voltage corresponds to your receiver power supply voltage!

Here are some installation and connection examples. As described virtually all kinds of rpm sensors may be used. Unfortunately it is impossible to try and enumerate all types. If in doubt about whether a particular sensor can be used in conjunction with MICROBEAST PLUS ask your dealer to find out.

Electric drive system with external phase sensor
Connect the motor wires of the phase sensor with any two phases of the electric motor. It is recommended to solder those wires to the plugs of the speed controller. So for maintenance purposes it is easier to remove the motor from the model later. In some cases the use of only one phase wire is sufficient. Usually this is the case when the speed controller powers the system with a BEC thus there is no galvanic isolation between motor and receiver circuit. However, we recommend using both wires in any case! This ensures that the sensor provides an interference-free signal as possible

The electronic speed controller is plugged into the **[CH5]** output.
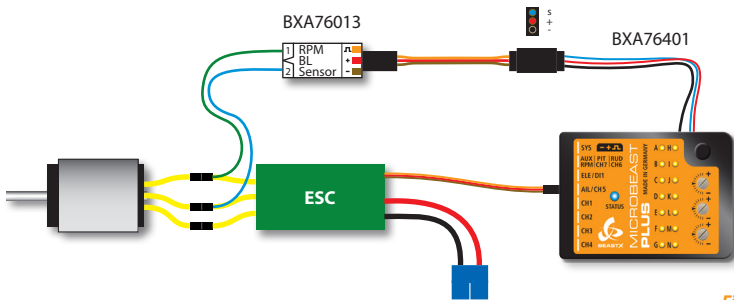
Fig. 5

Electric drive system with rpm signal output from the speed controller
When a speed controller is used that provides a rpm signal output you can alternatively use the **[RPM]** sensor input on the front connection board of MICROBEAST PLUS (lowest pin of the tripple signal input). (RPM sensors can't be connected here as this pin header does not provide any power supply!)
The speed controller's signal input wire is plugged into the output **[CH5]** as usual.

RPM signal wire

ESC

Control signal wire
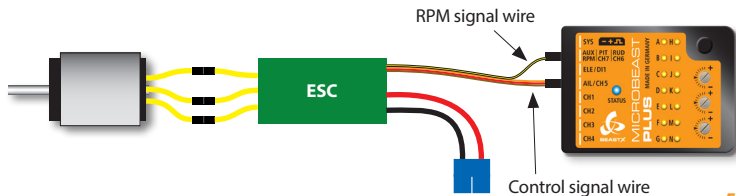
Fig. 6

Combustion drive system (nitro/gas)

Particularly when using sensors for combustion engines check for correct polarity of the sensor power supply on the adapter cable BXA76401. Here commonly sensors are used that are designed for governor systems from other manufacturers and therefore have a special pin assignment. In this case the colors of the connecting cables may not follow the norm. (The wire colors of the ALIGN governor sensor HE50H22 are swapped for example. Here red denotes the negative and black the positive pole!)

Magentic sensor located at clutch bell

BXA76401

Throttle servo
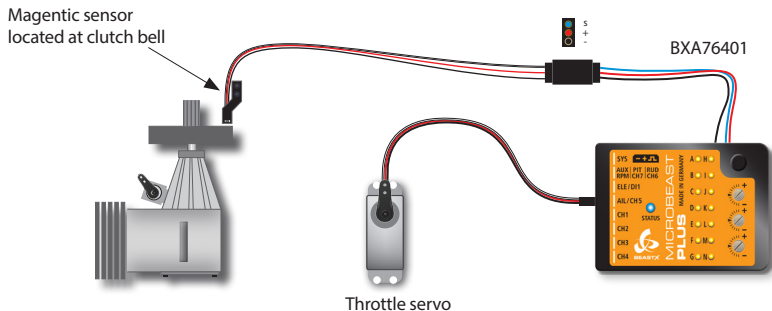
Fig. 7

At menu point **Ⓐ** we check whether the rpm sensor is functioning properly and the rpm sensor wire is connected correctly and in general if there is a usable rpm signal. **Watch out! At this menu point the throttle channel is unlocked.** This means you have full control over the throttle output **[CH5]** with your remote control to control the speed controller or throttle servo.

When using an electric model it is necessary to give some gas so that the motor starts to rotate and the phase sensor or the speed controller outputs a rpm signal. Once the motor is running the Status-LED on the MICROBEAST PLUS should light up in red color.

With a nitro/gas powered helicopter you can simply rotate the clutch or engine crankshaft by hand until the signal generator (magnet or similar) passes the sensor. Whenever the signal generator is within the detection range of the sensor the Status-LED should light up in blue color.

If the Status-LED on the MICROBEAST PLUS does not light up as described please double check the wiring. Particularly pay attention whether the power wires of the sensor are of correct polarity (on some sensors the wire colors do not match the usual standard!). If you have a magnetic sensor check if the magnets are installed with the correct polarity and if they are passing the front of the sensor close enough. Using a crankshaft sensor make sure that the sensor is mounted close enough to the frame accordingly.

In addition to the function control of the sensor, check the throw setting for the throttle servo in the remote control and adjust if necessary: Set the throttle to mid stick position and attach the servo horn, so that the throttle linkage is at a right angle to the servo horn. Then adjust the length of the linkage according to the instructions of the helicopter, so that it also is positioned perpendicular to the linkage lever at the carburetor. Adjust the lever at the carburetor so that it is opened halfways (note the markings on the carburetor!). Now move the throttle stick towards full throttle and adjust the servo travel in the transmitter accordingly, so that the full throttle position is reached without binding. Lastly move both throttle stick and throttle trim on the transmitter to the „motor off" position and also adjust the servo travel in that direction until the carburetor is fully closed. If the servo travel must be greatly reduced in both directions, it is recommended that the linkage ball on the servo arm is mounted further in so that the servo can be moved over a wider range. For more information, refer to the instruction manual for your helicopter.

Throttle at mid stick position

Servo horn and throttle lever parallel and perpendicular to linkage rod
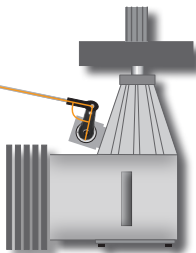
Fig. 8

Also with an electric model, the control range of throttle is crucial. Usually here the throttle endpoints of the transmitter are fixed by an initial programming of the speed controller. But also speed controller exist that require adjusting the servo throw of throttle channel in the transmitter, so that the throttle range is in accordance with the specification of the speed controller. At menu point Ⓐ there is the possibility to check again whether this setting has been performed correctly. Carefully apply some gas. The motor should start to turn immediately if you move the stick just a little bit and full speed should be reached when the stick just reaches full throttle position. If the engine turns much earlier at the maximum possible speed or only starts to turn at a very high stick deflection decrease the travel of throttle channel in the transmitter or repeat the programming of the speed controller. Thus the RPM Governor of MICROBEAST PLUS can operate correctly, the motor speed should increase as linear as possible when the stick is moved and there should be no ranges in that the motor speed does not change.

⚠ **Watch Out! Electric motors rotate at high speeds.** Keep a safe distance during the function test. We highly recommend to remove the motor from the main gear. However, please observe the manufacturer's specifications of the motor. Some motors may not be operated without load. In this case only let the motor run for a short time or let the motor stay attached to the main gear and only remove the main and tail rotor blades (Warning! Increased risk of injury).

If in doubt, do without the function test or throw adjust of the throttle stick.

Briefly push the button to save the configuration and to proceed to menu point Ⓑ.

Ⓑ Motor off/Idle Position

Menu point Ⓑ is used to set the lowest throttle position. **Watch Out! Output [CH5] can be directly controlled by the throttle stick.**

Using an **electric model** bring the throttle stick to the position at which the motor just does not start. If the stick throw has been correctly adjusted as described at menu point A (or the speed controller has been programmed to the stick throws), the necessary gas position should be achieved at the lowest position of the throttle stick. Some speed controllers provide a special mode that allows for a quick start-up in case of aborting an autorotation landing. Here there is a larger area between the actual „motor off" position of the speed controller and the point at which the motor actually starts. Also in this case move the throttle stick to the point at which the motor is just before to start, so that MICROBEAST PLUS can determine the effective throttle range correctly.

With a **nitro/gasser model** you bring the throttle stick to idle position or a slightly increased idle position (not „motor off"!), so MICROBEAST PLUS can determine the effective throttle range in the next step. Using the RPM Governor without an auxiliary channel to control the RPM Governor as described in chapter 4, this position additionaly will be used as idle position when performaning an autorotation maneuver. So you should set the throttle as high as necessary so the motor will have a stable run and doesn't quit when performing the autorotation.

When setting the low throttle position make sure the Status-LED lights up in **blue** lights color (both **electrical as well as nitro)**. This means that a new valid throttle position has been detected. If the Status-LED lights up in **red** then the throttle stick is too close to the throttle stick center position, which is not considered optimal and therefore can not be used as throttle position. In this case check the setting of the transmitter and the programming of the speed controller or readjust throttle servo, carburetor position and throttle linkage rod.

> When entering menu point Ⓑ the Status-LED is **off**. As long as you do not move the throttle stick, the currently stored position will not be changed. So you can skip menu point Ⓑ by a brief push of the button without changing the throttle position when performing subsequent adjustments in Setup menu or Governor menu. Conversely this means that you need to move the throttle stick at menu point Ⓑ at least once to change the current throttle position!

Briefly push the button to save the configuration and to proceed to menu point Ⓒ.

ⓒ Full throttle position

At menu point ⓒ you have to set full throttle position of your ESC or throttle servo. **Here the output [CH5] can be only controlled by the throttle stick when the RPM Governor type is set to „nitro".** In „electric" mode the throttle output will stay locked to your low throttle value. So you can set the full throttle position quite comfortable without the motor running high. Otherwise there are no differences between the modes „electric" and „nitro".

Move the throttle stick to full throttle position. The Status-LED must light up in **blue** color. This means that a new valid throttle position has been detected. If the Status-LED lights up in **red** the distance between the lowest throttle position and the full throttle position is too small. Since this will have a negative effect on the control behavior of the system, this throttle position can not be used. In this case check the setting of the transmitter and the programming of the speed controller or readjust throttle servo, carburetor position and throttle linkage rod. If necessary, set the lowest throttle position at menu point ⓑ again.

Similar to menu point ⓑ the Status-LED is **off** when entering menu point ⓒ. As long as you do not move the throttle stick, the currently stored position will not be changed. So you can skip menu point ⓒ by a brief push of the button without changing the throttle position when performing subsequent adjustments in Setup menu or Governor menu. Conversely this means that you need to move the throttle stick at menu point ⓒ at least once to change the current full throttle position!

Briefly push the button to save the configuration and to proceed to menu point ⓓ.

ⓓ Adjusting throttle curves in the transmitter

Similar to menu point ⓐ, menu point ⓓ only serves to give you some status information. At menu point ⓓ the different activation points of the RPM Governor will be displayed based on color and state of the Status-LED. So you can prepare your transmitter for use with the RPM Governor function. The information conveyed by the Status-LED is basically the same in every Governor operation mode. However, the setup of the transmitter will be slightly different, depending on whether the mode „electric" or „nitro" is used.

Electric

In „electric" mode the speed controller is no longer controlled by the pilot via the transmitter. MICROBEAST PLUS takes over full control of the speed controller. With the transmitter you only specifiy the desired rotor rpm you want the helicopter to maintain. When setting an rpm higher than zero, MICROBEAST PLUS will speed up the rotor smoothly and ensure that the rotor rpm is kept constant throughout the flight. To practice autorotation landings, you can keep MICROBEAST PLUS in a special mode that causes the speed controller to be switched off during the maneuver but speed up the rotor rpm faster when aborting the autorotation (faster than with the initial soft start).

The rotor rpm is set via the throttle channel of the transmitter. You may use the transmitter's throttle curves for instance, so you can switch the motor on and off and pretend different speeds using the flight mode system of the transmitter. Instead of curves you only have to set horizontal lines so that the rotor rpm value does not depend on the throttle stick position but is fixed in each flight mode. The flight mode switch then acts as a switch that switches between different speed settings.

Normal flight mode
- Motor off
- Throttle is 0% over the entire range
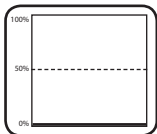
Status-LED **off**

Idle up 1
- RPM Governor enabled
- 1680 rpm = 42% throttle
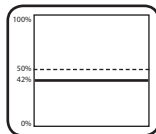
Status-LED **red**

Idle up 2
- RPM Governor enabled
- 2200 rpm = 55% throttle
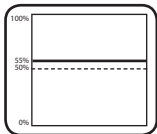
Status-LED **red**

Autorotation
- RPM Governor on standby
- Motor off
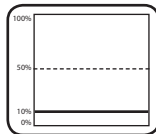
Status-LED **blue**

In „electric" mode the adjustable throttle range is 3400 rpm/min. The lowest rotor speed that can be set is 600rpm/min, the maximum speed is 4000rpm/min. To enable autorotation bail out mode the throttle must be set to a value between 5% and 15%.

Throttle position		Rotor rpm*	Status-LED
Futaba®	**Spektrum®**		
100	100%	4000	purple
90	95%	3800	red
80	90%	3600	
70	85%	3400	
60	80%	3200	
50	75%	3000	
40	70%	2800	
30	65%	2600	
20	60%	2400	
10	55%	2200	
0	50%	2000	
-10	45%	1800	
-20	40%	1600	
-30	35%	1400	
-40	30%	1200	
-50	25%	1000	
-60	20%	800	
-70	15%	600	
-80	10%	Motor off/ Autorotation	blue
-90	5%		
-100	0%	Motor off	off

The list is not exhaustive. Intermediate values result accordingly.

Nitro

In „nitro" mode the throttle servo can be controlled entirely via the throttle channel of the remote control as long as the RPM Governor is switched off. Only when the RPM Governor is switched on, this will control the throttle servo to spool up the rotor to the desired speed (if this is not yet reached) and ensure that the rotor speed is maintained during the flight. The manual throttle control is especially necessary to start and warm up the engine as well as to stop the engine after flight. Also some model engines react very sensitive in the lower throttle sector and too abrupt engagement can cause the engine to quit, i.e. when the clutch is not fully engaged and/or the rotor is not yet turning. In this case a manual throttle control can be of advantage as the pilot can run the engine to speed by hand before control is passed over to the RPM Governor.

Depending on whether an auxiliary channel was assigned to control the RPM Governor in Receiver setup menu or not, the RPM Governor is either controlled separately via this channel or you can control both RPM Governor and throttle servo alone by using the throttle channel of the transmitter. In general the adjustable throttle range in „nitro" mode is 2400 rpm/min. The lowest head speed to govern is 600 rpm/min, the maximum head speed is 3000 rpm/min.

If a separate control channel is used for the RPM Governor the throttle servo can be controlled as usual via throttle channel and throttle curves of the transmitter. By switching the separate control channel in different positions, the RPM Governor can be activated and the desired rotor rpm can be preset. Note that for safety reason the throttle channel has priority over the RPM Governor when the output is below 25%. So you can always control the lower throttle servo positions by hand, even if the RPM Governor is already switched on. Then when the throttle is raised above 25% the RPM Governor intervenes and spools up the rotor. Also when you want to bring the throttle servo to idle position for autorotation or to shut off the engine you can always do this, regardless of how the RPM Governor is switched. Anyhow keep in mind that MICROBEAST PLUS will be set to autorotation bail out mode if the RPM Governor is switched on and the throttle channel is brought below 25%. When throttle then is increased again, the RPM Governor will speed up the rotor faster than on initial spool up! Therefore if you make a stopover and the rotor is completely stopped, the RPM Governor must be completely disabled once by using the separate control channel. So the RPM Governor is reset and will perform an initial startup again. Otherwise if autorotation mode would still be active, the helicopter may tip over due to the abrupt speed up (this does not apply if you set the bail out spool up rate at Parameter menu point Ⓚ as high as the initial spool up rate - see chapter 8).

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Normal flight mode
- Throttle curve controls throttle
- RPM Governor off
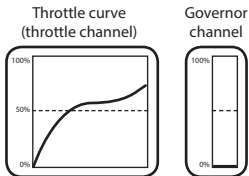
Throttle curve (throttle channel)

100%

50%

0%

Governor channel

100%

0%

Status-LED **off**

Idle up 1
- RPM Governor on
- 1800 rpm = 52.5%

Throttle curve (throttle channel)

100%

50%

0%

Governor channel

100%

52.5%

0%

Status-LED **red**

Autorotation
- RPM Governor on standby
- Increased idle position

Throttle curve (throttle channel)

100%

50%

0%

Governor channel

100%

52.5%

0%
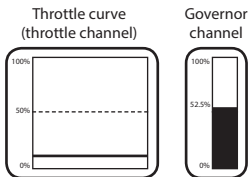
Status-LED **blue**

| Throttle position | | | Rotor rpm* | Governor channel |
Futaba®	Spektrum®			
100	100%		3000	100
90	95%		2874	90
80	90%		2747	80
70	85%		2621	70
60	80%		2495	60
50	75%		2368	50
40	70%		2242	40
30	65%	**Manual control/**	2116	30
20	60%	**RPM control**	1989	20
10	55%		1863	10
0	50%		1737	0
-10	45%		1611	-10
-20	40%		1484	-20
-30	35%		1358	-30
-40	30%		1232	-40
-50	25%		1105	-50
-60	20%		979	-60
-70	15%		853	-70
-80	10%	**Manual control/**	726	-80
-90	5%	**Autorotation**	600	-90
-100	0%		aus	-100

The list is not exhaustive. Intermediate values result accordingly.

If no separate control channel is used for the RPM Governor, throttle servo and RPM Governor are solely controlled by the throttle channel. For this purpose the control range of the throttle channel is divided into two parts: Below the center position, the throttle servo is controlled manually by the throttle channel. The RPM Governor is switched off and the servo output range is doubled, so that the throttle servo can be moved over the entire range. Once the throttle channel is moved (switched) to the upper area, the RPM Governor will activate, spool up the rotor and try to hold the preset rpm. Similar as it was described above for electric models you make the throttle curve a horizontal line, so that regardless of the position of the throttle stick MICROBEAST PLUS will always see the same throttle value and so the preset rpm will stays the same. So at least two flight phases are necessary. One that the throttle curve goes only up to the middle and in which the motor can be controlled by hand, i.e. for starting the motor and one flight phase that activates the RPM Governor and the throttle curve is used to preset the desired rotor head speed.

Normal flight mode
- RPM Governor off
- Throttle stick controls throttle servo
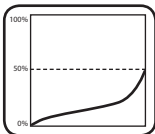
Idle up 1
- RPM Governor on
- 1800 rpm = 75%
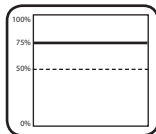
A third flight mode is used for auto-rotation: Here the throttle channel is constantly set to a value close below center position (between 40% and 50%) . When you switch to this flight mode once the governor was active, the throttle servo will be moved to the idle position set at menu point **Ⓑ**. When switching back to governor mode, i.e. when you want to bail out from autorotation, the rotor will be spooled up at an increased rate (this does not apply if you set the bail out spool up rate at Parameter menu point **Ⓚ**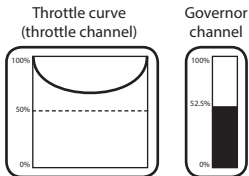 as high as the initial spool up rate - see chapter 8). Alternatively if it is switch back to the flight phase with manual control, autorotation mode is canceled and the next time you switch on the RPM Governor, the rotor is spooled up slowly.

Autorotation*
- RPM Governor on standby
- Increased idle position
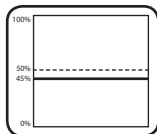
* Only effective when RPM Governor was active before

| Throttle position | | Rotor rpm* | Status-LED |
Futaba®	Spektrum®		
100	100%	3000	**purple**
90	95%	2760	
80	90%	2520	
70	85%	2280	
60	80%	2040	
50	75%	1800	**red**
40	70%	1560	
30	65%	1320	
20	60%	1080	
10	55%	840	
0	50%	600	
-10	45%	Manual control/ Autorotation	**blue**
-20	40%		
-30	35%	Manual control	**off**
-40	30%		
-50	25%		
-60	20%		
-70	15%		
-80	10%		
-90	5%		
-100	0%		

The list is not exhaustive. Intermediate values result accordingly.

Ⓔ Divider for rpm input signal

When using electric motors the rpm sensor signal usually consists of the (electric) field speed. In order to obtain the actual engine speed the field speed must be divided by half the number of motor poles. Using a 2-pole motor thus the measured speed corresponds to the motor speed. With a 10-pole motor on the other hand the field speed is five times higher than the actual speed.

Also for nitro/gas engines the measured speed of the sensor may be higher than the actual speed. For example when a magnetic sensor is installed and more than one magnets are used for measuring the rotational speed, the rpm output will be multiplied by the number of magnets. So when two sensor magnets are used the rpm signal from the sensor will be twice the engine revolutions.

At menu point Ⓔ you must specifiy the factor by how much the incoming rpm signal must be divided to get the actual motor rpm. The currently selected division factor is represented by the color of the Status-LED. Use the rudder stick to switch between options.

Status-LED	Divider
off	**no division** (2 motor poles or 1 magnet)
purple *flashing*	**2** (4 motor poles or 2 magnets)
purple	**3** (6 motor poles)
red *flashing*	**4*** (8 motor poles)
red	**5** (10 motor poles)
blue *flashing*	**6** (12 motor poles)
blue	**7** (14 motor poles)

* Factory setting

The motor poles of an electric motor can be easily determined by counting the number of magnets built into the motor housing. Each magnet corresponds to one magnetic pole. Note that on some motors pairs of magnets are used rather than one single large magnet. These pairs together form just one magnetic pole! If in doubt refer to the datasheet of the motor or ask the manufacturer or your local dealer.

To determine the number of magnets that are used for a magnetic rpm sensor in a nitro helicopter, you can use menu point **Ⓐ**. Each time a magnet passes the sensor the Status-LED will light up in blue color there, i.e. when you turn the clutch bell by hand. So you simply count how often the Status-LED lights up during one rotation. Then this is the divider you have to set a menu point **Ⓔ**.

Briefly push the button to save the configuration and to proceed to menu point Ⓕ.

Ⓕ Ⓖ Ⓗ Divider for main gear ratio

The RPM Governor of MICROBEAST PLUS in general calculates with the rotor head speed of the helicopter. So (as shown at menu point **Ⓓ**) you can set the desired head speed very easily and MICROBEAST PLUS will try to maintain this headspeed as close as possible. Thus the detected rotation speed of the motor can be converted into rotor head speed, you must specify the main gear ratio of the helicopter. This is done at menu points **Ⓕ**, **Ⓖ** and **Ⓗ**. Menu point **Ⓕ** sets the number of gear ratio before the decimal point, menu points **Ⓖ** and **Ⓗ** specify the first two decimal places. Compare the following table and set the Status-LED to the corresponding color and condition at each menu point so the desired gear ratio will result as a combination of all three menu points. The ratio can be adjusted in increments of 0.05. Choose the ratio that is the closest for your helicopter and set the menu points one after the other.

The gear ratio should be specified in the instruction manual for your helicopter. Especially with electric models it will vary depending on the motor pinion used. For helicopters with a single-stage gear drive the reduction can be calculated by dividing the number of pinion teeth from the main gear tooth count.

Example: Shape S8 - Main gear tooth count 130 teeth / 15 tooth pinion. Gear ratio ca. 8,67:1.
Ⓕ - Status-LED purple flashing, **Ⓖ** - Status-LED red flashing, **Ⓗ** - Status-LED purple flashing

To proceed to the each menu point briefly push the button. After menu point Ⓗ the initial setup is finished and the button press will lead back to operation mode.

Main gear ratio - X.YZ : 1

Menu point F

Status-LED	X
off	user defined
purple *flashing*	8
purple	9*
red *flashing*	10
red	11
blue *flashing*	12
blue	13
red/blue flashing	14

Menu point G / Menu point H

Status-LED	YZ	Status-LED
off	.00	off
off	.05	purple *flashing*
off	.10	purple
off	.15	red *flashing*
purple *flashing*	.20	off
purple *flashing*	.25	purple *flashing*
purple *flashing*	.30	purple
purple *flashing*	.35	red *flashing*
purple	.40	off
purple	.45	purple *flashing*
purple	.50*	purple
purple	.55	red *flashing*
red *flashing*	.60	off
red *flashing*	.65	purple *flashing*
red *flashing*	.70	purple
red *flashing*	.75	red *flashing*
red	.80	off
red	.85	purple *flashing*
red	.90	purple
red	.95	red *flashing*

Setting the option „user defined" at menu point F you can choose a custom gear ratio that can be edited by using the StudioX software and the optional USB2SYS interface. This allows to choose ratios smaller than 8.00:1 or greater than 14.95:1or that are not a multiplier of 0.05.
In this case the menu points G and H will be skipped when the button is briefly pressed at menu point F.

In general the RPM Governor can only be switched on when MICROBEAST PLUS is ready for operation. During the initialization phase the signal from the throttle channel is passed directly to the throttle servo. Therefore (especially with electric models) make sure that during the initialization the throttle channel is set to „motor off" position at the transmitter (not „Autorotation"!).

Note that if your receiver does not send a valid control signal to MICROBEAST PLUS within two seconds after power up, the throttle channel will be locked for security reasons. In this case **[CH5]** output will be set to motor failsafe position (set at Receiver menu point **Ⓞ**). Only when MICROBEAST PLUS gets a valid signal from the receiver and the throttle stick is moved to the failsafe position (or below) the throttle channel will be unlocked.

As described above at Governor menu point **Ⓓ** set your throttle curves or the auxiliary channel in the various flight modes so the desired head speed will approached and observed. Keep in mind that the head speed should not be higher than 80% of the maximum head speed that is possible with this motor and this gear ratio. If the chosen head speed is too high, the RPM Governor will constantly give full throttle input and no effective govering will be possible because there is not enough room left to open the throttle for compensate of rotor head load.

With nitro helicopters always ensure that the RPM Governor is disabled when you start the model. Otherwise the RPM Governor would drive the throttle servo up to the full throttle position and stay there as it tries to reach the demanded head speed. So always check the throttle servo position before starting the engine very carefully!

Some transmitters offer a special setting that allows to automatically switch the auxiliary governor channel together with the flight mode switch. So the motor can be started in the first flight mode, you can spool up the rotor by applying throttle manually and hover the helicopter. With the second flight mode the throttle curve is switched to a „V"-shaped curve and simultaneously the RPM Governor is turned by the auxiliary channel. In this case pay special attention that the two throttle curves overlap as good as possible in the point at which the transfer between the two flight modes takes place. Otherwise the throttle servo would make a jump before the RPM Governor will take over control as you still may be in manual mode for a short amount of time. So in this type of operation it is not possible to activate the RPM governor from the get go and let the rotor spool up autonomously. If you want this, you must activate the RPM Governor before switching to your second flight mode!

In order to make fine adjustments to the RPM Governor the Parameter menu of MICROBEAST PLUS has been extended by menu point ❶, ❿, ⓚ compared to the versions 3.x.x. More over for AttitudeControl the parameter menu points ⓛ and ⓜ have been added.

❶ RPM Governor - Throttle response

Use menu point ❶ to change the response of the RPM Governor. This determines how fast and hard the system will open the throttle when the rotor rpm changes. Ideally the response is set as high as possible. If it is too low the main rotor may speed up immediately in unloaded conditions, e.g. when the helicopter is descening and the RPM Governor will only give soft throttle inputs when the head speed decreases. If the response is set too high on the other hand, the throttle may stutter audible and/or the motor rpm will kick in very hard and overshoot after the rotor head was loaded and the rpm decreased. The height of throttle response highly depends on factors such as heli size (blade size), motor power and performance and/or the throttle reponse behavior of the speed controller (when flying an electric heli). If you need to adjust the throttle response, we recommend to start with the lowest value and increase accordingly.

Status-LED	Throttle response
off	user defined
purple	normal
red *flashing*	slightly increased*
red	increased
blue *flashing*	fast
blue	aggressive

* Factory setting

Typically with electric helis the setting „normal" or „slightly increased" gives good results. Helis with a lot of power might use higher values.

Nitro helicopters with small engines (like .37 nitros) or gassser prefer a low setting. 90 size helis typically perform better with higher values.

Setting the option „user defined" to choose a custom value that can be edited by using the StudioX software and the optional USB2SYS interface.

Briefly push the button to save the configuration and to proceed to menu point ❿.

◑ RPM Governor - Initial spool up rate

When activating the RPM Governor this will not apply full throttle immediately but will increase the rotor head speed slowly until the desired preset head speed is reached. At menu point ◑ you can determine how quickly this soft start occurs when the RPM Governor is activated initially. The speed is given in number of revolutions by how much the rotor speed is increased per second. The higher the speed the faster your preset head speed will be reached. Please note that the given rates only are indicative. Depending on the response of the speed controller and the inertia of the rotor system it can actually take longer or shorter until the desired speed is reached. Associated with this the speed also determines how gently the rotor will start to turn. If the speed is too high, the rotor blades may fold in during startup because the system enters throttle too abruptly. With nitro helicopters this also may cause the engine to quit because the throttle is opened too fast and too far.

Status-LED	Spool up rate
off	user defined
purple	50 rpm/s
red *flashing*	100 rpm/s
red	200 rpm/s*
blue *flashing*	300 rpm/s
blue	400 rpm/s

Factory setting

Select „user defined" to choose a custom value that can be edited by using the StudioX software and the optional USB2SYS interface.

Briefly push the button to save the configuration and to proceed to menu point ⓚ.

Ⓚ RPM Governor - Quick change rate

If the RPM Governor is enabled and you increase the preset rotor head speed there will not be an abrupt change but the system will increase the rotor rpm with a given spool up rate that can be set at menu point Ⓚ. This rate also determines how fast the rotor head speed will increase when reactivating the RPM Governor after an autorotation maneuver. In this case the normal soft start would take too much time until the rotor has reached full speed and on the other hand it would not be necessary as typically the rotor is still turning at some speed when performing an autorotation.

Status-LED	Quick change rate
off	**user defined**
purple	same as initial spool up rate
red *flashing*	300 rpm/s
red	500 rpm/s*
blue *flashing*	700 rpm/s
blue	900 rpm/s

* Factory setting

If you don't need the autorotation spool up you can set to "**same as initial spool up rate**". The spool up rate will then be the same as set at menu point Ⓙ. So effectively there is no difference if you spool up from an initial state when the RPM Governor gets activated for the first time or when you reactivate the RPM Governor from autorotation.

> ⚠ Warning! A very high spool up rate can cause the throttle to be opened very fast and very far. This can cause the rotor blades folding in if the blade bolts are not tight enough or can damage the main gear especially in electric models. With nitro helicopters we recommend to use a rather low rate. Here an abrupt throttle change out of idle position can cause the engine to quit! Additionaly nitro motors react quite slow to throttle changes and it takes some time to speed up the rotor. When the change rate does not fit to the "mechanical" speed up it can happen that the motor is driven to full throttle during spool up.

Select "user defined" to choose a custom value that can be edited by using the StudioX software and the optional USB2SYS interface.

Briefly push the button to save the configuration and to proceed to menu point Ⓛ.

❶ AttitudeControl - Operation mode

At Parameter menu point ❶ you can choose between five different AttitudeControl operation modes. This is done as usual by selection with the rudder stick. If one of the AttitudeControl operation modes is selected, the AttitudeControl function is active and it can be activated/deactivated in operation by using the previously assigned transmitter channel for AttitudeControl. The „AttitudeControl disabled" option specifies the AttitudeControl is completely disabled and actuating the AttitudeControl channel has no effect (in terms of the AttitudeControl). The assignment to the colors of the Status-LED is as follows:

Status-LED	AttitudeControl operation mode
off	AttitudeControl disabled*
flashing purple	Bail out rescue mode
purple	Bail out rescue mode with collective pitch
flashing red	3D - Mode
red	3D - Mode with collective pitch
blue	Flight trainer mode

* Factory Setting

⚠ **Firstly enable AttitudeControl when all initial settings in Setup menu and Receiver menu have been performed.** Otherwise the servos may drive to the mechanical full stop, start binding and may get damaged, e.g. when AttitudeControl gets activated when leaving the menu and the system starts to try moving the heli.

⚠ If you repeat the adjustment in Receiver setup menu and setup the receiver channel assignment again, the AttitudeControl operation mode at Parameter menu point ❶ will be reset to „AttitudeControl disabled" for safety reason. So if you have previously used AttitudeControl, you must enable AttitudeControl again after a re-allocation of channels or switching the receiver type. In this regard check the settings of the transmitter and make sure that AttitudeControl can be activated/deactivated by the transmitter as before. Thereby other settings are not affected.

Bail out rescue mode

This operation mode can be used if the pilot becomes disoriented and would like to save the helicopter from crashing. In such case he just needs to let go the stick(s) for aileron and elevator and activate the AttitudeControl by flipping the assigned switch for AttitudeControl function. The helicopter then is rotated back into normal horizontal position by the shortest route over roll or pitch. The pilot must only operate the collective pitch function to control the height of the helicopter. Note that for safety reason there is a stick fading implemented. Even when AttitudeControl is switched on you can control aileron and elevator. The stick movements have priority over the AttitudeControl. The larger the deflection of the corresponding control stick, the less effect AttitudeControl has. On the other hand when both sticks are in center position AttitudeControl takes over full control of the aileron and elevator function.

Bail out rescue mode with collective pitch control

Bail out rescue mode with collective pitch control provides the same functionality as the „Bail out rescue mode" described above. In addition, here the AttitudeControl also controls the collective pitch function. During the rotation and after reaching the horizontal position, AttitudeControl inputs positive or negative collective pitch, making the helicopter turn (almost) without loss of height and maintain hover position (or slightly climbing up) when horizontal position is reached. So the pilot can completely let go all sticks as soon as he activates AttitudeControl and the helicopter is automatically brought into a (relatively) save location by AttitudeControl. Here it is possible to add some collective pitch and let the heli climb up even faster by moving the thrust stick beyond the point that is applied by AttitudeControl. But moving the thrust stick lower is locked as you can never apply less collective pitch than AttitudeControl does. So the helicopter can not be moved towards the ground by giving wrong collective pitch inputs by accident.

3D - Mode

In 3D - Mode MICROBEAST PLUS recognizes the current orientation of the heli (normal or inverted) and always rotates the helicopter to the nearest horizontal position when AttitudeControl is activated. This operation mode is well suited for practicing basic 3D - aerobatic maneuvers such as hovering or back flips. Since in 3D - Mode the stabilization can be fully overridden when actuating aileron or elevator function, it is possible to keep 3D - Mode activated for a longer period of time and to grope at an aerobatic maneuvers by only giving specific control inputs. Rolling and pitching back to horizontal position then does AttitudeControl for you. The pilot must only control collective pitch and rudder.
In addition, you can use this mode as rescue mode to stabilize the helicopter in an emergency situation. It should be noted, however, that the heli is always rotated to the nearest horizontal position. Therefore you must be very careful in controlling the collective pitch function as it may happen by accident that you give a collective input to the wrong direction. If you want to use 3D - Mode exclusively as rescue function, it is recommended to use 3D - Mode with collective pitch control.

3D - Mode with collective pitch control
3D - Mode with collective pitch control provides the same functionality as the „3D - Mode". In addition, here AttitudeControl takes over the collective pitch function. When reaching horizontal position AttitudeControl gives a positive or negative pitch input, so that the heli is held in the hover position or climbs up slightly. Here, the thrust stick is locked into each „wrong" direction. Therefore the pilot can only give additional collective pitch input (in normal position positive, in inverted position negative pitch) to increase the climb rate of the helicopter. But he cannot move the helicopter towards the ground by accidentally giving wrong pitch inputs.

Flight trainer mode
In Flight trainer mode you can only tilt the helicopter to a certain angle by giving aileron or elevator stick input. Moving the helicopter even further is impossible, as long as AttitudeControl is active. This prevents the helicopter from being tilted into a lateral position that may cause a big loss of height. As soon as the stick(s) for aileron and elevator is (are) released, the helicopter will be brought back to horizontal position by AttitudeControl. Additionally the helicopter is stablized all the time, independant of any stick input. This together makes the helicopter fly very similar to a multirotor helicopter. The pilot does not have to focus on the constant need of correcting the helicopter's attitude and he can not bring the helicopter in a difficult attitude by making violent control maneuvers.
Collective pitch and rudder are not affected by this operation mode.

Ⓜ AttitudeControl - Hovering pitch

If at Parameter menu point Ⓛ a mode „with collective pitch control" is selected, briefly pressing the button at menu point Ⓛ will lead to Parameter menu point Ⓜ. Otherwise menu point Ⓜ will be skipped!

At Parameter menu point Ⓜ the collective pitch will automatically be set to hovering position, which will be used when AttitudeControl is activated and the helicopter flies horizontally. Ideally the pitch angle is exactly as large as it is necessary to maintain a stationary hovering flight without ascending or descending. Typically this is somewhere in the range between 5 and 6 degrees. Depending on your personal preference the angle can be set larger, so that the heli climbs up and gains altitude when AttitudeControl is activated.

By moving the aileron stick left or right the hovering pitch can be adjusted. The color of the Status-LED indicates the range which the pitch is in between at the moment. This range is specified as percentage of maximum positive/negative pitch which was set at Setup menu point Ⓚ.

Status-LED	Hovering pitch
off	> 20% of maximum collective pitch
purple	> 30% of maximum collective pitch*
red	> 50% of maximum collective pitch
blue	> 70% of maximum collective pitch

* Factory setting: 37.5%

⚠ If the maximum positive/negative pitch angle is changed at Setup menu point Ⓚ then also the hovering pitch will change! So after re-adjusting the maximum angles also check and re-adjust the hovering pitch at Parameter menu point Ⓜ.

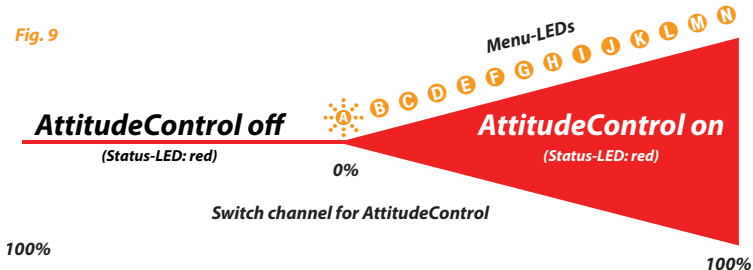⚠ When using the „3D - Mode with pitch control" make sure that the pitch range is symmetrical, i.e. the maximum positive and negative pitch angles are of same size. Otherwise the hovering pitch will differ in normal and inverted position as the hoving pitch is calculated from the maximum pitch! The setting at Parameter menu point Ⓜ affects both directions. A separate adjustment of the hovering pitch angles is not provided.

9. USAGE OF ATTITUDECONTROL

Once AttitudeControl was enabled by choosing one of the five AttitudeControl types at Parameter menu point ❶, AttitudeControl can be activated and deactivated in flight by using the switch on the transmitter whose channel was assigned as actuator for AttitudeControl in Receiver setup menu. When MICROBEAST PLUS is ready for operation check whether activation of AttitudeControl works as expected:

Similar to the tail gyro gain display you can determine the status of AttitudeControl by watching the yellow Menu-LEDs. These light up each time after the initialization sequence as well as when the amount of AttitudeControl gain is changed respectively when AttitudeControl is activated/deactivated. To distinguish the tail gyro gain display from AttitudeControl the Status-LED lights up in red color when the status of AttitudeControl is displayed. When AttitudeControl is deactivated Menu-LED ❹ starts to flash. If one of the Menu-LEDs ❽ – ❿ lights up, AttitudeControl is active. The individual Menu-LEDs signal the amount of AttitudeControl gain: The larger the deflection of the switch channel for the AttitudeControl is, the farther the Menu-LED will go in the direction of point ❿ and the stronger the effect of AttitudeControl will be. In particular this determines how fast and violent the helicopter will be rotated back to horizontal position. For the first flight it is recommended to adjust the throw of the AttitudeControl channel just until Menu-LED ❼ lights up when AttitudeControl is activated. If using a small helicopter like 450 size or below typically you can set the gain even higher (until Menu-LED ❾ lights up).

Fig. 9

Menu-LEDs

AttitudeControl off
(Status-LED: red)

AttitudeControl on
(Status-LED: red)

0%

Switch channel for AttitudeControl

100%

100%

9.1 AttitudeControl with separate switch channel

When a separate channel for AttitudeControl was assigned at Receiver setup menu point ❿ (or when the default assignment has been loaded) throw and direction of the AttitudeControl channel determine whether AttitudeControl is active or not and how strong it reacts. A deflection into one direction will activate AttitudeControl. Typically Menu-Led ⓝ (maximum gain) will light up when activating AttitudeControl for the first time, as the throw of the channel will be 100%. Adjust the deflection of this channel, i.e. by reducing the servo throw in the transmitter, so that one of the Menu-LEDs lights up next to point ⓖ (or point ⓘ when using a small helicopter) as described above.

When the switch channel is moved into the other direction Menu-LED ⓐ will light up and flash. In this case AttitudeControl is deactivated. Here it doesn't matter how big the deflection of the channel is as only the sign of the deflection determines whether AttitudeControl is on or off.

> If AttitudeControl works reversed, e.g. one of the Menu-LEDs ⓑ - ⓝ lights up when the switch for AttitudeControl is in „off"-position and the Menu-LED ⓐ does not disappear independant of the servo throw when the switch is in „on"-position, then simply reverse the channel for AttitudeControl in your transmitter by using the servo reverse function.

9.2 AttitudeControl with combined switch channel

If the tail gyro gain channel is also used for AttitudeControl (see chapter 4), then there is the following difference to the operation mode with separate channel as described above: In the switch position where AttitudeControl is off, the channel deflection determines the amount of tail gyro gain as usual. Increase or decrease the (servo) throw of this channel to adjust the tail gyro gain. The amount of tail gyro gain is indicated by the yellow Menu-LEDs each time after initialization procedure and always when the gain changes. Here the Status LED lights up in blue color. When you flip the switch and the channel is deflected to the other direction, MICROBEAST PLUS will keep the current tail gyro gain and activate AttitudeControl. When adjusting the height of deflection of the channel into this direction you can specify the AttitudeControl gain like described above. So here one channel is used for two functions. Depending on the direction you can either adjust tail gyro gain or AttitudeControl gain and by switching between directions AttitudeControl is activated or deactivated.

⚠ When using AttitudeControl with combined switch channel make sure AttitudeControl is at least deactivated once before take off. Otherwise the tail gyro gain would be minimal as the system would not have been able to determine your tail gain adjustment after initialization.

⚠ In this mode it is absolutely necessary to use a switch that changes the control directions directly and without intermediate steps. In particular, do not use a slider on the transmitter! Otherwise, when you activate AttitudeControl the tail gyro sensitivity would be decreased to 0% before the system turns on the AttitudeControl. So you would have 0% of tail gyro gain when AttitudeControl is active.

Fig. 10
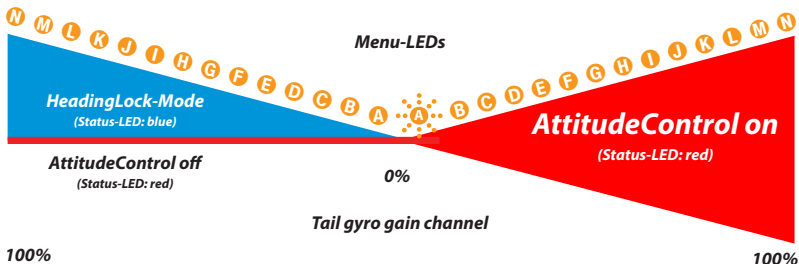
When AttitudeControl is enabled in general the tail gyro can not be used in Normal-Rate mode. If operating AttitudeControl with separate switch channel (see section 9.1) the channel for tail gyro gain activates HeadingLock - Mode in both directions. The sign of deflection is not relevant here, just the amount of deflection is important. When you also want to use the tail gyro in Normal-Rate mode (as described MICROBEAST PLUS instruction manual section 8.4) you must disable AttitudeControl at Parameter menu point ❶ (set Status-LED to „off").

10. FUNCTIONAL TEST OF ATTITUDECONTROL

When activating AttitudeControl you should be able to see an immediate impact on the swashplate control: If the heli is tilted to one side, MICROBEAST PLUS permanently steers the swashplate opposed to the inclination. In the region around horizontal position the swashplate will always stay nearly horizontal to the ground. The system constantly tries to bring the helicopter back to the horizontal position as long as the helicopter is oblique.

Fig. 11

Tilt the heli forward

The swashplate is tilted backwards and stays in this position...

... until the heli is brought back to horizontal.

When AttitudeControl is deactivated on the other hand, the swashplate will always be moved back to neutral position (perpendicular to main rotor shaft) as soon as the helicopter is standing still for a few seconds, independant of the current leveling. Here the system only corrects currently occurring rotational movements, but does not regulate the absolute deviation from horizontal position.

Tilt the helicopter forward

The swashplate briefly steers against the rotation but then goes back to neutral when the helicopter is not moved anymore.
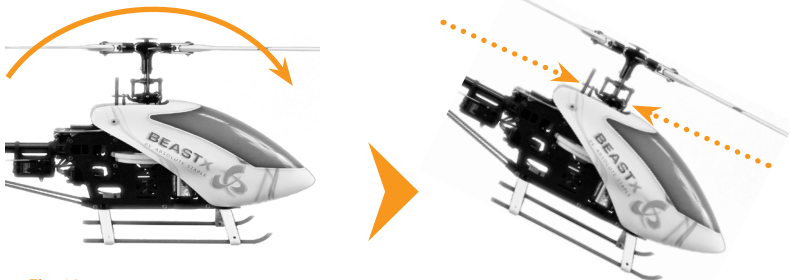
Fig. 12

When using an AttitudeControl mode with collective pitch control (see chapter 8) additonal to the cyclic movement also the collective pitch is moved in positive or negative direction when AttitudeControl is activated and the helicopter approaches the horizontal position. The pilot can add collective pitch in the same direction by using the thrust stick, but not in the opposite direction. Check to see if this works correctly and whether the control directions are correct. If the helicopter is kept in hovering position, some positive collective pitch must be applied by AttitudeControl and you can use the thrust stick to add more positive pitch, but not less. Analogous this must work when the heli is in inverted hovering position if using the „3D - Mode with collective pitch control". Here AttitudeControl will apply some negative collective pitch and you can only add more negative pitch, but not positive.

11. FLYING WITH ATTITUDECONTROL

11.1 First test flight

If not done already, for the first flight keep AttitudeControl deactivated and adjust all flight parameters like tail gyro gain, cyclic gain and so on as described in chapter 8 of the MICROBEAST PLUS instruction manual.

If the heli is setup well, you can familiarize yourself with the effect of AttitudeControl. For this we suggest to use the „Bail out rescue mode" (see chapter 8). Fly the helicopter in a sufficient amount of height in a stable hover and activate the AttitudeControl by using the appropriate switch. The helicopter should continue to hover in approximately the same position. Now give some aileron or elevator stick input and release the stick when the helicopter reached some oblique position. AttitudeControl should bring the helicopter back to the horizontal position more or less rapidly. Deactivate AttitudeControl and again tilt the helicopter by giving some stick input. Now the helicopter will stay tilted if you release the stick. Only when AttitudeControl is activated by flipping the switch again, the helicopter will be rotated back to horizontal position as before.

⚠ If using an AttitudeControl operation mode with collective pitch control (see chapter 8), moving the thrust stick does not have any effect in some area as AttitudeControl takes over collective pitch control as long as the thrust stick is in this area and AttitudeControl is activated. Therefore make sure the thrust stick is in a position that will roughly produce the same amount of collective pitch, before and while deactivating AttitudeControl. Otherwise when deactivating AttitudeControl the helicopter would make a leap down, if the thrust stick controls a smaller pitch angle than AttitudeControl.

⚠ For safety reason you should never take off or land with activated AttitudeControl. As AttitudeControl actively gives control commands to the control loop of MICROBEAST PLUS, the swashplate may tilt to one side if the helicopter is not placed perfectly level on the ground. This may cause the helicopter to tilt and crash when trying to take off or when the motor is switched off and the main rotor is running out.

11.2 Fine tuning of AttitudeControl

- The amount of deflection of the AttitudeControl switch channel controls the AttitudeControl gain. This determines the speed and roughness of the control input from AttitudeControl. If the effect of AttitudeControl is too low resp. the heli rotates back to horizontal position too slowly, increase the AttitudeControl gain by increasing the deflection of the AttitudeControl channel (i.e. by using the servo throw adjustment for this channel in the transmitter). If on the other hand the heli overshoots after reaching neutral position and bobs briefly, maybe the AttitudeControl gain is set too high. Reduce the gain accordingly. In such case also make sure that cyclic gain (dial1) and cyclic feed forward (dial 2) are well adjusted. It is recommended to adapt the AttitudeControl gain to the preferred application. If you would like to use AttitudeControl as emergency rescue then set the gain as high as possible. On the other hand when using AttitudeControl mainly as a training aid, for example in 3D - mode, then make the effect of AttitudeControl rather weak, so that the system does take over control gently.

- If the helicopter is not aligned horizontally as desired with active AttitudeControl, i.e drifts to one side in hovering, the artificial horizon can be readjusted. This is done at Parameter menu point **Ⓐ** which also serves as servo trim function (see chapter 9 of MICROBEAST PLUS instruction manual). If you activate AttitudeControl at Parameter menu point **Ⓐ** via the transmitter's AttitudeControl channel, you switch to trimming of the horizon instead of trimming the servos. By moving the aileron or elevator stick the roll and pitch tilt of the horizon can be increased/decreased. Briefly touching the appropriate stick will trim the horizon stepwise by 0.5 degrees to the specific direction. Touching the stick repeatedly or holding it for longer time will trim the horizon by several steps. The Status-LED indicates the trim values: when it lights in blue color both angles are 0 degrees resp. they are in the factory setting. If the Status-LED lights red one or both angles are adjusted slightly. If the Status-LED is purple, then one axis is trimmed by more than 5.0 degrees. When the status LED goes out, one of the two axes is further trimmed than 10.0 degrees, which is the limit for each axis! By moving the rudder stick you can remove the trimm that has been set since entering this menu point. Place the helicopter in horizontal position and you should be able to see the effect of trimming. Note that the helicopter usually is slightly tilted to the side in hovering flight due to the drag of the tail rotor. Therefore as a starting point it is recommended to trim about 5 degrees to the right when using a helicopter with clockwise turning main rotor. Also note that AttitudeControl can not recognize the absolute position

of the helicopter. Depending on wind and environmental conditions it may happen that the helicopter drifts slightly into a certain direction during hovering flight. Also long-lasting vibration or fluctuations in temperature can cause the helicopter not always comply exactly the same attitude. Therefore only trim in moderate steps and only when the helicopter reproducible drifts to the same direction!

Parameter menu point Ⓐ is used to adjust two different things: Trimming the servo center positions and trimming the AttitudeControl horizon. Depending on whether the AttitudeControl is activated or not, either the artificial horizon or the servo center positions can be trimmed. The Status LED provides information on the currently active trim mode. If the Status-LED is lit permanently, the servo center positions are trimmed. If the Status-LED flashes, the AttitudeControl is turned on and the artificial horizon can be trimmed.

- When using AttitudeControl in „Flight trainer mode" note that the control behavior which is set at Parameter menu point Ⓑ influences the maximum angle to that the helicopter can be tilted by control stick input when AttitudeControl is active. If Parameter menu point Ⓑ is set to „normal" (Status-LED = purple) the maximum angle is very small (apprx. 20 degrees). In „transmitter" mode (Status-LED = blue) the angle is the largest (apprx. 45 degrees). The exact angle suitable for each setting can not be specified because this setting scales the control signals of the transmitter. The angle thus directly depends on the transmitters signal length and therefore varies depending on the transmitter type. On the other hand this means that you can fine tune the maximum angle by simply increasing or reducing the maximum deflection of your control stick(s) in the transmitter for example by using the Dual Rate function of the transmitter. So you could even switch between different angles in flight.

SETUP MENU
(Menu-LED is steady ON)

		off	purple fl.	purple	red fl.	red	blue fl.	blue	red/blue
A	**Mounting orientation**	horizontal socket in front	vertical socket in front	hor. inv. socket in front	vert. inv. socket in front	horizontal socket at back	vertical socket at back	hor. inv. socket at back	vert. inv. socket at back
B	Swashplate - **servo frequency**	user defined		50 Hz*	65 Hz	120 Hz	165 Hz	200 Hz	
C	Rudder - **center position pulse length**	user defined		960 µs		760 µs		1520 µs*	
D	Rudder - **servo frequency**	user defined		50 Hz*	165 Hz	270 Hz	333 Hz	(560 Hz)	
E	Rudder - **servo endpoints**	Use rudder stick to move servo to right endpoint and wait, then left endpoint and wait (or vice versa).							
F	Rudder - **sensor direction**					normal*	reversed		
G	Swashplate - **servo centering**	reference position		CH1 center pos.		CH2 center pos.		CH3 center pos.	
H	Swashplate - **mixer**	user defined		mechanical	90°	120°*	140°	140° (1=1)	
I	Swashplate - **servo directions**	nor | inv | inv		nor | nor | inv*		nor | inv | inv		nor | nor | inv	
J	Swashplate - **cyclic pitch geometry**	Use aileron stick to adjust 6° cyclic pitch on the roll axis to one direction (blades aligned with fuselage).							
K	**Collective pitch range and endpoints**	Set collective stick to max/min position and use aileron stick to adjust desired pitch. Set pitch direction by rudder stick input: Status-LED blue = positive pitch, red = negative pitch							
L	Swashplate - **cyclic limit**	Move aileron, elevator and thrust stick. Adjust maximum limit by rudder stick input.							
M	Swashplate - **sensor directions**	inv | inv		inv | nor		nor | inv		nor | nor*	
N	**RPM Governor** - Operation mode	deactivated*				electric		nitro	

PARAMETER MENU
(Menu-LED is flashing quickly)

		off	purple fl.	purple	red fl.	red	blue fl.	blue
A	**Cyclic** and **rudder trim/ AttitudeControl trim**	Use aileron and elevator stick to trim, hold button 2s to trim rudder. Reset all by rudder stick input. Switch trim mode by activating AttitudeControl using the AttitudeControl switch channel.						
B	**Steuerverhalten**	user defined		normal	sport*	pro	extreme	transmitter
C	Taumelscheibe - **Aufbäumkompensation**	user defined		very low	low	medium*	high	very high
D	Heck - **HeadingLock-Anteil**	user defined		very low	low	medium*	high	very high
E	Knüppel - **Totzone**	user defined		very small	small*	medium	large	very large
F	Heck - **Drehmomentvorsteuerung**	user defined		off*	low - nor	high - nor	low - rev	high - rev
G	**Zyklisches Ansprechverhalten**	user defined		normal*	slightly increased	increased	high	very high
H	**Pitch - Verstärkung** (Pitch boost)	user defined		off*	low	medium	high	very high
I	**RPM Governor** - Throttle response	user defined		normal	slightly increased	increased	fast	aggressive
J	**RPM Governor** - Initial spool up rate	user defined		50 rpm/s	100 rpm/s	200 rpm/s	300 rpm/s	400 rpm/s
K	**RPM Governor** - Quick change rate	user defined		as initial rate	300 rpm/s	500 rpm/s	700 rpm/s	900 rpm/s
L	**AttitudeControl** - Operation mode	deactivated*	Bail out rescue	Bail out rescue with pitch	3D - Mode	3D - Mode with pitch		Flight trainer mode
M	(**AttitudeControl** - Hovering pitch**)**	Adjust by aileron stick input. Reset by rudder stick input.						

*Factory setting

GOVERNOR MENU
(Menu LED flashing slowly)

		off	purple fl.	purple	red fl.	red	blue fl.	blue	red/blue
A	**RPM sensor** - Function test	"nitro" mode: Status-LED blue when magnet passes sensor "electric" mode: Status-LED red when motor is running							
B	**Throttle** - Motor off/Idle position	"nitro" mode: throttle servo to (increased) idle position "electric" mode: throttle in "motor off" position, just before motor starts							
C	**Throttle** - Full throttle position	Set throttle channel/throttle servo to full throttle position							
D	**Transmitter** - Switch point display	RPM Governor off		RPM Governor maximum		RPM Governor on		RPM Governor autorotation	
E	**RPM sensor** - Divider	1	2	3*	4	5	6	7	
F	**Main rotor** - Gear ratio	user defined	8	9*	10	11	12	13	14
G	(Sum of **F** + **G** + **H** if not „**user defined**")	+0.00	+0.20	+0.40*	+0.60	+0.80			
H		+0.00	+0.05	+0.10*	+0.15				

RECEIVER SETUP MENU
(Menu-LED is flashing quickly)

		off	purple	red fl.	red	blue fl.
A	**Receiver type**	Standard*	Spektrum® satellite	Futaba® S-BUS	SRXL	PPM serial signal
B	**Collective pitch**					
C	**Aileron**					
D	**Elevator**	Status-LED light up in blue color if valid incoming signal from receiver. Move the stick/channel on the transmitter you want to assign. The Status-LED will flash briefly in case the movement has been detected. Menu points **H**, **I** and **J** can be skipped in case you don't want to use the specific function or you want to use nitro RPM Governor and/or AttitudeControl without separate channel. To load the default channel assigntment keep the button pressed at any menu point. You will directly jump to menu point **N**.				
E	**Rudder**					
F	**Tail gyro gain**					
G	**Throttle [CH5]**					
H	**Auxiliary [CH6]** (optional)					
I	**RPM Governor** (optional)					
J	**AttitudeControl** (optional)					
N	**Failsafe position** - Throttle [CH5]	Move throttle to failsafe position and push button to save all menu items and exit menu.				

* Factory setting

ADJUSTMENT OPTIONS OVERVIEW

Menü LEDs: Amount of tail gain Ⓐ = 0% to Ⓝ = 100%
AttitudeControl gain Ⓐ = „off" to Ⓝ = 100%
(only shown after powering up or when adjusting the gain)

Button:
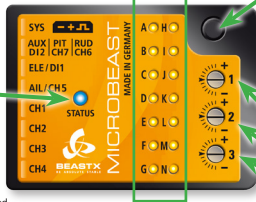
- to enter Setup menu push down several seconds until LED Ⓐ is steady on

- to enter Parameter menu push shortly until LED Ⓐ is flashing

Status-LED
Tail gyro mode
blue = HeadingLock mode
purple = Normal-Rate mode*

red = AttitudeControl

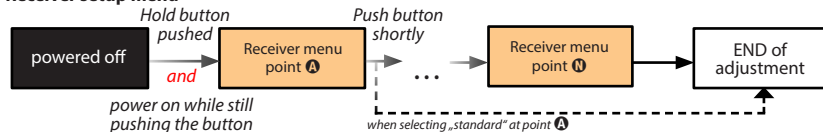* Only available if AttitudeControl is disabled

Dial 1: Cyclic gain
Dial 2: Cyclic feed forward
Dial 3: Tail gyro response

Parameter menu

operational → *Push button shortly* → Parameter menu point Ⓐ → *Push button shortly* → ... → Parameter menu point Ⓜ → operational

Setup menu

operational → *Hold button a long time* → Setup menu point Ⓐ → *Push button shortly* → ... → Setup menu point Ⓝ → operational

if „electric" or „nitro" is selected at menu point Ⓝ

Governor Menü

Governor menu point Ⓐ → ... → Governor menu point Ⓕ/Ⓗ

Receiver setup menu

powered off → *Hold button pushed* **and** *power on while still pushing the button* → Receiver menu point Ⓐ → *Push button shortly* → ... → Receiver menu point Ⓝ → END of adjustment

when selecting „standard" at point Ⓐ

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