

ACE RC®

GT5.2

3-axis Flybarless System

No.8089

Introduction / Safety notes

GT5 is a high performance 3-axis gyro system designed for flying flybarless model helicopters. It is not a self-leveling training system for beginners and cannot be used in combination with flybarred helicopters. If you are not experienced in flying model helicopters please contact your dealer or a local club for further assistance.

GT5 can be used with a broad variety of different receiver systems: Besides using it in combination with a conventional standard receiver system you can use GT5 in combination with different single line receiver systems and also directly connect Spektrum remote satellites to the unit. Please note that neither Spektrum nor we can guarantee for full range transmission and full functionality when using the system solely in combination with remote satellite receivers! This kind of application is not intended by Spektrum RC. Also because of the variety of electronic manufacturers and electronic systems on the market we can give no guarantee for failures and consequential damage, if a malfunction is not directly attributable to GT5.

GT5 has not been tested in combination with turbine powered helicopters. For this reason we can give no clearance for using the GT5 in such models. If you want to use it with turbines anyway, the usage will be on your own risk.

We remind you, that GT5 is made for use in RC helicopters and for this reason it's not a toy. Flying a helicopter has to be realized always on special, approved places with the usual security precautions in order not to harm yourself or property of other persons. Any liability due to the mentioned notes in the upper part is disclaimed by the manufacturer, THUNDER TIGER EUROPE and the seller.

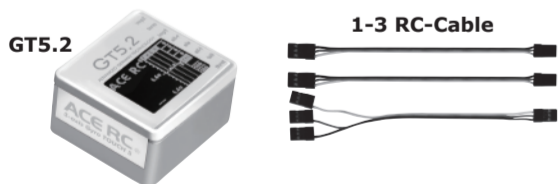
Features

- Very precise electric 3axis stabilization system
- OLED Display with Icon based User Interface
- Wear resistant „Touch-Pad“ for easy handling without the need for additional hardware
- Supports standard PPM receivers, Spektrum DSM2/DSMX & JR remote satellite receivers and singlewire connection of Futaba S-Bus, Graupner SUMD, BEASTX SRXL and PPM singlewire connection
- Suitable for Futaba and JR Servo- & RC-plug systems
- Compact size and lightweight
- High-quality Aluminum Case for optimal heat dissipation

Specifications

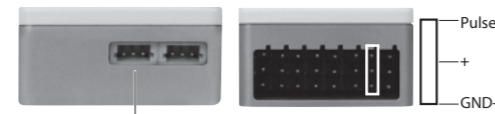
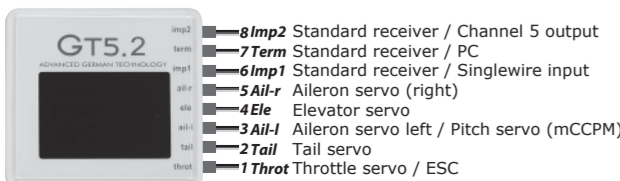
Display	96 x 64 pixels OLED
Input	Touch Pad
CPU	32-Bit High Speed Processor
Sensor-Speed	MEMS gyros with ± 1000°/sec for X-Y-Z axis
Tail servo pulse width	1500us/970us/760us
Tail control frequency	65Hz – 333Hz (571Hz with 760us)
Swash plate frequency	50Hz – 250Hz
Swash plate types	mCCPM and 90°, 120°, 135° (140°) eCCPM
Dimensions	29,5 x 32 x 16mm
Weight	15g without wiring
Operate Voltage	4.8V~8.4V

GT5.2 package contents



Note:
The supplied foam pads are very hard but normally suited for all kinds of helicopters. For some nitro powered helicopters or in general helicopters with a high vibration level the use of softer pads is recommended. But be aware that soft pads may cause the unit to sway and thus cause malfunction of the GT-5 unit.

Connectors



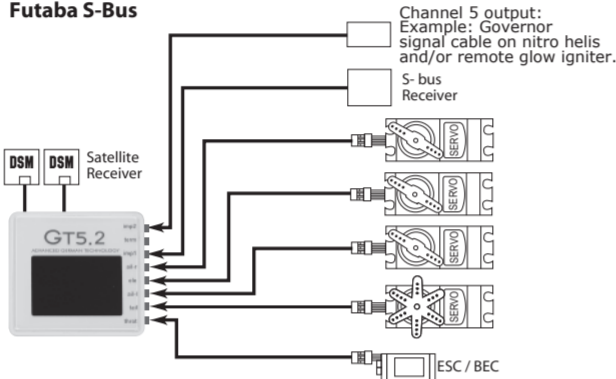
Connectors for 2,4GHz Spektrum remote satellite receiver. One or two receivers can be used. Always use receivers of same type (DSM2 or DSMX)!
Note:
The connector No.7 (term) has pulse input/output on all 3 pins. Use the 1-3 cable to connect a standard receiver. Never connect a power source to connector No. 7!

Connection to receiver/satellites

Spektrum remote satellite receivers can be directly connected to the GT5. The GT5 is working as the main unit to which you just have to connect the servos. Also you can use GT5 with singlewire systems like Futaba S-Bus, Graupner SUMD, BEASTX SRXL or PPM singlewire. In this case you just have to connect the wire from the receiver to connection **imp1** or **imp2** (in case PPM singlewire is used). Because these technologies constantly evolve we cannot guarantee full compatibility. For this reason the operation is at your own risk.

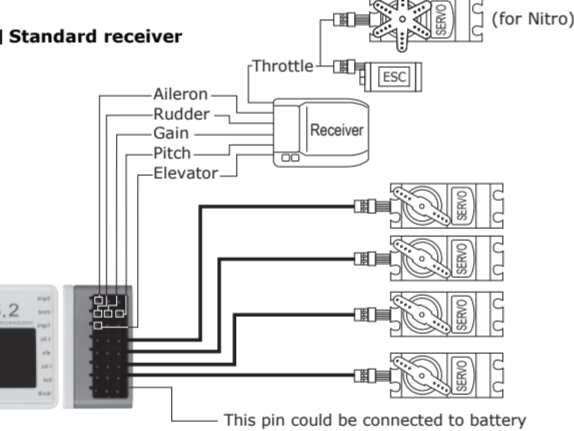
To prevent damage of the servos it is recommended to not connect the servos and servo linkages unless you did perform initial setup. When using the BEC of an electronic speed controller to power the system make sure the motor can not start by accident. To prevent the controller from getting configured incorrectly due to wrong signal output it also is recommended to not connect the speed controller and use a separate receiver battery instead unless you did complete receiver setup and gain full control over GT5's throttle output!

■ Spektrum/JR Satellite Receiver or Futaba S-Bus



To avoid causing damage to the servos, do not connect the servos until after the servo set-up procedure has been carried out step 5 & 6. To begin with, simply connect the GT5 directly to a 4.8Volt Rx battery, or regulated 6Volt power supply, into the Ch1 (Throt) port. On electric machines, make sure the ESC/BEC is set-up correctly before connection to the GT5.

■ Standard receiver



■ Connecting battery / BEC

If you use the GT5 with an electric helicopter and you have a speed controller with integrated BEC it's not obligatory that you use an external receiver battery.

Please pay special attention to the capability of your power supply as with flybarless helicopters the peak power consumption of the servos can be very high. With some BECs the voltage during hard flight may drop dramatically and cause total system failure resulting in crashing the helicopter. If the BEC allows to, using a buffering battery with equal voltage level is mandatory. Consult the manual of the ESC and ask the manufacturer for further assistance and capability of the BEC. If in doubt using a separate power supply is recommended.

Transmitter setup

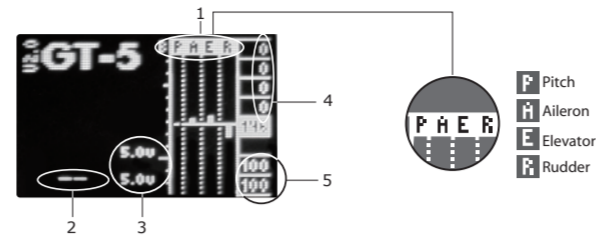
The swash plate mixing is done by the GT5. In the transmitter you must choose as swash plate type „mechanical Mixing“ (mCCPM) or „1 servo for each function“. You MUST NOT choose a swash plate type like 120° or 140°. Make sure all servo throws (ATV) are set to -100 and +100 (standard configuration for all transmitters) and all servo centers and trims are set to 0 (in all flight modes!). For initial setup the pitch curve also has to be set from -100 to +100 (after the configuration of GT5 you can set different pitch curves in your transmitter).

When using GT5 in combination with a standard receiver you need, besides the 4 channels for the control functions and the channel for the throttle, a sixth channel that controls the tail gyro gain. For this you may use your transmitter's gyro menu or simply a dial or knob.

When using GT5 in combination with Spektrum remote satellites or a singlewire receiver it is possible to adjust tail gyro gain and also swash gyro gain. These can be controlled by two separate channels, one common channel or you also may do without gain adjustment at all. Whatever you decide to, make sure the transmitter is prepared for it.

As throttle signal is only passed through the unit in singlewire application respectively is directly connected to the receiver, throttle is the only parameter, that has not to be treated specially. So adjust your throttle curves however you like. Please note that for performing function assignment when using a singlewire receiver it may be necessary to deactivate the throttle channel, e.g. by using the autorotation switch.

Display



- 1) The three bold bars show sensor movement – Aileron, Elevator and Rudder.
- 2) GT5 will scan receiver type when initial. It will show receiver type, if it shows " -- " means there is no receiver or wrong receiver type.
- 3) Voltage display Upper value: Voltage actually Lower value: Lowest voltage(break-in)during flight
- 4) The numbers show channel information for each function. When sticks in the transmitter are centered, the channels should be 0
- 5) The two numbers show swash gyro gain and tail gyro gain in percent. These values never can get below 50 and above 150.

Installation

GT5 can either be mounted flat on the top or bottom of the heli (eg. on the gyro platform) or vertical (preferably on the side of the frame of the helicopter).

It is only necessary that the pin connector and the cables must be aligned with or against the flight direction. The plugs of the cables must not show laterally out from the GT5. In addition, the edges of the housing of GT5 must always be aligned parallel to the three axes of the helicopter.

Initial Set-up

For the moment it is recommended to disconnect all servos. Only receiver and power source should be connected. When using the BEC of your electric speed controller to power the unit, it is recommended to disconnect the motor from the controller to prevent the motor from starting by accident.

1 Starting GT5

After powering up you will at first see the receiver scan. If GT5 does not detect any receiver or shows "not equal", this is not of importance for the moment. It may be necessary to program the correct receiver type first. Then you will see gyro initialization, during this time "Do not" move the unit as GT5 tries to calibrate zero positions of the gyro sensors (It is not important that the heli is standing level to the ground, only it mustn't be moved). Finally you will see the main screen of GT5 as already shown above. To interact with the unit touch with your finger to the touchpad on left side of the housing. A small cursor will appear on the left side of the display in the area of your finger.

2 Entering programming menu

If you move the cursor upwards to the ACE-RC Logo and hold it there for 3 seconds, you will enter the programming menu of GT5. To select a menu entry or confirm a value tap the touchpad with your finger twice. To move up/down in the menu or to increase/decrease values slide with the finger upwards or downwards on the touchpad. Programming menu is divided into two main sections: "control" and "setup" section. These two sections are indicated by the black and white bar on the very left side. When entering programming menu you will be located in control section at PID control menu which will be used very often in later usage. For initial setup the more interesting part is setup section which will be traversed from bottom to upper end. So move to the menu above which is symbolized by a wrench and enter this by tapping the touchpad twice.

3 General settings

The menu symbolized by the wrench is "General settings" menu. This menu is divided into "Device settings", "Servo settings" and "Sensor settings". When entering "General settings" menu again double tab the touchpad to directly proceed with "Device settings", which is the first menu entry in the list.

The first item at device settings menu is "Orientation of the unit". As mentioned above you can install the unit flat or vertical. Now you have to select how the unit is mounted. Again double tab the touchpad to select the item "Orientation". In the center of the screen a pictogram will be shown indicating the momentary selected orientation of the unit. By sliding the finger up or down you can switch between both options, the pictogram will show a horizontal or vertical standing unit. When you have chosen the correct type, again double tab the touchpad and the selection will be saved and you will get back to the menu item selection. For now the other available items are of no interest, so we will skip them and directly scroll down until we reach the "Exit" item. Select this item by double tabbing and you will jump back one menu level to selection of "General settings" items. Here again we are not interested in adjusting other items, so again scroll down to "Exit" and leave "General settings" menu by double tapping the "Exit" item.

Next menu item we have to adjust is in the "Receiver" menu. So now scroll up to the next item which shows the outline of a receiver an enter it by double tapping the touchpad.

4 Receiver menu

- a) Receiver type**
Directly select the first menu item which is receiver type selection. It will automatically scan for connected receivers and preselect the detected receiver type. It should only be necessary to confirm the type by double tapping the touchpad.
Receiver types in detail are:
(1) Standard receiver – this is any receiver which 5 channels are connected by multiple wires to imp1, term and imp2 connectors.
(2)and(3) Spektrum DSM remote satellite receivers connected to the white plugs in the side of GT5. Be very careful on correct selection of the type used. If DSMX satellites are used, select DSMX satellite. If DSM2 satellites are used, select DSM2 satellite. It does not depend on the mode in which the satellites are bound! So if you run a DSMX satellite in DSM2 mode, nevertheless select DSMX satellite. Also you must not mix different types of satellites. If you do not follow these instructions, a link failure during subsequent operation is very likely!
- b) Spektrum binding**
When using Spektrum remote satellite receivers you now will have to bind the receivers first. Scroll down until you read the menu item "Bind" and select it. The LEDs of the satellites will then start to flash quickly and you can initiate the binding process of the transmitter. After successful binding, the LEDs of the satellites must remain illuminated when the transmitter is turned on. If this is not the case, it is necessary to repeat the process.
- c) Function assignment**
In the receiver submenu you have two options to choose from. You can start with the default function assignment ("Def."), then no further steps are required to put the system into operation. When scrolling down one item and selecting "Ch Sel" you will have to assign each transmitter channel individually to one function.
- Default assignment

Spektrum	Futaba SBus	HOTT	SRXL	SPPM
Throttle	Aileron			
Aileron	Elevator			
Elevator	Throttle			
Rudder	Rudder			
Swash gain	Swash gain			
Collective pitch	Collective pitch			
Tail gyro gain	Tail gyro gain			

- Channel Selection

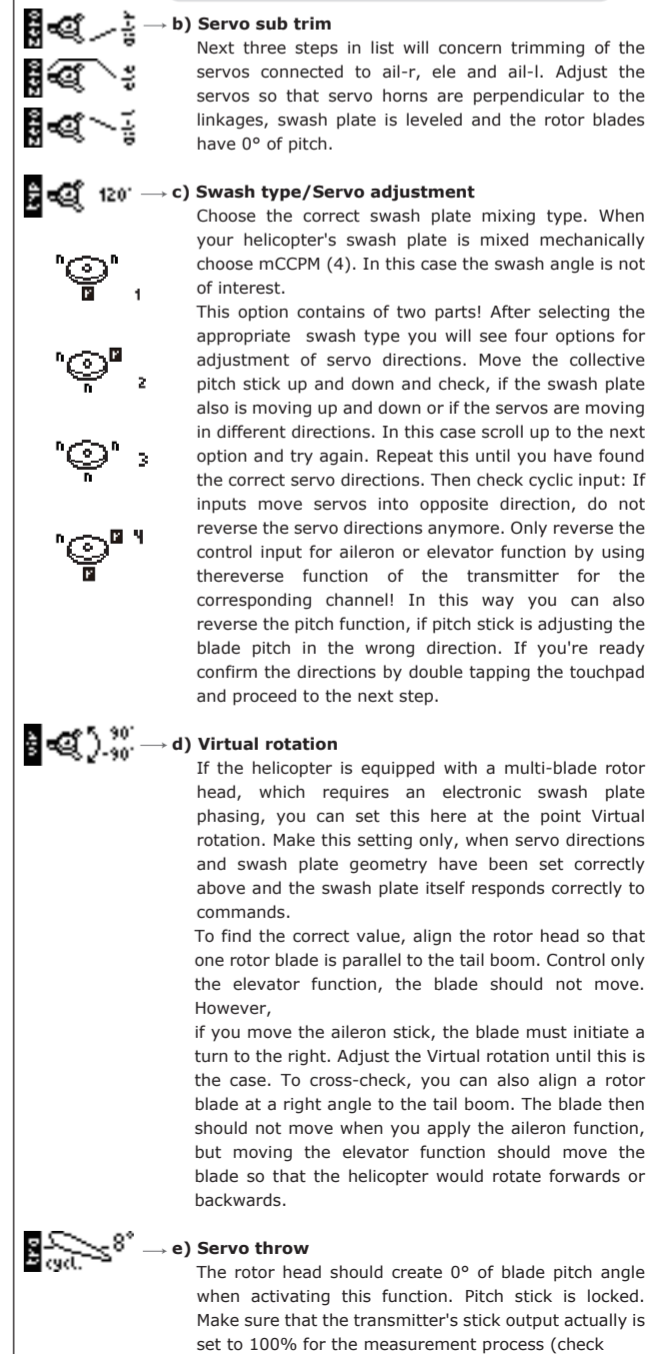
When choosing "Ch Sel" you can assign functions step by step by simply moving the desired stick/adjusting the channel on the transmitter. For correct assignment you have to make sure that each stick/function is controlling exactly one channel, otherwise the detection can't work correctly. So for the throttle stick you have to lock the throttle output by using autorotation switch or similar, as at first you will have to assign collective pitch function:
After selection of "Ch Sel" you see a line in the middle of the display and you can read "Pitch" on the bottom. Now move the throttle stick to full deflection and then back to initial position. You should see a small line moving away from center line showing the stick position and then the line moving back. When reaching the center line again, pitch function should get assigned and aileron is next. So now move aileron stick to full deflection and back again to assign aileron. Then follow elevator and rudder. When you proceed to assignment of throttle function you now may unlock your autorotation switch to gain back control over throttle channel. Now you can move throttle stick again to assign the throttle channel. It is of no harm if now also pitch channel does get moved as this was already assigned before!
Lastly you have to assign the two gain channels, swash gain ("G SW") and tail gyro gain ("G TL"). Here you have several options:
- you can assign both channels as before by using individual channels of the transmitter, e.g. using different switches or gyro menus to adjust these channels.
- you can assign both functions to one channel so you only have one gain for everything
- you can skip one or both gain function assignments. To do so you simply have to double tap the touchpad of the GT5. Then the specific gain function will be fixed to 100% and can't be adjusted by transmitter.
- If you skip the assignment of swash gain additionally you will be prompted to adjust the "AUX" channel which is an additional servo output you can connect at imp2 connector. If you also don't want to use/assign this function anyway, again double tab the touchpad to skip this assignment.

d) Failsafe

After the setup of receiver type and control functions is complete, choose "Failsafe" in "Receiver" menu and increase the number to 5.
Failsafe is later used when no signal from the receiver is received. For security reason it is important that this item is properly set, especially to prevent the electric motor from starting unwanted or to prevent blocking of the throttle servo. When using Spektrum remote satellite receivers that are directly connected to the GT5, failsafe additionally will determine the positions that are taken in the event of the radio link failure (this implies that time is set larger than 0. If time is set to 0, the last valid stick positions will be held in case of signal loss).
Move the sticks on the transmitter to the desired failsafe positions (especially throttle to 0) and double tap the touchpad. You will read „No exit“. Scroll up so you read „Yes“ and confirm the positions by double tapping the touchpad. Now failsafe is set properly and you can „Exit“ the „Receiver“ menu and proceed to the next step in „Setup“ section which „Swash plate“ menu.

5 Swash plate setup

- a) Update frequency**
Select Update frequency (in Hz) for the swash plate servos according to the specifications of the servo manufacturer. If analog servos are used, never set the frequency higher than 65Hz (some very old servos even only work with 50Hz correctly!). With analog servos a higher setting leads directly to the destruction of the electronics. Modern digital servos in most cases can easily be used with frequencies of about 120 Hz. High-quality digital servo with brushless or brushed motor can usually be used with much higher frequencies. Note that setting a too high frequency can cause strong heating of servo motor and/or servo electronics and result in the destruction of the servos. Furthermore, the information provided by the servo manufacturer are usually maximum values. Depending on the ambient conditions such as temperature, vibration level or supply voltage, it may happen that in practice the servos can be operated only with a much lower frequency. When in doubt, always set a lower Servo update frequency. Although a low Servo update frequency reduces the performance of the control system, because this will then work slower, the servos are also less stressed. We expressly point out that setting a frequency higher than 50Hz is at your own risk.
- b) Servo sub trim**
Next three steps in list will concern trimming of the servos connected to ail-r, ele and ail-l. Adjust the servos so that servo horns are perpendicular to the linkages, swash plate is leveled and the rotor blades have 0° of pitch.
- c) Swash type/Servo adjustment**
Choose the correct swash plate mixing type. When your helicopter's swash plate is mixed mechanically choose mCCPM (4). In this case the swash angle is not of interest.
This option contains of two parts! After selecting the appropriate swash type you will see four options for adjustment of servo directions. Move the collective pitch stick up and down and check, if the swash plate also is moving up and down or if the servos are moving in different directions. In this case scroll up to the next option and try again. Repeat this until you have found the correct servo directions. Then check cyclic input: If inputs move servos into opposite direction, do not reverse the servo directions anymore. Only reverse the control input for aileron or elevator function by using thereverse function of the transmitter for the corresponding channel! In this way you can also reverse the pitch function, if pitch stick is adjusting the blade pitch in the wrong direction. If you're ready confirm the directions by double tapping the touchpad and proceed to the next step.
- d) Virtual rotation**
If the helicopter is equipped with a multi-blade rotor head, which requires an electronic swash plate phasing, you can set this here at the point Virtual rotation. Make this setting only, when servo directions and swash plate geometry have been set correctly above and the swash plate itself responds correctly to commands.
To find the correct value, align the rotor head so that one rotor blade is parallel to the tail boom. Control only the elevator function, the blade should not move. However, if you move the aileron stick, the blade must initiate a turn to the right. Adjust the Virtual rotation until this is the case. To cross-check, you can also align a rotor blade at a right angle to the tail boom. The blade then should not move when you apply the aileron function, but moving the elevator function should move the blade so that the helicopter would rotate forwards or backwards.
- e) Servo throw**
The rotor head should create 0° of blade pitch angle when activating this function. Pitch stick is locked. Make sure that the transmitter's stick output actually is set to 100% for the measurement process (check



Dual-rate and servo throw in transmitter; also the stick output is indicated in the display of GT5 when it is in flight mode).

Measure the cyclic pitch range, either on aileron or elevator: you should see 8° of cyclic pitch angle when giving 100% stick input. Adjust the value until the required angle on the rotor blade is applied.

To measure the deflection of the aileron function, align the rotor blades in a line to the tail boom. To measure on the elevator function, align the blades/rotor head at right angles to the tail boom. Keep in mind that most helicopters are slightly tilted forward, so the rotor blades are not necessarily aligned to the ground at 0° pitch!).

It is sufficient to measure the blade angle on one axis, aileron or elevator. Usually there might be slight variations in pitch angle between the two functions, or even within a function, e.g. a few 10ths of a degree more aileron pitch to the left than to the right. This is often caused by the nonlinear rotor control and servo movement and should be no cause for alarm! It is sufficient that at least the applied cyclic pitch has an angle of 8° on average.



f) Pitch range (A & B)

Here you can set the maximum collective pitch angle for both directions. The adjustment should always be performed with linear and unchanged pitch curve in the transmitter (i.e. pitch curve from -100 to +100). In addition, the pitch angle must be set only after the Servo travel adjustment has been done correctly. Otherwise, a subsequent change of the Servo travel would affect the pitch angle.

After completing the whole setup, you can adjust the pitch curves in the transmitter as you like, e.g. by changing pitch curve in different flight phases. The values set here will only set the maximum pitch range.



g) Cyclic limit (maximum servo throw)

Push the throttle stick to full positive and negative and simultaneously move aileron and elevator stick in all four directions (be careful, servos may jam!). Reduce or enlarge the Cyclic limit so that the servos just do not jam in any of the possible maximum positions. This prevents the servos from blocking in flight and on the other hand, the maximum possible control for the system is guaranteed. If there is some more leeway in one place than elsewhere this is not a problem. The cyclic boundary affects all positions and the adjustment should be based on the place where the servos could jam the earliest. Do not reduce the cyclic boundary unnecessary. Always try to achieve the maximum possible throw. The Cyclic limit has no effect on the rate of rotation in flight. If you want to make a change here, e.g. so that the helicopter does not react so strongly to stick movements, use the settings at "Stick" menu in "control" section.



h) Sensor directions

Last two points in swash plate menu are about adjustment of sensor directions:

Elevator sensor - Tilt the helicopter on the elevator axis and observe the compensatory movement of the swash plate - it has to act against the movement of the helicopter. So if the nose of the helicopter is rotated towards the ground, the swashplate should tilt backwards, just as you would enter a command to pull elevator back. Same as when the heli is tilted back, the swashplate must steer forwards.

Aileron sensor - Tilt the helicopter around the longitudinal axis to one side and watch the compensatory movement of the swash plate - it has to act against the rolling movement. Thus, when the helicopter is tilted to the right, the swash plate needs to perform a control command to the left. Similar when the heli is tilted to the left, the swashplate must steer to the right.

Be very careful when doing these adjustments! A wrong setting will inevitably lead to the helicopter being destroyed at liftoff!

After swash plate setup now we also have to adjust the parameters for tail rotor. So for the last step in initial setup select the tail rotor pictogram in „setup“ section.

6 Tail rotor setup



a) Center pulse

First menu item in „tail rotor“ menu is the center pulse for the tail rotor servo. Almost all servos use a center pulse of 1500µs. Only some special tail servos from Futaba, MKS and other use a shortened center pulse of 760µs. These servos are specially designed for use with gyro systems. You can not plug them directly to a remote receiver. A similar type also exists from Logitech which uses 960µs center pulse.

When a special center pulse is required, this is usually printed on the servo case or mentioned in the manual of the servo. Otherwise it is assumed that a servo has to be operated with 1500µs (some servos also are specified with 1520µs - this is not a problem here: use 1500µs). If you set the wrong pulse width, most servos won't react and appear as if they were not plugged in. For safety reasons it is recommended not to plug in the servo until the center pulse has been changed or at least remove the servo horn to prevent from damage.



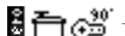
b) Update frequency

Select Update frequency (in Hz) for the rudder servo according to the specifications of the servo manufacturer. If an analog servo is used, never set the frequency higher than 65Hz. With analog servos a higher setting leads directly to the destruction of the electronics. Modern digital servos in most cases can

easily be used with frequencies of about 120 Hz. High-quality digital servo with brushless or brushed motor can usually be used with much higher frequencies. Note that setting a too high frequency can cause strong heating of servo motor and/or servo electronics and result in the destruction of the servo. Furthermore, the information provided by the servo manufacturer are usually maximum values. Depending on the ambient conditions such as temperature, vibration level or supply voltage, it may happen that in practice the servos can be operated only with a much lower frequency. When in doubt, always set a lower Servo update frequency. Although a low Servo update frequency reduces the performance of the control system, because this will then work slower, the servo will also be less stressed. We expressly point out that setting a frequency higher than 65Hz is at your own risk.

Note:

GT5 can not provide all the frequencies within the specified range. It will then automatically jump to the next possible value up or down. When a servo with 760µs center pulse is used, an Update frequency of up to 571Hz can be set. For other types, the maximum frequency is 333Hz.



c) Sub trim

Adjust the tail linkage according to the manufacturer of the helicopter. The rod should form a right angle with the servo horn when the servo is at center position and the tail rotor angle should be set so that the tail rotor will produce thrust slightly against torque. When sub trim adjustment was entered, the servo will not respond to stick movements or commands of the gyro system and will stay at the trimmed center position. Use sub trim to fine adjust center position.



d) Servo limit A & B

Next two steps concern servo limit adjustment. Move the rudder stick to the right or to the left and adjust the maximum possible deflection of the rudder servo with limit A or limit B. On most helicopters, the sensible maximum deflection is determined by the tail pitch slider. But note that there are helicopters, which enable a very large angle of the tail rotor. Here the limit should not be set as large as possible, but only as large as necessary. Too extreme pitch angles may otherwise cause the tail rotor blades to stall at certain maneuvers causing a loss of performance and loss of tail control.



e) Sensor direction

Turn the helicopter on the vertical axis. If the nose of the helicopter is rotated to the right, the tail rotor has to compensate so that the nose of the helicopter is moved to the left, and vice versa.

You can check the correct direction very easy if you only watch the tail rotor blades: During a movement of the tail the rotor blades must be controlled so that the trailing edge of the blades point in the direction in which the tail is moved, the tail rotor then is producing a thrust in the opposite direction and attempts to counteract the movement of the tail.

Be very diligent with this setting. A wrong sensor direction will cause the helicopter to rotate very fast, when you attempt to lift off the heli as the tail gyro will not compensate but amplify the deviation of the tail rotor.



f) Pirouette correction

Finally you have to check for correct direction of pirouette correction and adjust if necessary. When entering this step the swash plate will be tilted forwards or backwards automatically. Now the helicopter must be rotated on the vertical axis, while the swash plate has to be observed. If the compensation direction is correct, the swash plate will keep its position in space. When the swash plate rotates with the movement of the helicopter, however, the direction has to be reversed.

Pirouette correction is necessary so that the helicopter does not rear up when the tail is rotated in fast forward flight. As the swash plate is tilted forward in forward flight, without compensation it suddenly would show to the side when performing a pirouette. The system could not recognize the rotation fast enough.

This was the last step of initial setup. You can now exit the menu sections and go back to flight mode by clicking the exit symbol on the top or bottom of menu list. Alternatively you could simply wait until the Exit timer has counted down.

7 Preflight check

When being back in flight mode check if all functions do work as you would expect. Recheck the sensor directions by tilting the helicopter back and forth, left and right and rotating it on vertical axis and watch the reaction of swash plate and tail rotor. They always have to counteract against the rotation with a movement that should compensate the rotation. Note that in flight mode the reaction of the servos will be much less than in adjustment menus!

Check the display: Voltage should stay stable when moving all servos simultaneously and channel display on the very left should show 0 at least for aileron, elevator, rudder when these sticks are centered at the transmitter. The two values for swash and tail gain at the bottom right corner should be set to 100.

When the servos seem to get out of sync after doing some stick movement this is no issue as in flight mode the control system is working and does not know that the heli is standing on the ground. If you move collective stick to center and give a short aileron or elevator input

to full deflection all swash servos will get back to center positions. Also take care that the tail servo is centered when taking off as the gyro may have moved the servo to full deflection due to moving rudder stick on the ground or carrying around the helicopter.

Now you should be ready for take off. If you are a beginner pilot or if you never have flown a flybarless helicopter before please read on and note the hints regarding adjusting expo and rotation rate, as the flybarless helicopter may react very sensible to your control input, in a way you did not expect.

In general please note the hints about adjusting swash and tail gains and the control loop as it may be necessary to fine tune the behavior of the system slightly.

Additional parameters

In "control" section you have access to adjusting the control system of GT5 and you can adjust the control behavior of stick inputs. Additionally we will mention a few parameters in "General settings menu" of "setup" section, as these are of minor importance and have been left out when making the initial setup.

Control system menu is separated into adjustments for swash plate and tail gyro. Please note that all adjustments in swash menu will be scaled by the swash gain. All adjustment of the tail gyro system will be scaled by tail gyro gain. So 100% gain means the values are used 1:1 as you can read them. When setting the gain to 50% most of the values only will have half of the effect as you did adjust.

1 PID Control system

a) Swash plate adjustment



(1) Stability

Stability is used to directly correct a sudden deviation from the flight path with a counter reaction. On the swash plate, this value can be adjusted over a very wide range, changes will only have very little effect. When this value is set too high, typically a very fast oscillation of the rotor pane will occur. If Stability is too low, the helicopter will not track exactly, e.g. when giving fast collective pitch input the helicopter will not rise straight but will tend to one side on aileron or elevator axis. Also in fast forward flight, when the helicopter does not track exactly and reacts nervous and tends to break out to one side, you should increase Stability.

The default value of 80 should be sufficient for most applications. On 450 size helis (Mini Titan 325/360) or smaller, the value should be reduced due to the low inertia. Start with a value of 60 here.



(2) Consistency

This is the first setting that you should consider more in detail and that may need to be optimized by the pilot! Consistency serves for controlling the rotation rates and for keeping the helicopter on spot. If possible you should fly one or more stationary elevator flips and then stop in horizontal position. If the heli does not stop immediately but continues to rotate a few degrees, Consistency is too low. Increase this value just until the helicopter stops on the spot. Do not increase it anymore, as if it's set too high the helicopter will swing back slowly when stopping from a rotation. In addition the stick feeling will get unnatural and indirect, as the higher the value, the more the control system takes over control.

A further effect of Consistency is that the helicopter better remains in one position, the higher the value is. So the setting also affects the consistency of 0 rotation rate. If the helicopter in hover flight does move around very much when you release the sticks, then this also is a sign that the value is set too low.

For most helicopters values between 80 and 90 are usual.



(3) Response

This parameter is of minor importance!

Increasing Response will make the control system to react more aggressive. If the heli has the tendency to oscillate lightly when a stick input is applied, you can increase this value. It then may lock in more accurate and harder. But if the values are too high, this can cause the rotor blades reaching their aerodynamic limit. Often you literally can hear the blades stalling when quick changing cyclic stick inputs are applied. The control then will feel greatly delayed when making fast directional changes (e.g. when doing fast TicTocs). On the other hand, reducing the value against 0, will make the system react softer and smoother and as a result of this also stick inputs will feel softer and smoother.

The default value of 15 should not be changed under normal circumstances.



(4) Stick mix

This is the second important parameter which has fundamental influence on the behavior of the helicopter!

Stick mix determines how much part of the stick signals is directly passed to the servos. The higher the value, the more natural and direct the helicopter feels to cyclic control inputs. However, as Stick mix is not evaluated by the control system, increasing the value too much will cause the helicopter to wobble after stick inputs, as stick control will cause more servo movement than necessary which the control system then has to correct additionally. So Stick mix should be set just as high as the heli will not wobble when giving cyclic control inputs.

The setting of this parameter strongly depends on the rotor blades used. With special flybarless blades values between 70 and 80 should be possible. But also values from 30 to 40 may be normal under certain circumstances. If you only can reach very low values and the helicopter therefore feels very indirect, then it



is advisable to test a different brand of rotor blades.

(5) Speed stability

Fly fast forwards at high altitude and then suddenly apply negative pitch. Ideally the helicopter should maintain its alignment as it loses altitude. If the helicopter's nose moves down sharply (undercuts), increase Speed stability. Alternatively, you can also fly a big looping: when the heli tends to rear up even if you do not apply back elevator all the time, the value also is too low.

Values from 20 to 30 are considered to be in normal range. Set the value just as high so that the heli does not show the behavior as mentioned above. Values above 50 should be avoided as this can result in causing control artifacts, leading to some very unexpected movements (the system does compensate too long then). Also high Speed stability values can cause a slow wag on the elevator axis in straight forward flight.

Similar to Stick mix the type of rotor blades used has great influence on the effect of this parameter. In particular, the use of very maneuverable blades with center of gravity very close to the blade root, which have been designed for aggressive 3D flying with flybarred helicopters, can cause this parameter not being useful at all. Only the use of fast and powerful servos (or changing the rotor blades of course) can help here then!

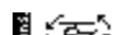


b) Tail gyro adjustment



(1) Stability

Stability primarily provides for holding the tail when changes in rotor torque occur. If the value is too low, the tail rotor responds very spongy to rudder inputs and will continuously tend to rotate in one or the other direction if pitch, aileron or elevator input are applied. Too high Stability, however, will cause the system to overcompensate. A fast tail oscillation will occur in fast forward flight or even while hovering. The approach to determine the optimal value is to gradually increase the parameter until the tail just starts to make noise or just starts to slightly overcompensate in very fast forwards or backwards flight. In this case now decrease the stability by 5 points and the tail rotor should hold fine then.



(2) Consistency

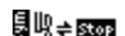
After adjusting Stability now do fast forward flying and make pirouettes by giving uniform rudder stick input. If the tail does not rotate uniformly but produce a weather vane effect (slowly struggling against the wind, but turning around fast when reaching the apex of the wind), increase Consistency. Note that the higher the value, the more synthetic the rudder control will feel because the gyro system then more takes over control. So only adjust this parameter just as high as necessary.

Even if very high values in the range of 100 do not give the desired result, it is recommended to try different tail rotor blades (different brand, different material, greater size). Possibly the tail then can not provide the necessary thrust to compensate the occurring loads. Another possibility for poor tail performance could also be that the allowed pitch angle of the tail rotor blades is too large, so that the tail rotor will stall at large control inputs. In this case test if reducing the tail servo limit may change the tail behavior.



(3) Smooth stop

Increase this parameter to cause the tail rotor stop softer and thereby more precisely after applying rudder input. Especially when the tail rotor tends to stop short but then overshoot slightly, this parameter should be increased. A typical value that fits for most helicopters is in the range around 5.



(4) Stop asymetry

When the tail rotor does stop softer/harder in one direction than in the other you can use Stop asymetry to move the effect of Smooth stop into one direction.



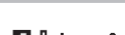
(5) Torque compensation

To support the tail gyro system when fast changes in rotor torque occur some amount of cyclic or collective stick input can be mixed directly to the tail servo output. So the tail servo will already start to move in the moment when the torque is about to change, not just after.

If for example a large pitch input causes the tail to shortly turn away with the direction of rotor torque then adding some amount of Torque compensation in the counter direction can be useful. On 700 size helis like Raptor e720 a value of 40 for pitch should be a good starting point. Cyclic compensation usually is not necessary.

Note that this parameter can be adjusted to both directions. The sign has to be chosen so that the tail rotor is controlled against the main rotor's torque direction when cyclic or collective pitch stick input is applied. At 0° pitch there is no mixing to the tail rotor servo and the mixing will increase (always to the same direction!) the further the sticks are moved away from the center position. For helicopters with main rotor rotating in clockwise direction the tail rotor should always cause a movement of the helicopter to the right!

2 Stick input



a) Trim save/Trim clear

Under normal circumstances it is not allowed to use sub trim function of your transmitter. Sub trim would cause a constant rotation command to the control system. Anyhow it may happen, that the heli drifts slightly while hovering due to bad balancing of the center of gravity or due to bad servo trimming or bad linkage adjustment.

In this case you are allowed to temporarily use the stick trim of your transmitter to compensate the drifting. As this trimming will only last until the next power up, now land the helicopter and enter "Stick" menu in "control" section. Double tab the menu item "Trim save". You will be asked to confirm the save. Click "YES" and the current trimming of your transmitter will cause a re-trim of the servo mid points. Now you can move the trims in the transmitter back to zero. The trimming will stay saved in GT5.

If you want to clear the trimming, select menu item "Trim clear" and confirm the deletion.



b) Elevator/Aileron/Rudder rate

The functions Elevator rate / Aileron rate determine the maximum achievable rate of rotation that can be adjusted by a given stick deflection. This function acts as a linear magnification/reduction of the control stick throw. Alternatively (or additionally) you can adjust the stick throw for the corresponding function in the transmitter, e.g. by using Dual-rate function.

Please note that changing the rate of rotation/stick throw will not have any visible effect on the deflection of the servos when the GT5 is in flight mode. Also remember that when making adjustments in GT5 regarding the swash plate or tail servos the stick throw in the transmitter must always be at 100% (the setting of the rotation rate in GT5, however, will not have any effect).

By using Expo the response of the system to motion of the stick in the center position can be alleviated. So small control movements can be performed more sensitive. On the other hand, if Expo is adjusted into the negative range, the response to small stick movements is amplified.

It is not recommended to additionally use the Expo function of the transmitter! The superposition of several Expo curves can lead to very unexpected control behavior. If you prefer to use the Expo function of the transmitter, set Expo in GT5 to 0.



c) Stick tolerance

Stick tolerance determines the range in which GT5 reacts to changes in stick position. A high Stick tolerance creates a greater stick deadband. This can be useful when the control stick of the transmitter does not work accurately and will not properly center to zero position. You can see this effect when the helicopter in flight sometimes drifts slowly to one side. In particularly severe cases it can be seen on the channel display of GT5 as some channels jitter, jumping back and forth between two values.

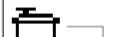
3 Additional parameters of "General settings" menu



a) Device menu

(1) Exit time is a countdown timer for the menu. When the countdown finishes, GT5 automatically jumps back into flight mode. This prevents that the helicopter is started while the menu is still active.

(2) By using **Reset** all parameters in GT5 are reset to default. Only the settings of the receiver system, the function assignment and the fail safe positions won't be reset for security reasons. To initiate reset double tap the "Reset" option. Then you will be prompted if you're really sure. Select „YES" and again confirm by double tapping. After a reset do not fly!



b) Servo settings

The parameter **Servo delay level** (dynamic) is a filter that will be mixed into the servo control. This filter causes the servos not to make large movements in one step. Especially in helicopters with high vibration level this can prevent from an excessive load on the servos through the ever changing movements. The servos remain much cooler and their power consumption is reduced. At level 0, however, all the control commands from the control is passed directly to the servos.

We recommend not to change the default setting of Servo delay level and primarily reduce the Update frequency, if the servos get remarkably warm. If you are sure that the servos can be operated with a certain frequency (e.g. in electric helicopters), then possibly by increasing the Servo delay level heating and the power consumption may be reduced. A reduction of the Servo delay level or disabling this parameter is not recommended in general.

You can adjust the levels for swash and tail servo separately.



c) Gyro settings

In sensor settings menu you will see several options. The first three options are used for calibration of sensor axis. **Do not** change these values, they are set by the factory! It is recommended to note these values in the manual for later reference if you change these values by accident.

It is factory set and not of further interest. It can't be changed anyway.

Other item of interest



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