

INNOVATION & TECHNOLOGY

**GRAUPNER**

# Manual

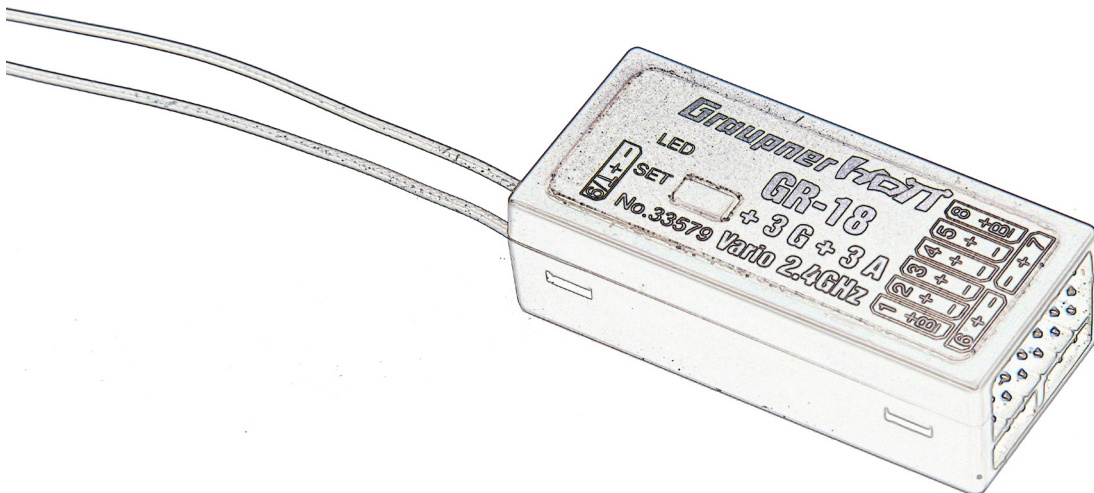
## HoTT Receiver GR-18

with firmware for Racecopter, Copter without GPS supported mode, 3D Copter

No. 33579 - GR-18 + 3G + 3A Vario

No. S1019 - GR-18L + 3G + 3A (without Vario)

EN



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## Introduction

Thank you very much for purchasing the **Graupner GR-18 receiver**. This receiver is extremely versatile.

This manual is valid for all receivers listed on the cover sheet.

Read this manual carefully to achieve the best results with your **Graupner GR-18 RECEIVER** and first of all to safely control your models. If you experience any trouble during operation, take the instructions to help or ask your dealer or **Graupner Service Centre**.

Due to technical changes, the information may be changed in this manual without prior notice. Be always updated by checking periodically on our website, **www.graupner.de** to be always up to date with the products and firmwares.

This product complies with national and European legal requirements.

**To maintain this condition and to ensure safe operation, you must read and follow this user manual and the safety notes before using the product!**



### NOTICE

This manual is part of that product. It contains important information concerning operation and handling. Keep these instructions for future reference and give it to third person in case you gave the product.

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## Service Centre

### Graupner Central Service

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**Graupner in Internet** For the service centers outside Germany please refer to our website **www.graupner.de**

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## Intended use

The receiver is only suitable to be installed on multicopter models. More punctual information about receiver can be found in the Technical data section.

The receiver is designed exclusively to be used in battery-powered, radio controlled models, any other use is not allowed. For any improper use no warranty or liability is accepted.

Read through this entire manual before you attempt to install or use the receiver.

**Graupner/SJ** constantly works on the development of all products; we reserve the right to change the item, its technology and equipment.

### Target group

The product is not a toy. It is not suitable for children under 14 years. The installation and operation of the receiver must be performed by experienced modellers. If you do not have sufficient knowledge about dealing with radio-controlled models, please contact an experienced modeller or a model club.

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## Package content

- ◆ 33579 Receiver GR-18 or S1019 Receiver GR-18L
- ◆ Manual

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## Declaration of conformity



**33579 Receiver GR-18**  
**S1019 Receiver GR-18L**

Graupner/SJ declares that the product is conform to EU norms.

EN 301 489-1 V1.9.2 EN 301 489-17 V2.2.1

EN 300 328 V1.8.1

EN 60950-1+A11+A1+A12+A2:2013

EN 62311:2008

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## Symbols explication



Always follow the information marked with the **CAUTION** or **WARNING** symbol. The signal word **WARNING** indicates the potential for serious injury, the signal word **CAUTION** indicates possibility of lighter injuries.



The signal words **note** and **caution** indicate potential damages to objects.

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## Safety notes



### General

These safety instructions are intended not only to protect the product, but also for your own and other people's safety. Therefore please read this section very carefully before using the product!

Do not carelessly leave the packaging material lying around, since it might become a dangerous toy for children.

- ◆ Persons, including children, with reduced physical, sensory or mental capabilities, or lack of experience or knowledge, or not capable to use safely the receiver must not use the receiver without supervision or instruction by a responsible person.
- ◆ Operation and use of radio-controlled models needs to be learnt! If you have never operated a model of this type before, start carefully and make yourself familiar with the model's reactions to the remote control commands. Proceed responsibly.
- ◆ First, always perform a range and function test on the ground (to do so, hold your model tight), before you use your model. Repeat the test with running motor and with short throttle bursts.
- ◆ Before you start using the remote control model, you have to check the further relevant laws and regulations. These laws you must obey in every case. Pay attention to the possibly different laws of the countries.
- ◆ The insurance is mandatory for all kinds of model operation. If you already have one, please inform yourself if the operation of the respective model is covered by your insurance. If this is not the case, conclude a special liability insurance policy for models. We recommend to provide the copter with a label, where are indicated the name, address, tel. n., E-mail and Insurance N. So that the copter can be clearly assigned in the event of a crash.

- ◆ Due to safety and licensing reasons (CE), any unauthorized reconstruction and/or modification of the product is prohibited.
- ◆ Only use the components and spare parts that we recommend. Always use matching, original Graupner plug-in connections of the same design and material.
- ◆ Make sure that all of the plug-in connections are tight. When disconnecting the plug-in connections, do not pull the cables.
- ◆ Protect the receiver from dust, dirt, moisture and other foreign parts. It must be protected from vibration as well as excessive heat or cold. The models may only be operated remotely in normal outside temperatures such as from -10°C to +55°C.
- ◆ Only operate all your components using the current software version.
- ◆ If you have questions which cannot be answered by the operating manual, please contact us (contact information see page 3) or another expert in the field.

## WARNING



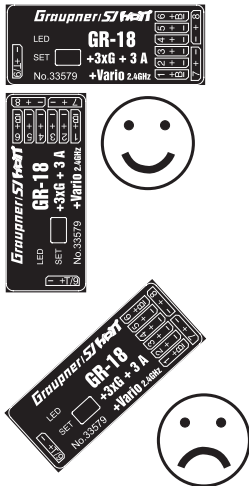
- ◆ Also while programming, make sure that a connected electric motor cannot accidentally start. Injury risk by the turning propellers!
- ◆ Avoid shock and pressure. Check the receiver regularly for damages to the housings and cables, specially after model crashes. Damaged or wet receiver, even if re-dried, should no longer be used!

## WARNING



Risk of injury! For safety reasons the motors start only if in Attitude mode the throttle stick is in the quarter lowest part. Then it is possible to control the speed normally. In Rate mode the motors start after the switch on through the motor stop switch only by idle throttle. Only after that the throttle stick has passed the middle position the motors speed can be controlled regularly. Move the throttle stick slowly over the middle so that the motors do not start uncontrolled fast and the copter flies away without control. Install the propellers only as very last operation before flight. Make practice with this function without propellers before you install them on the copter.

## Installation in the model (multicopter)



The receiver must be aligned at right angles to the copter on the receiver platform. The lower surface of the receiver must always be parallel to one of the copter sides. Prior to installation, remove the sticker on the back of the receiver. We recommend using double-sided tape No.: S8376 for Gr-18 to fix the receiver in place.

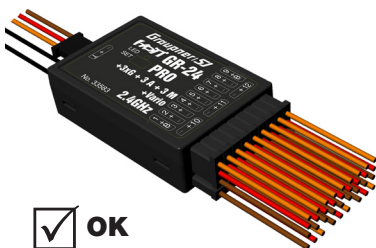
## Binding

Binding is only possible if the receiver has not been linked with a bound transmitter since being switched on (red LED lights). Press the SET button to set the receiver to BIND mode.

If you wish to bind the receiver to a new model memory, this is the procedure:

- ◆ Switch the transmitter's RF section off in the "Basic model settings" menu (see transmitter manual)
- ◆ Switch on the receiver and put it in binding mode, by pressing and holding the binding button (green and red LED on the receiver are flashing)
- ◆ Initiate binding in the transmitter's "Basic model settings" menu.
- ◆ If the red LED of the receiver goes out within about 10 seconds and the green LED is illuminated, the binding process has been completed successfully.
- ◆ Your transmitter/receiver combination is now ready for operation.
- ◆ If the red LED is still lit, the "binding" failed. In this case, repeat the whole procedure.

## Interfaces



Connect the speed controllers or servos to the row of sockets on one end of the receiver. The connectors are reverse polarity protected: note the small chamfers on the sides. Never use force – the connectors should engage easily. The polarity is also printed on the receiver; the negative wire (-) is brown, the positive (+) red and the signal orange.

The servo sockets of **Graupner HoTT 2.4** receivers are numbered sequentially. The socket for channel 6 can also be programmed to deliver a (digital) sum signal (see following section).

## Power supply

The receiver does not feature specific sockets for connecting the battery. We recommend that you connect the power supply to the socket(s) close to the servos already connected to the receiver. If you wish to connect multiple separate batteries, the



batteries must be of the same nominal voltage and capacity. Never connect different battery types or batteries with strongly different charges since this can cause an effect similar to a short circuit. In such cases for safety reasons, insert voltage stabilizing elements such as PRX-5A (No. 4136) receiver power supplies between the batteries and receiver.

### Telemetry or channel (T/9) socket

The optional telemetry sensors are connected to the socket marked "T" (T/9)- Telemetry. In addition, the update is performed on this socket. The socket can even be used as optional channel 9. (see following section)

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## Receiver setup menu

```
RECEIVER 1.0 >
>ALARM VOLT: 3.8V
ALARM TEMP: 70°C
Altitude max: 25m
CYCLE: 20ms
SUMD at CH6: No
Sensor at CH9: No
LANGUAGE: English
Ant.1 100% Ant.2 100%
```

The receiver setup menu appears in the "Telemetry" menu under SETTINGS / DISPLAYS or if you are using a SMART-BOX under SETTING & DATAVIEW. How to access this menu is described in the operating instructions supplied with your transmitter or Smart-Box.

### ALARM VOLT (receiver low voltage warning)

If the receiver voltage falls below the set value, a low-voltage warning is generated by the transmitter's RF module in the form of a "general alarm tone" (regular beeping at a rate of approx. one beep per second) or the "receiver voltage" speech output message.

### (ALARM TEMP): Temperature warning

If the receiver temperature exceeds the set temperature, a warning is generated by the transmitter's RF module in the form of a "general alarm tone" (regular beeping at a rate of approx. one beep per second) or the "receiver temperature" speech output message.

### (Max. altitude) Maximum altitude (not by S1019 GR-18L)

This is where you can specify a maximum altitude. When the model reaches this altitude, an alarm is triggered either by the transmitter's RF module in the form of a "general alarm tone" (regular beeping at a rate of approx. one beep per second) or the "altitude" speech output message. Note: When the receiver is switched on, the model's current altitude is set to 0; the displayed altitude is therefore the altitude relative to the launch point. For Racecopter we suggest to set an alarm at 25 meters, otherwise it should be set maximum at 100 meters.

**Inform yourself before flying your model on which maximum altitude you can fly in the uncontrolled airspace over the starting position and do not exceed it.**

**Setting necessary when servos are installed for additional functions**

**Cycle time (PERIOD)**

If your system is used exclusively with digital servos, you can set a cycle time (frame rate) of 10 ms. If your system includes some or uses exclusively analogue servos, you should always select 20 ms, as many analogue servos cannot process the higher frame rate and may respond by "jittering" or "growling". Not important for connected speed controllers.

**HoTT sum signal (SUMD)**

If you activate the digital sum signal at channel 6, a sum signal containing 8 channels is present at this socket, instead of a servo signal. The HoTT receiver configured as SUMD constantly generates a digital sum signal from 8 control signals from the transmitter and makes this signal available at the appropriate servo socket, which is receiver-specific. At the time this manual was revised, this type of signal was being used by several of the latest electronic applications of flybarless systems, power supplies, etc.

**(Sensor at CH9):Telemetry sensor**

Telemetry sensor (sensor at CH9): This socket allows you to use either for telemetry or for an extra channel (9). (Attention! Both together is not possible!) Switching is done in this menu item. If you select "Yes", the socket is connected to the connection of a sensor. If you select "No" a jack is connected to the control channel 9.

**Ant. 1 - Ant. 2**

This indicator shows strength of the signal received (as a percentage) from the antennas of the receiver. The display is used to find the correct position of the antennas during the installation.

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**Transmitter presettings**

**Step 1  
Setting of the flight-mode -  
attitude or rate mode**

E5	3	+100%	+100%
▶E6		+100%	+100%
▼                      - TRV +			

In the transmitter it must be selected a free model memory, the model type must be "surface model" and the channel 1 direction must be set so that in "motor off" position the power indicator must show -100%.

The flight mode must be set on channel 5. For this program a 2-way switch (e.g. switch 3) in the transmitter control menu on Channel 5 as follows:

**Attitude mode:** Channel 5 = -100% to +50%. The stick movement determinates the Copter reaction on Roll and Nick. It allows a maximal angle of about 50° at 100% of stick movement. Mode suggested for beginners. The stick movements acts directly proportionally to Roll and Nick.

**Rate mode:** Channel 5 = more than +50%. The stick movement determinates the rate without angle limit. Aerobatic mode that allows rolls and loopings.

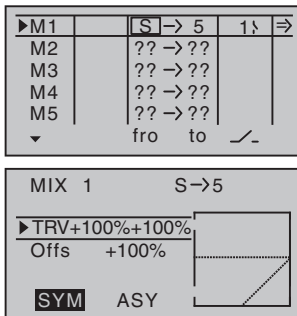
**Do not forget to set the failsafe up!**

We suggest to set the fail-safe on channel 5 and channel 1 at -100% , so that in fail safe it is active the attitude mode.

## Program motor-off switch!

Program always the motors stop switch on the transmitter. (See transmitter manual) This prevents accidental starting of motors, thus reducing the risk of injury.

## Mixer motors stop with channel 5



**In Acro 3D Mode:** In addition to the motors stop switch you need to program a mixer to be able to switch the motors off in 3D Acro mode too. If the 3D Acro mode enabled and you control over the rate mode, the motor stop function would control the motors fully backward. To prevent this, the mixer switches to attitude mode, here then the stopping of the motors is ensured via the switch. Set a free mixer from S1 to CH5. (see display screenshot on the left)

## Initialization of the gyro

### Initialization by switching on

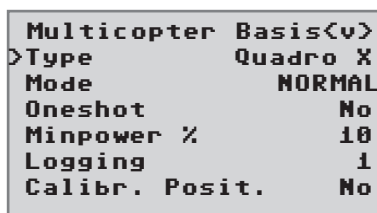
Once the model has been switched on, the gyro immediately becomes active but still needs to be initialised. To initialise the gyro, keep your model still when you switch it on. The calibration process can only be performed when the receiver is absolutely still. After 3 seconds in still position you will hear beeps emitted by all motors. The signal tone can vary depending on the esc model. These "wiggles" signal that initialisation has been successful and that calibration is complete. Always wait until the calibration process has finished before starting to fly the model. The motors will not start until the calibration is complete.

## Basic settings

### Step 2 Basic settings

### Type

**Quadro x, Quadro +, Hexa I, Hexa V, Tri L, Tri R, Hexa-rotor Y, Hexa-rotor IY, Octo-rotor I, Octo-rotor V, Octo-rotor X**



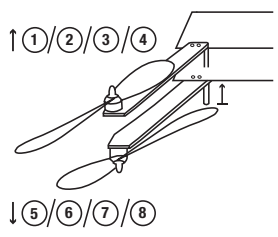
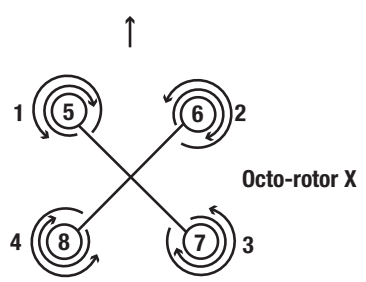
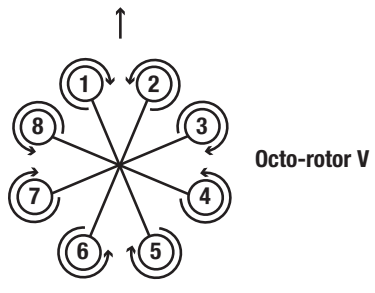
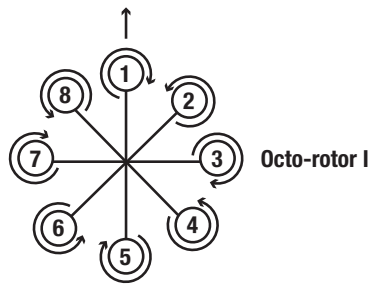
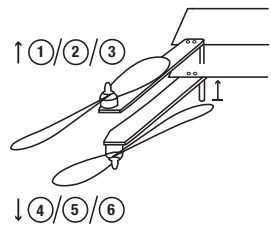
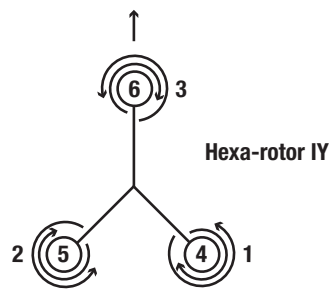
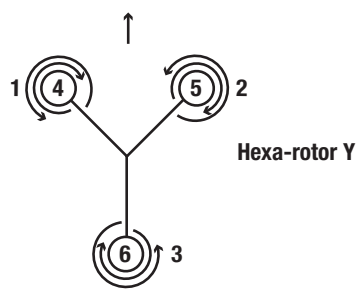
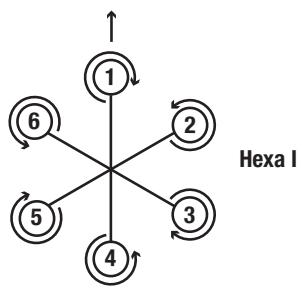
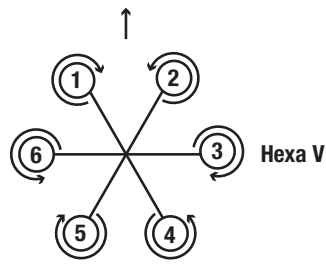
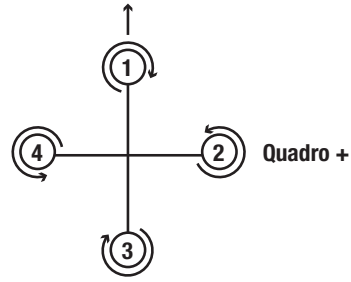
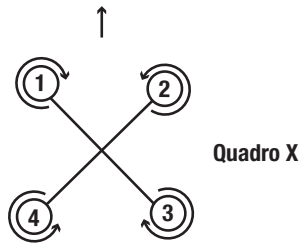
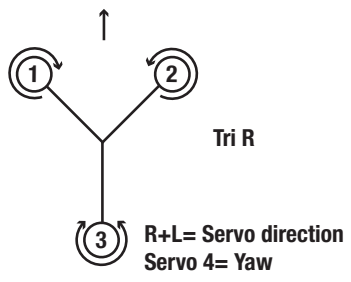
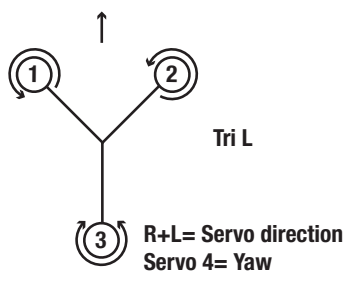
Channel connections to the receiver for the different copter types.

Connect the speed controllers of the motors to the receiver following the proper scheme (see next page).

In case of tricopter use only digital servos for servo 4.

The motor direction is referred to the copter seen from the top.

# Connection scheme of different type of copter



## MODE

**ESC settings** for the learning of the controller the receiver K1 signal will be passed directly to the controller.

**Normal** is set for 'normal' multicopter (without reverse rotation).

**Acro 3D** setting for multicopter whose speed controllers are equipped with reverse rotation. (Acro flight mode)

### Note:

For safety reason the **Type** and **Mode** changes take effect after switching off and on (only for this parameter).



## CAUTION

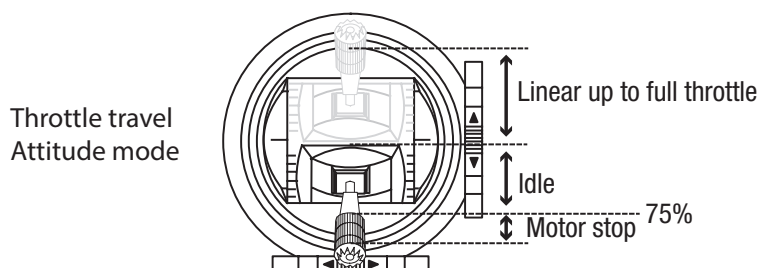
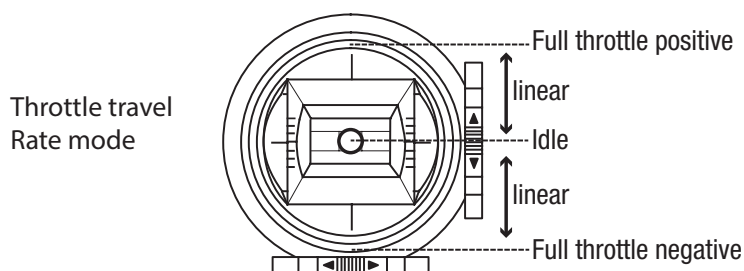


Risk of injury by rotating propellers when motors are running. The motors can start while switching from Attitude to Rate mode. Hold the throttle stick in central position when you switch. Install the propellers only as very last operation before flight.

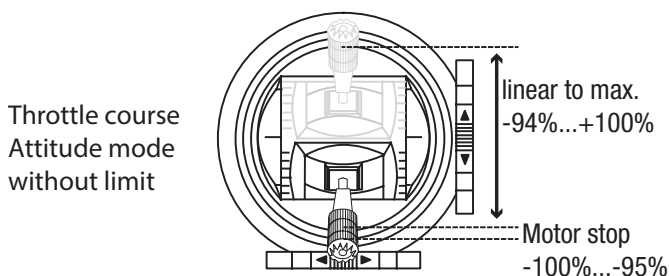
Start and land always in Attitude mode. Note that in Rate mode the throttle curve has different reaction. (see scheme below)

Example: If the throttle stick is down when you turn in rate mode, the motors run at once fully backward.

### Throttle curve in Acro 3D mode

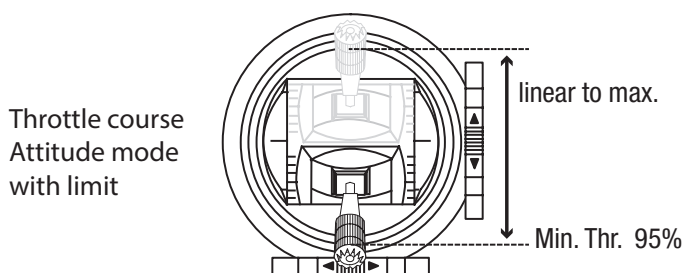


### Throttle curve in normal mode



## Suggested throttle course setting

The motors arm at -95%, for this you need to limit the servo travel to -94...100%, so that the motors cannot stop during the flight.



## WARNING



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### Protection function against undesired start of the motors. Risk of injury by propellers!

#### Normal mode:

For safety reasons the motors start after the switching on through the motor stop switch only if in Attitude and in Rate mode the throttle stick is in the lower position. Move the throttle stick slowly in the lower position, then it is possible to control the speed normally.

#### Only in Acro 3D mode:

In Rate mode the motors start after the switch on through the motor stop switch only by lower throttle. Only after that the throttle stick has passed the middle position the motors speed can be controlled regularly.

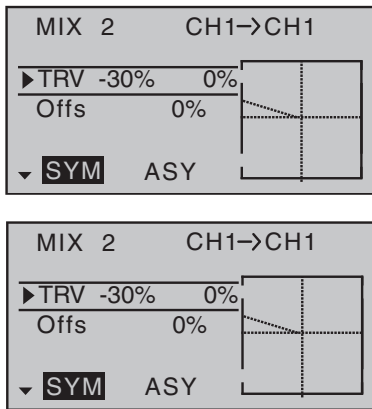
Move the throttle stick slowly over the middle so that the motors do not start uncontrolled fast and the copter flies away without control.

Install the propellers only as very last operation before flight. Make practice with this function without propellers before you install them on the copter..

This safety function will be automatically set off if in the transmitter you program a time delay on the gas channel. Be sure that in the flight phase switching or in the throttle stick menu no delay is set.

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**Optional mixer for reduction of throttle curve in attitude mode**



**Optional:** If the motor off area is not desired in Attitude mode then you can reduce the lower servo travel to -70%. Thus the reduction has no effect on the rate mode, program the reduction through a switchable free mixers. In this mixer the reduction is active only in Attitude mode. (see display screenshot on the left)

**Oneshot**

Oneshot is a quick communication protocol between receiver and speed controller and should only be activated if the speed controllers allow this function. It allows the speed controllers to communicate much faster with receiver. So the motors react faster to receiver controls. The motor output signal is now shorter, about 125µs-250µs, instead of before PWM (1000µs – 2000µs).

**Minpower%**

The setting is principally used to prevent the motors shut down in flight. Adjust so that the motors are running straight. Under no circumstances unnecessarily high set, this would limit the controller possibilities.

**Logging**

Value 1 is the general attitude control, rest as needed

logs the corresponding servo to SD card for later evaluation and error analysis.

Settable values:

0 = No logging, Telemetry display of Euler and yaw angle

1 = roll and nick logging

We recommend always logging at least one function.

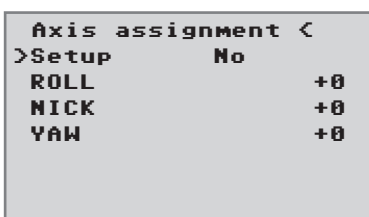
**CALIBR. POSITION**

With **Calibr. Position** the acceleration sensors can be calibrated so that in attitude mode with stick and trim neutral, the copter is precisely horizontally aligned. For this purpose, it is simply placed on absolute level surface and set the value to Yes. After a moment, it jumps back to No and the calibration is done. Do not forget to store disabling the field!

**Axis assignment**

**Step 3**

**Axis assignment in the gyro**



**Setup:** Setup: Yes/No

Assignment of the gyros and their operating direction.

In the receiver's "Axis assign" menu, go to the "Setup" option and set it to "Setup: Yes". Now assign the axes as follow:

On the transmitter, briefly set the roll command fully to the right; the roll axis is highlighted. Roll the copter more than 45 degrees to the right the identified axis with the required prefix is displayed, the field is no longer highlighted and identification of this axis is complete.

Now do the same for nick: on the transmitter, briefly set the nick command so that it is fully forward. Roll the copter more than 45 degrees forwards; the axis is displayed, the field is no longer highlighted and identification of this axis is complete.

Finally complete the procedure for yaw: on the transmitter, briefly set the yaw command fully to the right. Turn the copter so that the nose turns more than 45 degrees to the right; the axis is displayed, the field is no longer highlighted and identification of this axis is complete.

The gyros and operating directions have now been assigned. Now check to make sure that the operating directions are correct.

To do this remove the propeller of the copters and give approximately a quarter throttle, all motors are running at the same speed.

Tilt the Copter in Attitude mode so that its nose is facing downwards the front motors must turn faster than back ones. Tilt the Copter in Attitude mode to one side the motors of the side, in witch you tilt the model, must turn faster then the motors on the other side.

## Roll and Nick setting

### Step 4

#### Optional setting for Roll and Nick

```

Multicopter RO/NIC >
>ROLL/NICK P      50
ROLL/NICK D      30
DAMPING           0
ROLL FACTOR %    65
POWER2SENS. 80
--ATTITUDE MODE--
ROLL/NICK I      40
AGILITY          3
  
```



```

Multicopter RO/NIC >
--RATE MODE--
R/N RATE I       25
RATE             3
  
```

### For Attitude and Rate mode:

#### ROLL/NICK P:

Set this parameter in steps of 5 higher and higher, until a medium-speed overshoot occurs. Then go some steps back in order to prevent the soar up climb in case of full throttle.

#### ROLL/NICK D:

Now adjust well to the D component in steps of 5, until the Copter engages exactly on nick and roll. A too high value leads to very rapid oscillations.

#### DAMPING

The damping factor should be set as low as possible, but as high as necessary, so that the PID control can operate optimally and the setting can be increased at best. If you do not get vibrations away with the PID settings, then change the damping of a step and test whether the setting works better or worse. Recommended settings:

For Racecopter with fast controllers and 5-6 inch propellers: **1 - 2**

For copters with fast controllers and 8 inch propellers: **2**

Copter with bigger propellers: **2** or higher.



**ROLL FACTOR %:**

Set the Roll setting as percent value of the overall gain. For symmetric Copters the value can be 100. If, because of its gravity centre, the Copter is more agile on the Roll axis than on the Nick axis, then you can change here the roll factor. In the **Graupner ALPHA RACE 250 Q** this value is set about 65%.

**POWER2SENS.: Consideration:**

Very strong drives can lead to oscillating at full throttle. This parameter allows you to set a kind of gyro suppression. Higher values result in an increased gyro suppression towards full throttle.

**Only fo attitude mode:****ROLL/NICK I:**

Set the I component of the Attitude mode. At too low values of Copter swings slowly. If it stops after a roll or pitch command and “oscillates”, the value must be reduced.

**AGILITY:**

Agility determines at what speed (yaw rate) a new position is occupied.

**Only for rate mode:****R/N RATE I:**

Sets the I component of the rotation in rate mode. At too low values of Copter swings slowly. If it stops after a roll or pitch command and “oscillates”, the value must be reduced.

**RATE:** Sets the max. potential rate of rotation in Rate mode.

---

## Multicopter Yaw settings

```
Multicopter Yaw<v>
>Yaw P      40
Yaw I       20
Yaw D       20
```

### Yaw P - Factor

Default setting: +45

The P factor is responsible for the harder snap to yaw. Higher values result in a faster stop. At too high P-values the copter starts to “swing”. In such cases, the value must be reduced again.

### Yaw I - Factor

Default setting: +15

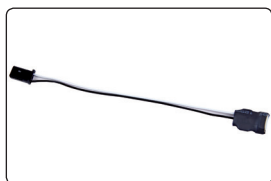
The I-factor ensures constant rotations. Start with low values and only increase them until the rotations are constant. Too high value cause an oscillation when you stop and possibly the motors can run higher. This can lead to an undesirable rise.

### Yaw D - Factor

Default setting: MIN

The D-factor affects the stopping behavior in yaw. In most Copters a hard D action is necessary. The D component must be set as low as possible, since it affects the whole system.

## Firmware Update



Updates to the receiver's firmware are made via the telemetry socket using a PC running Windows XP, Vista or 7. You will also need a USB interface, order No. 7168.6, and adapter lead, order No. 7168.6A or 7168.S, which are available separately.

The programs and files required can be found in the Download area for the corresponding products at [www.graupner.de](http://www.graupner.de).

Connect the adapter lead to the USB interface No. 7168.6. The connectors are reverse polarity protected: note the small chamfers on the sides. Never use force – the connectors should engage easily.

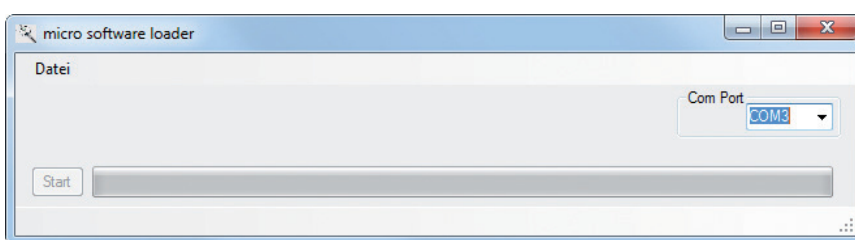
Connect the adapter lead to the receiver's telemetry socket. The connectors are reverse polarity protected: note the small chamfers on the sides. Never use force – the connectors should engage easily.

### Starting the "Slowflyer/Gyro receiver update"

We recommend accessing the "Slowflyer/Gyro receiver update" program from the "Firmware\_Up-grade\_grStudio" program. Click on the "Receiver Downloader" item under "Link" in the left function menu. (Alternatively, select the "Micro Receiver Upgrade" under "Menu").

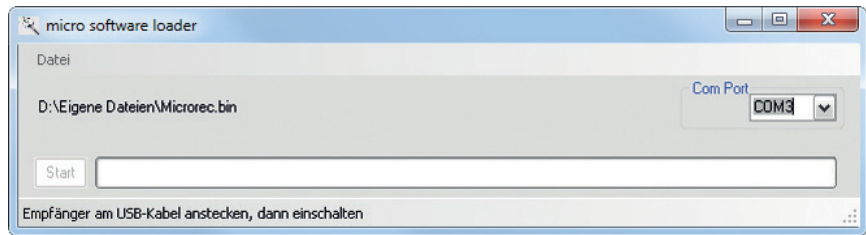
It is also possible to start the associated application program directly. by double-clicking on the file "micro\_gyro\_swloader.exe". By double-clicking on the file "micro\_gyro\_swloader.exe". You will find this .exe file in the "Graupner\_PC Software" folder of the "HoTT\_Software VX" package.

A program window will now appear in which you should first set the "correct" COM port for the USB interface No. 7168.6 in the selection window. (See following picture)

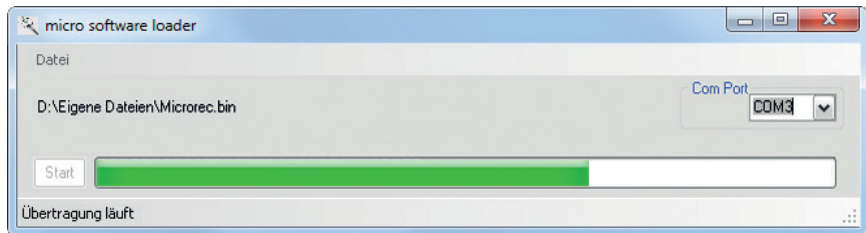


If you are not sure which port to use, check the COM port in the "Select Port" window in the "Menu" of the "Firmware\_Up-grade\_grStudio" and note down the COM port number for the "Silicon Labs CP210x USB to UART Bridge" entry – in this case "COM03". (If you select the wrong port, you will be alerted to this when you read out the receiver data). Click on "File" to load the corresponding firmware file named "MicroStabi7X\_V\_XX.bin" from the hard disc ("XX" stands for the version number).

When the file has loaded, click on start...



... connect the receiver and switch it on.



The progress bar shows that the transfer is running normally. The receiver LED lights up red and green during this process and flashes red and green alternately once the transfer is complete.

Please refer to the detailed update instructions for the item in question in the Download area at [www.graupner.de](http://www.graupner.de).

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## Notes on environmental protection



### Disposal notes

This symbol on the product, user manual or packaging indicates that this product must not be disposed of with other household waste at the end of its life. It must be handed over to the applicable collection point for the recycling of electrical and electronic equipment.

The materials are recyclable as marked. By recycling, material reusing or other forms of scrap usage you are making an important contribution to environmental protection.

Batteries and accumulators must be removed from the device and disposed of at an appropriate collection point. Please inquire if necessary from the local authority for the appropriate disposal site.

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## Care and maintenance



### Notes on care

The product does not need any maintenance, it works so as it is without any special care. In your own interests protect it from dust, dirt and moisture.

Clean the product only with a dry cloth (do not use detergent!) lightly rub.

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## Warranty certificate

The Graupner, Henriettenstrasse 96, 73230 Kirchheim/Teck grants from the date of purchase of this product for a period of 24 months. The warranty applies only to the material or operational defects already existing when you purchased the item. Damage due to wear, overloading, incorrect accessories or improper handling are excluded from the guarantee. The legal rights and claims are not affected by this guarantee. Please check exactly defects before a claim or send the product, because we have to ask you to pay shipping costs if the item is free from defects.

The present construction or user manual is for informational purposes only and may be changed without prior notice. The current version can be found on the Internet at [www.graupner.de](http://www.graupner.de) on the relevant product page. In addition, the company **Graupner** has no responsibility or liability for any errors or inaccuracies that may appear in construction or operation manuals.

No liability can be accepted for printing errors.

