33579 Receiver GR-18 3xG+3A+Vario
33583 Receiver GR-24 PRO 3xG+3A+3M+Vario
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Preamble

MANY THANKS
for deciding to purchase the Graupner/SJ HoTT 2.4 system. Please read right through these operating instructions before you attempt to install and operate the Graupner HoTT 2.4 system.

- The receiver stabilises the model aircraft in difficult, windy conditions, acting on a maximum of three axes
- Proportional gyro suppression for natural flying characteristics
- Excellent stabilisation for smooth, accurate manoeuvres
- The triple-axis gyro endows even very demanding aerobatic models with docile flying characteristics, and greatly simplifies aerobatics
- Aerobatic manoeuvres can be flown much more accurately
- Simple gyro assignment procedure
- Facility to adjust parameters using HoTT telemetry
- Altitude sensor for vario and altimeter function

Attention!
Prior to the installation and commissioning of the receiver be sure to read the instructions completely.

Approved Usage

Note: The receivers may only be used in electric heli models!

The receiver is intended exclusively for use in radio-controlled models. Any other usage is prohibited, and may result in damage to the receiver or model, and serious personal injury. We grant no guarantee and accept no liability for any type of use outside the stipulated range.
Not suitable for children under fourteen years. This receiver is not a toy!

The receiver is also equipped with a telemetry function which is only available in combination with a Graupner/SJ HoTT 2.4 system. If you do not own a Graupner/SJ HoTT 2.4 system, the receiver will not work.
Please start by reading through the whole instructions before you attempt to install and operate the receiver. These operating instructions are an integral part of the product. They contain important notes on operating and handling the receiver. For this reason please store the operating instructions in a safe place, and pass them on to the new owner if you ever dispose of the product. Failure to observe the operating instructions and safety notes invalidates the guarantee. Here at Graupner we are constantly working on the further development of all our products; for this reason we are obliged to reserve the right to introduce changes to the set contents in form, technology and features. Please understand that we will not countenance claims resulting from information and illustrations in these operating instructions.
Please store the operating instructions in a safe place for future reference!

Key to the Symbols

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Text</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Caution!]</td>
<td>This symbol alerts you to prohibited actions which must be observed at all times. Any failure to observe the prohibited action indicated in this way may prevent the equipment working, and endanger the safety of the operator.</td>
</tr>
<tr>
<td>![Caution!]</td>
<td>This symbol alerts you to information which must be observed at all times. Any failure to observe the information indicated in this way may prevent the equipment working properly, and endanger the safety of the operator.</td>
</tr>
<tr>
<td>![This symbol]</td>
<td>This symbol indicates information which should always be observed in order to ensure that the equipment operates reliably.</td>
</tr>
</tbody>
</table>
Safety notes

- **Warnung!**
  Das Betreiben des Empfängers unter Einfluss von Medikamenten, Alkohol, Drogen, usw. ist verboten.

- **Caution!**
  Any deviation from the instructions may have an adverse effect on the function and operational security of the receiver, and must be avoided under all circumstances.

- **Caution!**
  The operator bears full responsibility for using the receiver. The only way to guard against personal injury and property damage is to handle the equipment carefully and use it exactly as recommended.

- **Caution!**
  Not suitable for children under fourteen years.

- **Caution!**
  Protect the receiver from dust, soiling, damp and foreign bodies. Never subject the receiver to excessive vibration, heat or cold.

- **Caution!**
  During the programming process you must bear in mind that an internal combustion engine or electric motor could unexpectedly burst into life at any time.

- **Caution!**
  Avoid subjecting the receiver to shocks and pressure. Check the receiver regularly for damage to the case and cables. Do not re-use a receiver which is damaged or has become wet, even after it has dried out again.

- **Caution!**
  When deploying the cables ensure that they are not under tension, not tightly bent (kinked) or fractured. Avoid sharp edges which could damage cable insulation.

- **Caution!**
  Ensure that all plug-in connections are firmly seated. Do not pull on the wires when disconnecting plugs and sockets.

- **Caution!**
  The receiver must not make physical contact with the model's fuselage, hull or chassis, as this would allow motor vibration and landing shocks to be transferred directly to it.

- **Caution!**
  It is not permissible to carry out modifications of any kind to the receiver. Any changes invalidate product approval, and you forfeit any insurance protection.

- **Caution!**
  Ensure that the equipment is working correctly and at full range before every flight. Check the state of the batteries at regular intervals.

- **Note!**
  Ensure that all your HoTT components are loaded with the current version of the software at all times.

- **Note!**
  Safety is no accident, and radio-controlled models are not playthings!

General notes

- The receiver’s integral gyros are very fast, high-resolution components. This means that you should always use high-speed digital servos wherever possible, so that the gyro’s corrective signals are converted directly and accurately into servo movement; this helps to prevent the model oscillating.

- Keep all servo extension leads as short as possible.

- When switching on or adjusting the radio control system, it is essential to keep the transmitter aerial at least 15 cm from the receiver aerial(s). If the transmitter aerial is too close to the receiver aerials, the receiver will be swamped and the red LED on the receiver will light up. The transmitter responds with a flashing red LED and repeated beeps at approximately one-second intervals, i.e. the radio control system reverts to fail-safe mode. If this should happen, increase the distance until the audible warning ceases, and the blue transmitter LED lights up constantly once more. The red LED on the receiver should now be off.
Binding

The Graupner/SJ HoTT 2.4 receiver must be “bound” to “its” Graupner/SJ HoTT 2.4 RF module (transmitter) before a radio link can be created between them; this process is known as “binding”. Binding is only necessary once for each combination of receiver / RF module, so the binding procedure described below only needs to be repeated if you add more receivers. However, binding can be repeated at any time if you wish; for example, if you switch transmitters. This is the procedure in detail:

- 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 have already bound a receiver to the transmitter, and 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.
  - Switch the receiver on, and press the SET button to set it to Bind mode.
  - Initiate binding in the transmitter’s “Basic model settings” menu.
  - If the receiver’s red LED moved within about 10 seconds to green, the Binding Operation was completed successfully.
  - Your transmitter / receiver combination is now ready for use.
- However, if the red LED continues to glow, then the binding process has failed. If this should happen, repeat the whole procedure.

Binding multiple receivers per model

If necessary it is also possible to bind more than one receiver to a particular model. First bind each receiver individually as described earlier.

When the system is actually in use, the receiver which was last bound acts as the Master unit, and any telemetry sensors installed in the model must be connected to this receiver, as only the Master receiver transmits the data to the ground using the downlink channel. The second - and any other - receivers operate in Slave mode, in parallel with the Master receiver, with the downlink channel switched off. The channel mapping function of HoTT telemetry also allows the control functions to be divided up amongst multiple receivers, or alternatively the same control function to be assigned to multiple receiver outputs. For example, this is useful if you wish to actuate each aileron with two servos instead of just one.

Fail-Safe function

In the receiver’s default state, all connected servos remain in their last valid position (“Hold” mode) if a fail-safe situation should arise. In fail-safe mode the red LED on the receiver lights up, and the transmitter generates an audible alert by beeping at a rate of around one per second.

You can exploit the safety potential of this option by at least setting the throttle position (for internal-combustion powered models) to Idle, or the motor function (electric-powered models) to “Stop”, or “Hold” for a model helicopter, if a fail-safe event should occur. These settings ensure that the model is less likely to fly out of control if interference should occur, thereby helping to avoid property damage or even personal injury.

Read the operating instructions supplied with your radio control system for more details.

The gyro system remains active in a fail-safe situation.

Range-checking

- The range of your Graupner/SJ HoTT 2.4 system can be checked as described in the following instructions. We recommend that you ask a friend to help you with the procedure.
- Ideally the receiver should already be bound to the transmitter. Install it in the model in its final position.
- Switch the radio control system on, and wait until the red LED on the receiver goes out. The servo movements can now be observed.
- Place the model on a flat surface (pavement, close-mown grass, earth), and ensure that the receiver aerials are at least 15 cm above the ground. It may be necessary to pack up the model to achieve this for the period of the range-check.
- Hold the transmitter away from your body at hip-level. Don’t point the transmitter aerial straight at the model; instead rotate or angle the aerial tip in such a way that it is vertical when you operate the transmitter controls.
- Select range-check mode, as described in the transmitter instructions.
- Walk away from the model, moving the transmitter sticks. If you detect an interruption in the radio link at any time within a distance of about 50 m, see if you can reproduce the problem.
- If your model is fitted with a motor or engine, switch it on or start it, so that you can check effective range when potential interference is present.
- Walk further away from the model to the point where full control is no longer possible.
- At this point you should manually switch off range-check mode.
- The model should now respond to the controls again. If this is not 100% the case, do not use the system. Contact the Graupner/SJ Service Centre in your locality and ask their advice.
- We recommend that you carry out a range-check before every flight, simulating all the servo movements which occur in flight. To guarantee reliable model operation, radio range must always be at least 50 m on the ground.

• If you want to use another Flybarless system with this receiver, select the Surface menu and turn off the gyro function, set the digital sum signal on a corresponding output.
Installation in the model (airplane)

The gyro receiver must be installed straight and at right angles to aircraft longitudinal axis, so that the rotors can work as intended, because of the accelerometer in addition also horizontal to the longitudinal axis.

Installation in the model (heli)

The receiver has to be aligned strictly at right angles and parallel to the floor on the receiver platform on the helicopter. You can also install on edge at right angles to the receiver. There must always be an edge of the receiver are parallel to a Heli axis.

This mounting position is at the moment not important, but for later use the accelerometers be important (through Software Update)!
Connections

Connect the servos to the row of sockets on one end of the receiver. The connectors are polarised: note the small chamfers on one side. 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/SJ HoTT 2.4 receivers are numbered sequentially. The socket for channel 8 can also be programmed to deliver a (digital) sum signal (see section 3.2: Receiver set-up).

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 batteries of different type, or packs of greatly differing states of charge, as this can cause effects similar to a short-circuit. If you encounter this problem, we recommend the use of a voltage stabiliser unit (e.g. PRX-5A receiver power supply, Order No. 4136) between the batteries and the receiver.

Telemetry (T/9 at GR-18)

The optional telemetry sensors are connected to the socket marked “T” (T/9)- Telemetry. In addition, the update is performed on this socket (see point 5). At the GR-18, the socket can be used optionally for K9.

Receiver setup menu for surface models

The receiver can be programmed with a suitable HoTT transmitter or in connection with the SMART-BOX (Order No. 33700).

menu GR-24

The receiver set-up menu appears in the “Telemetry” menu under SETTINGS / DISPLAYS; alternatively - if you are using a SMART-BOX - under SETTING & DATAVIEW. The method of accessing this menu is described in the operating instructions supplied with your transmitter or the Smart-Box.
**Display Explanation Settings**

<table>
<thead>
<tr>
<th>Display</th>
<th>Explanation</th>
<th>Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>RECEIVER 1.0</td>
<td>1.0 indicates the version of the receiver’s firmware</td>
<td>-</td>
</tr>
<tr>
<td>Type of Model</td>
<td>Selection of model type</td>
<td>Plane, Heli</td>
</tr>
<tr>
<td>ALARM VOLT.</td>
<td>Alarm threshold for the receiver’s low voltage warning</td>
<td>2.5 - 24.0 V \n<strong>Default setting:</strong> 3.8 V</td>
</tr>
<tr>
<td>ALARM TEMP.</td>
<td>Receiver overheating warning</td>
<td>50 - 80°C \n<strong>Default setting:</strong> +70°C</td>
</tr>
<tr>
<td>Max. altitude</td>
<td>maximum altitude</td>
<td>0 - 2500 m \nin 25 m increments</td>
</tr>
<tr>
<td>PERIOD</td>
<td>Cycle time (frame rate) in ms</td>
<td>10 / 20 ms</td>
</tr>
<tr>
<td>SUMD at CH8</td>
<td>Digital sum signal at channel 8</td>
<td>Yes / No</td>
</tr>
<tr>
<td>Sensor at CH9</td>
<td>Telemetry-Sensor at channel 9 (only at GR-18)</td>
<td>Yes / No</td>
</tr>
<tr>
<td>LANGUAGE</td>
<td>Select menu language</td>
<td>German, English, French, Italian or Spanish</td>
</tr>
</tbody>
</table>

**Model type selection (Type of model):** here you can choose the model type.

By selecting “Plane” you will be able to access the gyrosettings for surface models, as described in chapter 4.

The selection “Heli” will be made available through a future software update. It will enable a receiver-integrated flybarless system, which can be adjusted inside the transmitters telemetry settings.

**Low-voltage warning (ALARM VOLT):** 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 the “general alarm tone”: a regular beeping at a rate of about one per second; alternatively the speech output message “Receiver voltage”.

**Temperature warning (ALARM TEMP):** if the receiver temperature exceeds the set temperature threshold, a warning is generated by the transmitter’s RF module in the form of the “general alarm tone”: a regular beeping at a rate of about one per second; alternatively the speech output message “Receiver temperature”.

**Maximum altitude (Max. altitude):** at this point you can enter a maximum altitude, at which an alarm is triggered, either via the transmitter’s RF module in the form of the “general alarm tone”: a regular beeping at a rate of about one per second; alternatively the speech output message “Height”. Note: the model’s actual height is adopted as zero when the receiver is switched on; the indicated height is therefore the altitude relative to the launch point.

**Cycle time (PERIOD):** if your system is used exclusively with digital servos, you can set a cycle time (frame rate) of 10 ms at this point. If your system includes some or all 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”.

**HoTT sum signal (SUMD):** if you activate the digital sum signal at channel 8, a sum signal containing eight 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 these instructions were revised, this type of signal is used by several of the latest electronic developments in the area of flybarless systems, heavy-duty airborne power supplies, etc.

**WARNING:** if you wish to use this facility, it is essential to observe the set-up information supplied with the devices connected to the receiver, otherwise there is a risk that your model may be uncontrollable!

**Menu item only at 33579 GR-18 PRO 3XG +3 A + Vario**

Telemetry sensor (sensor at K9): This jack allows you to use either for telemetry or for an extra channel (9). (Note: 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.
initialising the gyro (plane)

After switching on the model of the gyroscope is immediately active but not yet initialized. To initialize it, you keep your model when switching quiet and straight in level flight - the best place it on the flat ground or a flat table. After about 2 seconds, the ailerons move up and down just once. This “wiggle” signaled the successful initialization, the end of the calibration, only then the model may be moved again.

All sticks are to be kept strictly in neutral!

**WARNING:** during the initialisation phase the gyro detects the model’s neutral attitude, and for this reason it is absolutely essential to leave the model in its ‘normal flight attitude’ during the activation phase, and avoid moving it! If you neglect this, the gyro may detect an incorrect flight attitude, with the result that the model will not fly as you expect it to. It may be difficult to control, and could even crash!

During the initialisation phase the receiver also detects the centre points of the individual control channels; this information is used for gyro suppression. Gyro suppression reduces the stabilising action progressively as the transmitter controls are deflected away from centre; at +/- 100% the gyro is completely disabled.

**Free mixer**

**Important note:** If you wish to use the gyros, you must always set the tail type to ‘normal’ in the transmitter’s model type menu. If your model is a delta, features a V-tail, or has two elevator servos, you must use the receiver mixer - not the transmitter mixer - to control these control surfaces, since the gyro stabilisation system will have no effect on these servos otherwise. The four receiver mixers work ‘downstream’ of the gyros. If you have already programmed mixer functions in the “Wing mixers” or “Free mixers” menu of your HoTT transmitter, you must ensure that those mixers do not overlap with those available in this menu!

<table>
<thead>
<tr>
<th>Screen Display</th>
<th>Key</th>
<th>Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIXER</td>
<td>Mixer select</td>
<td>1, 2…4</td>
</tr>
<tr>
<td>FROM CHANNEL</td>
<td>Signal source / source channel</td>
<td>0,1,2,…6</td>
</tr>
<tr>
<td>TO CHANNEL</td>
<td>Target channel</td>
<td>0,1,2,…6</td>
</tr>
<tr>
<td>TRIM</td>
<td>Trim position in %</td>
<td>-15 - + 15%</td>
</tr>
<tr>
<td>TRAVEL-</td>
<td>Travel limit at % Servo travel</td>
<td>-150 bis +150%</td>
</tr>
<tr>
<td>TRAVEL+</td>
<td>Travel limit at % Servo travel</td>
<td>-150 bis +150%</td>
</tr>
</tbody>
</table>

**MIXER:** up to four mixers can be programmed simultaneously. You can switch between Mixer 1, Mixer 2, … and mixer 4 in the “Mixer” line.

The following settings only affect the mixer selected in this line.

**FROM CHANNEL:** the signal present at the signal source (or source channel) is mixed in to the target channel (TO CHANNEL) to an extent which can be set by the user. The method of setting up the values is analogous to the “Free mixers” menu in HoTT transmitters.

**TO CHANNEL:** part of the source channel signal (FROM CHANNEL) is mixed into the target channel (TO CHANNEL). The mixer ratio is determined by the percentage values entered in the “TRAVEL-” and “TRAVEL+” lines. Select “0” if you do not require the mixer.

**Mixer ratio (TRAVEL-/+):** in these two lines you can define the mixer ratio in relation to the source channel (FROM CHANNEL); the value is set separately for both directions.
Programming examples:

V-tail with rudder differential

<table>
<thead>
<tr>
<th>RX FREE MIXER</th>
<th>MASTER CH:</th>
<th>SLAVE CH:</th>
<th>TRIM:</th>
<th>TRAVEL+:</th>
<th>TRAVEL-:</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;MIXER:</td>
<td>1</td>
<td>3</td>
<td>96%</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>MASTER CH:</td>
<td>2</td>
<td>4</td>
<td>96%</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>SLAVE CH:</td>
<td>3</td>
<td>5</td>
<td>96%</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>TRIM:</td>
<td>4</td>
<td>6</td>
<td>96%</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>TRAVEL+:</td>
<td>5</td>
<td>7</td>
<td>96%</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>TRAVEL-:</td>
<td>6</td>
<td>8</td>
<td>96%</td>
<td>100%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Differential is not normally necessary with this tail type. Mixer 3 is not required if you do not need rudder differential, and TRAVEL- for mixer 2 must then be set to -100%.
Alternatively you may prefer to carry out the programming using the transmitter menu. A ‘Rudder → elevator’ mixer can be set up at the transmitter instead of ‘Free mixer 3’ at the receiver; the mixer should be set up asymmetrically, e.g. +30%, -30%. This option frees up one mixer at the receiver.

Delta with aileron differential (1 aileron)

<table>
<thead>
<tr>
<th>RX FREE MIXER</th>
<th>MASTER CH:</th>
<th>SLAVE CH:</th>
<th>TRIM:</th>
<th>TRAVEL+:</th>
<th>TRAVEL-:</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;MIXER:</td>
<td>1</td>
<td>3</td>
<td>96%</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>MASTER CH:</td>
<td>2</td>
<td>4</td>
<td>96%</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>SLAVE CH:</td>
<td>3</td>
<td>5</td>
<td>96%</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>TRIM:</td>
<td>4</td>
<td>6</td>
<td>96%</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>TRAVEL+:</td>
<td>5</td>
<td>7</td>
<td>96%</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>TRAVEL-:</td>
<td>6</td>
<td>8</td>
<td>96%</td>
<td>100%</td>
<td>0%</td>
</tr>
</tbody>
</table>

In this example aileron differential is set to 40%. Alternatively you may prefer to carry out the programming using the transmitter menu. An ‘Aileron → elevator’ mixer can be set up at the transmitter instead of ‘Free mixer 3’ at the receiver; the mixer should be set up asymmetrically, e.g. +30%, -30%. This option frees up one mixer at the receiver.

Two elevator servos
(channel 6 for the second elevator servo)

<table>
<thead>
<tr>
<th>RX FREE MIXER</th>
<th>MASTER CH:</th>
<th>SLAVE CH:</th>
<th>TRIM:</th>
<th>TRAVEL+:</th>
<th>TRAVEL-:</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;MIXER:</td>
<td>1</td>
<td>3</td>
<td>96%</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>MASTER CH:</td>
<td>2</td>
<td>4</td>
<td>96%</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>SLAVE CH:</td>
<td>3</td>
<td>5</td>
<td>96%</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>TRIM:</td>
<td>4</td>
<td>6</td>
<td>96%</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>TRAVEL+:</td>
<td>5</td>
<td>7</td>
<td>96%</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>TRAVEL-:</td>
<td>6</td>
<td>8</td>
<td>96%</td>
<td>100%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Only for transmitters without a butterfly (crow) mixer (e.g. mx-10 HoTT):
If a butterfly (crow) mixer is required, you will not be able to use one of the two functions ‘differential’ or ‘landing flap’ adjustment, as two mixers are needed for this.

Programming example:

<table>
<thead>
<tr>
<th>RX FREE MIXER</th>
<th>MASTER CH:</th>
<th>SLAVE CH:</th>
<th>TRIM:</th>
<th>TRAVEL+:</th>
<th>TRAVEL-:</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;MIXER:</td>
<td>1</td>
<td>3</td>
<td>96%</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>MASTER CH:</td>
<td>2</td>
<td>4</td>
<td>96%</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>SLAVE CH:</td>
<td>3</td>
<td>5</td>
<td>96%</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>TRIM:</td>
<td>4</td>
<td>6</td>
<td>96%</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>TRAVEL+:</td>
<td>5</td>
<td>7</td>
<td>96%</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>TRAVEL-:</td>
<td>6</td>
<td>8</td>
<td>96%</td>
<td>100%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Programming example:

<table>
<thead>
<tr>
<th>RX FREE MIXER</th>
<th>MASTER CH:</th>
<th>SLAVE CH:</th>
<th>TRIM:</th>
<th>TRAVEL+:</th>
<th>TRAVEL-:</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;MIXER:</td>
<td>1</td>
<td>3</td>
<td>96%</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>MASTER CH:</td>
<td>2</td>
<td>4</td>
<td>96%</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>SLAVE CH:</td>
<td>3</td>
<td>5</td>
<td>96%</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>TRIM:</td>
<td>4</td>
<td>6</td>
<td>96%</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>TRAVEL+:</td>
<td>5</td>
<td>7</td>
<td>96%</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>TRAVEL-:</td>
<td>6</td>
<td>8</td>
<td>96%</td>
<td>100%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Programming example:
Assigning the gyro axes

Aileron servos: you should enter the value 2 in this line if your model has two aileron servos; in this case the gyro for channel (servo) 2 also acts on servo 5. If the ailerons are also used as flaperons or speedbrakes, gyro suppression is based on the sum of both channels.

**CAUTION:** the servo reverse setting must be the same for both aileron servos, i.e. either both 'normal' or both 'reverse'. If this is not possible, **on no account** should you reverse one servo in the transmitter menu. The only option is to re-install it in the model by turning it round physically.

However, **if your model is fitted with programmable servos** (e.g. Graupner DES, HVS or HBS types - see the instructions for the update program 'Firmware_Upgrade_grStudio - then it is possible to reverse the direction of rotation at the servo itself.

Please read the installation notes on page 22-23 of these instructions. The first step is to define the three gyro axes and the orientation of the receiver. This is accomplished by switching on the transmitter and model, and selecting ‘New setting: yes’ in the receiver’s ‘Gyro settings’ menu.

- Now move the stick for any control surface to full travel in one direction; in the following example we use the aileron channel.
- The detected axis (aileron) is highlighted (black background). (In the receiver’s default state the value for all axes is shown as ‘+0’; the axes can also be set manually to ‘+0’. 0 = inaktiv)
- Now turn the model through at least 45° in the direction corresponding to the stick movement. For example, if you moved the aileron stick to the left, you must simulate a left turn with the model -> move the left wing down through at least 45°.
- This process defines the one axis and direction; now you must repeat the procedure for the other two axes.
- The gyro axis 1, 2 or 3 is now displayed in the ‘Aileron / Elevator / Rudder’ display; a negative prefix will appear if servo reverse is activated.

Once all three axes are defined, the display automatically reverts to ‘New setting: no’.

**WARNING:** once you have completed this procedure, it is absolutely essential to check that all the gyros are working in the correct direction. This is accomplished by moving the model around all three axes in turn, and checking the control surface deflections - see diagrams below. You must not fly the model before doing this: crash hazard!
### AILERON

<table>
<thead>
<tr>
<th>Model movement</th>
<th>Control surface response (seen from the tail)</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Diagram" /></td>
<td><img src="image2" alt="Diagram" /></td>
</tr>
</tbody>
</table>

#### Adjust servolimit for channels

In this menu, you can limit the servo travel for all channels. Limit the servo travel to the maximum possible deflection, so that the servos can not run in the stop in the gyro operation. Move the cursor to the desired line (by further downward move of the cursor will be displayed further channels), here “1” for channel 1 Pressing the SET button is pressed the “SEL” field in “STO”.

<table>
<thead>
<tr>
<th>SERVOLIMIT T</th>
<th>&lt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: -150% +150% SEL</td>
<td></td>
</tr>
<tr>
<td>2: -150% +150% SEL</td>
<td></td>
</tr>
<tr>
<td>3: -150% +150% SEL</td>
<td></td>
</tr>
<tr>
<td>4: -150% +150% SEL</td>
<td></td>
</tr>
<tr>
<td>5: -150% +150% SEL</td>
<td></td>
</tr>
<tr>
<td>6: -150% +150% SEL</td>
<td></td>
</tr>
<tr>
<td>7: -150% +150% SEL</td>
<td></td>
</tr>
</tbody>
</table>

Now move the stick of channel 1 in the desired direction and position, while the corresponding percentage display is shown inverted. Now press the SET button again and the set value is displayed and stored. Go through the procedure for the other channels.

<table>
<thead>
<tr>
<th>SERVOLIMIT T</th>
<th>&lt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: -150% +150% STO</td>
<td></td>
</tr>
<tr>
<td>2: -150% +150% SEL</td>
<td></td>
</tr>
<tr>
<td>3: -150% +150% SEL</td>
<td></td>
</tr>
<tr>
<td>4: -150% +150% SEL</td>
<td></td>
</tr>
<tr>
<td>5: -150% +150% SEL</td>
<td></td>
</tr>
<tr>
<td>6: -150% +150% SEL</td>
<td></td>
</tr>
<tr>
<td>7: -150% +150% SEL</td>
<td></td>
</tr>
</tbody>
</table>

#### Programming the gyro settings

**PID (Proportional Integral Differential) correction**

The stabilising effect of the gyro sensors is based fundamentally on three parameters:

- **P factor**: defines proportional correction
  - P = proportional: if the intended value is not the same as the actual value, then the difference is fed proportionally into the corrective signal; in simple terms, the input value (e) is multiplied by a fixed value: \( u(t) = K_p e(t) \). \( K_p \) is termed the amplification value. The output value is therefore proportional to the gyro’s input value. Proportional correction cannot occur until a deviation from the intended value is present; if the deviation is 0, then the product is also zero. If the amplification value is set too high, the P factor causes the model to oscillate and become unstable.

- **I factor**: integral correction (not currently implemented)

- **D factor**: defines differential correction
  - D = differential: in this case the corrective output value is affected by the rate of change of the input value, i.e. the faster the model tilts around the axis, the more pronounced the corrective response of the gyro. If the model changes attitude very gently, then the D factor causes hardly any corrective action. It also makes absolutely no difference how far the model has already changed attitude; the crucial value is only the speed or rate of the movement. The rate of change is again multiplied by a factor (as with P correction) to produce the output value. For this reason pure D correction is not used; it must always be employed in combination with P correction.
CAUTION: before you start entering settings for a new model, it is essential to select the number of aileron servos in the Aileron servos menu point, and to define the gyro axes and orientation in the New settings menu point.

Aileron / Elevator / Rudder: shows the programmable P factors for the corresponding control surface.
Note: the gyro axes must first be defined under New settings (see section 3.4).
If you wish to disable the gyro, enter the value OFF in the appropriate control function.

P factor:
The P factor should always be set first, followed by the D factor (adjustment range in each case 0 to 10). A general rule is that the larger the control surface, the smaller the P factor required. Start with a factor of 2 (default setting), and do not exceed 4 - 5 as maximum value for the normal flight phase, 2 - 3 for speed, 3 - 6 for landing; the maximum value of 10 should be reserved for torque-rolls only.

WARNING: if you program separate flight phases, it is essential to select the appropriate flight phase when the model is in the air, as inappropriate gyro settings may cause the control surfaces to oscillate, possibly resulting in the loss of the model!

Note: the higher the model's speed, the more quickly oscillation may set in.

D factor: for a given P factor setting, the model's tendency to oscillate can be reduced by setting a lower D factor. However, if you select a lower setting for the P factor, then you may be able to set a higher D factor value before the onset of control surface oscillation. The gyro effect can be optimised by fine-tuning the D factor.

Note: the standard P and D values should cause the gyros to correct the model's attitude quickly when it is upset by an outside influence, without causing oscillation, but in practice the optimum values for a particular model can only be found by flight-testing. If the model displays little or no automatic stabilisation with the default settings, the value should be raised; on the other hand, if the model oscillates (wave-like movements in flight), the value should be reduced.
If your transmitter has spare proportional controls, you can use them to adjust the values while the model is flying. Some transmitters allow the corrective factors to be altered during a flight using the proportional controls, whereas others allow fixed values only.

Programming, transmitter with proportional controls

If your HoTT transmitter is equipped with proportional controls, it is also possible to adjust the P and D factors for each axis during a flight: what you might call ‘flying the settings’. You need to assign proportional controls (e.g. the sliders on the mc-20) to any channel in the range 5 to 16 (in this example channel 9); now you can alter the P factor (and the D factor) using these controls. In each case the current values are shown in brackets.

Procedure, using the ailerons as an example:

- Move the cursor to the appropriate line, in this case “Ail” for aileron.
- Press the SET button to activate the Channel field.
- Select the appropriate channel, and save the setting with pressing the SET button again
- Move the corresponding proportional control to alter the factor (adjustment range 0 - 10; 0 means no gyro correction for that axis).
- You can also adopt this factor directly by pressing the left button < or the right button >.
  This frees up the channel previously occupied by the proportional control, so that it can be used for some other purpose, e.g. for elevator or rudder.
- Move on to elevator and / or rudder, and select the channel and factor (you can either select the same channel, in order to alter all the axes simultaneously, or different channels, allowing you to program the axes individually).
- Move the cursor to the Factor line, where you can also change the P factor for aileron, elevator and rudder with priority (adjustment range up to 200%).
- Move the cursor to the D factor line, where you can alter the D factor for aileron, elevator and rudder with priority using a proportional control (adjustment range up to 200%; channel value -100% equates to a factor of 0%, channel value 0% equates to 100%, and +100% equates to 200%). This makes it a very easy matter to match the gyro’s corrective effect to the model’s airspeed. In particular, higher gyro gain can be used for the landing approach without the need to switch flight phases.
- Now test-fly your model and fine-tune the values one by one until your preferred stabilising effect is achieved without the model oscillating.
- It may be sensible or easier to activate the gyro for one axis only at first, and then to establish the optimum setting for that axis, rather than for several axes simultaneously.
Programming, transmitter without proportional controls

- Move the cursor to the appropriate line, in this case “Ail” for aileron.
- Press the SET button to activate the Channel field, select the appropriate value (1 - 10 of OFF), then press the SET button to save it.
- First select a low value (see P factor section for starting points) and carry out a test-flight. If gyro stabilisation is not sufficiently pronounced, increase the value step by step until the level of correction is as required; if the model already oscillates, reduce the value step by step.
- Do not select a channel (Ch5 - Ch16); this function is only relevant to transmitters with proportional controls.

- Move on to elevator or rudder and select the desired value (or OFF).
- Leave the settings for “Factor” and “Factor D” at OFF.
- It may be sensible or easier to activate the gyro for one axis only at first, and then to establish the optimum setting for that axis, rather than for several axes simultaneously.

Once you have found the optimum settings, you can set up a transmitter switch to control the gyro, i.e. for switching between gain settings. For example, you could assign a three-position switch to “Factor” and “Factor D”, and then use it to switch the values between 0% (OFF), 100% and 200%. If no switch is assigned to the factors, it means signal “OFF”. This does not correspond to switching off the system, but simply no switch has been selected and the pre-set value is 100%. (Otherwise the system would be ineffective if no switch is selected)

Flight phase specific settings
It is possible to use a channel to control the factor value by setting up flight phase specific transmitter control settings, but only if the transmitter is an MX20 / MC20 or MC32; please see the instructions supplied with your transmitter and refer to the “Transmitter control settings” and “Flight phase settings” menu points for more information.

**RECEIVER SETUP MENU FOR HELICOPTERS**

<table>
<thead>
<tr>
<th>Display</th>
<th>Explanation</th>
<th>Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>RECEIVER 1.0</td>
<td>1.0 indicates the version of the receiver's firmware</td>
<td>-</td>
</tr>
<tr>
<td>Type of Model</td>
<td>Selection of model type</td>
<td>Plane, Heli</td>
</tr>
<tr>
<td>ALARM VOLT</td>
<td>Alarm threshold for the receiver's low voltage warning</td>
<td>2.5 – 24.0 V</td>
</tr>
<tr>
<td>ALARM TEMP</td>
<td>Receiver overheating warning</td>
<td>50 – 80°C</td>
</tr>
<tr>
<td>max. altitude</td>
<td>Maximum altitude</td>
<td>0 – 2500 m</td>
</tr>
<tr>
<td>PERIOD</td>
<td>Cycle time in ms</td>
<td>10/20 ms</td>
</tr>
<tr>
<td>SUMD at K8 (6)</td>
<td>Digital sum signal at channel 8 (6)</td>
<td>Yes/No</td>
</tr>
<tr>
<td>Sensor at K9</td>
<td>Telemetry sensor at channel 9 (for GR 18 only)</td>
<td>Yes/No</td>
</tr>
<tr>
<td>LANGUAGE</td>
<td>Select menu language</td>
<td>English, French, German, Italian and Spanish</td>
</tr>
</tbody>
</table>
Maximum altitude (max. altitude): 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.

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".

HoTT sum signal (SUMD): If the digital sum signal is activated at channel 8 (6 for GR 18), a sum signal with 8 channels is issued from 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 specified servo socket, which is receiver-specific. At the time this manual was revised, this type of signal is used by several of the latest electronic developments relating to heavy-duty power supplies, etc.

**WARNING:** If you wish to use this option, you must observe the setup information supplied with the device connected to the receiver, otherwise there is a risk that your model may be uncontrollable.

---

### Installing the receiver

The receiver must be aligned at right angles to the helicopter on the receiver platform. Please ensure you always observe the installation instructions in section 3.1. Prior to installation, remove the sticker on the back of the receiver. We recommend using double-sided tape (order no.: 96382.1) to fix the receiver in place. The receiver must be connected to a stable power supply with at least two power cables. Comply with the maximum power consumption permitted by the servos.

**Caution:** The receivers may only be used in electric helicopter models.

---

### Preparing the helicopter

Set all servos to neutral; the arms must be at right angles and the swashplate must be in the neutral position (perpendicular to the main rotor axis). The swashplate pushrods must be the same length.

---

### Transmitter presettings

Select the free/deleted model memory and activate the helicopter model. All trims must be set to 0 and must not be altered in flight under any circumstances. If possible, trims should therefore be deactivated in the transmitter. With transmitters MX-20, MC-16/20/32 and mz-18/24, disable the trim in the menu. (Set trim increments to 0).

- Activate or retain the servo for swashplate type 1 (the swashplate mixer is implemented in the FBL system).
- The travel of the gas channel (K6) must be set so that a value close to -100% (servo display) is reached when the motor is off, as otherwise gyro calibration will not take place.
- Transmitter travel settings always remain at 100% for the basic settings.
- Do not connect the tail servo if it does not have a mid-point of 1.5 ms (standard).
- Swashplate servo arrangement at 120/135/140 degrees:
  - front left = 1, front right = 2, back = 3

- Bind the receiver to the transmitter
- Access the receiver's "Telemetry" menu and set the model type to "Heli" in the first row of the first screen
- Set all the servo settings on the transmitter to neutral (servo display 0%)
Initialising the gyro (helicopter)

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 approx. 3 seconds in the idle position, the swashplate moves briefly three times. 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.

Basic model settings (procedure)

1. Once the transmitter and helicopter have successfully been prepared, access the "Telemetry" menu in the transmitter (see transmitter manual) and switch to the "Base setup contr." menu.
2. Scroll past the swashplate/tail setup menus; these will be used later on.
3. You must work through each item of this menu in order from top to bottom:

Base setup controller

<table>
<thead>
<tr>
<th>BASE SETUP CONTR.</th>
<th>v</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotating dir</td>
<td>right</td>
</tr>
<tr>
<td>Swp type</td>
<td>140 Deg</td>
</tr>
<tr>
<td>Swp frequency</td>
<td>50Hz</td>
</tr>
<tr>
<td>Swp dir</td>
<td>+0</td>
</tr>
<tr>
<td>S1 mid</td>
<td>+0</td>
</tr>
<tr>
<td>S2 mid</td>
<td>+0</td>
</tr>
<tr>
<td>S3 mid</td>
<td>+0</td>
</tr>
</tbody>
</table>

Pressing the arrow keys on the right touchpad allows you to access additional menu items that are listed further down.

- Swp travel 7d: +100
- Collective_B: +100
- Cyclic max: +50
- Swp rotate: +0
- Tail servo: 1.5ms
- Tail frequency: 50Hz
- Tail mid: +0
- Tail limit B: +50
- Expo: Yes
- Logging: +3
- Expertmode: No

Rotating dir
Select the rotating direction for the rotor: right or left

Swp type
Swashplate type: select the correct swashplate type. 90°, 120°, 135°, 140°.
Default setting 140°
The roll servos are connected to channels 1 and 2, the nick servo to channel 3, and the tail servo may only be connected to channel 4 once the "Tail servo" parameter has been set correctly.
The motor control system is connected to channel 6.

Swp frequency
Swp frequency: frequency for the swashplate servos
Default setting: 50 Hz

⚠️ Warning: Analogue servos may only be operated at 50 Hz. If they are not, the servos will be destroyed. Many digital servos can be operated at a higher frequency. (Use at your own risk). This allows the model to be controlled more quickly. With HBS servos, we recommend setting the frequency to 200 Hz.
Swp direction
Default setting: 0
Here, the direction of rotation of the Swp servos is set so that the Swp does not tilt during pitching. Select the right setting from the options (pitch direction is set under K1 in the transmitter's servo menu, if required).

The direction of rotation of the swashplate is now monitored. If the model pitches upwards, the swashplate must move upwards in parallel. If the swashplate is travelling in the opposite direction, the servo reverse setting must be applied in the transmitter for the servo 1 settings and the roll and nick direction is set via the servo 2 and servo 3 servo reverse.

S1 mid, S2 mid and S3 mid
Default setting: 0
The swashplate should be aligned as far as possible at right angles to the main rotor axis. First, set the optimum mechanical settings and then set up the 3 servos in the menu. The swashplate is set up perfectly when the helicopter is able to hover on the spot.

Swp travel 7d
Default setting: +100
When the menu is activated, set the Swp cyclic travel to 7 degrees so that when the full roll command is applied (= 100% travel in the transmitter servo display), the rotor blades generate a cyclic travel that is as close to ±7° as possible on both sides. To do this, the field must be selected (highlighted) so that the swashplate can be controlled and adjusted in direct mode when gyro gain is switched off. This is the only mode in which the travel can be set correctly. It is very important that the travel is set correctly. It plays a major role in terms of acquiring the correct gyro gain. The setting should therefore be made as accurately as possible using a digital pitch gauge.

Collective_A/B
Default setting: 100
It is selected automatically based on the pitch stick travel on the transmitter. Use the pitch gauge to measure the required pitch travel when the full commands are applied (+-100%) and set it in this menu. All of the other settings can be made later on the transmitter for the pitch curves in the respective flying phase.

Cyclic max
Default setting: 50
Swashplate limit. The swashplate limit must be set so that it is not possible for a servo to reach its mechanical limits, while ensuring that the servo's travel is as large as possible. No humming should come from any of the servos when full travel commands are applied.

Swp rotate
"Swp rotate" = a virtual Swp rotation (in degrees) can be set here (for certain systems with several blades).

The Swp (swashplate) is now fully set up and you can move on to the tail:

Tail servo
Tail servo: select the correct mid-point for your tail servo here.

Mid pulse width: 1.5 ms, 760 μs or 960 μs.
Default setting: 1.5 ms. 1.5 ms is generally the default setting for tail servos. Narrowband servos (generally special tail rotor servos) may however require a different mid pulse width. You must locate this value in the servo manual and set it correctly. If a value has not been specified, it is probably a standard servo set at 1.5 ms. If you have a DES, HVS or HBS servo, this value can sometimes be programmed. However, we recommend sticking with the default setting.

Tail frequency
Tail frequency: the tail frequency can be set to between 50 and 333 Hz.
Default setting: 50 Hz

⚠️ Warning: Analogue servos may only be operated at 50 Hz. If they are not, the servos will be destroyed.

Many digital servos can be operated at a higher frequency. (Use at your own risk). This allows the model to be controlled more quickly. With HBS servos, we recommend setting the frequency to 333 Hz.

Tail mid
Default setting: 0
The tail servo arm should be at a 90-degree angle to the tail linkage pushrod.
The fine trim is then adjusted based on the mid-point of the tail. When the servo is set to neutral, the tail rotor should be set to a pitch angle of approx. 2 to 3° against the torque at the tail rotor.
Tail limit A/B
Default setting: 50
Limits the tail servo travel. It must be set so that it never reaches its mechanical limits but so that the full travel can be used. Values that are suitable in terms of aerodynamics should be selected here. If the travel is too large, this may cause the servo to stall.

Expo
"Expo" is set to "Yes" by default; this means that within the controller an exponential value of approx. 25% is used on the Swp and approx. 30% on the tail. The setting can also be made on the transmitter (dual rate/expo). To do this, set the value to "No"; however, you must set similar values on the transmitter for the first flight.

Logging
Logs the respective servo function on the SD card to carry out an evaluation and error analysis later on.
0 = no logging
1 = roll and nick logging
2 = roll logging
3 = nick logging
4 = tail logging
We recommend always logging at least one function.

Expertmode
"Expertmode" is set to "No" by default. Even experts should stick with this setting when carrying out the first steps with the new system (there are much fewer options in the Swp and tail menu) and they should only switch to Expertmode and its additional options if they need to and when they have got used to the system.

You have completed the basic model settings and can now move on to the following settings:

### Axis assignment

**Setup**
Yes/No
Assignment of the gyros and their operating direction.
If you have not already done so, you must now set the K1-4 servo directions so that everything works correctly.
In the receiver's "Axis assign" menu, go to the "Setup" option and set it to "Setup: Yes". Now assign the axes as follows:
- On the transmitter, briefly set the roll command fully to the right; the roll axis is highlighted. You will then have both hands free again to operate the helicopter.
- Roll the helicopter 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 helicopter 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 the tail: on the transmitter, briefly set the tail command fully to the right
- Turn the helicopter 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.
See the illustrations below.

Checking nick = Elv = elevator
Tilt the helicopter so that its nose is facing downwards; the swashplate must be controlled so that it stays horizontal.

Incorrect!                          Correct!

Checking roll = Ail = aileron
Tilt the helicopter to the right; the swashplate must automatically stay horizontal.

Incorrect!                          Correct!

Checking the tail direction of operation (viewed from the back)
Turn the tail to the left; the tail rotor blade must turn to the right. Turn the tail to the right; the tail rotor blade must turn to the left. **The helicopter and the tail rotor must move in opposite directions.**

If one of the directions of operation is wrong, you must repeat the axis assignment process.

The swashplate and tail parameters can be optimised in Expertmode to suit your helicopter model and flying style. However, we strongly recommend flying your model first using the settings without Expertmode. If the directions are changed on the transmitter due to any modifications being made to the helicopter (e.g. new servos) or if the receiver is installed in a different position, the teach-in procedure must be repeated in full.
Swashplate setting without Expertmode

**SWASHPLATE ADJUST**

>SWP sensitivity (5) K9

Direct stick +85

**SWP sensitivity**
Swashplate sensitivity, 1 – 10, Min or K5 – K16
Default setting: 5
The "SWP sensitivity" row allows you to specify a sensitivity setting either using the values 1 to 10 or by assigning a channel (K5 to K16) with a proportional control, which is used to control the value. Once you have found a satisfactory setting, this value can be applied as a fixed value by pressing the "right" or "left" button.
Different settings can then be used to adjust the sensitivity based on specific flight phases.
**If the values are too high:**
Overstabilisation; the helicopter responds to commands with just a slight delay and oscillates during high-speed flights.
**If the values are too low:**
Helicopter no longer hovers in a stable manner, susceptible to wind.

**Direct stick**
Default setting +85
The direct stick setting allows you to set the direct response of the helicopter to the pilot's commands. 3D pilots should test the response with values ranging between 80 and 95.
If the nick command stops abruptly, the helicopter will oscillate if the value is set too high.

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Swashplate setting with Expertmode

**SWASHPLATE ADJUST**

>SWP sensitivity (5) K9

Direct stick +85
P swp +100
I swp +70
D swp +25
Speedflight +20

Pressing the down ▼ arrow keys on the right touchpad allows you to access additional menu items that are listed further down.

(See above for swashplate sensitivity menu item)
(See above for direct stick menu item)

**P swp (proportional) swashplate**
Swashplate P-factor
Default setting: +100 (typ. 50 – 70)
The P swashplate option is responsible for effecting a harder stop with the swashplate. Higher values result in a faster stop. If the P values are too high, the helicopter and/or the swashplate will start to "oscillate". In such cases, the value must be reduced again.

**I swp (integral) swashplate**
Swashplate I-factor
Default setting: +70 (typ. 70 – 90)
The I-factor ensures constant rolling/nicking. Start with low values and only increase them until the roll and nick rates are constant.
D swp (differential)
D-factor for swashplate
Default setting: +25
The D swp D-factor influences the how the swashplate is stopped.
If the helicopter bounces somewhat when nick is stopped, this parameter should first be increased in 5-degree increments to test the nick stop.

Speedflight optimisation
Default setting: +20
When the helicopter is flying quickly in a straight line, it should fly precisely in one line/at one altitude and not in a wave form. If the helicopter flies in a wave form, the value can be increased until the helicopter flies straight. This parameter should generally not be changed.

Hovering stabilisation
High = stable hovering even when windy
Normal = normal stability when hovering
Low = agile for extreme 3D flying style

Tail rotor setting without Expertmode

TAIL ADJUST<v>
>Tail sensitiv. (5)K9

Tail sensitivity
Tail sensitivity: 1 – 10, MIN or K5 – K16
Default setting: 5
The “Tail sensitiv.” row allows you to specify a sensitivity setting either using the values 1 to 10 or by assigning a channel (K5 to K16) with a proportional control, which is used to control the value. Once you have found a satisfactory setting, this value can be applied as a fixed value by pressing the “right” or “left” button.
Different settings can then be used to adjust the sensitivity based on specific flight phases.
If the tail swings up, the corresponding value must be reduced.

Tail rotor setting with Expertmode

TAIL ADJUST<v>
>Tail sensitiv. (5)K9
P tail +80
I tail +70
D tail +15
Collect. torque +25
Cycl torq +8

(See above for tail sensitivity menu item)

P tail
Tail P-factor
Default setting: +80
The P tail option is responsible for effecting a harder stop with the tail. Higher values result in a faster stop. If the P values are too high, the tail will start to “oscillate”. In such cases, the value must be reduced again.
I tail
Tail I-factor
Default setting: +70
The I-factor ensures constant pirouetting. Start with low values and only increase them until the pirouettes are constant. If the values are too high, this will cause the tail to oscillate slowly.

D tail
Tail D-factor
Default setting: +15
The tail D-factor influences how the tail is stopped. If the tail bounces somewhat when the tail is stopped, this parameter should first be increased in 5-degree increments to test the tail stop.

Collect. torque  Cycl torque
Collect. torque  Cycl torque
Default setting: +25  Default setting: +8

These two functions work best when they are set together. In the event of fast pitch pumping and swashplate movements, the tail should remain stable even when load is applied. If the tail swings out briefly, the "Collect. torque" setting can be increased until the tail stops.
On the ground, you can easily check whether the tail is working against the torque.
As a rule, "Cycl torque" should be set 1/3 lower than "Collect. torque".

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.

Connect the adapter lead to the USB interface (order 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 "micro_gyro_swloader.exe" file. 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 (order no. 7168.6) in the selection window.

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 http://www.graupner.de.
Contents of the manufacturer’s declaration:
If material defects or manufacturing faults should arise in a product distributed by us in the Federal Republic of Germany and purchased by a consumer (§ 13 BGB), we, Graupner/SJ GmbH D-73230 Kirchheim/Teck, Germany, acknowledge the obligation to correct those defects within the limitations described below.
The consumer is not entitled to exploit this manufacturer’s declaration if the failure in the usability of the product is due to natural wear, use under competition conditions, incompetent or improper use (including incorrect installation) or external influences.
This manufacturer’s declaration does not affect the consumer’s legal or contractual rights regarding defects arising from the purchase contract between the consumer and the vendor (dealer).

Extent of the guarantee
If a claim is made under guarantee, we undertake at our discretion to repair or replace the defective goods. We will not consider supplementary claims, especially for reimbursement of costs relating to the defect (e.g. installation / removal costs) and compensation for consequent damages unless they are allowed by statute. This does not affect claims based on legal regulations, especially according to product liability law.

Guarantee requirements
The purchaser is required to make the guarantee claim in writing, and must enclose original proof of purchase (e.g. invoice, receipt, delivery note) and this guarantee card. He must send the defective goods to us at his own cost, using the following address:

Graupner/SJ GmbH, Service Department,
Henriettenstr.96, D 73230 Kirchheim/Teck, Germany
Service Department: tel. [0049] 7021-722130

The purchaser should state the material defect or manufacturing fault, or the symptoms of the fault, in as accurate a manner as possible, so that we can check if our guarantee obligation is applicable. The goods are transported from the consumer to us and from us to the consumer at the risk of the consumer.

Duration of validity
This declaration only applies to claims made to us during the claim period as stated in this declaration. The claim period is 24 months from the date of purchase of the product by the consumer from a dealer in the Federal Republic of Germany (date of purchase). If a defect arises after the end of the claim period, or if the evidence or documents required according to this declaration in order to make the claim valid are not presented until after this period, then the consumer forfeits any rights or claims from this declaration.

Limitation by lapse of time
If we do not acknowledge the validity of a claim based on this declaration within the claim period, all claims based on this declaration are barred by the statute of limitations after six months from the time of implementation; however, this cannot occur before the end of the claim period.

Applicable law
This declaration, and the claims, rights and obligations arising from it, are based exclusively on the pertinent German Law, without the norms of international private law, and excluding UN retail law.
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explains that the product:

Geräteklasse:
Equipment class
1

den grundlegenden Anforderungen des § 3 und den übrigen einschlägigen Bestimmungen des FTEG (Artikel 3 der R&TTE) entspricht.

Angewendete harmonisierte Normen:
Harmonised standards applied

Health and safety requirements pursuant to § 3 (1) 1. (Article 3 (1)a))
EN 301 489-1 V1.9.2
Schutzanforderungen in Bezug auf elektromagnetische Verträglichkeit § 3 (1) 2, Artikel 3 (1) b))
EN 301 489-17 V2.1.1 
Protection requirement concerning electromagnetic compatibility § 3 (1) 2, Artikel 3 (1) b))
EN 300 328 V1.7.1 
Maßnahmen zur effizienten Nutzung des Frequenzspektrums § 3 (2) (Artikel 3 (2))

Kirchheim, 17. April 2013
Ralf Helbing, Geschäftsführer
Graupner/SJ GmbH
Henriettenstraße 96
D-73230 Kirchheim/Teck Germany
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#33579: GR-18 +3xG + 3A + Vario
FCC ID: SNL-16006100
#33583: GR-24 PRO +3xG + 3A + Vario + Vario HoTT
FCC ID: SNL-16005800

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Die Adresse der Servicestellen außerhalb Deutschlands entnehmen Sie bitte unserer Webseite www.graupner.de.

For addresses of service points outside of Germany please refer to www.graupner.de/en/.

Pour adresses des points de service situés en dehors de l'Allemagne s'il vous plaît se référer à www.graupner.de/fr/.


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Garantie-Urkunde
Warranty certificate / Certificat de garantie
33579-GR-18/33583-GR-24

Übergabedatum
Date of purchase/delivery
Date de remise

Name des Käufers
Owner’s name
Nom de l’acheteur

Straße, Wohnort
Complete adress
Adresse complète

Firmenstempel und Unterschrift des Einzelhändlers
Stamp and signature of dealer
Cachet et signature du vendeur
## Environmental protection notes

The symbol on this product, its operating instructions or packaging gives notice that this product may not be discarded as common household waste at the end of its service life. It must be turned over to a recycling collection point for electric and electronic apparatus.

The materials can be recycled according to their markings. You make an important contribution to protection of the environment by utilizing facilities for reuse, material recycling or other means of exploiting obsolete equipment.

Batteries must be removed from the unit and disposed of separately at an appropriate collection point. Please inquire with local authorities about the responsible waste collection locations.