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Environmental protection notices

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.

This manual serves only as a source of information and can be changed without prior notification. Graupner accepts no responsibility or liability for errors or inaccuracies which may be contained in the information section of this manual.

Safety notices

Be sure to pay attention!

In order to enjoy your modeling hobby for a long time, please read these instructions thoroughly and give particular attention to the safety notices. You should also register right away at <https://www.graupner.de/de/service/produktregistrierung.aspx> since this is the only way for you to automatically receive current information about your product via email.

If you are a beginner with remote controlled model aircraft, ships or cars, you should really ask an experienced model pilot for assistance.

If this remote control system changes ownership, these instructions should surely be included with remote control system.

Intended usage

This remote control system may only be used for the purpose intended by the manufacturer, i.e. for the operation of *unmanned remote controlled models*. Any other usage is not permissible.

Safety notices

SAFETY IS NO ACCIDENT
and

REMOTE CONTROLLED MODELS ARE NOT TOYS
... because even small models can cause substantial property damage and/or personal injuries if they are not handled properly - even if caused by third parties.

Technical defects of an electrical or mechanical nature can lead to unexpected startup of a motor and/or parts being hurled through the air to pose a danger of injury to you and to others.

Short circuit conditions are to be avoided absolutely! A short circuit condition may not only destroy parts of the remote control system but, depending on the circumstances and the battery energy involved, may also pose acute danger of incineration or even explosion.

All motor-driven parts, such as aircraft or ship propellers, helicopter rotors, open gearboxes etc.

represent a constant danger. Contact with these parts must be avoided. A rapidly turning aircraft propeller can, for example, sever a finger. Also pay attention that other objects do not come into contact with driven parts.

When a drive battery is connected or a motor is running: **never** get into the danger zone of driving mechanisms.

Be sure to pay attention that motors do not start up unintentionally while performing programming operations. Disconnect the fuel supply or battery terminals to motors before programming.

Protect all units from dust, dirt, moisture and other foreign parts. Never expose these units to vibrations or excessive hot or cold temperatures. Remote control operation may only be performed under "normal" outdoor temperatures, i.e. within a range of -15 °C to +55 °C.

Avoid mechanical jarring and pressure stresses. Always check units for damage to housings and cables. Do not use units which have been damaged or become wet, even after they are dry again.

Only those components and accessories which we recommend may be used. Always use original *Graupner* plug and jack connectors which are made for one another out of the same materials.

When routing cables, pay attention that they are not stressed, unduly kinked or broken. The sharp edges of adjacent parts also represent a hazard for insulated conductors.

Be sure that all plug and jack connections are firmly seated. Do not pull on the cable to disconnect a plugged connector.

No modifications whatsoever may be made to units. Modifications will void the operating permit and all insurance protection.

Installing the receiver

The receiver is to be installed with a cushion of foam

rubber to afford protection against jarring; in aircraft models behind a strong rib, for a car or ship model the location must be protected against dust and spray water.

The receiver may not be mounted in direct contact with the hull or chassis as this would allow motor vibrations and/or roadway jarring to be transferred directly to the receiver. When a receiver system is installed in a model with a combustion motor, all receiver parts should always be protected against the intrusion of exhaust gases and oil residue. Above all, this applies to the model's ON/OFF switch, which is typically built into the model's outer surface.

Position the receiver such that connecting cables to the servos and the power supply are routed with a bit of slack and that the receiver's antenna is at least 5 cm away from any large metal parts or wiring except for other receiver wires/cables. In addition to steel, this also includes carbon fiber parts, servos, electric motors, fuel pumps and all sorts of cables, etc.

Optimally the receiver should be placed at a readily accessible location that is well away from all other equipment. Under no circumstances may a servo cable be wrapped around the antenna or routed close to it.

Make sure that cables near the antenna cannot move about during flight.

Routing the receiver's antenna

The receiver and its antennas must be positioned as far away as possible from drives of any kind. If the model's hull is made of carbon fiber material, the ends of the antennas must extend outside of the hull.

The orientation of antennas is not critical.

Nevertheless, a vertical (upright) installation of receiver antennas is advantageous. In the case of diversity antennas (two antennas), the second antenna should be oriented at a 90° angle to the first antenna.

Servo installation

Always mount servos with the provided rubber vibration-damper parts. Only in this manner can these parts be protected against excessively hard vibrations.

Installing control rods

Control rods must be installed such that they operate freely and smoothly. It is particularly important that all rudder levers are able to move to their full limits, i.e. not otherwise mechanically blocked.

In order to be able to stop a running motor at any time, control rods must be adjusted such that the carburetor tap is completely closed when the joystick and trim wheel are brought into their end idle position. Pay attention that no metal parts, e.g. as a result of rudder actuation, vibration, rotating parts, etc., rub against one another. Metal-to-metal contact causes electrical "noise" which can interfere with the correct operation of the receiver.

Transmitter antenna orientation

Transmission field strength is minimal in an imaginary line extending straight out from the end of the transmitter's antenna. This means that "pointing" the transmitter's antenna directly toward the model will not produce good reception but rather degrade reception.

When multiple remote controls are operating simultaneously, pilots should position themselves in a loose group. Pilots standing off to themselves not only endanger their own models but those of others as well.

However, when 2 or more pilots using 2.4 GHz remote control systems are closer than 5 m to one another this can lead to return channel overdrive which, in turn, will trigger a range warning much too early. Increase your distance between one another until the range warning ceases.

Pre-start checks

Before switching the receiver on, be sure the throttle control is at its Stop/Idle position.

Always switch the transmitter on first and then the receiver.

Always switch the receiver off first and then the transmitter.

If this sequence is not maintained, such that the receiver is still switched on when the corresponding transmitter is switched to "OFF", then the receiver may respond to other transmitters or general radio frequency noise. This can cause the model to execute uncontrolled operations that may cause personal injuries and/or property damage.

In particular, for models *equipped with a mechanical gyro*:

before switching off the receiver, disconnect the model's power supply to prevent the motor from revving up unintentionally.

The residual spin of a gyro often produces so much voltage that the receiver may falsely interpret a throttle signal! This will then cause the motor to start up unexpectedly.

Range test

Perform checks for proper operation and range before every *session*. Secure the model adequately in place and ensure that no one is in front of the model.

Perform a complete functional test on the ground and execute a complete simulated flight to exclude the possibility of system faults or problems with the model's programming. When doing this, be sure to follow the notices provided on pages 80 and 88.

Never operate the transmitter in Model mode, i.e. for flying or driving, without an antenna. Be sure the antenna is firmly seated in its socket.

Operating a winged aircraft, helicopter, ship or car

Never fly over spectators or other pilots. Never endanger humans or animals. Never fly in the vicinity of high-voltage wires. Do not operate the model in the vicinity of sluice locks or where real boats or ships are operating. Do not operate a model on public streets or highways, paths or plazas, etc.

Monitoring transmitter and receiver batteries

You must stop running the model to recharge the transmitter's battery no later than when low transmitter battery voltage triggers the "**Batt must be recharged!!**" display and acoustic signal.

Check the charge in batteries routinely, particularly the receiver's battery. Do not wait until the movements of controlled mechanisms are noticeably slower. Replace expended batteries before they cause problems.

The battery manufacturer's charging instructions are always to be followed, this includes mandatory adherence to the length of charging time. Never leave batteries being charged unattended.

Never attempt to charge primary batteries (non-rechargeable batteries) because they can explode.

All secondary batteries (rechargeable batteries) must be charged before every session. To avoid short circuit conditions, first connect the charger cable's banana plugs, polarity correct, into the charger and thereafter connect the charger cable's plugs to the transmitter and receiver batteries.

Disconnect all power sources from the model when it is not to be used for an extended period of time.

Never attempt to use defective batteries, damaged batteries or mixed-type battery combinations as a single group. Do not use mixed combinations of old and new batteries or batteries of different manufacture.

Safety notices

Capacity and operating time

The rule: "capacity is reduced with every successive recharging", applies to all batteries. Internal resistance increases at low temperatures to further reduce capacity. As a consequence, the battery's ability to provide current and hold its voltage is reduced.

Frequent charging or the use of battery maintenance programs can also result in gradual loss of battery capacity. Therefore the capacity of batteries should be checked at regular intervals, not in excess of every six months, and replaced if performance is found to be significantly deficient.

Purchase only genuine *Graupner* batteries!

Interference suppression for electric motors

All conventional electric motors produce sparks between their collector and brushes. Depending on the type of motor involved, this may cause more or less interference with the functionality of the remote control system.

The electric motors of a properly built system should therefore have interference suppression features. For electric drive models it is particularly important that every one of its motors is provided with proper interference suppression. Interference filters extensively suppress such disturbances and should always be included.

Follow the respective recommendations included in the motor's operating and installation notices.

For further details about interference filters, refer to the *Graupner* RC main catalog or in Internet at www.graupner.de.

Servo interference filters for extension cables

Order no. **1040**

The servo interference filter is necessary when an extended-length servo cable is used. This filter is attached directly to the receiver output. In critical cases a second filter can be attached to the servo.

Using electronic speed controllers

Choosing the right electronic controller is largely a matter of matching controller performance to the motor to be controlled.

In order to prevent an overload or damage to the speed controller, its current rating should be at least

half of the maximum locked-rotor current draw of the motor to which it is connected.

Particular attention is appropriate for so-called "tuning motors". Because of their low-turns coils these motors can draw a multiple of their rated current in a locked-rotor condition and this can lead to the destruction of the speed controller.

Electric ignition systems

Combustion motor ignition systems also produce interference that can negatively influence remote control functionality.

Always supply power to an electric ignition system from a separate, dedicated battery.

Use only interference-suppressed spark plugs, spark caps and shielded ignition leads.

Mount the receiver sufficiently far away from ignition system components.

Static charges

A remote control system will be destroyed by the magnetic shock waves produced by a lightning strike - even if the storm is miles away. Therefore ...

... stop flying right away if a storm is approaching. Static charging via the antenna also represents a lethal hazard.

Attention

- In order to fulfill FCC HF emission requirements for mobile transmitters, a distance of at least 20 cm must be maintained between this system's antenna and other persons when this system is operating. Operation of this system at a lesser distance is therefore not recommended.
- To avoid disturbance caused by the electrical characteristics and emissions of other transmitters, keep at least a 20 cm distance from other transmitters.
- Operation of the remote control system requires a correct program setting for the given country in the

Safety notices and handling regulations for Lithium-Ion (Lilo) and Lithium-Polymer (LiPo) batteries

transmitter unit. This is necessary for compliance with diverse regulations like FCC, ETSI, CE etc. Follow the respective instructions provided for this with the transmitter and receiver.

- Prior to every flight, perform a complete functional test, range test and execute a complete simulated flight in order to exclude the possibility of system faults or problems with the model's programming.
- Never program the transmitter or receiver while the model is being operated.

Care and maintenance

Never clean the housing, antenna, etc. with cleaning agents, gasoline, water or similar means. Use only a dry, soft cloth.

Components and accessories

As manufacturer of this equipment *Graupner* GmbH & Co. KG recommends only components and accessories which have been tested and approved by *Graupner* for their suitability, functionality and safety. If this recommendation is followed, *Graupner* accepts responsibility for the product.

***Graupner* cannot accept any responsibility for the parts or accessories of other manufacturers which have not been approved and *Graupner* cannot evaluate every individual product made by other companies to assess if they are safe to use.**

Liability exclusion / damage compensation

This manual serves only as a source of information and can be changed without prior notification.

Graupner accepts no responsibility or liability for errors or inaccuracies which may be contained in this manual.

Graupner cannot monitor compliance with the assembly instructions, the operating instructions or the conditions and methods under which remote control components are installed, operated, utilized or maintained. Therefore *Graupner* accepts no form

of liability for loss, damage or costs consequential to incorrect usage or operation or which can be attributed to same.

Unless otherwise prescribed by law, the obligation of *Graupner* to provide damage compensation, regardless of legal grounds, is limited to the invoice value of the quantity of *Graupner* goods contributing directly to the damage-inducing event. This does not apply if *Graupner* is found to be subject to unlimited liability pursuant to binding legal stipulations with respect to intent or gross negligence. As applicable for all highly technical products, observance of the following safety notices and handling instructions is essential for a long service life, fault-free operation, and harmless utilization of lithium/polymer batteries. These instructions are to be safeguarded. If the unit is transferred to another user, these instructions should certainly be passed along to the new user.

General notices

- Lilo-/LiPo batteries require particularly attentive handling. This applies to charging, discharging as well as for storage and other handling. Adherence to the following special specifications is necessary:
- Incorrect handling can lead to explosions, fire, smoke and poisoning hazards. Furthermore, disregard for instructions and warnings can lead to performance losses and other defects.
- The battery's capacity is reduced by every charge/discharge cycle. Storing the battery at temperatures which are too high or too low can also lead to a gradual reduction in capacity. In model operation, battery capacity drops to about 50 ... 80% of new battery capacity after about 50 charge/discharge cycles – even though all charge/discharge rules are followed. This is due in part to the high discharge currents and inductive currents caused by motors.
- Battery packs may only be connected in series or parallel in exceptional cases as cell capacities and

charged state can differ too greatly. This is why the battery packs we deliver are selected.

Special notices for charging Lilo-/LiPo batteries from *Graupner*

- Since *Graupner* GmbH & Co. KG cannot supervise the correct charging and discharging of cells, the entire guarantee is void in cases of improper charging or discharging.
- Never leave batteries being charged unattended.
- Only approved chargers with appropriate charging cables may be used for charging Lilo-/LiPo batteries. Any manipulation to the charger or charger cables can lead to severe damage.
- The maximum charging capacity must be limited to 1.05 times the battery's capacity.
Example: 700 mAh battery = 735 mAh max. charging capacity
- Use only the outlet-charger included with the set or a specially designed charger/discharger from *Graupner* to charge and discharge Lilo-/LiPo batteries, refer to page 17 or www.graupner.de.
- Ensure the settings for the number of cells or for final charging voltage and final discharge voltage are correct. Be sure to observe the operating instructions for your charger/discharger.

Other handling notices

- The battery to be charged must be placed on a non-combustible, heat resistant, non-conducting surface during the charging process. Combustible or readily ignited objects are to be kept away from the charging configuration. Batteries may only be charged under supervision.
- Lilo-/LiPo batteries connected in series within a pack may only be charged as a group if the voltage of individual cells do not differ by more than 0.05 V. The Lilo battery included with the set, order no. **33000.1** (changes reserved), is equipped with a special safety circuit such that

"compensation" for voltage differences between individual cells, by way of an otherwise typical balancer plug connection, is not necessary.

- Under these conditions *Graupner* Lilo-/LiPo batteries can be charged with a maximum of 2C (the value 1C corresponds to the cell capacity) charging current. At a voltage of maximum 4.2 V per cell and above, charging must continue a constant voltage of 4.2 V per cell until charging current drops below 0.1 ... 0.2 A.
- Charging voltage over 4.20 V per cell must be avoided absolutely as the cell would otherwise be permanently damaged and could cause a fire. In order to prevent the over-charging of individual cells in a pack, a cut-off voltage between 4.1 V ... 4.15 V per cell should be set to increase service life.
- Never attempt to charge battery cells with the wrong polarity. Abnormal chemical reactions take place when batteries are charged with reversed polarity and the battery will be useless. This can cause breaks, smoke and flames.
- The permissible temperature range for charging and storing Lilo-/LiPo batteries is 0 ... +50 °C.
- Storage: Lilo-/LiPo cells should have a 10 ... 20% charge capacity when stored. If cell voltage drops below 3 V, then Lilo-/LiPo cells must absolutely be recharged to a capacity of 10 ... 20% of full capacity. Otherwise, further deep-discharging of the battery will make it useless during storage in a discharged state.

Special notices for discharging Lilo-/LiPo batteries from *Graupner*

- A continuous current rate of about 1C does not represent a major problem for *Graupner* Lilo-/LiPo batteries. For larger currents, please follow the catalog specifications. In any case, observe the maximum current rating for the connector system, see maximum discharge current on the battery.

- Discharging below 2.5 V per cell damages cells permanently and is therefore to be avoided absolutely. The **MC-16** HoTT transmitter switches itself off when its power supply voltage reaches its lower limit of 3.3 V. Short circuit conditions are to be avoided absolutely. Permanent short circuits lead to destruction of the battery, high temperatures and perhaps even self-ignition may follow.
- During discharge, battery temperature must not rise, in any case, to over +70 °C. Otherwise, better cooling or a lower rate of discharge must be introduced. The temperature can easily be checked with the infrared thermometer, order no. **1963**. The battery must never be discharged via the transmitter's charging socket. This socket is not suitable for this purpose.

Other handling notices

- Never short-circuit the battery. A short-circuit allows very high current to flow and this heats up the cells. This will lead to loss of electrolyte, the production of gases and perhaps even explosions. In the vicinity of, or while handling, *Graupner* Lilo-/LiPo batteries, avoid electrically conducting surfaces because of the danger of creating a short-circuit condition.
- Handling connectors:
These connectors are not as robust as for other batteries. This applies particularly to the plus pole connector. The connections can easily be broken off. Due to thermal transfer, the connector tabs may not be soldered directly.
- Cell connection:
Direct soldering on battery cells is not permitted. The heat of direct soldering can damage battery components, such as separator or isolator. Battery connections should only be made by industrial spot welding. A professional repair made by the manufacturer or distributor is necessary to

replace missing or torn-off cables.

- Replacing individual battery cells:
The replacement of battery cells may only be made by the manufacturer or distributor and never by the user himself.
- Damaged cell usage:
Damaged cells may never be used or returned to service.
- Characteristics of damaged cells include:
damaged housing packing, deformed battery cells, electrolyte or leaking electrolyte. In these cases, further use of the battery is not permissible.
- Damaged or useless cells are hazardous waste items and must be appropriately disposed.

General warning notices

- Batteries must never be put in fire or burned.
- Battery cells must not be submerged in liquids, such as water, seawater or beverages. Any contact with liquids, of whatever nature, is to be avoided.
- Individual battery cells and batteries are not toys and must therefore not get into the hands of children. Batteries/cells must be kept out of the reach of children.
- Batteries must not get into the vicinity of babies or small children. If a battery is swallowed, immediately go to a doctor or emergency medical facility.
- Batteries must not be put in a microwave oven or put under pressure. Smoke, fire and more can be the consequences.
- Never dismantle a Lilo-/LiPo battery. Dismantling a battery can cause internal short-circuits. Gas, fire, explosions and other problems can result.
- The electrolyte and electrolytic vapors in Lilo-/LiPo batteries are harmful. Absolutely avoid all direct contact with electrolytes. If electrolytes come into contact with skin, eyes or other body parts, immediately wash out or rinse out with generous amounts of fresh water then be sure to consult

a doctor.

- Batteries built into equipment must always be removed from that equipment when it is not currently in use. Always switch off equipment after it is used to prevent deep discharging. Always charge batteries before it is too late. Store batteries on a non-combustible, heat resistant, non-conducting surface! Deep-discharged Lilo-/LiPo batteries are defective and may no longer be used!

Notice for remote control set MC-16 HoTT

Order no. **32032**

This remote control set is factory equipped with a Lilo transmitter battery (changes reserved). Once the factory preset voltage limit of 3.60 V has been reached, a warning will appear in the display.

Disposal of used batteries:

Some countries have laws requiring that all used batteries be turned over to an authorized collection center.

Disposing of batteries along with common household garbage is forbidden. Old batteries can be turned into communal collection centers for disposal at no charge or they can be returned to one of our dealerships or anywhere else where batteries of that given type are sold. Used batteries we have delivered can also be sent back to us, at your cost, through the mail. Use the return address below:

Graupner GmbH & Co. KG

Service: Used batteries

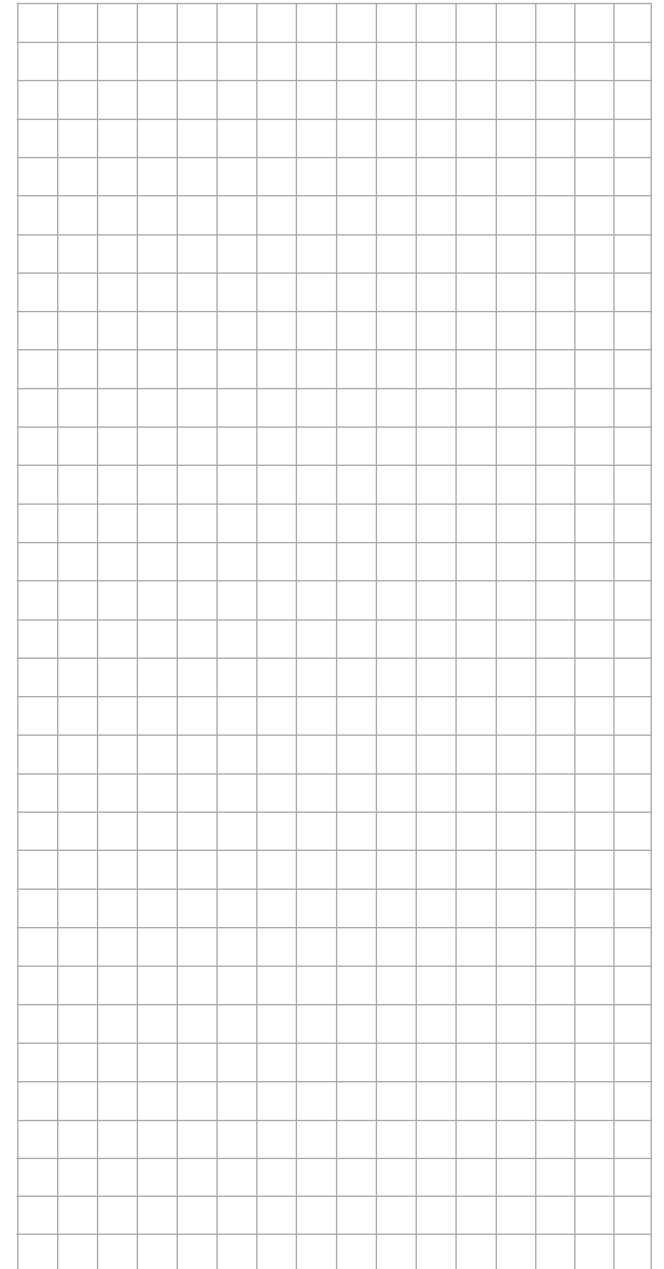
Henriettenstr. 94-96

D-73230 Kirchheim unter Teck

This represents an essential contribution to environmental protection.

Caution:

Damaged batteries require among other things, special packaging, because they are very toxic!



RC-16 HoTT the Newest Generation of Remote Control Technology

The technical advances across the entire spectrum of model building is an ever-present challenge to design engineers. This is why the introduction of new transmission technology in the 2.4 GHz band represents a new milestone.

The HoTT-System (**Hopping Telemetry Transmission**) developed by *Graupner* is a synthesis of know-how, engineering and testing done around the world by professional pilots.

Established *Graupner* HoTT techniques theoretically permit over 200 models to be operated at the same time. However, because of the interspersed radio-frequency utilization permitted by certification for the 2.4 GHz ISM band, this number is significantly lower in practical application. Nevertheless, in general more models can be operated simultaneously in the 2.4 GHz band than would be the case in conventional 35 or 40 MHz frequency bands. The real limiting factor is—as often before—is still likely to be the size of available operating space (i.e. airspace for aircraft). Alone the fact that it is no longer necessary to coordinate transmitting frequencies with other pilots in the vicinity (which is sometimes quite difficult in broken landscapes, such as on hillside slopes) represents an enormous boost for remote control operating security.

Bidirectional communication between transmitter and receiver, by way of a return channel built into the receiver, permits convenient access to data and programming in the HoTT receiver. For example, this makes it possible to swap receiver outputs or to divide up control functions among multiple servos (channel mapping). Servo travel and servo rotation directions in the receiver can also be matched to one another with these facilities. Telemetry data, like VARIO and GPS data, can be called up from optionally available modules.

Based on the **mc-24** *Graupner/JR* computerized remote control system, the **RC-16** HoTT remote

control system has been especially developed for experienced RC pilots. All conventional model types can be readily operated with the **RC-16** HoTT system, regardless of whether the model is a winged aircraft, helicopter, ship or land vehicle.

Complex mixed-control functions of guiding surfaces are often necessary for winged aircraft (rudder, elevators) and helicopter models (swashplate). Thanks to modern computer technology, very diverse model requirements can be programmed in the simplest conceivable manner with touch-sensitive keys (CAP Touch). Simply select the given model type from the **RC-16** HoTT program and its software will assemble all significant mixer functions and coupling functions automatically. This eliminates the need for separate modules in the transmitter to implement complex coupled functions and also makes sophisticated mechanical mixer mechanisms in the model unnecessary. For example, this makes the **RC-16** HoTT transmitter fully equipped with both software and hardware to operate the well-known NAUTIC modules on the receiver side. The "channel sequencer" is new. It permits the operation of up to three servos to be automated.

The **RC-16** HoTT system offers optimal security and reliability without having to forgo great operating convenience. The **RC-16** HoTT remote control system has 80 model memory locations. Additional flight-phase-specific settings can be stored in every model memory location. For example, such settings can be made for various parameters that can be called up to implement particular flight maneuvers at the "press of a button". Additional model memories can be stored on the SD card, which is included standard with the set. Even telemetry data can be recorded for subsequent evaluation on a PC.

Since the **RC-16** HoTT is equipped with two displays, the lower display has been optimized for comprehensible, simple operation of the software.

The graphic representation of mixer functions is particularly helpful. The upper display allows telemetry data to be called up from the receiver. Functionally-related options are clearly arranged by content in a simple organization. The clear, comprehensible program structure permits a beginner to quickly become familiar with the various functions and able to use all options pertinent to his level of expertise with remote control models.

This handbook describes every menu in detail. There are tips, many notices and programming examples to supplement the descriptions and also explanations for model specific technical terms, like transmitter control, dual rate, butterfly, and so on.

Please observe the safety notices and technical notices. Read through the instructions attentively. Before usage, test all functions by simply attaching servos to the receiver included in the set. While doing this, observe respective notes on page 68. This will help you learn the essential operating techniques and functions of the **RC-16** HoTT.

Always handle your remote controlled model with a sense of responsibility so that you do not endanger yourself or others.

The *Graupner* team wishes you much pleasure and success with your **RC-16** HoTT, the newest generation of remote control systems.

Kirchheim-Teck, December 2011

Computer System MC-16 HoTT

32 channel remote control set in 2.4 GHz-Graupner-HoTT technology
(Hopping Telemetry Transmission)



Technology that enthralls

The superior functional security of Graupner HoTT technology accomplished with bidirectional communications between transmitter and receiver with integrated telemetry, freely programmable voice output via headset connector, and ultra-fast response times.

Programming is simplified by a programming technique implemented with capacitive touch buttons.

High contrast, 8 line, graphic display for perfect presentation of all parameter settings. Switch on/off of blue back-lighting at will. A second, independent display for presentation of telemetry data. Storage of telemetry data on a micro SD memory card.

4096 steps of 12-bit resolution on the channel signal assures extreme control sensitivity. USB connection to read and write the model's memories as well as for making firmware updates

- Integrated Graupner HoTT 2.4 GHz transmission system
- Maximum interference immunity made possible by optimized frequency hopping through as many as 75 channels and wider channel spread
- Intelligent data transfer with correction function
- Over 200 systems can be used simultaneously
- The HoTT technique of bidirectional communication between sender and receiver, as well as the fastest possible transmission rate (10 ms) assures extremely short reaction times.
- 5 different languages (German, English, French, Italian and Spanish) available per software update. For the availability of a given language, refer to the download area.
- 80 model memories with storage for all model-specific programs and parameter settings
- Seven switches (two 3-way switches, three 2-way switches and two 2 pushbutton switches) as well as three digital actuators are already built-in and can be used as desired
- A function encoder with two touch-sensitive, four-way keys ("CAP Touch") permit simplified programming and precise settings
- Key-lock function to prevent unintentional operation.
- Voice and, as applicable also MP3 file, output over headset output or loudspeaker
- Simple, very fast model-independent binding
- Extremely fast rebinding, even at maximum distance
- Range: test and warning function
- Under-voltage warning
- Extremely wide receiver operating voltage range of 3.6 V to 8.4 V (functional to 2.5 V)
- Fail-safe, free channel assignment (channel mapping), mixer functions and all servo settings are simple to program

Computer System **MC-16** ~~HO~~ **HoTT**

32 channel remote control set in 2.4 GHz *Graupner*-HoTT technology (Hopping Telemetry Transmission)

- Binding of any number of receivers to the channel expansion (32 channels maximum)
- As many as four servos can be controlled simultaneously as a block in the SAME operating mode with a servo cycle time of 10 ms (digital servos only).
- Thanks to cycle time reduced down to as little as 10 ms, extremely short response times are achieved.
- Real-time telemetry evaluation in the transmitter display Additionally, telemetry data can also be selectively displayed by the SMART-BOX.

Additional HoTT features of the **MC-16**

- Super-fast response time through use of a fast main processor for data transmission.
- Micro-SD card for storage of telemetry data and for additional functions
- Obsolescence-proof through update capability over USB interface as well as via the micro-SD card
- The included Lilo battery (changes reserved) has a capacity of over 6000 mAh. This makes extremely long flight times possible and also reduces the number of charging repetitions.
- Modulation changeover per software: e.g. from "EXT. PPM" (e.g. Weatronic) to HoTT at the press of a button.
- Swashplate limiting: This function limits the swashplate's tilt angle to prevent the potential for mechanical collision in helicopter 3D operation at full-limit roll and pitch-axis
- Ring-limiter: functions similar to swashplate limitation but is used for control of up to three Voith-Schneider drives in ship models
- Channel sequencer for automating servo motion sequences of up to three servos, e.g. to automate the lowering of landing gear or to extend/retract drives in self-launching gliders
- Multi-channel function for operating *Graupner*

product line NAUTIC modules

- Digital trimming with pseudo »analog« endless pinions, effective per specific flight-phase
- Auto-trim function. The current joystick positions for trimming fixed-wing or helicopter models will be stored in trim memory at the press of a button. (Model »compensation«, activate switch and release joystick. The correction will be blended in »gently« upon return of the joystick.
- C1 changeover, brake/elec. motor: This changeover can be implemented very easily via enhanced flight phase programming. The pilot determines the joystick positions (forward/rear) at which the motor is to be switched off or the airbrakes are to be retracted.
- 16 control functions maximum
- Simplified arrangement of operating elements, such as joysticks, external switches, proportional controls and trim levers as control functions
- Protection against obsolescence is provided by virtue of a fast 32-bit operating system with modern flash memory that can be updated.
- Blue back-lighted MULTI-DATA-GRAPHIK-LCD monitor with significantly better legibility under unfavorable light conditions
- CONVENIENCE MODE SELECTOR to simplify changeovers between operating modes 1 ... 4 (e.g. throttle left/throttle right)
- Two freely programmable mixers for fixed-wing or helicopter models, each with freely selectable input and output functions; four curve mixers with innovative 8-point curve technology for easy to set and adjust curve values at up to eight points for throttle, pitch, tail or other non-linear characteristics. The arithmetic unit in the CPU employs an ingenious method of calculating polynomial approximations for truly-rounded, ideal MPC (multi-point curve) mixer curves

- Shifting curve mixer points can be done along both axes with the CAP touch pad keys
- Eight flight-phase programs can be individually adapted for each model and given a name. The switchover time is programmable separately.
- SUPER SERVO menu with a perfect overview of all servo setting data and simple parameter correction at four "levels": direction of rotation, mid-point setting, separate servo travel on both sides and separate travel limiting on both sides for 16 servos with a total of 96 setting options
- SUPER-DUAL-RATE, EXPO and EXPO/DUAL-RATE menu with 36 potential setting variants for three servo functions and six flight phases
- Practice-optimized multi-function menu for aerofoils and helicopter models. Entry of the number of aileron and flap servos automatically programs all necessary mixer functions in the multi-function "Wing mixers" menu. Differential aileron mixer, butterfly mixer, dual-flap mixer, automatic gyro set function and other special functions
- Helicopter swashplate mixer for 1, 2, 3, or 4 point steering.
- Selectable cycle time: 10 ms or 20 ms/30 ms, depending on receiver and operating mode
- A convenient timers menu with a system of eight stopwatches, alarm timer, countdown timer, laps counter and so on. Two running timers and one lap timer can be displayed at the same time in large characters.
- Stopwatch with history: In addition to the lap counter there is a "Time 1" which captures the switch-on time and a "Time 2" which records the ON and OFF times separately
- *Channel mapping* in the receiver allows free distribution of control functions.
- The travel distance and rotation direction settings

integrated into the receiver make it possible, for example, to match up *mapped* servos with one another

- The programmable fail-safe functions »Hold«, »Off« and »Move to preset positions« that are built into the receiver for every individual servo channel can be set separately
- A slot for FAT or FAT32 formatted SD and SDHC memory cards is available on the transmitter for log files and model programs

Model programs

- Transmitter operating time timer
- Flight phase switch assignments: six switches, two with a priority function. Every switch combination can be named freely. This makes the number of flight phases independent of the number of flight phase switches.
- Tail type normal, V-tail, Delta/flying-wing and 2 HR Sv 3+8 (which immediately makes two coupled elevator servos available without using free mixers or dual mixers)
- Flap count 4 AIL/4 FL: Full support of eight wing servos, even without use of free mixers
- Flight phase switching cutoff delay: the delay time can be switched off for individual channels on a flight-phase basis (e.g. for motor off in electric models or to activate/deactivate helicopter head lock).
Ten additional, user definable phase names: aside from the prescribed flight phase names, the user can also freely assign up to ten phase names of his own choice.
- Enhanced transmitter control menu: option to assign input-side mid-point setting for C1 control + trim as a transmitter control. A single input can be assigned to two switches for a true 3-way switch function.
- Wing mixers: New concept for the multi-flap menu

to simplify settings of one to eight wing servos on a flight-phase specific basis in a comprehensible manner without requiring the use of free mixers

- »Info« sub-option in the Base setup model menu
Any kind of additional information about every model can be entered here. This additional information will then appear in the newly designed model select function
- »Logical switches«: this function permits two switches to be coupled as »and« or »or« logic functions. The result can be employed as a virtual switch. Typical application: The activation of certain functions should only be possible in conjunction with other functions, e.g. wheel brake can only be activated when the landing gear is down. A number of functions which are normally independent of one another, are to be put in their base settings by way of an »Emergency switch«. This program automation can be activated by multiple switches that also select the appropriate program.
- Servo-middle setting range extended to $\pm 125\%$
- Number of flight phases: (fixed-wing: 8, helicopter: 7 + AR)
- Settable »Throttle too high« warning threshold in the helicopter menu, programmable switch-on warning
- Time-frame can only be stopped, and thus also erased, (if the timer switch is in its OFF position) by touching the center **ESC** key while the ◀▶ or ▲▼ selection keys are also being touched.
- Phase trim for all axes of fixed-wing models possible
- Hotkey for servo display: one tap on the ◀ and ▶ keys of the left CAP touch pad (touch sensitive keys) will call up the servo display directly from virtually all menus.
- Servo occupancy swap on the receiver output

- CAP TOUCH operating elements with key lock function to prevent unintentional operation.
- CAP TOUCH display change from the main menu to the telemetry main menu via **ESC**.
- Numerous telemetry displays, programming functions and evaluation functions are presented directly in the transmitter's screen
- Graphic presentation of model icons for the model type display (fixed-wing/helicopter)
- Built-in connector sockets for PC-USB interface, headset, SMART BOX, external RF module, DSC system. Prepared for teacher/pupil operation.
- Teacher/pupil system with or without cable for complete transfer; all settings are made on the teacher transmitter.
- Additional functions are planned for implementation via software update.

Computer System **RC-16 HoTT**

16 channel remote control set in 2.4 GHz *Graupner*-HoTT technology (Hopping Telemetry Transmission)

The set, order no. 33016, includes

- Microcomputer transmitter **RC-16**HoTT with built-in Lilo single cell six-pack/6000 mAh/3.7 V transmitter battery (change reserved)
- Electric outlet charger (4.2 V, 500 mA)
- *Graupner* bidirectional receiver, GR-32 Dual HoTT (order no. **33516**) for connection of up to 16 servos
- USB adapter/interface (order no. **7186.6**) including suitable USB cable for connection to a PC and an adapter cable for receiver updates
- Micro-SD card (2 GB) with an adapter for a card reader
- Sturdy aluminum transmitter case with foam cushioning (order no. **3080**)

Accessories

Order No. Description

71.26 Transmitter straps, *Graupner* HoTT

72.40 Transmitter straps, deluxe

Teacher/pupil cable for **RC-16** HoTT
see page 213

Replacement parts

Order No. Description

3080 Aluminum transmitter case, HoTT,
400x300x150 mm

33000.1 Transmitter battery, flat Lilo, single cell six-pack/6000 3.7 V TX

33002.1 Micro-SD card, 2 GB for HoTT transmitter

33032.2 Transmitter metal hanger for **RC-16**

33032.3 Hand rests for **RC-16** (2 piece)

33801 HoTT transmitter antenna

Technical data for the **RC-16** HoTT transmitter

Frequency band	2.4 ... 2.4835 GHz
Modulation	FHSS
Region	EURO or FRANCE, see page 261
Control functions	16 functions, 4 of these can be trimmed
Temperature range	-10 ... +55 °C
Antenna	collapsible
Operating voltage	3.2 ... 4.8 V
Current draw	about 500 mA
Range	up to about 4 000 m
Dimensions	about 252 x 252 x 60 mm
Weight	about 1,685 g with transmitter battery

Receiver **GR-16** Dual HoTT

Graupner HoTT 2.4 GHz technology gives the dual-receiver a new Hopping Telemetry Transmission high-frequency section with state-of-the-art components and software. The dual-receiver has two complete receiver sections and additional hardware antenna diversity. Reception is always switched over to the better antenna signal and, for transmitting, the antenna last used for receiving will always be used. Thus it is assured that return channel data is transmitted via the better positioned antenna. Parameters for receiver supply voltage, receiver temperature and signal strength are transmitted without any additional sensors.

The receiver has a connector for telemetry sensors and one for sum signal input or output.

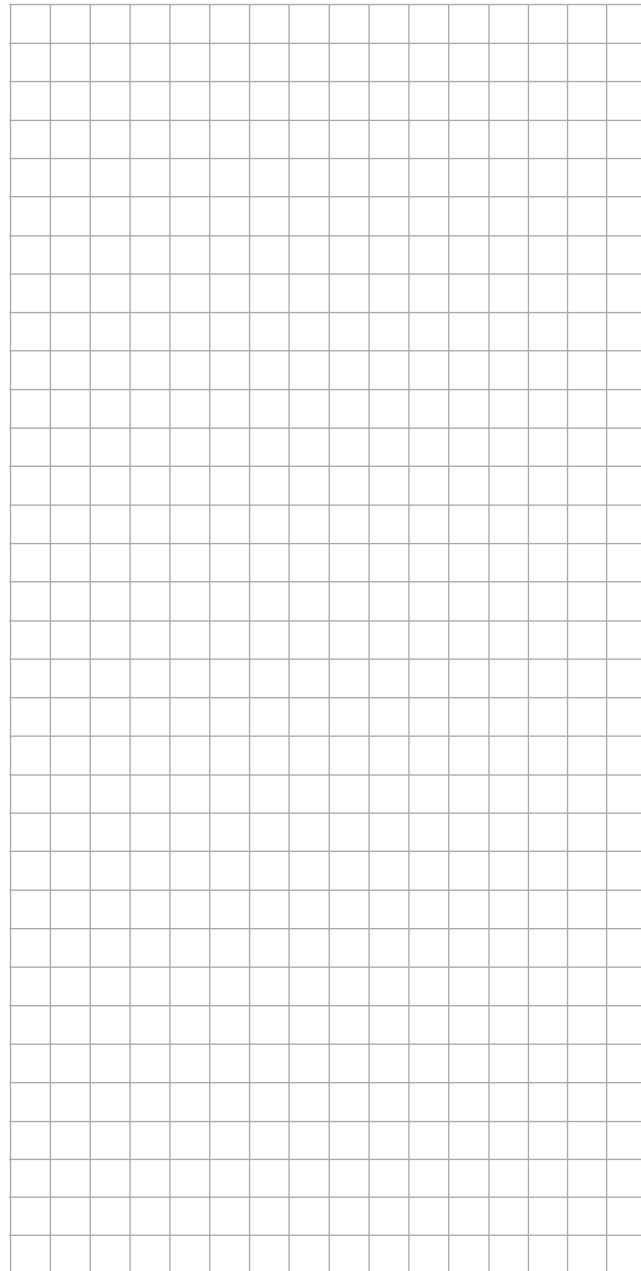
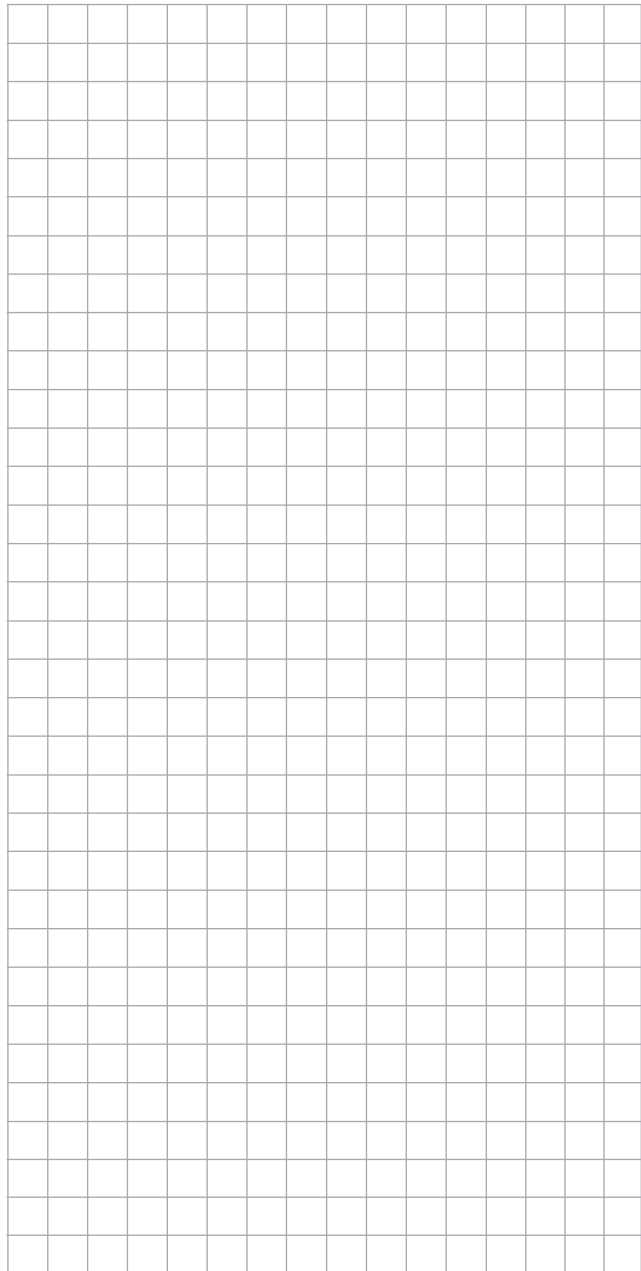
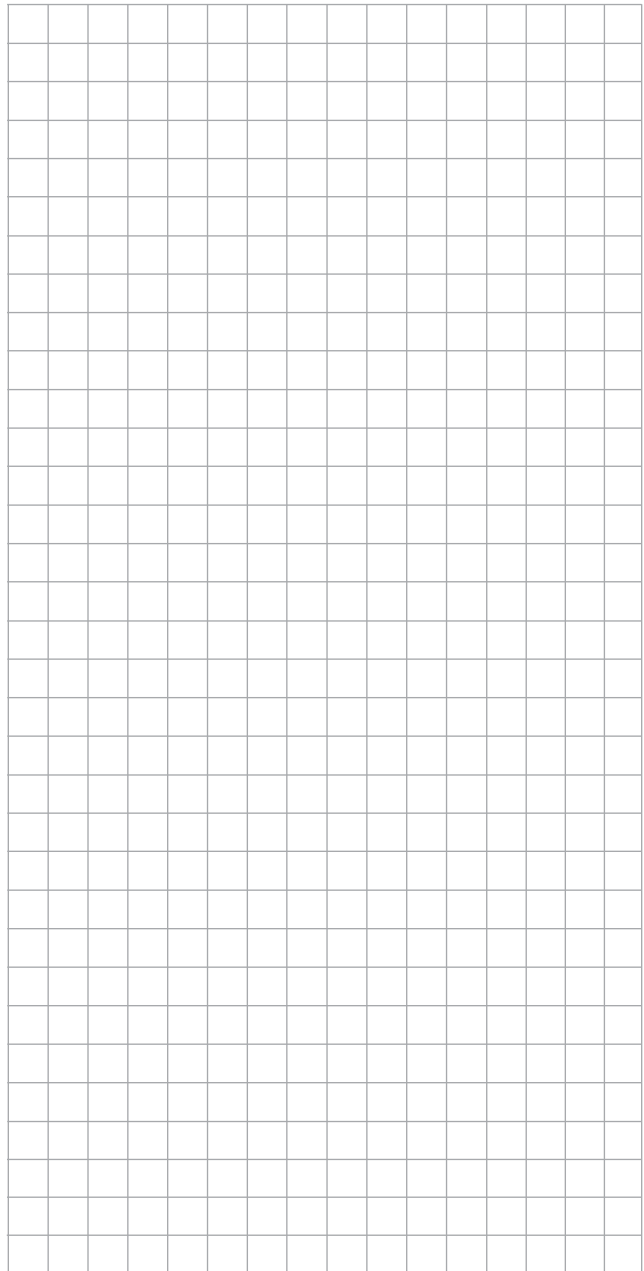
The receiver has six battery inputs to make it an excellent power source for even high-load servos.

Technical data for the **GR-16** Dual HoTT receiver Order no. **33516**

Operating voltage	3.6 ... 8.4 V*
Current draw	about 140 mA
Frequency band	2.4 ... 2.4835 GHz
Modulation	FHSS
Antenna	2 x 2 diversity antennas, about 145 mm long, about 115 mm of this length encapsulated and about 30 mm active
Plug-in servos	16
Plug-in sensors	up to four sensors
Temperature range	about -10 ... +55 °C
Range	up to about 5 000 m
Dimensions	about 63 x 30 x 14 mm
Antenna length	4 x wire 145 mm (active antennae 30 mm)
Weight	about 24 g

* The specification for permissible operating voltage range applies only to the receiver. Please note in this context that receiver input voltage is applied without regulation to connected servos but the voltage range for most connectible servos (speed controls, gyros, etc.) is only 4.8 to 6 V.

Other accessories in Internet at www.graupner.de.
Contact or visit your local dealer. He will be glad to provide advice.



General operating notices

Transmitter

Opening the transmitter housing

Switch off the transmitter before opening it (power switch to »OFF«). Push both housing base latches in the opposite the direction of the arrow marks, toward the inside, to their limits. Now tilt the transmitter somewhat to the rear so the housing base can flip open and can be unhooked. Close the transmitter's housing base by first hooking it to the underside, flip the base closed then push both latches toward the outside. When closing the base, pay attention that no cables are pinched.

Notes:

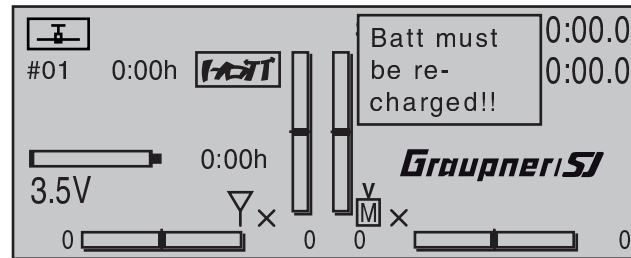
- **Make no modifications of any kind to the circuit boards as this will void the guarantee as well as the unit's official permit.**
- **Be sure not to touch the circuit boards with any metallic objects. Do not touch contacts with your fingers.**
- **Before performing any tasks inside the transmitter, disconnect the transmitter's battery (see next page) to avoid potential short circuit damage to the transmitter's circuit boards.**



Transmitter power supply

The **MC-16** HoTT transmitter is equipped with a high-capacity, rechargeable Lilo 1s6p/6000 3.7V TX battery (order no. **33000.1**) as standard equipment. (changes reserved) **However, the standard built-in battery is not charged upon delivery of the transmitter.**

When the transmitter is used, its battery voltage should be monitored by way of the indicators provided in the LCD display. If the voltage level preset in the "Battery warning" line of the »**General basic settings**« menu, page 260, (default setting 3.60 V) is underrun, an acoustic signal will be sounded and a warning message will appear in the display.



No later than now, operation must be terminated so the battery can be charged again.

Note:

Be sure the correct battery type is set in the »General basic settings« menu, page 260!
The standard setting for this is "Lith.".

Charge the transmitter battery with the plug-in charger.

The transmitter's rechargeable Lilo battery can be charged by way of the charger socket located behind a cover on the left, front side of the transmitter – as viewed from the front – with the included plug-in charger (order no. **32032.4**).

Depending on the state of discharge, the included plug-in charger (4.2V/500mA) requires up to about 15 hours to fully recharge the transmitter battery.

Never use plug-in chargers from other manufacturers or chargers intended for other battery types. Charger output voltage which is too high or possibly even different plug polarity, see further below, can cause immense damage. We recommend that this plug-in charger be appropriately labeled.

Also observe the safety notices provided on pages 4 ... 7.

The transmitter must be switched "OFF" during the entire charging procedure. Never switch on the transmitter when it is connected to the charger. Even a brief interruption to charging can cause charging voltage to rise to a level that will immediately damage the transmitter with over-voltage. Also for this reason, be sure all connectors are always plugged in securely and have good contact.



Charging with automatic chargers

To achieve quicker recharging of the single cell Lilo battery, Graupner automatic chargers can also be used. The table below shows a selection of these chargers.

Recommended chargers (accessory)

Order No.	Designation	Input voltage		suitable for battery types				integr. balancer
		220 V	12 V	NiCd	NiMH	LiPo/Lilo	lead battery	
6411	Ultramat 8	x	x	x	x	x		
6463	Ultramat 12 plus		x	x	x	x	x	x
6464	Ultramat 14 plus	x	x	x	x	x	x	x
6466	Ultra Trio plus 14	x	x	x	x	x	x	x
6468	Ultramat 16S	x	x	x	x	x	x	x
6469	Ultra Trio Plus 16	x	x	x	x	x		x
6470	Ultramat 18	x	x	x	x	x	x	x
6475	Ultra Duo Plus 45	x	x	x	x	x	x	x
6478	Ultra Duo Plus 60	x	x	x	x	x	x	x
6480	Ultra Duo Plus 80	x	x	x	x	x	x	x

Charger cable, order no. 3022 is additionally needed for the transmitter and charger cable, order no. 3021 is additionally needed for the receiver.

Other charger units and details about the listed chargers can be found in the Graupner RC main catalog or in Internet at www.graupner.de.

The charger socket is equipped standard with a diode to protect against reversed polarity. Original Graupner automatic chargers also detect battery voltage polarity.

Observe the configuration notices for the charger used.

First connect the charger cable's banana plugs to the charger and only then connect the cable's other end into the charging jack on the transmitter. Never allow the bare ends of the banana plugs to come into contact with one another when the other end of the cable is plugged into the transmitter.

Charging current may not exceed 1.5 A as otherwise the diode, and perhaps other components, could be damaged. If necessary, limit the current at the charger.

NC-16 HoTT charging jack polarity

The charger cables on the market from other manufacturers often have different polarities. Therefore use only an original Graupner charger cable, order no. 3022.



Removing the transmitter's battery

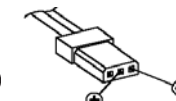
To remove the transmitter's battery, first unlatch the cover of the battery compartment on the rear side of the transmitter housing then remove the cover.



Take out the transmitter's battery then disconnect the transmitter battery's connector by carefully pulling on the supply line cable.

Inserting the transmitter's battery

The battery connector is protected against a reverse polarity connection by two slanted edges, see illustration. When correctly plugged in, the unconnected pin of the connector is at the bottom, as shown in the illustration. The plus pole (red lead) is in the middle and the minus pole (brown or black lead) is toward the antenna side.



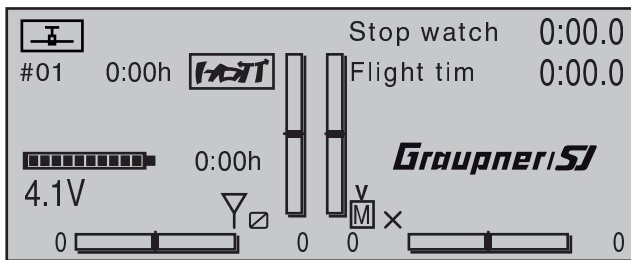
Never try to force the connector onto its circuit-board socket.

Place the battery into its compartment and close the transmitter's cover.

Battery operation timer at the bottom left of the screen

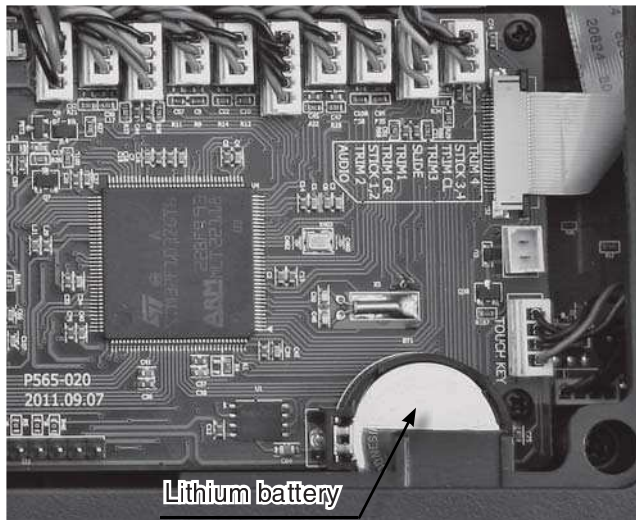
This timer shows the transmitter's cumulative operating time since the transmitter's battery was last charged.

This timer is automatically reset to "0:00" when the transmitter is switched on and its battery voltage is significantly higher than when the transmitter was last used, e.g. because the battery was charged.



Lithium battery, CR 2032

On the side of the transmitter board opposite the transmitter battery there is a fixture containing a lithium battery, type CR 2032, which can be replaced by the user.

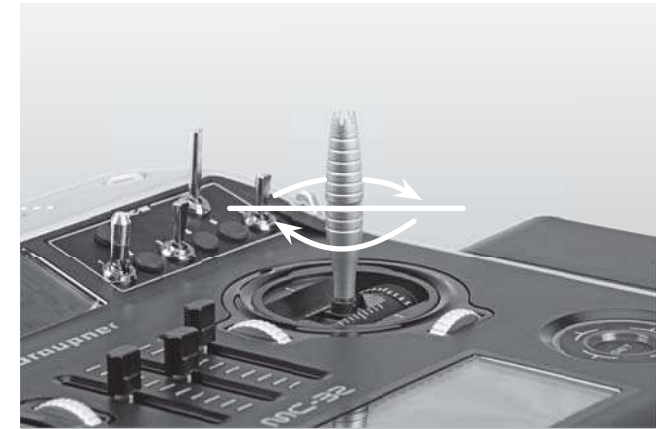


This battery maintains the date and time settings during a transmitter power supply outage, for example when the transmitter's main battery is being replaced.

Joystick length adjustment

The length of both joysticks can be continuously adjusted to adapt these transmitter controls to the pilot's preference.

Hold the lower half of the knurled grip in place then turn the upper section to release its counter-locked threads.



Now pull up or push down on the joystick's end to the desired length. When the length is suitable, tighten the counter-locked threads of the upper and lower sections again.

Joystick conversions

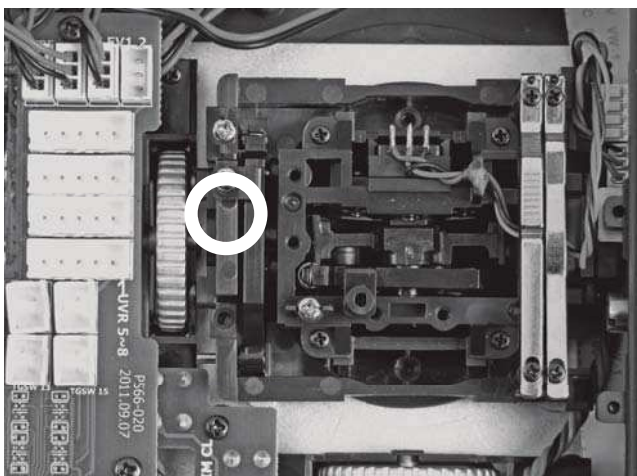
Neutralization

Both the left and the right joystick can be configured for neutralized or non-neutralized operation. Open the transmitter.

To change the joystick's factory setting, locate the screw shown in the figure below enclosed in a white circle.

Note:

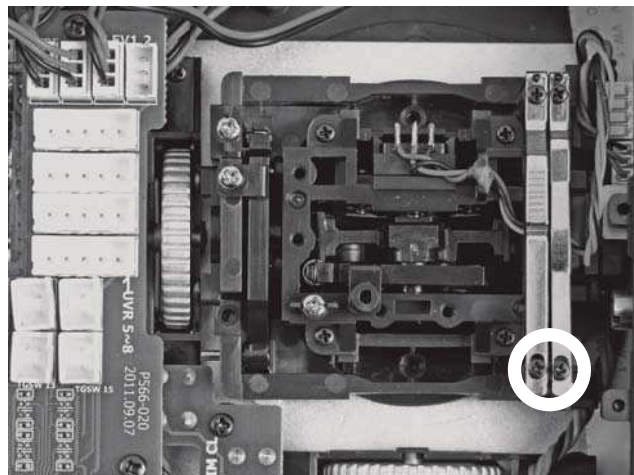
The aggregate for the right joystick is a mirror image of the left joystick so the corresponding screw for the right joystick is on the right side just below the middle.



Now turn this screw down until the respective joystick is free to move from limit to limit - or turn the screw out until the joystick again completely self-restoring.

Brake spring and ratchet

The outboard screw of the two marked in the next figure adjusts the braking force and the inboard screw adjusts the strength of the ratchet for the respective joystick.



Note:

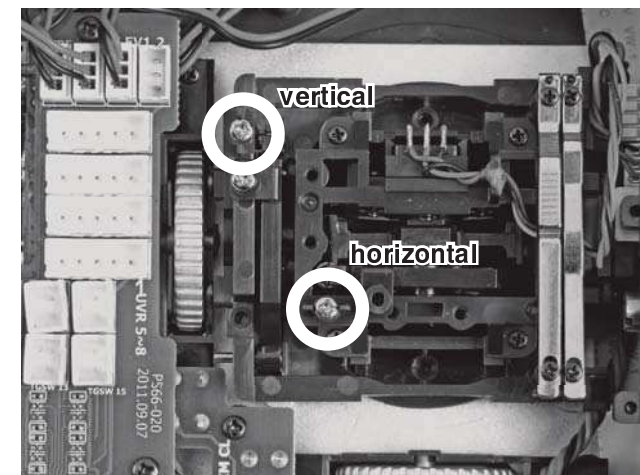
The aggregate for the right joystick is a mirror image of the left joystick so corresponding screws for the right joystick are located at the top left.

Joystick restoring force

The joystick's restoring force can also be adjusted to the pilot's preference. The adjustment is located next to the return springs, see markings in the figure below.

Spring force for the given direction of motion can be adjusted by turning the respective screw with a Phillips screwdriver.

- clockwise = stronger return,
- counter-clockwise = weaker return.



Note:

The aggregate for the right joystick is a mirror image of the left joystick so corresponding screws for the right joystick are located to the right of the middle.

Holder bracket for transmitter straps

A stable transmitter hanger for fastening neck straps is standard equipment on the **NC-16** HoTT transmitter.

To unfold the holder brackets, first press both brackets inward a bit near where they are lettered then turn them upward by 90°. The brackets will automatically lock into position.

If you have a neck strap fastened to the holder bracket with key-rings, first press lightly on the right holder bracket to release its latch so it can be folded down then do the same with the left holder bracket. Afterward, press both brackets **SIMULTANEOUSLY** into the recess.

The following straps are available as accessories:

Order no. Description

- | | |
|-------|--|
| 71.26 | Transmitter straps, <i>Graupner</i> HoTT |
| 72.40 | Transmitter straps, deluxe |



Installation of switches, switch modules and knob modules

There are a total of 20 holes in the transmitter's housing available for mounting accessory modules.

To be safe, always disconnect the transmitter battery before installation to avoid short circuit conditions. Be sure to pay attention that soldered points on the transmitter board do not come into contact with metal objects!

Unoccupied holes in the transmitter's housing are closed with blind plugs. These can easily be pulled out from the outside with one's fingernails.

Insert the accessory switch, etc. through a hole in the housing from the inside.

Accessory switches, potentiometers, etc. are fastened into place by screwing a nut onto the threaded shaft protruding through the housing and tightening it with a suitable wrench. If the control has a knob, it can be reattached after the nut is tightened down. Trim nut wrench (order no. **5733**) is well suited for tightening down these nuts.



Trim nut wrench (order no. **5733**) is well suited for tightening down switch element trim nuts.

Aligning the antenna

The removable, articulated antenna is to be screwed into the ball-joint connector then aligned by hand. The antenna exhibits very limited field strength straight out from its end, pointing it directly toward the model is wrong.

When screwing in the antenna, pay attention that the center pin in the antenna socket does not get bent or pressed back in the socket.



Transmitter description

Front side

Antenna

removable antenna, with kink and twist joint

Connector sockets

on the face side, protected by a cover, see beginning page 22

Function modules

Drum roller control: left "DG5", top "DG3", right "DG1"

Function modules

Knob control (depressible): left "DG4", right "DG2"

Option locations

for retrofitting the transmitter with switches and knob modules 8 switches included as standard equipment

Function module

rotary control: left-side "SD2", right-side "SD1"

Function modules

three sliders, "SR1", "SR2", "SR3"

Digital trim

For the fine-tuning of servo positions (travel neutralization). When turned, each click produces an increment of adjustment (position indicator in display). A press on the trim wheel will reset the trim adjustment.

left touch pad:



SET = select/confirm
touched for about 1 s: Changeover between telemetry menu and basic display

- . - = scroll in one of the four directions with every tap (◀, ▶, ▲, ▼)



simultaneous horizontal tap (◀▶)

= changeover between basic display and servo display



simultaneous vertical tap of the left (▲▼) keys + "SET" of the right touch pad = changeover to the "secret options", see page 32.

LC Display (more details available on page 28.)

Telemetry indicators: receiver parameters, standard. Other indicators dependent on the data from the optional sensors connected.

ON/OFF switch (ON/OFF with LED display)

Note:

Always switch on the transmitter then the receiver. When switching off, first switch off the receiver then the transmitter.

LED indicators

BATTERY: illuminates when voltage is sufficient

RF: illuminates during RF radiation

WARNING: blinks, for example, when "Throttle too high", "no pupil signal", "Transmitter battery voltage too low", ...

Loudspeaker

Joystick

Two joysticks for a total of four independent control functions. The length of the joysticks can be adjusted. The correlation of control functions 1 ... 4 can be set on a model type basis by way of the »Basic settings, model« and »Control adjust« menus, e.g. throttle left or right. The throttle joystick can be converted from neutralizing to non-neutralizing, see page 19.

touch sensitive keys, left and right

LC Display (more details available on page 28.)

Contrast adjustment: a simultaneous tap on (▲▼) + "SET" of the right touch pad = change to "secret options"

Warning indicators:

- for underrun of preset battery voltage threshold
- for fault function of the teacher/pupil system
- C1 joystick too far toward full throttle when transmitter is switched on
- ...

right touch pad:

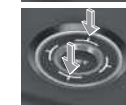


SET = select/confirm

{ } = scroll or change value with every touch of one of the four direction symbols (◀, ▶, ▲, ▼)



Circle with the finger around the circumference = scroll/change values. Alternative values selection with the left touch pad (◀, ▶, ▲, ▼)



or simultaneous tap on ▲▼ or ◀▶ = **CLEAR**

Face-side connections

Charger jack

The **MLC-16** HoTT transmitter's charger jack becomes accessible after turning the *left* face-side cover away.



The transmitter's rechargeable Lilo battery can be charged by way of the charger socket located behind a cover on the left, front side of the transmitter – as viewed from the front – with the included plug-in charger (order no. **32032.4**).

Maximum permissible charging current with Graupner automatic chargers: 1.5 A.

Never use plug-in chargers from other manufacturers or chargers intended for other battery types. Charger output voltage which is too high or possibly even different plug polarity, see further below, can cause immense damage.

More information about charging the transmitter's battery can be found on page 16. Observe the safety notices on pages 7 ... 9 when handling lithium batteries.

DSC / Direct Servo Control

The acronym "DSC" is a carryover which stands for the original "Direct Servo Control" function. However, in HoTT systems the "direct servo control" function is no longer available via a diagnose cable due to technical reasons.

Once the left face-side cover has been moved away, the **MLC-16** HoTT transmitter's DSC socket is accessible:



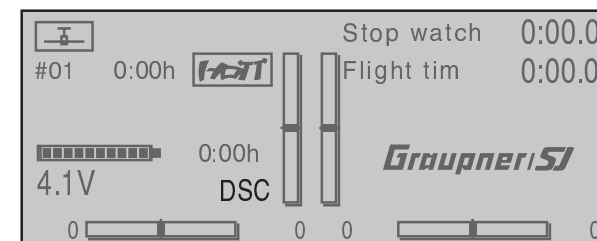
The standard two-pole DSC jack in the **MLC-16** HoTT transmitter is used as the teacher or pupil jack as well as an interface to flight simulators.

To ensure a proper DSC connection, please observe:

1. Make any necessary menu changes.
Refer to the section beginning on page 210 to adapt the **MLC-16** HoTT transmitter to a teacher/pupil system.
2. When operating a flight simulator or when operating the **MLC-16** HoTT transmitter as a *pupil* transmitter, **ALWAYS** leave the transmitter's ON/OFF switch in the "OFF" position as only in this position does the transmitter's RF module remain inactive after the DSC cable is inserted. This also reduces the transmitter's power consumption somewhat.

Only the "BATTERY" LED should remain constantly illuminated and the transmitter's basic display should show the character string "DSC" below the operating time clock. At this time, the display of

telemetry data and symbols will be suppressed.



The transmitter's upper display will show the message "CANNOT RECEIVE DATA" during this time.

Thus the transmitter is ready for operation.

In contrast, the **MLC-16** HoTT transmitter in teacher mode is to be switched on *prior* to plugging in the respective cable.

3. Connect the other end of the cable to the desired unit in compliance with the given operating instructions for that unit.

Important:

Pay attention that all plugs are inserted securely into their respective sockets and use only the prescribed 2-pole TRS connector plugs on the DSC-side.

4. In the line "DSC Output" in the »**Basic settings, model**«, page 81 or 88 or the line "Pre-set DSC Output" in the »**General basic settings**«, page 258, – depending on the number of functions transferred – one of the following modes can be set: PPM10, PPM16, PPM18 or PPM24. Default setting: PPM10.

Notice about flight simulators:

Because of the myriad of flight simulators available on the market, it may be necessary to have the contact layout of the audio plug or DSC module appropriately modified by Graupner Service.

Mini-USB connector

Connector jack for software updates as well as for changing date and time from a PC with a Windows XP, Vista or 7 operating system.



The USB cable, order no. **32032**, which is included with the set is to be connected to this jack. The procedure for carrying out a software update via a PC is described on page 43.

The PC software required, as well as the suitable USB driver, can be found on the download page for the given product on the Graupner website at www.graupner.de.

Once the necessary driver and software is installed on the PC, this USB connection can be used to update the transmitter or even just to set the transmitter's date and time.

To set the transmitter's date and time by way of this jack, refer to the »**Info display**« menu, beginning page 266.

Data jack

The so-called "DATA jack" is located at the right of this group of connector sockets.



This jack is intended for connection of the optional Smart-Box, order no. **33700**.

Details about the Smart-Box can be found with the given product in the *Graupner* RC main catalog or in Internet at www.graupner.de.

Card slot

micro SD and micro SDHC

The **MC-16** HoTT transmitter's card slot for type micro-SD and micro-SDHC memory cards becomes accessible once the *right* face-side cover has been turned away.

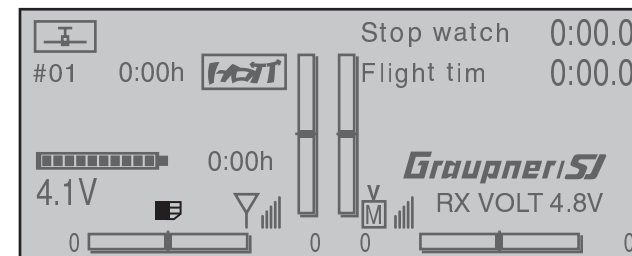


All conventional micro SD memory cards up to 2 GB and micro SDHC cards up to 32 GB storage capacity can be used. However, as a manufacturer we recommend the use of memory cards no larger than 4 GB as this is completely adequate for all normal situations.

The type of memory card to be used in the transmitter is that known in conjunction with digital cameras and cell phones. It is to be pushed into the slot, contacts up, until it latches, see photos above.

Once the memory card has been inserted, the transmitter's cover flap can be closed again.

The stylized image of a memory card will appear in the basic setup screen to indicate the presence of the inserted memory card.




Removing the memory card

Press the SC card a bit further into the card slot to

release the slot's latch then pull out the memory card.

Data acquisition / storage

The storage of data on the SD card is coupled to the flight timer. If this timer is started – when a suitable memory card is inserted in the card slot and a telemetry link to the receiver exists – data acquisition is also started. Data acquisition will stop again when the flight timer is stopped. The flight timer is started and stopped as described in the section "Timers (general)" on page 153.

While data acquisition is ongoing, the on-screen card image  will blink continuously at a slow rate.

The amount of data written on the memory card is presented as a black bar graph which grows from left to right as data fills the memory card.

After a data acquisition session is finished, there will be an (empty) folder "Models" and a "LogData" folder on the memory card. Within the "LogData" folder there will be log files in sub-folders that are designated with names in the format 0001_year-month-day.bin, 0002_year-month-day.bin, etc. If a model memory folder is still "unnamed" when the memory card is removed from the transmitter and inserted into the card slot of a PC or laptop, the respective log files can be found in a sub-folder designated "NoName". There is a PC program available on the transmitter's download web page at www.graupner.de with which the stored data can be evaluated on a compatible PC.

Importing voice files

As mentioned in section "Headsets", here at the right, the transmitter's acoustic signals as well as those signals and announcements associated with the telemetry menu can be output by way of the headset connector. These announcements are made in German language by default. These announcements are summarized in a voice packet which is stored in a transmitter-internal memory but can be replaced by a

voice packet of a different language at any time. More information about this can be found in the section »**SECRET MODE**« beginning on page 32.

Importing/exporting model memories

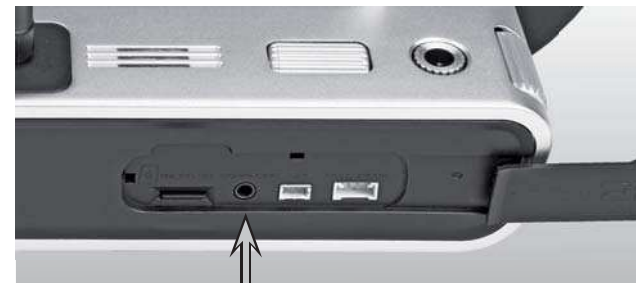
Any model memory can be stored to an inserted memory card or from an inserted card into the transmitter. This feature is intended to support data exchange between identical transmitters or even use as data backup. More information about this can be found in the section »**Copy / Erase**« beginning on page 71.

Note:

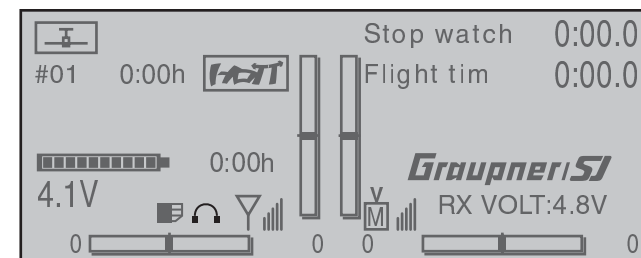
Some special symbols that can be used in model names are subject to specific restrictions associated with the FAT or FAT32 file system used by the memory cards and these special symbols will be replaced during the copy process with a tilde (~).

Headset connector

Once the right face-side cover has been moved away, the **MC-16** HoTT transmitter's headset connector is accessible:



The jack is intended for connecting conventional earplugs or a headset by way of a 3.5 mm TRS plug. (not included in the set) An appropriate symbol will appear in the basic display when a headset is connected.



The transmitter's acoustic signals as well as those signals associated with the telemetry menu are output via this connection. These announcements are made in German language by default. More about this can be found under "Voice output" in the section »**SECRET MODE**« beginning on page 32 and »**Telemetry**« beginning on page 228.

The volume of signals and voice output sent to the headset can be adjusted individually in the lines "Voice volume", "Vario volume", and "Touch-beeps vol." of the »**General basic settings**« menu, page 259.

EXT.PPM

An external RF module, for example a WEATRONIC module, can be connected to this jack, see illustration below.



An external RF module, for example a WEATRONIC module, can be connected to this jack.

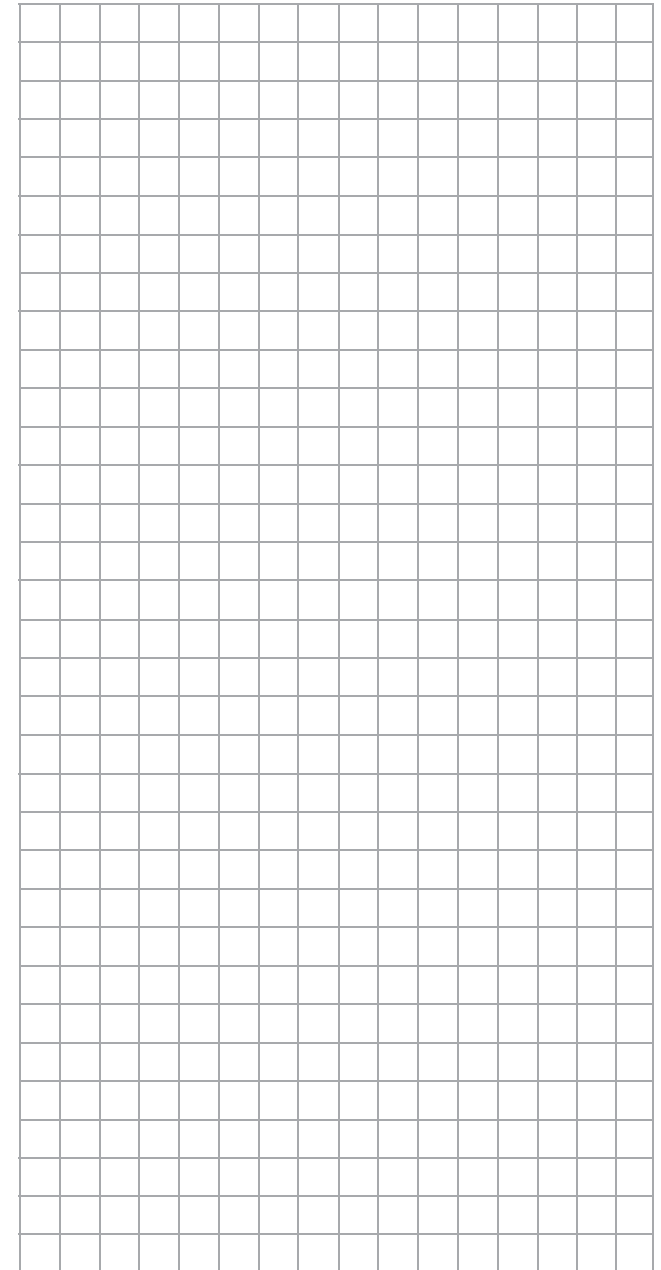
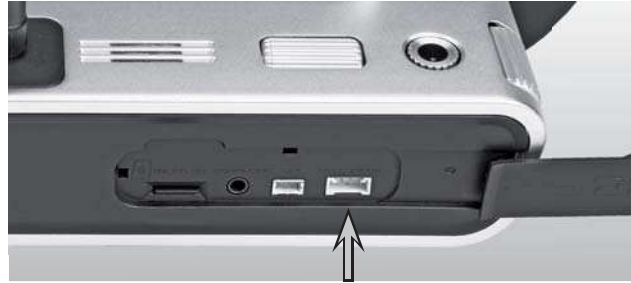
If an external RF module is attached, then switching between the external module and the internal HoTT RF module is accomplished in the "Module" line of the »**Basic settings, model**« menu, page 77 or 85, by selecting either "HoTT" or "EXT.PPM". If necessary, the signal provided on this connection can be inverted by selecting the appropriate option for the line "ext. PPM signal" in this same menu, see page 83 or 92.

Note:

The "INT PPM" socket located inside the transmitter is also suitable for this purpose. However, a connecting cable must be passed through to the outside of the transmitter housing by way of one of the module openings originally intended for a switch.

SPI

The designation "SPI" stands for an interface for future applications. This socket is currently non-functional and may not be connected.



Bottom side transmitter interior

Notes:

Disconnect the transmitter battery at its connector when performing any type of work inside the transmitter. Never allow solder points to come into contact with objects as this can create short circuit conditions.

All jacks and plugs not described are to be left unconnected.

INT PPM plug-in location

One free plug-in location for connecting an additional – internal – RF module

Plug-in location

One free plug-in location for a proportional rotary control module, order no. **33001.11**

Plug-in locations

Six free plug-in locations for additional switches are standard, see page 21
These switch plug-in locations can be used in any sequence.

Plug-in locations (UVR, 5-pole)

eight free plug-in locations for future rotary control installations.

Transmitter battery

Observe charging rules, see page 16

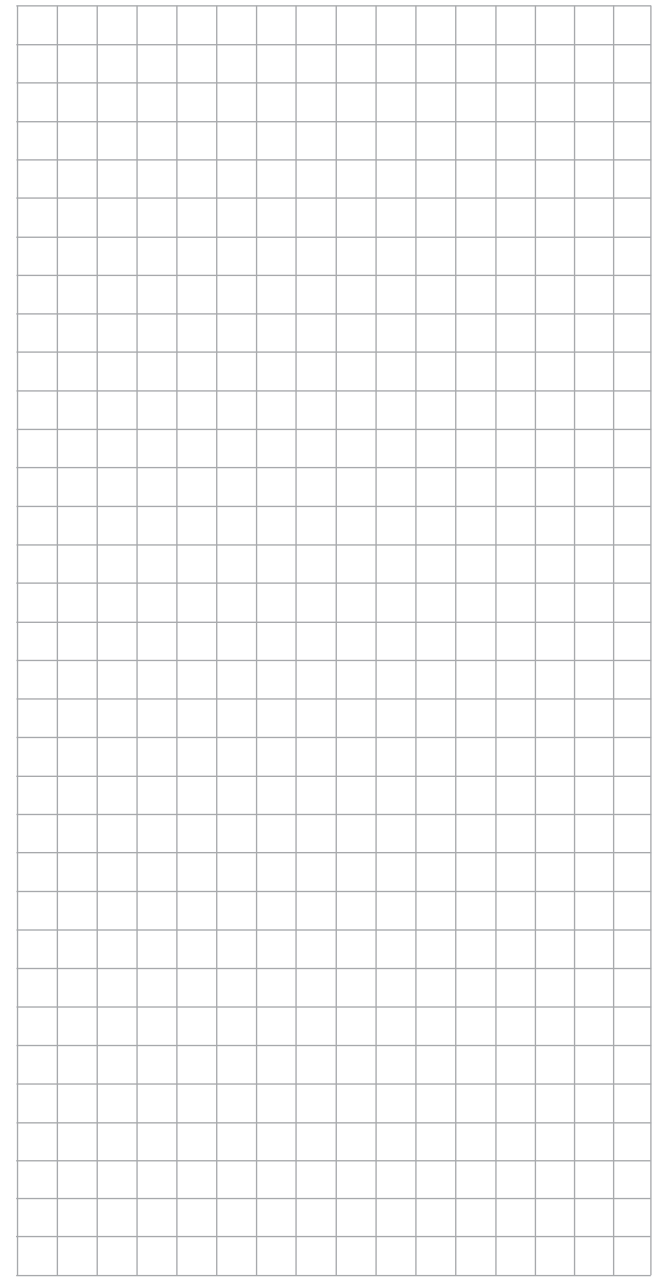
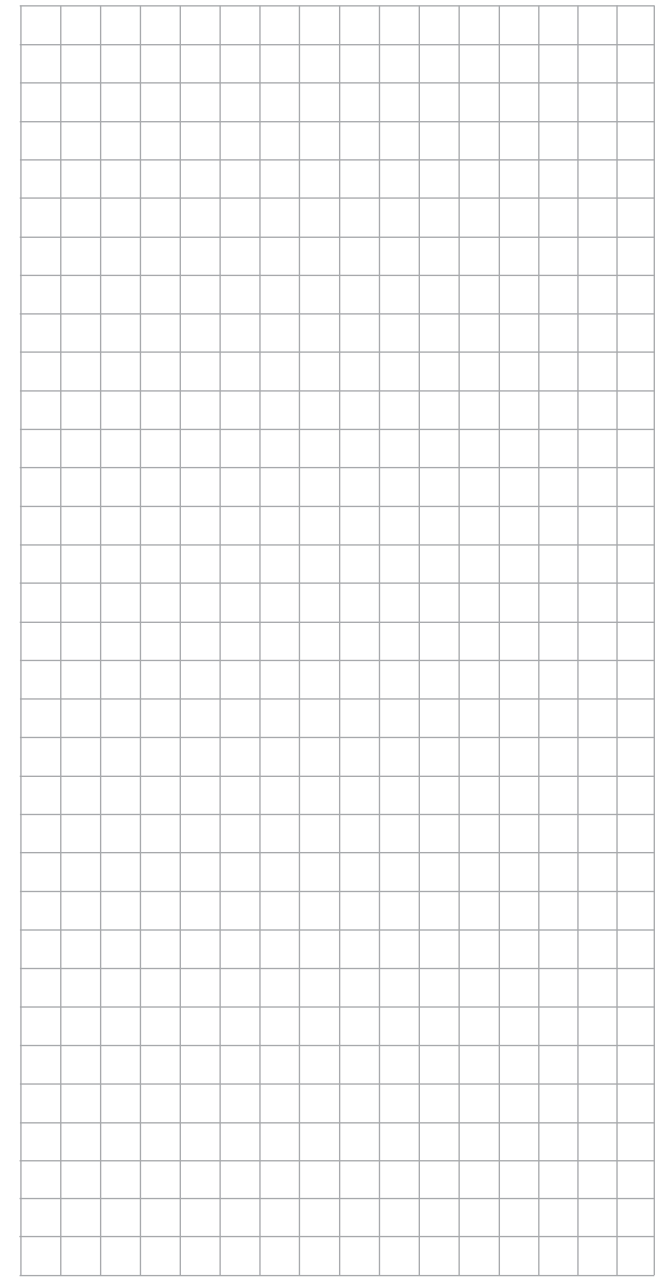
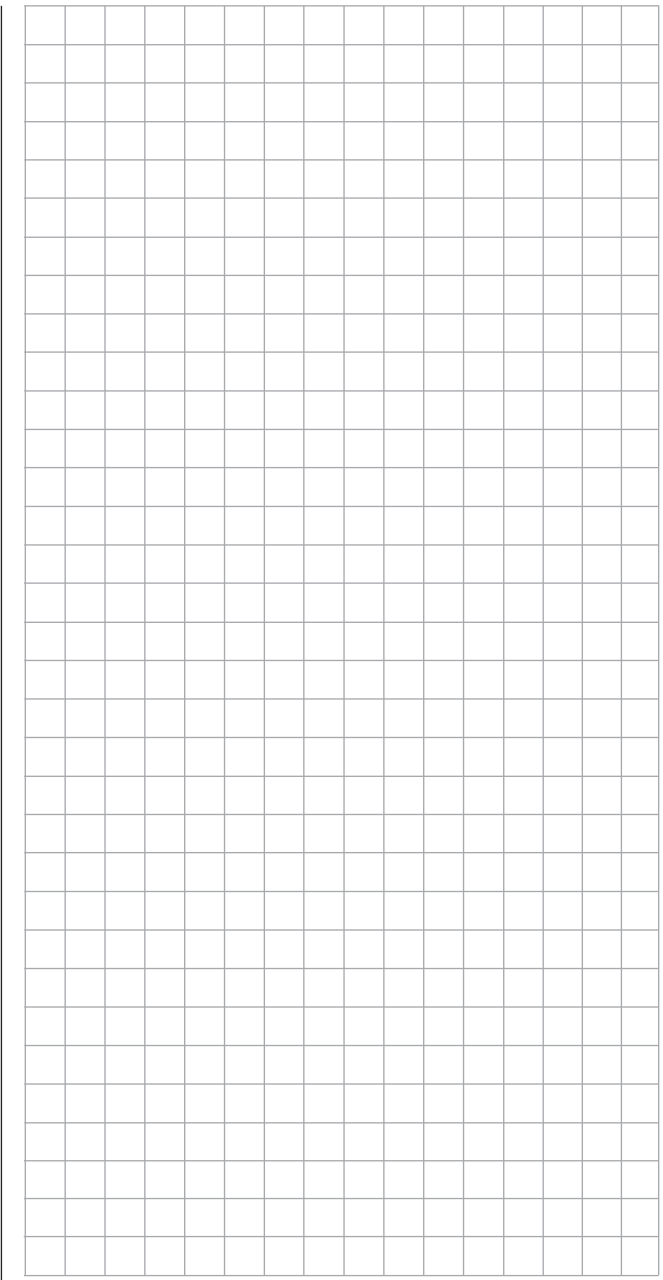
Transmitter battery plug

For charging the battery and a list of suitable automatic chargers, see page 17

Lithium battery CR2032 (not rechargeable)

Independent backup for the transmitter's date and time settings, see »Info display« menu on page 266.





Display and keypad

left touch pad:



SET = select/confirm
SET touched for about 1 s: Changeover between telemetry menu and basic display

← → = scroll one of the four directions with every tap: (←, →, ▲, ▼)



simultaneous horizontal tap (← →) = changeover between basic display and servo display



simultaneous vertical tap of the left (▲ ▼) keys + "SET" of the right touch pad = changeover to the "secret options", see page 32.

Model memory location 1 ... 80

Model type indicator
winged model, helicopter

Owner name

Model name

Model operating time

Operating mode
HoTT/PPM

No pupil signal!

Throttle too high!

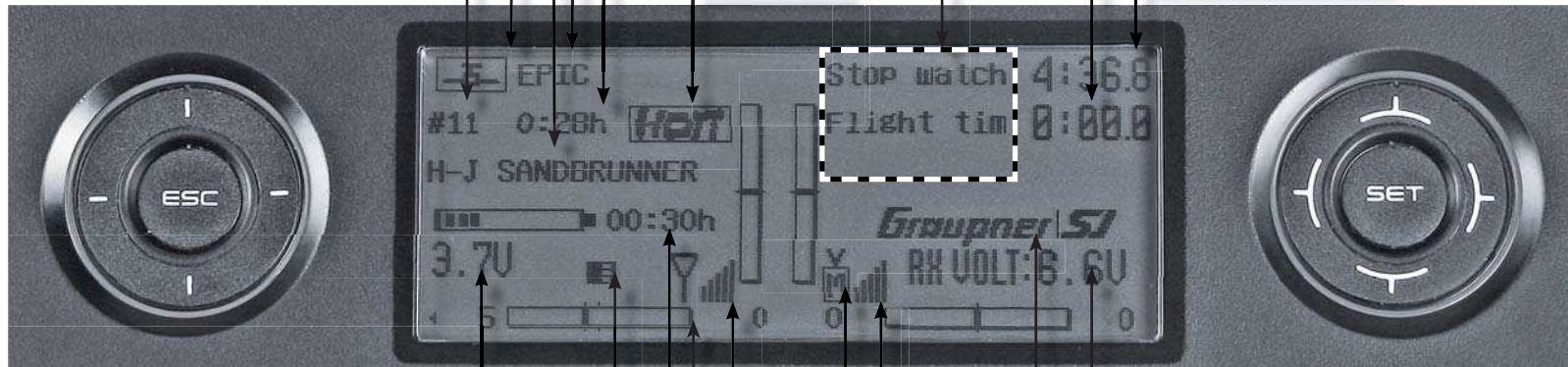
Batt. must be re-charged!!

Fail Safe setup t.b.d.

A selection of potential warnings and notices. More about this on page 30.

Flight timer in min:s

Stopwatch in min:s
(upward/downward)



Transmitter battery voltage with dynamic bar indicator. If the lithium battery voltage underruns the 3.60 V (adjustable) threshold a warning message will appear and an acoustic warning will sound. (switchover for NiMH batteries.)

micro-SD card inserted

Transmitter operating time This will automatically be reset to zero after a charging process.

Display diagram for all four digital trim levers with numeric indicator and direction indicator

M=Model operation
P = Pupil (pupil transmitter)

Signal strength

Graupner/SJ logo or flight phase name

Receiver battery voltage RX-SPG

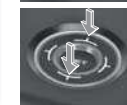
right touch pad:



SET = select/confirm

○ = scroll or change value with every touch of one of the four direction symbols (←, →, ▲, ▼)

Circle with the finger around the circumference = scroll/change values. Alternative values selection with the left touch pad (←, →, ▲, ▼)








simultaneous tap on ▲ ▼ or ◀ ▶ = CLEAR

Operating the "data terminal"

Entry keys **ESC** and **SET**

Display symbols

Displayed telemetry symbols

-  the active model memory has not yet been "bound" to a HoTT receiver. More about the "Binding" process can be found on page 77 and 85.
-  Switched off on RF transmitter side
blinking antenna symbol:
The last receiver bound to the active model is inactive or out of range
-  no telemetry signal to receive
-  signal strength indicator of the connection to the model
-  signal strength indicator of the connection to the pupil transmitter in the display of the teacher transmitter for wireless teacher/pupil operation

Keys left of the display

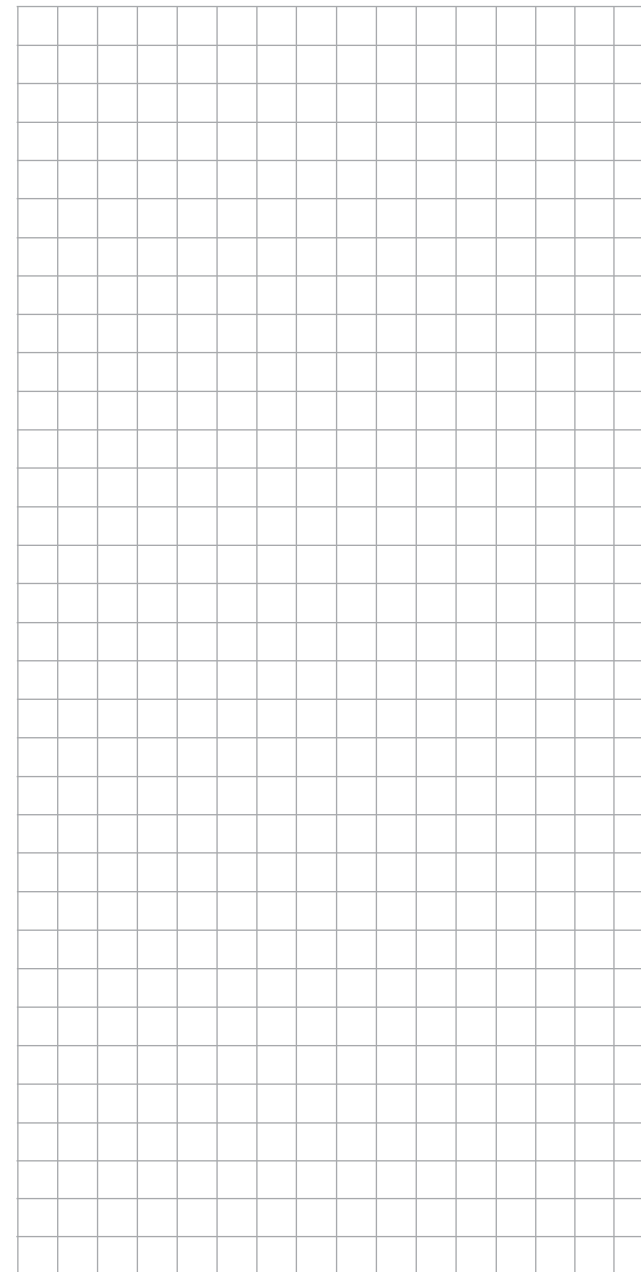
- **ESC** key
each brief tap on the **ESC** key will cause a stepwise return in function selection or even further to the base screen. Any changes made to settings remain.
Momentarily touching the **ESC** key for about 1 s while in the base screen will open and close the Telemetry menu.
- Selection keys ◀ ▶ ▲ ▼
 1. A tap on one of these keys will scroll, appropriate for the given arrow direction, through lists, such as through the model selection list or the multi-function list or within menus through the menu's lines.
 2. A brief simultaneous tap on the ◀ ▶ keys will cause a switch from the transmitters base screen, as well as from almost any menu position, into the »**Servo display**« menu.

Keys to the right of the display

- **SET** key
 1. After switching the transmitter on, a brief tap on the **SET** key will cause a jump from the displayed base screen to the Multi-function menu. In the same manner, a selected menu can now be called up with the **SET** key.
 2. Within menus having settings, activate / deactivate (confirm) the given setting fields with a tap on the **SET** key.
- Selection keys ◀ ▶ ▲ ▼
 1. "Scrolling" through the Multi-function menu and menu lines within the Basic Settings menu analogous to the selection keys of the left touch pad or by "circling" over the four selection keys.
 2. Select or set parameters in setting fields after their activation with a tap on the **SET** key, whereby the ▶ ▲ and ◀ ▼ keys will have the same given function. In this case it is completely irrelevant which of these two keys are used.
 3. A brief simultaneous tap on the ▲ ▼ or ◀ ▶ keys will set a changed parameter value in the entry field back to its default value (**CLEAR**).

Notes:

- *Touching the given touch pad does not itself initiate the given action but rather the end of the touch.*
- *In the event the touch pads do not exhibit any functionality immediately after switching the transmitter off and then on again right away, this is not a fault. Just switch the transmitter off again then wait for several seconds before switching it on again.*



Shortcuts

The following key combinations can be used to directly call up certain menus and options:

- **CLEAR**

A brief simultaneous tap on the ▲▼ or ◀▶ keys of the right touch pad will reset a changed parameter value in the active entry field back to its default value.

- »**Servo display**«

A brief simultaneous tap on the ◀▶ keys of the left touch pad will change from the transmitter's base screen or from almost any menu position to the »**Servo display**« menu, see page 262.

- »**Telemetry**« menu

Tap the center **ESC** key of the left touch pad for about 1 s to call up the »**Telemetry**« menu from the transmitter's base screen or return to the base screen again, see text beginning on page 228.

- **Graphic display of telemetry data**

Briefly touching one of the selection keys of the left or right touch pad will cause a jump from the base screen directly to the transmitter's graphic display of telemetry data or will allow paging back and forth between individual graphic displays. A brief tap on the center **ESC** or **SET** key will cause a return back to the base screen.

- »**SECRET MODE**«

(language selection and contrast)

Touch and hold the ▲▼ selection keys of the left touch pad then momentarily touch the **SET** key of the right touch pad, see text beginning on the next double-page.

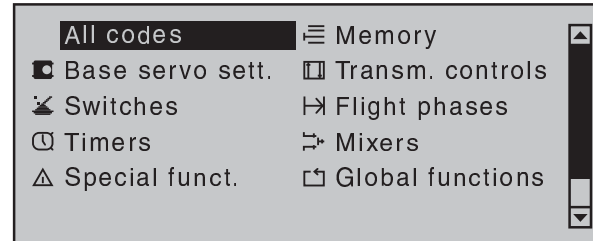
- **Entry lockout**

Entry lockout is activated and deactivated from the base screen by simultaneously touching the **ESC** and **SET** keys for about 2 s.

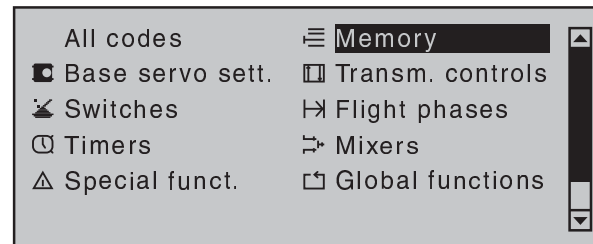
- **Quick-Select**

From the multi-function list, a jump can be made into a "Structure overview" by way of a brief,

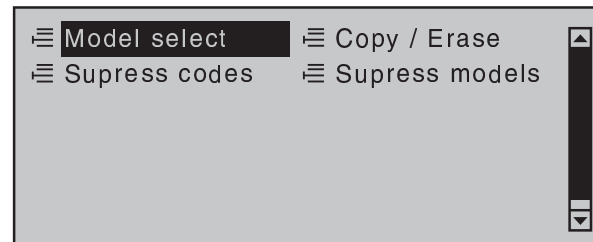
simultaneous tap on the ▲▼ or ◀▶ keys of the right touch pad. Menus are arranged in clear groups in this overview.



Now the desired group can be selected with the ▲▼ selection keys of the left or right touch pad ...



... then finally tap the center **SET** key of the right touch pad briefly. As soon as the key is released, only the respective generic term for the given menu will remain listed. For example:



Warning notices

Warning notices

BIND. N/A OK	<p>"Bind not available" A receiver has not yet been bound to the currently active model memory. A brief tap on the SET key will cause a direct jump to the appropriate option.</p>
CAN'T RECEIVE DATA	<p>No bound receiver in range</p>
Please select RF on/off? ON OFF	<p>Only for a receiver that has already been bound: Please select RF "on" or "off"?</p>
RF MUST BE OFF OK	<p>Prompt to switch off RF transmission (A bound receiver can only be replaced by another receiver when RF transmission is switched off.)</p>
TRAINER Wireless Link ACT INH	<p>Is the "wireless teacher/pupil connection" that was active when the transmitter was last used to be continued, ACT (active, i.e. continue) or switched off INH (inhibit, i.e. discontinue)?</p>
Batt. must be re- charged!!	<p>Operating voltage is too low</p>

Fail Safe
setup
t.b.d.

Failsafe has not yet been activated

Throttle
too
high!

Helicopter throttle joystick or limiter too high

No
pupil
signal

Connection between teacher and pupil is interrupted

SD-CARD
INSERT
OK

No SD or SDHC memory card in the card slot or card is not legible

- The transmitter has not been operated within the time period specified by the "Stick warning" line of the »General basic settings« menu, see page 260. The message ...

!Stick!

..., die "WARNING" LED at the right next to the on/off switch will blink and an acoustic warning will sound. If the transmitter is not operated within the next minute, the transmitter will switch itself off.

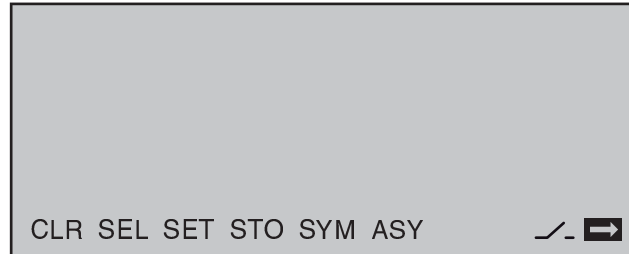
- If battery voltage is too low, a model switch is blocked for reasons of safety. An appropriate message will appear in the screen:

not possible now
voltage too low

Function fields in the display

SEL, STO, SYM, ASY, /-, ↵

Depending on the given menu, certain function fields will appear on the bottom display line.



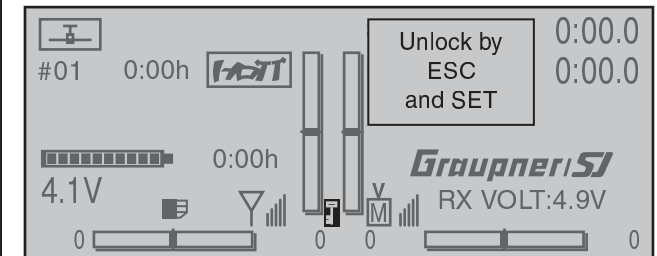
A marked function is activated with a tap on the **SET** key.

Function fields

- **CLR** (clear) erase
- **SEL** (select): selection
- **SET** (set) "set" or adjust a value
- **STO** (store): store (e.g. control position)
- **SYM** set values symmetrically
- **ASY** set values asymmetrically
- /- switch field symbol (assignment of all types of switches)
- ↵ within a menu, change to the second page, (menu continuation)

Entry lockout

A lockout for the touch keys, and thus protection against inadvertent use of all setting options, can be established by touching and holding the **ESC** and **SET** keys simultaneously for about two seconds while the **RC-16** HoTT transmitter is in its basic display. This lockout condition is indicated by a key symbol, located at the intersection point of the trim bars, which is displayed in reverse video.



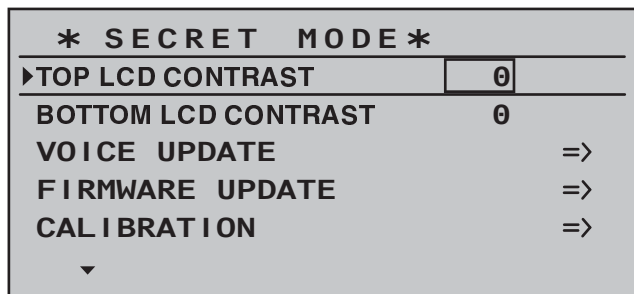
The lockout is effective immediately but controls remains operationally ready.

This lockout can be removed by again touching and holding the **ESC** and **SET** keys for about two seconds. A lockout condition is also removed the next time the transmitter is switched on.

SECRET MODE

Language selection and display contrast

The **MC-16** HoTT transmitter's »**SECRET MODE**« menu can be called up from almost any menu position by touching and holding the ▲▼ selection keys of the left touch pad and the **SET** key of the right touch pad for at least 3 seconds. This will produce the display shown below.



TOP / BOTTOM LCD CONTRAST

Following a tap on the center **SET** key of the right touch pad, a selected "... CONTRAST" line can be used to adjust the contrast of the given display to meet personal preference with the selection keys, as described in more detail on page 259. Another tap on the **SET** or **ESC** key will return to line selection.

The line ...

VOICE UPDATE

As mentioned in section "Headsets" on page 24, the transmitter's acoustic signals as well as those signals and announcements associated with the telemetry menu can be output by way of the headset connector. These announcements are made in German language by default. These announcements are summarized in a voice packet which is stored in a transmitter-internal memory but they can be replaced by a voice packet of a different language at any time. At the time of this manual's printing, the standard

SD card delivered with the set includes the following languages:

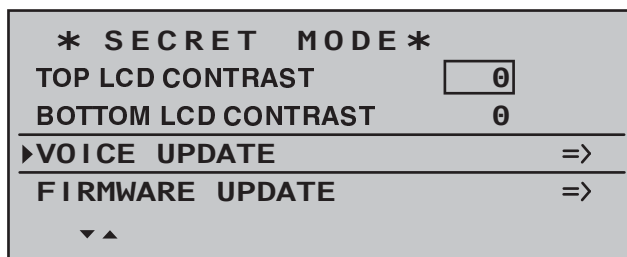
- German
- English
- French
- Italian
- Spanish

The given active language packet can be swapped out either with the PC program available as a download from the transmitter's web page at www.graupner.de or with the SD card, as described below. If not already done, insert the SD card or SDHC card into the transmitter as described on page 23. Once the memory card is inserted in the transmitter, switch the transmitter on *with RF switched off*.



Language change

Use the selection keys of the left or right touch pad to select the line "VOICE UPDATE" line.



Use the center **SET** key of the right touch pad to switch to the selection page for the "VOICE UPDATE" line.

FILE LIST

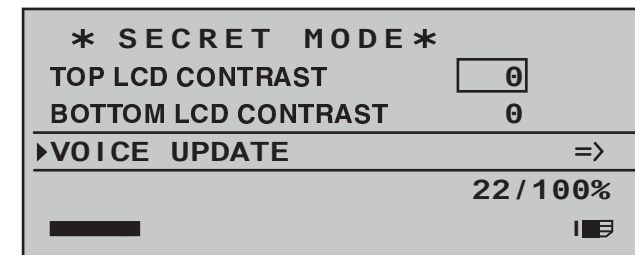
- ▶ **VOICE_ENGLISH.VDF**
- VOICE_FRANCE.VDF
- VOICE_GERMAN.VDF
- VOICE_ITALIANO.VDF
- VOICE_SPAIN.VDF

Now use the ▲▼ keys of the left or right touch pad to choose the desired language, for example:

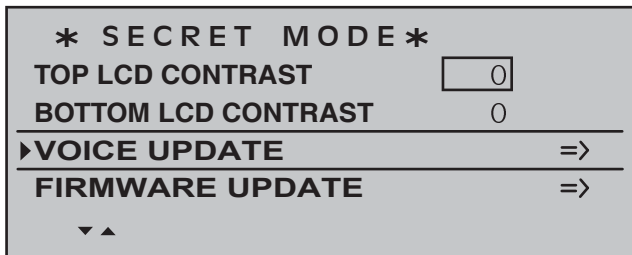
FILE LIST

- ▶ **VOICE_ENGLISH.VDF**
- VOICE_FRANCE.VDF
- VOICE_GERMAN.VDF
- VOICE_ITALIANO.VDF
- VOICE_SPAIN.VDF

Confirm the choice with another tap on the center **SET** key of the right touch pad. The selected language packet will be loaded into the transmitter's memory.



The loading process is finished as soon as the progress bar at the lower edge of the display disappears.



When this process is finished, switch off the transmitter. All settings stored in the transmitter remain intact after a change of language has been made.

Notes:

- If the warning ...



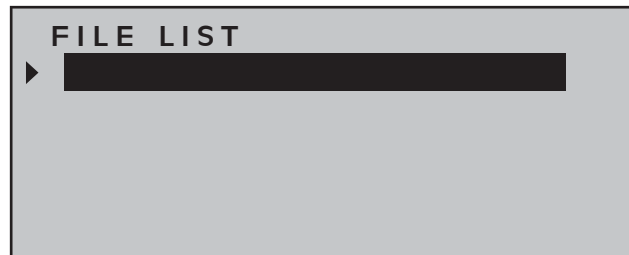
... appears, then the transmitter's RF radiation is still active. Jump to the »**Base setup model**« menu, select the "RF transmit" line, select its "OFF" option then repeat the procedure

- If the warning ...



... appears then the transmitter does not detect a memory card in its card slot or the card found cannot be read.

- If the selection window is empty ...

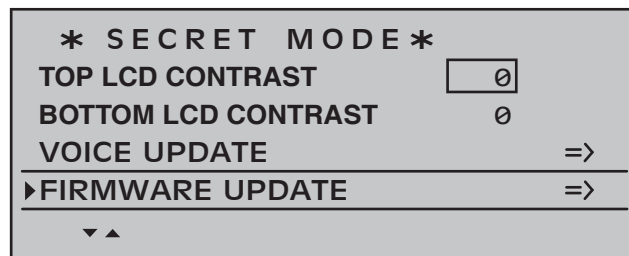


... then the transmitter could not find an appropriate file on the inserted memory card. Check the contents of the SD card's "VoiceFile" directory on a PC or laptop.

FIRMWARE UPDATE
Change display language

Important notice:

Be sure to check the charge status of your transmitter's battery or charge its battery as a precaution before every update. Also backup all occupied model memories so they can be restored if that should become necessary.

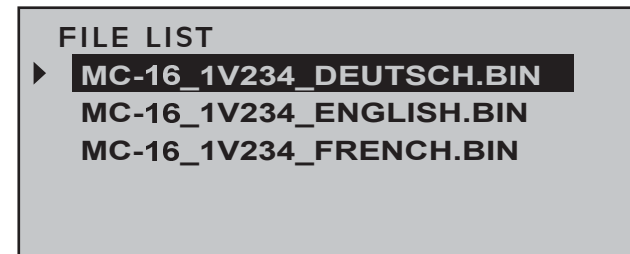


In the same manner as described above in the section "VOICE UPDATE", this menu item can be used to update or change the transmitter's firmware, including its display language. At the time of this manual's printing, the standard SD card delivered with the set includes the following languages:

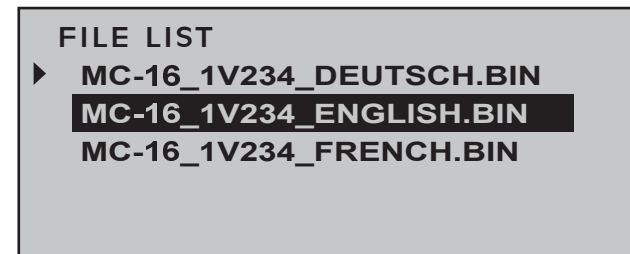
- German
- English

A French, Italian and Spanish version are to be implemented at a later point in time.

Appropriate updates and information can be found on the **MC-16** HoTT transmitter's product page under the Download link at www.graupner.de.



Now use the ▲▼ selection keys of the left or right touch pad to choose the desired firmware version, for example:



Confirm the choice with another tap on the center **SET** key of the right touch pad. The loading of firmware into the transmitter's memory will be started and following two displays, visible only very briefly, which only make reference to the firmware update ...


```

-----
* Firmware Download      *
* Prozess Start         *
* Please Wait....      *
-----

```

```

-----
* Boot Download         *
* Success!!!           *
* Please Wait....      *
-----

```

..., the message:

```

-----
* Firmware              *
* Downloading...        *
* Progress 023/275      *
-----

```

... will appear in the display. As soon as the counter to the left of the "/" character reaches the value shown on the right as the volume to be loaded, the message ...

```

-----
* Firmware Upgrade     *
* Success!!!           *
-----

```

... will appear. After a few seconds this message will be erased and the transmitter will automatically restart. The transmitter is now again operational.

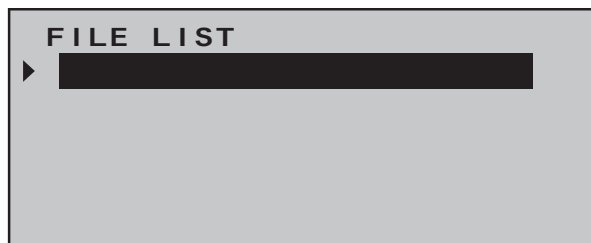
Notes:

- If the warning ...



... appears then the transmitter does not detect a memory card in its card slot or the card found cannot be read.

- If the selection window is empty ...



... then the transmitter could not find a suitable firmware file on the inserted memory card. Check the contents of the SD card's "Firmware" directory on a PC or laptop.

JOYSTICK CALIBRATION

If you feel the neutral position of your self-calibrating joysticks (controls 1 ... 4) are not exactly 0% of their control travel, then this can be checked and, if necessary, corrected as follows.

Jump to the »**Model select**« menu and initialize a free model memory as described on page 69. Whether the model to be initialized is a winged aircraft or a helicopter is irrelevant.

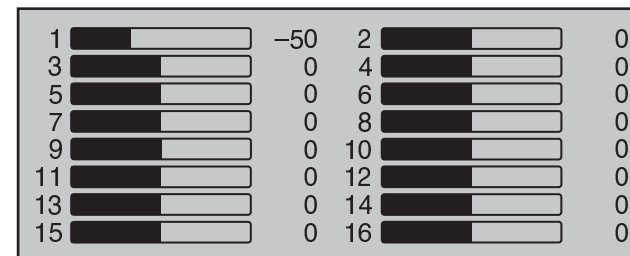
Wait for the notices which typically appear in the transmitter's base screen following a model change then jump to the »**Servo display**« menu, for example

by simultaneously touching the ◀▶ keys of the left touch pad (WITHOUT any interim changes to trim settings or other program settings).

If all four of your transmitter's joystick functions are still self-neutralizing, this display should ideally look like the one shown below.



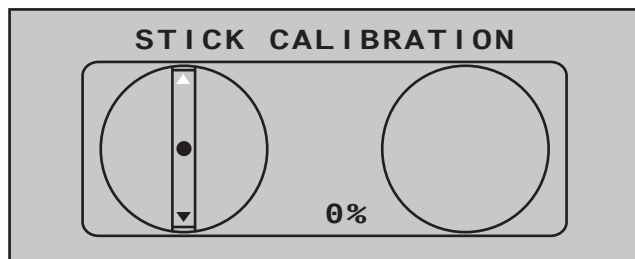
Otherwise the graph bars show current setting percentages for joystick control functions which are not self-neutralizing—typically for the "C1" throttle/brake or throttle/pitch joystick. For example, if the throttle/brake joystick is in its "quarter-throttle" position, the display would appear as shown below.



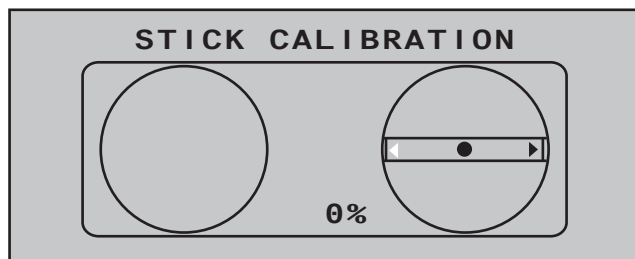
One after the other, put both joysticks into each of their four possible limit positions *without* exerting force at the limit position. In each of these eight possible limit positions, the—side dependent—indication for exactly -100% or +100% should be displayed. For example, if transmitter control 2 is at its right limit and the other three joystick functions are in their respective middle positions then the transmitter's display should look like the one shown below.



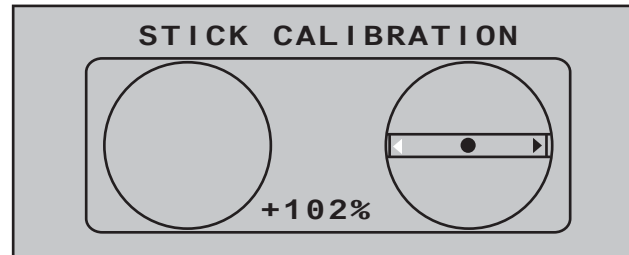
Regardless of the number of self-neutralizing joystick functions available on your transmitter, if these checks produce four 0% results and eight 100% results then your transmitter's joysticks are optimally calibrated. You can terminate this process then, if appropriate, delete the model memory just created. Otherwise jump (as described at the outset of the previous double page) to the "Stick calibration" line in the »**SECRET MODE**« menu then briefly touch the center **SET** key of the right touch pad.



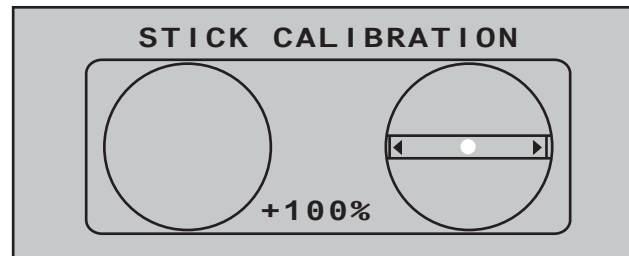
The ◀ ▶ selection keys of the right touch pad will now allow you to cyclically select the four calibrated joystick planes, e.g. the left/right plane of the right joystick.



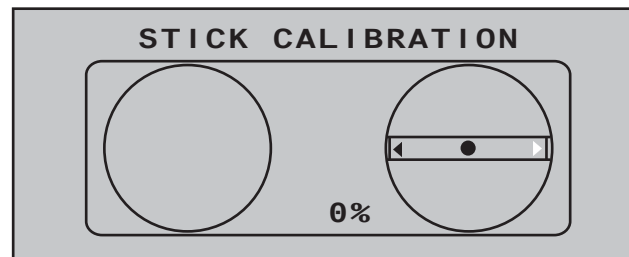
Now position the *right* joystick—without exerting extra force—to its left limit corresponding with the on-screen blinking arrow pointing to the left.



... and briefly tap the center **SET** key of the right touch pad. This concludes this example calibration of the right joystick's left limit. The circle in the middle of the stylized joystick plane will now blink as confirmation of the calibration.

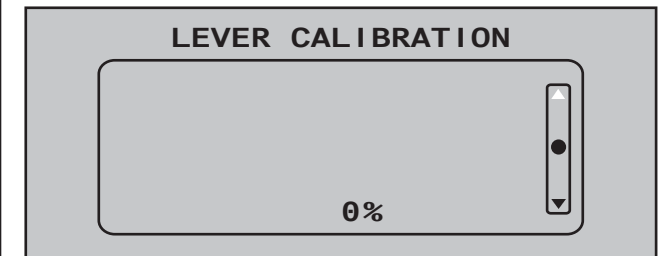


Now release the self-neutralizing joystick so it can return to its center position and then tap again on the center **SET** key to calibrate the joystick's centered position. The right triangle marker will begin to blink.



Repeat the calibration process for the *right* limit of the right joystick. The other joystick planes are calibrated analogously.

Proceed similarly to calibrate the three sliders mounted in the middle console and the two proportional rotary controls on the sides of the transmitter. The calibration options for these five proportional controls can be reached by repeatedly tapping on the ◀ or ▶ selection keys of the right touch pad until the desired calibration position is reached, e.g.:



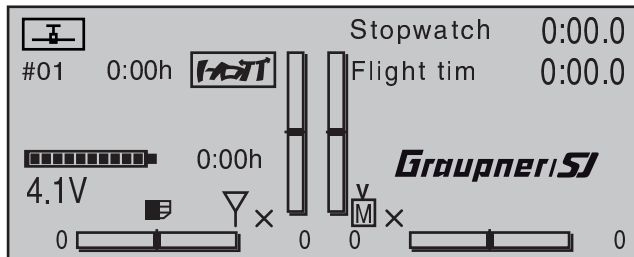
Notes:

- Correct any bad calibrations by repeating the respective process.
- Within a given joystick plane, each of the three calibration positions can be selected directly with the ▲ ▼ selection keys of the left or right touch pad.

Briefly touching the center **ESC** key of the left touch pad will terminate the process and return to the sub-menu "Stick calibration".

Telemetry data display

The **MC-16** transmitter has two independent displays; a large display for operating the transmitter and a smaller display just below the antenna socket for the graphic display of telemetry data. The telemetry display is activated automatically as soon as the transmitter receives telemetry data from the receiver via the return channel.



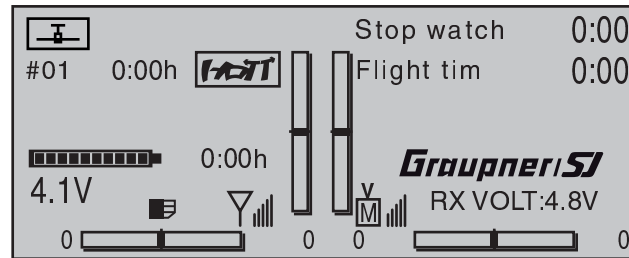
If however, at the lower edge of the base display, only "X"-as shown in the figure above—is displayed at two locations instead of "||||" then the telemetry display will show the warning ...



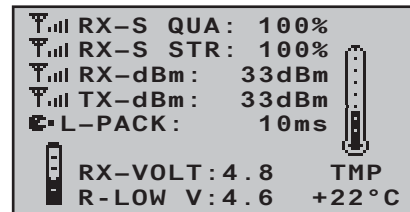
... which will be replaced shortly thereafter with the *Graupner/SJ* logo and the transmitter names ...



... to indicate there is no receiver with a responding telemetry connection within range. Switch on the model's receiver system or bind a receiver to the active model memory as described in detail on page 77 and 85.



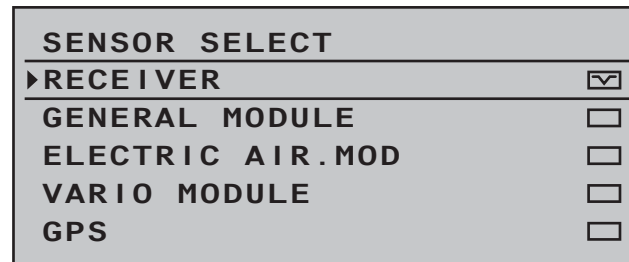
When a telemetry connection exists, the upper display will automatically present the "Receiver" screen ...



... which is described in more detail in a section by the same name on the next page.

Sensor Select

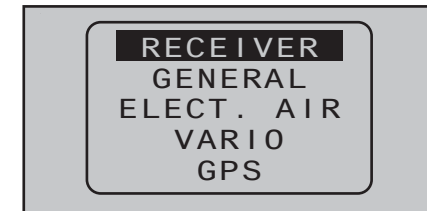
Up to four sensors can be connected, in any combination, to a telemetry-capable receiver. However, the data output by these sensors must be (as described on page 240) selected in the »SENSOR SELECT« sub-menu of the »Telemetry« menu ...



... in order to activate their display. This data from the selected sensors is then appropriately prepared for illustration by the graphic indicators as described below. Furthermore, only sensors activated in the »SETTING & DATAVIEW« sub-menu of the

»Telemetry« menu, beginning page 229, according to the instructions included with the given sensor will be responsive.

To switch between the screens for activated sensors in the »SENSOR SELECT« sub-menu of the »Telemetry« menu, tap briefly on one of the ▲▼ selection keys of the left or right touch pad ...



... and, after the selected screen has been displayed, use one of the ▲▼ two keys to select the line of the desired sensor. If no sensor is activated, then all display lines and sensors described in the next column, except for the "RECEIVER" line, are blended out of the display and the selection list:



The selection can be confirmed right away by activating the center **SET** key of the right touch pad or by simply waiting until, after a brief pause, the main display of the given selected sensor appears automatically.

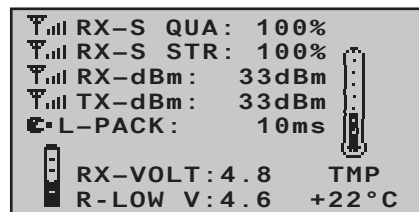
Note:

The sequence of the below described displays is a consequence – starting from the given main display – of taps on the ► key.

More details about the following named modules can be found in the appendix and in Internet at

www.graupner.de in the web page for the given product.

RECEIVER

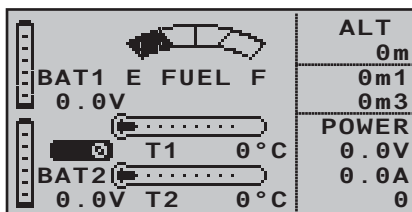
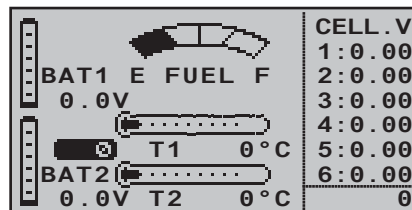
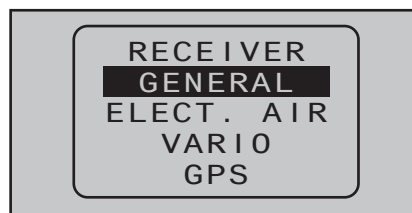


This screen presents the »RX DATAVIEW« of the Telemetry menu's »SETTING & DATAVIEW« sub-menu, see page 229, with data processed and displayed graphically.

The displayed items are as follows:

Value	Explanation
RX-S QUA	signal quality in %
RX-S ST	signal strength in %
RX-dBm	Reception power in dBm
TX-dBm	transmit power in dBm
V PACK	Indicates the longest time span in ms in which data packages are lost in the transmission from the transmitter to the receiver.
RX-VOLT	current operating voltage of the receiver's power supply in volts
M-RX V	Lowest receiver operating voltage since last startup, in volts
TMP	the thermometer depicts the receiver's current operating temperature

GENERAL MODULE



If attached to the receiver, this screen will display the data acquired by a General-Engine module, order no. **33610**, or a General-Air module, order no. **33611**. More details about these modules can be found in the appendix or in Internet at www.graupner.de in the web page for the given product.

Depending on how this module is equipped with sensors, this screen can permanently display the data shown in the table below.

The current voltage of up to two batteries (BAT1 and BAT2), the measurement results of up to two temperature sensors (T1 and T2) and a fill level gage for the fuel tank.

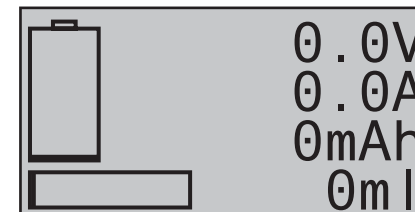
An alternating display along the screen's right edge will display a list of current cell voltages for a LiPo battery with up to six cells or operational data (current

altitude with respect to the starting location, ascent/decant m/1 s and m/3 s, current current being drawn in amperes and current voltage of the battery connected to the sensor).

The displayed items are as follows:

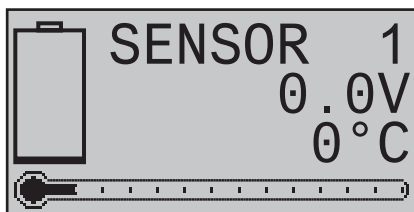
Value	Explanation
BAT1 / BAT2	battery 1 or 2
FUEL	fuel level / tank gage
E / F	empty / full
T1 / T2	temperature of sensor 1 or 2
CELL V	cell voltage of cells 1 ... max. 6
ALT	current altitude
0m1	m/1 s ascent/decant rate
0m3	m/3 s ascent/decant rate
A	current draw i amperes
V	battery voltage

Battery and load indicators



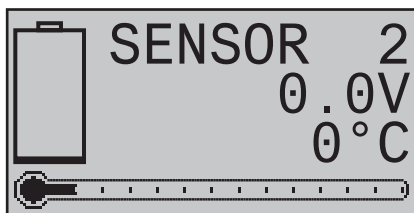
This display depicts current voltage, current current draw and, if attached, the expended capacity of "Batt 1" connected to the General-Engine module (order no. **33610**) or General-Air (order no. **33611**) module as well as the fuel consumed in ml.

SENSOR 1



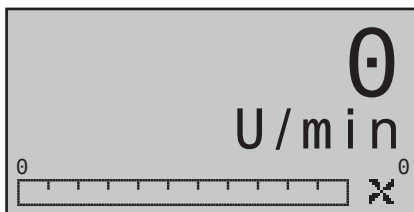
If attached, this display depicts currently measured voltage and temperature from a temperature/voltage sensor, order no. **33612** or **33613**, connected to "T(EMP)1" of the General-Engine module (order no. **33610**) or the General-Air module (order no. **33611**).

SENSOR 2



If attached, this display depicts currently measured voltage and temperature from a temperature/voltage sensor, order no. **33612** or **33613**, connected to "T(EMP)2" of the General-Engine module (order no. **33610**) or the General-Air module (order no. **33611**).

Rotary speed sensor



If attached, this display depicts the measured rotary speed of a speed sensor (order no. **33615**

or **33616**) attached to a General-Engine module (order no. **33610**) or a General-Air module (order no. **33611**).

Note:

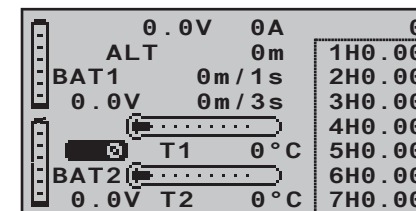
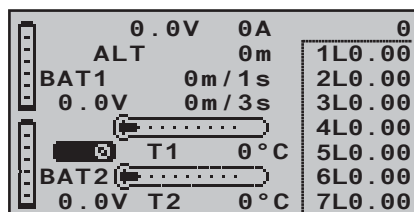
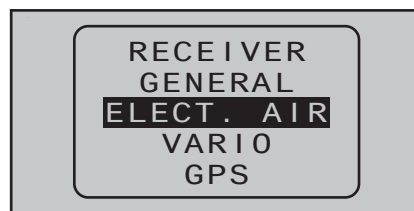
The appropriate blade count must first be set in the module's telemetry menu before the correct speed can be displayed.

Vario



If attached, this display will depict the altitude (in m) relative to location, starting location as well as the current rate of ascent/descent (in m/s) data originating from a Vario integrated into a General-Engine module (order no. **33610**) or General-Air module (order no. **33611**).

ELECTRIC AIR MODULE



If attached to the receiver, this display will depict the data acquired by an Electric-Air module, order no. **33620**. More details about this module can be found in the appendix or in Internet at www.graupner.de in the web page for the given product.

Depending on how this module is equipped with sensors, this screen can permanently display the data shown in the adjacent table.

The current voltage of up to two batteries (BAT1 and BAT2), up to two temperature measurements (T1 and T2), current altitude with respect to the starting location, the model's ascent/decent rate in m/1 s and m/3 s and, in the middle of the screen, the current draw currently being taken from a power source.

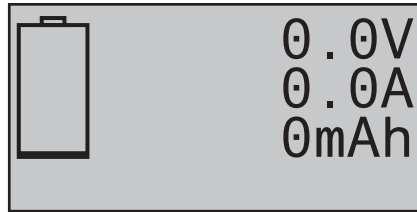
Along the right edge of the screen is a table of alternating values for cell voltages at balancer connections (L) or voltages for up to 7 attached battery cell packs (H).

The displayed items are as follows:

Value	Explanation
V	current voltage
A	current current
BAT1 / BAT2	battery 1 or 2
ALT	current altitude
m/1 s	m/1 s ascent/decent rate
m/3 s	m/3 s ascent/decent rate
T1 / T2	temperature of sensor 1 or 2

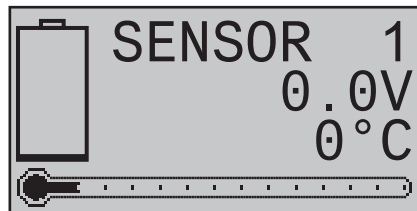
L or H cell voltage of cells 1 ... max. 14
 L = balancer connection 1
 H = balancer connection 2

AKKU 1



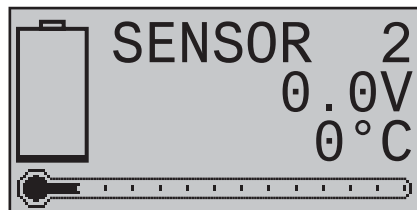
This display depicts current voltage, current current draw and, if attached, the expended capacity of "Batt 1" connected to the Electric-Air module (order no. **33620**).

SENSOR 1



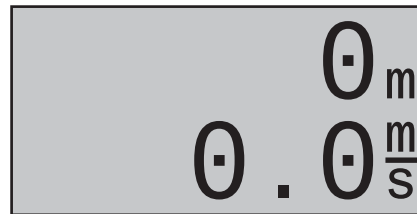
If attached, this display depicts currently measured voltage and temperature from a temperature/voltage sensor (order no. **33612** or **33613**) connected to "T(EMP)1" of the Electric-Air module (order no. **33620**).

SENSOR 2



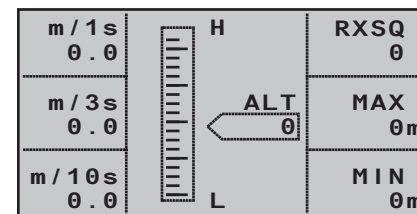
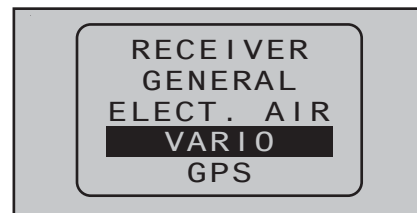
If attached, this display depicts currently measured voltage and temperature from a temperature/voltage sensor (order no. **33612** or **33613**) connected to "T(EMP)2" of the Electric-Air module (order no. **33620**).

Vario



If attached, this display will depict the altitude (in m) relative to location, starting location as well as the current rate of ascent/descent (in m/s) data originating from a Vario integrated into a Electric-Air module (order no. **33620**).

VARIO



If attached to the receiver, this display will depict the data acquired by a Vario module, order no. **33601**.
 The displayed items are as follows:

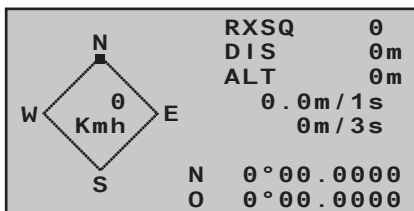
Value	Explanation
ALT	current altitude
RXSQ	Signal strength of the signal received by the receiver in%, see page 230.
MAX	the preset maximum altitude limit relative to starting location at which, when exceeded, will cause an audible warning to be sounded
MIN	the preset minimum altitude limit relative to the starting location at which, when underrun, will cause an audible warning to be sounded
m/1 s	m/1 s ascent/decent rate
m/3 s	m/3 s ascent/decent rate
m/10 s	m/10 s ascent/decent rate

Vario



If attached, this display will depict altitude relative to location or starting location (in m) as well as the current rate of ascent/descent (in m/s) from data acquired by a Vario module (order no. **33601**).

GPS



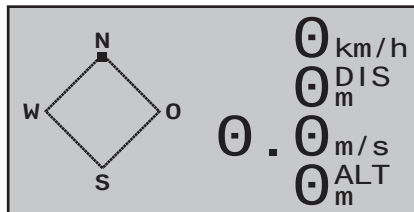
If attached to the receiver, this display will depict the data from a GPS module with integrated Vario, Order No. **33600**.

Aside from the model's current position and speed, the center section of this screen will also display current altitude with respect to the starting location as well as the model's current ascent/decant rate in m/1 s, m/3 s and m/10 s, current reception quality and the model's distance from its starting location.

The displayed items are as follows:

Value	Explanation
W/N/O/S	west / north / east / south
Kmh	speed
RXSQ	return channel signal strength
DIS	distance
ALT	current altitude with respect to starting
m/1 s	m/1 s ascent/decant rate
m/3 s	m/3 s ascent/decant rate
m/10 s	m/10 s ascent/decant rate

GPS



If attached to the receiver, this display will depict the data from a GPS module with integrated Vario, Order No. **33600**.

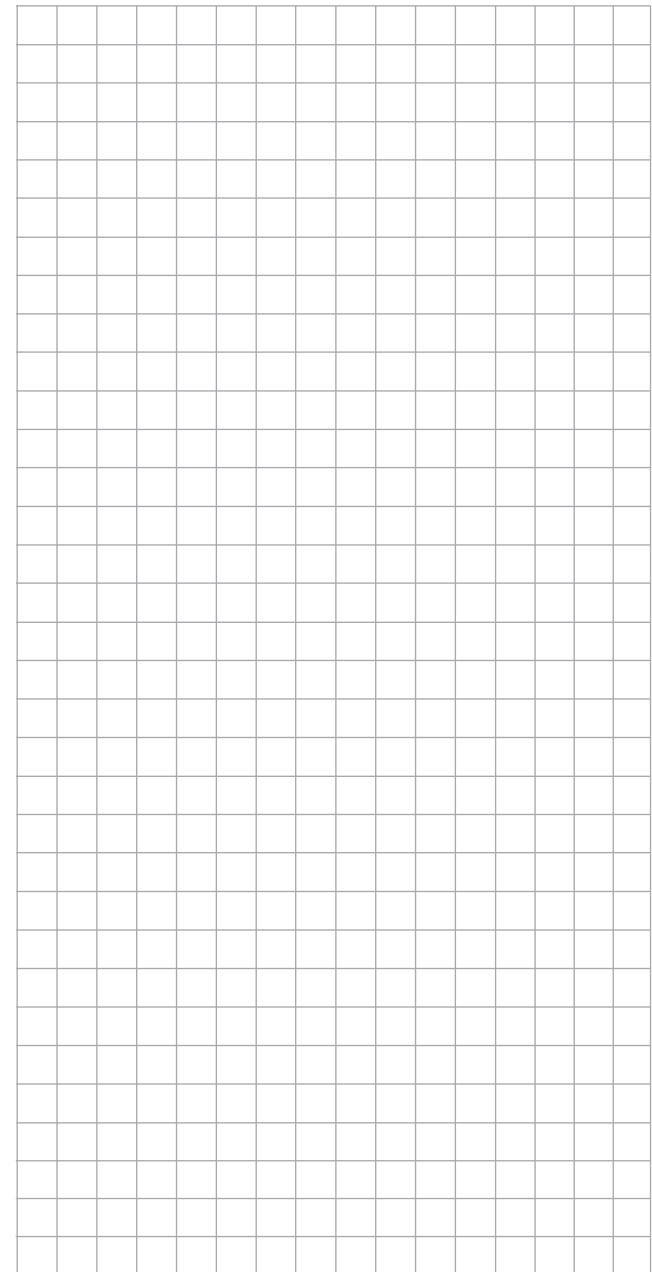
The displayed items are as follows:

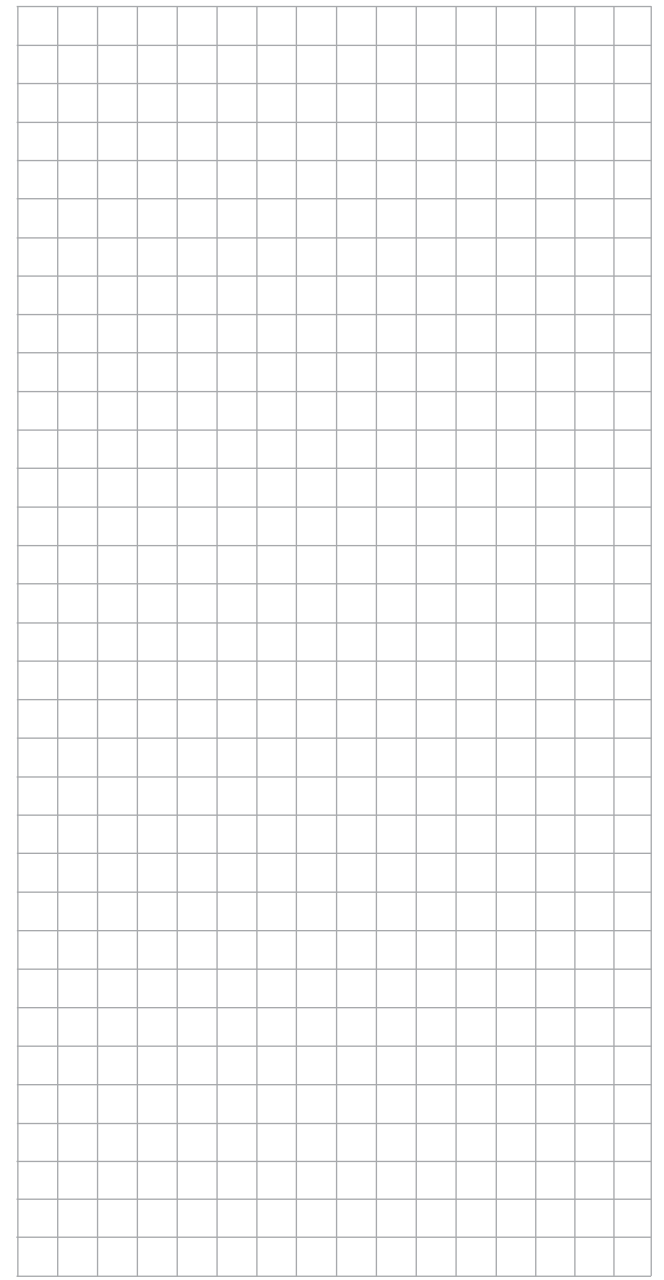
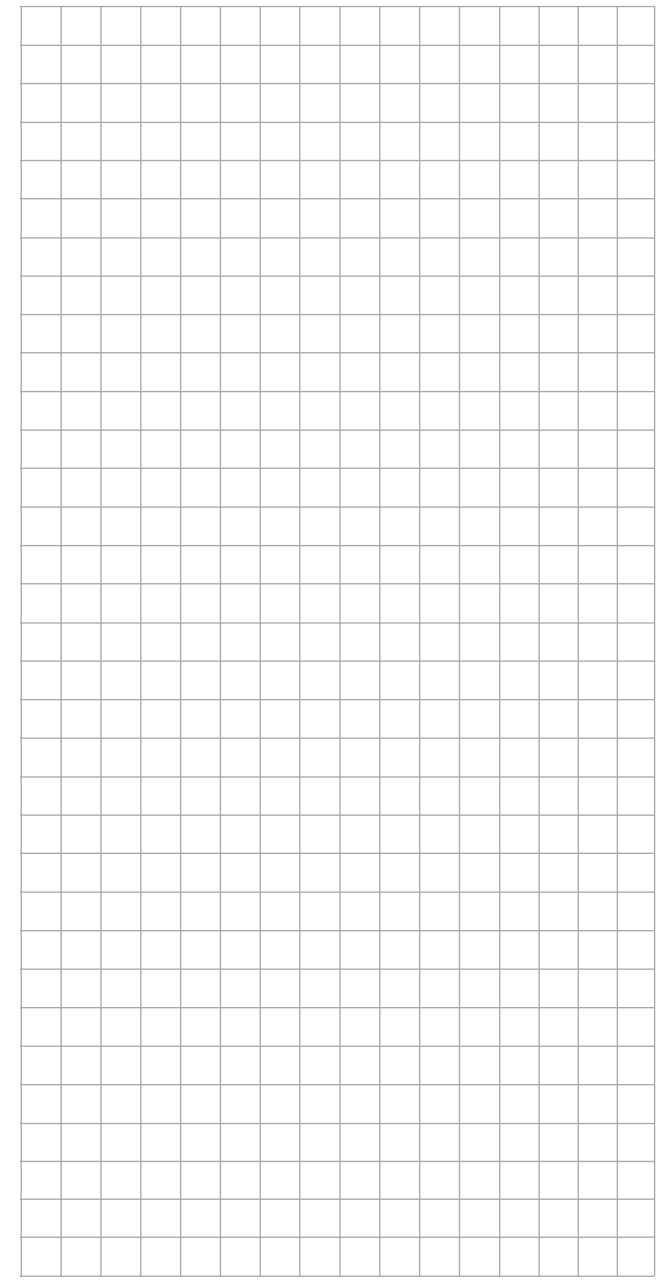
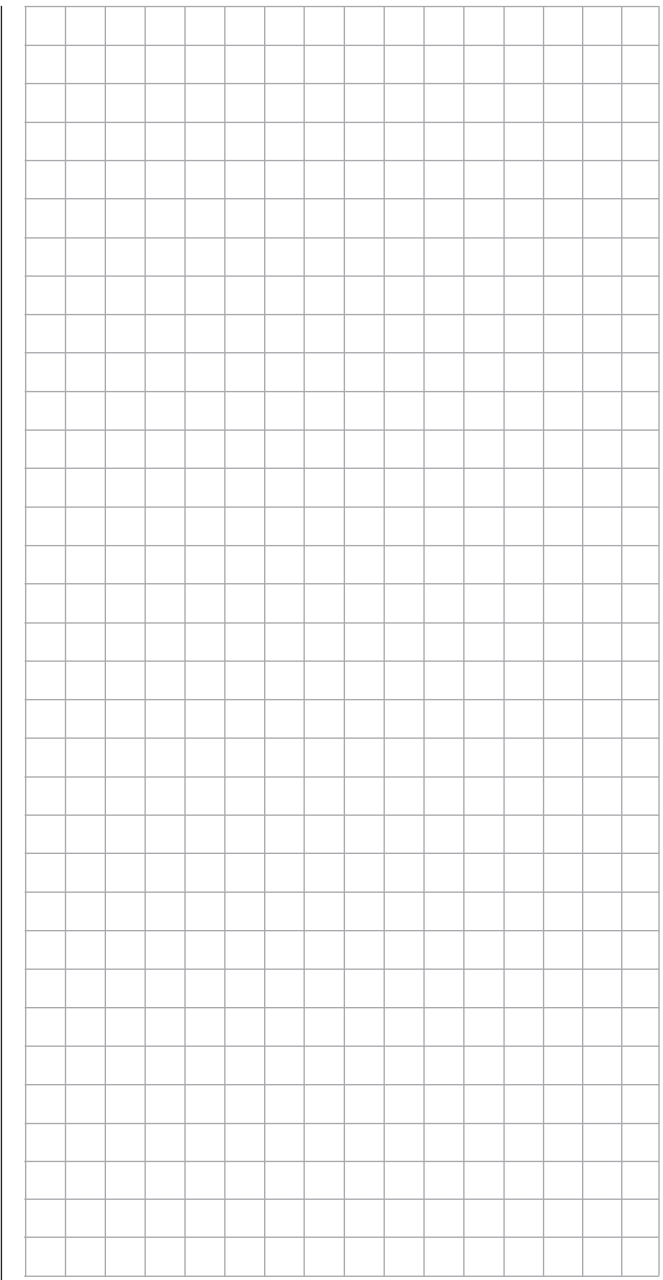
Value	Explanation
km/h	speed
DIS	horizontal distance in m
m/s	ascent/decant rate in m/s
ALT	altitude relative to starting location in m

Vario



If attached, this display will depict the altitude (in m) relative to location, starting location as well as the current rate of ascent/decant (in m/s) from data originating from the Vario integrated into the GPS-/Vario module (order no. **33600**).





Commissioning the transmitter

Preliminary remarks about the **RC-16** HoTT transmitter

Preliminary remarks

The *Graupner* HoTT system theoretically permits simultaneous operation of more than 200 models. However, because of the interspersed radio-frequency utilization permitted by certification for the 2.4 GHz ISM band, this number is significantly lower in practical application. Nevertheless, in general more models can be operated simultaneously in the 2.4 GHz band than would be the case in conventional 35 or 40 MHz frequency bands. The real limiting factor is—as often before— is still likely to be the size of available operating space (i.e. airspace for aircraft). Along the fact that it is no longer necessary to coordinate transmitting frequencies with other pilots in the vicinity (which is sometimes quite difficult in broken landscapes, such as on hillside slopes) represents an enormous boost for remote control operating security.

Battery charged?

Since the transmitter is delivered with an empty (not charged) battery, the battery must first be charged according to the charging instructions on page 16. Otherwise a warning tone will be sounded and an appropriate message will be blended into the basic display if the low voltage threshold set in the "Battery warning" line of the »General basic settings« menu (see page 260) is underrun.

Batt. must be re-charged!!

Transmitter startup

After being switched on, the message shown below will appear in the transmitter's screen for about two seconds.



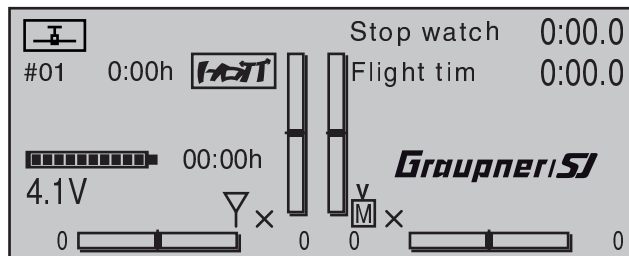
Within this brief period there is an opportunity to switch RF transmission off by using the ▲ or ► key of the right touch pad to shift the position of the field shown in inverse video to the right so that **ON** is in standard video and **OFF** is presented in inverse video.



Now switch the RF module off by tapping on the center **SET** key of the right touch pad. The telemetry display just below the antenna socket will then briefly show the message ...



... and in parallel to this, the transmitter's basic display will appear similar to that shown below:



The symbol combination **TX** means that the currently active model memory has already "bonded" with a

Graupner-HoTT receiver but there is no connection to that receiver at the moment. (In this example, RF transmission has been switched off.)

If, however, the transmitter is switched on *without* switching RF transmission off, the symbolic antenna mast will blink. At the same time, an acoustic warning will sound until a connection is established with the respective receiver. As soon as the connection is established, the "X" at the base of the symbolic antenna will be replaced with a field strength indicator, for example **TX**, and the visual and acoustic warnings will cease.

If a telemetry connection has also been established for the incoming signal, that is output by the receiver in the model, then the right side of this same screen line will display a similar indication of signal strength for this reception of the receiver's transmitted signal (M) as well as the current voltage of the receiver's power supply.

On the other hand, if the symbol combination **TX** appears in the display and the front display shows the message "Can't receive data" then the currently active model memory is not "bonded" to any receiver at the moment.

Under-voltage warning

If the transmitter's voltage drops below a certain value set in the »General basic settings« menu (page 260), 4.7 V by default, there will be visual and acoustic under-voltage warnings issued.

Important notices:

- **The transmitter in the set is already preset, as delivered, with default values which are correct for operation in most European countries (except France).**
If the remote control system is to be operated in France then the transmitter's "Region" setting MUST be changed over to "FRANCE" mode, see page 261. IN NO CASE may the

Transmitter firmware updates

Universal/EUROPE mode be used IN FRANCE.

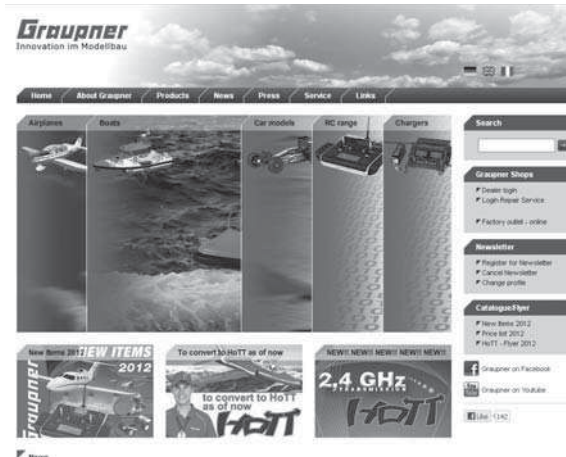
- **As many as 16 servos can be attached to the standard receiver included with the 01C-16 HoTT 2.4 Set. The specific receiver included in the set has already been bound to the set's transmitter at the factory.**
In order to achieve the greatest possible flexibility but still preclude unnecessary inadvertent operator errors, control channels 5 ... 16 have not been assigned to any controls. This means that servos connected by way of these channels will remain in their middle positions until an operator element has been assigned. Practically all mixers are initially inactive for this same reason. More about this can be found on page 108 (winged aircraft) or 112 (helicopter models).
- **The fundamental procedure for initial programming of a new model memory location can be found on page ?? and the programming examples that begin on page 268.**
- **When the remote control system is switched on, being bonded or when making settings, that the transmitter's antenna is always far enough away from the receiver's antennas. If the transmitter's antenna is brought too close to the receiver's antennas this will cause receiver over-modulation and its red LED will illuminate. At the same time the return channel will drop out and, as a consequence, the field strength indicator in the transmitter's screen will be replaced by an "x" and the receiver's current battery voltage display will show 0.0 V. The remote control is then in Fail-Save mode, see page 208, i.e. servos will remain in their current positions until a new, valid signal can be received. In such a case, increase the distance (between the transmitter and the model containing the receiver) until the indicators are again "normal".**

Transmitter firmware updates are carried out either as described under "FIRMWARE UPDATE / Change display language" in the section »**Secret mode**« on page 33 or as described below with the help of a PC running a Windows XP, Vista or 7 operating system. This second method connects the transmitter to the PC via its 5-pole mini-USB interface connector, located behind the transmitter's left front cover –as viewed from the front– and, if this method is chosen, it is done at one's own risk. Current software and information is available in Internet at www.graupner.de under the Download link for the given product.

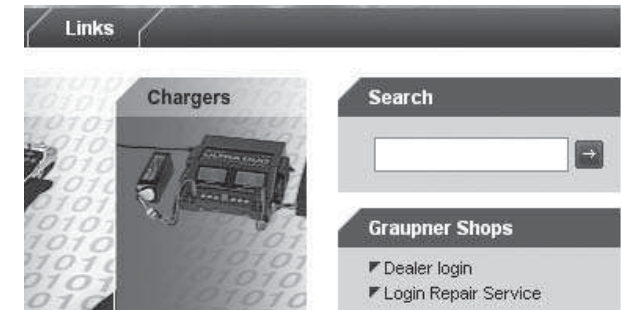
Note:

You will automatically be notified of new updates per email after registering your transmitter at <https://www.graupner.de/de/service/produktregistrierung>.

The aforementioned "given product page" is most easily reached by entering "www.graupner.de" into your Internet browser's address line then pressing the ENTER key on your PC or laptop keyboard.



On the so-called "homepage" for *Graupner*, click on one of the "flags" to switch the website to a language of your choice, e.g. the British flag for English. Afterwards locate the entry field with the title "Search".



Place the cursor in this field with a mouse click then enter a search keyword, e.g. the article number printed on the type plate located on the rear side of the transmitter.



Another press of the ENTER key on the PC or laptop will open the sought page:



Now use your Internet browser's vertical scroll bar to move down the page a bit until the tabs "Characteristics", "Spare parts", "Accessories" and "Downloads" appear. Because the "Downloads" tab is still missing on the **MC-16** HoTT transmitter's page at the time of this manual's printing:



Now search here for the necessary file/s and start the download with a double-click on the "Download" control button beneath the selected file.



Store the file on your computer in a directory of your choice.

Updating **MC-16** HoTT software

The USB interface cable, order no. **7168.6** (included with the set), will be needed to update the transmitter's software via the transmitter's face-side USB interface connector. This cable's connector is to be directly plugged into the 5-pole mini-USB connector socket on the rear side of the transmitter.

Note:

Be sure to check the charge status of your transmitter's battery or charge its battery as a precaution before every update. Also backup all occupied model memories so they can be restored if that should become necessary.

1. Installing drivers

Install the required driver software, included in the "USB Drivers" folder of the program packet, onto your PC or laptop so your computer can handle the transmitter's integrated USB interface.

Start driver installation with a double-click on the respective file and follow the on-screen instructions. Once this software has been successfully installed, the computer must be re-started. Drivers only need to be installed once.

2. Installing the software up-loader

Unpack the file "Firmware_Upgrade_grStudio_Ver-XX.zip" in a suitable directory then execute the "Firmware_Upgrade_grStudio_Ver-XX.exe" program file with a double-click on its filename. Follow the instructions provided by the installation wizard.

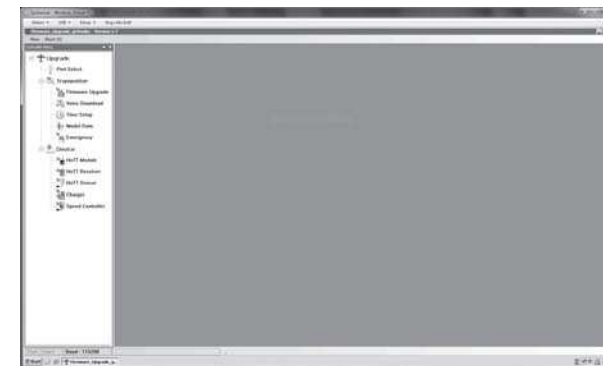
3. Establishing a transmitter-to-PC connection

With the transmitter switched off, connect the USB cable by way of its 5-pole mini-USB socket to

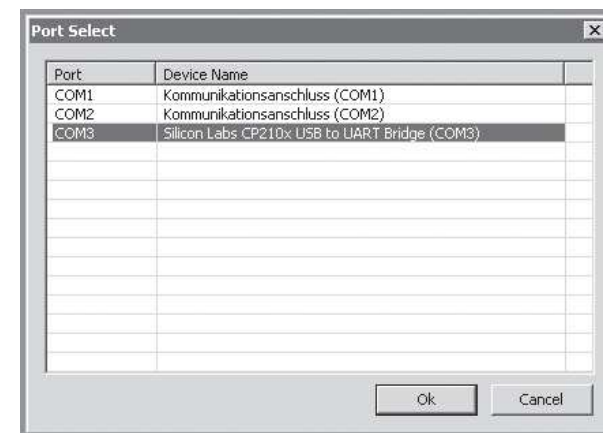
the rear side of the transmitter.

4. Updating **MC-16** HoTT transmitter software

Start the "Firmware_Upgrade_grStudio_Ver-X.X" program from the directory where it is located.



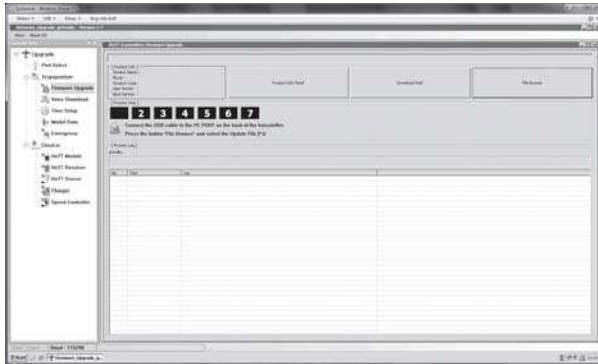
Use the selection sequence "Menu", "Port Setup" or open the "Controller Menu" and click on "Port select".



Now in the "Port select" window, select the COM port connected to the USB interface. The correct port can be recognized by its designation "Silicon Labs CP210x USB to UART Bridge" in the "Device Name" column. In the above example this would

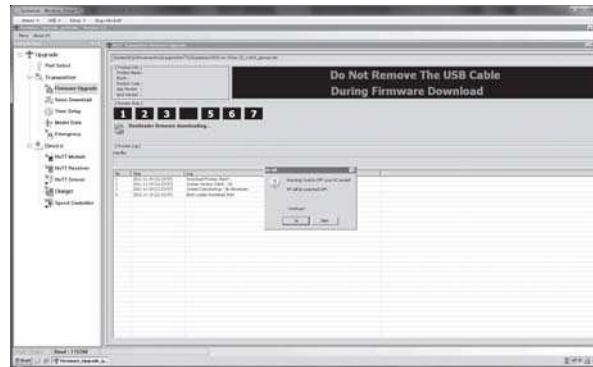
be the "COM 3" port.

Now call up menu option "Firmware Upgrade" from "Menu" or open the "Controller Menu" and click on "Firmware Upgrade".



Click on the button labeled "File Browse" and select the desired firmware update file with a ".bin" filename extension from the "Open file" window. Firmware files are product-specifically coded, i.e. if you should accidentally select a file which does not correspond to the product (e.g. receiver update file instead of a transmitter update file), the "Product code error" popup window will appear and the block the update process from starting. Now switch on the transmitter then start the transmitter update by clicking on the "Download Start" button.

After a brief period a warning will appear stating that the transmitter's RF transmission will now be interrupted and that, because of this, any receiver system currently in operation should be switched off. Switch off your receiver system if it is switched on then click on "Yes".



This will start the actual update process. A progress bar will begin to operate above a sequence of running text lines.



Do not terminate the update process before the progress bar has reached its right end and the "Firmware Download Success" message appears.



Click on "OK". Subsequently switch off the transmitter and disconnect the USB cable between the transmitter and the PC or Laptop. If the progress bar hangs up without showing any further progress, close the program and repeat the update process. Be sure to watch for any error messages that may appear.

Receiver initialization

Preliminary remarks about the GR-32 DUAL receiver

Receiver system

The **RC-16** HoTT remote control set includes a type GR-32 DUAL, 2.4 GHz bidirectional receiver for connecting up to 16 servos.

After switching on this HoTT receiver, should "its" transmitter not be within range or switched off, then the receiver's red LED will illuminate continuously for about 1 s then begin to blink slowly. This indicates the receiver has not (yet) established a link to a *Graupner* HoTT transmitter. If a link has been established, the green LED will illuminate continuously and the red LED will extinguish.

In order to establish a link to the transmitter, the *Graupner* HoTT receiver must first be "bound" to "its" particular model memory in "its" *Graupner* HoTT transmitter. This procedure is known as "binding". This "binding" linkage is only necessary once for each receiver/model memory combination. Refer to pages 77 or 85. The "binding" procedure has been done at the factory for model memory 1 of the units delivered together as a set so this "binding" procedure will only be necessary to link additional receivers or if a memory location change becomes necessary (and – e.g. after a change of transmitter – can be repeated anytime).

On-board voltage display

The current voltage of the receiver's power supply will be shown in the right side of the transmitter's screen if a telemetry link exists between the receiver and transmitter.

Temperature warning

Should the receiver's temperature sink below an adjustable threshold (default value -10 °C) or rise above an adjustable threshold (default value +55 °C), an acoustic warning will be issued by the transmitter in the form of a uniform beep of about 1 s duration. The aforementioned threshold limits are stored and adjusted in the receiver.

Servo connections and polarity

Graupner HoTT receiver servo connections are numbered. The connectors used are keyed against polarity reversal. Pay attention to the small side chamfers when plugging in these connectors. Never use force.

The four outer, vertical connectors, designated with "B + -" are intended for battery connections.

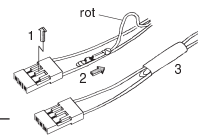
Do not reverse the polarity of this connection. Reversed polarity could destroy the receiver and devices attached to it.

The supply voltage is bussed across (i.e. common for) all numbered connections. The function of every individual channel is determined by the transmitter used, not by the receiver. It is not only the throttle servo connection which is different for every manufacturer and model type. For example, in *Graupner* remote control systems the throttle servo is on channel 1 for winged aircraft and on channel 6 for helicopter models.

Concluding notices:

- *The significantly greater servo resolution characteristic of the HoTT system produces a noticeably firmer response behavior in comparison to previous technology. Please take the time to familiarize yourself with this sensitive behavior.*
- *If you have a speed controller with integrated BEC* arranged in parallel with the receiver battery, its positive pole (red cable) may be removed from the 3-pole connector. Be sure to look for notices about this in the instructions for the speed controller used.*

With a small screwdriver, carefully lift up the the connector's center latch (1) just a bit then pull out the red lead (2) and tape it up with insulation tape to prevent possible short circuits (3).



* Battery Elimination Circuit

Follow the installation instructions on page 52 for the receiver, the receiver antenna and for mounting the servo.

Reset

To execute a reset of the receiver, press and hold the **SET** button on the receiver's top-side while switching the power supply on.

If a receiver reset is done while the transmitter is switched off or on a receiver which is not bound, the receiver's LED will slowly blink red for about 2 or 3 seconds. Now release the button again. The binding process can now be initiated right away on the transmitter-side.

If reset is done on a bound receiver and the corresponding model memory is active in the powered on transmitter, the LED will illuminate in green after 2 or 3 seconds as an indication that the transmitter/receiver system is again ready for operation. Now release the button again.

Please note the following:

A receiver RESET will cause ALL receiver settings, except for binding information, to return to their factory settings.

Therefore if a RESET is triggered unintentionally, any custom settings that had been present in the receiver before the reset will have to be established again by way of the Telemetry menu.

A deliberate RESET is recommended, especially if a receiver is to be "transferred" into another model. This is a rather simple method to eliminate settings which are no longer applicable.

Receiver power supply

Receiver power supply

Among other aspects, the safe operation of a model depends on a reliable power supply. In the event that, despite smooth operating rods, fully charged battery, battery leads with adequate cross-section, minimum contact resistances at connectors, etc., the transmitter indicates repeated receiver voltage collapses or is receiver voltage is generally too low; please give attention to the following notices.

Give primary attention to fully charged batteries when model operation is to be started. Be sure that the contact surfaces of connectors and switches really are low resistance. If necessary, measure the voltage drop across installed switch cables when they are under load because even new heavy-duty switches can cause a voltage drop of up to 0.2 V. This value can increase in contacts by factors as a consequence of aging and oxidation. The constant vibrations and jarring also takes its toll on contacts to produce a creeping increase of contact resistance.

Servos present another possible problem source. Even rather small servos like a *Graupner/JR DS-281* can draw up to 0.75 A of current when it is blocks under load. Just four of these servos in a "foam" model can therefore load down the on-board power supply by as much as 3 A ...

Therefore you should choose a power supply which will not break down under greater loads but rather always deliver sufficient voltage. To "calculate" necessary battery capacity you should always figure on at least 350 mAh for every analog servo and at least 500 mAh for every digital servo.

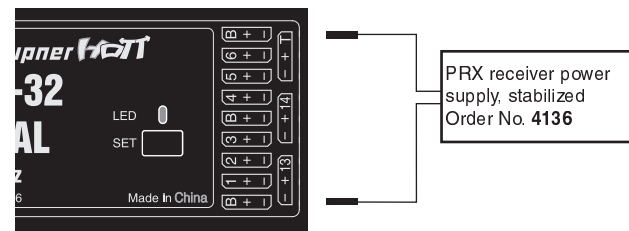
For example, from this point of view a battery with 1400 mAh would be the absolute minimum to power a receiver system with a total of 4 analog servos. But be sure to also consider the receiver itself into the calculation because its bidirectional functionality will draw about 70 mA of current too.

In any case, it is recommended that several of the six

available connections designated "- +/B" be used for the supply of power. (These connections are ONLY intended for battery connections.)

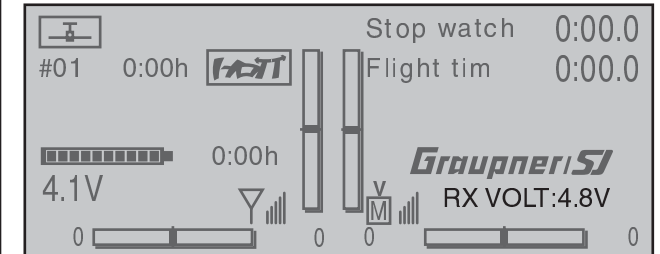
Connect the power supply preferably by way of the socket/s which are close to connectors of attached servos. Where only high-power servos are connected, it may be necessary to use all receiver battery connections to connect as many as three PRX receiver power supplies (depending on battery power). Even where only two batteries are used via 1 PRX it is preferable to use the receiver connections closest to the servos which draw the most current. The figure below shows an example of a stabilized receiver power supply (PRX-5A, order no. **4136**) for the connection of two batteries. As an alternative solution, a switch could be inserted with power supply cables to two receiver connectors. Such a double connection not only reduces the risks associated with a cable break but also ensures a more uniform supply of power to attached servos.

If a separate battery is connected to each receiver battery connection, be absolutely sure the batteries have the same voltage and power rating. Never connect different battery types or batteries charged to significantly different levels to the receiver. This can lead to effects similar to short circuit conditions. In such cases, insert voltage stabilizers, such as the PRX-5A receiver power supply, between the batteries and the receiver.



For reasons of safety, do not use battery boxes or dry cell batteries.

The voltage of the on-board power supply will be displayed at the bottom right of the transmitter's screen while the model is in operation.



If the adjustable warning threshold (default value 3.60 V) set in the Telemetry menu, see page 260, is underrun, a visual and an acoustic under-voltage warning will be issued.

Despite this feature, be sure to check the condition of the battery at regular intervals. Do not wait for the warning to be issued before recharging the battery.

Note:

An overview of available batteries, chargers and current source test instruments can be found in the Graupner RC main catalog or in Internet at www.graupner.de. A selection of suitable Compter chargers are listed in the table on page 17.

Receiver system power supply

NiMH 4-cell battery packs

In compliance with the aforementioned conditions, your *Graupner* HoTT receiver system can be readily operated with traditional 4-cell battery packs as long as the packs have adequate capacity and voltage level.

NiMH 5-cell battery packs

Five-cell battery packs offer a greater voltage tolerance than do 4-cell packs.

However, be aware that not every servo available on the market is able to tolerate the voltage level output by a 5-cell pack over the long term, this is particularly true when the battery pack is freshly charged. Some of these servos react to this with a noticeable "grinding" sound.

Therefore pay attention to the specifications of the servos you use before making a choice for a 5-cell battery pack..

LiFe 6.6 V batteries with 2 cells

From a contemporary perspective, these new cells are the very best choice.

LiFe cells are also available in hard plastic casings to protect them from mechanical damage. Like LiPo cells, LiFe cells can be quick charged in suitable chargers and they are comparatively robust.

This type of secondary cell battery is also rated for a significantly greater number of charge/discharge cycles than, for example, LiPo batteries. The nominal 6.6 V output of a 2-cell LiFe battery pack does not present a problem for either *Graupner* HoTT receivers nor for those servos, speed controllers, gyros and other devices which have been specifically approved for operation in this –higher– voltage range.

Please note however that practically all servos, speed controllers, gyros and other devices built in the past and most such devices currently still offered on the market have only a permissible voltage range of 4.8 to 6 V. Use of these batteries in conjunction with these devices demand use of

a stabilized voltage regulator, e.g. the PRX, Order No. **4136**, see appendix. Otherwise there is danger that attached devices will incur damage within a short period of time.

LiPo 2-cell packs

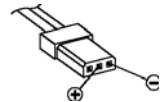
For a given capacity, LiPo batteries are lighter than, for example, NiMH batteries. LiPo batteries are also available in hard plastic casings to protect them from mechanical damage.

The comparatively high nominal voltage, 7.4 V, for a 2-cell LiPo pack does not present a problem for either *Graupner* HoTT receivers nor for those servos, speed controllers, gyros and other devices which have been specifically approved for operation in this –higher– voltage range. **Please note however that practically all servos, speed controllers, gyros and other devices built in the past and most such devices currently still offered on the market have only a permissible voltage range of 4.8 to 6 V.** Use of these batteries in conjunction with these devices demand use of a stabilized voltage regulator, e.g. the PRX, Order No. **4136**, see appendix. Otherwise there is danger that attached devices will incur damage within a short period of time.

Charging the receiver battery

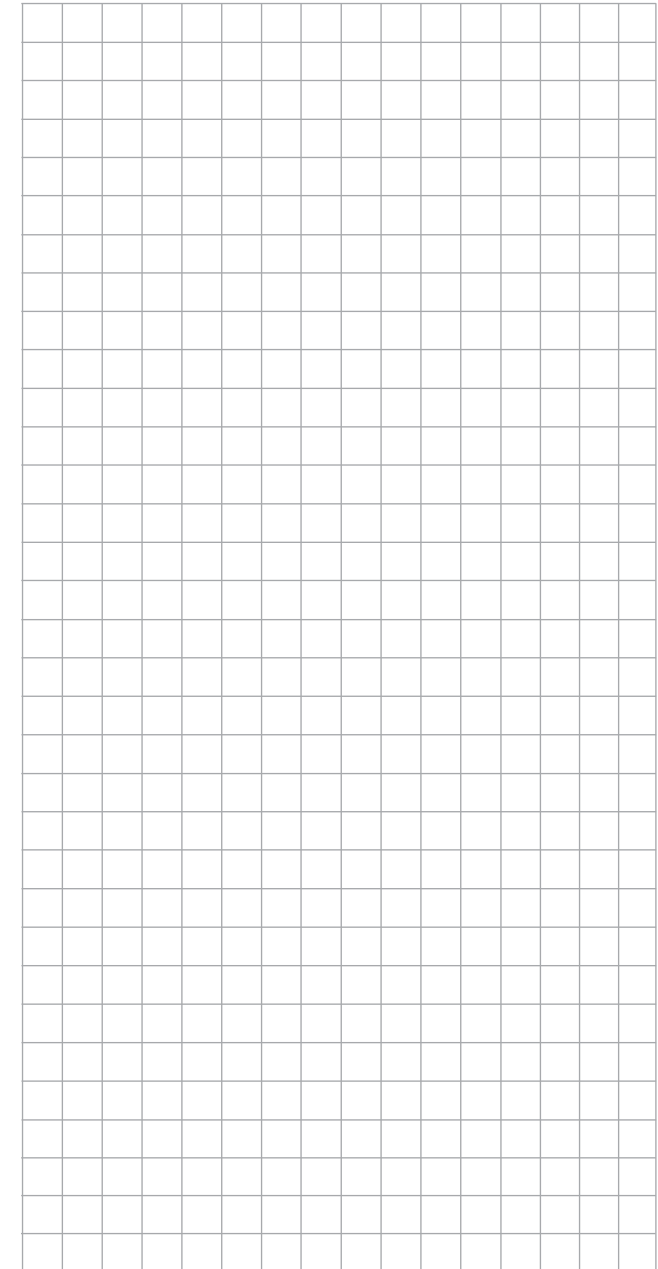
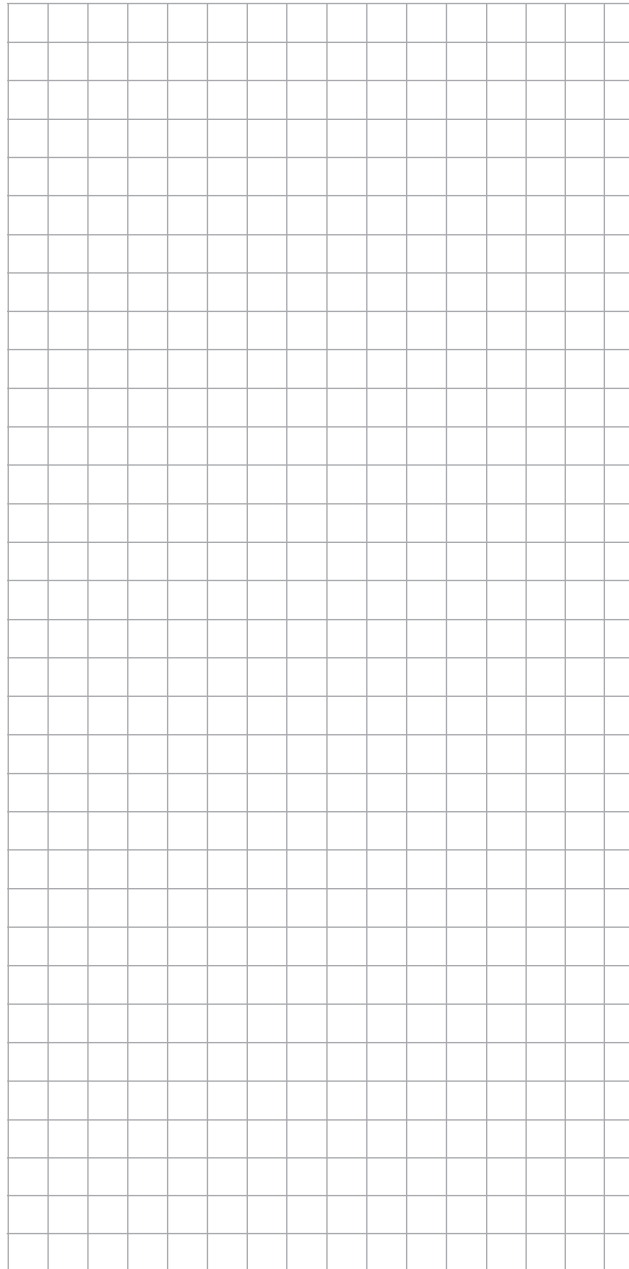
Charger cable, order no. **3021**, can be plugged directly onto the receiver's battery for charging. If the battery in the model is connected by way of an order no. **3046, 3934, 3934.1** or **3934.3** power supply cable, then charging can be accomplished via the charging jack or special charging connector integrated into the switch. The switch in the power supply cable must be in its "OFF" position for charging.

Receiver battery connection polarity



General charging notices

- The charging instructions for the charger as well as for the battery from its manufacturer to be observed.
- Pay attention to the maximum permissible charging current specified by the battery's manufacturer. In order to prevent damage to the transmitter, charging current should never exceed 1 A. If necessary, limit the current at the charger.
- If the transmitter battery is nevertheless to be charged at a current rate in excess of 1 A, then it is imperative that this is done outside the transmitter. Otherwise there is a risk of damage to the transmitter's board due to overloading its printed circuit paths and/or overheating of the battery.
- If an automatic charger is to be used for charging, perform several test charging procedures to ensure the flawless functionality of its automatic shut-off. This applies particularly if you want to charge the standard installed NiMH battery with an automatic charger unit intended for NiCd batteries Monitor the charger's shut-off behavior if it has that option.
- Do not execute a battery discharge or battery maintenance program through the charger jack. The charger jack is not suitable for this purpose.
- Always connect the charger cable to the charger first and then to the receiver or transmitter battery. This avoids the possibility of shorting the bare banana plug ends together.
- If the battery heats up significantly, check the battery's condition, replace the battery or reduce the charging current.
- **Never leave a charging battery unattended.**
- **Follow the safety notices and handling instructions provided on page 7.**



Receiver firmware updates

Receiver firmware updates are made by way of the connector located on the side of the receiver and the help of a PC running under Windows XP, Vista or Windows 7. The optional USB interface cable needed for this is order no. **7168.6** along with adapter cable, order no. **7168.6A**. The programs and files also needed can be found in Internet on the Graupner website at www.graupner.de under the downloads for the particular product.

Note:

After registering your receiver at <https://www.graupner.de/de/service/produktregistrierung>, you will automatically receive notification of future updates per email.

Updating receiver firmware

Note:

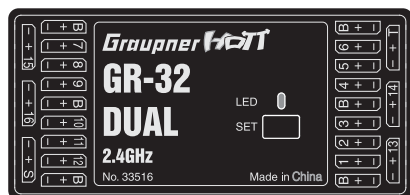
Before any update procedure, be sure to check the charged status of the receiver's battery. If necessary, charge the battery before beginning with an update.

1. Installing drivers

If not already done, install the required driver software for the USB interface, order no. **7168.6**, as described on page 43.

2. Establishing a receiver / PC connection

Connect the USB interface cable, order no. **7168.6**, via the adapter cable, order no. **7168.6A**, with the "- + T" connector on the receiver. These connectors are protected against polarity reversal so pay attention to the small chamfers on the sides of connectors. Do not use brute force, these connectors should latch in rather easily.



Adaptor cable
Order No. **7168.6A**
If available,
disconnect the central, red lead

Caution:

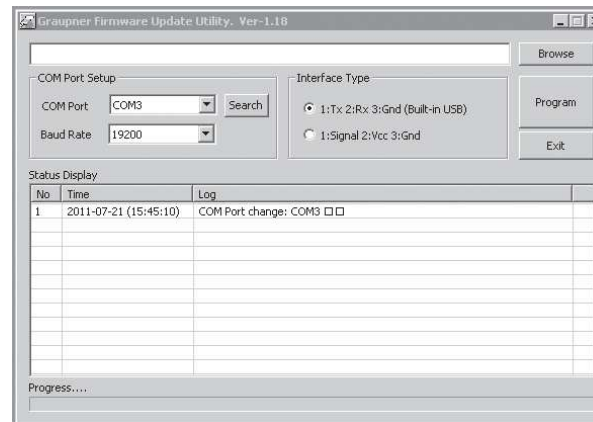
If the adapter cable is still has wires for all three poles, cut the red insulated wire for the middle connector pin of the adapter cable, Order No. 7168.6A.

Afterward, connect the USB interface with the included USB cable to the PC or laptop (PC USB/mini-USB interface connector). A red LED on the interface board should illuminate for a few seconds even though the connection is made correctly.

If not already off, now switch the receiver off.

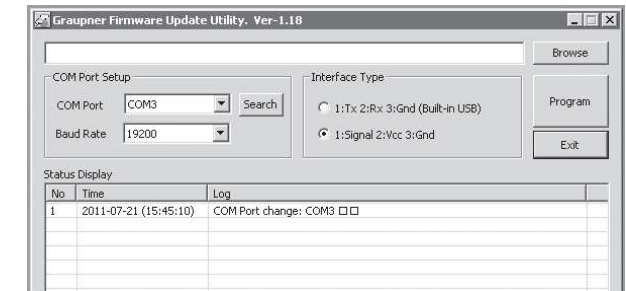
3. Firmware update utility program

On the PC, start the "Graupner_Firmware_Update_Utility_VerX.XX.exe" program with a double-click. This program is located among the files in the "Firmware-Updater" folder. (At the time of printing for this manual, this program's current version is 1.18 and it can be started without first being installed.)

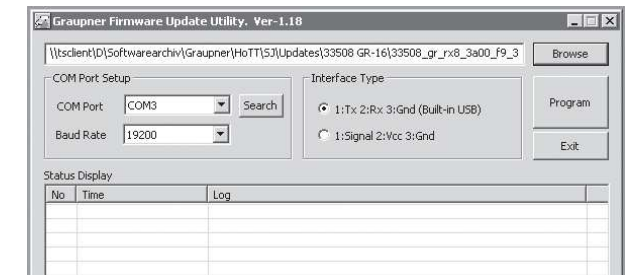


In the "COM Port Setup" group box, select the COM port to which the USB interface is connected. If you are not sure which selection is correct, press the "Search" control, choose the connection labeled "Silicon Labs CP210x USB to UART Bridge" from

the popup window and then activate "OK". The "Baud Rate" setting should be "19200". Afterwards, click on the "Signal 2:Vcc3:Gnd" radio button in the "Interface Type" group box.



Now click on the control labeled "Browse" that is located at the top right corner of the window. From the "Open file" window which appears, select the appropriate firmware update file for your receiver. Such files always have the ".bin" filename extension. Typically this file can be found in the folder whose name is prefixed with the order number of the receiver to be updated. This folder should contain the ZIP file that was downloaded and unpacked. Its filename should also be prefixed with the order number of the receiver to be updated. For the standard GR-32 DUAL receiver included in this set, the directory would be designated "33516_16CH_RX". The filename will appear in the corresponding window.



Firmware files are product-specifically coded, i.e. if a wrong file is accidentally selected which does