

CONTROLLER SYSTEM



14+

WARNING
Children's toy. Small parts.
Not for children under 3 years.
For age 3 and up.



Programming manual

Table of contents

General instructions	
Before use	3
Introduction	3
Warning and advisory symbols and their meaning	3
Safety instructions	4
PROPER USE	4
Safety and handling instructions for ...	
... Nickel metal hydride rechargeable batteries	8
... Lithium-ion and lithium polymer rechargeable batteries	10
Disposal of used single-use and rechargeable batteries	12
Environmental protection information	12
Description of remote control sets mz-18 and mz-24	13
Technical data	14
General operating notices	
Transmitter power supply	15
Recommended chargers (accessories)	16
Adjusting the control sticks	17
Description of the transmitter	
Control elements on the mz-24 HoTT transmitter	18
Button lock	19
The buttons ▲▼◀▶ as well as ESC and ENT	19
Digital trim	19
Display	20
Operating the displays	21
Warnings	22
Backside of the transmitter	24
DSC socket	24
Data socket	25
Headphone connector	25
Card slot	26
mini-USB connector	27
Initial use	
Starting up the transmitter	28
Updating the transmitter software	30
Restoring the transmitter software	30

Starting up the receiver	32
Receiver firmware updates	33
Backing up the receiver settings	33
Installation instructions	34
Receiver power supply	35
Definition of terms	37
Control, switch and control switch assignment	38
Receiver configuration	
Fixed-wing models	40
Helicopter models	41
Program description	
Program description	42
Base menu	
Model selection	44
Model name	45
Model Type	64
E.P.A.	66
Reverse/Slow	68
Sub-Trim	70
Motor (electric motor)	72
Throttle Cut (gas engine)	72
Transmitter control	74
Timers	80
Fail Safe	84
Trim settings	86
Servo	90
Channel Set	92
Gas limit function	94
Output swap	96
Function menu	
Fixed-wing models and helicopter models	
What is a mixer?	98
General information on freely programmable mixers	72
Prog.MIX	100
Trainer	107
Connecting scheme	110
Wireless HoTT system	111

Telemetry	114
Fixed-wing models	
Q.Link	132
D/R.EXP	136
Wing Mix	140
THR.CRV	144
Idle LOW	148
Snap roll	149
Aile differentiation	150
Flap mixer	152
Flap Sett	156
Airbrake	160
Butterfly	162
V-Tail	166
Helicopter models	
Q.Link	168
D/R.EXP	171
Pitch curve	175
Throttle curve	181
Gyro/governor	186
THR.HOLD	190
Swashplate mixer	192
Swashplate limiter	193
Swash mixer	194
Throttle mixer	196
PIT>>RUDD	198
System menu	
Stick mode	200
Warning	201
Etc.Set	202
Display	205
Stick calibration	208
MP3 Player	210
Telemetry	
Telemetry data display	213
Programming example	
Sequencer	218

Appendix

Appendix.....	220
Declaration of conformity.....	226
Graupner Service Centre	227
Warranty certificate.....	227

Before use

We are glad that you have chosen a *Graupner mz-18* HoTT or *mz-24* HoTT 2.4 GHz remote control system. This system is extremely versatile and can be used by both beginners and experts.

Please carefully review this manual to achieve the best results with your remote control, and especially for safe flying. If any difficulties arise during use, consult the manual, contact your dealer, or contact the *Graupner* Service Center.

Due to technical changes, the information within this manual may be changed without prior notification.

Introduction

The *Graupner* remote-control system can be used to control airplanes, gliders and helicopter models, and is the perfect choice for anyone looking for a superior remote-control system. The HoTT system transmits a range of real-time data such as the motor speed, voltage, temperature, warnings programmed by the user, etc. Such data are for example transmitted directly from a HoTT-compatible governor without requiring additional sensors. Of course, these data can also be transmitted from separately-connectable sensors that are compatible with the HoTT system.

WARNING:

 Read all of the instructions so that you become familiar with how to operate the system before you start using it. Misuse can damage the system, cause property damage and/or serious injury.

Warning and advisory symbols and their meaning

WARNING:

 This symbol indicates subsequent information that is essential for the user to observe. If these instructions are not followed, the reliable operation of the system and safety of the operator and third parties cannot be ensured.

NOTE:

 This symbol indicates subsequent information that the user must observe. If these instructions are not followed, it may result in damage of every category, a loss of warranty, etc.

 Without a specific heading, this symbol indicates subsequent information or suggestions which the user must follow. If these instructions or suggestions are not followed, damage of every category can result.

 This symbol indicates instructions and suggestions of all kinds which the user must follow.

 This symbol indicates instructions on the care of the device that the user must follow to ensure the device remains useful over a long period.

Safety instructions

Please follow the instructions.

To extend your enjoyment of your model, carefully read this entire manual and pay special attention to the safety instructions. You should also register now under https://www.graupner.de/en/service/product_registration.aspx to automatically receive latest product information by e-mail.

If you are a beginner on remote-controlled model airplanes, ships our cars, contact an experienced model pilot for their advice.

PROPER USE

NOTE:



This remote-control system must only be used for the purpose specified by the manufacturer for operation of remote control models without passengers. Any other type of use is not permitted and may damage the system and cause significant property damage and/or personal injury. No warranty or liability is therefore offered for any improper use not covered by these provisions.

NOTE:



THIS SYSTEM IS UNSUITABLE FOR UNSUPERVISED CHILDREN UNDER 14. SAFETY IS INTENTIONAL, AND REMOTE-CONTROLLED MODELS ARE NOT TOYS.

If improperly used or mishandled by third parties, even small models can cause significant property damage and/or personal injury.



This operating manual is considered part of the product. It contains important instructions on how to operate and handle your remote control system. These instructions must therefore be stored in a safe place and passed on to any subsequent user.



The warranty expires in case of not observing the operating and safety instructions.

Additional instructions and warnings



Technical defects of electrical or mechanical nature may cause motors to start without warning, or may generate flying parts which can cause significant injury to both you and others.

Avoid short-circuits in any circumstance. Short-circuits can destroy parts of the remote control system and cause serious burns or explosions depending on the circumstances and the battery charge.

All parts driven by the motor such as air and water propellers as well as helicopter rotors, exposed gears, etc. always pose an injury hazard. Never touch these parts! A fast-rotating propeller can cut off a finger! Make sure that no other objects come into contact with driven parts.

Once the battery is connected or the motor is running, **always** maintain a safe distance from the hazard area posed by the propulsion system.

While programming, make sure that a connected gas motor or electric motor cannot start accidentally. Disconnect the fuel supply or drive battery beforehand. Protect all equipment from dust, dirt, moisture and other foreign parts. All equipment must be protected from vibration as well as excessive heat or cold. The models may only be operated remotely in normal outside temperatures such as from -10°C to +55°C.

Avoid impacts and crushing. Check for damage to the housing and cables. Devices that become wet or damaged may not be used anymore even if they dry out.

Only use the components and recommended spare parts. Always use matching, original *Graupner plug-in connectors of the same design and material.*

When running the cables, make sure that they are not excessively tight, kinked, or severed. A sharp edge may damage insulation.

Make sure that all of the plug-in connectors are tight. When disconnecting the plug-in connectors, do not pull the cables.

No changes may be made to the devices. This will void permission to use the device along with the warranty. If

appropriate, send the relevant device to the responsible *Graupner service center*; see page 227.

Installing the receiver



For flying models, the receiver is installed behind a strong rib and is protected against dust and splash water in car and ship models. When you install your receiver, make sure that it is not excessively airtight to prevent it from overheating during operation.

The receiver may not directly touch the fuselage or chassis since this may directly transmit motor vibration or impact from landing. When installing the receiver in a model with a gas motor, all of the parts must be protected to prevent exhaust or oil from penetrating. This holds true in particular for the ON/OFF switch that is installed in the shell of the model in most cases.

Install the receiver so that the connecting cables for the servos and power supply remain loose, and so that the receiving antennas are at least 5 cm from all large metal parts or wires that do not directly originate from the receiver. This includes carbon fiber parts, servos, electric motors, fuel pumps, all types of cables, etc. in addition to metal parts.

It is preferable to install the receiver away from all other installed parts at an easily accessible location in the model. Servo cables may not be wound around antennas or run next to them.

Make sure that the cables cannot shift to lie directly adjacent to antennas during flight.

Installing the receiver antennas

The receiver and antennas should be as far away as possible from drives of all kinds. If the tails are made of carbon fiber, the ends of the antennas should extend from the fuselage by at least 35 mm. If necessary, exchange the approx. 145 mm standard antennas of HoTT receivers with longer antennas.

It does not matter how the antennas are aligned. However, a vertical installation of a single receiver antenna in the model is advantageous. In the case of

diversity antennas (two antennas), the active end of the second antenna should be at a 90° angle from the end of the first antenna, and the distance between the active ends should ideally be more than 125 mm.

Installing the servos

Always install the servos with the provided rubber vibration damper as shown in the "Installation instructions" on page 34. This is the only way to protect them somewhat from excessive vibration.

Installing the linkages

The linkage must be installed so that it is unhindered and can move easily. It is particularly important for all a rudder levers to execute their entire range of movement without any mechanical restrictions.

To make it possible for running motors to be stopped at any time, the linkage must be adjusted so that the carburettor is completely closed when the throttle control stick and trim are moved into idling end position.

Make sure that no metal parts rub against each other when moving the rudder, vibrations, rotating parts, etc. This may produce glitches and malfunction of receiver.

Aligning the transmitter antenna

The field strength emitted from the transmitter antenna when it is pointing in a straight line is weak. It is therefore incorrect to point the transmitter antenna directly to the model in the belief that this will increase reception.

When a number of remote control systems are being used at the same time, the pilots should stand next to each other in a loose group. Pilots standing away from the group pose a danger both to their own model and those of others.

If two or more pilots are using a 2.4 GHz remote control system and are closer than 5 m from each other, it can cause interference with the feedback channel, and a range warning may be generated too early. The pilots should move away from each other until the range warning stops.

Checklist before starting

Before turning on the receiver, make sure that the

throttle control stick is at stop/idle.

Always switch on the transmitter before the receiver.

Always switch off the receiver before switching off the transmitter.

WARNING:



If this sequence is not observed and the receiver is switched on while the associated transmitter is "OFF", the receiver can respond to other transmitters, interference, etc. This can cause the model to move in an uncontrolled manner and cause property damage or personal injury.

When models have a *mechanical gyro*, the following holds true:

Before turning on your receiver, make sure that the motor cannot start unintentionally by disconnecting the power supply.

When the gyro is running down, it frequently generates so much voltage that the receiver thinks that the throttle signals are okay. This can cause the motor to start unintentionally.

Range and function test



Before every use, check the range and functioning. Firmly secure the model, and make sure that no one is nearby.

Perform at least one complete range and function test on the ground, and run through an entire flight simulation to determine if there are any problems with the system or the programming of the model. Follow the instructions on page 77.

WARNING:



If the range and function test as well as the flight simulation are not performed completely and conscientiously, malfunctions may go unrecognized and reception may be lost which could cause a loss of control or even cause the model to crash. This can result in major property damage and/or

personal injury.

Operating models: Airplane, helicopter, ship and automobile

WARNING:

-  ***Never fly the model over the heads of observers or other pilots. Never endanger people or animals. Never fly close to power lines. In addition, never operate your model close to locks and open nautical traffic. Do not operate your model on open roads, highways, paths, public walkways, etc.***
- ***Never switch off the transmitter while operating the model! If this nonetheless accidentally happens, do not panic, and wait until the transmitter display goes dark which indicates that the transmitter is completely off. This will take at least 3 seconds. After this time, switch on the transmitter again. Otherwise, the transmitter may freeze directly after being switched on, and you will be unable to control the model. The transmitter may only be switched on again after it has been switched off and the described procedure has been correctly repeated.***

Towing

WARNING:



When operating towed models, maintain a minimum distance of approximately 50 cm between the participating receivers. Using the satellite receiver is an option. Otherwise, malfunctions from the feedback channel are possible.

Checking the transmitter and receiver batteries



Stop operation and recharge the transmitter battery at the latest when the transmitter battery is running low, the message "**Charge the battery!**" appears in the display, and an acoustic warning sounds.

Regularly check the battery charge, especially of the receiver battery. Do not wait until the movements of

the rudder are noticeably slower. Replace damaged batteries in a timely manner.

Always follow the manufacturers charging instructions. Do not charge the batteries without monitoring them.

Never attempt to charge dry batteries. An acute explosion hazard exists.

All batteries must be charged before each use. To prevent short-circuits, first plug the banana plugs of the charging cable into the charger (make sure the poles are correct). Then plug in the charging cable plugs into the sockets of the transmitter and receiver battery.

If you are not going to use your model for a while, disconnect all power sources.

Never use rechargeable or replaceable batteries with damaged, defective or different cell types; that is, a mixture of old and new cells, or cells by a different manufacturer.

Capacity and operating time

The following applies to all power sources: The capacity decreases with each charge. At low temperatures, the internal resistance increases while the capacity decreases further. As a result, the battery's ability to discharge and retain power is reduced.

Frequently charging and/or using battery care programs can also gradually reduce the capacity. Nevertheless, check the capacity of power sources at least every six months, and replace them if their performance is significantly low.

Only use original *Graupner rechargeable batteries!*

Suppressing interference in electric motors



All conventional electric motors generate sparks between the collector and brushes which more or less interfere with the operation of the remote control system depending on the type of motor.

Interference-suppressed electric motors are therefore required for the system to work well. Particularly when the models have an electric drive, the interference for each motor must be carefully suppressed. Noise

filters largely suppress such interference and must be installed.

Follow the related instructions in the motor's operation and installation instructions.

Additional details on noise filters can be found in the main *Graupner FS catalogue* or on the *Internet* at www.graupner.de.

Servo noise filters for extension cables

Order No. **1040**

The servo noise filter is required when using longer-than-usual servo cables. The filter is connected directly to the receiver output. In critical cases, a second filter can be placed on the servo.

Electronic speed controllers

The performance of the electric motor determines which electronic speed controller is used.

To keep the speed controller from overloading or becoming damaged, the current carrying capacity of the speed controller should be at least 150% that of the maximum stall current of the motor.

Exercise caution with tuning motors, because they only have a few windings and take several times their rated current in a stall which can destroy the speed controller.

Electrical ignitions

Ignition systems of gas motors also generate interference that may impair the correct function of remote controls.

The power supply for electrical ignitions should always be from a separate source.

Only use interference-suppressed spark plugs and spark plug connectors and shielded ignition cables.

The receiver should be at a sufficient distance from the ignition system.

Static energy

WARNING:



Magnetic shock waves generated by lightning can cause remote control systems to malfunction even if the

lightning is miles away. If a thunderstorm is approaching, land your model. Static discharge via the antenna can also be life-threatening.

Note:

-  To satisfy the high-frequency transmission requirements of the FCC for mobile transmitters, a distance of 20 cm or more must be maintained between the transmitter antenna and people. Operation at a closer distance is therefore not recommended.
- Make sure that no other transmitter is closer than 20 cm to prevent electrical malfunctions and impairment of emissions.
- To operate the remote control system, the country setting must be correct for the transmitter. This is required to satisfy the various national guidelines (FCC, ETSI, CE, etc.). Follow the respective instructions for the transmitter and receiver.
- Before each flight, perform at least one complete range and function test, and run through an entire flight simulation to determine if there are any problems with the system or the programming of the model. Follow the instructions on page 77.
- Never program the transmitter or receiver while using the model.

Care



Never clean the housing, antenna, etc. with cleansers, gas, water, etc. Only use a dry, soft cloth.

Components and accessories

NOTE:



As the manufacturer, Graupner|SJ GmbH recommends only using components and accessories that have been tested and accepted by Firma Graupner|SJ GmbH for suitability, functioning and safety. If this is done, Graupner|SJ GmbH will assume responsibility for the product.

However, Graupner|SJ GmbH assumes no liability

for products or accessories by other manufacturers that have not been approved, and is incapable of evaluating every single third-party product to determine if it can be used safely.

Disclaimer/damages



This manual is exclusively for information purposes and is subject to change without prior notification. *Graupner*|*SJ* GmbH assumes no responsibility or liability for mistakes or ambiguities that may be found in this manual.

Graupner|*SJ* GmbH is also incapable of ensuring that the installation and operation instructions are observed, and cannot monitor the maintenance of the conditions and methods for installation, operation, use and servicing the remote control components. *Graupner*|*SJ* GmbH is also not liable for any loss, damage or costs arising from, or in anywise associated with, improper use and operation.

As permitted by law, the responsibility of *Graupner*|*SJ* GmbH shall be restricted to damages, for whatever legal reason, equivalent to the invoice value of the equipment of *Graupner*|*SJ* GmbH directly involved in the event leading to the loss. This does not apply in the event of unlimited liability on the part of *Graupner*|*SJ* GmbH due to intent or gross negligence according to binding law.



Furthermore, only those claims can be reimbursed which are supported by a log file (see "Collecting/saving data" on page 26 and "Timer" on page 80. The transmitter must also be updated to the most recent software.

Please note, for technical reasons there is no data recording during playing mp3 files.

In order to be aware of important software updates, you should therefore register at https://www.graupner.de/en/service/product_registration.aspx. This will allow you to automatically receive updates by e-mail.



Safety instructions and handling guidelines for nickel metal hydride rechargeable batteries

As is the case with all high-quality products, the following safety instructions and handling guidelines must be observed to ensure long, trouble-free and safe use.

NOTE:

-  Batteries as well as individual cells are not toys and must be kept from children. They must therefore be stored out of the reach of children.
- Before each use, make sure that the batteries are in a satisfactory condition. Defective or damaged cells or batteries may not be used.
- Cells and batteries may only be used in accordance with the technical specifications for the specific cell type.
- **Batteries and cells may not be heated, burned, short-circuited or charged with excessive current or with reversed polarity.**
- **Batteries from parallel-connected cells, combinations of old and new cells, cells of different makes, sizes, capacities, manufacturers, brands or type may not be used.**
- Batteries which have been installed in a device should always be removed when the device is not being used. Always switch off devices after you have finished using them to prevent battery drainage. Be sure to charge the batteries in a timely manner.
- While they are being charged, the batteries must be placed on a nonflammable, heat-resistant and non-conductive surface. Combustible or highly flammable objects are to be kept away from the charging area.
- Batteries must be monitored while they are being charged. The maximum charging current specified for the respective cell type may not be exceeded.
- If the battery heats up above 60°C while it is being charged, stop charging and let the battery cool down to approximately 30°C.
- Do not charge batteries that have already been charged, are hot, or have not discharged to the specified level.

- The batteries may not be modified. Do not directly solder or weld the cells.
- If handled improperly, there is a danger of fire, explosion, irritation and burns. To extinguish a fire, use a fire extinguishing blanket, CO2 extinguisher or sand.
- Leaked electrolyte is caustic and should not be touched or come into contact with your eyes. In case of emergency, rinse with a large quantity of water and then consult a physician.
- The valve openings for the cells should never be blocked or sealed, for example with solder. When soldering, the maximum soldering temperature of 220°C should not exceed 20 seconds.
- To avoid deformation, avoid excessive mechanical pressure.
- If the batteries overheat, proceed as follows:
Disconnect the battery, and place it on a nonflammable surface (such as cement) until it cools down. Never hold the battery in your hand due to the risk of explosion.
- Make sure to observe the charging and discharging instructions.

General instructions



The battery capacity decreases each time it is charged and discharged. Storage can also gradually reduce the battery's capacity.

Storage

Batteries may only be stored completely discharged in dry rooms with an ambient temperature of +5°C to +25°C.

NOTE:



The cell voltage should **not fall below 1.2 V** when stored for a long time. Before being stored, the battery may have to be charged.

Equalizing the individual battery cells

- To adjust the cells of a new battery to each other, charge them normally to the maximum charge. As a

rule of thumb, charge *empty* batteries for 12 hours with a current which is 1/10 of the rated capacity (the "1/10 C" method). The cells will then all have the same charge. The cell charge should be equalized about every 10th charge in order to extend the life of the battery.

- If you are able to discharge individual cells, do this before each charging. Otherwise, the battery pack should be discharged to 0.9 V per cell. With the four-pack used in the transmitter, this corresponds for example to a discharge voltage of 3.6 V.

Charging

While charging, the specified current, charging time and temperature range should be observed under constant monitoring. If you do not have a suitable fast charger that allows the charging current to be precisely adjusted, charge the battery the usual way using the 1/10 C method (see the example above).

Given the different charges of the cell, transmitter batteries should be charged using the 1/10 C method whenever possible. The charging current should never exceed the maximum permissible level indicated in the transmitter instructions.

Fast charging

If your charger has this option, set the delta peak cutoff voltage to 5 mV per cell. Most chargers are permanently set to 15 ... 20 mV per cell and can therefore be used for both NiCd batteries as well as NiMH batteries. In case of doubt, consult the operating instructions or the dealer to determine whether your device can handle NiMH batteries. In case of doubt, charge your batteries with one-half the indicated maximum charging current.

Discharging

All of the batteries that are sold by *Graupner* and *GM-Racing* can handle a maximum continuous charging current of 6... 13 C depending on the battery type (refer to the manufacturer's specifications). The battery life decreases as the continuous current load increases. Reflex charging as well as charging/discharging pro-

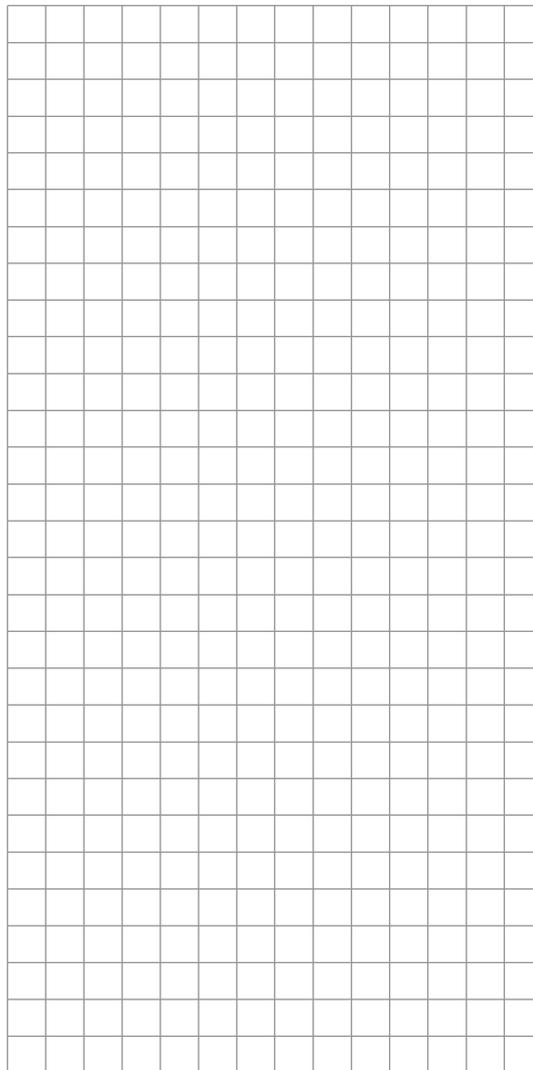
grams unnecessarily shorten the life of batteries and are only suitable for checking the battery quality or restoring old cells. It is likewise not recommendable to charge and discharge a battery before a single use unless you want to check the battery's quality.

Instructions on the mz-18 HoTT remote control set

Order No. **S1005**



The respective Transmitter set is equipped with a four-cell NiMH transmitter battery (subject to change). After reaching the factory default undervoltage limit of 4.8 V, a warning message appears in the display of the transmitter.



Safety instructions and handling guidelines for lithium-ion and lithium polymer rechargeable batteries

As is the case with all high-quality products, the following safety instructions and handling guidelines must be observed to ensure long, trouble-free and safe use of lithium-ion and polymer batteries.

Lithium-ion/lithium polymer batteries require special treatment. This is true when charging, discharging, storing and all other types of handling. Observe the following specifications:

Special instructions on charging *Graupner* lithium-ion/lithium polymer batteries

NOTE:

-  Since *Graupner*/SJ GmbH is unable to monitor whether the batteries are correctly charged and discharged, all warranties are voided upon incorrect charging or discharging.
- Only use the approved chargers with the associated charging cables to charge lithium-ion/lithium polymer batteries. Any alterations to the charger or charging cables can cause serious damage.
- The maximum charging capacity must be limited to a factor of 1.05 of the battery capacity.
Example: 700mAh battery = 735mAh max. charging capacity
- To charge and discharge lithium-ion/lithium polymer batteries, only use the plug-in charger in the set, or the specially designed charger/dischargers by *Graupner*, see page 16 or listed at www.graupner.de.
- Make sure that the number of cells, charging cutoff and discharging cutoff voltage are set correctly. Refer to the operating instructions of your charger/discharger.
- Under these prerequisites, *Graupner* lithium-ion/lithium polymer batteries can be charged with a maximum 2C (1C corresponds to the cell capacity) charging current. Starting at a maximum 4.2 V per cell, continue charging at a constant 4.2 V per cell until the charging current falls below 0.1... 0.2 A.
- Do not charge with more than 4.20 V per cell. This

would permanently damage the cell and may cause a fire. To keep from overcharging individual cells within the pack, set the cutoff voltage between 4.10 ... 4.15 V per cell in order to extend the battery life.

- The permissible temperature range for charging and discharging lithium-ion/lithium polymer batteries is 0 ... +50 °C.
- Batteries as well as individual cells are no toys and must be kept from children. They must therefore be stored out of the reach of children.
- Keep batteries away from infants and small children. If a battery is swallowed, immediately consult a physician or go to an emergency room.
- Never place a battery in a microwave or under pressure. This may cause smoke, fire or an explosion.
- Do not disassemble lithium-ion/lithium polymer batteries. Disassembling a battery can cause internal short-circuits. This same results in the release of gas, fire and explosion, or other problems.
- The electrolyte and electrolyte vapours within lithium-ion/lithium polymer batteries are hazardous to health. Avoid direct contact with electrolytes. If the electrolyte comes into contact with your skin, eyes or other body parts, use a large amount of fresh water for rinsing and then consult a doctor.
- Before each use, make sure that the batteries are in a satisfactory condition. Defective or damaged cells or batteries may not be used.
- Cells and batteries may only be used in accordance with the technical specifications for the specific cell type.
- Batteries and cells may not be heated, burned, short-circuited or charged with excessive current or with reversed polarity.**
If handled improperly, there is a danger of fire, explosion, irritation and burns. To extinguish a fire, use a fire extinguishing blanket, CO2 extinguisher or sand.

- If the batteries overheat, proceed as follows:
Disconnect the battery, and place it on a nonflammable surface (such as cement) until it cools down. Never hold the battery in your hand due to the risk of explosion.
- Batteries from parallel-connected cells, combinations of old and new cells, cells of different makes, sizes, capacities, manufacturers, brands or type may not be used.**
- Batteries which have been installed in a device should always be removed when the device is not being used. Always switch off devices after you have finished using them to prevent battery drainage. Dead lithium-ion/lithium polymer batteries are considered defective and may not be reused.
- Be sure to charge the batteries in a timely manner. While they are being charged, the batteries must be placed on a nonflammable, heat-resistant and non-conductive surface. Combustible or highly flammable objects are to be kept away from the charging area.
- Batteries must be monitored while they are being charged. The maximum charging current specified for the respective cell type may not be exceeded.
- You may only charge a pack of series-connected lithium-ion/lithium polymer batteries all at once as long as the voltage of the individual cells does not deviate by more than 0.05 V, or if the differences in voltage are monitored and equalized by a balancer connector using a balancer or equalizer during charging.
The lithium-ion battery in the set comes with a special safety shut off. The voltage differences between individual cells are therefore not balanced by means of the usual balancer plug-in connector.
- If the battery heats up above 60 °C while it is being charged, stop charging and let the battery cool down to approximately 30 °C.
- The batteries may not be modified. Do not directly solder or weld the cells.
- To avoid deformation, avoid excessive mechanical pressure.

- Make sure to observe the charging and discharging instructions.

Storage



Lithium lithium-ion/lithium polymer cells should be stored charged with 10-20% of their capacity. If the cell voltage falls below 3 V, the lithium-ion/lithium polymer cells must be recharged to 10-20% of the full capacity. Otherwise, the battery will die during storage and become useless.

Special instructions on discharging *Graupner* lithium-ion/lithium polymer batteries

-  A continuous current of approximately 1 C does not pose a problem for *Graupner* lithium-ion/lithium polymer batteries. If the current is higher, refer to the instructions in the catalogue. Bear in mind the maximum load for the plug-in system (see the maximum discharge current on battery).
- Discharging below 2.5 V per cell will damage the cells and should therefore be avoided at all costs.
- The batteries should never be short-circuited. Short-circuits generate a very high current which heats up the cells. This causes a loss of electrolyte, gas formation or even explosions. *Graupner* lithium-ion/lithium polymer batteries should therefore be kept away from and not touch conductive surfaces due to the short-circuit hazard.
- The battery's temperature during discharging should never exceed +70°C. Otherwise, make sure that the battery is sufficiently cooled, or reduce the discharge current. The temperature can be easily checked using the infrared thermometer (order No. 1963). However, the battery may not be discharged using the transmitter's charging socket. This socket is not designed for this purpose.

Additional instructions on handling

-  The battery capacity decreases each time it is charged and discharged. Charging when the temperature is too high or too

low can also gradually reduce the battery's capacity. After 50 cycles, the battery capacity of models is only 50-80% of that of a new battery due to the occasionally high discharge current and induction current of the motor, even when all charging and discharging instructions have been followed.

- Batteries may only be series-connected or parallel-connected in exceptions since the cell capacity and charge can differ. The battery packs that we supply are therefore preferable.
- The connectors of lithium-ion/lithium polymer batteries are not as robust as other batteries. This holds true particularly for the plus connector. The connectors can easily break.

Cell connector



Direct soldering on the battery cells is not permitted.

The heat from direct soldering can damage battery components such as the separator or isolator. Battery connectors should only be created by spot welding in the factory. If the cable is missing or severed, have it repaired professionally by the manufacturer or dealer.

Replacing individual battery cells



Individually battery cells may only be exchanged by the manufacturer or dealer and not by the user.

Do not use damaged cells



Damaged cells may not be used.

Indications of damaged cells include damaged housing packaging, deformed cells, the smell of electrolyte or leaking electrolyte. The battery may not be used in these cases.

Damaged or useless cells are considered hazardous waste and must be disposed of properly.

General warnings



Batteries may not be immersed in liquid such as tap water, sea water or beverages. Avoid all contact with liquids of any kind.

Instructions on the mz-24 HoTT remote control set Order No. S1006



The remote control set comes standard with a lithium-ion transmitter battery with an integrated protective circuit (subject to modification). A warning appears in the transmitter display after the voltage falls below the default low-voltage limit of 3.60 V which may be modified by the user.

Computer systems for the mz-18 ~~HoTT~~ and mz-24 series ~~HoTT~~

two remote control sets with a 2.4 GHz *Graupner* HoTT system (hopping telemetry transmission)

Common features

- Microcomputer remote control system using the latest 2.4 GHz *Graupner* HoTT technology
- Maximum insensitivity to interference from optimized frequency hopping over a max. 75 channels and a wide channel spread
- Intelligent data transmission with a correction function
- Ultrafast reaction times by direct data transmission from the main processor to the 2.4 GHz RF module with reliable transmission. No additional delays or rerouting through other processors.
- Bidirectional communication between the transmitter and receiver
- Extremely fast rebinding even at maximum distances
- Range test and warning function
- Receiver low voltage warning in the transmitter display
- Extremely wide receiver operating voltage range from 3.6 V to 8.4 V (fully functional down to 2.5V)
- Fail Safe
- A host of programming and evaluation functions shown directly on the transmitter with special telemetry displays
- All components may be updated which extends usefulness
- Cutting-edge wireless trainer system for easy beginner training
- Touch-sensitive coloured TFT display
- Additional side control buttons
- Etc.

mz-18 remote control set, order No. S1005

• Delivered items

mz-18 HoTT transmitter, order No. **S1005.en**, with installed flat NiMH transmitter battery 4NH-2000 RX RTU (subject to modification), plug-in charger (5.6V/200 mA), bidirectional *Graupner* receiver GR-12L HoTT (order No. **S1012**) and GR-24 HoTT (order No. **33512**), USB adapter/interface (order No. **7168.6**) including USB cable and adapter cable (order No. **7168.6S**) for receiver updates, carrying strap and instructions, warranty card and stylus for alternative use of the touch sensitive display

• Individual transmitter features

Max. 9 control channels
30 model memories
2 trimmable control stick systems (controls 1... 4)
1 two-position switch with long handle (S6*)
1 three-position switch with long handle (S3*)
4 three-position switches with short handle (S1*, S4*, S5* and S7*)
2 one-side, self-neutralizing three-position switches with long handle (S2* and S8*)
2 rear proportional sliders (SL1* and SL2*)
2 front proportional dials (DV1 and DV2*)

mz-24 remote control set, order No. S1006

• Delivered items

mz-24 HoTT transmitter, order No. **S1006.de**, with installed lithium polymer transmitter battery LiPo 1s2p/4000mAh/3.7V TX (subject to modification), plug-in charger (4.2V/500 mA), bidirectional *Graupner* receiver GR-12L HoTT (order No. **S1012**) and GR-24 HoTT (order No. **33512**), USB adapter/interface (order No. **7168.6**) including USB cable and adapter cable (order No. **7168.6S**) for receiver updates, as well as a micro SD card with adapter for card readers, carrying strap, carrying case and instructions, warranty card and stylus for alternative use of the touch sensitive display

• Individual transmitter features

Max. 12 control channels
30 model memories
Integrated MP3 player
2 trimmable control stick systems (controls 1... 4)
1 two-position switch with long handle (S6*)
1 three-position switch with long handle (S3*)
4 three-position switches with short handle (S1*, S4*, S5* and S7*)
2 one-side, self-neutralizing three-position switches with long handle (S2* and S8*)
2 INC/DEC buttons (DT1* and DT2*)
2 rear proportional sliders (SL1* and SL2*)
4 proportional dials (DV1* ... DV4*)

* See "Transmitter control elements" on page 18

Technical data

mz-18 and mz-24 HoTT transmitters

Frequency band	2.4 ... 2.4835 GHz
Modulation	FHSS
Transmitting power	100 mW EIRP
Control functions	mz-18 HoTT: 9 functions of which 4 can be trimmed mz-24 HoTT 12 functions of which 4 can be trimmed
Temperature range	-10 ... +55 °C
Antenna	Can be turned and folded
Operating voltage	3.4 ... 6 V
Power consumption	Approximately 540 mA
Dimension	Approx. 194 x 287 x 112 mm
Weight	approx. 840 g with transmitter battery

GR-12L HoTT receiver

order No. **S1012**

Operating voltage	3.6 ... 8.4 V*
Power consumption	Approximately 70 mA
Frequency band	2.4 ... 2.4835 GHz
Modulation	FHSS
Antenna	1 x approx. 145 mm long, approx. 115 mm encapsulated and approx. 30 mm active
Pluggable servos	6
Pluggable sensors	1 (instead of servo 5)
Temperature range	Approx. -10 ° ... +55 °C
Dimension	Approx. 36 x 21 x 10 mm
Weight	Approx. 7 g

GR-24 HoTT receiver

order No. **33512**

Operating voltage	3.6 ... 8.4 V*
Power consumption	Approximately 70 mA
Frequency band	2.4 ... 2.4835 GHz
Modulation	FHSS
Antenna	Diversity antennas, 2 x approx. 145 mm long, approx. 115 mm encapsulated and approx. 30 mm active
Pluggable servos	12
Pluggable sensors	1
Temperature range	Approx. -10 ° ... +55 °C
Dimension	Approx. 46 x 31 x 14 mm
Weight	Approx. 16 g

Accessories

Order No.	Description
1121	Shoulder strap, 20 mm wide
70	Shoulder strap, 30 mm wide
3097	Windshield for manual transmitters
<i>For additional accessories, see the Annex or the Internet at www.graupner.de. You can also contact your dealer. He would be glad to assist you.</i>	
	Trainer cable for the HoTT transmitter, see page 110

Replacement parts

Order No.	Description
S8360	HoTT aluminum case for the mz transmitter
2498.4FBEC	4NH-2000 RX RTU flat
S8345	Lithium-ion 1s2p/4000mAh/3.7V
33800	HoTT transmitter antenna

*



The specified permissible operating voltage range applies exclusively to the receiver. In this context, please note that the input voltage for the receiver is provided unregulated to the servo connectors; however, the permissible operating voltage range for most of the servos, speed controllers, gyros, etc. on the market is only 4.8 to 6 V.

General operating instructions

mz-18 and mz-24 HoTT transmitters

Transmitter power supply

The **mz-18** HoTT transmitter comes standard with a rechargeable NiMH battery with 2000mAh capacity, and the **mz-24** HoTT transmitter comes standard with a 1s2p lithium-ion battery with 4000mAh capacity (subject to modification).



The standard battery installed in the transmitter is uncharged upon delivery.

The transmitter battery voltage should be monitored in the LCD display during operation. Once the adjustable voltage in the "battery warning threshold" is reached in the "Etc.Set" submenu of the system menu, page 202, a standard 4.8V (NiMH) for the **mz-18** HoTT transmitter and 3.6V (lith.) for the **mz-24** HoTT transmitter, a warning beep sounds, and the following window appears in the display:



or:



Now at the latest, stop operation and recharge the transmitter battery.

Note:

-  Make sure that the correct battery type has been set in the submenu "Etc.Set" of the system menu, page 202!
- In a special calibration menu that can be opened by touching the voltage display in the basic display of the transmitter using a finger or the provided stylus, the real displayed voltage can be fine-tuned (see "Battery warning" on page 202).

The rechargeable NiMH battery of the **mz-18** HoTT transmitter or the 1s2p lithium-ion battery of the **mz-24** HoTT transmitter may be charged as described below using the charging socket on the rear labelled CHARGE with the provided plug-in charger:



The charging socket comes standard with a protective diode that protects against polarity reversal. Original *Graupner* automatic chargers recognize the battery charge. Note the setting instructions of the charger which is used.

Polarity of the mz charging socket

The charging cables available on the market by other manufacturers frequently have different polarities. For this reason, you should only use original *Graupner* charging cables with order No. **3022**.



Charging the transmitter battery using the plug-in charger

The charging time with the plug-in charger provided in the set may be up to 15 hours depending on the existing transmitter battery charge.



Do not use plug-in

chargers by other manufacturers or chargers designed for different battery types. If the output voltage is too high or the plug polarity is incorrect (see above), it can cause significant damage. We recommend labelling the plug-in charger.

Consult the corresponding safety instructions on pages 4 ... 12.



The transmitter must be switched off while charging. Never switch on the transmitter when it is connected to the charger. If the charging is interrupted even for a short time, the charging voltage can rise enough to immediately damage the transmitter from overvoltage. You should therefore make sure that all plug-in connectors are well-seated.

Charging using automatic chargers

To fast charge the transmitter battery, *Graupner* automatic chargers can be used. The following table offers a selection.

Recommended chargers (accessories)

Order No.	Name	Connection 230V AC	Connection 12V DC	Suitable for the following battery types				integrated balancer
				NiCd	NiMH	LiPo	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
6478	Ultra Duo Plus 60	x	x	x	x	x	x	x
6480	Ultra Duo Plus 80		x	x	x	x	x	x

For charging the transmitter battery, the charging cable with order No. 3022 is required, and for charging the receiver battery, the charger cable with order No. 3021 is required.

Other chargers as well as details on the listed chargers can be found in the main *Graupner* FS catalogue or on the Internet at www.graupner.de.



First plug the banana plugs of the charging cable into the charger, and then plug the other end of the charging cable into the transmitter charging socket. Never connect the bare ends of the plugs of a charging cable that is already connected to the transmitter!

To prevent damage to the transmitter, the charging current should generally not exceed 1.5A. Limit the charge current if necessary.

Removing the transmitter battery

To remove the transmitter battery, first remove the cover of the battery compartment on the back of the transmitter.



Then disconnect the transmitter battery plug by carefully pulling the supply cable. Then lift the battery and pull it gently off of the velcro.

(The display shows the battery for the transmitter **mz-24** HoTT.)

Inserting the transmitter battery

The battery connector is protected by two bevelled edges from polarity reversal when plugging in. The free socket of the battery connector faces upward at the bottom of the battery compartment as can be seen in

the following picture. The plus pole (red cable) is in the middle, and the minus pole (brown or black cable) is on the side facing the pole.



Never forcefully insert the plug into the socket on the transmitter board.

Then place the battery into the compartment, and close the battery cover.

Battery operating time in the bottom left display

The time (green) is automatically reset to 0:00 once the transmitter battery voltage is recognizably higher than the most recent voltage after the transmitter is started, and the display shows the cumulative operating time of the transmitter since last charging.



General charging instructions

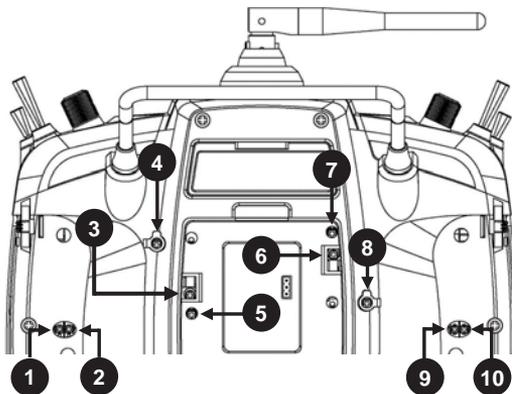
-  Follow the charging instructions of the charger manufacturer and battery manufacturer.
-  Do not exceed the maximum permissible charging current of the battery manufacturer. To prevent damage to the transmitter, the transmitter charging current should generally not exceed 1.5 A. Limit the charge current if necessary.

If the transmitter battery is charged with more than 1.5A, it must be charged outside of the transmitter. Otherwise, the printed circuit board may be damaged from overloading the printed connectors and/or overheating the battery.

- Perform a few test charges to make sure that the automatic cutoff of automatic chargers works. This is especially true when you want to use an automatic charger to charge the NiMH battery which comes standard in the **mz-18** HoTT transmitter, or the lithium battery which comes standard in the **mz-24** HoTT transmitter. Monitor the cutoff behaviour if the charger that you are using has this option.
- Do not discharge the battery or run battery care programs using the charging socket. The charging socket is only for charging.
- Always first connect the charging cable to the charger, and then connect it to the receiver or transmitter battery. This prevents unintentional short-circuiting with the bare ends of the charging cable plug.
- If the battery becomes hot, check the battery and exchange it or reduce the charging current.
- **Do not charge the batteries without monitoring them.**
- **Follow the safety instructions and handling guidelines starting page 4.**

Adjusting the control sticks

Both the left and right control sticks can optionally be set from neutralizing to non-neutralizing and vice versa. The resetting force on the control sticks can be set to the pilot's preferences. The related adjusting system is on the back of the transmitter in the battery compartment, under the rubber covers, and under the side grips attached with double-sided adhesive tape (see the marks in the following picture). Make the desired adjustment by turning the relevant setscrew using a Phillips or standard screwdriver. Hold the control stick tight as a precaution:



- **1 and 2 / 9 and 10**
Adjust the braking force with the outermost of the two screws, and adjust the strength of the control stick ratchet using the innermost screw.
- **4 and 5 / 7 and 8**
Adjust the return force of the control direction by turning the relevant setscrew using a Phillips or standard screwdriver.

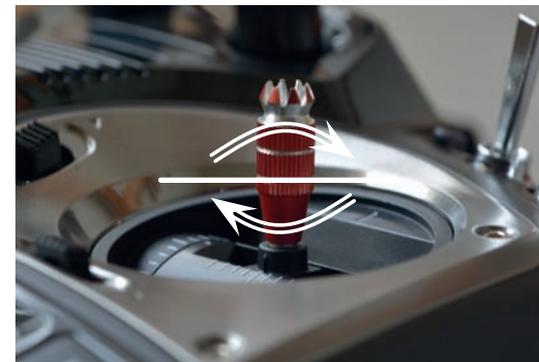
• 3 and 6

To change the standard setting of the left and right control sticks, turn the screw toward the inside of the transmitter until the relevant control stick can move freely from stop to stop, or turn it outward until the control stick resets itself independently.

Adjusting the length of the control sticks

Both control sticks can be gradually adjusted over approximately 8 mm to adapt the transmitter control to the pilot's preferences.

Hold down the bottom half of the knurled grip, and loosen the screwed connection by turning the top part:



You can now lengthen or shorten the control stick by screwing it up or down. Then clamp the top and bottom part of the grip by rotating them against each other.

Transmitter description

Front side

Control elements on the mz-24 HoTT transmitter



Button lock

Access to adjustments can be blocked in the basic transmitter display by simultaneously pressing the **ESC** and **ENT** buttons for about one second. This is indicated by a change of colour of the button icon at the top right in the display from gray to blue/yellow:



The lock is activated immediately, but the controls remain operational.

Press the **ESC** and **ENT** buttons again for about three seconds to release the lock. The colour of the icon returns to grey:



Buttons ▲ ▼ ◀ ▶ as well as **ESC** and **ENT**

Although the two **mz-18** HoTT and **mz-24** HoTT transmitters are primarily operated by touching the touch-sensitive screen with a finger or the provided stylus, the transmitters can be operated in special cases using the two sets of three buttons on the side of the display.

Buttons to the left of the display

- Adjusting buttons ▲ ▼
 1. Set the parameters in the setting fields after they are activated by pressing the **ENT** button.
 2. Simultaneously press the ▲ ▼ buttons to reset a changed parameter in the active entry field to the default (**CLEAR**).
 3. Simultaneously pressing the buttons in the basic display as well as in all menus with **SERVO** or a **Sv** button switches directly to the »**Servo display**«.

- **ESC** button

Firmware version before V 1.023

Press the **ESC** button to confirm the current setting and deactivate the active settings field.

Firmware version V 1.023 and higher

Pressing the **ESC** button brings about a stepwise return to function selection or back to the basic display. Any setting changed in the meantime is retained.

Buttons to the right of the display

- Selection buttons ◀ ▶

"Scrolling" through the menu lines in the setting menus or through the icons that can be called up in the basic display.
- **ENT** button
Activate (confirm) the settings fields by pressing the **ENT** button.

Digital trim

With an optical and acoustic display

The two control sticks come with digital trim. Briefly touch the trim switch to move the neutral position of the control stick by a specific value with each click. Hold down the switch to move the trim in the corresponding direction with increasing speed.

The adjustment is made audible by tones of varying levels. It is therefore easy to find the middle position during flight without looking at the display. If you go past the middle position, a brief pause is inserted.

The current trim values are automatically saved when the model memory is changed. In addition, the digital trim functions within a memory in specific relation to the Quick Link (with the exception of the trim of the Throttle/brake valves or the gas/pitch control stick called control function "THR" (channel 1)).

When a gas motor is selected in the "Drive type" display, page 47, the trim of the throttle control stick only functions for wing or helicopter models in the bottom half of the control stick path, that is, only in the starting range.

The current trim positions are displayed numerically and graphically in the transmitter's basic display (see the picture on the left and on the next page) as well as in a special display, see page 88.

Display

Graphic display of the position of the standard, left INC/DEC button DT 1 with a numeric position and direction display that only comes with the **mz-24** HoTT transmitter.

Graphic display of the position of the proportional dials DV 1 (**mz-18** HoTT) and DV 2 (**mz-24** HoTT) with a numeric position and direction display.



These icons are for information only:
coloured = active
Gray = inactive

Model type*

MP3 player* (as of V 1.023)

Model operating time*

Model memory ...*

Model name*

Transmitter operating time: This is automatically reset to zero after charging or changing the battery.

 Touching "mz" like all of the fields on this page identified with an asterisk (*) at the end of the description opens a context menu.

Graphic display of the position of the standard, right INC/DEC button DT 2 with a numeric position and direction display that only comes with the **mz-24** HoTT transmitter.

Graphic display of the position of the proportional dials DV 2 (**mz-18** HoTT) and DV 3 (**mz-24** HoTT) with a numeric position and direction display.

Three colour display of the transmitter battery voltage. Once a set warning threshold is reached, a warning appears on the display and acoustic warning signals are emitted*.

Timer 1*

Timer 2*

Quick Link name*

Button for opening the telemetry displays

Button for opening the system settings

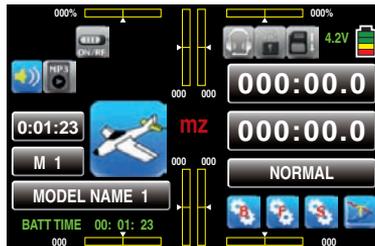
Button for opening the model settings

Button for opening the basic settings

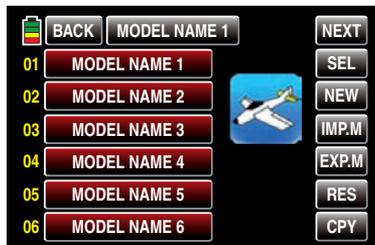
Graphic display of the position of the four digital trim levers with a numeric position and direction display.

Operating the displays

The display is basically operated by touching the desired field with a finger or the provided stylus:



By touching the model memory field labelled "M 1" in the above display with a finger or the provided stylus, the "Model memory" selection menu opens.



In this menu, you can change the model by touching the desired model memory.

Just as described on page 45, touch **NEW** to start programming a new model, or touch the field **MODEL NAME 1** at the upper edge of the display to switch to the "Model name" entry menu, or touch **BACK** at the top left to return to the previous menu item. In contrast, touch the button **NEXT** [next page] (generally using the rotation method) which is also available in several menus to go to the next page. In the above display of the model memory, to the display of model memories 07 ... 12, etc.

The other fields on the left side identified with an asterisk (*) basically function the same way.

In contrast, if you touch one of the three gear icons

identified with "B", "F", and "S", special selection menus open on the bottom right from which you can switch to other submenus. Starting with the green **base menu**, see page 44 the selection displays appear as follows:



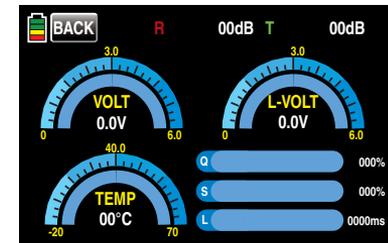
It should be noted that they blue **FUNCTION** menu which is described starting on page 100 or 171 contains model-type-specific submenus. The first of the two following pictures therefore shows examples of the menu structure of a fixed-wing model, and the second one shows the menu structure of a helicopter model:



The pink **SYSTEM** menu that can be opened by pressing "S" and is explained starting on page 208 appears as follows:



The telemetry displays which can be opened by pressing "T" and are described in detail starting on page 213 appear as follows:



Warnings

Depending on the context, different warning windows appear in the display for the **mz-18** HoTT transmitter and the **mz-24** HoTT transmitter. These can be divided into two groups:

Warning display

These smaller windows primarily appear after the transmitter is switched on and indicate certain operating states. In the following illustration, for instance, the red dot after "CH1-POS" indicates that the CH1 control stick, or as of firmware version V 1.023, the gas servo, connected to output 1 on a surface model and to output 6 on a helicopter model, is not in the idle position and there is the risk of a runaway engine.

Note:

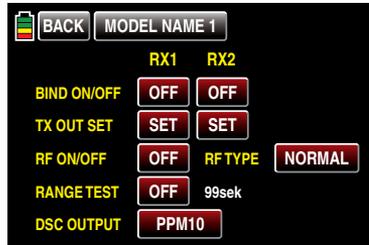


The default "Rear idle" can be switched to "Front idle" for fixed-wing models in the **"THR. CRV"** menu, page 144, by inverting the control curve.

The bottom line also indicates that a receiver has not been bound to the current model memory.



Touch **SET** with a finger or the provided stylus to go directly to the **"Transmitter control"** display in which you can link the receiver to the model memory as described on page 74:



Or touch the **BACK** button at top left to terminate the procedure.

Firmware versions up to and including V 1.022

If in contrast a receiver is already linked to the current model memory and it is not switched on or out of the range when the transmitter is switched on, a related warning window appears:



Firmware versions as of V 1.023 and higher

As of firmware version V 1.023 and higher, switching on the transmitter generally also activates the HF transmissions and the display shown above appears in the centre of the transmitter display. At the same time, audible warning signals sound for a few seconds.

You now have the option of waiting a few seconds until the display disappears automatically or maintaining the HF transmissions by manually tapping the **ON** button with your finger or the provided stylus, or switching them off by tapping the **OFF** button.

In the field between the two green lines, the message

"Normal signal" indicates that the transmitter is set to normal remote control. Alternately, messages such as "TEACH signal" or "PUPIL signal" can appear here. Another – possible – variant is to display "F/S setup t.b.d" as an indication that no fail-safe settings have yet been made.

Answer the request "Turn RF ON/OFF" in the area below as desired by touching the button **ON** or **OFF** with a finger or the provided stylus.

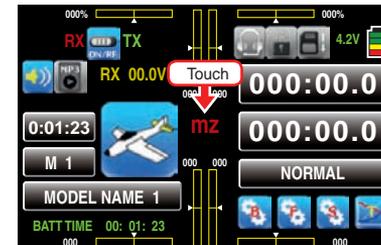
Note:



By default, only the monitoring of the "THR position" is activated in the display of the submenu **"Warning"** of the system menu, page 201.

"acute warning" display

You can open this display by touching **mz** in the middle of the transmitter's basic display:



And touch the **BACK** button at top left to close the display.

If acoustic warnings sound and the normal transmitter display is covered by this display, take note of the message in red. For example because the transmitter's supply voltage has reached the warning threshold set in the submenu "Etc.Set" of the system menu, page 202:

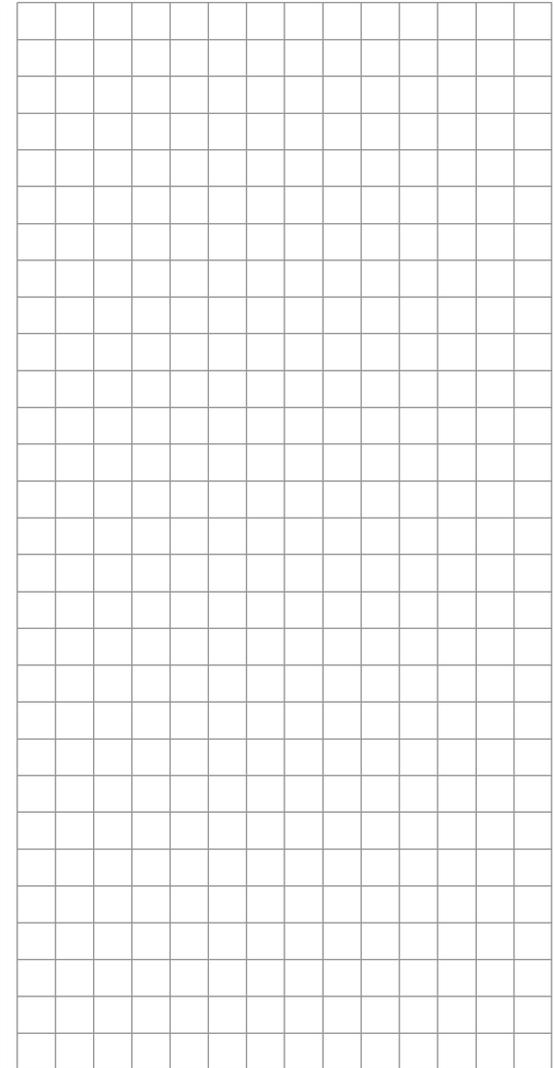


At the same time, the display contrast is reduced to 05 to save power.

This warning can be kept from reappearing by touching the **ON** button at the top right then deleted by touching the **BACK** button at the top left in the display. (In specific cases, stop operating the model as soon as possible and charge the transmitter).

The red number at the top right shows the number of current warnings; in the above example, the warning is the third one. This count can be deleted by touching the **CLR** button at top left.

All other warnings in this display can be handled in the same way. However, in the case of a field strength alarm, you can also suppress other alarms triggered by the low field strength by touching the **ON** button under "STRENGTH ALARM" for the duration of the current operation of the transmitter.



Backside of the transmitter

(The figure shows the **mz-24** HoTT transmitter.)



DSC socket

The abbreviation "DSC" is from the initial letters of the original function, "direct servo control". With the HoTT system, "direct servo control" using a diagnostic cable is not possible for technical reasons.

The standard two-pin DSC socket on the back of the **mz-18** HoTT and **mz-24** HoTT transmitters functions as a trainer or pupil socket as well as an interface for flight simulators or other external devices.

To ensure a correct DSC connection, observe the following:

1. Perform any necessary adaptations in the menu.
To adapt to the transmitter to a trainer system, see page 107.
2. Connect the other end of the connecting cable to the desired device while observing the relevant operating instructions.

Important:



Make sure that all the plugs are securely inserted in the respective sockets, and only use the provided plug-in connectors with a 2-pin jack plug on the DSC side.

3. In the "Transmitter control" submenu, page 74, you can set one of the following modes in the "DSC output" line depending on the number of functions to be transmitted: PPM10, PPM16, PPM18 and PPM24. Default: PPM10.

Instructions regarding flight simulators:

-  Given the numerous flight simulators on the market, it is possible that the contacts on the jack plug or DSC module may have to be adapted by Graupner Service.

NOTE:

-  When your transmitter is directly connected to a desktop computer or laptop by a connecting cable (DSC cable) and/or a computer interface is connected to your simulator, the transmitter may be destroyed by electrostatic discharge. This type of connection should therefore

Data socket

only be used if you protect yourself from electrostatic discharge while operating the simulator by wearing a commercially available grounding armband. Graupner therefore strongly recommends only using wireless simulators.

The so-called DATA socket is found under the back cover of the **mz-18** HoTT **mz-24** HoTT transmitters:



This is for connecting the optional Smart Box (order No. **33700**).

Further information on the Smart Box can be found in the main *Graupner FS* catalogue and on the Internet at www.graupner.de for the respective product.

Headphone connector

The headphone connector is found left of center under the back cover of the **mz-18** HoTT **mz-24** HoTT transmitters:



The socket is for connecting commercially available earbuds or headphones with a 3.5 mm stereo jack (not included in the set). When headphones are plugged in, the transmitter's speaker is switched off, and the stylized icon of a headphone is depicted in colour and not grey in the basic display, see page 20.

In addition acoustic signals from the transmitter, signals and messages associated with the "**Telemetry**" menu are output via this connector. These messages are in German language by default. Further information can be found under "Messages" in the section "**Telemetry**" starting on page 114.

Card slot

micro-SD and micro-SDHC

The card slot for micro-SD and micro-SDHC memory cards is found right of center under the back cover of the **mz-18** HoTT **mz-24** HoTT transmitters:



In addition to the micro-SD memory cards that come standard, all conventional micro-SD memory cards with up to 2 GB and micro-SDHC cards with up to 32 GB memory can be used. The manufacturer recommends using memory cards with a maximum of 4 GB since this capacity is normally sufficient.

The memory card delivered with the transmitter like the memory cards used in digital cameras or cell phones is inserted into the slot behind the cover with the contacts facing up and then locked in place. After insertion of the memory card, the transmitter cover can be closed.

When the provided memory card or another memory card has been inserted in the transmitter at least once, the card is ready for use directly after the transmitter is switched on. If the transmitter is switched on after the memory card is inserted, the stylized memory card icon is displayed in colour and not grey in the basic display, see page 20. Otherwise, a few folders are first created on the memory card.

Removing the memory card

Open the cover on the back. Press the SD card slightly toward the card slot to unlock it and then remove it.

Capturing and saving data



The data memory on the SD card is linked to timer 1. Once this starts, data storage also starts assuming that an appropriate memory card is in the card slot and there is a telemetry link with the receiver. Data storage stops when the timer 1 stops. Timer 1 starts and stops as described in the section "Timer" on page 80.

After data storage is finished, an (empty) "Models" folder and "LogData" folder appear on the memory card. Finally, the log files are saved in subfolders called "Modelname" named according to the structure 0001_year-month-day.bin, 0002_year-month-day.bin. If in contrast a model memory is still nameless, the corresponding log files are saved in a subfolder entitled "NoName" after the memory card is removed from the transmitter and inserted in the card slot of a desktop or laptop computer. The data can be evaluated on a compatible computer using the programs found on the downloads page for the transmitter under www.graupner.de.

Important instructions:

-  **Claims cannot be reimbursed which are not supported by a log file. For the same reason, the transmitter must also always be updated to the most recent software. Please note, for technical reasons there is no data recording during playing mp3 files.**
-  **In order to be aware of important software updates, you should therefore register at https://www.graupner.de/en/service/product_registration.aspx. This will allow you to automatically receive updates by e-mail.**

Importing and exporting model memories

To exchange data between transmitters of the same make or to backup data, model memories can be copied to the inserted memory card, or from the memory card to the transmitter. More information can be found in the section "Importing/exporting from the SD card" starting

on page 59.

Note:

-  *Some of the special characters used in model names cannot be transferred to FAT and FAT32 file systems due to the specific restrictions of these file systems used by the memory card and are therefore replaced by a tilde (~) during the copying process.*
- The model memories of the **mz-18** and **mz-20** transmitters are in principle compatible, however: In order to import from an SD card in another a transmitter, the desired model memory must be copied or moved to a corresponding directory on a desktop or laptop. For example from `\\Models\mz-24` to `\\Models\mz-18` or vice versa.*

More information on importing from an SD card can be found on page 59.

NOTE:



After importing from an SD card, you need to check each and every model function and in particular adapt the control and switch functions into the respective transmitter.

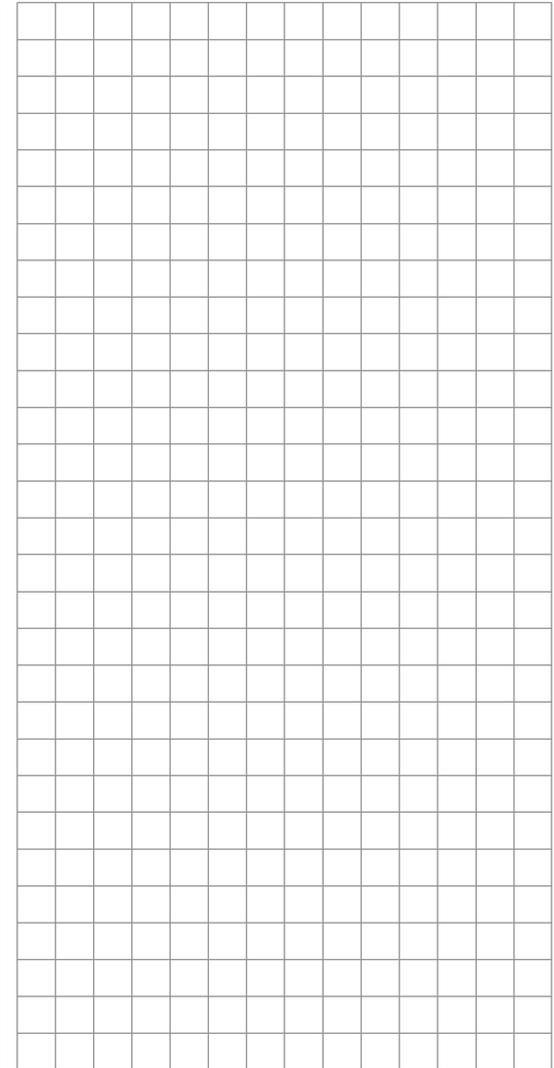
mini-USB connector

Located under the rear cover of the **mz-18** HoTT and **mz-24** HoTT transmitters, there is a connector socket for software updates as well as the date and time setting from a desktop or laptop with one of the Windows operating systems (XP, Vista, 7 or 8):



The USB cable that comes with the set is plugged into this socket. The procedure for obtaining software updates through a computer is described in the software package instructions.

The software that the computer needs as well as the appropriate USB driver can be found on the download page at www.graupner.de for the respective product. After the required driver and software are installed, the transmitter can be updated as needed using this connector, or the date and time can be set.



Starting up the transmitter

Introductory remarks on the **mz-18** HoTT and **mz-24** HoTT transmitters

Theoretically, the *Graupner*-HoTT system allows more than 200 models or remote-control systems to be operated at the same time. This number will be significantly less in practice since permits are required for combined remote operation within the 2.4 GHz ISM band. Generally however, more models can be operated at the same time within the 2.4 GHz band than was previously the case within the conventional 35/40 MHz frequencies.

Battery charged?

Since the transmitter is delivered with an uncharged battery, you will need to charge it observing the instructions on page 15. Otherwise, a warning signal will sound after a short time and a related message will appear in the basic display after a certain voltage is reached (normally 4.8V with the **mz-18** HoTT transmitter and 3.6V with the **mz-24** HoTT transmitter) which can be changed in the line "Bat. warning threshold" in the sub-menu "Etc.Set" page 202, within the system menu.



Transmitter startup

As of firmware version V 1.023 or higher, switching on the transmitter in the as-delivered state generally also activates the HF transmissions and the display appears in the centre of the transmitter display as previously:



At the same time, audible warning signals sound for a few seconds.

You now have the option of waiting a few seconds until the display disappears automatically or maintaining the HF transmissions by manually tapping the **ON** button with your finger or the provided stylus, or switching them off by tapping the **OFF** button.

You can switch off a receiver that is on and then first touch **ON** for demonstration purposes. You are then in the basic display of the **mz-18** HoTT or **mz-24** HoTT transmitter:

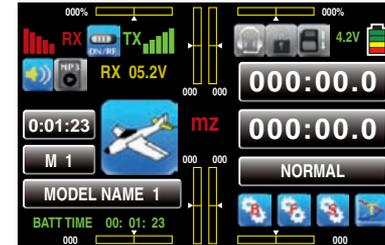


The blue switch symbol at the top left between the red "RX" and the green "TX" means that the high-frequency transmission of the transmitter is on.

The red "RX" and green "TX" on the left and right of this switch symbol mean that the currently active model memory has once been linked to a *Graupner*-HoTT

receiver but is presently not linked.

Once this link exists, the field strength display appears next to the red "RX" and right next to the green "TX", and the yellow numeric display underneath shows the current voltage of the receiver power supply, for example:



If in contrast the transmitter is switched on while the high-frequency transmission is off, all of this information is not displayed, and the high-frequency switch symbol is grey:



If the following warning appears in the display after the transmitter is switched on:



the currently active model memory is not linked to any receiver.

Important instructions:

-  **The transmitter which comes with the set comes with the correct operating settings for most countries in Europe. However in this context, please also note the instructions on page 76.**
- **Using connectors 1 ... 9, a maximum of 9 servos can be operated with the mz-18 HoTT transmitter together with the GR-24 receiver which comes with the set and is already linked to the first model memory. Any servos which are connected to connectors 10 - 12 remain in their middle position by default and cannot be actuated by the transmitter.**
A maximum of 12 servos can be operated with the mz-24 HoTT transmitter together with the GR-24 receiver which comes with the set and is already linked to the first model memory.
For the sake of maximum flexibility and to prevent unintentional misuse, control channels 5-9 and 5-12 are initially not assigned to any control elements, and the servos linked to these channels first remain in their middle position until an operating element has been assigned. For the same reason, nearly all mixers are inactive. More information on this subject can be found on page 92.
- **The basic procedure for initially programming a new model memory starts on page 45.**
- **When training, linking or adjusting the remote control, make sure that the transmitter antenna is always far enough from the receiver antennas. If the transmitter antenna is too close to the receiver antennas, the receiver will overamplify the receiver, and the red LED on the receiver will shine. At the same time, the feedback channel will stop working, the field strength bar in the**

transmitter display will disappear, and the current receiver battery voltage will be displayed as 0.0 V. The remote control is simultaneously in fail safe mode (see page 84). That is, due to the loss of reception, the servos remain in the last correctly received or fail safe positions until a new valid signal is received. In this case, move away until the displays return to normal.

WARNING:

 **Never switch off the transmitter while operating the model! If this nonetheless accidentally happens, do not panic, and wait until the transmitter display goes dark which indicates that the transmitter is completely off. This will take at least four seconds. After this time, switch on the transmitter again. Otherwise, the transmitter may freeze directly after being switched on, and you will be unable to control the model. The transmitter may only be switched on again after it has been switched off and the described procedure has been correctly repeated.**



Updating the transmitter software

Firmware updates for the **mz-18** HoTT and **mz-24** HoTT transmitters can be obtained via the mini-USB connector on the back of both transmitters using a computer operating on Windows XP, Vista, 7 or 8.

With the provided USB cable (USB-A to 5-pin mini-B-USB), connect your *switched-off* transmitter to your computer by inserting one end of the USB cable directly into the five-pin mini-USB connecting socket of the transmitter, and the other end into a free USB connector of your computer.

The programs and files required for updating the transmitter as well as detailed instructions for the corresponding product (combined into one software package) can be downloaded from www.graupner.de.

Download this software package from the Internet, and unpack it on your computer. All other information can be found in the instructions that come in the software package.

Note:



After your transmitter has been registered at https://www.graupner.de/en/service/product_registration.aspx, you will automatically be notified of updates by e-mail.

Important instructions:

-  **Please note that compatible firmware is required for reliable communication between the HoTT components. The programs and files that are required to update all HoTT components are therefore combined into a single file that is currently named "HoTT_Software_V4.zip".**
- **Only operate your transmitter using the current software version. When these instructions were drafted, the corresponding information could be found at <http://www.graupner.de/en/supportdetail/e2a02e43-4a3b-484c-a10c-b5b0cff1ed99>. If this link does not work, the same information**

Restoring the transmitter software

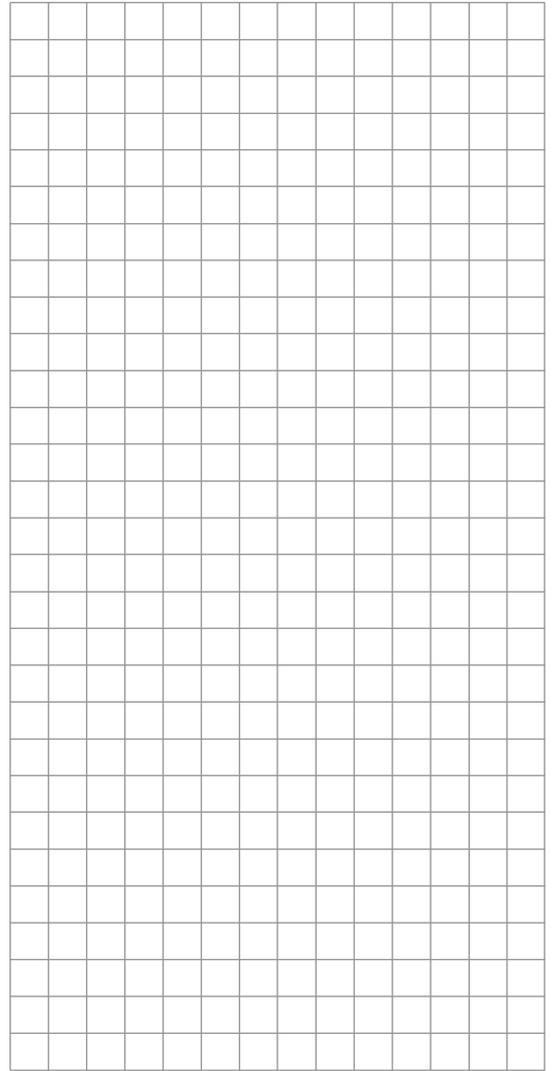
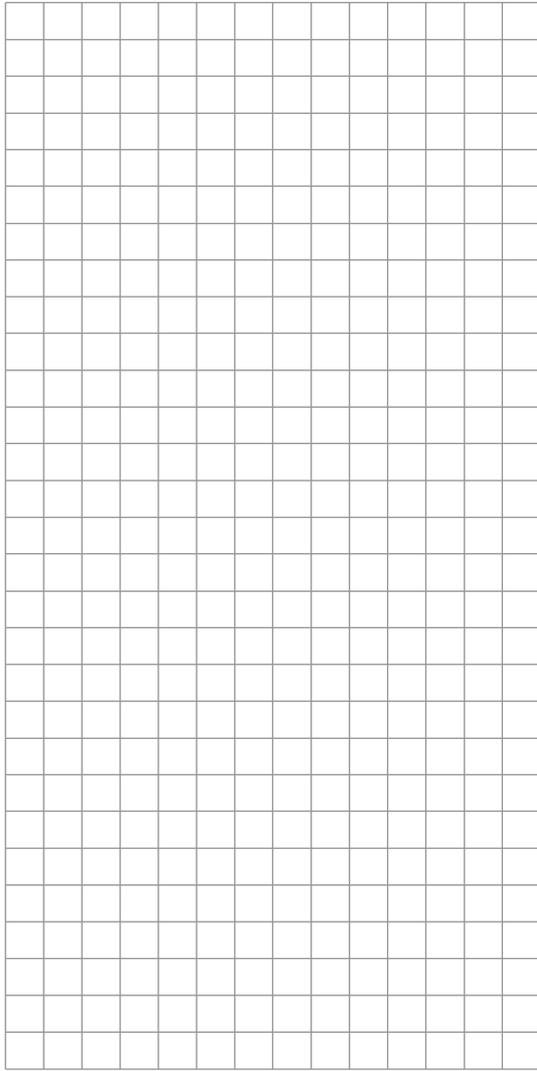
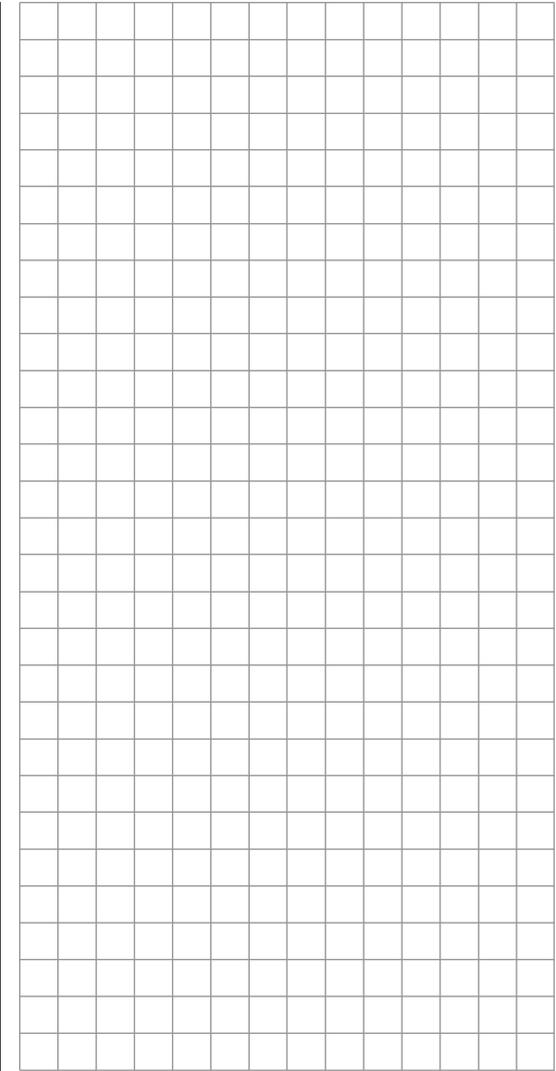
Program: "Restore"

If a firmware update for the transmitter is unsuccessful or the transmitter program freezes and the transmitter cannot be switched off using the "POWER" switch, remove the transmitter's battery after setting the switch to "POWER = OFF" position, or pull the plug from the transmitter battery. While making sure that the POWER switch is in the "OFF" position, wait a few seconds and then switch on the battery.

In this case as well, download a current software package from the Internet and open it on your computer or, if you have already done this, start the program `gr_Studio`, and follow the information in the section "Restoration" in the instructions provided in the software package.

can be found at: www.graupner.de => Service & Support => Update- Revisions-History of GRAUPNER HoTT-Komponenten.

- ***Before each update, check the transmitter battery charge or charge it as a precaution, and save all model memories so that they can be restored if necessary.***
- ***Do not disconnect the link to the computer during an update! Make sure that the link between the transmitter and computer is operational.***
- ***After each update, check to make sure that the models function correctly.***



Starting up the receiver

Preliminary remarks

The **mz-18** HoTT and **mz-24** HoTT remote control sets each come with a GR-24 bidirectional 2.4 GHz receiver which can be connected to a maximum of 12 servos, as well as a bidirectional GR-12L HoTT receiver.



Using connectors 1 ... 9, a maximum of 9 servos can be operated with the **mz-18** HoTT transmitter together with the GR-24 HoTT receiver which comes with the set and is already linked to the first model memory. Any servos which are connected to connectors 10 ... 12 remain in their middle position by default and cannot be actuated by the transmitter.

In contrast, a maximum of 12 servos can be operated with the **mz-24** HoTT transmitter together with the GR-24 HoTT receiver which comes with the set and is already linked to the first model memory.

If you have already switched on the GR-24 HoTT receiver that comes with the set and its transmitter is not in range or is switched off, the red receiver LED will shine for a few seconds and then start to slowly flash. This means that a link has not (yet) been established with a *Graupner*-HoTT transmitter. Once a link is established, a green LED shines continuously, and the red LED extinguishes.

To establish a telemetry connection with the transmitter, first the *Graupner* HoTT receiver must be "bound" to its model memory in its *Graupner* HoTT transmitter. This procedure is called "binding." This binding only needs to be performed once for each receiver/model memory combination (see) and has already been done at the factory for model memory 1 for the devices provided in the set. Binding therefore only needs to be performed for other receivers when the memory is changed (you can repeat this at any time after changing a transmitter).

NOTE:



An activated receiver that has linked at least once with "its" transmitter responds to any incoming control signals from other model memories of "its" transmitter like a secondary receiver.

Onboard voltage display

When a telemetry link exists, the current voltage of the receiver power supply appears at the top left in the transmitter display in yellow.



Temperature warning

If the receiver temperature falls below a threshold which can be set in the receiver (-10°C by default) or exceeds a top warning threshold (+55°C by default) which can also be set in the receiver, the receiver emits a warning in form of a beep that repeats approximately once per second.

Servo connectors and polarity

The Servo connectors of the *Graupner*-HoTT receiver are numbered. The polarity of the plug-in system cannot be reversed. When inserting the plug, note the small bevels on the side (see the figures on the next double-page). Do not apply force.

The supply voltage runs through all the numbered connectors.

With the GR-24 receiver, the two outermost vertical connectors are for the battery. These are identified with "11+B-" and "12+B-". A corresponding servo along with the power supply can be connected to the two connectors using a V or Y cable (order No.: **3936.11**).

NOTE:



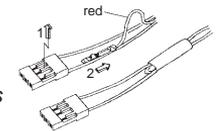
Do not reverse the polarity of these connectors! This can destroy the receiver and connected devices (see the next double page).

The function of each channel is determined by the transmitter and not the receiver. Depending on the make and model, throttle servo connection, along with other connections, can be different. With *Graupner*/JR and *Graupner* remote controls, this connection is at channel 1 for fixed-wing models, and at channel 6 for helicopters. Note the installation instructions for the receiver, receiver antennas and servos on page 34.

Final instructions:

-  The significantly higher servo resolution of the HoTT system leads to a noticeably more direct response in comparison to the previous systems. Take time to familiarize yourself with this more sensitive response!
- If you are using a speed controller with an integrated BEC* in addition to the receiver battery, the plus pole (red cable) may have to be removed from the 3-pin plug depending on the speed controller. In this regard, take note of the related information in the speed controller instructions.

Use a short screwdriver to carefully lift the middle tab of the plug (1), remove the red cable (2), and use electrician's tape to protect against shorts (3).



Reset

To reset the receiver, hold down the SET button on the top of the receiver while turning on the power. Hold down the SET button of the receiver until, after about 3 seconds, the slowly flashing red/green LED extinguishes for about 2 seconds.

If the reset procedure is performed while the transmitter is switched off or the receiver is not linked, the green and red LEDs flash four times over about 3 seconds in the standard GR-24 receiver that comes with the set, then both LEDs extinguish for about 3 seconds, and then the red LED starts to flash. Release the button once the LEDs extinguish.

Receiver firmware updates

Backing up the receiver settings

You can then start a binding procedure for the transmitter and receiver.

If a linked receiver is reset and the associated model memory is active in the switched-on transmitter, the LED shines green continuously for about 2-3 seconds to indicate that your transmitter/receiver system is ready to use.

Please note the following:



Resetting resets all of the settings in the receiver to the factory settings with the exception of the binding information.

If a reset is performed accidentally, all of these settings that were made using the "Telemetry" menu in the receiver should be restored.

Resetting is particularly recommendable when you want to switch a receiver to a different model. This makes it easy to keep settings which do not match from being transferred.

Receiver firmware updates can be obtained via the receiver telemetry connection using a computer operating on Windows XP, Vista, 7 or 8. To do this, you will need a USB interface (order No. **7168.6**) and the adapter cable (order No. **7168.S**) that come with the set. The programs and files which are also required for updating the transmitter as well as detailed instructions for the corresponding product (combined into one software package) can be downloaded from www.graupner.de.

Download this software package from the Internet, and unpack it on your computer. All other information can be found in the instructions that come in the software package.

Note:



After your receiver has been registered at https://www.graupner.de/en/service/product_registration.aspx, you will automatically be notified of updates by e-mail.

The software package downloaded from the Internet and opened on your computer contains the program "Firmware_Upgrade_grStudio". This program may already be installed on your computer.

Using the "Receiver settings" section of the Firmware_Upgrade_grStudio program, you can save all of the settings programmed in a receiver within a file on the computer so that you can upload them to the receiver if needed. This makes it unnecessary to have to reprogram the receiver using the "Telemetry" menu.

The USB interface (order No. **7168.6**) and the interface cable (order No. **7168.S**) that come standard with the **mz-18** HoTT (order No. **S1005**) and **mz-24** HoTT (order No. **S1006**) remote control sets are required for this program.

All other information can be found in the instructions that come in the software package.

Installation instructions

Installing the receiver

Whatever *Graupner* receiver system you use, the procedure is the same.



Note that the receiver antennas must remain at least 5 cm from all large metal parts or wires that do not come directly from the receiver. In addition to steel parts, this includes carbon fiber parts, servos, fuel pumps, every kind of cable, etc. It is preferable to install the receiver away from all other installed parts at an easily accessible location in the model. Servo cables may not be wound around antennas or run next to them.

Note that the cables can shift under the influence of acceleration during flight. You therefore need to make sure that the cables cannot move to be directly adjacent to antennas. Moving cables can interfere with reception. Tests have shown that installing an individual antenna vertically yields the best results for distant flights. In the case of diversity antennas (two antennas), the active end of the second antenna should be at a 90° angle from the end of the first antenna, and the distance between the active ends should ideally be more than 125 mm.

If the fuselage are made of carbon fiber, the ends of the antennas should extend from the fuselage by at least 35 mm. In both cases, the approx. 145 mm standard antennas for HoTT receivers should be exchanged with antennas that are 300 mm or 450 mm long (order No. **33500.2** and order No. **33500.3**, respectively).

The connectors identified as "X+B-" on the GR-24 HoTT receiver that comes with the set are for the battery. The power supply runs through all the numbered connectors, and the power can in principle be supplied through any of the 12 connectors. If applicable, use a V or Y cable (order No. **3936.11**).

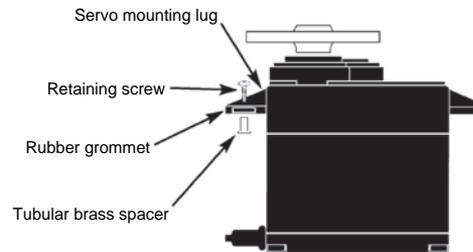
Due to the additional power loss, perpendicular connectors 8 ... 10 of the GR-12 receiver should not be used to connect to a receiver battery.

The function of each channel is determined by the transmitter and not the receiver. The channel

assignment can be changed in the receiver by programming using the "Telemetry" menu. It is however recommended to do this on the transmitter using the "Output swap" option, see page 96.

To follow are a few examples and suggestions for installing remote-control components in the model:

1. For flying models, the receiver is installed behind a strong bulkhead and is protected against dust and splash water in car and ship models. When you install your receiver, make sure that it is not excessively airtight to prevent it from overheating during operation.
2. All of the switches must be installed so that they are not influenced by exhaust or vibration. The switch knob must be freely accessible over its entire operating range.
3. Install the servos on rubber grommets with tubular brass spacer to protect them from vibration. Do not overtighten the fixing screws; this could counteract the vibration protection provided by the rubber grommets. The system offers both safety and vibration protection for your servos when the servo fixing screws are properly tightened. The following figure shows how to correctly mount a servo. The tubular brass spacer are inserted from below into the rubber grommets:



4. The servo arms must be freely movable throughout their operating range. Make sure that no linkage parts block the free movement of the servo.

5. Connect the receiver's power supply cable(s) and the servo connecting cable to the receiver as follows:



They should never be connected as follows:



NOTE:



With GR-24 receivers, servos or other components are only connected horizontally at connectors 8, 9 and 10. Components and in particular the receiver battery must never be connected flat as shown in the figure to the other connectors to 1 to 7 and 11 and 12. This will immediately short out the receiver battery, destroy the other connected components, and immediately void all warranties.

In contrast, the sequence for connecting the servos

Receiver power supply

depends on the model type. Refer to the connector assignments on pages 40 and 41.

In addition, consult the safety instructions on pages 4 ... 12.



To prevent uncontrolled movements of the servos connected to the receiver system, during startup

**first switch on the transmitter
and then the receiver.**

When turning off the model,

**first switch off the receiver
and then the transmitter.**

When programming the transmitter, make sure that an electric motor cannot accidentally start. When a gas motor with an automatic starter is used, make sure that it cannot unintentionally start. For safety's sake, disconnect the drive battery or the fuel supply.



To safely operate the model, a reliable power supply is required. If the receiver voltage shown on the transmitter display always drops or is generally (too) low even though the linkage moves freely, the battery is full, the cross-section of the battery connecting cable is sufficient, and the transition resistance that the plug-in connectors is minimal, etc., observe following:

First make sure that the battery is fully charged when initially operating the model. Make sure that the resistance of the contacts and switches is low. Measure the voltage drop over the installed switch cables under a load since even robust, new switches cause a voltage drop of up to 0.2 V. This value can be several times higher due to aging and oxidation of the contacts. In addition, constant vibration and shaking of the contacts also gradually increases the transition resistance.

Furthermore, even small servos such as a *Graupner/ JR DS-281* draw a stall current up to 0.75 A when you stop under load. Four of these servos in a foam seat can hence draw up to 3 A from the onboard power supply.

Furthermore, servos connected to a 2.4 GHz receiver receive control pulses more frequently than comparable receivers in the classic frequency range. This affects the power consumption of the receiver system as well as the characteristic of many modern digital servos of maintaining the last position specified by the last control pulse until the next pulse arrives.

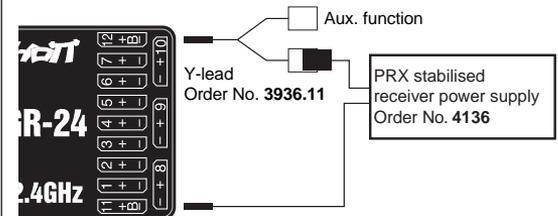
You should therefore choose a power supply that does not fail under a high load and always provides sufficient voltage. To calculate the required battery capacity, add at least 350 mAh for each analogue servo, and at least 500 mAh for each digital servo.

Using this method, a battery with 1400 mAh represents the absolute minimum for supplying power to a receiver with four analogue servos. In your calculation, also include the receiver which requires about 70 mA due to its bidirectional function.

Apart from the above considerations, it is generally recommendable to connect the receiver to the power

supply using two cables. As usual, connect cable "1" to the "12+B-" receiver connector, and cable "2" to the opposite end of the connector strip labelled "11+B-" when for example using a switch or voltage regulator with two power supply cables leading to the receiver. Between the cable and receiver, you can use a V or Y cable (order No. **3936.11**, see figure) if one or both receiver connectors also need to be connected to a servo, speed controller, etc. With the double connection to the switch or voltage controller, you not only reduce the risk of a cable rupture but also ensure an even power supply to the connected servos.

If you connect a separate battery to each battery connector, be sure that each of the batteries has the same rated voltage and capacity. Never connect different battery types or batteries with strongly different charges since this can cause an effect similar to a short circuit. In such cases for safety reasons, insert voltage stabilizing elements such as PRX-5A receiver power supplies between the batteries and receiver:



For safety reasons, never used battery boxes or dry batteries.

The voltage of the onboard power supply is shown at the top left of the transmitter display in yellow text:



If the voltage falls below the warning threshold (normally 3.8 V) which can be adjusted in the "RX SERVO TEST" display of the "SETTING & DATA VIEW" of the "Telemetry" menu, starting on page 124, a visual and acoustic low-voltage warnings are generated.



The battery level should be checked regularly. Do not wait to charge the battery until the voltage decreases enough for a warning signal to be generated.

Note:



A summary of the batteries, chargers and measuring devices for checking the power sources can be found in the main Graupner FS catalogue as well as on the Internet at www.graupner.de. A selection of suitable chargers is offered in the table on page 16.

Receiver system power supply

NiMH battery packs with 4 cells

With a traditional 4-cell pack, you can reliably operate your Graupner HoTT system providing that the above conditions are observed, and assuming that the packs have a sufficient capacity and charge.

NiMH battery packs with 5 cells

Battery packs with five cells offer greater leeway in comparison to 4-cell packs.

You should note, however, that not every servo available on the market can handle the voltage from a 5-cell pack over the long term, especially when the pack is freshly

charged. Some of these servos audibly "growl" when operated with a 5-pack.



You should therefore note the specifications for your servo before you choose to use a 5-cell pack.

LiFe packs with 2 cells

Given the above considerations, these cells are the best choice.

LiFe cells are also available in a hard plastic housing to protect against mechanical damage. Like lithium polymer cells, LiFe cells can be charged quickly with suitable chargers and are comparably robust.

In addition, this type of cell can undergo significantly more charging/discharging cycles than conventional LiPo batteries. The comparatively high rated voltage of 6.6 V of two cell LiFe battery packs do not pose any problems to Graupner HoTT receivers or the servos, speed controllers, gyros, etc. which are approved for operation with this higher voltage.



However, practically all of the previously marketed servos, speed controllers, gyros, etc. as well as many which are offered today have a permissible operating voltage range of 4.8 to 6 V. Stabilized voltage control such as the PRX (order No. 4136) is therefore needed to connect them to the receiver. Otherwise, the connected devices may quickly become damaged.

LiPo packs with 2 cells

LiPo batteries are lighter than NiMH batteries yet offer the same capacity. LiPo batteries also come in a hard plastic housing to protect against mechanical damage.

The comparatively high rated voltage of 7.4 V of two cell LiPo battery packs do not pose any problems to Graupner HoTT receivers or the servos, speed controllers, gyros, etc. which are approved for operation with this higher voltage.



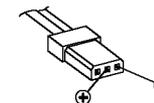
However, practically all of the previously marketed servos, speed controllers, gyros, etc. as well as many which are offered

today have a permissible operating voltage range of 4.8 to 6 V. Stabilized voltage control such as the PRX (order No. 4136) is therefore needed to connect them to the receiver. Otherwise, the connected devices may quickly be damaged.

Charging the receiver battery

The charging cable (order No. 3021) can be connected directly to the receiver battery to charge it. If the battery in the model is connected by a power supply cable (order No. 3046, 3934, 3934.1 or 3934.3), the battery is charged via the charging socket integrated in the switch, or a separate charging connector. The switch for the power supply cable must be set to "OFF" for charging.

Polarity of the receiver battery plug



Definition of terms

Control, function input, control channel, mixer, switch, control switch

To make it easier to use the **mz-18/24** HoTT manual, we offer a few definitions of terms that appear repeatedly in the manual.

Control function

A control function is understood as the signal for a specific control function independent of the signal within the transmitter. With airplanes, the control signals would be throttle, rudder, aileron or elevator; with helicopters, these would be pitch, roll, yaw. The signal of a control function can be transmitted directly into one control channel, or through a mixer to several control channels. A typical example of the latter are separate aileron servos, or the use of two roll or elevation servos in helicopters. The control function includes the influence of the mechanical control path on the corresponding servo. This can be spread or concentrated and modified from linear to highly exponential.

Controls

Controls are the control elements on the transmitter that are activated directly by the pilot that control the connected servos, speed controllers, etc. on the receiver. These include:

- The two control sticks for control functions 1 to 4 and its trims. These four functions in both model types (wing and helicopter) can be exchanged using the mode setting in the software, such as throttle left or right. The control stick function for Throttle/brake control for fixed-wing models or throttle/pitch control in helicopters is frequently identified as the CH1 control.
- The two (**mz-18** HoTT) or four (**mz-24** HoTT) proportional dials DV1 and DV2 or DV1 ... DV4
- The two side proportional rotary controls SL1 and SL2 mounted on the bottom.
- Switches S1 ... S8
- INC/DEC buttons DT1 and DT2 of the **mz-24** HoTT transmitter

With the type DV and SL proportional controls as well as the INC/DEC buttons, the servos directly follow the control position, whereas only a two or three-stage adjustment is possible with a switch.

The assignment of the controls and switches to servos 5 ... 9 of the **mz-18** HoTT transmitter or 5 ... 12 of the **mz-24** HoTT transmitter is freely programmable.

Important note:



In the basic programming for the transmitter, inputs 5 ... 8 and 5 ... 11 for helicopters and 5 ... 9 and 5 ... 12 for airplanes are generally free, that is, not yet assigned.

Function input

This is an imaginary point in the signal flow and should not be confused with the control connector on the printed circuit board. The selected control mode and the settings in the "TX OUT SET" line of the "TX ctl" submenu (Transmitter control) of the base menu influence the sequence beyond the physical connecting points, and this can generate differences between the number of function inputs and the number of subsequent control channels.

Control channel

From the point at which a signal contains all control information necessary for a particular servo, whether directly from the control or indirectly via a mixer, the term control channel is used.



For example, the "aileron" control function of a fixed-wing model for the model type "2AILE" is divided into control channels for the left and right aileron. Analogously, the "Roll" control function for the helicopter model "3Sv(2Roll)" governs the control channels for both the left and right roll servo.

This signal is only influenced by the settings made in the submenus "**E.P.A**" (end point adjustment), "**REVERSE**" (servo reverse/delay) and "**Sub-Trim**" (servo middle and neutral position) to adjust the servo, and possibly the settings in the submenu "**OUT.SWAP**" (transmitter output) and is then transmitted by the transmitter

through the RF module. Once it arrives in the receiver, this signal may be modified by settings saved in the "**Telemetry**" menu, after which it controls the associated servo.

Mixer

The transmitter program contains a variety of mixing functions. These allow a control function to influence several servos, or several control functions to influence one servo.

In this context, you can refer to the numerous mixing functions described starting on page 98.

Switch

The series of toggle switches S1 ... S8 can also be included in the control programming. The switches are however generally also intended to switch program options such as to start and stop the timers, activate and deactivate mixers, as trainer switches etc. Each of the switches can be assigned any number of functions. Related examples are listed in the manual.

Control switch

Since it is occasionally practical to automatically switch a timer or a function on or off when a control is in a specific position (a stopwatch turns on/off to measure engine operating time), the program for the **mz-18** HoTT and **mz-24** HoTT transmitters also allows you to program control switches.

With these control switches, all you have to do is specify the switching point along the control path in the direction of switching. More information can be found in the section "Control, switch and control switch assignment" from page 38.

Control, switch and control switch assignment

Basic procedure

In many places in the program, you can actuate a control function with a freely selectable control (ST1 ... 4, DV1 ... max. D4, DT1 and DT2, SL1 and SL2), switch (S1 ... 8), or switch between settings by a switch (S1 ... 8) or control switch (see below). In both cases, multiple assignments are possible. (The distinction between a control and switch is explained in the section "Definition of terms" on page 37.) It should be noted however that incorrect responses may arise from functional overlaps such as using the same physical switch as a switch to switch between Q.Link *and* as a control for Q.Link trim. In such cases, you should change your switch assignment.

Since the same method is used to assign the controls and switches in all relevant menus, the basic procedure will be explained at this point which will allow you to focus on the specifics in the detailed menu descriptions.

Control and switch assignment

In the "CH set" submenu (control assignment), starting on page 92, you can ...



... assign transmitter inputs 5 ... 9 and 5 ... 12 to operate servos, as well as any control stick (ST1 ... ST4) and control identified as "DVx", "SLx" or "DTx", or any switch identified as "S1 ... S8".

The following window appears in the display after touching the corresponding button, such as the **NONE** button to the right of "AUX 1" at the bottom edge of the display, with a finger or the provide stylus:



Actuate the desired control (control stick 1 ... 4, DV1 ... max. DV4, SL1 ... SL2, or DT1 ... DT2) or switch (S1 ... S8), such as the right proportional rotary control SL1:



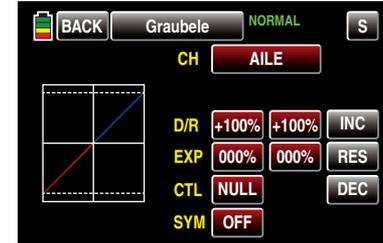
Note:



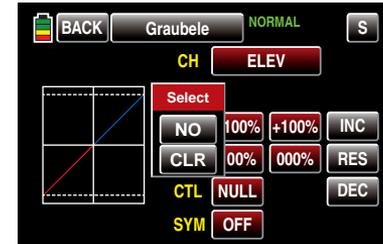
The controls are only recognized after a specific path. Therefore move the control to the left or right, forward or backward until the assignment appears on the display. If the length of travel is insufficient, move the control in the opposite direction.

Switch and control switch assignment

The places in the program where a switch or control switch can be assigned are identified with "CTL", such as the following illustration of the Dual Rate/Expo display:

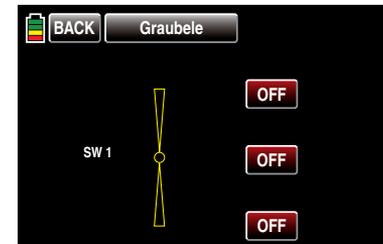


On the right next to "CTL", touch the red **NONE** button with a finger or the provided stylus. The following appears in the display:

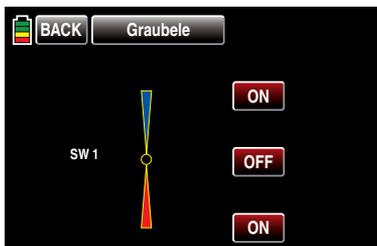


Switch assignment

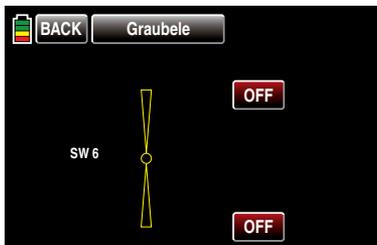
Operate the desired switch:



In this display, you can determine the switch position in which the selected switch is "ON" by touching the corresponding button, for example:



If you choose the 2-stage switch SW 6 instead of the 3-stage switch SW 1, the display appears as follows:



Select the desired switching direction as above.

Deleting switches

After the switching assignment has been activated as described at the beginning of this section, touch the **CLR** button with a finger or the provided stylus:

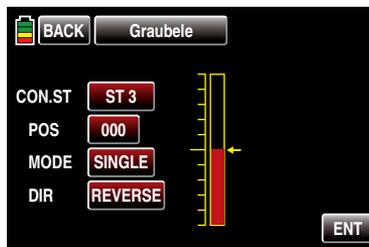


Cancelling the switch assignment

After the switching assignment has been activated as described at the beginning of this section, touch the **NO** button.

Control switch assignment

Actuate the desired control such as the elevator control stick identified in the display with "ST 3":



The yellow arrow to the right of the bar diagram illustrates the current control position which can be accepted by touching the **ENT** button as the switching point in the value field to the right of "POS". Reverse the switching direction by touching **REVERSE** in the line "DIR(ection)".

In the "MODE" line, the switching function of the control switch can be changed from on/off like a 2-stage switch to the switching behaviour of a 3-stage switch.



In this case, be sure to specify a switching position that is not "000". Otherwise, you risk switching continuously back-and-forth between the two switching states while the relevant control is in the middle control position.

Note:

All of these switches can be given multiple assignments. Make sure that you do not accidentally assign competing functions to a switch. It is recommendable to write down the switching functions.

Practical examples:

- Turning an onboard glow plug heater on and off when a idling switching point for the THR control stick is exceeded or undershot. The switch for the glow plug heater is controlled at the transmitter by a mixer.

- Automatically turning the stopwatch on and off to measure the actual flight time of a helicopter by means of a control switch on the throttle limiter.
- Automatically turning off the mixer "AILE → RUDD" when the brake flap extends to adapt the landing position of the model to the ground contour when landing on a slope without affecting the direction of flight by rudders which are otherwise involved.
- Extend the landing flaps and retrim the elevator while approaching a landing once the throttle control stick is moved beyond the switching point.
- Switch on the stop watch and off to measure the operating time of electric motors.
- ...

Receiver assignment

Fixed-wing models

Installation instructions



The servos must be connected to the receiver in the indicated sequence. Outputs that are not required are simply not assigned.

Please note following for the mZ-18 HoTT transmitter:

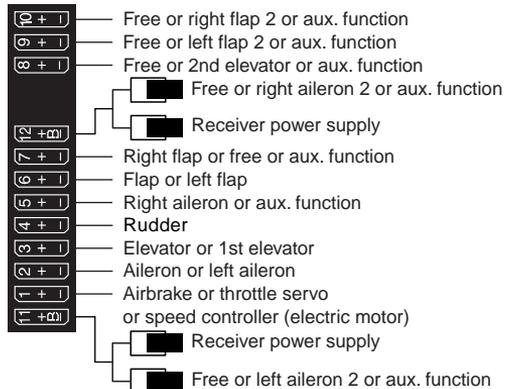


By default, the 9-channel mZ-18 HoTT transmitter can only control outputs 1 to 9. Any servos that are connected to outputs 10 to 12 remain in their neutral position with this transmitter.

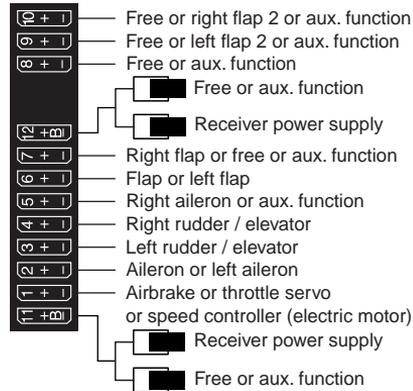
Follow the instructions on the subsequent pages.

Fixed-wing models with and without a motor with up to 4 ailerons and up to 4 flaps ...

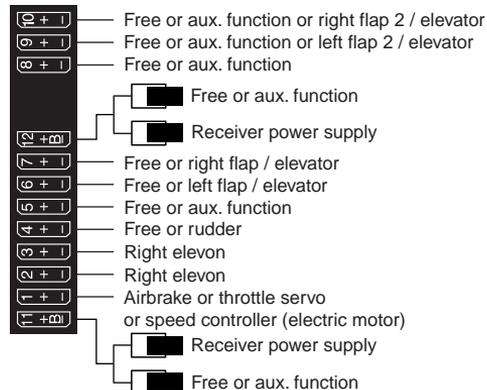
... and a normal tail unit or 2 elevator servos



... and a V-tail



Delta/flying wing models with and without a motor with up to 4 ailerons/elevators and 4 flap/elevator servos



Due to the different installation of the servos and rudder linkages, the operating direction for certain servos may be reversed. The following table offers assistance in this regard.

Model type	Servo with wrong direction of rotation	Solution
V-tail	Reversed rudder and elevator	Change the poles of servos 3 + 4 in the submenu "REVERSE"
	The rudder is correct and the elevator is reversed	Switch servos 3 + 4 on the receiver
	The elevator is correct and the rudder is reversed	Change the poles of servos 3 + 4 in the submenu "REVERSE", and on the receiver
Delta, Flying wing	The elevator and aileron are reversed	Change the poles of servos 2 + 3 in the submenu "REVERSE"
	The elevator is correct and the aileron is reversed	Change the poles of servos 2 + 3 in the submenu "REVERSE", and on the receiver
	The aileron is correct and the elevator is reversed	Switch servos 2 + 3 on the receiver

All of the relevant menus for a fixed-wing model are identified by an wing icon in the "Program descriptions"

...



... so that you only have to deal with these menus when programming fixed-wing models.

Helicopter models

Advice to pilots switching from some older Graupner systems:



In comparison to the receiver configuration of some older transmitters, servo connector 1 (pitch servo) and servo connector 6 (throttle servo) have been switched. The servos **must** be connected to the receiver outputs as depicted on the right. Outputs that are not required are simply not assigned.

More details on the swashplate type may be found on page 48 in the menu "**Model selection**".

Installation instructions



The servos must be connected to the receiver in the indicated sequence. Outputs that are not required are simply not assigned.

Follow the instructions on the subsequent pages.

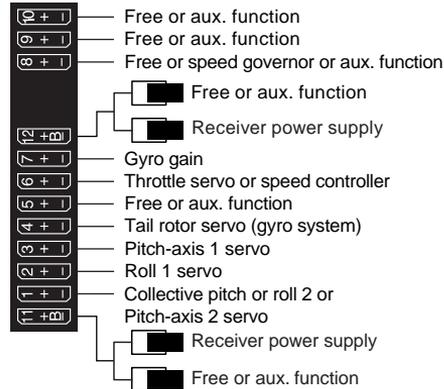
Note:



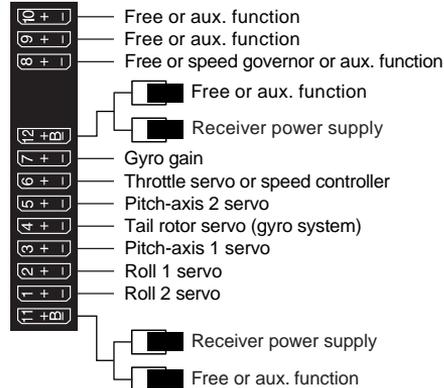
In order to take advantage of the comfort and safety features of the throttle limiter, starting on page 94, a governor should be connected to receiver output 6 instead of receiver output 8 in the adjacent receiver configuration. More information on this subject can be found on page 182.

Receiver assignment for helicopter models ...

... with 1 to 3 swashplate servos



... with 4 swashplate servos



All of the relevant menus for helicopter models are identified with a helicopter icon in the "Program description section ...



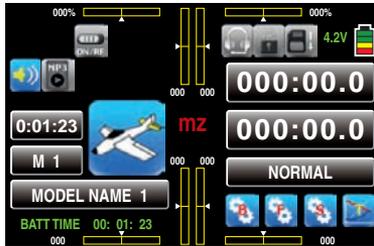
... so that you only have to deal with these menus when programming helicopter models.



Program description

Whoever has worked his way through this manual up to this point will have probably tried out some form of programming. Nonetheless, an attempt will be made to describe each menu in detail.

As already mentioned in section "Operating the displays" on page 21, you can touch one of the three gear icons at the bottom right of the basic display identified with "B", "F" and "S" ...



... to open the respective selection menu. These three menus contain all of the setting and display menus required to program a model as well as the transmitter, including telemetry functions.

Note:



The description of the individual menu items starting on the next double page is offered in the sequence provided by the transmitter.

Specifically, these are:

"B" (green base menu)

Touch the gear icon labelled "B" with a finger or the provided stylus.



This menu contains all of the setting and display menus that are needed to set up the model:

Name	Menu	Page
Model Sel	"Model Select"	44
Model Type	"Model type"	64
E.P.A	"End Point Adjustment"	66
Rev/Slow	"Servo reversal/control delay"	68
Sub-Trim	"Servo neutral position"	70
Motor / THR.CUT	"Throttle Cut"*	72
TX ctl	"Transmitter control"	74
Timer	"Timer"	80
Fail Safe	"Fail-safe"	84
Trim Step	"Trim step"	86
Servo	"Servo monitor / test"	90
CH Set	"Control setting"	92
Out.Swap	"Transmitter output swap"	96

* hidden for models without a motor

"F" (blue function menu)

Touch the gear icon labelled "F" with a finger or the provided stylus.



Depending on the model type of the currently active model memory, two different menu structures are displayed. These can also vary depending on the basic settings of the model. The following two menus therefore only offer a selection as an example:



Common function menus

Name	Menu	Page
Prog.MIX	"programmable mixer"	100
Trainer	"Trainer"	107
Telemetry	"Telemetry setting"	114



Fixed-wing models



Name	Menu	Page
Q.Link	"Q.Link setting"	132
D/R,EXP	"Dual rate, Expo"	136
Wing MIX	"Wing mixer"	140
THR.CRV	"THR.CRV"*	144

Idle LOW	"Idle setting"*	148
Prog.MIX	"programmable mixer"	100
Snap roll	"Snap role setting"*	149
AILE diff	"AILE differentiation"*	150
Flap MIX	"AILE and FLAP mix"*	152
Flap Sett	"Flap setting"*	156
Airbrake	"Airbrake settings"*	160
Butterfly	"Butterfly setting"*	162
Trainer	"Teacher/pupil system"	107
V-tail	"V-tail"*	166
Telemetry	"Telemetry setting"	114

* May not be shown depending on the model

Helicopter models



NAME	Menu	Page
Q.Link	"Quick Links"	168
D/R,EXP	"Dual rate, Expo"	171
PIT.CRV	"Pitch curve"	175
THR.CRV	"THR curve"	181
Gyr/Gover	"Gyro/governor"	186

THR.HOLD	"Throttle autorot"	190
Swash	"Swashplate mixer"	192
S.Limit	" Swashplate limiter"	193
S.MIX	"Heli mixer"	194
THR.MIX	"Throttle mixer"	196
Prog.MIX	"programmable mixers"	100
Trainer	"Teacher/pupil system"	107
PIT->RUDD	"Pitch >> rudder mixer"	198
Telemetry	"Telemetry"	114



Common system menus

"S" (purple system menu)

Touch the gear icon labelled "S" with a finger or with the provided stylus:

This menu offers transmitter-specific setting and display menus:



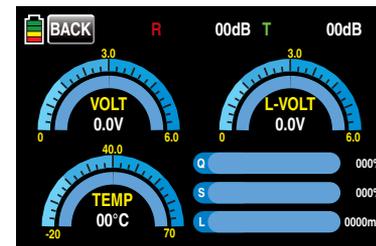
NAME	Menu	Page
ST mode	"Stick mode"	200
Warning	"Warning settings"	201

Etc.Set	"Various settings"	202
Display	"Display settings"	205
Stick Cali	"Stick calibration"	208
MP3	"MP3" (only mz-24 HoTT)	210

"T" ("Telemetry displays")

Touch the gear icon labelled with "T" at the bottom right with a finger or with the provided stylus:

The display switches from the basic display to a display of the telemetry data such as:

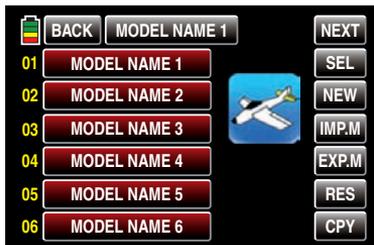
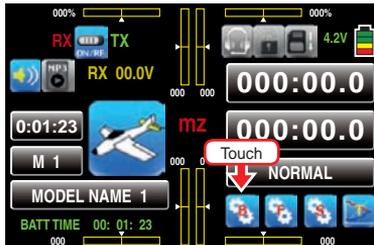




Model selection

Edit model memories 1 ... 30

Switch on the transmitter, and then in the basic display of the transmitter, touch the value field **M x** on the left in the display with a finger or the provided stylus to directly display the submenu "Model Sel", or alternately touch the gear icon labelled "B" to open the same menu from the **base menu**:

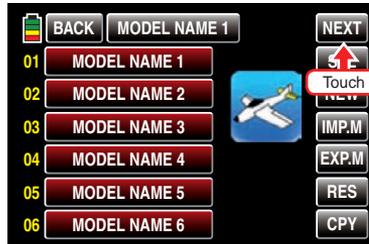


The following description of this extensive menu follows the sequence of the function buttons at right edge of the display starting with the top function Button:

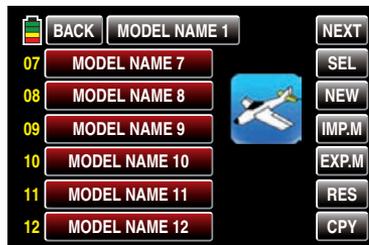
NEXT

(next page)

Touch the **NEXT** button in the display at the top right with a finger or the provided stylus to switch from the first six model memories...



... to a display of the next six...

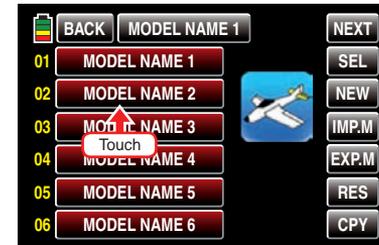


... Etc. After model memories 25 ... 30 are displayed, model memories 01 ... 06 reappear for selection, etc.

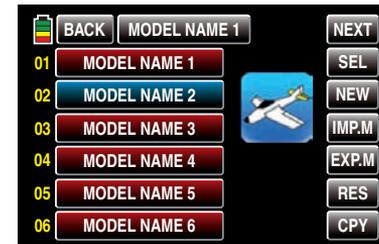
SEL

(change model)

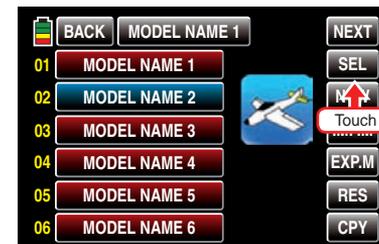
Touch the selection field for the desired model memory with a finger or the provided stylus, for example:



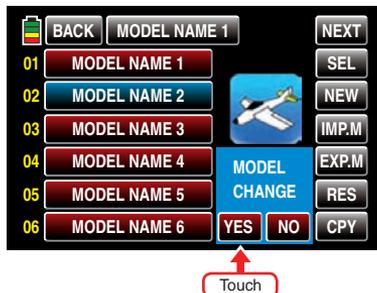
The color of the field switches from red to blue:



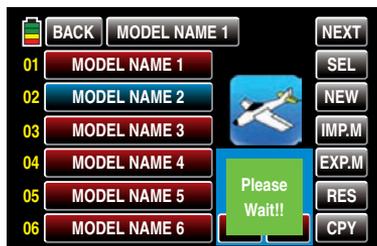
Touch the **SEL** icon with a finger or the provided stylus on the right edge of the display:



... and then touch **NO** to terminate the process or **YES** to change the model ...



... "Please wait" appears for about 1 second:



After this message disappears, the model has changed, and the name of the selected model memory appears in the top line for confirmation:



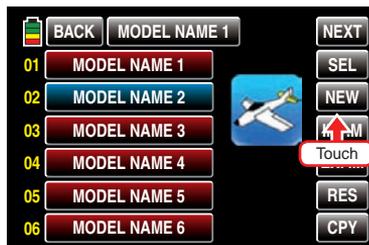
As of firmware version V 1.023—as illustrated above—the message "Fail Safe setup t.b.d." appears for a few seconds, if you have not yet made any fail-safe settings in the selected model memory.

NEW (create new model)

Note:

-  Switch between model memories with **SEL**.
- In order to reach model memories with numbers higher than 06, touch **NEXT** (next page) at the top right of the display.

As described above, to set up a new model, select a free model memory or a model memory that has already been assigned but is no longer required. Instead of **NEXT**, touch **NEW** with a finger or the provided stylus at the right edge of the display:



After you touch **NEW**, the selection window in the following display appears. In this window, you can choose between manual and assistant-controlled programming, or press **NO** to terminate the process. In the following menu, the options for configuring a fixed-wing model or helicopter are offered depending on the selected model type. Since the manual programming of a fixed-wing model is described in this section, touch the **MAN** button with a finger or the provided stylus:



Note:

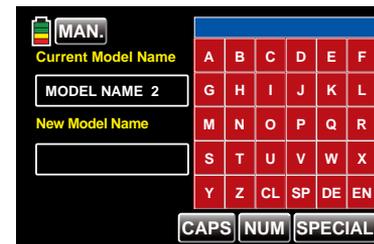


Assistant-controlled model programming will be subsequently addressed with reference to programming a helicopter.

Manually programming the basic settings of a new model

Manually programming of a model is always started by entering the model name.

- "Model name"



On the screen keypad, touch the first character of the model name to be entered with a finger or the provided stylus.

Switch between capital and small letters and vice versa with the **CAPS** button at the bottom edge of the screen, and similarly, press the **NUM** button to go to the numbers 0 ... 9 and special characters.

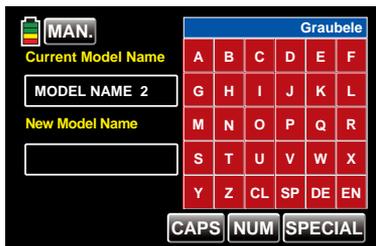
To enter a space, touch the **SP** [Space] button.

You can select other special characters by touching the **SPECIAL** button.

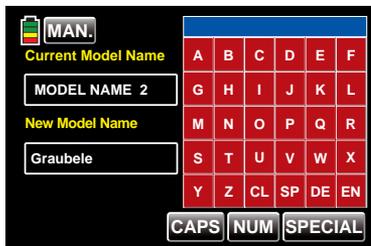
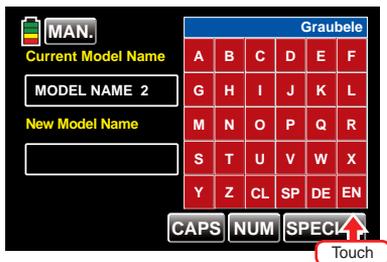
All other characters can be entered in the same manner. A maximum of 15 characters can be entered for a model name.

By touching **DE** [DELETE] in the bottom row of red buttons, the last character is deleted. To delete all of the entered characters at once, touch **CL** [CLEAR].

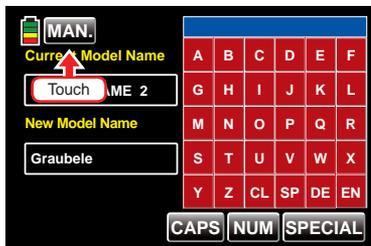
The characters which are entered in this manner appear in the blue field above the keypad, for example:



To transfer the model name into the model memory, touch the red button **EN** [ENTER] at the bottom right:

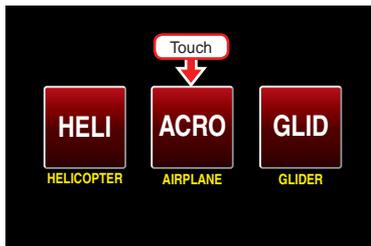


Touch the **MAN.** button at the top left to go to the next option:



"Model Type"

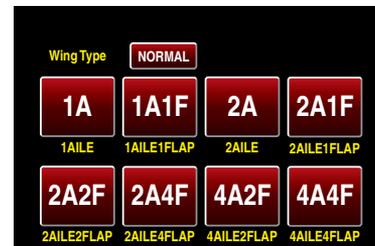
Since at this juncture we want to program an "airplane with electric drive", touch the selection field "ACRO" with a finger or the provided stylus:



After selecting the basic model type, the following appears in the display ...

"Wing type"

... in which you can specify the number of aileron and flap servos by touching the corresponding selection field:



Note:



In contrast to the display of the 12-channel mz-24 HoTT transmitter, only "1A" to a max. "2A2F" are offered in the display of the 9-channel mz-18 HoTT transmitter.

You can switch beforehand to the selection list for delta/flying fixed-wing models by touching the top button labelled Normal:



After you select a wing type, the following display appears ...

- "Tail type"

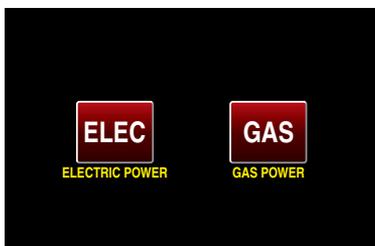
..., in which you can specify the type of your tail:



Finish your entry by selecting ...

- "Propulsion type"

... for your model:



Note:



The default for "Motor off" or "Idle" = "Rear thro position" can be switched to "Front thro position" for fixed-wing models in the "THR.CRV" menu, page 144, by inverting the control curve.

After the propulsion type has been selected, a display appears with an overview of the previous entries such as ...



..., which you can leave to go to the base menu by touching the **ENT** button at the right bottom with a finger or the provided stylus:



Entering the basic settings of a new model with an wizard

The previous section described the basic *manual* programming of a fixed-wing model. In the following, the *assistant-controlled* programming of a helicopter model will be described.

As described under "Model Sel" on page 44, to set up a new model, select a free model memory or a model memory that has already been assigned but is no longer required.

After touching **NEW**, a selection window appears in the following screenshot as described in the previous section. In this window, you can choose between **MAN.**, manual processing, or **WIZ.**, assistant-controlled programming, or press **NO** to terminate the process.

In the following menu, the necessary settings for a fixed-wing model or helicopter are offered depending on the selected model type.

Since the programming of a helicopter with the help of an assistant is described in this section, touch the **WIZ.** button with a finger or the provided stylus:



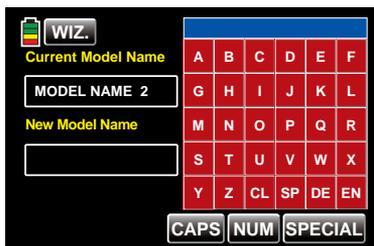
Note:



An example of manual model programming is described in the previous section in the context of programming a model with an electric motor.

As previously described with reference to manual model programming, basic programming is started by entering a model name when programming a model with an wizzard.

- "Model name"



On the screen keypad, touch the first character of the model name to be entered with a finger or the provided stylus.

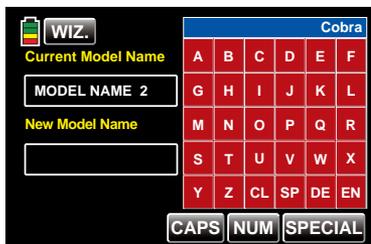
Switch between capital and small letters and vice versa with the **CAPS** button at the bottom edge of the screen, and similarly, press the **NUM** button to go to the numbers 0 ... 9 and special characters.

To enter a space, touch the **SP** [Space] button. You can select other special characters by touching the **SPECIAL** button.

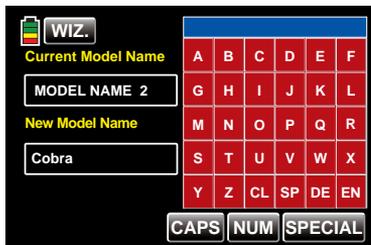
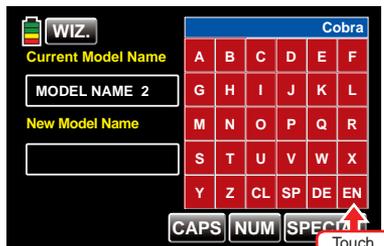
All other characters can be entered in the same manner. A maximum of 15 characters may be entered for a model name.

By touching **DE** [DELETE] in the bottom row of red buttons, the last character is deleted. To delete all of the entered characters at once, touch **CL** [CLEAR].

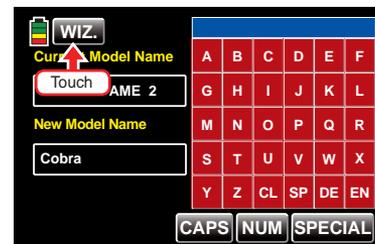
The characters which are entered in this manner appear in the blue field above the keypad in the sequence in which they are entered, for example:



To transfer the model name into the model memory, touch the red button **EN** [ENTER] at the bottom right:



Touch the **WIZ.** button at the top left to go to the next option:



- "Model Type"

Since at this juncture we want to program a "helicopter model", touch the **HELI** button with a finger or the provided stylus:



After selecting the basic model type, the following appears in the display ...

- "Swashplate type"

... in which you can specify the number of swashplate servos by touching the corresponding selection field:



- **"1SERVO NOR"**

You are using a flybar system, or the swashplate is tilted by a roll and elevator servo. A separate servo is used for the *pitch control*.

(Since helicopter models with only one pitch servo that have three swashplate servos for pitch, elevation and roll also operate without a mix of functions in the transmitter as is usually the case with flybar systems, the menu item **"SWASH MIX"**, page 192, normally does not appear on the multifunction menu.)

- **"2SERVO 180"**

The swashplate is shifted axially for the pitch control by means of two roll servos; the elevation control is decoupled by means of a mechanical compensation rocker.

- **"3S 120 (Roll)"**

Symmetrical three-point control of the swashplate by means of three articulations points offset by a 120°, by means of which one elevation servo (front or rear) and two roll servos (to the left and right side) are connected. All of the three servos of the swashplate shift axially for pitch control.

- **"3SERVO 140"**

Asymmetrical three-point control of the swashplate by means of three articulations points offset by a 120°, by means of which one elevation servo (front or rear) and two roll servos (to the left side and right front) are connected. All of the three servos of the swashplate shift axially for pitch control.

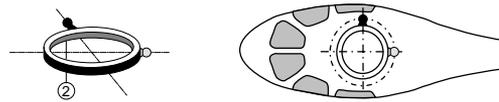
- **"3S 120 (Nick)"**

Symmetrical three-point axis as before, but rotated 90°; one roll servo on the side, and two elevation servos, front and rear.

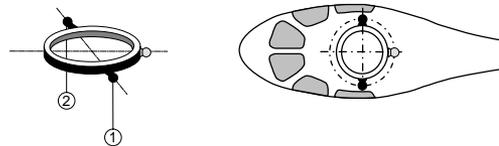
- **"4SERVO 90"**

Four-point control of the swashplate by means of two roll servos and two elevation servos.

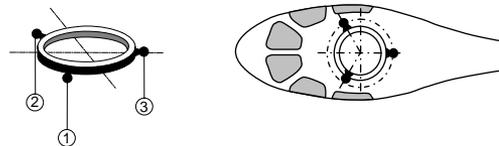
Swashplate type: 1 servo



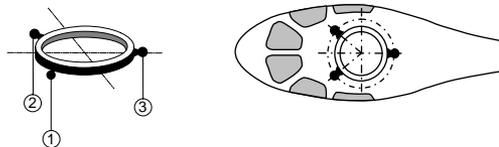
Swashplate type: 2 servos



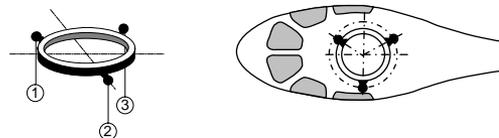
Swashplate type: 3 servos (2 roll)



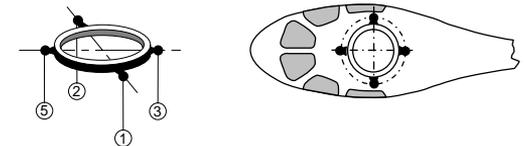
Swashplate type: 3 servos (140°)



Swashplate type: 3 servos (2 elevation)



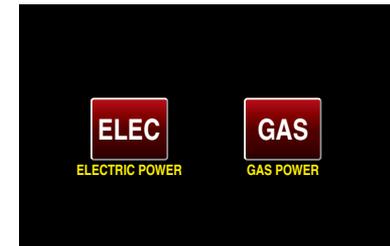
Swashplate type: 4 servos (90°) 2 elevation / 2 roll



Directly after you make your selection, the following display appears:

- **"Propulsion type"**

... where you specify whether your helicopter is driven by an electric motor or gas motor.



After you select the propulsion mode, the assistant takes you to the first model-dependent settings in the following display ...

• "REV/SLOW" (servo reverse/delay)



Note:
 In contrast to the displays of the 12-channel **mz-24** HoTT transmitter, only channels 1 ... 9 are offered in the display of the 9-channel **mz-18** HoTT transmitter.

• **Setting the rotational direction of the servos independent of the Quick Link**

In this display, you set the rotational direction of the servos *independent of the Quick Link* by touching the corresponding button to switch from **NOR** to **REV** and vice versa with a finger or the provided stylus, for example for CH8:



• **Setting a transmitter-side symmetrical delay depending on the Quick Link**

NOTE

 Set a *symmetrical* delay for the transmitter-side control signal with buttons with the standard labelling **0.0s**. A delay which is set here affects the servo that has the number of the delayed receiver connector as well as all servos controlled by the control element connected to control function X.

To set a *control-side* delay, touch the desired button normally labelled **0.0s** with a finger or the provided stylus, for example the control assigned to input 8 in the menu "**Channel set**" starting on page 92.



The color of the option field switches from red to blue:



Touch the **INC** button at the right edge of the display to gradually increase the value to a maximum of 9.9 seconds:



Touch the **DEC** button underneath to reduce the value to a minimum of 0.0 s, and touch the **RES** button to reset the changed value back to the default.

Touch the **WIZ.** button ...



... to go to the next option, ...

• "E.P.A" (servo travel/limit)



Note:



In order to reach control channels with numbers higher than CH5, touch **NEXT** [next page] at the top right of the display.

The travel and limitation are shown separately for each side in this display. The setting range in both cases is 0 ... 150% of the normal travel.

The set values always refer to the settings in the submenu "Sub-Trim".

To change a current value, touch the desired option field with a finger or the provided stylus, for example:



The color of the option field switches from red to blue:



Touch the **INC** button at the right edge of the display to gradually increase the value of the active option field. Touch the **DEC** button underneath to reduce the current value of the active option field, and touch the **RES** button to reset the changed value back to the default.

Once all you have adjusted all of your servos, touch the **WIZ.** button at the top left to switch to the next adjustment phase:

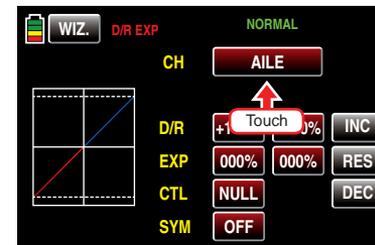


• "D/R,EXP"

1. Display "D/R,EXP"

The classic dual rate/expo function of this menu item allows you to switch or influence the control deflections and characteristics of rolling, elevation and tail rotor, i.e. control functions 2 ... 4, independent of the Quick Link using a switch if desired.

In order to switch between the individual control functions, touch the button on the right next to the yellow "CH":



Note:



In the graphic of the display, the curve characteristics are shown directly.

- If you have created Quick Links in the submenu "Q.Link" page 168, and have assigned an appropriate name, it appears at the top right such as "NORMAL". Activate the corresponding switches if desired to switch between Quick Links.
- By default, the dual rate and/or expo values for the selected control function are set for each control side. After switching the option "SYM" added to the bottom line as of firmware version 1020 from **OFF** to **ON**, a simultaneous (symmetrical) setting of both control sides is possible.

Analogous to the previously described displays, touch the corresponding option field with a finger or the provided stylus to change a current value, and increase or decrease the value by touching the **INC** and **DEC** buttons at the right side of the display the appropriate number of times.

The adjustment range is $\pm 125\%$ in the "D/R" line and $\pm 100\%$ in the "EXP" line.

Touch the **RES** button to reset a changed value in a blue (active) value field to the default value.

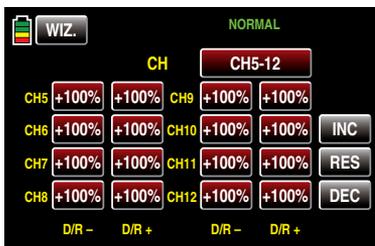
In addition, a switch or a control switch can be assigned in the line "CTL" as described in section "Control, switch and control switch assignment"

on page 38.

2. Display "Control path setting" CH5 ... 9 or CH5 ... 12

The above-described classic dual rate/expo function now has a non-switchable dual rate function or control path setting for the control functions 5 ... 9 of the **mz-18** HoTT transmitter and 5 ... 12 of the **mz-24** HoTT transmitter.

As shown in the above illustration, repeatedly touch the button with a finger or the provided stylus in the "CH" line until "CH5-9" or "CH5-12" appears:



Note:



*In contrast to the display of the 12-channel **mz-24** HoTT transmitter, only channels 1 ... 9 are offered in the display of the 9-channel **mz-18** HoTT transmitter.*

Analogous to the previously described displays, touch the corresponding button with a finger or the provided stylus to change a current value, and increase or decrease the value by touching the **INC** or **DEC** buttons at the right side of the display the appropriate number of times.

The adjustment range is $\pm 125\%$.

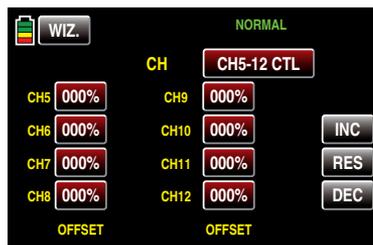
Touch the **RES** button to reset a changed value in a blue (active) value field to the default value.

3. Display "Offset setting" CH5 ... 9 and 5 ... 12

The last display in this series makes it possible to adjust a control offset within the range of $\pm 125\%$

for each of inputs 5 ... 9 (**mz-18** HoTT) and 5 ... 12 (**mz-24** HoTT).

As shown in the illustration at the top left, repeatedly touch the button with a finger or the provided stylus in the "CH" line until "CTL CH5-9" or "CTL CH5-12" appears:



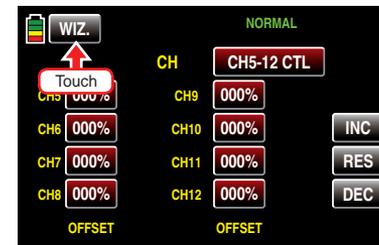
*In contrast to the display of the 12-channel **mz-24** HoTT transmitter, only channels 1 ... 9 are offered in the display of the 9-channel **mz-18** HoTT transmitter.*

Analogous to the previously described displays, touch the corresponding button with a finger or the provided stylus to change a current value, and raise or lower the value by touching the **INC** or **DEC** buttons at the right side of the display the appropriate number of times.

The adjustment range is $\pm 125\%$.

Touch the **RES** button to reset a changed value in a blue (active) value field to the default value.

Touch the **WIZ.** button at the top left of the display to leave this menu and go to the next:



• "Pitch curve"

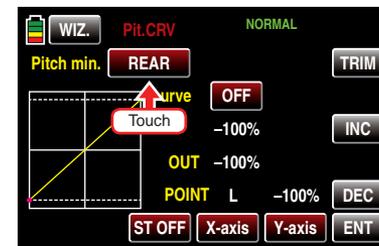
In this display you can adjust the pitch curve and, as of firmware version 1.021, you can additionally change in the line "PITCH MIN" the operating direction of the pitch stick to your needs:

Firmware version V 1.021 and higher

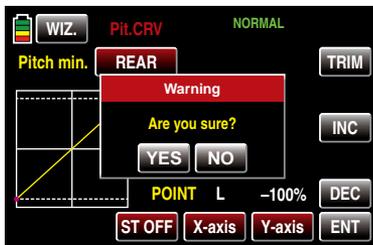
"Pitch min." line

In the helicopter program for the **mz-18** HoTT and **mz-24** HoTT transmitters, the "rear" throttle position is the "Pitch min." position by default.

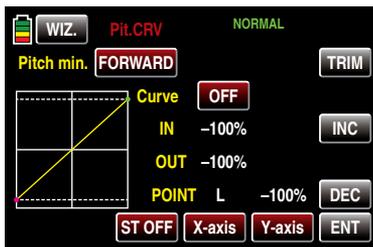
With this option, which was introduced in firmware version V1.021, the control direction of the pitch control stick can be easily switched from "Pitch min. rear" to "Pitch min. front" or vice versa by touching the **REAR** or **FORWARD** button in the "Pitch min." line:



After the button is touched, the confirmation prompt appears:



Touch **NO** with a finger or the provided stylus to terminate the procedure. Touch **YES** to confirm the procedure which changes the direction of travel of the pitch control stick.



"Pitch curve" setting

Note:



In the graphic of the display, the curve characteristics are shown directly.

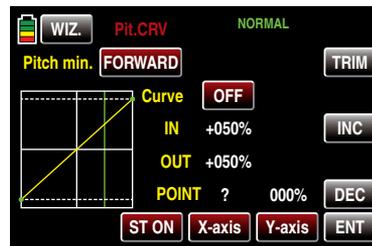
- If you have created Quick Links in the submenu "Q.Link" page 168, and have assigned an appropriate name, it appears at the top right such as "NORMAL". Activate the corresponding switches if desired to switch between Quick Links.

Basic operating steps

- ST OFF** button

Touch this button with a finger or the provided stylus to switch on and off the graphic and numeric display of the control stick position, for

example:



Use the control element (throttle/brake control stick) to then move a vertical green line between the two endpoints "L" and "H" in the graphic. The momentary control stick position is also displayed numerically in the line "IN" (-100% to +100%). The intersection of this line with the curve is identified as "OUT" and can be varied at the support points between -125% and +125%. The control signal which is changed in this way then affects all of the following mixing and coupling functions.

- ENT** button

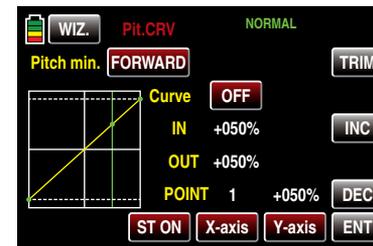
Touch the button at the bottom right of the display with a finger or the provided stylus to set up to five additional points between the two endpoints "L" and "H".

In the following example, the control stick is exactly halfway between the middle and end of its path, at +50% of the control path, and generates an output signal that is also +50% due to the linear characteristic.

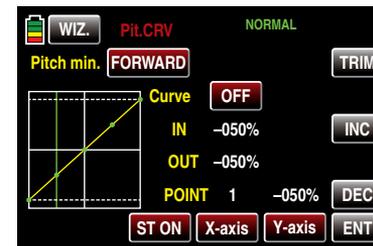
Between the two endpoints "L" and "H", up to five additional support points can be set, and the distance between neighbouring support points may not be less than approximately 25%.

Move the control stick. As long as there is a question mark next to the right of "POINT", you can press the **ENT** button set the next support point. At the same time, the "?" is replaced with a

number:

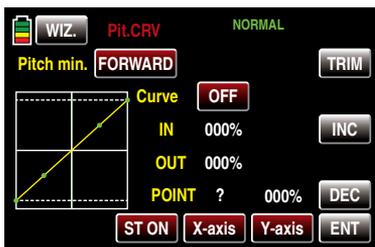
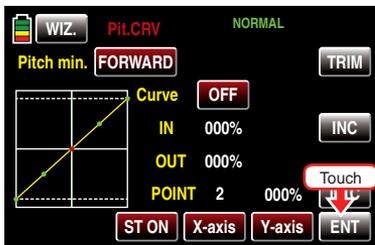


The sequence in which the up to 5 points between the edge points "L" and "H" are generated does not matter since the support points are automatically renumbered sequentially from left to right after one support point is set or deleted, for example:



Deleting a support point

In order to delete the set support points 1 to 5, move the vertical line with the control stick next to the relevant support point. Once the support point number appears along with the associated value in the line "POINT" and the point is red (see the screenshot below), you can delete it by touching the **ENT** button, for example:

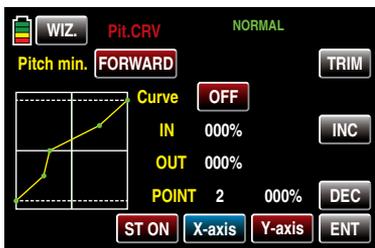


Changing the support point value

- **X-axis** button (X-axis)

Activate this function by touching the button at the bottom edge of the display with a finger or the provided stylus.

You can then move an active (red) point to the right by pressing the **INC** button, or to the left by pressing the **DEC** button, for example:



Touch the **X-axis** button again to deactivate the function.

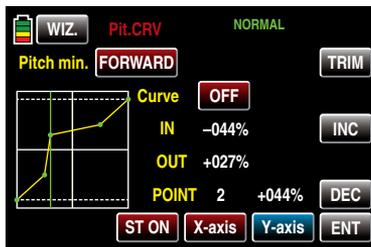
Note:

-  If you move the red point horizontally away from the current control position, the point soon becomes green and a "?" appears in the POINT line. This question mark does not relate to the point which has been moved but rather indicates that another point can be set at the current control position.
- Remember that the percentages in the "IN" and "OUT" line always refer to the momentary position of the control stick and not to the position of the point.

- **Y-axis** button (Y-axis)

Activate this function by touching the button at the bottom edge of the display with a finger or the provided stylus.

You can then move an active (red) point upward by pressing the **INC** button, or downward by pressing the **DEC** button, for example:



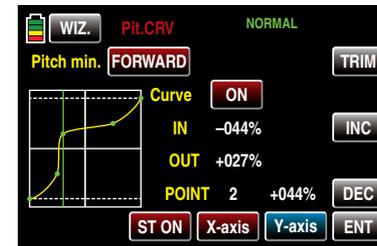
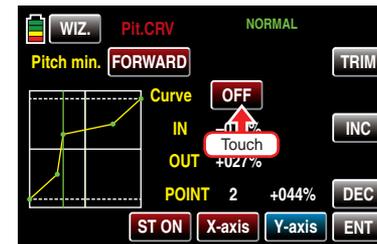
Touch the **Y-axis** button again to deactivate the function.

Note:

-  Remember that the percentages in the "IN" and "OUT" line always refer to the momentary position of the control stick and not to the position of the point.

Rounding off the channel 1 curve

- **ON/OFF** button in the "Curve" line
The default angled curve profile can be automatically rounded off by turning on the rounding function by pressing this button with a finger or the provided stylus, for example:



Important note:

-  The curves portrayed here are for demonstration purposes only and do not represent real pitch curves.

Additional functions

- **TRIM** button
The **mz-18** HoTT and **mz-24** HoTT transmitters have a function that is integrated in the transmitter program for trim up to six support points of the two options "throttle curve" and "pitch curve" during flight.
Open the following window by touching the **TRIM** button at the top right edge of the display with a

finger or the provided stylus:



Basic operating steps

- **"CTL" column:**

In the first column of the menu with the heading "Control", select a control that appears suitable for this purpose as the controls offered by your **mz-18** HoTT or **mz-24** HoTT transmitter.

To assign a control, touch the button in this column in the desired line with a finger or the provided stylus, for example:



The following appears in the display:



Then press the desired control such as the right proportional rotary control SL1:



- **"MIXER" column**

In the six value fields of the second column with the header "MIXER", you can select individual helicopter mixers, or one of the two available mixers in any combination.

To select a mixer, touch the button in "MIXER" column in the desired line with a finger or the provided stylus, for example:



The button color changes from red to blue:



You can change the current value in the blue (active) value field by touching the **INC** or **DEC** buttons at the right edge of the display the desired number of times, for example:



Touch the **RES** button to reset a changed value in a blue (active) value field to the default value.

- **"POINT" column**

You have selected one or more mixers in the lines of the "Mixer" column. In the "Point" column, identify the support point(s) to be trimmed.

To select a point, touch the button in the "POINT" column in the desired line with a finger or the provided stylus, for example:



You may change the current value in the blue (active) value field by touching the **INC** or **DEC** buttons at the right edge of the display the desired number of times, for example:



Touch the **RES** button to reset a changed value in a blue (active) value field to the default value.

Note:



When selecting an undefined point (in the basic version of the relevant curve mixer, the points "L" and "H" input are set), and the associated governor does not have any effect.

- **"Q.LINK" column**

If you want to, specify in the right "Q.LINK" column the programmed Quick Links in which the governor should be active. The number in the value field ("1 (Normal)" in the example)

refers to the Q.Link number which also appears in the "Q.Link" menupage 168. To select another Q.Link than default Q.Link1, touch the button in the "Q.Link" column in the desired line with a finger or the provided stylus, for example:



You may change the current Q.Link number in the blue (active) value field by touching the **INC** or **DEC** buttons at the right edge of the display the desired number of times, for example:



Touch the **RES** button to reset a changed value in a blue (active) value field to the default value.

Note:



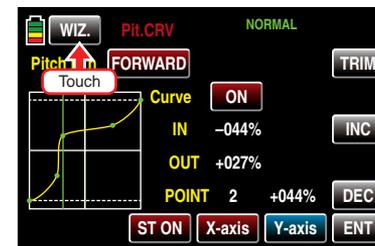
The settings that appear in this display affect the same records as those at a comparable location in the "TRIM" display of the "THR.CRV" submenu (see next column) which is why

changes always affect each other.

After you finish making your settings, touch the **WIZ.** button at the top left of the display to leave this menu and go to "Pitch curve":



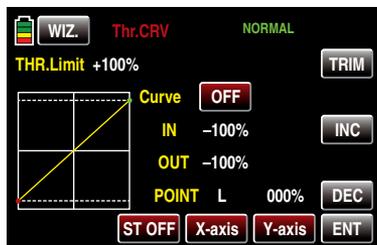
Touch the **WIZ.** button again in the "Pitch curve" display ...



... To leave the assistant and open the next menu: ...

- "Thr.CRV"

The throttle curve can be specified by up to 7 points, the so-called support points, along the entire control stick travel depending on the Quick Link:



The support points are set, changed and deleted in the same manner as explained in the previous section, "Pitch curve", starting on page 175. First specify the throttle curve using three points, that is, the two end points "L" and "H", as well as the other set point "1" in the control center in order to harmonize the motor performance curve with the pitch curve.

Note:

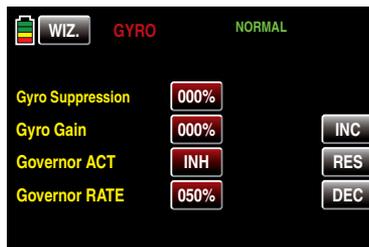
-  The value displayed in the line "Throttle limit" at top left only indicates the position of the gas limiter.
- When selecting an undefined point (in the basic version of the relevant curve mixer, the points "L" and "H" input are set), and the associated governor does not have any effect.
- The settings that appear in this display affect the same records as those at a comparable location in the "TRIM" display of the "THR.CRV" submenu which is why changes always affect each other.



Further information for setting throttle curves can be found starting on page 181.

Touch the **WIZ.** button in the "Throttle curve" display to leave the assistant and open the next menu: ...

- "GYRO" (gyro/governor)
Within this display, you can make initial basic settings as needed for your gyro and/or for any governor that is used in your model.



- Gyro Suppression



This option may normally not be used for current standard gyro systems. You therefore need to consult your gyro setting instructions since otherwise you may make it impossible to fly your helicopter. Nonetheless, this menu was retained to satisfy all requirements and conventions.

This option can influence the effect of the gyro sensor (gyroscope) as the tail rotor control stick is moved, assuming that a gyro system is used

in which the gyro's effect can be set by the transmitter using an additional channel, channel 7 in the *Graupner* remote-control system. The gyro suppression reduces the gyro's effect in a linear manner in proportion to the deflection of the tail rotor control stick corresponding to the set value. If the gyro has not been suppressed (at a value of 0%), the gyro's effect remains independent of the control stick deflection.

The Gyro's effect can however be additionally varied smoothly (depending on the Quick Link if desired) between a minimum and maximum using a control assigned in the "Gyro" line in the "channel set" menu, page 92, for example with one of the proportional dials DVx. More on this subject (not discussed here for reasons of space) can be found in the section "Gyro/governor" from page 186.

- Gyro Gain

NOTE:

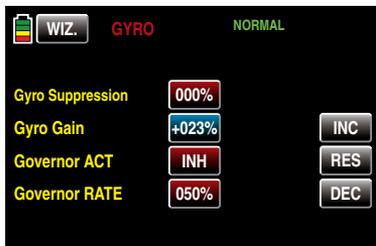


Note that the offset values entered in this option as well as in the line "CH7" of the display "CTRL CH5-12" of the menu "D/R,EXP", page 174, add up! For the sake of clarity, make sure to only enter or change an offset value in one of the two options.

Most of the current gyro systems can be adjusted for a smooth, proportional effect, you can also choose between two different modes of action by the transmitter.

If the gyro that you are using also has one of these options, the alternative offset setting enables both the normal gyro effect and "heading lock mode" as well as flying with maximum stabilization in normal, slow fights within this selected mode, and reducing the gyro gain in fast roundtrips and aerobatics.

Values up to $\pm 125\%$ are possible, for example:

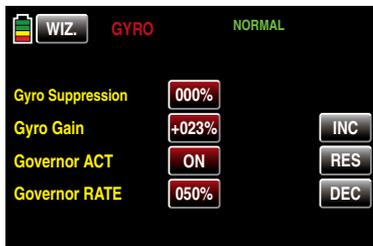


Based on these Q.Link-specific (offset) settings, the gyro gain can also be smoothly varied with a control such as DVx assigned in the line "CH7" of the display "CTRL CH5-9" or "CTRL 5-12" of the "D/R,EXP" menu, page 173.

- **Governor ACT**

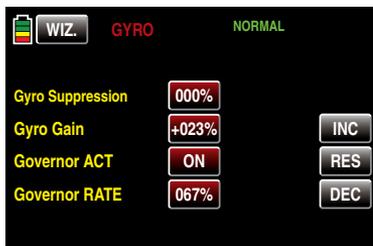
In contrast to speed *controllers* that only regulate performance like a carburettor, governors maintain a constant speed in the system that they are monitoring by independently regulating the provided output. In the case of a gas helicopter, the control independently controls the throttle servo like the motor control unit of an electric helicopter. *Governors therefore only require a speed setting and not a classic throttle curve.* A deviation from the set speed occurs when the required output exceeds the maximum available output.

To change the current value, touch the desired button in the "GOVERNOR" line with a finger or the provided stylus. The display switches from "OFF" to "ON" and vice versa, for example:



- **Governor RATE**

In the "GOVERNOR" line, let us say that you have switched on the function "Governor at CH8". In the "GOVERNOR OFFSET" line, enter the appropriate offset value for the desired rotor speed. The value to be set depends on the governor as well as the desired target speed and, after finish using the assistant, it can also be varied for specific Quick Links, for example:



This value can also be smoothly varied with a control such as DVx assigned in the line "CH8" of the display "CTRL CH5-9" or "CTRL CH5-12" of the "D/R,EXP" menu, starting on page 171.

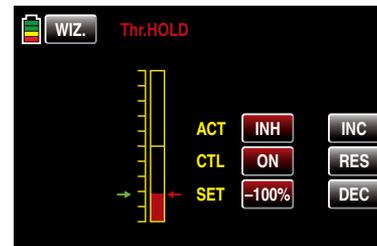
Touch the **WIZ.** button in the "Gyro/Gover" display to leave the assistant and open the next menu: ...

- **"Thr.HOLD"**

During competition, it is expected that gas engines should be completely switched off. In the training phase, this is a bit inconvenient since you would have to restart the motor after each autorotation

landing.

Therefore, as described in detail in the section "THR. HOLD" starting on page 190, make the appropriate settings during the training phase in this display so that the gas motor can be kept idling during the autorotation phase without the clutch engaging and any electric drive is definitely off, for example:



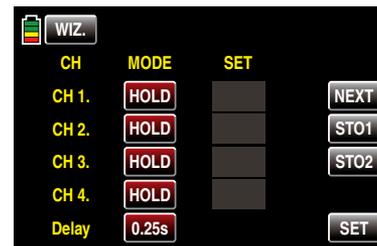
Note:



With the "Thr.CUT" option in the "BASE" menu, there is an alternative emergency off function.

Touch the **WIZ.** button in the "THR AR" display to leave the assistant and open the next menu: ...

- **"FAIL SAFE"**



Since there is normally no connection with the receiver at this juncture when setting up a model, you may omit this menu item at the moment. Touch the **WIZ.** button again, and a display appears with an overview of your previous entries such as ...



..., which you can leave to go to the base menu by touching the **ENT** button at the right bottom with a finger or the provided stylus:



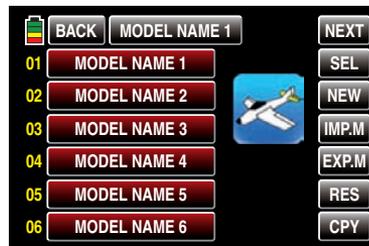
IMP.M

(import from SD card)

Once a memory card is in an operational transmitter, a blue memory card icon appears at the top right of the basic display:

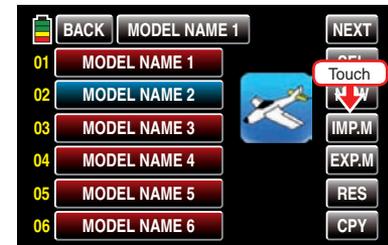


In the "Model Sel" menu described here ...

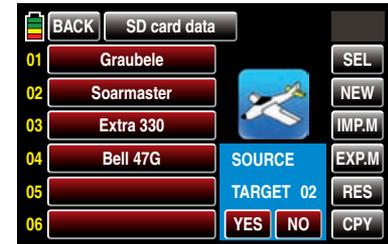


... you can import compatible models into the transmitter memory from the memory card inserted in the transmitter's card slot.

From the list of empty model memories offered in the "Model Sel" display, first select one that appears appropriate, such as model memory 2 which is still available in this example. Touch the field on the right adjacent to the yellow 02 with a finger or the provided stylus. The color of the field switches from red to blue:

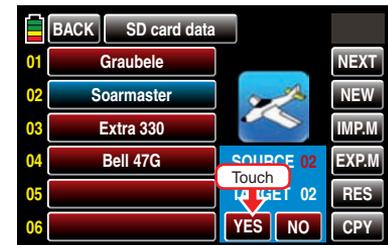


Then switch to the display of the data model saved on the SD card by touching the **IMP.M** button in the middle of the right column:



Touch the model to be imported from the SD memory card with a finger or the provided stylus. The color of the field switches from red to blue, and additional information and buttons appear at the bottom right.

Touch **NO** to terminate the action and return to the start page. Touch **YES** ...



... and then after a short while the message "Please wait!!" appears ...



... while the selected model is imported into the selected mode memory.

Once the process is completed, the message "Please wait!!" disappears, and the display returns to the list of models and the transmitter:



EXP.M (Export to SD card)

Use this option to export models saved in the transmitter to a memory card inserted into the transmitter's card slot.

Once a memory card is in an operational transmitter, a blue memory card icon appears at the top right of the basic display:



In the "Model Sel" menu described here ...



... you can export assigned model memories as desired to the memory card inserted in the card slot of the transmitter.

From the list of assigned model memories offered in the "Model Sel" display, select the desired model memory such as memory 2. Touch the field with the selected model name using a finger or the provided stylus. The color of the field switches from red to blue:



And the next step, touch the **EXP.M** button with a finger or the provided stylus on the right edge of the display:



The color of the button switches from grey to red, and additional information and buttons appear at the bottom right.



Touch **NO** to terminate the action and return to the start page. Touch **YES** ...



... and then after a short while the message "Please wait!!" appears ...



... while the selected model is being exported to the SD card.

Once the process is completed, the message "Please wait!!" disappears, and the display returns to the list of models and the transmitter:



RES (reset model memory)

In the "Model Sel" menu described here ...



... you can delete an assigned model memory using the **RES** button at the right edge of the display.

From the list of assigned model memories offered in the "Model Sel" display, select the desired model memory such as memory 2. Touch the field with the selected model name using a finger or the provided stylus. The color of the field switches from red to blue:



And the next step, touch the **RES** button with a finger or the provided stylus on the right edge of the display:



The color of the button switches from grey to red, and additional information and buttons appear at the bottom right:



Touch **NO** to terminate the action and return to the start page. Touch **YES** ...



... and then after a short while the message "Please wait!!" appears ...



... while the selected model is being initialized.
Once the process is completed, the message "Please wait!!" disappears, and the display returns to the list of models and the transmitter:



WARNING

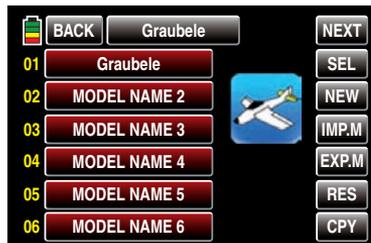


This deletion cannot be restored. All of the data in the selected model memory are completely deleted.

CPY

(copy model → model)

In the "Model Sel" menu described here ...



... using the **CPY** button at the right edge of the display, you can copy an assigned model memory to any other model memory.

From the list of assigned model memories offered in the "Model Sel" display, select the desired model memory such as memory 1. Touch the field with the selected model name using a finger or the provided stylus. The color of the field switches from red to blue:



And the next step, touch the **CPY** button with a finger or the provided stylus on the right edge of the display:



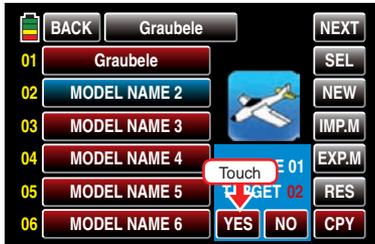
The color of the button switches from grey to red, and additional information and buttons appear at the bottom right:



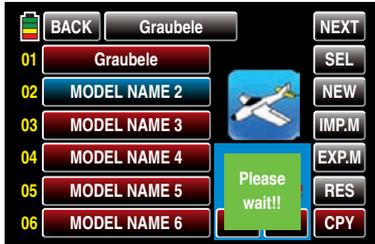
Touch the desired target memory with a finger or the provided stylus. The color of the selected field switches from red to blue, and the number of the selected target memory appears in red next to "Target" in the blue field, for example:



Touch **NO** to terminate the action and return to the start page. Touch **YES** ...

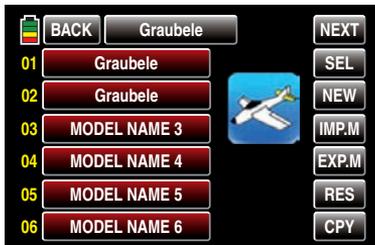


... and then after a short while the message "Please wait!!!" appears ...



... while the selected model is being copied to the target memory.

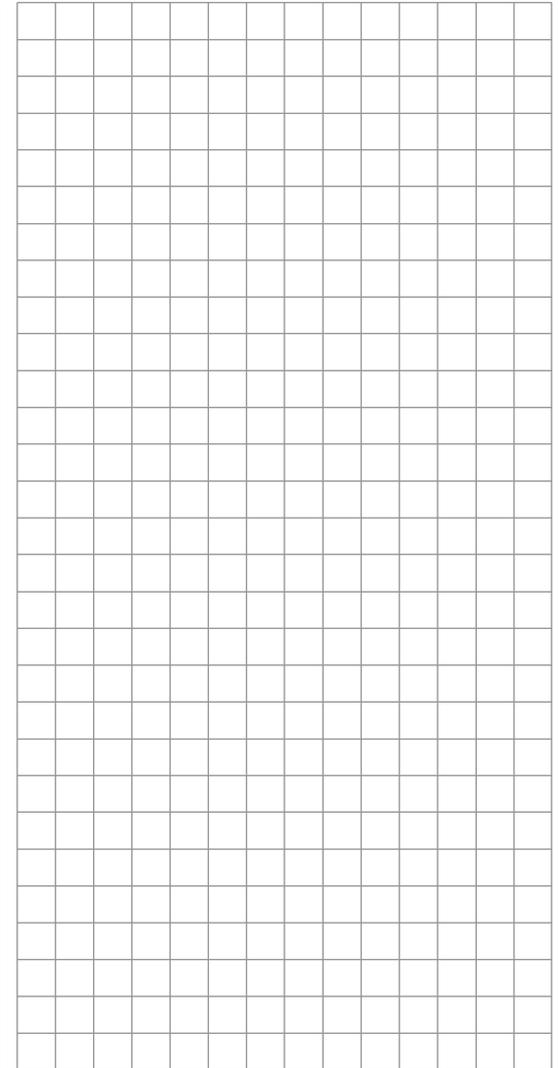
Once the process is completed, the message "Please wait!!!" disappears, and the display returns to the list of models and the transmitter:



Note:



When copying a model memory, the binding data are also copied along with the model data. For this reason, the receiving system associated with the original model memory can be operated with the copy of the model memory in the same transmitter without reestablishing the binding.

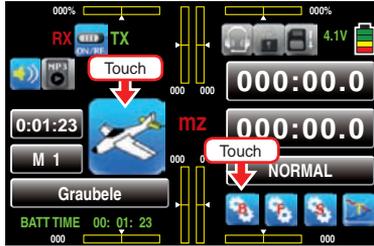




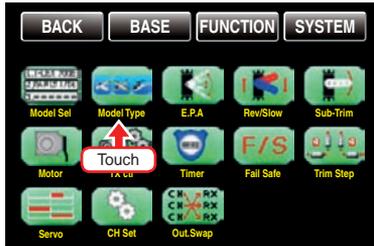
Model Type

Change the model type

Touch the icon for the model type in the basic transmitter display with a finger or the provided stylus to directly display the submenu "Model Type", or alternately touch the gear icon labelled "B" to open the same menu from the base menu:



In the latter case, the display switches to the green base menu. Touch the menu item "Model Type" with a finger or the provided stylus.



Normally, the basic type of model is specified when creating the model memory in the submenu "Model Sel" of the base menu (see page 45). In the "Model Type" submenu, you can directly change the type of the current model. When such a change is made, all of the mixers, coupling functions, etc. for the previous model type are also deleted or need to be adapted to be changed type.

After you open the "Model Type" submenu, a graphic display of the basic information of the current model appears, for example:



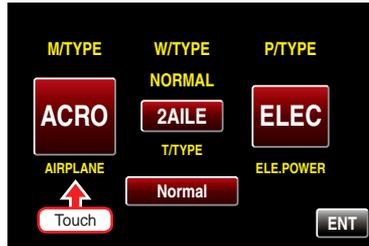
WARNING



Once you change any of the existing settings, all of the relevant parameters are reset.

For example, the model memory with an airplane needs to be reprogrammed for a helicopter model type.

Use a finger or the provided stylus to touch the first field to be changed; in this example, the field "Airplane":



As described in detail in the section "Manually programming the basic settings of a new model", starting on page 45, the manual configuration of a model memory starts by selecting the basic model type.



As of firmware version V 1.023, the corresponding selection window appears in modified form:



Tapping **BACK** with your finger or the provided stylus cancels the process. Tapping **OK** confirms the process and allows the model type to be selected:



Following the example, touch the left button labelled "Heli" in this display ...

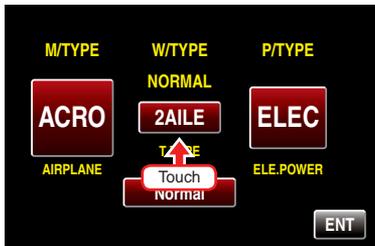


... the display then switches to the selection of the swash plate servo ...



... etc. For the remainder of the process, you only need to use the assistant as described in the mentioned section until all the basic settings of the newly selected model type are entered.

Basically, use the same procedure as you would, for example, to change the wing type of the current model from "2AILE" to "2AILE 2FLAP". In this case, use a finger or the provided stylus to touch the value field "W/Type" ...



... and change the wing type in the display "W/Type" that appears ...

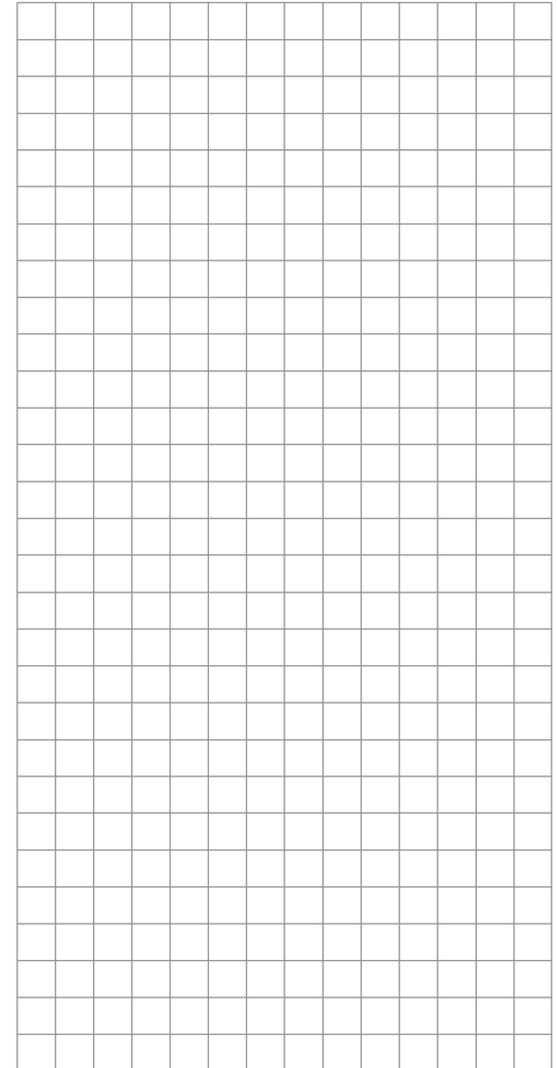


... by touching the new wing type with a finger or the provided stylus. Use the same procedure for all of the selectable fields.

Note:



In contrast to the display of the 12-channel mz-24 HoTT transmitter, only "1A" to a max. "2A2F" are offered in the display of the 9-channel mz-18 HoTT transmitter.

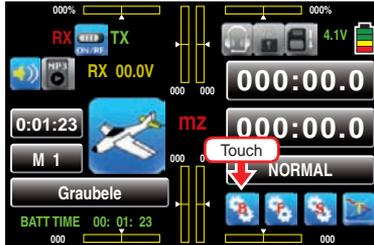




E.P.A

End Point Adjustmen

In the basic transmitter display, use a finger or the provided stylus to touch the gear icon labelled "B":



The display switches to the green base menu. Touch the menu item "E.P.A" with a finger or the provided stylus.



E.P.A

In this display, the parameters are set that exclusively relate to the servo, that is the servo path and angle of rotation as well as its limit.

The set values always refer to the settings in the submenu "(Servo)Sub-Trim" on page 70.

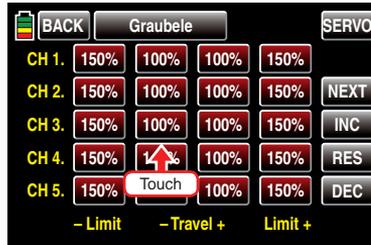


Note:



*In order to reach control channels with numbers higher than CH5, touch **NEXT** [next page] at the right column of the display.*

To change a current value, touch the desired button with a finger or the provided stylus, for example:



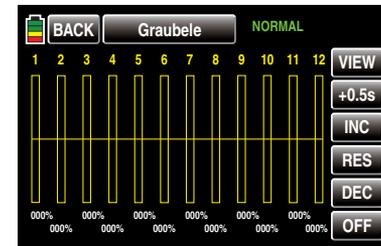
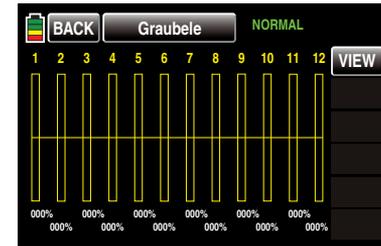
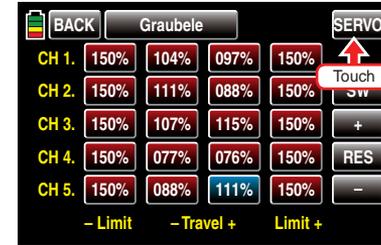
The button color changes from red to blue:



Repeatedly touch the **INC** button at the right edge of the display to gradually increase the current value, and touch the **DEC** button to lower the value in the active value field. Touch the **RES** button to reset a changed value back to the default.

Use the same procedure for all the other settings.

Touch the **SERVO** button in the top right of the display to open the graphic display of the servo travel described in greater detail on page 90 and activate (if desired) the "Servo test" function integrated in this display by touching the **VIEW** field:

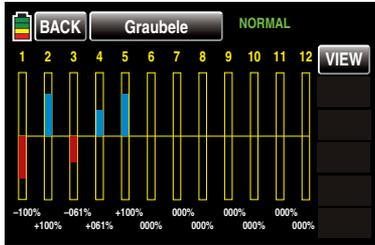


Note:



In contrast to the display of the 12-channel mz-24 HoTT transmitter in this section, only channels 1 ... 9 are offered in the display of the 9-channel mz-18 HoTT transmitter.

Once you activate one or more control elements of your transmitter, the resulting servo travel is graphically displayed, for example:



To go to the "base menu", leave the "Servo display" by touching the **BACK** button at the top left:

Important:



In contrast to the "CH Set" menu, all the settings of this menu refer to the relevant servo independent of where the control signal for the servo comes from, i.e., either directly from the control element or from mix functions.

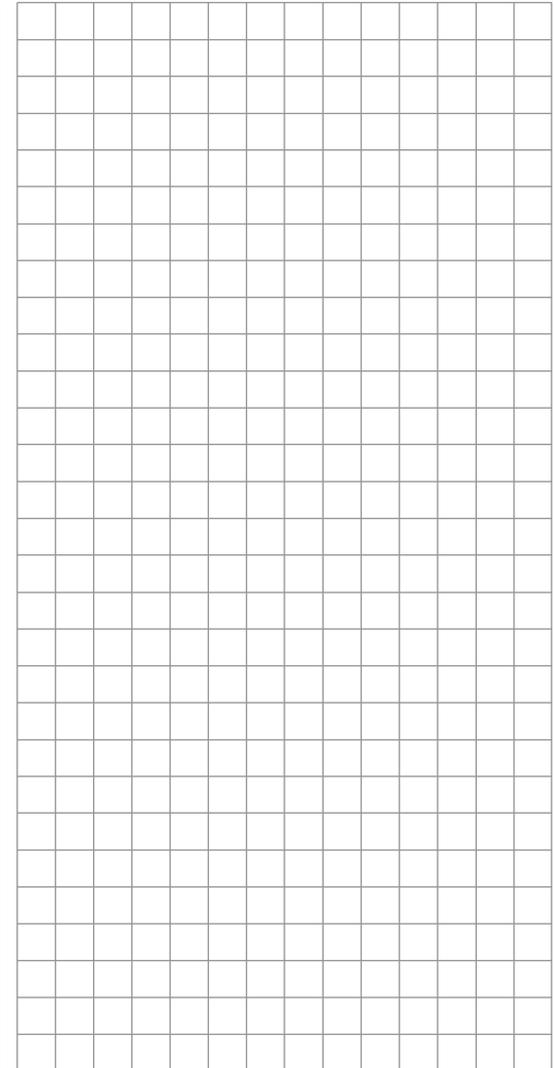
Example of a servo limit:

The rudder servo is controlled directly from its control and, for reasons of comfort, also from an "aileron >> rudder" mix.

For model-specific reasons, the rudder servo can only follow a maximum servo travel of 100% since the rudder would contact the elevator if it were to travel more than 100%.

As long as only the rudder is used, this is not a problem. It becomes a problem, however, if the signals add up to a total travel of more than 100% when simultaneously using the rudder and the aileron. The linkages and servos can be subject to an extreme load ...

To prevent this, the path of the relevant servo should be limited individually. In the case of the rudder servos used here as an example, this would be slightly less than 100% since we are assuming that the rudder is already traveling 100%.

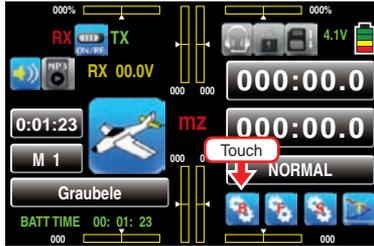




Reverse/Slow

Setting the servo rotational direction and delay

In the basic transmitter display, use a finger or the provided stylus to touch the gear icon labelled "B":



The display switches to the green base menu. Touch the menu item "Rev/Slow" with a finger or the provided stylus.



Servo direction of rotation and control delay



In this display, exclusively the direction of rotation relating to the respective servo is set in the left column. In contrast, a delay is entered in the right column for the control function corresponding to the selected channel.

Note:

-  In contrast to the display of the 12-channel **mz-24** HoTT transmitter in this section, only channels 1 ... 9 are offered in the display of the 9-channel **mz-18** HoTT transmitter.
- If you have created Quick Links in the submenu "Q.Link" (page 132 or 168) and have assigned an appropriate name, it appears at the top right such as "NORMAL" as shown.



However, the settings in the left column, "direction of servo rotation", have a global effect. Only the delays may be set for the specific Quick Links in the right column, "Delay". When setting the delays, activate the wanted Quick Link by operating its corresponding switch.

- Setting the rotational direction of the servos is independent of the Quick Link

Important:

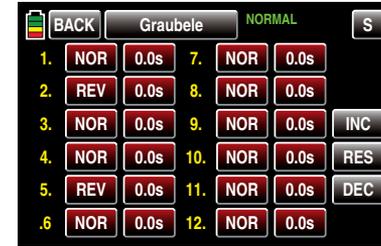


The numbers for the servos refer to the the servos connected to the corresponding receiver outputs providing that the transmitter and receiver outputs have not been swapped. A change in the control mode therefore does not influence the numbering of the servos.

With this option, the direction of servo rotation is adapted to the specifics in the particular model independent of the Quick Link so that, when the control linkages and articulations are installed, the servo's rotational direction does not have to be considered.



The servo's rotational direction should be determined before the servo travel is set. The direction of travel is reversed by touching the corresponding value fields labelled **NOR** and **REV**, such as:



Note:



As of firmware version V1.020, a warning was inserted which appears when an attempt is made to change the direction of travel of CH1:



Touch **NO** with a finger or the provided stylus to terminate the procedure. Touch **YES** to confirm the procedure which changes the direction of travel of the servo connected to CH1.

- Setting a transmitter-side symmetrical delay depending on the Quick Link

Important:



In contrast to the left column, numbers CH1 ... CH9 for the **mz-18** HoTT transmitter and CH1 ... CH12 for the **mz-24** HoTT transmitter refer to the control-side control channels..

NOTE

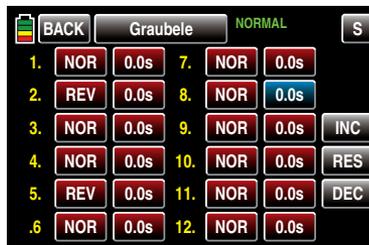


Set a *symmetrical* delay for the transmitter-side control signal with buttons with the standard labelling **0.0s**. A delay which is set here affects the servo that has the number of the delayed receiver connector as well as all servos controlled by the control element assigned to control function X.

To set a *control-side* delay, touch the button normally labelled **0.0s** with a finger or the provided stylus, for example CH8.



The button color changes from red to blue:



Touch the **INC** button at the right edge of the display to gradually increase the value to a maximum of 9.9 seconds:

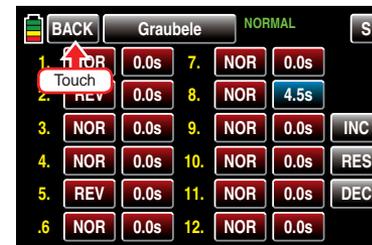


Touch the **DEC** button underneath to reduce the value to a minimum of 0.0 s, and touch the **RES** button to reset the changed value back to the default.

Touch the **S** button in the top right of the display to open the graphic display of the servo travel and positions described in greater detail on page 90 and activate (if desired) the "Servo test" function integrated in this display.

Use the same procedure for the other settings.

To go to the "Home menu", leave the **"REVERSE/SLOW"** display by touching the **BACK** button at the top left:

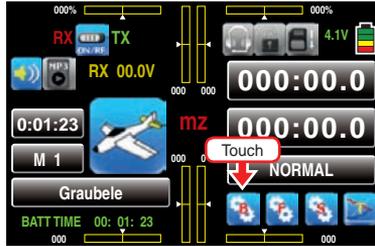




Sub-Trim

Setting the neutral position of servos

In the basic transmitter display, use a finger or the provided stylus to touch the gear icon labelled "B":



The display switches to the green base menu. Touch the menu item "Sub-Trim" with a finger or the provided stylus.



Sub-Trim

The servo middle position is for adapting servos that are not standard (servo middle position with a pulse length of 1.5 ms or 1500 µs) as well as for minor adaptations, for example fine adjustment to the neutral position of the control surfaces on the model.

Independent of trim levers and any mix settings, the neutral position can be shifted around ±125% within the maximum servo travel of ±150%. The servo is always adjusted directly independent of all other trim and mix settings.



Note that if the neutral position is adjusted strongly, servo travel on one side may be restricted since the total travel is limited to ±150% for electronic and mechanical reasons.

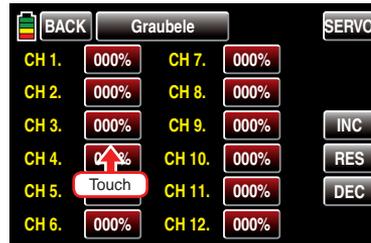


Note:

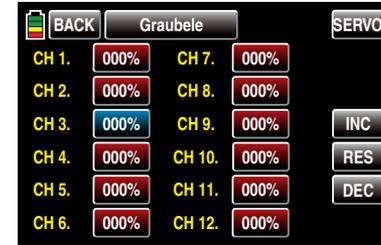


- Move the trim lever into the middle position before changing the middle values.
- In contrast to the display of the 12-channel mZ-24 HoTT transmitter in this section, only channels 1 ... 9 are offered in the display of the 9-channel mZ-18 HoTT transmitter.

To change the neutral position of a specific servo, touch the corresponding button, for example:



The button color changes from red to blue:



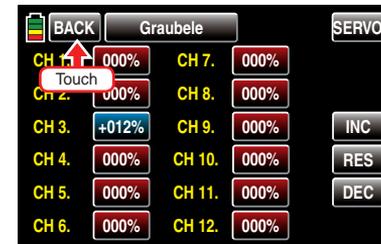
Change the value by touching **INC** or **DEC** on the right to the outside, for example:

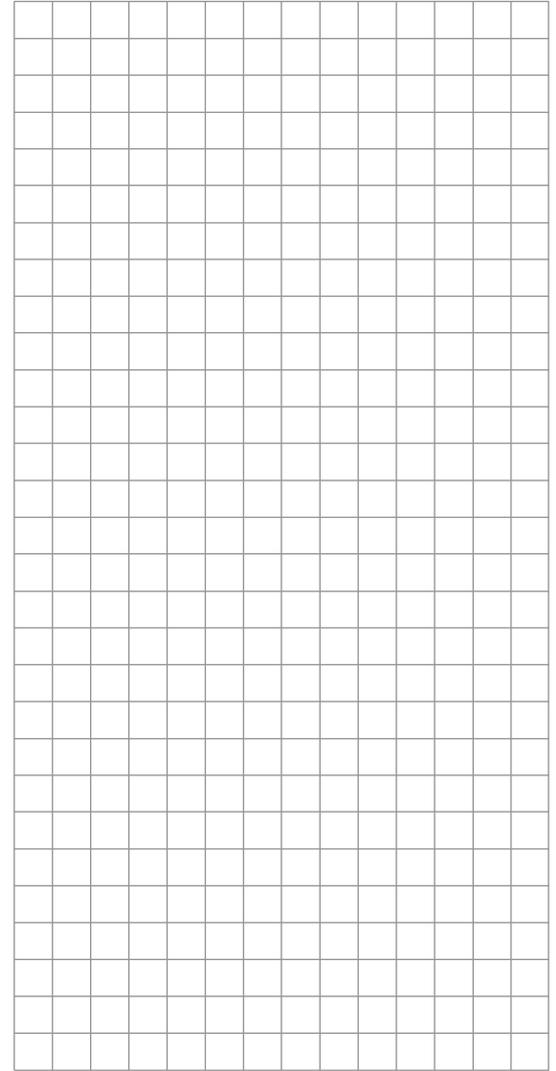
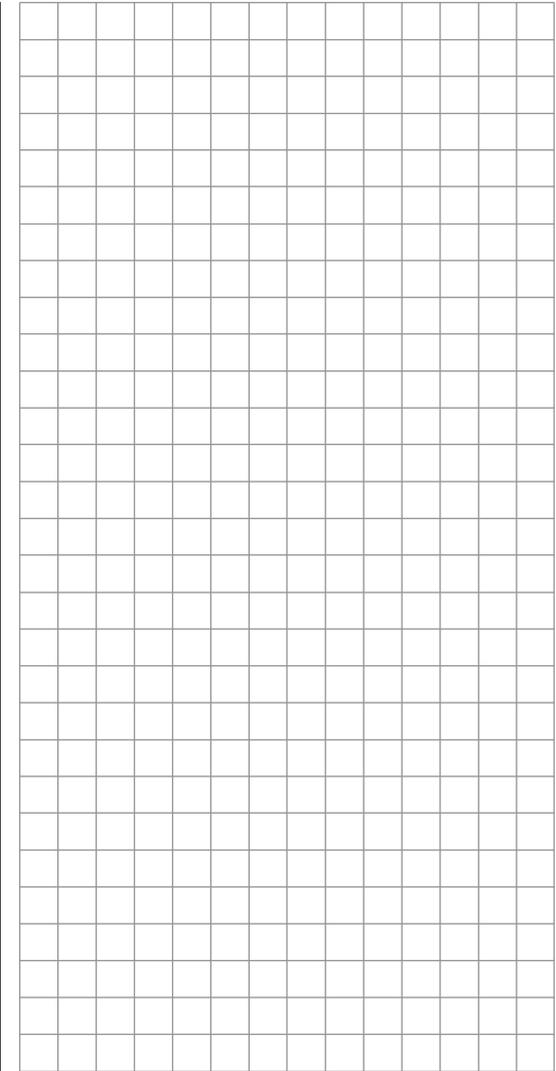


Touch the **RES** button to reset a changed value in the blue field back to the default.

Touch the **SERVO** button in the top right of the display to open the graphic display of the servo travel and positions described in greater detail on page 90 and activate (if desired) the "Servo test" function integrated in this display:

To go to the "Home menu", leave the "Sub-Trim" display by touching the **BACK** button at the top left:







Motor (electric motor)

Throttle Cut (gas engine)

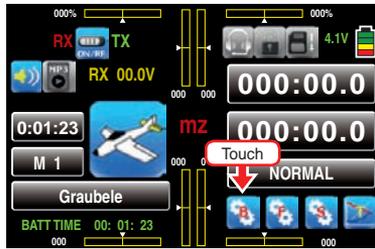
Switchable throttle cut or motor limiter

Note:



This menu is hidden when selecting a model configuration "NO POWER" in the basic settings of the "Model Sel" or "Model type" menu.

In the basic transmitter display, use a finger or the provided stylus to touch the gear icon labelled "B":



The display switches to the green base menu. Touch the menu item "Motor" (airplane or glider with electric motor) or "Throttle Cut" (helicopter with electric or gas engine and airplane with gas engine) with a finger or the provided stylus.



NOTE:



"Motor" is working over the complete range (-100 to +100% CH1 control stick position) and "Throttle Cut" is only working, when CH1 control stick position is below -66%.



Motor / Throttle Cut

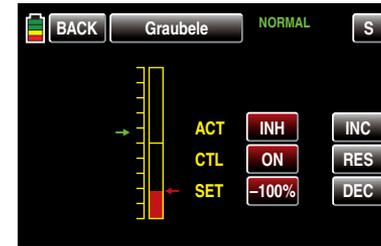
In the "Motor" or "Throttle Cut" menu, you can switch off a speed controller by a switch, or move a servo for the throttle control into motor OFF position (or to idle position). This option can also be used as an emergency Cut OFF function as well. The motor OFF position, or for example an idle position, is designated in the value field of the "SET" line and needs to be determined through experimentation.

The speed controller or the throttle servo only assumes the set position after a switch has been activated and the switching threshold in the "SET" line is undershot by the CH1 control stick.

- If the set percentage in the "SET" line is *greater* than the current Ch1 control stick position, that is, the current position represented by the green arrow to the left of the bar graph is below the switching threshold, switching occurs when the switch is in the ON position.
- If the set percentage in the "SET" line is *less* than the current CH1 control stick position, that is, the current servo position represented by the green arrow to the left of the bar graph is above the switching threshold, the speed controller reduces the motor speed, or the throttle servo closes the carburettor as specified in the "SET" line once the CH1 control stick position *falls below* the switching threshold when the switch is in the ON position. In this motor OFF position, the speed controller or throttle servo are disabled until the selected switch

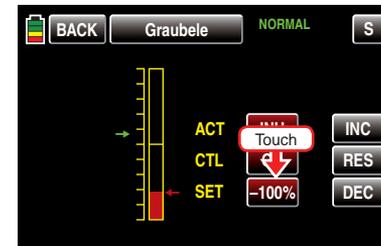
is switched. The throttle servo or speed controller is then moved beyond the preprogrammed switching threshold with the Throttle/brake control stick.

A threshold of -100% the servo position is the default in the value field of the "SET" line:

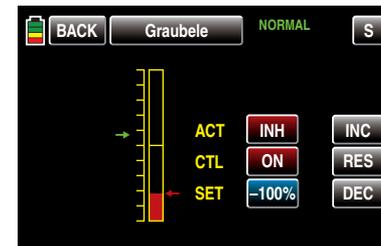


Programming

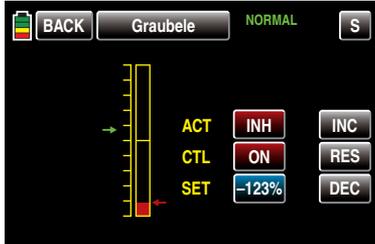
To change the default for the switching threshold or "Motor OFF" position, touch the value field in the "SET" line with a finger or the provided stylus:



The color of the field switches from red to blue:

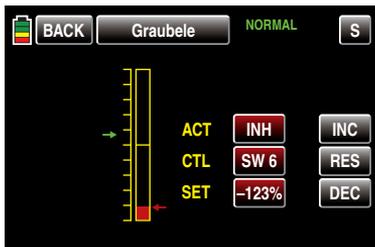


Set a value with **INC** or **DEC** on the right to the outside at which the motor runs comfortably at your desired idle speed or is for example definitely "off":

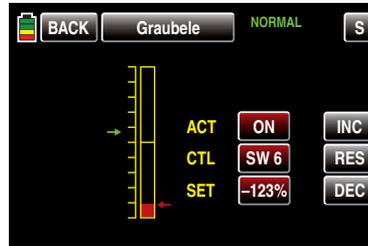


With a gas motor, make sure that the throttle servo does not mechanically overtravel.

Assign the required ON/OFF switch (such as S6) in the "CTL" line as described in detail in "Control, switch and control switch assignment" on page 38:

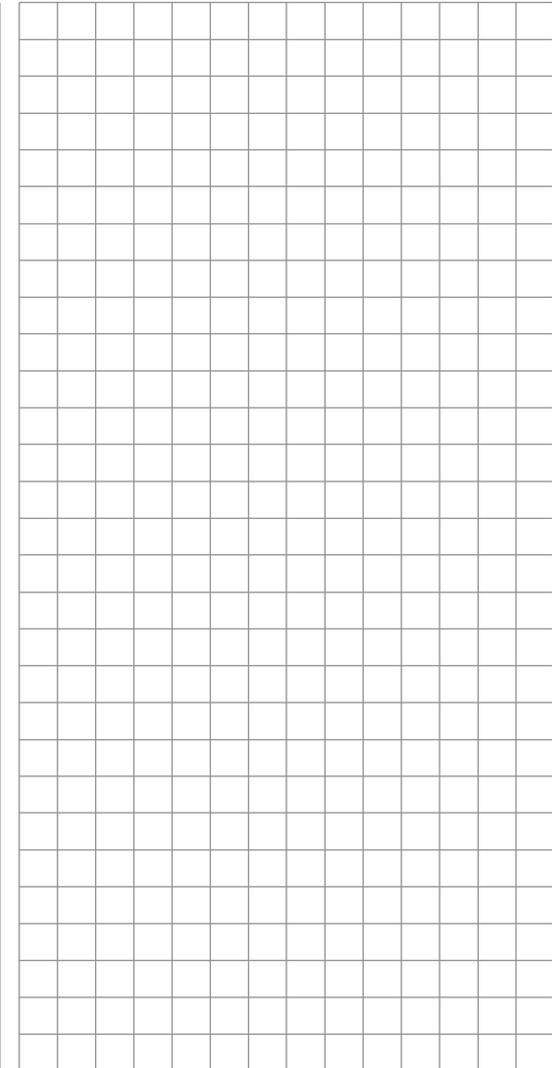
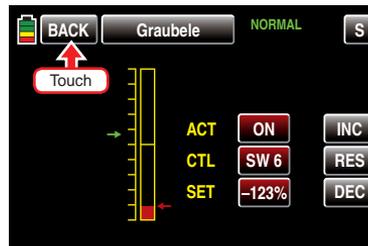


In conclusion, touch the value field in the "ACT" line to release the option which is blocked by default (**INH**). Depending on the switch position, the display of this field switches to **ON** or **OFF**.



Touch the **SERVO** button in the top right of the display to open the graphic display of the servo travel and positions described in greater detail on page 90 and activate (if desired) the "Servo test" function integrated in this display:

To go to the "Home menu", leave the "THR.CUT" display by touching the **BACK** button at the top left:

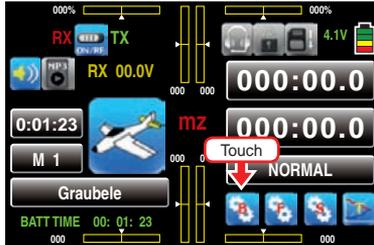




Transmitter control

Transmitter settings

In the basic transmitter display, use a finger or the provided stylus to touch the gear icon labelled "B":

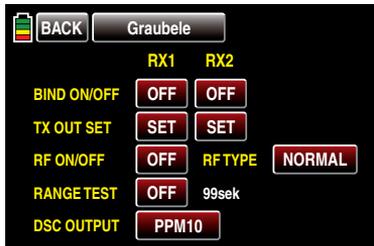


The display switches to the green base menu. Touch the menu item "TX ctl" with a finger or the provided stylus.



Transmitter settings

This menu allows you to configure transmitter-specific functions such as "Binding", "Transmitter outputs", "RF ON/OFF", "RF type", "Range test" and "DSC output":



Bind ON/OFF

To establish a telemetry connection to the transmitter, *Graupner* HoTT receivers must be "trained" to communicate exclusively with one specific model (memory) of a *Graupner* HoTT transmitter. This procedure is termed "binding" and only needs to be done *once* for each new receiver/model memory combination (and can be repeated anytime).

Important instructions:

- 

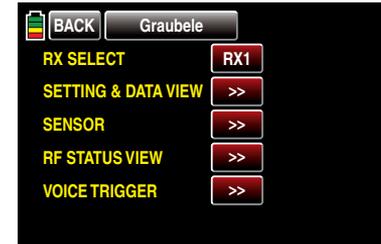
When binding, make sure that the transmitter antenna is always far enough away from the receiver antenna. Maintain a distance of 1 meter to be on the safe side. Otherwise, you risk endangering the connection with the feedback channel and causing malfunctions.
- Make sure that the receiver power supply is correct. If the power supply is too low, the receiver LEDs will react as described below in response to your binding attempt, but the binding will not work.**
- When binding to other receivers, note that other switched-on receivers already bound to the transmitter (and hence not directly affected by the binding process) enter fail safe mode while the transmitter is binding.**

Binding several receivers per model

If desired, several receivers per model can be bound. In the related programs of the **mz-18** HoTT and **mz-24** HoTT receivers, you can directly manage *two receivers bound to each active model memory* and use a menu to distribute the 9 or 12 transmitter control channels between the two receivers (see below in this section): First bind the two receivers one by one as described below.



During subsequent operation, only the receiver establishes a telemetry link to the transmitter that was either last bound to the active model memory, or was selected in the "RECEIVER SELECT" line in the "Telemetry" menu, for example:



Any telemetry sensors which are installed in the model should therefore be connected to this receiver since only the data received through the feedback channel of the receiver *selected in this line* is evaluated by the transmitter. The second receiver (and all other receivers) run independently at the same time in model memory-independent slave mode.

Binding the transmitter and receiver

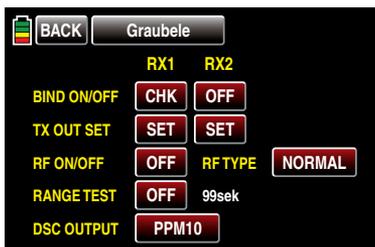
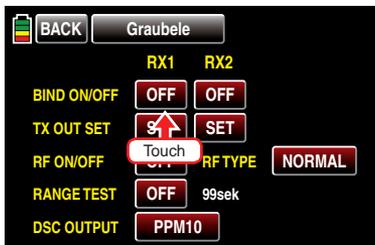
Switch off the power supply to your receiver at this time (at the latest).

GR-16 and GR-24 receivers

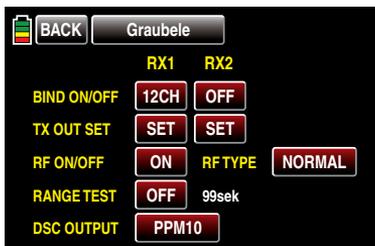
The red LED flashes on the receiver.

Hold down the SET button on the receiver until, after about 3 seconds, the flashing red LED flashes red/green for around 3 seconds. Then release the SET button on the receiver. As long as the LED is flashing red/green, the receiver is in binding mode.

Within this 3 second window, start binding the receiver to the current model memory by touching one of the two buttons in the "BIND ON/OFF" line with a finger or the provided stylus, for example.



Binding is complete once (within a period of approximately 10 seconds) the flashing red receiver LED shines green continuously. Your model memory/receiver combination is now operable. At the same time, instead of **OFF**, an abbreviation of the receiver type such as **12CH** appears for the receiver GR-24 HoTT receiver which comes standard:



At the same time, RF transmission is switched on (see the line "RF ON/OFF" in the following display).

If the red receiver LED continues to flash for more than 10 seconds, the binding process was unsuccessful. At the same time, **OFF** appears again in the line "BIND ON/OFF". Change the positions of the associated antennas and try the entire procedure again.

• GR-12L receivers

The red LED on the receiver shines.

Hold down the SET button on the receiver until, after about 3 seconds, the red LED goes dark for around 3 seconds. Then release the SET button on the receiver. As long as the LED is dark, the receiver is in binding mode.

As described above, within this 3 second window, start binding the receiver to the current model memory by touching one of the two buttons in the "BIND ON/OFF" line with a finger or the provided stylus, for example.

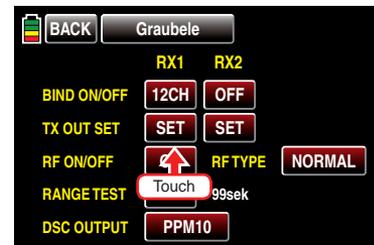
Binding has been successful if the receiver LED remains dark and the receiver display switches to **6CH**.

If the red receiver LED shines red again, the binding process was unsuccessful. At the same time, **OFF** appears again in the line "BIND ON/OFF". Change the positions of the associated antennas and try the entire procedure again.

Out.Swap (receiver output)

As mentioned in the introduction to the section "Binding receivers", the **mz-18** HoTT and **mz-24** HoTT transmitters allow you use this menu item to distribute the transmitter control channels *within a receiver* as desired, and you can also distribute the 9 or 12 receiver control channels to the two receivers as preferred. This distribution will be termed mapping or channel mapping in the following.

Switch on your receiver and, with a finger or the provided stylus, touch the receiver (such as "RX1") to be mapped in the line "**Out.Swap**":



Channel assignment within a receiver

Like the channel mapping described on page 118 (also termed "channel mapping" in the "**Telemetry**" menu), you can easily distribute transmitter control channels at the receiver inputs to the outputs, or servo connections, of the selected receiver:



Note:



In contrast to the display of the 12-channel mz-24 HoTT transmitter in this section, only channels 1 ... 9 are offered in the display of the 9-channel mz-18 HoTT transmitter.

After the desired *output* has been selected by touching the channel button with a finger over the provided stylus in the line of the desired receiver output, the color switches from red to blue, for example:



Repeatedly touch **INC** or **DEC** with a finger or the provided stylus to select the desired input channel or transmitter output (see page 96), for example:



Touch the **RES** button to reset a changed output to the default mapping.

Use the same procedure to switch other control channel/receiver output combinations.

NOTE:



If for example you entered "2AILE" in the basic settings for a model, the transmitter assigns *control function 2 (aileron)* to control channels 2+5 for the left and right aileron. The corresponding transmitter outputs (receiver inputs) to be mapped would in this case be channels 2+5 (see the examples below).



All that remains is for your settings to be transmitted to the receiver since these settings are only saved in the receiver, and can only be changed in the "Telemetry" Menu in the receiver. Touch the **STO** [store] button to start

transmitting, and touch the **BACK** button at the top left of the display to return to the "Transmitter setting" menu.

Examples:

- On a large model, you want to control each aileron flap using two or more servos:
Assign the same input (control channel) to the relevant outputs (servo connectors). In this case, assign one of the two default aileron control channels 2 + 5 as an input depending on the left or right wing.
- On a large model, you want to control the rudder using two or more servos:
Assign the same input (control channel) to the relevant outputs (servo connectors). In this case, default rudder channel 4.

Note:



- The maximum number of available lines (outputs) corresponds to the maximum number of servos that can be connected to each receiver.
- You can use the "Output swap" option, page 96, of the **mz-18 HoTT** and **mz-24 HoTT** transmitters to switch the transmitter control function as desired, or assign the same control function to several outputs. For the sake of clarity, it is strongly recommended to only use one of the two options.

Assigning a channel to two receivers

As mentioned above, you can use the "receiver output" option to distribute the 9 control channels of the **mz-18 HoTT** transmitter, or the 12 control channels of the **mz-24 HoTT** transmitter to two receivers as desired. The numbering of the outputs (servo connectors) and the maximum number of available lines (outputs) correspond to the maximum number of servos that can be connected to the respective receivers. Follow the same procedure as above.

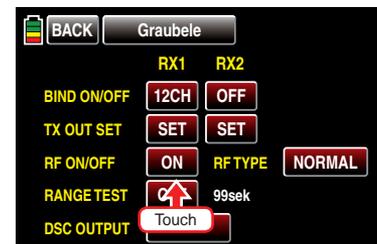
RF ON/OFF

In this line, you can manually turn the transmitter's RF transmission off and back on while the transmitter is currently switched on, for example, to save power while programming a model.



The next time the transmitter is switched on or a model is switched, the OFF setting is reversed.

To manually switch on or off the high-frequency transmission of your transmitter, touch the corresponding button with a finger or the provide stylus in the "RF ON/OFF" line:



RF type

(country setting)

The specific RF type needs to be set to satisfy the relevant guidelines (FCC, ETSI, IC, etc.).

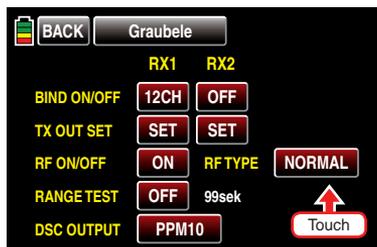
In France for example, originally a remote control system could only be operated within a restricted frequency band. With the publication of a new list of "Class 1 Devices" in July 2012 by the standing EU Commission and the associated lifting of the permissible frequency band limit of the relevant subclass 22 from 2.400 to 2.4835 GHz that affects 2.4 GHz remote control systems, the legal requirements for the earlier "France mode" are no longer applicable.



For this reason, the "France Mode" was removed from the selection as of firmware version V 1.023. However, temporarily retain the following paragraph in the original version for the sake of compatibility with older firmware versions.

The previous France mode *can* nonetheless still be used, including outside of France, for example to use the upper frequency range of the 2.4 GHz band that this left available for transmitting pictures from an onboard camera. In this case, however, make sure that the antenna(s) of the video broadcast system in the model is/are attached at least 3 m from the active ends of the antennas for the RC receiver system. For safety reasons, it is therefore strongly recommended to use satellite receivers located in an exposed area. In addition, you should always perform an extensive range test with the video signal on since range loss can be expected.

To switch the "Country Setting" of your transmitter between "NORMAL", "USA" or possibly even "FRANCE", tap the button to the right of "RF Type" as often as necessary with your finger of the provided stylus:



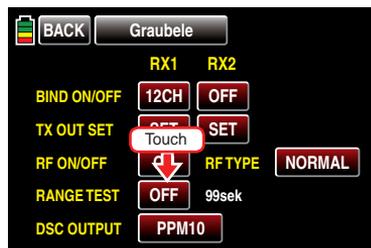
RANGE TEST

The integrated range test reduces the transmitter output so that you can perform a function test at a distance of less than 100 m.

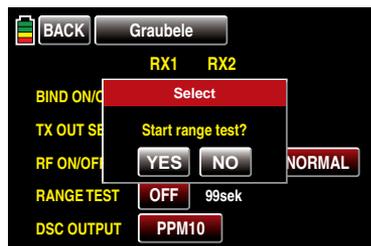
Perform the range test for the *Graupner*-HoTT system according to the following instructions. It is useful to have an assistant to help you with the range test.

1. Install the receiver(s) already bound to the transmitter into the model as described.
2. Switch on the remote control, and wait until the green LED of your GR-16 and GR-24 receiver(s) shines, or the red LED of the GR-12L receiver goes dark. You are now able to monitor servo movements.

3. Place the model on a flat surface (cement, mowed lawn or ground) so that the receiver antennas are at least 15 cm above the ground. It may therefore be necessary to place a support underneath the model during the test.
4. Hold the transmitter at hip level at a slight distance from your body. Do not point the antenna directly at the model; rotate and/or bend the antenna so that it is approximately at a right angle to the model.
5. In the next-to-last line of the display, activate the range test mode by touching the button to the right of "RANGE TEST" with a finger or the provided stylus ...



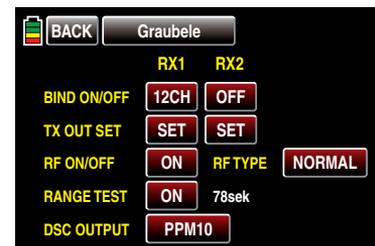
... a confirmation prompt then appears (starting with firmware version V 1.017):



Touch **YES** with a finger or the provided stylus to start the range test. Touch **NO** to terminate the procedure.

When the range test starts, the output of the transmitter decreases significantly. At the same time,

the illuminated company name *Graupner* below the two middle proportional dials starts to flash. Simultaneously, the time display in the transmitter display starts to count backwards and emits a double beep every 2 seconds.



5 seconds before the range test ends, a triple beep sounds every second. After the 99-second range test, the transmitter switches back to full output, and the *Graupner* logo shines continuously.

6. During this time, move away from the model, and also move the transmitter's control elements. If you notice an interruption in the connection at any time within a distance of about 50 m, try to reproduce it.
7. If the model has a motor, switch it on to also check interference resistance.
8. Move further away from the model until it does not respond perfectly.
9. At this location, wait for the remainder of the test period with the still operable model. The model should still react to control commands once the range test is finished. If the model does not react to all the control commands, do not use the system, and contact the responsible Service Center of *Graupner*/SJ GmbH.
10. Perform a range test before each flight, and simulate all servo movements that could occur during the flight. The range test always must be performed on the ground at least 50 m away from the model to make sure that the model operates correctly.

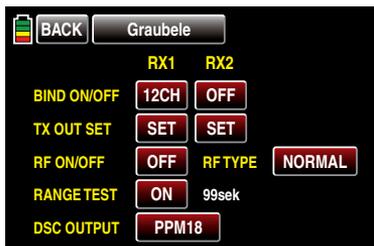
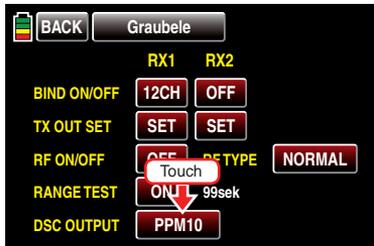
NOTE:



Never start a range test on the transmitter during normal model operation!

DSC OUTPUT

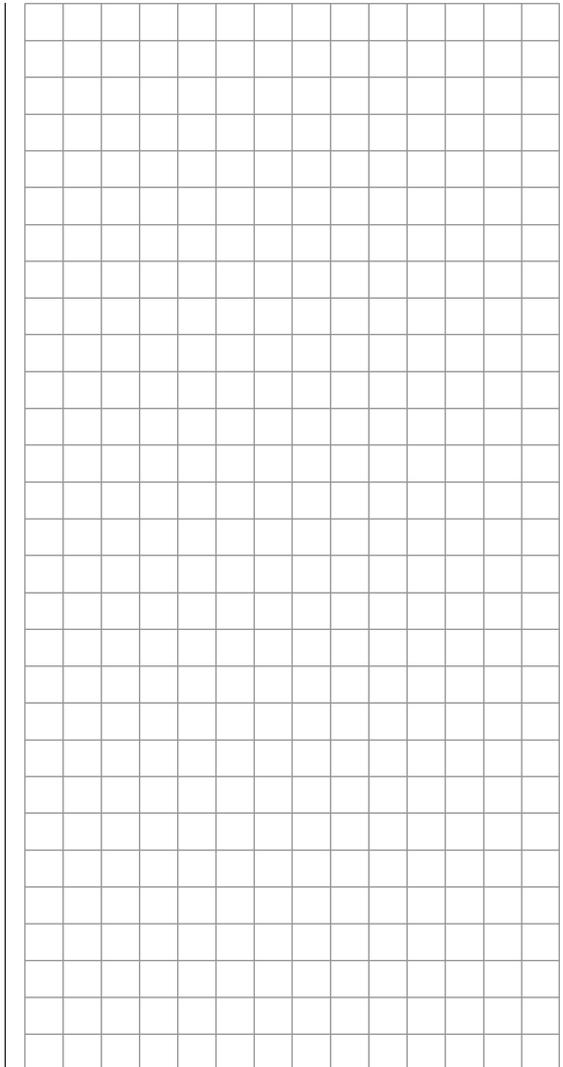
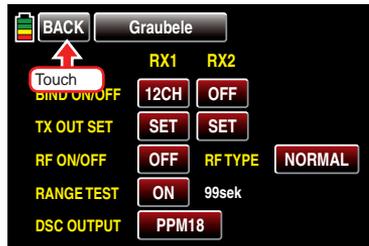
To set the modulation of your transmitter at the DNC output, touch the button with the current setting in the "DSC Output" line (repeatedly if necessary) until the desired modulation appears. Four types of modulation are available in this sequence: "PPM10", "PPM16", "PPM18" and "PPM24":

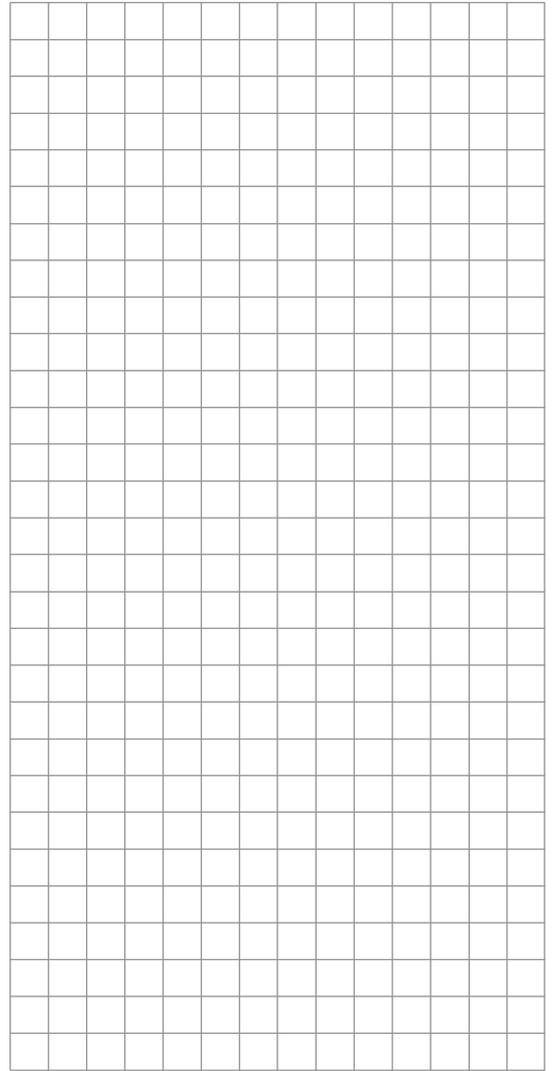
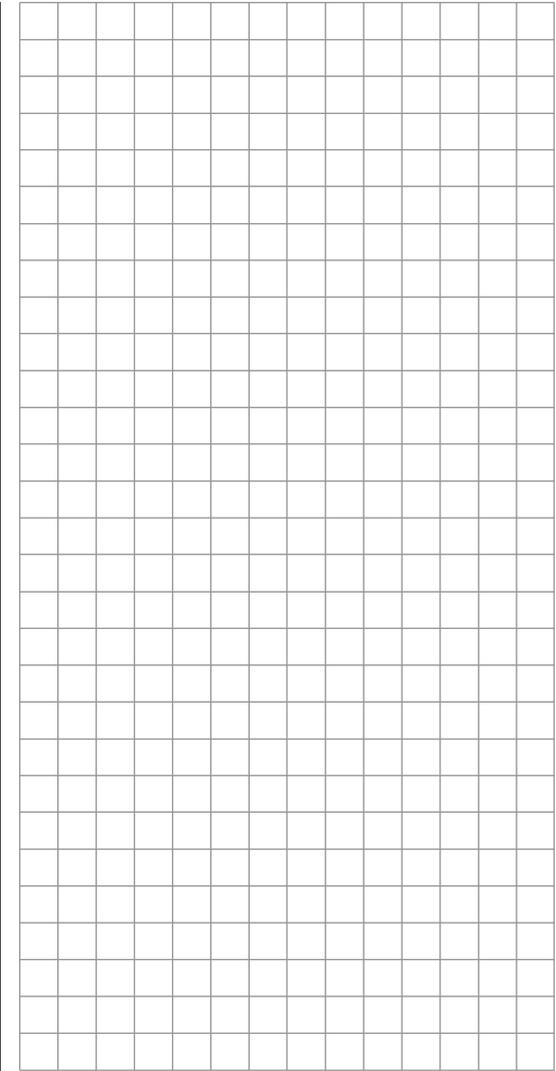


The selected modulation primarily influences the number of available control channels at this DSC socket and hence also influences a flight simulator, trainer system or external RF module connected to this socket. If "PPM10" is selected, the channels are 1 ... 5; with "PPM16", the channels are 1 ... 8, with "PPM18", the channels are 1 ... 9, and with "PPM24", the control channels are 1 ... 12.

Touch the **BACK** button at the top left of the display to

leave this menu and return to the base menu.







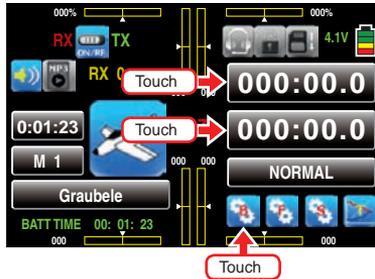
Timers

Setting TIMER 1 and TIMER 2 as well as the date and time

The basic transmitter display comes with four timers (see the display below). Next to the green transmitter operating time and the model time on the left side of the display, there is an upper and lower timer on the right side of the display.

To set the upper timer 1 and/or lower timer 2 as well as the date and time, touch the corresponding value field in the right half of the display with a finger or the provided stylus to the display of the desired timer.

Alternately, you can also access the "Timer" menu item from the "base menu": Touch the gear icon labelled "B" in the home display of the transmitter ...



The display switches to the green base menu. Then use a finger or the provided stylus to touch the "TIMER" menu item:



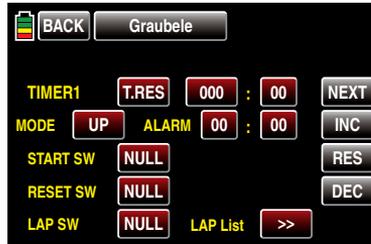
NOTE:



The recording of telemetry data on an SD card inserted in a card slot located in the back of the transmitter is linked to this timer. When the timer starts, the telemetry data start being recorded on the SD card, and recording stops when the timer stops.

Complaints can only be considered if there is a log file (see page 7). For your own benefit, it is recommendable to save telemetry data on the SD card inserted in the transmitter's card slot while using "Timer1".

Please note, for technical reasons there is no data recording during playing mp3 files.



Note:



*Press the **NEXT** button at the top right edge of the display to switch the rotation procedure from "TIMER1" to "TIMER2", and from "DATE" back to "TIMER1":*

TIMER1 and TIMER2

To program one of the two timers, it is preferable to start in the "MODE" line by checking the value field directly to the right. By default, **UP** is provided as a synonym for counting forward (see the figure above).

If this is what you want and you do not need an alarm for a forward-counting timer, then jump to the following section and start reading at "START SW" on the next page.

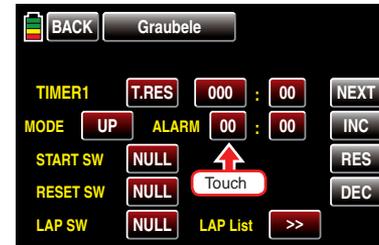
Alarm function

An alarm function can be activated for a forward-counting and backward-counting timer by setting the desired time frame in the minute and/or second field to the right next to "ALARM". Within the last 20 seconds of this period, beeps sound so that you do not have to continuously monitor that display during the flight.

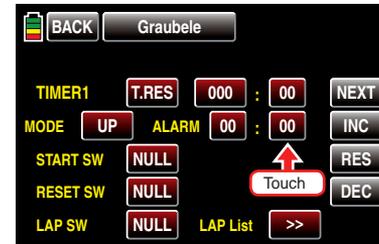
Acoustic signal sequence

- 20s before for zero: 2 beeps
Single beep every 2 seconds
- 10s before zero: single beep
Single beep every second with a changed pitch
- 5s before zero: single beep every second with reduced frequency
- Zero: voice trigger

To specify the desired time period, and touch the left minute field ...



... and/or the right second field with a finger or the provided stylus:



The color of the field switches from red to blue:



Repeatedly touched the **INC** or **DEC** button on the right edge of the display, or hold down the relevant button until your desired time is displayed between 00:00 and a maximum of 59:59, for example:



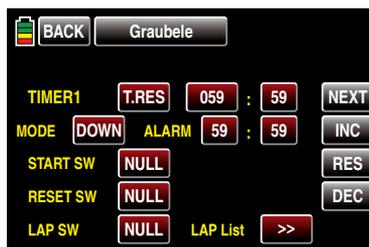
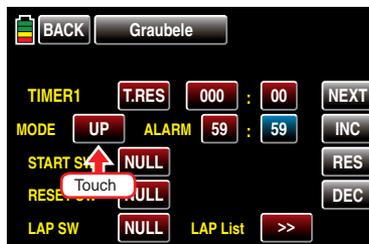
Touch the **RES** button to reset a changed value in the active field to the default.

Forward-counting timer (UP)

Since a forward-counting timer starts at 000:00, such a timer is only assigned a start switch and timer reset switch if desired as described below.

Backward-counting timer (DOWN)

To transfer the time period selected as described above to the minutes:seconds fields of the respective "Timer" line, and to switch "Timer X" from counting forward to counting backward, touch the **UP** button to the right of "MODE":



Note:

- 

Alternately, a timer can be switched beforehand from forward counting to backward counting, and a timeframe entered or changed afterward can be transferred by touching the **RES** button.
- If a started and then stopped timer is switched from forward to backward counting or vice versa by touching a relevant button, only the remaining time on the relevant timer is updated, and the time is not reset.

Resetting started timers

To reset a started timer, use a finger or the provided stylus to touch the **RES** button, or press the switch which is assigned as described below in the "RESET SW".

"START SW" line (start switch)

In this line, assign a switch to the timer, as described in detail in the section "Control, switch and control switch

assignment" starting on page 38, to start the selected timer.

"RESET SW" line (reset switch)

In this line, assign a switch to the timer, as described in detail in the section "Control, switch and control switch assignment" starting on page 38, to reset the selected timer to the initial value.

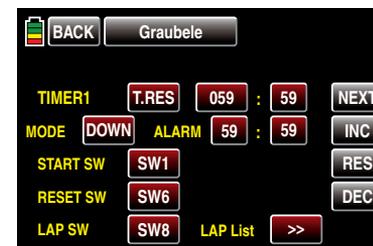
Note:



A time period that has been changed is automatically transferred to the "TIMER" line when this switch is activated. You can alternately touch the **RES** button.

"LAP SW" line (lap switch)

In the "Lap switch/lap list" line, you can only set one switch as described in detail in the section "Control, switch and control switch assignment" starting on page 38. It is preferable to use one of the two intermittent switches S2 or S8 which adds a lap to the number of laps and the time is (automatically) stopped (and saved) that has expired during this lap. At the same time, the intermittent switch starts the timer for the next round such as:



Option field **>>**

Touch this button to switch to the list of lap times, i.e., the first 20 of a total of 100 possible lap times. Scroll between individual pages using the forward button **NEXT** and the back button **PREV**:



Touch the **CLR** button to clear the lap times:



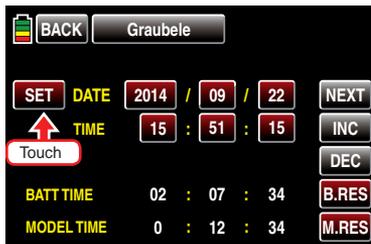
Touch the **BACK** button at the top left to go back to the timer setting display:



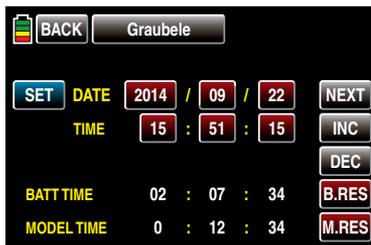
In this display, you can make any required settings for "TIMER2" analogous to "TIMER1". In contrast to "TIMER1", the time is not recorded on the memory card with "TIMER2".

Date and time

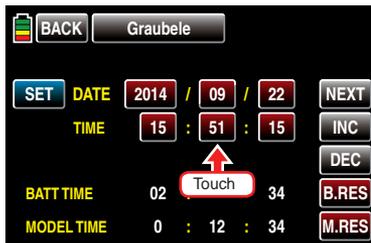
On the third display page of the "Timer" menu, you can enter or change the date and time. You can only set or change the date and/or time after this option has been released by touching the **SET** button with a finger or the provided stylus.



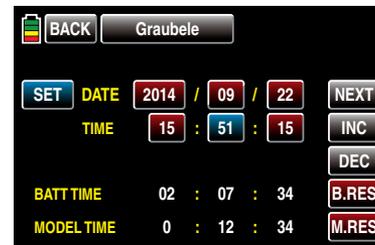
The color of the **SET** field switches from red to blue:



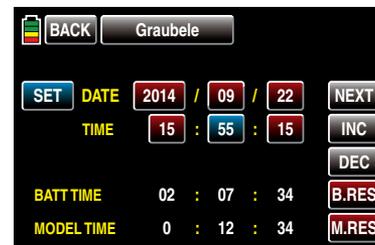
Then, with a finger or the provided stylus, touch the value field to be set or changed, for example:



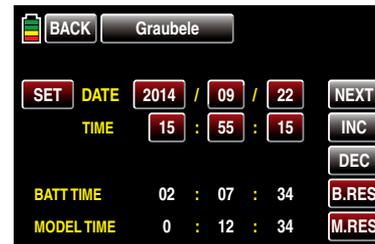
The color of this field also switches to blue:



Set the desired value with the **INC** or **DEC** button at the right edge of the display, for example:



Use the same procedure with the other values. Finally, to transfer your changes to the transmitter memory, touch **SET** again:



All value fields are red, and the current date and time have been transferred to the memory.

Note:



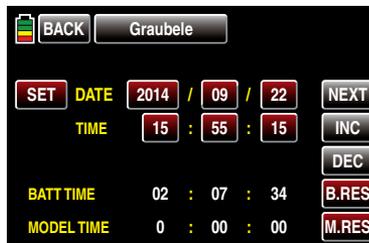
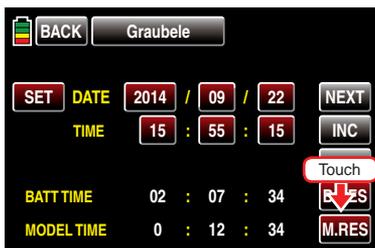
As of firmware version V 1.023, the date and time can also be updated with the aid of "Firmware_Upgrade_grStudio V4.x".

"BATT TIME" and "MODEL TIME" lines

To monitor the transmitter battery, use the operating time meter to record the overall total operating time of the transmitter from the last recognized increase in transmitter supply voltage. A switch cannot be assigned. The timer is automatically reset to "0.00h" when the voltage of the transmitter battery is noticeably higher than before after restarting the transmitter, for example from charging or exchanging the battery with a charged battery.

The model time timer in contrast shows the currently recorded overall access time to the active model memory.

Both timers cannot be switched, but they can be manually reset to zero if desired by touching the **RES** button:



After you have finished making your settings, touch the **BACK** button at the top left of the display to leave the "Timer" menu and return to the base menu.

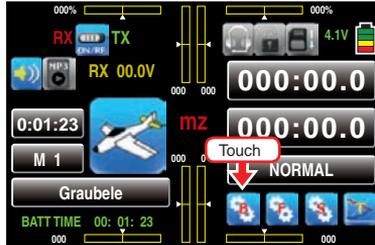




Fail Safe

What to do in case of a malfunction

In the basic transmitter display, use a finger or the provided stylus to touch the gear icon labelled "B":



The display switches to the green base menu. Use a finger or the provided stylus to touch the "Fail Safe" menu item:

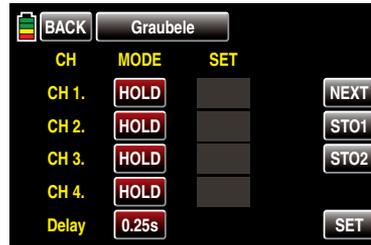


Fail Safe

In comparison to classic PPM technology, the system-related greater reliability of the HoTT system is because the microprocessor in the HoTT receiver can process both undistorted signals from its transmitter as well as distorted control signals. Only when the signals are excessively distorted or garbled, for example from noise, the processor replaces them with control signals that are saved in the receiver depending on the settings described below. This allows intermittent disturbances such as drops in field strength, etc. to be overlooked which would otherwise lead to familiar "wobbles". When this occurs, the red LED on the receiver shines during the interference.



When a receiver is delivered, all outputs are set to "hold" by default. This default can be individually changed for all receiver outputs with the assistance of the menu discussed here as well as the "Telemetry" menu, page 118.



Note:



In order to set control channels with numbers higher than CH4, touch **NEXT** [next page].

Programming

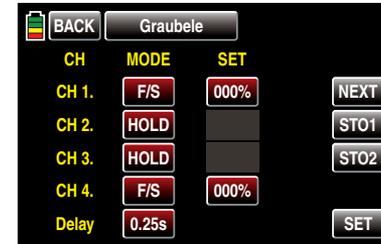
The "Fail Safe" function determines the response of the receiver when there is an interruption in transmission from the transmitter to receiver. Receiver outputs 1 ... 9 of the **mz-18** HoTT transmitter and 1 ... 12 of the **mz-24** HoTT transmitter can optionally retain their momentary position...

1. ... ("HOLD").

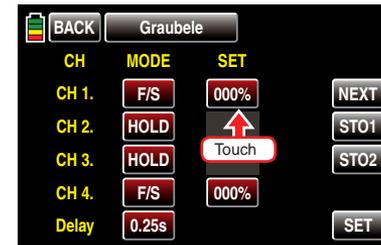
In case of transmission interruptions, all servos programmed to "hold" remain at their position which was last identified as correct until a new, correct control signal is received by the receiver.

2. ... move to a freely selectable position ("F/S") after a delay when there is an interruption in the transmission.

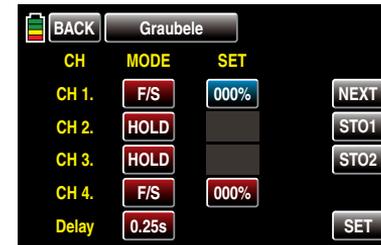
To switch between "HOLD" and "F/S", touch the button in the "Mode" column in the line of the channel to be switched to with a finger or the provided stylus, for example:



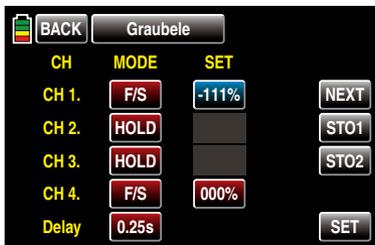
After switching to "F/S", in the "SET" column touch, with a finger or the provided stylus, one of the value fields that appears upon switching to "F/S" such as the value field that appears in the "CH1" line:



The color of the field switches from red to blue:

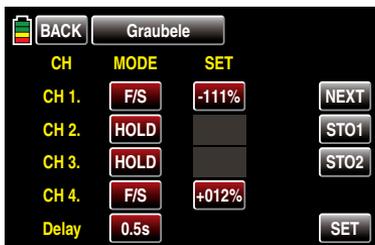


Move the control element for this control channel into the desired position and, with a finger or the provided stylus, touch the **SET** button at the bottom right of the display to transfer the position into the value field, for example:



Use same procedure to save additional fail safe positions.

Finally, in the bottom line "Delay", repeatedly touch the value field to choose the desired delay from among the four delays (0.25 s, 0.5 s, 0.75 s and 1 s), for example:



Once all the fail safe positions and appropriate delays are specified, transmit these values to the desired receiver.

Transmitting the selected fail safe positions to the receiver

Now at the latest, switch on your receiver so that you can transfer the selected fail safe positions to the receiver by touching the **STO1** button with a finger or the provided stylus, for example:



Transmitting the selected delays to the receiver

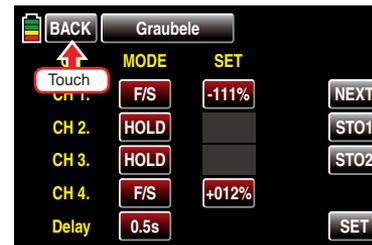
The delays selected as described are transferred to the operable receiver(s) by touching the **STO2** button, for example:



NOTE:

- Note that the chosen fail safe settings are saved in the receiver. The fail safe settings should be restored after changing a receiver and should be deleted in the previous receiver by resetting, for example, as described on page 33.
- Use this safety option to program a fail safe for at least the motor throttle position in gas models while idling, or to program the motor function to stop with electric models, or to hold with helicopter models. This makes it more difficult for the model to operate independently in case of malfunctions and cause property damage and injury. If necessary, ask for assistance from an experienced pilot.

Touch the **BACK** button at the top left of the display to leave this menu and return to the base menu.

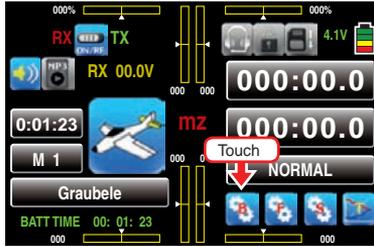




Trim settings

Trim settings

In the basic transmitter display, use a finger or the provided stylus to touch the gear icon labelled "B":



The display switches to the green base menu. Use a finger or the provided stylus to touch the "Trim Step" menu item:



The two control sticks come with digital trimming. With each click, briefly touching the trimming lever, moves the initial position of the control stick by a certain value. If it is held, the trimming moves in the corresponding direction with increasing speed.

The current trim positions are displayed in the main display, and adjustments are audible. It is therefore easy to find the middle position during flight without looking at the display: When you pass over the middle position, a brief pause is inserted.

The current trim values are automatically saved when the model memory is switched.

In addition, the digital trim of a newly delivered **mz-18** HoTT transmitter and **mz-24** HoTT transmitter always has a global effect within a model memory (with the

exception of trim the throttle/brake control stick, also generally termed control function "THR" (channel 1)). **T:CO** (common) or **T:SE** (single) is specified at the top right of the submenu "Channel set", page 92, of the base menu. CH1 trim is generally set to "common", i.e., independent of the Quick Link, in the software program:



Note:

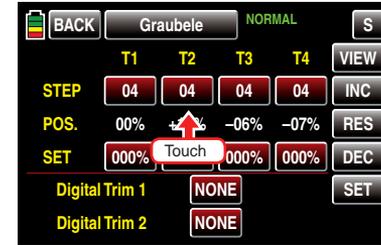


In contrast to the display of the 12-channel mz-24 HoTT transmitter shown in this section, only channels 1 ... 9 are shown in the display of the 9-channel mz-18 HoTT transmitter.

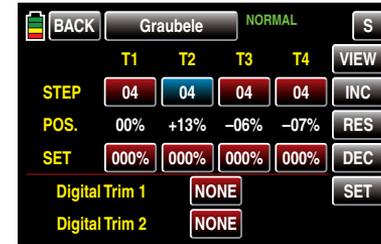
"STEP" line (trim step)

With each click, the four digital trim levers shift the neutral position of the respective control stick by an increment adjustable between "01" and a max. of "10" in each direction. The maximum trim path is always approximately $\pm 30\%$ of the control path independent of the selected number of trim steps. This setting is *always* global independent of the setting **T:CO** (common) or **T:SE** (single).

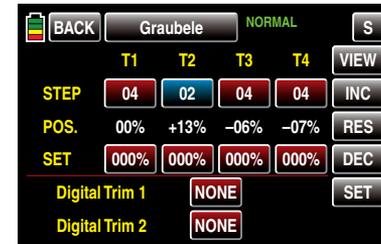
To change the current step of a trim control, use a finger or the provided stylus to touch the corresponding value field in the "STEP" line, for example:



The color of the field switches from red to blue:



Set the desired value with the **INC** or **DEC** button at the right edge, for example:



Touch the **RES** button to reset a changed value in the blue (and hence active) field to the default.

Use the same procedure with the other trim controls.

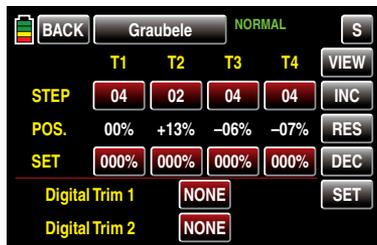
Note:



The numbering of the trim controls T1 ... T4 refers exclusively to the assignment of control channels 1 ... 4. Whether a specific name relates to a trim control of the left and right control stick depends on the selected stick mode, see page 200.

"POS." line (trim position)

The current trim positions are shown in the "POS" column. (The trim range is about $\pm 30\%$ of the entire control path.) These current trim positions can appear as follows for example:



"SET" line (saving trim positions)

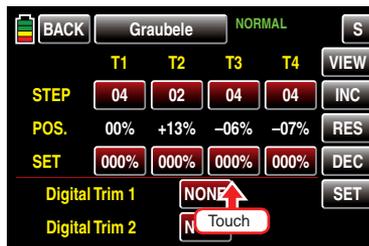
This option allows you to optionally save the current position of the four digital trims so that they can be returned to the visual middle position. After a model memory is changed or after long periods between flights, the last safe trim positions are available in the middle positions of the respective trim display of the control functions 1 ... 4.

As an example, you have landed your model and trimmed it. The current trim positions displayed white in the "POS." line approximately in the middle of the display. (The trim range is approximately $\pm 30\%$ of the overall control path.) The value fields in the "SET" line underneath the display the saved trim and, since no values have yet been saved, the value fields all contain 000%. The display therefore appears e.g. as above in the section "POS." line.

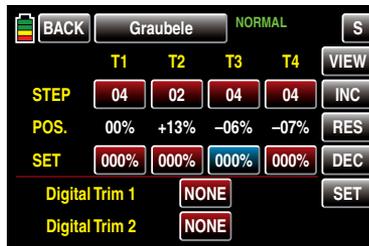
The trim values are saved taking into account your

"common" or "single" setting in the header of the submenu "Channel set" of the base menu, page 92, once you have defined the Quick Links in the "Q.Link" submenu, page 132 and 168. The active Quick Link is shown green at the top edge of the display.

To save a trim value, use a finger or the provided stylus to touch the value field below the trim value to be transferred, such as the value field in column "T3" (elevator):

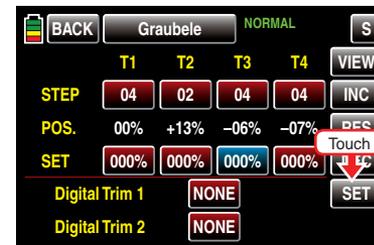


The color of the field switches from red to blue:

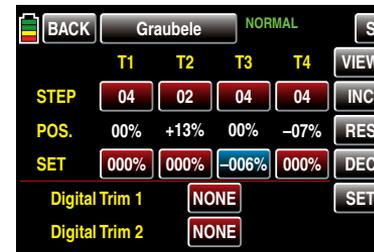


Touch the **SET** button at the bottom right of the display

...



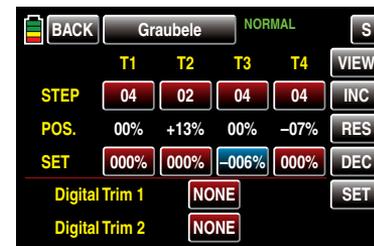
... to transfer the trim value from the "POS." line into the trim memory:



Use the same procedure for other trim values.

Deleting saved trim positions

With a finger or the provided stylus, touch the value field with the trim value you want to delete, for example:

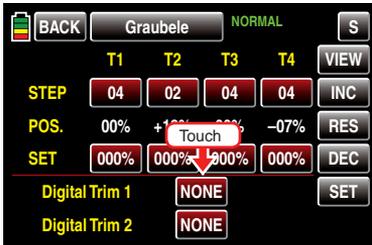


Touch the **RES** button to reset a changed value in the blue (and hence active) field to the default.

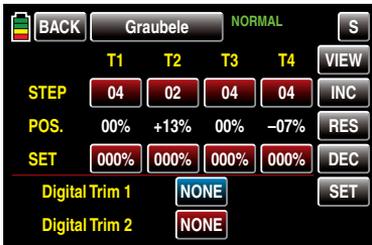
Use the same procedure with the other trim controls.

Digital Trim 1 or 2

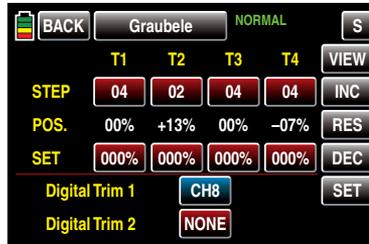
Independent from the above, you can assign the INC/DEC buttons "DT1" and "DT2" only installed in the **mz-24** HoTT transmitter in the lines "Digital Trim 1" and "Digital Trim 2" to any desired control channel, see "Definition of terms" on page 37, as the control. Touch the button in the line of the desired control, such as "Digital Trim 1":



The color of the button switches from red to blue:



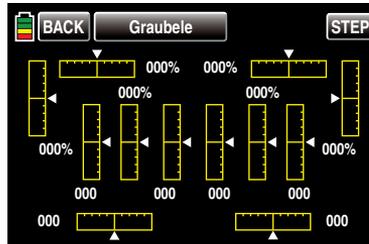
Set the desired channel "CH5 ... CH9" or "CH5 ... CH12" with the **INC** or **DEC** button at the right edge, for example:



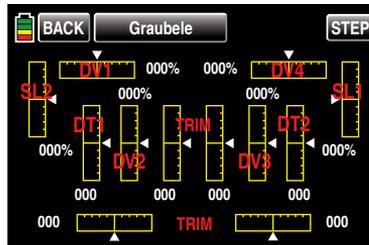
Touch the **RES** button to reset a changed value in the blue (and hence active) field to the default **NONE**.

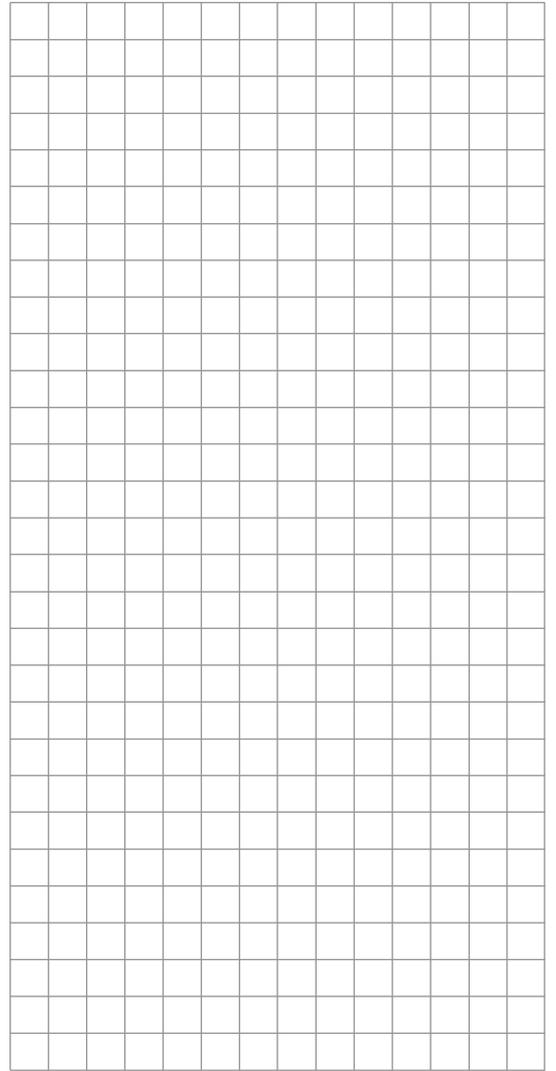
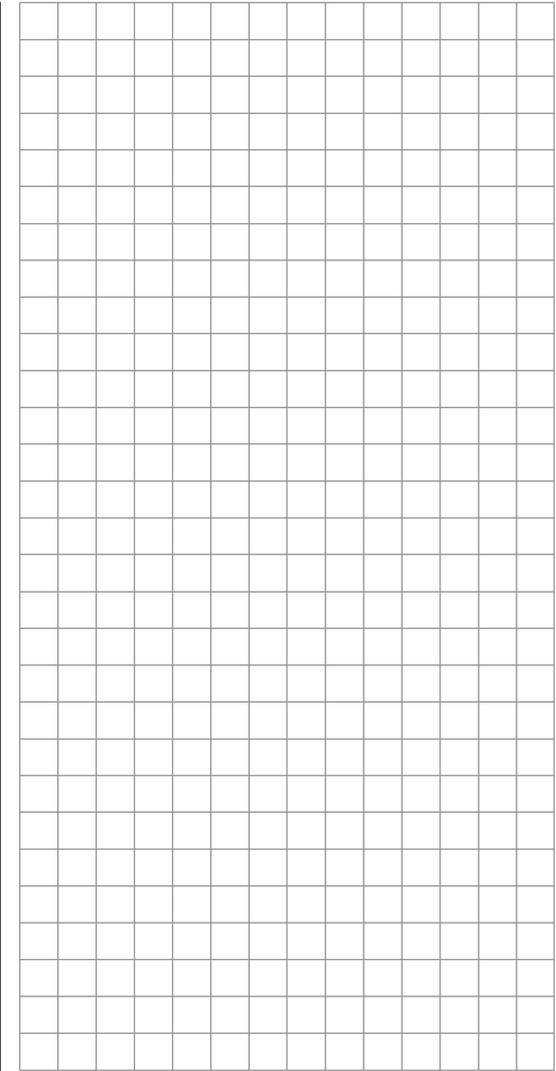
Use the same procedure for "Digital Trim 2".

To display your settings, touched the **VIEW** button at the top right of the display to graphically display the positions of all trim controls ...



... and the graphic display is assigned to the individual trim controllers according to the following scheme:



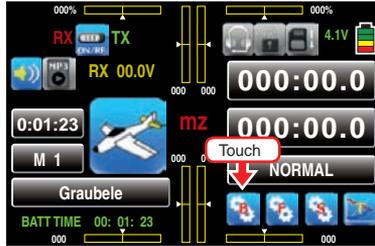




Servo

Display of servo positions and servo test function

In the basic transmitter display, use a finger or the provided stylus to touch the gear icon labelled "B":



The display switches to the green base menu. Use a finger or the provided stylus to touch the "SERVO" menu item:



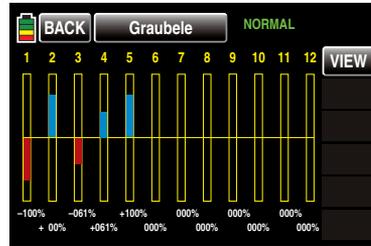
You can retrieve the visual display of the current servo positions by selecting this menu item, and you can also retrieve it from nearly every menu by touching the option button labelled **SERVO** or sometime only **S** in the top right of the display with a finger or the provided stylus. Touch the **BACK** button to return to your starting point.

Firmware version V 1.023 or higher

Changing to the servo display can now also be initiated in both the basic display and all menus where the option button **SERVO** or **S** appears at the upper right by simultaneously pressing the buttons ◀ ▶ to the left of the display.

Servo monitor

The current setting of each servo is displayed precisely between -150% and +150% of the normal path taking into account the control and servo settings, dual rate/expo functions, the interaction between the linear and curve mixes, etc. 0% equals the middle position of the servo. You can therefore quickly check your settings without having to switch on the receiver. This does not relieve you of the responsibility, however, of carefully testing all the program steps on the model before first use to make sure there are no errors.



For normal fixed wing models, the display follows the assignment below:

Bar 1	Throttle/brake servo
Bar 2	Aileron or left aileron
Bar 3	Elevator
Bar 4	Rudder
Bar 5	Right aileron
Bar 6	Flap (left) / free channel
Bar 7	Flap (right) / free channel
Bar 8	Free channel / second elevator servo
Bar 9	Free channel / flap2 left
Bar 10	Free channel / flap2 right
Bar 11	Free channel / aile2 left
Bar 12	Free channel / aile2 right

... and with helicopter models:

Bar 1	Pitch or roll (2) or elev (2) servo
Bar 2	Roll (1) servo
Bar 3	elev (1) servo
Bar 4	Rudder servo (gyro)
Bar 5	elev (2) servo / free servo
Bar 6	Throttle servo or governor
Bar 7	Gyro sensitivity / free channel
Bar 8	Speed controller / free channel
Bar 9	Free channel
Bar 10	Free channel
Bar 11	Free channel
Bar 12	Free channel

Note:

- 

Note that the servo display refers exclusively to the original sequence of the servos, that is, it does not refer to any changes to the outputs made in the "Output swap" menu, page 96, or in the "Receiver output" submenu of the "Transmitter setting" menu, page 75.
- The number of channels shown in this menu corresponds to the maximum available control channels in the respective transmitter (see the dividing line between "bar 9" and "bar 10" in the above table). The number of usable channels depends on the type of receiver as well as the number of connected servos and may therefore be significantly less.
- Use this display while programming the model since you can immediately check all your settings on the transmitter. This does not relieve you of the responsibility, however, of carefully testing all the program steps on the model before first use to make sure there are no errors.

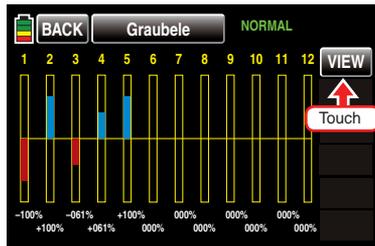
Servo test

Note:

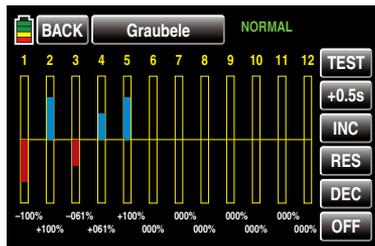


Only start a servo test in a model memory created for this purpose without any mixer. Otherwise, unforeseeable servo deflections will occur.

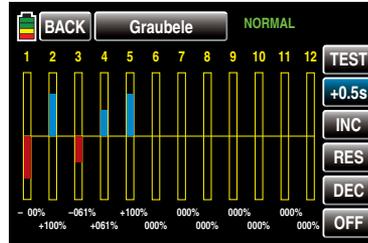
To activate the servo test function, use a finger or the provided stylus to touch the **VIEW** field at the top right:



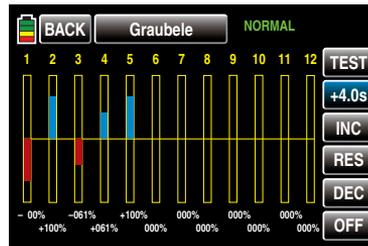
Additional buttons appear at the right edge of the display:



To change the default cycle time of 0.5 seconds, touch the corresponding value field. The color of the field switches from grey to blue:

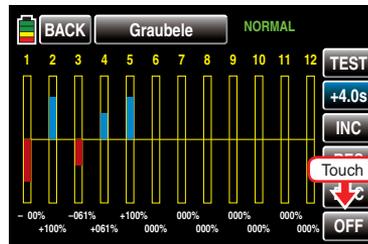


In the blue value field, the time for a movement cycle can be changed at 0.5 s steps between 0.5 and a maximum of 5.0 seconds with the **INC** or **DEC** button at the right edge:

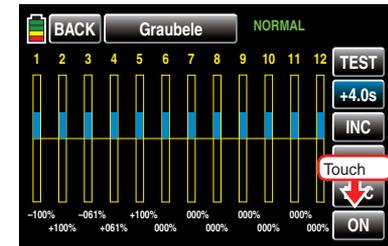


Touch the **RES** button to reset a changed value in the active field to the default of 0.5 seconds.

Start the servo test by touching the **OFF** button at the bottom right:



The "Servo test" function automatically controls the servos operating under the assumption that the associated controls (starting from the neutral position) will be simultaneously and continuously moved back and forth between -100% and +100% during the set period. All of the servos that are active in the model memory move within the set servo paths and servo path limits until the servo test is stopped by touching the **ON** button at the bottom right:



Touch the **BACK** button at the top left of the display to leave this menu and return to the base menu.

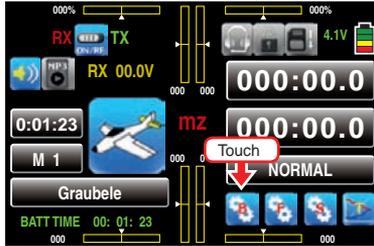




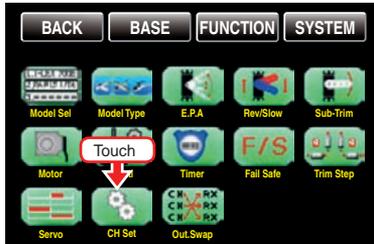
Channel Set

Control and switch assignment

In the basic transmitter display, use a finger or the provided stylus to touch the gear icon labelled "B":



The display switches to the green base menu. Use a finger or the provided stylus to touch the "CH Set" menu item:



Beyond the equivalent design of the **mz-18** HoTT transmitter and **mz-24** HoTT transmitter with two control sticks for control functions 1 to 4 and their trim levers, these two transmitters come standard with a different number of additional control elements.

• mz-18 HoTT

- 1 two-position switch with long handle (S6)
- 1 three-position switch with long handle (S3)
- 4 three-position switches with a short handle (S1, S4, S5 and S7)
- 2 one-side, self-neutralizing three-position switches with long handle (S2 and S8)
- 2 rear proportional sliders (SL1 and SL2)
- 2 proportional dials (DV1 ... DV2)

• mz-24 HoTT

- 1 two-position switch with long handle (S6)
- 1 three-position switch with long handle (S3)
- 4 three-position switches with a short handle (S1, S4, S5 and S7)
- 2 one-side, self-neutralizing three-position switches with long handle (S2 and S8)
- 2 INC/DEC buttons (DT1 and DT2)
- 2 rear proportional sliders (SL1 and SL2)
- 4 proportional dials (DV1 ... DV4)

In contrast to the two control sticks that immediately act on the servos connected to receiver outputs 1 ... 4 with a newly initialized model memory for a fixed wing model, the aforementioned control elements are initially inactive.

Consequently, only the servos controlled by the two control sticks can be moved when these systems are initially delivered and a new model memory for a flying model is initialized and bound to the receiver to be installed. In contrast, the servos connected to different slots remain in their middle position.

Even though this may initially appear to be inconvenient, it is the only way to freely select from the other control elements of your transmitter and avoid the deactivation of unnecessary control elements.



Even if misused, an unnecessary control element will not influence the model if it remains inactive, that is, when it has not been assigned a function.

As needed, you can therefore assign all of the aforementioned control elements within the "Channel set" menu addressed here to any function input without restriction, page 37. This also means that each of these control elements can also be simultaneously assigned several functions as needed. For example, the same toggle switch that is assigned to an input in this menu can also be assigned as a timer on/off switch in the "Timer" menu, etc.

Note:



- *In contrast to setting servo travel, setting the control travel affects all outgoing mixing and coupling functions and hence all servos that are activated by the relevant control element.*
- *In contrast to the displays of the 12-channel **mz-24** HoTT transmitter shown in this section, only channels 1 ... 9 are shown in the display of the 9-channel **mz-18** HoTT transmitter.*

T:CO / T:SE option button (common/single)

Touch this button on the right at the top edge of the display ...



... to switch to the trim of control functions 2 ... 4 from cross-phase ("T(rim):CO(mmon)") to quick-link-specific ("T(rim):S(ingl)E") and vice versa. More information on this can be found in the section "Trim step" a few pages previous.

Control assignment

With a finger or the provided stylus, touch the value field in the line of the desired control channel, for example:



The "SELECT" display appears:



Touch **NO** to terminate the process. To assign the desired control or switch, activate it. Remember that the proportional dials and rotary controls are only recognized after a pause and therefore need to be activated for slightly longer. If the travel is no longer sufficient, activate the control in the opposite direction if necessary. With an assigned 2-position switch, you can only switch back-and-forth between the end values such as motor ON and OFF. The 3-position switch offers a middle position.

The display shows either the control name or the switch number, such as:



Deleting controls or switches

Touch the value field of the assignment to be deleted with a finger or the provided stylus, for example:



The "SELECT" display reappears:



To delete the assigned control or switch, touch **CLR**:



Important instructions:

- 

The controllers assigned in this menu globally affect all Quick Links. Only the offset to be adjusted in the "D/R,EXP" submenu of the function menu and the "travel adjustment" also made in the "D/R,EXP" submenu, see page 136 and 171, affect specific phases.
- 

If, with a model that has flaps, you assign to input 6 a control or switch identified as "FLAP1", its function is dependent on the current setting in the line "ACT" of the submenu "Flap Sett" of the function menu, page 156. If the value field to the right of "ACT" is **INH** or **OFF**, then this control or switch acts exclusively on servo 6 and possibly 7 with the values set in the submenu "D/R,EXP". Otherwise, this control or switch assumes the function of Q.Link trim with the value set in the submenu "Flap Sett".



Gas limit function

With helicopter models, input 9 is assigned to proportional dial DV1 with the **mz-18** HoTT transmitter, and input 12 is assigned to the proportional dial DV1 with the **mz-24** HoTT transmitter:



Note:



In contrast to the display of the 12-channel **mz-24** HoTT transmitter shown below, only channels 1 ... 9 are shown in the display of the 9-channel **mz-18** HoTT transmitter.

With this default setting, it is unnecessary to program two Quick Links (THR.HOLD and no THR.HOLD) that is frequently the usual approach with other remote control systems. As opposed to THR.HOLD, increasing the system speed below hovering is much more flexible and can be adjusted and more precisely with the options offered by the they **mz-18** HoTT **mz-24** HoTT transmitters. If you would still like to program your helicopter with THR.HOLD, then turn off the gas limit function described below by switching input 9 or 12 to **NONE**.

Meaning and use of gas limit

In contrast to fixed-wing models, the performance of the power unit for helicopters cannot be directly controlled with the CH1 control stick; it can only be indirectly controlled by the gas curve settings made in certain helicopter menus of the function menu, or by a *governor* if the model has one.

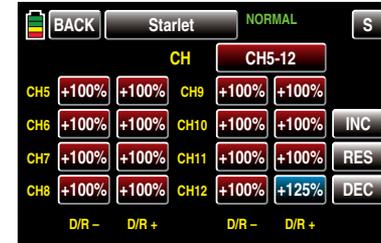
Note:



For different Quick Links, you can of course also adjust individual gas curves when programming the Quick Links.

Both methods of controlling the output prevent carburettor motors of a helicopter from approaching to idling during normal flight which allows them to be reliably started and stopped without additional intervention. The gas limit function elegantly solves this problem by *limiting* the position of the throttle servo or the performance of a motor control unit: The proportional dial DV1 that is at the top left on the **mz-18** HoTT transmitter and the front left of the **mz-24** HoTT transmitter. This makes it possible to optionally turn down the gas to idle with the gas limit control, upon which the trim control of the throttle/pitch control stick assumes control, or to directly turn off an electric drive. Conversely, the throttle servo or motor control unit can only reach its full throttle position when the gas limit control also releases the entire travel.

The set value on the (right) plus side of the "Travel" column in the display "CH5-9" or "CHK5-12" of the submenu "D/R,EXP" of the function menu, page 173, therefore has to be large enough so that, when the gas limit control is at its maximum position, the full throttle setting achievable by the gas curve settings is not limited. Normally, a value between +100% and +125% is set.



The value on the (left) minus side of the "Travel" column should be set to allow an electric drive to be reliably switched off with the gas limit control, or to allow a carburettor to be closed enough so that the gas engine can also be switched off in conjunction with digital CH1 trim. This value should therefore (at least initially) be left at +100%.

This variable limitation of the throttle travel allows the drive to be comfortably started and stopped, and generally this approach is significantly safer. Imagine what could happen if for example you carried a helicopter to the takeoff site while the motor is running and accidentally a activated the CH1 control stick.

If the carburettor or motor control unit is open to much, a beep sounds when you turn on the transmitter, and the following message appears in the main display:



Tip:



View the "Servo" menu to monitor the influence of the gas limit control. Be sure to remember that servo output 6 controls the throttle servo for the **mz-18** HoTT and **mz-24** HoTT transmitters.

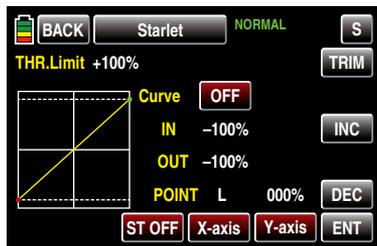
Basic idle settings

First turn the gas limiter (the proportional dial DV1 on the front left or top left of the transmitter) clockwise all the way. Move the throttle/pitch control stick to the maximum pitch position and, in the submenu ...

"THR.CRV" (starting on page 181)

... of the function menu, make sure that the standard gas curve is active.

If the standard gas curve has already been changed after a model memory has been initialized, reset it (at least temporarily) to "POINT L = 0%", "POINT 3 = +50%" and "POINT H = +100%":



Note:



Since the gas trim lever does not work when the gas limiter is open, its position is irrelevant in this case.

Without starting the gas engine, adjust the throttle servo (preferably mechanically), and if desired additionally by adjusting the travel of servo 6 in the submenu "E.P.A" of the base menu to completely open the carburettor.

Then completely close the gas limiter by turning the proportional dial DV 1 all the way counterclockwise. Use the trim lever of the throttle/pitch control stick to move the marking of the trim position into the motor OFF position.

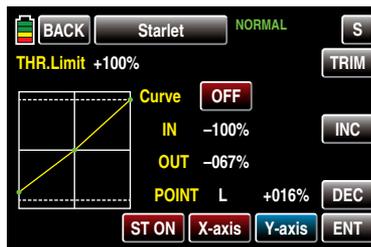
Note:



The position of the throttle/pitch control stick is irrelevant when the gas limiter is closed. It can therefore remain in the maximum pitch position as long as you can switch between full throttle (gas limiter open) and "Motor OFF" (gas limiter closed) using just the gas limiter when adjusting the carburettor linkage.

While the gas limiter is closed, adjust the carburettor linkage so that the carburettor is completely closed. Make sure that the throttle servo does not mechanically overtravel in the two extreme positions (full throttle/ motor OFF).

To conclude this basic setting, match the setting range of idle trim with point "L" of the gas curve. Adjust point "L" of the "gas curve" display to approximately +15 to +18%, for example:



To precisely adjust a seamless transition from idle trim to the gas curve, move the pitch control stick back and forth slightly at the minimum stop while the gas limiter is closed and idle trim is completely open. The throttle servo should not move. Any subsequent adaptation of the gas curve must be done later during flight.

The motor should always be started with the gas limiter completely closed. Adjusted the idle only with the trim lever of the throttle/pitch control stick, and turn off the motor with digital trim.

Note:



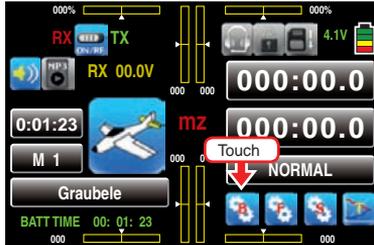
View the "Servo" menu to monitor the influence of the gas limit control. Be sure to remember that servo output 6 controls the throttle servo for the mZ-18 HoTT and mZ-24 HoTT transmitters.



Output swap

Changing the outputs in the transmitter

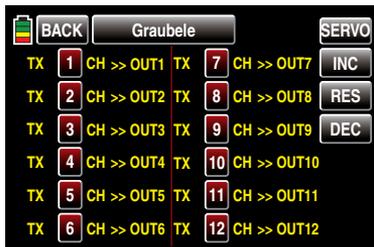
In the basic transmitter display, use a finger or the provided stylus to touch the gear icon labelled "B":



The display switches to the green base menu. Touch the menu item "Out.Swap" with a finger or the provided stylus.



To ensure maximum flexibility in regard to receiver assignment, you can switch transmitter outputs 1 to a maximum of 9 or 12 in the program of the **mz-18** HoTT and **mz-24** HoTT transmitters:



Note:



In contrast to the display of the 12-channel mz-24 HoTT transmitter shown in this section, only channels 1 ... 9 are shown in the display of the 9-channel mz-18 HoTT transmitter.

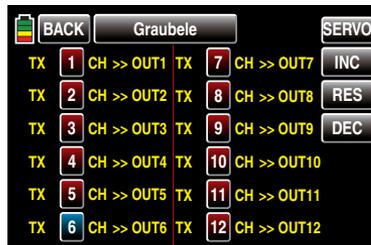
With this option, you can distribute the 9 control channels of the **mz-18** HoTT transmitter or the 12 control channels of the **mz-24** HoTT transmitter to transmitter outputs 1 ... 9 or 12 as desired. Remember that the display in the "servo", page 90, exclusively refers to the control channels that are set according to the receiver assignment, and that the outputs are not changed.

Programming

Use a finger or the provided stylus to touch the value field in the line of the channel/output combination to be changed, for example:



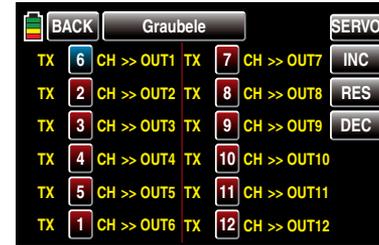
The color of the field switches from red to blue:



Set the desired value with the **INC** or **DEC** button at the right edge.

Use the same procedure for the other transmitter

outputs, for example:



Touch the **RES** button to reset a changed value in the blue (and hence active) field to the default.

Any subsequent changes to the settings such as servo travel settings, dual rate/expo, mixer, etc., **always have to correspond with the original receiver assignment.**

After you have finished making your settings, touch the **BACK** button at the top left of the display to return to the menu selection:



Example:

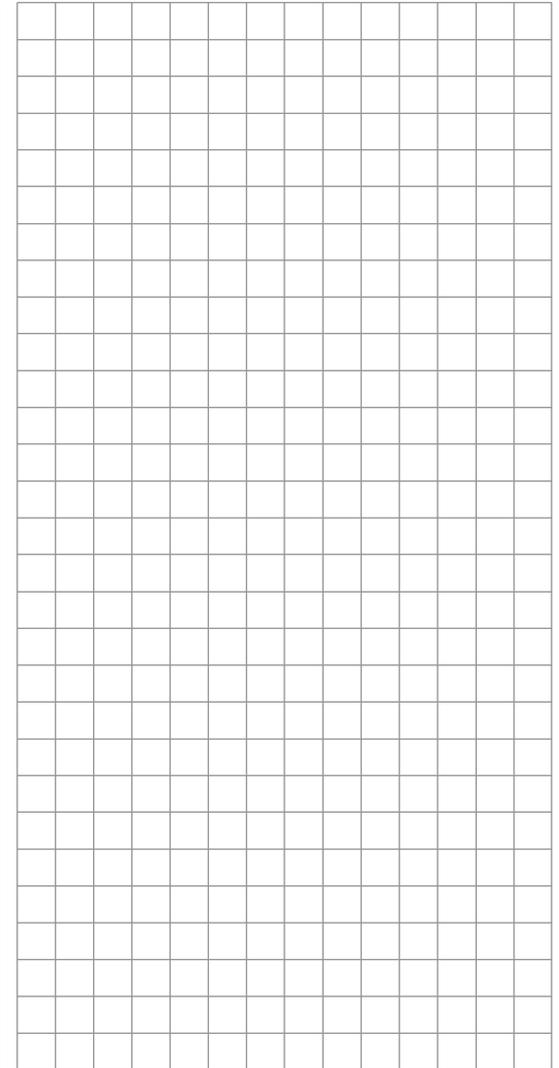


In the helicopter program for the mz-18 HoTT and mz-24 HoTT transmitters, the outputs for a pitch servo and the throttle servo have been changed in comparison to a few previous Graupner/JR transmitters. The throttle servo is assigned to transmitter output 6, and the pitch servo is assigned to output 1. You may wish to keep the previous configuration. In this case, switch channels 1 and 6 so that (as described above) (control) channel 6 is at output 1 and vice versa.

Note:



By using the receiver-side channel assignment function called *channel mapping* which is integrated in the "**Telemetry**" menu of the **mz-18** HoTT and **mz-24** HoTT transmitters, the maximum 9 or 12 control channels of these transmitters can be distributed as desired within one receiver as well as to several receivers. In addition, several receiver outputs can be assigned the same control function, for example to control each aileron with two servos instead of just one, etc. For the sake of clarity, it is strongly recommended that only one of the two options be used.

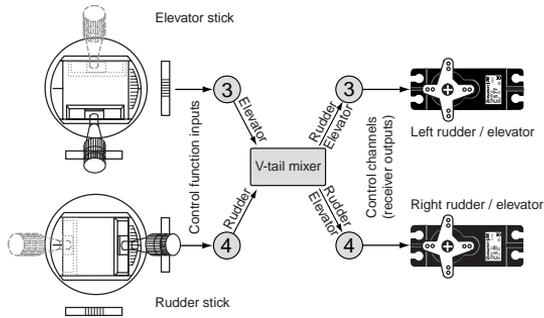


What is a mixer?

Basic functions

In many models, it is frequently desirable to mix functions within the model, for example to couple ailerons and rudders, or to couple two servos when you want two rudders with the same function to be controlled by a single servo. In all these cases, the signal flow at the output of the transmitter-side control function branches at a point at which the influences of all transmitter options such as **"dual rate / expo"**, **"channel set"**, **"throttle curve"**, etc. are contained within the signal so that the signal can act specifically on the input of another control channel and hence on another receiver output.

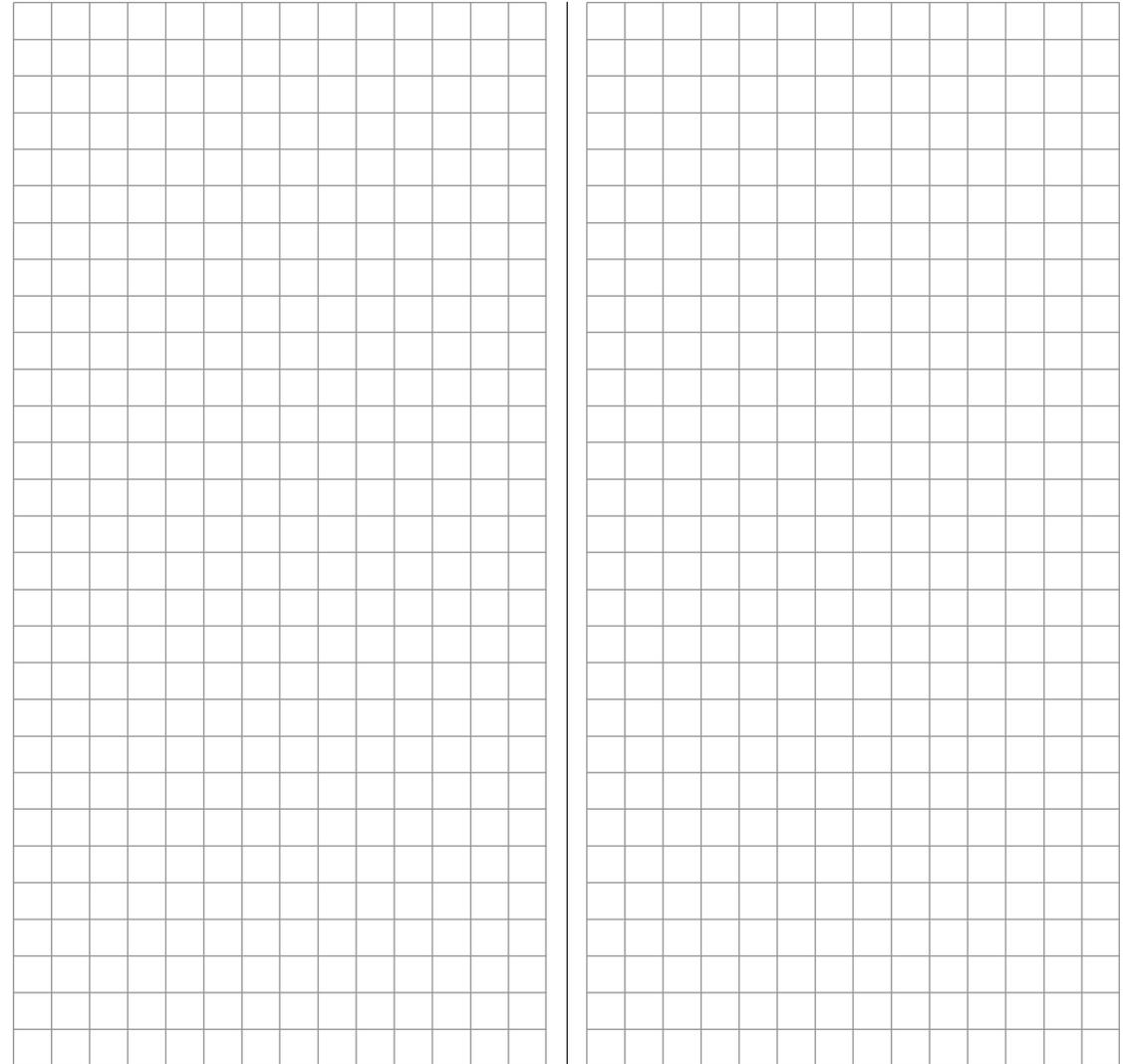
Example: V-tail mixer



The program of the **mz-18** HoTT and **mz-24** HoTT transmitters already contains numerous preprogrammed coupling functions in which two (or more) control channels are mixed with each other. The mixer cited as an example can therefore be activated in the form of a V-tail in the program while making the basic settings for a model, starting on page 45.

In addition, the program in each model memory of the fixed-wing and helicopter program has five freely programmable linear mixers and three curve mixers per activated Q.Link.

More information about this subject can be found on the relevant page on "programmable mixers".



General information about programmable mixers

This manual has described numerous preprogrammed coupling functions. The basic meaning of mixers and their functions are explained on the page to the left. The following offers information on "programmable mixers".

In addition to the aforementioned preprogrammed mixers, the **mz-18** HoTT and **mz-20** HoTT transmitters offer five freely programmable linear mixers and three curve mixers in each of the 30 model memories per programmed Quick Link in which you can define inputs and outputs as well as the degree of desired mixing.

This maximum of 48 mixers per model memory should be sufficient, and is in particular for taking advantage of the options of pre-programmed coupling functions.

The input signal for a control function (1 ... 9 and 1 ... 12) is used as the *input signal* for programmable mixers. The signal that is on the control channel and supplied to the mixer input is always influenced by its control element and its set characteristic that for example is specified by settings in the "**D/R,EXP**", "**THR.CRV**" and "**CH.Set**" menus.

The mixer output acts on a freely-selectable control channel (1 to a maximum of 12 depending on the transmitter and receiver) which, before it sends the signal to the servo, can only be influenced by the functions Reverse, Sub-Trim, Travel and E.P.A, and possibly the option "**(Transmitter) output swap**".

One *control function*, page 37, may be used simultaneously for any number of mixer inputs when for example you want mixers to be parallel-connected.

Conversely, any number of mixer outputs can affect one and the same *control channel*, page 37. Particularly in the latter case, however, you should make sure that the affected servo does not reach its mechanical limit when several mixing signals combine into one which is too large. To be safe, a corresponding travel limit should therefore be set in the "**E.P.A**" menu, page 66.

In the program, a programmable mixer is initially always **blocked (INH)** and therefore needs to be explicitly switched on while programming it. Optionally, the mixer can also be assigned an ON/OFF switch. Given the

numerous switchable functions, make sure that you do not unintentionally assign a switch two functions.

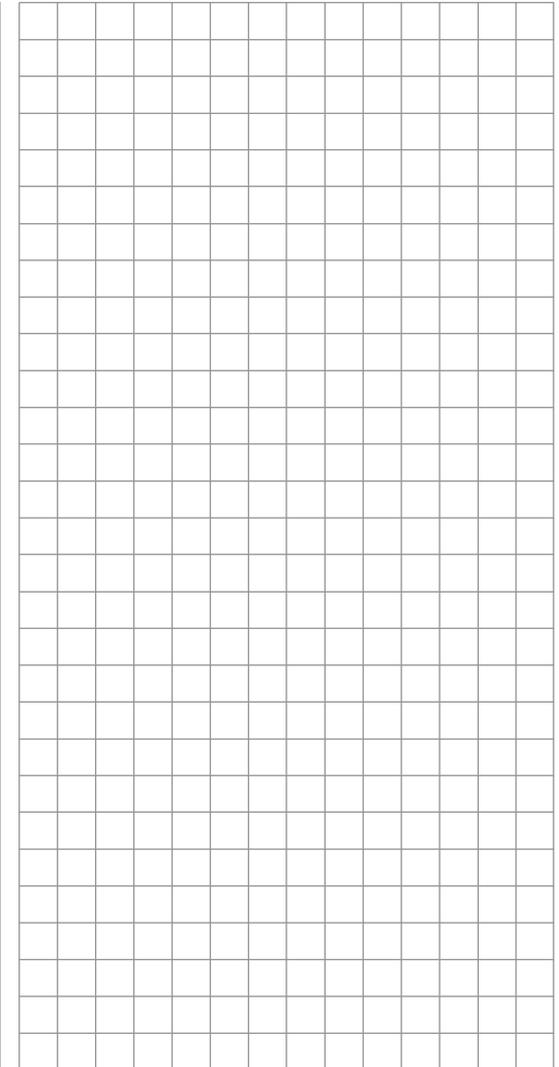
The two essential parameters of the mixers are ...

- ... **the degree of mixing** that determines the level of influence of the input signal on the control channel connected to the mixer output.

With linear mixers, the mixing level can be adjusted symmetrically or asymmetrically. With curve mixers, the mixing level can also be configured according to your own specifications by up to 7 points to produce extremely nonlinear curves.

- ... **the neutral point** of a linear mixer, also termed the offset.

The offset is the point along the travel of a control element (control stick, proportional control or switch) at which the mixer no longer influences the control channel connected to its output. Normally, this is the middle position of the control. The offset can also be located at any other position along the servo travel. Since curve mixers can be configured as desired, it is only recommendable and possible to specify a mixer neutral point for the 5 linear mixers.

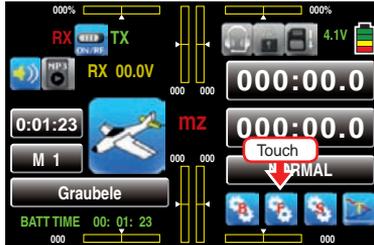




Prog.MIX

freely programmable linear and curve mixers

In the basic transmitter display, use a finger or the provided stylus to touch the gear icon labelled "F":



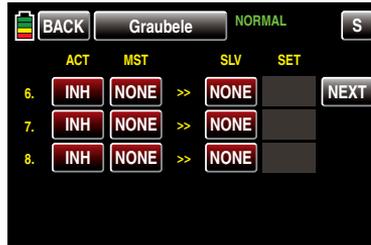
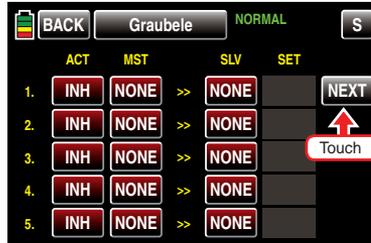
The display switches to the blue function menu. Use a finger or the provided stylus to touch the "Prog.MIX" menu item:



Independent of the selected model type, there are five linear mixers and three 7-point curve mixers in each of the 30 model memories per set-up Quick Link.

Flight-phase-dependent settings of programmable mixers

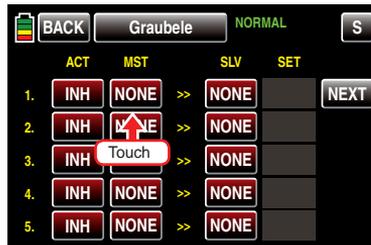
If you have created Quick Links in the submenu "Q.Link", page 132, and have assigned an appropriate name, it appears at the top right in green font such as "NORMAL". Activate the corresponding switches if desired to switch between Quick Links.



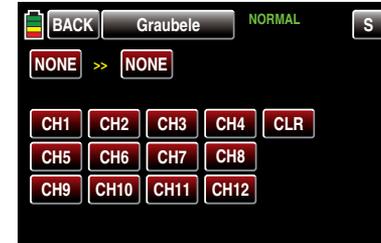
Setting up mixers

Switch to the desired Quick Link.

Use a finger or the provided stylus to touch one of the two buttons in the columns "MST" and "SLV" in the line of the mixer to be set up.

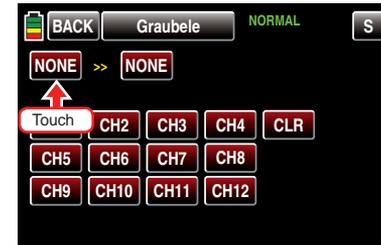


The selection page "MST >> SLV" of the selected mixer appears in the display:

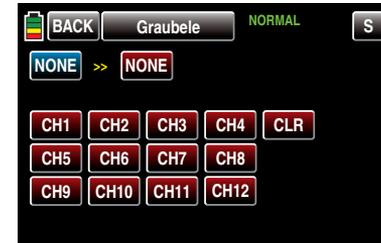


"MST"

In this display, touch the left of the two top red buttons:



The button color changes from red to blue:

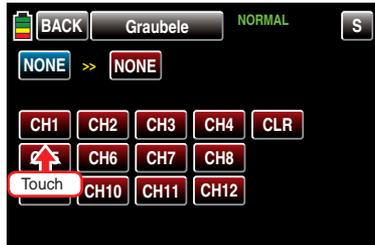


Note:

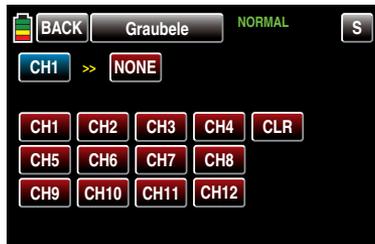


In contrast to the display of the 12-channel mZ-24 HoTT transmitter in this section, only channels 1 ... 9 are offered in the display of the 9-channel mZ-18 HoTT transmitter.

Select one of the control functions 1 ... 9 or 1 ... 12, see "Definition of terms" on page 37, with a finger or the provided stylus, for example:



Touch the desired channel to transfer it to the blue (active) value field:



Touch the **CLR** button to reset a changed value in the blue (and hence active) field to **NONE**.

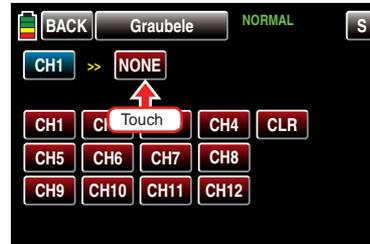
Note:



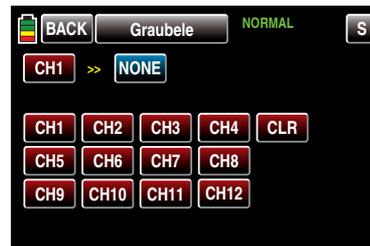
Do not forget to assign a control to any selected control functions 5 ... 12 for fixed-wing models, or 5, 7 ... 12 for helicopter models in the "Channel set" menu.

- "SLV"

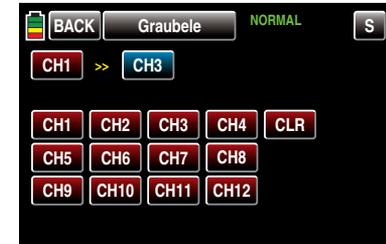
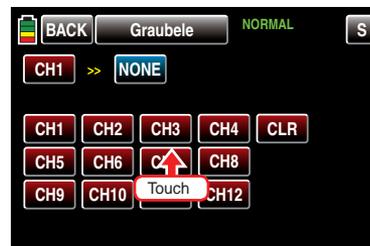
In the input field of this column, specify the target of the mixer, i.e., the mixer output on one of the control channels, by touching the right button of the two red buttons with a finger or the provided stylus:



The button color changes from red to blue:



Select one of the control channels 1 ... 9 or 1 ... 12 as the target, see "Definition of terms" on page 37, with a finger or the provided stylus, for example:

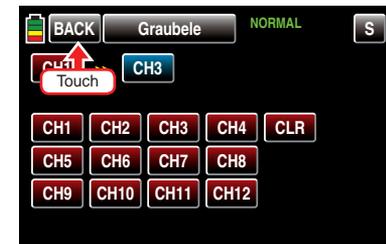


Note:

-  *The touched control function is transferred immediately to the blue field.*
- *Mixers in which the mixer input is set to be the same as the mixer output (such as CH1 >> CH1) allow you to achieve special effects in connection with the option of turning programmable mixers on and off as desired.*

Touch the **CLR** button to reset a changed value in the blue (and hence active) field to **NONE**.

Touch the **BACK** button at the top left of the display ...



... to leave the menu for "Mixer selection":



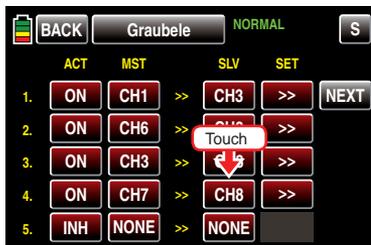
Activating and deactivating mixers

To activate or deactivate a mixer set up as described above, touch the value field of the mixer to be activated or deactivated in the "ACT" column, for example:

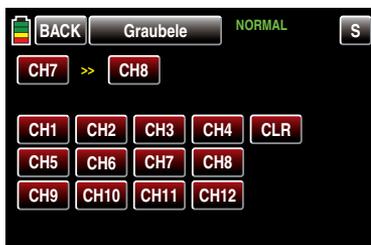


Deleting mixers

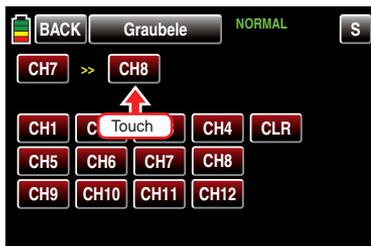
To delete a mixer which has been defined, touch the "MST" or "SLV" button of the mixer to be deleted with a finger or the provided stylus, for example:



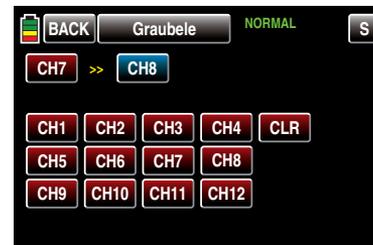
The channel selection display opens:



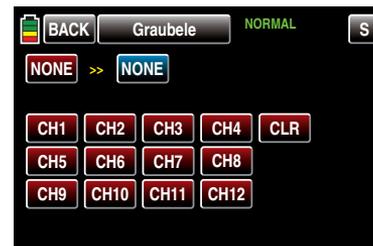
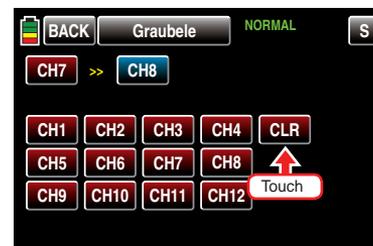
In this case as well, touch the "MST" or "SLV" button of the mixer to be deleted with a finger or the provided stylus. In this example, **CH 8** to the right of the two angle brackets:



The button color changes from red to blue:



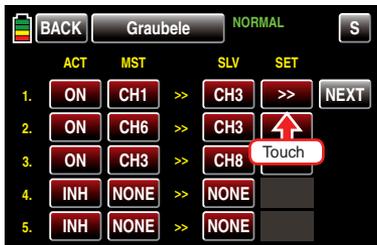
Touch the **CLR** button to reset the blue (active) and red field on the same line to **NONE**.



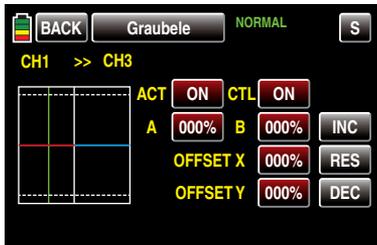
Touch the **BACK** button at the top left of the display to leave this menu and return to mixer selection.

Setting linear mixers 1 ... 5

To set one of linear mixers 1 ... 5, use a finger or the provided stylus to touch the button in the "SET" column in the line of the mixer to be set, for example,



The settings page for the selected mixer appears in the display:



The vertical green line represents the present position of the control at input 1.

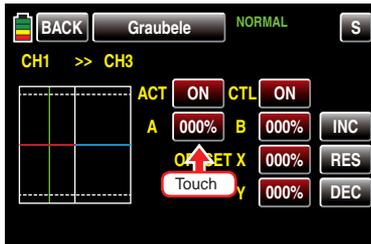
The horizontal line (left half red and right half blue) indicates the mixing level that is consistently zero at present over the entire control travel. The elevator will accordingly not respond to the actuation of the CH1 transmitter.

First, define the ...

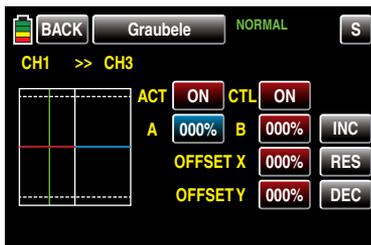
Mixing levels

... above and below the mixer neutral point proceeding from its momentary position.

To set the mixing level under the "A" with a finger or the provided stylus:



The color of the field switches from red to blue:

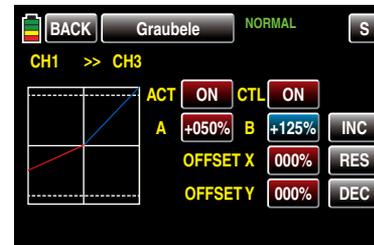


Set the desired value with the **INC** or **DEC** button at the right edge.

The adjustment range is $\pm 125\%$.

Use the same procedure for a value above the neutral point.

Symmetrical and asymmetrical values can be set, for example:



Touch the **RES** button to reset a changed value in the blue (and hence active) field to the default.

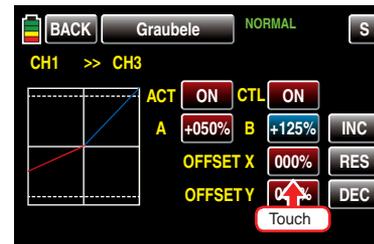
Offset (mixer neutral point)

By default, the mixer neutral point (offset) (the point along the control travel at which the mixer does not influence the control channel connected to an output) is precisely in the middle of the control range.

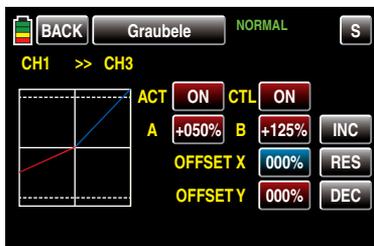
• Offset X

A value unequal to "000%" entered in the "Offset X" line causes the offset to shift *horizontally* by a maximum of $\pm 100\%$.

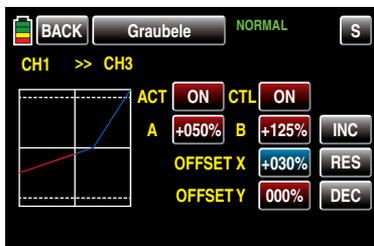
To move the offset point 30% to the right (for example), use a finger or the provided stylus to touch the value field to the right of "OFFSET X":



The color of the field switches from red to blue:



Use the **INC** button to move the offset the aforementioned 30% to the right:

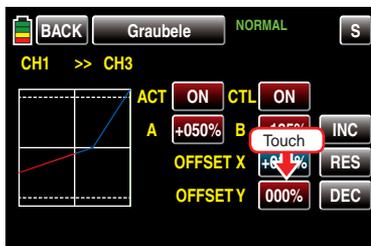


Touch the **RES** button to reset a changed value in the blue (and hence active) field to the default.

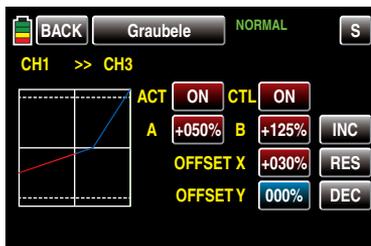
- **Offset Y**

A value unequal to "000%" entered in the "Offset Y" line in contrast causes the characteristic of the mixer to shift *vertically* by a maximum of $\pm 100\%$.

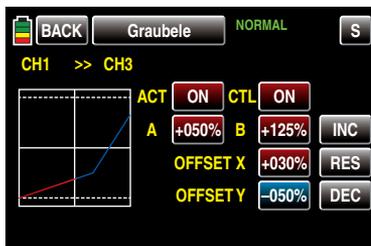
To move the characteristic curve down 50% (for example), use a finger or the provided stylus to touch the value field to the right of "OFFSET Y":



The color of the field switches from red to blue:



Use the **DEC** button to move the mixer characteristic curve downward the aforementioned 50%:



Touch the **RES** button to reset a changed value in the blue (and hence active) field to the default.

Important note:

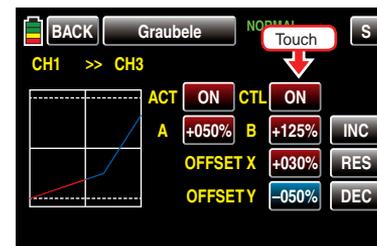


The curve shown here is only for demonstration purposes and does not represent an actual mixer curve.

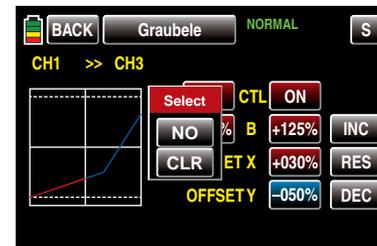
Mixer switch

Once a mixer is activated as described in the section "Activating and deactivating mixers" on page 102, the value fields to the right of "ACT" and "CTL" are also **ON**. This activates the relevant mixer and turns it permanently on in the current Quick Link.

Independent of other factors, each mixer can, however, be switched on and off by assigning it its own switch. On the right next to "CTL", touch the value field with a finger or the provided stylus ...



... and assign a switch or control switch, as described in the section "Control, switch and control switch assignment" on page 38:



After you have finished making your settings, touch the **BACK** button at the top left of the display to return to the mixer selection:

Setting curve mixers 6 ... 8

These three curve mixers make it possible to define extremely nonlinear mixer curves with up to five freely positionable points between the two endpoints "L" (low = -100% control travel) and "H" (high = +100% control travel) along the control travel.

Programming details

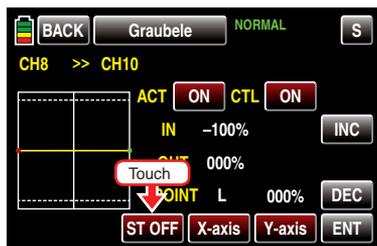
The control curve is defined by up to 7 points, so-called support points. In the default settings of the program, 2 support points are already defined, the endpoints "L" and "H".



The following examples are only for demonstration purposes and do not represent a realistic mixer curve.

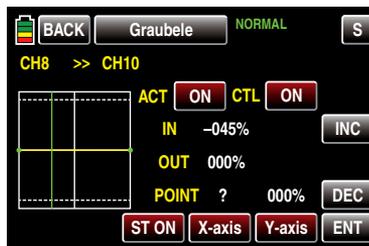
Setting support points

A green vertical line (normally hidden) is moved synchronously in the graphic between the two endpoints with the mixer input control, here the control function 8 of the side proportional rotary control SL1. To show this line, use a finger or the provided stylus to touch the **ST OFF** button at the bottom left:



After this value field is switched to **ST ON**, the green vertical line representing the momentary control position appears, and the control position is also numerically displayed in the "IN(put)"line.

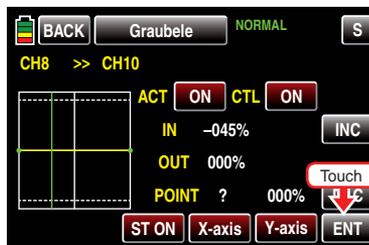
In the following example, the control at input 8 is at -45% of the control travel. The output signal remains 0% since a value has not been entered:



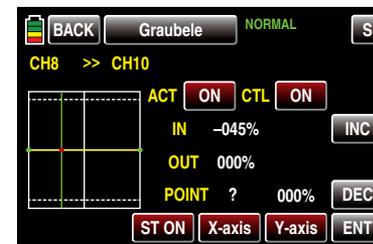
The intersection of this line with the mixer curve is identified as "OUT(put)" and can be varied at the support points within a range of $\pm 125\%$ (see below). This control signal affects the mixer output.

Between the two endpoints "L" and "H", up to five additional support points can be set, and the distance between neighbouring support points may not be less than approximately 25%.

Once you touch the **ENT** button at the right bottom with a finger or the provided stylus ...



... a red dot appears at the interface between the two lines. At the same time, the "?" is replaced with a point number, and the value field to the right shows the current output value:



As described below, the set point can be moved horizontally with the **X-axis** function within a range of approximately $\pm 90\%$, and vertically with the **Y-axis** function within a range of $\pm 125\%$.

Note:

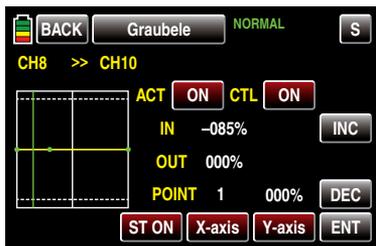
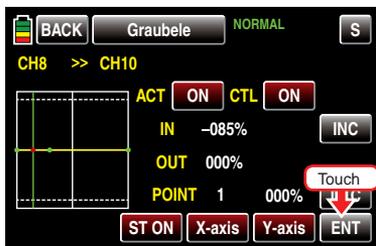


If the relevant control is not set precisely at the support point, it should be remembered that the percentages of the "input" and "output" lines always refer to the momentary control position.

Use the same procedure for the other support points. The sequence in which the up to 5 points between the end points "L" and "H" are generated does not matter since the support points are automatically renumbered sequentially from left to right after one support point is set or deleted.

Deleting a support point

In order to delete the set support points 1 to 5, move the vertical line with the associated control element next to the relevant support point. Once the support point number appears along with the associated value in the line "POINT" and the point is red (see the screenshot below), you can delete it by touching the **ENT** button, for example:

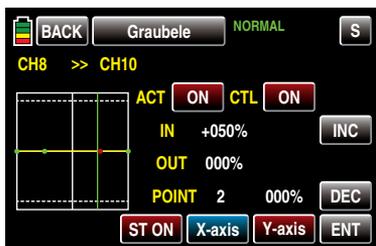


Changing the support point value

- **X-axis** button (X-axis)

Activate this function by touching the button at the bottom edge of the display with a finger or the provided stylus.

You can then move an active (red) point to the right by pressing the **INC** button, or to the left by pressing the **DEC** button: For example, to move point 1 set at -45% and point 2 set at +45% precisely between the end position and middle position:



Touch the **X-axis** button to deactivate the function.

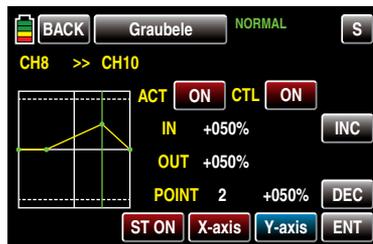
Note:

-  *If you move the red point horizontally away from the current control position, the point soon becomes green and a "?" appears in the POINT line. This question mark does not relate to the point which has been moved but rather indicates that another point can be set at the current control position.*
- Remember that the percentages in the "IN" and "OUT" line always refer to the momentary position of the control stick and not to the position of the point.

- **Y-axis** button (Y-axis)

Activate this function by touching the button at the bottom edge of the display with a finger or the provided stylus:

You can then move an active (red) point upward by pressing the **INC** button, or downward by pressing the **DEC** button, for example:



Touch the **Y-axis** button to deactivate the function.

Note:

-  *Remember that the percentages in the "IN" and "OUT" line always refer to the momentary position of the control stick and not to the position of the point.*

After you have finished making your settings, touch the **BACK** button at the top left of the display to return to the mixer selection and, if desired, further to the

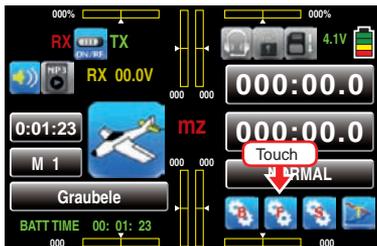
menu selection:



Trainer

Connection between two transmitters with a DSC cable

In the basic transmitter display, use a finger or the provided stylus to touch the gear icon labelled "F":

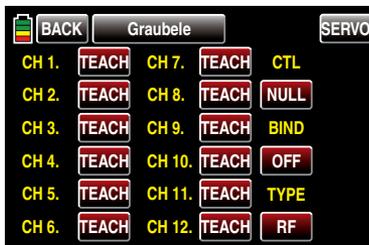


The display switches to the blue function menu. Use a finger or the provided stylus to touch the "Trainer" menu item:



The **mz-18** HoTT and **mz-24** HoTT transmitters come standard with a DSC socket in the rear of the transmitter. This can be used to connect flight simulators (as described on page 24), but also to integrate the transmitter into a cable-linked trainer system.

In order to make necessary settings, open the menu item "Trainer" by touching it with a finger or the provided stylus:



Note:

- 

In contrast to the display of the 12-channel mz-24 HoTT transmitter in this section, only channels 1 ... 9 are offered in the display of the 9-channel mz-18 HoTT transmitter.
- The above figure shows the initial status of this menu: The PUPIL control has not been released; neither has a switch been assigned.*

TEACH transmitter settings

You can transfer up to nine (**mz-18** HoTT) or 12 (**mz-24** HoTT) *function inputs*, see the definition of terms on page 37, of a **mz-18** HoTT TEACH transmitter, and up to 12 *function inputs* of a **mz-24** HoTT TEACH transmitter to the PUPIL transmitter either individually or in any desired combination.

The **TEACH** value fields or buttons identify the *function inputs* to which the control functions 1 ... 4 (control stick functions for fixed-wing and helicopter models) are assigned, as well as the freely assignable inputs 5 ... max. 12 of the "Channel set" menu.

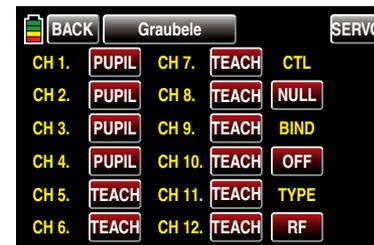
Note:

- 

It does not matter which specific controls are assigned to the control function inputs to be transferred to the PUPIL. They can only be assigned in the "Channel set" menu when the trainer connection is switched off.

Use a finger or the provided stylus to touch the control function inputs 1 to max. 12 to be transferred to the

PUPIL, for example:

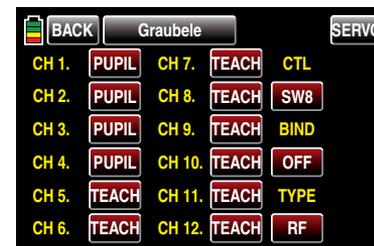


Observe the standard conventions when assigning control functions:

Channel	Function
1	Motor/airbrake or pitch
2	Aileron or roll
3	Elevator or elevation
4	Rudder or tail rotor

To make the transfer, you need to assign a trainer switch in the value field under "CTL" at the right of the display, as described in the section "Control, switch and control switch assignment" on page 38.

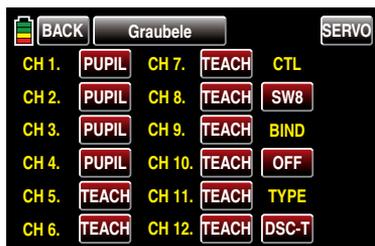
It is preferable to use an intermittent switch such as S8 so that you can withdraw the control from the trainer at anytime:



Since at this early point in the trainer system programming an operable PUPIL transmitter will not

be connected to a TEACH transmitter, the transmitter immediately reacts with acoustical alarms to switches connected during the switch assignment. At the same time, a warning message flashes every second at the top left in the transmitter's main display (see the figure at the end of the section, "Wireless HoTT system"). Open the switch that has just been assigned.

First, in the value field under "TYPE", change the default **RF** to **DSC-T** in the bottom line to the right in order to switch the DSC connector to "signal input":



The model to be controlled by the PUPIL *must* be programmed with all its functions including trim and any mixed functions in a model memory of the **mz-18** HoTT or **mz-24** HoTT TEACH transmitter. The HoTT receiver of the relevant model must also be bound to the TEACH transmitter since it is responsible for controlling the model even in PUPIL mode.

A **mz-18** HoTT or **mz-24** HoTT TEACH transmitter can be connected to any suitable PUPIL transmitter, including transmitters with a classic 35/40 MHz range. For example, a **mz-18** HoTT or **mz-24** HoTT TEACH transmitter can be connected to a **mc-24** PUPIL transmitter.



If the connection to the PUPIL is not made with a two-pin DSC socket but rather a three-pin Trainer jack by *Graupner*, for a correct connection to a PUPIL transmitter, the modulation type PPM(10, 16, 18 or 24) must be set in the PUPIL transmitter independent of the type of modulation used in the TEACH transmitter.

PUPIL transmitter settings

The model to be controlled by the PUPIL *must* be programmed with all its functions including trim and any mixed functions in a model memory of the **mz-18** HoTT or **mz-24** HoTT TEACH transmitter. If applicable, the HoTT receiver of the relevant model must also be bound to the TEACH transmitter. In principle, a HoTT PUPIL transmitter can be connected to a TEACH transmitter with the classic 35/40 MHz range since the required PPM signal by the TEACH transmitter is applied to the DSC socket of a HoTT transmitter.

Almost any transmitter from the past and current *Graupner* product line with at least four control functions can be used as the PUPIL transmitter. The PUPIL transmitter should however be equipped with the current connection module for PUPIL transmitters. The module should be connected to the transmitter board in accordance with the provided installation instructions.

The specified cable is used to connect to the TEACH transmitter (see the next two pages).

More information can be found in the main *Graupner* FS catalogue and on the Internet at www.graupner.de.

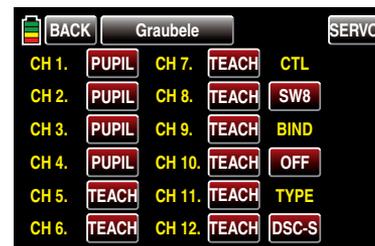


The control functions of the PUPIL transmitter must act directly on the control channels, i.e., the receiver outputs, without any intermediate mixers.

With transmitters of the series "mc", "mx" or "mz", it is best to assign the model name "PUPIL" to a free model memory activated with the required model type ("wing" or "heli"), and adapt the control arrangement (mode 1 ... 4) and "THR min or PITC min front/rear" to the PUPIL's preferences. All other settings as well as mixing and coupling functions are made in the TEACH transmitter and are transmitted by the TEACH transmitter to the receiver.

With transmitters of the "mz" series, also use a finger or the provided stylus to touch the value field under "TYPE" in the bottom line of the "Trainer" submenu at the bottom right of display to switch it to **DSC-S** and hence switch the rear DSC transmitter connector to

"signal output":



With a **mx-20** HoTT, **mc-16** HoTT, **mc-20** HoTT or **mc-32** HoTT PUPIL transmitter, adapt the modulation types to the *number* of control channels to be transferred in the line "DSC OUTPUT" of the "BASE" menu. For example, the signal package with modulation type "PPM10" only contains control channels 1 ... 5, and channels 6 and higher are not included. In order for the PUPIL to use one or more of channels 5 and above, select one of the modulation types that includes the required channels. If in addition PUPIL mode is to be used with an existing model memory instead of a newly initialized one in one of the aforementioned transmitters, make sure to enter "HoTT" in the "Module" line of the "BASE" menu. Otherwise, the PPM signal at the DSC socket may be inverted.

In the case of older transmitters of the "D" and "FM" type, check the servo direction and control mode and change them if necessary by switching the corresponding cables. If necessary, switch off all the mixers or set them to zero.

If you wish to assign other control functions to the TEACH transmitter in addition to the functions of the two control sticks (1 ... 4), assign control elements to the *inputs* in the "Channel set" menu of the PUPIL transmitter that correspond to the released function inputs 5 ... 12 in the "Trainer" menu of the TEACH transmitter.

Important:

-  ***If you forget to assign a control in the PUPIL transmitter, the relevant servo(s) remain in middle position after transferring control functions to the PUPIL transmitter.***
- ***Independent of the type of RF link of the TEACH transmitter to the model, the PUPIL transmitter should always be operated in normal PPM mode.***

Trainer mode

Both transmitters are connected to each other using an appropriate cable (see the overview on the next page). Insert the plug identified as "M" (master) in the socket of the TEACH transmitter, and insert the plug with "S" (student) (depending on the available cable) in the socket of the PUPIL transmitter.

Important instructions:

-  ***Before starting trainer mode for the operational model, be sure to check whether all the functions have been correctly transferred.***
- ***Do not insert an end of your trainer cable identified with "S" or "M" with a 3-pin jack plug into a socket of the DSC system. It is not designed for this purpose. The DSC socket can only be used for cables with a 2-pin jack plug.***

Trainer cable

- 4179.1** for trainer mode between any two *Graupner* transmitters with a DSC socket which can be identified by a 2-pin jack plug on both ends.
- 3290.7** Trainer cable to connect a TEACH transmitter having a DSC socket (such as an **mx-12** to **HTC-32** HoTT transmitter, or a transmitter retrofitted with the optional DSC module - order No. **3290.24**) to a *Graupner* PUPIL transmitter with a PUPIL socket for the optoelectronic system - identifiable by the "S" on

the side of the three-pin jack plug.

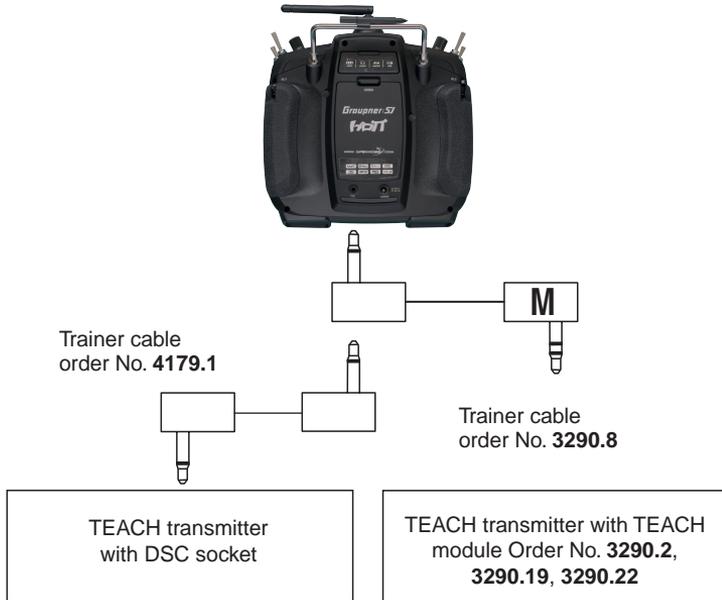
- 3290.8** Trainer cable to connect a PUPIL transmitter having a DSC socket (such as an **mx-12** to **HTC-32** HoTT transmitter, or a transmitter retrofitted with the optional DSC module - order No. **3290.24**) to a *Graupner* TEACH transmitter with a TEACH socket for the optoelectronic system - identifiable by the "M" on the side of the three-pin jack plug.

Additional information on the cables and modules mentioned in this section for the TEACH and PUPIL transmitters can be found in the relevant transmitter instructions in the main *Graupner* FS catalogue, and on the Internet at www.graupner.de.



Connecting scheme

mz-18 and mz-24 HoTT PUPIL transmitters



MC-16 HoTT,
MC-20 HoTT
MC-32 HoTT
mx-12 HoTT
mx-16 HoTT
mx-20 HoTT
mz-10 HoTT
mz-12 HoTT
mz-18 HoTT
mz-24 HoTT

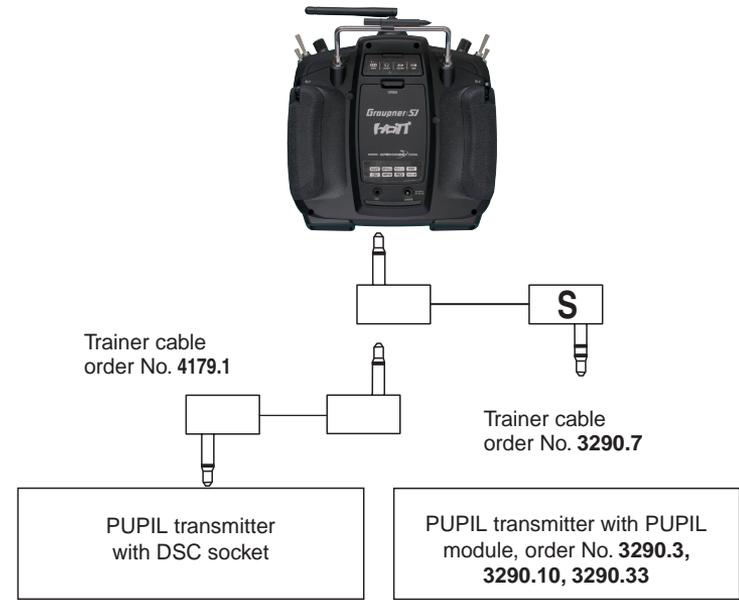
mc-19(s, iFS + HoTT) to **mc-24**,
mx-22(iFS), **mx-24s**

Note:



The connecting schemes on this page constitute the transmitter and transmitter combinations possible at the time at which this manual was created.

mz-18 and mz-24 HoTT TEACH transmitters



MC-16 HoTT,
MC-20 HoTT
MC-32 HoTT
mx-12 HoTT
mx-16 HoTT
mx-20 HoTT
mz-10 HoTT
mz-12 HoTT
mz-18 HoTT
mz-24 HoTT

D 14, FM 414, FM 4014, FM 6014,
mc-10 ... **mc-24**, **mx-22**(iFS),
mx-24s

Wireless HoTT system

The trainer system of the **mz-18** HoTT and **mz-24** HoTT transmitter can also be operated remotely. As described below, the TEACH transmitter is bound to a PUPIL transmitter. This configuration is possible between two transmitters that are available in the "Trainer" menu using the "BIND" option (see the figures in this section).

Preparing for training mode

TEACH transmitter

The training model *must* be programmed with all its functions including trim and any mixed functions in a model memory of the HoTT TEACH transmitter.



The model provided for training must therefore be completely controllable by the TEACH transmitter.

Firmware versions up to and including V 1.019

To conclude preparations, bind the training model to the pupil transmitter. A detailed description of the binding process can be found on page 74.

Firmware version V 1.020 and above

The training model remains bound to the TEACH transmitter.

Important note:



Regardless of the firmware version of the teacher transmitter, the schooling model **MUST ALWAYS** be linked to the pupil transmitter in the case of a type **mx-10** HoTT pupil transmitter with firmware version V 1a20. In addition, it is absolutely essential for correct schooling that both option buttons in the "BIND ON/OFF" line of the »TX SET« menu be set to **OFF** in the model memory of the teacher transmitter used for schooling. In other words, there is no link to a receiver in this model memory under either RX1 or RX2.

PUPIL transmitter

With *Graupner* HoTT transmitters of the series "RC", "mx" or "mz", it is best to assign the model name "PUPIL" to a free model memory activated with required model type ("wing" or "heli"), and adapt the control arrangement (mode 1 ... 4) and "THR min or PITC min front/rear" to the PUPIL's preferences. All other settings as well as all mixing and coupling functions are made in the TEACH transmitter and are transmitted by the TEACH transmitter to the receiver.

Observe the standard conventions when assigning control functions:

Channel	Function
1	Motor/airbrake or pitch
2	Aileron/roll
3	Elevator/elevation
4	Rudder/tail rotor

If you wish to assign other *control functions* to the TEACH transmitter in addition to the functions of the two control sticks (1 ... 4), assign control elements to the inputs in the "Channel set" menu of the PUPIL transmitter that correspond to the released function or control inputs 5 ... 12 in the "Trainer" menu of the TEACH transmitter.

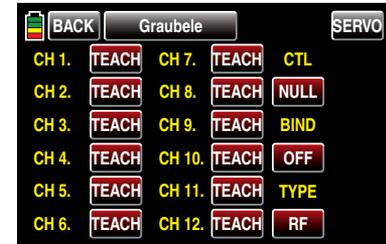
Important:



If you forget to assign a control in the PUPIL transmitter, the relevant servo(s) remain in middle position after transferring control functions to the PUPIL transmitter.

Preparing TEACH and PUPIL transmitters

After binding the training model to the PUPIL transmitter (see left column), also switch on the TEACH transmitter and open the "Trainer" display on the two transmitters:



Note:



The above figure shows the original layout of the menu.



Note that the value field under "TYPE" at the bottom right of the display is set to **RF in both the PUPIL and TEACH transmitter.**

PUPIL transmitter

Check the display and modify it so that it corresponds with the above screenshot.

TEACH transmitter

You can transfer up to nine *function inputs*, see the definition of terms on page 37, of a **mz-18** HoTT TEACH transmitter, or 12 function inputs of a **mz-24** HoTT TEACH transmitter, to the PUPIL transmitter, either individually or in any desired combination.

Note:



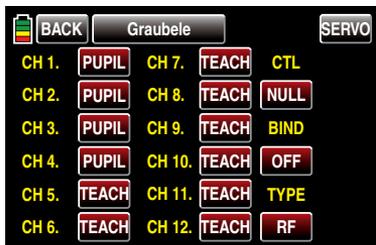
It does not matter which specific controls are assigned to the inputs to be transferred to the PUPIL. They can only be assigned in the "Channel set" menu when the trainer connection is switched off.

Observe the standard conventions when assigning control functions:

Channel	Function
1	Motor/airbrake or pitch

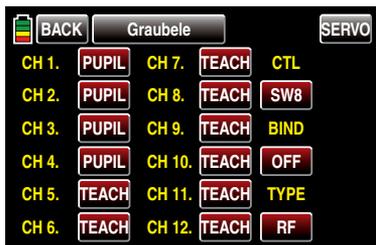
2	Aileron or roll
3	Elevator or elevation
4	Rudder or tail rotor

Use a finger or the provided stylus to touch the control function inputs 1 to max. 12 to be transferred to the PUPIL, for example:



To make the transfer, you need to assign a trainer switch in the value field under "CTL" at the right of the display, as described in the section "Control, switch and control switch assignment" on page 38.

It is preferable to use an intermittent switch such as S8 so that you can withdraw the control from the trainer at anytime:



Since at this early point in the trainer system programming an operable PUPIL transmitter will not be connected to a TEACH transmitter, the transmitter immediately reacts with acoustical alarms to switches connected during the switch assignment. At the same time, a

warning message flashes every second at the top left in the transmitter's main display (see the figure at the end of the section). Reopen the assigned switch.

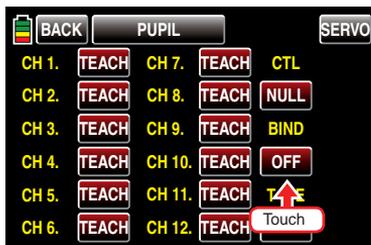
Binding the PUPIL transmitter to the TEACH transmitter

Note:

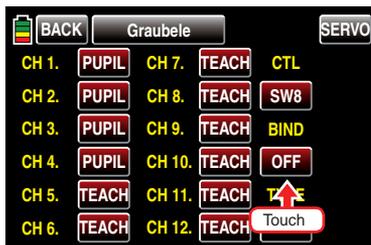


During the binding process, the distance between the two transmitters should not be too great. If necessary, change to the position of the two transmitters and restart the binding process.

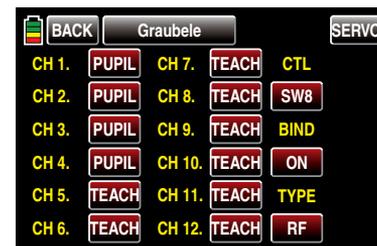
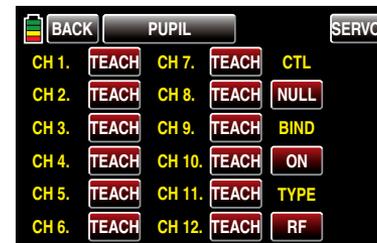
Initially, start the "BINDING" process in the PUPIL transmitter by touching the middle button in the right column ...



... and then directly afterward in the TEACH transmitter:



Once this process has concluded, **ON** appears in both displays instead of **CHK**:



Both transmitters can then return to the basic display and commence training after a thorough check of all functions.

If only one or neither transmitter displays **ON** indicating that the binding process failed, change the positions of the two transmitters and repeat the entire procedure.

Important note:



Before starting trainer mode for the operational model, be sure to check whether all the functions have been correctly transferred.

During ...

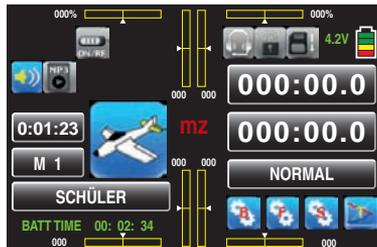
training

... the teacher and pupil can maintain a comfortable distance. The "earshot" distance (a maximum of 50 m) should not be exceeded, and no one should be between the teacher and pupil since this would reduce the range of the feedback channel used to connect the two transmitters.

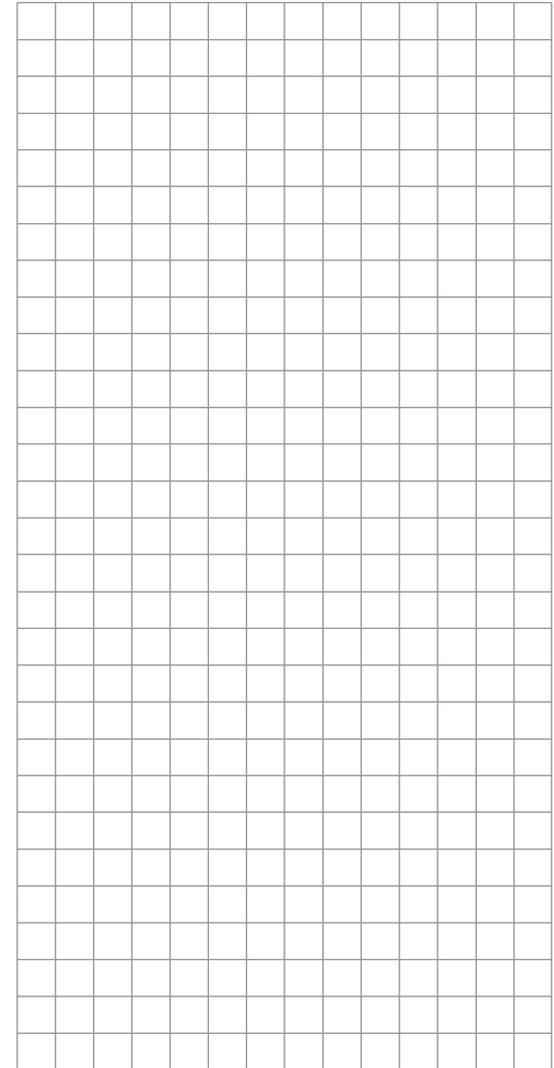
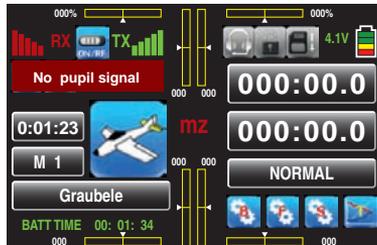
During this mode, the basic display of the TEACH transmitter can have the following appearance ...



... and the PUPIL transmitter has the following appearance:



If the connection becomes lost between the TEACH and PUPIL transmitters during training, the TEACH transmitter automatically assumes control of the model. If the TEACH/PUPIL switch is in the "pupil" position in this situation, acoustic warnings sound while the signal is lost, and a warning message flashes every second at the top left of the display:





Telemetry

Settings and displays

Receiver settings and the displays and settings of the connected telemetry sensors can be retrieved and programmed in real time in the **"Telemetry"** menu. The connection to the receiver is maintained by the feedback channel integrated in the HoTT receivers.

Up to four sensors can be connected by a V or Y cable at the telemetry connectors of the receivers GR-12S HoTT (order No. **33505**), GR-12 HoTT (order No. **33506**), GR-16 (order No. **33508**), GR-24 HoTT (order No. **33512**) and GR-32 DUAL (order No. **33516**) with updated firmware.

The ability of these and future receivers to be updated by the user keeps the associated **"Telemetry"** menus current and allows additional functions or languages to be added.

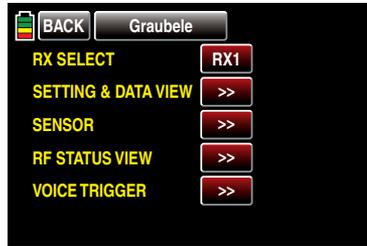
Note:



After the product has been registered at https://www.graupner.de/en/service/product_registration.aspx, you will automatically be notified of updates by e-mail.

Important instructions:

-  These instructions are based on the functions available at the time at which this manual was drafted.
- As already noted in the section "Binding several receivers" on page 74, if desired several receivers per model can be bound. In the related programs of the **mz-18** HoTT and **mz-24** HoTT receivers, you can directly manage one or two receivers and use a menu to distribute the 9 or 12 transmitter control channels between the two receivers.
During subsequent operation, only the receiver selected in the line "RX SELECT" of the "Telemetry" menu can establish a telemetry connection with the transmitter.



Conversely, this also means that only these receivers can be addressed by the **"Telemetry"** menu. The selection therefore may have to change before settings can be made to a specific receiver.

The second and all additional receivers are running in parallel, but in the model memory-independent slave mode!

- Since the telemetry data between the transmitter and receiver are only exchanged after every fourth data packet, the data transmission requires a certain amount of time for technical reasons. The reaction to control buttons and changes to settings is therefore delayed. This does not constitute an error.
- **When adjusting the remote control, make sure that the transmitter antenna is always far enough from the receiver antennas. Maintain a distance of 1 meter to be on the safe side. Otherwise, you risk endangering the connection with the feedback channel and causing malfunctions.**
-  **When operating towed models, maintain a minimum distance of approximately 50 cm between the participating receivers or their antennas. Using the satellite receiver is an option. Otherwise, malfunctions from the feedback channel are possible.**
- The model or sensors may only be programmed when the model is on the ground. Only perform settings when the motor is switched off or the drive battery is disconnected. Otherwise, unanticipated reactions may occur.

A servo test that is accidentally activated in the receiver, for example, could cause the model to crash and cause injury or property damage.

- In addition, consult the safety instructions on pages 4 ... 7 of this manual and the respective individual instructions.
- All settings that have been made using the **"Telemetry"** menu (such as fail safe, reversal of the direction of servo rotation, servo travel, mixer and curve settings, etc.) are only saved in the receiver and are therefore transferred to other models to when the receiver is switched. You therefore need to reinitialize your HoTT receiver if you want to use your receiver in another model, see "Reset" on page 33.
You should therefore only program the rotational direction of servos, servo travel, mixer and curve settings, etc. in a specified standard menu of the respective transmitter. Otherwise, the settings will overlap each other which at least will cause a lack of clarity and, at worst, will cause problems in subsequent operation.
- By using the channel assignment function called channel mapping which is integrated in the **"Telemetry"** menu of the **mz-18** HoTT and **mz-24** HoTT transmitters, control channels can also be distributed as desired within one receiver as well as to several receivers. In addition, several receiver outputs can be assigned the same control function, for example to control each aileron with two servos instead of just one, etc. **It is strongly recommended to exercise extreme caution when programming.**

Telemetry

The menus that fall under the generic term of "**Telemetry**" can be accessed from the blue function menu of the **mz-18** HoTT and **mz-24** HoTT transmitters. Use a finger or the provided stylus to touch the "**Telemetry**" menu item:

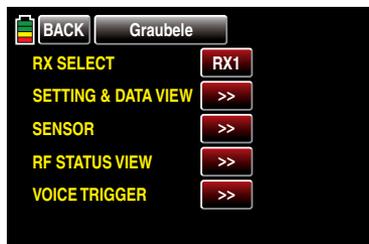


In the basic transmitter display, you can open the function menu by using a finger or the provided stylus to touch the gear icon labelled "F":



Basic operation

Basically the "**Telemetry**" menu corresponds to the other menus of the **mz-18** HoTT and **mz-24** HoTT transmitters:



The few deviations are described below:

Switch between the individual pages of the "**Telemetry**" menu by touching the **ENT** button (forward or ">") and **ESC** (reverse or "<") with a finger or a provided stylus. Corresponding pointers indicating direction can be found on each page of the display at the top right in the form of angled brackets (<>), such as:

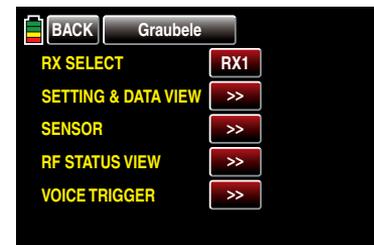


If there is only one angled bracket, you are on the first or last page. You can then only change pages in the displayed direction.

Menu lines in which parameters can be changed are indicated by a preceding angle bracket (>) (see screenshot above). Touch the **INC** or **DEC** button to move the ">" pointer one line up or down. Lines which cannot be jumped cannot be changed.

To change a parameter, use a finger or the provided stylus to touch the **SET** button at the right edge of the screen. The corresponding parameter is red. Then use the **INC** or **DEC** buttons to change the value within the possible range, and accept the value by touching **SET**. Touch the **ESC** button at the top right

of the display to return to the previous page, and touch the **BACK** button at the top left of the display to return to the initial position:



Use a finger or the provided stylus to touch the button in the desired submenu. If however the following message appears instead of the desired submenu ...



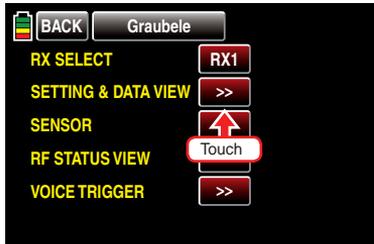
... there is no connection with a receiver. Switch on your receiver, or bind the corresponding receiver as described on page 74, or activate it as described under "Important instructions" on the previous page.

SETTING & DATA VIEW

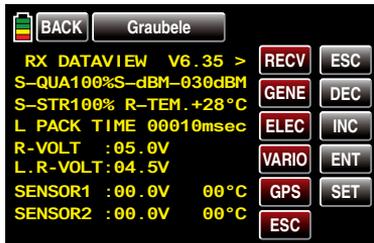
On the first page of the display with the header ...

RX DATAVIEW

... of the submenu "SETTING & DATA VIEW" of the "Telemetry" menu ...



... you will not be able to make any settings. This page is for information only:



Value	Explanation
Vx.xx	Firmware version of the receiver
S-QUA	Quality expressed as a percentage of the signal packages from the transmitter arriving at the receiver
S-dBm	Level in dBm of the signal from the transmitter arriving at the receiver
S-STR	Signal strength expressed in percentage of the signal from the transmitter arriving at the receiver
R-TEM.	Receiver temperature in °C

L PACK TIME	Shows the longest time in milliseconds in which data packages were lost when transmitting from the transmitter to receiver
R-VOLT	Current operating voltage of the receiver
L.R-VOLT	Current operating voltage of the receiver since the last time the receiver was switched on
SENSOR1	Indicates the voltage and °C of the optional telemetry sensor 1
SENSOR2	Indicates the voltage and °C of the optional telemetry sensor 2

S-QUA (signal quality)

This value is a type of evaluation of usefulness, expressed as a percentage, of the signal packages from the transmitter arriving at the receiver.

This evaluation in percentage of the quality of the signal packages from the transmitter received by the receiver's microprocessor is shown live on the transmitter's display via the receiver's feedback channel.

S-dBm (reception level)

dBm is a logarithmic value that provides a comparative overview of extreme differences in level. A level of 0 dBm corresponds to 1 mW. The dBm is positive for an output > 1 mW, and the dBm is correspondingly negative for an output < 1 mW.

In practice, this means that when a remote control system is used, generally (significantly) less than 1 mW and hence a level < 0 dBm is received by the receiver from a 100 mW output of a standard transmitter (= 20 dBm) because of the fanning out of the radio waves and associated weakening of the signal on the way to the receiver. Consequently, the reception shown in dBm in the display is generally negative. The higher the number after the minus sign, the worse the reception. This is important to remember during range tests before using the model.

Perform a range test before each flight as described on page 77, and simulate all servo movements that could occur during the flight. The range must be at least 50 m on the ground in an activated range test. At this distance, a maximum of -80 dBm may be displayed in the "RX DATAVIEW" display under "S-dBm" to ensure safe operation. If the value is lower, such as -85 dBm, you should not operate your model. Check the installation of the receiver and antenna position.

During operation, the reception should not fall below -90 dBm; if this is the case, you should reduce your distance to the model. Normally before this level is reached, the acoustic range warning is triggered (one beep every second) which reflects the *signal strength* of the feedback channel to ensure safe operation.

S-STR (signal strength)

The signal strength (S-STR) is displayed in percentage. In general, an acoustic range warning (1 beep every second) is emitted once the receiver signal in the feedback channel becomes too weak. Since the transmitter's output is significantly higher than the receiver, the model can always be operated safely. The model distance should nevertheless be reduced for reasons of safety until the warning tone stops.

R-TEM. (receiver temperature)

Make sure that the temperature of your receiver remains within the permissible range under all flight conditions (ideally between -10 and +55 °C).

The receiver temperature threshold which triggers a warning can be set in the submenu "RX SERVO TEST" under "ALARM TEMP+" (50 ... 80°C) and "ALARM TEMP-" (-20 ... +10°C). When the temperature is too high or too low, a continuous warning tone sounds, and "TEMP.E" appears in red at the top right in the receiver menu "RX". On the display page "RX DATAVIEW", the parameter "R-TEM" is also displayed in red.

L PACK TIME

(data packages)

This indicates the longest period in milliseconds in which data packages are lost when transmitted from the transmitter to receiver. In practice, this is the longest period in which the remote control system enters fail safe mode.

R-VOLT

(receiver operating voltage)

Always keep an eye on the receiver's operating voltage. If it is too low, do not operate or start your model.

The receiver low-voltage warning can be set in the submenu "RX SERVO TEST" under "ALARM VOLT" between 3.0 and 7.5 V. When it is too low, a continuous warning tone sounds, and "VOLT.E" appears in red at the top right in the receiver menu "RX". In the submenu "RX DATAVIEW", the parameter "R-VOLT" is displayed in red.

The current receiver battery voltage is displayed in the basic display, see page 20.

L.R-VOLT

(lowest receiver operating voltage)

"L.R-VOLT" shows the lowest operating voltage of the receiver since the last time the receiver was switched on.

If this voltage differs significantly from the current operating voltage "R-VOLT", the drain on the receiver battery from the servos may be too much. This results in voltage drops. In this case, use a more powerful voltage supply to maximize operating safety.

Sensors 1 + 2

Indicates the voltage and temperature in °C of the optional telemetry sensors 1 and 2.

RX SERVO



Before programming on this display page, consult the instructions on page 114.

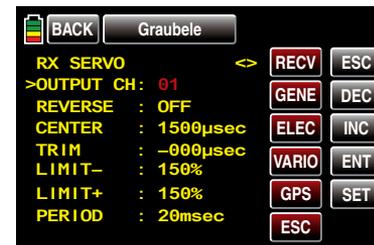
Value	Explanation	Possible settings
OUTPUT CH	Selected channel	1 ... depending on the receiver
REVERSE	Servo reverse	ON/OFF
CENTER	Servo center in µs	Currently set servo center
TRIM	Trim position in µs deviation from the CENTER position	-120 ... +120 µs
LIMIT-	Limit on the "-" side of the servo travel in percentage servo travel	30 ... 150 %
LIMIT+	Limit on the "+" side of the servo travel in percentage servo travel	30 ... 150 %
PERIOD	Cycle time in ms	10 or 20 ms

OUTPUT CH

(selected channel)

Using the selection buttons to select the line "OUTPUT CH". Touch the **SET** button at the bottom right of the

display. The parameter is displayed in red.



Select the desired receiver servo connector (such as 01) using buttons **INC** or **DEC**.



The following parameters always refer to the connection which is set here.

Reverse

(servo reverse)

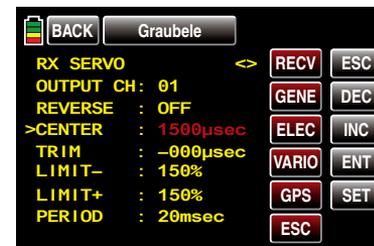
When the value field is *active*, this sets the direction of rotation of the servo connected to the selected control channel: Servo Reverse ON / OFF

CENTER

(servo center)

In the "CENTER" line, the currently saved pulse time for the servo center of the control channel selected in the "OUTPUT CH" line is displayed in µs. The set channel pulse time of 1500 µs is the standard center position and hence the normal servo center.

To change this value, select the "CENTER" line, and use a finger or the provided stylus to touch the **SET** button at the bottom right of the display. The value field is displayed in red:



Now move the corresponding control, control stick and/or trim lever into the desired position, and save the current control position by touching the **SET** button. This position is saved as the new neutral position.

The displayed new value depends on the current position of the control influencing this control channel, and if applicable the position of the trim when you touched to the **SET** button.

TRIM (trim position)

In the "TRIM" line, you can sensitively adjust the neutral position in 1- μ s increments of a servo connected to the control channel selected in the line "OUTPUT CH". Activate the value field by touching the **SET** button at the bottom right of the display with a finger or the provided stylus. The TRIM parameter is displayed in red. The TRIM value set here can be adjusted $\pm 120 \mu$ s in the "CENTER" line with the **INC** or **DEC** buttons.

Factory setting: 0 μ s.

LIMIT-/+ (side-dependent limit -/+)

This option is for adjusting a side-dependent limit of the servo travel (rudder deflection) of the servo connected to the receiver output selected in the "OUTPUT CH" line. An adjustment within 30 ... 150% is performed separately for both directions.

Factory setting: 150%.

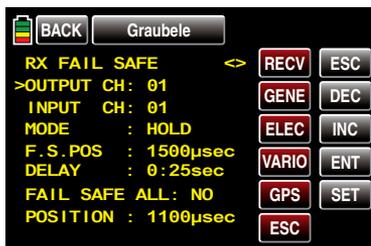
PERIOD (cycle time)

In this line, specify the periods for the individual channel pulses. This setting is transferred for all control channels. When using digital servos, you can set a cycle time of 10 ms.

If your system includes some or uses exclusively analogue servos, always select 20 ms since the analogue servos may be overloaded and respond by "jittering" or "growling".

Touch the **SET** button at the bottom right of the display with a finger or the provided stylus to switch to the "FAIL SAFE ALL" line and activate the value field. "NO" is displayed in red.: Set the parameter with the **INC**- or **DEC** button to "SAVE".

RX FAIL SAFE



Before describing this menu, a few precautionary words:



Doing nothing is the worst thing you can do here. "HOLD" is the default in the base menu of the HoTT receiver.

If a malfunction occurs, in a best-case scenario the flying model will fly straight for a certain amount of time and then land somewhere without causing too much damage. If this happens at the wrong time and place, the airplane may become uncontrollable and buzz the flight field and endanger pilots and spectators.

It is therefore recommendable to at least program "motor off" to prevent such risks. If necessary, consult a competent pilot to find a recommendable setting for your model.

An additional recommendation regarding the fail safe setting for the three possible versions of the **mz-18** HoTT and **mz-24** HoTT transmitters:

The easiest and most recommendable way to make fail safe settings is to use the "Fail Safe" submenu that can be reached from the base menu and is described on page 84.

Furthermore, although a bit more involved, the "FAIL SAFE ALL" option described on the next two pages also works.

Beyond this is the relatively complex method of individual adjustments within the "RX FAIL SAFE" menu of the "Telemetry" menu using the options "MODE", "F.S.Pos." and "DELAY". The description of these versions starts with the "MODE" option below.

Value	Explanation	Possible settings
OUTPUT CH	Output channel (servo connector of the receiver)	1 ... depending on the receiver
INPUT CH	Input channel (control channel coming from the transmitter)	1 ... max. 12
MODE	Fail safe mode	HOLD FAIL SAFE OFF
F.S.POS.	Fail safe position	1000 ... 2000 μ s
DELAY	Reaction time	0.25, 0.50, 0.75 and 1.00s
FAIL SAFE ALL	Save the fail safe positions of all control channels	NO / SAVE
POSITION	Display the saved fail safe position	between approximately 1000 and 2000 μ s

OUTPUT CH (servo connector)

In this line, select the OUTPUT CH to be set (receiver servo connector).

INPUT CH (selected input channel)

As mentioned on page 114, the 9 control functions of the 9-channel **mz-18** HoTT transmitter, or the 12 control channels of the 12-channel **mz-24** HoTT transmitter, can be distributed as desired within a receiver, or to several receivers, or several receiver inputs can be assigned the same control function. This can for example be done to control each aileron with two servos instead of just one, or to control a large rudder with coupled servos instead of a single servo.

Distributing the control functions to several HoTT

receivers is recommendable for large models, for example to avoid long servo cables. In this case, remember that only the receivers selected in the "RECEIVER SELECT" line can be addressed by the "Telemetry" menu.

The 9 or 12 control channels (INPUT CH) of the **mz-18** HoTT and **mz-24** HoTT transmitters can be correspondingly administered by assigning the servo connector of the receiver selected in the OUTPUT CH line to the INPUT CH of another control channel by "channel mapping".

NOTE:



If for example you entered "2AILE" in the basic settings for a model memory, the transmitter assigns control function 2 (*aileron*) to control channels 2+5 for the left and right aileron. The corresponding INPUT CH of the receiver to be mapped would in this case be channels 02 + 05 (see the example below).

Examples:

- On a large model, you want to control each aileron flap using two or more servos:
Assign the relevant OUTPUT CH (servo connectors) as the INPUT CH to one of the two default aileron control channels 2 or 5 depending on the left or right wing.
- On a large model, you want to control the rudder using two or more servos:
Assign the same INPUT CH (control channel) to the relevant OUTPUT CH (servo connectors). In this case, default rudder channel 4.

MODE

(method)

The settings of the options "MODE", "F.S.Pos." and "DELAY" determine the response of the receiver when there is an interruption in transmission from the transmitter to receiver.

The setting programmed under "MODE" *always* refers to the channel set in the line OUTPUT CH.

The factory setting for all servos is "HOLD".

For each selected OUTPUT CH (receiver servo channel), you can select between the following:

- FAI(L) SAFE
With this selection, the corresponding servo moves into the position displayed in μ s in the line "POSITION" in case of a malfunction after expiration of the delay set in the "DELAY" line for the remainder of the malfunction.
- HOLD
With the "HOLD" setting, over the course of a malfunction, the servo remains in the last correctly received servo position.
- OFF
With the "OFF" setting, over the course of a malfunction, the receiver stops transmitting (buffered) control pulses for the relevant servo output. The receiver switches off of the pulse line in a manner of speaking.

NOTE:



Analogue servos and many digital servos no longer experience resistance to the ongoing control pressure after control pulses stop and are moved out of their position at greater or lesser speed.

F.S.POS.

(fail safe position)

For each OUTPUT CH (receiver servo connector), after activating the value field (red parameter) by touching the **SET** button at the bottom right of this display, set the servo position for the servo to assume in a malfunction in "FAI(L) SAFE" in the line "F.S.POS." by using the **INC** or **DEC** buttons. The setting is made in 10- μ s increments, for example:



Factory setting: 1500 μ s (servo center).

Important note:



In all three modes "OFF", "HOLD" and "FAI(L) SAFE", the function "F.S.POS." is particularly important when waiting for a valid signal after turning on the receiver:

The servo immediately moves into the fail safe positions set in the "POSITION" line. This prevents landing gear from retracting when the receiver is accidentally switched on while the transmitter is off. In normal model operation, the corresponding servo contrastingly acts according to the set "MODE" in a malfunction.

DELAY

(fail safe reaction time or delay)

Set the delay after which the servos are to move to their set positions when the signal is interrupted. This setting is adopted by all the channels and only affects the servos programmed for "FAIL SAFE" mode.

Factory setting: 0.75 s.

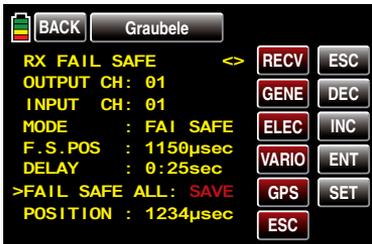
FAIL SAFE ALL (global fail safe setting)

This submenu allows you to easily determine the fail safe positions of servos by pressing a button similar to the "Fail Safe" submenu, described on page 84:

Touch the **SET** button at the bottom right of the display with a finger or the provided stylus to switch to the "FAIL SAFE ALL" line and activate the value field. "NO" is displayed in red: Set the parameter with the **INC** or **DEC** button to "SAVE".

Use the transmitter's control elements to simultaneously move all servos that you have to assigned (or wish to assign) "FAI(L) SAFE" in the "MODE" line into the desired fail safe position, and hold it.

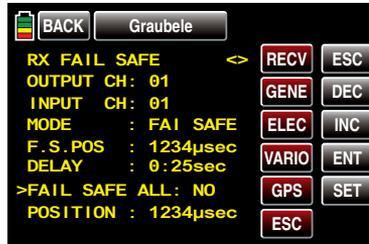
In the bottom "POSITION" line, the current servo position is displayed for the selected OUTPUT CH, for example:



Touch the **SET** button at the bottom right of the display to switch the display from "SAVE" to "NO".

This saves the positions of all of the servos affected by these measures and simultaneously transfers them to the "F.S.Pos." line so that the receiver can access them in a malfunction.

You can now release the control elements of the transmitter.

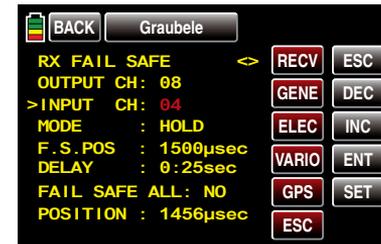
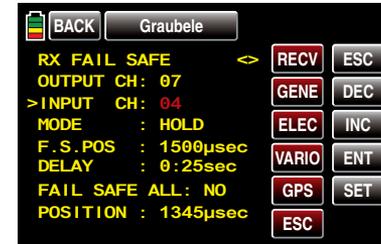


Switch off the transmitter and check the fail safe positions by checking the servo travel.

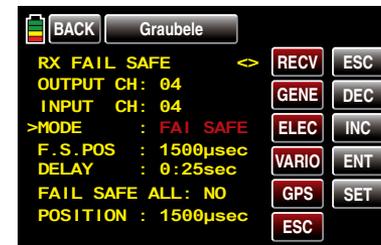
Fail Safe in combination with channel mapping

To make sure that mapped servos react in the same way even in a malfunction, that is, servos that are controlled by common control channel (INPUT CH), the corresponding settings of the *INPUT CH* determine the behaviour of mapped servos.

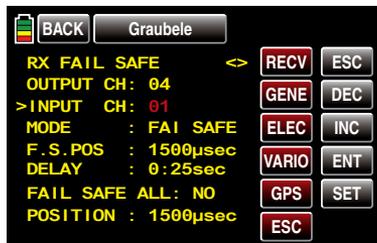
If for example servo connectors 6, 7 and 8 of a receiver are mapped by assigning the same control channel "04" as the INPUT CH to OUTPUT CH (servo connectors) 06, 07 and 08 ...



... then INPUT CH 04 determines the fail safe behaviour of these three servos connected to control channel 4 fully independent of the settings of the respective OUTPUT CH:



This is also true when INPUT CH 01 is used for mapping:



In this case, servo connector 04 reacts according to the fail safe settings of CH 01.

The reaction time or delay set in the "DELAY" line contrastingly applies uniformly to all channels set to "FAI(L) SAFE".

RX FREE MIXER



Value	Explanation	Possible settings
MIXER	Mixer selection	1 ... 5
MASTER CH	Signal source or source channel	0, 1 ... depending on the receiver
SLAVE CH	Target channel	0, 1 ... depending on the receiver
S-TRAVEL-	Mixing on the "-" side of the servo travel in percentage servo travel	0 ... 100%
S-TRAVEL+	Mixing on the "+" side of the servo travel in percentage servo travel	0 ... 100%
RX WING MIXER TAIL TYPE	Tail type	NORMAL, V-TAIL, ELEVON (elevator/aileron mixer for delta and flying wing)

MIXER

Up to five mixers can be programmed. In the "MIXER" line, select one of mixers 1 ... 5:

The following settings in this display *only* relate to the mixers selected in the "MIXER" line.

Important note:



If you have already programmed mixer functions in the "Wing Mix" or "programmable mixers" menus, pay special attention to ensure that these mixers do not overlap with those in the "RX FREE MIXER" menu!

MASTER CH

("from")

According to the same principles described in the section "**programmable mixers**" on page 72, the signal at MASTER CH (signal source or source channel) can be mixed with the SLAVE CH (target channel) to the adjustable amount.

Select "00" if you not wish to set any mixer.

SLAVE CH

("to")

The signal of the MASTER CH (signal source or source channel) is proportionately mixed with the SLAVE CH (target channel). The level of mixing is determined by the percentages entered in the "TRAVEL-" and "TRAVEL+" lines.

Select "00" if you not wish to set any mixer.

TRAVEL-/+

(level of mixing in %)

With the settings of these two lines, the percentage of mixing is specified in relation to the MASTER signal separately for both directions.

RX WING MIXER TAIL TYPE

(tail type)

The following model types are also available in the base menu of a model and should preferably be preset there. In this case, *always* leave the TAIL TYPE at NORMAL.

If you still want to use the mixers integrated in the receiver, you can then select the preset mixer functions for the corresponding model type:

- **NORMAL**

This setting corresponds to the classic airplane type with a rear tail and separate rudder and elevator. No mixing function is required for this model type.

- **V-TAIL**

With this model type, the control functions of the elevator and rudder are linked to each other so that each of the two tail flaps assumes the elevator and rudder function controlled by a separate servo.

The servos are normally connected to the receiver as follows:

OUTPUT CH 3: V-tail servo, left

OUTPUT CH 4: V-tail servo, right

If the rudder travel is not as desired, observe the instructions on page 40.

- **ELEVON (delta/flying wing models)**

The servos connected to outputs 2 and 3 assume an aileron and elevator function. The servos are normally connected to the receiver as follows:

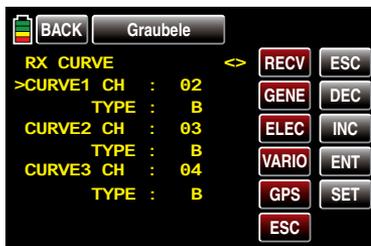
OUTPUT CH 2: Aileron/elevator, left

OUTPUT CH 3: Aileron/elevator, right

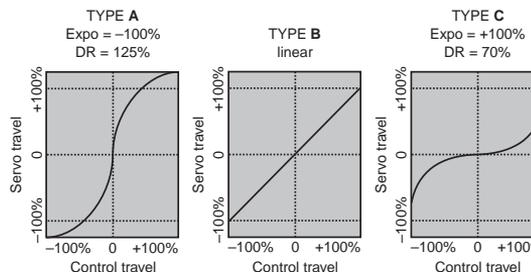
If the rudder travel is not as desired, observe the instructions on page 40.

RX CURVE

With the RX CURVE function, you can administer control characteristics for up to three servos:



Value	Explanation	Possible settings
CURVE1, 2 or 3 CH	Channel assignment of the respective curve setting	1 ... depending on the receiver
TYPE	Curve type	A, B, C see figure



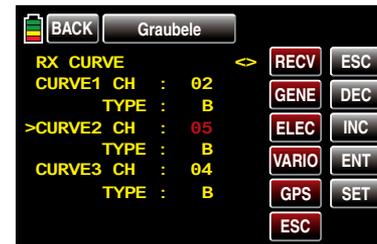
Generally, a nonlinear control function is used for the aileron (channel 2), elevator (channel 3) and rudder (channel 4). These channel settings also correspond to the factory setting.

NOTE:



This assignment is only relevant when you have not specified "V-TAIL" or "2ELEVATOR" for your tail type, or "2AILE" or "2/4AILE 2/4FLAP" for your flaps in the transmitter. Otherwise, the control function 3 (elevator) is split to control channels 3 + 8 in the transmitter, and control functions 2 (aileron) is split to control channels 2 + 5 for the left and right aileron. In these two cases, the corresponding control channels (INPUT CH) of the receiver would be channels 03 + 08 and 02 + 05.

If you have for example specified "2AILE" in the transmitter and wish to use the RX CURVE option instead of the individually settable menu "D/R,EXP", page 136 or 171, of the **mz-18** HoTT and **mz-24** HoTT transmitters, then set two curves. Otherwise, the left and right aileron have different control characteristics:



- **CURVE 1, 2 or 3 CH**

Select the desired *control channel* (INPUT CH).

The following setting in TYPE only affects the selected channel.

TYPE

Select the servo curve:

A: EXP = -100% and D/R = 125%

The servo reacts strongly to control stick movement around the neutral position. The curve becomes flatter as the rudder deflection increases.

B: Linear setting.

The Servo follows the control stick travel in a linear

manner.

C: EXP = +100% and D/R = 70%

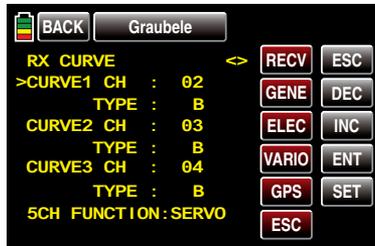
The servo reacts weakly to control stick movement around the neutral position. The curve becomes steeper as the rudder deflection increases.

Note:



The control characteristics that are programmed here affect the mapped receiver outputs.

5CH FUNCTION: "SERVO" or "SENSOR"



With certain receivers, a certain servo connector is designed to be switchable instead of an independent telemetry connector. For example, with the GR-12L receiver that comes standard with **mz-18** HoTT and **mz-24** HoTT sets, a telemetry sensor can also be connected to servo connector 5 identified with an additional "T" ...

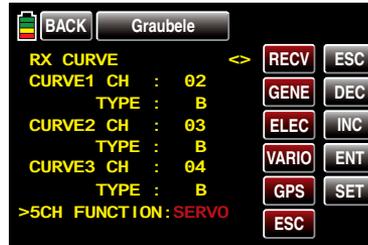


Servo OR Sensor

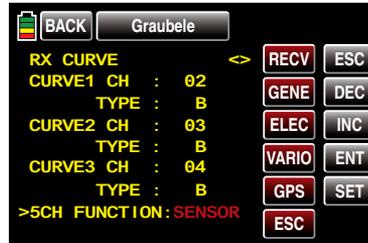
... as well as the adapter cable (order No. **7168.6S**) for updating the receiver.

In order for the connected device to be correctly identified by the receiver, servo connector 5 needs to be switched from "SERVO" to "SENSOR" and vice versa.

Use the **INC** button to move the ">" icon at the left edge in front of the last line, and touch the **SET** button at the bottom right of the display:



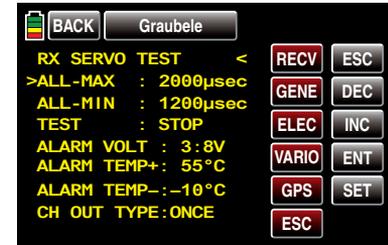
Use the **INC** or **DEC** button to select the alternative setting "SENSOR":



Touch the **SET** button again at the bottom right of the display to finalize your selection and, if desired, return to the main display of the transmitter by repeatedly pressing the **BACK** button at the top left of the display.

RX SERVO TEST

With the RX SERVO TEST function, you can test the servos connected to the currently active receiver:



Value	Explanation	Possible settings
ALL-MAX	Servo travel on the "+" side for all servo outputs for the servo test	1500 ... 2000µs
ALL-MIN	Servo travel on the "-" side for all servo outputs for the servo test	1500 ... 1000µs
TEST	Test procedure	START / STOP
ALARM VOLT	Alarm threshold for the receiver's low voltage warning	3.0 ... 7.5V Factory setting: 3.8 V
ALARM TEMP+	Alarm threshold when the receiver temperature is too high	50 ... 80°C Factory setting: 55°C
ALARM TEMP-	Alarm threshold when the receiver temperature is too low	-20 ... +10°C Factory setting: -10°C

Value	Explanation	Possible settings
CH OUTPUT TYPE	Channel sequence or type of aggregate symbol	ONCE, SAME, SUMI, SUMO and SUMD

ALL-MAX (servo travel on the "+" side)

In this line, set the maximum servo travel on the plus side of the control travel for the servo test.

2000µs corresponds to a full deflection on the "+" side of the servo travel, and 1500µs corresponds to the neutral position.

Make sure that the servos do not strike anything during the test routine.

ALL-MIN (servo travel on the "-" side)

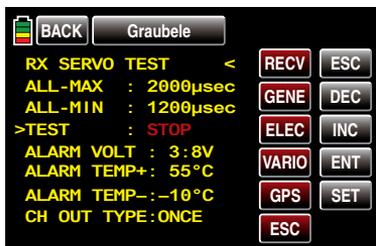
In this line, set the maximum servo travel on the minus side of the control travel for the servo test.

1000µs corresponds to a full deflection on the "-" side of the servo travel, and 1500µs corresponds to the neutral position.

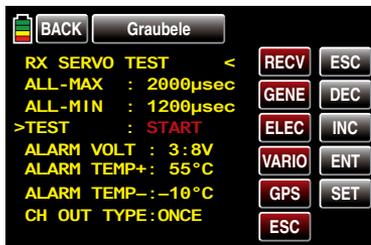
Make sure that the servos do not strike anything during the test routine.

TEST (start/stop)

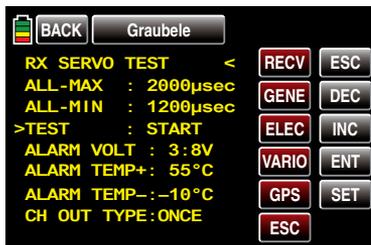
In this line, briefly touch the **SET** button at the bottom right of the display with a finger or the provided stylus to start and stop the servo test integrated in the receiver.



Use the **INC** or **DEC** button to select "START" ...



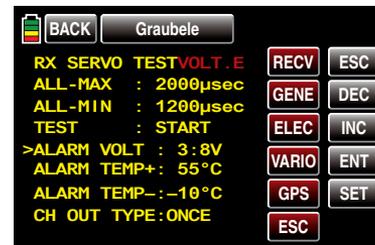
... and touch the **SET** button again at the bottom right of the display to start the test. The entry field returns to normal:



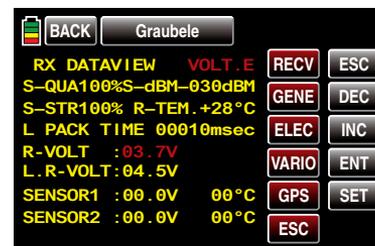
To stop the servo test, reactivate the entry field as described above, select "STOP", and confirm by touching the **SET** button at the bottom right.

ALARM VOLT (receiver low voltage warning)

The receiver voltage is monitored with "ALARM VOLT". It can be set between 3.0 and 7.5 V. When the voltage falls below the set alarm threshold, a warning tone sounds, and "VOLT.E" appears in red at the top right in all "RX..." displays.



In the "RX DATAVIEW" display, the parameter "R-VOLT" is displayed in red.



ALARM TEMP +/- (receiver temperature monitoring)

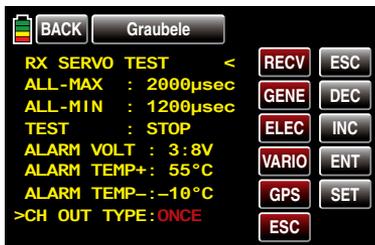
These two options monitor the receiver temperature. You can program a bottom threshold "ALARM TEMP-" (-20 ... +10°C) and an upper threshold "ALARM TEMP+" (+50 ... +80°C). If the upper lower thresholds are exceeded, a continuous warning tone sounds, and "TEMPE" appears in red at the top right in all receiver displays. On the display page "RX DATAVIEW", the parameter "R-TEM" is also displayed in red.

Make sure that the temperature of your receiver remains within the permissible range under all operating conditions (ideally between -10 and +55°C).

CH OUTPUT TYPE (connection type)

In this line, select the type of servo control or alternately the signal type of the aggregate signal output:

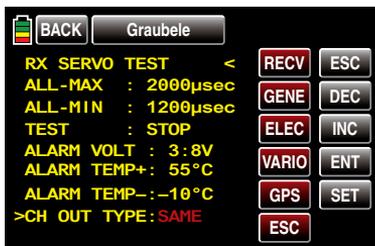
- **ONCE**



The servo connectors of the receiver are actuated sequentially. Recommended for analogue servos.

With this setting, the servos are automatically operated at a cycle of 20 ms (30 ms for a 12 channel GR-24 receiver (order No. **33512**)) no matter what is set or displayed in the "RX SERVO" display in the line "PERIOD".

- **SAME**



The servo connectors of the receiver are actuated simultaneously in blocks. That is, the servos connected to connectors 1 to 4 as well as 5 to 8 can be simultaneously supplied with their control signals with a GR-16 receiver (order No. **33508**), and the servos connected to connectors 1 to 4, 5 to 8 as well as 9 to 12 can be simultaneously supplied with their control signals with a GR-24 receiver (order No.

33512).

This is recommended for digital servos when several servos are used for a single function (such as an aileron) so that the servos are fully synchronized.

When exclusively digital servos are used, it is recommendable to set "10 ms" in the line "PERIOD" of the display "RX SERVO" to exploit the fast reaction of digital servos. When analogue servos or mixed operation is used, be sure to select "20 ms".



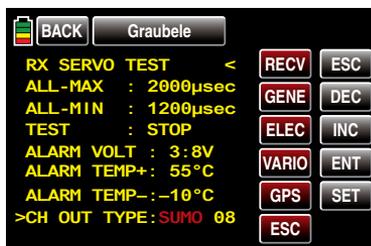
When this setting is used, make sure that the receiver power supply is sufficiently large. Since four servos are

always triggered simultaneously when "SAME" is selected, the power supply is subjected to a greater load.

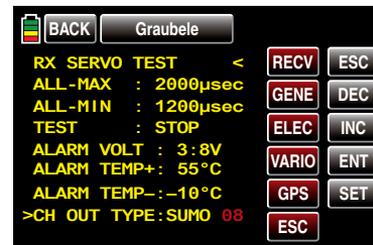
- **SUMO** (aggregate signal OUT)

A HoTT receiver configured as SUMO always generates an aggregate signal from the control signals of all its controls channels, and forwards this to servo connector 8 of the GR-24 receiver (order No. **33512**) which comes standard with the sets.

With receivers that have a two-digit number to the right of "SUMO" in their display, ...



... the active field switches to the right to channel selection by touching the **SET** button at the bottom right after "SUMO" is confirmed. With the selection, you determine the *highest* control channels within the SUMO signal.



You can confirm this setting by again touching the **SET** button at the bottom right, or use the **INC** or **DEC** buttons to select one of the other channels between 04 and 09 or 12 and confirm it with **SET**.

The receiver outputs 1 ... 8 and possibly 9 and higher are sequentially actuated in a 20 ms cycle (30 ms with the GR-32 DUAL receiver, order No. **33516**), even when 10 ms is set on the display page "RX SERVO" in the line "PERIOD", and the corresponding aggregate signal is sent to servo output 8.

Primarily conceived for the satellite operation (described below) of two HoTT receivers, the aggregate signal that is generated by the receiver and defined as a SUMO can also be used to control a flybar system, providing that it has an appropriate input, or it can be used to control flight simulators by means of the adapter cable (order No. **33310**).

In ...

satellite mode

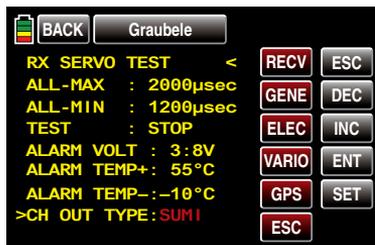
... two HoTT receivers are connected to each other by means of a three-wire connecting cable (order No. **33700.1** (300 mm) or **33700.2** (100 mm)) to servo connectors for specific receiver types. Type GR-16 receivers (order No. **33508**) and GR-24 (order No. **33512**) are for example connected to each other at servo output 8. Type GR-32 DUAL receivers (order No. **33516**) contrastingly have their own aggregate signal connector at the bottom left identified with "- + S". Further information can be found on the

Internet at www.graupner.de.

By means of this connection, all of the channels selected in the "CH OUT TYPE" line of the HoTT receiver configured as a SUMO and identified as the satellite receiver are continuously transferred to the second HoTT receiver, the main receiver, that needs to be programmed as the ...

- **SUMI** (aggregate signal IN)

The signal therefore always runs in the direction of the SUMI:



When reception fails, the receiver defined as SUMI only uses the aggregate signal coming from SUMO if at least one channel is programmed as fail safe in the SUMI.

If the reception fails of the receiver programmed as the SUMO satellite receiver, the servo(s) connected to this receiver assume the fail safe positions that are programmed in the satellite receiver independent of the main receiver.

If the reception fails for both receivers, then the fail safe settings of the SUMO are assumed in the receiver software current when these instructions were revised.

 In individual cases, interactions may occur. **It is therefore strongly recommended that relevant tests be performed before starting the model.**

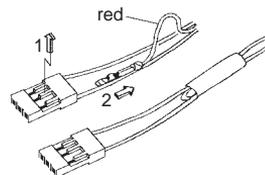
This receiver configuration is recommendable when for example one of the two receivers is installed in the model at a location with poor reception, or

nozzles, carbon fiber material, etc. may weaken the reception depending on the flight direction in which can restrict the range.

The most important control function should therefore be associated with the main receiver programmed as SUMI so that, in case of a malfunction, the model can still be controlled if the SUMO satellite receiver no longer receives a good signal. Connect telemetry sensors with the SUMO satellite receiver, and then select this receiver in the line "RECEIVER SELECT" of the "Telemetry" menu (RX 1 ... 2), see "Important instructions" on page 114.

Each receiver should be connected to the common power supply with its own cable. With receivers subject to high current load, it may even be useful to connect them to the common power supply with two cables.

If in contrast each of the two receivers are connected to their own power supply, the middle cable should be removed from one of the two plugs of the satellite cable (see figure).



If you wish to do additional programming such as fail safe settings, disconnect the 3-pin satellite connection between the two receivers, and only switch on the relevant receiver. You may also have to change the binding sequence.

- **SUMD** (digital sum signal)

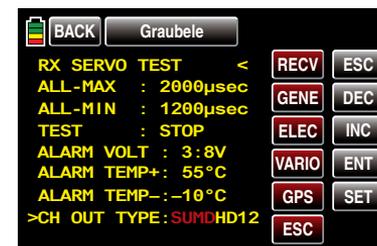
A HoTT receiver configured as SUMD as described earlier always generates a digital aggregate signal from the control signals of a selectable number of its controls channels, and forwards this to servo connector 8 in the GR-16 and GR-24 receivers.

At the time this manual was revised, this type of signal was being used by several of the latest electronic applications of flybarless systems, power sup-

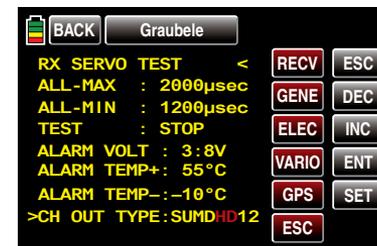
plies, etc.



You therefore need to consult your setting instructions for the attached device since otherwise you may make it impossible to fly the model.

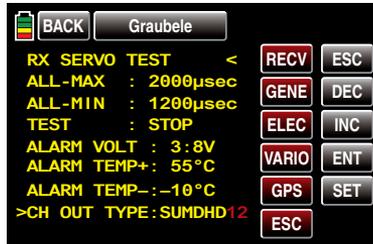


After confirming "SUMD" by touching the **SET** button at the bottom right in the display, the active value field switches to the right for selecting one of the three possible receiver reactions in case of a loss of reception (fail safe):



- **HD** ("hold")
The last signals recognized as being correct are retained at the output (hold).
- **FS** (fail safe)
The signals of previously-saved fail safe positions are provided at the output, see the section "Fail Safe" on page 84.
- **OF** (OFF)
No signals are supplied for the duration of the loss of reception.

Finally, switch the active field to channel selection by touching the **SET** button at the bottom right. With the selection, you determine the *highest* transmitter channels within the SUND signal.



Note:



Normally, a value greater than "12" is not required by potentially connectable devices.

SETTING & DATA VIEW for sensors

If one or more sensors are connected to a receiver and a telemetry link exists with this receiver, you can retrieve the display of any sensor and change its settings after the display "RX SERVO TEST" described above.



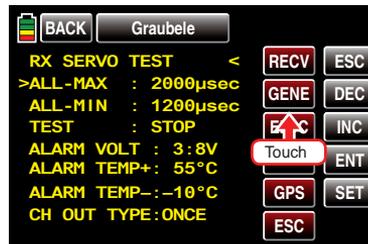
Transmitters of the **mz-18** HoTT and **mz-24** HoTT type automatically recognize any sensor or sensors connected to the receiver.

If you have connected at least one sensor to your telemetry receiver and it has firmware from the same Vx firmware package as your receiver, you can switch directly between the individual devices.

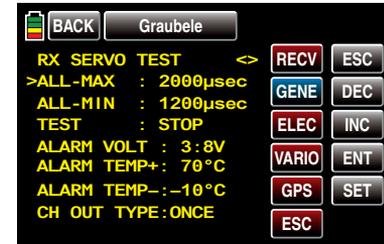
- The abbreviations on the selection buttons stand for the following:

- REC V** = Receiver
- GENE** = General air module
- ELEC** = Electric air module
- VARIO** = Vario module
- GPS** = GPS module
- ESC** = Electronic speed controller

You can switch between the displays of the automatically activated sensors by touching a red selection button with a finger or the provided stylus, for example:



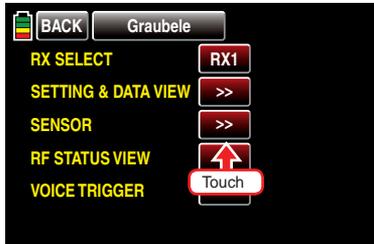
The color of the field switches to blue, and briefly afterward, an angle bracket (>) appears, providing that the sensor was actually recognized by the receiver, for example:



Press the **ENT** button at the bottom right of the display of the selected sensor, and check or change its settings as described in the instructions that came with the sensor.

SENSOR

Display of active/inactive sensors

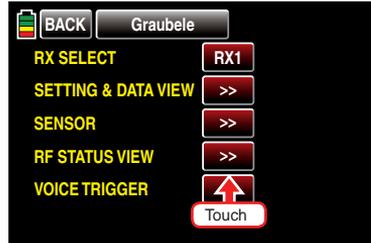


With transmitters of the type **mz-18** HoTT and **mz-24** HoTT, any sensors that are connected to the receiver are automatically recognized and activated when the power supply is switched on. Active or inactive sensors are automatically labelled in this submenu provided that a telemetry link exists. Manual sensor selection is then unnecessary and impossible, for example:

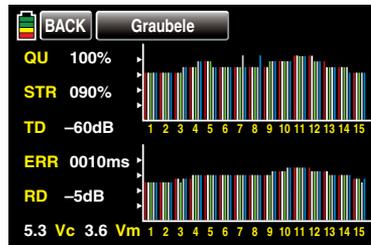


Display of RF status

Touch the corresponding button with a finger or the provided stylus ...



... to open the selected submenu. This visualises the quality of the connection between transmitter and receiver:



Top row: Level of channels 1 ... 75 coming from the receiver of the 2.4 GHz band in dBm at the transmitter.

Bottom row: Level of channels 1 ... 75 coming from the transmitter of the 2.4 GHz band in dBm at the receiver.

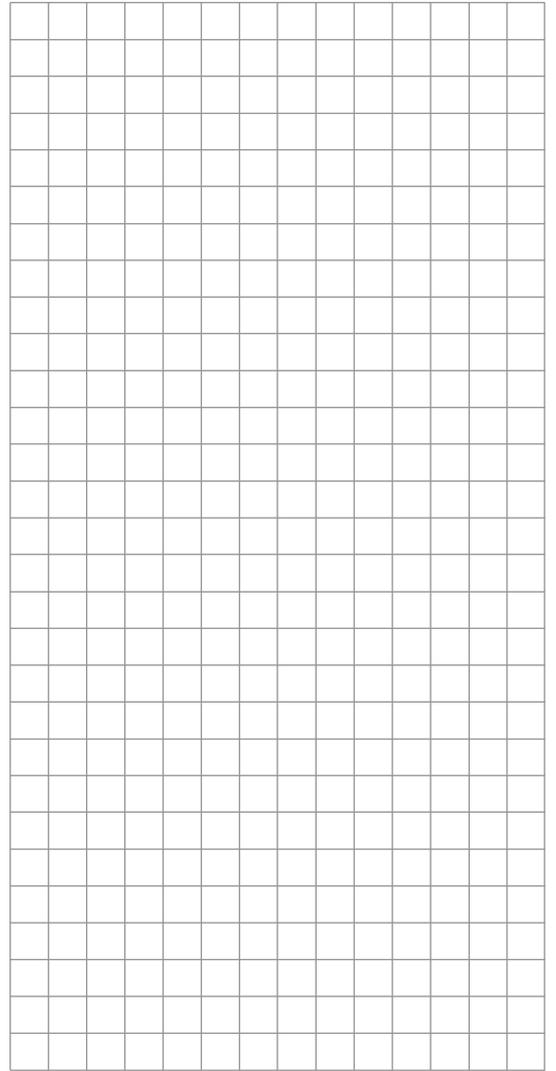
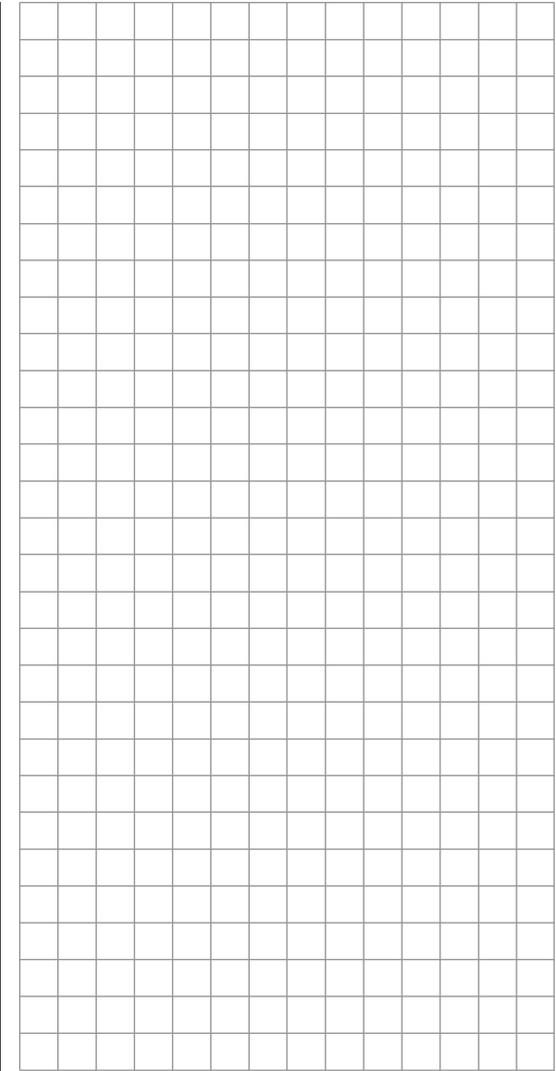
Note:

The height of the bar is a measure of the reception level expressed as logarithmic values with the unit dBm (1 mW = 0 dBm).

0 dBm corresponds to the two baselines in the above graph. Consequently, the level is poorer the higher the bar and vice versa (see also "S-dBm (reception level)" on page 116).

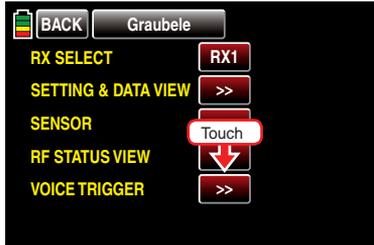
In addition to the graphic display of the reception level, additional numeric information is provided to the left. The abbreviations have the following meaning:

Value	Explanation
QUA	Quality expressed as a percentage of the signal packages from the receiver arriving at the transmitter
STR	Quality expressed as a percentage of the signal packages from the transmitter arriving at the receiver
TD	Level in dBm of the signal from the receiver arriving at the transmitter
ERR	Shows the longest time in increments of 10 ms in which data packages were lost when transmitting from the transmitter to receiver
RD	Level in dBm of the signal from the transmitter arriving at the receiver
Vc	Current operating voltage of the receiver
Vm	"L.R-VOLT" shows the lowest operating voltage of the receiver since the last time the receiver was switched on.

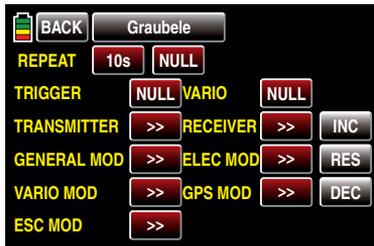


VOICE TRIGGER

Touch the corresponding button with a finger or the provided stylus ...

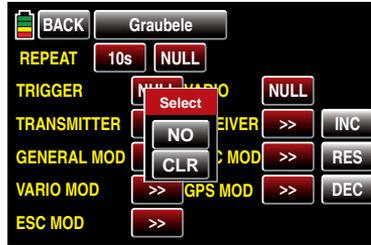
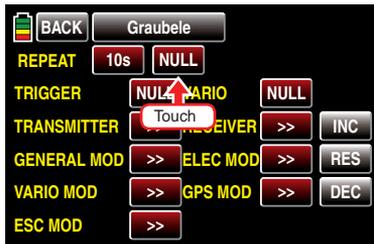


... to open the selected submenu.



REPEAT

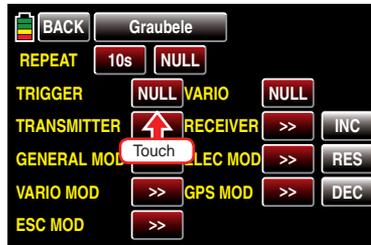
To be able to start the audio response in the headphones, the "REPEAT" line must be assigned a switch. Follow the procedure described in the section "Control, switch and control switch assignment" on page 38:



Use the selected switch to repeat the last voice trigger for the duration set to the left of the switch as long as the assigned switch is closed.

TRIGGER (VOICE TRIGGER)

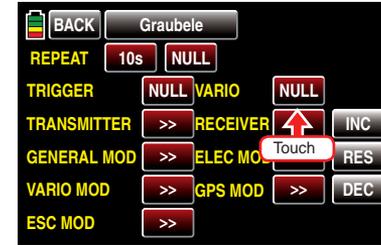
With a switch assigned to this line, preferably one of the two pushbuttons, you incrementally switch in a loop between the options (described below) "TRANSMITTER", "RECEIVER", and voice triggers selected under "Sensors".



For the subsequent switch assignment, follow the procedure described in the section "Control, switch and control switch assignment" on page 38.

VARIO

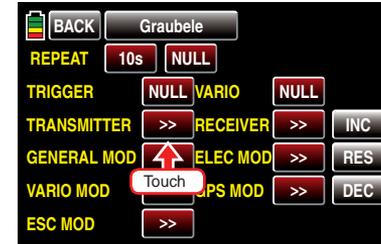
When the line "VARIO" is active in the submenu "SENSOR" (ON), you can use one of the switches assigned to this line to retrieve vario-specific voice triggers such as "slowly ascending/descending" through the transmitter's headphones independent of the other voice triggers, i.e., voice triggers triggered by a change in height.



For the subsequent switch assignment, follow the procedure described in the section "Control, switch and control switch assignment" on page 38.

TRANSMITTER

Touch the desired button with a finger or the provided stylus ...



... to open the selected submenu:

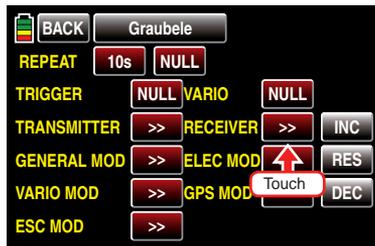


In this menu, you can activate or deactivate the voice triggers available for selection by touching them with a finger or the provided stylus, for example:



RECEIVER

Touch the desired button with a finger or the provided stylus ...



... to open the selected submenu:



In this menu, you can activate or deactivate the voice triggers available for selection by touching them with a finger or the provided stylus:

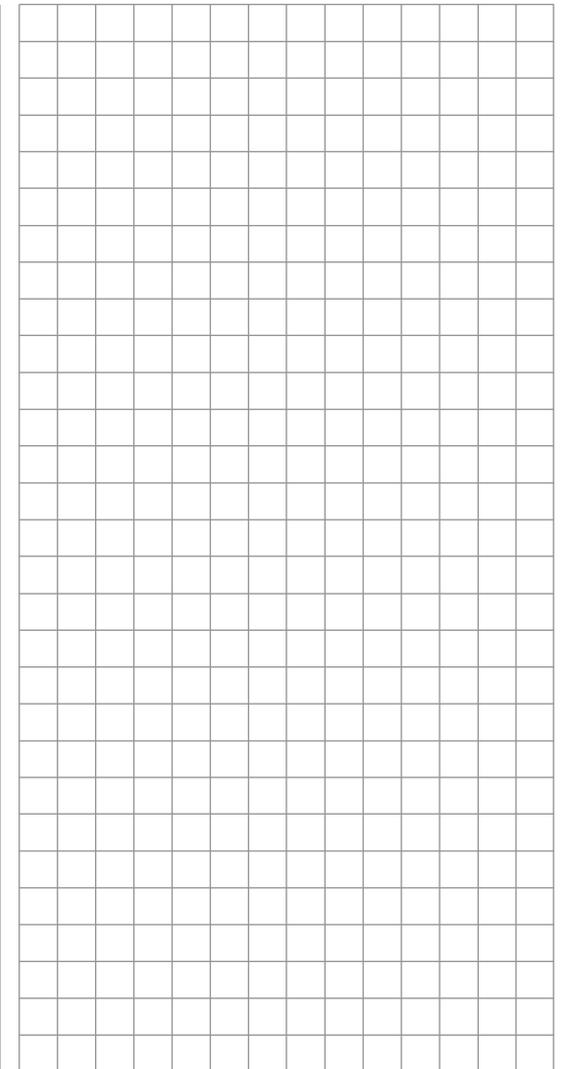
Sensors

The displays for selecting sensor-specific voice triggers should only be opened when the sensors connected to the receivers are recognized when the receiver is switched on. Three corresponding voice triggers are selected as described above.

Note:

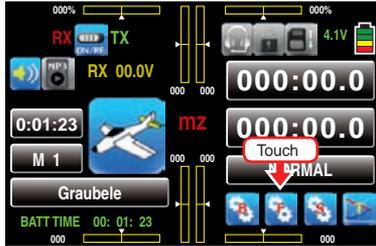


The selection made here is independent of the "VARIO" voice triggers.



Setting up Quick Links

In the basic transmitter display, use a finger or the provided stylus to touch the gear icon labelled "F":



The display switches to the blue function menu. Touch the menu item "Q.Link" with a finger or the provided stylus:



Within a model memory, the **mz-18** HoTT and **mz-24** HoTT transmitters make it possible to program up to six different settings for different flight states, normally termed Quick Links, in the corresponding menus.

Setting up Quick Links

Setting up Quick Links for fixed-wing models starts in this menu item by assigning the individual links a name and a time for smoothly switching to the respective link. The assignment sequence of links 1 to a maximum of 6 is irrelevant and can have gaps. Nevertheless, always start with "Q.LINK1" as the "NORMAL" link which is always active when ...

- no Quick Link switch is set, or
- no Quick Link has been assigned to a specific switch combination.

Assigning or leaving the Q.Link name "NORMAL" for "Q.Link1" could therefore be recommendable. The names themselves do not have any technical relevance to the program and only serve to visually identify the Q.Link that has been switched on and are therefore displayed in all Q.Link-dependent menus as well as the transmitter's main display.

"Q.Link" column

To set up the first real Q.Link, touch the desired value field in the "Q.LINK" column such as "Q.LINK1" with a finger or the provided stylus:



The color of the field switches from red to blue:



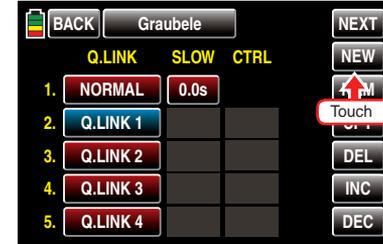
Note:



In order to set Q.LINK6, touch **NEXT** [next page] at the top right of the display.

NEW button

Activate the selected Q.Link by touching the **NEW** button with a finger in the provided stylus:

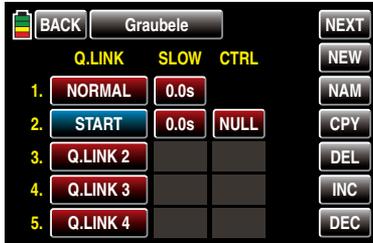


At the same time, additional value fields appear in the "DELAY" and "CTRL" columns:



NAM button

You can describe or change to the existing Q.Link name by touching the **NAM** [Name] button at the right of the display with your finger or provided stylus as described in detail in the section "Model name", starting on page 45, such as to the name "START":

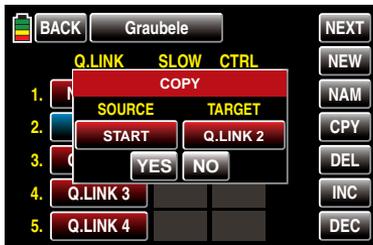


• **CPY button** (copy)

A blue, and therefore active, adjusted Q.Link can be copied to any another Q.Link by touching the **CPY** [copy] button at the right of the display with your finger or the provided stylus, for example:

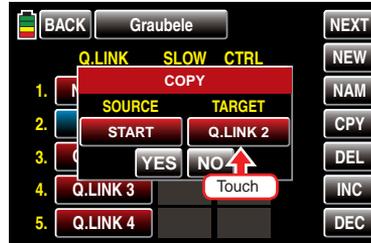


After you touch the **CPY** button, a window appears and asks you the reason for copying:

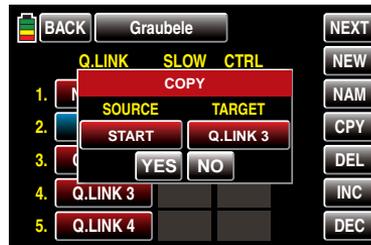


The next Q.Link is entered in this window by default. To change this setting, repeatedly touch the button below "TARGET" with a finger or the provided stylus

...

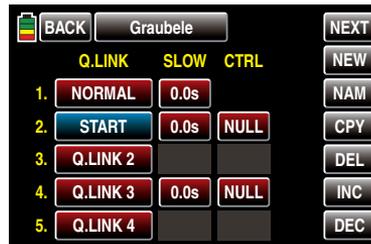


... until the desired Q.Link appears, for example:



Touch **NO** with a finger or the provided stylus to terminate the procedure.

Touch **YES** with a finger or the provided stylus to confirm the procedure: The source Q.Link is copied to the selected target Q.Link.



You can change the existing Q.Link name as described in detail in the section "Model name", starting on page 45, and/or adapt to the transferred delay or transferred switch to your needs.

• **DEL button** (delete)

A blue, and therefore active, adjusted Q.Link can be deleted by touching the **DEL** [delete] button at the right of the display with your finger or the provided stylus, for example:



• **"DELAY"** column

If you switch Q.Links, it is advisable to program a time for a smooth transmission to the respective Q.Link. It is therefore also possible to set a different time for switching from a Q.Link to (for example) Q.Link 3 then for switching to Q.Link 1.

To change a switchover time, activate the value field "switchover time" for the desired Q.Link by touching it with your finger or the provided stylus, for example:



The color of the field switches from red to blue:



Set the desired value with the **INC** or **DEC** button at the bottom right. In the blue and hence active value field, you can select switchover times from 0 to 9.9 seconds, for example:



Use the same procedure with the other Q.Links.

Note:

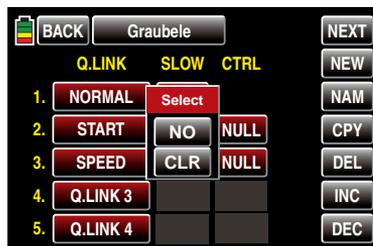


The switchover time, that is set here, acts uniformly on all Q.Link-specific settings as well as all mixers that are activated in the

Wing Mix menu. The switchover between Q.Link-dependent mixers then also proceeds smoothly.

- "CTRL" column (control/switch)

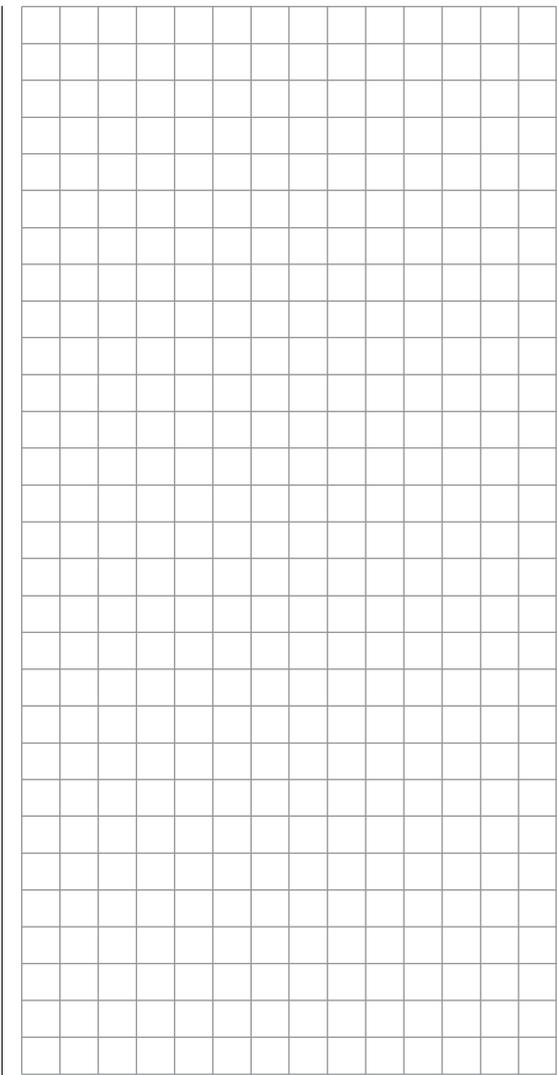
In the previously described columns "Q.Link" and "DELAY", you assigned names to Q.LINK1 ... Q.LINK6 and may have programmed switchover times; however switching between the Q.Links is not yet possible. To enable this, touch the desired value field in the "CTRL" column with a finger or the provided stylus, for example ...



... and assign a switch or control switch as described in the section "Control, switch and control switch assignment" on page 38.

After you have finished making your settings, touch the **BACK** button at the top left of the display to return to the menu selection:

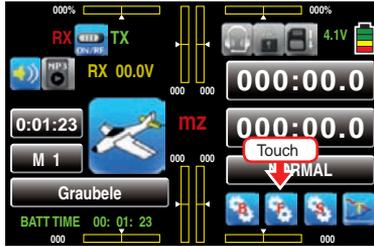




D/R,EXP

The control characteristic for the aileron, elevator and rudder as well as control functions 5 ... 9 or 5 ... 12

In the basic transmitter display, use a finger or the provided stylus to touch the gear icon labelled "F":



The display switches to the blue function menu. Touch the menu item "D/R,EXP" with a finger or the provided stylus.



The dual rate/expo function allows you to switch or influence the control deflections and characteristics of the aileron (AILE), elevator (ELEV) and rudder (RUDD), i.e. control functions 2 ... 4, independent of the Quick Link using controls if desired.



An individual characteristic curve for control function 1 (throttle/brake) can be set in the menu "THR.CRV", see page 144, by means of which 7 separately programmable points can be set. Similar to the control travel setting in the display "CH5-9" or "CH5-12", **dual rate** acts directly on the corresponding *control function* independent of whether it affects the individual servo or several servos by means of complex mixing and coupling functions.

The control deflections can be set for each switch position between 0 and 125% of the normal control travel.

Expo allows a more sensitive control of the model in the central position of the respective control function (aileron, elevator and rudder) for values greater than 0% without having to do without the complete deflection in the end position of the control stick.

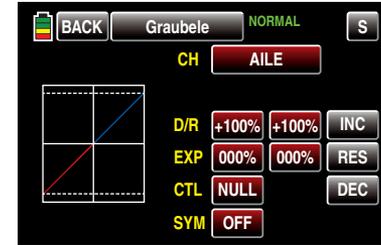
Conversely, the effect of the control around neutral position increases for values less than 0% and decreases in the direction of the full deflection. The progression can be set from -100% to +100%; 0% corresponds to the normal linear control characteristic.

There is another use for the most common rotary servos: The actual rudder control is nonlinear since the rudder deflection from the control linkage becomes increasingly smaller as the angle of rotation of the connecting pulley or cantilever increases. When expo values are greater than 0%, this effect can be counteracted so that the angle of rotation increases disproportionately as the control stick deflection increases.

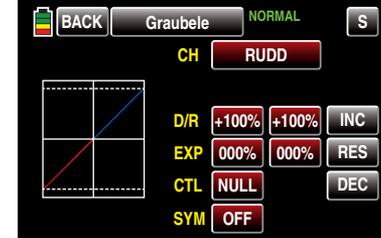
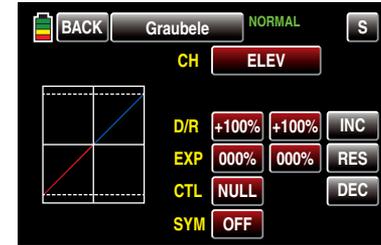
The EXP setting always acts directly on the corresponding control function independent of whether it affects the individual servo or several servos by means of complex mixing and coupling functions.

The D/R and EXP functions can be switched together by a single control if the control has been correspondingly assigned. It is therefore possible to link the dual rate and expo functions which can be advantageous, especially with fast models.

In the graphic of the display, the curve characteristics are shown directly to make it easier to evaluate the curve dependent on control travel.



Between the displays of individual control functions, alternately touch the value field of the line "Ch" with a finger or the provided stylus:





Note:



In contrast to the display of the 12-channel mz-24 HoTT transmitter in this section, only channels 1 ... 9 are offered in the display of the 9-channel mz-18 HoTT transmitter.

Q.Link-dependent D/R and EXP settings

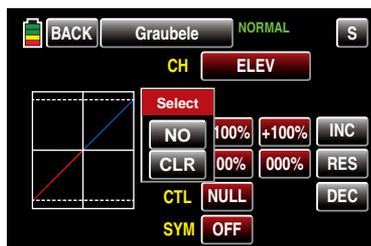
If you have created Quick Links in the submenu "Q.Link", page 132, and have assigned an appropriate name, it appears at the top right in green font such as "NORMAL". Activate the corresponding switches if desired to switch between Quick Links.

Setting symmetrical or asymmetrical values

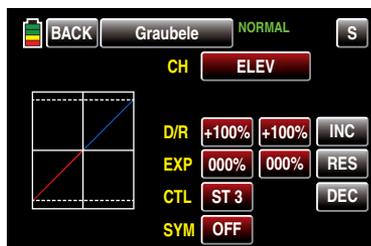
By default, the dual rate and/or expo values for the selected control function are set for each control side. After switching the option "SYM", added to the bottom line as of firmware version 1020, from **OFF** to **ON**, a simultaneous (symmetrical) setting of both control sides is possible.

D/R function

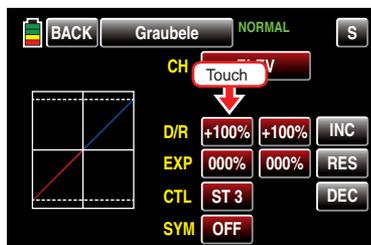
If you want to switch between two versions, assign a control in the line "CTL" as described in the section "Control, switch and control switch assignment" on page 38.



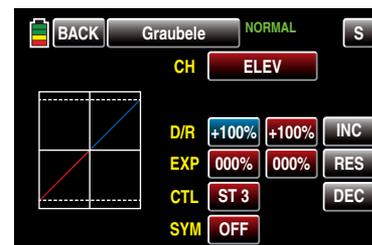
If desired, a control switch as well, for example:



With a finger or the provided stylus, touch the left value field in the "D/R" line to set a dual rate value to the minus side of the control travel, and/or on the right to set a dual rate value on the plus side of the control travel, for example:



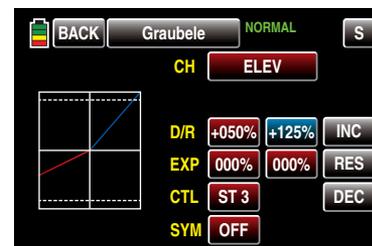
The color of the field switches from red to blue:



Set the desired value with the **INC** or **DEC** button at the right edge.

The adjustment range is $\pm 125\%$.

Use the same procedure for a value on the plus side of the control travel, for example:



The dual rate curve is simultaneously displayed in the graph.

Touch the **RES** button to reset a changed value in the blue (and hence active) field to the default.

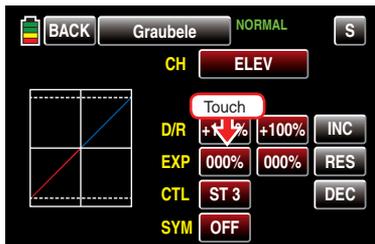
NOTE:



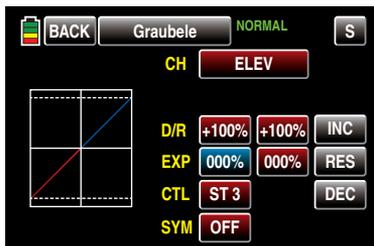
For safety reasons, the dual rate value should not fall below 20%.

Exponential function

To program the exponential function, touch the left value field in the EXP line with a finger or the provided stylus to set an exponential value to the minus side of the control travel, and/or on the right to set an exponential value on the plus side of the control travel, for example:



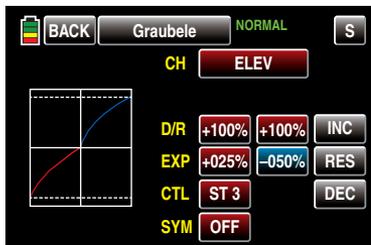
The color of the field switches from red to blue:



Set the desired value with the **INC** or **DEC** button at the right edge.

The adjustment range is $\pm 100\%$.

Use the same procedure for a value on the plus side of the control travel, for example:



The exponential curve is simultaneously displayed in the graph.

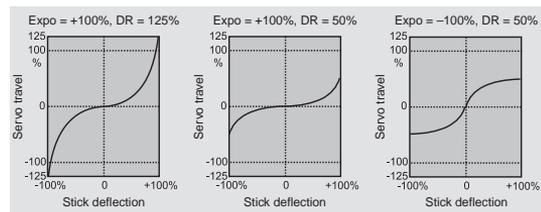
Note:



The curve shown here is only for demonstration purposes and does not represent an actual exponential curve.

Combining dual rate and exponential values

If you enter a value for both the dual rate and exponential function, the effects of the two functions overlap as follows:



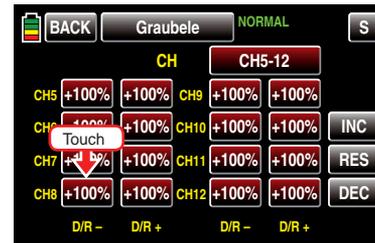
Display "CH5 ... 9" or "CH5 ... 12"

In the "CH set" menu in the base menu, starting on page 92, let us say you have assigned a control element to one of control functions 5 ... 9 or 5 ... 12, such as the side proportional slider SL1 to input 8:

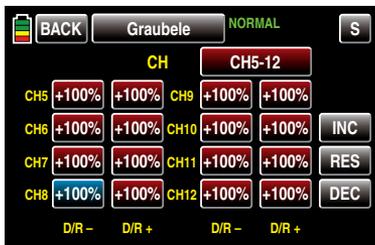


You can define this travel in the display "CH5 ... 9" or "CH5 ... 12", if desired in relation to a specific Q.Link.

With a finger or the provided stylus, touch the left value field in the corresponding line to set a value to the minus side of the control travel, and/or on the plus side of the control travel, for example:



The color of the field switches from red to blue:



Set the desired value with the **INC** or **DEC** button at the right edge.

The adjustment range is $\pm 125\%$.

Use the same procedure for a value on the plus side of the control travel, for example:



Touch the **RES** button to reset a changed value in the blue (and hence active) field to the default.

Note:

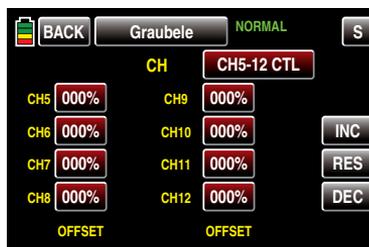


In contrast to the display of the 12-channel mZ-24 HoTT transmitter in this section, only channels 1 ... 9 are offered in the display of the 9-channel mZ-18 HoTT transmitter.

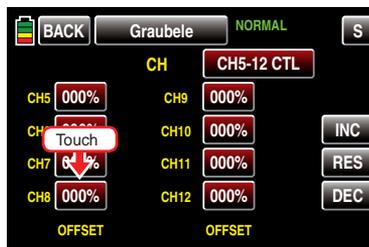
Offset

As described above, in the "CH set" submenu of the base menu, page 92, you have assigned a control element to one of control functions 5 ... 9 or 5 ... 12, such as the side proportional slider SL1.

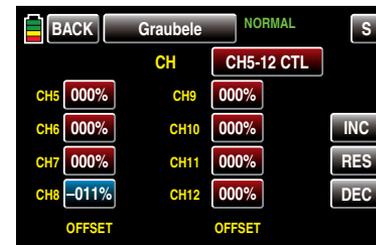
Change the center of this control element, i.e., its zero point (if desired with reference to a specific Q.Link), in the last display of the "D/R,EXP" menu.



With a finger or the provided stylus, touch the offset value to be changed, for example:



The color of the value field switches from red to blue. Set the desired value with the **INC** or **DEC** button at the right edge, for example:



The adjustment range is $\pm 125\%$.

Touch the **RES** button to reset a changed value in the blue (and hence active) field to the default.

Note:



In contrast to the display of the 12-channel mZ-24 HoTT transmitter in this section, only channels 1 ... 9 are offered in the display of the 9-channel mZ-18 HoTT transmitter.

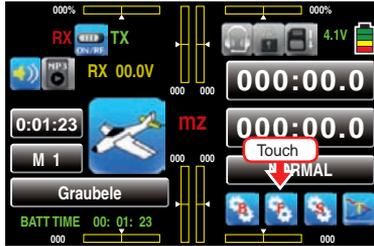
After you have finished making your settings, touch the **BACK** button at the top left of the display to return to the menu selection:



Wing Mix

Adjusting mixers

In the basic transmitter display, use a finger or the provided stylus to touch the gear icon labelled "F":



The display switches to the blue function menu. Use a finger or the provided stylus to touch the "Wing Mix" menu item:



• Q.Link-dependent settings

If you have created Quick Links in the submenu "Q.Link", page 132, and have assigned an appropriate name, it appears at the top right in green font such as "NORMAL". Activate the corresponding switches if desired to switch between Quick Links.

• ACT column (active)

Within the value field for this column, specify whether the mixer is generally blocked **INH** or **ON**.

Once you set this value field to **ON**, you can switch on and off the mixer with a control assigned in the right column "CTL".

• "SET" column

To switch to the setting menu, touch the corresponding **>>** button in the "SET" column with a finger or the provided stylus.

• Ctrl column (control/switch)

In the value field in the Ctrl column, assign a control or control switch to the mixer as described in section "Control, switch and control switch assignment" on page 38.

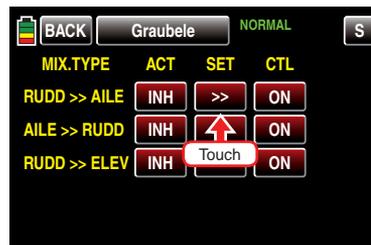
RUDD >> AILE line (rudder >> aileron)

Frequently, the behaviour of the longitudinal axis is influenced when the rudder is actuated. This is particularly problematic in "knife edge flying" in which the only lift is from the fuselage when the rudder is deflected since the wings are vertical in this flight position. This can cause a model to rotate as if the aileron were actuated. A correction is necessary along the longitudinal axis (aileron) within an adjustable range when the rudders are controlled.

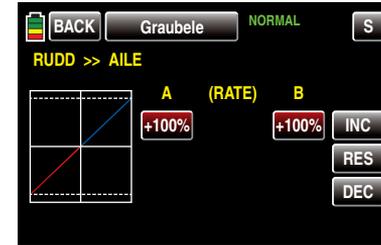
Of course, the rudder and aileron remain separately controllable.

The setting range of $\pm 150\%$ makes it possible to appropriately adapt the direction of deflection. This mixer can optionally be switched on and off by one of the controls which cannot be independently reset, or a control switch if applicable, so that the model can be controlled exclusively using the aileron or rudder.

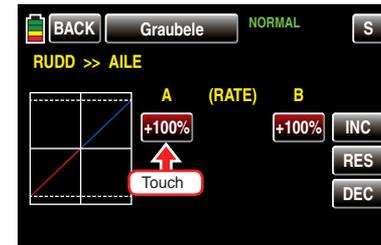
To set the mixer, use a finger or the provided stylus to touch the middle button in the line "RUDD >> AILE":



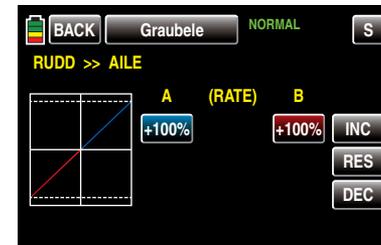
The corresponding setting menu opens:



To enable this, touch the desired value field, such as the left one, with a finger or the provided stylus:

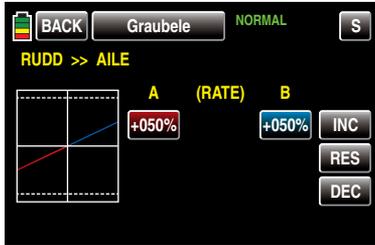


The color of the field switches from red to blue:



Set the desired value with the **INC** or **DEC** button at the right edge.

Use the same procedure for a value on the plus side of the control travel, for example:



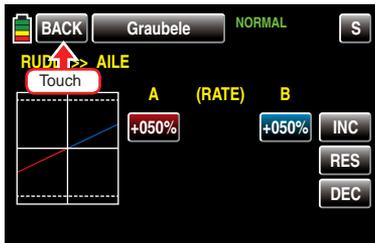
Touch the **RES** button to reset a changed value in the blue (and hence active) field to the default.

Note:



To graphically display the current servo positions, you can access them from nearly every menu with the button labelled **SERVO** or **S** in the top right of the display with a finger or the provided stylus. Touch the **BACK** button to return to your starting point.

Touch the **BACK** button at the top left of the display ...



... to return to the mixer selection:



AILE >> RUDD line (aileron >> rudder)

The rudder also moves to an adjustable degree when the aileron is actuated. This can compensate for the negative torque in conjunction with aileron differentiation, page 150, which smoothes flight in curves. Of course, the rudder remain separately controllable.

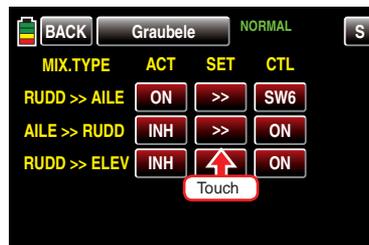
The setting range of $\pm 150\%$ makes it possible to appropriately adapt the direction of deflection. This mixer can optionally be switched on and off by one of the controls which cannot be independently reset, or a control switch if applicable, so that the model can be controlled exclusively using the aileron or rudder.



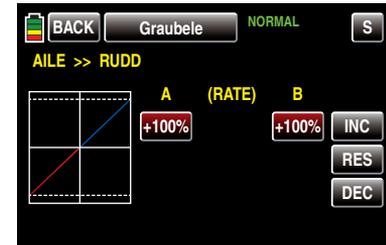
Normally, this mixer is adjusted so that the rudder extends on the side of aileron moving upward; an adjustment of 50% is generally appropriate.

The adjustment should normally be only be symmetrical with the neutral point of the aileron control stick.

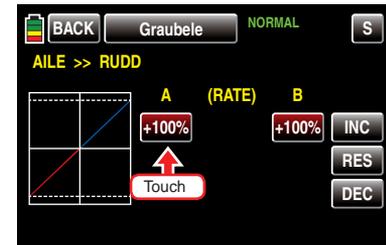
To set the mixer, use a finger or the provided stylus to touch the middle button in the line "AILE >> RUDD":



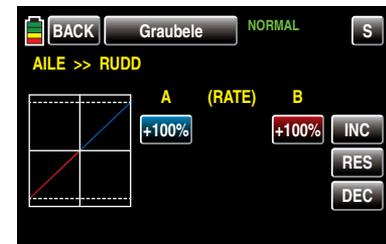
The corresponding setting menu opens:



To enable this, touch the desired value field, such as the left one, with a finger or the provided stylus:

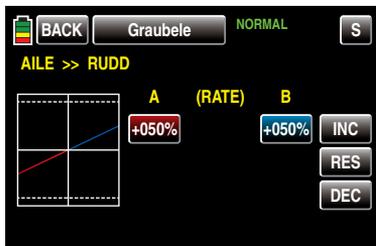


The color of the field switches from red to blue:



Set the desired value with the **INC** or **DEC** button at the right edge.

Use the same procedure for a value on the plus side of the control travel, for example:



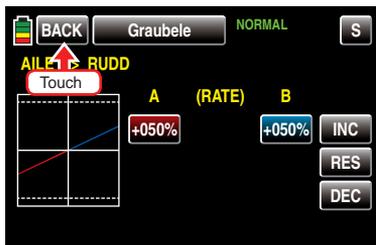
Touch the **RES** button to reset a changed value in the blue (and hence active) field to the default.

Note:



To graphically display the current servo positions, you can access them from nearly every menu with the button labelled **SERVO** or **S** in the top right of the display with a finger or the provided stylus. Touch the **BACK** button to return to your starting point.

Touch the **BACK** button at the top left of the display ...



... to return to the mixer selection.



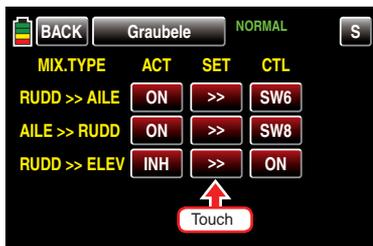
RUDD >> ELEV line (rudder >> elevator)

Frequently, the behaviour of the transverse axis is influenced when the rudder is actuated. This is particularly problematic in "knife edge flying" in which the only lift is from the fuselage when the rudder is deflected since the wings are vertical in this flight position. Changes in direction can occur as if the elevator were actuated. A correction is necessary along the transverse axis (elevator) within an adjustable range when the rudders are controlled.

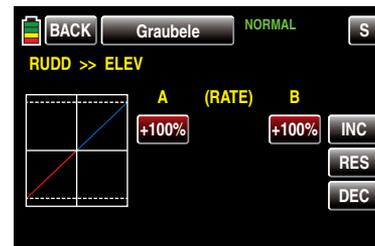
Of course, the rudder and elevator remain separately controllable.

The setting range of $\pm 150\%$ makes it possible to appropriately adapt the direction of deflection. This mixer can optionally be switched on and off by one of the controls which cannot be independently reset, or a control switch if applicable, so that the model can be controlled exclusively using the rudder or elevator.

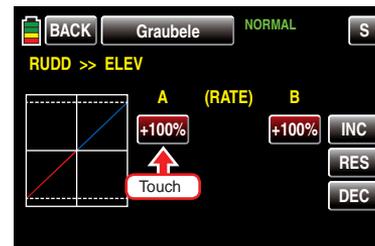
To set the mixer, use a finger or the provided stylus to touch the middle button in the line "RUDD >> ELEV":



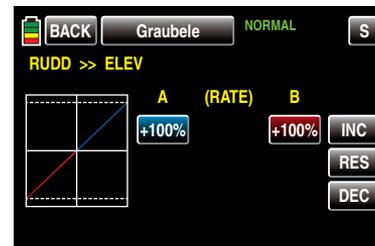
The corresponding setting menu opens:



To enable this, touch the desired value field, such as the left one, with a finger or the provided stylus:

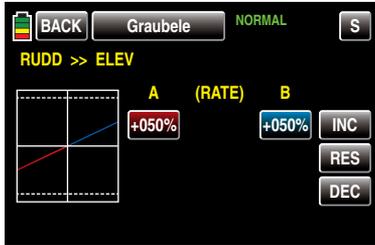


The color of the field switches from red to blue:



Set the desired value with the **INC** or **DEC** button at the right edge.

Use the same procedure for a value on the plus side of the control travel, for example:



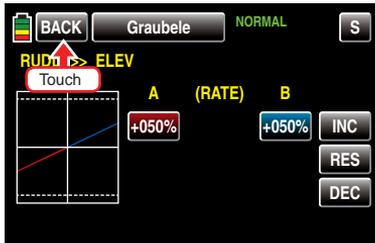
Touch the **RES** button to reset a changed value in the blue (and hence active) field to the default.

Note:



To graphically display the current servo positions, you can access them from nearly every menu with the button labelled **SERVO** or **S** in the top right of the display with a finger or the provided stylus. Touch the **BACK** button to return to your starting point.

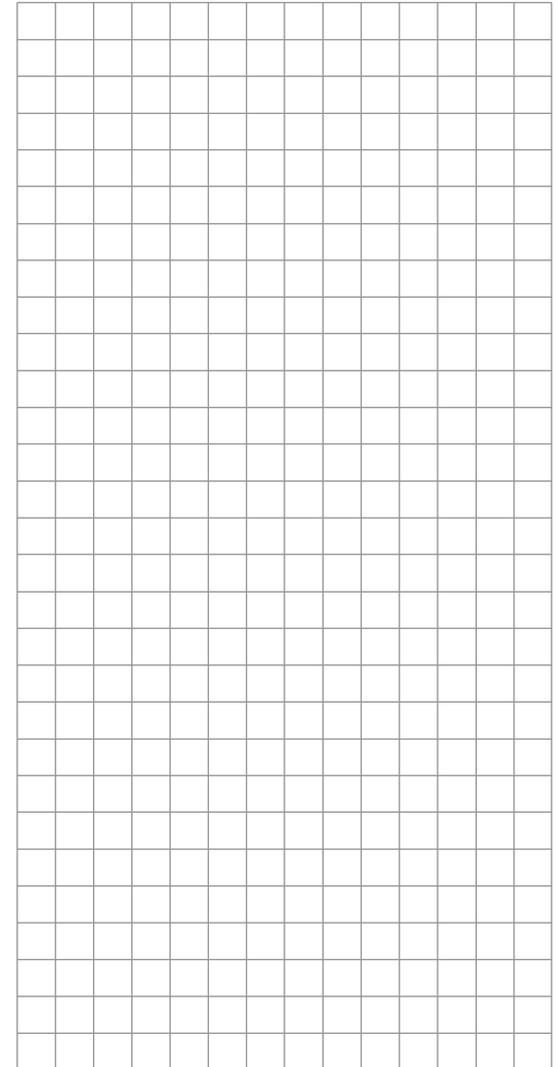
Touch the **BACK** button at the top left of the display ...



... to return to the mixer selection.



After you have finished making your settings, touch the **BACK** button at the top left of the display to return to the menu selection.



Setting the control characteristic of the Throttle/brake control stick

Note:



This menu is hidden when selecting a model with "NO POWER" in the basic settings of the "Model Sel" or "Model type" menu.

In the basic transmitter display, use a finger or the provided stylus to touch the gear icon labelled "F":



The display switches to the blue function menu. Use a finger or the provided stylus to touch the "THR.CRV" menu item:



In this menu, you can adapt the carburettor characteristic as well as the idle LOW and "motor off" position of the throttle.

This menu allows you to change the *control characteristic of the throttle control stick* independent of whether the control function acts directly on a servo connected to control channel 1, or via a number of mixers on several servos.

Q.Link-dependent settings

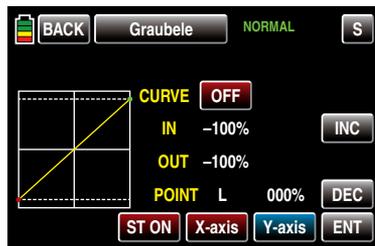
If Quick Links are specified in the "Q.Link" menu, page 132, this option can be adopted depending on the Quick Link. The name of the Quick Link is displayed in green at the top right of the display, such as "NORMAL".

First switch to the desired Quick Link, if desired.

Changing the control direction

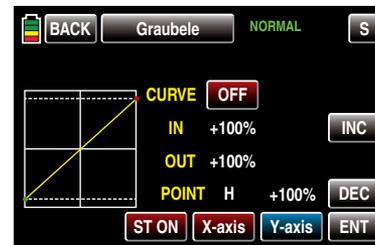
In the wing program of the **mz-18** HoTT and **mz-24** HoTT transmitters, the rear throttle position is the default for the "motor off" position with electric drives, and "idle LOW" for gas motors. By inverting the throttle curve, the control direction of the throttle can be changed as needed from "accelerate from back to front" to "accelerate from front to back".

Switch on the graphic and numerical display of the control stick position by touching the **ST OFF** button at the bottom left of the display with a finger or the provided stylus, and then activate the Y-coordinate adjustment option by touching the **Y-axis** button:

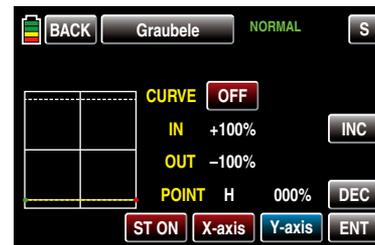


Use the throttle to move a vertical green line between the two endpoints "L" and "H" in the graphic. The momentary control stick position is also displayed numerically in the line "IN" (-100% to +100%).

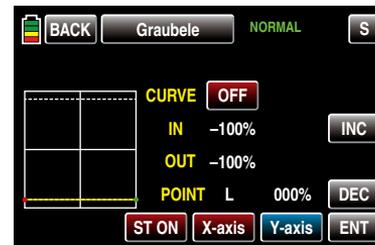
Then move the throttle to one of the two end positions such as the front. The green line moves the right and disappears under the white frame. At the same time, the color of the point at the top right changes from green to red:



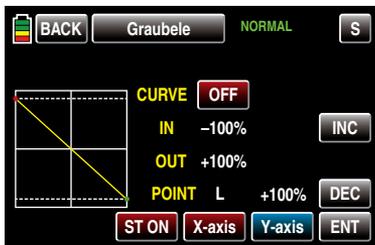
Hold down the **DEC** button at the right edge of the display with a finger or the provided stylus to move the red point down to a value of 000% in the line "POINT":



Then move the throttle to the opposite end position, such as the rear. The green line moves to the left, and the points at the ends of the yellow horizontal line change color:



Use a finger or the provided stylus to hold down the **INC** button at the right side of the display until a value of +100% is reached in the "POINT" line.

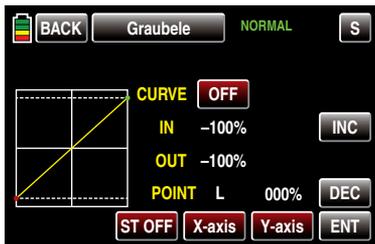


Such an inverted control signal acts on all following mixed and coupling functions and the active Power OFF time of the Thro Position.

Setting support points

The control curve can be specified by up to 7 points, termed support points in the following, along the entire control stick travel: The graphic display makes it much easier to specify the support points and their adjustment. It is, however, recommendable to start with just a few support points.

In the basic setting in the program, 2 support points describe a linear characteristic, that is, the two endpoints at the bottom control stick stop "L" (low = -100% control travel) and at the top control stick stop "H" (high = +100% control travel).



- **ST OFF / ST ON** button

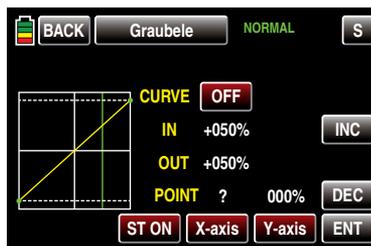
Touch this button with a finger or the provided stylus to switch on and off the graphic and numeric display of the control stick position.

Use the control element (throttle) to then move a

vertical green line between the two endpoints "L" and "H" in the graphic. The momentary control stick position is also displayed numerically in the line "IN" (-100% to +100%). The intersection of this line with the curve is identified as "OUT" and can be varied at the support points between -125% and +125%. The control signal which is changed in this way then affects all of the following mixing and coupling functions.

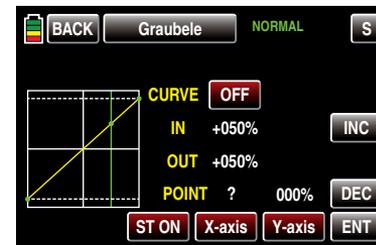
In the following example, the control stick is exactly halfway between the middle and end of its path, at +50% of the control path, and generates an output signal that is also +50% due to the linear characteristic.

Between the two endpoints "L" and "H", up to five additional support points can be set, and the distance between neighbouring support points may not be less than approximately 25%.

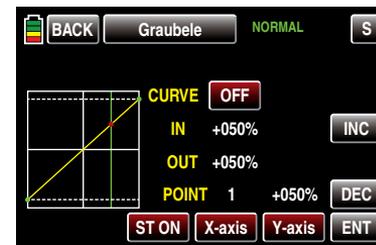


- **ENT** button

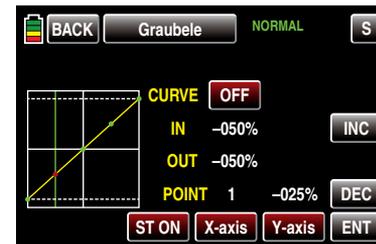
Move the control stick. As long as there is a question mark next to the right of "POINT", you can press the **ENT** button set the next support point. At the same time, a green point appears at the intersection between the yellow and green lines:



Once the green line is moved with the control stick around the point, it becomes red, and the "?" is replaced with a number, and the point to value appears in the value field to the right of the support point number:

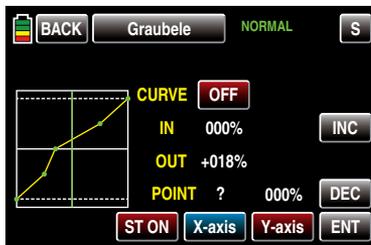
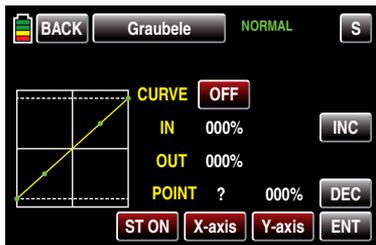
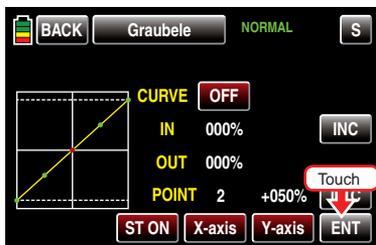


The sequence, in which the up to 5 points between the edge points "L" and "H" are generated, does not matter since the support points are automatically renumbered sequentially from left to right after one support point is set or deleted, for example:



Deleting a support point

In order to delete the set support points 1 to 5, move the vertical green line with the control stick next to the relevant support point. Once the support point number appears along with the associated value in the line "POINT" and the point is red (see the screenshot below), you can delete it by touching the **ENT** button, for example:



Touch the **X-axis** button again to deactivate the function.

Note:

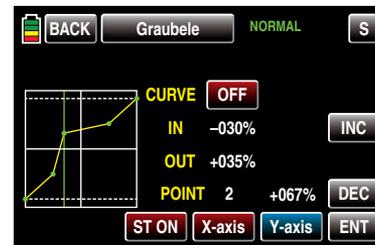
- 

If you move the red point horizontally away from the current control position, the point soon becomes green and a "?" appears in the POINT line. This question mark does not relate to the point which has been moved but rather indicates that another point can be set at the current control position.
- Remember that the percentages in the "IN" and "OUT" line always refer to the momentary position of the control stick and not to the position of the point.

Y-axis button (Y-axis)

Activate this function by touching the button at the bottom edge of the display with a finger or the provided stylus.

You can then move an active (red) point upward by pressing the **INC** button, or to the left by pressing the **DEC** button, for example:



Touch the **Y-axis** button again to deactivate the function.

Note:

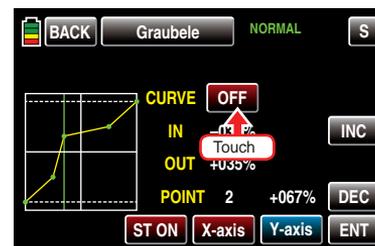
- 

Remember that the percentages in the "IN" and "OUT" line always refer to the momentary position of the control stick and not to the position of the point.

Rounding off the channel 1 curve

ON/OFF button in the "Curve" line

The default angled curve profile can be automatically rounded off by turning on the rounding function by pressing this button with a finger or the provided stylus, for example:

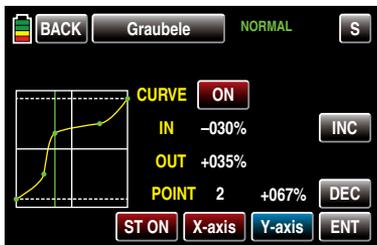


Changing the support point value

X-axis button (X-axis)

Activate this function by touching the button at the bottom edge of the display with a finger or the provided stylus.

You can then move an active (red) point to the right by pressing the **INC** button, or to the left by pressing the **DEC** button, for example:



Important note:



The curves shown here are only for demonstration purposes and do not represent actual throttle curves.

After you have finished making your settings, touch the **BACK** button at the top left of the display to return to the menu selection.



Idle LOW

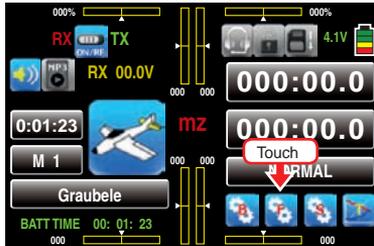
Setting a stable idle

Note:



This menu is hidden depending on the basic settings of the "Model Sel" or "Model type" menu.

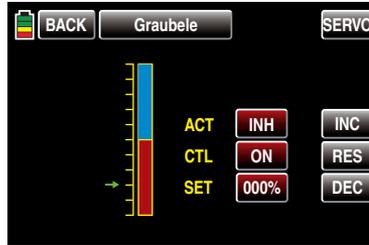
In the basic transmitter display, use a finger or the provided stylus to touch the gear icon labelled "F":



The display switches to the blue function menu. Touch the menu item "Idle LOW" with a finger or the provided stylus:

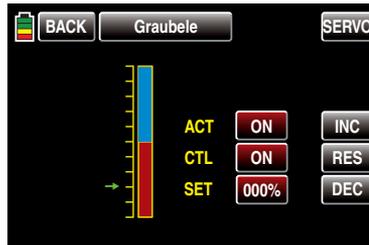


Normally, the idle of a gas motor is set using the digital trim control for the throttle. This idle position of the throttle servo (which depends on the position of the trim control) can be adjusted as necessary to a higher or lower idle with a switch to a value that can be set in this menu within a range of $\pm 20\%$.

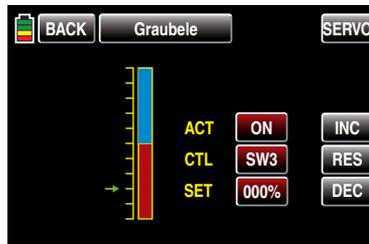


Programming

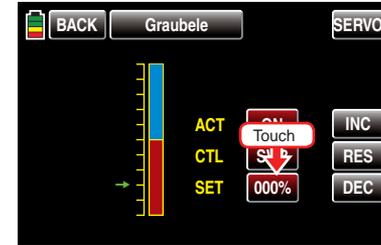
In the "ACT" line, activate or deactivate the "Idle LOW" option by touching the associated button with a finger or the provided stylus, for example:



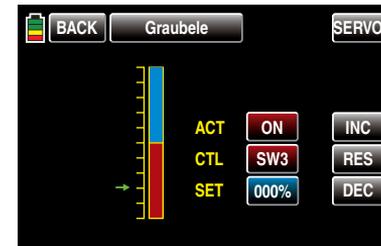
In the "CTL" line, assign a control for adding or removing the corrective value to be set in the line "SET" as described in the section "Control, switch and control switch assignment" on page 38, such as:



In the "SET" line, set the desired corrective value by touching the associated value field with a finger or the associated stylus:



The color of the field switches from red to blue:



Set the desired value with the **INC** or **DEC** button at the right edge.



The adjustment range is $\pm 100\%$. A value of +100% moves the idle position of the throttle servo set with the throttle trim 20% toward Idle LOW, and vice versa.

Touch the **RES** button to reset a changed value in the blue (and hence active) field to the default.

After you have finished making your settings, touch the **BACK** button at the top left of the display to return to the menu selection.

Snap roll

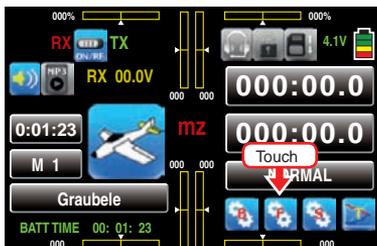
Automated programming

Note:



This menu is hidden depending on the basic settings of the "Model Sel" or "Model type" menu.

In the basic transmitter display, use a finger or the provided stylus to touch the gear icon labelled "F":



The display switches to the blue function menu. Use a finger or the provided stylus to touch the "Snap roll" menu item:



Some pilots like to automatically program snap rolls when flying.

Flight-phase-dependent settings

If you have created Quick Links in the submenu "Q.Link", page 132, and have assigned an appropriate name, it appears at the top right in green font such as "NORMAL". Activate the corresponding switches if desired to switch between Quick Links:



The automated programming described here for the **mz-18** HoTT and **mz-24** HoTT transmitters enables up to four pre-programmed snap settings (positive right/negative right and positive left/negative left) per Quick Link. The position of the switch assigned to the individual presets determines the respective figure program in which the control stick signals are set at a fixed value independent of the momentary control stick positions. That is, all aileron, elevator and rudder servos move as if the relevant control stick had been shifted to the preset position.

As usual, you can activate settings within a range of $\pm 150\%$ in the blue value field activated by a finger or the provided stylus with the three buttons at the right edge of the display, for example:



In general, the individual figure programs are activated and deactivated by switching the corresponding value field in the "ACT" column from **INH** to **ON** or vice versa, by touching them with a finger or the provided stylus, for example:



Finally, you should assign each activated figure program, as described in the section "Control, switch and control switch assignment" on page 38, a control with which you can switch on and off the figure programs during flight.

WARNING:



Never switch on one of these figure programs accidentally, especially during flight! If the programs are switched on at the wrong location or time, it can cause significant property damage and/or injury.

After you have finished making your settings, touch the **BACK** button at the top left of the display to return to the menu selection:



Aile differentiation

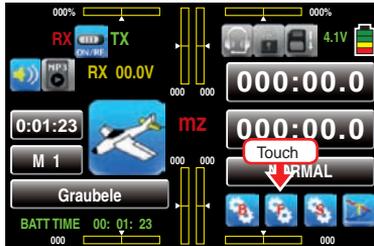
Setting the aileron differentiation

Note:



This menu is hidden when you select "1AILE" or "1AILE 1FLAP" in the "Model Sel" or "Model type" menu.

In the basic transmitter display, use a finger or the provided stylus to touch the gear icon labelled "F":



The display switches to the blue function menu. Use a finger or the provided stylus to touch the "AILE diff" menu item:

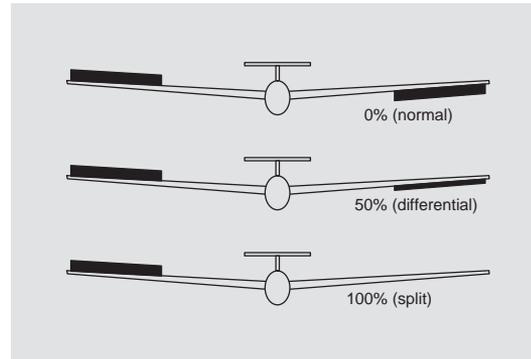


An aileron deflected downward generates greater resistance for aerodynamic reasons than one deflected upward.

Given this asymmetrical resistance, torque is generated about the vertical axis which causes a turning out of the intended flight direction. This undesirable side-effect is also determined adverse yaw. This effect naturally occurs more strongly on the comparatively long wings of gliders than with motorized airplanes with their generally much shorter lever arms, and normally must be compensated by a simultaneous, counteracting

rudder deflection. This rudder deflection also generates additional resistance and impairs flight.

If the rudder deflection is differentiated so that the downward deflection of the aileron is less than the upward deflection, the adverse yaw can be reduced or eliminated. In order for this to work, each aileron must have its own servo that can also be installed in the wings. The shorter linkages yield the additional benefit of more consistent aileron positions that have less play.



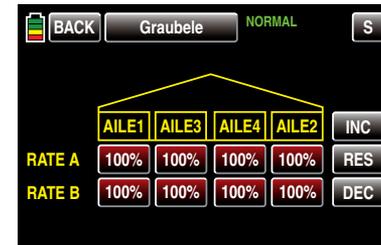
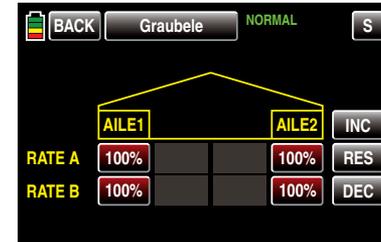
The conventional differentiation that is now provided by the transmitter has significant advantages over earlier mechanical solutions that were generally permanently set while building the model and generated additional play during operation in cases of strong differentiation.

Now, the degree of differentiation can be changed at any time, and downward aileron deflections can be entirely suppressed in the so-called split position. This reduces or suppresses adverse yaw and can even generate positive yaw in certain instances to cause rotation about the vertical axis in the direction of the curve in response to an aileron deflection. In large gliders, smooth curves can be easily generated using just the ailerons.

Flight-phase-dependent settings

If you have created Quick Links in the submenu "Q.Link", page 132, and have assigned an appropriate

name, it appears at the top right in green font such as "NORMAL". Activate the corresponding switches if desired to switch between Quick Links.



Note:

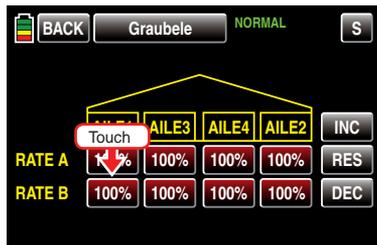


The available setting options depend on the number of ailerons selected in the "Model Sel" or "Model Type" menu.

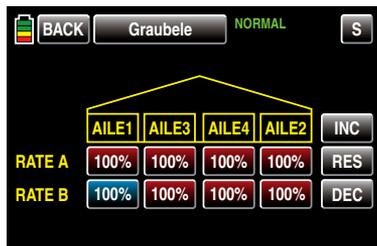
The adjustment range of 100% to both sides allows you to adjust different deflection on the right side independent of the direction of rotation of the aileron servos. 100% (travel) corresponds to normal deflection (no differentiation), and 0% (travel) corresponds to the split function.

High absolute values are required during stunt flying in order for the model to rotate precisely about the longitudinal axis when the aileron is deflected. Average values of about 50% are typical for supporting curved flight in a thermal. Split position (0% travel downward) is useful in ridge soaring if you want to execute a turn with just the ailerons.

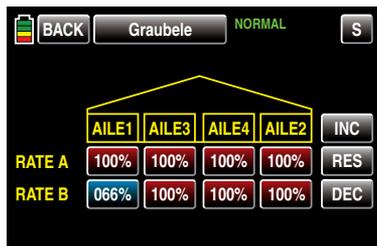
To change a value, touch the corresponding value field with a finger or the provided stylus, for example:



The color of the field switches from red to blue:



Then, in the active (blue) value field, press **INC** to increase the current value and **DEC** to reduce it, for example:



Use same procedure with the differentiation value for the right aileron and any inboard aileron.

Touch the **RES** button to reset a changed value in the blue (and hence active) field to the default.

After you have finished making your settings, touch the **BACK** button at the top left of the display to return to the menu selection:



Flap mixer

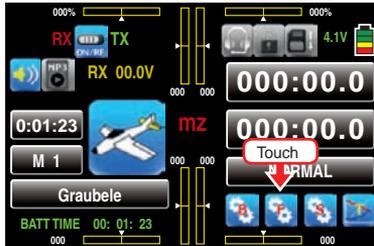
Adjustment of the flap mixer

Note:



This menu is hidden when you only select "1AILE" or "2AILE" in the "Model Sel" or "Model type" menu.

In the basic transmitter display, use a finger or the provided stylus to touch the gear icon labelled "F":

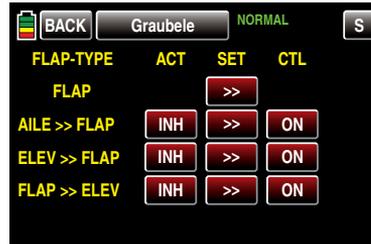


The display switches to the blue function menu. Use a finger or the provided stylus to touch the "Flap MIX" menu item:



Flight-phase-dependent settings

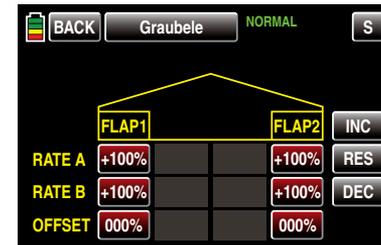
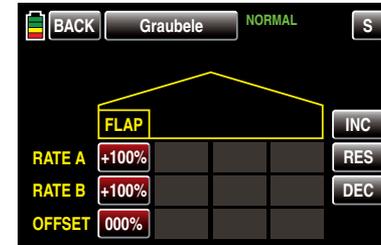
If you have created Quick Links in the submenu "Q.Link", page 132, and have assigned an appropriate name, it appears at the top right in green font such as "NORMAL". Activate the corresponding switches if desired to switch between Quick Links:



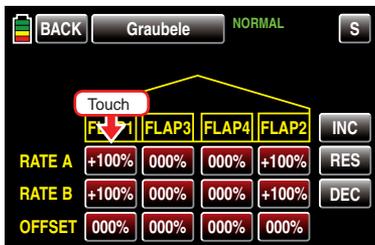
- "ACT" column** (active)
 Within the value field for this column, specify whether the mixer is generally blocked **INH** or **ON**. Once you set this value field to **ON**, you can switch on and off each mixer individually with a control assigned in the right column "CTL".
- "SET" column**
 To switch to the setting menu, touch the corresponding **>>** button in the "SET" column with a finger or the provided stylus.
- "CTL" column** (control/switch)
 In the value field in the CTL column, assign a control or control switch to the mixer as described in section "Control, switch and control switch assignment" on page 38.

FLAP line

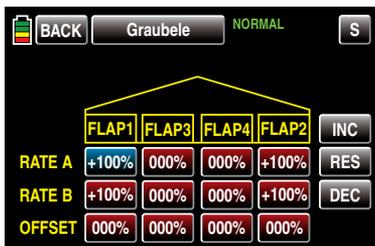
Depending on the selected number of flaps, the display shows one of three views:



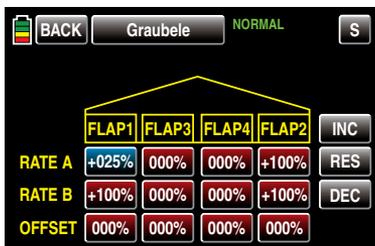
- Lines RATE A / B**
 If you have activated Q.Link trim as described in the section "Flap Sett", starting on page 156, you can change the effect in the value fields for the two lines. Touch the corresponding value field with a finger or the provided stylus, for example:



The color of the field switches from red to blue:



Then, in the active (blue) value field, press **INC** to increase the current value within a range of $\pm 125\%$ and **DEC** to reduce it, for example:

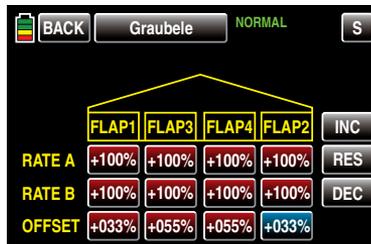


Use the same procedure with value for the downward deflection of the left flap (RATE B) and for the values of the right flap and for any second flap pair. Symmetrical and asymmetrical values are possible.

• "Offset" line

In this line, set the Q.Link-specific positions for all of the flaps in the respective model. This allows you to set the positions that the individual flaps are to assume for each Q.Link.

The adjustment range of $\pm 100\%$ allows the flaps to be moved to the desired position independent of the rotational direction of the flap servos, for example:



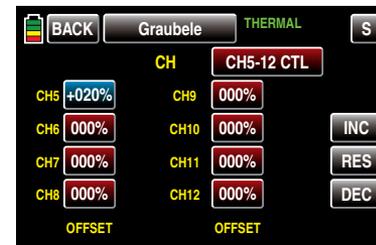
Note:



The available setting options depend on the number of flaps selected in the "Model Sel" or "Model Type" menu.

- The flap offset value set here is transferred to the Quick Link trim described in the following section, "Flap Set".

Set the Quick Link-specific flap positions of the aileron in the **mz-18** HoTT transmitter in the display "CH 5-9" or in the **mz-24** HoTT transmitter in the display "CH 5-12" of the respective "D/R,EXP" menu, starting on page 136, in line "CH5" such as in the Quick Link "THERMAL":



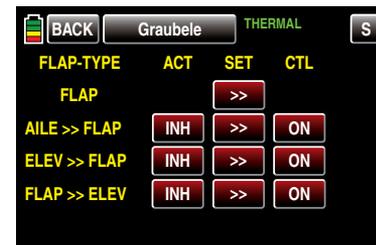
Note:



In contrast to the above display of the 12-channel **mz-24** HoTT transmitter, only channels 1 ... 9 are offered in the display of the 9-channel **mz-18** HoTT transmitter.

Touch the **RES** button to reset a changed value in the blue (and hence active) field to the default.

After you have finished making your settings, touch the **BACK** button at the top left to return to the mixer selection:



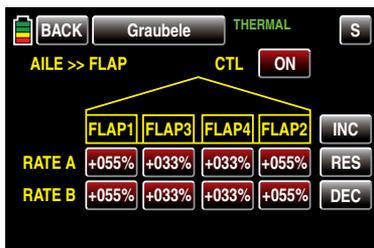
AILE >> FLAP line

In this line, you can set for each Quick Link the amount of movement of the flap pair "FLAP" (and possibly "FLAP2") as an aileron when the aileron is actuated. Normally, the flaps follow the ailerons with less deflection, that is, the mixed amount is less than 100%. The setting range of $\pm 125\%$ makes it possible to appropriately adapt the direction of deflection to the ailerons depending on the direction of rotation of the

flap servos.

Since all values are set separately, the aileron deflections of the flaps can also be different.

Adapt the individual values as described above, for example:



Note:



The available setting options depend on the number of flaps selected in the "Model Sel" or "Model Type" menu.

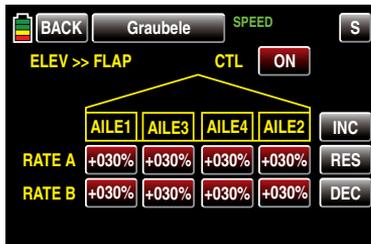
After you have finished making your settings, touch the **BACK** button at the top left to return to the mixer selection:



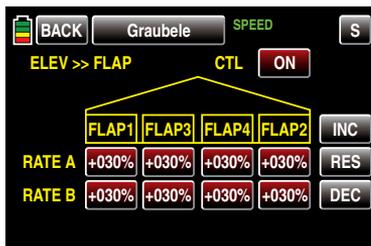
ELEV >> FLAP line

To support the elevator in tight curves and aerobatics, the flap function can be included by controlling the elevator with this mixer. Select the mixing direction so that the flaps move downward when the elevator is pulled (up), and conversely upward when the elevator is pushed (down), that is, in an opposite direction.

A symmetrical or an asymmetrical effect can be defined for each flap pair. Values of $\pm 125\%$ are possible. By default, uniform values of $+30\%$ are set for the aileron ...



... and the flaps:



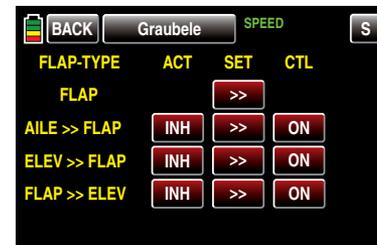
Adapt the individual values as described under "FLAP line".

Note:



The available setting options depend on the number of flaps selected in the "Model Sel" or "Model Type" menu.

After you have finished making your settings, touch the **BACK** button at the top left to return to the mixer selection:

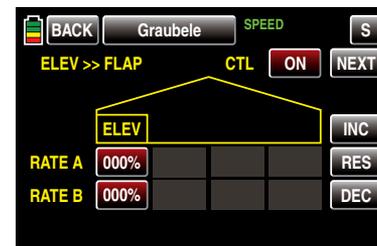


FLAP >> ELEV line

When setting flaps, upward or downward torque can arise about the transverse axis. It may also be desirable for the model to pick up the pace somewhat when slightly elevating the flaps. Both of these reactions can be achieved with the mixer.

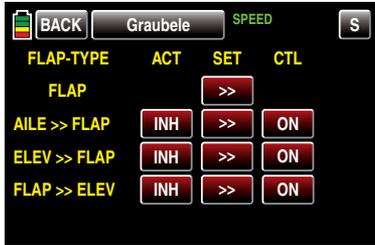
When setting the flaps, you can use this mixer to have the position of the aileron automatically track the flaps depending on the set value. The setting can be symmetrical or asymmetrical to the neutral point of the flap control.

The adjustment range is $\pm 125\%$. With this mixer, normal settings lie within the single-digit to low double -digit range. By default, 0% is uniformly set:

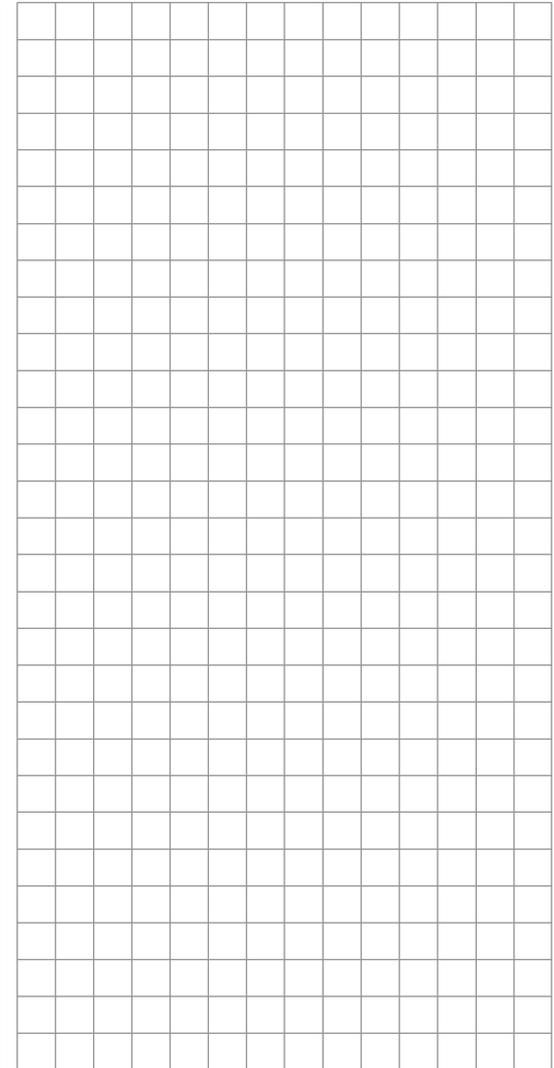


Adapt the individual values as described at the beginning of this section under "FLAP line".

After you have finished making your settings, touch the **BACK** button at the top left to return to the mixer selection:



After you have finished making your settings, touch the **BACK** button at the top left of the display to return to the menu selection:



Flap Sett

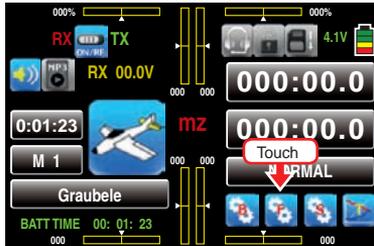
Adjusting the effect of the flap servo

Note:



This menu is hidden when you only select "1AILE" in the "Model Sel" or "Model type" menu.

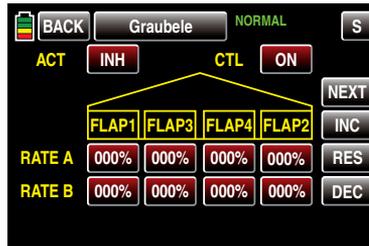
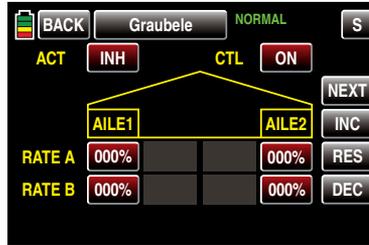
In the basic transmitter display, use a finger or the provided stylus to touch the gear icon labelled "F":



The display switches to the blue function menu. Use a finger or the provided stylus to touch the "Flap Sett" menu item:



Depending on the selected number of ailerons and flaps, the display shows different views: The top of the two following figures shows the display when setting the minimum "2AILE" and the bottom figure shows the display when selecting the maximum "... 4FLAP".



Flight-phase-dependent settings

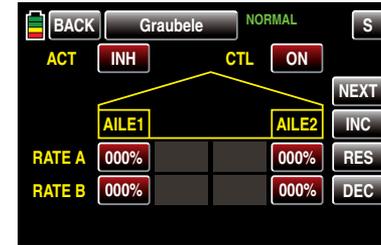
If you have created Quick Links in the submenu "Q.Link", page 132, and have assigned an appropriate name, it appears at the top right in green font such as "NORMAL". Activate the corresponding switches if desired to switch between Quick Links.

Programming

In the submenu "CH SET", page 92, let us say you have assigned a control or switch to input 6 (identified as "FLAP" or "FLAP1" depending on the selected number of flaps), for example, with a model having two aileron servos and two flap servos:

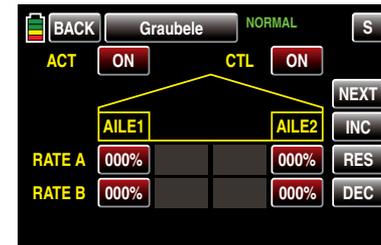


- **Option ACT** (active/blocked)
If the value field to the right of "ACT" is set to **INH** or **OFF** ...



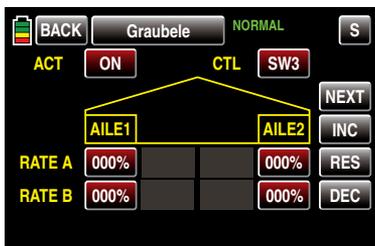
... the control element assigned to input 6 in the submenu "CH set" affects servos 6 and 7. In a model with only one flap servo, the control element only acts on servo 6 exclusively with the values set in the submenu "D/R,EXP" of the function menu.

If this value field is set to **ON** ...



... the control element assigned to the input 6 in the submenu "CH set" is switched to the Quick Link trim function described below in this section. However, a proportionate influence of the values set in the submenu "D/R,EXP" of the function menu is retained. In the displays described below, you specify the effect of the control elements assigned to channel 6 in the menu "CH set", page 92, in the form of a Quick Link trim on the positions of the ailerons, flaps, and possibly the elevators.

- **CTL option** (control/switch)
In the value field in the CTL column, assign a control or control switch for a specific Quick Link to the mixer as described in the section "Control, switch and control switch assignment" on page 38, for example in the Quick Link "THERMAL":



NOTE:

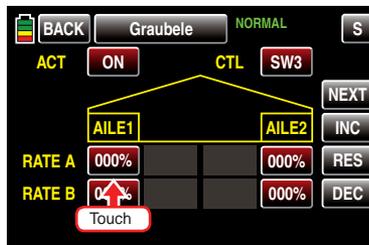


If you select **OFF**, you switch off both the Quick Link trim described here as well as the values saved in the submenu "D/R,EXP"! By default, this is 100% per side.

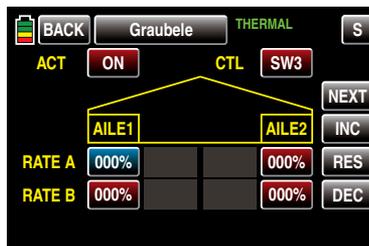
Lines RATE A / B

A symmetrical or an asymmetrical effect can be defined for each flap pair. If you leave the travel setting in line CH5 at 100% in the display "CH5-9" or "CH5-12" in the menu "D/R,EXP", page 136, 5-20% is generally sufficient.

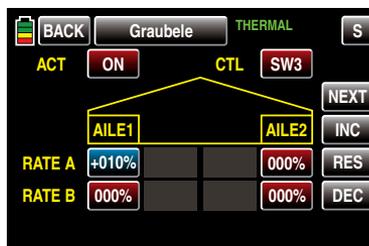
Switch to the desired Quick Link, and touch the value field to be set with a finger or the provided stylus:



The color of the value field switches from red to blue:



In the active (blue) value field, press **INC** to increase the current value within a range of ±100% and **DEC** to reduce it, for example:

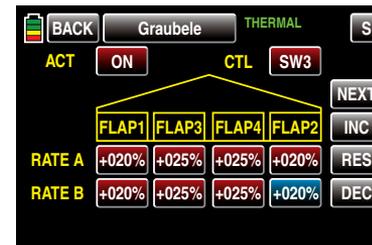


Use same procedure with the other values to be set, as well as any inboard aileron "AILE3" and "AILE4".

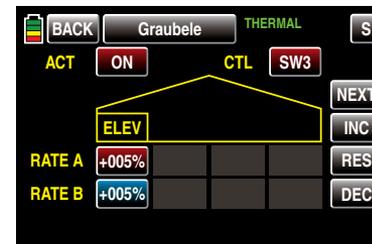
Touch the **RES** button to reset a changed value in the blue (and hence active) field to the default.

After completing the settings for the ailerons, you can switch to the page for setting the flaps by touching **NEXT** at the right edge of the display and enter the

desired settings using the procedure described above, for example:



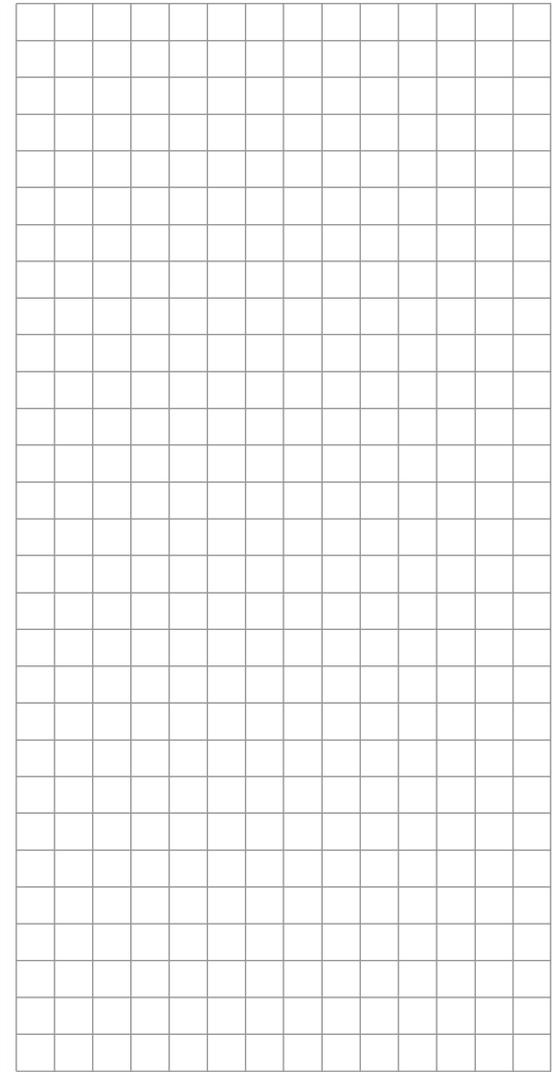
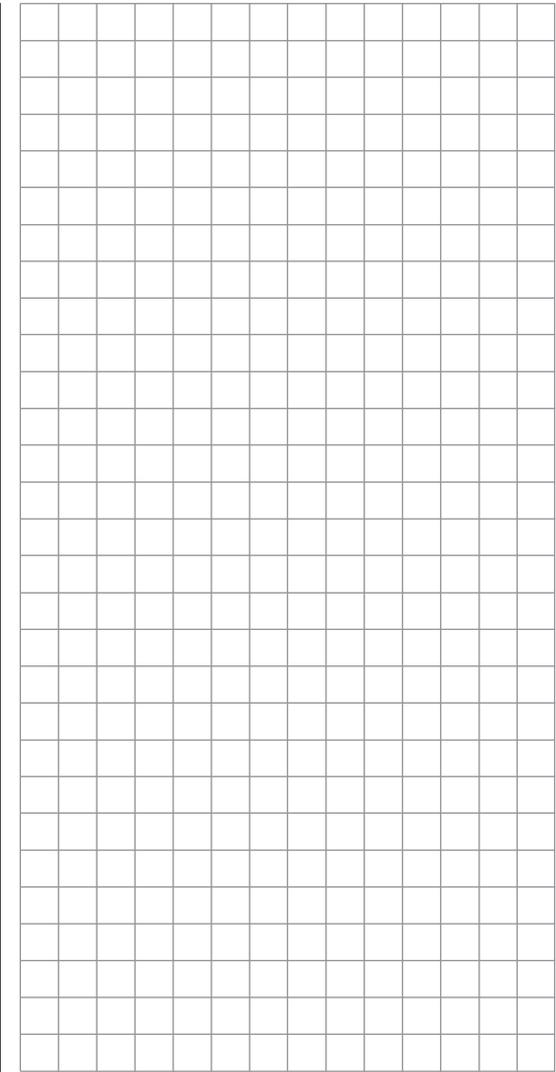
Finally, you can switch to the page for setting the elevator by touching **NEXT** at the right edge of the display and enter the desired settings using the procedure described above, for example:



Note:



By default, no control has been assigned to input 6 in the menu "CH set". However, you can assign a control or switch at a time at any time and hence set different flap positions within a quick link as described in this section.



Airbrake

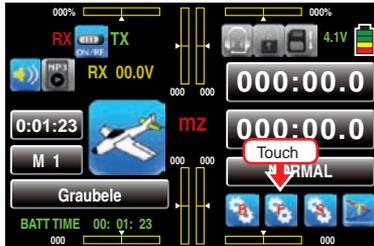
Adjusting the braking system of airplanes

Note:



This menu is hidden when you only select "1AILE" in the "Model Sel" or "Model type" menu.

In the basic transmitter display, use a finger or the provided stylus to touch the gear icon labelled "F":



The display switches to the blue function menu. Use a finger or the provided stylus to touch the "Airbrake" menu item:



Depending on the selected number of ailerons and flaps, the display shows different views: The top of the two following figures shows the display when setting the minimum "2AILE" and the bottom figure shows the display when selecting the maximum "... 4FLAP".



Flight-phase-dependent settings

If you have created Quick Links in the submenu "Q.Link", page 132, and have assigned an appropriate name, it appears at the top right in green font such as "NORMAL". Activate the corresponding switches if desired to switch between Quick Links.

Programming

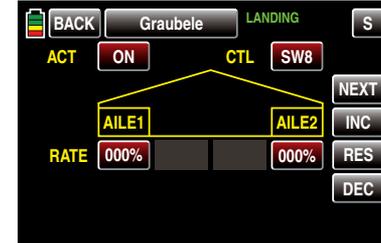
In the display described below, enter the amount and direction of the deflection of your flaps, and possibly also the elevator, for braking. In order for these settings to be effective and retrievable with a switch, for example, start programming the option fields "ACT" and "CTL" described below:

- Option ACT** (active)

Within the value field for this column, specify whether this function is generally blocked (**INH**) or **ON**. Once you set this value field to **ON**, you can switch on and off the effect of the selected control element on the flap position for specific quick links individually with a control assigned in the option field "CTL".

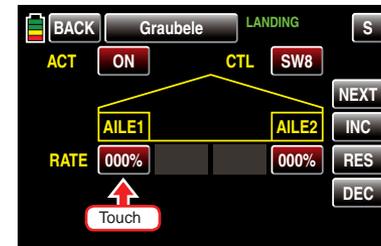
- CTL option** (control/switch)

In the value field in the CTL column, assign a control or control switch for a specific Quick Link to the mixer as described in section "Control, switch and control switch assignment" on page 38, for example in the Quick Link "LANDING":

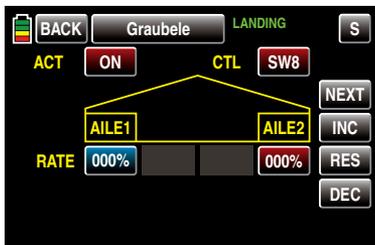


RATE line

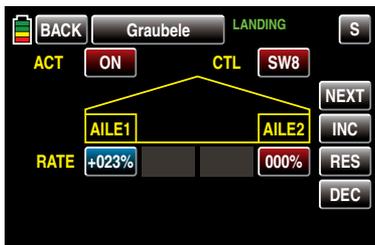
A symmetrical or an asymmetrical effect can be defined for each flap pair. In order to be able to define upward and downward deflections, the setting range is $\pm 150\%$. Switch to the desired Quick Link such as "LANDING", and touch the value field to be set with a finger or the provided stylus:



The color of the value field switches from red to blue:



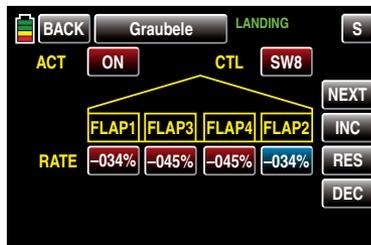
In the active (blue) value field, press **INC** to increase the current value within a range of $\pm 150\%$ and **DEC** to reduce it, for example:



Use the same procedure for the value of the aileron on the opposite side as well as any inboard ailerons.

Touch the **RES** button to reset a changed value in the blue (and hence active) field to the default.

After completing the settings for the ailerons, you can switch to the page for setting the flaps by touching **NEXT** at the right edge of the display and enter the desired settings using the procedure described above, for example:



To prevent the sudden deflection of (brake) flaps adjusted in this manner when activating the selected control, touch in the **NEXT** button at the right of the display to go to the last display of this option. Incorporate a delay for the *deflection* of the flaps as described above, for example:



Note:



Smoothly retract the flaps by setting up a "LANDING" Quick Link in addition to the "NORMAL" Quick Link in the "Q.Link" menu, page 132, and incorporate a switching delay. For the switch, use the same control that (is to be) used to trigger the braking function.

After you have finished making your settings, touch the **BACK** button at the top left of the display to return to the menu selection:



Butterfly

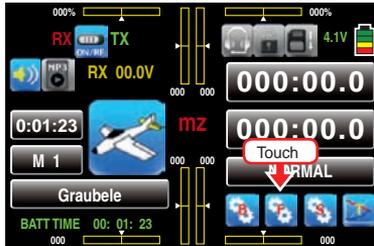
Adjusting the braking system of gliders

Note:



This menu is hidden depending on the basic settings of the "Model Sel" or "Model type" menu.

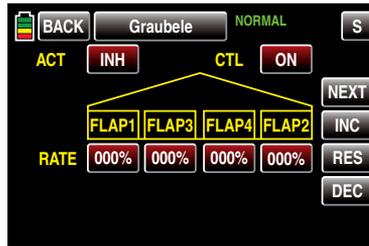
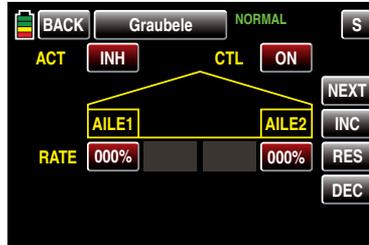
In the basic transmitter display, use a finger or the provided stylus to touch the gear icon labelled "F":



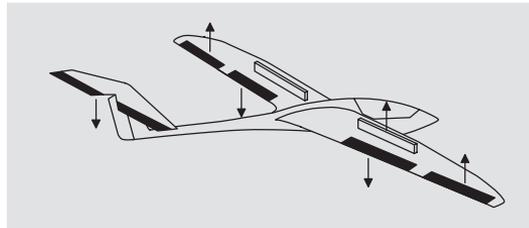
The display switches to the blue function menu. Use a finger or the provided stylus to touch the "Butterfly" menu item:



Depending on the selected number of ailerons and flaps, the display shows different views: The top of the two following figures shows an example of the display when setting the minimum "2AILE" and the bottom figure shows the display when selecting the maximum "... 4FLAP".



In this menu, you can set a special flap arrangement, named *crow position* or *butterfly*. In this braking position, both ailerons are moved slightly upward, and the flaps move downward as far as possible. By means of a third mixer, the elevator is trimmed so that the flight speed does not change significantly in comparison to the normal flight position.



This interaction of the flaps, aileron and elevator control the gliding angle when approaching a landing. (The butterfly flap position is often used in sport and competition gliders instead of speed brakes or spoilers.)

Flight-phase-dependent settings

If you have created Quick Links in the submenu "Q.Link", page 132, and have assigned an appropriate name, it appears at the top right in green font such as "NORMAL" (see figures on the left). Activate the corresponding switches if desired to switch between Quick Links.

Programming

The butterfly mixers described below are actuated by the throttle/brake control stick assigned by default to the "CH1" input, or alternately by any other transmitter control element that is assigned to the "Throttle input" of the "CH set" menu, page 92.

In most cases, however, the selection is limited to the preset input 1, and the airbrake is operated using the non-neutralizing CH1 control stick:

	BACK	Graubele	T:CO	SERVO
1. Throttle	ST 1	7. Aux 2	NONE	
2. Aileron 1	ST 2	8. Aux 3	NONE	
3. Elevator	ST 3	9. Aux 4	NONE	
4. Rudder	ST 4	10. Aux 5	NONE	
5. Aileron 2	NONE	11. Aux 6	NONE	
6. Aux 1	NONE	12. Aux 7	NONE	

Note:



In contrast from the displays of the 12-channel **mz-24** HoTT transmitter shown in this section, only channels 1 ... 9 are shown in the display of the 9-channel **mz-18** HoTT transmitter.

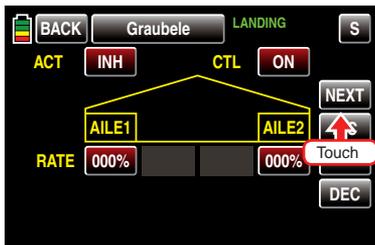
If other control elements are used, you can activate the air brake using one of the supplementary function controls if the throttle position is to have a different use.

The neutral point (offset) to be set on the last display page of the menu described here, or in the control position identified as "BUTTERFLY OFF" in the display, can be placed at any position. Since however this is essential to correctly set the flap deflections, a

corresponding description is provided beforehand.

BUTTERFLY OFF display

Switch to the desired Quick Link, such as in the Quick Link "LANDING", and repeatedly touched the **NEXT** button at the right edge of the start page of the "BUTTERFLY" menu ...



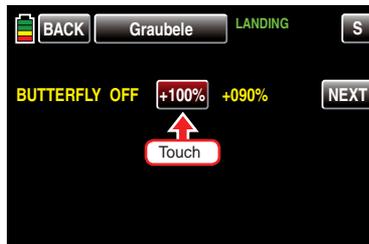
... until this page appears:



Then move the control element assigned to the input "CH1", by default the throttle/brake control stick, to the position at which the flaps are to be retracted or closed. The current control position is displayed in yellow to the right of the value field.



Once the desired position is reached, transfer it to the value field by touching it with a finger or the provided stylus, for example:



The current yellow control position is transferred to the value field:



The selected offset or BUTTERFLY OFF point determines the control position at which the brake system is retracted or closed, and it also determines the *direction of actuation* of the assigned control element, by default the throttle control stick, when extending in the brake system:

- The flaps are extended for brake offset values with a "+" when the corresponding control element such as the throttle control stick is moved *from front to rear* toward the pilot.
- The flaps are extended for brake offset values with a "-" when the corresponding control element such as the throttle control stick is moved *from back to front* away from the pilot.
- If the offset point is not placed at the end of the control travel (see the figures above), the remainder of the travel up to this stop is "free travel", i.e., the "free travel" does not influence the flap mixer described below.

This free travel ensures that all brake settings are at neutral even when there are slight deviations in the end stop of the brake flap control. At same time, the effective control travel is automatically extended to 100%.

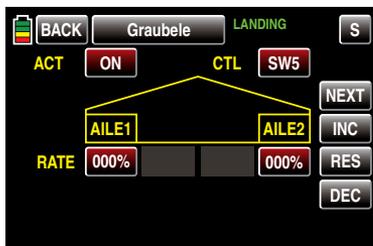
After the brake offset is set (which is helpful for correctly evaluating the flap deflections to be set), go back to the first display page of the "BUTTERFLY" menu by touching the **NEXT** [next page] button at the right edge of the display with a finger or the provided stylus:





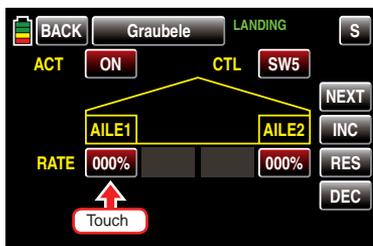
In this display, enter the amount and direction of the deflection of your flaps, and possibly also the elevator, for braking. In order for these settings to be effective and if necessary retrievable with a switch, it is also recommendable to program the two option fields "ACT" and "CTL" described below after setting the preferable offset point:

- Option ACT** (active)
 Within the value field for this column, specify whether this function is generally blocked (**INH**) or **ON**. Once you set this value field to **ON**, you can switch on and off the effect of the selected control element on the flap position for specific quick links individually with a control assigned in the option field "CTL".
- CTL option** (control/switch)
 In the value field in the CTL column, assign a control or control switch for a specific Quick Link to the mixer as described in section "Control, switch and control switch assignment" on page 38. This can be for example the same control that you used to switch to the "LANDING" Quick Link:

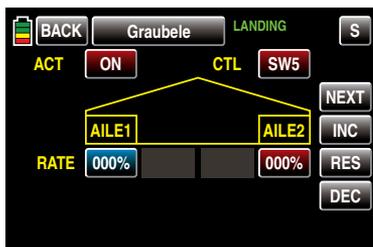


RATE line

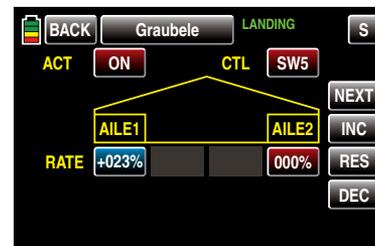
Switch to the desired Quick Link such as "LANDING", and touch the value field to be set with a finger or the provided stylus. In order to be able to define upward and downward deflections, the setting range is $\pm 150\%$.



The color of the value field switches from red to blue:



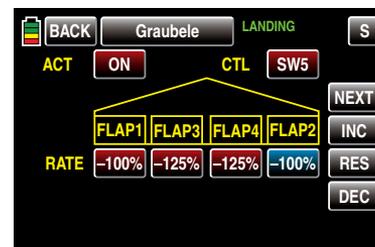
In the active (blue) value field, press **INC** to increase the current value **DEC** to reduce it, for example:



Use the same procedure for the value of the aileron (AILE2) on the opposite side as well as any inboard ailerons.

Touch the **RES** button to reset a changed value in the blue (and hence active) field to the default.

After completing the settings for the ailerons, you can switch to the page for setting the flaps by touching **NEXT** [next page] at the right edge of the display and enter the desired settings using the procedure described above, for example:



Once the above-described values are set, you can set a special flap arrangement, also termed the *crow* position or butterfly. In this braking position, both ailerons are moved slightly upward, and the flaps move downward as far as possible. By means of an additional mixer (the "elevator curve" mixer described below), the elevator is trimmed so that the flight speed does not change significantly in comparison to the normal flight position. Otherwise, there is a danger that the model will slow down too much and, after the brake system is retracted (for example to lengthen a landing approach

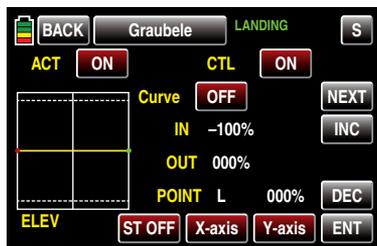
that is too short), will crash or fall.

Tips for visualizing the braking effect:

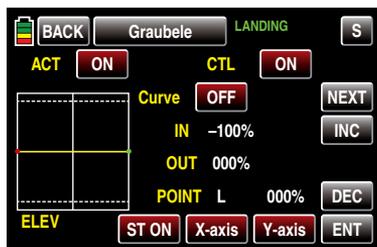


Spread the flaps and, from the front, look at the surface from above and below. The greater the projected surface of the protruding rudder, the greater the braking effect.

Elevator curve display



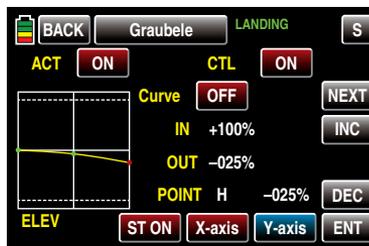
Switch to the display for the control position by touching the **ST OFF** button at the bottom left of the display with a finger or the provided stylus in order to make the necessary settings:



The green, vertical bar in the graphic display which indicates the position of the brake control moves away from the edge of the graph when the set offset value is exceeded. The brake flap control travel automatically respreads to 100%. The neutral point of the mixer always lies at the left edge of the graph independent of the set offset.

Move the elevator curve toward the opposite stop as

needed. The method for adjusting the curve of this 7-point curve mixer follows the same principles as those used for the curve mixer described on page 144 with reference to the "THR.CRV" menu.



The chosen setting should be tried out and adjusted if necessary at a sufficient height. Make sure that the model does not become too slow when the brake system is extended! Otherwise, there is a risk that, after the brake system is retracted (for example to lengthen a landing approach that is too short), the model will crash or fall.

After you have finished making your settings, touch the **BACK** button at the top left of the display to return to the menu selection:



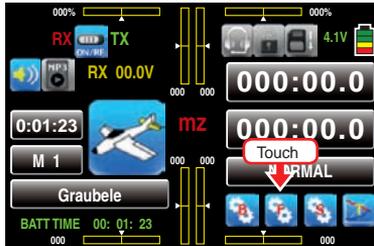
Adjusting the actuation of a V-tail

Note:



This menu only appears when a V-Tail has been selected in the basic settings of the "Model Sel" or "Model type" menu.

In the basic transmitter display, use a finger or the provided stylus to touch the gear icon labelled "F":



The display switches to the blue function menu. Use a finger or the provided stylus to touch the "V-Tail" menu item:



The elevator and rudder are controlled by two separately-actuated rudders arranged in a V-shape. The coupling function for the rudder and elevator control is automatically transferred from the program.

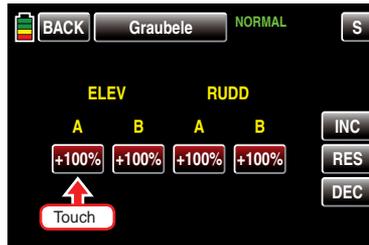
Flight-phase-dependent settings

If you have created Quick Links in the submenu "Q.Link", page 132, and have assigned an appropriate name, it appears at the top right in green font such as "NORMAL". Activate the corresponding switches if desired to switch between Quick Links:



Programming

Touch the corresponding value field with the value to be changed using a finger or the provided stylus, for example:



The color of the value field switches from red to blue:



In the active (blue) value field, press **INC** to increase the current value **DEC** to reduce it, for example:



Use the same procedure with the values in the other value fields.

Touch the **RES** button to reset a changed value in the blue (and hence active) field to the default.

Note:



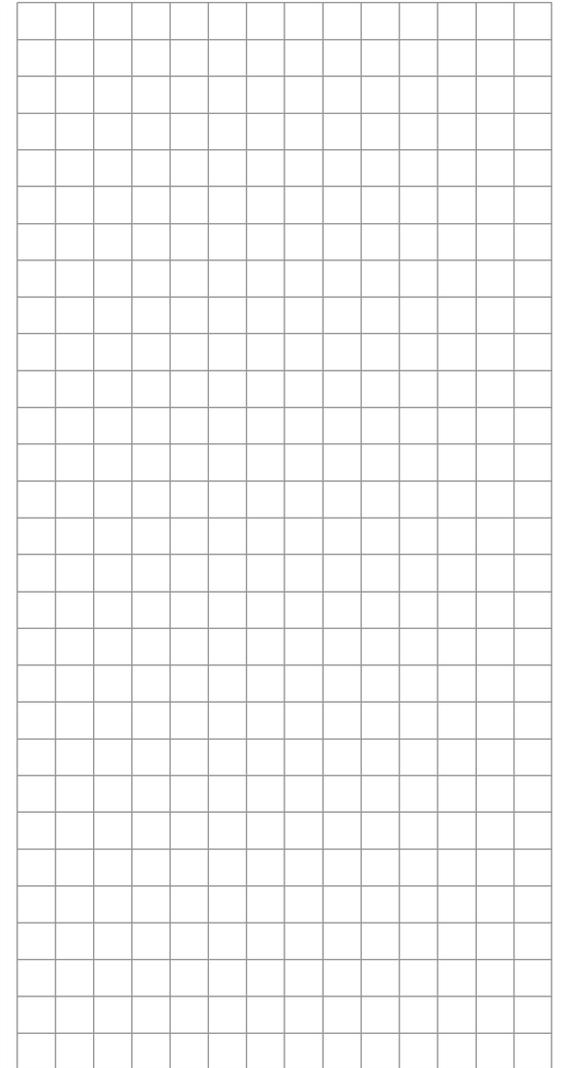
Remember that the mixing travel of the mixers is cumulative with simultaneous control stick movement, and one servo or both servos may mechanically collide. To prevent this, reduce the set mixing values if necessary.

After you have finished making your settings, touch the **BACK** button at the top left of the display to return to the menu selection:



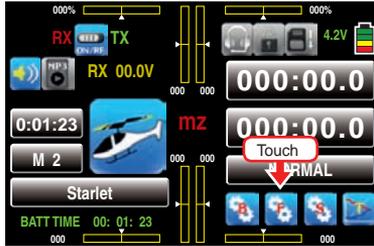
◀ Airplane function menu

Helicopter model function menu ▶



Setting up Quick Links

In the basic transmitter display, use a finger or the provided stylus to touch the gear icon labelled "F":



The display switches to the blue function menu. Touch the menu item "Q.Link" with a finger or the provided stylus:



Within a model memory, the **mz-18** HoTT and **mz-24** HoTT transmitters make it possible to program up to six different settings for different flight states including the autorotation phase, normally termed Quick Links, in the corresponding menus.

Setting up Quick Links

Setting up Quick Links for helicopter models starts in this menu item by assigning the individual links a name and a time for smoothly switching to the respective link. Even if the two first Quick Links are already assigned, the assignment sequence of links 1 to a maximum of 6 is irrelevant and can have gaps. Nevertheless, always start with "Q.LINK1" as the "NORMAL" link which is always active when ...

- no Quick Link switch is set, or

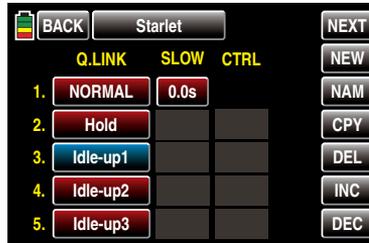
- no Quick Link has been assigned to a specific switch combination.

Assigning or leaving the Q.Link name "NORMAL" for "Quick Link 1" could therefore be recommendable. The names themselves do not have any technical relevance to the program and only serve to visually identify the Q.Link that has been switched on and are therefore displayed in all Q.Link-dependent menus as well as the transmitter's main display.

To set up the first real Q.Link, touch the desired button in the "Q.LINK" column such as "Idle-up1" with a finger or the provided stylus:



The button color changes from red to blue:



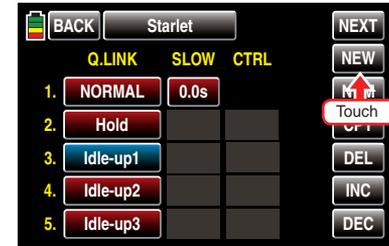
Note:



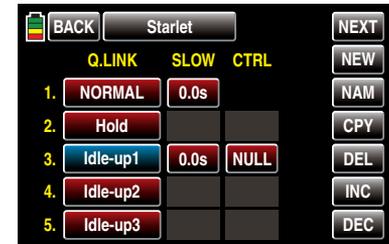
In order to set "Quick Link 6", touch **NEXT** [next page] at the top right of the display.

- **NEW** button

Activate the selected Quick Link by touching the **NEW** button with a finger in the provided stylus:



At the same time, additional value fields appear in the "DELAY" and "CTRL" columns:



- **NAM** button (name)

You can describe or change to the existing Quick Link name by touching the **NAM** [Name] button at the right of the display with your finger or provided stylus as described in detail in the section "Model name", starting on page 45, such as to the name "HOVER":



• **CPY button** (copy)

A blue, set-up Quick Link that is therefore active can be copied to any another Quick Link by touching the **CPY** [copy] button at the right of the display with your finger or the provided stylus, for example:



After you touch the **CPY** button, a window appears and asks you the reason for copying:



The next Quick Link is entered in this window by default. To change this setting, repeatedly touch the button below "TARGET" with a finger or the provided stylus ...



... until the desired Quick Link appears, for example:



Touch **NO** with a finger or the provided stylus to terminate the procedure.

Touch **YES** with a finger or the provided stylus to confirm the procedure: The source Quick Link is copied to the selected target Quick Link.



You can change the existing Quick Link name as described in detail in the section "Model name", starting on page 45, and/or adapt to the transferred delay or transferred switch to your needs.

• **DEL button** (delete)

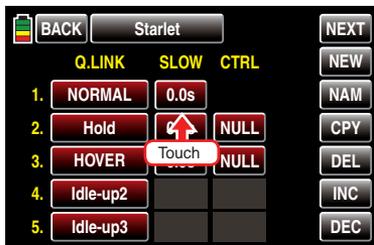
A blue, set-up Quick Link that is therefore active can be deleted or deactivated by touching the **DEL** [delete] button at the right of the display with your finger or the provided stylus, for example:



• **SLOW** column

If you switch Quick Links, it is advisable to program a time for a smooth transmission to the respective Quick Link. It is therefore also possible to set a different time for switching from a Quick Link to (for example) Quick Link 3 then for switching to Quick Link 1. You should always leave the standard switchover time of 0.0 s in the "Autorot" Quick Link line.

To change a switchover time, activate the value field "switchover time" for the desired Quick Link by touching it with your finger or the provided stylus, for example:



The color of the field switches from red to blue:



Set the desired value with the **INC** or **DEC** button at the bottom right. In the blue and hence active value field, you can select switchover times from 0 to 9.9 seconds, for example:



Use the same procedure with the other Quick Links.

Note:



The switchover time that is set here acts uniformly on all Quick Link-specific settings as well as all mixers that are activated in the "Helicopter mixer" menu. The switchover between Quick Link-dependent mixers then also proceeds smoothly.

• **CTRL column** (control/switch)

In the previously described columns "Q.LINK" and "SLOW", you assigned names to Quick LINK 1 ... 6 and may have programmed switchover times; however switching between the Quick Links is not yet possible. To enable this, touch the desired value field in the "CTRL" column with a finger or the provided stylus, for example ...



... and assign a switch or control switch as described in the section "Control, switch and control switch assignment" on page 38.

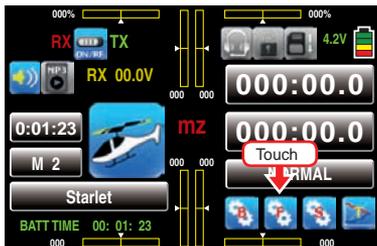
After you have finished making your settings, touch the **BACK** button at the top left of the display to return to the menu selection:



D/R,EXP

The control characteristic for roll, elevation and tail as well as control functions 5 ... 9 or 5 ... 12

In the basic transmitter display, use a finger or the provided stylus to touch the gear icon labelled "F":



The display switches to the blue function menu. Touch the menu item "D/R,EXP" with a finger or the provided stylus.



The classic dual rate/expo function of this menu item allows you to switch or influence the control deflections and characteristics of roll, elevation and tail, i.e. control functions 2 ... 4, independent of the Quick Link using a switch if desired.



An individual characteristic curve for control function 1 can be set in the menus "PIT.CRV", see page 175, and "THR.CRV", see page 181, by means of which 7 separately programmable points can be set.

Similar to the control travel setting in the display "CH5-9" or "CH5-12", **dual rate** acts directly on the corresponding *control function* independent of whether it affects the individual servo or several servos by means of complex mixing and coupling functions.

The control deflections can be set for each switch position between 0 and 125% of the normal control travel.

Exp allows a more sensitive control of the model in the central position of the respective control function (roll, elevation and tail) for values greater than 0% without having to abandon complete deflection in the end position of the control stick.

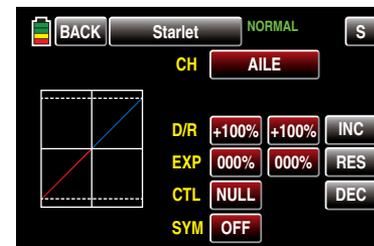
Conversely, the effect of the control around neutral position increases for values less than 0% and decreases in the direction of the full deflection. The progression can be set from -100% to +100%; 0% corresponds to the normal linear control characteristic.

There is another use for the most common rotary servos: The actual rudder control is nonlinear since the rudder deflection from the control linkage becomes increasingly smaller as the angle of rotation of the connecting pulley or cantilever increases. When expo values are greater than 0%, this effect can be counteracted so that the angle of rotation increases disproportionately as the control stick deflection increases.

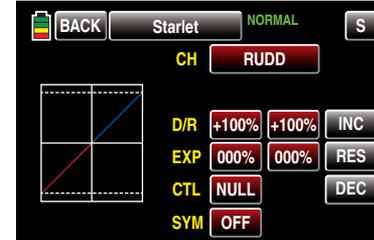
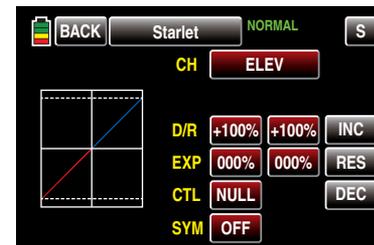
The EXP setting always acts directly on the corresponding control function independent of whether it affects the individual servo or several servos by means of complex mixing and coupling functions.

The D/Rand EXP functions can be switched together by a single control if the control has been correspondingly assigned. It is therefore possible to link the dual rate and expo functions which can be advantageous, especially with fast models.

In the graphic of the display, the curve characteristics are shown directly to make it easier to evaluate the curve dependent on control travel.



Between the displays of individual control functions, alternately touch the value field of the line "Ch" with a finger or the provided stylus:





Note:



In contrast to the displays of the 12-channel **mz-24** HoTT transmitter shown in this section, only channels 1 ... 9 are shown in the display of the 9-channel **mz-18** HoTT transmitter.

Q.Link-dependent D/R and EXP settings

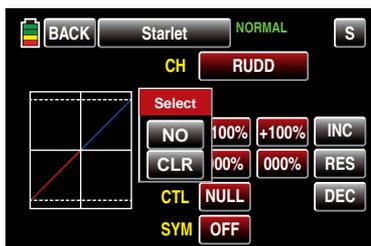
If you have created Quick Links in the submenu "Q.Link", page 168, and have assigned an appropriate name, it appears at the top right in green font such as "NORMAL". Activate the corresponding switches if desired to switch between Quick Links.

Setting symmetrical or asymmetrical values

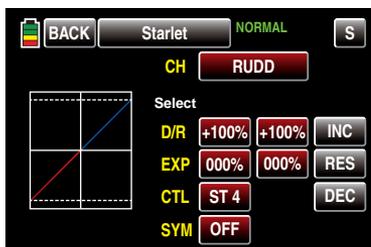
By default, the dual rate and/or expo values for the selected control function are set for each control side. After switching the option "SYM", added to the bottom line as of firmware version 1020, from **OFF** to **ON**, a simultaneous (symmetrical) setting of both control sides is possible.

D/R function

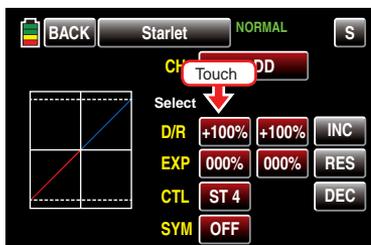
If you want to switch between two versions, assign a control in the line "CTL" as described in the section "Control, switch and control switch assignment" on page 38.



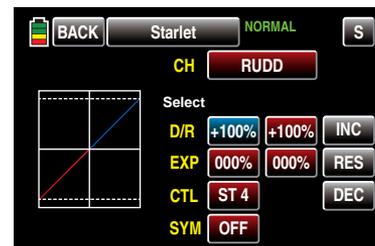
If desired, a control switch as well, for example:



With a finger or the provided stylus, touch the left value field in the "D/R" line to set a dual rate value to the minus side of the control travel, and/or on the right to set a dual rate value on the plus side of the control travel, for example:



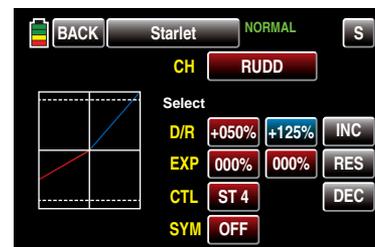
The color of the field switches from red to blue:



Set the desired value with the **INC** or **DEC** button at the right edge.

The adjustment range is $\pm 125\%$.

Use the same procedure for a value on the plus side of the control travel, for example:



The dual rate curve is simultaneously displayed in the graph.

Touch the **RES** button to reset a changed value in the blue (and hence active) field to the default.

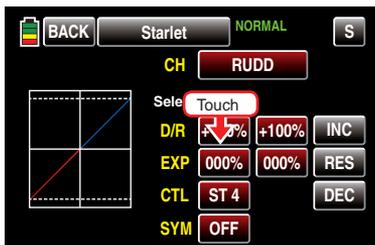
NOTE:



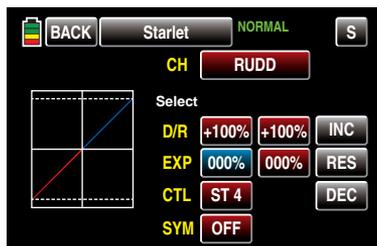
For safety reasons, the dual rate value should not fall below 20%.

Exponential function

To program the exponential function, touch the left value field in the EXP line with a finger or the provided stylus to set an exponential value to the minus side of the control travel, and/or on the right to set an exponential value on the plus side of the control travel, for example:



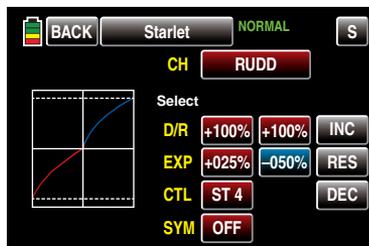
The color of the field switches from red to blue:



Set the desired value with the **INC** or **DEC** button at the right edge.

The adjustment range is $\pm 100\%$.

Use the same procedure for a value on the plus side of the control travel, for example:



The exponential curve is simultaneously displayed in the graph.

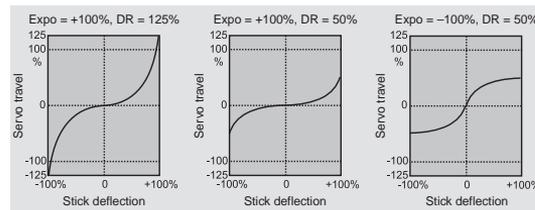
Note:



The curve shown here is only for demonstration purposes and does not represent an actual exponential curve.

Combining dual rate and exponential values

If you enter values for both the dual rate and exponential function, the effects of the two functions overlap as follows:



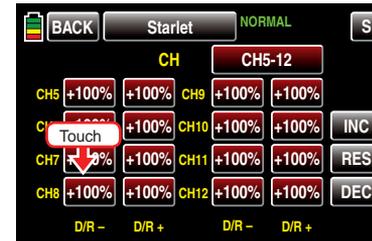
Display "CH5 ... 9" or "CH5 ... 12"

In the "CH set" menu in the base menu, starting on page 92, let us say you have assigned a control element to one of control functions 5 ... 9 or 5 ... 12, such as the side proportional slider SL1 to input 8:

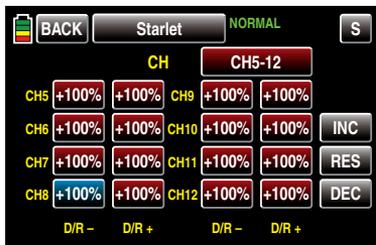


You can define this travel in the display "CH5 ... 9" or "CH5 ... 12".

With a finger or the provided stylus, touch the left value field in the corresponding line to set a value to the minus side of the control travel, and/or on the right to set a value on the plus side of the control travel, for example:



The color of the field switches from red to blue:



Set the desired value with the **INC** or **DEC** button at the right edge.

The adjustment range is $\pm 125\%$.

Use the same procedure for a value on the plus side of the control travel, for example:



Touch the **RES** button to reset a changed value in the blue (and hence active) field to the default.

Note:



In contrast to the displays of the 12-channel m_z-24 HoTT transmitter shown in this section, only channels 1 ... 9 are shown in the display of the 9-channel m_z-18 HoTT transmitter.

Offset

As described above, in the "CH set" menu of the base menu, starting on page 92, you have assigned a control element to one of control functions 5 ... 9 or 5 ... 12, such as the side proportional slider SL1 to input 8. Change the center of this control element, i.e., its zero point, in the last display of the "D/R,EXP" menu.



With a finger or the provided stylus, touch the offset value to be changed, for example:



The color of the value field switches from red to blue. Set the desired value with the **INC** or **DEC** button at the right edge, for example:



The adjustment range is $\pm 125\%$.

Touch the **RES** button to reset a changed value in the blue (and hence active) field to the default.

Note:



In contrast to the displays of the 12-channel m_z-24 HoTT transmitter shown in this section, only channels 1 ... 9 are shown in the display of the 9-channel m_z-18 HoTT transmitter.

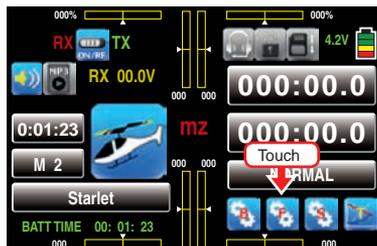
After you have finished making your settings, touch the **BACK** button at the top left of the display to return to the menu selection:



Pitch curve

Quick-Link-specific setting of the pitch control curve

In the basic transmitter display, use a finger or the provided stylus to touch the gear icon labelled "F":



The display switches to the blue function menu. Use a finger or the provided stylus to touch the "PIT.CRV" menu item:

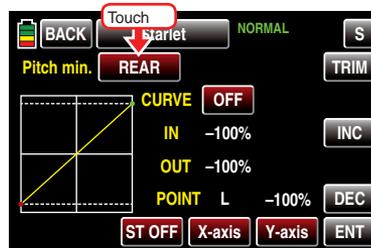


Firmware version V 1.021 and higher

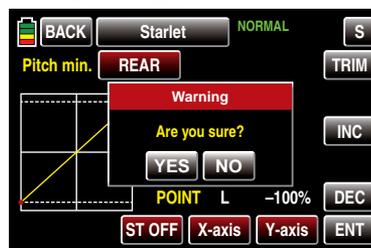
- "Pitch min." line

In the helicopter program for the **mz-18** HoTT and **mz-24** HoTT transmitters, the "rear" throttle position is the "Pitch min." position by default.

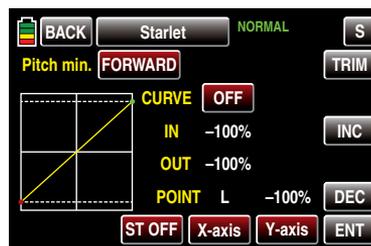
With this option, which was introduced in firmware version V1.021, the control direction of the pitch control stick can be easily switched from "Pitch min. rear" to "Pitch min. front" or vice versa by touching the **REAR** respectively the **FORWARD** button in the "Pitch min." line:



The following warning appears:



Touch **NO** with a finger or the provided stylus to terminate the procedure. Touch **YES** to confirm the procedure, which changes the pitch control stick's direction of travel:



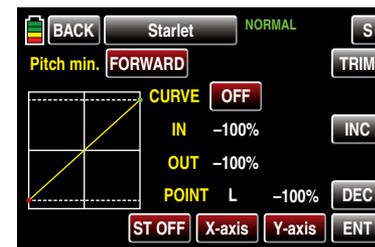
The inverted control signal affects all subsequent mixing and coupling functions, as well as the switch-on warning of the CH1 control stick if enabled.

Flight-phase-dependent settings of the pitch curve

If you have created Quick Links in the submenu "Q.Link", page 168, and have assigned an appropriate name, it appears at the top right in green font such as "NORMAL". Activate the corresponding switches if desired to switch between Quick Links.

Pitch curve

In this display, you can adapt the pitch curve as needed, depending on the Quick Link if desired:



Note:



In the graphic of the display, the curve characteristics are shown directly.

The pitch control curve can be specified by up to 7 points, the so-called support points, along the entire control stick travel depending on the Quick Link.

At the beginning, fewer support points are required to set the pitch curve. It is, however, highly recommendable to start with three support points. These three endpoints, the two endpoints "Pitch low (L)" = -100% control travel and "Pitch high (H)" = +100% control travel, as well as a point to be placed in the control center, describe a linear characteristic for the pitch curve.

Basic operating steps

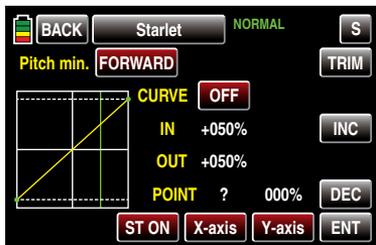
- Taste **ST OFF**

Touch this button with a finger or the provided stylus to switch on and off the graphic and numeric display of the control stick position.

With the control element (gas/pitch control stick), a vertical green line is moved synchronously in the graph between the two endpoints "L" and "H". The momentary control stick position is also displayed numerically in the line "IN" (-100% to +100%). The intersection of this line with the curve is identified as "OUT" and can be varied at the support points between -125% and +125%. The control signal which is changed in this way then affects all of the following mixing and coupling functions.

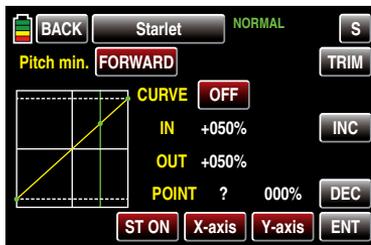
In the following example, the control stick is exactly halfway between the middle and end of its path, at +50% of the control path, and generates an output signal that is also +50% due to the linear characteristic.

Between the two endpoints "L" and "H", up to five additional support points can be set, and the distance between neighbouring support points may not be less than approximately 25%.

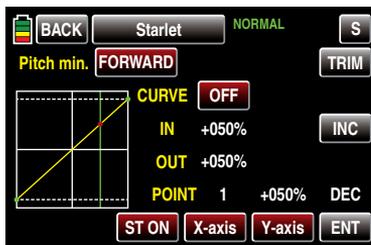


- **ENT** button

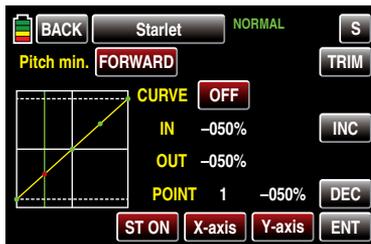
Move the control stick. As long as a ? is next to the "POINT", you can set the next support point by touching the **ENT** button. At the same time, a green point appears at the intersection between the yellow and green lines:



Once the green line is moved with the control stick around the point, it becomes red, and the "?" is replaced with a number, and the point to value appears in the value field to the right of the support point number:

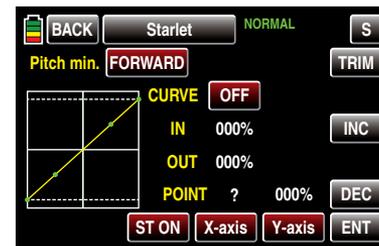
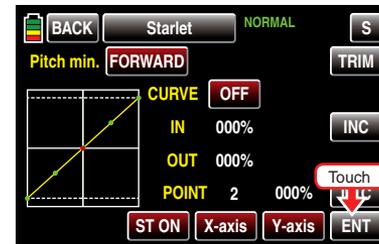


The sequence in which the up to 5 points between the end points "L" and "H" are generated does not matter since the support points are automatically renumbered sequentially from left to right after one support point is set or deleted, for example:



Deleting a support point

In order to delete the set support points 1 to 5, move the vertical green line with the control stick next to the relevant support point. As long as the support point number and the associated value appear in the "POINT" line and the point is red (see figure below), you can delete it by touching the **ENT** button, for example:

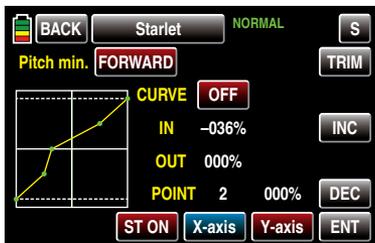


Changing the support point value

- **X-axis** button (X-axis)

Activate this function by touching the button at the bottom edge of the display with a finger or the provided stylus.

You can then move an active (red) point to the right with the **INC** button, and to the left with the **DEC** button, for example:



Touch the **X-axis** button again to deactivate the function.

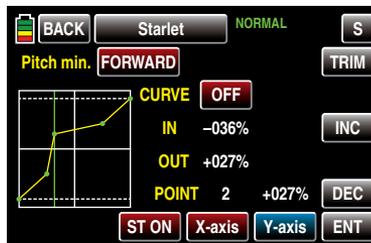
Notes:

- 
 If you move the red point horizontally away from the current control position, the point becomes green after a short while, and a "?" appears in the Point line. This question mark does not relate to the point which has been moved but rather indicates that another point can be set at the current control position.
- Note that the percentage in the "IN(put)" online and "OUT(put)" lines always refers to the momentary control stick position, and not to the position of the point.

• **Y-axis** button (Y-axis)

Activate this function by touching the button at the bottom edge of the display with a finger or the provided stylus.

You can then move an active (red) point to the top with the **INC** button, and to the bottom with the **DEC** button, for example:



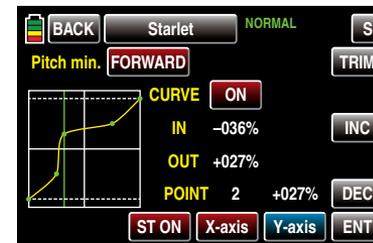
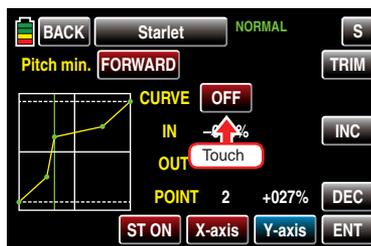
Touch the **Y-axis** button again to deactivate the function.

Note:

- 
 Remember that the percentages in the "IN" and "OUT" line always refer to the momentary position of the control stick and not to the position of the point.

Rounding off the channel 1 curve

- ON/OFF** button in the "Curve" line
 The standard angular curve can be automatically rounded by turning on the rounding function by pressing a button with a finger or the provided stylus, for example:

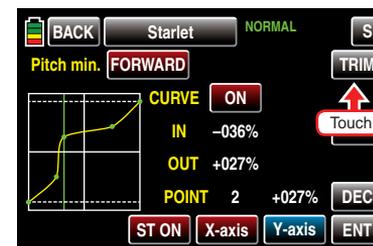


Important note:

- 
 The curves portrayed here are for demonstration purposes only and do not represent real pitch curves.

Additional functions

- TRIM** button
 The **mz-18** HoTT and **mz-24** HoTT transmitters have a function that is integrated in the transmitter program for trim up to six support points of the two options "throttle curve" and "pitch curve" during flight. Touch the **TRIM** button at the top right edge of the display with a finger or the provided stylus to open the corresponding display:





Basic operating steps

- **CTL column**

In the first column of the menu with the heading "Control", select a control that appears suitable for this purpose from the controls offered by your **mz-18** HoTT or **mz-24** HoTT transmitter.

In order to assign a control, touch the button in this column and the desired line with a finger or a provided stylus, for example:



The following appears in the display:



Then press the desired control such as the right proportional rotary control SL1:



- **MIXER column**

In the six value fields of the second column with the header "MIXER", you can select individual helicopter mixers, or one of the two available mixers in any combination.

In order to select a mixer, touch the button in "MIXER" column and the desired line with a finger or a provided stylus, for example:



The current value in the blue (active) value field can then be changed by repeatedly touching the **INC** or **DEC** buttons at the right edge of the display, for example:



Touch the **RES** button to reset a changed value in a blue (active) value field to the default value.

- **POINT column**

In the lines in the "MIXER" column, you have selected one or more mixers. In the "POINT" column, specify the support point(s) to be trimmed.

In order to select a point, touch the button in "POINT" column and the desired line with a finger or a provided stylus, for example:



The current value in the blue (active) value field can then be changed by repeatedly touching the **INC** or **DEC** buttons at the right edge of the display, for example:



Touch the **RES** button to reset a changed value in a blue (active) value field to the default value.

Note:



The associated controller does not have any effect if an undefined point is selected (in the basic version of the relevant curve mixers, only the points "L" and "H" are set).

• Q.LINK column

If you want to, specify in the right "Q.LINK" column the programmed Quick Links in which the governor should be active. In the value field (in the example, "1 (normal)"), the number refers to the Quick Link number that can be found in the submenu "Q.LINK", page 168.

In order to select a different Quick Link than the default Q.LINK1, touch the button in the "Q.LINK" column and the desired line with a finger or a provided stylus, for example:



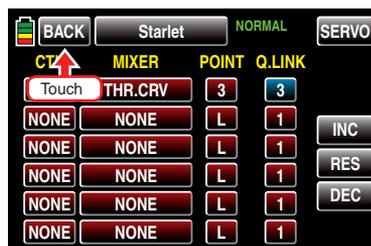
The current Quick Link number in the blue (active)

value field can then be changed by repeatedly touching the **INC** or **DEC** buttons at the right edge of the display, for example:



Touch the **RES** button to reset a changed value in a blue (active) value field to the default value.

After making your settings, leave this menu and go to "PIT.CRV" by touching the **BACK** button at the top left of the display:



Note:

The settings that appear in this display access the same records as those at a comparable location in the "TRIM" display of the "THR.CRV" menu (see the next section), which is why changes always affect each other.

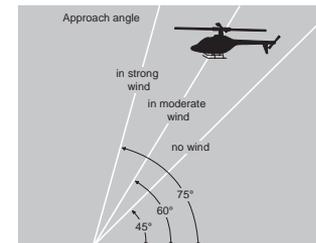
Autorotation setting

In a powered flight, the maximum wing angle is limited by the available motor output; in autorotation, however, it is limited by the stall at the main rotor blades. To provide sufficient lift even while the speed is decreasing when flaring the helicopter, the maximum pitch needs to be set.

Switch to the autorotation phase, and move the green vertical line to the "H" point with the control stick. First set a value that is about 10 to 20% *higher* than the normal maximum pitch. Do not set a value at the very beginning that is significantly higher than normal flight since of the behaviour of the pitch control will be significantly different after switching in comparison to the usual reaction. The danger exists of over-controlling after flaring the model continuing to rise; then the motor speed will decrease suddenly high above the ground, and the model will drop. Later, after a few test autorotations, the value can always be readjusted.

The minimum pitch can be different from that for normal flight. It depends on conventional control practice during normal flight. In any case, you need to set a minimum pitch for the "L" point for autorotation that will allow your model to be brought into a descent of approximately 60-70° out of forward flight path at an average speed when the pitch is reduced to a minimum. If you use such a setting in normal flight like most of helicopter pilots, the value can be easily transferred.

If you normally let your model descend at a flatter angle, increase the value at the "L" point and vice versa.



Approach angle under different wind conditions.

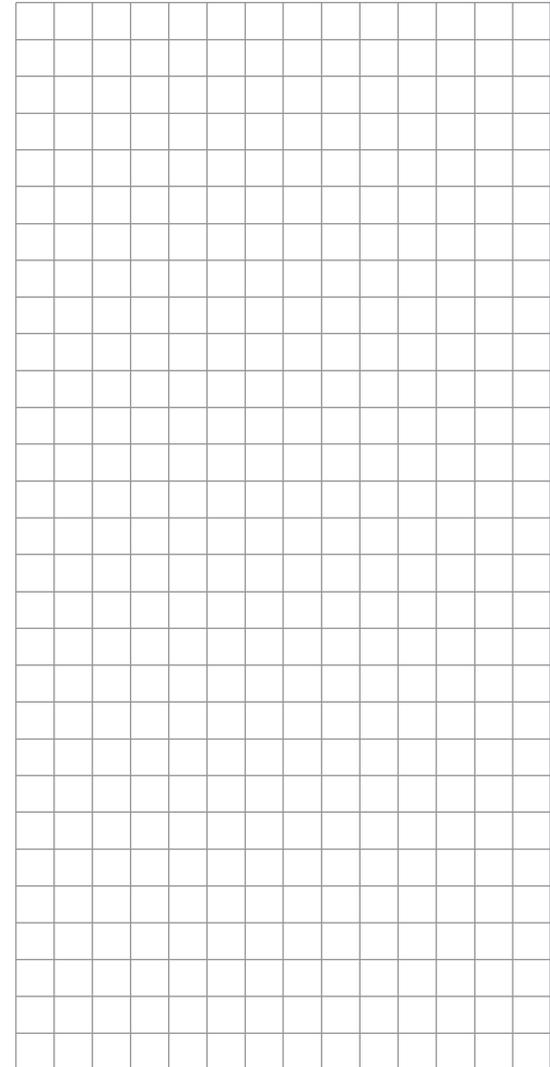
The pitch control stick is not necessarily in the bottom position during autorotation. Typically, it is between hovering position and the bottom stop so that the longitudinal inclination can be corrected using the elevation control.

You can shorten the approach by carefully pulling back on the elevation control and sensitively reducing the pitch, or extending the approach by pushing the elevation control forward and carefully increasing the pitch.

After making your settings, leave this menu and go to "PIT.CRV" menu by touching the **BACK** button at the top right of the display:



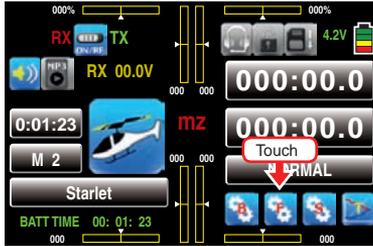
... and go to the menu selection of the function menu:



Throttle curve

Quick-Link-specific setting of the throttle curve

In the basic transmitter display, use a finger or the provided stylus to touch the gear icon labelled "F":



The display switches to the blue function menu. Use a finger or the provided stylus to touch the menu item "THR.CRV":



Flight-phase-dependent setting of throttle curves

If you have created Quick Links in the "Q.Link" submenu, page 168, and assigned them an appropriate name, "NORMAL" (for example) appears in green at the top right of the display. Activate the corresponding switches if desired to switch between Quick Links.

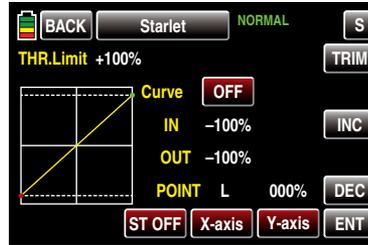
Notes:

- 

The "Throttle" setting for the autorotation phase is described in the menu "THR.HOLD", page 190.
- The value displayed in the line "Throttle limit" at top left only indicates the position of the gas limiter.

Throttle curve

The throttle curve can be specified by up to 7 points, the so-called support points, along the entire control stick travel depending on the Quick Link:



Support points can be set, changed and deleted in the same manner as described in the previous section, "Pitch curve", starting on page 175. First specify the throttle curve using three points, that is, the two end points "L" and "H", as well as the other set point "1" in the control center in order to harmonize the motor performance curve with the pitch curve.

Helicopter with gas motor or electric drive with a speed controller

This setting only refers to the control curve for the throttle servo or the speed controller.

The appropriate adjustment of the throttle curve to a helicopter equipped with a governor will be addressed below.

- The control curve should be set so that the carburettor is completely open when the throttle/pitch control stick is in end position, or the actuator of an electric helicopter is fully enabled (with the exception of autorotation flight).
- For the hovering point which is normally in the center of the control, the carburettor setting or performance control of the motor control unit needs to be coordinated with the pitch curve to produce the desired system speed.
- At the minimum position of the throttle/pitch control

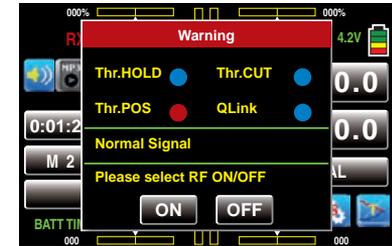
stick, initially set the throttle curve so that a gas motor runs significantly faster in comparison to idling, and the clutch engages reliably.



Both a gas and electric motor are stopped using the throttle limiter within the Quick Link.

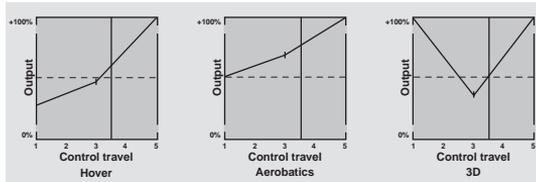
It is unnecessary to program two quick links ("with throttle preset" and "without throttle preset" to thereby "gift" a quick link to the gas preset) which is sometimes used in other remote control systems to accomplish the same purpose since the system speed can be increased below the hovering point much more flexibly and sensitively with the the **mz-18** HoTT and **mz-24** HoTT transmitters than by using a gas preset.

To start the gas motor, make sure that the gas limiter is closed; that is, the carburettor can only be adjusted by trim its idle position. Make sure to follow the safety instructions on page 185. If the throttle is set too high when the transmitter is switched on, a visual and acoustic warning are generated.



The following three diagrams show typical 3-point throttle curves for different quick links such as hovering, aerobatics and 3-D flight.

Example throttle curves for different Quick Links:

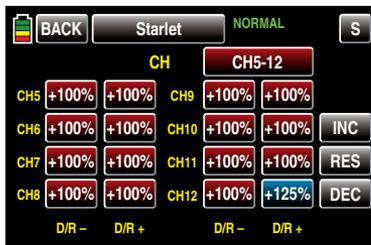
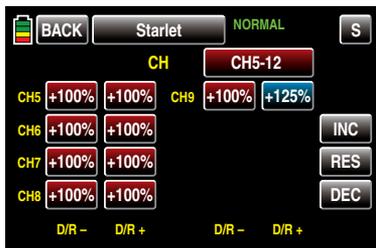


References to using the throttle limit function:

- 

In any case, you should use the throttle limit function ("Channel set", page 94). The throttle servo is normally completely separate from the throttle curve at the left stop of the (throttle limit) proportional dial DV1, the motor is idling and only reacts to CH1 trim. This option allows you to start the motor from any Quick Link and switch it off using digital trim.

After starting the motor, slowly turn the throttle limiter to the opposite stop in order to completely actuate the throttle servo using the throttle/pitch control stick. To keep the throttle servo from being limited by the throttle limiter in the full throttle direction, in line "CH9" (mz-18 HoTT) or "CH12" (mz-24 HoTT) of the display "CH5-9" or "CH5-12" of the submenu "D/R,EXP" of the base menu, set the control travel on the plus side of the "Travel" column to +125%:



- Since electric drives do not require an idle setting, when making the basic settings for an electric helicopter, ensure that the control range of the throttle limiter reliably exceeds or falls below the setting range of the motor control unit which normally extends from -100% to +100%. The "Travel" setting of the throttle limiter may have to be correspondingly adapted in all Quick Links in the line "CH9" or "CH 12" of the display "CH5-9" or "CH5-12" of the submenu "D/R,EXP".

The throttle curve should be adapted in the same manner as with a gas helicopter in flight.
- In order to measure the flight time of a (gas) helicopter, you can assign a control switch to the throttle limit servo and use it to switch on and off a timer, see page 80.



During autorotation flight, this mixer automatically switches to a settable default, see page190.

Helicopters with a governor

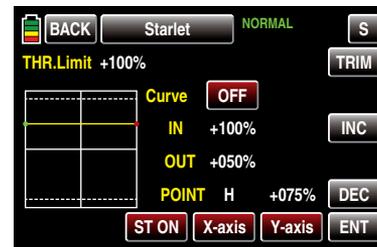
In contrast to speed controllers that only regulate performance like a carburettor, governors maintain a constant the speed in the system that they are monitoring by independently regulating the provided output. In the case of a gas helicopter, the control independently controls the throttle servo like the motor control unit of an electric helicopter. Governors therefore only require a speed setting and not a classic throttle curve. A deviation from the set speed occurs when the required output exceeds the maximum available output.

Normally, receiver output 8 is used for connecting a governor, see receiver assignment on page 41. If this connection is used, the gas throttle limiter is not used since it exclusively acts via the "Throttle curve" mixer on output 6 which is not assigned.

In order to take advantage of the comfort and safety features of the throttle limiter, connect the governor to receiver output 6 in deviation from the general connecting strategy, and only adapt the throttle curve so that it can assume the task of the normal servo.

Since the throttle curve in this case only determines the target speed of the motor control unit and this target speed normally remains constant over the entire pitch adjustment range, set a horizontal line in the "Throttle curve" mixer (each (pitch) input value results in the same (throttle) output value) whose level determines the target speed.

First, delete support points 1 to 5 that may be set, and then set the support points "L" (input = 0%) and "H" (input = +100%) to the same value, for example:



The value to be set depends on the governor that is used as well as the desired target speed, and can of course be varied for specific Quick Links.



During autorotation flight, this mixer automatically switches to a settable default, see page190.

Adjusting the throttle and pitch curve

The throttle and collective pitch control are always activated by separate servos which, however, are always activated together by the throttle/pitch control stick (except in the autorotation Quick Link). The helicopter program automatically couples the servos.

The trim lever for control function 1 in principle only acts on the throttle servo of the **mz-18** HoTT and **mz-24** HoTT transmitter programs.

The coordination of throttle and pitch, i.e., the performance curve of the motor with collective blade adjustment is the most important setting for helicopters. The **mz-18** HoTT and **mz-24** HoTT transmitter programs allow the throttle, pitch and torque compensating curves to be independently adjusted.

These curves can be characterized with up to seven points, but generally fewer points are sufficient. It is strongly recommended to first start with 3-point curves. Individual values can be entered for the center position and any other support points, as well as for the two end positions ("L" ("low") and "H" ("high")) of the throttle/pitch control stick which establish the control curves.

Before adjusting the throttle and pitch function, the linkage of all servos must be first correctly pre-adjusted mechanically according to the helicopter's adjusting instructions.

Remark:



The hovering point should always be in the center position of the throttle/pitch control stick. In special cases, for example for 3-D flight, deviating hovering points can also be programmed, for example a point for the normal flight position above the center, and a point for inverted flight below the center.

Idle setting and throttle curve

Note:

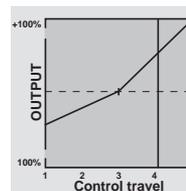


Since electric drives do not require an idle setting, an idle adjustment is unnecessary with this type of drive. The coordination of the throttle and pitch curve(s) described here is similar to gas helicopters, however.

The idle adjustment, described in detail on page 94, is done exclusively when the throttle limiter is closed, normally with the trim lever of the CH1 function, and only in special cases with the throttle limiter as well.

Programming a corresponding value at the "L" point of the throttle curve adjusts the descent speed of the motor without influencing the hovering setting.

You can use the Quick Link programming, for example, to set different throttle curves. This higher system speed below the hovering point is useful for example in fast, steep landing approaches when the pitch is very low, and in aerobatics.



The figure shows a curve with a throttle position that changes slightly below the hovering point in the control center.

Different throttle curves depending on the Quick Link are programmed for optimum adjustment for hovering and aerobatics:

- A lower system speed with smooth, soft control reactions and less noise while hovering.
- A higher rotor speed for aerobatics at the maximum motor output. In this case, the throttle curve needs to be adapted within the hovering range as well.

Basic settings

Although the pitch and throttle curves in the **mz-18** HoTT and **mz-24** HoTT transmitters can be electronically adjusted over a wide range, all the linkages in the model must be correctly adjusted mechanically according to the helicopter instructions. Experienced helicopter pilots will in all likelihood be glad to help you with the basic settings.

The carburettor control must be adjusted so that the throttle is completely open at the maximum pitch position, or the motor control unit of an electric helicopter is at full power. When the throttle limiter is closed, the carburettor must also be able to be completely closed with the CH1 trim lever, and the servo may not mechanically overtravel. The motor control unit must reliably switch off the electric power when the throttle limiter of an electric helicopter is closed.

Perform these settings are very carefully by correspondingly adapting the control linkage and/or changing the articulation point on the servo or carburettor arm. Only after this is done should the throttle servo be finely adjusted electronically.

NOTE:



Before you start the motor the first time, become familiar with the dangers and precautions involved in handling motors and helicopters.

After these basic settings are made, the motor should be started according to the motor operating instructions, and the idling can be adjusted using the trim lever of the throttle/pitch control stick. The idling position that you set is displayed in the transmitter's basic display by a horizontal bar in the position display of the CH1 trim lever.

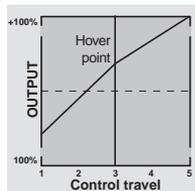
Hover settings

The model should lift off the ground when the pitch control stick is approximately in center position and hover at the set speed. If this does not occur, proceed as follows:

1. The model lifts off when the pitch control stick is past center position:

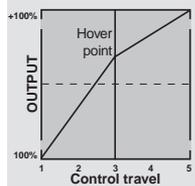
a) The rotary speed is too low

Solution: Increase the value of point "1" in the THR.CRV display.



b) The rotary speed is too high

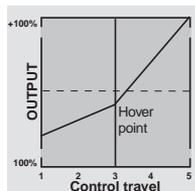
Solution: Increase the pitch angle of the rotor blades by increasing the value of point "1" in the PIT.CRV display.



2. The model lifts off before the pitch control stick reaches center position:

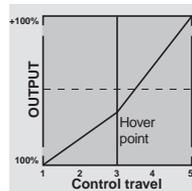
a) The rotary speed is too high

Solution: Reduce the carburettor opening by reducing the value of point "1" in the THR.CRV display.



b) The rotary speed is too low

Solution: Reduce the pitch angle of the rotor blades by reducing the value of point "1" in the PIT.CRV display.



Important:



Perform these adjustments until the model hovers at the correct rotary speed when the throttle/pitch control stick is in center position. All the other adjustments of the model parameters depend on this being performed correctly.

Standard adjustments

Standard adjustments are performed after the above-described basic settings where the model hovers at the provided speed in normal flight when the throttle/pitch control stick is in center position. The standard adjustments are made to allow the model to hover and perform roundtrips in all phases at a *constant rotary speed*.

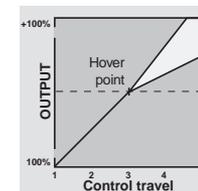
Adjustments for climbing

A combination of the throttle/hovering setting, the pitch setting for the hovering point and the maximum pitch position (point "H") allows you to easily achieve a constant rotary speed from hovering to maximum climbing.

First, perform a slow vertical climbing flight by moving the pitch control stick to the end position. The motor speed should not change in comparison to the hover setting.

If the speed decreases while climbing even though the drive is at maximum output and no additional power can be provided, reduce the maximum blade angle while the pitch control stick is fully deflected, that is, the value of point "H". Conversely, increase the pitch angle if the motor speed increases while climbing. In the graph of

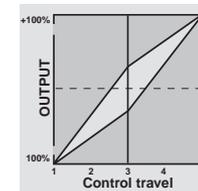
the PIT.CRV display, move the vertical line to point "H" with the pitch control stick, and correspondingly change its value.



This picture only shows changes of the maximum pitch setting.

Then make the model hover which should occur when the throttle in the center position. If the pitch control stick needs to be moved out of the center position toward higher values for the hovering point, compensate this deviation by slightly increasing the pitch value during hovering (i.e., from point "1") until the model hovers when the control stick is in the center position. If the model hovers below the center position, correspondingly reduce the pitch angle.

In certain circumstances, it can also be necessary to adjust the carburettor opening at the hovering point (point "1") of the THR.CRV display.



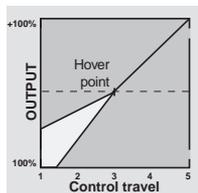
This picture illustrates the change of the hovering point, that is the minimum and maximum pitch were left at -100% and +100%.

Modify these settings until the speed remains constant over the entire control travel between hovering and climbing.

Adjustments for descending

Descent is adjusted so that the model descends from forward flight at a great height while the pitch is completely pulled back. Set the minimum pitch (point "L") so that the model descends at an angle of

60-70°. In the graph of the "Pitch" display, move the vertical line to point "L" with the pitch control stick, and correspondingly change its value.



This picture only shows an example of changes of the minimum pitch setting.

Once this flight response is achieved, adjust the value for "Throttle min" (the value of point "L" in the graph of the THR.CRV display) so that the speed neither increases nor decreases. The coordination of throttle and pitch is now complete.

Final important instructions



Before starting the motor, make sure that the throttle limiter is completely closed so that the carburettor only reacts to the throttle trim lever. If the carburettor is opened too wide when the transmitter is switched on, a visual and acoustic warning are generated. If the carburettor is open too wide or if the speed controller is set too high, there is a danger that the motor will start at a high speed once it is switched on, and the centrifugal clutch will engage immediately.

You should therefore always

hold the rotor head tightly when starting.

If the motor accidentally starts when the carburettor is open too wide, always remember

do not panic!

Keep a firm grip on the rotor head!

Do not let go,

immediately turn down the throttle limiter even if there is a danger of the drive becoming damaged since

you are responsible for ensuring that the helicopter does not move in an uncontrollable manner.

The cost of repairing a clutch, transmission or at the motor are negligible in comparison to the injury and damage that can arise from the rotor blades of a model helicopter flying around uncontrollably.

Make sure that no one else is within the hazard zone of the helicopter.

In addition, you should not switch from idling to the flight setting while the motor is operating at a high speed. This would suddenly speed up the rotor which prematurely wears out the clutch and gearing. In addition, the main rotor blades which are generally loosely hinged would not smoothly follow such a sudden acceleration and would swing out of their normal position, perhaps even striking the tail boom.

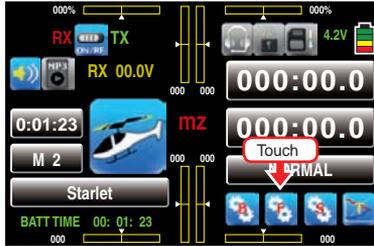
After starting the motor, you should therefore **slowly** accelerate the system speed with the throttle limiter.



Gyro/governor

Settings for the gyro and governor

In the basic transmitter display, use a finger or the provided stylus to touch the gear icon labelled "F":



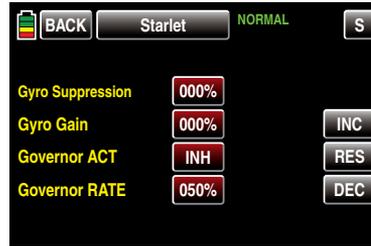
The display switches to the blue function menu. Touch the menu item "Gyro/Gover" with your finger or the provided stylus.



Flight-phase-dependent settings for the gyro and governor

If you have created Quick Links in the "Q.Link" sub-menu, page 168, and assigned them an appropriate name, "NORMAL" (for example) appears in green at the top right of the display. Activate the corresponding switches if desired to switch between Quick Links.

"Gyro suppression" line



This option may normally not be used for current standard gyro systems. You therefore need to consult your gyro setting instructions since otherwise you may make it impossible to fly your helicopter. Nonetheless, this menu was retained to satisfy all requirements and conventions.

This option can influence the effect of the gyro sensor (gyroscope) as the tail rotor control stick is moved, assuming that a gyro system is used in which the gyro's effect can be set by the transmitter using an additional channel, channel 7 in the *Graupner* remote-control system. The gyro suppression reduces the gyro's effect in a linear manner in proportion to the deflection of the tail rotor control stick corresponding to the set value. If the gyro has not been suppressed (at a value of 0%), the gyro's effect remains independent of the control stick deflection.

The gyro's effect can however be additionally varied smoothly (depending on the Quick Link if desired) between a minimum and maximum using a control assigned in the "Gyro" line in the "channel set" menu, page 92, for example with one of the side proportional dials SL1 or SL2. The maximum gyro gain occurs at the full deflection of the control and is zero at the opposite limit.

In the program, you are of course free to restrict the effective range to both sides by setting the control travel. Depending on the position of the control, the gyro gain

is as follows in response to the full deflection of the tail rotor control stick:

**"Momentary control position
minus the value of the gyro suppression".**

If the gyro is in the neutral position and gyro suppression is set, the gyro's effect is accordingly reduced from 100% to zero with increasing tail rotor excursion. For values between 100% and a maximum of 199%, full gyro suppression is achievable before full tail rotor excursion (depending on the control position) (see the figure after the next).

With the *Graupner/JR*-Gyro NEJ-120 BB, order No. **3277**, both the bottom and top value are set: control 1 sets the minimum gyro gain in the bottom position of the servo, control 2 sets the maximum effect in the top end position of the servo. The switch between these two values occurs approximately in the center of the servo travel.

The gyro systems PIEZO 900, PIEZO 2000 and PIEZO 3000 contrastingly feature proportional, infinitely variable adjustment of gyro gain (see the following example graphs).

As an example, the option to configure flight phase-specific – and static – gyro gain gives you the opportunity to exploit maximum stabilization for normal, slow flying, but to reduce gyro gain for fast circuits and aerobatics.

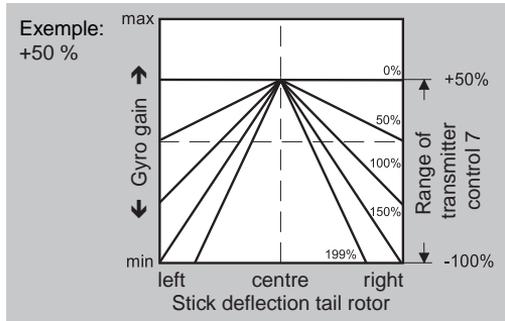
Samples of various gyro settings and configuration notes

- *Linear gyro suppression: 0% to 199%.
With the tail rotor control stick in the center position, the resulting gyro gain is set using the selected control. Using a proportional rotary control, the effect is infinitely variable between zero ("min") and maximum ("max"), provided that control travel is not restricted. With full tail rotor deflection, the effective gyro gain is as follows:*

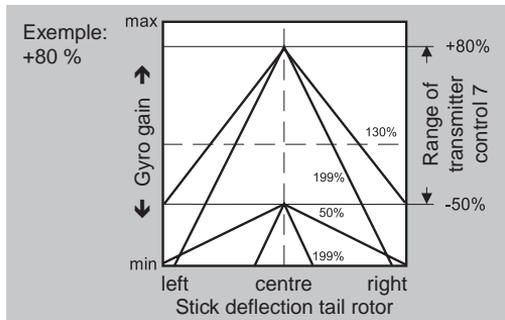
**"current control position
minus**

gyro suppression value".

Accordingly: at 0% gyro suppression, gyro gain is constant for tail rotor control stick movement; at 50% suppression, gyro gain is reduced to half if the assigned control is moved to the +50% position (as shown here); and only at >150% suppression is gain reduced to zero with the control at this position, well before full tail rotor deflection.



- *Linear gyro suppression with reduced control travel, e.g. -50% to +80% of full travel. Gyro gain is smoothly variable within these control limits. Here too, for purposes of illustration, we plot gyro gain values in relation to tail rotor deflection for various parameter values of gyro suppression.*



Adjusting the gyro sensor

To achieve the maximum possible level of stabilization for the helicopter with the gyro along the vertical axis, observe the following:

- The controls should have as little friction and "play" as possible.
- There should be no "spring" in the control linkage.
- Use a strong and – in particular – a fast servo.

When the gyro sensor detects a model rotation, or a corresponding corrective change to tail rotor thrust takes effect, the further the gyro gain adjuster can be moved without causing the tail of the model to start oscillating, and the better the model's stability about its vertical axis. If the response is slower, there is a risk that the model's tail will start to oscillate even at low gyro gain settings. Here, further reductions to gyro gain will need to be made to eliminate the oscillation.

If the model is flying forward at high speed or hovering in a powerful headwind, the net result of the stabilizing effect of the vertical fin combined with the gyro may also lead to an overreaction that once again manifests itself through tail oscillation. To achieve optimum gyro stabilization under all conditions, you can make use of the option to adjust gyro gain from the transmitter using a transmitter control assigned to input "7", in connection with gyro suppression and/or the two settings on the Gyro NEJ-120 BB.

Further notes on gyros with configurable multilevel gyro gain (e. g. NEJ-120 BB)

Since you cannot specify the gyro gain from the transmitter proportionally via the transmitter control, the gyro's own control 1 must be used to set the (weaker) gyro gain (e. g. for aerobatics) and control 2 must be used to set the stronger gyro gain (e. g. for hovering). Even though a proportional control is used for control function 7, only a switch-over between these two values takes place and the setting is therefore not proportional.

You should therefore advance control 2 to the point where the model is on the brink of oscillating when

hovering in calm conditions, and advance control 1 to the point where the model does not oscillate with its tail even when flying at maximum speed into a strong headwind. Depending on the state of the weather and the flight program planned, you can also switch the gyro gain from the transmitter, possibly with gyro suppression dependent on tail rotor deflection if required.

"Gyro Offset" line

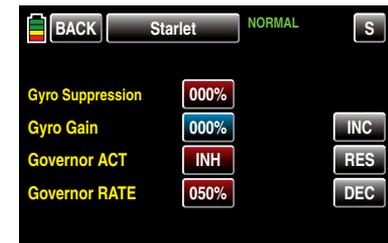
NOTE:



An offset value entered in this option as well as in the line "CH 7" of the display "CH5-9 CTRL" or "CH5-12 CTRL" of the menu "D/R,EXP", page 173, add up! For the sake of clarity, make sure to only enter or change an offset value in one of the two options.

Most of the current gyro systems can be adjusted for a smooth, proportional effect; you can also choose between two different modes of action by the transmitter. If the gyro that you are using also has one of these options, the alternative offset setting enables both the normal gyro gain and "heading lock mode" as well as flying with maximum stabilization in normal, slow fights within this selected mode, and reducing the gyro gain in fast roundtrips and aerobatics.

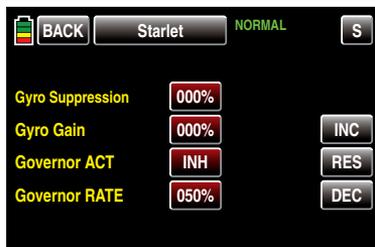
You should accordingly take advantage of switching flight phases to enter different settings in the "GYRO OFFSET" line. Values between -125% and +125% are possible, for example:



Based on the these Q.Link-specific (offset) settings, the

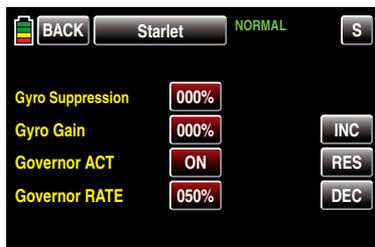
gyro gain can also be smoothly varied with a control in the "Gyro" line in the "Channel set" menu, page 92.

"Governor ACT" line



In the above figure, this option is normally **INH**, which means that the control channel can be normally used without restriction.

If you have or wish to connect a *governor* to output 8 to automatically maintain the rotor speed, touch the value field of this line with a finger or the provided stylus to switch it **ON** ...



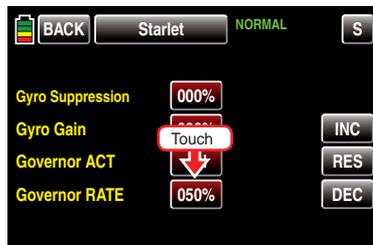
... and vice versa.

"Governor RATE" line

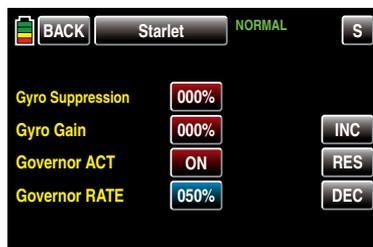
After you have activated the option "Governor ACT" by switching to **ON** in the previous line, you can set the rotor speed to be maintained by your governor in this line by changing the percentage.

The adjustment range is 0 to 100%.

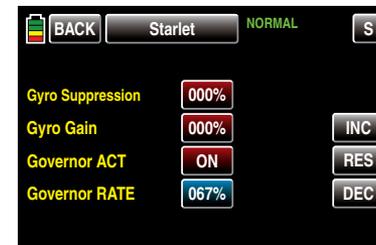
Touch the value field of this line with a finger or the provided stylus:



The color of the field switches from red to blue:



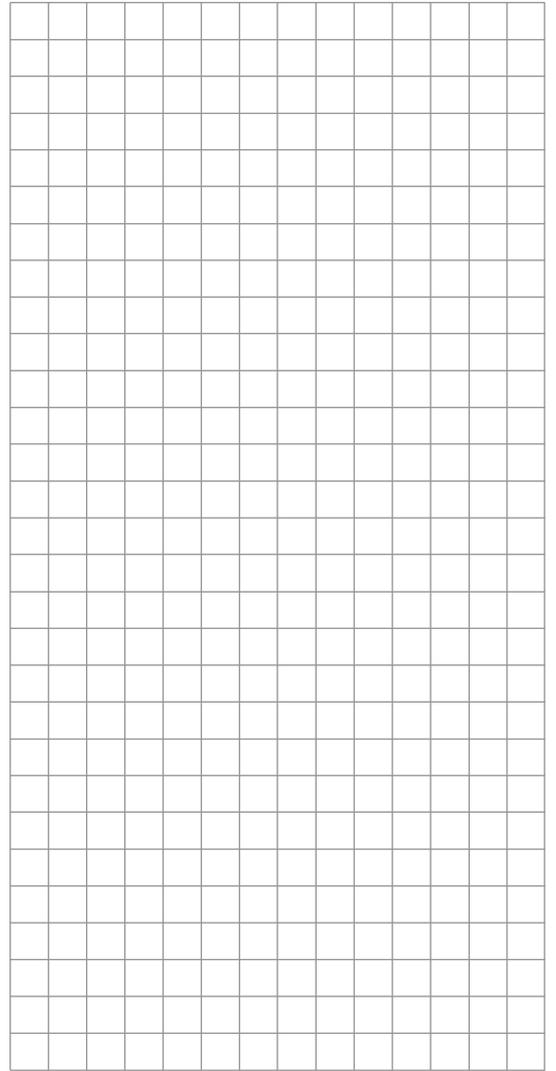
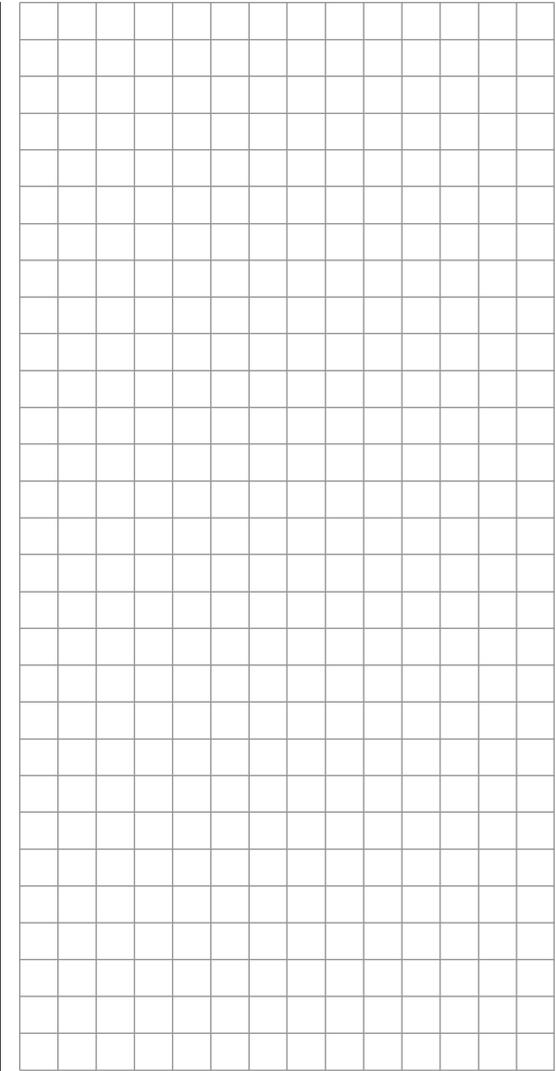
You can change the current value in the blue (active) value field by touching the **INC** or **DEC** buttons at the right edge of the display, for example:



Touch the **RES** button to reset a changed value in a blue (active) value field to the default value.

After making your settings, leave this menu and go to "Menu selection" by touching the **BACK** button at the top left of the display:

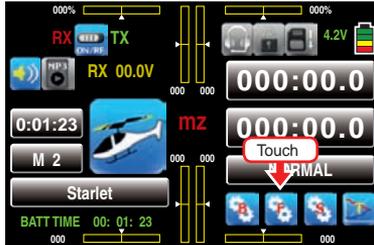




THR.HOLD

Throttle HOLD position

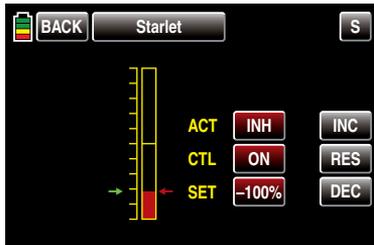
In the basic transmitter display, use a finger or the provided stylus to touch the gear icon labelled "F":



The display switches to the blue function menu. Use a finger or the provided stylus to touch the menu item "THR.HOLD":



throttle HOLD position



During competition, it is expected that gas engines should be completely switched off. In the training phase, this is a bit inconvenient since you would have to restart the motor after each autorotation landing.

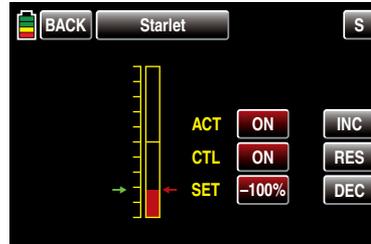
Therefore, set the value during the training phase in this display so that the gas motor can be kept idling during the autorotation phase without the clutch engaging, and so any electric drive is definitely off.

Note:

With the "Thr.CUT" option in the Base menu, there is an alternative emergency off function.

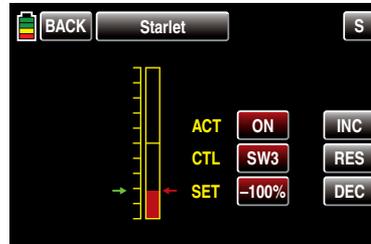
• ACT line

To switch on and off this option, touch the value field of the "ACT" line with a finger or the provided stylus, for example:



• CTL line

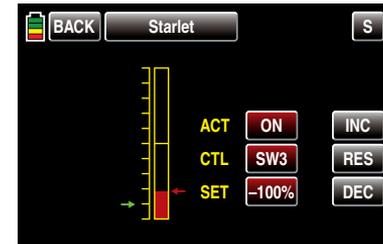
as described in the section "Control, switch and control switch assignment" on page 38, in this line assign **the same** switch with which you switch to the autorotation phase, for example:



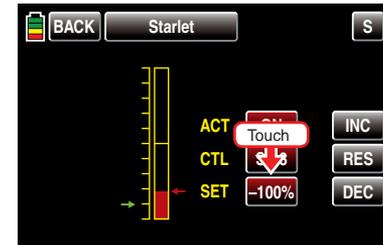
• SET line

The green arrow to the left of the bar graph indicates the current position of the throttle servo. The red arrow to the right indicates the currently set autorotation throttle position.

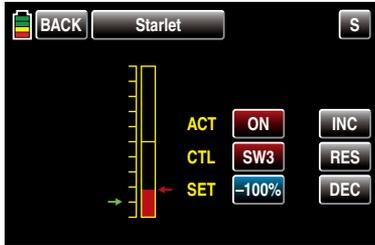
To change the current autorotation throttle position, use the throttle/pitch control stick to move the green arrow, and possibly the throttle trim, to the position that the throttle servo is to assume during autorotation, for example:



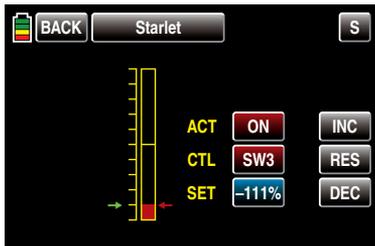
Then touch the value field of the "SET" line with a finger or the provided stylus:



The color of the field switches from red to blue:

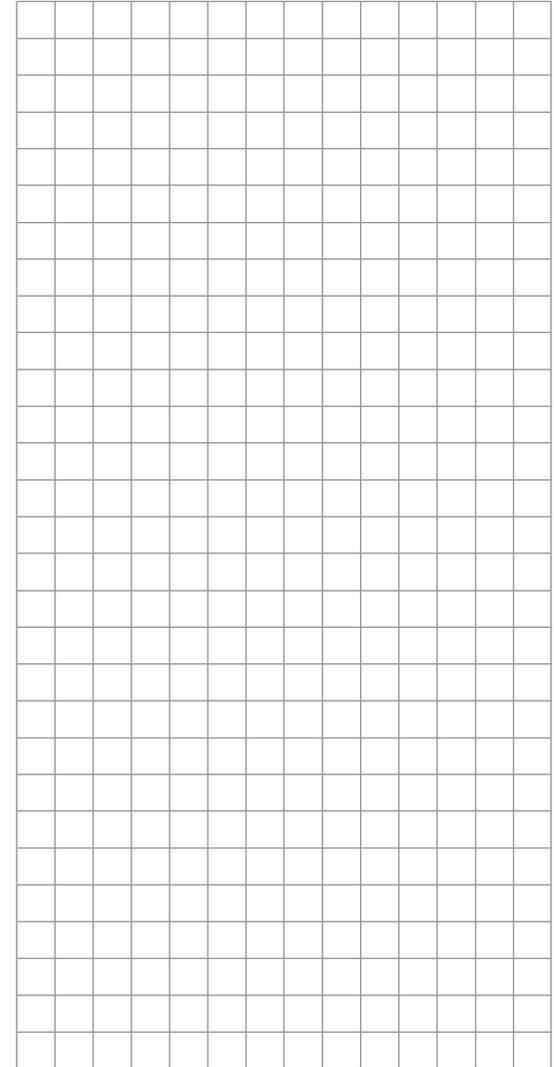


In the blue (active) value field, touch the **INC** or **DEC** buttons at the right edge of the display, move the red arrow relative to the green arrow, for example:



Touch the **RES** button to reset a changed value in a blue (active) value field to the default value.

After making your settings, leave this menu and go to "Menu selection" by touching the **BACK** button at the top left of the display.



Swashplate mixer

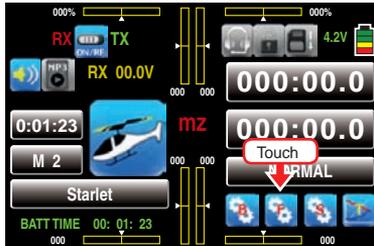
Pitch, roll and elevation mixer

Note:

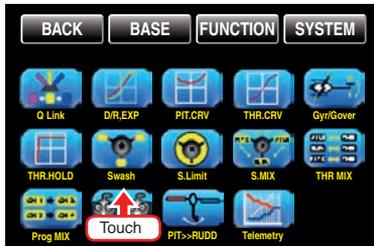


This menu is hidden when selecting "1 (swashplate) servo" in the basic settings of the "Model selection" or "Model type" menu.

In the basic transmitter display, use a finger or the provided stylus to touch the gear icon labelled "F":



The display switches to the blue function menu. Touch the menu item "Swash" with your finger or the provided stylus:

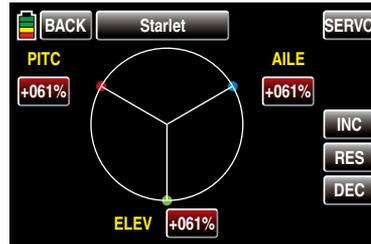


In the basic settings, you have specified how many servos are installed for pitch control in your helicopter in the "Swash" display. Once this entry is made, the required mixers for the swashplate functions of roll, elevation and pitch axis are activated so that you do not have to define any additional mixers.

With helicopters that are controlled only using a separate pitch servo, the menu item "Swash" is unnecessary since three swashplate servos are operated separately for pitch, elevation and roll by the software program; that is, without any mixer. In this scenario, this menu

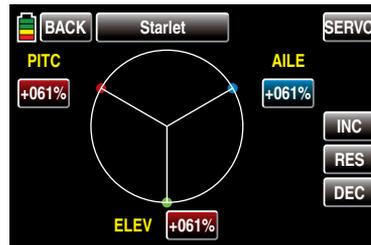
option is therefore *no longer* available to you from the multi-function list.

With all other swashplate linkages employing 2 ... 4 collective pitch servos, the mixer ratios and directions are set up by default, as can be in the following display. The preset is +61% ...

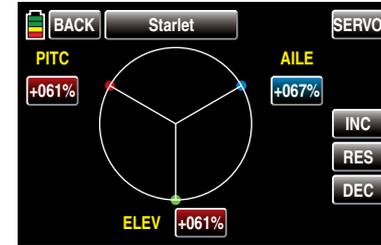


... but the value can be varied from -100% to +100% if required.

As usual, touch the value field of the mixer to be changed with a finger or the provided stylus, for example:



You can change the current value in the blue (active) value field as needed by touching the **INC** or **DEC** buttons at the right edge of the display, for example:



Touch the **RES** button to reset a changed value in a blue (active) value field to the default value.

If the swashplate control (pitch, roll and elevation) does not respond to the control sticks properly, you should alter the mixer directions ("+" or "-") before trying to correct the directions of servo rotation.

Note:



Ensure that changed mixer values do not result in the servos mechanically striking their end-stops.

After making your settings, leave this menu and go to "Menu selection" by touching the **BACK** button at the top left of the display:

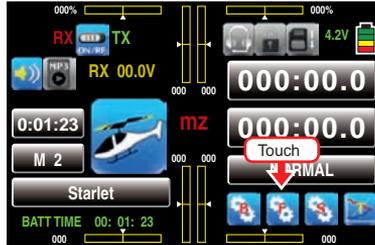




Swashplate limiter

Adjustable limitation and rotation of deflection

In the basic transmitter display, use a finger or the provided stylus to touch the gear icon labelled "F":

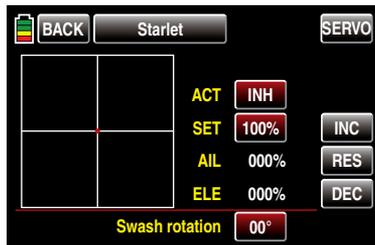


The display switches to the blue function menu. Touch the menu item "S.Limit" with your finger or the provided stylus:

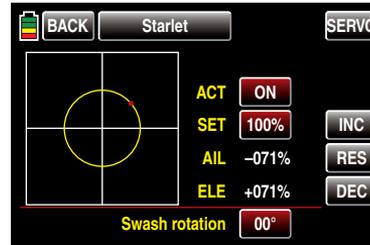


Swashplate limiter

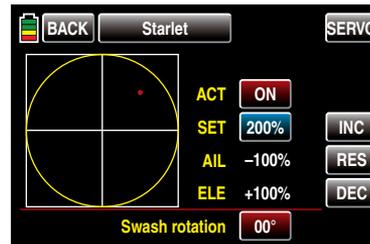
This function acts like a circular mechanical fence that limits the normally square path ...



... of a control stick to a maximum of one circular area provided that the limiter is switched **ON** in the "ACT" line:



If the helicopter is adjusted so that the deflections for roll and/or elevation exploit the maximum travel mechanically possible, e. g. for 3D helicopters, then the total tilt applied to the swashplate if full roll and elevation commands are applied simultaneously will be considerably greater (141% in numerical terms). The swashplate mechanism may then strike its endstops and, in the worst case, the ball-heads could even be disengaged.



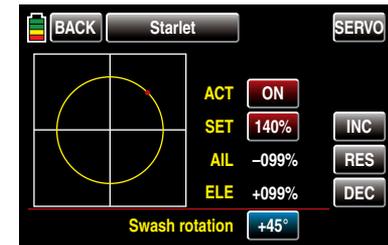
In the **mz-18** HoTT and **mz-24** HoTT transmitters, the relevant software function offers a limitation of the swashplate deflection that can be adjusted between any combination of circular and square. That is, the limitation of the overall swashplate deflection or the swashplate tilt angle can be limited between 100% (the deflection has a circular limit to the value achievable with roll or elevation) and 200% (no effective limit) in the "SET" line with the **INC** or **DEC** buttons at the right edge of

the display. In addition, the function can be completely deactivated by selecting **INH** in the line "ACT".

Touch the **RES** button to reset a changed value in a blue (active) value field to the default value.

Swash rotation

With some rotor head controls, it is necessary to tilt the swashplate in another direction than the intended rotor plane angle during cyclical control. For example if a four-blade rotor is used, it may be necessary to turn the actuation 45° to the right or left with this menu item so that the control linkage from the swashplate to the rotor head can be precisely vertical. This allows the blades to be controlled correctly without undesirable differentiation. The controlling linkage then does not have to be mechanically changed. Negative angles equate to a virtual rotation of the rotor head to the left; positive angles a virtual rotation to the right.

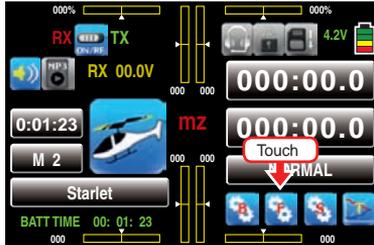


After making your settings, leave this menu and go to "Menu selection" by touching the **BACK** button at the top left of the display.

Swash mixer

Flight-phase-dependent setting of pitch, roll and elevation

In the basic transmitter display, use a finger or the provided stylus to touch the gear icon labelled "F":



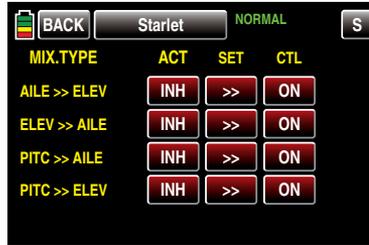
The display switches to the blue function menu. Touch the menu item "S.MIX" with your finger or the provided stylus:



In the following menu "S.MIX" addressed below, the flight-phase dependent mixers "AILE >> ELEV", "ELEV >> AILE", "PITC >> AILE", and "PITC >> ELEV" are described. These menus are used especially for compensating asymmetrical helicopter reactions to control commands and to adjust helicopters with multi-blade rotors.

Flight-phase-dependent settings

If you have created flight phases in the submenu "Q.Link" and have assigned an appropriate name, it appears at the top right such as "NORMAL". Activate the corresponding switches if desired to switch between Quick Links:



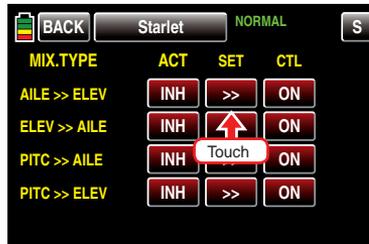
ACT column (active)

In the value fields of this column, indicate whether the function of the line is generally blocked (**INH**) or **ON**.

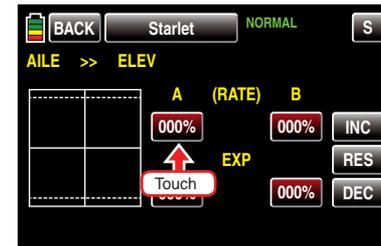
Once you set this value field to **ON**, you can individually switch on and off the effect of the respective control element on the selected mixer for specific quick links with a control assigned in the option field "CTL" (see below in the section).

SET column (setting)

Touch one of the four buttons in this column with a finger or the provided stylus to open the setting page for the selected mixer, for example:



Based on the defaults shown here, you can adapt the current settings as needed by touching the value field to be changed with a finger or the provided stylus to activate it, for example:



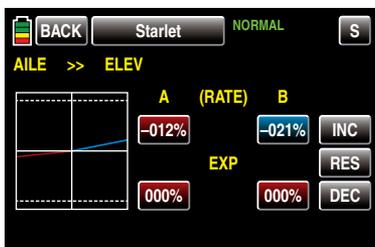
The color of the value field switches from red to blue:



Then change the current value in the blue (active) value field by touching the **INC** or **DEC** buttons at the right edge of the display, for example:



Use the same procedure for the value on the opposite side of the control travel, for example:



Touch the **RES** button to reset a changed value in a blue (active) value field to the default value.

You can make any necessary settings in the two bottom EXP value fields as in the related description in the section "D/R,EXP", starting on page 171.

After making your settings, leave this display and go to "Heli-Mix" selection by touching the **BACK** button at the top left of the display.



Important note:



The mixed value is portrayed here for demonstration purposes only and do not represent real values.



Select another mixer here if desired and adjust it as described.

- **"CTL" column** (control/switch)
In this column assign as described in the section "Control, switch and control switch assignment" on page 38, a control to the respective mixer that you can use to switch on and off the mixer, for example:



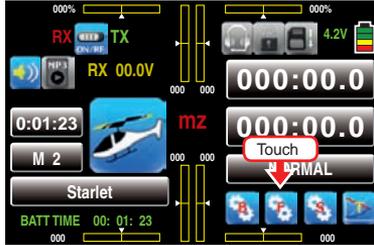
After making your settings, leave this menu and go to "Menu selection" by touching the **BACK** button at the top left of the display.



Throttle mixer

Flight-phase-dependent settings of throttle tracking with roll, elevation and tail

In the basic transmitter display, use a finger or the provided stylus to touch the gear icon labelled "F":



The display switches to the blue function menu. Use a finger or the provided stylus to touch the menu item "THR.MIX":



The throttle needs to follow an increase in pitch; likewise, the throttle should track with large cyclical control movements, that is, tilting a swashplate in a desired direction. The motor output should also be adapted when the thrust of the tail rotor is increased so as to maintain a constant system speed. In the **mz-18** HoTT and **mz-24** HoTT transmitter programs, throttle tracking with roll, elevation and tail control can be attempted separately.

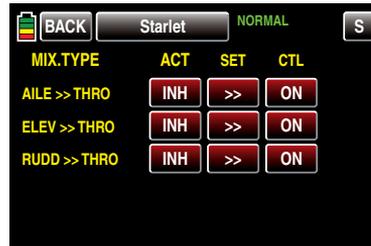
If you are using a *governor* to automatically maintain the rotor speed, the governor adapts the output as necessary. Otherwise, you can adjust throttle tracking in these three mixers.

This is advantageous especially with aerobatics (for example when performing rolls) since cyclical control deflections are used with middle collective pitch values

where the carburettor is about halfway open that require significantly higher motor output.

• Flight-phase-dependent settings

If you have created Quick Links in the "Q.Link" sub-menu, page 168, and assigned them an appropriate name, "NORMAL" (for example) appears in green at the top right of the display. Activate the corresponding switches if desired to switch between Quick Links.



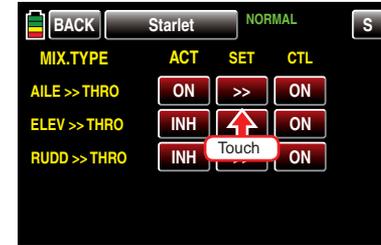
• ACT column (active)

In in the value fields of this column, indicate whether the function of the line is generally blocked (**INH**) or **ON**.

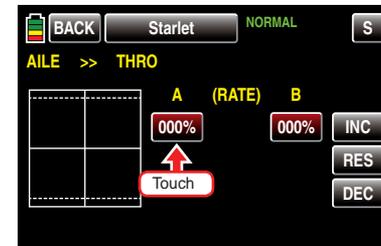
Once you set this value field to **ON**, you can individually switch on and off the effect of the respective control element on the selected mixer for specific quick links with a control assigned in the option field "CTL" (see below in the section).

• SET column (setting)

Touch one of the four buttons in this column with a finger or the provided stylus to switch to the setting page for the selected mixer, for example:



Based on the defaults shown here, you can adapt the current settings as needed by touching the value field to be changed with a finger or the provided stylus to activate it, for example:



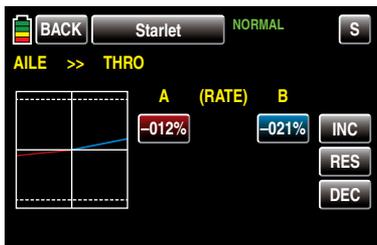
The color of the value field switches from red to blue:



Then change the current value in the blue (active) value field by touching the **INC** or **DEC** buttons at the right edge of the display, for example:

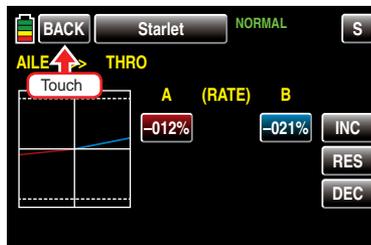


If desired, use the same procedure for the value on the opposite side of the control travel, for example:



Touch the **RES** button to reset a changed value in a blue (active) value field to the default value.

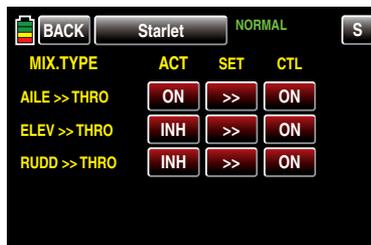
After making your settings, leave this display and go to the "Throttle mixer" selection by touching the **BACK** button at the top left of the display.



Important note:

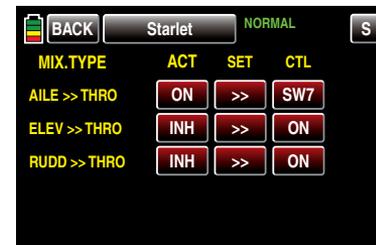


The mixer values portrayed here are for demonstration purposes only and do not represent real values.



Select another mixer here if desired and adjust it as described.

- **"CTL" column** (control/switch)
In this column as described in the section "Control, switch and control switch assignment" on page 38, assign a control to the respective mixer that you can use to switch on and off the mixer, for example:

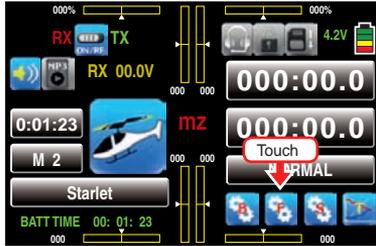


After making your settings, leave this menu and go to "Menu selection" by touching the **BACK** button at the top left of the display.



Flight-phase-dependent static torque compensation

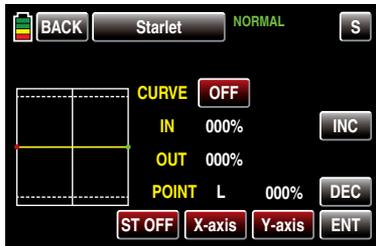
In the basic transmitter display, use a finger or the provided stylus to touch the gear icon labelled "F":



The display switches to the blue function menu. Use a finger or the provided stylus to touch the menu item "PIT>>RUDD":



A torque compensation curve with a linear mixer ratio of 0% is uniformly set by default which is necessary for gyro sensors that operate in heading-lock mode:



NOTE:

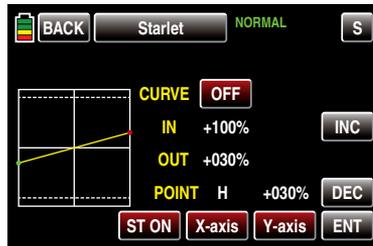


You therefore need to consult your gyro setting instructions since otherwise you may make it impossible to fly your helicopter.

If you are using your gyro sensor in normal mode or the sensor can only handle normal mode, adjust the mixer as follows:

Similar to adjusting the pitch curve, see page 175, the control curve for the tail rotor can also be defined with up to 7 points. As needed, you can therefore modify the mixer at any time and specify symmetrical and asymmetrical mixer ratios above and below the hovering point.

Starting with -30% at point "L" and +30% at point "H", adjust the mixer so that the helicopter does not rotate about the vertical axis, even during long vertical ascents and descents, as a result of differing main rotor torque in comparison to hovering. While hovering, only change the trim using the digital tail rotor trim lever:



In order to reliably adjust the torque compensation, the pitch and throttle curves must be correctly adjusted; in other words, the speed must remain constant over the entire collective pitch adjustment range.

Autorotation setting

In normal flight, the tail rotor is adjusted so that it compensates for the torque of the main rotor during hovering. It therefore generates a certain amount of thrust in home position. This thrust is then varied by the tail rotor control and different mixers for all types of torque compensation and is adjusted by trim the tail rotor to accommodate the weather, system speed and other influences.

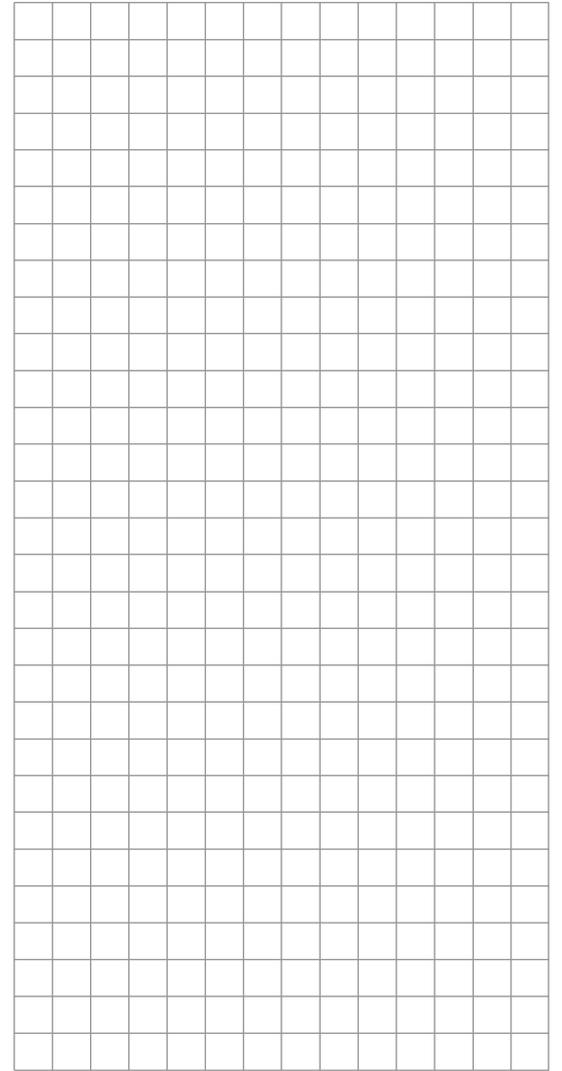
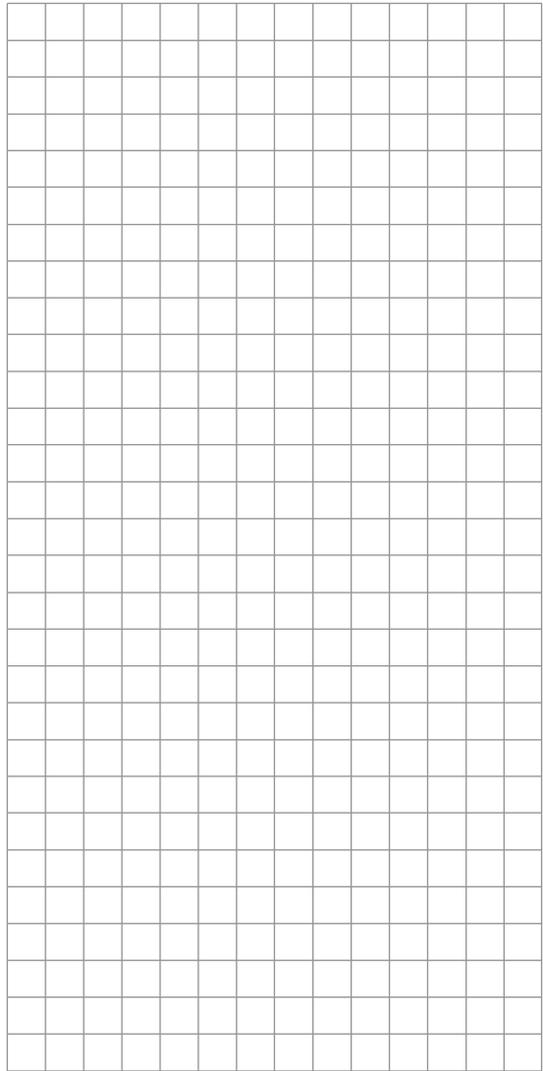
During autorotation however, the main rotor is not driven by the motor but according to the windmill principle.

In this context, there is no torque that the tail rotor must compensate. All of the corresponding mixers are therefore automatically switched off.

Since the aforementioned thrust is no longer necessary during autorotation because of the lack of torque, the basic position of the tail rotor must also be different:

While the motor is switched off, place the helicopter in a horizontal position. Switch on the transmitter and receiver, select the Quick Link "autorotation", fold down the tail rotor blades, and change the mixer settings until the pitch angle of the tail rotor blades equals 0°. The tail rotor blades are then parallel with each other when viewed from the rear.

Depending on the friction and operating resistance of the gearing, the fuselage may still rotate slightly. This relatively slight torque should then be corrected using the tail rotor blade pitch angle. In any case, this value is between 0° and a pitch angle that is opposite the direction of the pitch angle during flight.

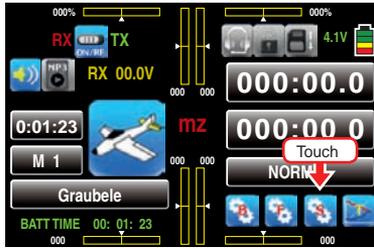




Stick mode

Model-specific basic settings

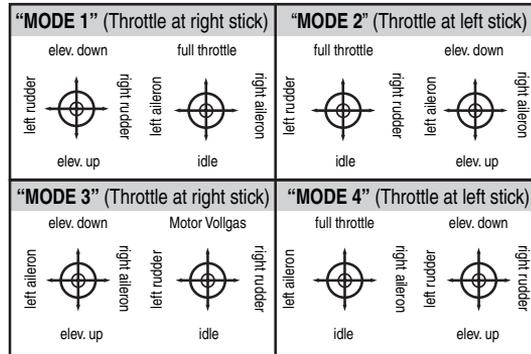
To open the submenus of the SYSTEM menu, touch to the gear symbol labelled "S" in the transmitter's basic display at the bottom right.



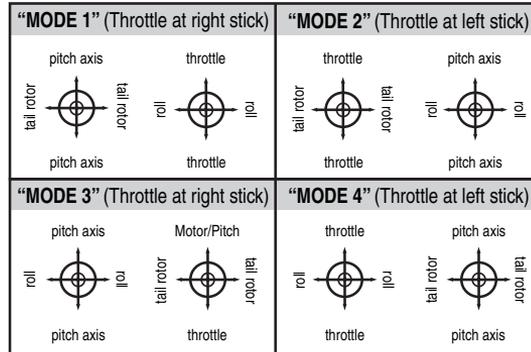
The display switches to the purple main menu. Touch the menu item "ST mode" with your finger or the provided stylus.



There are four different ways of assigning the four control functions of aileron, elevator, rudder and throttle or pitch of a wing model ...



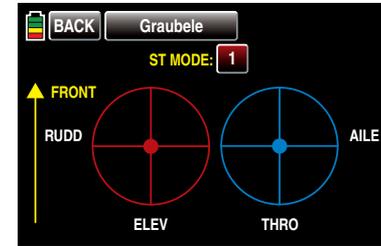
... or roll, elevation, tail rotor and throttle or pitch of a helicopter ...



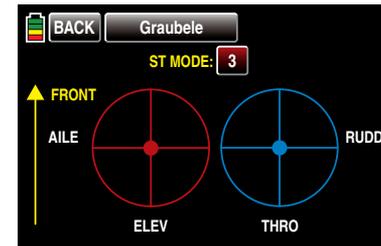
... to the two control sticks. The options that are chosen depend on the individual preferences of the model pilot. "Mode 1" is the default.



This setting is independent of the model and therefore equally applies to all model memories:



In order to switch to a control mode different from the default, touch the red mode button with a finger or the provided stylus until the number appears of the control mode that you want, for example:



Touch the **BACK** button at top left to return to the system menu:





Warning

Transmitter-wide warning settings

In the basic transmitter display, use your finger or the provided stylus to touch the gear icon labelled "S":



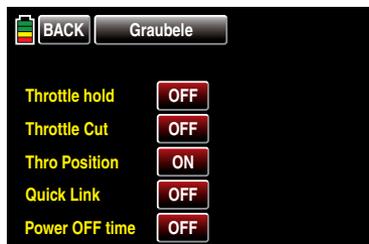
The display switches to the purple main menu. Touch the menu item "WARNING" with your finger or the provided stylus.



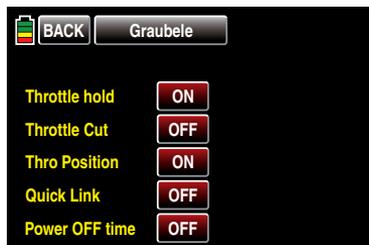
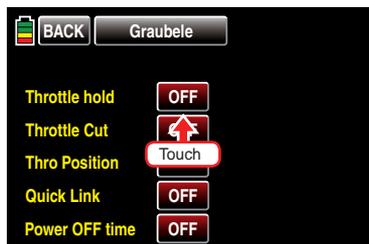
In this submenu, you can switch on and off five triggers of a visual and acoustical alarm. Normally, only the throttle/pitch control stick is actively monitored. The options "Throttle hold", "Throttle Cut", "Quick Link" and "Power OFF time" can also be activated.



These settings are independent of the model and therefore equally apply to all model memories:

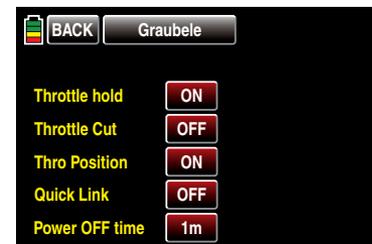


In order to switch back and forth between ON and OFF, touch the field for the other options with a finger or the provided stylus, for example:



In the last line (Power OFF time), you can also specify how long the transmitter should wait following the last actuation of a control element until triggering a visual and acoustic warning before the transmitter turns off after an additional three minutes of inactivity.

The following selections are available: OFF, 30s and 1, 5, 10, 20, 30 and 60 minutes. Repeatedly touch the field of this line with a finger or the provided stylus:



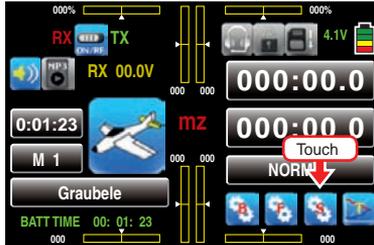
Touch the **BACK** button at the top left to return to the system menu:



Etc.Set

Various transmitter-wide settings

In the basic transmitter display, use your finger or the provided stylus to touch the gear icon labelled "S":



The display switches to the purple main menu. Use a finger or the provided stylus to touch the menu item "Etc.Set":



In the submenu "Etc.Set", you can switch on and off the defaults for the lines "Battery type" and "Batt warning", as well as the volume of the acoustic output and the power-on melody of the transmitter.

NOTE:



The mz-18 HoTT transmitter comes standard with a 4-cell NiMH battery, and the mz-24 HoTT transmitter comes standard with a 1s2p lithium-ion battery. The defaults for the two transmitters are correspondingly different in the lines "Battery type" and "Batt warning" described below.

Note:

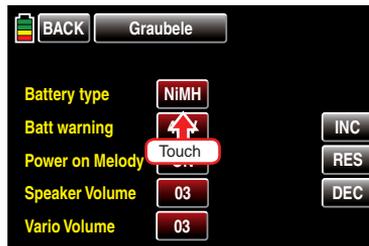


Firmware version V 1.023 expands the available setting options by adding the line "Vario Volume".

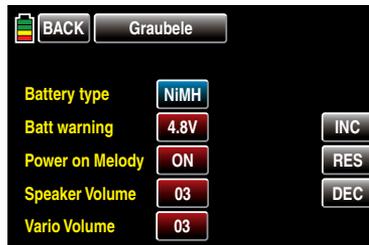
Battery type

In the first line, inform the transmitter whether the power supply is a four-cell NiMH battery or a 1s lithium battery. Depending on the setting, an adapted voltage range is offered in the next line, BATT warning.

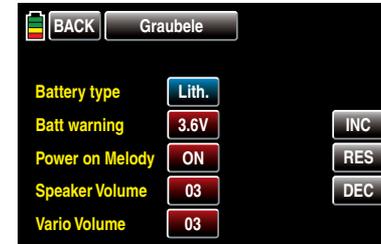
To make any necessary changes to the setting, touch the field of the line "Battery type" with a finger or the provided stylus:



The color of the field switches from red to blue:



Touch **INC** or **DEC** at the right edge of the display to select the appropriate battery type, for example:



Touch the **RES** button to reset a changed value back to the default.

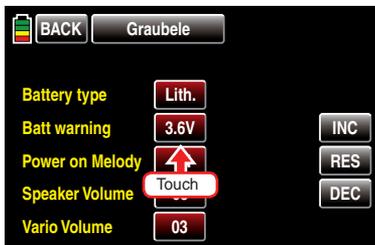
BATT warning

In the "BATT warning" line, you can set the warning threshold of the display ...



... depending on the selected battery type in the line above, in increments of 0.1V between 4.5 and 5.5V (NiMH battery) or 3.4 and 4.2V (lithium-ion/lithium polymer battery). Make sure that the set value is not too low to give you sufficient time to land your model after a battery warning.

To make any necessary changes to the setting, touch the field of the line "BATT warning" with a finger or the provided stylus:



The color of the field switches from red to blue:



Touch **INC** or **DEC** at the right edge of the display to select the appropriate warning threshold, for example:



Touch the **RES** button to reset a changed value back to the default.

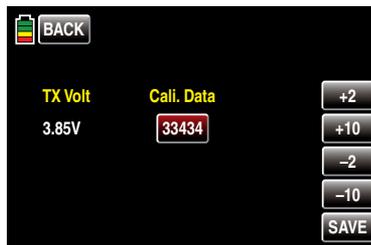
Note:



In a special calibration menu, which can be opened by touching the voltage display in the basic display of the transmitter using your finger or the provided stylus ...



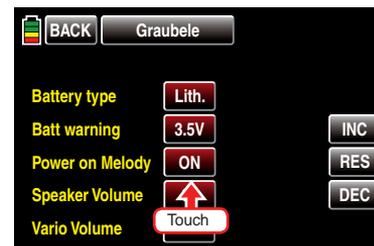
... the voltage display and hence the threshold of the battery warning can be fine-tuned using a precision voltmeter.



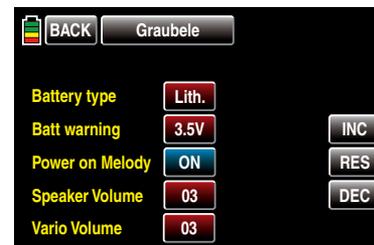
Power on Melody

You can switch on and off the power on and power off melody of the transmitter in this line.

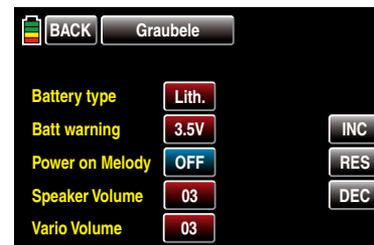
Repeatedly touch the field in the line "Power on Melody" with a finger or the provided stylus:



The color of the field switches from red to blue:



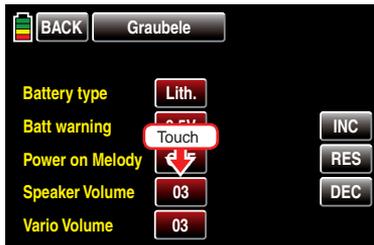
Touch the **DEC** button at the right edge of the display to switch off the power on melody ...



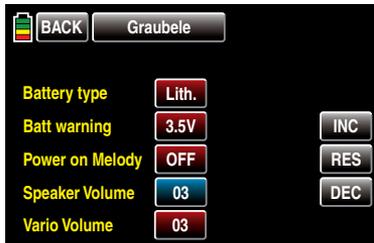
... and touch the **INC** button to switch it on.

Speaker Volume

In this line, you can individually adjust the volume of the acoustic signals and voice triggers of the transmitter.
Repeatedly touch the field in the line "Speaker Volume" with a finger or the provided stylus:



The color of the field switches from red to blue:

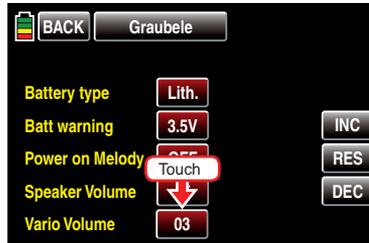


Touch **INC** or **DEC** at the right edge of the display to select the appropriate volume. The following selections are available: "OFF", "1 ... 5", for example:

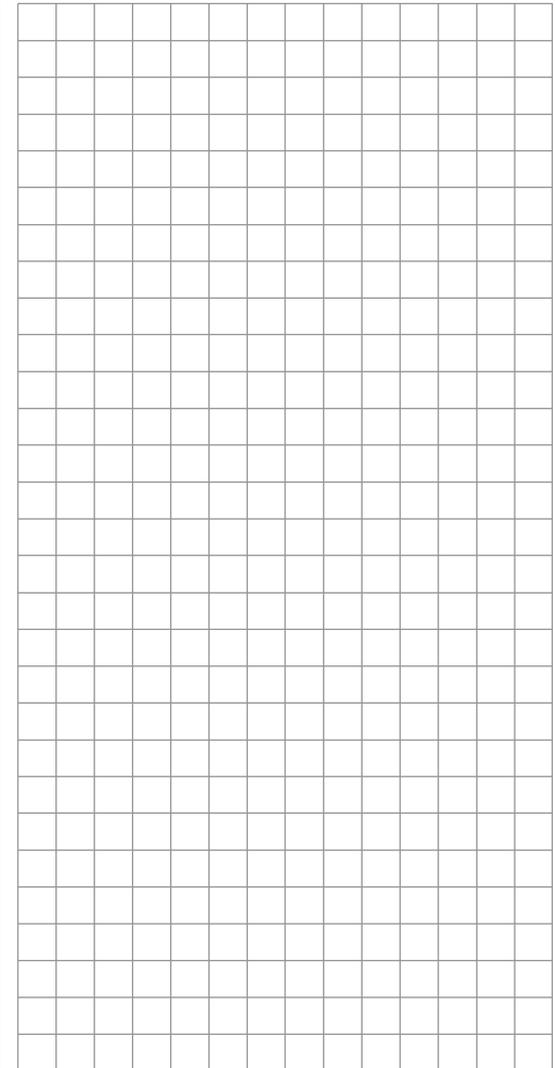
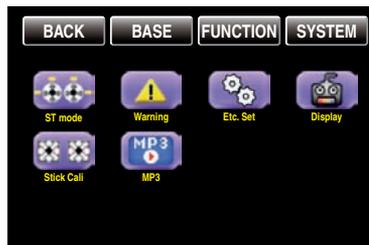


Vario Volume

In this –last–line, you can individually adjust the volume of the Vario announcements of the transmitter as described at the left under "Vario Volume":



Touch **RES** to reset a changed value to the default, and touch **BACK** at the top left of the display to return to the system menu:





Display

Transmitter-wide display settings

In the basic transmitter display, use your finger or the provided stylus to touch the gear icon labelled "S":



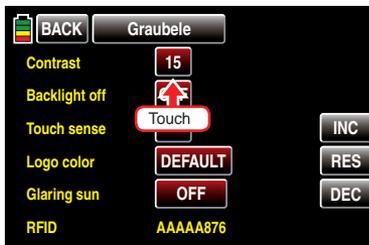
The display switches to the purple main menu. Touch the menu item "DISPLAY" with your finger or the provided stylus.



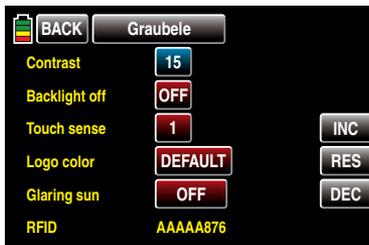
In the "Display" submenu, you can enter display settings such as changing the contrast, turning the backlighting on or off, and adjusting the touch sensitivity to your preferences. Furthermore, you can change the color of the transmitter logo, and switch on and off a function that makes it easier to read the display in a sunny environment.

Contrast

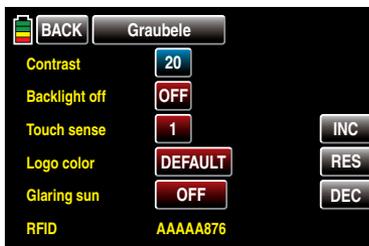
You can adjust the display's contrast in this line to make the **mz-18** HoTT and **mz-24** HoTT transmitter displays easy to read in all weather conditions and temperatures. To make any necessary changes to the setting, touch the field of the line "Contrast" with a finger or the provided stylus:



The color of the field switches from red to blue:



Touch **INC** or **DEC** at the right edge of the display to select the appropriate contrast from a range of 1 ... 20, for example:



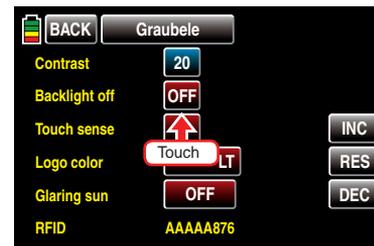
Touch the **RES** button to reset a changed value back to the default "15".

Backlight

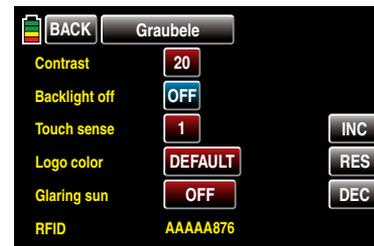
In this line, specify how long the background lighting of the display remains on after turning on the transmitter without actuating a control element, or since a control element has been actuated.

The following options are available: "OFF" (unlimited) "10s", "30s", "1 m" and "3m".

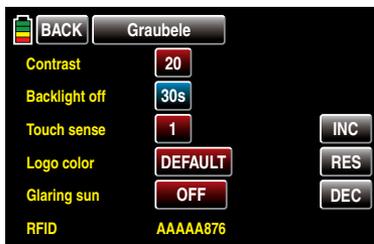
Repeatedly touch the field in the line "Backlight off" with a finger or the provided stylus:



The color of the field switches from red to blue:



Touch **INC** or **DEC** at the right edge of the display to select the appropriate value, for example:



Touch the **RES** button to reset a changed value back to the default **OFF**.

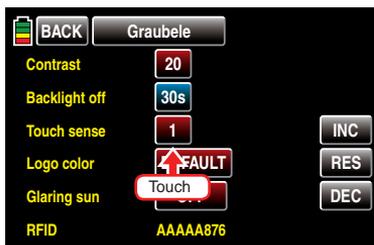
Firmware version V 1.023 and higher

A display that has gone dark after a set time has elapsed can be illuminated again by pressing one of the two buttons ◀ ▶ to the right of the display.

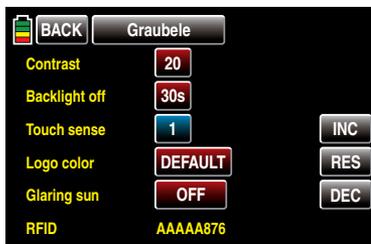
Touch sense

In this line, you can select, within the range of 1 to 5, the reactivity of the transmitter to touching the touch-sensitive display fields. The lower the number, the more sensitive the response to touching the touch-sensitive fields and vice versa.

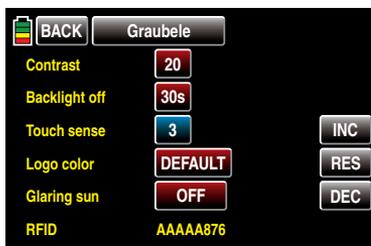
Repeatedly touch the field in the line "Touch sense" with a finger or the provided stylus:



The color of the field switches from red to blue:



Touch **INC** or **DEC** at the right edge of the display to select the appropriate value, for example:

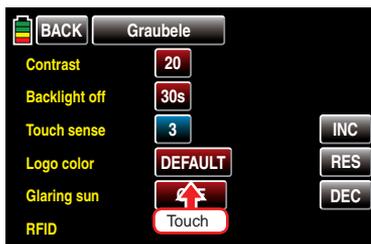


Touch the **RES** button to reset a changed value back to the default "1".

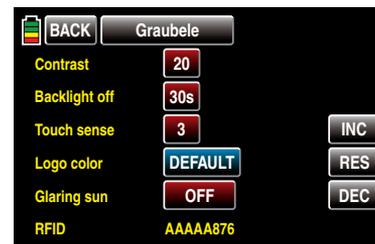
Logo color

In this line, you can adapt the color of the transmitter logo to your preference.

Repeatedly touch the field in the line "Logo color" with a finger or the provided stylus:



The color of the field switches from red to blue:



Touch **INC** or **DEC** at the right edge of the display to select your preference. The following are available for selection: red, green, blue, pink, yellow and skyblue:

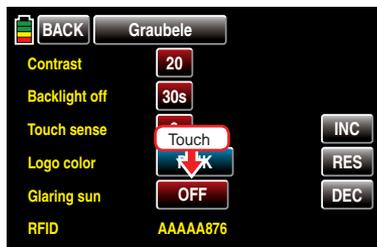


Touch the **RES** button to reset a changed value back to the default.

Glaring sun

To maintain the legibility of the **mz-18** HoTT and **mz-24** HoTT transmitter displays even in bright surroundings or sunlight, you can set the default to "high contrast".

In order to switch back and forth between **ON** and **OFF**, touch the field for the other options with a finger or the provided stylus, for example:



The display immediately switches to **ON** (or vice versa) ...



... and then the transmitter's basic display has the following appearance:



RFID

The RFID of the transmitter is displayed in this last line. This ID is specific for each transmitter, is only issued once per transmitter, and cannot be changed. During the binding process, this ID is transmitted to the receiver which allows it to always identify the radio signals of its transmitter.

Touch the **BACK** button at the top left to return to the system menu:

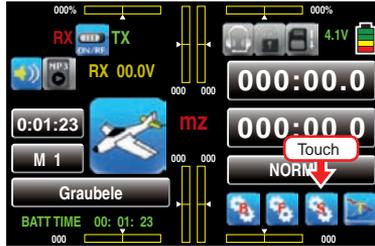




Stick calibration

Calibration of the neutral position of the two control sticks

In the basic transmitter display, use your finger or the provided stylus to touch the gear icon labelled "S":



The display switches to the purple main menu. Touch the menu item "Stick Cali" with your finger or the provided stylus.

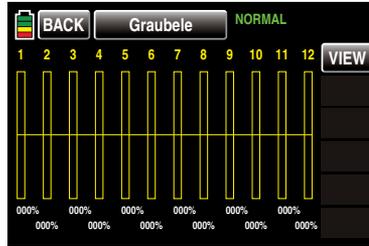


If you feel that the center position of your self-neutralizing control stick (controls 1 ... 4) does not precisely correspond to 0% control travel, you can check and correct it as follows:

As described for example starting on page 45, initialize a free model memory. Whether the model to be initialized is a winged aircraft or a helicopter is irrelevant.

Then switch to the submenu "Servo" found in the base menu without adjusting the trim or performing any additional programming.

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

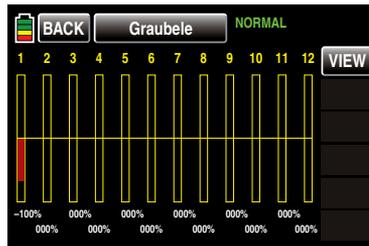


Note:

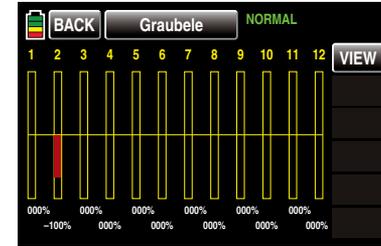


In contrast to the display of the 12-channel mZ-24 HoTT transmitter in this section, only channels 1 ... 9 are shown in the display of the 9-channel mZ-18 HoTT transmitter.

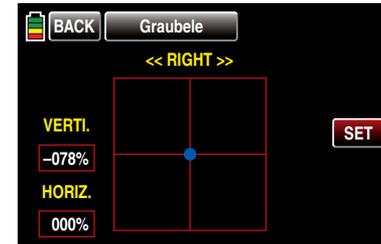
Otherwise the graph bars show current setting percentages for stick control functions which are not self-neutralizing – typically for the "CH1", throttle/brake or throttle/pitch control stick. For example, if the throttle/brake control stick is in its "idle LOW" position, the display would appear as shown below.



One after the other, put both control sticks 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 control 2 is at its right limit and the other three other control stick functions are in their respective middle positions, then your transmitter's display should look like the one shown below.



Regardless of the number of self-neutralizing control stick functions available on your transmitter, if these checks produce four 0% results and eight 100% results, then your transmitter's control sticks are optimally calibrated. You can terminate this process and then, if appropriate, delete the model memory just created. Otherwise, switch to the submenu "Stick Cali" of the system menu in which you can cyclically select the positions of the four calibratable control stick levels, starting with the neutral position of the right control stick system:



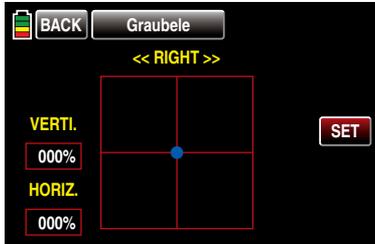
The blue point (in the midpoint of the square in the display above) indicates the control stick position to be adjusted.

The percentages in white in the red rectangles on the left of the display under VERTI(cal) and HORIZ(ontal) indicate the current control stick position.

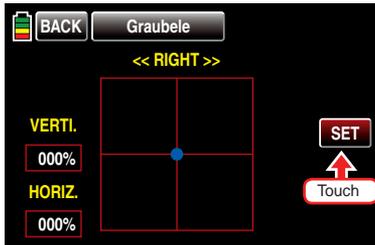
In the above display, the horizontal, self-neutralizing right control stick (for example) is precisely in the middle of its travel. The vertical position is contrastingly angled rather far toward the pilot since the throttle/brake control

stick is not self-neutralizing.

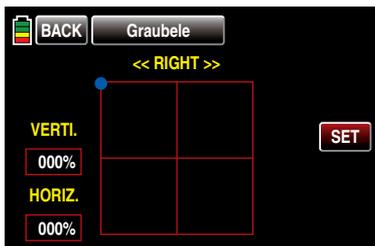
Before touching the **SET** button on the right, the right control stick should be moved away from the pilot toward the center until 000% is displayed:



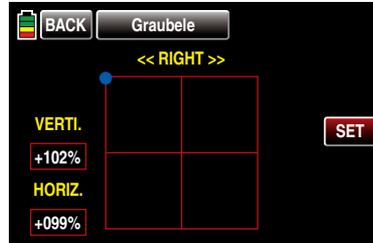
Once this position is reached, you can touch the **SET** button with your finger or the provided stylus on the right edge of the display:



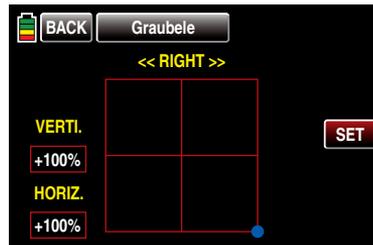
The neutral position of the right control stick is then calibrated in this example, and the blue circle is in the left, top corner of the red square:



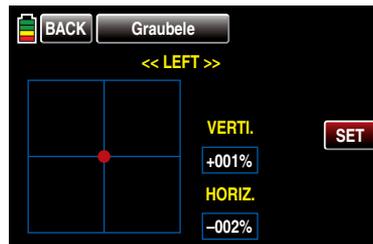
Move the right control stick to the left, front corner *without* exerting pressure at the limit. If the transmitter is incorrectly adjusted, the results can have the following appearance:



Touching the **SET** button at the right edge of the display with a finger or the provided stylus to transfer the 100% position to the memory; the selected point then switches to the opposite corner:



Use the same procedure for the opposite corner; the display will then switch to calibrate the left control stick:



Use the same procedure for calibrating the left control

stick.

Note:



The entire process will have to be repeated if the calibration is incorrect.

Touch the **BACK** button at the top left to return to the system menu:





MP3 Player

Program for playing MP3 files such as music files

Note:



This menu is only available with the **mz-24** HoTT transmitter.

Firmware version V 1.023 and higher

The MP3 menu can now be accessed not only from the system menu, as described in the following, but also directly by tapping the MP3 icon in the basic display:

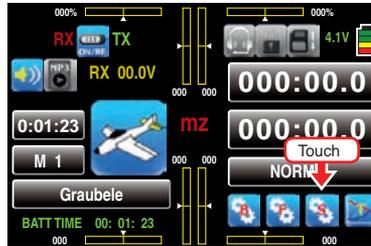


Furthermore, it is now also possible to operate the MP3 menu by means of the buttons on either side of the display:

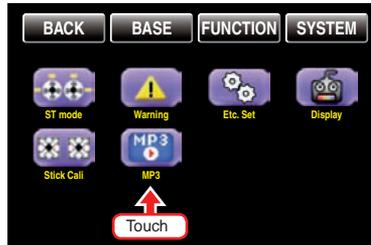
- Start and stop the currently selected MP3 file by pressing the **ENT** button to the right of the display.
- Change the volume by pressing one of the two buttons **▲▼** to the left of the display.
- Scroll forwards/backwards in the current album by pressing one of the two buttons **◀▶** to the right of the display.
- Exit the MP3 menu by pressing the **ESC** button to the left of the display.

Firmware version before V 1.023

In the basic transmitter display, use your finger or the provided stylus to touch the gear icon labelled "S":



The display switches to the purple main menu. Touch the menu item **"MP3"** with your finger or the provided stylus:

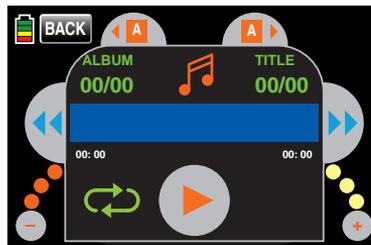


NOTE:

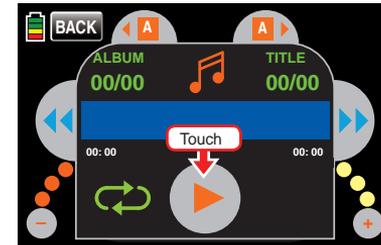


Please note, for technical reasons there is no data recording during playing mp3 files.

Whether or not an SD card with MP3 files is inserted, the display has the following appearance directly after this menu item is opened:



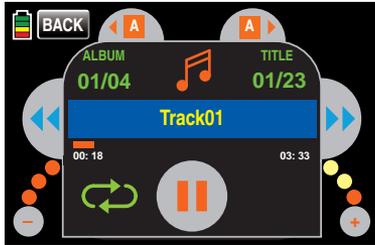
Touch the large red triangle to start playing the first MP3 file of album 1. The file starts playing immediately, but the information on the number of albums and titles as well as the name of the current MP3 file may appear after a slight delay depending on the size of the MP3 file.



If no track starts and no further information or, as of firmware version V 1.023, the text "NO FILE" appears on the display instead of a title, the transmitter is unable to find any suitable MP3 files on the inserted SD card or there is no SD card in the card slot.

Insert a suitable card, or check on a computer the content of the MP3 directory on the SD card removed from the transmitter. The MP3 files may only be saved within the MP3 directory or one folder below. If this directory is empty, copy suitable MP3 files into the directory.

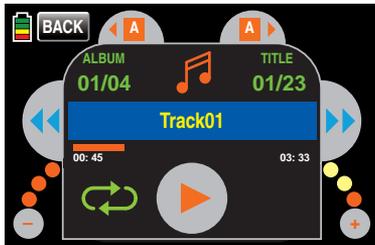
Use an SD card with MP3 files in the MP3 directory, and try again after turning on the transmitter:



Album one will automatically play back until you stop it by touching the stop button ...



...



... or switch off the transmitter.

During playback, you can leave the menu at any time by touching the **BACK** button and use all the features of the transmitter.

Note:



Any activated voice triggers are displayed in the MP3 file that is playing.

Volume

To reduce the volume, touch the gray dot with the "-" at the bottom left of the display with a finger or the provided stylus. Each time you touch the dots, one of the three small dots at the bottom left and right switch from red to yellow, for example:



Touch

Touch the dot with the "+" to increase the volume.

Album

To switch albums, touch the field at the top left ...

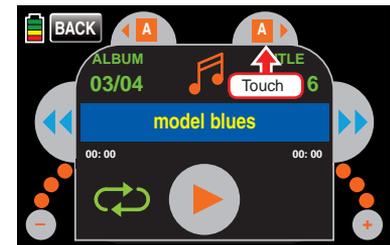


... which updates the album number and number of titles in the album.

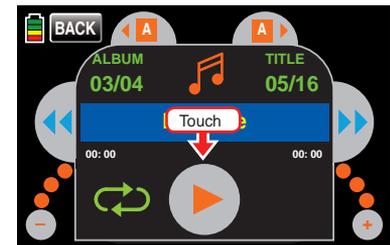


Title

To change a title or look for title, (repeatedly) touch the field at the top right ...



... and start the title as described above by touching the large start button in the middle at the bottom:



Note:



The name of the MP3 file is displayed as the title, and not the title in the metadata fields of the MP3 file which may have the same name.

- *The number of titles of the selected album displayed on the right is calculated from the number of MP3 files per directory.*

Control panels



You can jump forward to a title by touching the right selection button and jump back a title by touching the left button similar to corresponding buttons on MP3 players or other players.

Touch the field to cycle through the following three options:



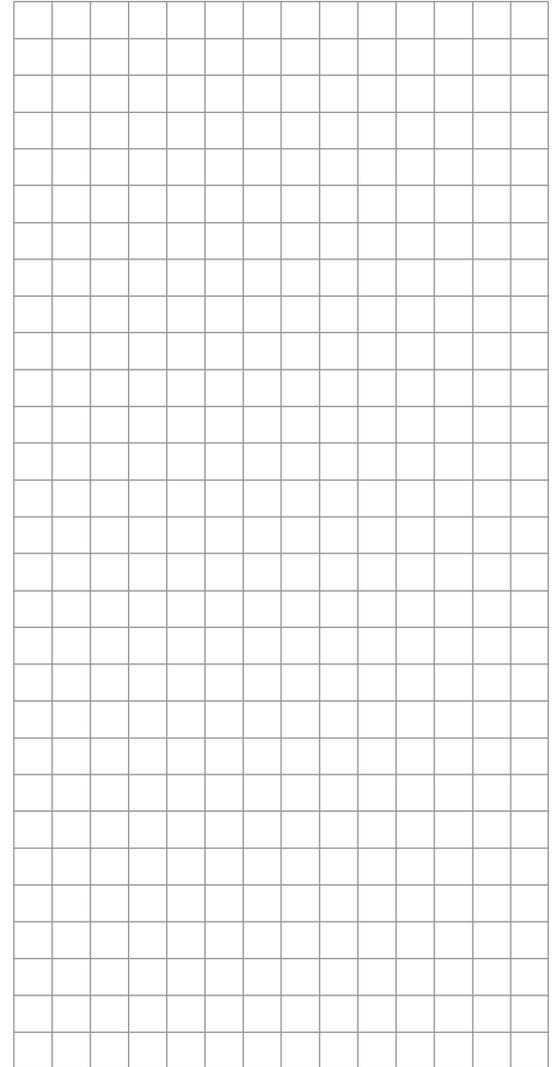
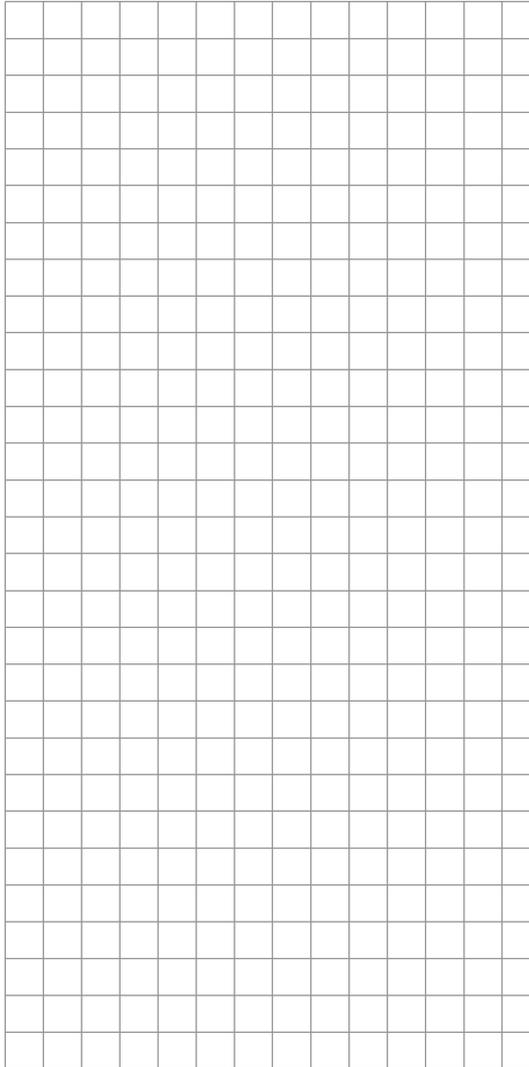
The selected album is played in a continuous loop until you either stop it or turn off the transmitter.



The current title is played in a continuous loop until you either stop it or turn off the transmitter.



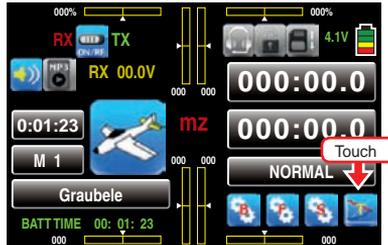
Playback automatically stops at the end of the current title.



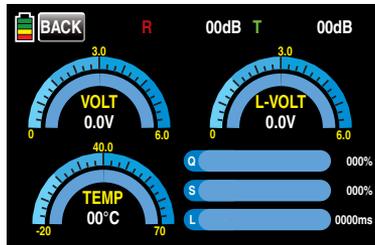


Telemetry data display

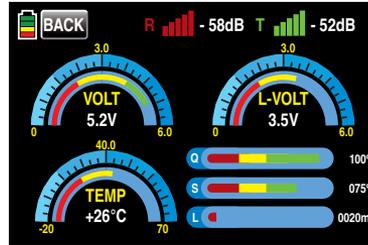
The display of the **mz-18** HoTT and **mz-24** HoTT transmitters is used for operating the transmitter and to graphically display telemetry data. You can switch between modes by touching the "T" icon at the bottom right of the basic display with a finger or the provided stylus:



By default, the receiver display appears after you select the telemetry display. If you do not see any field strength displays ...I at the top edge and no other data are displayed ...



..., no receiver is within range which can respond to the telemetry link. Turn on your receiver or bind a receiver to the active model memory as described in detail on page 74.



A more detailed description of this display can be found below in the section of the same name.

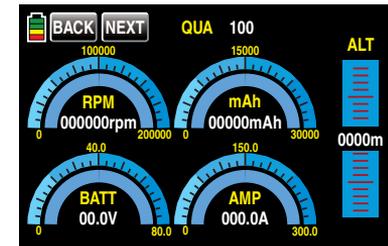
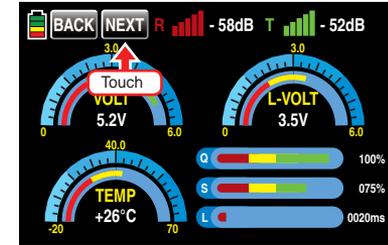
Sensor(s)

Any combination of up to four sensors can be connected to a receiver that operates by telemetry.

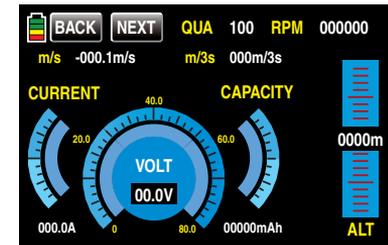


The data from the sensors are transmitted to the graphs described below only if they are properly connected to the receiver before the receiver is switched on. In addition, make sure that the relevant receiver is bound (as described above) in the line "BIND ON/OFF" of the submenu "Tx SET" of the base menu, page 74, and that the receiver is selected in the "RECEIVER SELECT" line of the "Telemetry" menu (RX1 ... RX2), and that the receiver is switched on. If another receiver has been selected, only the data from this receiver is displayed in the "Receiver" display. In addition, sensors in the submenu "SETTING & DATA VIEW" of the "Telemetry" menu, page 127, will only respond under the above prerequisite corresponding to the instructions for the respective sensor.

You can switch between the displays of the automatically activated sensors by touching the **NEXT** button at the top edge of the display ...



... and switch to the next sensor by touching the button again.



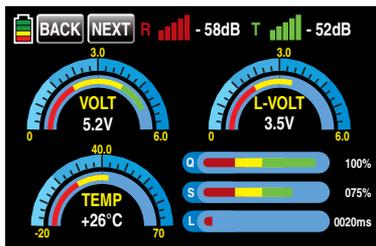
Note:



product.

Further information on the modules cited below can be found in the Annex and on the Internet at www.graupner.de for the respective

Receiver



This display offers a graph of the data from the display "RX DATAVIEW" of the "Telemetry" menu "SETTING & DATA VIEW, page 116.

The abbreviations have the following meanings:

Value	Explanation
Q	Quality expressed as the percentage of transmitter signal packages arriving at the receiver
S	Signal strength expressed as the percentage of the transmitter signal arriving at the receiver
R dB	Level in dBm expressed as the percentage of the transmitter signal arriving at the receiver
T dB	Level in dBm expressed as the percentage of the receiver signal arriving at the transmitter
L	Shows the longest time in ms in which the data packets are lost during a transmission from the transmitter to receiver
VOLT	Current operating voltage of the receiver power supply in Volts

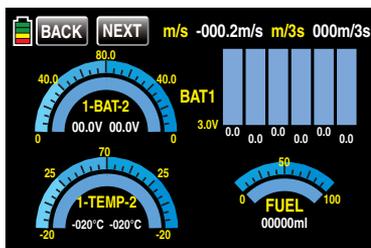
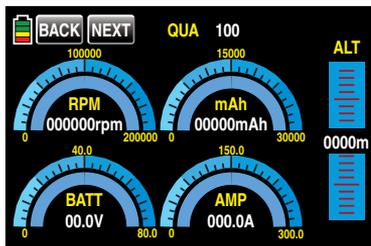
L-VOLT	Lowest operating voltage of the receiver power supply since the last startup in Volts
TEMP	The thermometer visualizes the current operating temperature of the receiver

Note:



Detailed explanations of the terms in the "Value" column can be found in the section "RX DATA VIEW", starting on page 116.

General module



These two displays visualize the data of a general engine module (order No. **33610**) or a general air module (order No. **33611**) that may be connected to the receiver.

Further information on these modules can be found in the Annex or on the Internet at www.graupner.de for the respective product.

Depending on the configuration of the modules with ad-

ditional sensors, the following data can be permanently shown on the display.

Firmware versions up to and including V 1.020

The two displays appear alternately about every 4 seconds.

Firmware versions V 1.021 and above

In order to switch between the two displays, touch one of the dials or scales in the display with a finger or the provided stylus.

1st Display

At the top edge of the display, "QUA" identifies the quality, expressed as a percentage, of the signal coming from the transmitter.

The graphic at the top left shows the speed detected by a speed sensor connected to the module, and the graphic adjacent to the right shows the remaining charge of the connected battery.

Note:



To correctly display the data, the relevant number of blades and the charge must be entered beforehand in the "Telemetry" menu.

The graphic at the bottom left shows the current voltage of the battery connected to the module, and the adjacent graph to the right shows the momentary flow of current. The graph at the right edge of the display shows the current height relative to the location.

2nd Display

The current ascent/descent is displayed at the top edge in m/1 s and m/3 s.

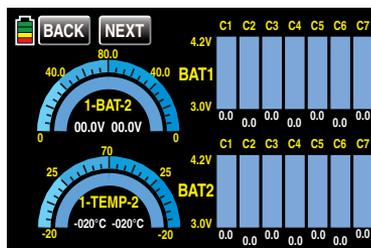
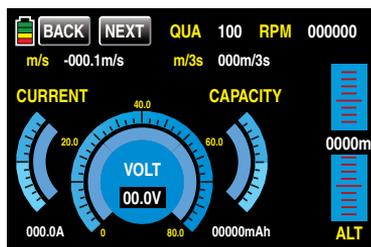
The two graphics to the left show the current voltage measured by the temperature and voltage sensors (order No. **33612** and **33613**) connected to the model from up to two batteries (BAT-1 and BAT-2). They also show the corresponding temperature: On the left side you can see the data of sensor 1 and on the right side the data of sensor 2.

In the right top half of the display, the current cell voltages are displayed of a lithium polymer battery with up to six cells, as well as the level of a fuel tank measured by a sensor connected to the module.

The abbreviations have the following meanings:

Value	Explanation
1-BAT-2	BATT 1 to the left, and BATT 2 to the right
QUA	Signal quality expressed as percentage
FUEL	Fuel level/tank display
ml	accumulated consumption in ml
1-TEMP-2	Temperature of sensors 1 and 2
BAT-1	Cell voltage of cells 1 ... 6
ALT	Current altitude (only with module 33611)
m/s	Ascent/descent in m/1 s (only with module 33611)
m/3s	Ascent/descent in m/3s (only with module 33611)
VOLT	Current voltage of the battery connected to the module
AMP	Momentary current in amps

ELECTRIC AIR MODULE



These two displays that alternate about every 4 seconds visualize the data of an electric air module (order No. **33620**).

Further information on this module can be found in the Annex or on the Internet at www.graupner.de for the respective product.

Depending on the configuration of the module with additional sensors, the following data can be permanently shown on the display.

Firmware versions up to and including V1.020

The two displays appear alternately about every 4 seconds.

Firmware versions V1.021 and above

In order to switch between the two displays, touch one of the dials or scales in the display with a finger or the provided stylus.

1st Display

At the top edge of the display, "QUA" identifies the quality, expressed as a percentage, of the signal coming from the transmitter. The line above shows the current ascent/descent in m/1 s and m/3s. The graphic at the right edge of the display visualizes the current height relative to the location.

The central graphic is a graphic and numeric display of the current voltage of the connected battery. The scale to the left shows the momentary current in amps, and the scale to the right shows the momentary charge of the power source connected to the module at the battery connector.

Note:



To correctly display the data, the charge must be entered beforehand in the "Telemetry" menu.

2nd Display

The two graphics to the left show the current voltage measured by the temperature and voltage sensors (order No. **33612** and **33613**) connected to the model from up to two batteries (BAT-1 and BAT-2). They also show the corresponding temperature: On the left side you can see the data of sensor 1 and on the right side the data of sensor 2.

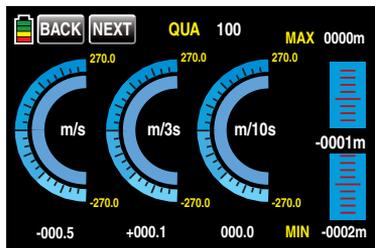
The right half of the display shows the current cell voltages of the (max.) seven-cell battery pack connected to balancer connector 1 (L) and possibly 2 (H).

The abbreviations have the following meanings:

Value	Explanation
V	Current voltage
A	Momentary current
ALT	Current altitude
m/s	Ascent/descent in m/1 s
m/3s	Ascent/descent in m/3s

QUA	Signal quality expressed as percentage
1-BAT-2	BATT 1 and BATT 2
1-TEMP-2	Temperature of sensors 1 and 2
BAT-1/ BAT-2	Cell voltage of each cell 1 ... 7 of battery 1 and each cell 1 ... 7 of battery 2

VARIO

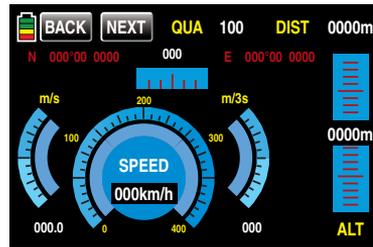


This display visualizes the data of a Vario module connected to the receiver (order No. **33601**).

The abbreviations have the following meanings:

Value	Explanation
QUA	Transmitter signal quality received by the receiver expressed as percentage, see page 116.
MAX	Maximum altitude relative to the starting location in meters
MIN	Maximum depth below the starting location in meters
m/s	Ascent/descent in m/1 s
m/3s	Ascent/descent in m/3 s
m/10s	Ascent/descent in m/10 s

GPS



This display shows the data of a GPS module with an integrated Vario module connected to the receiver (order No. **33600**).

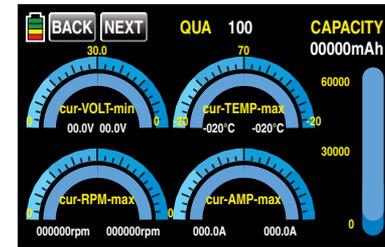
In addition to the current position data and model speed in the center of the display, the current height is displayed in relation to the starting location along with the ascent and descent of the module in m/1 s and m/3 s; the current reception as well as the distance from the starting location are also shown.

The abbreviations have the following meanings:

Value	Explanation
QUA	Transmitter signal quality received by the receiver expressed as percentage, see page 116.
DISTANCE	Distance
N / E	North/east
m/s	Ascent/descent in m/1 s
m/3s	Ascent/descent in m/3 s
Kmh	Speed above ground calculated by the GPS system
ALT	Current altituderelative to the starting location

ESC

(Electronic Speed Controller)



This display shows the data from a brushless controller connected to the receiver with integrated telemetry (order No. **33718 to 33770** and **33850** current at the time of revision of this manual).

The display shows the current and maximum electrical values of the drive, the current and maximum temperature of the controller, and the current and maximum speed of the motor connected to the controller.

The abbreviations have the following meaning:

Value	Explanation
QUA	Transmitter signal quality received by the receiver expressed as percentage, see page 116.
cur-VOLT-min	Left value: current battery charge Right value: lowest battery level since the device has been switched on
cur-TEMP-max	Left value: current controller temperature Right value: maximum controller temperature since the device has been switched on
cur-RPM-max	Left value: current motor speed Right value: maximum motor speed since the device has been switched on

Cur-AMP-
Max Left value: Momentary current
Right value: maximum current since the
device has been switched on

Microcopter display



This display shows the data of a HoTT-compatible microcopter and appears after the ESC display of the electric air, Vario and GPS module. The abbreviations have the following meaning (from top to bottom starting on the left):

Value	Explanation
VOLT	Current voltage
TIME	Time switched on
mAh	Used battery charge since the device has been switched on
00	Position number of satellite
km/h	Speed above ground calculated by the GPS system
ALT	Current altitude relative to the starting location
DIR	Direction of movement
AMP	Momentary current
m	Distance from the starting location calculated by the GPS system

000 Position in angular degrees relative to the starting location calculated by the GPS system

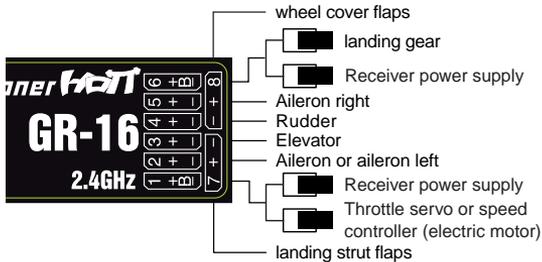
Messages from the microcopter sensor are displayed in the bottom line in the above display.



Programming example

Sequencer

With this programming example, you must have already covered the description of the individual menus, and you must be familiar with the use of the transmitter. In addition, your model must be completely programmed in the transmitter. The following will therefore only present how to integrate a sequencer in the programming of a model with a common landing gear servo and two flap servos for separately actuating the cover for the landing struts and wheels. To cover the limited options of the **mz-18** HoTT receiver as well as the options of a GR-16 HoTT eight-channel receiver, the following connection layout will be assumed in the example:



Everything is entirely normal up to this point. The only thing that is unconventional is the actuation of these three servos via an auxiliary channel and correspondingly programmed curve mixers.

Let us start with programming this example in the submenu ...

CH SET (page 92)

... of the base menu.

Since the relevant control channels 6, 7 and 8 will be actuated using mixers as mentioned above, make sure that the buttons display **NONE** for the corresponding inputs 6, 7 and 8:



Input 9 which is also normally unassigned assumes the role of the auxiliary channel mentioned above, is assigned with one of the proportional DV dials such as DV1 for the sake of a more sensitive response.



(This proportional control is only needed for programming the sequencer and is replaced with a control after the mixer is programmed as described below.)

After the control is assigned, leave the menu and go to the submenu ...

"Prog.MIX"

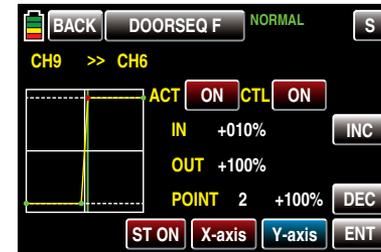
(page 100)

... of the function menu in which you will be programming three curve mixers ...

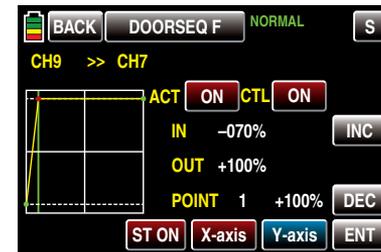


... as follows:

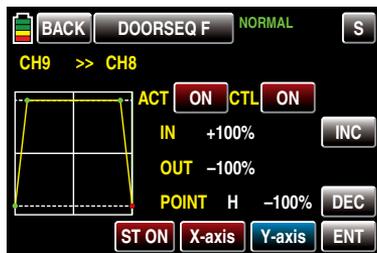
One curve mixture for the landing gear function:



One curve mixture for actuating the servo of the landing strut flaps which are to remain open after the landing gear extends:



And another curve mixture for the smaller wheel cover flaps that are to be closed after the landing gear extends:



After the last curve mixer is programmed, the procedure should function as desired after the aforementioned proportional control is actuated. If this is true, switch back to the submenu ...

CH SET (page 92)

... of the base menu, and assign a control instead of the aforementioned proportional control, such as the easy to reach two-position switch with a long handle S6 to the front left which appears as SW 6 in the menu:



After this programming, switch back to the submenu ...

REV/DEL (page 68)

... of the base menu, and set the desired time for the auxiliary channel CH9 controlling the sequencer function, such as 6 seconds:



After the selected control is actuated, the extension and retraction of the landing gear and opening of the flaps should function as desired.

In conclusion it is noted that when, for example, a 12-channel GR-24 HoTT is used, a floodlight control could be connected to receiver output 9 (which does not exist in a receiver in this example). The floodlight is actuated along with the landing gear. Additional applications can of course be found after becoming familiar with the range of options.



Appendix



PRX (power for receiver)

Order No. 4136

Highly developed, stabilized receiver power supply with intelligent power management.

The unit offers a stabilized and adjustable receiver power supply to further enhance the reliability of the power supply. Appropriate for different receiver batteries for uncomplicated and wide-ranging use. If the battery voltage fails during operation, this event is saved and displayed to help prevent the use of a receiver battery which is too small, or to prevent the failure of the battery.

- For operation with one or two receiver batteries. (simultaneous discharge when two batteries are used)
- Appropriate for a 5- or 6-cell NiMH battery, or 2-cell LiPo or LiFe battery *Graupner*/JR, G3,5, G2 and BEC plug-in systems.
- Three adjustable levels for the output voltage to supply the receiver (5.1V / 5.5V / 5.9V).
- Two ultrabright LEDs separately display the charge of battery 1 and battery 2.
- Integrated high-quality On/Off switch
- High-current resistant design
- Flatter design of the fastening brackets, LEDs and switches for easy installation with an accompanying drilling template.



Graupner HoTT GPS/Vario module

Order No. 33600

Vario with altitude signals and five tones for ascending and descending, an integrated GPS with distance measurement, travel measurement, speed display, and display of the direction of flight and coordinates

- Additional warning thresholds for min. altitude, max. altitude, speed of ascent and descent in two levels
- Altitude display and storage of min. and max. altitude.
- Settable warning time: OFF, 5, 10, 15, 20, 25, 30 seconds, constant
- Settable repeated warning time: constant, 1, 2, 3, 4, 5 min., once
- The GPS/Vario sensor can be connected directly to the telemetry input of the receiver.

Technical data for the Vario:

- Altitude measurement: -500m ... +3000m
- Resolution: 0.1 m
- Vario sensitivity: programmable 0.5m/3s, 1 m/3s, 0.5m/s, 1 m/s, 3m/s pro tone
- Average calculation: programmable 4 - 20 measurements per measured value



Graupner HoTT Vario module

Order No. 33601

Vario with altitude signals and 5 tones for ascending and descending, altitude display and storage of min. and max. altitude.

- Additional warning thresholds for min. altitude, max. altitude, speed of ascent and descent in two levels
- Settable warning time: OFF, 5, 10, 15, 20, 25, 30 seconds, constant
- Settable repeated warning time: constant, 1, 2, 3, 4, 5 min., once
- The Vario sensor can be connected directly to the telemetry input of the receiver.

Technical data

- Altitude measurement: -500 m ... +3000 m
- Resolution: 0.1 m
- Vario sensitivity: programmable 0.5m/3s, 1 m/3s, 0.5m/s, 1 m/s, 3 m/s pro tone
- Average calculation: programmable 4 - 20 measurements per measured value



Graupner HoTT 2.4 General Engine Module
Order No. 33610

General sensor for *Graupner* HoTT receivers and models with gas or electric motor

- 2x temperature and voltage measurements with warning thresholds for min. and max. voltage and min. and max. temperature
- Single cell measurement with warning thresholds for min. voltage
- Voltage, current and capacity measurement with warning thresholds for min. and max. voltage, max. capacity and max. current
- Programmable current limiting
- Current limiting with shunt resistors 2 x 1 mOhm parallel = 0.5 mOhm
- Rotational speed measurement and warning thresholds for min. and max. rotational speed
- Fuel measurement with warning thresholds in 25 % increments (after software update).
- Settable warning time: OFF, 5, 10, 15, 20, 25, 30 seconds, constant
- Settable repeated warning time: constant, 1, 2, 3, 4, 5 min., once
- 2x temperature selectively 0 to 120°C or 200°C and voltage measurement up to 80 V DC
- 1x rotational speed measurement up to 100,000 rpm with a two-blade propeller
- 1x speed controller/servo input, 1x rotational speed regulation input, 1x speed controller/servo output for rotational speed regulation
- etc.: see www.graupner.de



Graupner HoTT 2.4 General Air Module
Order No. 33611

General sensor for *Graupner* HoTT receivers and models with gas or electric motor

- Vario with altitude signals and ascent and descent signals, and additional warning thresholds for min. altitude, max. altitude, rate of ascent and descent in two stages
- Altitude display (-500 ... +3000 m) and storage of the min. and max. altitude.
- 2x temperature and voltage measurements with warning thresholds for min. and max. voltage and min. and max. temperature
- Single cell measurement with warning thresholds for min. voltage
- Voltage, current and capacity measurement with warning thresholds for min. and max. voltage, max. capacity and max. current
- Rotational speed measurement with rotational speed regulation (programmable) and warning thresholds for min. and max. rotational speed
- Fuel measurement with warning thresholds in 25% increments
- Settable warning time: OFF, 5, 10, 15, 20, 25, 30 seconds, constant
- Settable repeated warning time: constant, 1, 2, 3, 4, 5 min., once
- 2x temperature selectively 0 to 120°C or 200°C and voltage measurement up to 80 V DC
- 1x rotational speed measurement up to 100,000 rpm with a two-blade propeller
- etc.: see www.graupner.de



Graupner HoTT 2.4 Electric Air Module
Order No. 33620

General sensor for *Graupner* HoTT receivers and models with electric motor

- Vario with altitude signals and ascent and descent signals, and additional warning thresholds for min. altitude, max. altitude, rate of ascent and descent in two stages
- Altitude display (-500 ... +3000 m) and storage of the min. and max. altitude.
- 2x temperature and voltage measurements with warning thresholds for min. and max. voltage and min. and max. temperature
- Single cell measurement 2 ... 14 s with warning thresholds for min. voltage
- Voltage, current and capacity measurement with warning thresholds for min. and max. voltage, max. capacity and max. current
- Settable warning time: OFF, 5, 10, 15, 20, 25, 30 seconds, constant
- Settable repeated warning time: constant, 1, 2, 3, 4, 5 min., once
- 2x temperature selectively 0 to 120°C or 200°C and voltage measurement up to 80 V DC
- 1x speed controller input, 1x speed controller output for single cell undervoltage correction
- 1x current and voltage and capacity measurement up to 150 A (short-term 1 sec 320 A) and up to 60 V
- 1x single cell monitoring for 2 - 14S lithium batteries (LiPo, Lilo, LiFe)



Graupner HoTT RPM magnetic sensor
Order No. **33616**

For connecting to the General Engine (order No. **33610**), General Air (order No. **33611**) or Electric Air module (order No. **33620**).

Select the number of blades in the module's telemetry menu.

Graupner HoTT RPM optical sensor
Order no. **33615**

For connecting to the General Engine (order No. **33610**), General Air (order No. **33611**) or Electric Air module (order No. **33620**).

Select the number of blades in the module's telemetry menu.



Graupner HoTT Vario module
Order No. **33700**

Wide-ranging functions combined into one device make the SMART BOX your future smart companion. Whether it comes to displaying real-time telemetry data or making settings on your HoTT system, 8 x 21 characters on a large display enable easy use. An integrated buzzer that emits an acoustic signal and warning tone and enhances the flexible use of the BOX even further.

Using the accompanying installation set, the device can be mounted on brackets of the transmitter and is thus optimally positioned to enable the reading of real-time telemetry data even while controlling your model.

The user-installed updates ensures that the SMART BOX always has the latest software and can be safely expanded with future functions.

- Transmitter voltage display with adjustable warning threshold
- Range test
- Receiver temperature
- Servo reversal
- Servo travel
- Channel switching
- Mixer settings
- Country setting
- Signal quality
- Receiver voltage
- Servo neutral position
- Cycle time
- Fail-Safe settings
- Servo test

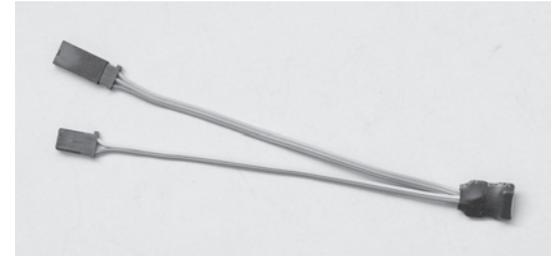
Dimensions: approx. 76 mm x 72 mm x 17 mm (L x W x H)

Weight: approx. 55 g



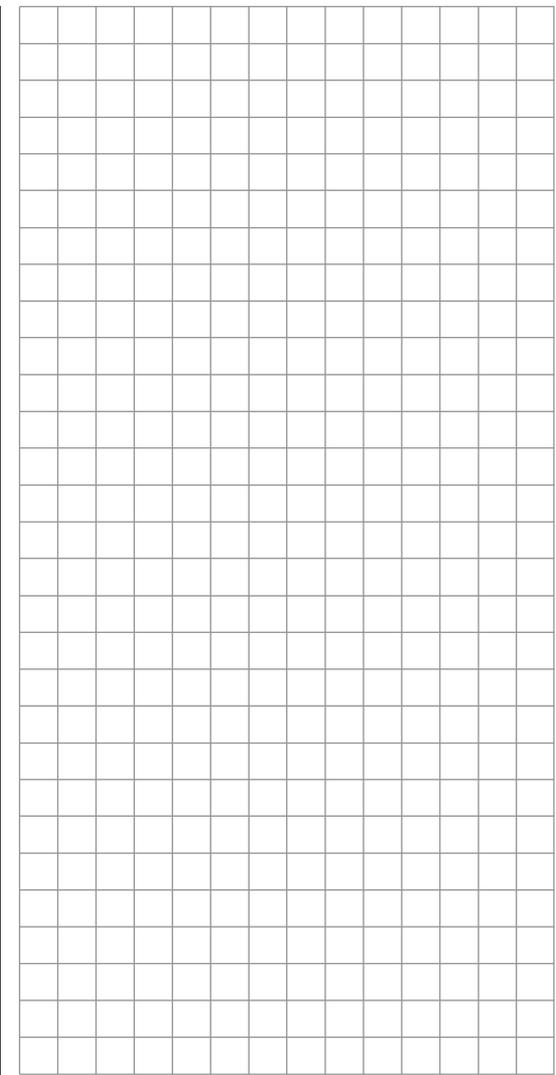
Graupner HoTT USB interface
Order No. **7168.6**

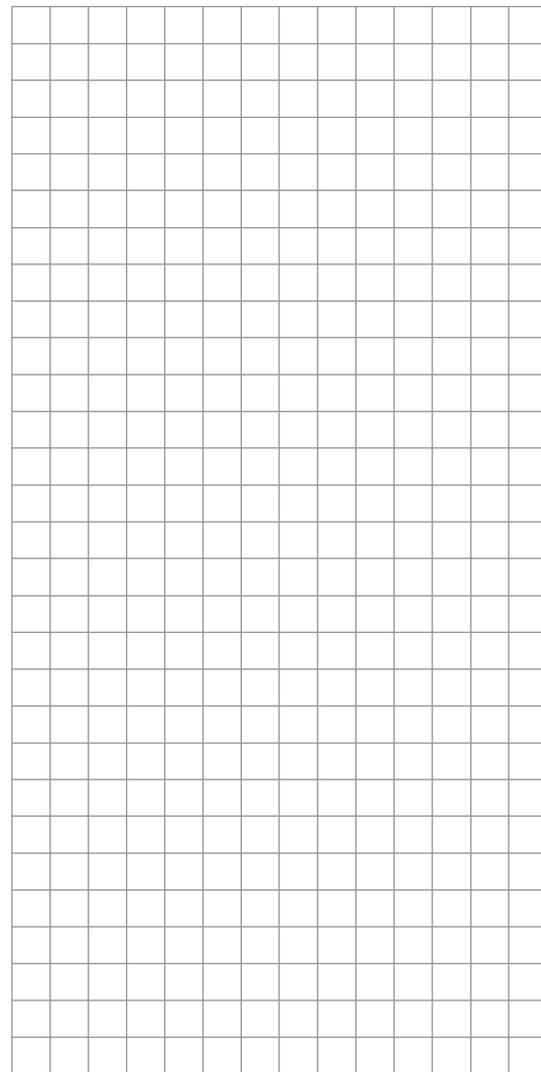
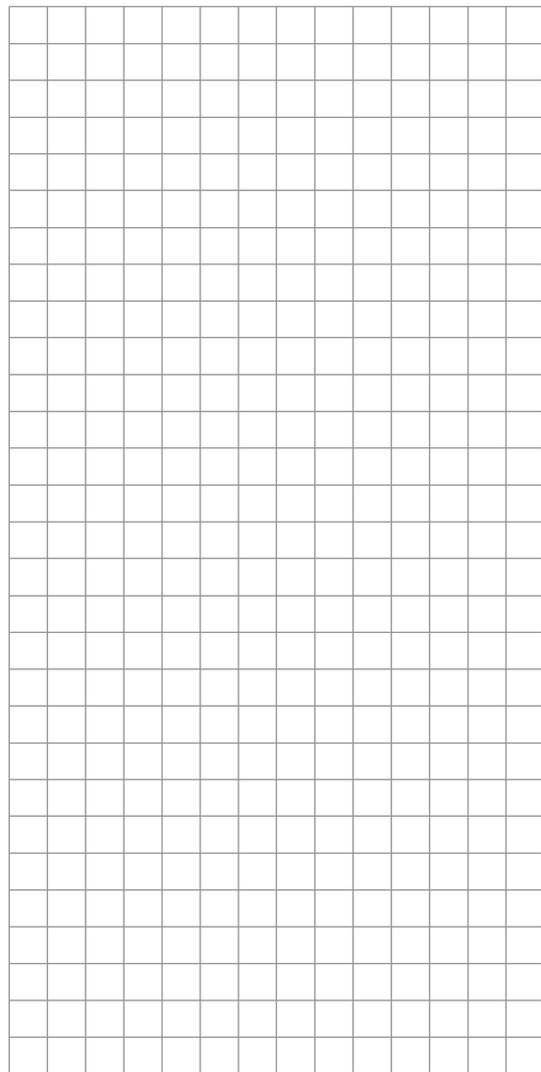
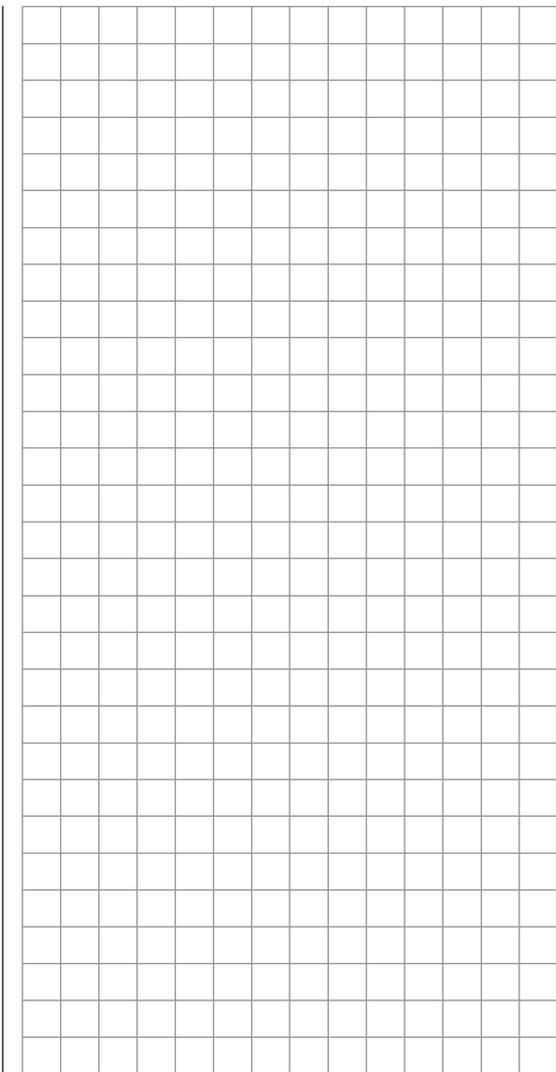
This USB interface is required together with the separately available adapter cable (order No. **7168.6S**) for updating receivers and sensors, and the **mz-18** HoTT and **mz-24** HoTT transmitters can be updated directly with the USB cable included in the delivery with the interface.

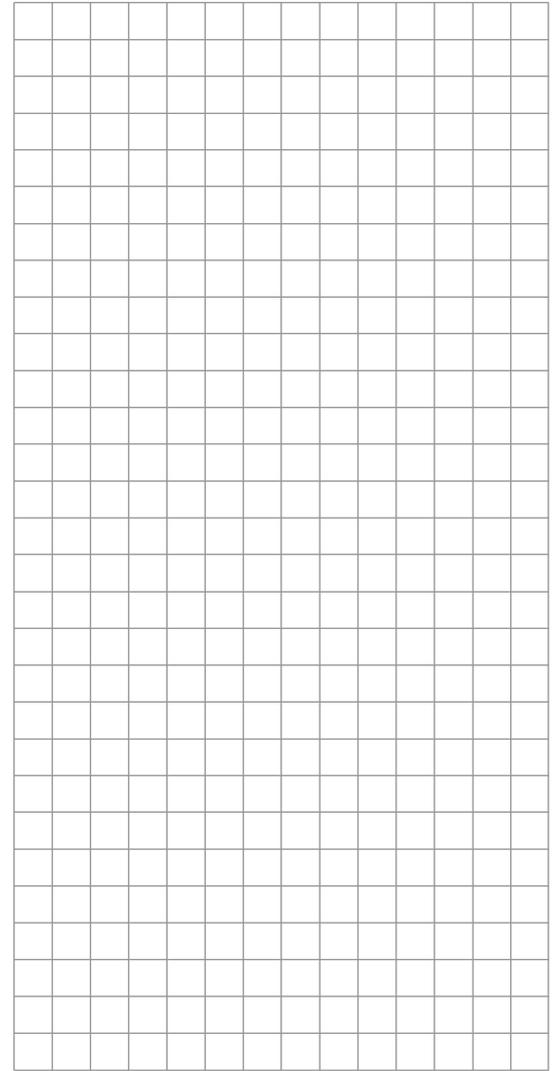
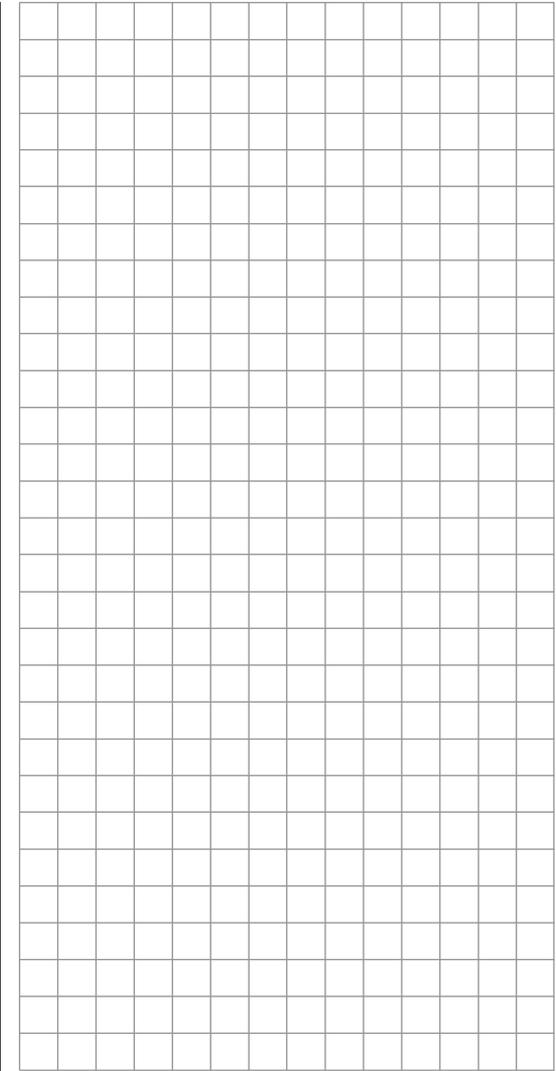


Graupner HoTT adapter cable
Order No. **7168.6S**

This adapter cable is required together with the separately available USB interface (order No. **7168.6**), for updating receivers and sensors. The **mz-18** HoTT and **mz-24** HoTT transmitters can be updated directly with the USB cable included in the delivery of the interface.







Declaration of conformity



EU-Konformitätserklärung EU-Declaration of Conformity

Hiermit bestätigen wir, dass das nachfolgend bezeichnete Gerät den angegebenen Richtlinien entspricht.
We herewith confirm that the following appliance complies with the mentioned directives.

Artikelbezeichnung: mz-18 HoTT / mz-24 Hott / GR-12L HoTT / GR-24 HoTT

Article description:

Artikelnummer: S1005 / S1006 / S1012 / 33512

Article number:

Geräteklasse: 2

Equipment class:

Firmenanschrift: Graupner/SJ GmbH
Henriettenstrasse 96
D-73230 Kirchheim/Teck

Company address:

Einschlägige EU-Richtlinien / Governing EU-directives / Directives CE concernées :

- 1. Elektromagnetische Verträglichkeit (EMV)
Electromagnetic compatibility (EMC)
2004/108/EC
- 2. Niederspannungs-Richtlinie
Low-voltage directive
2006/95/EC
- 3. Maschinenrichtlinie
Machine directive
2006/42/EC
- 4. Medizinprodukte (Klasse 1)
Medical device directive (Class 1)
93/42/EEC
- 5. Funkanlagen u. Telekommunikationseinrichtungen
Radio a. Telecommunication Terminal Equipment
R&TTE 1999/5/EC
- 6. Ökodesign-Richtlinie
Energy related products directive (ErP)
2009/125/EEC
- 7. Beschränkung der Verwendung bestimmter gefährlicher Stoffe in Elektro- und Elektronikgeräten
Restriction of the use of certain hazardous substances
2011/65/EC

Harmonisierte EN-Normen / Harmonised EN-Standards

Der Artikel entspricht folgenden, zur Erlangung des CE-Zeichens erforderlichen Normen:
The article complies with the standards as mentioned below which are necessary to obtain the CE-symbol:

Zu 1:
EN 301 489-1 V1.9.2
EN 301 489-17 V2.1.1

Zu 5:
EN 300 328 V1.8.1

Zu 7:
EN 60950-1:2006 + A11:2009 + A1:2010 + A12:2011
EN 62479:2010

Unterschrift / Signature

Position

Geschäftsführer / Managing Director

Ausstellungsdatum / Date of issue

10.12.2014

Graupner Service Centre

Postal address: Graupner|SJ GmbH
Service
Henriettenstrasse 96
D-73230 Kirchheim

Service hotline

Mo. - Th.: 09:15 a.m. - 17:00 p.m.
Friday: 09:15 a.m. - 13:00 p.m.
☎ from inside Germany: 07021 72 21 30
☎ from outside Germany: 0049 7021 72 21 30

Email: service@graupner.de

additional service centres can be found on the Internet
at www.graupner.de/en/service/servicepoints.aspx

Die Fa. *Graupner|SJ* GmbH, Henriettenstraße 96, D-73230 Kirchheim/Teck gewährt ab dem Kaufdatum auf dieses Produkt eine Garantie von 24 Monaten. Die Garantie gilt nur für die bereits beim Kauf des Produktes vorhandenen Material- oder Funktionsmängel. Schäden, die auf Abnutzung, Überlastung, falsches Zubehör oder unsachgemäße Behandlung zurückzuführen sind, sind von der Garantie ausgeschlossen. Die gesetzlichen Rechte und Gewährleistungsansprüche des Verbrauchers werden durch diese Garantie nicht berührt. Bitte überprüfen Sie vor einer Reklamation oder Rücksendung das Produkt genau auf Mängel, da wir Ihnen bei Mängelfreiheit die entstandenen Unkosten in Rechnung stellen müssen.

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Garantieurkunde

Warranty certificate / Certificat de garantie

mz-18 HoTT Set

Order No. **S1005**

mz-24 HoTT Set

Order No. **S1006**

Übergabedatum:

Date of purchase/delivery:

Date d'achat :

Name des Käufers:

Owner's name:

Nom de l'acheteur :

Straße, Wohnort:

Complete address:

Adresse complète :

Firmenstempel und Unterschrift des Einzelhändlers:

Stamp and signature of dealer:

Cachet et signature du détaillant :

Graupner

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GRAUPNER/SJ GMBH
POSTFACH 1242
D-73220 KIRCHHEIM/TECK
GERMANY

www.graupner.de

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