

# Manual

## mz-24 Pro

12 channel HoTT 2.4 GHz transmitter

No. S1006.PRO



CE Part 2  
Programming manual

**Graupner**

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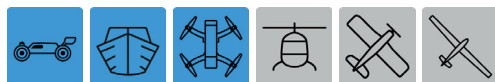
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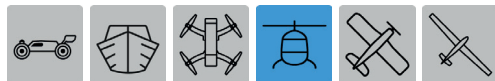
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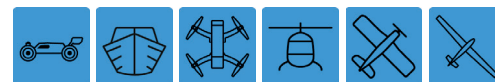
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## System Menu



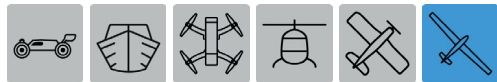
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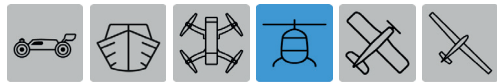
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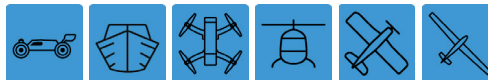
### Before Use

Thank you very much for purchasing the *Graupner mz-24 HoTT Pro* transmitter.

This transmitter comes with two manuals: **Part 1** is a quick-start guide included in the transmitter's packaging. **Part 2** is a programming manual providing in-depth details about the advanced functions of the **mz-24 PRO**. Both manuals are available for download at [www.graupnerusa.com](http://www.graupnerusa.com).

Carefully read both manuals for all safety precautions and for information on optimal transmitter and model use. If you experience any trouble during operation, ask experienced modelers, your dealer or contact the *Graupner Service Center*.

For ease-of-use in locating specific information, certain sections in this manual are marked with the same model type symbols used in the transmitter display menus. Icons will be highlighted blue when pertaining to the model it represents; icons will be grayed out if the information is irrelevant to that model. Refer to the highlighted icons for information related to your model type:



### Warning Symbols and Their Meaning



Always observe the information indicated by this warning icon, particularly those which are additionally marked with the following signal words:

**WARNING** indicates the potential for serious injury.

**CAUTION** indicates possibility of lighter injuries.



This icon indicates information that may be helpful in diagnosing or troubleshooting, especially when accompanied by the following signal words:

**Note** indicates potential malfunctions.

**Attention** indicates potential damages to objects.



This symbol indicates instructions on the care and maintenance of the device. Following these instructions will help the device remain in good functioning condition.

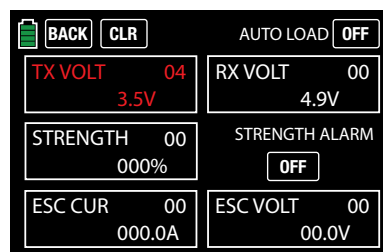
# Transmitter Start Up

## Preliminary Remarks

The *Graupner*-HoTT system allows more than 200 models or remote-control systems to be operated at the same time, though in practice this number will be significantly less since permits are required for combined remote operation within the 2.4 GHz ISM band. Ultimately, however, the only thing limiting pilots is the size of the flying field.

## Battery Charged?

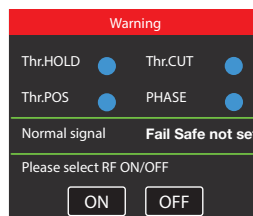
The battery delivered with the transmitter is only partially charged. Charge it according to the charge instructions in Part 1 of the manual. If not fully charged, a warning signal will sound once the voltage drops below a certain threshold. To change the voltage setting, adjust the value in the "Batt warning" line in the SYSTEM submenu **Etc.Set** (page 212).



## Transmitter Startup

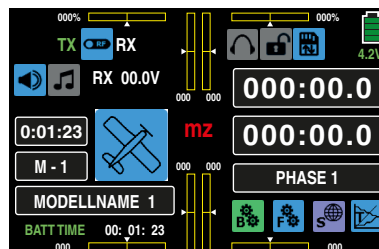
Whenever the transmitter is switched on, the servo outputs on channels 1 through 12 are checked. For safety reasons, the RF module will remain off to avoid accidental motor starts if the impulse is outside a pre-selected bandwidth for idling.

When the transmitter is turned on the RF module will display the message:



Audible warning signals will sound for a few seconds. Either wait a few seconds until the display automatically disappears or press the **ON** or **OFF** button to initiate or turn off the RF transmission.

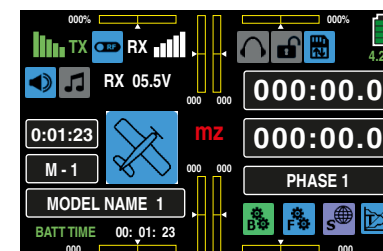
The basic display menu of the **mz-24** HoTT Pro transmitter now appears:



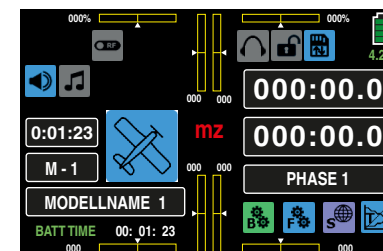
Icon symbols are either active (highlighted blue) or inactive (grayed out). The RF switch symbol is located at the top left corner of the display. In this example the symbol appears blue and is positioned between the green "TX" and the white "RX", meaning that the RF transmission of the transmitter is on.

The green "TX" and white "RX" to the left and right of this switch symbol indicate that an active model memory had once been linked to a *Graupner*-HoTT receiver but is currently not detected.

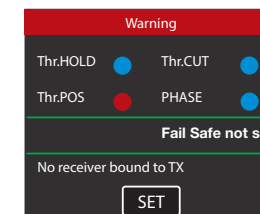
Once this link is established, the field strength display appears to the left of the green "TX" and to the right of the white "RX", and a numeric display underneath shows the current voltage of the receiver power supply. For example:



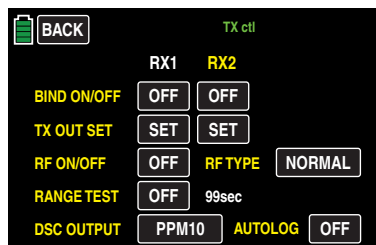
If the transmitter is turned on while the RF transmission is off, none of this information is displayed, and the RF switch symbol is gray:



If the transmitter is turned on and no receiver or model memory is linked, the following warning appears:



Press the **SET** button to pull up the BASE submenu TX ctl:



Bind the receiver by pressing the buttons in the BIND ON/OFF line, or press the **BACK** button at the top left of the display to exit and return to the basic display menu.

#### Tip

Refer to the **Model Name** section (page 42) for additional instructions on how to bind the receiver using the Setup Wizard and program a new model memory.

#### Notices



- With the **mz-24 HoTT Pro** transmitter it is possible to control up to 12 functions. Any servos which are connected to connections 13 and higher remain in their default center position and cannot be actuated by the transmitter.
- For maximum flexibility, and to prevent unintentional misuse, control channels 5-12 are not initially assigned to any control elements, and the servos linked to these channels remain in their center positions until an operating element has been assigned. For the same reason, nearly all mixers are inactive. Refer to **Control/Switch Setting** (page 90) for information on how to change these settings.

- 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 overdrive, and the red LED on the receiver will shine to indicate that no signal is being received. 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. In this moment the transmitter is in **Fail Safe Mode** (page 80). When in Fail Safe Mode, during reception loss, the servos remain in the last known positions or will move to preset Fail-Safe positions and remain until signal re-established. When this happens, move the two antennas apart until the displays return to normal.

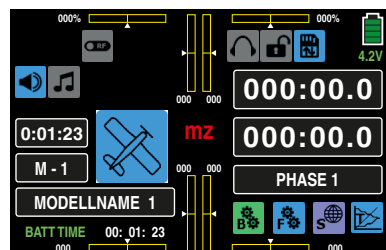
#### CAUTION



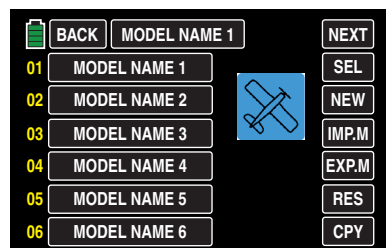
**Never turn off the transmitter while operating the model! If this happens, wait three seconds for the display to go dark, then turn the transmitter on again. The transmitter may freeze if turned on before the screen goes dark. If a transmitter is turned off during flight, wait three seconds until the display screen goes dark, then turn on the transmitter. Transmitter may freeze if turned on before the display screen goes dark, and models may become uncontrollable.**

# Display Operation

Operate the display by pressing value fields or icons with a finger or the provided stylus:



The main menu display has shortcuts and icons that easily take users to desired menus or information displays. For example, pressing the model memory field labeled **M-1** in the above display is a shortcut to the BASE submenu **Model Sel**:



Many menus and submenus have additional display screens or pop-up menus that can be accessed by pressing the buttons. For example, in the above screen, highlighting a model name line number and pressing **SEL** brings up a pop-up menu for changing the model saved in that memory line. Conversely, pressing **NEW** brings up a pop-up menu allowing the user to manually setup model names or use the setup Wizard.

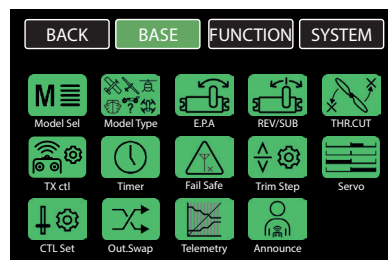
Pressing **YES** or **NO** will accept or cancel pop-up selections.

Pressing **BACK** returns users to the previous menu screen. Pressing **NEXT** advances users to the next option screen.

## 6 Operating the displays

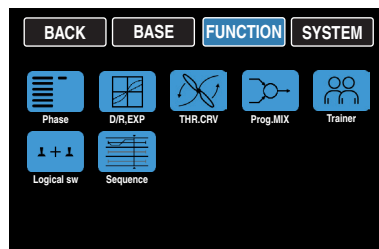
To access the **BASE**, **FUNCTION**, **SYSTEM** and **TELEMETRY** menu screens, press one of the four gear icons along the bottom of the basic display: the green "B", the blue "F", the purple "S" or the blue "T". Selection menus open from which you can choose related submenus.

The **BASE** submenu selection display (page 38) appears as follows:

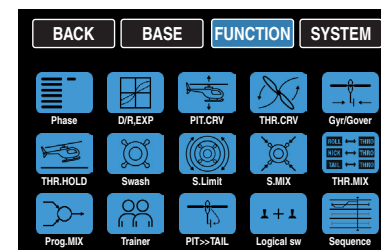


The **FUNCTION** submenu selection display (page 120) is model-type-specific, and the icons shown will change depending on which model is being used. The submenus are divided into three types: **Vehicles/Drones/Boats**, **Helicopters**, **Fixed-Wing**. Refer to the Table of Contents for information on type-specific functionalities, as the manual divides the Function menu into thirds according to model differences.

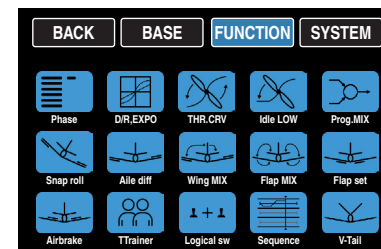
The **FUNCTION Vehicle/Drone/Boat** menu selection display appears as follows:



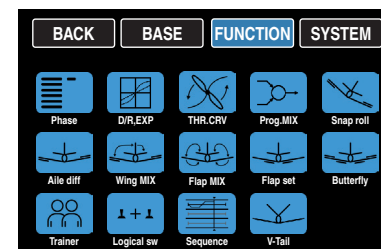
The **FUNCTION Helicopter** menu selection display appears as follows:



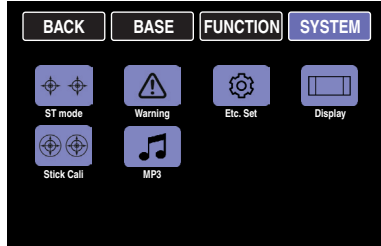
The **Fixed-Wing** models are further divided into two additional screens. The **FUNCTION Motor-Powered** menu selection display appears as follows:



And the **FUNCTION Glider** menu selection display appears as follows:



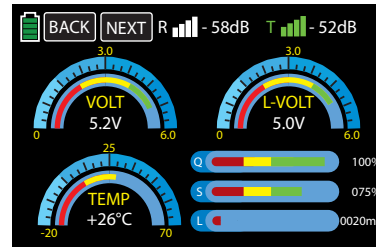
The **SYSTEM** menu selection display appears as follows:



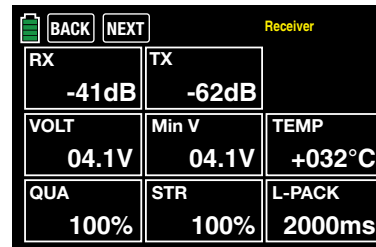
This menu is transmitter-specific and the submenus are applicable to all models. However, the **Warning** menu options will vary slightly according to certain model settings.

The **TELEMETRY** display had no submenu selection. The screen can differ depending on system settings.

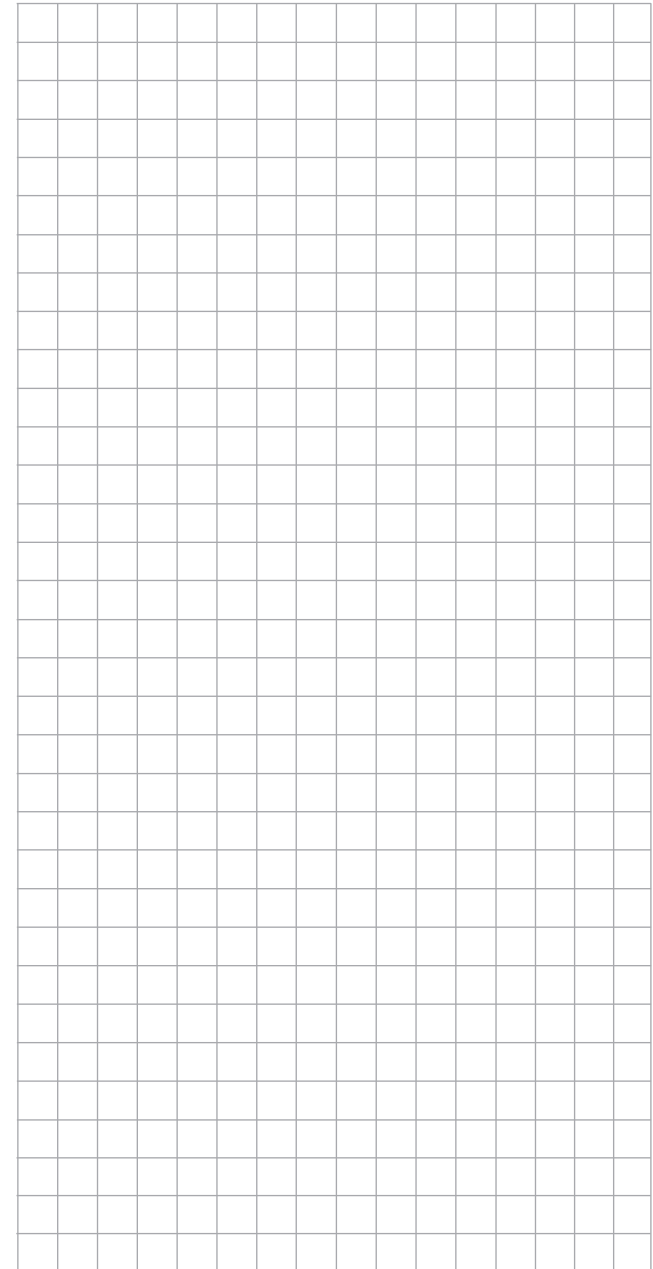
If the **Outdoor disp** option of the SYSTEM submenu **Display** is turned **OFF**, the **TELEMETRY** menu selection display appears as follows:



If the **Outdoor disp** option of the SYSTEM submenu **Display** is turned **ON**, the **TELEMETRY** menu selection display appears as follows:



Refer to the **Telemetry** section (page 225) for additional information on telemetry settings and outdoor display functions.



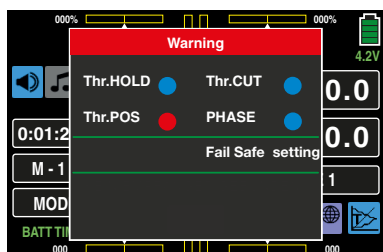
# Warning Displays

There are two warning systems in the **mz-24 Pro** HoTT transmitter. Active warning pop-up screens appear if receiver and transmitter operation statuses are not detected or are incorrect. System warnings appear as highlighted data information that require immediate attention.

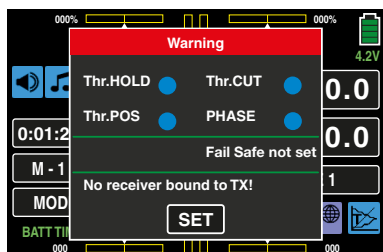
## Active Warning Display

These warnings will only appear if the function is active via the **ON** buttons in the **SYSTEM** submenu **Warning** (page 210).

These warning windows primarily appear after the transmitter is turned on. In the example below, the red dot after **Thr.POS** indicates that the throttle servo connected to Output 1 (fixed-wing models), or the throttle servo and to Output 6 (helicopter model), is not in the idle position, risking a runaway engine. Until the throttle/pitch is corrected, no other information or buttons will appear in the warning box:



Once the throttle/pitch is corrected, additional information and options appear:

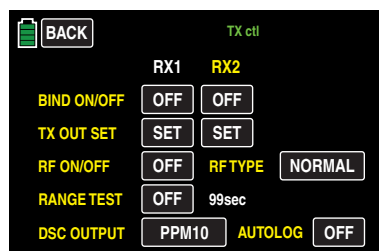


## Notice



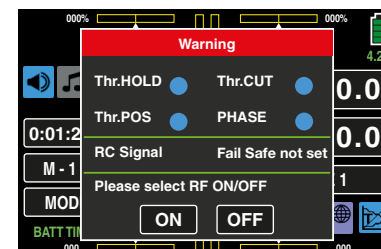
Do not use the Servo Reverse option on Channel 6 (helicopters) and Channel 1 (all other model types) to reverse the control stick direction. The Thr.POS and Thr.HOLD warning systems are not equipped to recognize changes made via that option. Instead, reverse the control direction using the **Pitch Curve** (helicopters models) or **Throttle Curve** (all other model types) menus (pages 154 and 160 respectively).

If a receiver is not detected by the transmitter, the warning window will display the message: "**No receiver bound to TX!**". Press the **SET** button to go directly to the BASE submenu **TX ctl** (transmitter settings) to link the receiver to the model memory:



Or touch the **BACK** button at the top left to exit and return to the basic display menu.

If a receiver is bound and saved into the model memory, *and* there is an inactive Thr.POS warning, the RF module will automatically turn on with the transmitter. Otherwise, the following warning display will appear, and an acoustic warning will sound:



Press the **ON** button to maintaining the RF transmissions, or switch them off by tapping the **OFF** button. If no action is taken this screen automatically disappears after a few seconds.

Additional warning messages may appear in the field between the two green lines. For example, the message "**RC signal**" indicates the transmitter is set to normal remote control, "**TEACH signal**" or "**PUPIL signal**" indicate student/trainer settings, and "**Fail safe not set**" indicates that fail-safe settings have not been programmed.

## Notices

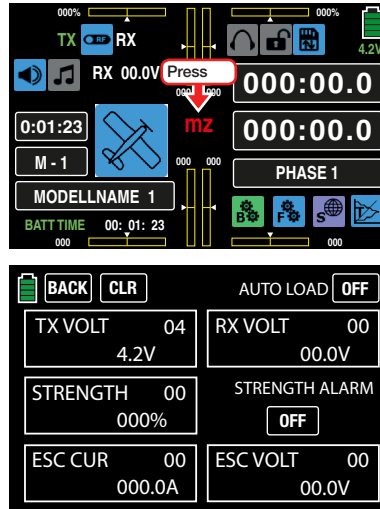


- The Active Warning Display is monitored by the options found in the **SYSTEM** submenu **Warning** (page 210).
- To set a reminder to turn on the fail-safe functions, select the **REV** option in the **Throttle Hold** line of the **SYSTEM** submenu **Warning** (page 210).

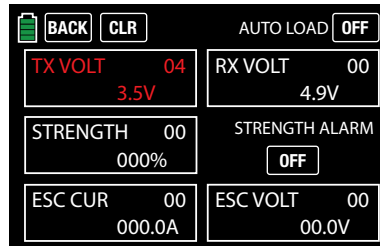


## System Warning Display

Additional warnings may be triggered based on power and signal information, located in the **mz-24 PRO** system menu. Press the **mz** button in the center of the basic display to access the menu:



Acoustic warnings will sound and systems requiring attention will be highlighted in red. In the example below, the transmitter's supply voltage has reached the warning threshold:



Stop operating the model as soon as an acute warning is displayed and attend to the issue before continuing.

The mz system data display will automatically appear when the transmitter is turned on and alarm function is triggered. To stop the mz system display screen from automatically appearing, touch the **ON** button at the top right to change to **OFF**, and press the **BACK** button to save setting.

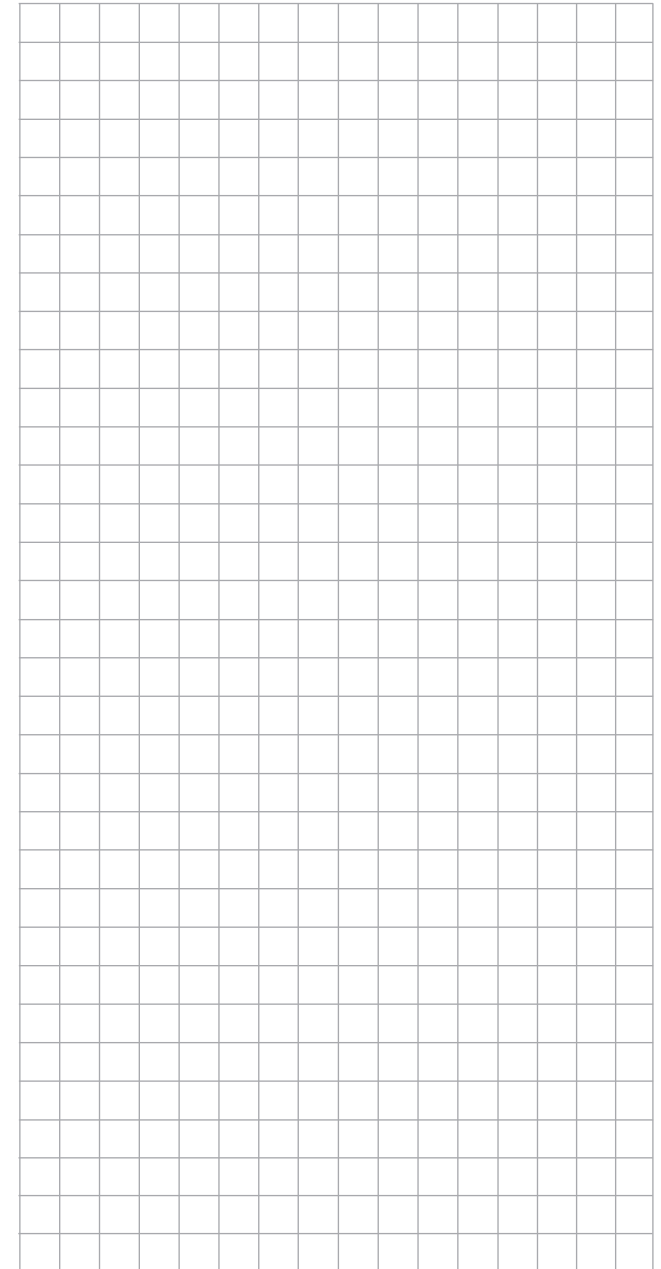
The red number at the top right of each warning field shows the number of current warnings; in the prior example, the warnings generated are at **04**. Deleted this count by pressing the **CLR** button next to the back button. All warning counts can be cleared the same way. With the Strength Alarm, triggered alarms can be turned off by pressing the **ON** button under **STRENGTH ALARM** to switch it to **OFF**.

Press the **BACK** button to exit and return to the basic display.

## CAUTION



A **STRENGTH ALARM** set to the **OFF** position will stay off the next time the transmitter is turned on. Manually change the setting back to **ON**.



## DSC Port

The abbreviation DSC stands for "direct servo control." Traditionally, this function allowed users to control models by direct wired connection instead of by wireless radio transmissions. DSC was useful for performing model adjustments without any chance of interfering with other models utilizing FM radio frequencies. However, with the HoTT technology system, it is no longer necessary to use a diagnostic cable in that manner.

The standard two-pin DSC port on the back of the **mz-24 Pro** HoTT transmitters is now used to function as a TRAINER / PUPIL port and as an interface for flight simulators or other external devices.



**To ensure a correct DSC connection, observe the following:**

1. Perform adaptations in the menu appropriate for the task. For example, to adapt to the transmitter to a trainer system, refer to the FUNCTION sub-menu **Trainer** (page 141).
2. Connect the other end of the connecting cable to the desired device while observing all relevant operating instructions.

### Tip

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

3. Depending on the number of channels used for the connected flight simulator or for the Training mode, in the **DSC OUTPUT** line of the **BASE** sub-menu **TX ctl** (page 68), select one of the following modes: PPM10, PPM16, PPM18 or PPM24. Default setting: PPM10.

### Notice



Given the numerous flight simulators on the market, the contacts on the jack plug or DSC module may have to be adapted by *Graupner* Service.

### Attention



Exercise extreme caution when directly connecting the transmitter to a desktop computer or laptop by a DSC cable and/or connecting a computer interface to the simulator: the transmitter may be destroyed by electrostatic discharge. Only use this type of connection if precautions are taken, such as wearing a commercially available grounding armband while operating the simulator. *Graupner* strongly recommends only using wireless simulators.

## Data Port

The DATA port is found under the cover on the back side of the **mz-24 Pro** HoTT transmitter:



Use the DATA port for connecting a Smart Box (order No. **33700**) or for an external Bluetooth module (No. **S8351**).

Further information on the Smart Box and the Bluetooth module can be found in the main *Graupner* FS catalogue and on the Internet at [www.graupnerusa.com](http://www.graupnerusa.com).

## Audio Jack

The headphone connection is found under the cover on the back side of the **mz-24 Pro** HoTT transmitter:



The port is for connecting commercially available ear buds or headphones with a 3.5 mm stereo jack (not included).

When headphones are plugged in, the transmitter's speaker is turned off and the headphone icon on the main display screen changes from gray (inactive) to blue (active).

In addition to acoustic signals from the transmitter, signals and messages associated with the **BASE** sub-menu **Telemetry** are output via this connection. Further information can be found in the **Voice Triggers** subsection of the **Telemetry** section (page 116).

## Card Slot

Micro-SD and Micro-SDHC

The card slot for micro-SD and micro-SDHC memory cards is found under the cover on the back side of the **mz-24 Pro** HoTT transmitter:



In addition to the micro-SD memory card that come standard with the **mz-24 Pro** HoTT, all conventional micro-SD memory cards with up to 2GB and micro-SDHC cards with up to 32GB memory can be used. The manufacturer recommends using memory cards with a maximum of 4GB since this capacity is normally sufficient.

Insert the memory card into the slot behind the cover with the contacts facing up, pressing to lock it into place. After the memory card is inserted, close the port cover.

As soon as a memory card has been inserted in the transmitter, the card is immediately ready for use. Once the transmitter is turned on, the memory card icon on the main display screen changes from gray (inactive) to blue (active). Storage folders are automatically created on the memory card.

### Removing the Memory Card

Open the cover on the back. Press the SD card gently inwards to unlock the spring. The card will pop out slightly. It is now safe to remove.

### Capturing / Saving Data

The memory on the SD card is linked to Timer 1. Once the timer starts, data automatically begins recording (assuming that an appropriate memory card is being used and there is a telemetry link with the receiver). Data recording stops when Timer 1 is stopped. Refer to the **BASE** sub-menu **Timer** (page 74) for additional information on timer starts and stops. The memory card symbol will animate as long as data is being recorded.

After data recording stops, an (empty) **"Models"** folder and **"LogData"** folder automatically appear on the memory card. Log files are saved in subfolders called **"Modelname"** and utilize the following naming system: **0001\_year-month-day.bin**, **0002\_year-month-day.bin**, etc. If a model memory is nameless, the corresponding log files are saved in a subfolder entitled **"NoName"**. All folders and files are accessible once the memory card is removed from the transmitter and inserted into the card slot of a desktop or laptop computer. The data can be evaluated on any compatible computer using the firmware programs found in the downloads section of our website [www.graupnerusa.com](http://www.graupnerusa.com).

### Notice



Note that for technical reasons memory card data is inaccessible during MP3 playback.

## Micro-USB Connection

### Tip

To automatically receive email updates regarding important product information and software/firmware updates, register all products on our website [www.graupnerusa.com](http://www.graupnerusa.com).

### Importing and Exporting Model Memories

Model memories can be backed up and copied to and from the memory card and used interchangeably between transmitters of the same make or model. Refer to the **Import From SD Card** and **Export To SD Card** sections (pages 54-56) for more information on this procedure.

### Notices



- Certain 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. Characters within such filenames will be replaced by with a tilde (~) during the copying process.
- The model memories of the **mz-24** and **mz-24 Pro** transmitters are in principle compatible with one another, HOWEVER:

In order to import from an SD card, the model memory must first be copied or moved to a corresponding directory on a desktop or laptop. For example, from **Models\mz-24** to **Models\mz-24pro** or vice versa. Refer to the **Import From SD Card** section (page 54) for more information.

After importing from an SD card, always check each and every model function. In particular, adapt the control and switch functions to the respective transmitter.

The Micro-USB port is found under the cover on the back side of the **mz-24 Pro** HoTT transmitter:

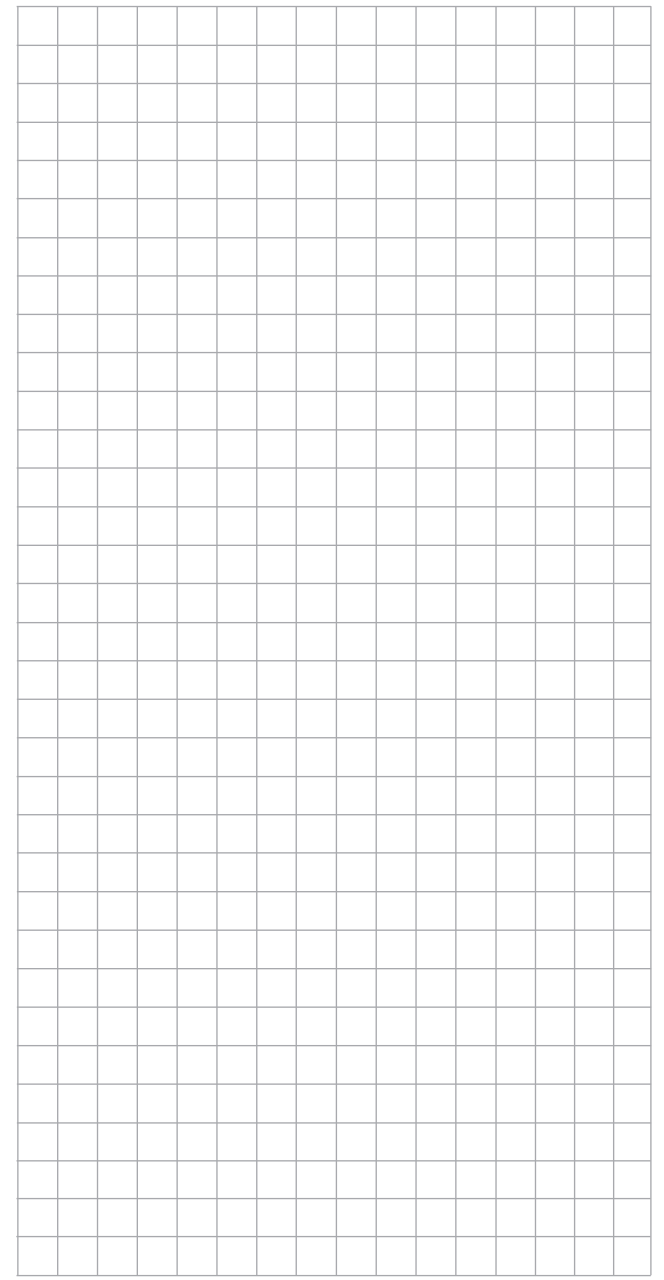
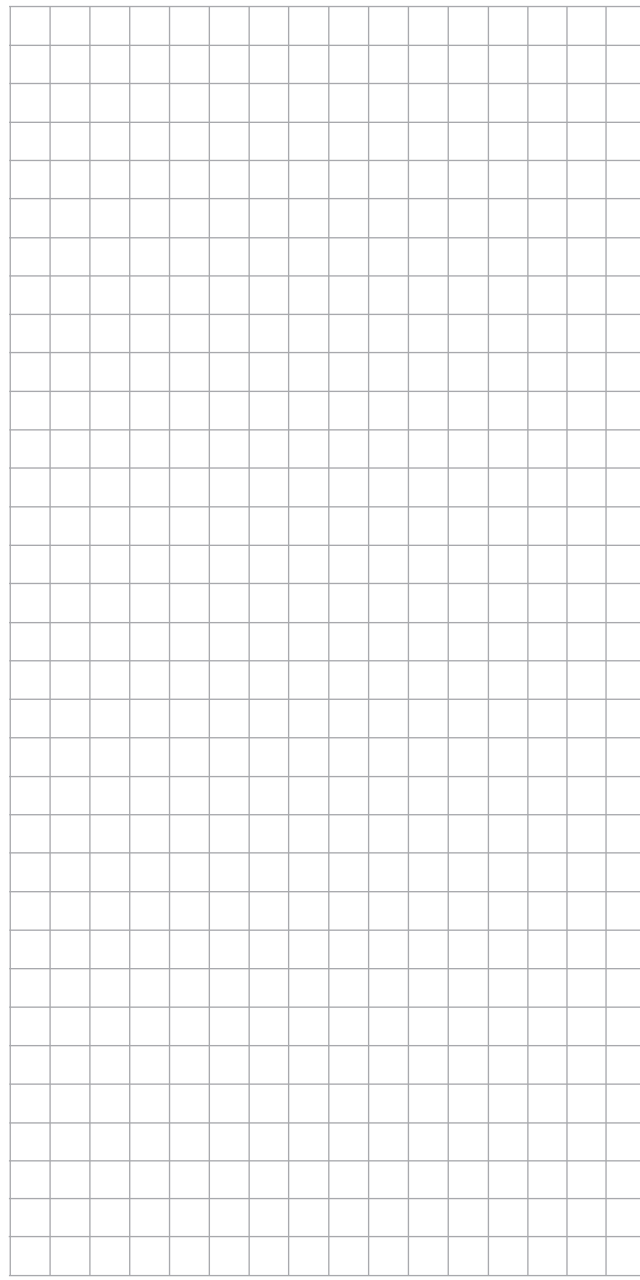
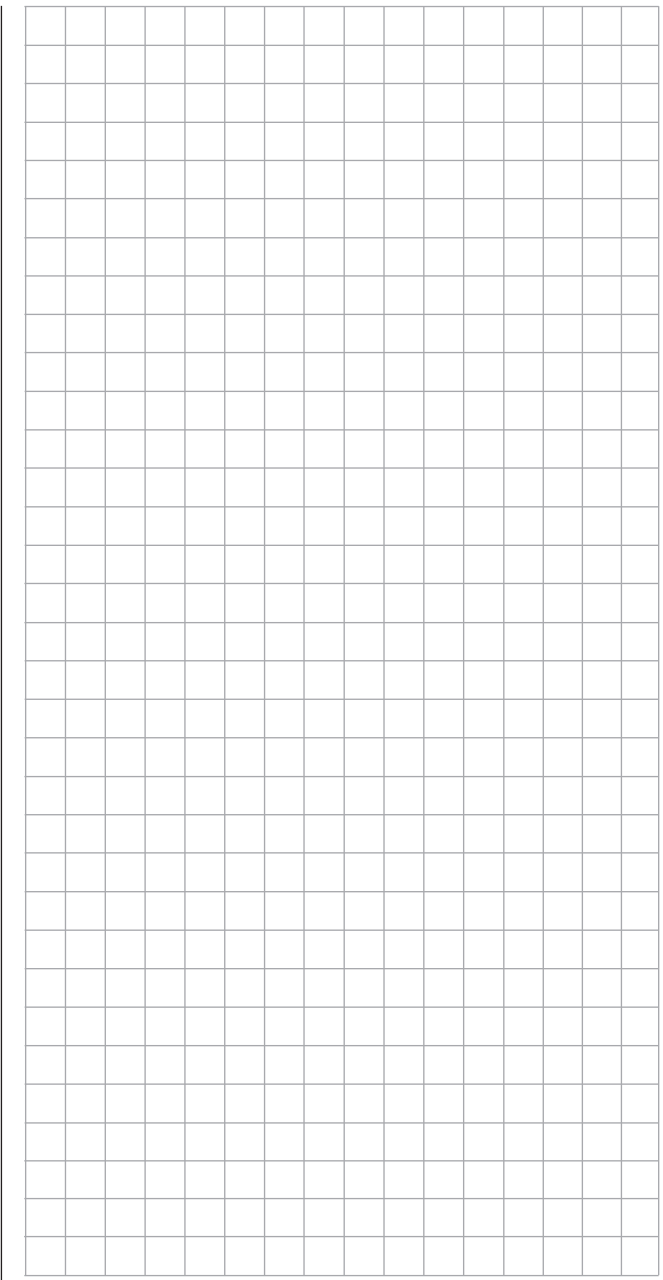


Use this connection for software updates and date/time setting from a desktop or laptop using any of the Windows operating systems (XP, Vista, 7 - 10).

The included USB cable is plugged into this port and the downloading procedure for obtaining software updates through a computer is described in the software package instructions.

The appropriate USB driver and software needed for the computer to interface with this system can be downloaded off our website [www.graupnerusa.com](http://www.graupnerusa.com).

After the required driver and software are installed, the transmitter can be updated at any time using the USB connection. The date and time can also set using the USB connection.



# Receiver Start Up

## Preliminary Remarks

### Notice

With the **mz-24 Pro** HoTT transmitter, it is possible to control up to 12 functions. Any servos which are connected to the receiver outputs 13 and higher remain in their middle position by default and cannot be actuated by the transmitter.

After turning on the receiver a LED indicates the transmitter reception is missing. This means that a link has not (yet) been established with a *Graupner*-HoTT transmitter. This happens if the transmitter is not yet bound to the receiver, if the bound transmitter is out of range, if the transmitter is turned off, or if the wrong model memory has been selected in the transmitter.

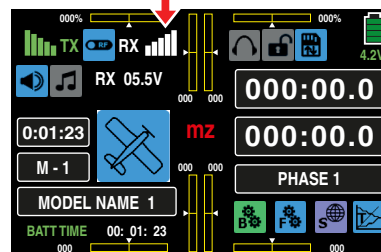
To establish a connection with the transmitter, first the receiver must be linked to the model memory in the transmitter. This process is known as "binding". Refer to the BASE submenu **TX ctl** section (page 68) for additional information on binding. This binding procedure is required once per each receiver-model memory combination or, after changes have been made to one or more model memories, once per each transmitter-receiver combination. Basically, binding must be performed only after buying a new transmitter, after buying additional receivers, or after changing the model memory.

### Notice

If the LED of your receiver indicates that it is ready for use but the receiver does not react to the SET button or to the control movements, check the polarity of the receiver power supply.

### On-board Voltage Display

When a telemetry link exists, the current voltage of the receiver power supply appears in the main display to the left of the RF icon:



### Temperature Warning

If the receiver temperature falls below a pre-set threshold (-10°C by default) or exceeds a pre-set threshold (+55°C by default), the receiver emits a warning beep that repeats approximately once per second. Temperature thresholds can be adjusted in the telemetry menus.

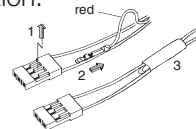
Refer to **Installation Notices** (page 16) for information on receiver and servo setup.

### Notice

Certain integrated BEC\* speed controllers cannot be used in conjunction with additional receiver batteries without first removing the plus pole (red cable) from the 3-pin plug. Check the speed controller's instructions for more information.

To remove the cable:

1. Use a short screwdriver to carefully lift the middle tab of the plug.
2. Remove the red cable.
3. Use electrician's tape to protect against shorts.



### Reset

To reset the receiver, hold down the **SET** button on the top of the receiver while turning on the power supply. If the reset is performed while the transmitter is turned off, or if the receiver is not bound to a transmitter, the LED on the receiver indicates the status (according to the receiver's instructions), usually by a series of flashes. Release the button after about 3 seconds.

If the reset is performed with a receiver not bound to a transmitter, you can then start a binding process at any time.

If a bound receiver is reset and the associated model memory is active in the turned-on transmitter, the LED will typically flash for 2-3 seconds (according to the description included in receiver instructions), indicating that the transmitter/receiver system is ready to use.

### Note

The **RESET ALL** function will delete all receiver settings and revert it to the factory defaults. The HoTT synchronization information is not affected.

If a reset is performed accidentally, all of the receiver settings made using the BASE submenu **Telemetry** should be restored.

Resetting is recommended when moving a receiver to a different model. Otherwise, settings may be transferred which do not match the new model.

\* BEC = Battery Elimination Circuit

# Installing the receiver

## Installing the Receiver

The following procedure is the same across all *Graupner* receiver systems.

Install the receiver behind a strong bulkhead where it is protected against dust or splash water. Make sure that it is not excessively airtight to prevent it from overheating during operation.

The receiver should not directly touch the fuselage or chassis since they can 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 ON/OFF switches that are installed on model shells.

The receiver's servo and power supply connecting cables should remain loose. The receiving antennas should be at least 2 inches (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, all steel parts, etc.

Install the receiver away from all other installed parts at an easily accessible location in the model. Servo cables should not be wound around or run next to antennas because radio transmission interference will occur.

Note that the cables can shift during flight acceleration. Make sure that the cables cannot slip and move directly adjacent to antennas and interfere with reception.

## Installing the Receiver Antennas

With a single antenna, orientation is not crucial.


With dual 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 be a minimum of 5 inches (125mm).

For carbon fiber fuselages, the ends of the antennas should extend from the fuselage about 2 inches (125 mm). If needed, replace the standard HoTT receiver antennas with longer 300 mm or 450 mm antennas (**No. 33500.2** or **33500.3**).


## Servo Connections and Polarity

*Graupner*-HoTT receiver servo connections are numbered; the supply voltage runs through the numbered connections. The polarity of the plug-in system cannot be reversed. When inserting the plug, note the small bevels on the side. Insert gently and do not use force.

### Attention

 Do not reverse connection polarity. This can destroy the receiver and connected devices.

### Notice

 In compact receivers, such as **GR-12L HoTT**, the outputs 1 through 6 are reversed 180° from that of the bigger receivers. Pay close attention while connecting any plug to the receiver. If applicable, use a V or Y cable (**No. 3936.11**).

## Channel Mapping

The function of each channel is determined by the transmitter and not the receiver. Change the channel mapping settings directly through the BASE submenu **Telemetry** (page 104), or indirectly through the BASE submenu **Out.Swap** (page 96).

# Installation Notices

## Components and Accessories

### Attention

Due to incompatibility and possible system failure, *Graupner* recommends only using official or approved parts, components and accessories that have been tested and accepted for suitability, functionality and safety. *Graupner* will only assume responsibility for the product if such components and accessories have been used.

*Graupner* assumes no liability for products or accessories produced by other manufacturers (unless otherwise approved for use by *Graupner*), as *Graupner* is incapable of evaluating all third-party products to determine safety and compatibility.

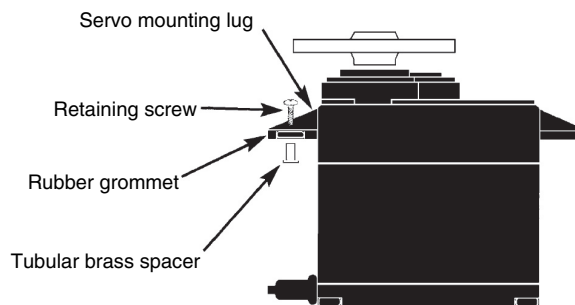
### Installing the Switch

Install switches in an area of the model free from exhaust or vibration. The switch knob must be freely accessible over its entire operating range.

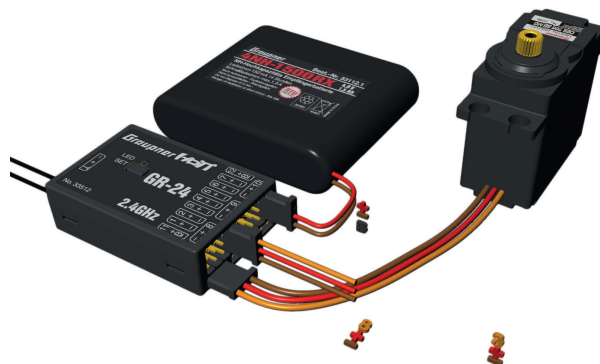
### Installing the Servos

To protect the servos from excessive vibration, always install them with the provided rubber vibration damper.

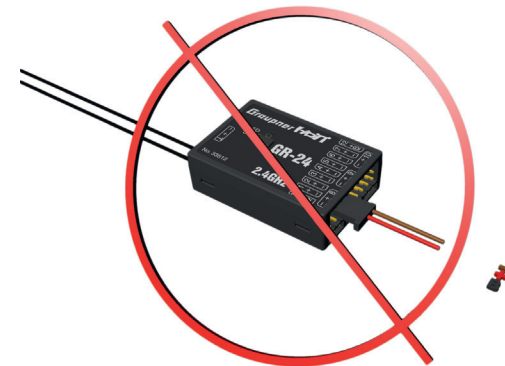
- Install the servos on rubber grommets with tubular brass spacers as protection from vibration. Do not overtighten fixing screws as this could counteract vibration protection provided by the rubber grommets. The system offers both safety and vibration protection for the servos when the fixing screws are properly tightened. The following figure shows how to correctly mount a servo. The brass spacers are inserted from below into the rubber grommets:



- Servo arms must freely move throughout entire operating range. Make sure no linkage parts block the servos movements.
- Connect the receiver's power supply cable(s) or the servo connecting cable to the receiver in a vertical line as shown below:



Do not connect to receiver horizontally as shown here:



- Servo connecting sequences may vary between model types. Refer to installation instructions for helicopters (page 154) and fixed-wings (page 180) for specific model information.

## WARNINGS



- Technical defects of an electrical or mechanical nature may cause motors to start without warning, or may generate flying parts which can cause significant injury to the pilot, spectators or products.
- Avoid short-circuiting. Short-circuits can destroy the remote-control system, cause serious burns and explosions. All motor-driven parts (air and water propellers, helicopter rotors, exposed gears, etc.) pose an injury hazard. Never touch these parts! A fast-rotating propeller can sever fingers or cause other significant damage! Ensure no other objects come in 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!**
- **Disconnect the fuel supply or drive battery beforehand programming the transmitter to prevent an accidental motor start.**

#### Notices



- Protect all equipment from dust, dirt, moisture, vibration and excessive heat or cold. The models may only be operated remotely in normal outside temperatures ranging from 14° to 130°F (-10°C to 55°C).
- To avoid electrical shock, check the model regularly for damages to the housings and cables, especially after a crash. Discontinue using any electronic components that have become wet; short-circuiting and shock risk is still prevalent even after components have dried.
- Only use *Graupner* approved and recommended components and accessories. Always use matching, original plug-in connections of the same design and material.
- Make sure routed cables are not under tension, excessively kinked or broken. Sharp edges can damage the insulation.
- Make sure that all of the plug-in connections are tight. When disconnecting the plug-in connections, do not pull the cables.
- The devices must not be modified in any way. Modifications will void insurance coverage and warranties. For assistance and repairs, contact the *Graupner USA Service Center*.

#### 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 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. Always follow the instructions under **Range Test** (page 71).

#### WARNING



**Always perform a complete and conscientious range and function test as well as the flight simulation. Malfunctions and reception issues can occur if a range, function test and flight simulation are not performed. Models may crash and cause major property damage and/or personal injury.**

#### Servo Noise Filters for Extension Cables

##### No. 1040

A servo noise filter is required when using long servo extension cables. The filter is connected directly to the receiver output. In severe cases, a second filter may be attached to the server.

#### Electrical Ignitions

Gas engine ignition systems also generate interference that can impair remote control functioning.

Electrical ignition systems should always obtain power 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.

#### Model Function

#### WARNING



- **Never fly the model over observers or other pilots. Never endanger people or animals, fly close to power lines, operate the model close to waterways or open nautical traffic, near open roads, highways, paths, public walkways, etc.**
- **Never turn off the transmitter while operating the model! If this happens, wait three seconds for the display to go dark, then turn the transmitter on again. The transmitter may freeze if turned on before the screen goes dark.**

- **If a transmitter is turned off during flight, wait three seconds until the display screen goes dark, then turn on the transmitter. Transmitter may freeze if turned on before the display screen goes dark, and models may become uncontrollable.**
- **To avoid feedback channel malfunctions when operating towed models, maintain a minimum distance of approximately 20 inches (50 cm) between the participating receivers or their antennas. In this case, use a satellite receiver.**

#### **Checking the Transmitter and Receiver Batteries**

When the warning message “Charge the battery!” appears in the display followed by a warning sound, immediately cease operation and recharge the transmitter battery.

Use the transmitter battery power display functions to check the battery charge of both the transmitter and receiver. Do not wait until the rudder movements are noticeably slower. Immediately replace dead batteries.

Always follow the manufacturer’s charging instructions. Always fully recharge batteries. Do not leave batteries unattended while charging. Never attempt to charge alkaline batteries as they may explode.

Recharge batteries before each use. To prevent short-circuits, insert the banana plugs into the charger first, and then insert the charging cable plugs into the battery charging ports.

Disconnect batteries when not in use.

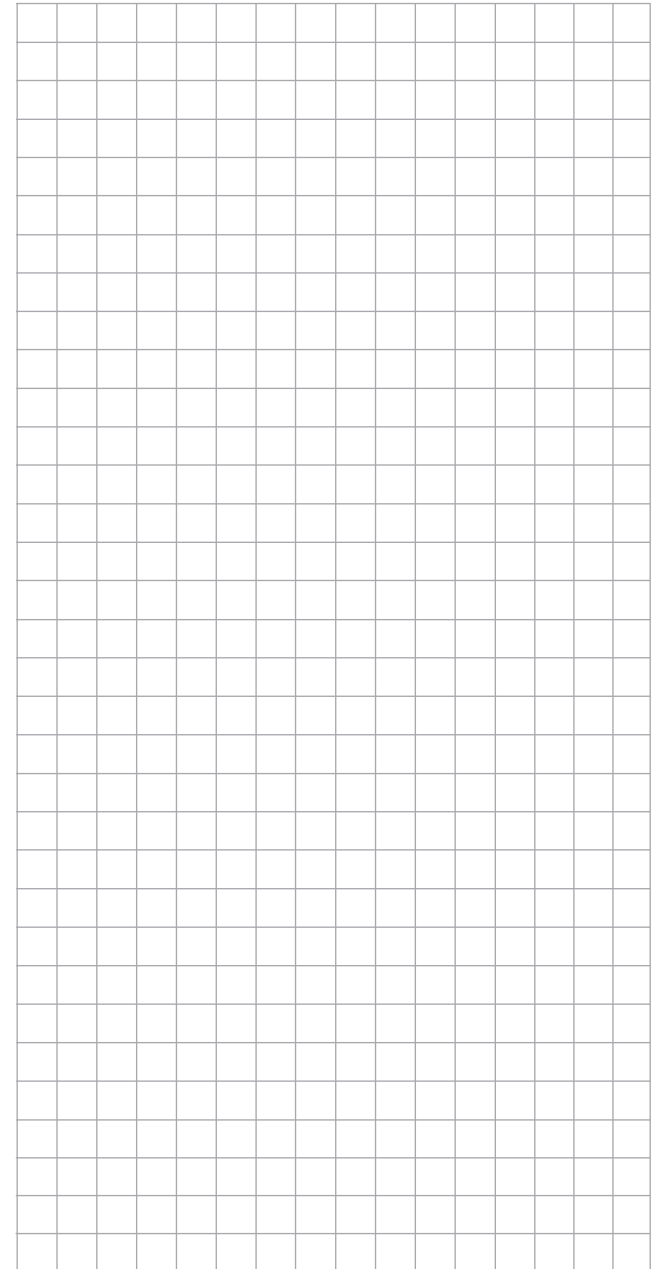
**Never** use rechargeable or replaceable batteries with damaged, defective or different cell types, i.e. do not mix combinations of old and new cells or cells from different manufacturers.

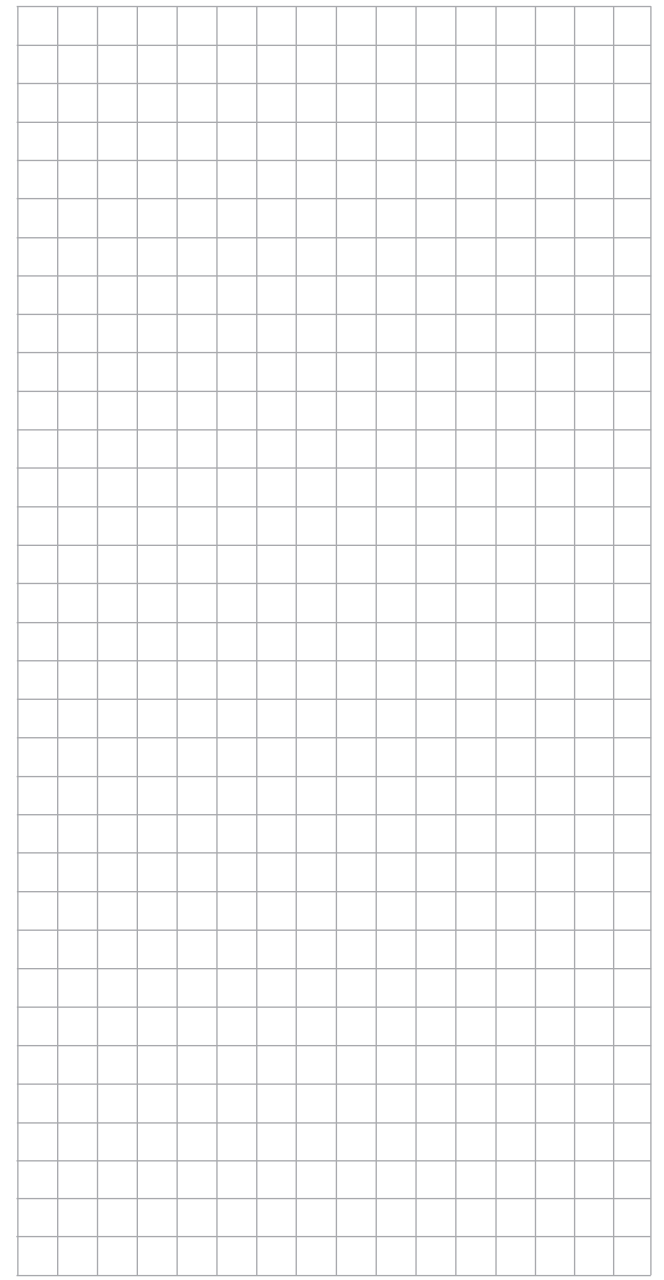
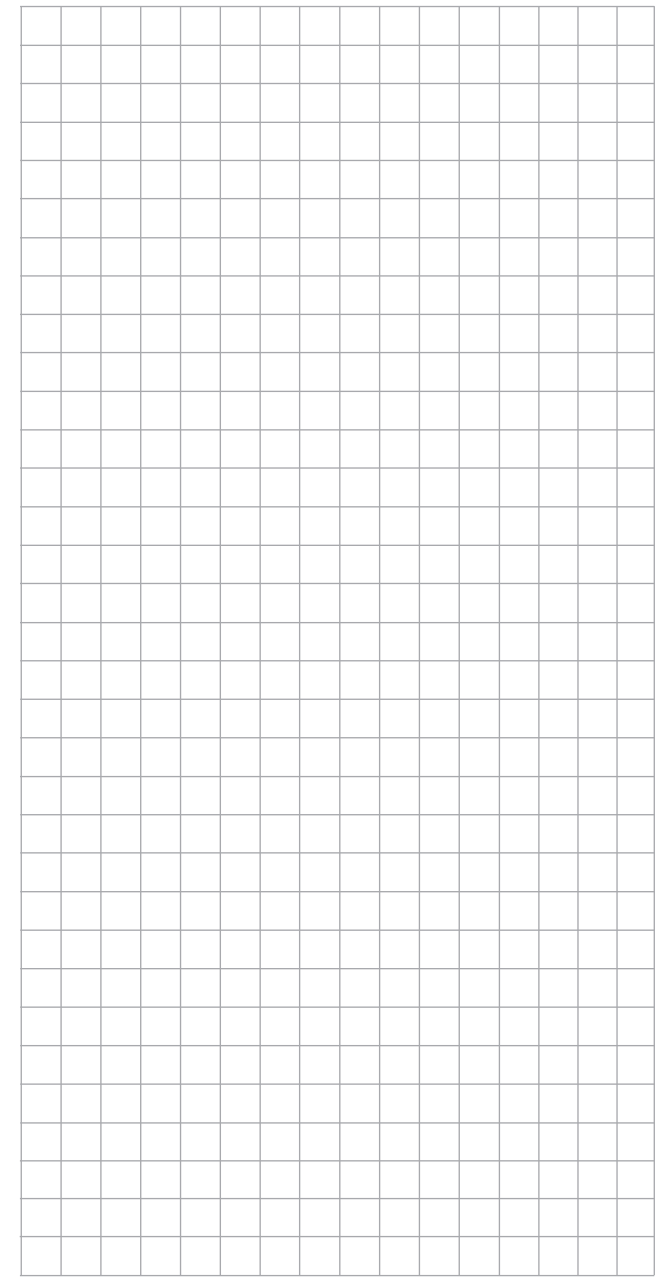
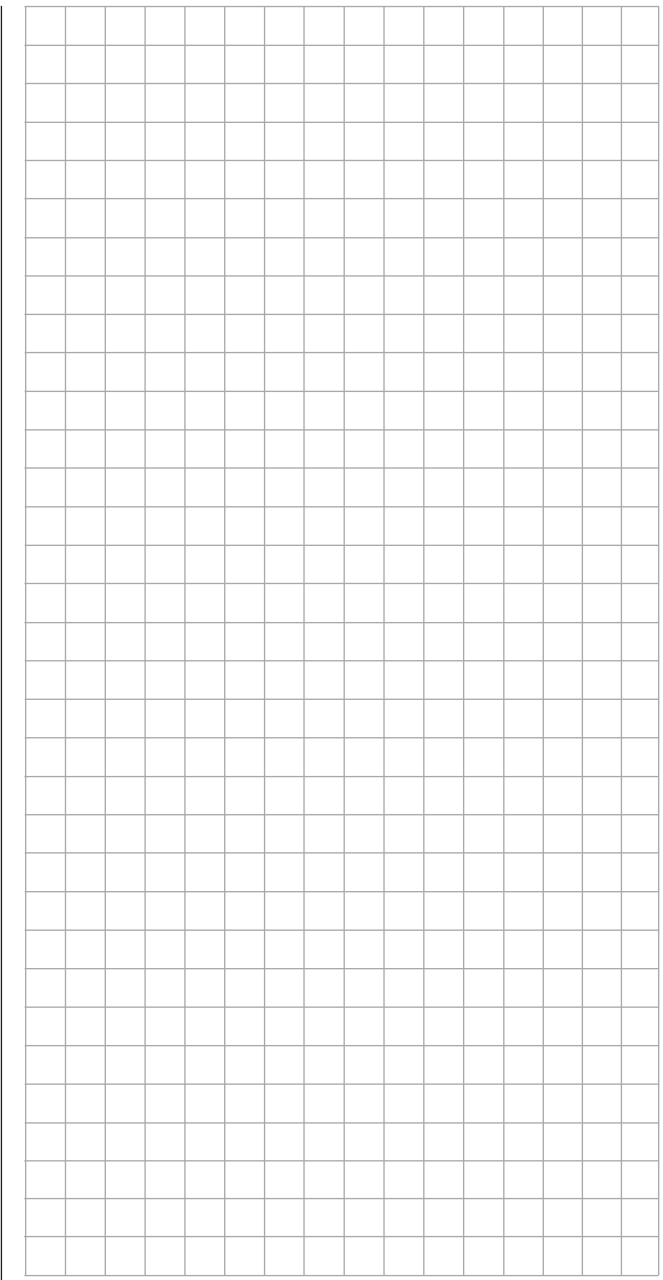
#### **Capacity and Operating Time**

The recharging process gradually reduces battery capacity. Check the capacity of power sources every 6 months, and replace any battery with low performance.

Additionally, never store batteries at low temperatures; the internal resistance increases while capacity decreases and the battery’s overall ability to discharge and retain power diminishes.

Only use original *Graupner* rechargeable batteries.





# Receiver System Power Supply

To safely operate the model, a reliable power supply is required. If the receiver voltage shown on the transmitter display consistently 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 at the plug-in connections is minimal, etc., troubleshoot according to the following information:

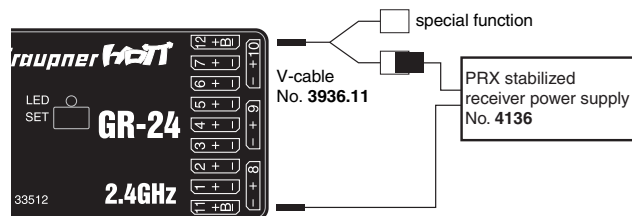
Make sure that the battery remains fully charged when initially operating the model. Make sure that the resistance of the contacts and switches is low. Measure the voltage drop over the installed switch cables under a load since even robust, new switches cause a voltage drop of up to 0.2 V. This value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

Even small servos such as a *Graupner/JR DS-281* draw stall current to 0.75A when you stop under a load. Four of these servos in a foam airplane can hence draw up to 3A from the on-board power supply. Servos connected to a 2.4 GHz receiver receive control pulses more frequently than comparable receivers in the classic frequency range. This affects the receiver system power consumption and prevents the digital servos from maintaining the last control pulse position specified while waiting for the next pulse to arrive. Choose a power supply that does not fail under a permanent high load and which always provides sufficient voltage. To calculate the required battery capacity, add at least 350 mAh for each analog servo, and at least 500mAh for each digital servo.

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

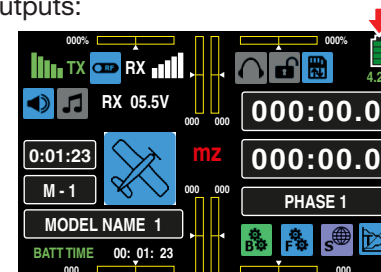
Apart from the above circumstances, it is generally recommended to connect the receiver to the power supply using two cables. As per the standard, connect the GR-16 or GR-24 receiver cable "1" to the "6+B" or "12+B-" output, and receiver cable "2" to the opposite end of the connector strip labeled "1+B-" or "11+B-". Between the cable and receiver, use a V or Y cable (No. **3936.11**, see figure below) if one or both receiver connections need to be connected to a servo, speed controller, etc. With the double connection to the switch or voltage controller, the risk of a cable rupture is reduced, and an even power supply is ensured to the connected servos.

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



Never used battery boxes or alkaline batteries.

When the model is in use, the on-board power supply voltage is graphically represented in the upper right side of the main display, showing a battery and numerical outputs:



If the voltage falls below the warning threshold (normally 3.8 V) visual and acoustic low-voltage warnings are generated. The warning threshold can be adjusted in the BASE submenu **Telemetry** section (page 108).

## Attention

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

## Tip

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 website [www.graupnerusa.com](http://www.graupnerusa.com).

## Receiver System Power Supply

### NiMH Battery Packs - 4 Cells

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

### NiMH Battery Packs - 5 Cells

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

Note 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.

### Notice



Note the specifications for the servo before deciding to use a 5-cell pack.

### LiFe Packs - 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 does not pose any problems to *Graupner* HoTT receivers or the servos, speed controllers, gyros, etc. which are approved for operation with this higher voltage.

### Attention



Note that practically all of the previously marketed servos, speed controllers, gyros, etc. as well as newly released servos have permissible operating voltage range of 4.8 to 6 V. Stabilized voltage control such as the PRX (No. **4136**) is needed to connect them to the receiver. Otherwise, the connected devices may become damaged.

### LiPo Packs - 2 Cells

LiPo batteries are lighter yet they offer the same capacity of NiMH batteries. 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 does not pose any problems to *Graupner* HoTT receivers or the servos, speed controllers, gyros, etc. which are approved for operation with this higher voltage.

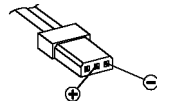
### Attention



Note that practically all of the previously marketed servos, speed controllers, gyros, etc. as well as newly released servos have a permissible operating voltage range of 4.8 to 6 V. Stabilized voltage control such as the PRX (No. **4136**) is needed to connect them to the receiver. Otherwise, the connected devices may become damaged.

## Charging the Receiver Battery

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



Polarity of the receiver battery plug

# Safety and Handling Instructions

## for Lithium-Ion (LiIo) and Lithium Polymer (LiPo) Rechargeable Batteries

Lithium-ion (LiIo) and lithium polymer (LiPo) batteries require special treatment when charging, discharging, storing and all other types of handling. Observe the following specifications:

### Charging *Graupner* LiPo/LiIo Batteries

- 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 and/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*, available online at [www.graupnerusa.com](http://www.graupnerusa.com).
- 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 to 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 not 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 can result in the release of gas, fire and explosion, or other problems.
- The electrolyte and electrolyte vapors 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 non-flammable surface (such as concrete) until it cools down. Never hold the battery in your hand due to the risk of explosion.
- Batteries from parallel-connected cells, and 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 turn devices off 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 non-flammable, 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 connection using a balancer or equalizer during charging.

The 1s lithium-ion battery in the set comes with a special safety shut off. The voltage differences between individual cells are not balanced by means of the usual balancer plug-in connection.

- 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

Lilo/LiPo cells should be stocked with about 50% of their nominal capacity. If the cell voltage falls below 3 V during the stocking, the lithium ion/lithium polymer cells must be recharged to 50% of the full capacity. Otherwise, the battery will die during storage and become useless.

### Special Discharging Instructions for *Graupner* Lilo/LiPo 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 indicated on the battery label).
- Discharging below 2.5 V per cell will damage the cells and should 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* Lilo/LiPo batteries should 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. If this occurs, make sure that the battery is sufficiently cooled, or reduce the discharge current. The temperature can be easily checked using the infrared thermometer (No. 1963). However, the battery may not be discharged using the transmitter's charging port. This port is not designed for this purpose.

### Additional Handling Instructions

- 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 connections of lithium ion/lithium polymer batteries are not as robust as other batteries. This holds true particularly for the plus pole connection. The connections can easily break.

### Cells Connection

#### Attention



Never directly solder on the battery cells. The heat from direct soldering can damage battery components such as the separator or isolator.

Battery connections 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

#### Attention



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

### Do not use Damaged Cells

Damaged cells should not be used.

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

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

### Contact with Liquids

Batteries should not be immersed in liquids of any kind. Avoid all contact with liquids.

# Definition of Terms

## Control, Control Channel, Control Function, Control Switch, Function Input, Logical Switch, Mixer, Switch

The following definitions appear repeatedly in this manual:

### 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 - 4, including the related trims. These four functions in all the six model types (vehicle, boat, drone, helicopter, airplane and glider) can be exchanged using the Mode Setting in the software. For example: throttle/brake or throttle/pitch left or right. The control stick function for throttle/brake flap control for fixed-wing models or throttle/pitch control in helicopters is usually identified as the THR Control (channel 1).
- The four proportional dials (DV1 - DV4)The two side proportional rotary controls SL1 and SL2.
- Switches S1 - S8
- The INC/DEC buttons DT1 and DT2

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

The assignment of controls and switches to servos 5 -12 is freely programmable.

### Control Channel

The term "control channel" is used to describe 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.

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 **3S 120(Roll)** governs the control channels for both the left and right roll servo.

This signal is influenced by settings made in the following BASE submenus: **E.P.A** (servo path/servo limit), **REV/SUB** (servo direction reverse/delay and servo middle and neutral position), and **Out.Swap** (transmitter output). The signal 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 FUNCTION submenu **Telemetry**. The signal then controls the associated servo.

### Control Function

A control function is the signal for a specific control function, independent from the signal within the transmitter. For example, in fixed-wing models the control signals would be throttle, rudder or aileron; in helicopter models these would be pitch, roll or nick.

The control function signal can be transmitted directly into a single 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.

### Control Switch

It is oftentimes impractical to automatically switch a timer or a function on or off when a control is in a specific position (e.g. a stopwatch turns on/off to measure engine operating times). The **mz-24 Pro** HoTT transmitter allows control switches to be programmed.

With these programmed switches, users identify the switching point along the control path in the direction of switching. Refer to the **Controls and Switches Assignment** (page 26) for additional information.

### Function Input

This is an imaginary point in the signal flow and should not be confused with the control connection on the printed circuit board. The selected Control Mode and the **TX OUT SET** setting of the BASE submenu **TX ctl** influence the sequence beyond the physical connecting points. This generates differences between the number of function inputs and the number of subsequent control channels.

### Logical Switch

This option allows two switches, controls and/or logical switches (or the preferred combination thereof) to be interconnected into a single AND/OR switch. A total of 8 logical switches, L1 - L8, can be programmed. Refer to the FUNCTION submenu **Logical sw** section (page 148) for additional information.

### Mixer

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

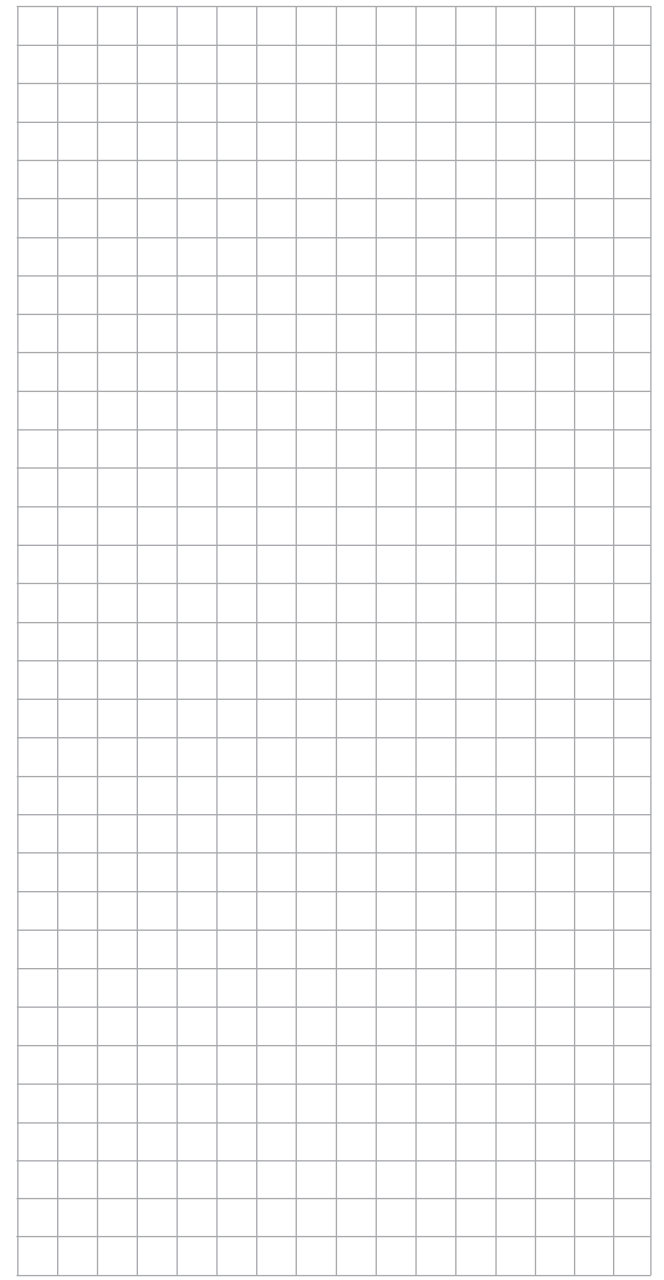
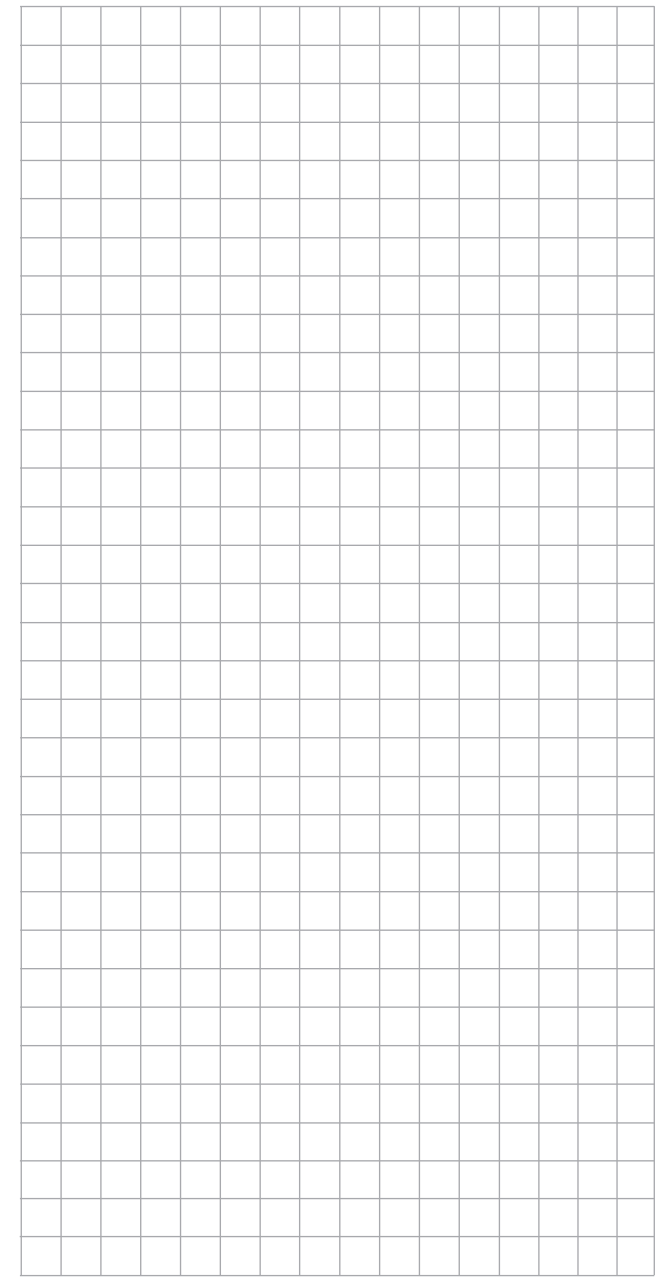
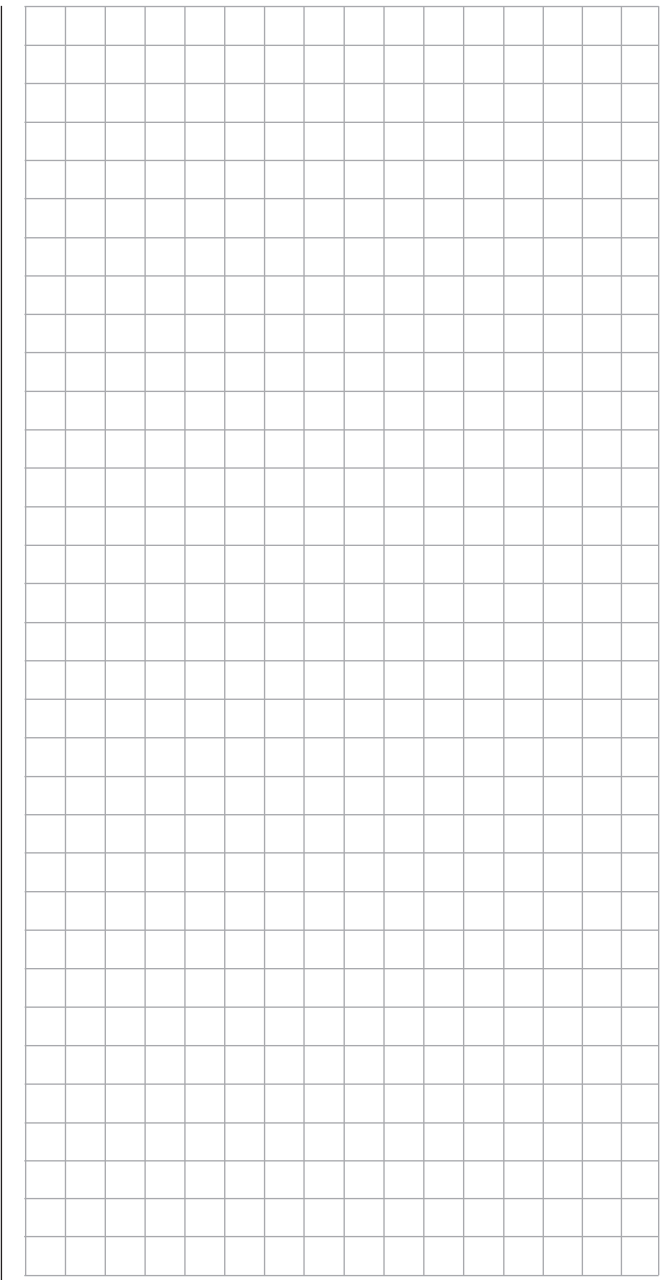
Refer to the **Basic Functions** section (page 132) for additional information on mixers.

### Switch

The series of toggle switches S1 - S8 can be used in control programming, to change program options (i.e. timer start/stop), to turn mixers on and off, as trainer switches etc. Each switch can be assigned any number of functions.

Related examples are described throughout the manual.





# Control and Switch Assignment

## Basic Procedure

Many options and settings can be actuated to a control function with a freely selectable control (ST1 - 4, DV1 - 4, DT1 and DT2, SL1 and SL2), switch (S1 - 8), or logical switch (see **Assigning a Logical Switch or Control**, page 27). In all cases, multiple assignments are possible. Refer to the **Definition of Terms** section (page 24) to distinguish between a control and switch.

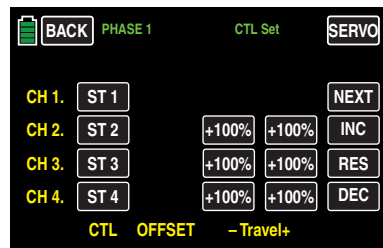
### Notice

➤ Note that incorrect responses may arise from functional overlaps, e.g. using the same switch to toggle between Phase changes and a control for Phase trimming. The functions are incompatible and the switch assignment should be changed.

The same method is used to assign the controls, switches, control switches and logical switches in all relevant menus. The basic procedure will be explained below; refer to the specific submenu sections for details on individual functions.

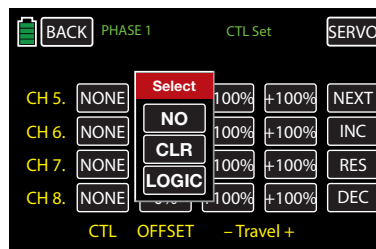
### Control and Switch Assignment

Open the BASE submenu **CTL Set**:

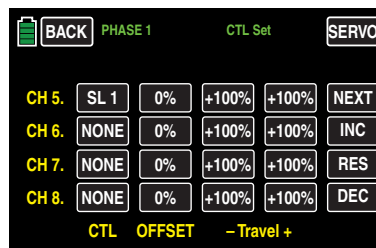


Use this display to assign transmitter inputs 1 - 12 to operate servos, any control stick (ST1 - ST4), any switch (S1 - S8), or any control (DV, SL or DT).

Pressing the **NONE** button in any channel line will bring up an active window. In the example below, the **CH 5** line needs a control assigned to **SL1**:



To assign a switch, simply move the desired control (stick 1 - 4, DV1 - DV4, SL1 - SL2, or DT1 - DT2) or the desired switch (S1 - S8). Once the switch, control or control stick is assigned the active window will disappear. In the example below, the right proportional rotary control **SL1** was flipped and the assignment shows in the **CTL** column of the **CH 5**. line:



### Note

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

### Deleting Controls or Switches

To delete, press the value field of the switch or control to be removed. The active window will appear. Press the **CLR** button:



The field returns to its default value (NONE).

### Canceling Control or Switch Assignment

To cancel an assignment, press the **NO** button:



The active menu will disappear.

### Notice

➤ For certain menu options, only physical controls or switches can be assigned. When the logical switch option is unavailable, the active windows will appear without the **LOGIC** button:

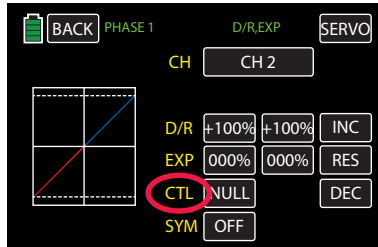


This is not an error.

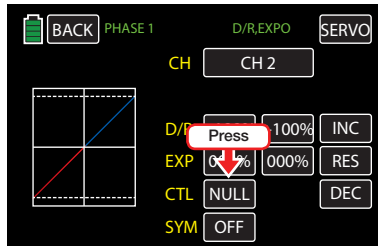
## Assigning Logical Switch or Control

### • Switch Assignment

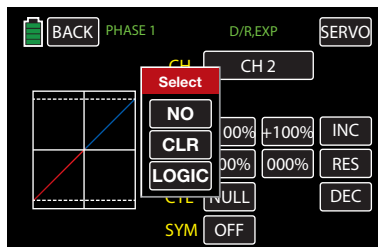
Logical switches can be assigned to a function wherever there is a **CTL** value field. In the example below, the D/R,EXP display menu has a CTL line:



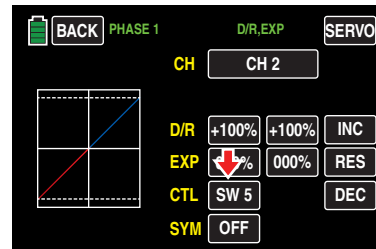
To assign a switch, press **NULL** button in the CTL line:



The active window will appear:



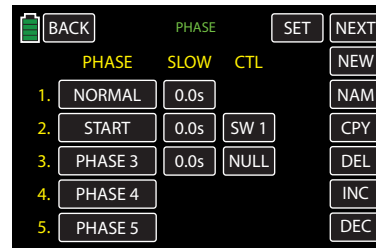
Move the desired switch. In the example below, the front left 3-way switch **S5** is assigned:



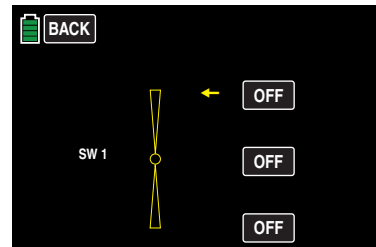
The assigned switch appears in the CTL value field. Press the **BACK** button to save and exit.

### • Switch Setup

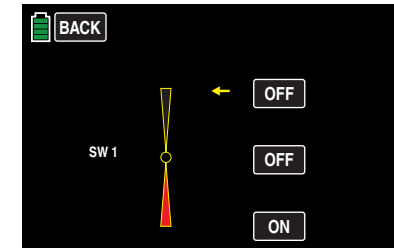
For certain functions, the exact switch position needs to be assigned. In the example below, **PHASE3** needs to be assigned to **S1**:



Press the **NULL** button. The active window appears (as described above). Flip the S1 switch. As soon as the switch is flipped, an accessory display will appear:



Press any **OFF** button at any time to activate the switch position. The value field will change to ON and the switch graphic display will color in blue (up), green (center), or red (down). In the example below, the down switch direction was activated:



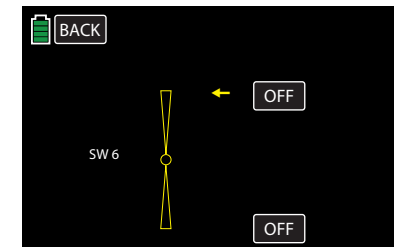
This switch position must be logically matched with the other switch positions.

To remove the position assignment, press the **ON** button to change the field to OFF.

### Notice

When none of the assigned phase switches are in the "ON" position, the default "normal phase" (Phase 1) will activate.

If a 2-stage switch is chosen instead of a 3-stage switch, the center position option will disappear. In the example below, the 2-stage **S6** was chosen:



Select the desired switch direction by pressing the appropriate **OFF** button.

- **Deleting Switches**

To delete, press the value field of the switch or control to be removed. The active window will appear. Press the **CLR** button:



- **Canceling the Switch Assignment**

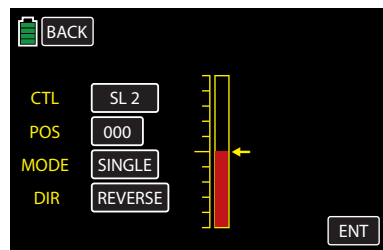
To cancel an assignment, press the **NO** button:



The active menu will disappear.

- **Control Switch Assignment**

Logical controls can be assigned to a function wherever there is a **CTL** value field. To assign a control, press **NULL** button near or next to any CTL line or column. An active window will appear. Turn or move the control that you want to use to assign. In the example below, left proportional rotary control **SL2** was assigned. As soon as the control is moved, an accessory display will appear:



Continue to move or turn the control. The yellow arrow to the right of the bar diagram will move along the control's throw. Select the position with-

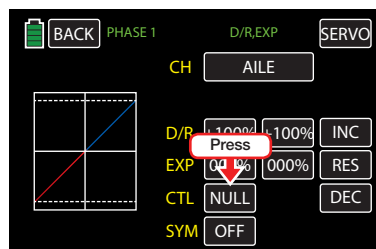
in the throw and press the **ENT** button. The precise position point along the control and produces a value in the **POS** line. Reverse the switching direction by pressing the **REVERSE** button in the **DIR** line. Press the button in the **MODE** line to toggle between **SINGLE** and **DUAL**. This changes the function of the control switch from an on/off switch (like a 2-stage switch) to the switching behavior of a 3-stage switch.

**Notice**

» When changing modes, be sure the switching position is not "000". Otherwise, there is risk of switching continuously back-and-forth between the two switching states while the relevant control is in the middle control position.

- **Assigning Logical Switch**

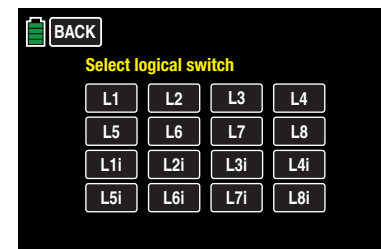
Logical switches can be assigned to a function wherever there is a **CTL** value field. To assign a control, press **NULL** button near or next to any CTL line or column. In the example below, the **L1** switch is being assigned through the D/R,EXP display:



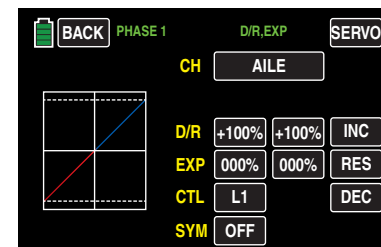
An active window will appear. Press the **LOGIC** button:



The logical switch display window appears listing the eight logical switches (L1 - L8) and eight inverted logical switches (L1i - L8i):



Press the desired button. The logical switch display closes and returns to the previous menu. The selected logical switch appears in the CTL value field. In the example below, **L1** appears in the field:



**Notice**

» Do not forget to program the selected logical switch in the FUNCTION submenu **Logical sw**.

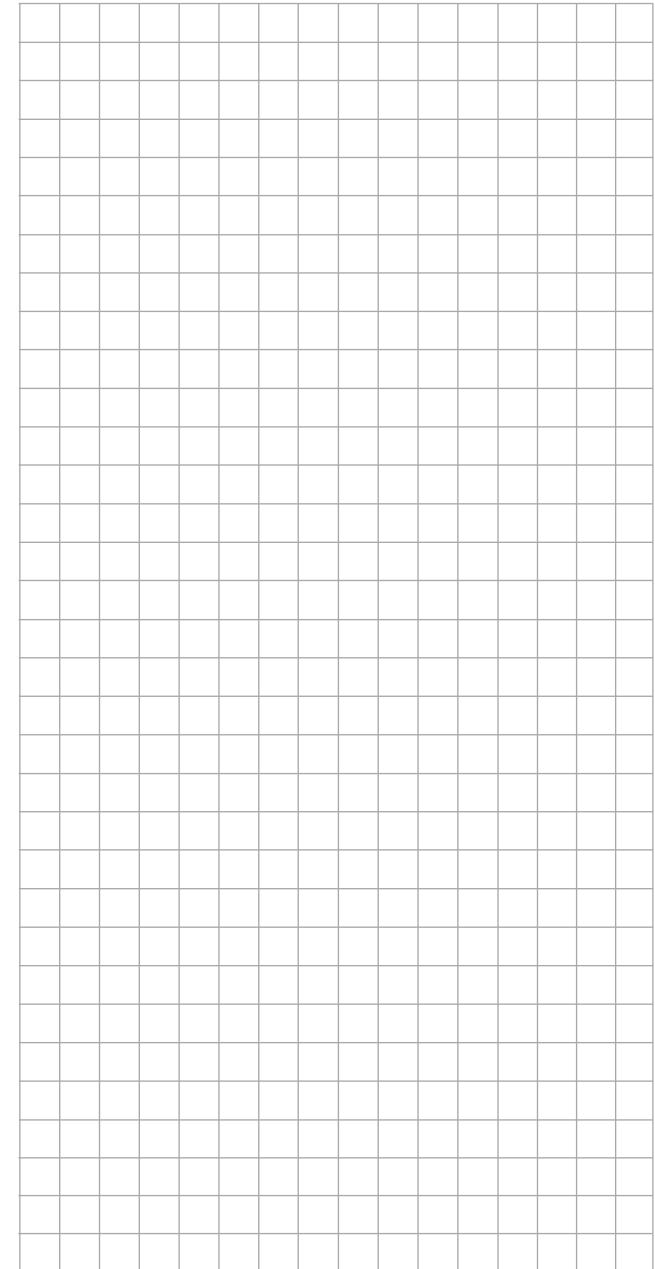
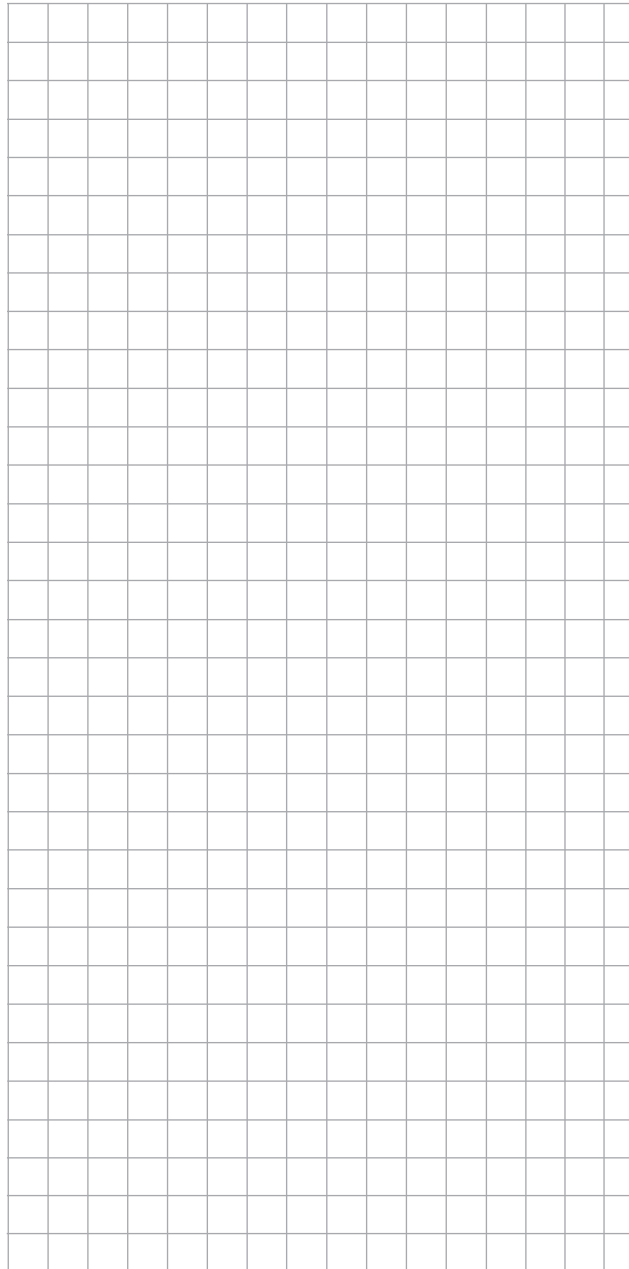
**Tips**

Logical switches can be used to logically interconnect two switches. They can also be used to establish a control switch as an AND/OR. A total amount of 8 logical switches L1 - L8 are available, each with a reversed (inverted) direction L1i - L8i. Refer to the FUNCTION submenu **Logical sw** (page 148) for additional information.

- 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:**

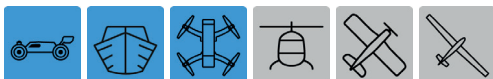
- Turning on/off an on-board glow plug heater when an idling switching point for the THR control stick is exceeded or undershot. The switch for the glow plug heater is controlled at the transmitter by a mixer.
- Automatically turning the stopwatch on/off to measure the actual flight time of a helicopter 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.
- Extend the landing flaps and retrim the elevator while approaching a landing once the throttle control stick is moved beyond the switching point.
- Turn the stop watch on/off to measure the operating time of electric motors.



# Receiver Configuration

## Vehicles, Boats and Drones

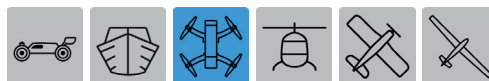
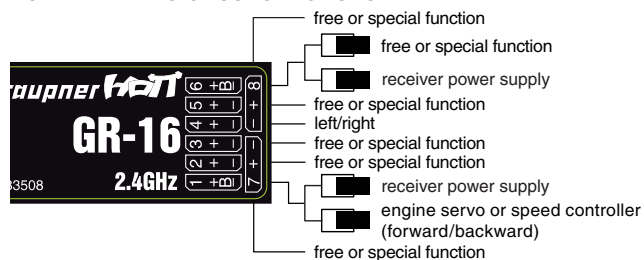
This manual is grouped by model type. Refer to sections of the appropriate model type for programming information specific to that model. For example, information specific to vehicles, boats and drones, look for any/all of the following three icons to be highlighted blue:



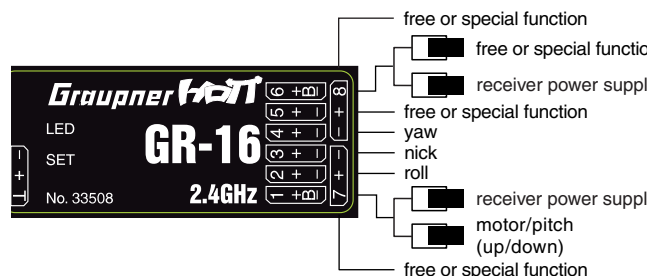
### Connection Notices



For surface models there are basically four different ways of assigning the control functions (forward/backward and left/right) of both control sticks. The options that are chosen depend on individual preferences. It is recommended to keep the control modes 1 - 4 compatible by connecting control function 1 with the forward/backward function and the control function 4 with the direction function:



For drones there are basically four different ways of assigning the four control functions (roll, nick, yaw and throttle/pitch) of both sticks. The options that are chosen depend on individual preferences. It is recommended to keep the control modes 1 - 4 compatible by connecting them according to the following schema:



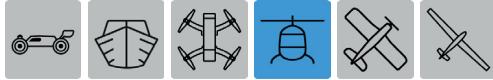


# Receiver Configuration



## Helicopters

This manual is grouped by model type. Refer to sections of the appropriate model type for programming information specific to that model. For example, information specific to helicopters, look for the following icon to be highlighted blue:



### Installation Notices

#### Notice



The servos must be connected to the receiver in the indicated sequence. Leave outputs that are not required unassigned.

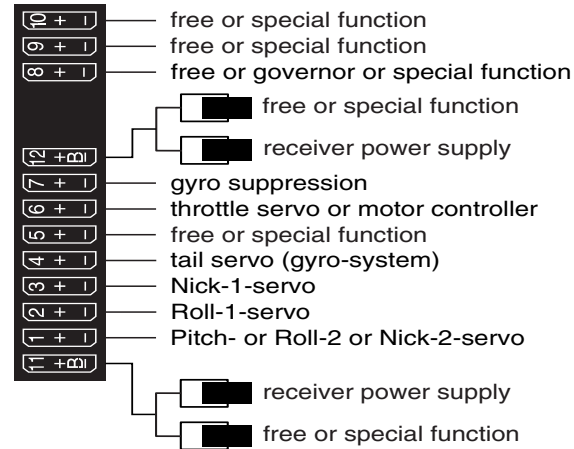
Follow the instructions on the subsequent pages.

#### Tip

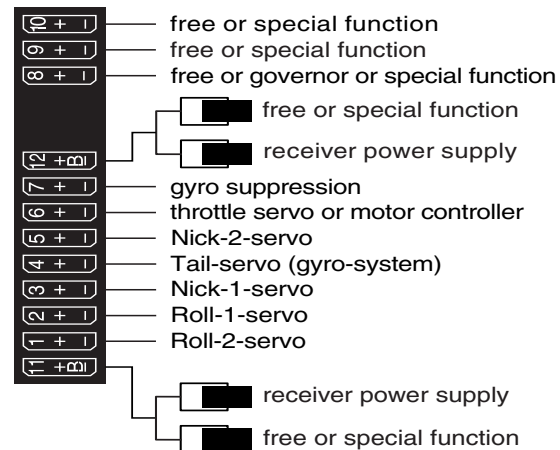
In order to take advantage of the comfort and safety of the **Throttle Limit** feature (page 94), a governor should be connected to receiver output 6 instead of receiver output 8 (as shown in the adjacent receiver configuration). Refer to the FUNCTION submenu **THR.CRV** section (page 160) for additional information on governors.

### Receiver Assignment for Helicopter Models

#### Models With 1 to 3 Swashplate Servos



#### Models With 4 Swashplate Servos



#### Notice



In comparison to the receiver configuration of some older *Graupner/JR* transmitters, servo connection 1 (pitch servo) and servo connection 6 (throttle servo) have been switched. The servos **must** be connected to the receiver outputs as depicted in the previous schema. Leave outputs that are not required unassigned.

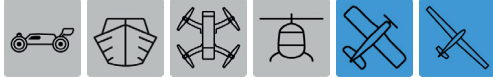


# Receiver Configuration



## Motor-Powered Airplanes and Gliders

This manual is grouped by model type. Refer to sections of the appropriate model type for programming information specific to that model. For example, information specific to airplanes and gliders, look for any/all of the following two icons to be highlighted blue:



### Installation Notices

#### Notice

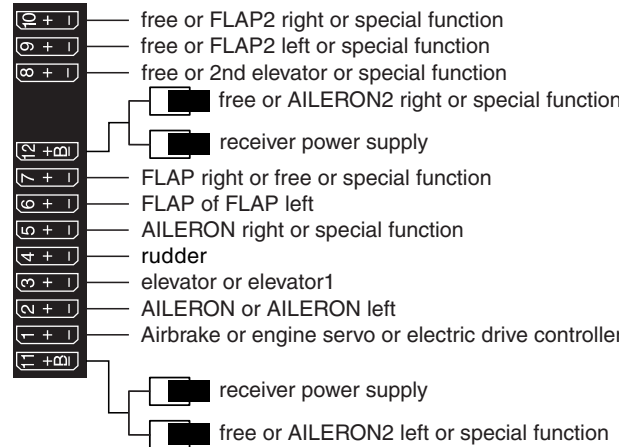


The servos must be connected to the receiver in the indicated sequence. Leave outputs that are not required unassigned.

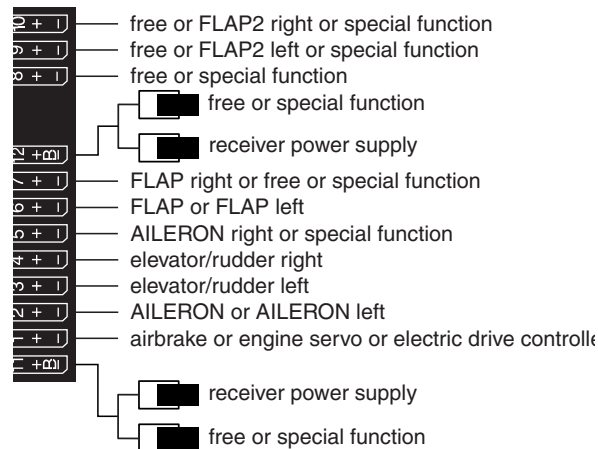
Follow the instructions on the following pages.

### Fixed-Wing Models With or Without Motor - Up to 4 Ailerons and 4 Flaps

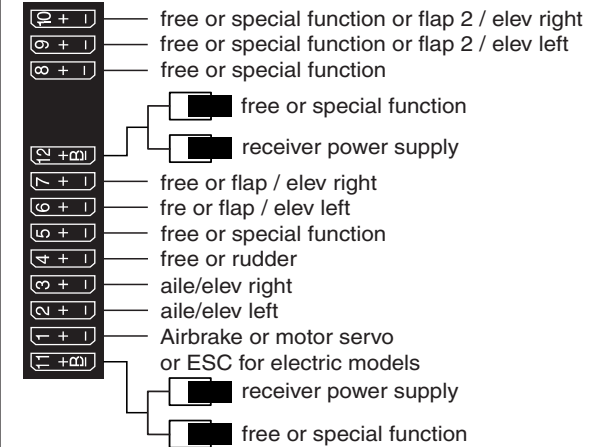
#### Normal Tail Unit or 2 Elevator Servos



#### V-Tail Unit



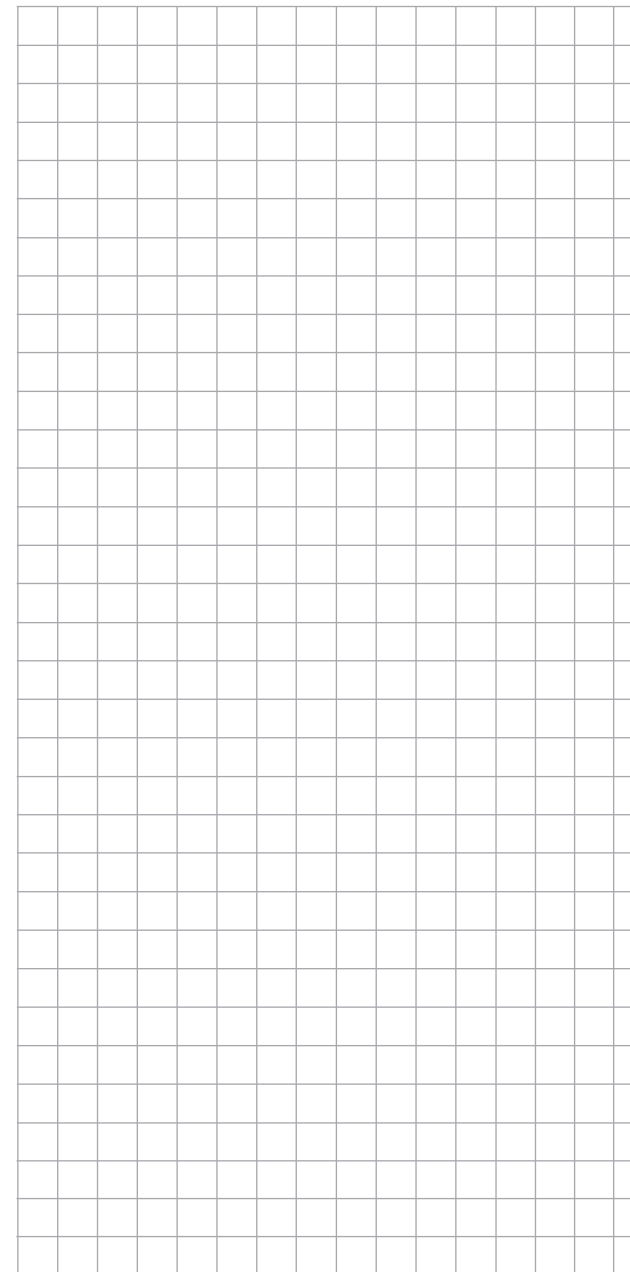
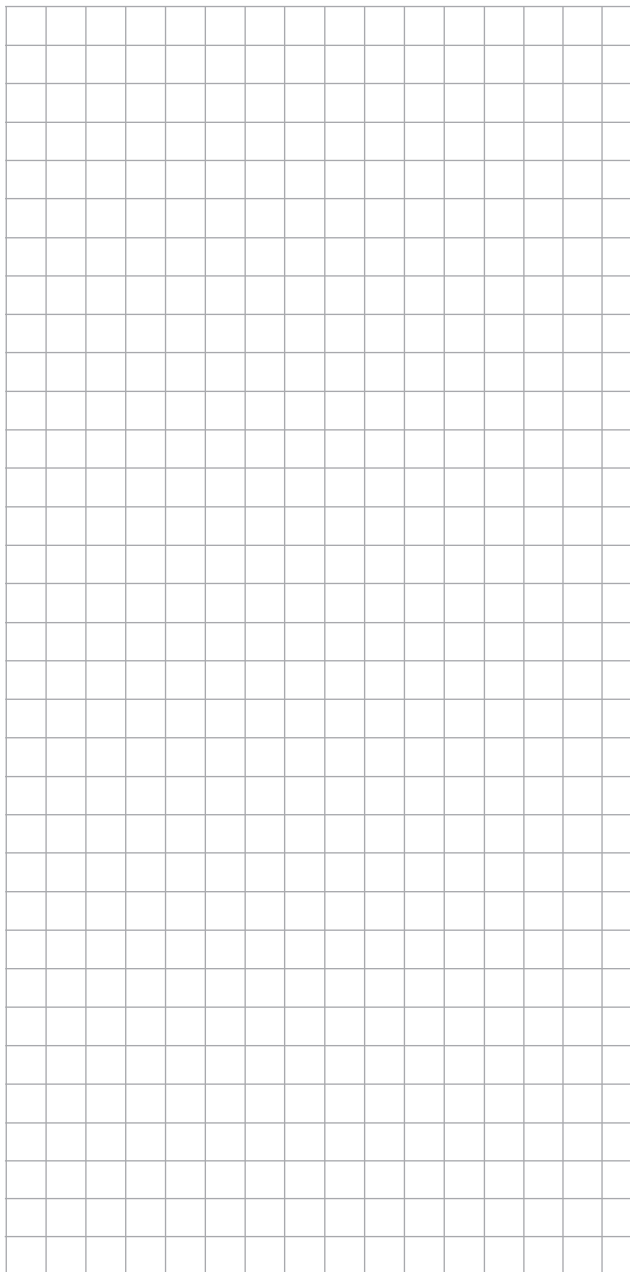
### Delta/Flying Wing Models With or Without Motor - Up to 4 Ailerons/Elevators and 4 Flap/Elevator Servos





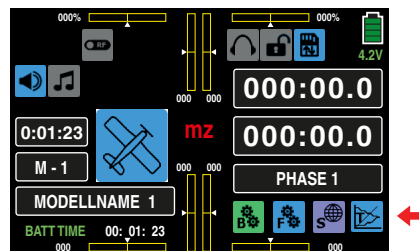
Due to the different installation of the servos and rudder linkages, the operating direction for certain servos can be reversed:

Model Type	Servo with Wrong Rotation Direction	Solution
<b>V-Tail</b>	Reverse rudder and elevator	Invert the servos 3 & 4 in the submenu <b>REV/SUB</b>
	Rudder correct, elevator reversed	Switch servos 3 & 4 on the receiver
	The elevator is correct, rudder is reversed	Invert the servo 3 + 4 in the submenu <b>REV/SUB</b> AND switch them in the receiver
<b>Delta/ Flying Wing</b>	Elevator and aileron reversed	Invert the servos 2 & 3 in the submenu <b>REV/SUB</b>
	Elevator correct, aileron reversed	Invert the servo 2 & 3 in the submenu <b>REV/SUB</b> AND switch them in the receiver
	Aileron correct, elevator reversed	Switch servos 2 & 3 on the receiver



# Program Description

To open the respective submenu, press one of the four colored gear icons at the bottom right of the main display:



**BASE** menu = green **B** icon



**FUNCTION** menu = blue **F** icon



**SYSTEM** menu = purple **S** icon



**TELEMETRY** menu = blue **T** icon

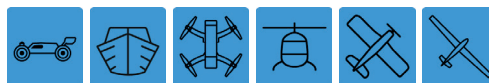
These submenus contain all of the setting and display menus required to program models and the **mz-24 PRO** transmitter.

This manual follows the sequence order of the menus as they appear in the transmitter.

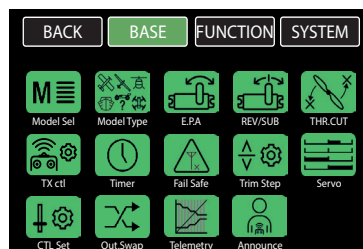
## Notice

» The display screen-shots of this manual are intended for illustration purpose only. Therefore please note that the represented settings and setting values cannot be used for 1:1 reference.

## B (BASE Menu)



Press the **BASE** menu gear icon (green “B”) to bring up the BASE submenu screen:



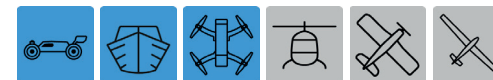
This menu contains all of the base setting and display menus that are needed to set up the model:

Name	Menu	Page
<b>Model Sel</b>	Model Selection	38
<b>Model Type</b>	Model Type	60
<b>E.P.A</b>	Servo Path/Servo Limit	62
<b>REV/SUB</b>	Servo Reverse/Servo Sub-Trim	64
<b>Motor</b>	Throttle Cut*	66
<b>TX ctl</b>	Transmitter Controls	68
<b>Timer</b>	Timers	74
<b>Fail Safe</b>	Fail Safe Settings	80
<b>Trim Step</b>	Trim Setup	82
<b>Servo</b>	Servo Monitor	86
<b>CTL Set</b>	Control Settings	90
<b>Out.Swap</b>	Transmitter Output	96
<b>Telemetry</b>	Telemetry Settings	98
<b>Announce</b>	Announcements	118

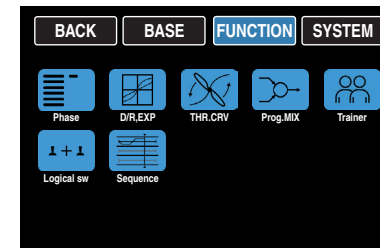
\* This icon remains hidden for models without a motor

## F (FUNCTION Menu)

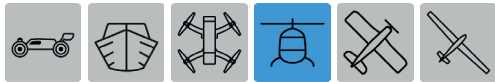
The icons displayed in the FUNCTION submenu screen vary depending on the active model type and basic settings. Locate the blue model type icon for information relative to that model.



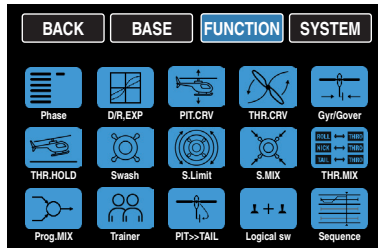
Press the **FUNCTION** menu gear icon (blue “F”) to bring up the FUNCTION submenu screen:



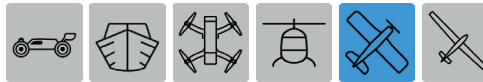
Name	Menu	Page
<b>Phase</b>	Phase setting	120
<b>D/R,EXP</b>	Dual rate, Expo	124
<b>THR.CRV</b>	Throttle curve	128
<b>Prog.MIX</b>	Programmable mixers	134
<b>Trainer</b>	Trainer system	141
<b>Logical sw</b>	Logical switch	148
<b>Sequence</b>	Sequencer	150



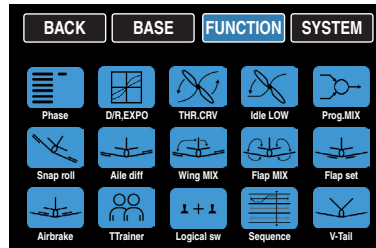
Press the **FUNCTION** menu gear icon (blue “F”) to bring up the FUNCTION submenu screen:



Name	Menu	Page
<b>Phase</b>	Phase setting	120
<b>D/R,EXP</b>	Dual rate, Expo	124
<b>PIT,CRV</b>	Pitch curve	154
<b>THR,CRV</b>	Throttle curve	160
<b>Gyr/Gover</b>	Gyro/governor	166
<b>THR,HOLD</b>	Throttle autorotation	170
<b>Swash</b>	Swashplate mixer	172
<b>S.Limit</b>	Swashplate limiter	173
<b>S.MIX</b>	Heli mixer	174
<b>THR,MIX</b>	Throttle mixer	176
<b>Prog,MIX</b>	Programmable mixers	134
<b>Trainer</b>	Trainer system	141
<b>PIT-&gt;TAIL</b>	Pitch >> tail mixer	178
<b>Logical sw</b>	Logical switch	148
<b>Sequence</b>	Sequencer	150



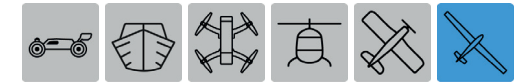
Press the **FUNCTION** menu gear icon (blue “F”) to bring up the FUNCTION submenu screen:



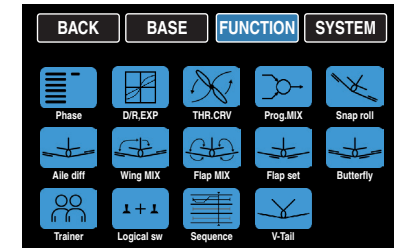
Name	Menu	Page
<b>Phase</b>	Phase setting	120
<b>D/R,EXP</b>	Dual rate, Expo	124
<b>THR,CRV</b>	Throttle curve	128
<b>Idle LOW</b>	Idle setting*	180
<b>Prog,MIX</b>	Programmable mixers	134
<b>Snap roll</b>	Snap roll setting	181
<b>Aile diff</b>	Aileron setting	182
<b>Wing MIX</b>	Wing mixer	188
<b>Flap MIX</b>	AILE and FLAP mix**	192
<b>Flap set</b>	Flap setting**	196
<b>Airbrake</b>	Airbrake settings**	200
<b>Trainer</b>	Trainer system	141
<b>Logical sw</b>	Logical switch	148
<b>Sequence</b>	Sequencer	150
<b>V-Tail</b>	V-Tail**	206

\* This icon remains hidden for models without a motor

\*\* This icon may remain hidden depending on the selected model type.



Press the **FUNCTION** menu gear icon (blue “F”) to bring up the FUNCTION submenu screen:



Name	Menu	Page
<b>Phase</b>	Phase setting	120
<b>D/R,EXP</b>	Dual rate, Expo	124
<b>THR,CRV</b>	Throttle curve*	128
<b>Prog,MIX</b>	Programmable mixers	134
<b>Snap roll</b>	Snap roll setting	181
<b>Aile diff</b>	Aileron setting	182
<b>Wing MIX</b>	Wing mixer	188
<b>Flap MIX</b>	AILE and FLAP mix**	192
<b>Flap set</b>	Flap setting**	196
<b>Butterfly</b>	Butterfly**	202
<b>Trainer</b>	Trainer system	141
<b>Logical sw</b>	Logical switch	148
<b>Sequence</b>	Sequencer	150
<b>V-Tail</b>	V-Tail**	206

\* This icon remains hidden for models without a motor

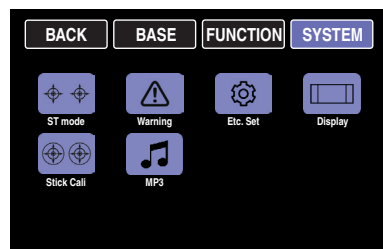
\*\* This icon may remain hidden depending on the selected model type.

## S

### (SYSTEM Menu)



Press the **SYSTEM** menu gear icon (purple “S”) to bring up the SYSTEM submenu screen:



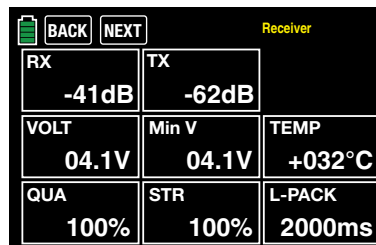
This menu is transmitter-specific and the submenus are applicable to all models. However, the **Warning** menu options will vary slightly according to certain model settings:

Name	Menu	Page
<b>ST mode</b>	Stick mode	208
<b>Warning</b>	Warning instructions	210
<b>Etc. Set</b>	Various settings	212
<b>Display</b>	Display settings	216
<b>Stick Cali</b>	Stick calibration	220
<b>MP3</b>	MP3 Player	222

## T

### (Telemetry Display)

Press the **TELEMETRY** icon (blue “T”) to bring up the TELEMETRY display. The Telemetry display has no submenu icons but has differing screens depending on system settings. By default, the receiver display appears:

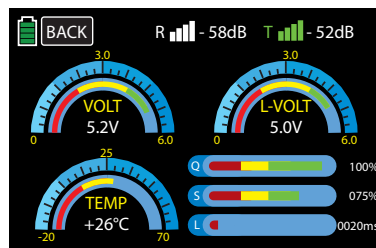


Note this display will only appear if the **Outdoor disp** function of the **SYSTEM** submenu **Display** is turned **ON**.

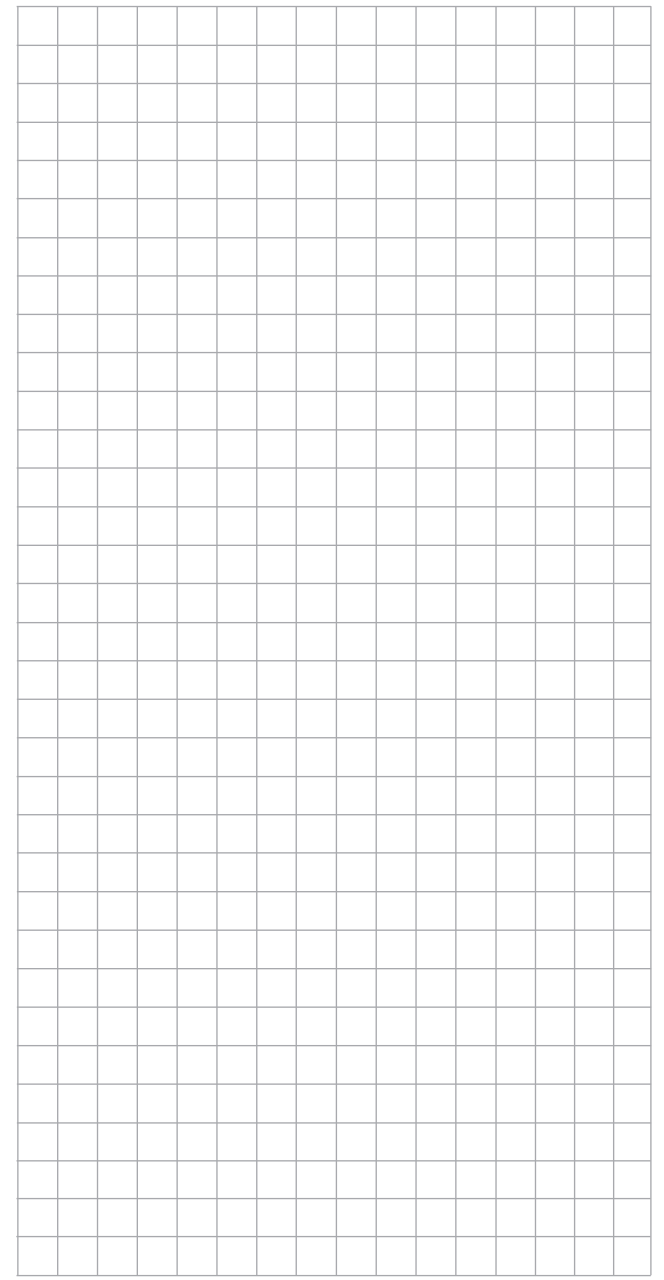
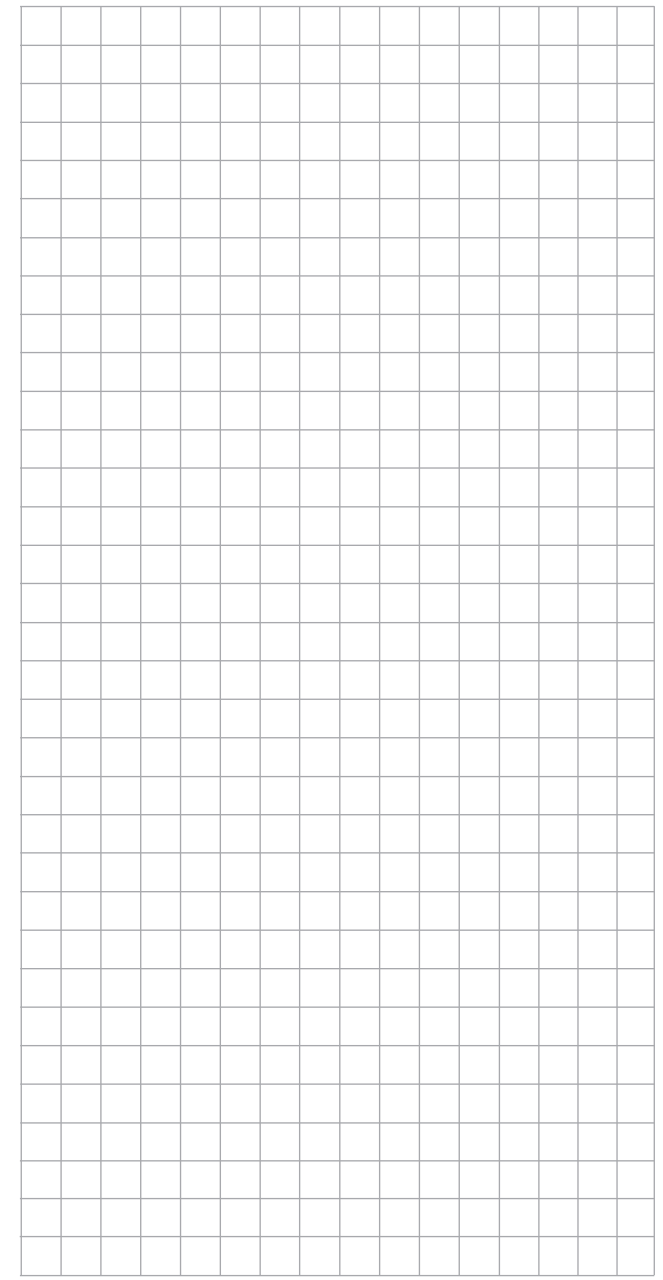
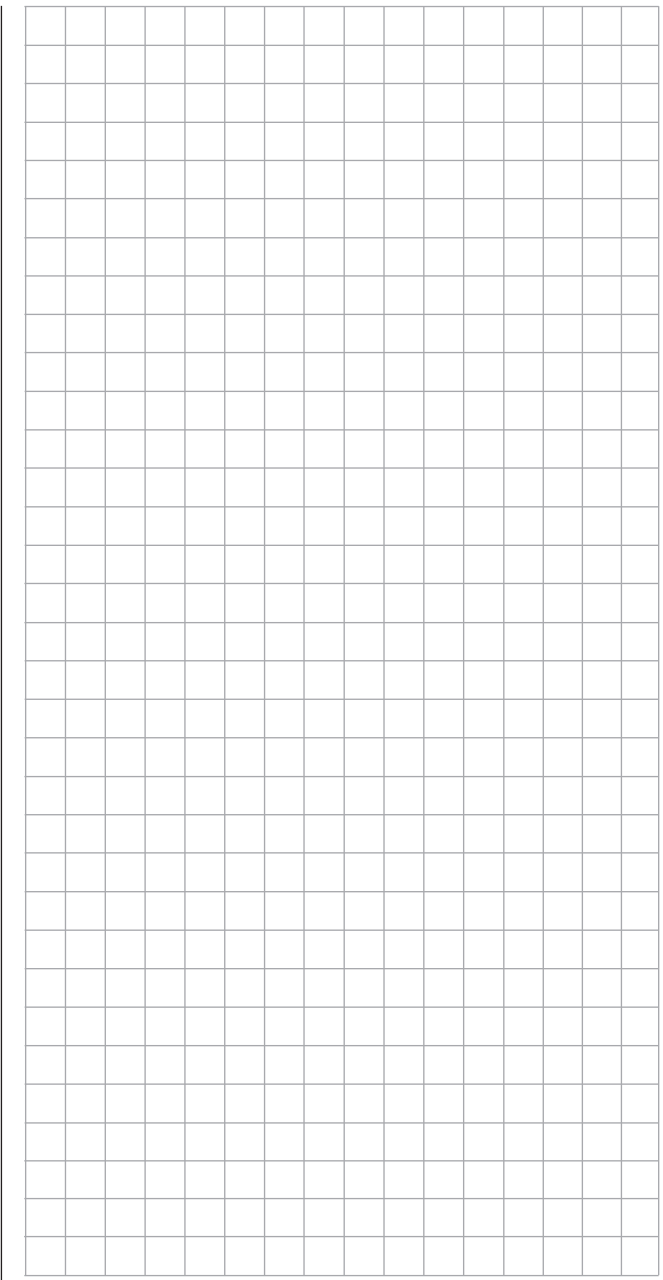
If *no* sensors are connected to the receiver and the **Outdoor disp** option is **OFF** (as shown below):

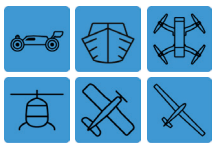


Then the display will appear as follows:



Refer to the **Telemetry** section of this manual (page 225) for additional information on the display screens.

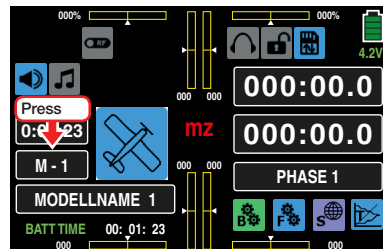




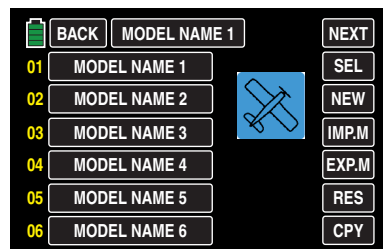
# Model selection

## Edit Model Memories 1 to 30

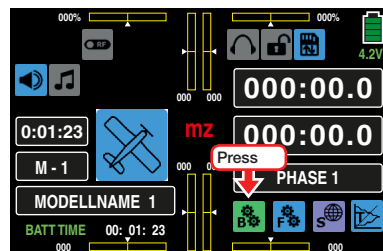
Turn off the receiver and the RF module of the transmitter. Press the **M - #** value field line in the left side of the main display with a finger or stylus:



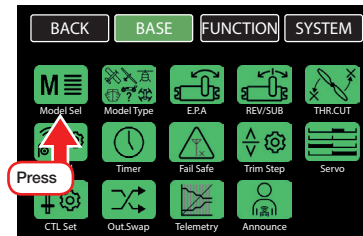
This is a direct shortcut to the **BASE** submenu Model select (**Model Sel**):



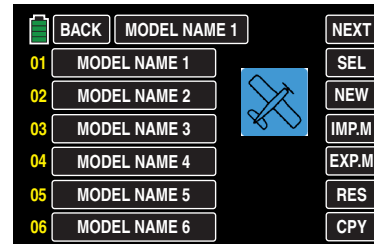
To access the same menu without using the shortcut, press the green **BASE** “**B**” gear icon to open the **BASE** menu display:



Then press the **Model Sel** submenu icon:



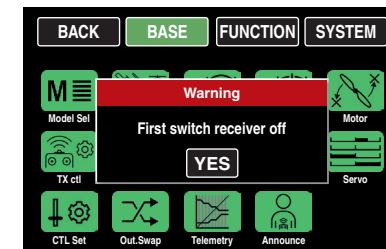
The Model Select function screen now appears:



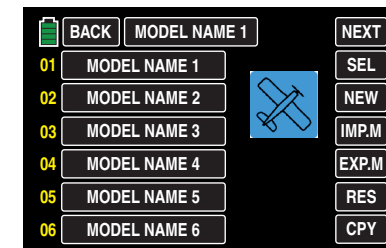
### Notices



- If there is no reaction either by pressing the main display's **M - #** button or by pressing the **BASE** menu's Model Sel submenu icon, the following Active Warning message may appear:



This means there is still a connection between transmitter and receiver. Turn off the receiver and try again until the Model Select function screen appears:

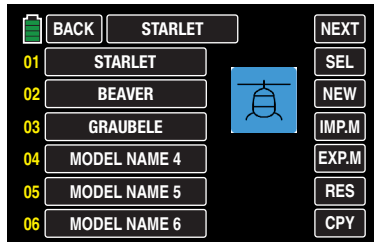


- Access to the Model Select submenu is generally blocked if the transmitter is in **Wireless Trainer Mode**.

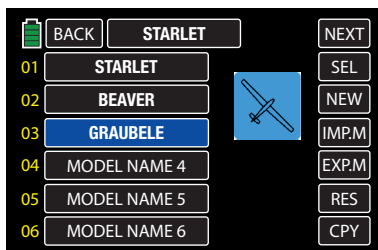
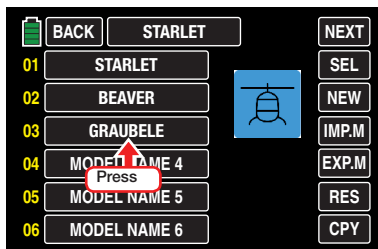
### Model Select Display

The currently active model is always shown in the name bar at the top of the Model Type Display in addition to the blue model-type icon shown to the left of center.

In the example below, the helicopter model named “Starlet” is currently active. The model’s name is visible in the active Model Memory line 01 as well as the name bar at the top of the screen. The model type icon is displayed. In the example below, the helicopter icon is visible:



To view the model-type of other models saved in memory, press to highlight any model name in the Model Memory lines. For example, by pressing line 03 in the example below, the glider icon appears:



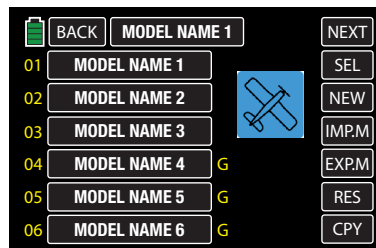
Note that “Starlet” remains in the name bar at the top of the screen because it is still the currently active model.

### HoTT Synchronization Methods Setting

As mentioned in the section **Starting the Receiver** (page 14): if both the receiver and the RF module function are turned off, every model saved in the Model Memory lines (01 - 30) can be switched from Standard Memory Specific HoTT-Synchronization to Transmitter Specific and vice-versa. Models saved in memory with active HoTT-synchronization, also known as **Global Bound**, have a yellow **G** to the right of the model memory line.

<b>MODEL NAME 1</b>	NO yellow <b>G</b> to the right of memory line = memory-specific bound
<b>MODEL NAME 1</b> <b>G</b>	Yellow <b>G</b> to the right of model memory line = transmitter-specific (global) bound

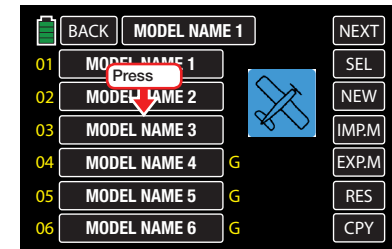
In the example below, Memory Lines 01, 02 and 03 are memory-specific HoTT-Synchronization; Memory Lines 04, 05 and 06 have been switched to transmitter-specific HoTT-Synchronisation:



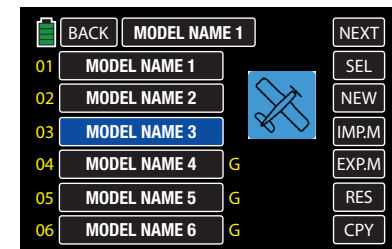
### Changing the HoTT-Synchronization

Turn the transmitter's RF module off.

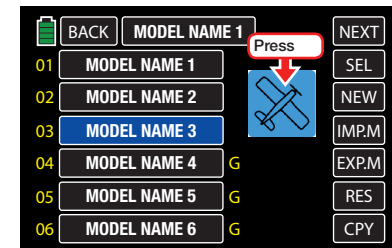
Press to highlight on model memory line to be changed. For the example below, Model Memory 03 is being changed from Standard Memory to Global:



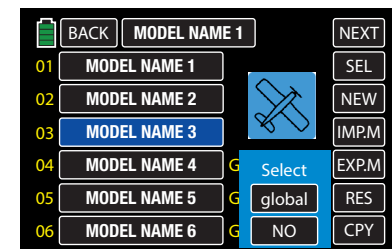
Once the line is selected the field is highlighted blue:



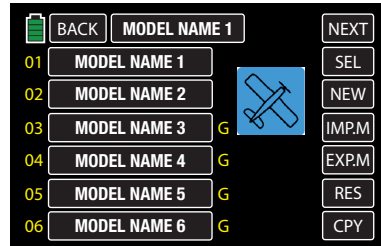
Press the model-type icon:



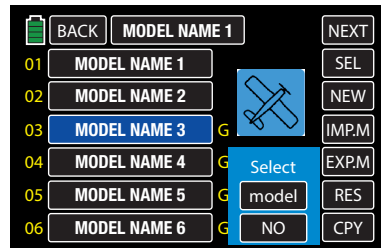
A selection window will pop up with two options:



Press **NO** to cancel. Press **GLOBAL** to change the selected model memory to Global (transmitter-specific HoTT-Synchronization):



To change from Global to Standard (model-specific HoTT-Synchronization), then the selection window appear as below:



Touch **NO** to cancel. Press **MODEL** to change the selected model memory back to Model (model memory specific HoTT-Synchronization).

- **NOTE: Re-bind all receivers after changing the HoTT Synchronization!**
- Global bound receivers react to the signals of all of the global bound model memories saved in the transmitter. For safety reasons a model memory change is only possible if the receiver system is turned off.

## CAUTION



If a receiver system is accidentally turned on after a model memory change, it will react to control movements of every global-bound model memory as soon as a valid signal is emitted from the transmitter.

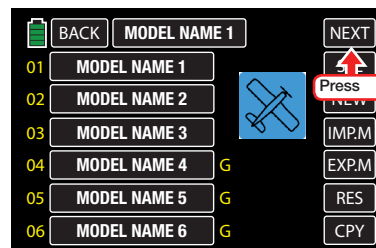
- Model-specific bound receivers react exclusively to the signal coming from the specifically assigned model memory. Accidentally using a non-specifically assigned model memory is NOT possible. Receivers turned on after a model memory change will automatically pass into Fail-Safe Mode.

## Tip

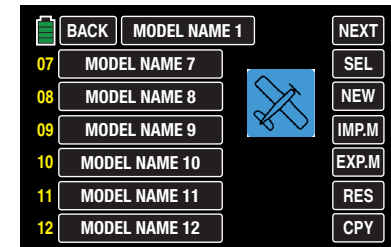
Refer to the **Import/Export from SD Card** section for additional information regarding HoTT-Synchronization after the copying, importing or exporting process (page 54).

## NEXT (Page Change)

Press the **NEXT** button at the top right corner of the display to scroll through additional Model Memory Lines:



There are six lines per screen:

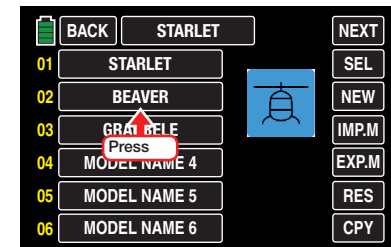


The screens are cyclical; pressing NEXT after reaching the screen displaying Lines 25 - 30, the first screen will reappear, displaying Lines 01 - 06.

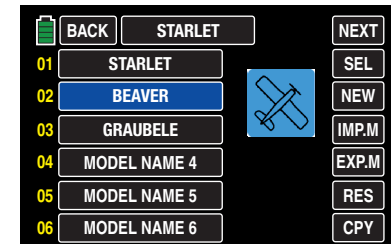
**NOTE: Pressing BACK will not recall the previous screen. Pressing BACK will bring up the last major menu, e.g. either the BASE submenu display or the Main Menu.**

## SEL (Change Model)

Press to highlight the Model Memory line to be made the active model. In this example Line 02 - Beaver:

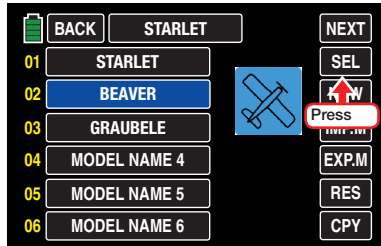


Line 02 is highlighted blue:

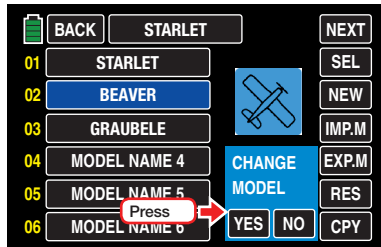




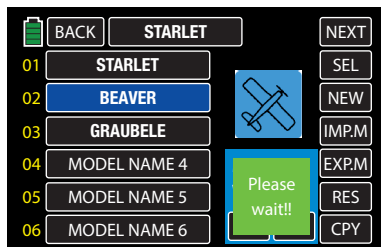
Press the **SEL** button on the right side of the display to Select the model:



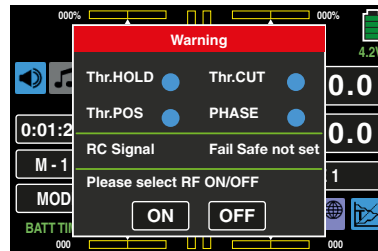
Press **NO** to terminate the process or **YES** to change the model:



After pressing YES, the message "Please wait!!" will appear as the transmitter searches for bound receivers:

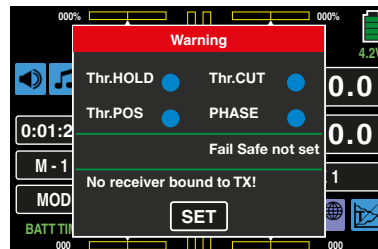


- If a receiver is already bound to the selected model memory and if the Thr.POS warning is *inactive*, the RF module of the transmitter will automatically turn on and the following active warning display appears:

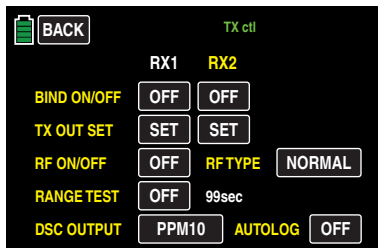


Maintain the RF transmissions by pressing **ON** button, or switch them off by pressing **OFF**. If no action is taken the warning display will automatically disappear after a few seconds.

- If *no* receiver is bound to the selected model memory the message "No receiver bound to TX!" within the following active warning display appears:



Pressing the **SET** button opens the BASE sub-menu **TX ctl**, where you can bind your receiver in the **Bind ON/OFF** line:



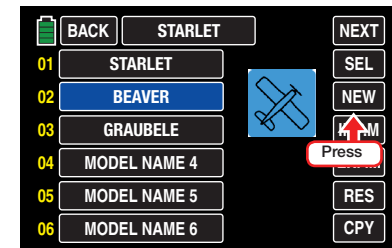
Press the **BACK** button to return to the main menu.

## **NEW** (Create New Model)

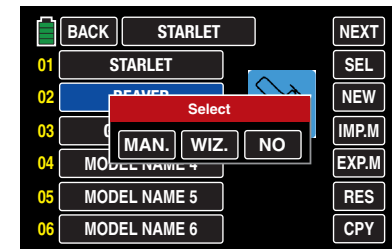
### Tips

- To view model memory lines 07 and higher, press the **NEXT** button.
- Change previously saved model memories by pressing **SEL**.

To set up a new model, select an open model memory line or an existing memory line to be reassigned. Press the **NEW** button on the right side of the display:



A selection window will appear with the option to program manually, use the setup wizard or press **NO** to exit:



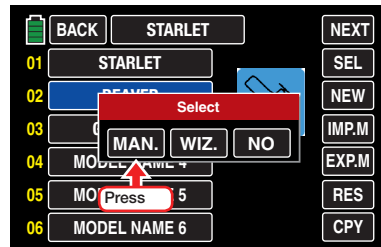
The next section, **New Model Basic Settings - MANUAL**, will focus on programming a fixed-wing model.

Refer to the **New Model Basic Settings - WIZARD** section (page 44) for an example of programming a helicopter.

## Tip

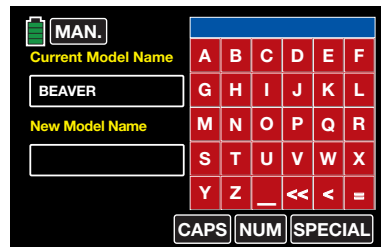
Refer to the **New Model Basic Settings - WIZARD** section (page 44) for an example of programming a helicopter.

### New Model Basic Settings - MANUAL



Both the Manual and Wizard options follow the same predefined procedure. After pressing **MAN.** the keypad display appears:

### Model Name



A maximum of 15 characters can be entered for each model name.

To toggle between uppercase and lowercase press the **CAPS** button at the bottom edge of the red keypad.

Press the **NUM** button bring up the numbers and punctuation keypad.

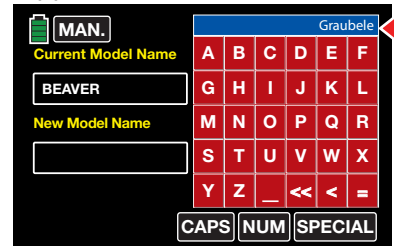
Press the **SPECIAL** button to bring up a special characters keypad.

Press the **[Space]** key on the red keypad to enter a space.

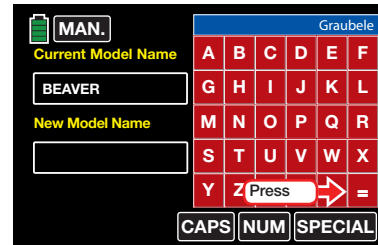
Press **[DELETE]** in the bottom row of the red keypad to erase a single character.

Press **[CLEAR]** to delete the entire selection.

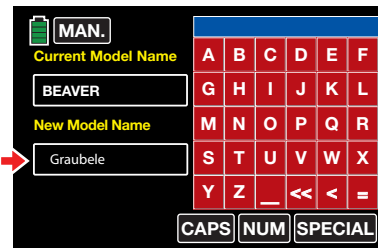
Characters appear in the blue field above the keypad:



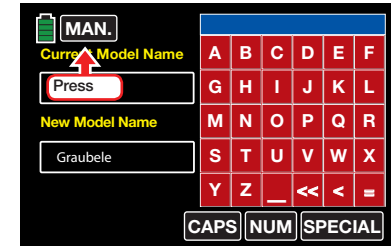
Press the **[ENTER]** button on the bottom of the red keypad to transfer the model name from the blue field into the Model Memory Name field at left:



The name is now entered in the New Model Name field:

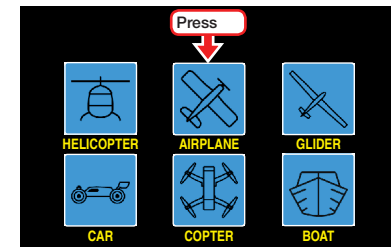


Press the **MAN.** button at the top left to advance to the next selection screen:



### Model Type

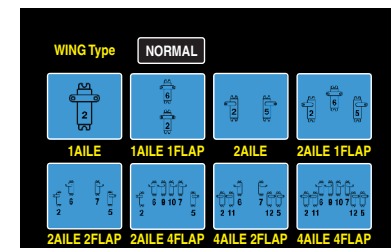
This example shows an electric motor fixed-wing. Press the blue **AIRPLANE** icon:



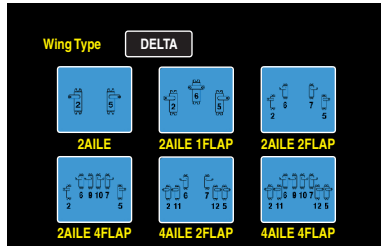
Pressing the model icon will bring up the wing type menu:

### Wing Type

Press to select the icon that corresponds to the number of aileron and flap servos on the model:



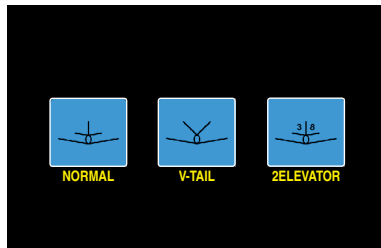
Press the button to the right of the **Wing Type** line to switch between delta/flying fixed-wing models. A different submenu appears depending on if the model is **NORMAL** or **DELTA**:



Pressing the wing icon will bring up the tail type menu:

### Tail Type

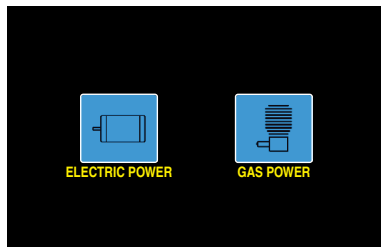
Press the blue icon that corresponds to the model's tail type:



Pressing the tail icon will bring up the propulsion type menu:

### Propulsion Type

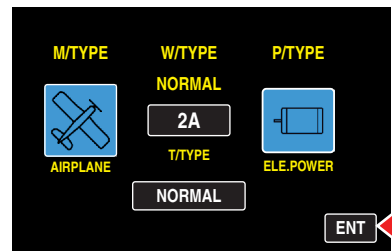
Press the blue icon that corresponds to the model's motor type:



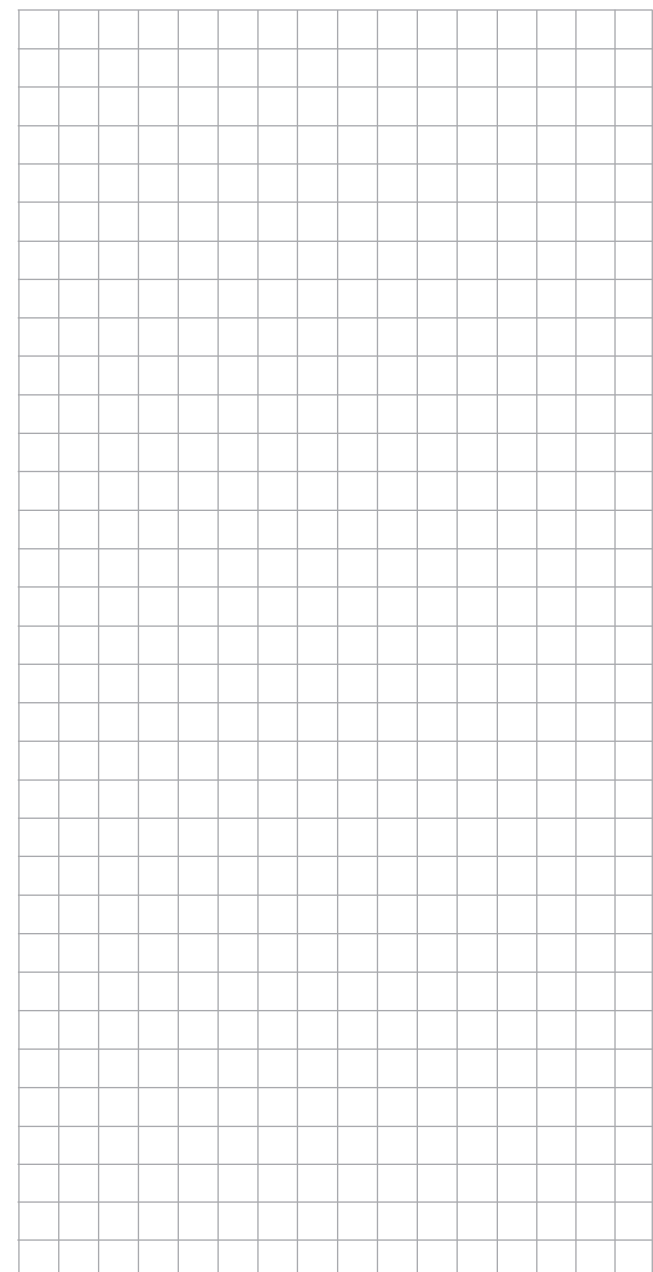
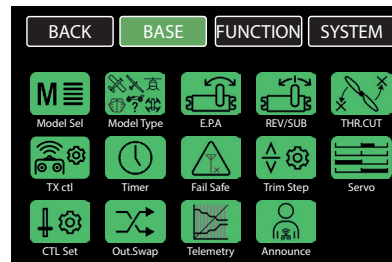
### Tip

The default for "Motor Off" or "Idle" is **Rear Thro Position**. This can be changed to **Front Thro Position** for fixed-wing models by inverting the control curve in the BASE submenu **Throttle Curve** (page 128).

Pressing the propulsion icon brings up an Overview Display showing all settings selected. To save, press the **ENT** button at the right bottom:



Pressing ENT brings up the BASE submenu display:



## New Model Basic Settings - WIZARD

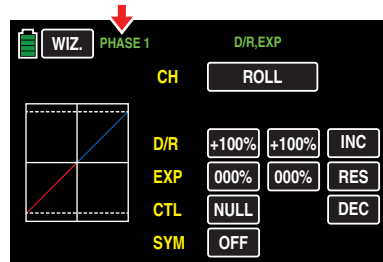
First-time users should utilize the Wizard function until comfortable inputting the information manually.

The following example will describe programming a helicopter model. Refer to the **New Model Basic Settings - WIZARD** section (page 42) for an example of programming a fixed-wing.

Both the Manual and Wizard options follow the same predefined procedure.

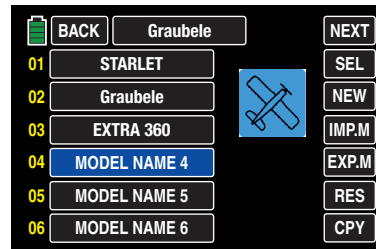
### Tip

Some of the sub-menus offer phase-specific settings. Each phase is indicated in the top left of the screen in green **PHASE #**, as shown below:

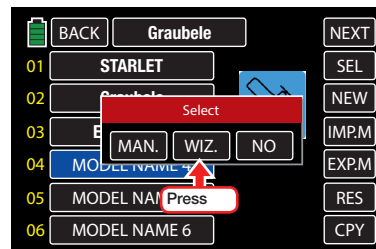


The setup wizard only allows "Phase 1" settings. For more information on the different phases, refer to the **Phase** section (page 120).

To set up a new model, select an open model memory line or an existing memory line to be reassigned. Press the **NEW** button on the right side of the display:



A selection window will appear with the option to program manually, use the setup wizard or press **NO** to exit. Model-type specific configuration options will appear based on the model icon chosen. The following example will describe programming a helicopter model. Press the **WIZ.** button:

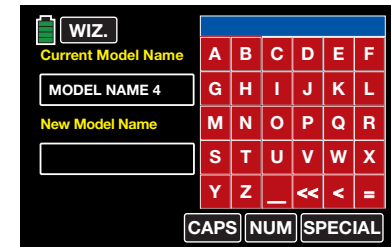


### Tip

Refer to the **New Model Basic Settings - WIZARD** section (page 42) for an example of programming a fixed-wing.

Both the Manual and Wizard options follow the same predefined procedure. After pressing **WIZ.** the keypad display appears:

## Model Name



A maximum of 15 characters can be entered for each model name.

To toggle between uppercase and lowercase press the **CAPS** button at the bottom edge of the red keypad.

Press the **NUM** button bring up the numbers and punctuation keypad.

Press the **SPECIAL** button to bring up a special characters keypad.

Press the **[Space]** key on the red keypad to enter a space.

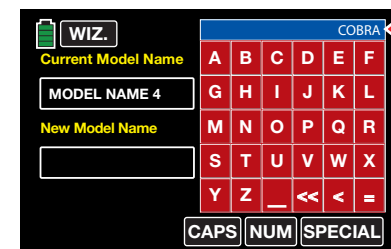
Switch to the desired symbols chart and tap on the first character of the model name.

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

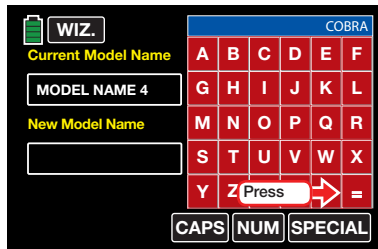
Press **[DELETE]** in the bottom row of the red keypad to erase a single character.

Press **[CLEAR]** to delete the entire selection.

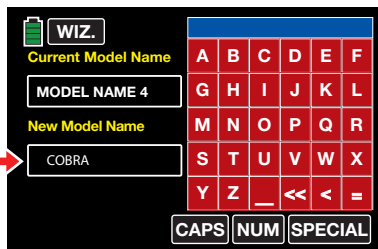
Characters appear in the blue field above the keypad:



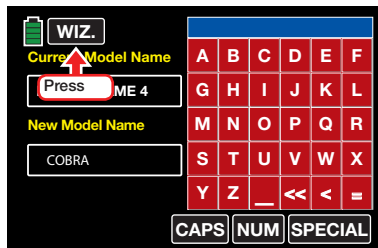
Press the **[ENTER]** button on the bottom of the red keypad to transfer the model name from the blue field to the New Model Name field at left:



The name is now entered in the New Model Name field:

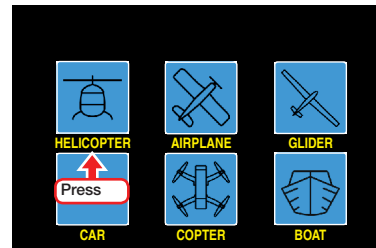


Press the **WIZ.** button at the top left of the screen to advance to the next display:



## Model Type

This example shows helicopter model. Press the blue **HELICOPTER** icon:



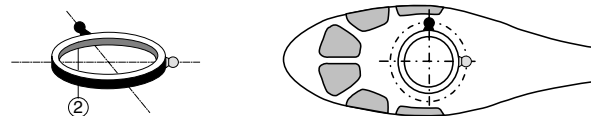
Pressing the model icon will bring up the swashplate type menu:

## Swashplate Type

Press to select the icon that corresponds to the number of swashplate servos on the model:



### • 1SERVO NOR

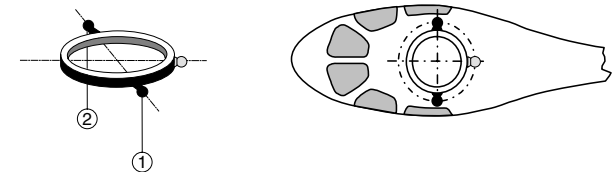


This option is for a flybar system, or where the swashplate is tilted by a roll and nick servo. *One* separate servo is used for the *pitch* control.

(Most flybar system helicopter models with only one pitch servo that have three swashplate servos for pitch, nick and roll also operate without a mix of functions in the transmitter. These options do not appear on the multifunction menu. Refer

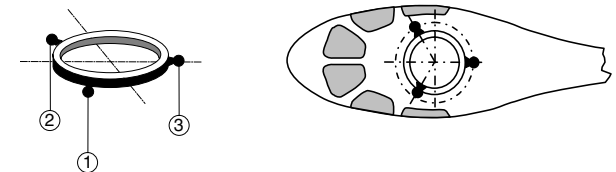
to the FUNCTION submenu **Swash** section (page 172) for more information.)

### • 2SERVO 180



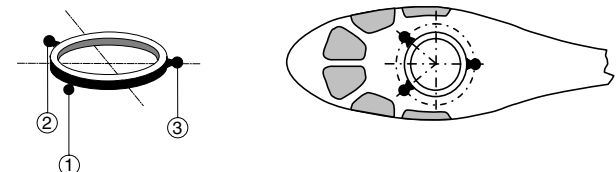
The swashplate is shifted axially for the pitch control by means of two roll servos; the nick control is decoupled by means of a mechanical compensation rocker.

### • 3S 120(Roll)



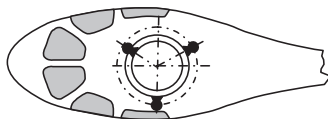
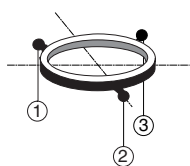
Symmetrical three-point control of the swashplate by means of three articulations points offset by 120°, by means of which one nick servo (front or rear) and two roll servos (to the left and right side) are connected. All of the three servos of the swashplate shift axially for pitch control.

### • 3SERVO 140



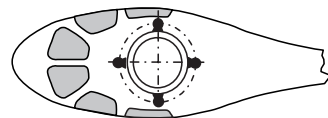
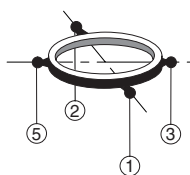
Asymmetrical three-point control of the swashplate by means of three articulations points offset, by means of which one nick servo (rear) and two roll servos (to the left side and right front) are connected. All of the three servos of the swashplate shift axially for pitch control.

• **3S 120(Nick)**



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

• **4SERVO 90**

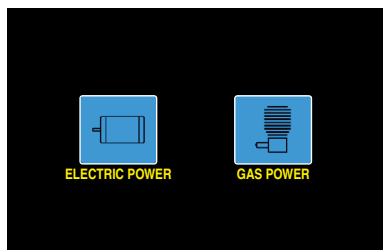


Four-point control of the swashplate by means of two roll servos and two nick servos.

Pressing the swashplate icon will bring up the propulsion type menu:

**Propulsion Type**

Press the blue icon that corresponds to the model's motor type:



Pressing the motor icon will bring up a model-dependent display:

**REV/SUB (Servo Reverse/Servo Sub Trim)**

WIZ.	REV	SUB.TR	SERVO
CH 1.	NOR	000%	
CH 2.	NOR	000%	NEXT
CH 3.	NOR	000%	INC
CH 4.	NOR	000%	RES
CH 5.	NOR	000%	DEC
CH 6.	NOR	000%	

**Tip**

In order to set control channels with numbers higher than CH6, press **NEXT** [change page].

Press the related button to set the directions, left column (REV), and the neutral positions, right column (SUB.TR), of each *phase specific* servo. In the following example servo 8 is changed by pressing CH 8 line, REV column:

WIZ.	REV	SUB.TR	SERVO
CH 7.	NOR	000%	
CH 8.	NOR	000%	NEXT
CH 9.	NOR	000%	INC
CH 10.	REV	000%	RES
CH 11.	NOR	000%	DEC
CH 12.	NOR	000%	

Servo 8 is now changed from NOR to REV:

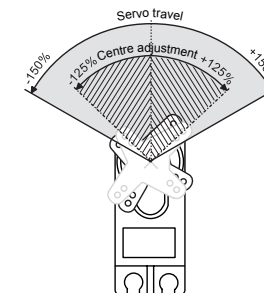
WIZ.	REV	SUB.TR	SERVO
CH 7.	NOR	000%	
CH 8.	REV	000%	NEXT
CH 9.	NOR	000%	INC
CH 10.	NOR	000%	RES
CH 11.	NOR	000%	DEC
CH 12.	NOR	000%	

**Notices**



- It is only possibility to reverse the direction of the servos connected to the output 6 (CH6) in a helicopter model and the output 1 (CH1) in the other types if matched with the different building cases. If not matched, the active warning during transmitter turn-on will not function properly. It is only possible to change the value field by confirming **YES** to the "SURE?" active warning pop-up.
- Independent of trim controls and any mix settings, the neutral position can be shifted around  $\pm 125\%$  within the maximum servo travel of  $\pm 150\%$ . 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  $\pm 150\%$  for electronic and mechanical reasons.



Press the **WIZ.** button to bring up the E.P.A display:

## E.P.A (Servo Travel/Limit)



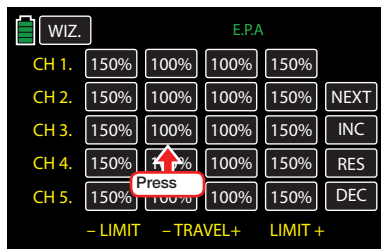
### Tip

Press the **NEXT** button on the right side of the display to scroll through the channel screens.

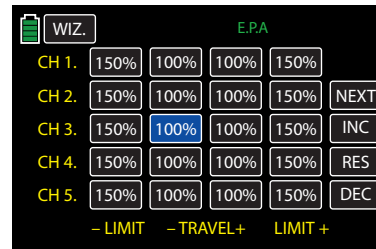
The travel and limitation are shown separately for each side in this display. The setting range in both cases is 0 - 150% of normal travel.

The set values always refer to the settings in the BASE submenu **REV/SUB** (page 64).

To change a value, touch the desired option field, for example:



The selected field will highlight blue:



Press the **INC** button at the right edge of the display to increase the value of the active option field. Press the **DEC** button to reduce the value of the active option field. Press the **RES** button to reset the changed value back to the default. Alternatively, press the arrow keys (▲▼) to the left of the display screen to achieve the same increase/decrease result.

Once all you have adjusted all of your servos, press the **WIZ.** button to bring up the D/R,EXP display:

### D/R,EXP (Dual Rate/Expo)

The dual rate/expo function allows you to switch or influence the control deflections and characteristics for the control functions of roll, nick and tail rotor, i.e. control functions 2 - 4 through switch.

**Dual Rate** allow one or more controls to have less (or more) control authority at the flick of a switch.

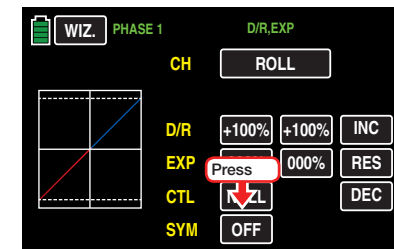
The control deflections can be set for each switch position between 0 and 125% of the normal control travel.

**EXP** (exponential curve) limits how much the servo moves within programmed stick parameters. This is used to help slow down the servos reaction to stick input, allowing a more sensitive model control in the central position of the respective control function (roll, nick and tail rotor) 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.

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.

By default, the dual rate and/or expo values are set for each control side. Press to change the option **SYM** from **OFF** to **ON**:



A symmetrical (joint) setting of both control sides is now possible.

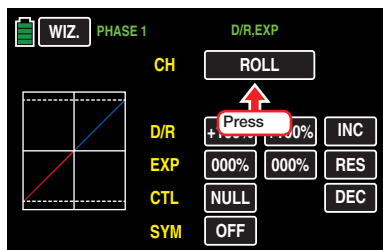
The curve characteristics are shown in the graphic on the left of the display screen the curve characteristics are shown directly.

### Tip

These options and settings can be changed via the FUNCTION submenus **PHASE** and **D/R,EXP** (page 120 and 124).

### Programming

To enter programming parameters on the different ROLL, NICK and TAIL channels, press the button to the right of the CH (channel) line:



Press the **INC** button at the right edge of the display to increase the value of the active option field. Press the **DEC** button to reduce the value of the active option field. Press the **RES** button to reset the changed value back to the default. Alternatively, press the arrow keys ( **▲▼** ) to the left of the display screen to achieve the same increase/decrease result. The adjustment range is  $\pm 125\%$  in the D/R line and  $\pm 100\%$  in the EXP line.

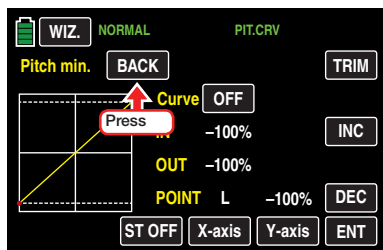
To switch between two variants, assign a switch or a control in the CTL line. Refer the **Control and Switch Assignment** section (page 26) for more information. Press the **WIZ.** button to bring up the **PIT.CRV** display:

### **PIT.CRV** (Pitch Curve)

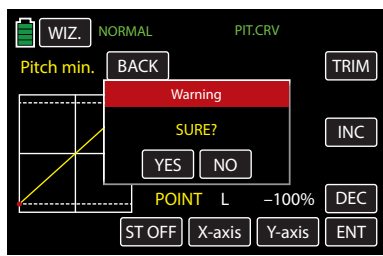
Use the **Pitch min** line to adjust the movement direction of the pitch stick. The remaining options will adjust the pitch curve.

#### 1. Stick Direction

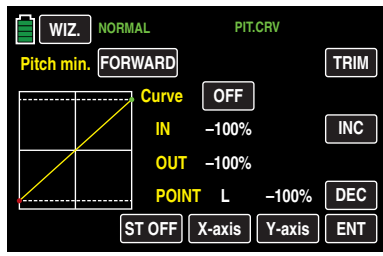
To reverse the control direction of the pitch control stick from the standard pre-set position "pitch min back" to "pitch min forward", and vice versa, press the **BACK** or **FORWARD** button in the "Pitch min" line:



Pressing the button will bring up an active warning:



Press **NO** to terminate the procedure. Press **YES** to confirm the procedure and reverse the movement direction of the pitch stick **WITHOUT** any visual changes in the display:



#### 2. Pitch Curve Settings

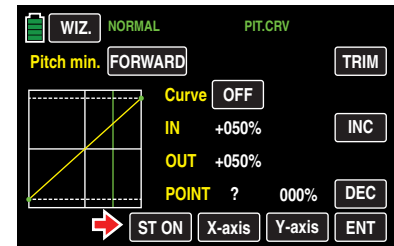
##### Tip

These options and settings can be changed via the **FUNCTION** submenu **PHASE** (page 120).

### Basic Operating Steps

- **Button ST OFF / ST ON**

Press this button to turn the graphic and numeric display of the control stick position on and off, as shown below:



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 (input) is displayed numerically in the **IN** line (-100 % to +100 %). The intersection of this line with the curve (output) is displayed numerically in the **OUT** line and can be varied at the support points between -125% and +125%. A control signal changed in this way affects all of the following mixing and coupling functions:

- **ENT Button**

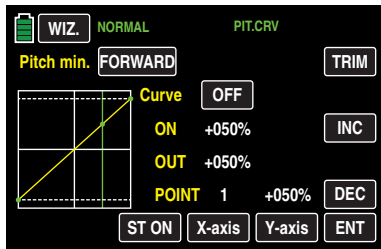
Press the button at the bottom right of the display to set up to 5 additional points between the two endpoints "L" and "H".

In the following example, the control stick is exactly 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.

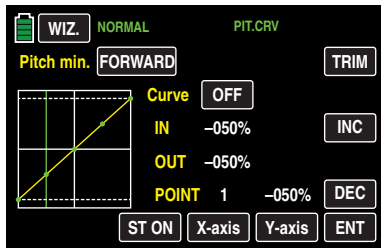


Between the two endpoints "L" and "H", up to 5 additional support points can be set, and the distance between neighboring support points may not be less than approximately 25%.

Move the control stick. As long as a "?" is next to the **POINT** line, you can set the next support point by touching the **ENT** button. Once a POINT value is entered, the "?" is replaced with a number:



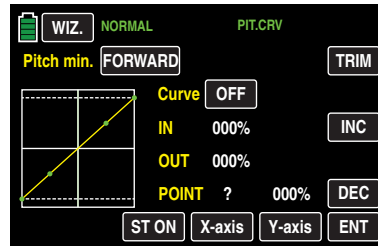
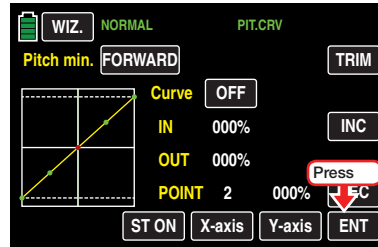
The support points can be entered in any order between the "L" and "H" endpoints; they will be automatically renumbered sequentially from left to right after each point is set, as shown in the example below:



### Deleting a Support Point

In order to delete the set support points 1 to 5, use the control stick to move the vertical line next to the point to be deleted. Selected points will turn red.

Once the support point number and value appear in the **POINT** line, delete the point by touching the **ENT** button, as shown below:

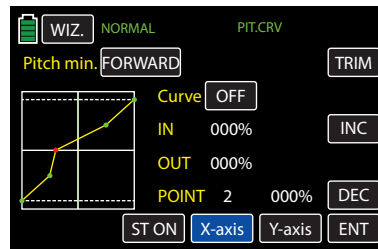


### Changing the Support Point Value

- **X-axis Button (X-axis)**

To activate this function, press to highlight the **X-axis** button at the bottom of the display.

Move the selected (red) point to the right with the **INC** button, and to the left with the **DEC** button, as shown below:



Press the **X-axis** button again to deactivate the function and save the setting.

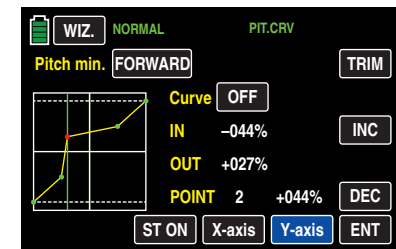
### Tips

- 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.
- Remember that the input/output percentages in the IN and OUT lines always refer to the momentary position of the control stick and not to the position of the point.

- **Y-axis Button (Y-axis)**

To activate this function, press to highlight the **Y-axis** button at the bottom of the display.

Move the selected (red) point to the top with the **INC** button, and to the bottom with the **DEC** button, as shown below:



Press the **Y-axis** button again to deactivate the function and save the setting.

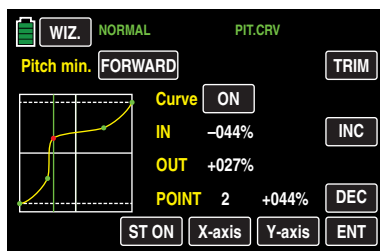
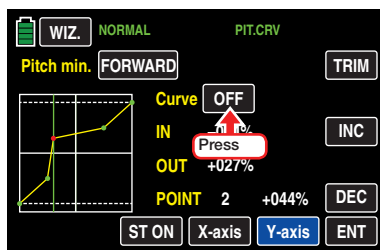
### Tip

Remember that the input/output percentages in the IN and OUT lines always refer to the momentary position of the control stick and not to the position of the point.

### Rounding Off the Throttle Curve

- **Curve Line ON/OFF Button**

The default angled curve profile can be automatically rounded off by turning on the rounding function by pressing the **ON/OFF** button in the Curve line, as shown below:



### Notice



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

- **TRIM Button**

The **mz-24 Pro** transmitter software has a function that is integrated in the helicopter program for trimming during flight up to six support points of the two options "throttle curve" and "pitch curve".

Open the following window by touching the **TRIM** button at the top right edge of the display:

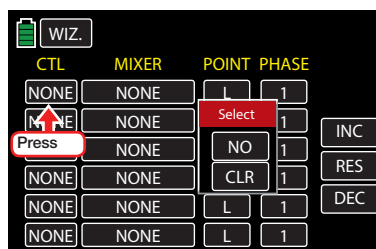


### Basic Operating Steps

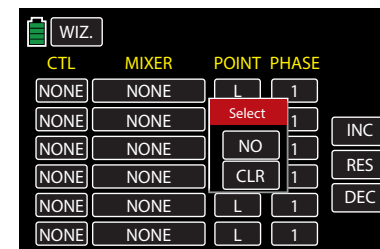
- **CTL Column**

Use the first column to select a control that appears suitable for the controls offered by the transmitter.

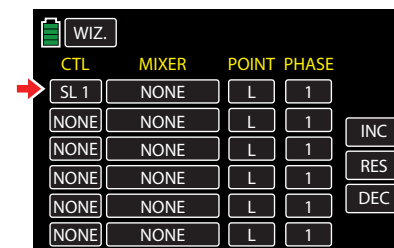
To assign a control, press the button in the **CTL** column along the appropriate row:



An active warning window will appear:



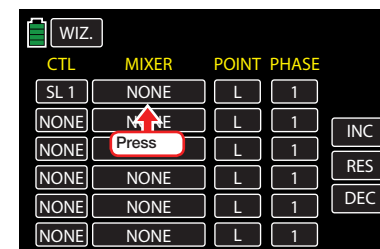
Press to scroll through the control options. In this example, the right proportional rotary control **SL1** is selected:



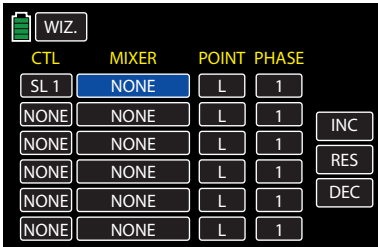
- **MIXER Column**

Use the second column to select individual helicopter mixers, or one of the two available mixers in any combination.

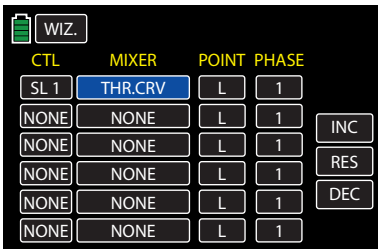
To select a mixer, press the button in the **MIXER** column along the appropriate row:



The button will highlight blue:



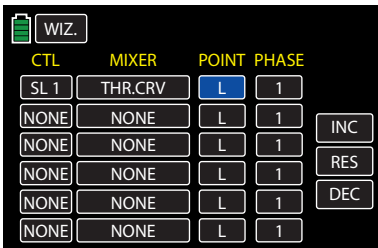
To scroll through the available mixers, press the **INC** or **DEC** buttons on the right side of the display. In the example below, **THR.CR.V** is selected:



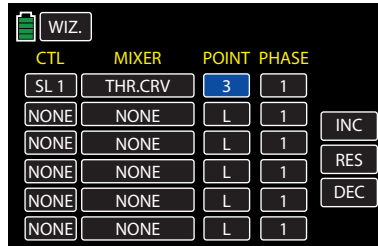
Press the **RES** button to reset the changed value field back to the default value (NONE).

- **POINT Column**

If one or more mixers are selected, the support points to be trimmed must be specified. To select a point, press to highlight the button in the **POINT** column along the appropriate row:



To scroll through the available points (L, 1 to 5 or H), press the **INC** or **DEC** buttons on the right side of the display. In the example below, support point #3 is selected:



Press the **RES** button to reset the changed value field back to the default value (L).

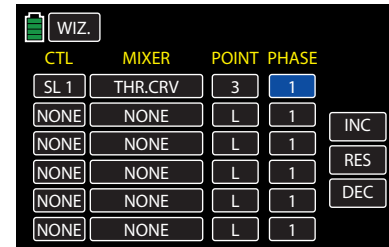
**Notice**

» 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).

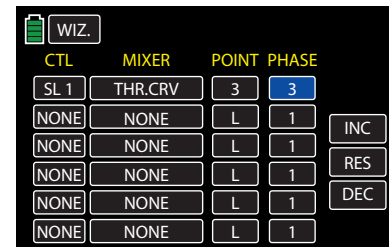
- **PHASE Column**

To activate the governor during a specific phase, the phase must be selected. The phase number corresponds to the phase number set in the FUNCTION submenu **PHASE**.

To select a phase other than the default Phase1, press to highlight the button in the **PHASE** column along the appropriate row:



To scroll through the available phases, press the **INC** or **DEC** buttons on the right side of the display. In the example below, Phase3 is selected:

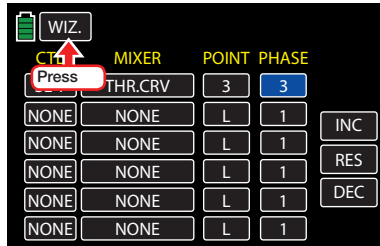


Press the **RES** button to reset the changed value field back to the default value (1).

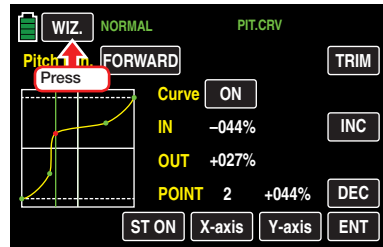
**Notice**

» These options and settings directly affect the TRIM display options found in the FUNCTION submenu **THR.CR.V** (page 128).

Press the **WIZ.** button to return to the Pitch Curve display:

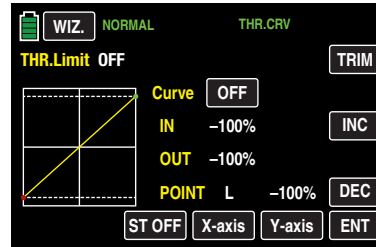


Press the **WIZ.** button again to advance to the Throttle Curve display:



## THR.CRV (Throttle Curve)

The throttle curve can be specified by assigning up to 7 support points, along the entire control stick travel:

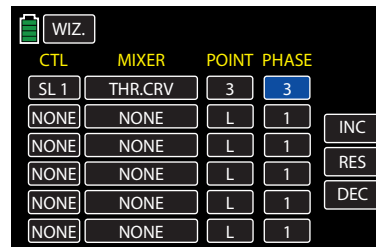


Support points can be set, changed and deleted in the same manner as described in the previous Pitch Curve section. First specify the throttle curve using three points: the two end points "L" and "H", in addition to the set point "1" in the control center. These three points harmonize the motor performance curve with the pitch curve.

### Tip

The value shown to the right of the **THR.Limit** line indicates the status or the position of the throttle limit.

Refer to the FUNCTION submenu **THR.CRV** section (page 160) for additional information about setting throttle curves.



## Notice

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).

## Tips

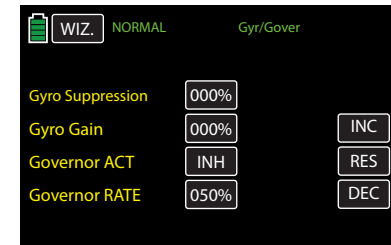
These options and settings directly affect the TRIM display options found in the FUNCTION submenu **PIT.CRV** (page 154).

These options, settings and phase-specific throttle curve functions can be changed via the FUNCTION submenu **PHASE** (page 120).

Press the **WIZ.** button again to advance to the Gyro/Governor display:

## Gyr/Gover (Gyro/Governor)

Initial basic settings are needed for the gyro and/or any governor used in the model.



## Tip

These options, settings and phase-specific values can be changed via the FUNCTION submenu **PHASE** (page 120).

- **Gyro Suppression Line**

**Notice**

» This option may not function with current standard gyro systems and render the helicopter impossible to fly. Consult the gyro setting instructions for compatibility.

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 (CH 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.

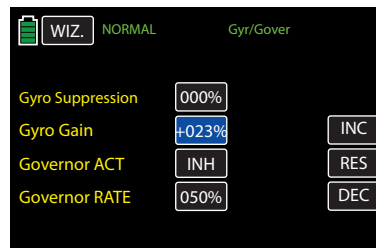
However, the gyro's effect can be varied smoothly between a minimum and maximum using a control assigned in the Gyro line in the BASE submenu **CTL Set** (for example with one of the proportional dials DVx). For more information refer to the **Gyro/Governor** section (page 166).

- **Gyro Gain Line**

Most of the current gyro systems can be adjusted for a smooth, proportional effect; the transmitter allows for a choice between two different modes of action.

If the gyro being used 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 flights within this selected mode, and reducing the gyro gain in fast roundtrips and aerobatics.

Values up to  $\pm 125\%$  are possible, as shown below:



Based on these phase specific settings (offset) the gyro gain can also be proportionally varied with a control assigned in the CH 7 line in the BASE submenu **CTL Set**, (for example the proportional dial DVx).

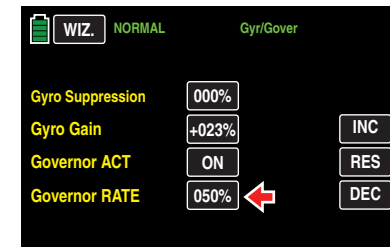
**Attention**

- »
- This option may not function with current standard gyro systems and render the helicopter impossible to fly. Consult the gyro setting instructions for compatibility.
  - Note that the offset values entered in this option as well as in the CH 7 line of the BASE sub-menu **CTL Set** must add up! For ease of use, make sure to only enter or change an offset value in one of the two options.

- **Governor ACT Line**

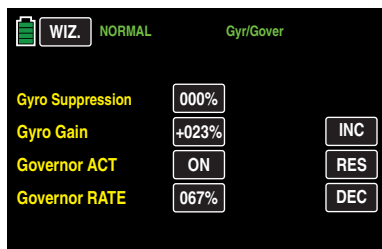
In contrast to speed *controllers* that only regulate performance like a carburetor, *governors* maintain a constant speed in the system they are monitoring by independently regulating the provided output. Like cruise control in cars, in an ICE helicopter a governor controls the throttle servo in the same way as the speed controller of an electric motor 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 ACT** line. The display switches from **INH** (inhibit/off) to **ON** and vice versa, as shown below:



- **Governor RATE Line**

In the BASE submenu **CTL Set** GOVERNOR line, if the function **Governor at CH8** is switched on: in the Governor RATE line, enter the appropriate offset value for the desired rotor speed. 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 phases, for example:



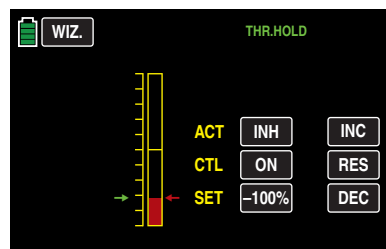
With a control assigned in the CH 8 line of the BASE sub-menu **CTL Set**, for example the proportional dial DVx, this value can also be proportionally varied.

Press the **WIZ.** button again to advance to the Throttle Hold display:

### THR.HOLD (Throttle Hold)

During competition, it is expected that gas engines be completely turned off. In the training phase, this is a bit inconvenient since it would be necessary to restart the engine after each autorotation training landing. (Refer to FUNCTION sub-menu THR.HOLD (page 170) for additional information.)

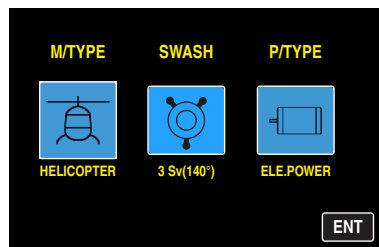
To make the appropriate settings during the training phase so the gas engine can be kept idling during the autorotation phase without the clutch engaging or so any electric drive is definitely off, as shown below:



### Tip

There is an alternative emergency off option in the BASE sub-menu **Throttle Cut** (page 66).

Press the **WIZ.** button again to advance to the final display:

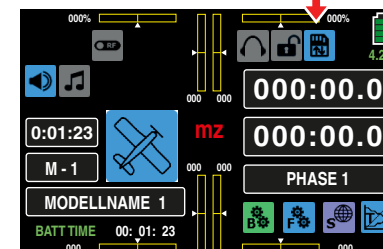


Press the **ENT** button to return to the BASE menu.

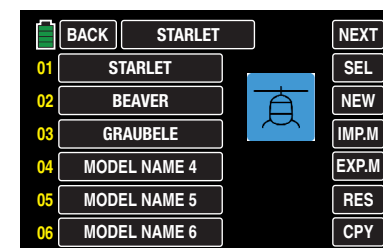
### IMP.M

### (Import From SD Card)

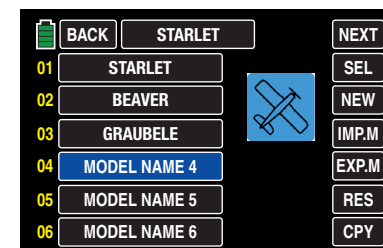
Once a memory card is inserted into an operational transmitter, a blue memory card icon appears at the top right of the main display:



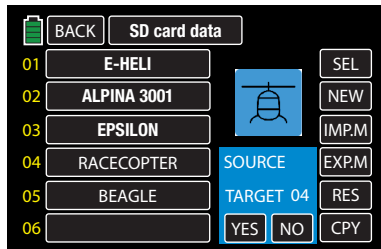
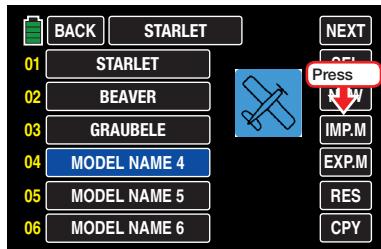
To import compatible models into the transmitter memory from the memory card, open the BASE sub-menu **Model Sel**:



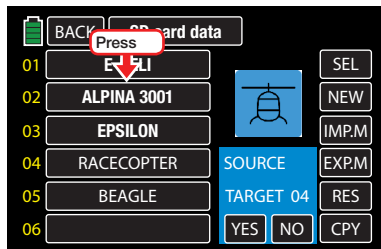
Choose from the list of empty model memories. For this example Line 04: **MODEL NAME 4** has been selected. Press to select and highlight the field blue:



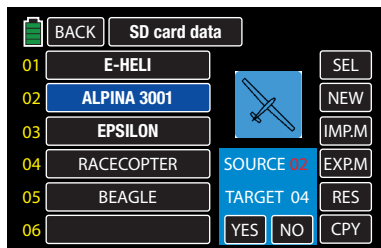
Press the **IMP.M** button in the middle of the right column to switch to the display of the data model saved on the SD card:



Press to select the model to be imported from the SD memory card, for example:



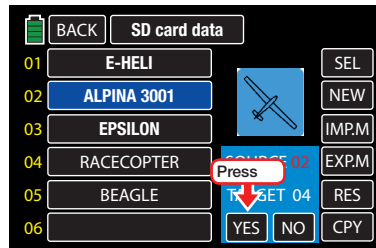
The field of the model to be imported will highlight blue. The model type icon will automatically change accordingly. In the information window the source number appears (in red) of the memory line to import:



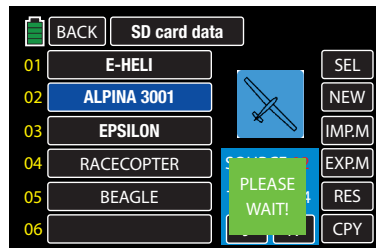
### Tip

The recall of each model type of the models saved on the memory card is performed as described in the BASE submenu **Model Type Display** section (page 60).

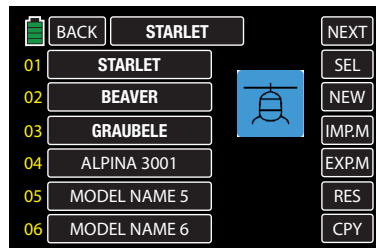
Touch **NO** to terminate the action and return to the start page. Press **YES** to confirm import:



The message "Please Wait!" will appear while the information is being transferred:



Once the process is completed, the warning message will disappear, and the display returns to the transmitter's list of model memories. The imported memory is seen in memory Line 04:



### Tips

If a memory specific bound (and at the same time assigned to the SD card, eventually for safety reasons) model is loaded again on the originally model memory of the same transmitter, the receiver binding will always be functional.

If, in contrast, the same model is copied in another model memory or in a completely different transmitter, the receiver MUST be bound again to the transmitter.

- If a transmitter specific bound (and at the same time assigned to the SD card, eventually for safety reasons) model is loaded again on another model memory of the same transmitter, the receiver binding will always be functional.

If, in contrast, the same model is copied in another transmitter, the receiver MUST be bound again to the transmitter.

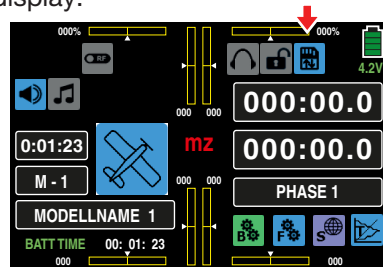
## EXP.M (Export to SD Card)

Use this option to export models saved in the transmitter to a memory card inserted into the transmitter's card slot. The binding information of the exported model memories remain intact.

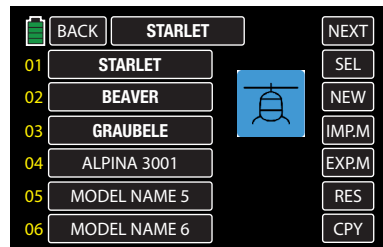
### Tip

Information about HoTT-Synchronisation of a model memory after importing from an SD card can be found in the previous pages, in the notices under **IMP.M** (page 55).

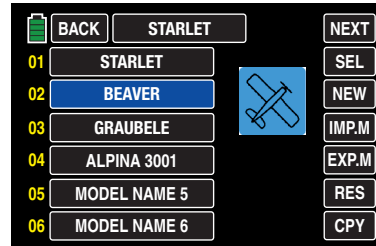
Once a memory card is in an operational transmitter, a blue memory card icon appears at the top right of the main display:



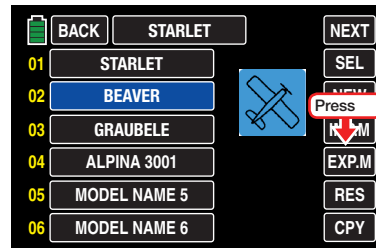
To export model settings from the transmitter memory onto the memory card, insert an SD card into the transmitter and open the BASE submenu **Model Sel**:



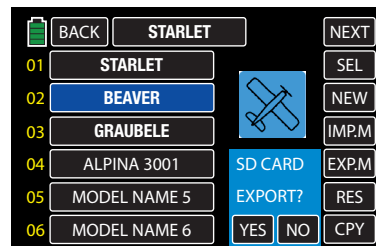
From the list of saved models, select the memory to be exported. In the example below, Memory Line 02 "Beaver" will be exported. Press to highlight the field. The color of the field highlights blue:



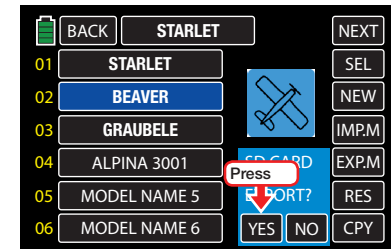
Press the **EXP.M** button on the right side of the display:



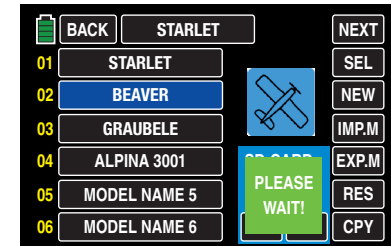
A pop-up box appears:



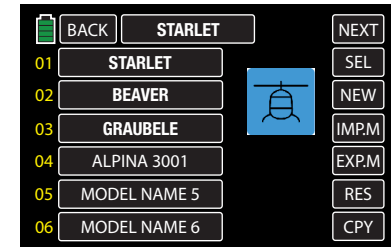
Press **NO** to terminate the action or press on **YES** to confirm transfer.



The message "Please Wait!" appears while the model memory is exported to the SD card:



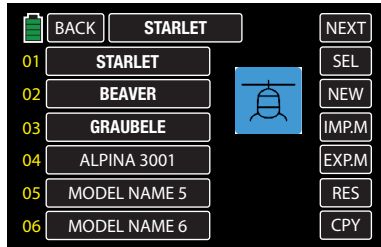
Once the process is completed, the message will disappear and returns to the Model Sel display:



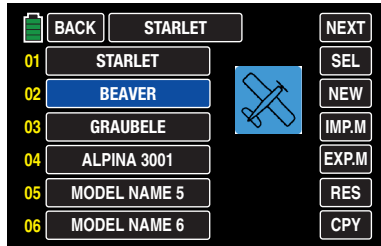


**RES (Delete Model)**

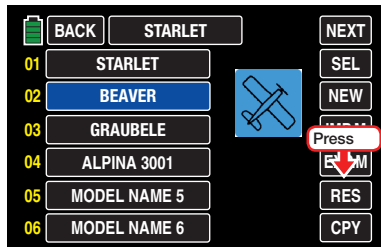
To reset an assigned model memory using the **RES** button, open the BASE submenu **Model Sel**:



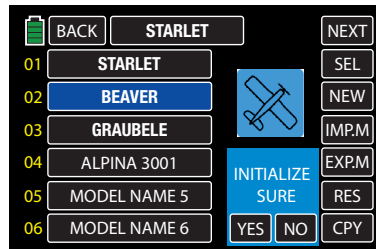
Select the model memory to be deleted from the list. In the example below, the Model Memory 02 "Beaver" will be deleted. Press to highlight the name. The field highlights blue:



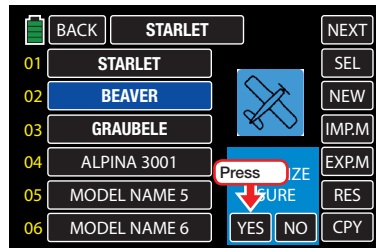
Press the **RES** button on the right side of the display:



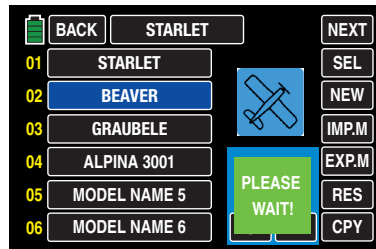
A pop-up box appears:



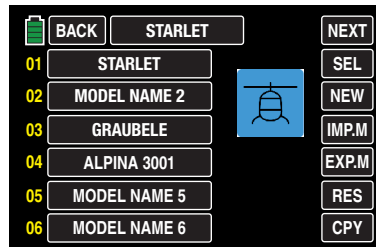
Press **NO** to terminate the action or press **YES** to initialize:



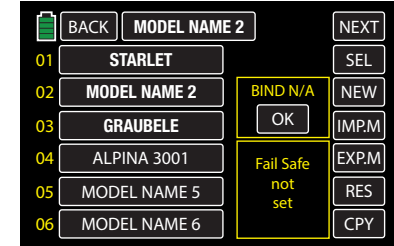
The message "**Please Wait!**" appears while the information is being deleted:



Once the process is completed, the messages will disappear and returns to the Model Sel display. Line 02 now reads the default title "MODEL NAME 2":



If the model currently in use has been initialized, an additional pop-up box will appear:



Pressing **OK** opens BASE submenu **TX ctl**, where the receiver can be re-bound. The message "**FAIL SAFE NOT SET**" indicates the fail safe function will need to be reset as well.

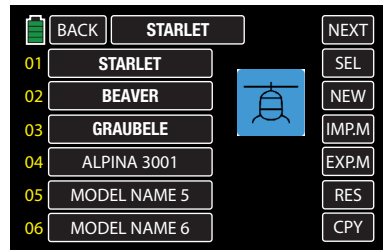
If no action is taken, the pop-up box will disappear after a few seconds.

**Notice**

**>>** The Restore function cannot be reversed. All the data in the selected model memory will be permanently deleted.

## CPY (Copy Model Memory)

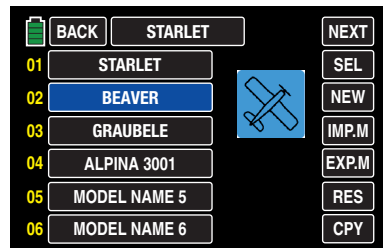
To use the **CPY** button to duplicate a saved model memory to another model memory line by opening the BASE submenu **Model Sel**:



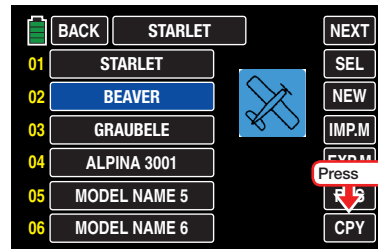
### Tips

- If a memory specific bound model is copied in another model memory of the same transmitter, the receiver must be bound again in the target model memory.
- If a transmitter specific bound model is loaded on another model memory of the same transmitter, the receiver binding will always be functional.

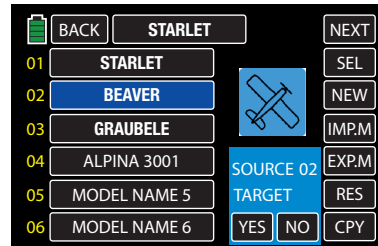
Select the model memory to be copied. In the example below, Model Memory Line 02 "Beaver" is being copied. Press to highlight. The field highlights blue:



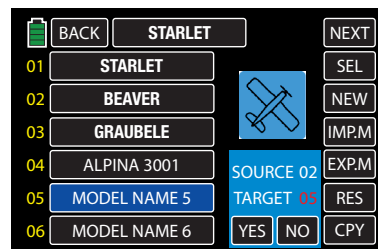
Press the **CPY** button right on the bottom:



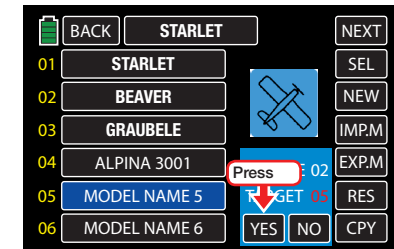
A pop-up box appears verifying Line 02 as the source memory to be copied:



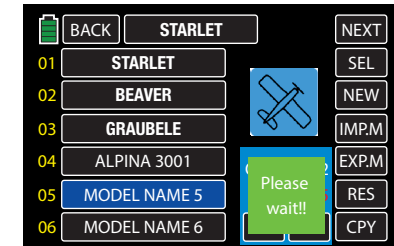
Press the target Memory Line where the information is to be duplicated. In the example below, Model Memory Line 05 is selected. The target line highlights blue, and the target line number appears in red. In the example below, the red line number "05" appears in the box:



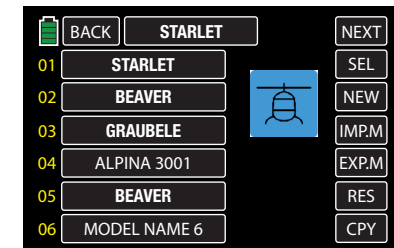
Press **NO** to terminate the action or press **YES** to begin the copying process:



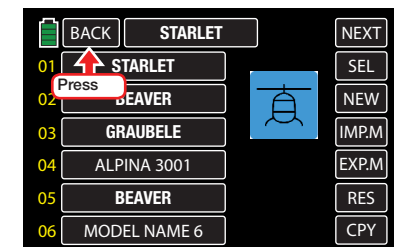
The message "Please Wait!" appears indicating the information is being copied:

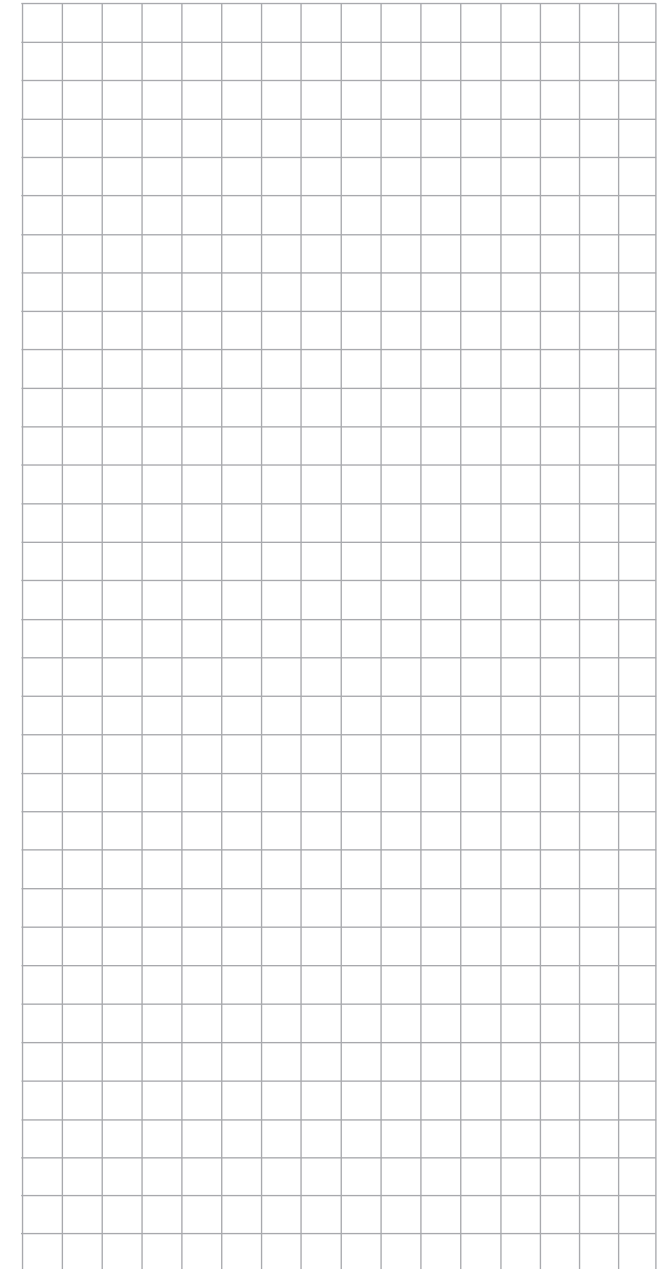
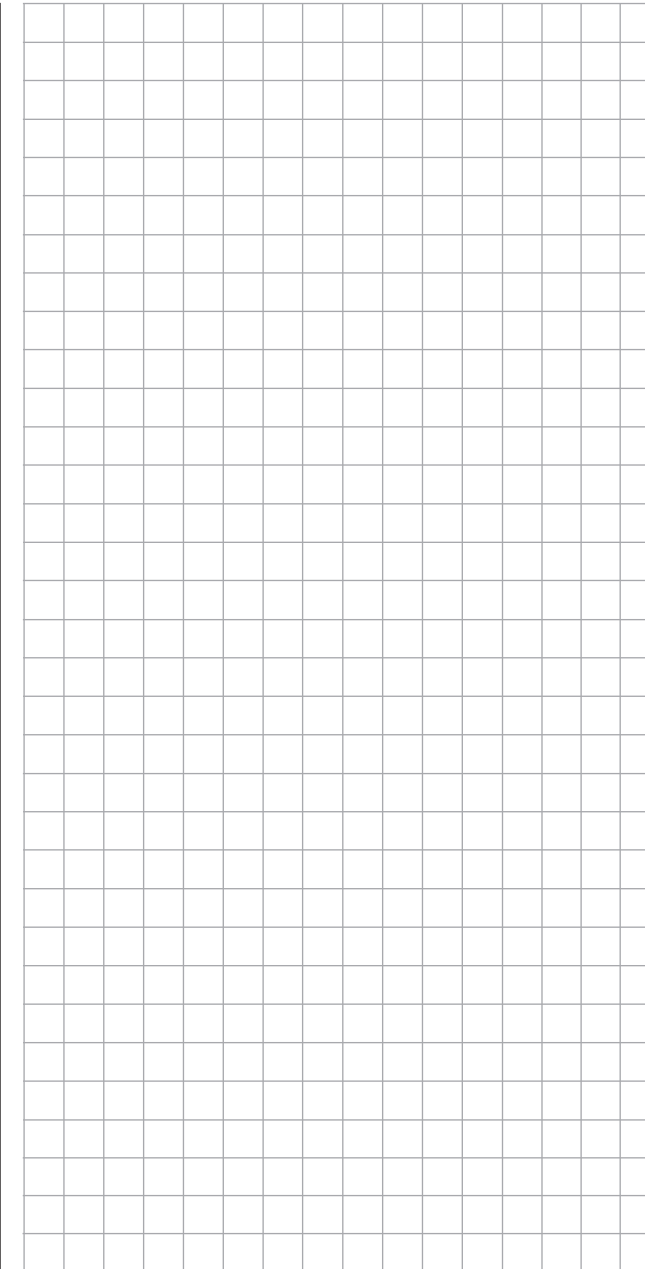
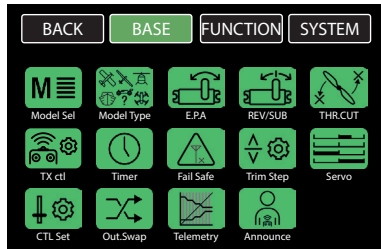


Once the process is completed, the message will disappear and returns to the Model Sel display:



Press the **BACK** button to return to the BASE menu:



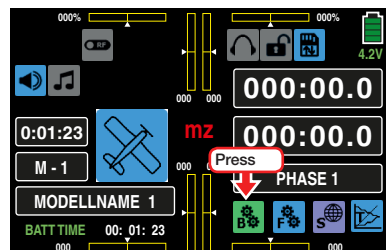


# Model Type

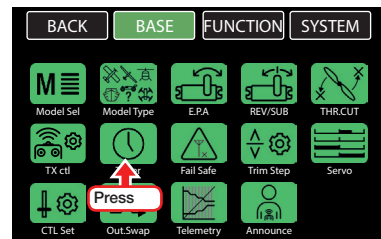
## Changing the Model Type

Use this submenu to change the type or details of the currently assigned model.

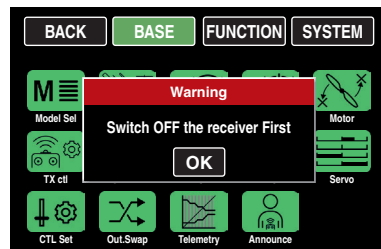
First, turn the receiver system off and turn the transmitter's RF module off. From the main display, press the BASE menu gear icon (green "B") to bring up the BASE submenu screen:



From the BASE submenu display, press the **Model Type** icon:

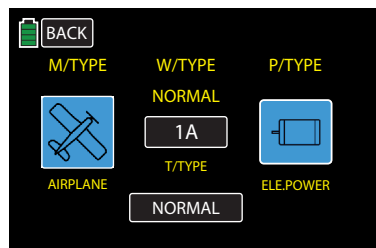


If the receiver is still powered and connected to the transmitter, the following Active Warning message will appear:



Press OK, turn the receiver off and press the Model Type icon again.

The information screen for the currently active model will appear:



The basic model type is assigned when creating a new model memory in the BASE submenu **Model Sel.** In the BASE submenu **Model Type**, it is possible to change the model type of the current model. When such a change is made, all of the mixers, coupling functions, etc. for the previous model type are deleted or need to be adapted to the changed type.

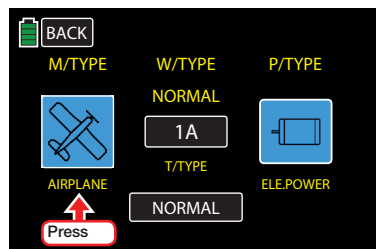
### Notice



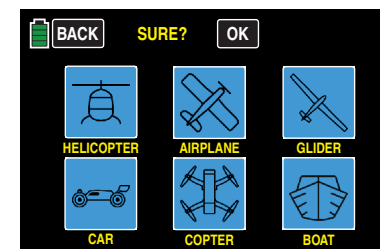
Once you change any of the existing settings, all of the relevant parameters are reset.

### Programming

In the following example, the Model Memory 01 is currently assigned to an airplane but needs to be changed to a helicopter. Begin by pressing the model type icon:

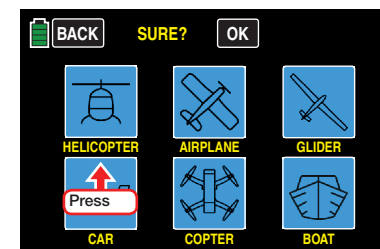


The safety message "**SURE?**" appears:



Press **NO** to terminate the procedure or press **OK** to proceed. The OK button will highlight blue for one second. Make the new model type choice as soon as the OK button changes back to black.

Press the HELICOPTER icon:

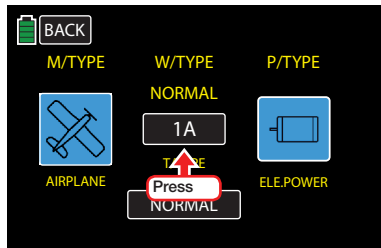


The display changes to the next selection screen for that model type:

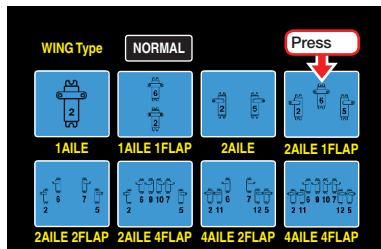


Refer to the section **New Model Basic Settings - MANUAL** (page 42) for further information on manually setting new models.

To retain the model type but change a model setting, the same procedure is utilized. In the example below, the wing type of the current model needs to be changed from "1AILE" to "2AILE 2FLAP". Press the Wing Type button:

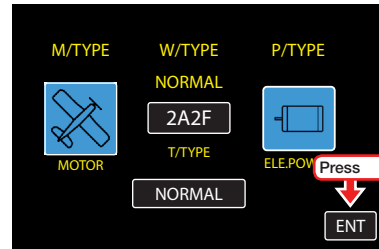


The WING Type menu will be displayed. Press to select the appropriate wing type:



Continue selecting the appropriate icons for the additional fields displayed in the following menus, such as Tail Type. The information display will appear when all selectable fields are completed:

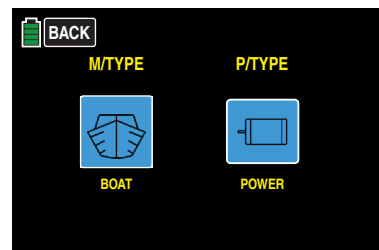
Press the **ENT** button at the lower right side of the display to return to the BASE menu display:



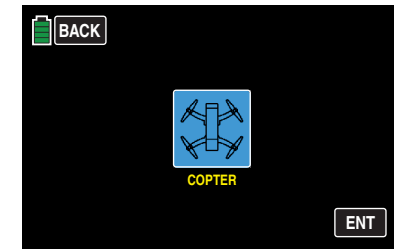
### Notices



- Options are limited depending on certain model types. When selecting **BOAT**, the only possible selection is between motor powered or non-motor powered model type:

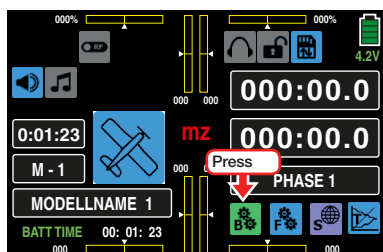


- When selecting **CAR** and **DRONE**, the only possible selection is the model type:

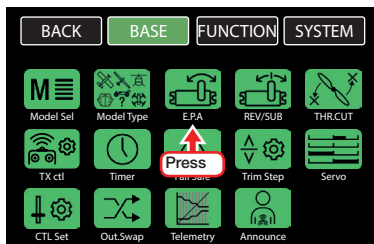


End Point Adjustments allows definition of the maximum servo travel for any channel. This feature is helpful with components, such as wing flaps, that may get damaged by excessive movements.

To set the E.P.A, from the main display press the BASE menu gear icon (green "B") to bring up the BASE submenu screen:

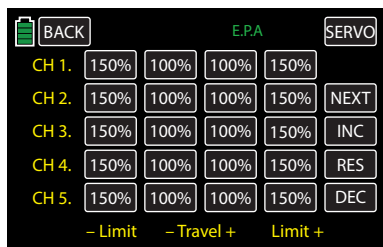


From the BASE submenu display, press the E.P.A icon:



### E.P.A. Adjustment

In the E.P.A display, the parameters are set as they relate to the servo, i.e. the servo path and angle of rotation or its limit.

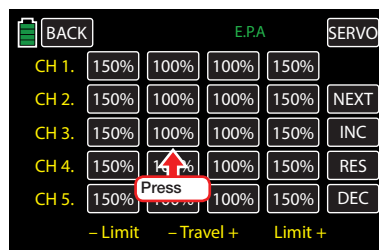


The set values always correspond to the settings in the BASE submenu **REV/SUB**.

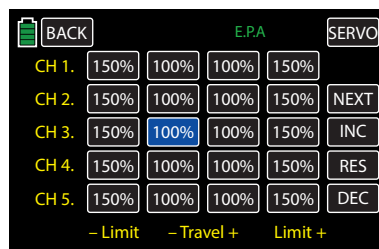
### Tip

Press the **NEXT** button on the right side of the display to scroll through the channel screens.

To change a value, press the desired button. In the example below, Channel 3 Travel:



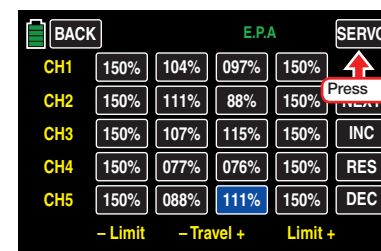
The field highlights blue:



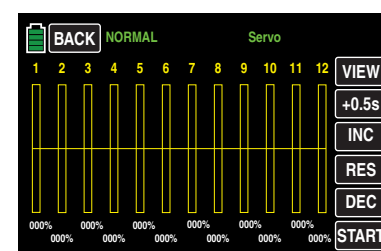
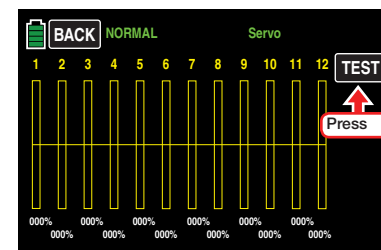
Press the **INC** or **DEC** button at the right edge of the display to increase/decrease the value of the active field. Press the **RES** button to reset the changed value back to the default. Alternatively, press the arrow keys (▲▼) to the left of the display screen to achieve the same result.

Use the same procedure for all settings.

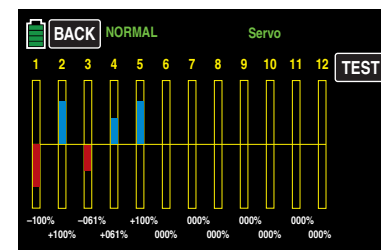
To advance directly to the BASE submenu **Servo** display, press the **SERVO** button in the top right corner of the screen. Alternatively, simultaneously press the arrow keys (▲▼) to the left of the display (*while no fields are highlighted*) to also bring up the Servo display:



Press the **TEST** button to activate the Servo Test function (page 87):



Upon activating one or more control elements of the transmitter, the resulting servo travel is graphically displayed, as shown below:



Press the **BACK** button to return to the E.P.A display screen.

**Notice**



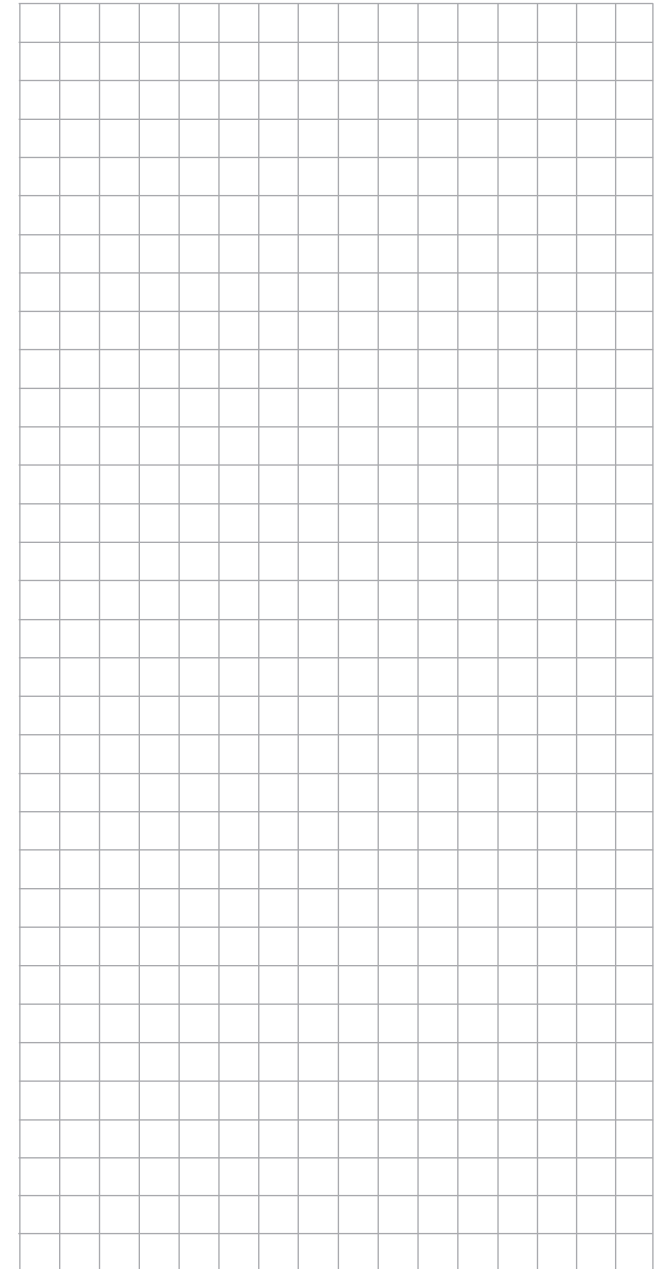
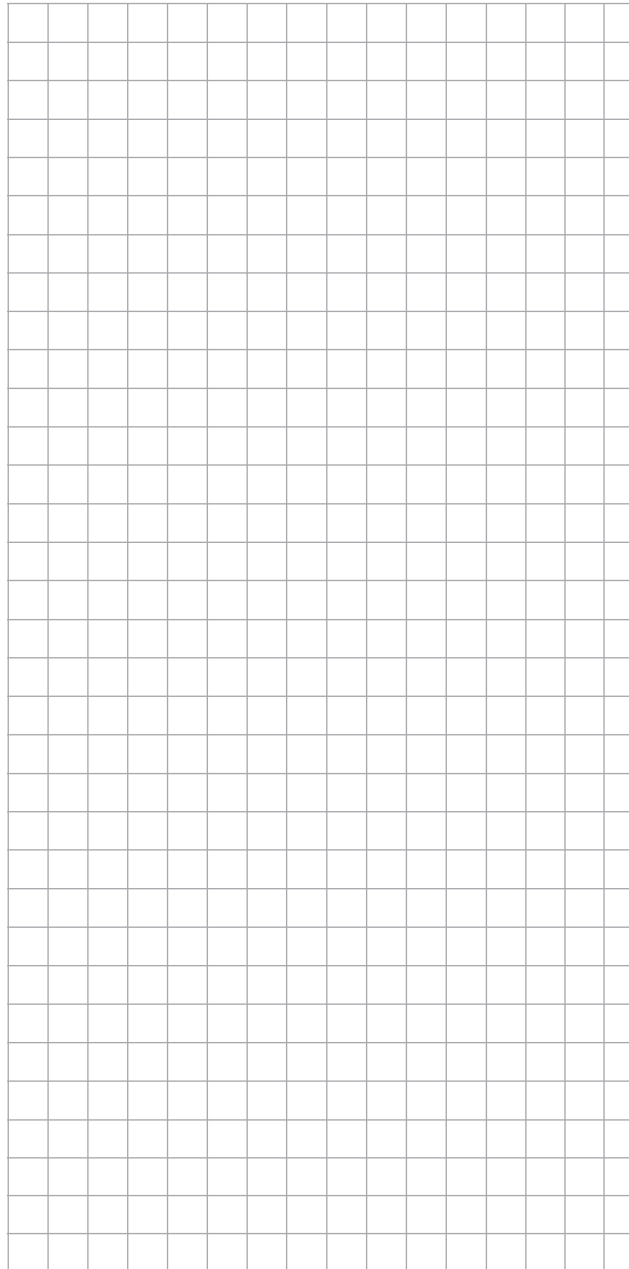
In contrast to the BASE submenu **CTL Set**, all the settings of the E.P.A submenu refer to the relevant servo independent of where the control signal for the servo comes from, i.e. either directly from the control element or from mix functions.

**Example**

The rudder servo of a model is directly controlled by the rudder control stick and also through an accessory "Aileron → Rudder" mixer. For model-specific reasons, this servo can only follow a maximum servo travel of 100% since, for example, the rudder would contact the elevator if the allowed mechanical travel was more than 100%.

As long as only the rudder is used, this is not a problem. It becomes problematic, 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, causing damage.

To prevent this, the path of the relevant servo has to be limited individually. In the rudder servos example, this would be slightly less than 100% since we are assuming that the rudder is already traveling 100%.



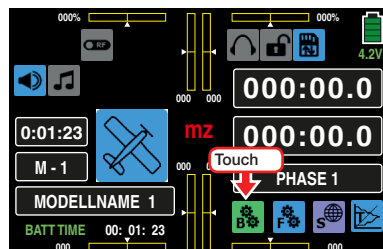
# REV/SUB



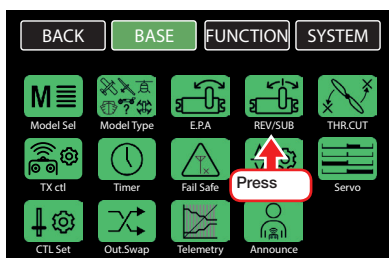
## Setting Servo Direction and Neutral Position

Setting the servo directions is necessary for to maintain the model's control system. Improperly set control movements will cause the model to crash.

To set the servos, from the main display press the BASE menu gear icon (green "B") to bring up the BASE submenu screen:

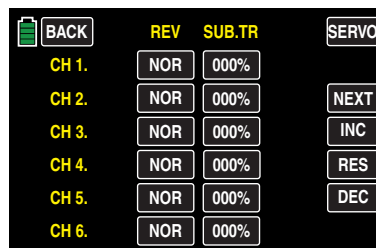


From the BASE submenu display, press the REV/SUB icon:

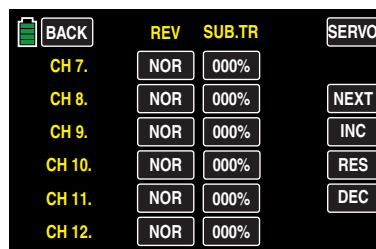


### Servo Direction and Neutral Position

Servo direction adjustments are done in the left REV column, the related center position adjustments are done in the right SUB.TR column:



Press **NEXT** button on the right side of the display to scroll through the channel screens:



### Notices

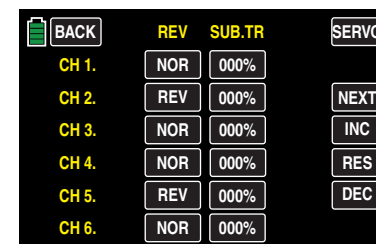


- Always begin by setting the direction in which the servos have to move before setting the other parameters!
- The servo numbering refers to the servos connected to the corresponding receiver outputs, providing that the transmitter and receiver outputs have not been switched. This allows for a change in the control mode that will not change the numbering of the servos.

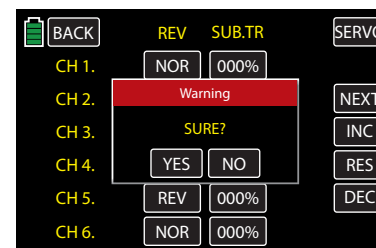
### 1. Setting Servo Direction

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

The travel direction is reversed by pressing to change the corresponding value fields labeled **NOR** and **REV**:



Whenever the travel direction of CH6 (in a helicopter) or CH1 (in the other model types) is changed, an Active Warning will be displayed:



Press **NO** to terminate the procedure. Press **YES** to change the servo travel direction connected to CH1 or CH6.



## Notice

Do not use the CH6 (helicopter) or CH1 (all other models) servo reverse option to reverse the control stick direction. The **Thr.HOLD** function active warning **CH1-Pos** does not follow this kind of reverse control direction. Only use for situation adaptation. To reverse the control direction, use the FUNCTION submenu **PIT.CRV** (page 154) for helicopters models and **THR.CRV** (page 128) for all the other model types.

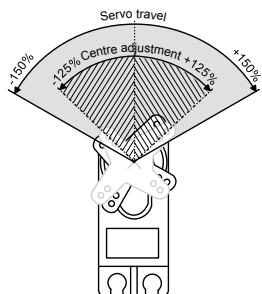
## 2. Setting the Center Stick Position

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  $\mu$ s) as well as for minor adaptations, for example fine adjustment to the neutral position of control surfaces on the model.

Independent of trim controls and any mix settings, the center stick position can be shifted around  $\pm 125\%$  within the maximum servo travel of  $\pm 150\%$ . The servo is always adjusted independently of all other trim and mix settings.

## Notice

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

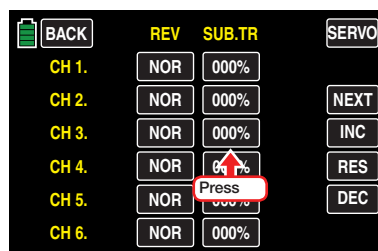


## Notice

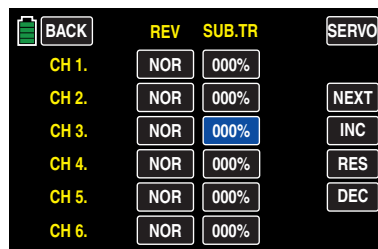
Move the trim control into the middle position before changing the middle values.

## Programming

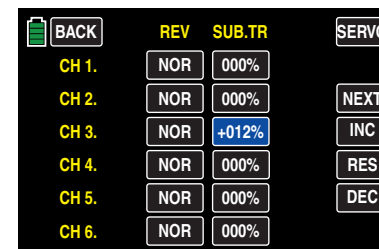
To change the neutral position of a specific servo, press the corresponding SUB.TR button:



The field highlights blue:



Press the **INC** or **DEC** button at the right edge of the display to increase/decrease the value of the active field. Press the **RES** button to reset the changed value back to the default. Alternatively, press the arrow keys ( $\blacktriangle$ / $\blacktriangledown$ ) to the left of the display screen to achieve the same result:



To advance directly to the BASE submenu **Servo** display, press the **SERVO** button in the top right corner of the screen. Alternatively, simultaneously press the arrow keys ( $\blacktriangle$ / $\blacktriangledown$ ) to the left of the display (while no fields are highlighted) to also bring up the Servo display.

Press the **BACK** button to return to the REV/SUB display screen.

# Throttle Cut



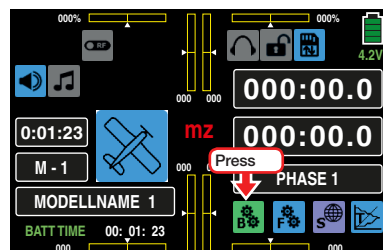
Switchable Throttle Cut/Motor Off



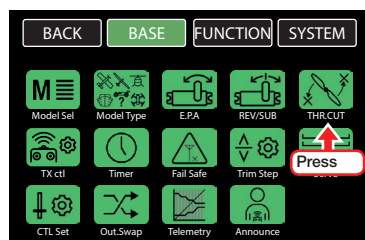
This submenu option is not available to motor-less glider model types.



To set throttle cut, from the main display press the BASE menu gear icon (green "B") to bring up the BASE submenu screen:



From the BASE submenu display, press the **Motor** or **THR.CUT** icon:



## Throttle Cut

The Throttle Cut option allows a speed controller to be shut off with a switch or move the throttle control servo to the pre-defined motor OFF position (or idle position).

This option can be used as an emergency OFF function. The Motor OFF position (or idle position) is des-

ignated in the value field of the **SET** line and needs to be determined through experimentation.

The speed controller or the throttle servo only utilizes the set position if a freely selectable switch has been activated:



- By moving the selected switch to the ON position the speed controller or the governor will be reduced to the value which has been input in the SET line, independent of the actual position of the throttle/brake or throttle/pitch control stick.



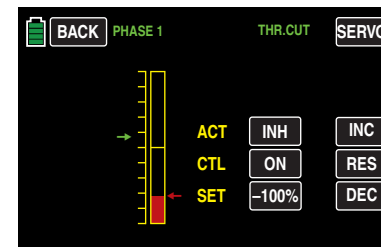
In models with an ICE:

- If the set percentage in the SET line is *less* than the current servo position, that is, the current servo position (green arrow to the left of the bar graphic) is *above* the switching threshold (red arrow to the right of the bar graphic), the speed controller reduces the motor speed, or the throttle servo closes the carburetor as specified in the SET line once the servo position *falls below* the switching threshold of -66% when the switch is in the ON position.
- If the control stick position (green arrow on the left of the bar graphic) is actually *under* the red arrow, the speed controller or governor increases the motor speed or the throttle servo opens the carburetor as specified in the SET line after moving the switch to the ON position as soon as the control stick moves *over* +66% or *under* -66% of the switch threshold if the Motor OFF position is set in the plus side.



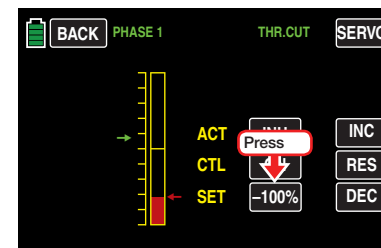
- In the Motor OFF position, the speed controller or governor is disabled until the selected switch is not moved again.

The default preset value of the field in the SET line of the idle or Motor Off position is -100% of the throttle/brake or throttle/pitch control stick travel:

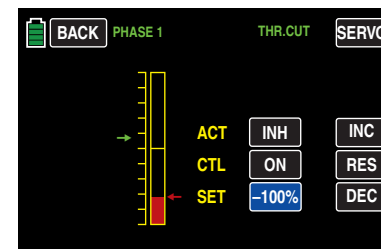


## Programming

To change the default for the Motor OFF position, press the value field in the **SET** line:

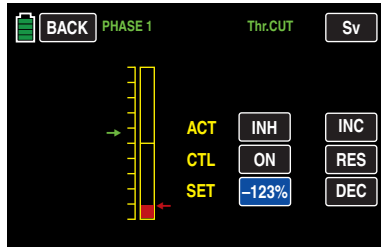


The field highlights blue:



Press the **INC** or **DEC** button at the right edge of the display to increase/decrease the value of the active field. Press the **RES** button to reset the changed value back to the default. Alternatively, press the ar-

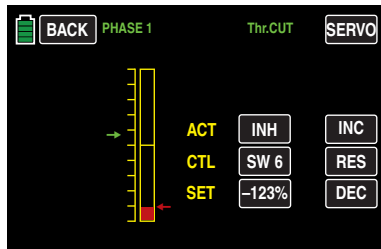
row keys ( ▲▼ ) to the left of the display screen to achieve the same result. This adjustment allows the motor or engine to run at the desired idle speed or switches the engine or motor off:  
The adjustment range is ±150%.



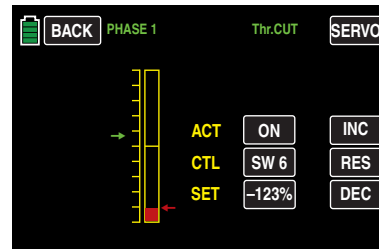
**Notice**

» With an ICE, make sure that the throttle servo does not mechanically over-travel.

Assign the required ON/OFF switches (such as SW6) to the **CTL** line as described in the **Control and Switch Assignment** section (page 26):

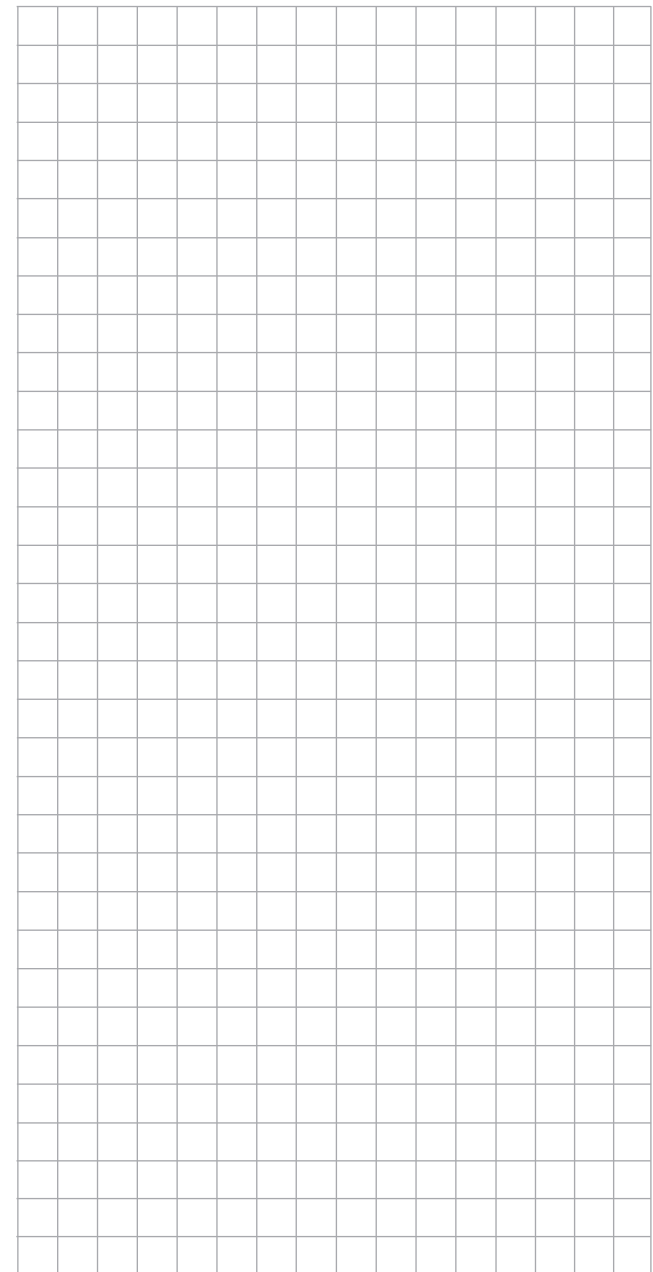
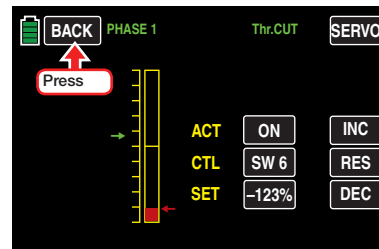


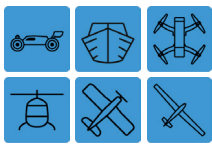
Press to change the field in the **ACT** line. Depending on the switch position, the display of this field switches to **ON** or **OFF**.



To advance directly to the BASE submenu **Servo** display, press the **SERVO** button in the top right corner of the screen. Alternatively, simultaneously press the arrow keys ( ▲▼ ) to the left of the display (*while no fields are highlighted*) to also bring up the Servo display.

Press the **BACK** button to return to the BASE menu display:



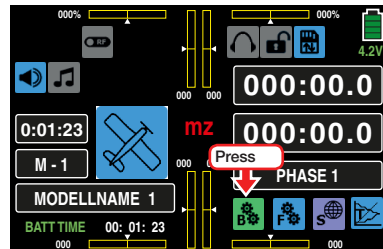


# Transmitter Setting

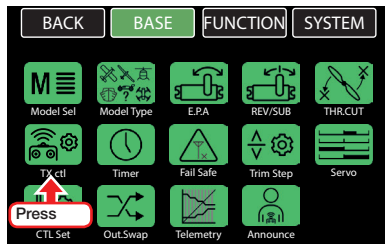
## Transmitter Settings

Use this sub-menu to configure transmitter-specific functions: bind settings, receiver output, transmitter settings, country settings, range test, transmitter modulation and auto-save option.

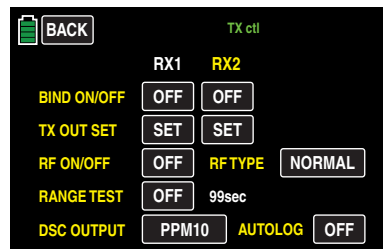
To configure the transmitter settings, from the main display press the BASE menu gear icon (green "B") to bring up the BASE submenu screen:



From the BASE submenu display, press the TX ctl icon:

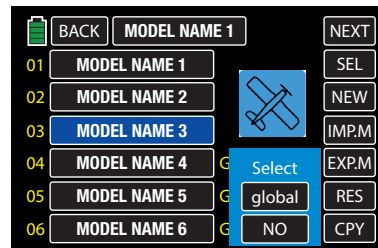


The transmitter control display appears:



## BIND ON/OFF

To establish a connection with the transmitter, the *Graupner* HoTT receiver must first be bound to at least one model memory in the assigned *Graupner* HoTT transmitter. This process is called **binding** and can be repeated as needed. Receivers are usually bound in the MODEL mode (model memory specific), but it can be changed at any time to GLOBAL (transmitter specific); any model memory saved in the transmitter can be changed via the BASE submenu **Model Sel.** A detailed description of this process is available in the **HoTT Synchronization Methods Setting** section (page 39):



- MODEL** Memory specific synchronized receivers react exclusively to the signal coming from the specifically assigned model memory. It is not possible to use another non-specifically assigned model memory. A receiver not bound to the model memory will pass into Fail-safe mode.
- GLOBAL** Transmitter specific, synchronized receivers react to the signals of all of the *global* bound model memories of the assigned transmitter. For safety reasons, making a model memory change is only possible after switching off the receiver system!

## WARNING



**In Global Mode a receiver system turned on after a model memory change will immediately react to all control movements of the model memories bound in Global Mode as soon as a valid signal is emitted from the assigned transmitter.**

- The HoTT synchronization process of a copied or imported model memory depends on many different factors. For more information, refer to sections **Import to SD Card** (page 54) and **Copy Model Memory** (page 58).

## Notices

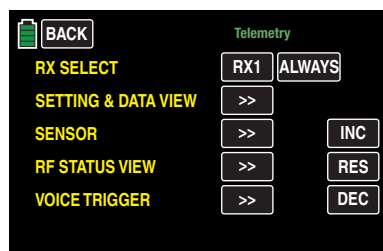


- Re-bind all involved receivers after changing model memory modes.
- When binding, make sure the transmitter antenna is far enough away from the receiver antenna. Maintain a distance of 3 feet (1 meter). Otherwise, there is a risk endangering the connection with the feedback channel and causing malfunctions.
- Make sure that the receiver power supply is adequate. If the power supply is too low, the receiver LEDs will react as though binding, but the HoTT synchronization connection may not be performed.
- When binding to a new receiver, note that any receiver that is turned on and previously bound to the transmitter (and not directly affected by the new binding process) will enter Fail Safe Mode while the transmitter is performing the new bind.

## Binding Multiple Receivers Per Model

Multiple receivers can be bound to each model. In compatible receivers, users can directly manage *up to two receivers bound to each active model memory* and utilize a menu to distribute the 12 transmitter control channels between the two receivers, as described in the subsequent sections. First, bind the two receivers one-at-a-time, as described in the **Binding Transmitter and Receiver** section below.

During operation, telemetry links with the transmitter are only established with the receiver that was either last bound to the active model memory, or was assigned in the **RX SELECT** line in the BASE submenu **Telemetry**, as shown below:



Telemetry sensors installed in the model must be connected to the assigned receiver; the transmitter will only indicate values coming from the back channel of a receiver *assigned in this line*. The second receiver (and all other receivers) run independently and concurrently in Slave Mode.

## Tip

- **RX2** can only be bound a receiver if there is already a bound receiver on **RX1**.
- If for any reason the binding of the **RX2** should fail, **RX1** will automatically change to **OFF**. Rebind a receiver to **RX1** first, before binding the second receiver to **RX2**.

## Binding Transmitter and Receiver

Turn off the power supply to the receiver and the transmitter. *Remove all propellers.*

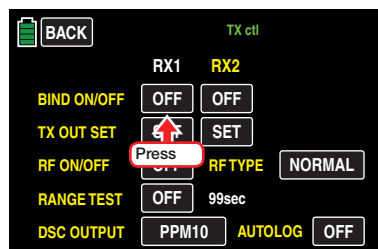
### • GR-16 and GR-24 and similar receivers

Turn on the transmitter. The active warning display will prompt a bind if no receiver is detected. Press **SET** to bring up the **TX ctl** menu. Otherwise, select the model to be bound in the **Model Sel** menu. The active warning display will again prompt a bind. Press **SET** to bring up the **TX ctl** menu.

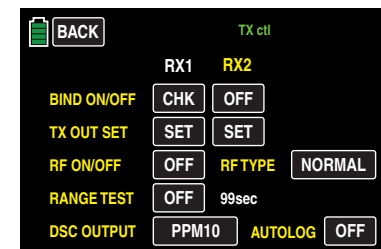
Turn on the receiver. The red LED flashes on the receiver.

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

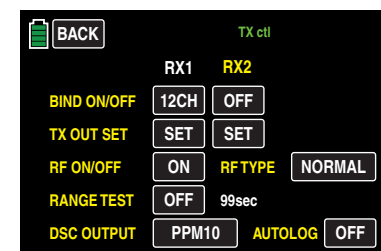
Within this 3 second window, start binding the receiver to the current model memory by pressing the **RX1** button in the **BIND ON/OFF** line:



The button will change from OFF to **CHK**:



Binding takes about 10 seconds, and when complete the flashing red receiver LED shines green continuously. The model memory/receiver combination is now operable. The **CHK** changes to the receiver type abbreviation, for example the GR-24 will appear as **12CH**, and the RF transmission (**RF ON/OFF**) automatically turns on, as shown below:



If the red receiver LED continues to flash for more than 10 seconds, the binding process was unsuccessful. The **CHK** button in the **BIND ON/OFF** Line will automatically turn to **OFF**. Change the antenna position and try the entire procedure again.

### • GR-12L and similar receivers

Turn on the transmitter. The active warning display will prompt a bind if no receiver is detected. Press **SET** to bring up the **TX ctl** menu. Otherwise, select the model to be bound in the **Model Sel** menu. The active warning display will again prompt a bind. Press **SET** to bring up the **TX ctl** menu.

Turn on the receiver. The red LED shines solid. Hold down the SET button on the receiver until,

after about 3 seconds, the red LED goes dark for about 3 seconds. Release the SET button on the receiver. As long as the LED is dark, the receiver is in binding mode.

As described in the above **GR-16 and GR-24** bind procedure, within the 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.

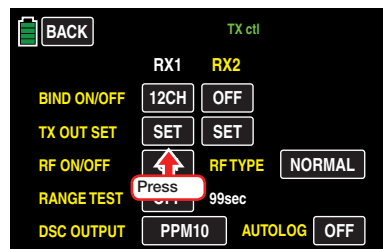
Binding has been successful if the receiver LED remains dark and the receiver display switches to **6CH**.

If the red receiver LED shines red again, the binding process was unsuccessful. The **CHK** button in the **BIND ON/OFF** Line will automatically turn to **OFF**. Change the antenna position and try the entire procedure again.

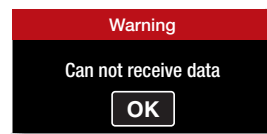
## TX OUT SET (Receiver Output)

The **mz-24** Pro HoTT transmitter allows users to distribute the transmitter control channels *within a receiver* as desired. In addition, users can distribute the 12 receiver control channels to the *two receivers* as preferred. This distribution process is called "mapping" or "channel mapping".

Press the applicable receiver to be mapped in the **TX OUT SET** line, in the example below **RX1** is chosen:



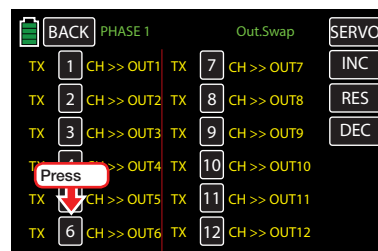
- If there is no reaction other than a "beep", the RF module is switched off. Switch the RF module on and repeat the process.
- If an active warning window appears, the RF module of the transmitter is switched off but there is no connection with the receiver:



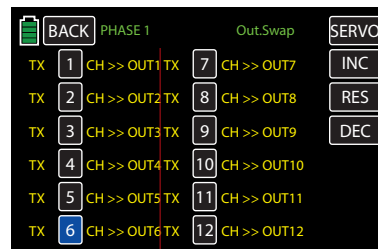
Press OK. Turn the receiver system on and/or bind the receiver and repeat the process.

## Channel Assignment Within a Receiver

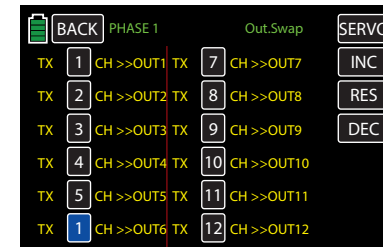
Users can distribute transmitter control channels (receiver inputs) to the outputs (servo connections), of the selected receiver. Select the desired *output* to map by pressing on the related channel button:



The field highlights blue:



Press the **INC** or **DEC** button at the right edge of the display or the arrow keys (▲▼) to the left of the display screen to increase/decrease the input channel related transmitter output, for example:



Press the **RES** button to reset the changed output to the default mapping.

All modified values will be automatically transmitted to the related receiver.

Press the **BACK** button to return to the **TX ctl** sub-menu.

## Notice

➤ If for example you entered "2AILE" in the basic settings for a fixed-wing 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).

## 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 connections). 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 connections). In this case, default rudder channel 4.

## Notices



- 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 **Transmitter Output** option (page 96), of the **mz-24** HoTT Pro transmitter to switch the transmitter control function as desired, or assign the same control function to several outputs. For ease of use, it is strongly recommended to only use one of the two options.

## Assigning One Channel to Two Receivers

Users can use the Receiver Output option to distribute the 12 control channels of the **mz-24** HoTT Pro transmitter to *two receivers* as desired.

The numbering of the outputs (servo connections) and the maximum number of available lines (outputs) corresponds to the maximum number of servos that can be connected to the respective receivers. Follow the same procedure as above.

## RF ON/OFF

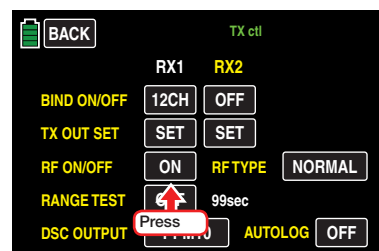
Manually turn the transmitter's RF transmission off and on while the transmitter is currently turned on. Use this function, for example, when changing model memory or model type .

## Notice



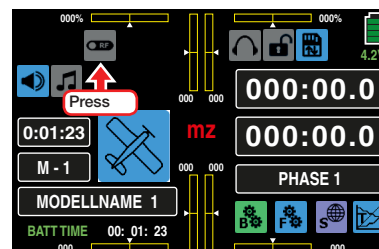
The next time the transmitter is turned on or a model is switched, the OFF setting is reversed.

To manually turn the high-frequency transmission of your transmitter on or off, touch the corresponding button in the **RF ON/OFF** line:



## Tip

Alternatively, press the RF Switch icon on the transmitter main menu to bring up a function similar to the RF Transmission:

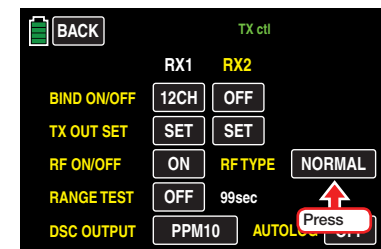


## RF TYPE

## (Country Setting)

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

To switch your transmitter's country setting between **NORMAL** or **AMERICA**, press the button to the right of the **RF TYPE** line:



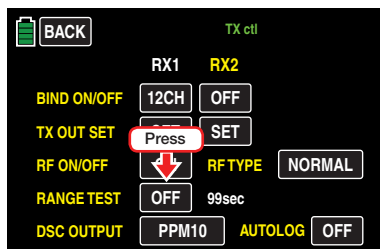
## RANGE TEST

The integrated range test reduces the transmitter output so that you can perform a function test at a distance of less than 330 ft (100 m).

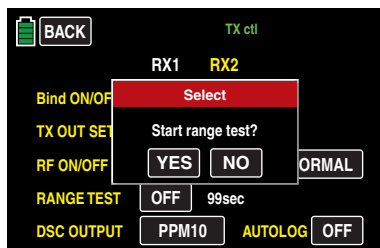
It is useful to have an assistant to help with the range test.

- Install the receiver(s) already bound to the transmitter into the model as described.
- Turn the transmitter on and wait until the receiver(s) indicate(s) a correct function connection. Servo movements can now be monitored.
- Place the model on a flat surface (concrete, mowed lawn or ground) so that the receiver antennas are at least 6 inches (15 cm) above the ground. It may be necessary to place a support underneath the model during the test.
- 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 transmitter antenna so that it is approximately at a right angle to the model.

5. Activate the range test mode by touching the button to the right of the **RANGE TEST** line:



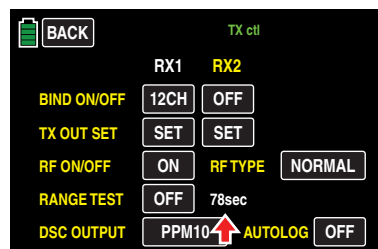
The following active safety warning appears:



Touch **NO** to terminate the procedure. Touch **YES** to start the range test.

When the range test starts, the output of the transmitter decreases significantly and the *Graupner* logo below dials DV2 and DV3 will flash.

Simultaneously, the time display in the transmitter display starts to count backwards and emits 2 beeps every 2 seconds.



5 seconds before the range test ends, 3 beeps are emitted every second. After the 99-second range test, the transmitter switches back to full output, and the *Graupner* logo shines continuously.

6. During the range test, move away from the model while moving the transmitter's control elements. If you detect an interruption in the link within a range of about 164 ft (50 m) at any time, attempt to reproduce it.
7. If the model has a motor, turn it on to check interference resistance.
8. Move further away from the model until it does not respond perfectly.
9. Wait at this location for the remainder of the test period. The model should still react properly to control commands once the range test is finished. If this is not always the case, do not use the system and contact the *Graupner* Service Center.
10. Perform a range test before each flight, simulating all servo movements that could occur during the flight. In order to guarantee a safe model operation, the range must always be at least 164 ft (50 m) on the ground.

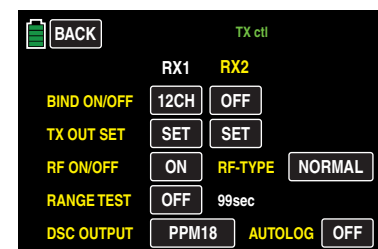
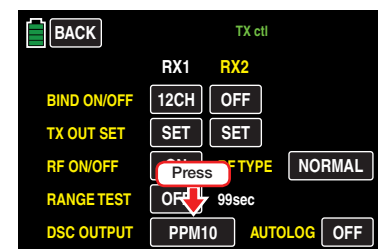
## WARNING



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

## DSC OUTPUT (Transmitter Modulation)

To set the modulation of your transmitter at the DSC output, press 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**:

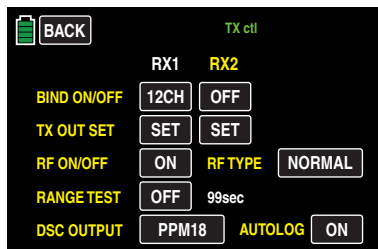
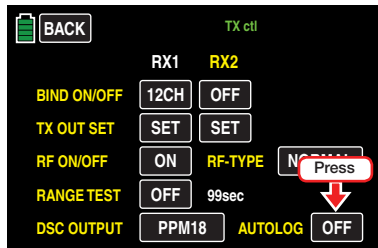


The selected modulation primarily influences the bandwidth and the number of available control channels at the DSC socket for a connected flight simulator or trainer system. If PPM10 is selected, the available control channels are 1 - 5; with PPM16, channels 1 - 8, with PPM18, channels 1 - 9, and with PPM24, channels 1 - 12.



## AUTOLOG (Auto-Save to SD Card)

Press the **ON/OFF** button at the bottom right of the display while RF module is switched off to activate/deactivate the automatic data logging save feature:

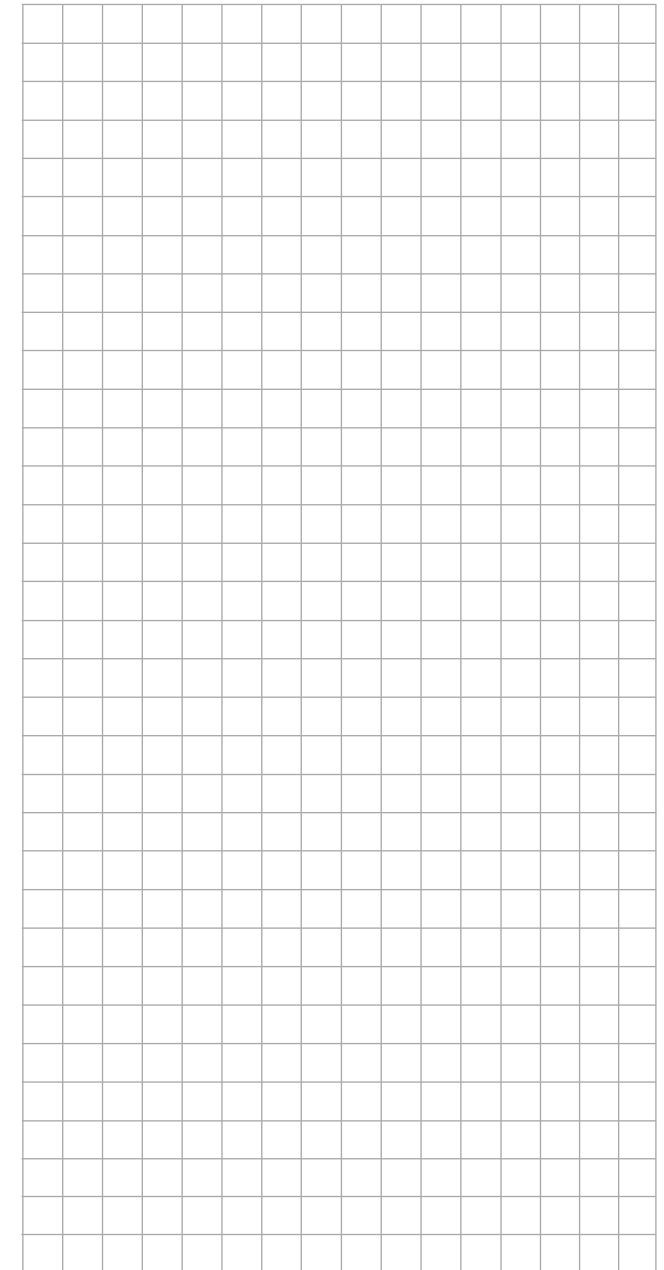
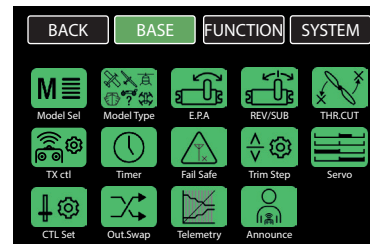
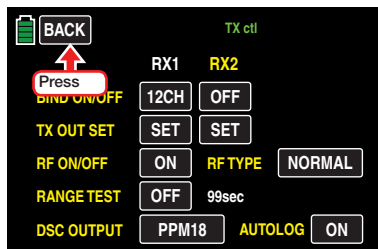


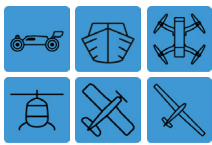
As soon as the RF transmission is turned on, the log data starts recording the information to the inserted memory card and will stop recording as soon as the transmitter or the RF module is switched off.

### Notice

» The AUTOLOG option remains switched ON or OFF as long as the actual setting is not changed while the RF module is switched off.

Touch the **BACK** button at the top left of the display to leave this submenu and return to the BASE menu.



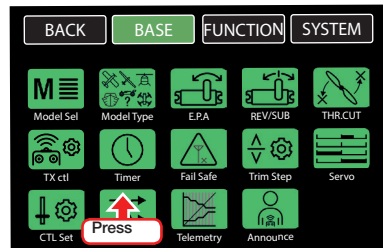
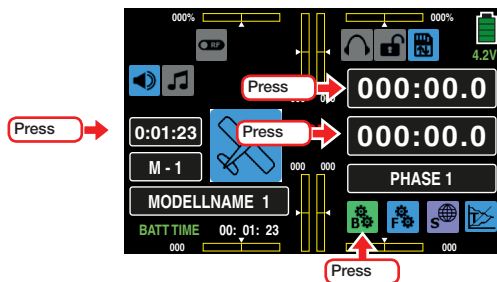


# Timers

## Timer and Clock Settings

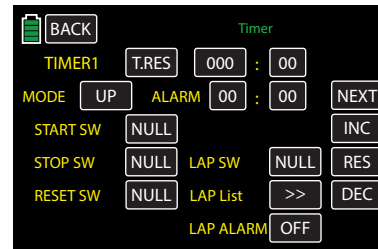
The **mz-24 PRO** comes with two forward/backward timers, alarm, battery and model timers and a date/time clock.

There are four ways to access the BASE submenu **Timer**. Press the battery/model timer on the left side of the main menu to bring up the battery/model setting screen. Press and hold either of the two large forward/backward timers on the right side of the main menu to bring up the timer displays (top timer for Timer1, bottom timer for Timer2). Or press the green gear icon at the bottom of the screen to bring up the BASE submenu. Press the **Timer** icon to bring up the timer display.



### Tip

Quickly press or tap the main menu Timer1 and Timer2 buttons to reset to the default values of **000:00.0**. Press and hold timer buttons to be taken to the corresponding timer setting display screen.



### Tip

Press the **NEXT** button at the top right edge of the display to scroll through the setting screens: TIMER1, TIMER2 and DATE/TIME.

### TIMER1 and TIMER2

To program TIMER1 or TIMER2, begin by choosing direction in the **MODE** line. By default, **UP** = forward count-up and **DOWN** = backwards countdown.

To proceed without setting an alarm, skip to the **Start/Stop Timer1 and Timer2** section (page 77).

### 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 in the **ALARM** line. A warning beep will sound during the last 20 seconds of the set duration so that users do not have to continuously monitor the display during flight.

### Acoustic Signal Sequence

20s before zero: 2 beeps

Single beep every 2 seconds

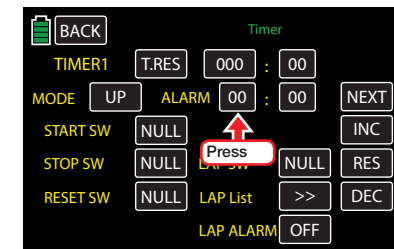
10s before zero: single beep

Single beep every second with a changed pitch

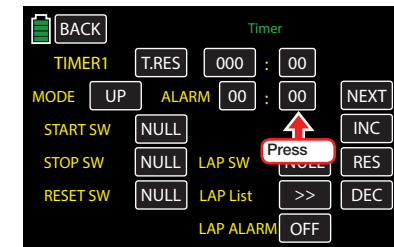
5s before zero: single beep every second with reduced frequency

Zero: voice trigger

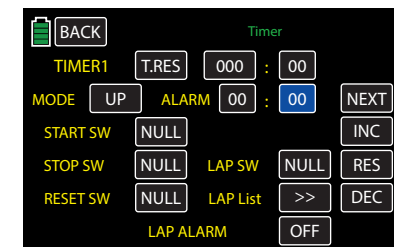
To set the desired time period, press the left minute field:



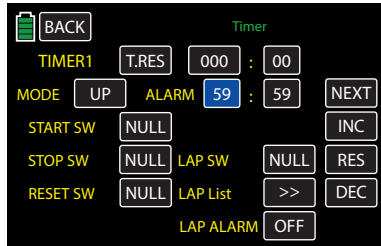
Or the right second field:



The field highlights blue:



Press the **INC** or **DEC** button at the right edge of the display or the arrow keys (▲▼) to the left of the display screen to increase/decrease time (between 00:00 to maximum 59:59), as shown below:



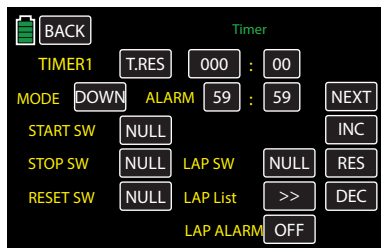
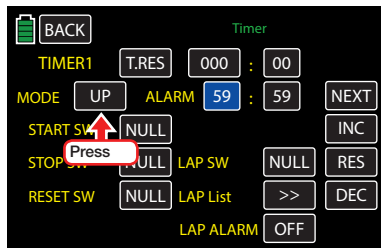
Press the **RES** button to reset the changed value back to the default.

#### Forward-counting timer **(UP)**

Forward-counting timers start at 000:00.

#### Backward-counting timer **(DOWN)**

Backward-counting timers start at -000:00. Press the button in the MODE line to change to this option:



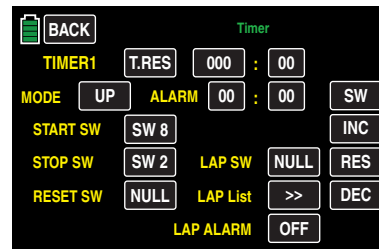
#### Notice

➤ If a timer is started, then stopped and switched from forward to backward counting (or vice versa), only the remaining time on the timer is updated; the time is not reset.

#### Start/Stop Timer1 and Timer2

##### • Timer 1

This timer can *only* be started through a switch assigned in the **START SW** line. In the example below, the S8 switch is assigned to start the timer and the S2 switch has been assigned to stop the timer.

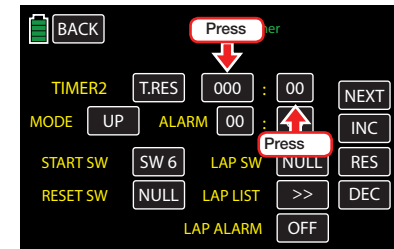


#### Notice

➤ Stopping Timer 1 also stops the data log recording to the SD memory card.

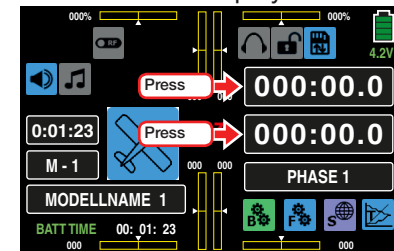
##### • Timer 2

This timer can be started and stopped by tapping on the minutes or seconds field or alternatively through a switch assigned in the **START SW** line:

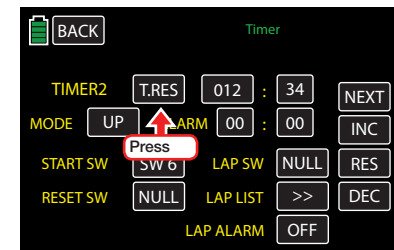


#### Resetting Started Timers

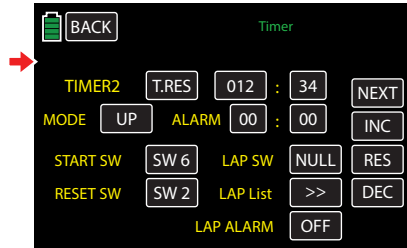
1. Both Timer 1 and Timer 2 can be reset to the default value at any time by tapping on the related timer field in the basic display



2. Both Timer 1 and Timer 2 can be reset to the default value at any time by pressing the **T.RES** button in the Timer1 and Timer2 displays:



- Both Timer 1 and Timer 2 can be reset to the default value at any time by moving the switch assigned in the **RESET SW** line in the Timer1 and Timer2 displays:



The Timer 1 data stream to the SD memory card will not be severed or influenced by the reset of the Timer1.

### START SW (Start Switch)

Use this line function to assign switches to Timer 1 or Timer 2 that start the selected timer. For more information on assigning switches, refer to the **Control and Switch Assignment** section (page 26).

### STOP SW (Stop Switch)

Use this line function to assign a switch to Timer 1 that stops the selected timer. For more information on assigning switches, refer to the **Control and Switch Assignment** section (page 26).

### RESET SW (Reset Switch)

Use this line function to assign switches to Timer 1 or Timer 2 that reset the selected timer to default values. For more information on assigning switches, refer to the **Control and Switch Assignment** section (page 26).

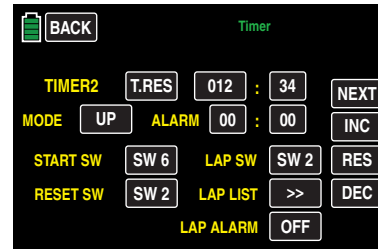
#### Tip

When the reset switch (or **RES** button) is activated, the recorded time is automatically transferred to the TIMER line.

### LAP SW (Lap Switch)

Use this line function to count ground laps by following these steps:

- Choose the forward or backward direction in either Timer 1 or Timer 2.
- Set the switches in the value fields of the line options: **START SW**, **RESET SW** and **LAP SW**, as shown below:

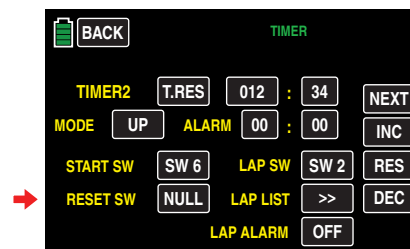


In this example above, by pushing SW6 (assigned to START SW), Timer 2 will start and as soon as SW6 is pushed again, the timer will stop.

SW2 is a 3-position intermittent switch. The first flip of SW2, for example when marking a lap, will reset Timer 2 to 000.00. At the same time the chronometer for Lap 1 will start.

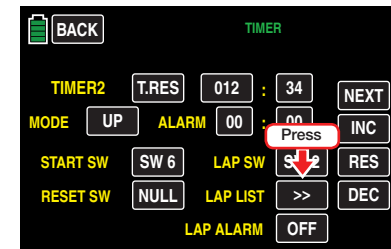
Subsequent pushes on SW2 will increase the lap counter by one and will stop (and save) the currently running lap time. At the same time, SW2 starts the timer for the next round, etc.

- The elapsed time will be saved as cumulative lap times when SW2 is pushed if there is no switch assigned in the value field RESET SW, shown below as NULL:



### LAP LIST

Press the **>>** button to switch to the list of lap times:



Up to 100 laps can be recorded and are displayed 20 to a screen. Scroll between screens using the **NEXT** and **PREV** buttons (forward/back):

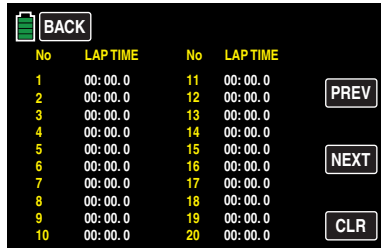
- If the lap counter starts at the same time that the timer has been reset, the lap list will record times individually, as shown below:

No	LAP TIME	No	LAP TIME
1	04:32.1	11	00:00.0
2	04:31.2	12	00:00.0
3	04:33.5	13	00:00.0
4	04:31.9	14	00:00.0
5	04:32.8	15	00:00.0
6	00:00.0	16	00:00.0
7	00:00.0	17	00:00.0
8	00:00.0	18	00:00.0
9	00:00.0	19	00:00.0
10	00:00.0	20	00:00.0

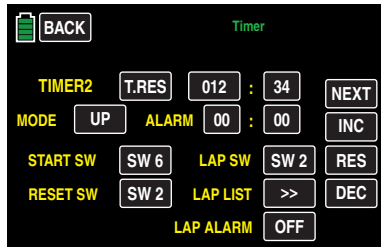
- Conversely, if the lap counter starts WITHOUT the timer being reset, the lap list will record times cumulatively, as shown below:

No	LAP TIME	No	LAP TIME
1	04:32.1	11	00:00.0
2	09:03.3	12	00:00.0
3	13:36.8	13	00:00.0
4	18:08.9	14	00:00.0
5	22:41.5	15	00:00.0
6	00:00.0	16	00:00.0
7	00:00.0	17	00:00.0
8	00:00.0	18	00:00.0
9	00:00.0	19	00:00.0
10	00:00.0	20	00:00.0

To reset the lap times to 00:00.0, press the **CLR** button:

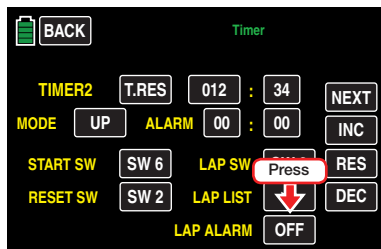


To exit the lap times list, press the **BACK** button to return to the Timer setting display:



### Lap Timer Alarm

Once lap times have been recorded, as described above, times can be saved, read and repeated after the end of every lap. Press the **OFF** or **ON** button on the LAP ALARM line, activate or deactivate the voice trigger function:



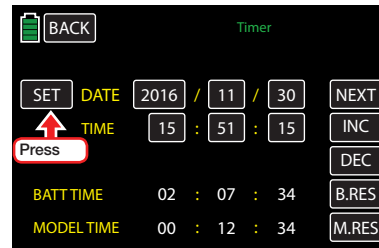
### Date and Time

The third display page of the **Timer** menu is the date and time clock.

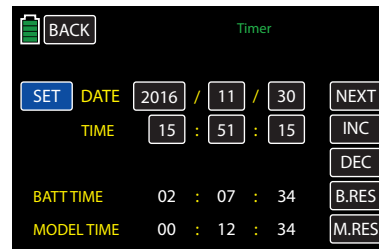
#### Tip

Press the model timer display from the main menu display to shortcut directly to this display.

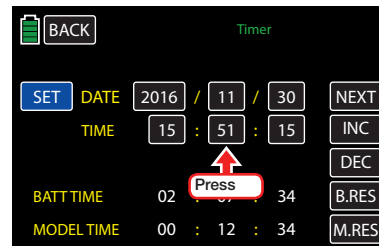
To set or change the date and/or time press the **SET** button:



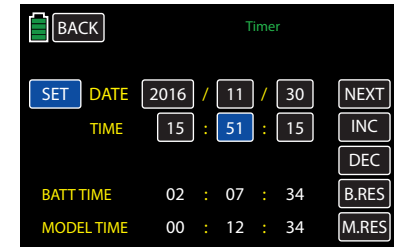
The button highlights blue:



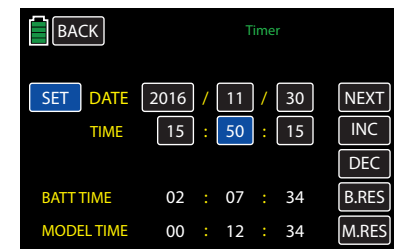
Press the value field to be set or changed. In the example below, the "minutes" field needs to be decreased:



The field highlights blue:

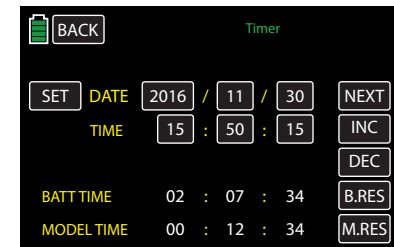


Press the **INC** or **DEC** button at the right edge of the display or the arrow keys (▲▼) to the left of the display screen to increase/decrease time, as shown below:



Use the same procedure with the other values.

To save changes to the transmitter memory, press **SET** again. The button returns to black:



The date and time have been saved and transferred to the transmitter memory.

#### Tip

When the transmitter is connected to a PC, the date and time can be updated via **Firmware Upgrade gr-Studio V4.x**.

## BATT TIME and MODEL TIME

- **BATT TIME**

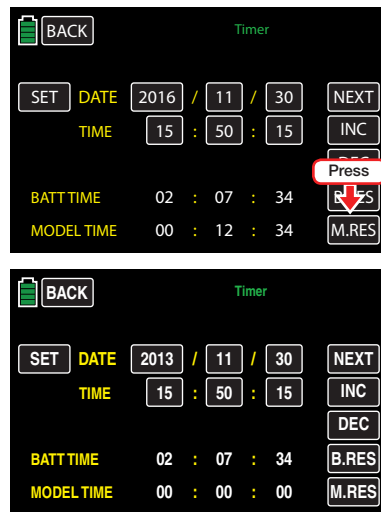
Use the BATT TIME meter to monitor the total operating time of the transmitter battery. A switch cannot be assigned.

When the transmitter is turned on and the battery voltage is noticeably higher than before, the timer is automatically reset to 00:00:00. This might occur, for example, after charging or exchanging the battery.

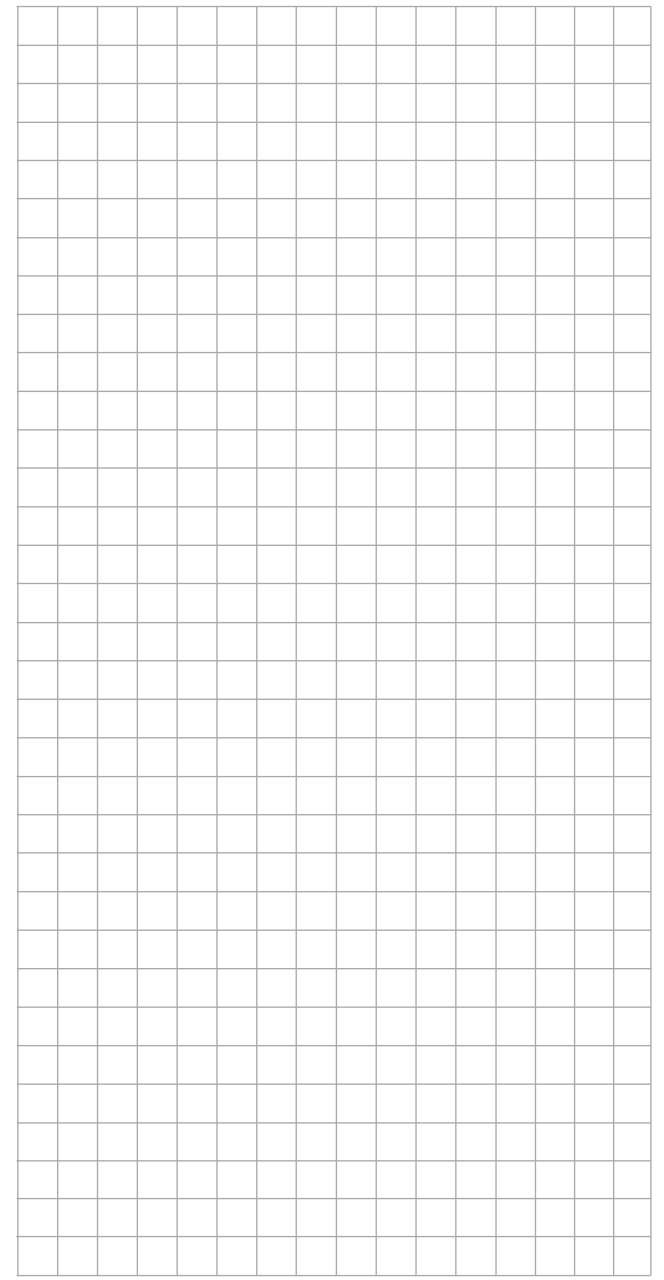
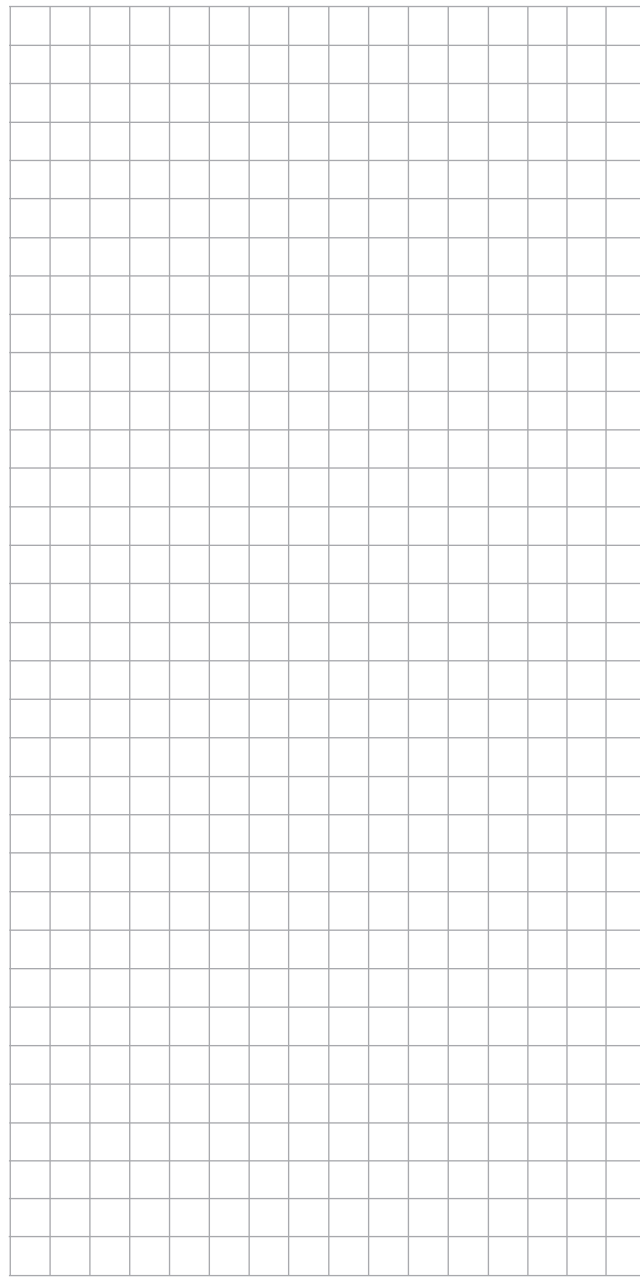
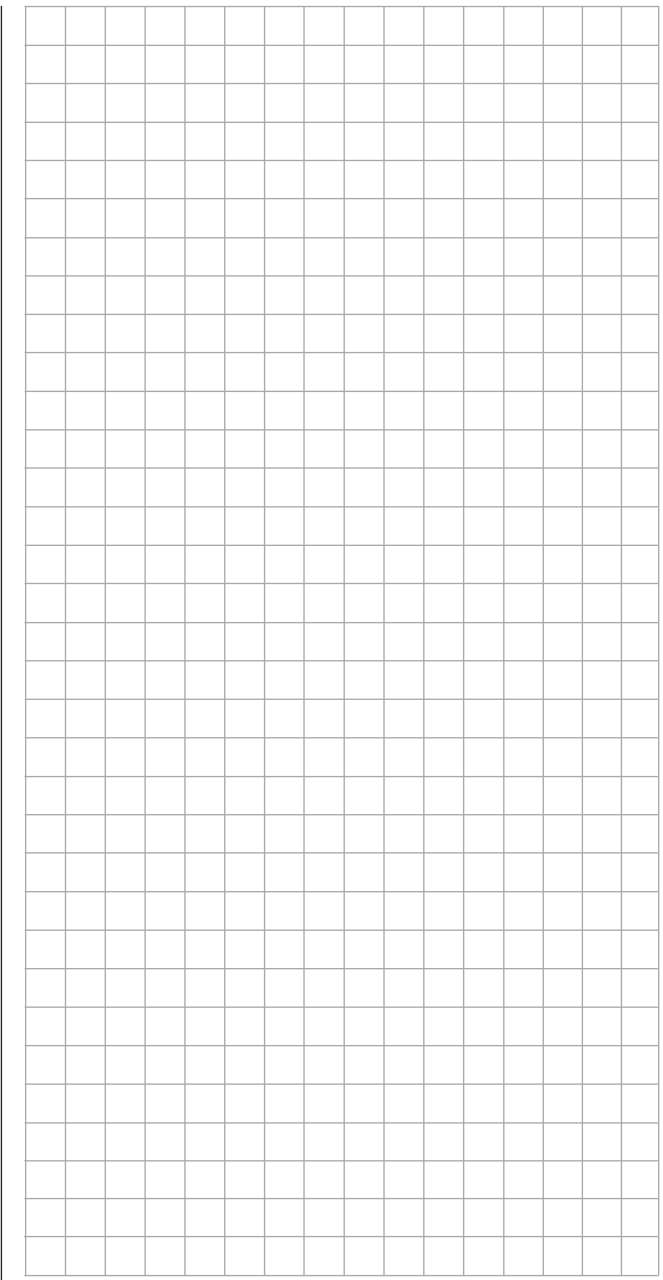
- **MODEL TIME**

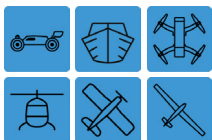
The MODEL TIME meter shows the overall recorded access time of the currently active model memory.

Neither timer can be assigned to a switch, but both can be manually reset to 00:00:00 by pressing the **B.RES** or the **M.RES** buttons. In the example below, MODEL TIME needs to be reset:



Press the **BACK** button at the top left of the display to leave the **Timer** display screen and return to the **BASE** submenu screen.



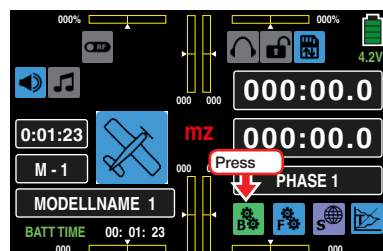


# Fail Safe

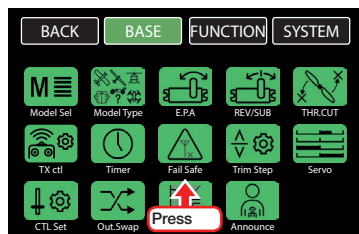
## In the Event of a Malfunction

The Fail Safe function determines the response of the receiver when the receiver system is turned on and if there is an interruption in transmission between the transmitter and receiver. Servo outputs can be programmed with pre-defined signals to prevent unwanted events, e.g. retractable landing gear will not close unexpectedly.

To configure the fail safe settings, from the main display press the **BASE** menu gear icon (green "B") to bring up the BASE submenu screen:



From the BASE submenu display, press the **Fail Safe** icon:



### Fail Safe

The HoTT system provides greater reliability, when compared to the classic PPM technology, because the microprocessor in the HoTT receiver can process both undistorted and distorted control signals from the transmitter. When the signals are excessively distorted or garbled, for example from noise, the processor replaces them with saved control signals that will place the receiver into Hold or Fail Safe Mode. This

eliminates intermittent disturbances, such as drops in field strength, which would otherwise lead to "wob-les" or servo output malfunctions such as retractable landing gear closing unexpectedly.

### Function description

The Fail Safe function determines the response of the receiver when turning on the receiver system and if there is an interruption in transmission from the transmitter to receiver.

The following options are available to the servos connected to the receiver Outputs 1 to 12:

- When the receiver is powered on and until there is no signal from the transmitter, defaults to the positions saved in the receiver independent from receiver settings HOLD or F/S.

### Notice

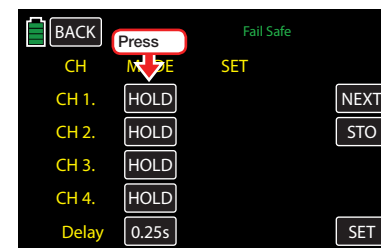


Unless reprogrammed, the standard default setting is the central position.

- When transmission connection is interrupted or encounters interference:
  1. HOLD - if transmission interference occurs, all servos remain at their current position until a new, correct control signal is received by the receiver.
  2. F/S - if the receiver is in the HOLD position and there is interruption in the transmission connection for a specified amount of time, servos move to a previously programmed position.

### Programming

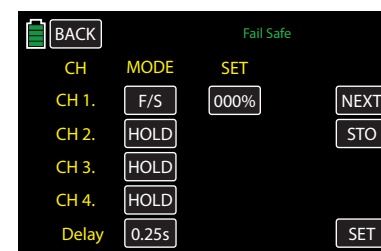
To change between Hold and Fail Safe modes, press the **HOLD** or **F/S** button in the **MODE** column in the appropriate channel line:



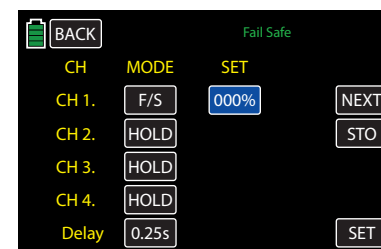
### Tip

Press the **NEXT** button to view the next two channel display screens.

By changing to **F/S**, value field defaulting to **000%** appears in the **SET** column:

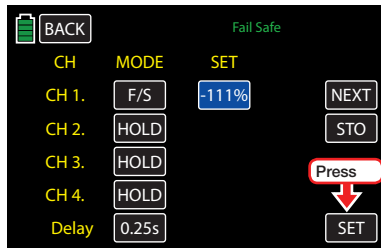


To set the fail safe position, press to highlight the **F/S** value field. In the example below, the fail safe for CH1 is being set:



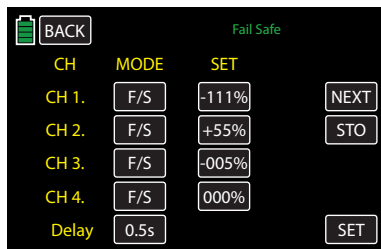


Move the control stick for this control channel into the desired position and press the **SET** button at the bottom right of the display to transfer the position into the value field, as shown below:



Use same procedure to save additional fail safe positions.

Finally, in the bottom **Delay** line, repeatedly press the value field to choose the delay times. The fail safe functions will not engage until the set time has elapsed: **0.25s**, **0.5s**, **0.75s** and **1s**. In the example below, a 0.5s delay was selected:

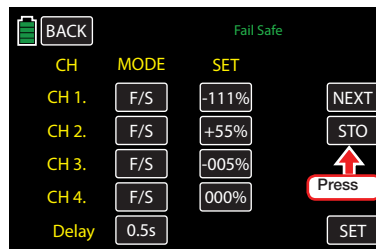


#### Notice

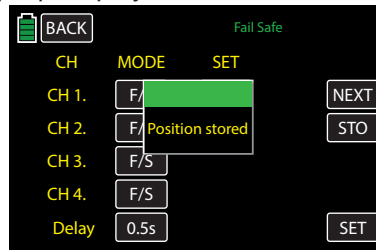


Fail safe settings are not applicable until saved to the transmitter and transmitted to the receiver.

Turn on the receiver and transmit the selected **F/S** values to the receiver by pressing the **STO** button:



The successful data storage is confirmed by the following pop-up display:



At the same time the **F/S** value fields will be unmarked again.

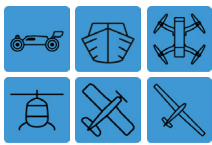
If the data is not successfully stored, check the radio transmission between your transmitter and receiver systems and repeat the process.

Touch the **BACK** button to exit this display and return to the **BASE** submenu screen.

#### WARNING



- The fail safe settings stored in the transmitter will not be automatically transmitted to the receiver during the operation! This transmission must be manually performed within a radio connection by tapping on the **STO** button!
- The fail safe settings stored in the transmitter should be restored after changing a receiver and should be deleted in the previous receiver by Re-set.
- Use this safety option to program a **FAILSAFE** for 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 after switching on the receiver system or in case of malfunctions and cause property damage and injury. If necessary, ask for assistance from an experienced pilot.

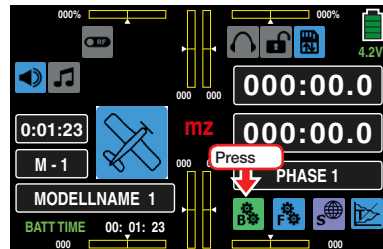


# Trim Settings

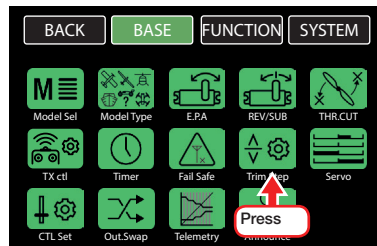
## Trim Settings

Trimming allows models to fly straight and level with the control sticks in their central positions, and with no input from the pilot. Adjusting the trims during each flying session is normal, as outside factors can affect flight characteristics. Set trims can be left alone until the natural flight path of the model changes and re-adjustment is required.

To configure the trim settings, from the main display press the **BASE** menu gear icon (green “B”) to bring up the BASE submenu screen:



From the BASE submenu display, press the **Trim Step** icon:



The two control sticks come with digital trimming. Trim can be adjusted incrementally by moving the control sticks in short bursts, or with increasing speed by moving and holding the control stick in the desired direction.

The current trimming positions are displayed in the main display, and all adjustments are audible. It is possible to find middle position during model use

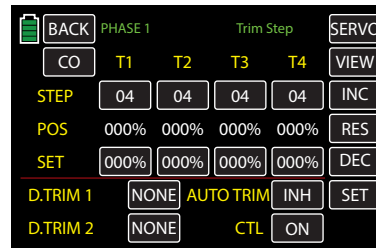
without looking at the display; when passing over middle position, a brief pause is inserted.

The current trimming values are automatically saved when the model memories are changed.

The default factory original trim setting for the **mz-24 Pro** HoTT transmitter is automatically saved along with each model memory but can be changed by assigning a different trim setting to each flight phase.

### Phase Dependent Settings

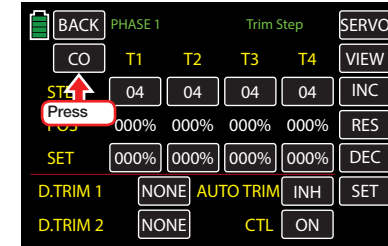
The phase display allows storage of phase-specific values. Phase name is visible in green in the upper left side of the display, titled **Phase #**. Up to 6 phases can be added and saved in the FUNCTION submenu **PHASE** (page 120). Change between the different phases by assigning switches.



### CO / SE Common/Single Option

The Common (**CO**) or Single (**SE**) options allow users to keep the same trim settings across all phases (common/phase dependent) or re-establish trim with each phase (single/phase-specific). The throttle/brake or throttle/pitch control stick trim (control function CH1), is set as Common, while control functions CH 2 - 4 is set as Single.

To change the setting, press the **CO** or **SE** button the top left of the display:



### STEP Line (Trimming Step)

With each click, the four digital trimming controls shift the neutral position of the respective control stick by an adjustable increment (between **00** and **10**) in each direction. The maximum trimming path is always approximately  $\pm 30\%$  of the control path, independent of the selected number of trimming steps.

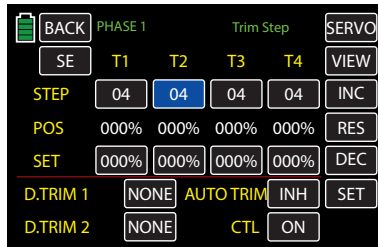
### Notice

**>>** This setting is always Common, independent of the **CO** or **SE** setting.

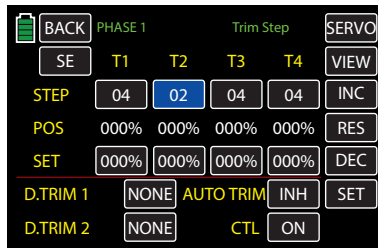
To change the current step incrementation of a trim control, press the corresponding value field in the **STEP** line:



The field highlights blue:



Press the **INC** or **DEC** button at the right edge of the display to increase/decrease the value of the active field. Press the **RES** button to reset the changed value back to the default. Alternatively, press the arrow keys (▲▼) to the left of the display screen to achieve the same result:



Use the same procedure with the other trim controls.

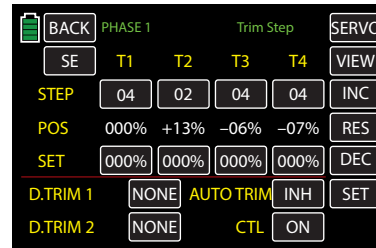
### Tip

Trim controls are numbered T1 - T4 and refers exclusively to control channels assignment 1 - 4. Use the SYSTEM submenu **ST mode** (page 208) to verify which control mode channel relates to the trim control of the left and right control sticks.

### POS Line (Trim Position)

The current trimming positions are shown in the POS line. (The trimming range is about ±30 % of the entire control path.)

The example below shows controls T2, T3 and T4 with trim position adjustments:

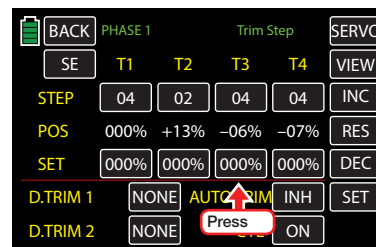


### SET Line (Saving Trim Positions)

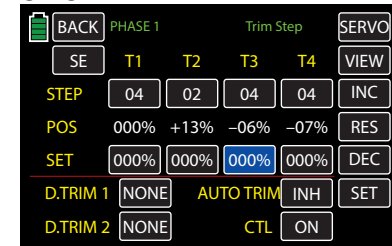
This option saves the current position of the four digital trimmings so that they can be returned to POS line of the display. After a model memory is changed, or after long periods between flights, the last saved trimming positions are visible in the **SET** line of the screen, as per the control function columns T1 - T4.

For example, a model is flown, landed and re-trimmed. The current trimming positions are displayed white in the **POS** line of the display. The value fields in the **SET** line underneath show the saved trimming but since no values have been saved, all value fields read 000%. The Trim Step display would look very much like the example above: current trim positions in the POS line, saved settings in the SET line.

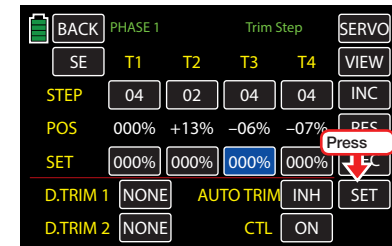
To save a trim value, press the field below the trim setting to be transferred. In the example below, a fixed-wing model elevator trim needs to be saved in column T3:



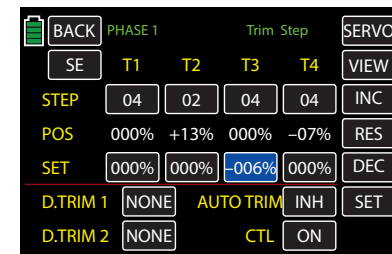
The field highlights blue:



Press the **SET** button at the bottom right of the display:



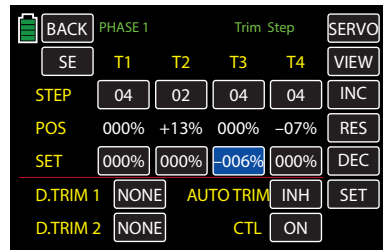
The trim value from the POS line to transferred to the SET memory line:



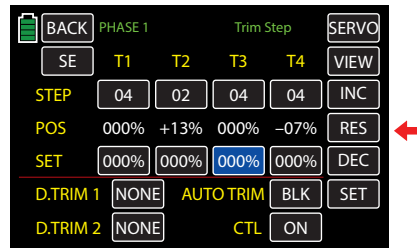
Use the same procedure for other trimming values.

## Deleting Saved Trimming Positions

Press to highlight the field with the trimming value to be deleted. In the example below, T3 needs to be reset:



Press the **RES** button to reset the highlighted field back to the default value. In the example below, T3 has been reset to 000%:



Use the same procedure for other trimming values.

## Digital Trim 1 and 2

Independent of the trim control 1 - 4 settings described above, the INC/DEC buttons **DT1** and **DT2** on the transmitter (near switches S2 and S3) can be assigned to control channels 5 - 12 via the **D.TRIM 1** and **D.TRIM 2** lines of this display. Depending on the **CO** (common) or **SE** (single) setting at the top left side of the display, follow the storage of their trim options accordingly **CO** (common) or **SE** (single).

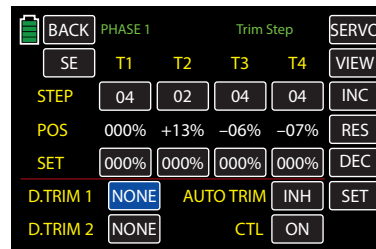
The possible trim amount is  $\pm 30\%$ .

## Programming

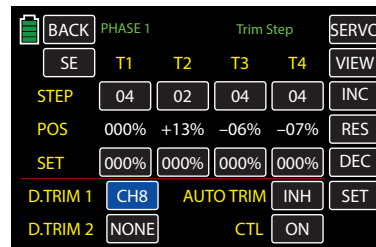
Press the button in the line of the desired control. In the example below, **D.TRIM 1** needs to be reassigned:



The field highlights blue:



Press the **INC** or **DEC** button at the right edge of the display to increase/decrease the channels CH5 - CH12. Alternatively, press the arrow keys ( $\blacktriangle$ / $\blacktriangledown$ ) to the left of the display screen to achieve the same result. Press the **RES** button to reset the changed value back to the default **NONE**. In the example below, **D.TRIM 1** needs to be reassigned to Channel 8:

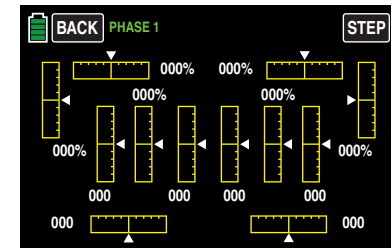


Use the same procedure for D.TRIM 2.

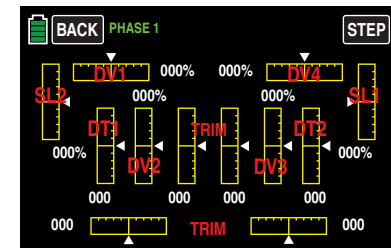
## Tip

Refer to the **Programming Examples** section (page 230) for trim setting examples.

Press the **VIEW** button on the top right of the display to view and verify setting changes. All trim controls are graphically displayed, as shown below:

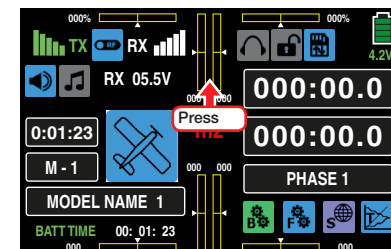


The graphic display represents individual trim controllers according to the following schematic:



## Tip

The main menu shortcut for this display can be reached by pressing on the top central yellow bar graphics:



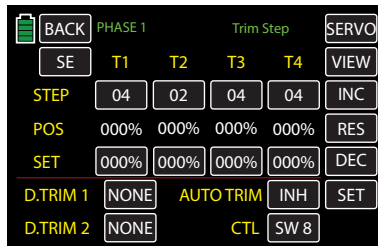
## AUTO TRIM

The **AUTO TRIM** function allows users to quickly and easily to trim a model, for example during the first flight or after large upgrades, repairs, etc.

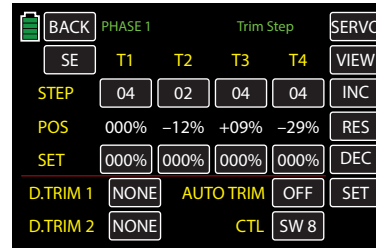
During a model's first flight, the previous ground performed settings may not be applicable to the new flight requirements. Correcting the attitude requires users to simultaneously move the control sticks and trim controls until the model flies straight.

Once the required flight attitude is reached by moving the control functions 2 - 4, the AUTO TRIM function can be activated by moving the assigned switch one time. This is typically a self-centering switch, such as the 3-position switch S8, which will return to the center position after the switch is flipped to the ON position. (For safety reasons it is highly recommended a self-centering switch is used, rather than a switch with a permanent ON position).

About one second after the AUTO TRIM switch is pushed, the deviation percentage from center position of control stick positions 2 - 4 are stored as trim value (within maximum  $\pm 30\%$ ):



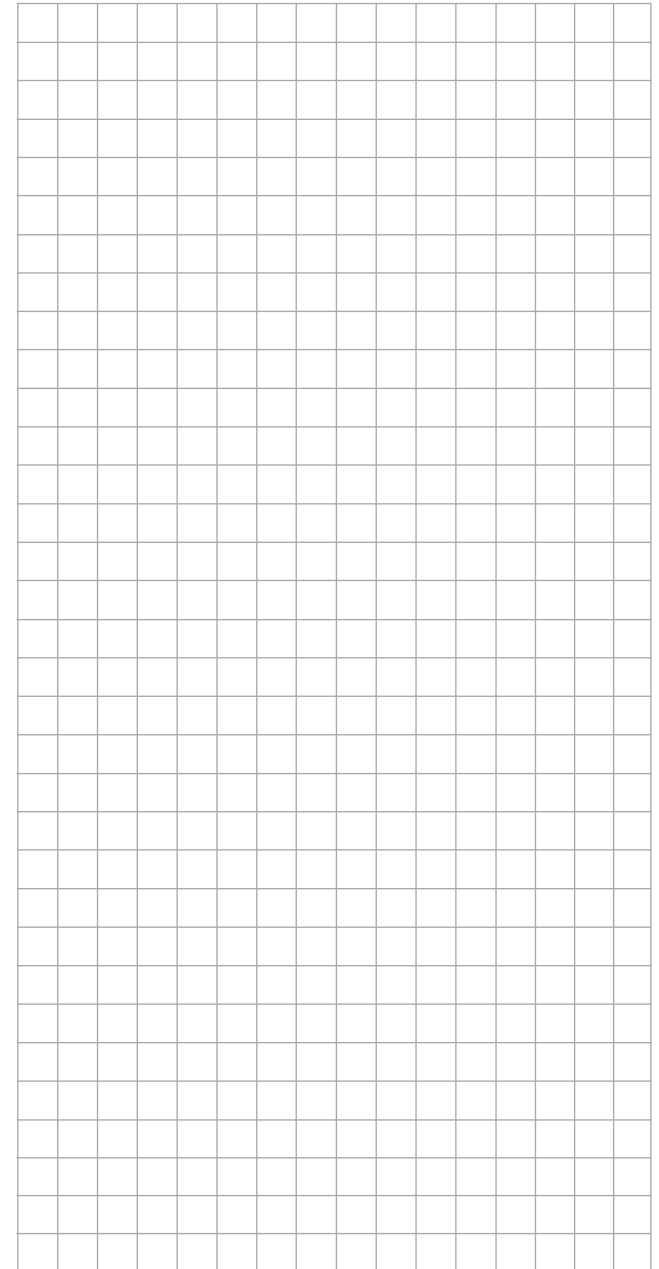
At the same time the control sticks can be released to the normal position, as shown below:



### Notices



- For safety reasons never use the AUTO TRIM option if the trim step is set to "0".
- Control sticks 2 - 4 must be in central position while the switch is assigned. Otherwise the deviation percentage from the central position will already be stored as trim values in the trim memory.
- All AUTO TRIM switch activations are cumulative. For safety reasons it is highly recommended to use the switch only once and to deactivate it after the "AUTO TRIM flight" has finished. Otherwise there is the risk that the AUTO TRIM function might be inadvertently activated.
- Never assign the AUTO TRIM function to a "normal" position holding switch where the switch will need to be switched to the OFF position after each AUTO TRIM process. **Otherwise, all other switch activations will inhibit the AUTO TRIM process.**
- Refer to the **POS Line** and **SET Line** settings section (page 83) for additional information on setting and storing these values.



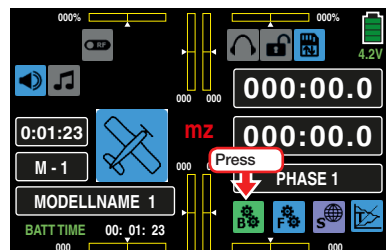


# Servo Monitor

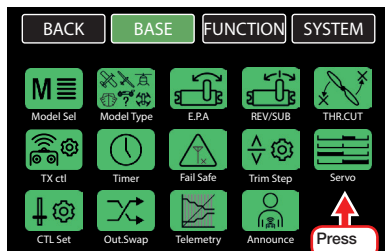
## Servo Positions / Servo Test Function Display

Use this display to check servo settings, program settings into different phases, and test and change servo settings prior to use.

To configure the servo settings, from the main display press the **BASE** menu gear icon (green “B”) to bring up the BASE submenu screen:



From the BASE submenu display, press the **Servo** icon:



The Servo display can be accessed at any time by simultaneously pressing the arrow keys (▲▼) to the left of the display screen or by pressing the **SERVO** button in the upper right hand corner of certain menu screens. Pressing the **ESC** key underneath the arrow keys brings up the previous screen.

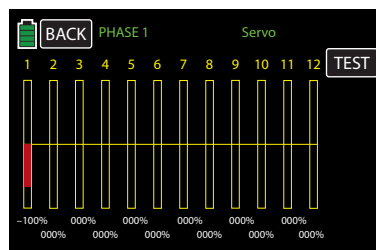
### Phase Depending Displays

The Servo submenu allows for different phase-specific values to be programmed. Phase names are displayed in green in the upper left side of the screen next to the BACK button. Standard defaults naming for the phases is usually displayed as **NORMAL**, or

**PHASE 1.** (Additional phases will be named numerically, e.g. Phase 2, Phase 3, etc.) To define multiple phases, refer to the FUNCTION submenu **Phase** section (page 120). Each new phase will need to be assigned to a different switch. To change the phases, activate the corresponding switch(es).

### Servo monitor

Current servo settings are displayed precisely between -150% and +150% of the normal path, taking into account control and servo settings, dual rate/expo functions, the interaction between the linear and curve mixes, etc. The middle position of the servo is shown as 000%. Settings can be checked without having to turn on the receiver. Carefully test all the program steps on the model before first use to make sure there are no errors.



The display follows model-specific channel assignments:

### Land and Water Models

Refer to the model’s manual for channel assignments.

### Drone

- Bar 1 Pitch (climb/sink)
- Bar 2 Roll
- Bar 3 Nick
- Bar 4 Yaw
- Bar 5 - 12 Open for user assignment

### Helicopter models

- Bar 1 Pitch or roll (2) or nick (2) servo
- Bar 2 Roll (1) servo
- Bar 3 Nick (1) servo
- Bar 4 Yaw servo (gyro)
- Bar 5 Nick (2)-Servo / free channel
- 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

### Fixed-wing models

- Bar 1 Throttle/brake servo
- Bar 2 Aileron or left aileron
- Bar 3 Elevator
- Bar 4 Rudder
- Bar 5 Aileron right
- Bar 6 Flap (left) / free channel
- Bar 7 Flap (right) / free channel
- Bar 8 Free channel / second elevator servo
- Bar 9 Free channel / AILE2 left
- Bar 10 Free channel / Flap2 right
- Bar 11 Free channel / AILE2 left
- Bar 12 Free channel / AILE2 right

### Notices

- Model types **Car**, **Drone** and **Boat** have no established pre-assignment list.
- The servo display channel assignments refer to the default servo sequence. It does not refer to any changes to the outputs made in the BASE submenus **Out.Swap** section (page 96), or **TX ctl** (page 68).

- The number of channels displayed in this menu refers to the maximum control channels available in the transmitter. The number of usable channels may be significantly lower depending on the type of receiver and the number of connected servos.
- This display is useful while programming the model since all transmitter settings can be quickly and easily checked. Carefully test all model program steps before first use to make sure there are no errors.

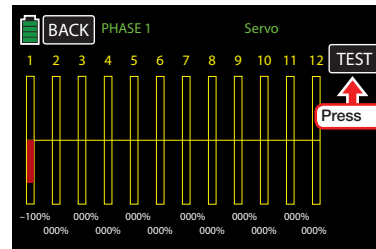
## Servo test

### Notice

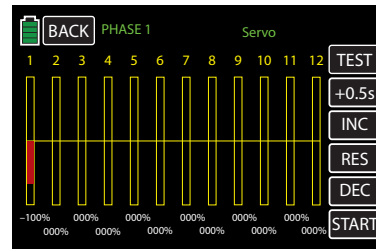


Start servo tests in the appropriate model memory and without using a mixer. Otherwise, unforeseeable servo deflections will occur.

To activate the servo test function, press the **TEST** button at the top right side of the Servo screen:

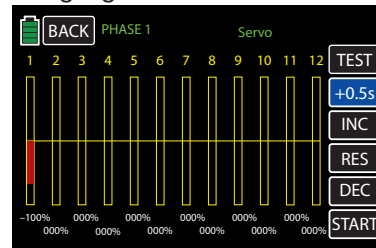


Additional buttons will appear below the TEST button:

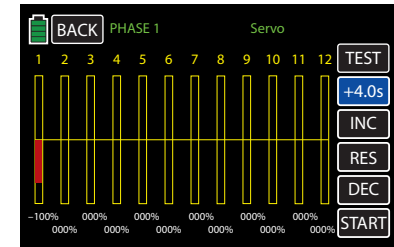


To change the default cycle time of 0.5 seconds, press value field button underneath the TEST button.

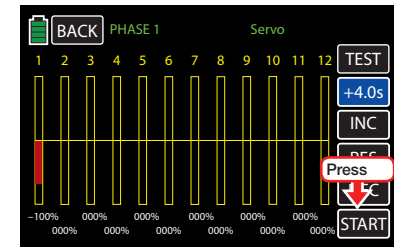
The field will highlight blue:



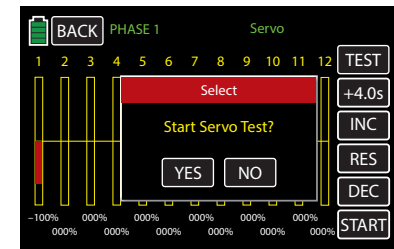
Press the **INC** or **DEC** button at the right edge of the display to increase/decrease the value in .05s increments. Alternatively, press the arrow keys (▲▼) to the left of the display screen to achieve the same result. Press the **RES** button to reset the changed value back to the default (0.5s). In the example below, the value is raised to +4.0s:



Start the servo test by touching the **START** button at the bottom right corner of the screen:

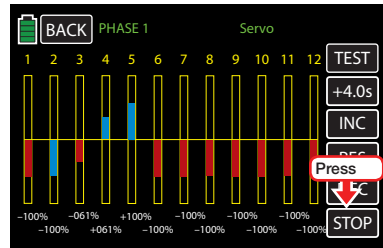


An active warning safety query will appear:

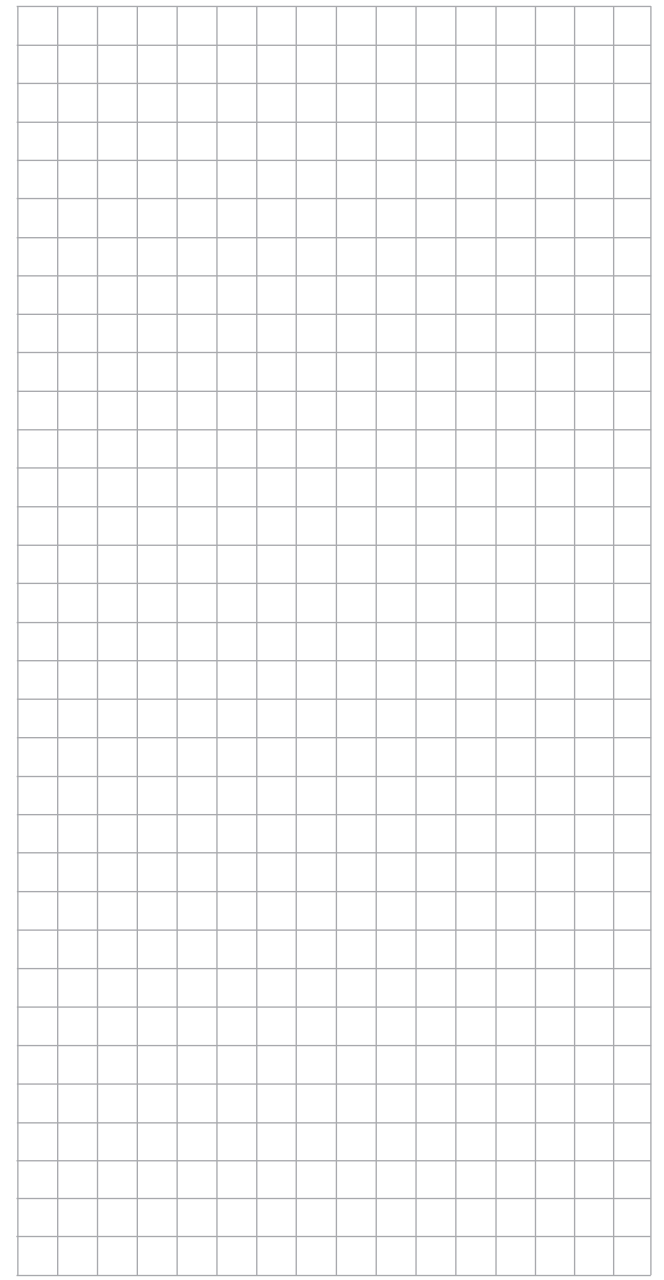
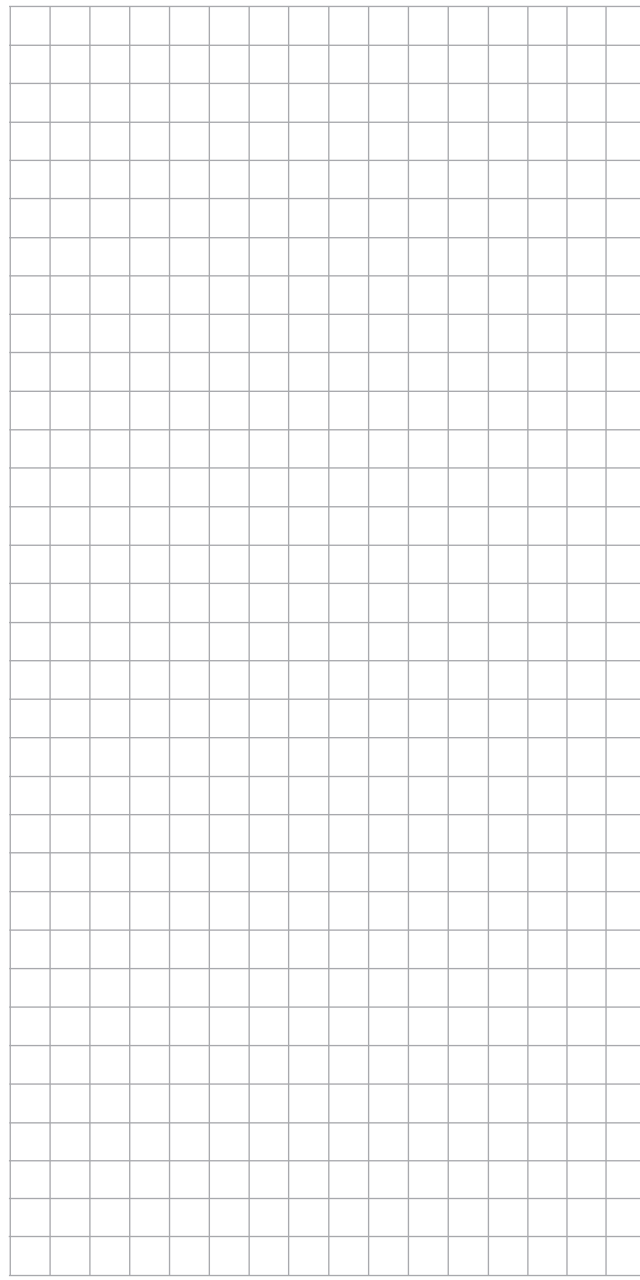
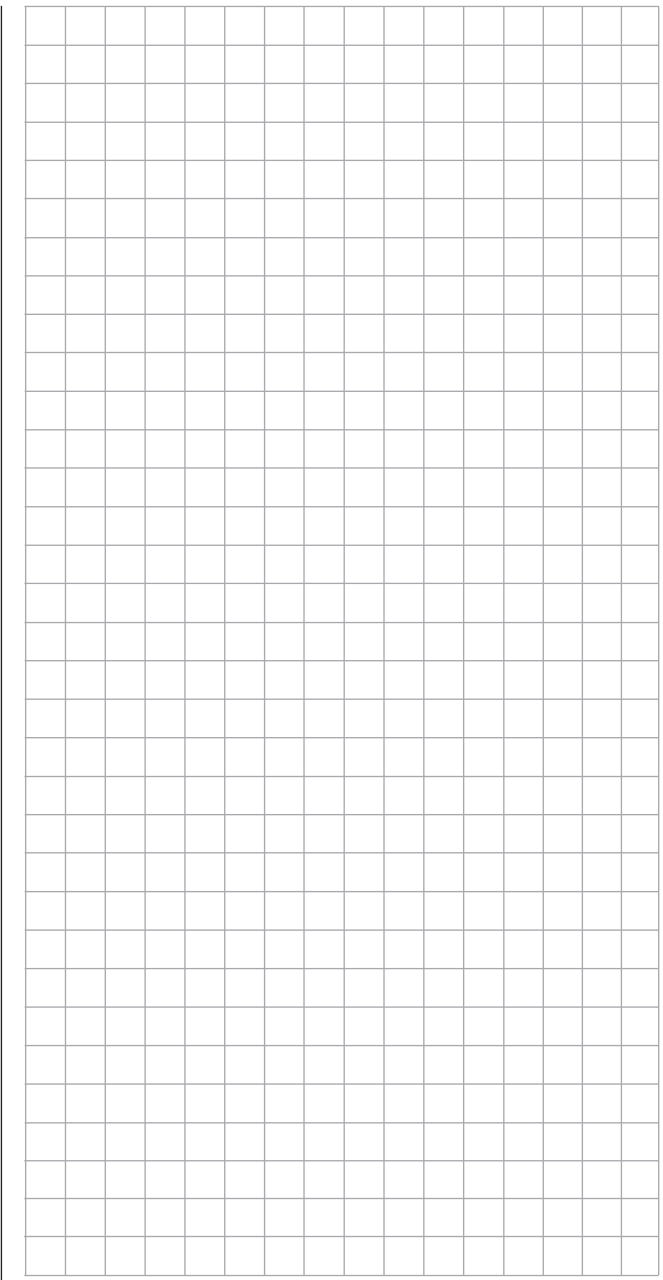


Touch **NO** to terminate the procedure.

Touch **YES** to start the servo test function. This 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 **STOP** button at the bottom right corner of the screen:







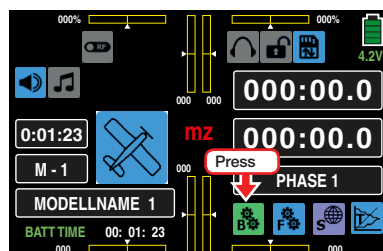
# Base Menu - Control/Switch Setting



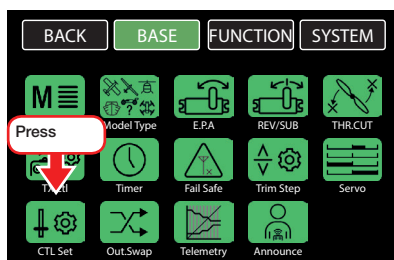
## Control and Switch Assignment

Use this menu to set control sticks and assign switches for phase changes, trim adjustments, timers, fail safe, delays, etc.

To configure the control/switch settings, from the main display press the **BASE** menu gear icon (green "B") to bring up the BASE submenu screen:



From the BASE submenu display, press the **CTL Set** icon:



Across the top of the **mz-24 Pro** HoTT transmitter are the dials and switches for servos responding to control functions 1 - 4 and their trim controls:

- 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**)

By contrast, a new model memory for a helicopter model for servo 6, the aforementioned control elements are initially inactive.

Only the servos controlled by the two control sticks can be moved when these systems are initially delivered and a new model memory is initialized and bound to the receiver. By contrast, the servos connected to different slots remain in their middle position.

Though inconvenient, it is the only way to freely select from the other control elements of the transmitter and avoid the deactivation of unnecessary control elements. Any control element not needed and accidentally activated has no influence on the model if it is not assigned to any function.


Use the **CTL Set** submenu to assign all of the aforementioned control elements as needed within any function input without restriction. Each of these control elements can be simultaneously assigned to several functions as needed. For example, the same toggle switch assigned to an input in the **CTL Set** submenu can also be assigned as a timer on/off switch in the **Timer** submenu, etc.


## Notices





- When assigning several functions to the same switch, note that incorrect responses may arise, i.e. using the same switch to change Phases and control Phase Trimming. To remedy the overlap, change switch assignments for one of the conflicting functions.

- Setting the control travel affects **all outgoing** mixing and coupling functions. All servos that are activated by the relevant control element will be affected.

-  Control direction of a glider's brake control, generally the "front" position of the CH1 control stick, is defined through the off-set value in the BUTTERFLY OFF line of the FUNCTION submenu **BUTTERFLY** (page 202).

-  Conversion of a motor powered model's control direction of the throttle control stick (CH1) is described in the FUNCTION submenu **THR.CR.V** (page 128).

-  Conversion of a helicopter's control direction of the throttle/pitch control stick (CH1) is described in the FUNCTION submenu **PIT.CR.V** (page 160).

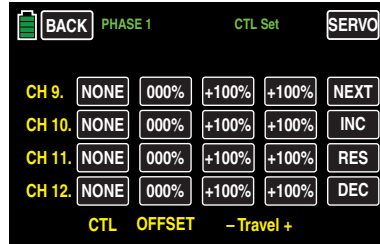
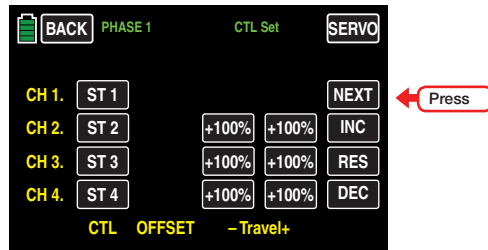
-  Conversion of a car, boat or drone control direction of the throttle control stick (CH1) is described in the FUNCTION submenu **THR.CR.V** (page 128).

## CTL Column (Control/Switch)

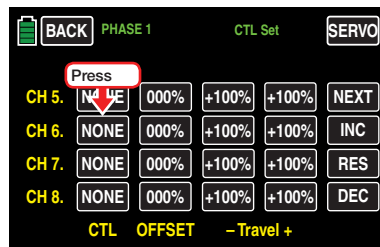
### Assigning Switch or Control

#### Tip

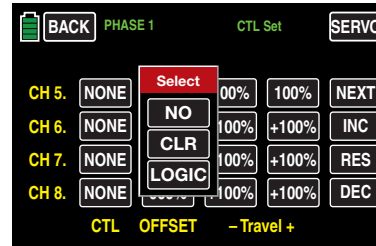
Channels 1 - 4 are located on the first page of this display screen, 5 - 8 on page 2, 9 - 12 on page three. The delay menu is on page 4. Press the **NEXT** button on the right side of the display to advance screens:



To assign a control element, press on the value field in the line of the desired control channel. In the example below, CH6 needs to be assigned to switch SL2:



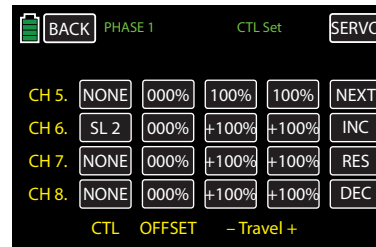
The active Select window appears:



Press **NO** to terminate the procedure.

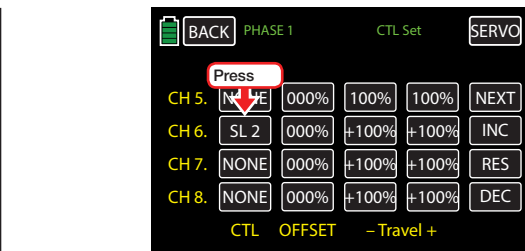
To assign the control or switch, activate the desired control element. Remember that the dials and rotary controls are only recognized after a pause and need to be activated for slightly longer than the switches. Turn the dial in either direction to register the assignment. Note that with an assigned 2-position switch, the only option is to flip back-and-forth between the end values (for example motor ON/OFF). The 3-position switch offers a middle position.

The field displays either the control name or the switch number. In the example below, CH6 has been assigned to SL2:

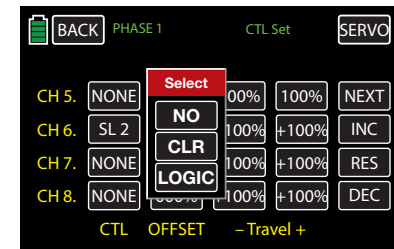


### Deleting Controls or Switches

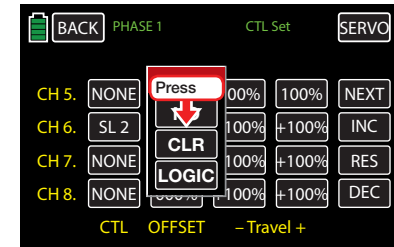
Press the value field of the assignment to be deleted. In the example below, the switch assigned to CH6 needs to be cleared:



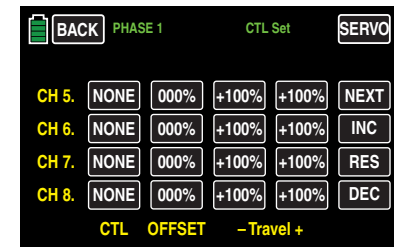
The active Select window reappears:



To delete the assigned control or switch, press **CLR**:



The CH6 field returns to NONE:



Use the same procedure for the other settings.

## Notices



- The controllers assigned in this sub-menu globally affect all the phases. Only the offset in the second line and the Travel Setting (third and fourth column) affect specific phases.
- Pay attention to default receiver channel assignments. For example, if a model with flaps assigns a control or switch identified as FLAP(1L) to input 6, its function is dependent on the current setting in the **ACT** line of the FUNCTION submenu **Flap set** (page 196). If the value field to the right of the **ACT** line is **INH** or **OFF**, then this control or switch acts exclusively on servo 6 (and possibly 7), whose values are set in the FUNCTION submenu **D/R,Exp** (page 124).

## Phase Depending Settings

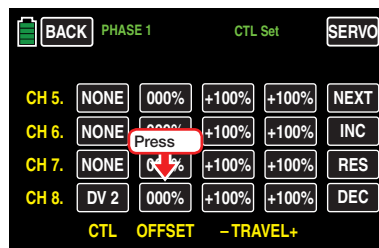
The CTL Set submenu allows for phase-specific symmetrical delay values to be programmed in the OFFSET and TRAVEL columns.

Phase names are displayed in green in the upper left side of the screen next to the BACK button. Standard defaults naming for the phases is usually displayed as **NORMAL/PHASE 1**. Additional phases will be named numerically, e.g. Phase 2, Phase 3, etc. To define multiple phases, refer to the FUNCTION sub-menu **Phase** section (page 120). Each new phase will need to be assigned to a different switch. To change the phases, activate the corresponding switch(es)

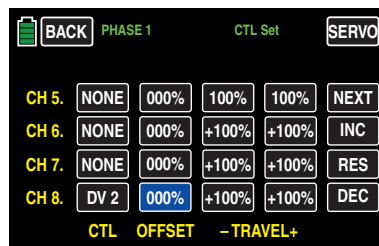
## OFFSET Column

Use this column to change the center of each control element, i.e. its zero point (or if desired with reference to a specific phase).

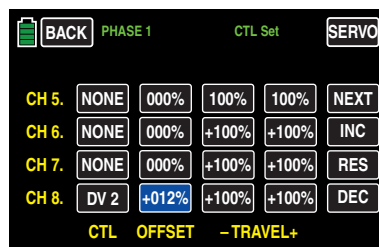
Press the Offset value to be changed. In the example below, the offset for CH8 needs to be increased:



The field highlights to blue:



The adjustment range is  $\pm 125\%$ . Press the **INC** or **DEC** button at the right edge of the display to increase/decrease the value. Alternatively, press the arrow keys ( $\blacktriangle$   $\blacktriangledown$ ) to the left of the display screen to achieve the same result:



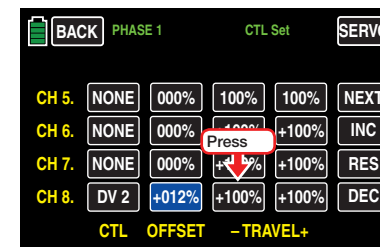
Press the **RES** button to reset the changed value back to the default (+100%).

Use the same procedure for the other settings.

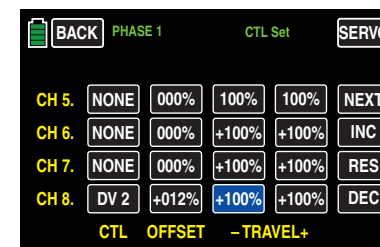
## -TRAVEL+ Column

Use this column to set the travel of each control element.

Press 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. In the example below, both the minus side of the travel distance needs to be decreased. Press the value field in the appropriate column of the Travel columns:

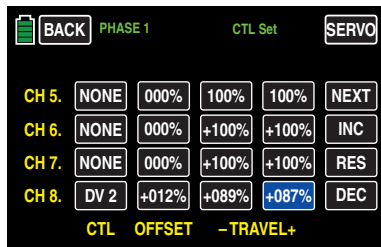


The field highlights to blue:



The adjustment range is  $\pm 125\%$ . Press the **INC** or **DEC** button at the right edge of the display to increase/decrease the value. Alternatively, press the arrow keys ( $\blacktriangle$   $\blacktriangledown$ ) to the left of the display screen to achieve the same result.

Use the same procedure for a value on the plus side of the control travel, for example:



Press the **RES** button to reset the changed value back to the default (+100%).

Use the same procedure for the other settings.

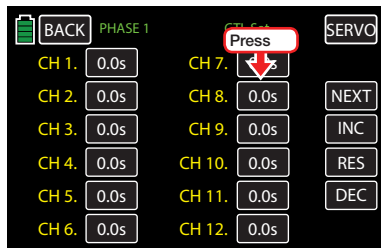
### Symmetrical Delay

Use this screen to set a time delay for the selected control signal.

Press the **NEXT** button on the right side of the screen to move to the delay screen of the CTL Set display:



Press the **0.0s** value field in the appropriate channel line. In the example below, CH8 requires a 4.5s delay:

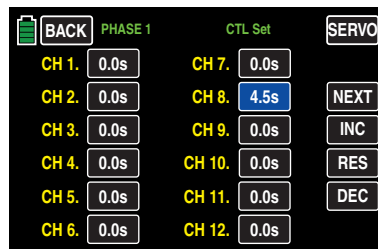


The field highlights to blue:



The maximum value adjustment range is 9.9 seconds. Press the **INC** or **DEC** button at the right edge of the display to increase/decrease the value. Alternatively, press the arrow keys (▲▼) to the left of the display screen to achieve the same result.

In the example below, CH8 has a 4.5s delay:



Press the **RES** button to reset the changed value back to the default (0.0s).

The Servo display can be accessed at any time by pressing the **SERVO** button in the upper right hand corner the screen or by simultaneously pressing the arrow keys (▲▼) to the left of the display screen or by. Pressing the **ESC** key underneath the arrow keys brings up the previous screen.

Use the same procedure for the other settings.

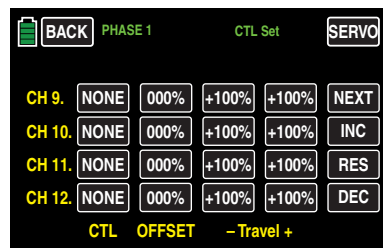
### Notice

Use this setting to set a **symmetrical** delay for the transmitter-side control signal with the standard labeling **0.0s**. A delay set here affects the servo with the same channel number of the delayed receiver connection as well as all servos controlled by the control element assigned to specific control function.



## Throttle Limit Function

After initializing a helicopter as a new model memory, input channel 12 will provide **Throttle Limit** functionality. This function is deactivated by default and remains so until a control switch is assigned.



### Notice



This input cannot be used for any other use! The throttle limit will remain deactivated until Ch 12 is free!

By assigning a control the Throttle Limit function will be activated and set according to the following description. In the example below, the DV2 dial has been assigned to Ch 12:



The standard approach of other remote control systems is to program two phases: THR.HOLD and no THR.HOLD. When Ch 12 has been assigned to a switch and the settings adjusted, it is not necessary to program both phases.

Instead of THR.HOLD, the **mz-24 Pro** HoTT transmitter offers more precise options for adjustment, such as increasing the system speed below hovering to increase flexibility.

### Meaning and Use of Throttle Limit

Unlike fixed-wing models, the performance of the power unit for helicopters cannot be directly controlled with the CH1 control stick. Instead, it can only be indirectly controlled by the gas curve settings (made in certain helicopter FUNCTION submenus), or by a **governor**, if the model has one.

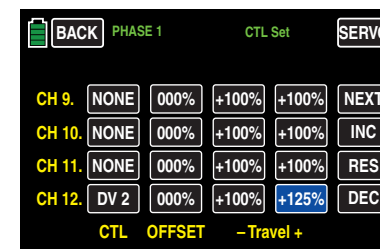
### Tip

Individual gas curves can also be adjusted while programming the different phases.

Both methods of controlling the output allows helicopters to be reliably started and stopped without additional intervention by preventing carburetor motors from approaching idling during normal flight.

The Throttle Limit function elegantly solves this problem by *limiting* the position of the throttle servo or the performance of a motor control unit. The Throttle Limit Control makes it possible to turn the throttle down to idle, allowing the trim control of the throttle/pitch control stick to assume control or to directly turn off an electric drive. Conversely, the throttle servo or motor control unit will only reach its full throttle position when the Throttle Limit Control releases the entire travel.

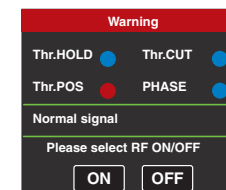
In the BASE submenu **CTL Set**, the value of the (right) **+plus** side of the Travel column has to be large enough so that when the Throttle Limit Control is at its maximum position the full throttle setting achievable by the throttle curve settings is not limited. Typically, a value between +100 % 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 turned off with the Throttle Limit Control, or to allow a carburetor to be closed enough so that the ICE engine can be turned off in conjunction with digital CH1 trimming. This value is usually best when left at +100%.

The variable limitation of the throttle travel allows the drive to be comfortably started and stopped. Generally this approach is much safer: for example, it could prevent the accidental activation of the CH1 control stick when a helicopter with an idling motor is being carried to the takeoff site.

If the carburetor or motor control unit is too open, a beep sounds when you turn on the transmitter or after a model change, and the following active warning message appears:



As long as the automatic switch on of the RF module is inhibited, the throttle limit or the throttle/pitch control stick lets the output signal of channel 6 be out of idle range.

### Tip

Monitor the influence of the Throttle Limit Control through the BASE submenu **Servo**. Remember that in the **mz-24 Pro** HoTT transmitter that servo output 6 controls the throttle servo.

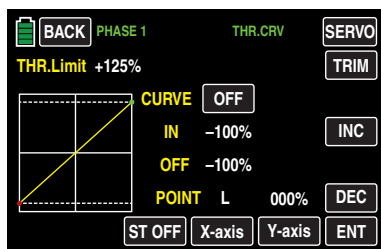
### Idle Basic Settings

Open the throttle limit all the way to the end point. Move the throttle/pitch control stick to the maximum pitch position and activate the standard throttle curve through the FUNCTION submenu **THR.CRV** (page 160).

### Throttle Curve

Access the throttle curve settings display through the FUNCTION submenu **THR.CRV**.

If the standard gas curve has automatically been changed after a model memory has been initialized, temporarily reset it to: **POINT L = 000%**, **POINT 3 = +050%** and **POINT H = +100%**:



### Notice



The position of the throttle trimming lever is irrelevant during the reset since it does not work when the throttle limiter is open.

Without starting the gas engine, completely open the carburetor by adjusting the throttle servo mechanically and by adjusting the servo 6 travel in the BASE submenu **E.P.A** (page 62).

Next, completely close the throttle limiter by turning the proportional dial **DV2** all the way clockwise. Use the throttle/pitch control stick trimming control to move the trimming position mark into the Motor OFF position.

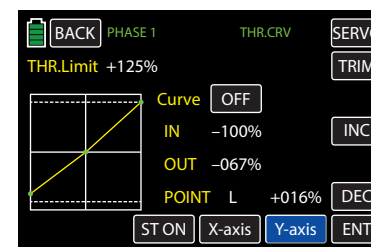
### Notice



The position of the throttle/pitch control stick is irrelevant when the gas limiter is closed. If only using the throttle limiter when adjusting the carburetor linkage, the throttle/pitch control stick can remain in the maximum pitch position while switching between full throttle (limiter open) and motor OFF (limiter closed).

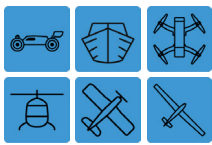
While the gas limiter is closed, adjust the carburetor linkage so that the carburetor is completely closed. Make sure that the throttle servo does not mechanically over-travel in the two extreme positions (full throttle/motor OFF).

Lastly, the setting range of idle trimming must be matched with **Point L** of the gas curve. On the Throttle Curve display, adjust Point L to approximately **+15 to +18%**, as shown in the example below:



To *precisely* adjust a seamless transition from idle trimming to the throttle curve: while the throttle limiter is closed and idle trimming is completely open, move the pitch control stick back and forth slightly at the minimum stop. 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 throttle limiter completely closed. Only adjust the idle with the throttle/pitch control stick trimming control, and only turn off the motor with digital trimming.

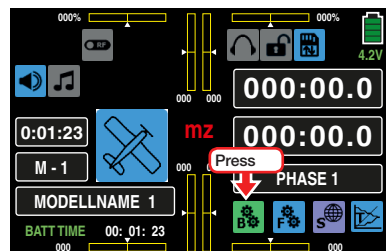


# Transmitter Output

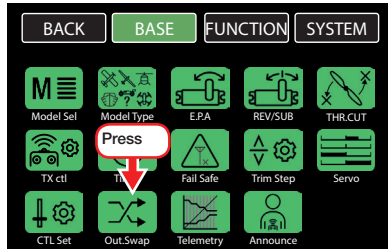
## Changing the Transmitter Outputs

The **mz-24 Pro** HoTT transmitter programming provides maximum flexibility in control channel receiver assignment allowing users to freely switch transmitter outputs 1 to 12 according to personal preference.

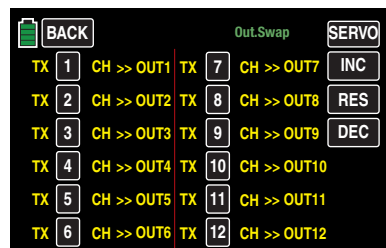
To change the transmitter output settings, from the main display press the **BASE** menu gear icon (green "B") to bring up the BASE submenu screen:



From the BASE submenu display, press the **Out.Swap** icon:



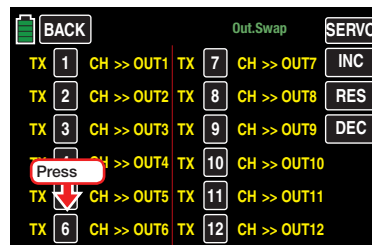
Use this display to assign the 12 transmitter *control channels* to *transmitter outputs* 1 - 12 according to personal preference:



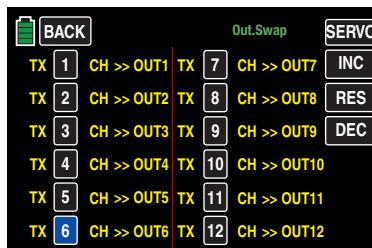
Remember that in the BASE submenu **Servo Monitor** display, the *control channels* are set according to the receiver assignment, and that the outputs are NOT changed.

### Programming

Press the value field in the line of the channel/output combination to be changed:



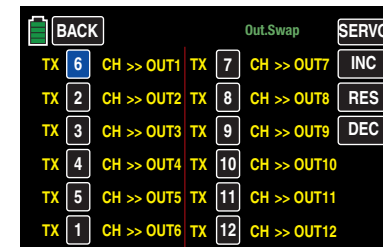
The field highlights blue:



Press the **INC** or **DEC** button at the right edge of the display to increase/decrease the value. Alternatively, press the arrow keys (▲▼) to the left of the display screen to achieve the same result.

Press the **RES** button to reset the changed value back to the default.

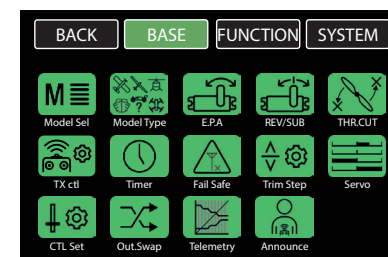
Use the same procedure for the other transmitter outputs, for example:



### Notice

Any subsequent changes to the settings, such as servo travel settings, dual rate/expo, mixer, etc., must always correspond with the original receiver assignment.

Touch the **BACK** button at the top left of the display to return to the BASE submenu:



### Example

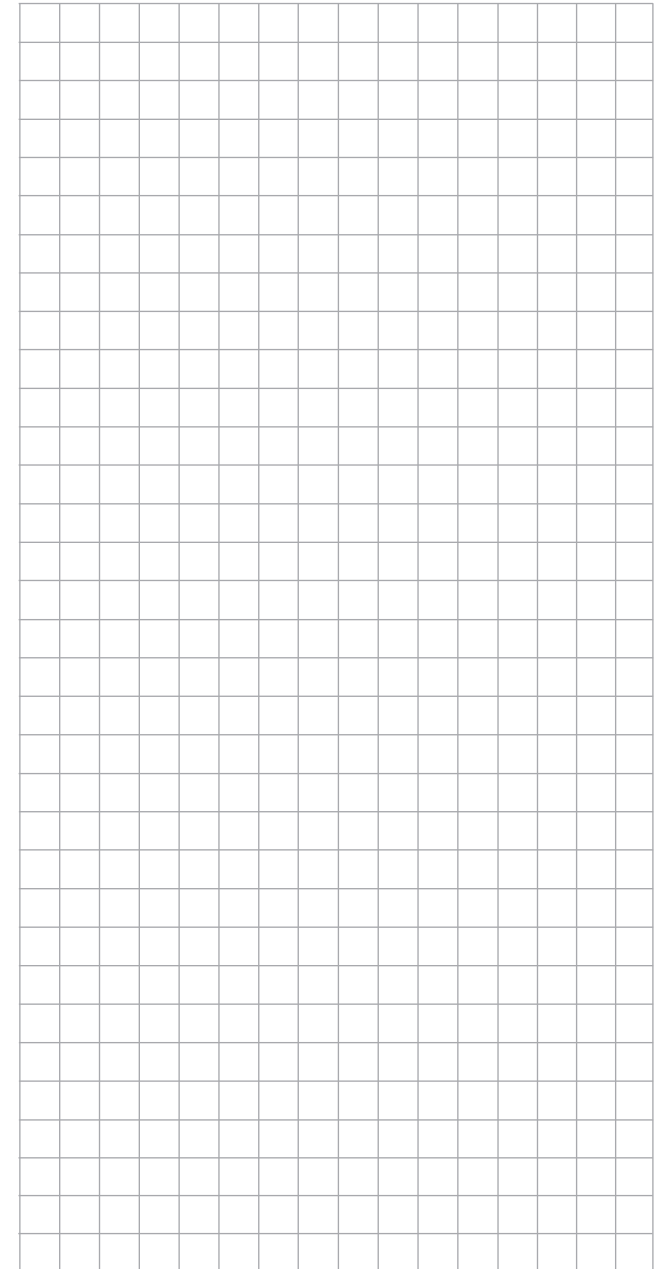
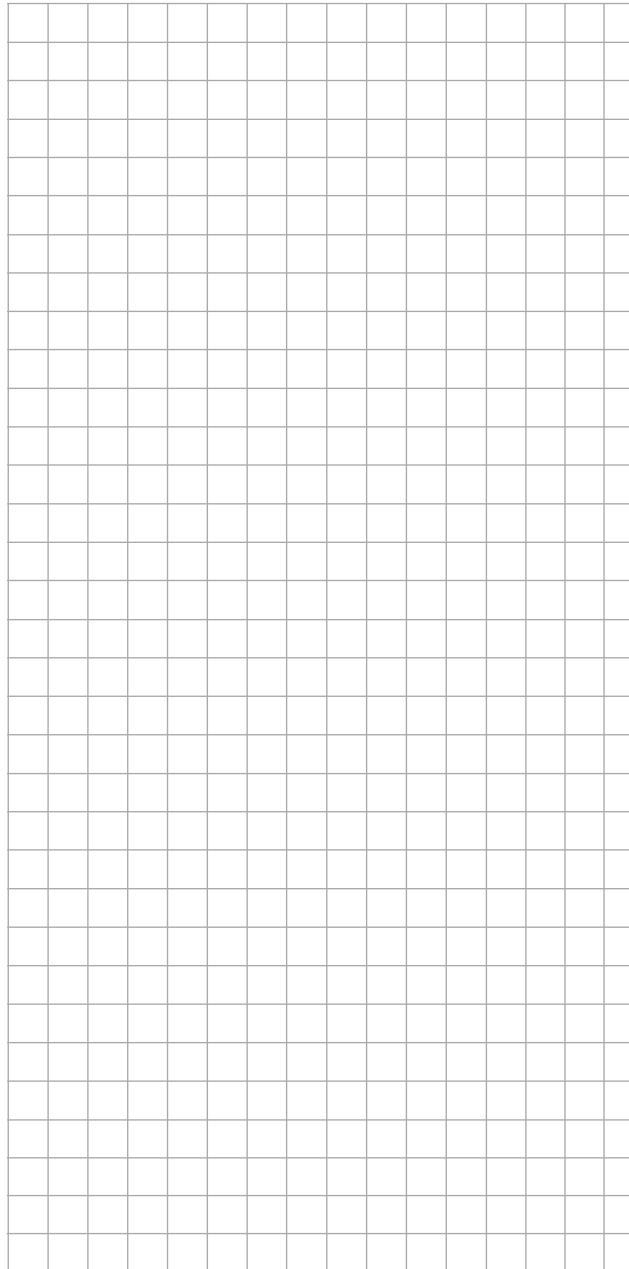
In the helicopter program for the **mz-24 Pro** HoTT transmitter, the outputs for a pitch servo and the throttle servo have been changed from previous *Graupner* transmitters. The throttle servo is now assigned to transmitter output 6, and the pitch servo is now assigned to output 1. To keep the previous configuration, switch channels 1 and 6 so that (control) channel 6 is at output 1 and vice versa.

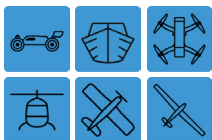


**Notice**



The **mz-24 Pro** allows the 12 transmitter control channels to be assigned according to personal preference in both single receivers as well as multiple receivers. Refer to the **Channel Mapping** section (page 104) of the BASE submenu **Telemetry** (page 98).





# 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 receiver connection is maintained by the feedback channel integrated in the HoTT receivers.

Up to four sensors can be connected through a V or Y cable at the telemetry connection of the HoTT receivers provided with actual firmware.

The Telemetry menus can be kept current by recent and future updates, and allow for additional functions or languages to be added and maintained.

### Tip

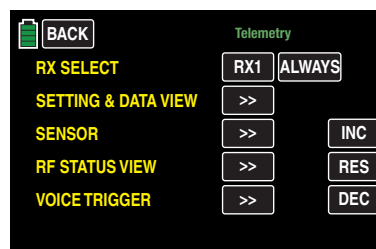
Automatic update notifications will be sent by e-mail once products are registered at [http://www.graupner-usa.com/PRODUCT-REGISTRATION\\_ep\\_56-1.html](http://www.graupner-usa.com/PRODUCT-REGISTRATION_ep_56-1.html).

### Notes



- **The following instructions are based on the functions available at the time this manual was drafted.**
- As noted in the **Binding Multiple Receivers** section (page 69), multiple receivers can be bound to a single model. Users can directly manage one or two receivers per model and use a setup menu to distribute the 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 between the transmitter and the most recently bound receiver.



Only these receivers can be addressed by the Telemetry menu. The selection may have to change before settings can be made to a specific receiver. This is because the second and subsequent receivers work in parallel in the Slave Mode.

- The telemetry data exchange between transmitter and receiver normally takes place after the four large RC data-packs are transmitted, resulting in a delay of control button reactions or setting changes. This does not constitute an error.
- When adjusting the remote control, make sure that the transmitter antenna is a minimum distance of 3 feet (1 meter) from the receiver antennas. Antennas too close to one another may cause an interruption in the feedback channel connection.
- All settings that have been made using the **Telemetry** menu (i.e. fail safe, servo rotation direction reversal, servo travel, mixer and curve settings, etc.) are saved in the receiver and are only transferred to other models when the receiver is changed.

The HoTT receiver should be reinitialized before use in another model. Refer to the Receiver Start Up and **Reset** section (page 14) for more information.

Only program the servo rotation direction, servo travel, mixer and curve settings, etc. in the transmitter with the model-specified standard menu. Settings will overlap different transmitters, causing operation failure.

- Transmitter control channels can be assigned according to personal preference within single or multiple receivers using the receiver-side channel assignment function called **Channel Mapping** (page 104). Additionally, multiple receiver outputs can be assigned the same control function. This is useful, for example, if using two servos (instead of one) to actuate each aileron, etc.

### WARNING

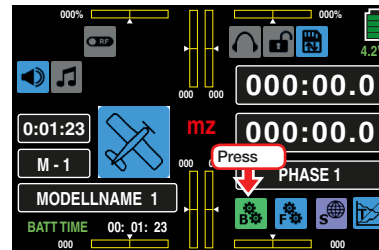


- **To avoid malfunctions from the feedback channel when operating towed models, maintain a minimum distance of approximately 20 inches (50 cm) between the participating receivers or their antennas. Using the satellite receiver is an option.**

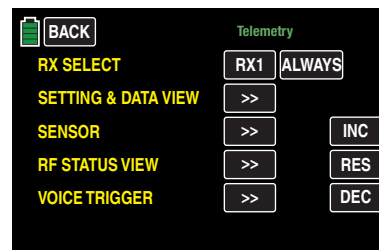
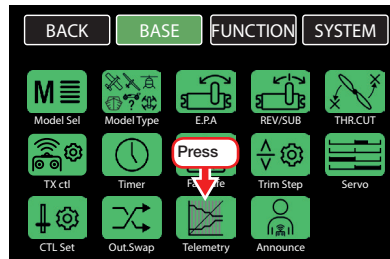
- To avoid accidental starts, models and sensors should only be programmed when the model is on the ground with the motor turned off or the drive battery disconnected.  
For example, a servo test that accidentally activates the receiver could cause the model to crash and cause injury or property damage.
- Consult the safety instructions contained in the Part 1 of the manual included in the transmitter packaging.

### Telemetry

To change the telemetry settings, from the main display press the **BASE** menu gear icon (green “B”) to bring up the BASE submenu screen:



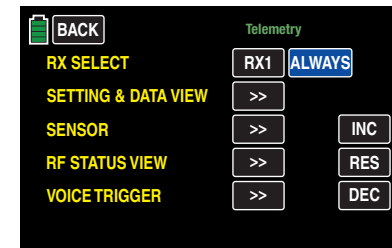
From the BASE submenu display, press the **Telemetry** icon:



### Basic operation

The **Telemetry** menu corresponds to the other menus of the **mz-24** HoTT Pro transmitter; the few deviations are described below:

If you have bound a receiver as RX1 or RX2 in the BASE submenu **TX ctl**, then designate one of the two receivers as the "telemetry-receiver" by changing the value of the field to the right of **RX1** in the RX SELECT line. It is standard practice to default to the most recent receiver bound. To change the default setting **ALWAYS**, press to highlight the field blue:



Press the **INC** or **DEC** button at the right edge of the display to change the value. Alternatively, press the arrow keys (▲▼) to the left of the display screen to achieve the same result.

Press the **RES** button to reset the changed value back to the default (ALWAYS).

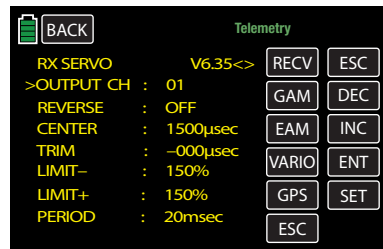
Value	Explanation
<b>ALWAYS</b>	The transmitter reacts to the back-channel of the selected receiver with normal/standard functionality.
<b>4TIME</b> <b>8TIME</b>	The transmitter reacts to the back-channel of the selected receiver with the selected delay.
<b>OFF</b>	The transmitter telemetry functions are turned off.

### Notice

Using settings other than the **ALWAYS** default is only suggested if two non-connected receivers are bound to two different transmitters for close distance use, as the back-channel of one of the two receivers is often disrupted.

Specifically, there is the possibility of back-channels reciprocal interference, e.g. a camera drone with separate camera and drone control or a towing model for model-parachute.

Scroll between the individual **Telemetry** menu pages by pressing the **ENT** (forward) and **ESC** (reverse) buttons. Angled brackets “>” and “<” will appear on the RX line indicating the direction of additional pages:



If only one angled bracket is showing, this indicates the first or final menu page; scroll only in the direction indicated.

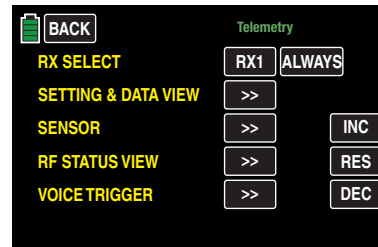
To change parameters on a menu lines, move the left-hand line bracket (seen above to the left of the OUTPUT CH line). Press the **INC** or **DEC** button to move the “>” pointer up or down one line. The bracket will automatically skip menu lines which cannot be changed.

To change a parameter, place the pointer on the menu line and press the **SET** button at the right edge of the screen. The parameter to be changed highlights white:



Press the **INC** or **DEC** buttons to change the value within the selected range. Press the **SET** button to confirm and store to the receiver memory.

Press the **ESC** button at the top right of the display to return to the previous page; press the **BACK** button at the top left of the Telemetry display to return to the BASE submenu screen:



### Notices

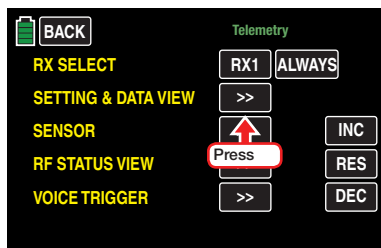


- If an active warning message appears instead of the desired Telemetry page menu, then there is no connection with the receiver. Turn on the receiver system, bind the receiver or activate it in the RX SELECT line as described above in the Basic Operation section (page 99).
- If an active warning message appears unexpectedly while the Telemetry page menu is being programmed, the connection to the receiver system has been suddenly lost. Turn the receiver system off and on again, or find the origin of the connection failure, or re-bind the receiver.

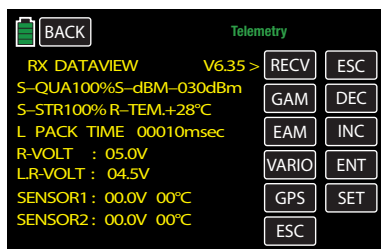
# SETTINGS AND DISPLAYS

## SETTING & DATA VIEW

Press the “>>” brackets in the SETTING & DATA VIEW line of the BASE submenu **Telemetry** main display:



This screen is for informational purposes only and not for making or adjusting settings:



Value	Explanation
V#.##	Receiver firmware version
S-QUA	Signal quality percentage from transmitter to receiver
S-dBm	Signal decibel-milliwatt level percentage from transmitter to receiver
S-STR	Signal strength percentage from the transmitter to receiver
R-TEM.	Receiver temperature in °C
L PACK TIME	Lost package duration in milliseconds showing longest duration in which data packs were lost during transmission
R-VOLT	Receiver current operating voltage

L.R-VOLT	Last receiver current operating voltage since the previous time the receiver was turned on
SENSOR1	Sensor 1 additional telemetry voltage and temperature in °C
SENSOR2	Sensor 2 additional telemetry voltage and temperature in °C

## S-QUA (Signal Quality)

This percentage represents the quality of the signal packages sent from the transmitter arriving at the receiver’s microprocessor.

This evaluation is shown live on the transmitter's display via the receiver's feedback channel.

## S-dBm (Reception Level)

dBm is a logarithmic value used to quantify power ratios in decibels. Here, it provides a comparative overview of the extreme differences in radio and receiver levels. A level of 0dBm = 1 mW. The dBm is positive for an output of >1 mW and negative for an output of <1 mW.

Specifically, this means that in typical remote control systems, generally less than 1 mW (or <0 dBm) is received by the receiver from a 100 mW output of a standard transmitter (or 20dBm). This is because radio waves fan out from the transmitter, which weakens the signal as it travels 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 while performing a Range Test.

Perform a **Range Test** (page 71) before each flight, and simulate all servo movements that could occur during the flight. The range must be at least 164 feet (50 m) on the ground in an activated range test. At this distance, a value no less than **-80dBm** may be displayed in the **RX DATAVIEW** display in the **S-dBm** line to ensure safe operation. If the value is lower, e.g. -85 dBm, do not operate the model. Check the receiver installation and antenna position.

During operation, if the reception falls below -90dBm, immediately reduce the distance between the transmitter and the model. Typically, before this level is reached the acoustic range warning is triggered (1 beep per second). The acoustic range warning *reflects the signal strength* of the feedback channel to ensure safe operation.

## S-STR (Signal Strength)

The signal strength is displayed in a percentage. In general, an acoustic range warning (1 beep per 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 safety reasons until the warning tone stops.

**R-TEM. (Receiver Temperature)**

The receiver temperature must remain within an acceptable range during all flight conditions (ideally between -10° to +55°C).

The receiver temperature threshold triggers a warning, which can be set in the submenu **RX SERVO TEST** under **ALARM TEMP+** (50 to 80°C) and **ALARM TEMP-** (-20 to +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**. In the **RX DATAVIEW** display, the parameter **R-VOLT** is displayed in white.

**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)**

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 or white at the top right in the receiver menu **RX**. In the submenu **RX DATAVIEW**, the parameter **R-VOLT** is displayed in white.

The current receiver battery voltage is displayed in the receiver menu.

**CAUTION**



**Always keep an eye on the receiver's operating voltage. If it is too low, do not operate or start the model.**

**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 turned on.

**Attention**



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 and/or the resistance of the wiring is too high. In this case, check and correct the power 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**

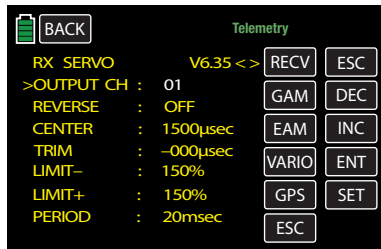


Before changing settings on this display page, refer to the **Notices** at the beginning of the BASE submenu **Telemetry** section (page 98).

Value	Explanation	Settings
<b>V#.##</b>	Receiver firmware version	None
<b>OUTPUT CH</b>	Selected channel	1+ (depending on the receiver)
<b>REVERSE</b>	Servo reversal	OFF / ON
<b>CENTER</b>	Servo center in µs	Currently set "servo neutral position"
<b>TRIM</b>	Trim position in µs deviation from the CENTER position	-120 µs to +120 µs
<b>LIMIT-</b>	Limit (in percentage of servo travel) the <b>-minus</b> side of the servo travel	30% to 150 %
<b>LIMIT+</b>	Limit (in percentage of servo travel) the <b>+plus</b> side of the servo travel	30% to 150 %
<b>PERIOD</b>	Cycle time in ms	10 ms or 20 ms

**OUTPUT CH (Selected Channel)**

Select with the bracket the **OUTPUT CH** line by pressing the **INC** or **DEC** buttons and press the **SET** button in the lower right side of the display. The parameter is displayed in white:



Select the desired receiver servo connection (such as 01) using the **INC** or **DEC** buttons.

### Notice



The following parameters refer to the example connection as shown in the above graphic.

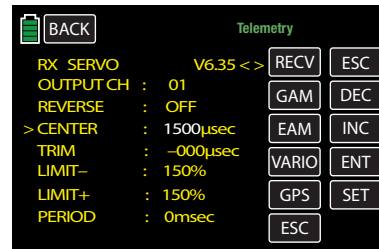
### Reverse (Servo Reverse)

When the value field is *active*, this sets the rotation direction 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  $\mu$ s. The set channel pulse time of 1500  $\mu$ s is the standard center position and hence the normal servo center.

To change this value, select with the bracket the **CENTER** line and press the **SET** button at the bottom right of the display. The value field is displayed in white:



Now move the corresponding control, control stick and/or trimming control into the desired position and press the **SET** button again. This position is saved as the new neutral position.

The new value displayed is determined by the current position of the control influencing this control channel, and the position of the trim (where applicable) when the **SET** button was pressed.

### TRIM (Trimming Position)

Use the TRIM line to sensitively adjust the neutral position in 1- $\mu$ s increments of a servo connected to the control channel selected in the OUTPUT CH line. Select with the bracket the **TRIM** line and activate the value field by pressing the **SET** button at the bottom right of the display. The TRIM parameter is displayed in white. The TRIM value set here can be adjusted  $\pm 120 \mu$ s with the **INC** or **DEC** buttons.

Default factory setting: 0  $\mu$ s.

### LIMIT-/+ (Side-Dependent Limit -/+)

Use this option to adjust a side-dependent limit of the servo travel (rudder deflection) of the servo connected to the receiver output selected in the OUTPUT CH line.

A separate adjustment for both directions can be entered between 30% to 150%.

Default factory setting: 150%.

### PERIOD (Cycle Time)

Use this option to specify the periods for the individual channel pulses. This setting is transferred for all control channels.

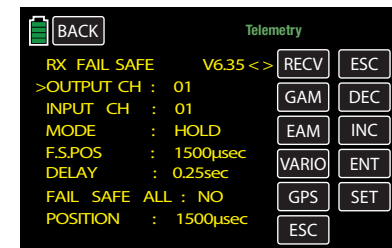
When using digital servos, set a cycle time of 10 ms.

### Attention



For systems that includes some analogue servos (or use them exclusively), always select **20 ms** or the analogue servos may overload and respond by "jittering" or "growling".

### RX FAIL SAFE



Regarding the Fail Safe function, please note:

Failure to set this function is not recommended. **HOLD** is the default setting in the base menu of all the HoTT receivers. This allows the receiver to hold the last position in the event of transmission disconnection.

Ideally, in the event of a malfunction a flying model will fly straight for a certain amount of time and then land without causing too much damage. Failing to set the fail safe function may cause the airplane to become uncontrollable and buzz the flight field, endangering pilots and spectators.

At the least, it is recommended to program **Motor OFF** to prevent such risks. Consult with an experienced pilot for settings tailored to the specific model being used.

The **Switch-On Fail Safe** function should always be utilized; if after turning the receiver system on and no valid signal from the transmitter is received, all servo outputs will default to pre-defined signals so that, for example, retractable landing gear will not close unexpectedly or other unwanted actions could occur.

The easiest way to program fail safe settings is to use the BASE submenu **Fail Safe**.

A slightly more involved method is the **FAIL SAFE ALL** option (page 105-106), which will achieve the same results.

A relatively complex method of individual adjustments is the set through the **RX FAIL SAFE** menu of the Telemetry screen. Refer to the **MODE**, **F.S.POS** and **DELAY** sections (page 104-105) for a description of this option.

Value	Explanation	Settings
<b>V#.#</b>	Receiver firmware version	None
<b>OUTPUT CH</b>	Output channel (receiver servo connection)	1 + (depending on the receiver)

<b>INPUT CH</b>	Input channel (transmitter control channel)	1 to max. 12
<b>MODE</b>	Fail safe mode	HOLD FAIL SAFE OFF
<b>F.S.POS</b>	Fail-Safe position	1000 to 2000 $\mu$ s
<b>DELAY</b>	Reaction time	0.25, 0.50, 0.75 and 1.00 s
<b>FAIL SAFE ALL</b>	Save the fail safe positions of all control channels	NO SAVE
<b>POSITION</b>	Display the saved fail safe position	between approximately 1000 and 2000 $\mu$ s

#### OUTPUT CH (Servo Connection)

Use the OUTPUT CH line to set the receiver servo connection.

#### INPUT CH (Channel Mapping)


As mentioned in the **Notices** at the begin of the BASE submenu **Telemetry** section (page 98), the 12 control channels of the 12-channel **mz-24 Pro** HoTT transmitter can be distributed according to personal preference within a receiver, or to several receivers, or several receiver inputs can be assigned the same control function. This function is useful, for example, 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 recommended for large models to avoid, for example, requiring long servo cables.

Note: only the receivers selected in the **RECEIVER SELECT** line can be programmed by the Telemetry menu.

The 12 control channels (INPUT CH) of the **mz-24 Pro** can be similarly set by assigning the servo connection of the receiver selected in the OUTPUT CH line to the INPUT CH of another control channel by channel mapping.

#### Notice

 For example, if 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 (receiver servo connections) 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 (receiver servo connections). In this case, default rudder channel 4.

#### MODE (Methods)

Setting the MODE, F.S.POS and DELAY options determine the receiver response when there is an interruption in transmission between the transmitter and receiver.



The setting programmed under **MODE** *always* refers to the channel set in the line **OUTPUT CH**.

The default factory setting for all servos is HOLD.

For each selected OUTPUT CH (receiver servo channel), choose between the following:

- **FAI-SAFE** (Fail Safe)

In the event of a malfunction, a delay (as set in the DELAY line) will occur, and the corresponding servo will move into the position displayed (in  $\mu\text{s}$ ) in the POSITION line. The servo will remain in this position for the duration of the malfunction.

- **HOLD**

In the event of a malfunction, the servo remains in the last servo position successfully received.

- **OFF**

In the event of a malfunction, the receiver stops transmitting (buffered) control pulses for the relevant servo output and the receiver switches the pulse line off.

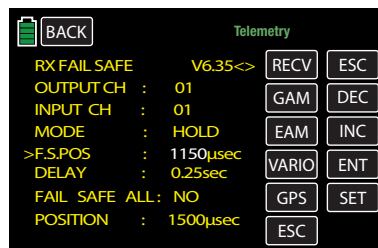
### Notice

» 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 connection), set the fail safe position for the servo to assume in a malfunction in the F.S.POS line by using the **INC** or **DEC** buttons.

The setting is made in 10- $\mu\text{s}$  increments, as shown below:



Default factory setting: 1500 $\mu\text{s}$  (servo center).

### Attention

» In all three modes OFF, HOLD and FAI-SAFE (fail safe), the function **F.S.POS** is particularly important when waiting for a valid signal after turning on the receiver because the servo automatically moves into the fail safe positions set in the POSITION line. This prevents unwanted or incorrect actions to occur whenever the receiver is accidentally turned on while the transmitter is off. In normal model operation, during a malfunction the corresponding servo acts according to the MODE setting.

### DELAY (Fail Safe Reaction Time or Delay)

Set the time delay between when the signal is interrupted and when the servos move to their set positions. This setting is adopted by all the channels and only affects the servos programmed for FAI-SAFE (fail safe) mode.

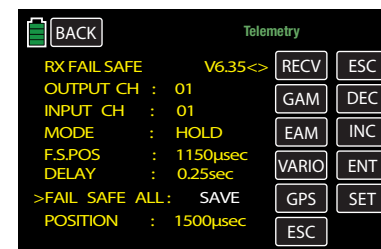
Default factory setting: 0.75s.

### FAIL SAFE ALL (Global Fail Safe Setting)

This selection allows you to easily determine the servos fail safe positions in a manner similar to the BASE submenu **Fail Safe**:

Press the **INC** or **DEC** button at right of the display to move the bracket to the FAIL SAFE ALL line and press the **SET** button to activate the value field. The current setting highlights white. Change the parameter by pressing the **INC** or **DEC** buttons until the **SAVE** option appears.

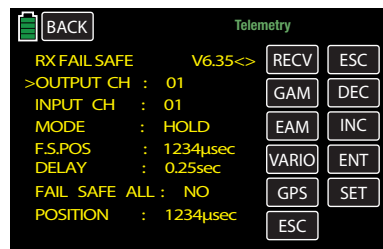
Simultaneously, use the transmitter control elements to move all the servos: those assigned in the **MODE: FAI-SAFE** line, any others programmed to take a specific position during the switch-on phase of the receiver system, and those with a set fail-safe position. In the bottom POSITION line, the current servo position is displayed for the selected OUTPUT CH, as shown in the example below:



Press the **INC** or **DEC** button to change the line option 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 during a malfunction.

Release the control elements of the transmitter.

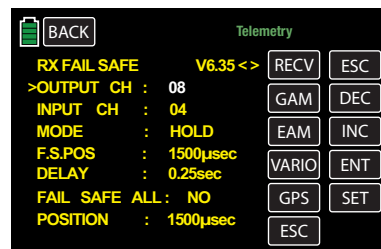
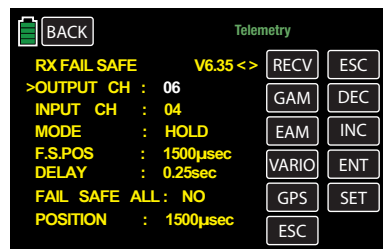


Turn off the transmitter and verify the fail safe positions by checking the servo travel.

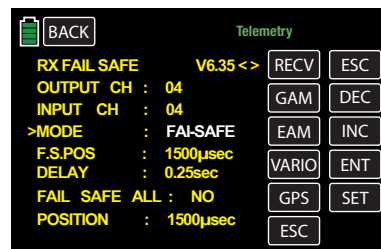
### Fail Safe in Combination With Channel Mapping

Make sure that mapped servos (controlled by common control channels) react in the same way during a malfunction. Use the corresponding settings of the INPUT CH to manage the mapped servo behavior.

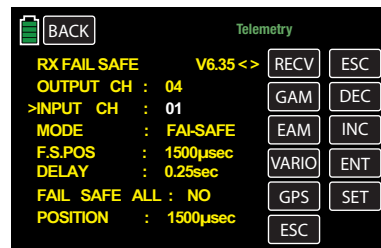
In the example below, receiver servo connections **06**, **07** and **08** are mapped by assigning the same control channel **04** as the INPUT CH to OUTPUT CH (receiver servo connections):



The INPUT CH 04 determines the fail safe behavior 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 connection 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 mode FAI-SAFE (fail safe).

## RX FREE MIXER



Value	Explanation	Settings
<b>V#.#</b>	Receiver firmware version	None
<b>MIXER</b>	Mixer selection	1 to 5
<b>MASTER CH</b>	Signal source or source channel	0, 1 + depending on the receiver
<b>SLAVE CH</b>	Target channel	0, 1 + depending on the receiver
<b>S-TRAVEL-</b>	Mixing (in percentage of servo travel) the <b>-minus</b> side of the servo travel	0% to 100 %
<b>S-TRAVEL+</b>	Mixing (in percentage of servo travel) the <b>+plus</b> side of the servo travel	0% to 100 %
<b>RX WING MIXER TAIL TYPE</b>	Tail type	NORMAL, V-TAIL (V-LW) ELEVON (elevator/aileron mixer for delta and flying wing)

### MIXER

Up to five mixers can be programmed in the MIXER-line by selecting one of mixers 1 to 5.

The settings programmed in this display *only* relate to the mixers selected in the MIXER line.

## Notice



If you have already programmed mixer functions in the FUNCTION submenus *Wing MIX* or *Prog. MIX*, pay special attention to ensure that these mixers do not overlap with those in the *RX FREE MIXER* menu!

## MASTER CH (Source Channel)

According to the same principles described in the **General Information on Programmable Mixers** section (page 133), the signal at MASTER CH (source) can be mixed with the SLAVE CH (target) to an adjustable amount.

Select **00** if you do not require the mixer.

## SLAVE CH (Target Channel)

The signal of the MASTER CH (source) is proportionately mixed with the SLAVE CH (target). The level of mixing is determined by the percentages entered in the TRAVEL- and TRAVEL+ lines.

Select **00** if you do not require the mixer.

## TRAVEL-/+ (Level of Mixing in %)

With the settings of these two lines, the percentage of mixing is specified separately for both directions in relation to the MASTER signal.

## RX WING MIXER TAIL TYPE (Tail Type)

### Notice



The following details are also programmable in the BASE submenus *Model Sel* and *Model Type* menu and should preferably be preset there. In this case, *always* leave the TAIL TYPE at NORMAL.

To use the mixers integrated in the receiver, 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

Often the installation of servo and rudder linkages are different. If the rudder travel is not as described above, refer to the **Receiver Configuration** instructions on how to setup servos with wrong rotation direction (page 33).

- **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:

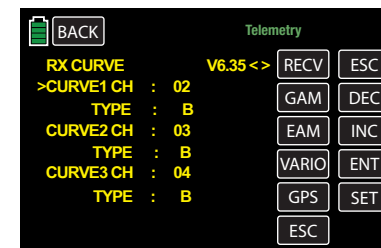
**OUTPUT CH 2:** Aileron/elevator, left

**OUTPUT CH 3:** Aileron/elevator, right

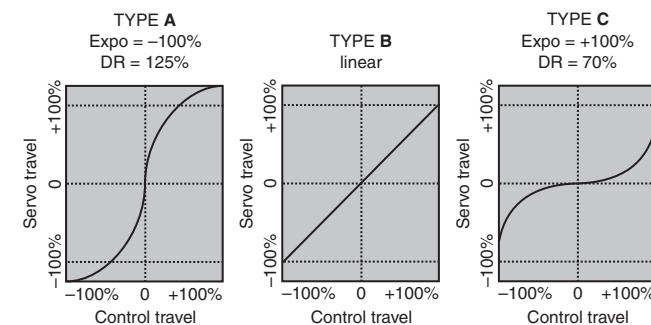
Often the installation of servo and rudder linkages are different. If the rudder travel is not as described above, refer to the **Receiver Configuration** instructions on how to setup servos with wrong rotation direction (page 33).

## RX CURVE

With the RX CURVE function, you can administer control characteristics for up to three servos:



Value	Explanation	Settings
V#.#	Receiver firmware version	None
CURVE 1, 2 or 3 CH	Channel assignment of the respective curve setting	1 + depending on the receiver
TYPE	Curve type	A, B, C (see figure below)



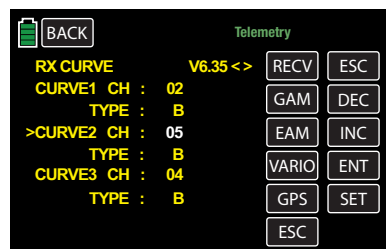
Generally, a nonlinear control function is used for the aileron (channel 2), elevator (channel 3) and rudder (channel 4). These channel settings also correspond to the default factory setting.

### Note



This assignment is only applicable to tail types other than V-wing or 2ElevSv 3+8, or flaps other than 2AILE or 2/4AILE 2/4FLAP. 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.

Set two curves, for example, if a model's flaps are specified as **2AILE** and pilots wish use the **RX CURVE** option instead of the individually programmable FUNCTION submenu D/R,EXP (page 124). 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 *control 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 to about 125% of the servo travel.

### B Linear setting.

The Servo follows the control stick travel in a linear manner in case of unchanged servo travel.

### C EXP = +100 % and D/R = 70%

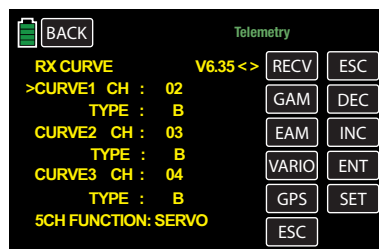
The servo reacts weakly to control stick movement around the neutral position. The curve becomes steeper as the rudder deflection reduces to about 70% of the servo travel.

### Notice



The control characteristics that are programmed here affect the all mapped receiver outputs.

### 5CH FUNCTION: SERVO or SENSOR



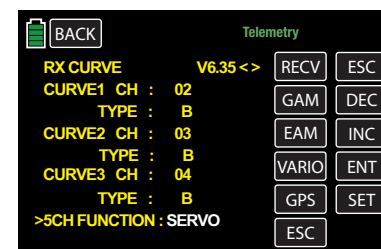
With certain receivers, a certain servo connection is designed to be switchable instead of an independent telemetry connection. For example, with the GR-12L receiver a telemetry sensor can also be connected to servo connection 5 (identified as 5T):



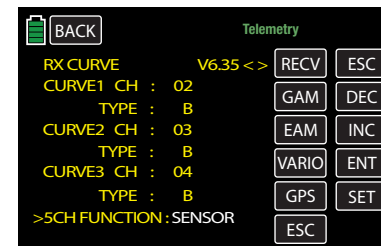
Connect the servo with either the receiver update adapter cable (No. **7168.6S**) or a telemetry sensor.

In order for the connected device to be correctly identified by the receiver, servo connection 5 **MUST** be switched from SERVO to SENSOR and vice versa.

Press the **INC** or **DEC** button to move the bracket to the **5CH FUNCTION** line, and press the **SET** button at the bottom right of the display. The field highlights white:



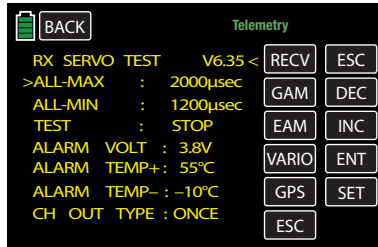
Use the **INC** or **DEC** button to select the alternative setting **SENSOR**:



Press the **SET** button again to save the selection. To return to the main display of the transmitter, repeatedly press 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	Settings
V#.#	Receiver firmware version	None
ALL-MAX	Servo travel (+plus side) for all servo outputs for the servo test	1500 to 2000 µs
ALL-MIN	Servo travel (-minus side) for all servo outputs for the servo test	1500 to 1000 µs
TEST	Test procedure	START / STOP
ALARM VOLT	Alarm threshold for the receiver's low voltage warning	3.0 to 7.5 V default factory setting: 3.8 V
ALARM TEMP+	Alarm threshold when the receiver temperature is too high	50 to 80 °C default factory setting: 55 °C

<b>ALARM TEMP-</b>	Alarm threshold when the receiver temperature is too low	-20 to +10 °C default factory setting: -10 °C
<b>CH OUTPUT TYPE</b>	Channel sequence or type of aggregate symbol	ONCE, SAME, SUMI, SUMO and SUMD

### ALL-MAX (Servo Travel +plus Side)

In this line, set the maximum servo travel on the plus side of the control travel for the servo test.

2000 µs corresponds to a full deflection on the +plus side of the servo travel, and 1500 µs corresponds to the neutral position.

Make sure that the servos do not strike anything during the test routine.

### ALL-MIN (Servo Travel -minus Side)

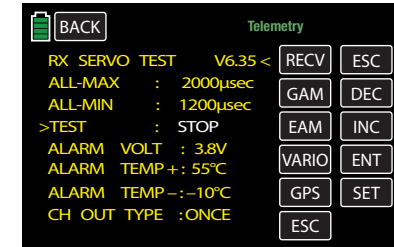
In this line, set the maximum servo travel on the -minus side of the control travel for the servo test.

1000 µs corresponds to a full deflection on the -minus side of the servo travel, and 1500 µs corresponds to the neutral position.

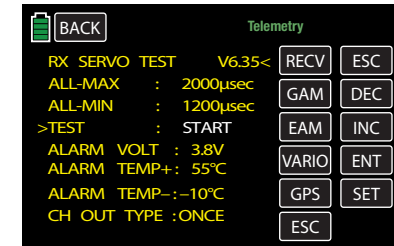
Make sure that the servos do not strike anything during the test routine.

### TEST (Start/Stop)

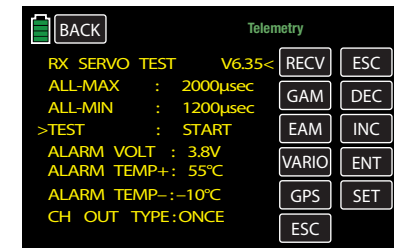
Use this line to start and stop the servo test integrated in the receiver. Press the **INC** or **DEC** button to move the bracket to the **TEST** line, and press the **SET** button at the bottom right of the display. The field highlights white:



Use the **INC** or **DEC** button to select the **START** setting:



Press the **SET** button again to save the selection. To return to the main display to start the test. The entry field returns to normal (yellow):

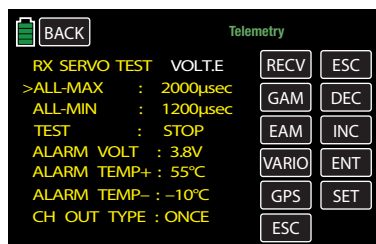


To stop the servo test, reactivate the entry field as described above, choose **STOP** and confirm by pressing the **SET** button.

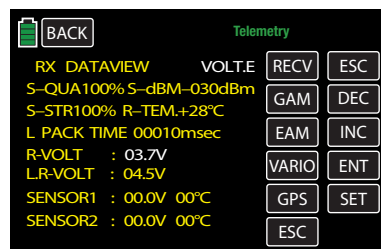
### ALARM VOLT (Receiver Low Voltage Warning)

Through the ALARM VOLT line the operating voltage of the receiver is monitored. The alarm threshold can be set between 3.0 and 7.5 Volts in 0.1 Volt increments.

When the voltage falls below the set alarm threshold, a warning tone sounds, and **VOLT.E** appears in white at the top right in all RX displays:



In the RX DATAVIEW display, the parameter **R-VOLT** is displayed in white:



### ALARM TEMP +/- (Receiver Temperature Monitoring)

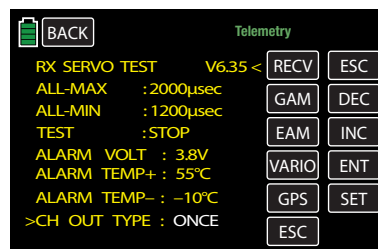
These two options monitor the receiver temperature: program the bottom threshold **ALARM TEMP-** (-20 to +10°C) and the upper threshold **ALARM TEMP+** (+50 to +80°C). If the upper or lower thresholds are exceeded, a continuous warning tone sounds, and **TEMP.E** appears in white at the top right in all receiver displays. On the display page RX DATAVIEW, the parameter **R-TEM** is also displayed in red or white.

Make sure that the temperature of the 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 signal type of the aggregate signal output:

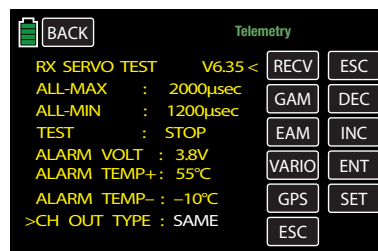
- **ONCE**



The servo connections of the receiver are actuated sequentially; recommended for analog servos.

With this setting, the servos are automatically operated at a cycle of 20ms (30 ms for a 12 channel GR-24 receiver (No. **33512**) regardless of what is set or displayed in the RX SERVO display in the line PERIOD.

- **SAME**



The servo connections of the receiver are actuated simultaneously in blocks: servos connected to connections 1 to 4 as well as 5 to 8 can be simultaneously supplied with their control signals with a GR-16 receiver (No. **33508**), and the servos connected to connections 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 (No. **33512**).

This is recommended for digital servos when several servos are used for a single function (i.e. an aileron) so that the servos are fully synchronized.

When exclusively digital servos are used, it is recommendable to set **10 ms** in the **PERIOD** line of the RX SERVO display to increase digital servo reaction time. When analogue servos or mixed operation is used, select **20 ms**.

### Attention

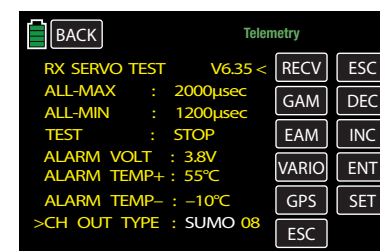
When this setting is used, use increased receiver power supply. The four servos are always triggered simultaneously in the SAME setting, causing greater drain on the power supply.

- **SUMO (Aggregate Signal OUT)**

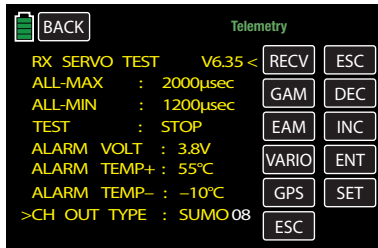
A HoTT receiver configured as SUMO always generates an aggregate signal from the control signals of all its controls channels, and forwards this to servo connection 8 of the GR-16 (No. **33508**) and GR-24 receiver (No. **33512**).

With receivers that have a two-digit number to the right of SUMO line in their display, the selection determines the *highest* control channels within the SUMO signal.

Press the **INC** or **DEC** button to move the bracket to the **CH OUT TYPE** line, and press the **SET** button at the bottom right of the display. The field highlights white. Use the **INC** or **DEC** button to select the **SUMO** setting:



Press **SET** again to confirm selection and move to the channel selection field:



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 sum signals of the channel 1 to x will be generated in a 20ms cycle to the related output (the GR-32 DUAL receiver (No. **33516**) uses a 30ms cycle) if the RX SERVO display page PERIOD line is set to 10ms.

This function is primarily utilized for the satellite operation of two HoTT receivers (see below). The aggregate signal that is generated by the receiver and defined as 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 with adapter cable (No. **33310**).

### Satellite Mode

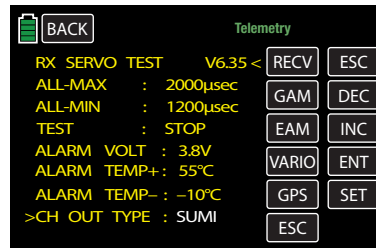
In Satellite Mode, two HoTT receivers are connected to each other with a 300mm (No. **33700.1**) or 100mm **33700.2** 3-wire connecting cable to servo connections for specific receiver types. For example, GR-16 receivers (No. **33508**) and GR-24 (No. **33512**) are connected to each other through servo output 8.

By contrast, GR-32 DUAL receivers (No. **33516**) have their own aggregate signal connection at the bottom left identified with - + S.

With 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 (main receiver). The main receiver needs to be programmed as SUMI (see below).

### SUMI (Aggregate Signal IN)

This setting allows the signal to always run 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 programmed SUMO satellite receiver reception fails, 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 reception fails for both receivers *at the same time*, then the fail safe settings of the SUMO are assumed in the most recent receiver software that was current when these instructions were revised.

### Notice

» In individual cases, interactions may occur. It is strongly recommended that relevant tests be performed before starting the model.

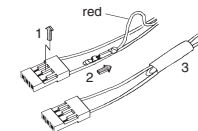
This receiver configuration is recommended when flight direction can restrict range, for example, if one of the two receivers is installed in the model at a location with poor reception or where nozzles, carbon fiber material, etc. may weaken reception.

The most important control function should 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 RECEIVER SELECT line of the **Telemetry** menu (RX 1 to 2), as explained in the beginning of the **Telemetry** section (page 107).

Each receiver should be connected to the common power supply with its own cable. With receivers subject to high current load, it may be necessary to connect them to the common power supply with two cables.

If 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:



For additional programming, such as fail safe settings, disconnect the 3-pin satellite connection between the two receivers and only turn on the relevant receiver. The binding sequence may also need to be changed.

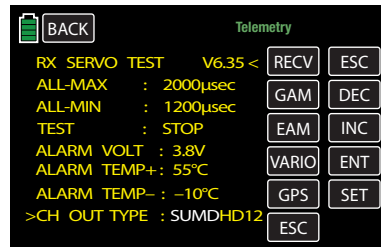
• **SUMD (Digital Sum Signal)**

A HoTT receiver configured as SUMD always generates a digital aggregate signal from the control signals of a selectable number of its controls channels and forwards this to servo connection 8 in the GR-16 and GR-24 receivers. Refer to the **SUMO** section (page 110) for more information.

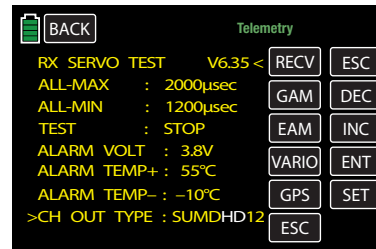
At the time of this writing, this type of signal is being used by several of the latest electronic applications of flybarless systems, power supplies, etc.

**Notice**

» Consult the setting instructions for any attached device to ensure the model will be able to fly.



After confirming SUMD by touching the **SET** button at the bottom right in the display, the active value field moves right and highlights the next field. In the event of reception loss, choose one of the three possible receiver reactions (fail safe):

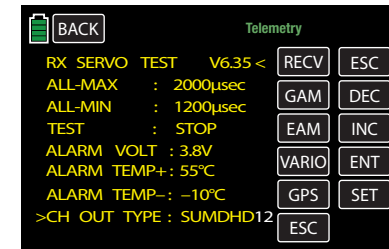


- **HD (Hold)**  
The last recognized signal is retained at the output (hold).
- **FS (Fail Safe)**  
The pre-selected fail safe position signals are provided at the output. Refer to the **Fail Safe** section (page 80).
- **OF (OFF)**  
No signals are supplied during reception loss.

**Attention**

» Analogue servos and many digital servos no longer experience resistance to the on-going control pressure after control pulses stop and are moved out of their position at greater or lesser speed.

Finally, switch the active field to channel selection by touching the **SET** button. With the selection, you determine the *highest* transmitter channels within the SUMD signal.



**Tip**

Connected devices normally do not require a value greater than 12.



## SENSOR SETTINGS and DISPLAYS

If one or more sensors are connected to a receiver and a telemetry link exists with this receiver, retrieve the sensor display and change its settings in the RX SERVO TEST screen (page 109).

### Tip

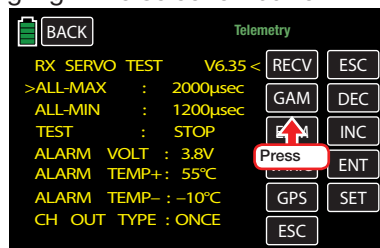
The **mz-24 Pro** HoTT transmitters automatically recognize any sensor(s) connected to a **switched on** receiver or sensor(s) that have been connected after the power supply is turned on.

If at least one sensor connected to the telemetry receiver and it has firmware from the same Vx firmware package as the receiver, change directly between the individual devices by pressing a selection button.

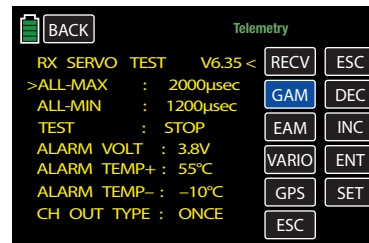
- The abbreviations on the selection buttons stand for the following:

- RECV** = Receiver
- GAM** = General Air Module
- EAM** = Electric Air Module
- VARIO** = Vario Module
- GPS** = GPS Module
- ESC** = Electronic Speed Controller

Press to highlight the selection button:



The field highlights blue:

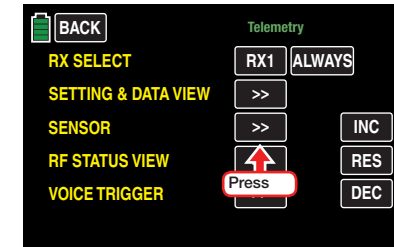


If a sensor was recognized by the receiver after it was turned on, an angled bracket (>) appears. Press the **ENT** button and check or change its settings as described in the instructions that came with the sensor.

## SENSOR

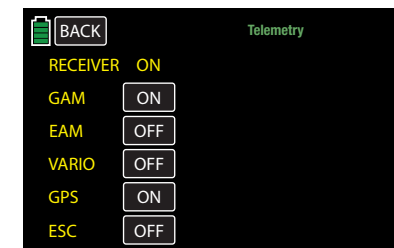
### Active/Inactive Sensor Display

To open the sensor submenu, press the button in the **SENSOR** line:



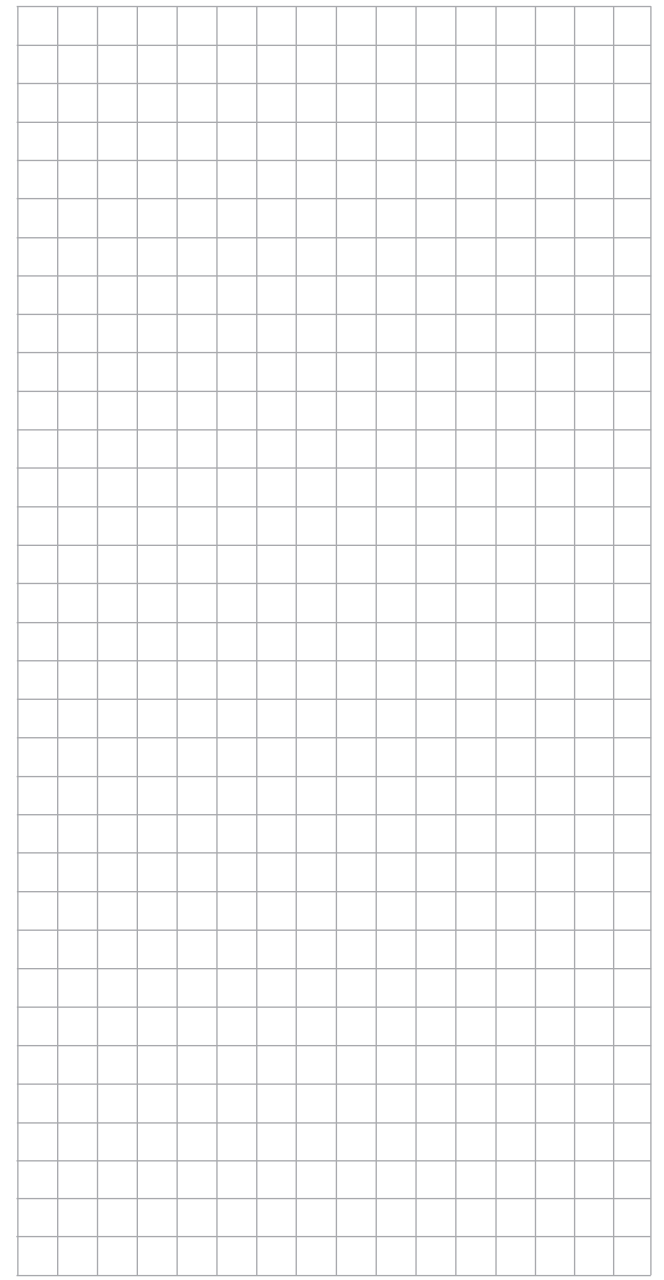
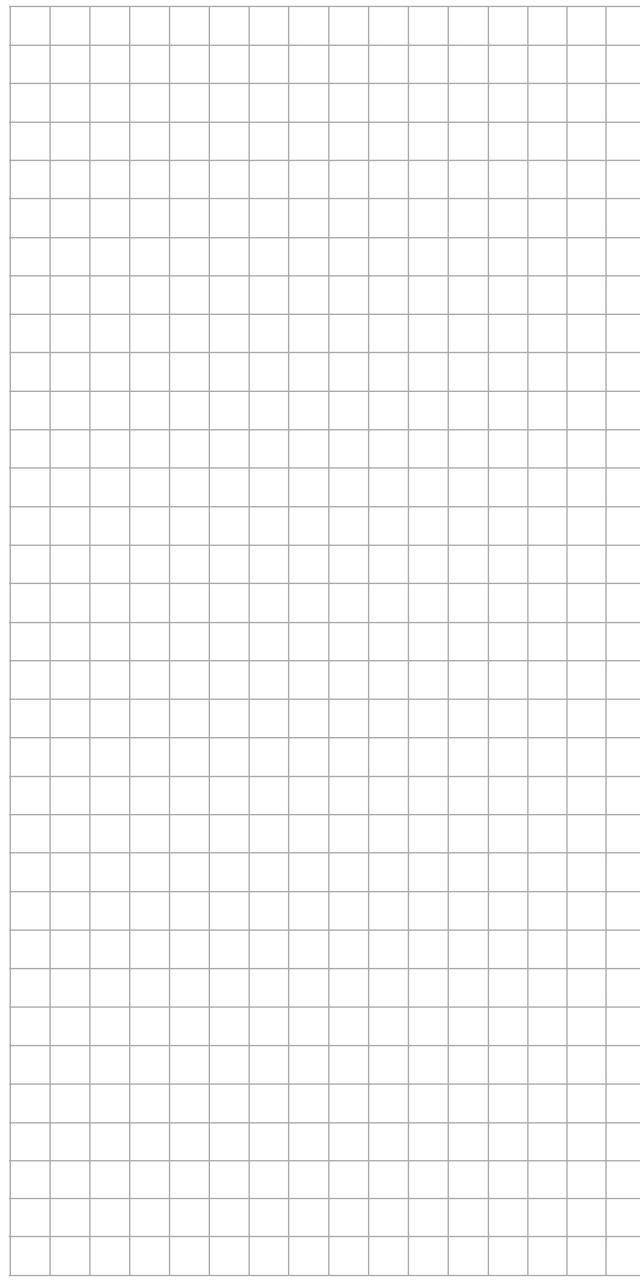
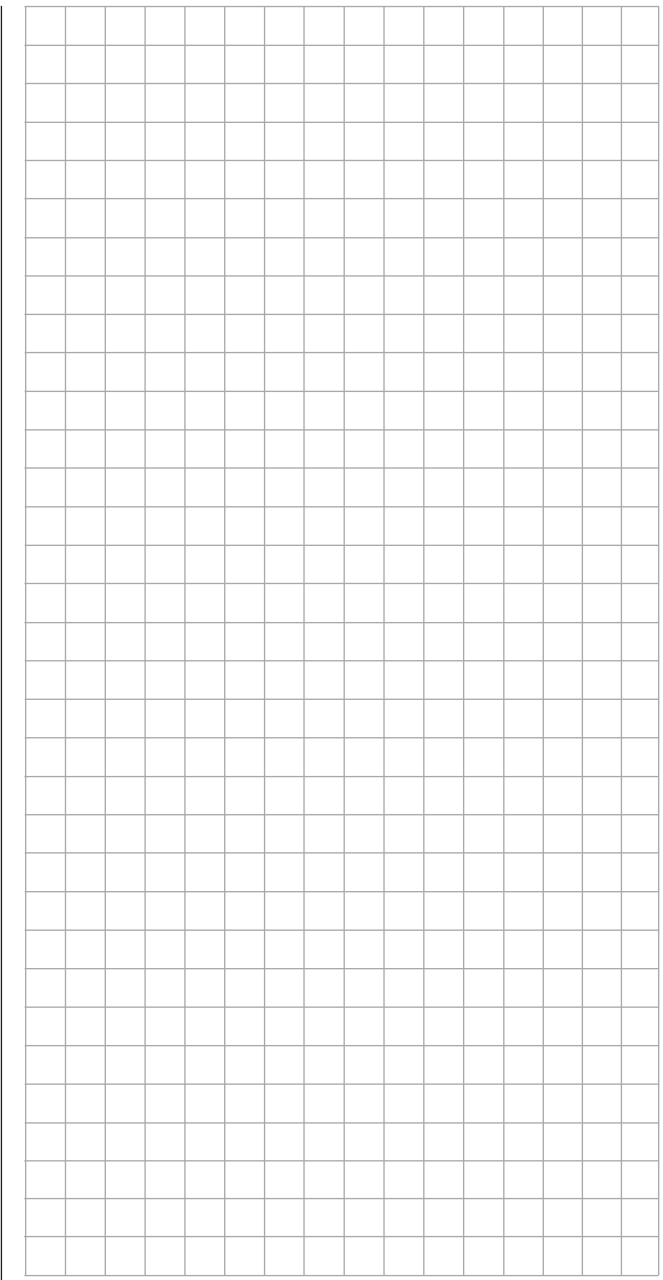
### Notice

The **mz-24 Pro** HoTT transmitters automatically recognize any sensor(s) connected to a **switched on** receiver or sensor(s) that have been connected after the power supply is turned on.



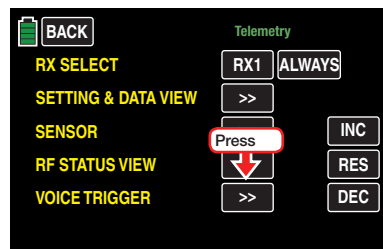
In this submenu, active or inactive sensors are automatically labeled as **ON** or **OFF**, provided that a telemetry link exists. Manual sensor selection is then unnecessary and impossible.



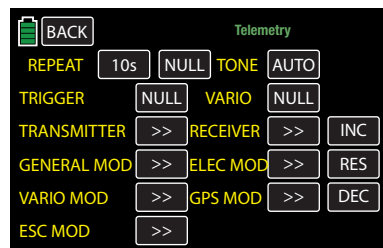


# VOICE TRIGGER

To open the Voice Trigger submenu, press the button in the **VOICE TRIGGER** line:

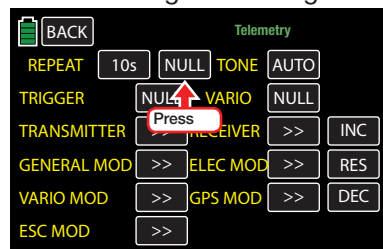


The following display opens:

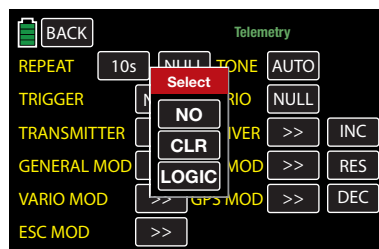


## REPEAT

To start audio reproduction in the REPEAT line a switch must be assigned. Refer to the **Control and Switch Assignment** section (page 26) for information on how to assign switches. Press the second field in the **REPEAT** line to assign or reassign a switch:



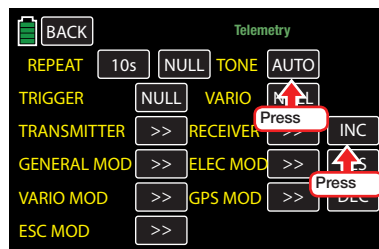
An active display box appears:



The active switch will play the reproduced message and repeat it at the time intervals selected in the first field of the REPEAT line.

## TONE (Module Select)

If the transmitter recognizes multiple Vario sensors, (e.g. both a General Electric and a GPS module are installed in the model and connected to the receiver), after pressing the value field in the **TONE** line, use the **INC** or **DEC** buttons to scroll through vario announce options:

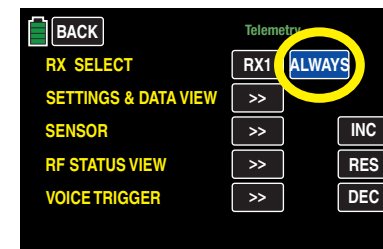


The following options are available: **VARIO**, **GAM**, **EAM**, **GPS** and **AUTO**. (In the AUTO position the sensors order will be selected as per the aforementioned list.)

## Tips

- To recall the vario tones, assign a switch in the following VARIO value field.

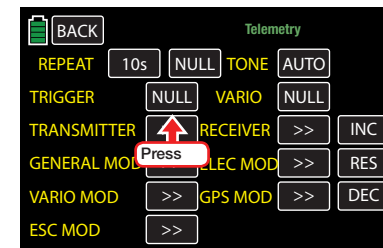
- As soon as the transmitter and/or the receiver have been switched on, the system starts to search the connected sensors. To change the value field in the TONE line, 30 seconds must pass so the system can complete the sensor search. If a value other than **ALWAYS** has been selected in the RX SELECT line, such as **4x** or **8x**, then the process will take longer:



## TRIGGER (NEXT ANNOUNCE)

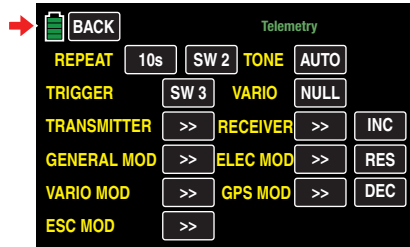
### Manual

When a switch is assigned to this line, users can incrementally cycle between the TRANSMITTER and RECEIVER options (page 117) and the voice triggers selected under the Sensors display (page 113). It is recommended to choose a self-neutralizing switch: S2 or S8. Refer to the **Control and Switch Assignment** section (page 26) for information on how to assign switches.



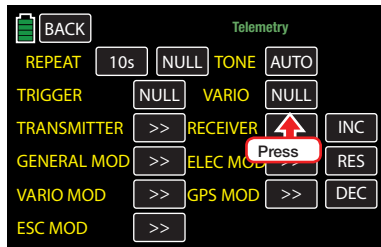
- **Automatic Sequential**

If switches assigned to the REPEAT and TRIGGER lines are activated, all the announcements included in this menu and its submenus will be repeated within the time interval selected in the REPEAT line:



### VARIO

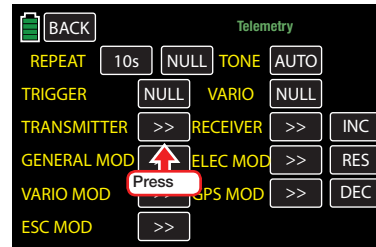
If the SENSOR submenu VARIO line is **ON** (page 113), the switches assigned to this line can be used to retrieve vario-specific voice triggers such as "slowly ascending/descending" through the transmitter's headphones independent of the other voice triggers, i.e., voice triggers triggered by a change in height.



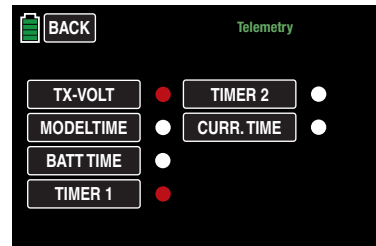
Refer to the **Control and Switch Assignment** section (page 26) for information on how to assign switches.

### TRANSMITTER

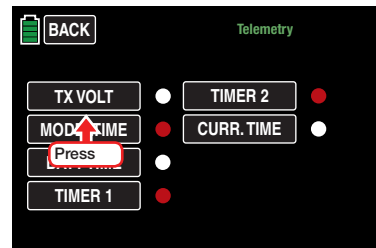
Press the bracket button in the TRANSMITTER line:



The transmitter display opens:

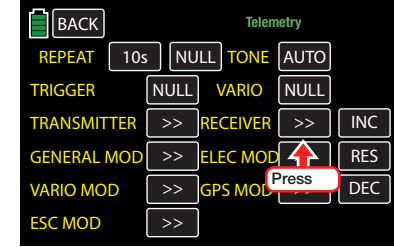


Use this submenu to activate and deactivate the voice triggers available for each selection in the value fields:

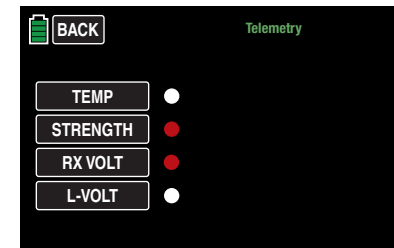


### RECEIVER

Press the bracket button in the RECEIVER line:



The receiver display opens:



Use this submenu to activate and deactivate the voice triggers available for each selection in the value fields.

### Sensors

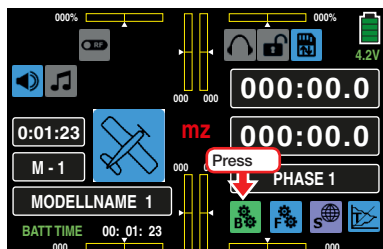
The displays for selecting sensor-specific voice triggers should only be opened when the sensors connected to the receivers are recognized after the receiver is switched on. Three corresponding voice triggers are selected as described above.



# Announce

## User Voice Recordings

To change the voice recording settings, from the main display press the **BASE** menu gear icon (green “B”) to bring up the BASE submenu screen:



From the BASE submenu display, press the **Announce** icon:



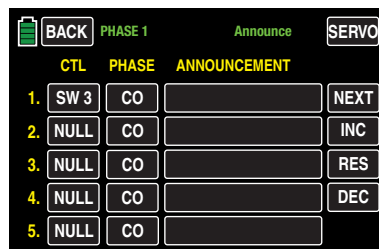
Saved in the **mz-24 Pro** HoTT transmitter memory, near the datafiles for the other transmitter announcements, are the **User-Voice-Files**, numbered from 285 to 294. These special announcements can be replaced by user-created .wav files via the Firmware\_Upgrade\_grStudio. All voice files can be assigned as phase-specific or phase-crossing in the BASE submenu **Announces**.

## Phase Depending Settings

This submenu allows for different phase-specific values to be programmed. Phase names are displayed in green in the upper left side of the screen next to the BACK button. Standard default naming for the phases are usually displayed as **NORMAL/PHASE 1**. (Additional phases will be named numerically, e.g. Phase 2, Phase 3, etc.) To define multiple phases, refer to the FUNCTION submenu **Phase** section (page 120). Each new phase will need to be assigned to a different switch. To change the phases, activate the corresponding switch(es).

## CTL Column

Use this column to assign a switch to the announcement:



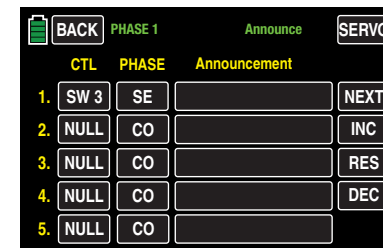
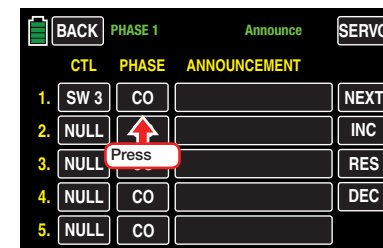
Refer to the **Control and Switch Assignment** section (page 26) for information on how to assign switches.

## Notices

Free switch assignment is only possible when the value field of the PHASE column is CO. When the PHASE value is SE, only switches that are not already assigned to a model memory phase will be available. This prevents error functions.

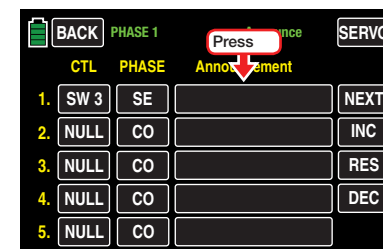
## PHASE Column

In this column changes between **CO** (common), model memory specific, and **SE** (single), phase specific announce. Press the value field of the value to change:

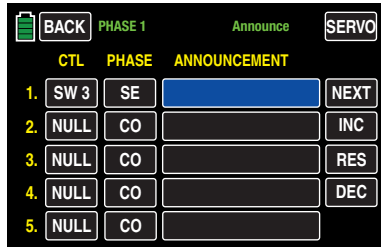


## ANNOUNCEMENT Column

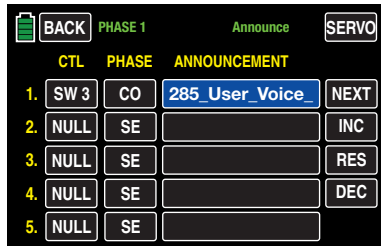
Use this column to activate, according to the switch position and phase, a User\_Voice announcement. Press the value field in the **ANNOUNCEMENT** column:



The field highlights blue:



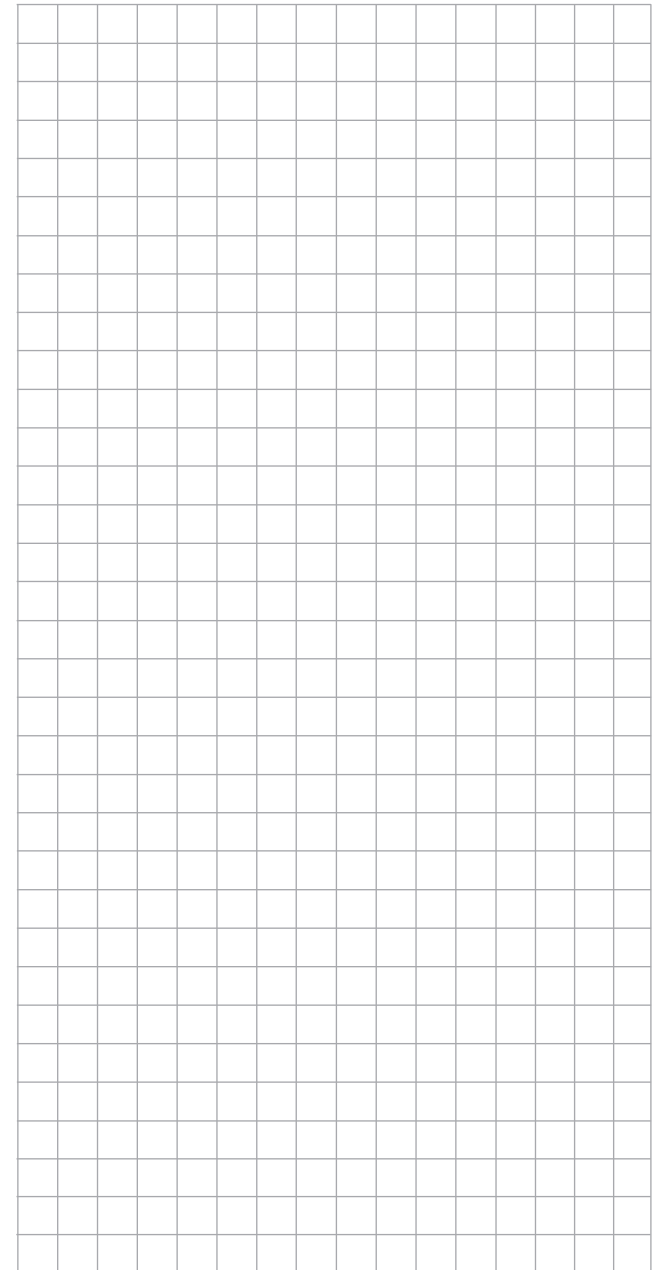
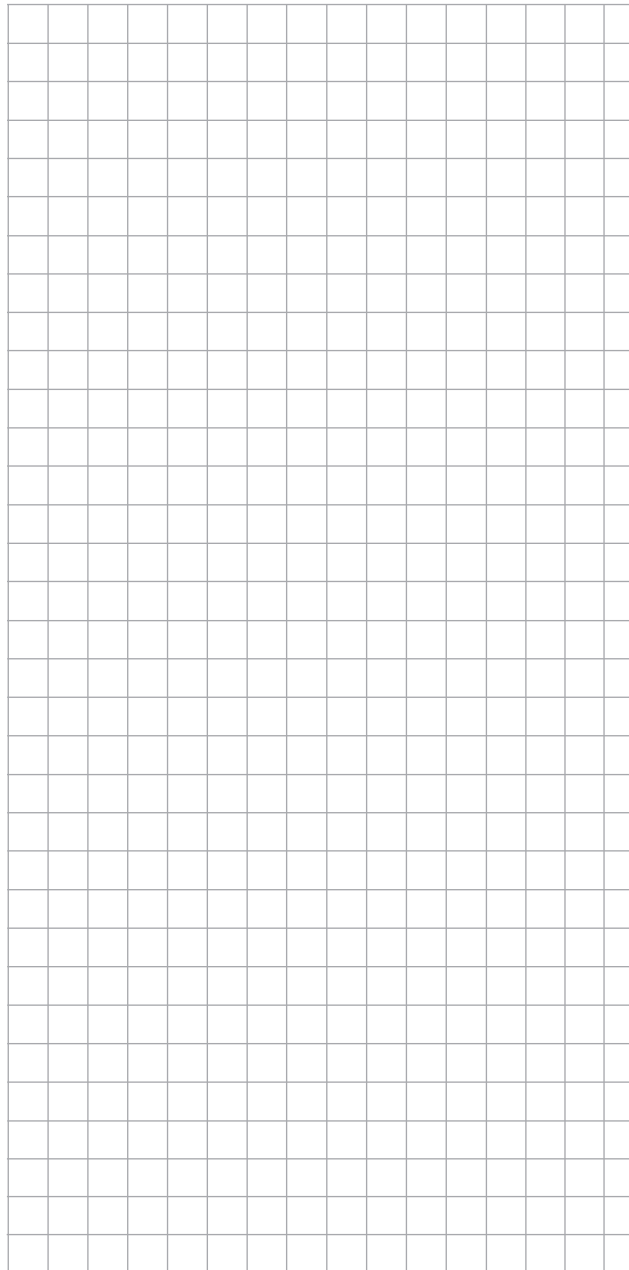
Press the **INC** or **DEC** buttons to scroll through the voice file list:



Repeat this process with each switch position and on other lines to assign additional voice announcements. Press the **RES** button to reset the field to the default value (blank).

**Tip**

To set announcements 6 to 10, press the **NEXT** button to bring up the next screen.

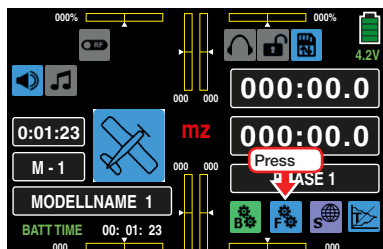


# Phase

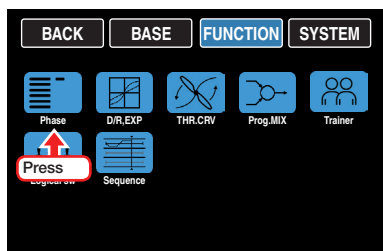
## Phase Settings

Referred to as Q.Links in previous *Graupner* radios, flight phases allow users to switch between different sets of trim settings according to the flight phase (i.e. takeoff, landing, etc.). The **mz-24 PRO** HoTT transmitter also allows phases to be linked to mixers. In the Phase menu, up to 6 different settings for different flight phases can be set within a model memory.

To change the phase settings, from the main display press the **FUNCTION** menu gear icon (blue “F”) to bring up the FUNCTION submenu screen:

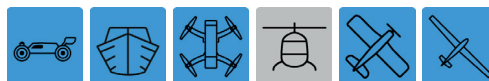


From the FUNCTION submenu display, press the **Phase** icon:

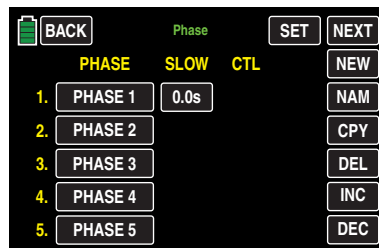


Phase names are displayed in green in the top center of the screen. Standard default naming for phases is usually displayed as **NORMAL/PHASE 1**. (Additional phases will be named numerically, e.g. Phase 2, Phase 3, etc.) Each new phase will need to be assigned to a different switch. To change the phases, activate the corresponding switch(es).

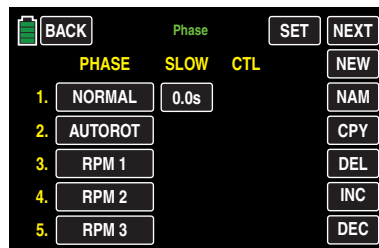
The six settings do not have to be sequential and phase lines can be left empty.



Phase display for all models (except helicopters):



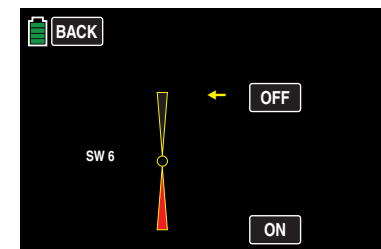
Phase display for helicopters:



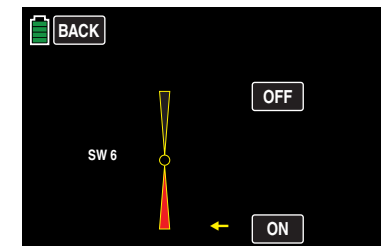
For all models (including helicopters) always start with **PHASE 1** of the **NORMAL** link. **NORMAL/PHASE1** is the default when no Phase switch is set, or when no Phase has been assigned to specific switch combinations.

Note that individual switches have allocation priority towards flight phases. The underlying schema is described as follows:

- If all flight phase switches, if any, are open (i.e. **OFF** position), the flight phase **NORMAL** is active:



- If only one switch is closed (i.e. **ON** position), then the flight phase that has been assigned to the currently closed switch is active:



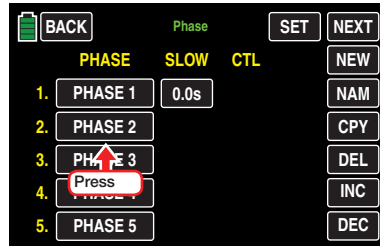
- If two or more switches are closed, the flight phase with the lower phase number is active.



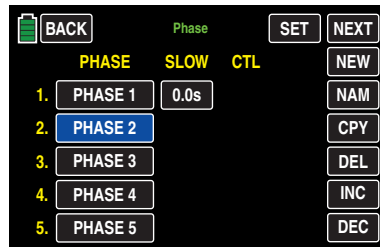
## Phase Setup

### • PHASE Column

To set up the first phase, press the appropriate field line in the PHASE column. In the example below, Line 2, titled PHASE 2, is being programmed:



The field highlights blue:

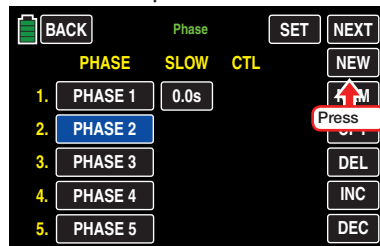


### Tip

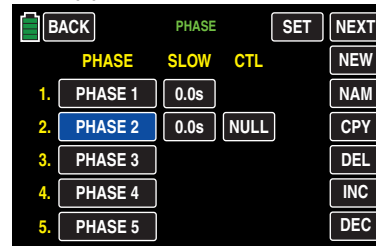
Phase 6 is on the following screen. Press the **NEXT** button to view the next screen.

### • NEW Button

Press the **NEW** button to bring up additional fields for the active phase line:



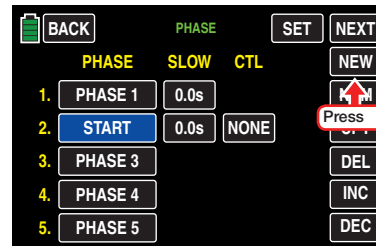
Value fields appear in the SLOW and CTL columns:



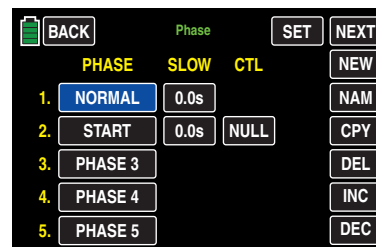
### • NAM Button

(Name)

Name or rename the existing phase title by pressing the **NAM** button at the right of the display. A red keypad screen will appear. Refer to the **Model Name** section (page 42) for instructions on using this display. In the example below, Phase 2 was renamed "**START**":



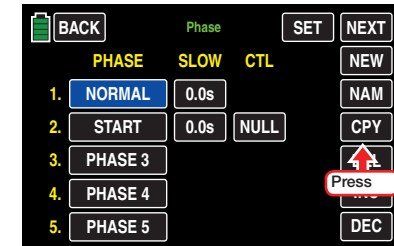
Rename Phase 1 so that announcements can be assigned. In the example below, it has been renamed "**NORMAL**":



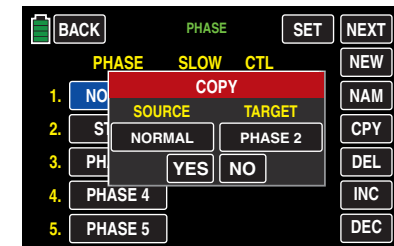
### • CPY button

(Copy)

The phase setting fields of any phase line highlighted blue can be copied to any another phase line by pressing the **CPY** button at the right of the display:

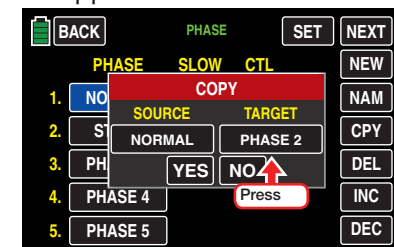


An active warning window appears to verify the source/target selection:

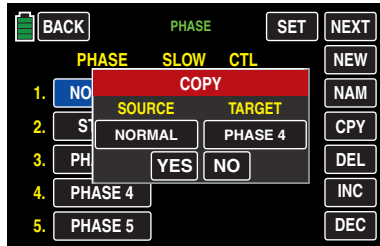


Press **NO** to terminate the procedure.

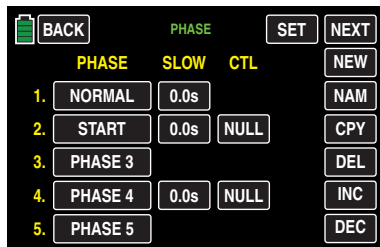
To change the target field, repeatedly press the button in the **TARGET** column until the desired phase line appears:



In the example below, the target field was changed from PHASE 2 to **PHASE 4**:



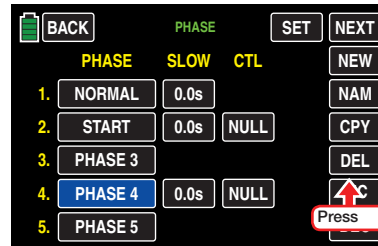
Press **NO** to terminate the procedure. Press **YES** to continue. The source phase information is duplicated to the selected target line:



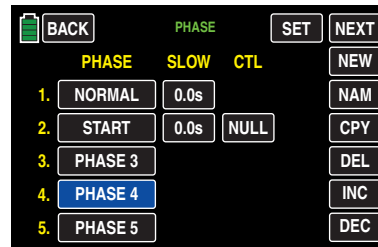
Change the copied phase line name information by using the **NAM Button** (page 121), and/or adapt the transferred delay or transferred switch as described in the **SLOW Column** section (page 122) and **CTL Column** section (page 123).

- **DEL Button** **(Delete)**

The phase information of any phase line highlighted blue can be deleted by pressing the **DEL** button at the right of the display. In the example below, the Phase 4 information needs to be cleared:



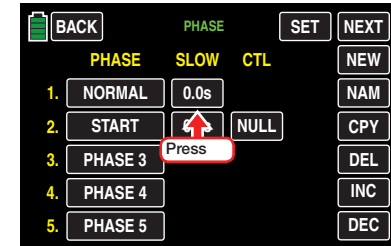
The Phase 4 settings disappear:



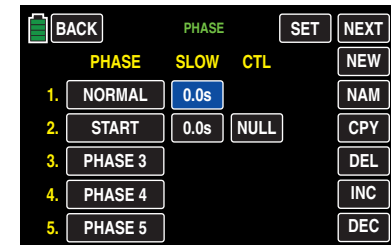
- **SLOW Column** **(Delay)**

Use this setting to set a delay for a smooth transition between phases. It is possible to set different delays for changing between different phases. For example, the time delay when moving from a phase into Phase 3 can differ from when moving to Phase 1.

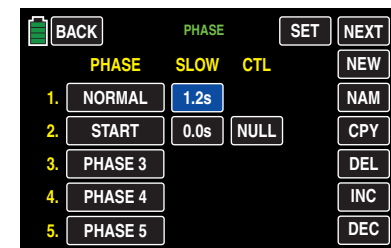
To set the delay time, press the field for the appropriate phase in the SLOW column:



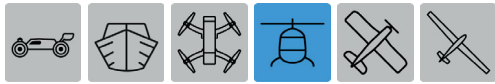
The field highlights blue:



Raise or lower the value with the **INC** or **DEL** buttons at the right edge. The delay switchover time can be set anywhere from 0.0 to 9.9 seconds. In the example below, the NORMAL phase delay is set for 1.2s:

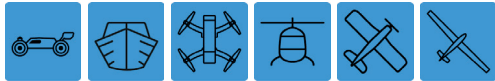


Use the same procedure with the other phase.



### Attention

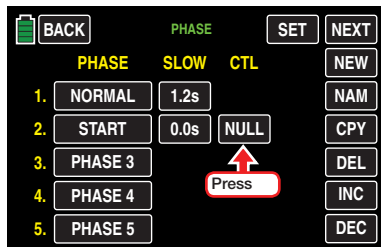
In the helicopter AUTOROT phase, always leave the standard delay time as 0.0s. For safety reasons, if a switchover is necessary the phase can be changed immediately and without delay.



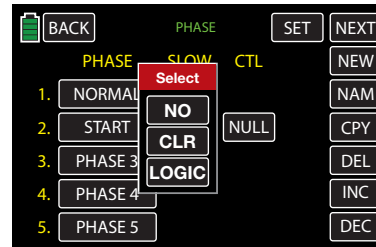
### Notice

For all models, the switchover time set here acts uniformly across all phase-specific settings and all active mixers. The switchover between phase-dependent mixers should proceed smoothly.

- **CTL Column (Control/Switch)**  
Use this function to change between phases. Press the field for the appropriate phase in the CTL column:



An active display pops up:

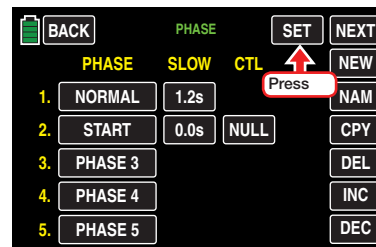


Press **NO** to terminate the process. Press **CLR** to clear any existing values. Press **LOGIC** to assign a switch to perform this function. Refer to **Control and Switch Assignment** section (page 26) for more information on assigning switches.

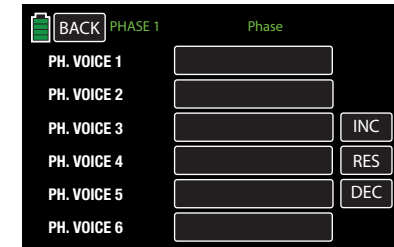
### Notices

- NORMAL/Phase1 is the default when none of the assigned phase switches are in the ON position.
- To avoid function errors, *never* assign a switch to both a User Voice Recording and a Phase function.

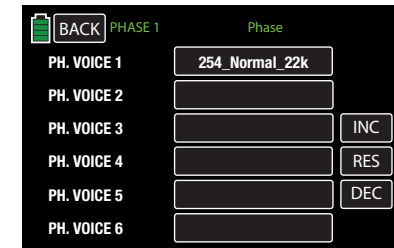
- **SET Button**  
To assign individual voice announcements to the different phases, press the **SET** button at the upper right of the display:



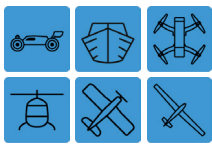
The following display appears:



Press to highlight the appropriate phase voice value field. Scroll through the list of available voice announcements by pressing the **INC** or **DEC** buttons at the right edge. Press the **RES** button to clear any selection. In the example below, Voice Announcement #254 has been selected:



Press the **BACK** button at the top left of the display to return to the main Phase display.

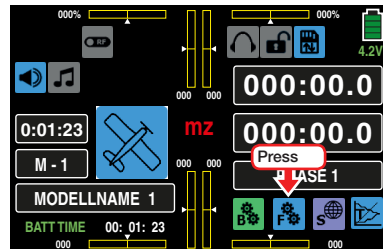


# D/R,EXP

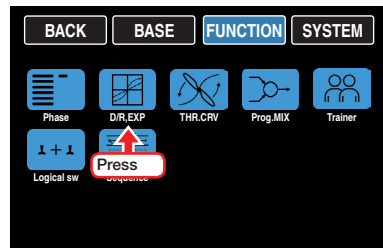
## Control Attitude Settings for Control Functions 2, 3 and 4

The dual rate/expo function allows users to assign switches and phases to change or influence the control deflections and characteristics of channels 2, 3 and 4.

To change these settings, from the main display press the **FUNCTION** menu gear icon (blue “F”) to bring up the FUNCTION submenu screen:



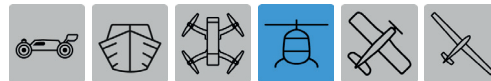
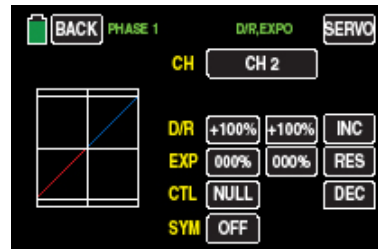
From the FUNCTION submenu display, press the **D/R,EXP** icon:



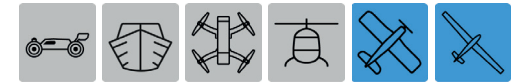
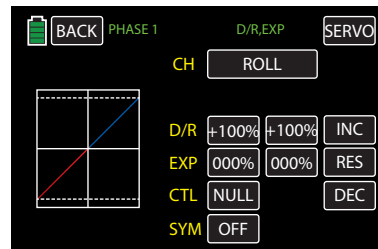
This procedure is identical for all models, but the channel page labeling differs between models. Refer to the model type to understand the different values in the field to the right of the CH line.



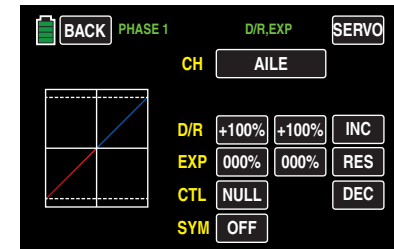
For all **CARS, BOATS** or **DRONES**, the channel setting pages of this submenu are labeled **CH2, CH3** and **CH4**, as shown below:



For all **HELICOPTERS**, the channel setting pages of this submenu are labeled **ROLL (CH2), NICK (CH3)** and **TAIL (CH4)**, as shown below:



For all **AIRPLANES** or **GLIDERS**, the channel setting pages of this submenu are labeled **AILE (CH2), ELEV (CH3)** and **RUDD (CH4)**, for aileron, elevator and rudder, as shown below:



### Tip

The 7 individual characteristic curve points for control function CH1 (throttle/brake) can be set in the following sections: all models except helicopters FUNCTION submenu **THR.CRV** (page 128), and helicopter models FUNCTION submenu **THR.CRV** (page 160).

**Dual Rate** enable the control surface deflection limits to be changed while still retaining full stick movement, i.e. ‘normal’ deflection plus a setting for decreased/increased deflection limits at full stick movement. D/R acts independently from functions that associate a single servo or are actuated through a complex mixer or coupling function by multiple servos. (Refer to the BASE submenu **CTL Set** (page 90) or Definition of Terms **Control Function** (page 24) for additional information.)

The control deflections can be set for each switch position between 0 and 125% of the normal control travel.

**EXP** allows users to adjust the sensitivity of the control surface deflection around smaller stick movements. For example, the elevators are barely moved when the stick moves around its central position, but

full deflection is allowed when the stick is moved to its limit.

Conversely, the effect of the control around center position increases for values less than 0% and decreases in the direction of full deflection. The progression can be set from -100% to +100%; 0% corresponds to the normal linear control characteristic.

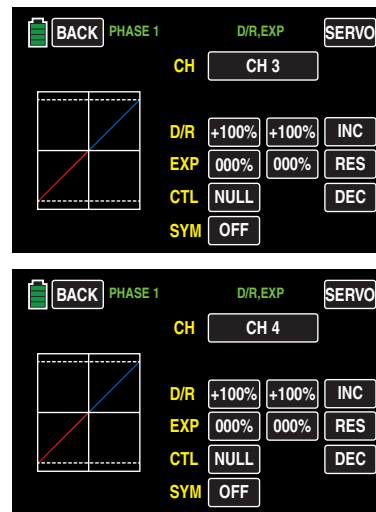
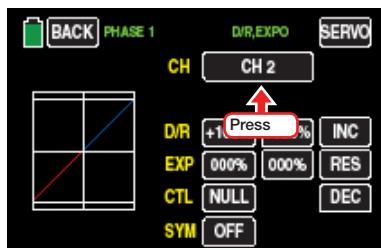
For the most common rotary servos, the rudder control is nonlinear since the rudder deflection from the servo linkage becomes increasingly smaller as the angle of rotation of the connecting pulley or cantilever increases. When EXP values are greater than 0%, this effect can be counteracted so that the 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 possible to link the dual rate and EXP functions: this can be advantageous, especially with fast models.

In the display graphic the green vertical line moves together with the related control stick to allow a clearer evaluation of the curve characteristics related to the control travel.

To change between the display screens of individual setting options, press the value field in the **CH** line:

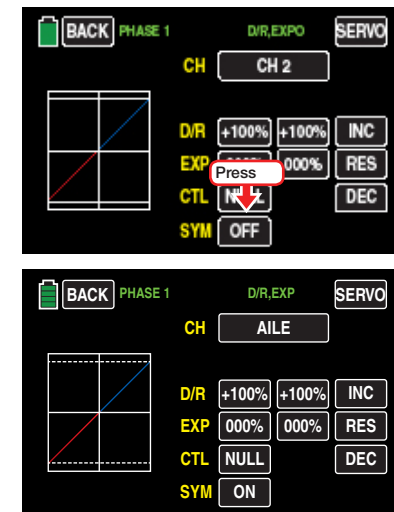


### Phase Depending Dual-Rate/Expo Settings

This submenu allows for different phase-specific values to be programmed. Phase names are displayed in green in the upper left side of the screen next to the BACK button. Standard default naming for the phases are usually displayed as **NORMAL/PHASE 1**. (Additional phases will be named numerically, e.g. Phase 2, Phase 3, etc.) To define multiple phases, refer to the **FUNCTION** submenu **Phase** section (page 120). Each new phase will need to be assigned to a different switch. To change the phases, activate the corresponding switch(es).

### SYM Button

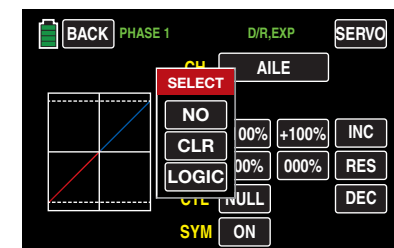
The SYM function allows a symmetrical, simultaneous, field adjustment of both control sides. Turn this function **OFF** or **ON** by pressing the button in the **SYM** line.

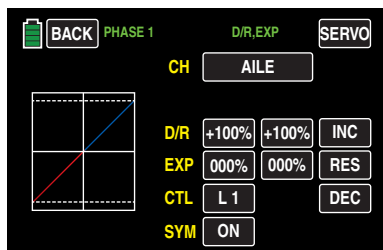


### D/R Function

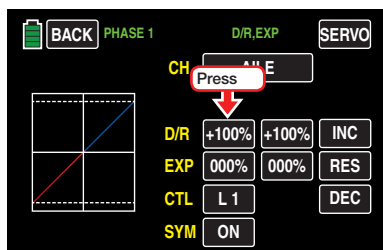
#### Setting Symmetrical Dual Rate Values

To change between the different versions, assign a control, 2- or 3-way switch or logical switch in the **CTL** line as described in the **Control and Switch Assignment** section (page 26):

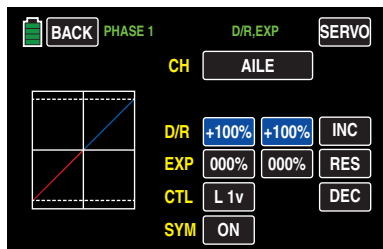




To set simultaneous dual rate values, make sure the **SYM** line value button is **ON**. Then press a value field in the **D/R** line:



Both value fields highlight blue:



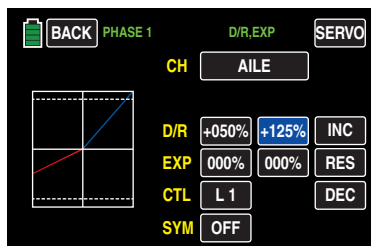
Press the **INC** or **DEC** button at the right edge of the display to increase/decrease the values. Alternatively, press the arrow keys (▲▼) to the left of the display screen to achieve the same result.

Press the **RES** button to reset the changed value back to the default.

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

### Setting Asymmetrical Dual Rate Values

To set individual dual rate values, make sure the **SYM** line value button is **OFF**. Then press to highlight the value fields in the **D/R** line one at a time. Use the left-side column to set the dual rate to the minus side of the control travel and use the right-side column to set the dual rate to the plus side of the control travel:



Press the **INC** or **DEC** button or the at the right edge of the display to increase/decrease the values. Alternatively, press the arrow keys (▲▼) to the left of the display screen to achieve the same result.

Press the **RES** button to reset the changed value back to the default.

The dual rate curve is automatically displayed in the graph.

### Attention



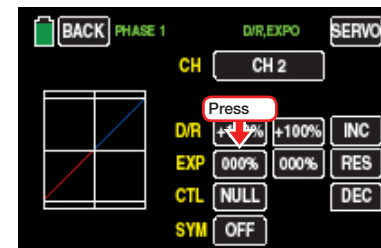
For safety reasons, the dual rate value should not fall below 20%.

### Exponential Function

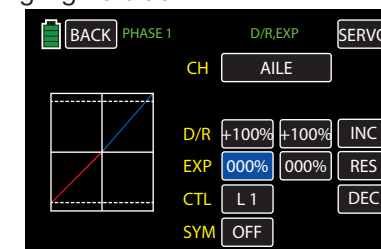
Set the exponential function the same way as the dual rate function.

To set simultaneous exponential values, make sure the **SYM** line value button is **ON**. Then press a value field in the **EXP** line. Both value fields highlight blue. Press the **INC** or **DEC** button at the right edge of the display to increase/decrease the values. Alternatively, press the arrow keys (▲▼) to the left of the display screen to achieve the same result. Press the **RES** button to reset the changed value back to the default.

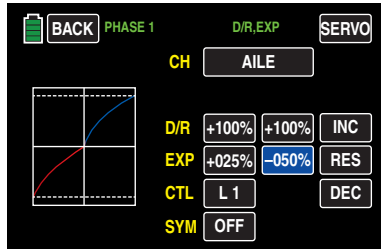
To set individual, asymmetrical exponential values, make sure the **SYM** line value button is **OFF**. Then press the value fields in the **EXP** line one at a time:



The field highlights blue:



Use the left-side column to set the expo value to the minus side of the control travel and use the right-side column to set the expo value to the plus side of the control travel.



Press the **INC** or **DEC** button at the right edge of the display to increase/decrease the values. Alternatively, press the arrow keys ( **▲▼** ) to the left of the display screen to achieve the same result.

Press the **RES** button to reset the changed value back to the default.

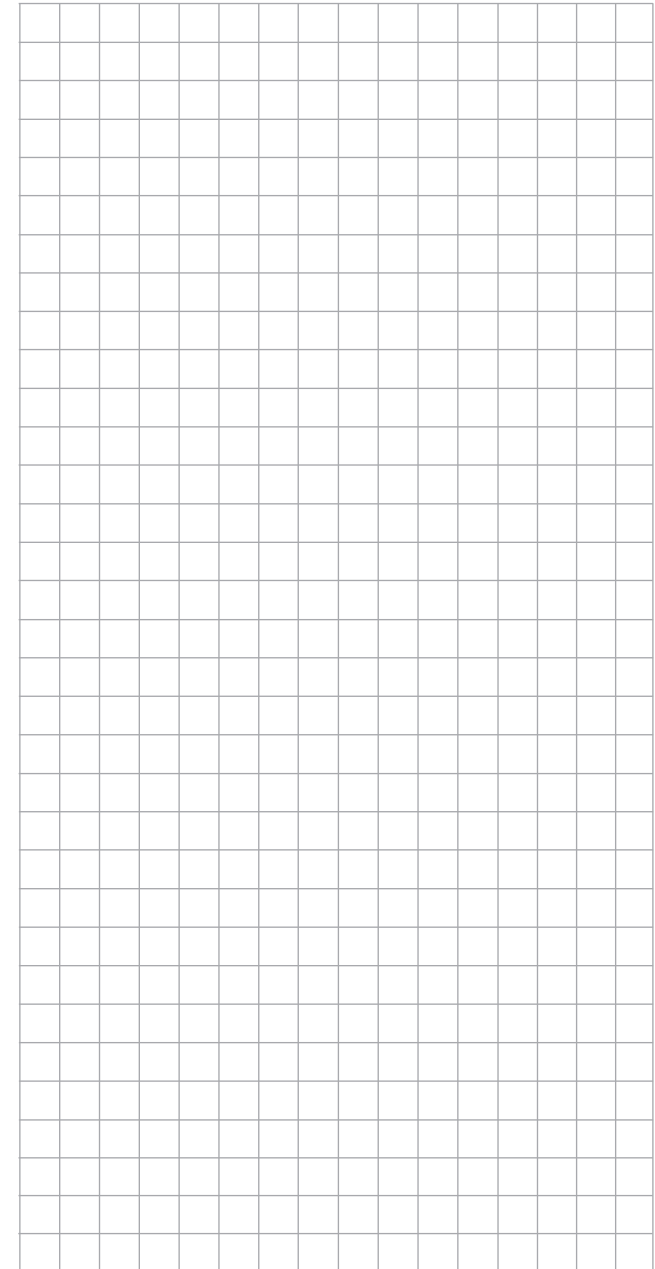
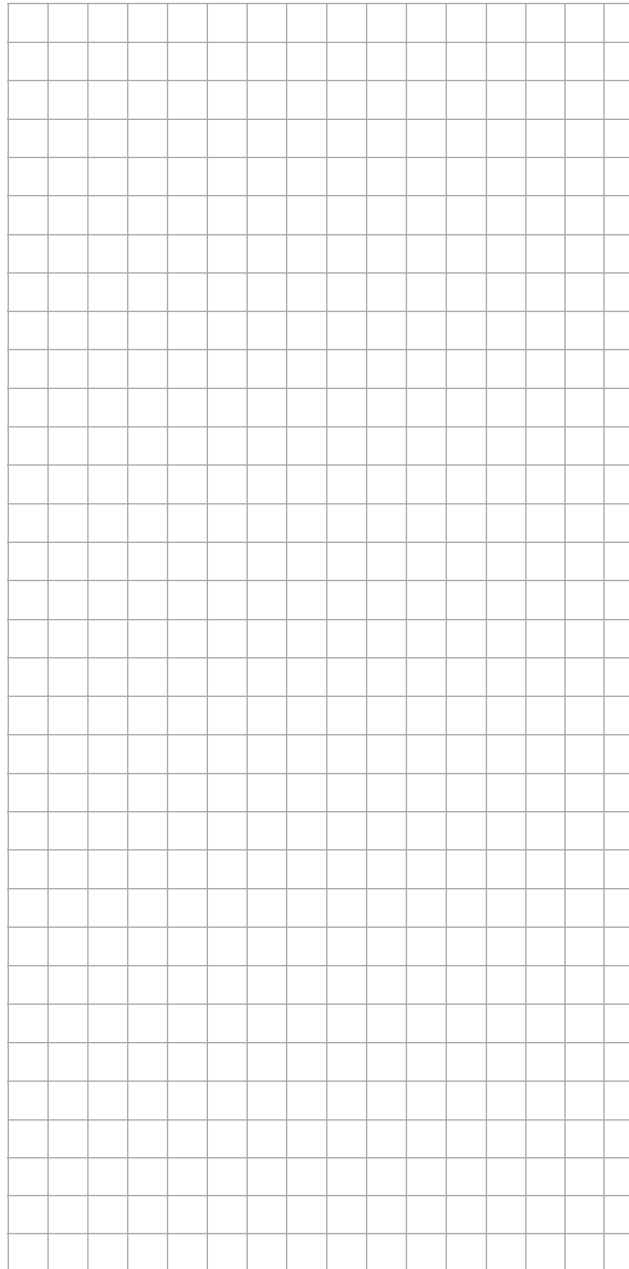
The adjustment range is  $\pm 100\%$ .

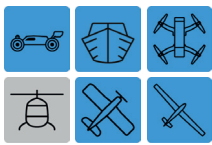
The exponential curve is automatically displayed in the graph.

**Notice**



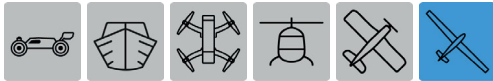
The curve shown in the example above is only for demonstration purposes and does not represent an actual exponential curve.





# THR.CRV

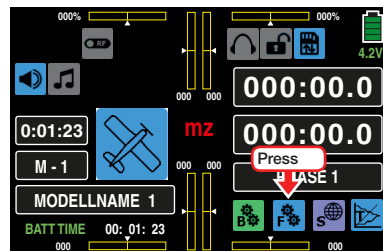
## Throttle Control Stick Characteristic Settings



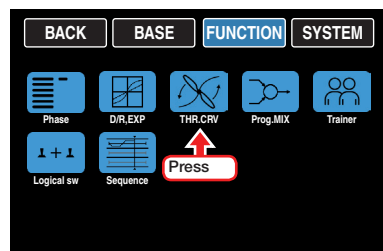
This submenu icon is not available for motor-less gliders.

Use this submenu to change the *control characteristic of the throttle and 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 multiple servos. Also use this submenu to adjust the idle LOW or “motor off” throttle position.

To change these settings, from the main display press the **FUNCTION** menu gear icon (blue “F”) to bring up the FUNCTION submenu screen:



From the FUNCTION submenu display, press the **THR.CRV** icon:



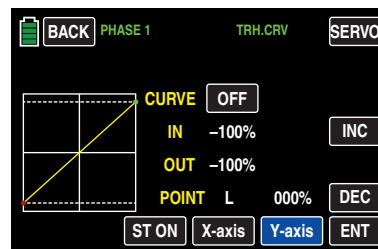
### Phase Dependent Settings

This submenu allows for different phase-specific values to be programmed. Phase names are displayed in green in the upper left side of the screen next to the BACK button. Standard default naming for the phases are usually displayed as **NORMAL/PHASE 1**. (Additional phases will be named numerically, e.g. Phase 2, Phase 3, etc.) To define multiple phases, refer to the FUNCTION submenu **Phase** section (page 120). Each new phase will need to be assigned to a different switch. To change the phases, activate the corresponding switch(es).

### Changing the Control Direction

In the **mz-24 PRO** transmitter, all fixed-wing rear throttle positions default to **Motor OFF** when using electric drives. The throttle control stick control direction can be inverted through the throttle curve from "accelerate from back to front" to "accelerate from front to back".

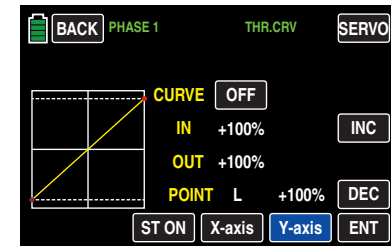
To make adjustments to this function, turn on the control stick position graphic/numerical display by pressing the **ST OFF** button at the bottom left of the display to change the value to **ST ON**. Activate the Y-coordinate adjustment option by pressing the **Y-axis** button:



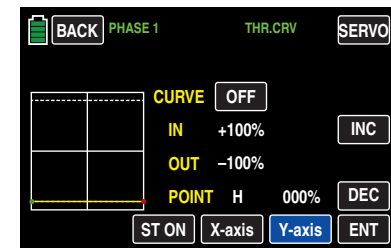
Use the throttle to move the vertical green line between the two endpoints **L** and **H** in the graphic.

The control stick position is also displayed numerically in the **IN** line (-100 % to +100 %).

Move the throttle to one of the two end positions. In the example below, the throttle is moved to the front position and the green line moves the right, disappearing under the white frame, and the color of the top point changes from green to red:

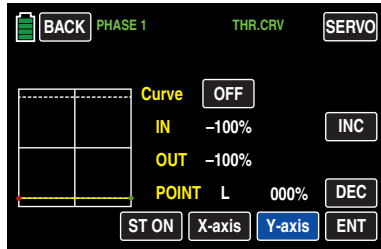


Press the **DEC** button or the down arrow key (▼) to move the red point down to a value of **000%** in the **POINT** line:

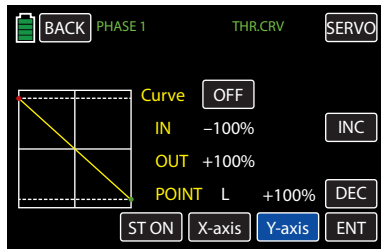


Move the throttle to the opposite end position. In the example below, the throttle is moved to the rear position and the green line moves to the left, disappearing under the white frame, and the point at the end of the yellow horizontal line change from green to red:





Press the **INC** button or the up arrow key (▲) to move the red point up to a value of **+100%** in the **POINT** line:



The inverted control signal shown above acts on all subsequent mixing and coupling functions and the active Power OFF time of the throttle position. Repeat as needed to change in every phase.

### Notice

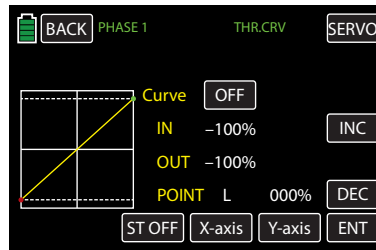
Never reverse the rotation direction of the control channel CH1 of the BASIC submenu **REV/SUB** (page 64) to reverse the control direction of the related control sticks. The switch-on warning CH1-Pos of the Thr.HOLD function (page 66) do not follow this kind of reverse control direction.

### Setting Support Points

The pitch control curve can be specified by up to 7 points (termed “support points”) along the entire control stick travel.

The graphic display makes it much easier to specify the support points and their adjustment. However, it is recommended to start with fewer support points.

In the basic setting of 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).

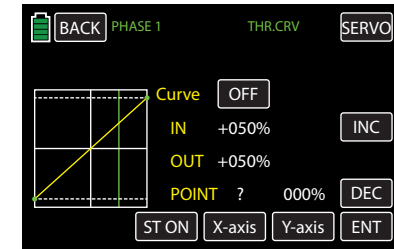


- **ST OFF or ST ON Button**

Touch this button to turn on or off the graphic and numeric display of the control stick position.

When **ST ON** on is selected and the control elements (throttle control stick) is moved, a vertical green line moves synchronously in the graph between the two endpoints **L** and **H**. The control stick position is also displayed numerically in the **IN** line (-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%. Control signals changed in this way affect all of the subsequent mixing and coupling functions.

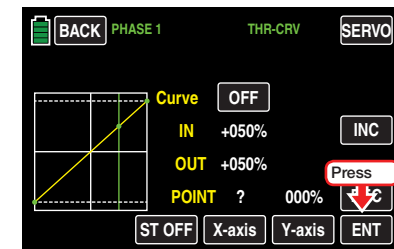
In the example below, the control stick is exactly halfway between the middle and end of its path, at +50% of the control path, and generates an output signal that is also +50% due to the linear characteristic:



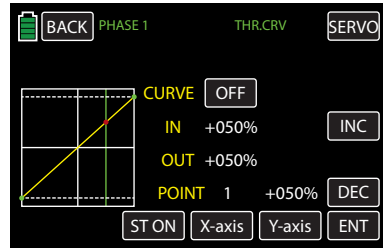
Between the two endpoints L and H, up to 5 additional support points can be set, though the distance between support points may not be less than 25%.

- **ENT Button**

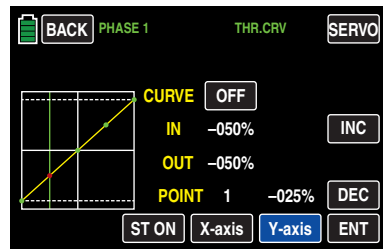
Move the control stick. Support points can be set by touching the **ENT** button whenever a question mark ? shows in the **POINT** line. A green point appears at the intersection of the yellow and green lines:



When the control stick is moved and the green line moves off the green point, the point will turn red, the ? is replaced with a number, and the point value appears in the value field to the right of the support point number:



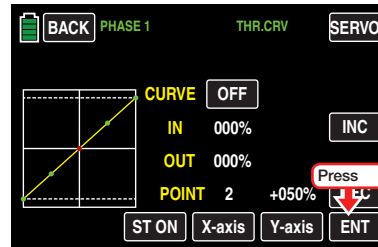
The 5 support points between the L and H endpoints can be created in any order; support points are automatically renumbered sequentially from left to right after points are set or deleted. In the example below, the red point at left near the L endpoint is now considered Point 1:



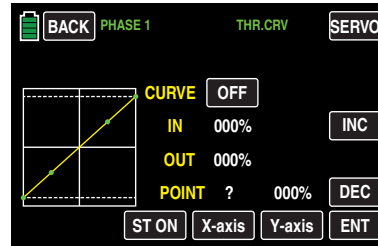
### Deleting a Support Point

To remove a set support point, move the control stick until the vertical green line aligns with the point to be deleted. The support point will turn red and its number and associated value will appear in the POINT line.

Press the **ENT** button to remove the point:



The red point disappears:

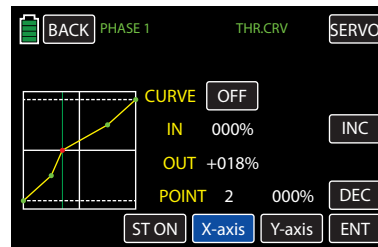


### Changing the Support Point Value

#### • **X-axis** Button (X-axis)

Activate this function, press to highlight the button at the bottom edge of the display.

Move the active (red) point to the right by pressing the **INC** button or to the left with the **DEC** button, as shown below:



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

### Notices

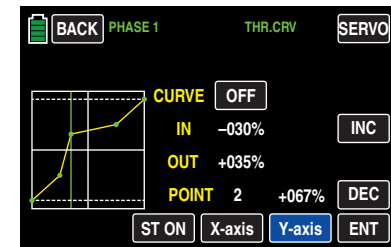


- Moving the red point horizontally away from the current control position will cause the point to become green after a short while, and a ? will appear in the Point line. This question mark does not relate to the point which has been moved, rather, it indicates that another point can be set at the current control position.
- Remember that the percentages in the input (IN) and output (OUT) line always refer to the temporary position of the control stick and not to the position of the point.

#### • **Y-axis** Button (Y-axis)

Activate this function, press to highlight the button at the bottom edge of the display.

Move the active (red) point up by pressing the **INC** button or down with the **DEC** button, as shown below:



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

### Notice

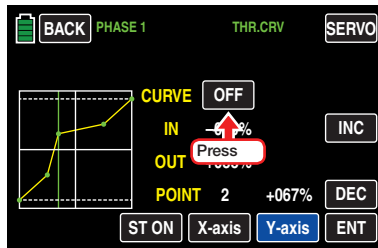


Remember that the percentages in the input (IN) and output (OUT) line always refer to the momentary position of the control stick and not to the position of the point.

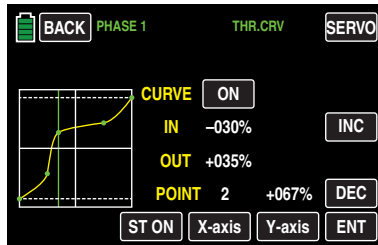
## Rounding Off the Throttle Curve

- **CURVE Line ON/OFF Button**

Curve profiles are angled by default. Automatically round off the lines by turning **ON** the rounding function in the CURVE line:



The angled curve lines are rounded:

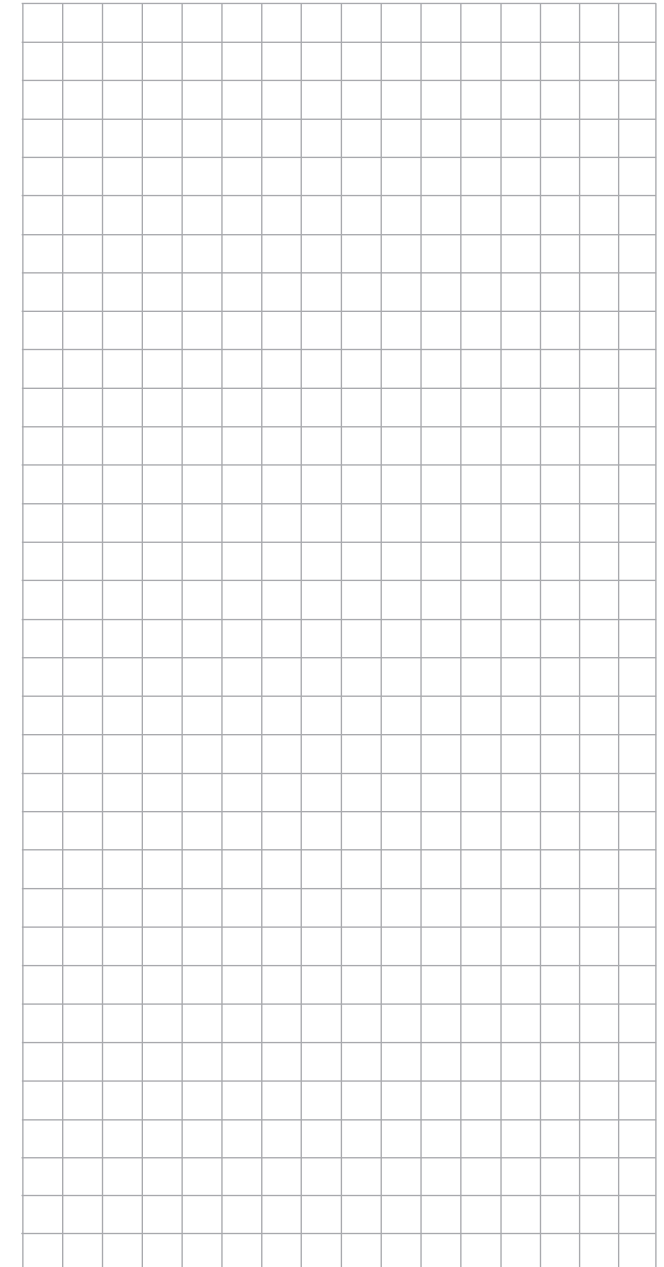
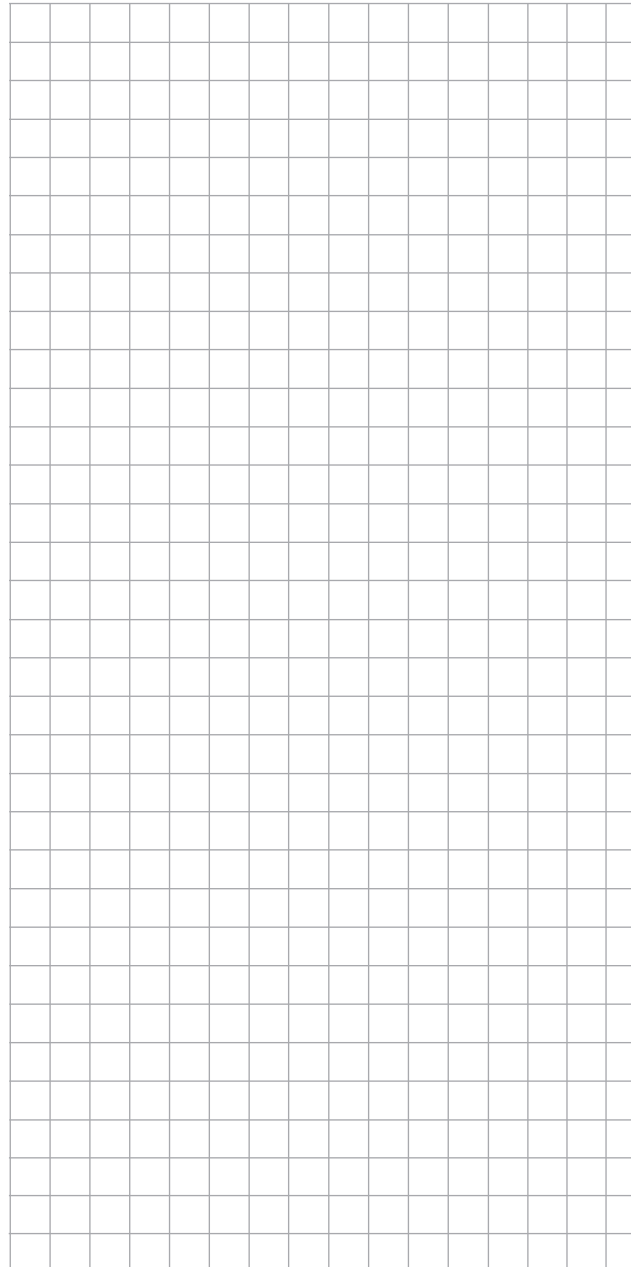


### Attention



The curves shown above are only for demonstration purposes and do not represent actual throttle curves.

Press the **BACK** button at the top left of the display to return to the menu selection.



# Mixer - Basic Functions

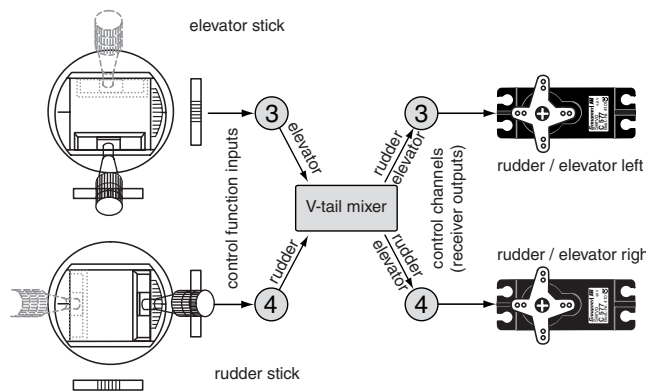
Mixing allows multiple functions to be controlled simultaneously by a single signal. There are two main types of mixing: control function mixing and channel mixing.

Control function mixing allows a single pair of control signals to act as two separate pairs. For example: when coupling elevator and aileron, the transmitter operates as a single function but the single pair of control signals combine the two different deflections in accordance with the control stick movements, thus moving together (as elevators move) and individually (as ailerons move) at the same time.

Control channel mixing allows separate channels to work in conjunction with one another. For example, the coupling of two servos with the same function, such as two rudders, to be controlled by a single servo.

When mixed, the control function signals flow from the transmitter output and branch at a point in which the transmitter options (i.e. **D/R,EXP, CTL Set, THR, CRV** etc.) are contained within a signal that relays another control channel's specific input, allowing another receiver to output the settings.

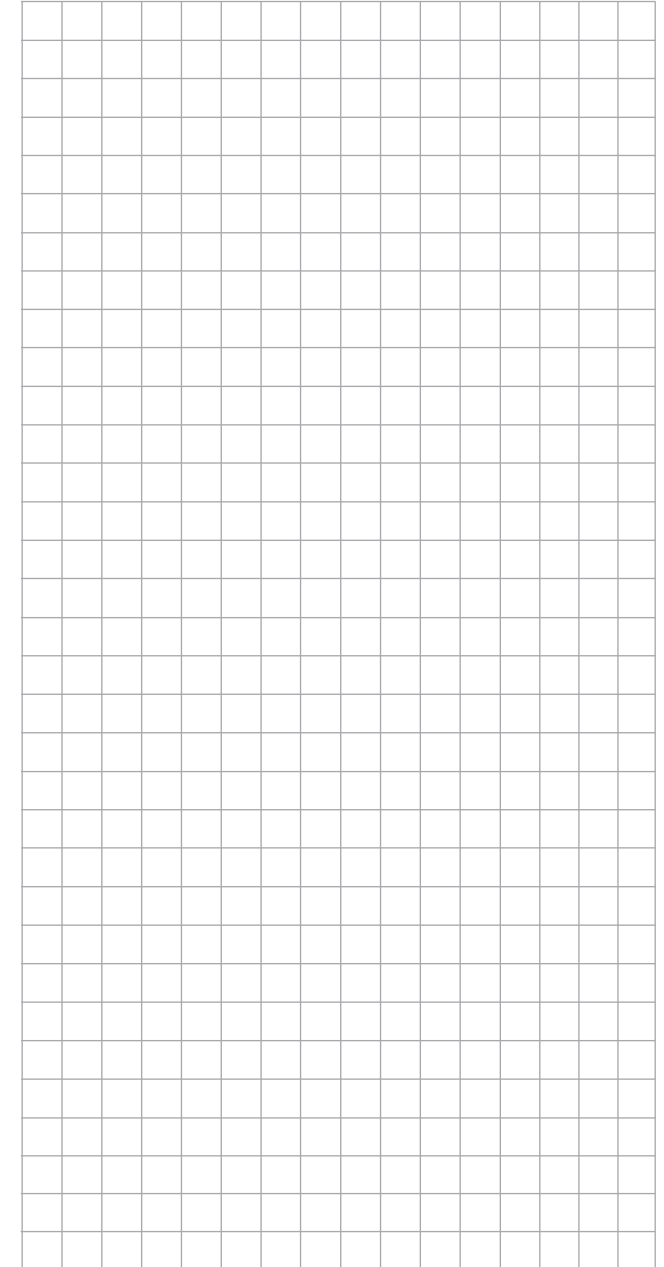
## Example: V-tail Mixer



The program of the **mz-24 Pro** HoTT transmitter already contains numerous preprogrammed coupling

functions in which two (or more) control channels are mixed with each other. The example mixer cited can be activated by selecting the V-tail option during the initial model selection. Refer to the BASE submenu **Model Sel** section (page 38) for additional information.

Each fixed-wing and helicopter model memory program has five programmable linear mixers and three curve mixers in each of the 30 model memories per programmed phase in which users can define inputs and outputs as well as the degree of desired mixing. (Refer to the FUNCTION submenu **Prog.MIX** (page 134) for additional information.)



# Programmable Mixers - General Information

Each fixed-wing and helicopter model memory program has five programmable linear mixers and three curve mixers in each of the 30 model memories per programmed phase in which users can define inputs and outputs as well as the degree of desired mixing. (Refer to the FUNCTION submenu **Prog.MIX** (page 134) for additional information.) This maximum of 48 mixers per model memory should be sufficient for taking advantage of pre-programmed coupling functions options.

The input signal for a control function (1 to 12) is used as the *input signal* for programmable mixers. The control channel signal functions relayed to the mixer input are determined by its control element and the characteristics specified via the **D/R,EXP, CTL Set**, and **THR.CRV** submenu settings.

The mixer output acts on a selectable control channel (1 to a maximum of 12, depending on the transmitter and receiver). The signal functions relayed to the servo are determined by the characteristics specified via the **REV/SUB, CTL Set, E.P.A**, and **Out.Swap** submenu settings.

One control function may be used simultaneously for any number of mixer inputs when, for example, mixers are to be parallel-connected.

Any number of mixer outputs can affect the same control channel. However, 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 be set in the BASE submenu **E.P.A** (page 62).

By default, all programmable mixers are initially **blocked** and will need to be turned on during programming. Additionally, mixers can also be assigned an ON/OFF switch. Pay attention to the multiple switch functions available to be assigned; do not unintentionally assign one switch two functions.

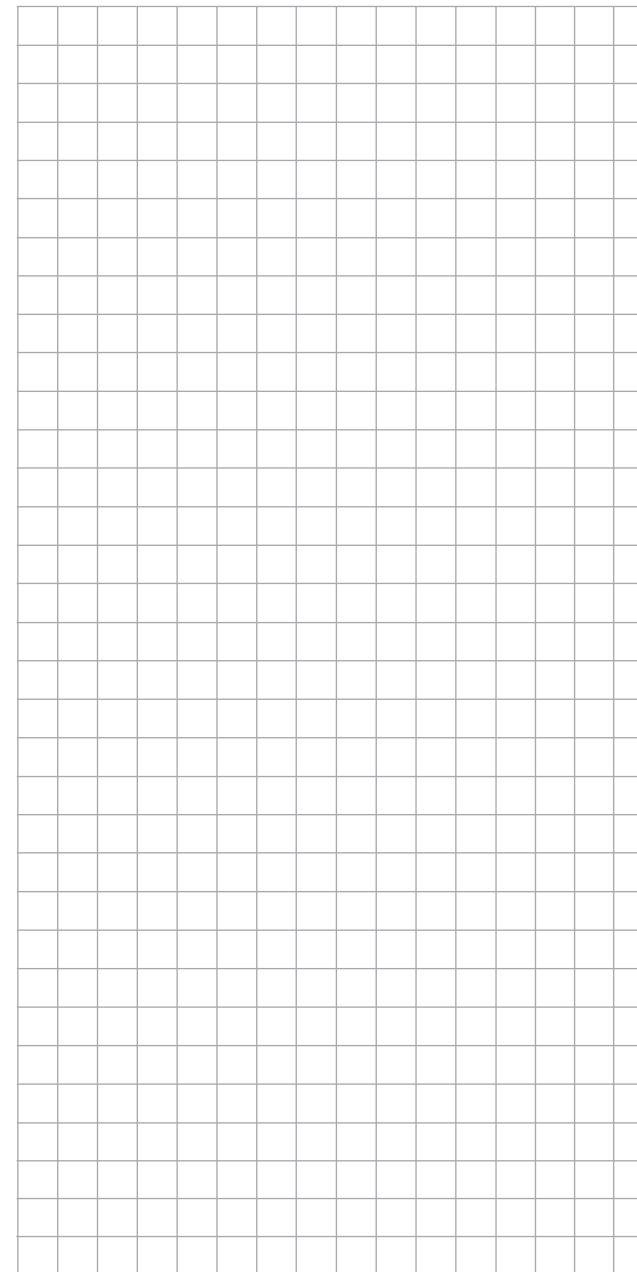
## Essential Mixer Parameters

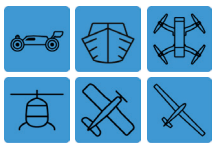
- **Mixing degree** that determines the level of influence of the input signal on the control channel connected to the mixer output.

With linear mixers, the mixing level can be adjusted symmetrically or asymmetrically. With curve mixers, the mixing level can also be configured according to user specifications by up to 7 points to produce extremely nonlinear mixer guide lines.

- **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 individually configured, it is recommended to specify a mixer neutral point for the 5 linear mixers.



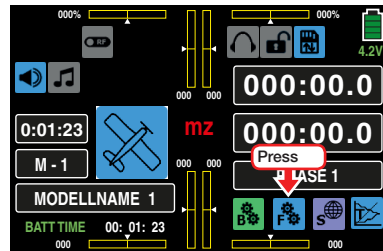


# Programmable Mixers

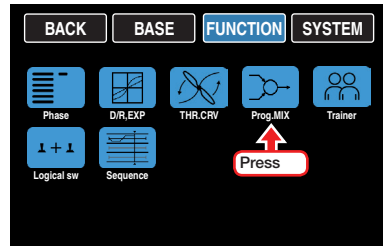
Programmable Linear and Curve Mixers

In addition to the different model types, per each set-up phase there are five linear mixers and three 7-point curve mixers in each of the 30 model memories.

To change these settings, from the main display press the **FUNCTION** menu gear icon (blue “F”) to bring up the FUNCTION submenu screen:



From the FUNCTION submenu display, press the **Prog.MIX** icon:

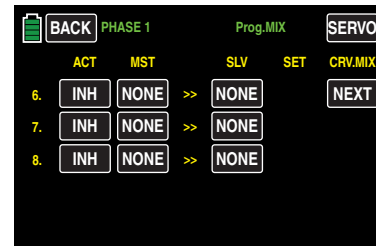
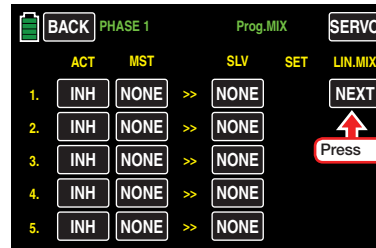


## Phase-Dependent Settings of Programmable Mixers

This submenu allows for different phase-specific values to be programmed. Phase names are displayed in green in the upper left side of the screen next to the BACK button. Standard default naming for the phases are usually displayed as **NORMAL/PHASE 1**. (Additional phases will be named numerically, e.g. Phase 2, Phase 3, etc.) To define multiple phases, refer to the FUNCTION submenu **Phase** section (page 120). Each new phase will need to be assigned to a different switch. To change the phases, activate the corresponding switch(es).

## Page Change

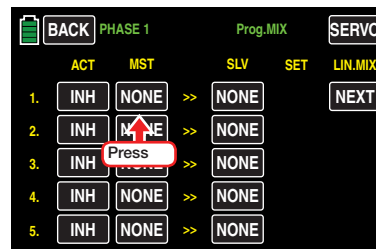
Linear mixers (1 to 5) are shown on the first display page. Press the **NEXT** button to view the curve mixer display (6 to 8):



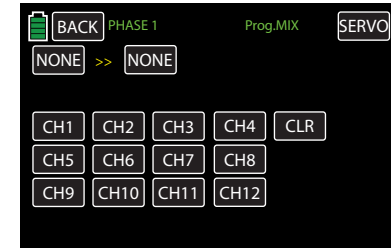
## Mixer Setup

Change to the appropriate phase.

Choose a number line to assign the mixer and press the **NONE** button. In the example below, the mixer is being assigned to Line 1:

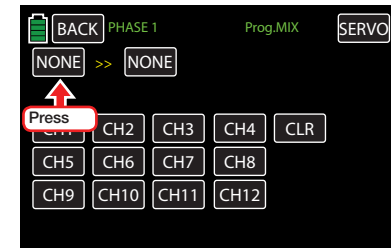


The Master >> Slave (source >> target) selection display page for the mixer appears:

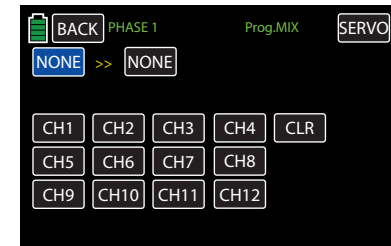


- **MST**

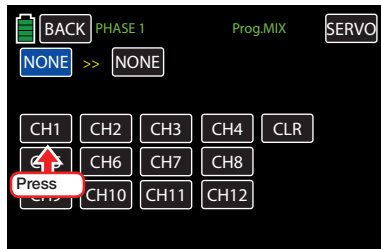
To choose the source (master) channel for mixer input, press the first (left) **NONE** button:



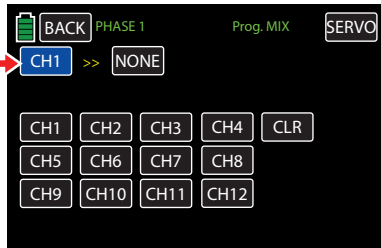
The button highlights blue:



Press to select control function 1 to 12. In the example below, **CH1** needs to be assigned:



As soon as the control function is selected, its value is transferred to the active MST field:



Press the **CLR** button to reset the default value in the blue field (**NONE**).

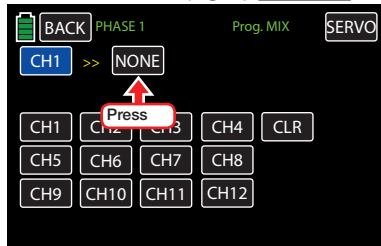
### Notice



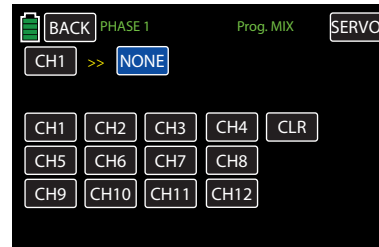
Do not forget to assign switches to the selected control functions 5 to 12 in the BASE sub-menu **CTL Set** (page 90).

- **SLV**

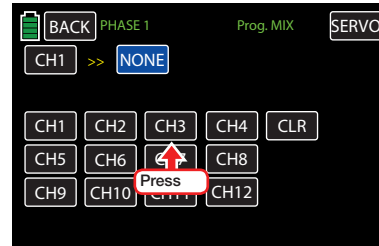
To choose the target (slave) channel for mixer output, press the second (right) **NONE** button:



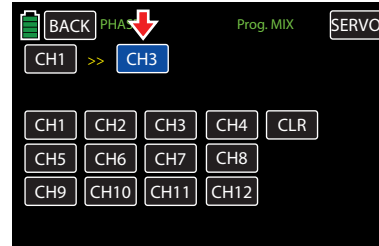
The button highlights blue:



Press to select control function 1 to 12. In the example below, **CH3** needs to be assigned:



As soon as the control function is selected, its value is transferred to the active SLV field:

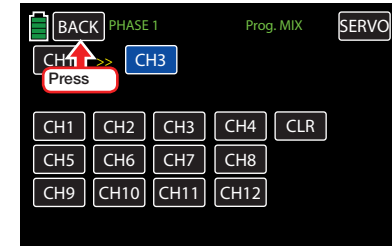


Press the **CLR** button to reset the default value in the blue field (**NONE**).

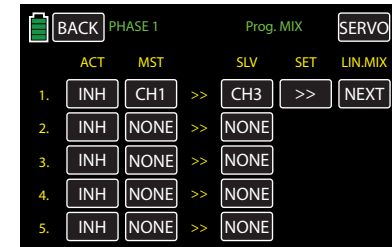
### Tip

A mixer programmed with the same input and output channels (such as CH1 >> CH1) allows for special effects when turning programmable mixers on and off as desired.

To store the selected settings, press the **BACK** button at the top left of the display:

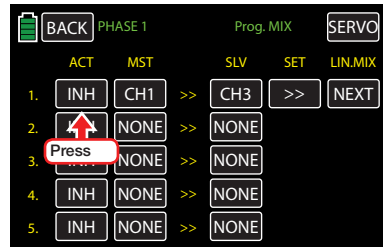


The Prog.MIX display screen appears with the mixer selections showing in Line 1:



## Activating and Deactivating Mixers

To activate (ON) or deactivate (INH) a mixer that has been setup as described above, press the value field in the **ACT** column of the appropriate mixer. In the example below, the mixer assigned to Line 1 needs to be activated:

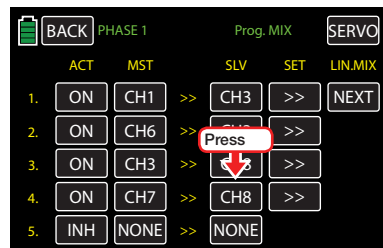


The Line 1 mixer is now activated (ON):

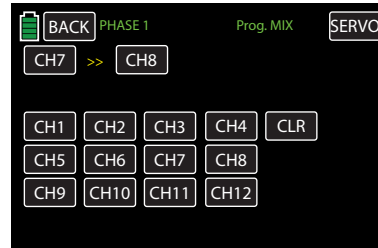


## Deleting Mixers

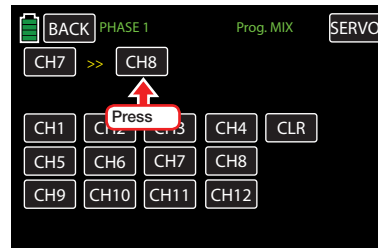
To reset a mixer, press either the **MST** or **SLV** column button of the appropriate mixer line. In the example below, the mixer assigned to Line 4 needs to be deleted:



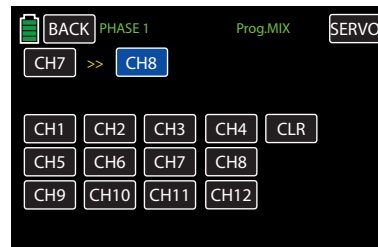
Both the MST and SLV column buttons will open the channel selection display screen:



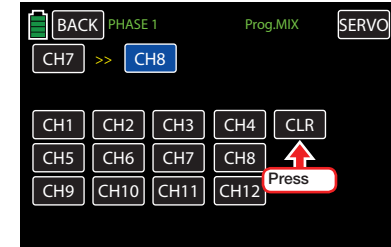
Press either the MST or SLV channel buttons in the top left of the screen. When cleared, both fields will return to their default settings so it doesn't matter which field is chosen. In the example below, **CH8** will be highlighted:



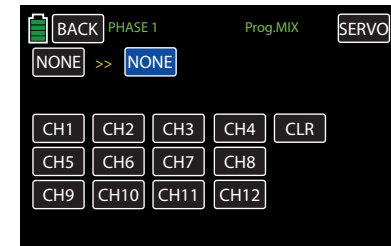
The button highlights blue:



Press the **CLR** button to reset both default values in the blue and black MST and SLV fields:



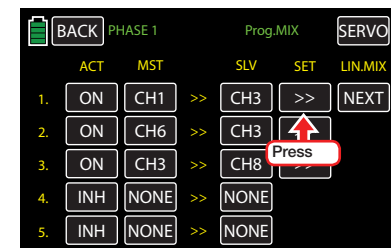
The fields have been reset to default:



Press the **BACK** button at the top left of the display to return to the mixer selection.

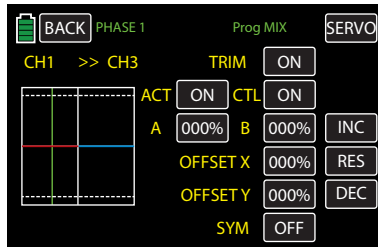
## Linear (1 to 5) Mixer Setup

To set linear mixers 1-5, press the brackets **>>** button in the **SET** column in the appropriate mixer line:





The mixer settings display page appears:



The vertical green line represents the present position of the control at input 1.

The horizontal line (left half red, right half blue) indicates a mixing level that is currently zero throughout the entire control travel. The elevator will not respond to the actuation of the CH1 transmitter.

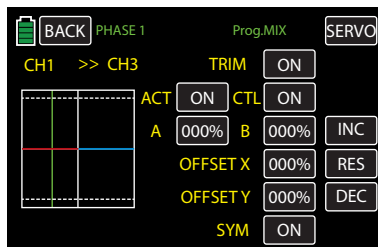
First, define the Mixing Levels.

### Mixing levels

Define mixing levels above and below the mixer neutral point beginning from its current position.

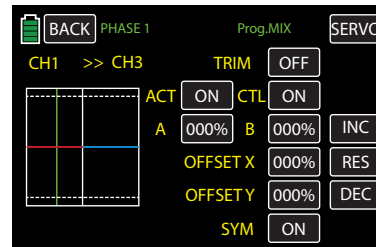
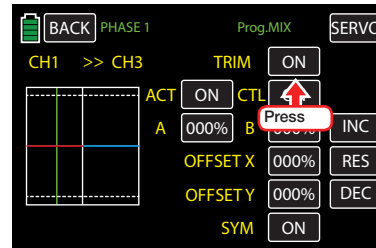
### Setting Symmetrical or Asymmetrical Values

By default, the values are set separately for each control side. To set the values simultaneously, turn ON the symmetrical function by pressing the **ON/OFF** button in the **SYM** line:



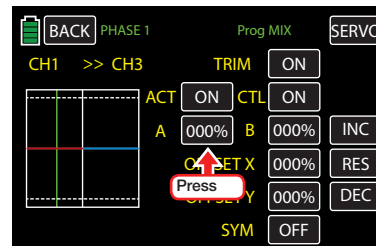
### TRIM Line

It is standard that the digital trim of control functions 1-4 act on the mixer input. The digital trim for control functions 5-12 also act on the mixer input. In the event that the functions have been assigned to one of the INC/DEC buttons (DT1 or DT2), the trim influence can be switched off by pressing the **ON/OFF** button in the **TRIM** line:

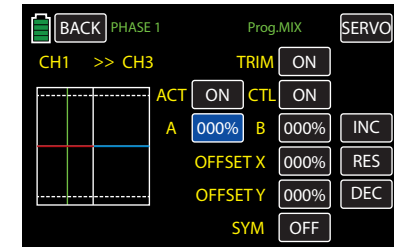


### Programming

To set the mixing value to be left of the 0% control travel and reset the central position in the middle of the graph, press the value field in the **A** line:



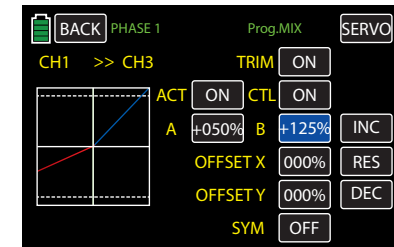
The field highlights blue:



Press the **INC** or **DEC** buttons or the arrow keys (▲▼) to increase/decrease the values. The adjustment range is  $\pm 125\%$ .

Use the same procedure for a value on the right of the neutral point.

Symmetrical and asymmetrical values can be set, for example:



Press the **RES** button to reset the changed value back to the default.

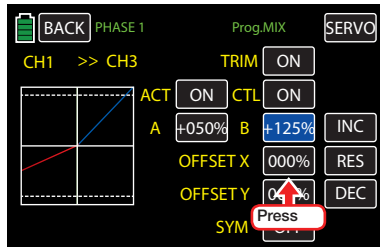
### Offset (Mixer Central Point)

The offset mixer central point is the point along the control travel at which the mixer does NOT influence the control channel connected to an output. By default is precisely in the middle of the control range. This point can be moved under the following two circumstances (Offset X and Offset Y):

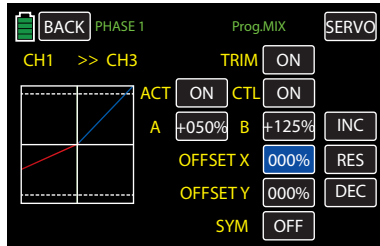
- **OFFSET X**

A value unequal to **000%** entered in the OFFSET X line causes the offset to shift *horizontally* by a maximum of  $\pm 100\%$ .

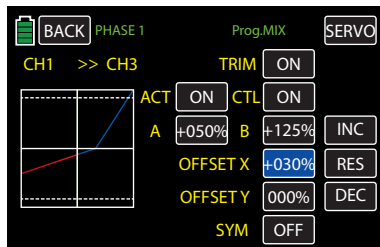
In the following example, the offset point needs to be moved 30% to the right. Press the value field in the **OFFSET X** line:



The field highlights blue:



Press the **INC** button or the up arrow key (▲) to move the offset point 30% to the right of the currently set mixer end point:

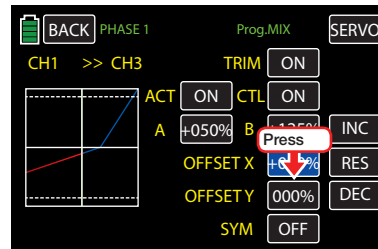


Press the **RES** button to reset the changed value back to the default.

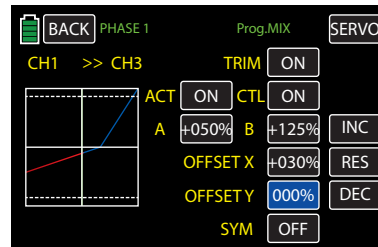
- **OFFSET Y**

A value unequal to **000%** entered in the OFFSET Y line causes the offset to shift *vertically* by a maximum of  $\pm 100\%$ .

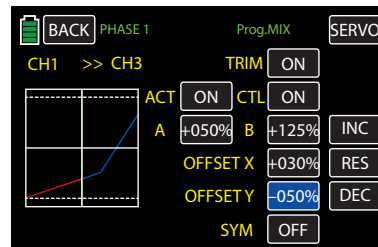
In the following example, the offset point needs to be moved 50% to the bottom. Press the value field in **OFFSET Y** line:



The field highlights blue:



Next, press the **DEC** button or the down arrow key (▼) to move the offset point 50% below the currently set mixer point:



Press the **RES** button to reset the changed value back to the default.

**Attention**

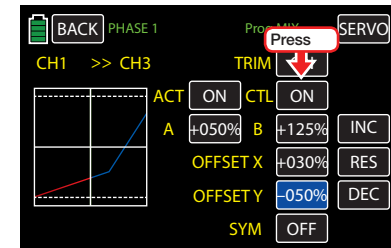


The curve shown above is for demonstration purposes only and does not represent an actual mixer guide line.

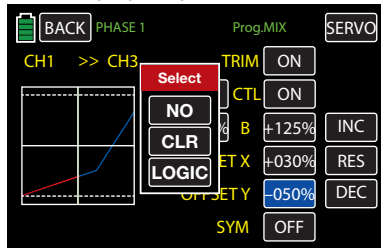
**Mixer Switch**

Once a mixer is activated, the value fields in the ACT and CTL lines automatically change to **ON**. This activates the relevant mixer and turns it on permanently in the current phase. Refer to the **Activating and Deactivating Mixers** section (page 136) for more information.

Each mixer can be turned on and off by assigning it a switch that has not been assigned other functions. Press the value field in the **CTL** line:



An active window pops up:



Assign a switch or control switch as described in section **Control and Switch Assignment** (page 26).

Press the **BACK** button at the top left of the display to return to the mixer selection.

### Curve (6 to 8) Mixer Setup

These three curve mixers make it possible to define extremely nonlinear mixer guide lines with up to five freely positionable points between the two endpoints along the control travel: **L** (low = -100% control travel) and **H** (high = +100% control travel) .

### Programming Details

The control curve can be specified by up to 7 points, (termed “support points”) along the entire control stick travel. In the basic program setting, 2 support points describe a linear characteristic; the two endpoints at the bottom control stick stop **L** and at the top control stick stop **H**.

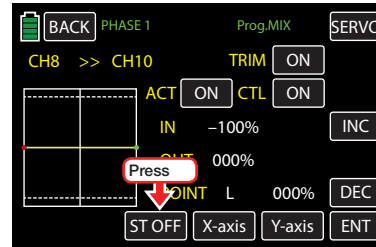
### Notice

» The following examples are for demonstration purposes only and do not represent a realistic mixer guide line.

### Setting Support Points

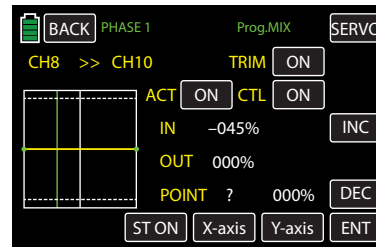
A green vertical line, normally hidden, appears and moves synchronously in the graphic between the two mixer input control endpoints once the control switch is activated. (In the example below, control function

CH8 is assigned to the side proportional rotary control SL1.) To show the green line, press the **ST OFF** button at the bottom left to activate the switch:



The value field changes to **ST ON**, the green vertical line representing the temporary control position appears in the graph and the control position is numerically displayed in the input **IN** line.

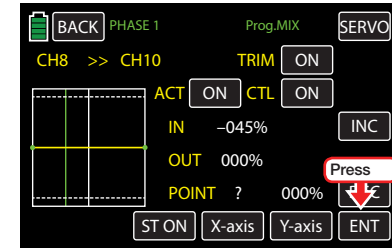
In the example below, the control at input CH8 is at -045% of the control travel. The output signal remains 000% since a value has not been entered:



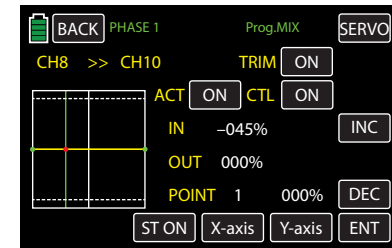
The intersection of this line with the mixer curve is identified as output in the **OUT** line and can be varied at the support points within a range of  $\pm 125\%$ . This alters the control signal which affects the mixer output.

Up to five additional support points can be set between the **L** and **H** endpoints; the distance between each support points must be a minimum of 25%.

Move the green line via the related control. To set a support point, press the **ENT** button:



A red dot appears at the intersection between the two lines. At the same time, the **?** in the **POINT** line is replaced with a point number, and the value field to the right shows the current output value:



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  $\pm 125\%$ . Refer to the **Changing the Support Point Value** section (page 140) for additional information.

### Notice

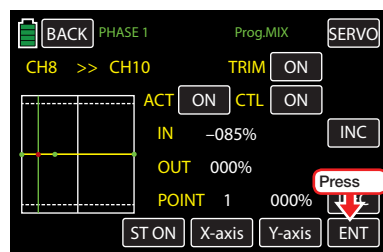
» Remember that the percentages in the input (IN) and output (OUT) line always refer to the temporary position of the control stick and not to the position of the point.

Use the same procedure to set the other support points. The 5 support points between the L and H endpoints can be created in any order; support points

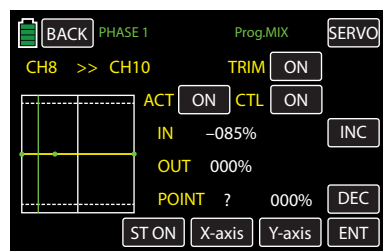
are automatically renumbered sequentially from left to right after points are set or deleted.

### Deleting a Support Point

To remove a set support point, move the control stick until the vertical green line aligns with the point to be deleted. The support point will turn red and its number and associated value will appear in the **POINT** line. To clear the point, press the **ENT** button:

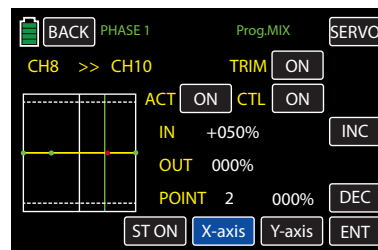


The red point disappears:



### Changing the Support Point Value

- X-axis Button (X-axis)**  
 Activate this function, press to highlight the **X-axis** button at the bottom edge of the display. Point values can be changed only when the button is blue.  
 Move the active (red) point to the right by pressing the **INC** button or to the left with the **DEC** button. In the example below, Point 1 (set at -45%) and Point 2 (set at +45%) is moved and placed precisely between the end position and middle position:

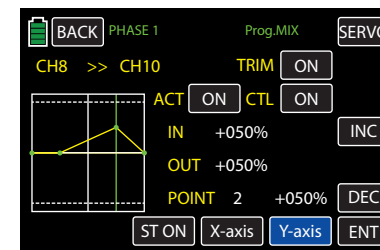


Press the **X-axis** button to deactivate the function. The button changes back to black.

#### Notices

- Moving the red point horizontally away from the current control position will cause the point to become green after a short while, and a ? will appear in the Point line. This question mark does not relate to the point which has been moved, rather, it indicates that another point can be set at the current control position.
- Remember that the percentages in the input (IN) and output (OUT) line always refer to the temporary position of the control stick and not to the position of the point.

- Y-axis Button (Y-axis)**  
 Activate this function, press to highlight the **Y-axis** button at the bottom edge of the display. Point values can be changed only when the button is blue.  
 Move the active (red) point to the right by pressing the **INC** button or to the left with the **DEC** button:

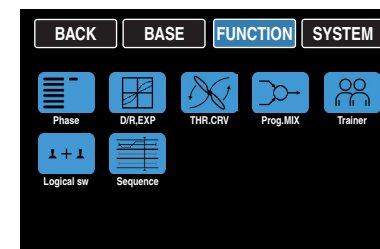


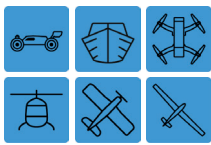
Press the **Y-axis** button to deactivate the function. The button changes back to black.

#### Notice

- Remember that the percentages in the input (IN) and output (OUT) line always refer to the temporary position of the control stick and not to the position of the point.

Press the **BACK** button at the top left of the display to return to the mixer selection.



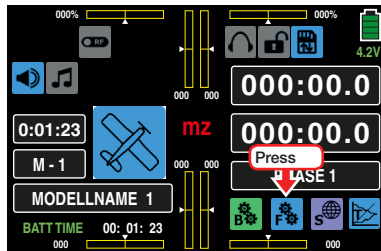


# Trainer

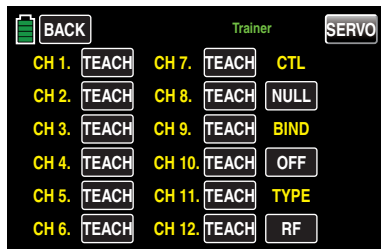
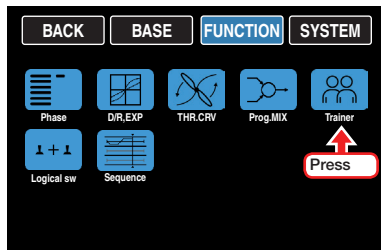
## Dual Transmitter Connection With DSC Cable

An **mz-24 Pro** HoTT TEACH transmitter can be connected to any suitable PUPIL transmitter, including transmitters with a classic 35/40 MHz range. Use the DSC port on the back of the transmitter to establish a cable-linked trainer system.

To establish these settings, from the main display press the **FUNCTION** menu gear icon (blue “F”) to bring up the FUNCTION submenu screen:



From the FUNCTION submenu display, press the **Trainer** icon:



### Notice



The previous graphic shows the default status of this submenu. PUPIL control has not been released; neither has a switch been assigned.

### Transmitter Settings - TEACH

The PUPIL-controlled model *must be programmed with all its functions* including trimming and any mixer functions in a model memory of the **TEACH** transmitter. The receiver of the pupil-model must also be bound to the **TEACH** transmitter since that receiver is responsible for controlling the model even in PUPIL mode.

Transfer up to 12 *function inputs* (see **Definition of Terms**, page 24) of the TEACH transmitter to the PUPIL transmitter, either individually or in any desired combination.

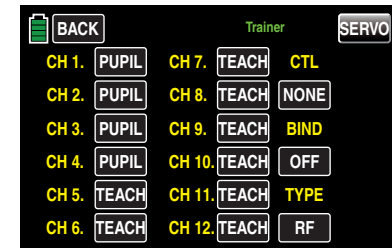
The **TEACH** labeling value field or button follows the standard control stick function assignment for function inputs 1 - 4 found in all model types. Function inputs 5 - 12 are typically free, or open, inputs. Refer to the BASE submenu **CTL Set** (page 90).

### Notice



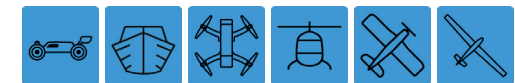
It does not matter which specific controls are assigned to the control function inputs to be transferred to the PUPIL. Inputs can only be assigned in the BASE submenu **CTL Set** (page 90) when the trainer connection is turned **OFF**.

To transfer any of the control function inputs 1 - 12 to the PUPIL, press the **TEACH** button. The inputs will be assigned as **PUPIL**:



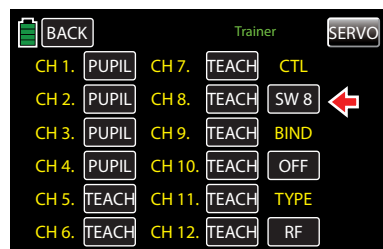
Following the standard conventions for model types Airplane, Glider and Helicopter when assigning control functions.

Channel	Function
1	Motor/airbrake or pitch
2	Aileron or Roll
3	Elevator or Nick
4	Rudder or Yaw



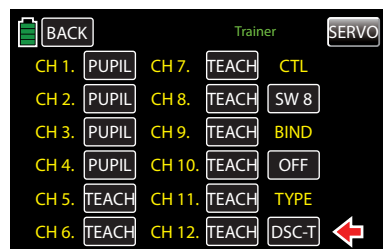
To change between teacher and pupil, a **trainer-switch** must be assigned in the value field in the **CTL** column, as described in section **Control and Switch Assignment** (page 26).

Using an intermittent switch, such as **S8**, is highly recommended so that control can be easily withdrawn from the trainer at any time:



Since the trainer system programming an operable PUPIL transmitter will not be connected to a TEACH transmitter, the transmitter will react with acoustical alarms to switches connected during the switch assignment. A warning message flashes every second at the top left in the transmitter's main display. Open the switch that has just been assigned.

To change the DSC connection to "signal input," press the value field in the **TYPE** column. The default **RF** will change to **DSC-T**:



If the connection to the PUPIL is made with anything other than a two-pin DSC socket, e.g. a three-pin T/P jack by *Graupner*, the connection to the PUPIL transmitter will not work. Change the modulation type PPM (10, 16, 18 or 24) must be set in the PUPIL transmitter independently from the modulation type used in the TEACH transmitter.

### Transmitter Settings - PUPIL

The PUPIL-controlled model *must be programmed with all its functions* including trimming and any mixer functions in a model memory of the **TEACH** transmitter. The receiver of the pupil-model must also be bound to the **TEACH** transmitter since that receiver is responsible for controlling the model even in PUPIL mode. A suitable PUPIL transmitter can be connected to any TEACH transmitter, including transmitters with a classic 35/40 MHz range since the required PPM signal required by the TEACH transmitter is normally applied to the DSC socket of a HoTT transmitter.

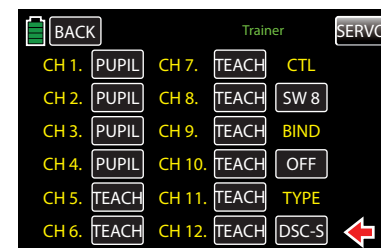
Almost any transmitter from the past and current *Graupner* product line with at least 4 control functions can be used as the PUPIL transmitter. The PUPIL transmitter must be equipped with the current connection module for PUPIL transmitters. The module must be connected to the transmitter board in accordance with the provided installation instructions.

The specified cable is used to connect to the TEACH transmitter. Refer to the **Trainer Cable** section (page 143) for more information.

The control functions of the PUPIL transmitter must act directly on the control channels without any intermediate mixers, i.e. receiver outputs.

With *Graupner* transmitter series **mc**, **mx**, or **mz** it is recommended that student models be named "PUPIL" in the model memory line. Assign the correct model type and adapt the control arrangement (mode 1 - 4) and throttle/pitch to the PUPIL preferences. All other settings, including mixing and coupling functions, are made in the TEACH transmitter and are transmitted by the TEACH transmitter to the receiver.

For transmitters in the **mz-18** and **mz-24** series, press the value field in the **TYPE** column at the bottom of the FUNCTION submenu **Trainer** display. Change to **DSC-S** and change the rear DSC transmitter connection to "signal output":



With a **mx-20**, **mc-16**, **mc-20** or **mc-32** PUPIL transmitter, adapt the modulation types to the *number of control channels* to be transferred in the **DSC OUTPUT** line of the BASE submenu **TX ctl**. 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 PUPIL mode is to be used with an existing model memory, instead of one newly initialized in the PUPIL transmitter, make sure to enter "HoTT" in the "Module" line of the BASE submenu. Otherwise, the PPM signal at the DSC socket may be inverted.

To assign control functions other than the two control sticks functions (1 - 4) to the TEACH transmitter, assign control elements to the *inputs* in the BASE submenu **CTL Set** of the PUPIL transmitter that correspond to the released *function inputs* 5 - 12 in the **Trainer** submenu of the TEACH transmitter.

With 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, turn off all the mixers or set them to zero.

### Notices



- Failure to assign a control in the PUPIL transmitter will result in the relevant servo(s) remaining in middle position after transferring control functions to the PUPIL transmitter.
- Regardless of the type of RF link between the TEACH transmitter and model, the PUPIL transmitter should always be operated in normal PPM mode.

### Teacher/Pupil Function

Both transmitters are connected to each other using an appropriate cable. Refer to the **Trainer Cable** section (page 143). Insert the plug identified as **M** (master) in the TEACH transmitter socket, and insert the plug with **S** (student) in the PUPIL transmitter socket (this many vary depending on the cable).

### Attention



BEFORE starting trainer mode for the operational model, always make sure all functions have been correctly transferred.

### Notice



Do not insert a 3-pin jack plug trainer cable into the DSC system socket; it is not designed for this purpose. The DSC socket can only be used for cables with a 2-pin jack plug.

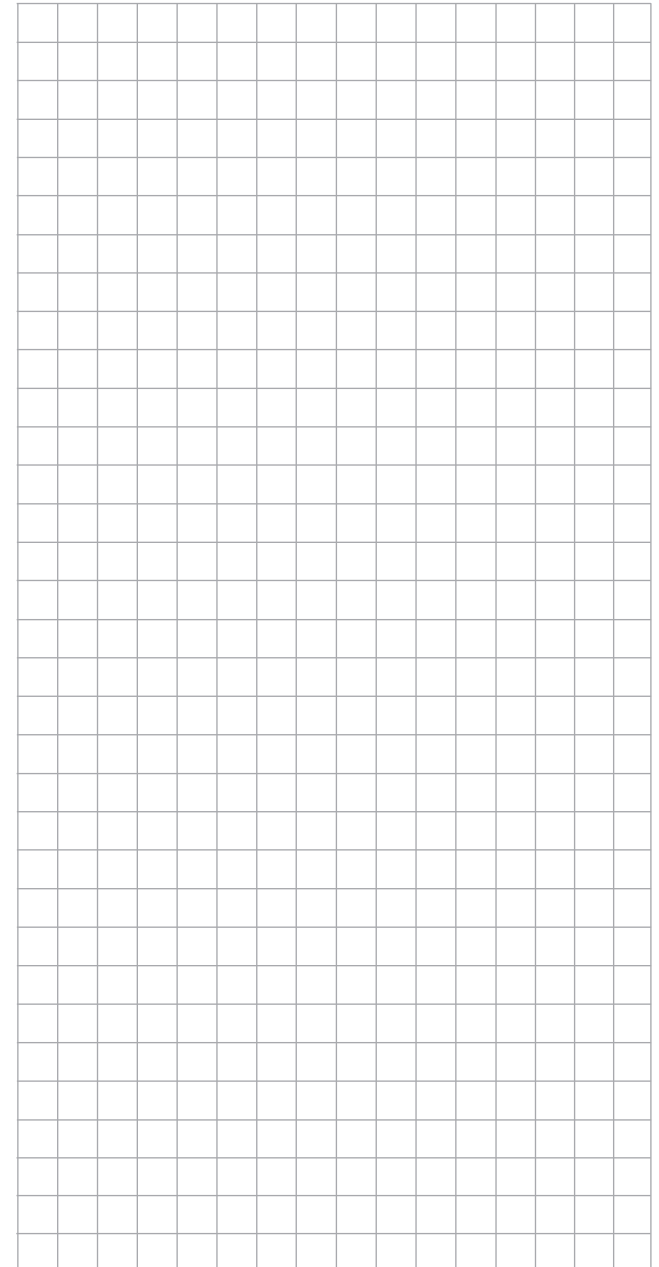
### Trainer Cable

**4179.1** Trainer cable to connect any two *Graupner* transmitters with a DSC socket. This cable has a 2-pin jack plug on both ends.

**3290.7** Trainer cable to connect a TEACH transmitter with a DSC socket to a *Graupner* PUPIL transmitter with a PUPIL socket for the optoelectronic system. This cable has a 2-pin jack plug on the **M** side and a 3-pin jack plug on the **S** side. (Example: an **mz-24 Pro** to an **mc-16**, or a transmitter retrofitted with a DSC module - order No. **3290.24**)

**3290.8** Trainer cable to connect a TEACH transmitter having a socket for the optoelectronic system to a *Graupner* PUPIL transmitter with a DSC socket. This cable has a 3-pin jack plug on the **M** side and a 2-pin jack plug on the **S** side. (Example: an **mc-16** to an **mz-24 Pro**, or a transmitter retrofitted with a DSC module - order No. **3290.24**)

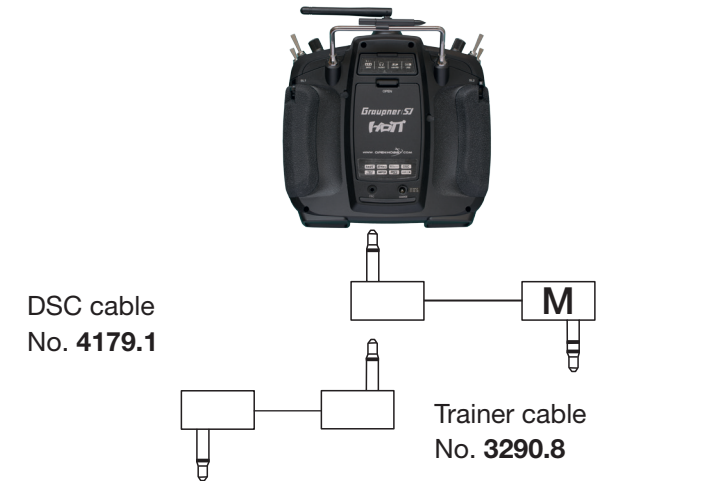
Additional information on the cables and modules mentioned in this section for the TEACH and PUPIL transmitters can be found in the relevant transmitter instructions in the main *Graupner* FS catalogue, and on the Internet at [www.graupnerusa.com](http://www.graupnerusa.com).



# Connecting Schema

The following connecting schema represent all transmitter combinations possible at the time this manual was created.

## Pupil transmitter mz-24 Pro HoTT



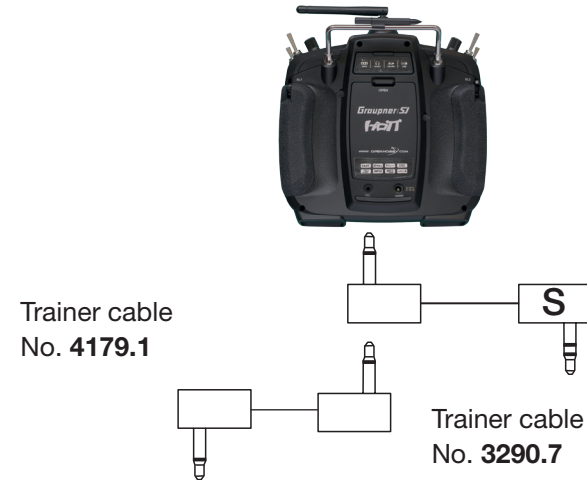
TEACH transmitter  
with DSC socket

**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 Pro

Trainer transmitter  
with TEACH module No.  
**3290.2, 3290.19, 3290.22**

**mc-19** to **mc-24**  
**mx-22**(iFS)  
**mx-24s**

## Teacher transmitter mz-24 Pro HoTT



PUPIL transmitter  
with DSC socket

**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 Pro

PUPIL transmitter with PU-  
 PIL module, No. **3290.3,**  
**3290.10, 3290.33**

**D 14**  
**FM 414**  
**FM 4014**  
**FM 6014**  
**mc-10** to **mc-24**  
**mx-22**(iFS)  
**mx-24s**



# Wireless HoTT System

The **mz-24** HoTT Pro transmitter trainer system can be operated remotely. Configuration two available transmitters in the **FUNCTION** submenu **Trainer** display via the **BIND** option. Refer to the **Binding PUPIL Transmitter to TEACH Transmitter** section (page 146) for more information.

## Preparing for Training Mode

### TEACH Transmitter

The training model functions *must be programmed entirely* including trimming and any mixers in a model memory of the **TEACH** transmitter.

### Attention

» The model provided for training must be completely controllable by the **TEACH** transmitter and remain connected to the teacher transmitter for the duration of the training phase.

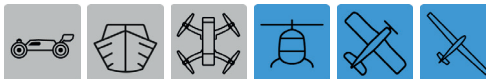
### Notice

» If the **PUPIL** transmitter is a **mx-10** with firmware version V 1a20, regardless of the teacher transmitter firmware version, the training model **MUST ALWAYS** be linked to the pupil transmitter. In addition, for correct functionality, in the model memory of the teacher transmitter, both option buttons in the **BIND ON/OFF** line of the **BASE** submenu **TX ctl** be set to **OFF**. In other words, there should be no link to a receiver in this model memory under either **RX1** or **RX2**.

### PUPIL Transmitter

With *Graupner* transmitter series **mc**, **mx**, or **mz** it is recommended that student models be named “**PUPIL**” in the model memory line. Assign the correct model type and adapt the control arrangement (mode 1 - 4) and throttle/pitch to the **PUPIL** preferences. All other settings, including mixing and coupling func-

tions, are made in the **TEACH** transmitter and are transmitted by the **TEACH** transmitter to the receiver.



Following the standard conventions for model types Airplane, Glider and Helicopter when assigning control functions.

Channel	Function
1	Motor/airbrake or pitch
2	Aileron or Roll
3	Elevator or Nick
4	Rudder or Yaw



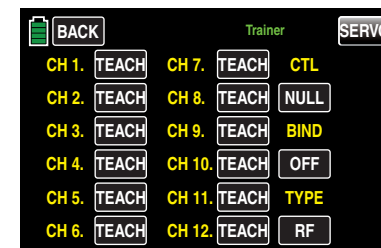
To assign control functions other than the two control sticks functions (1 - 4) to the **TEACH** transmitter, assign control elements to the *inputs* in the **BASE** submenu **CTL Set** of the **PUPIL** transmitter that correspond to the released *function inputs* 5 - 12 in the **Trainer** submenu of the **TEACH** transmitter.

### Notice

» Failure to assign a control in the **PUPIL** transmitter will result in the relevant servo(s) remaining in middle position after transferring control functions to the **PUPIL** transmitter.

## Preparing TEACH and PUPIL Transmitters

Bind the training model to the **PUPIL** transmitter, then turn on the **TEACH** transmitter and open the **FUNCTION** submenu **Trainer** display on both transmitters:



The above graphic shows the default layout of the submenu.

### Notice

» Note the value field under **TYPE** column at the bottom of the display is set to **RF** in both the **PUPIL** and **TEACH** transmitter.

### PUPIL Transmitter

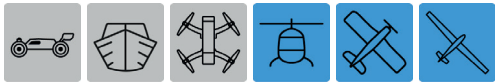
Verify that the display is configured identically with the above screen-shot graphic.

### TEACH Transmitter

Transfer up to twelve function inputs of an **mz-24 Pro** **TEACH** transmitter to the **PUPIL** transmitter, either individually or in any desired combination.

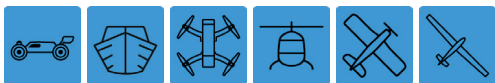
### Notice

» It does not matter which specific controls are assigned to the control function inputs to be transferred to the **PUPIL**. Inputs can only be assigned in the **BASE** submenu **CTL Set** (page 90) when the trainer connection is turned **OFF**.

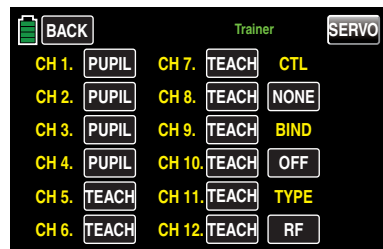


Following the standard conventions for model types Airplane, Glider and Helicopter when assigning control functions.

Channel	Function
1	Motor/airbrake or pitch
2	Aileron or Roll
3	Elevator or Nick
4	Rudder or Yaw

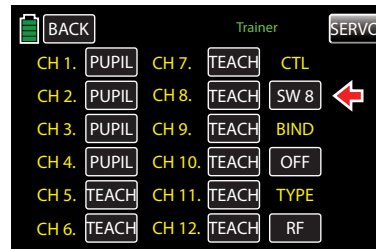


Select by pressing the control function inputs 1 to 12 to be transferred to the PUPIL. In the example below, inputs 1 - 4 have been transferred to the pupil:



To change between teacher and pupil a **trainer-switch** must be assigned in the **CTL** column value field. Refer to the **Control and Switch Assignment** section (page 26).

Using an intermittent switch, such as **S8**, is highly recommended so that control can be easily withdrawn from the trainer at any time:



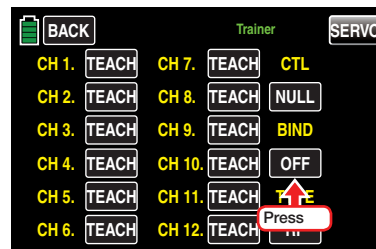
Since the trainer system programming an operable PUPIL transmitter will not be connected to a TEACH transmitter, the transmitter will react with acoustical alarms to switches connected during the switch assignment. A warning message flashes every second at the top left in the transmitter's main display. Open the switch that has just been assigned.

### Binding PUPIL Transmitter to TEACH Transmitter

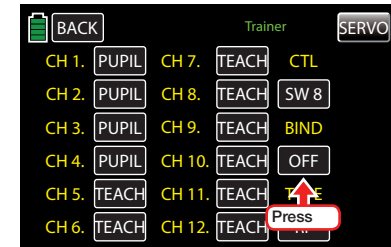
#### Notice

During binding, the transmitters cannot be too far apart. If binding fails, bring the two transmitters closer together, and restart the binding process.

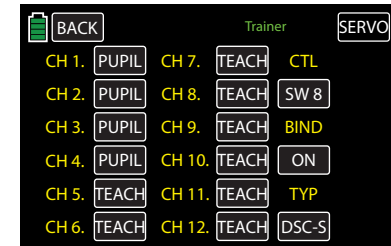
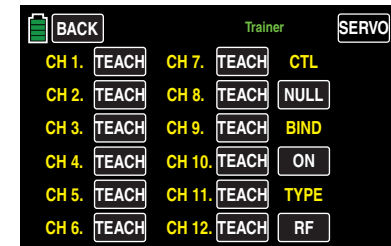
Start the binding process in the **PUPIL** transmitter by pressing the value field button in the **BIND** column:



Immediately press the same button on the **TEACH** transmitter:



The value field shows **ON** in both displays:



The transmitters are now bound. Both transmitters can now return to the basic display and commence training after a thorough check of all functions.

Bind has failed if only one (or neither) transmitter displays **ON** in the BIND column. Bring the two transmitters closer together, and restart the binding process.

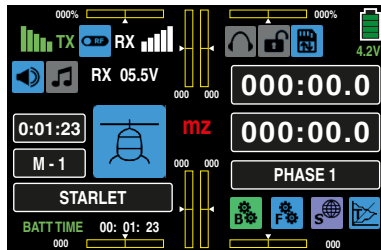
#### Attention

BEFORE starting trainer mode for the operational model, always make sure all functions have been correctly transferred.

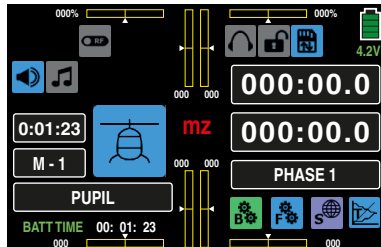
## Training Mode

During training, the teacher and pupil can maintain a comfortable distance. Do not exceed a distance of 164 feet (50 m). No one should be between the teacher and pupil: this reduces the feedback channel range used to connect the two transmitters.

While in Training Mode, the main display of the **TEACH** transmitter may look like the example graphic below:

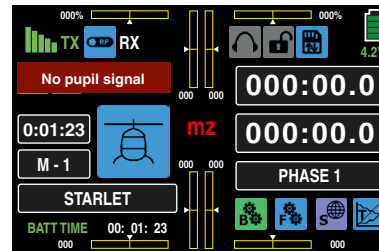


The **PUPIL** transmitter may look like the example graphic below:



If connection between TEACH and PUPIL transmitters is lost during training, the TEACH transmitter automatically assumes control of the model.

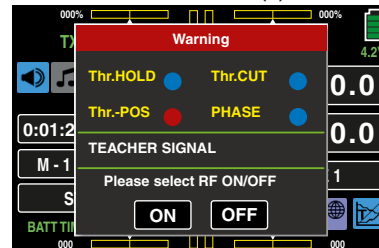
If connection is lost and the **trainer-switch** is in the **pupil** position, acoustic warnings sound, and a warning message flashes every second at the top left of the display:



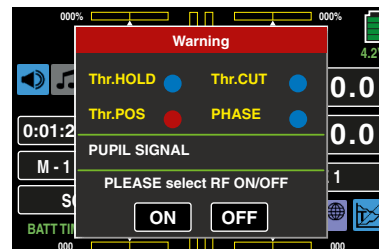
In both examples, bring both transmitters closer together. If does not restore the connection, immediately stop using the model and troubleshoot the connection problem.

## Restarting the Trainer Mode

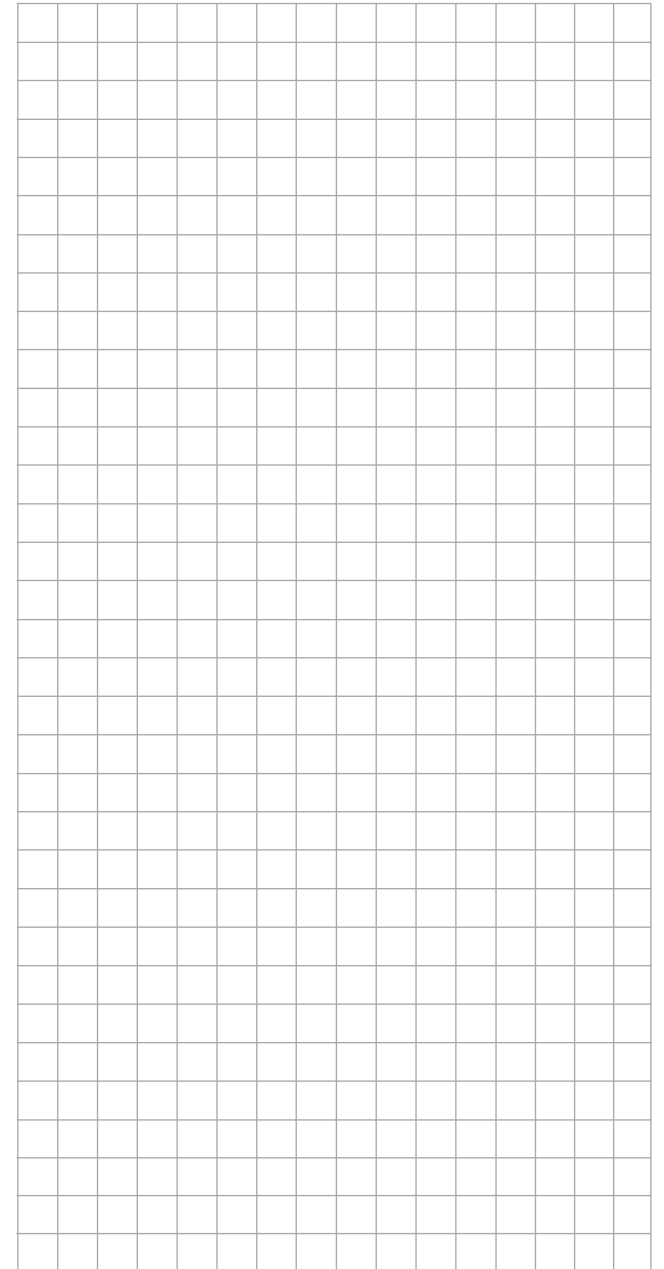
If one of both transmitters have been turned off, the following active warning will appear in the TEACH transmitter once the transmitter(s) is turned on:

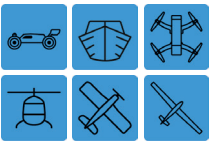


The following active warning will appear in the PUPIL transmitter once the transmitter(s) is turned on:



Pressing the **ON** button confirms the Trainer Mode is active. Pressing **OFF** stops the training mode.



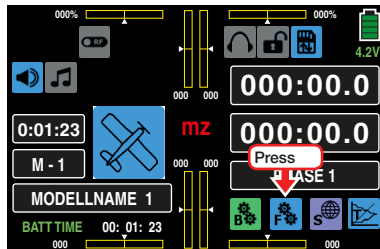


# Logical Switch

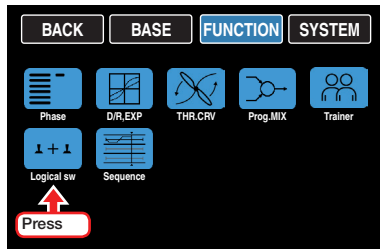
## Logical Switch Setup

This function allows two switches, controls and/or logical switches (or any combination thereof) to be interconnected in an **AND** or **OR** switch. Logical switches activate when certain conditions are met: two switch conditions must be met to activate an AND switch; conversely, functions can activate an OR switch if one of two conditions are met.

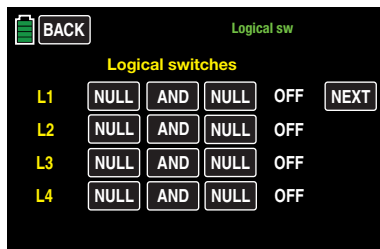
To setup a logical switch, from the main display press the **FUNCTION** menu gear icon (blue "F") to bring up the FUNCTION submenu screen:



From the FUNCTION submenu display, press the **Logical sw** icon:



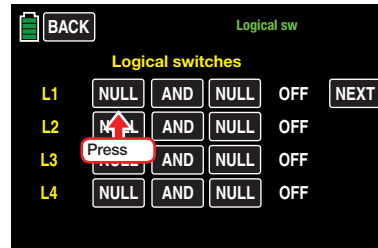
A total amount of 8 logical switches, L1 - L8, can be programmed:



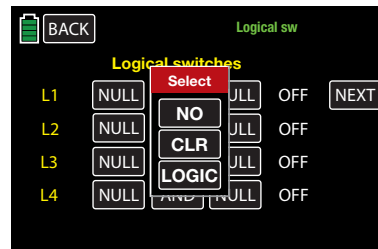
The result of a logical switch is that it can be used as alternative switch function. The ON/OFF column in the display shows when the switch function has been activated.

### Programming

Assigning the required switch for a logical connection is performed with both value fields on one line. Press the left value field of the appropriate line to assign switches. In the example below, switches S6 and S3 need to be assigned to L1:

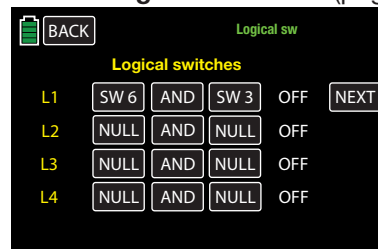


An active window appears:



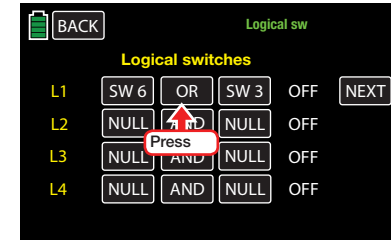
Press **NO** to terminate the procedure.

Assign a switch following the instructions in the **Control and Switch Assignment** section (page 26):



### AND / OR

Changing the switch connection between **AND** and **OR** can be done by pressing the button in the center column of the display for the appropriate logical switch line:



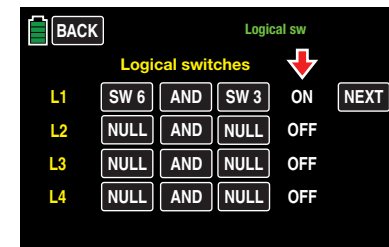
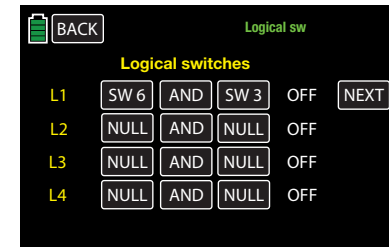
- **AND**

A logical switch is activated only when **both** switches are activated.

- **OR**

A logical switch is activated when **one** of the two assigned switches activated.

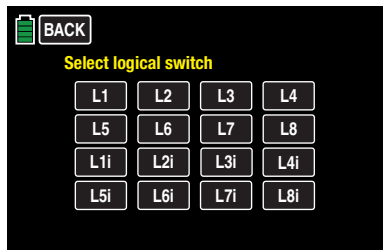
The actual switch position of the logical switches is displayed in the right column:



Once the parameters are established in the FUNCTION submenu **Logical sw** display, assign the logical switches to a switch. In many submenus there is a CTL option. By pressing any **CTL** field the following active window will appear:



Pressing the **LOGIC** button will bring up the logical switch menu:

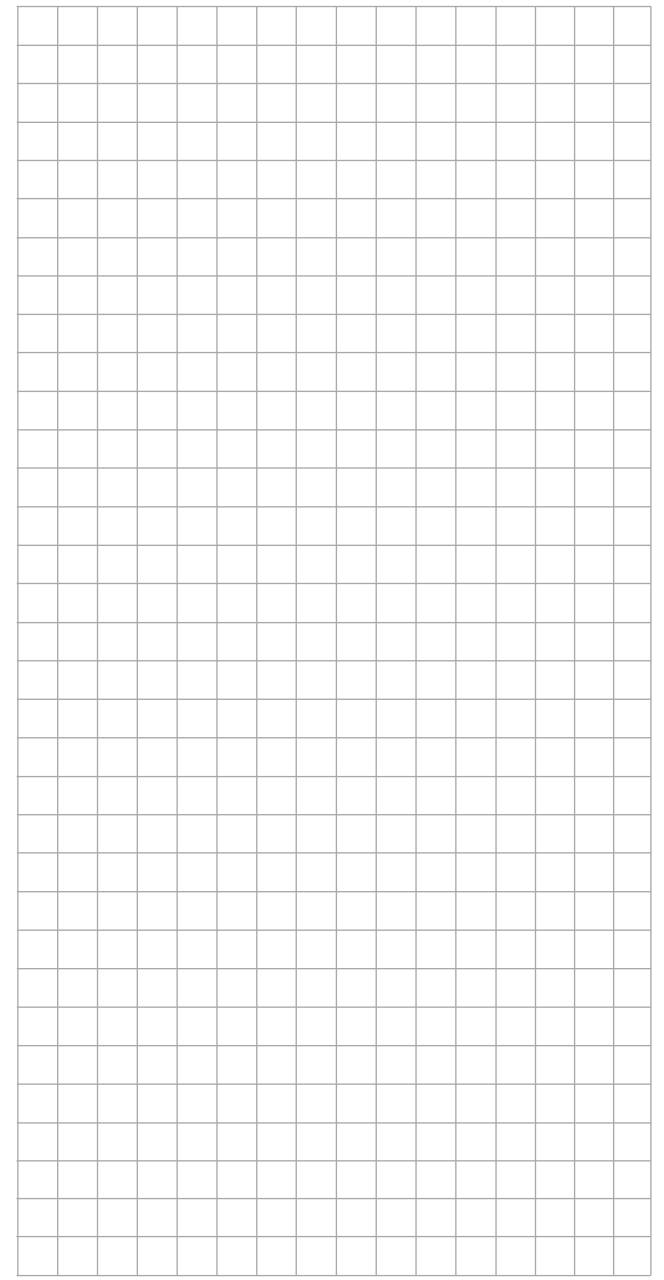
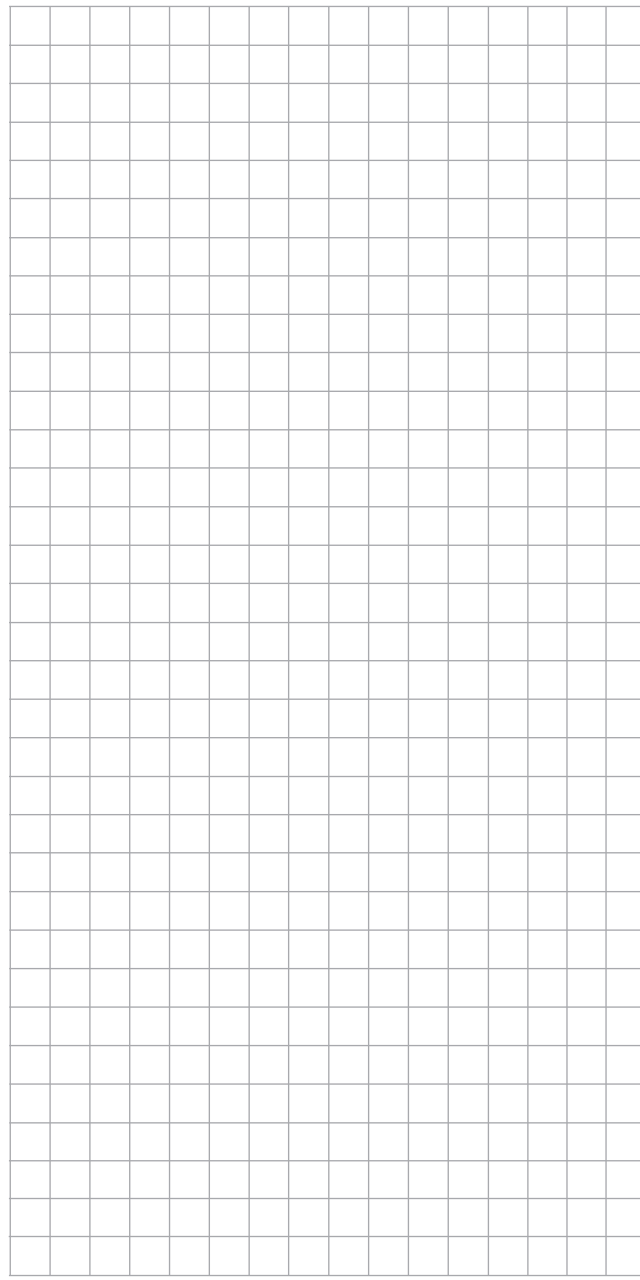


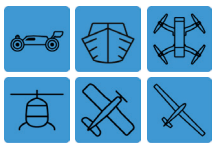
Press the logical switch to assign to the related value field.

**Tip**

Selecting an inverted switch, e.g. "L3i" instead of "L3", note that only the *switch direction* of this specific switch will be reversed and not the logical switch itself!

If a specific "L" switch activates a *function* (i.e. a timer), the "i" (inverted) setting will activate the function regardless whether the switch is in the **ON** or **OFF** position. Therefore, a possible use-case scenario might include using the same switch to activate one function while deactivating another function and vice versa.



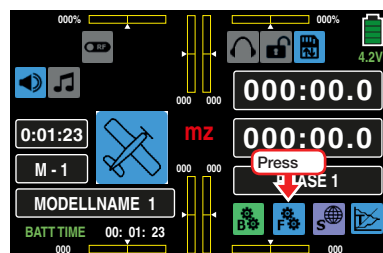


# Sequencer

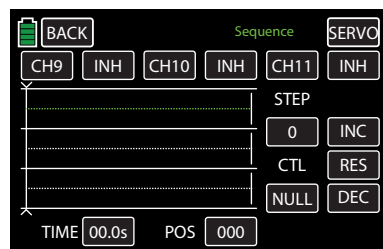
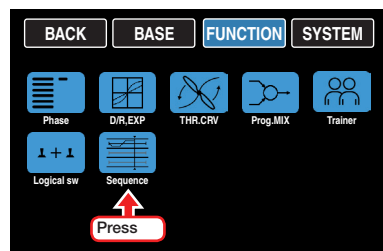
## Logical Switch Setup

A sequence allows up to three servos to perform up to nine steps during a 30-second period. For example, sequencing can allow the cover doors to open while folding landing gear descends the fuselage, then close again when the landing gear leg has extended. Alternatively, sequencing can allow the canopy to open, the pilot turn his head and wave his hand. All of these actions must first be divided into a logical sequence of single movements.

To set a sequence, from the main display press the **FUNCTION** menu gear icon (blue "F") to bring up the FUNCTION submenu screen:



From the FUNCTION submenu display, press the **Sequencer** icon:

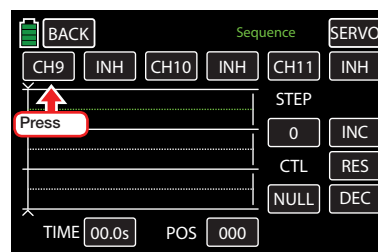


Through the **Sequence** display, one common switch can be assigned to activate up to three servos performing up to 9 precisely determined steps within 30 seconds.

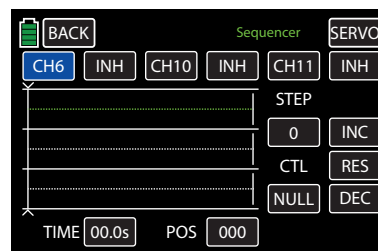
### Selection and Control Channel Activation

- Channel Selection**

The three pre-set channels **CH9**, **CH10** and **CH11** can be changed by pressing the value field:



The field highlights blue. Press the **INC** or **DEC** button or the arrow keys (▲▼) to scroll through the available channels (5 - 12). In the example below, the default CH9 field is changed to **CH6**:

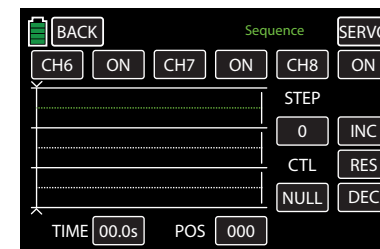


Use the same procedure with the other channel value fields.

Press the **RES** button to reset the changed value back to the default.

- Activation / Deactivation**

The control channels specifically required for the channel sequencing are activated and deactivated by pressing the **INH** buttons next to the channel fields to change to **ON** and vice versa. In the example below, all channels have been changed to ON:



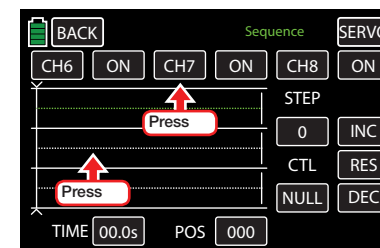
### Notice

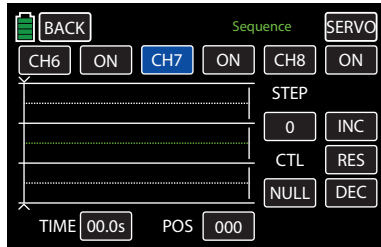
➤➤ All control functions activated in the FUNCTION submenu **Sequence** are unavailable for other uses.

### Sequencing

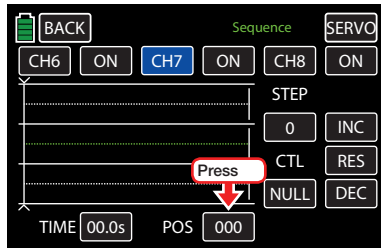
- STEP 0: Setting the Output Position**

The output position can be activated in one of two ways. Press any channel field to highlight the button blue. The corresponding output position line highlights green. Or, press any output position line to highlight green. The corresponding channel field button highlights blue:

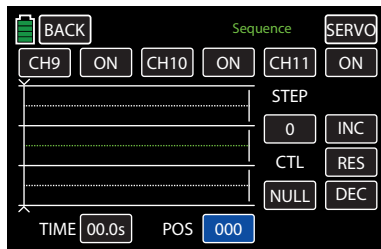




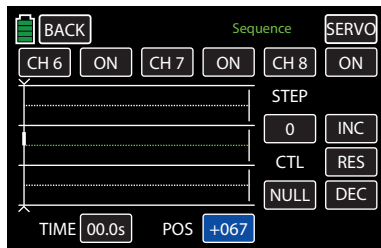
Press the **POS** button at the bottom right of the display:



The field highlights blue:



Press the **INC** or **DEC** button or the arrow keys (▲▼) to increase or decrease the value. In the example below, the POS needs to be increased **+67**:



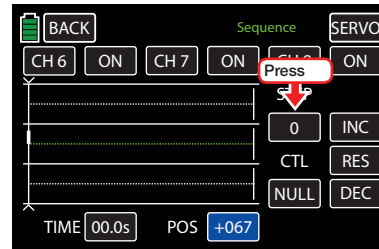
The setting range is ±100.

Repeat the process for the other two channels. Press the **RES** button to reset the changed value back to the default.

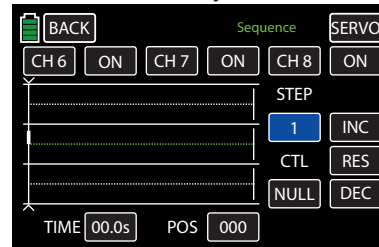
### • STEP 1: First Result

After setting the output positions a time lapse must be set before the desired action does or does not occur.

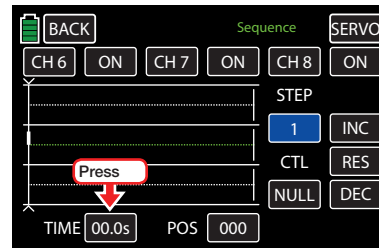
Press to highlight the **STEP** button at the right of the display:



Press the **INC** button or the up arrow key (▲) increase the STEP value by 1:

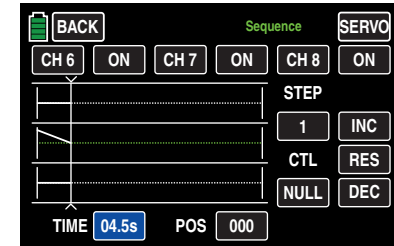


Press to highlight the **TIME** value field:

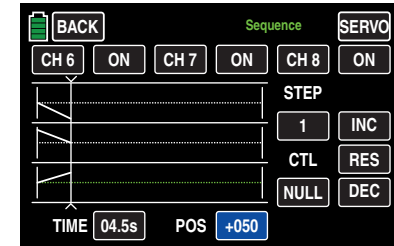


Press the **INC** or **DEC** button or the arrow keys (▲▼) to increase or decrease the value. In the

example below, the time delay is set for **4.5s**. The vertical line, representing the time flow, moves to the right while the angled lines, representing the flow of the servo positions, are displayed between the time points "0" and "1":

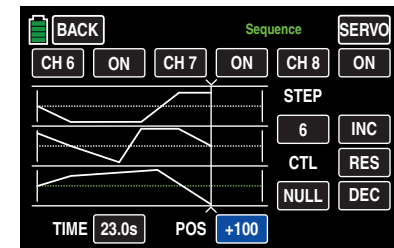


After the first time lapse, set the desired servo output positions (as described in **STEP 0**), or leave the servo(s) in the previous sequence position:



### • STEP 2 through 9:

Repeat the previous steps to continue the sequence until the servos target position has been reached:



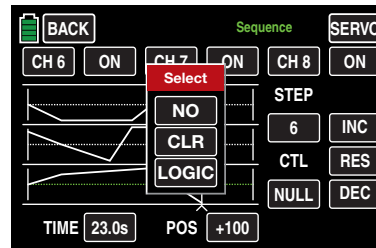
## Notice



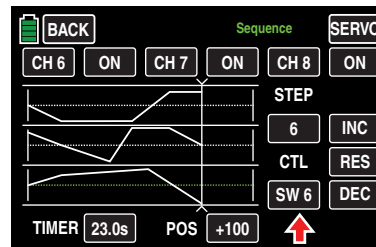
The sequencing examples shown are for demonstration purposes only and do not represent real servo sequence movements.

## Switch Assignment

To assign an activation switch to the completed sequence, follow the instructions in the **Control and Switch Assignment** section (page 26):



Use the switch to change between the output and the target positions of the servos. In the example below, **S6** is assigned in the **CTL** column:



When the switch is in the CLOSED position, the selected servos sequence movement can be followed in the servo monitor. Bring up the servo monitor in one of three ways: pressing the **SERVO** button in the upper right corner of the display, by simultaneously pushing both arrow keys (▲▼), or by pressing the BASE submenu **Servo** icon. When the switch is OPEN, all the movements will be reversed.

## Notices



- The POS value field input settings are overlapping the common control signals. Before programming a sequencer in the BASE submenu **Servo**, carefully check that none of the channels involved in the planned sequence are assigned to any transmitter control element. The

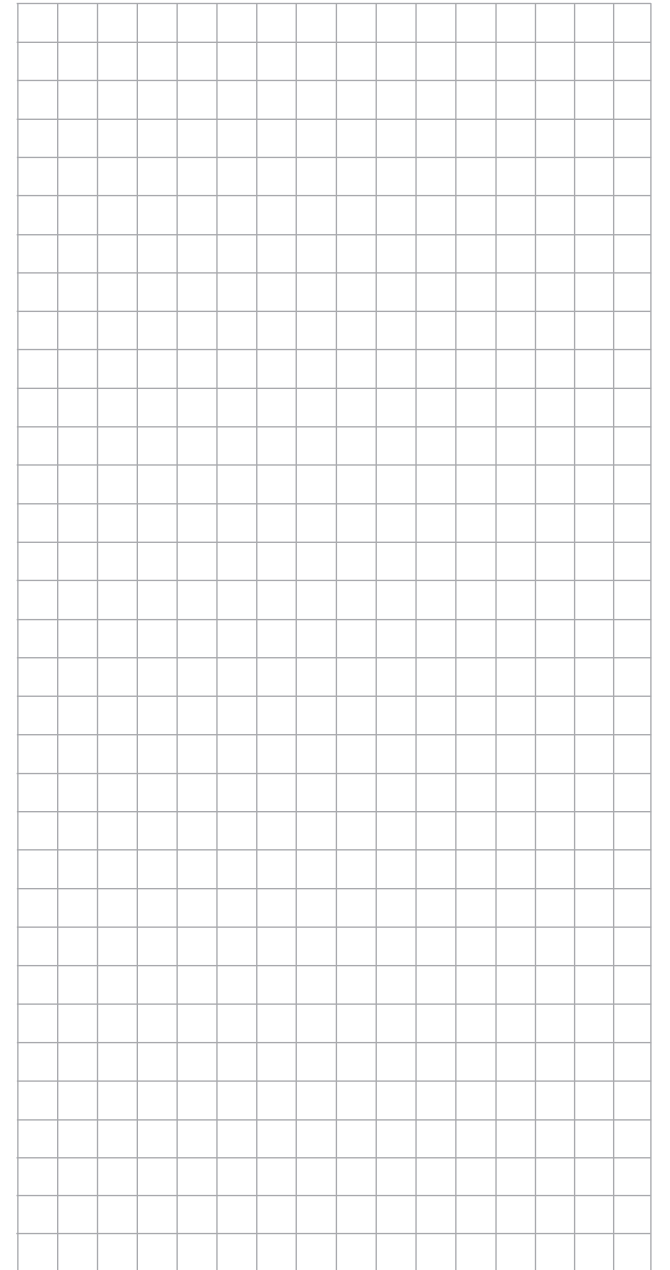
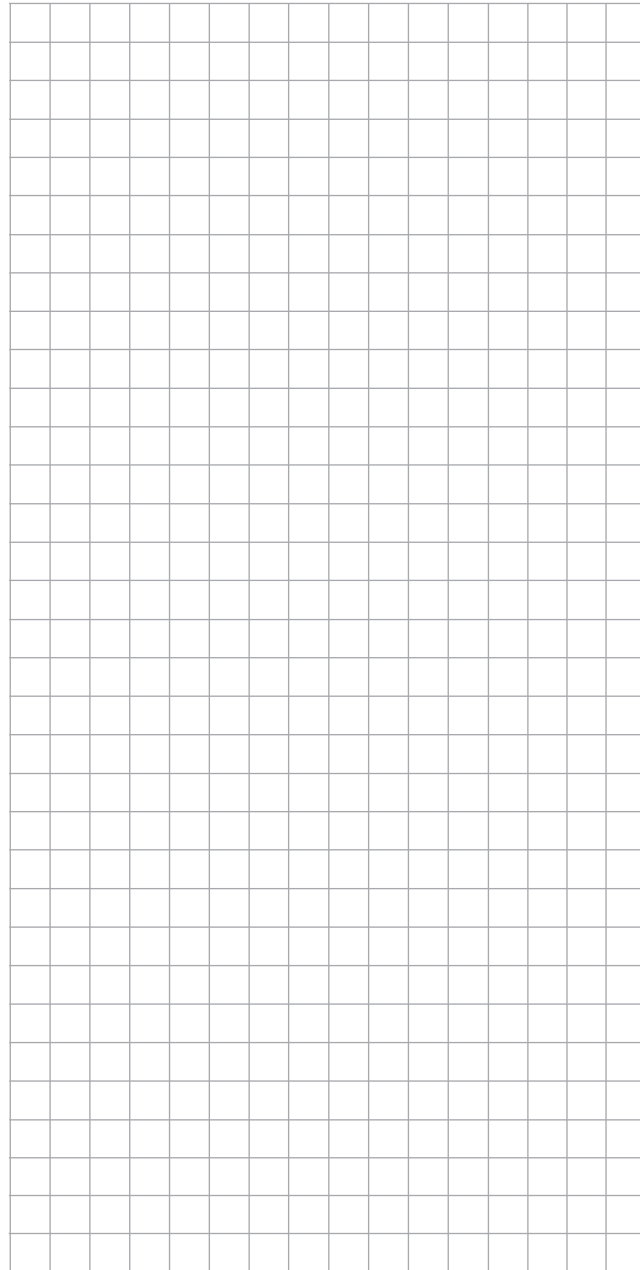
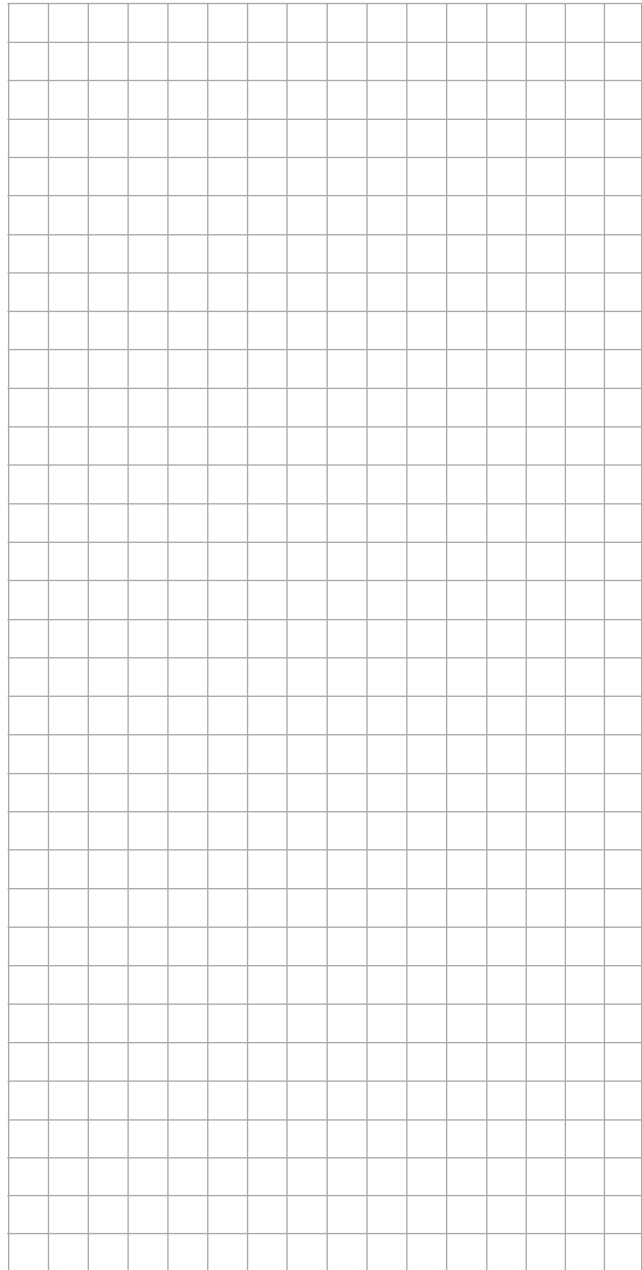
action on those controls may lead to process malfunction.

- Make sure that the servos do not strike anything when preparing and setting a sequencer. Use the BASE submenu **E.P.A** (page 62) for fine-tuning these end-point adjustments.



◀ Common Function Menus

Helicopter Model Function Menus ▶



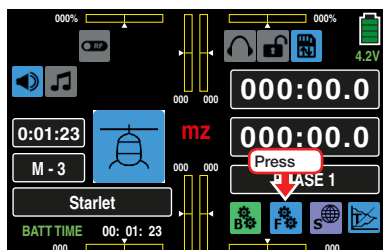


# PIT.CRV

## Phase-Specific Pitch Control Curve Setup

Use this function to set adjustments to the pitch of helicopter blades at certain stick positions. For example, when the control stick is all the way forward with the intent for the helicopter to quickly fly straight up, the curve should be programmed for maximum pitch on the blades. Conversely, when the helicopter is shut down for a stop, the curve should be programmed for little or no pitch on the blades.

To adjust these settings, from the main display press the **FUNCTION** menu gear icon (blue "F") to bring up the FUNCTION submenu screen:



From the FUNCTION submenu display, press the **PIT. CRV** icon:



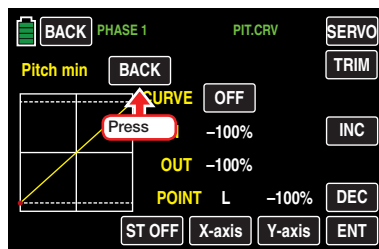
A curve mixer is available in every flight phase for pitch curve settings. However, linear mixers cannot be programmed for actions analog to the control stick travels.

### Pitch min Line

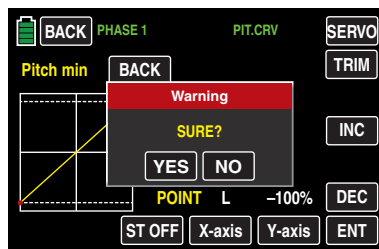
In the **mz-24 Pro**, the helicopter program defaults the "rear" throttle to the **Pitch min** position.

This option allows users to easily reverse the pitch control stick control direction from the standard pre-

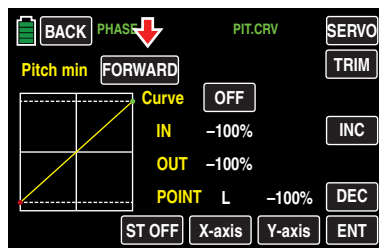
set position **Pitch min BACK** to **Pitch min FORWARD**, and vice versa. Press the **BACK** or **FORWARD** button in the **Pitch min** line:



An active warning message appears:



Press **NO** to terminate the procedure. Press **YES** to confirm, and the pitch control stick travel direction changes:



Inverted control signals act on the following: mixed and coupling functions and the throttle position active Power OFF time.

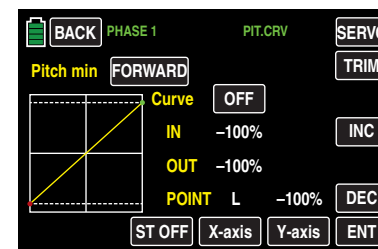
### Phase-dependent settings of the pitch curves

This submenu allows for different phase-specific values to be programmed. Phase names are displayed in green in the upper left side of the screen next to

the **BACK** button. Standard default naming for the phases are usually displayed as **NORMAL/PHASE 1**. (Additional phases will be named numerically, e.g. Phase 2, Phase 3, etc.) To define multiple phases, refer to the **FUNCTION** submenu **Phase** section (page 120). Each new phase will need to be assigned to a different switch. To change the phases, activate the corresponding switch(es).

### Pitch Curve Setting

Use this display to adapt the pitch curve as needed, and assign to different phases if necessary:



### Notice



The example graphs represent the curve characteristics directly, independent from the actual direction selected on the pitch control stick.

The pitch control curve can be specified by up to 7 points (termed "support points") along the entire control stick travel.

During initial setup, fewer support points are required to set a pitch curve. However, it is recommended to start with at least three support points.

These three endpoints describe the linear characteristic of a pitch control curve: the two endpoints **Pitch low (L = -100% control travel)** and **Pitch high (H = +100% control travel)** and the control (placed in the center).

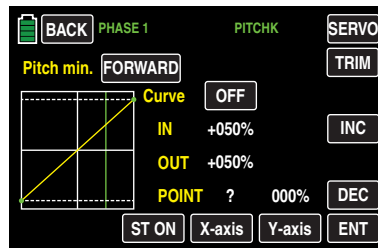
## Basic Operating Steps

- **ST OFF** or **ST ON** Button

Touch this button to turn on or off the graphic and numeric display of the control stick position.

When **ST ON** on is selected and the control elements (throttle/pitch control stick) is moved, a vertical green line moves synchronously in the graph between the two endpoints **L** and **H**. The control stick position is also displayed numerically in the **IN** line (-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%. Control signals changed in this way affect all of the subsequent mixing and coupling functions.

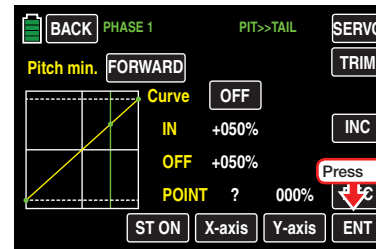
In the example below, the control stick is exactly halfway between the middle and end of its path, at +50% of the control path, and generates an output signal that is also +50% due to the linear characteristic:



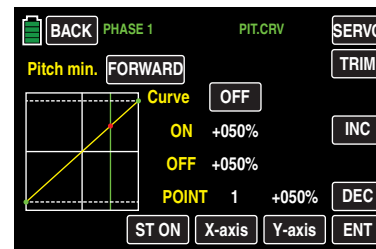
Between the two endpoints L and H, up to 5 additional support points can be set, though the distance between support points may not be less than 25%.

- **ENT** Button

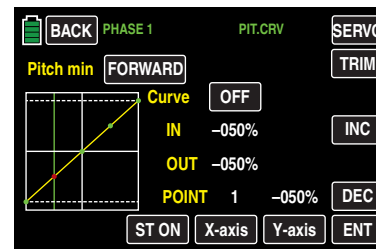
Move the control stick. Support points can be set by touching the **ENT** button whenever a question mark ? shows in the **POINT** line. A green point appears at the intersection of the yellow and green lines:



When the control stick is moved and the green line moves off the green point, the point will turn red, the ? is replaced with a number, and the point value appears in the value field to the right of the support point number:



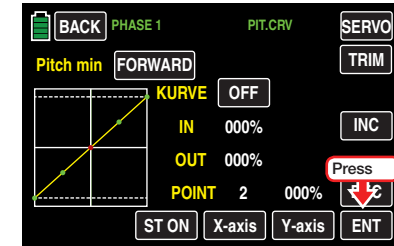
The 5 support points between the L and H endpoints can be created in any order; support points are automatically renumbered sequentially from left to right after points are set or deleted. In the example below, the red point at left near the L endpoint is now considered Point 1:



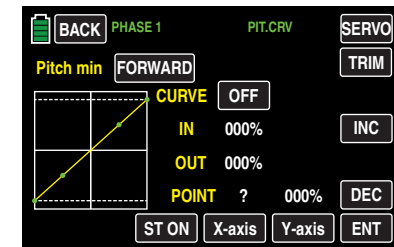
### Deleting a Support Point

To remove a set support point, move the control stick until the vertical green line aligns with the

point to be deleted. The support point will turn red and its number and associated value will appear in the **POINT** line. Press the **ENT** button to remove the point:



The red point disappears:

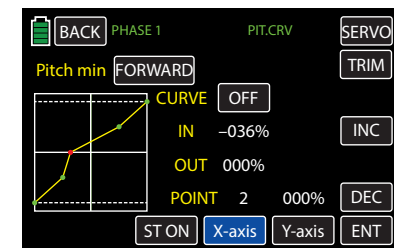


### Changing the Support Point Value

- **X-axis** Button (X-axis)

Activate this function, press to highlight the button at the bottom edge of the display.

Move the active (red) point to the right by pressing the **INC** button or to the left with the **DEC** button, as shown below:



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

## Notices

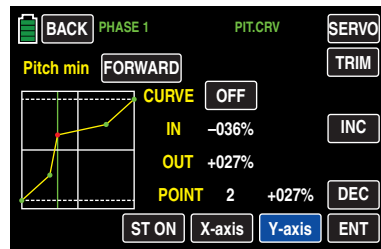


- Moving the red point horizontally away from the current control position will cause the point to become green after a short while, and a ? will appear in the Point line. This question mark does not relate to the point which has been moved, rather, it indicates that another point can be set at the current control position.
- Remember that the percentages in the input (IN) and output (OUT) line always refer to the temporary position of the control stick and not to the position of the point.

### Y-axis Button (Y-axis)

Activate this function, press to highlight the button at the bottom edge of the display.

Move the active (red) point up by pressing the **INC** button or down with the **DEC** button, as shown below:



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

### Notice

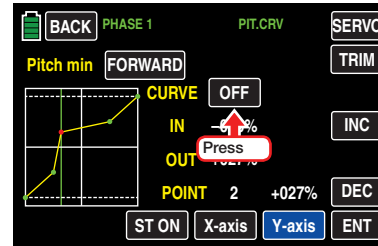


Remember that the percentages in the input (IN) and output (OUT) line always refer to the momentary position of the control stick and not to the position of the point.

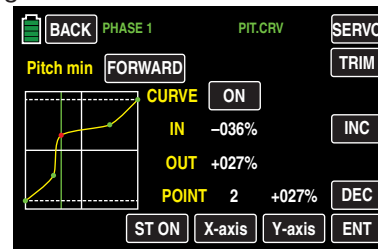
## Rounding off the throttle curve

### CURVE Line ON/OFF Button

Curve profiles are angled by default. Automatically round off the lines by turning **ON** the rounding function in the CURVE line:



The angled curve lines are rounded:



### Notice



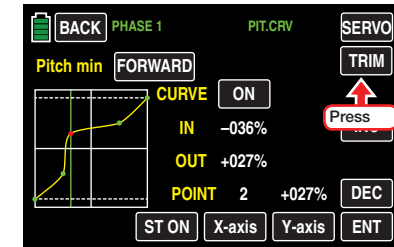
The curves shown above are only for demonstration purposes and do not represent actual throttle curves.

## Additional Functions

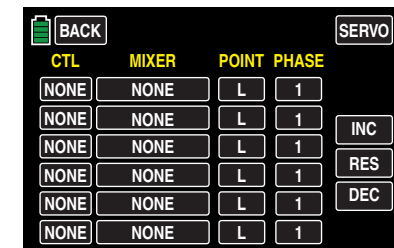
### TRIM Button

The **mz-24 Pro** has a function integrated in the helicopter program that allows trimming up to six throttle curve and pitch curve support points during flight.

Press the **TRIM** button at the top right edge of the display:



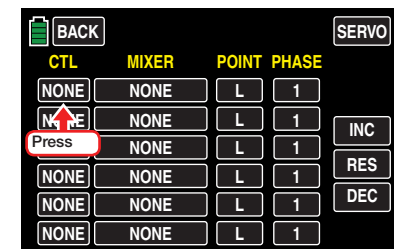
To open the trim setting screen:



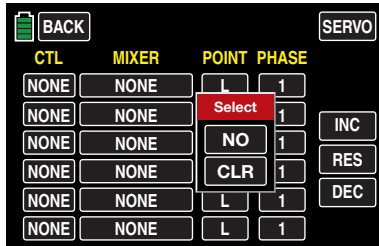
## Basic Operating Steps

### CTL Column

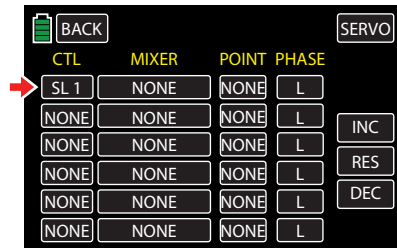
In the **CTL** column of the menu, select a suitable control from the controls offered by pressing the value field in the appropriate row. In the example below, the first line needs to be set:



The following appears in the display:



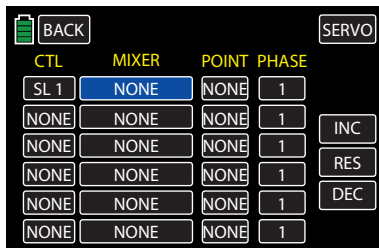
To assign a switch, move the desired control, or press **NO** to cancel and **CLR** to return the field value to NONE. In the example below, the right proportional rotary control **SL1** is assigned:



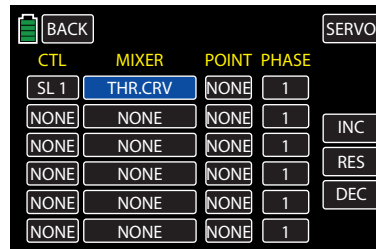
• **MIXER Column**

The MIXER column allows users to select individual helicopter mixers, or one of the two available mixers in any combination.

To select a mixer, press to highlight the value field in the appropriate row. In the example below the first line needs to be set:



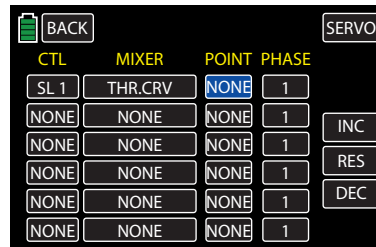
Press the **INC** or **DEC** buttons or the arrow keys (▲▼) to increase/decrease the values:



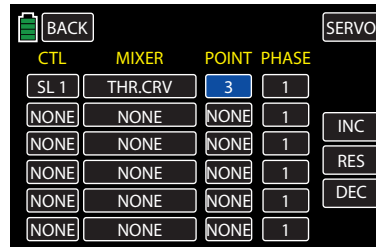
Press the **RES** button to reset the changed value back to the default.

• **POINT Column**

In the POINT column allows users to specify the support point(s) of the related mixer to be trimmed. To select a point, press to highlight the value field in the appropriate row. In the example below the first line needs to be set:



Press the **INC** or **DEC** buttons or the arrow keys (▲▼) to increase/decrease the values:



Press the **RES** button to reset the changed value back to the default.

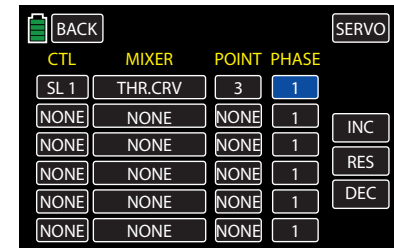
**Notice**

» 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).

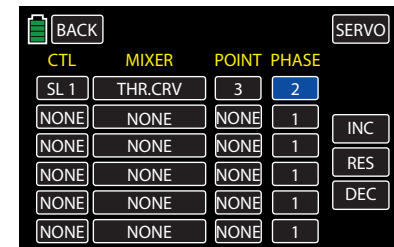
• **PHASE Column**

The PHASE column allows users to assign the phase in which the governor should be active. The number in the value field refers to the phase number that can be found in the FUNCTION submenu **Phase**.

To select another phase than default Phase1, press to highlight the value field in the appropriate row. In the example below the first line needs to be set:



Press the **INC** or **DEC** buttons or the arrow keys (▲▼) to increase/decrease the values:



Press the **RES** button to reset the changed value back to the default.

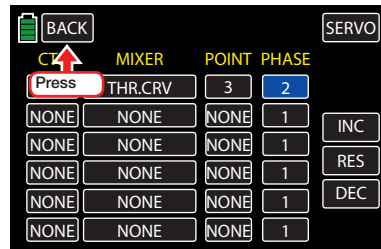
# Autorotation Setting

## Notice



When selecting a phase that has not been defined, by default only Phase 1 is active and the associated controller will not have any effect.

To save and exit, press the **BACK** button at the top left of the display to return to the **Pitch curve** menu:



## Notice



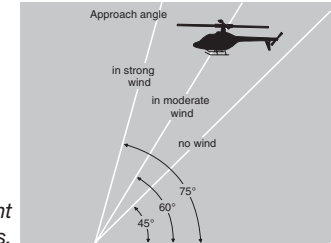
The settings in the Pitch Curve submenu affect the same settings in the Throttle Curve submenu (page 160). Changes made to either section always affects the other.

In a powered flight, the maximum wing angle is limited by the available motor output; in autorotation flight, 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. Set a value that is about 10% to 20% **higher** than the normal maximum pitch. At the very beginning **do not** set a value that is significantly higher than normal flight since of the behavior of the pitch control will be significantly different after switching, in comparison to the usual reaction. The danger exists of over-controlling after flaring with the model continuing to rise; then high above the ground the motor speed will suddenly decrease and the model will drop. After a few test autorotations, the value can always be readjusted.

The minimum pitch **can** be different from that for normal flight, depending on conventional control practice during normal flight. Set a minimum pitch for the **L** point for autorotation that will allow the model to be brought into a descent of approximately 60-70° out of a forward flight path at an average speed when the pitch is reduced to a minimum. If such a setting is used in normal flight like most of helicopter pilots, the value can be easily transferred.

If the model's descent is normally at a flatter angle, increase the value at the L point and vice versa.

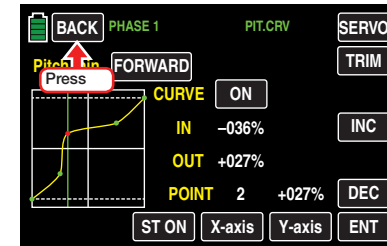


Approach angle under different wind conditions.

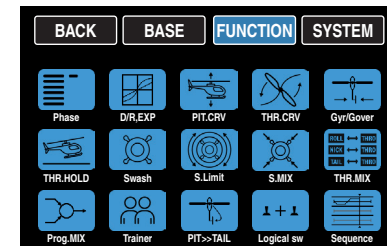
The pitch control stick is not necessarily in the bottom position during autorotation. Typically, it is between hovering position and the bottom stop so that the longitudinal inclination can be corrected using the elevation control.

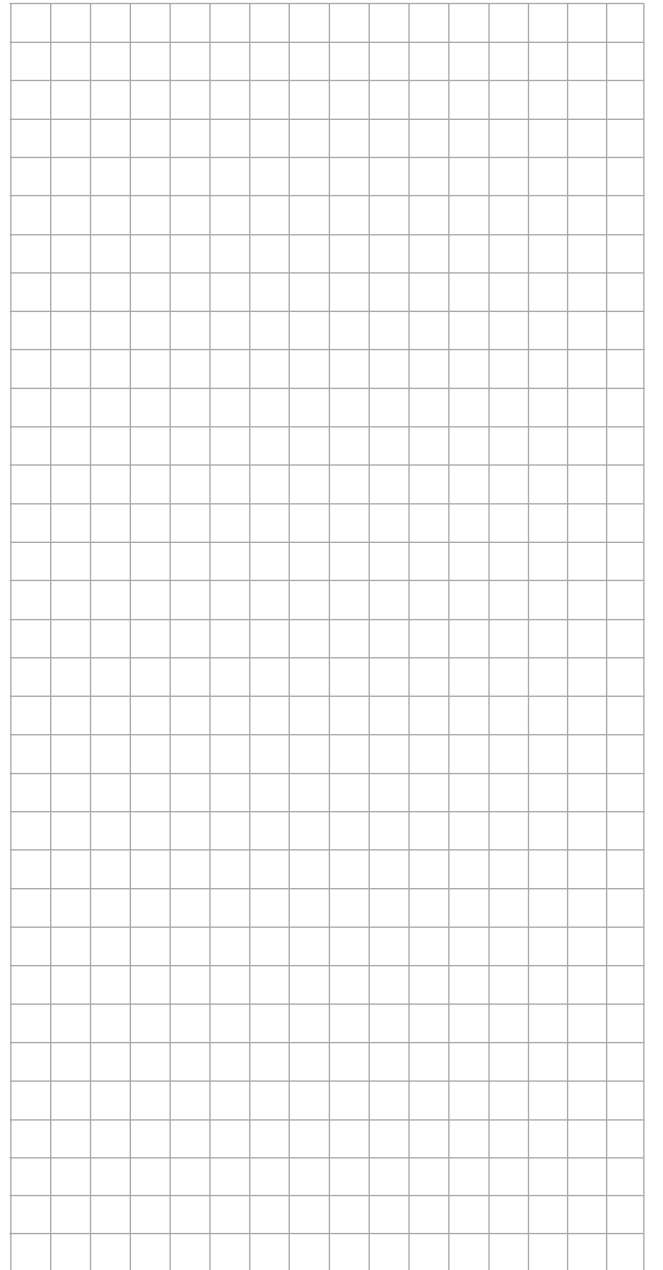
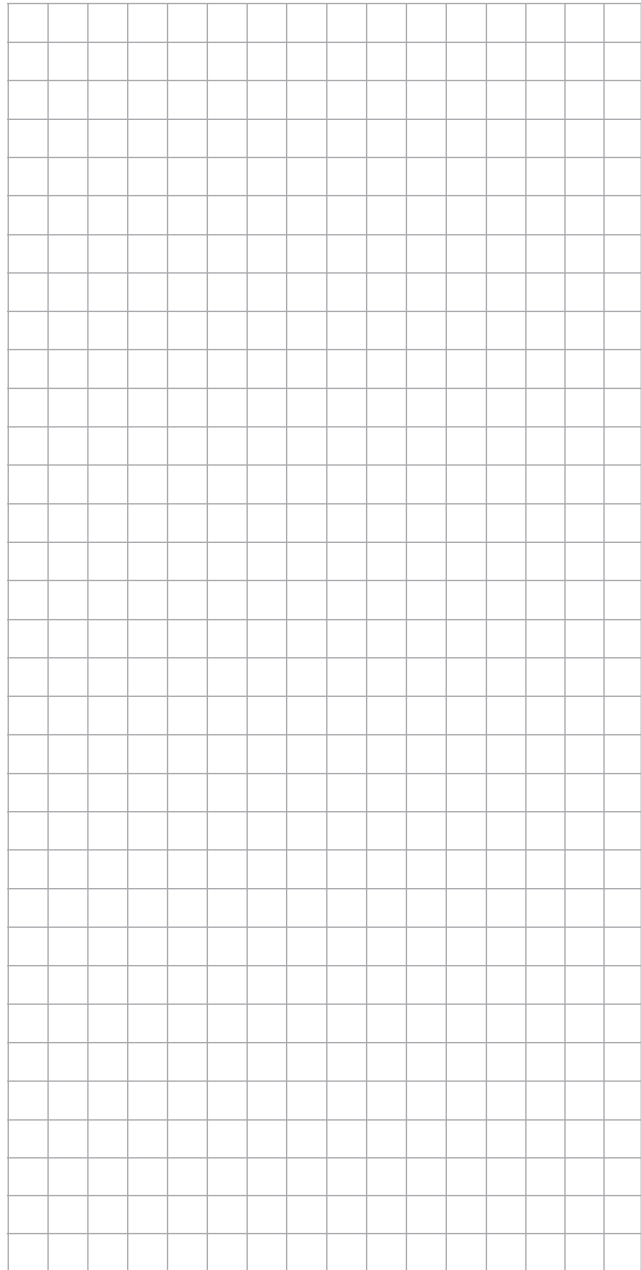
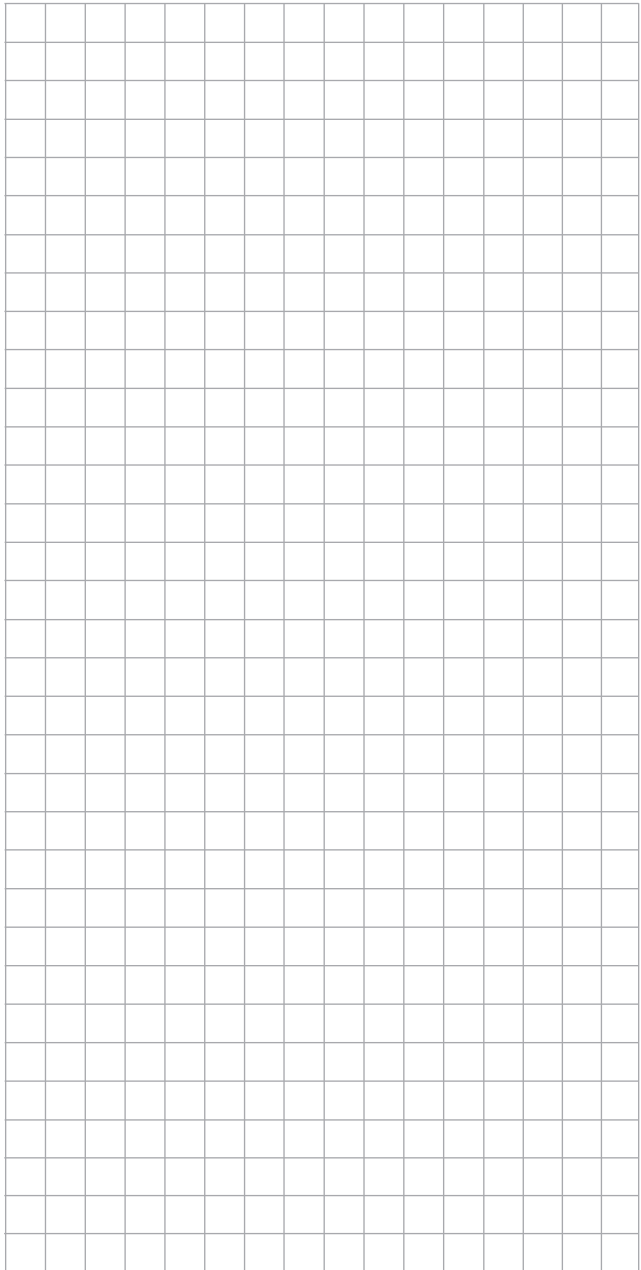
Shorten the approach by carefully pulling back on the elevation control and sensitively reducing the pitch, or extending the approach by pushing the elevation control forward and carefully increasing the pitch.

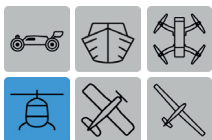
To exit the PIT.CRV menu, press the **BACK** button at the top right of the display:



The **FUNCTION** submenu screen appears:





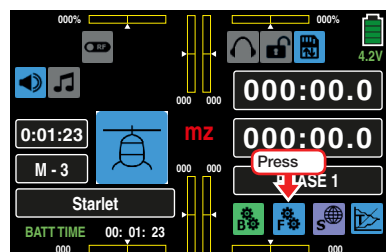


# THR.CRV

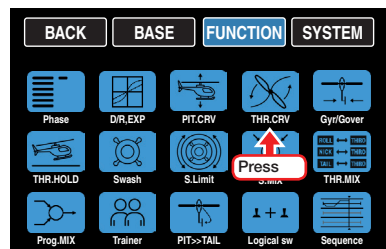
## Phase-Specific Throttle Control Curve Setting

Use this throttle curve function to program specific throttle output settings to specific throttle stick settings. Since throttle settings affect the motor speed, the throttle curve must be set in conjunction with the pitch curve to provide sufficient power to keep a consistent head speed.

To adjust these settings, from the main display press the **FUNCTION** menu gear icon (blue "F") to bring up the FUNCTION submenu screen:



From the FUNCTION submenu display, press the **THR.CRV** icon:



A curve mixer is available in every flight phase for pitch curve settings. However, linear mixers cannot be programmed for actions analog to the control stick travels.

### Phase-Dependent Settings of the Throttle Curve

This submenu allows for different phase-specific values to be programmed. Phase names are displayed in green in the upper left side of the screen next to the BACK button. Standard default naming for the phases are usually displayed as **NORMAL/PHASE 1**. (Additional phases will be named numerically, e.g.

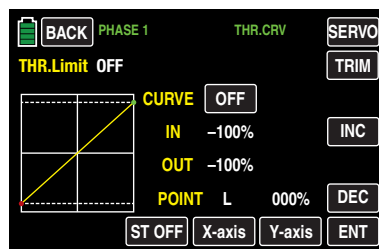
Phase 2, Phase 3, etc.) To define multiple phases, refer to the FUNCTION submenu **Phase** section (page 120). Each new phase will need to be assigned to a different switch. To change the phases, activate the corresponding switch(es).

### Tips

- The **Throttle** setting for the autorotation phase is described in the FUNCTION submenu **THR.HOLD** (page 170).
- If the **THR.Limit** (page 94) has been activated in the BASE submenu **CTL Set** by assigning a switch control, the previously assigned numerical value is displayed in the THR.Limit line.

### Throttle Curve

The throttle control curve can be specified by up to 7 points (termed "support points") along the entire control stick travel:



During initial setup, fewer support points are required to set a throttle curve. However, it is recommended to start with at least three support points.

These three endpoints describe the linear characteristic of a throttle control curve: the two endpoints Throttle low (**L** = -100% control travel) and Throttle high (**H** = +100% control travel) and the control (placed in the center).

Support points can be set, changed and deleted in the same manner as described in the previous section, **PIT.CRV** (page 154). First specify the throttle curve using three points: the two end points L and H,

and the control (center) point. This synchronizes the motor performance curve with the pitch curve.

### Gas Motor / Electric Drive Helicopters With Speed Controller

### Notice

Refer to the **Helicopters with Governor** section (page 161) for appropriate throttle curve adjustment to helicopters equipped with a **governor**.

This setting only refers to the control curve for the throttle servo or the **speed controller**.

- 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 (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.

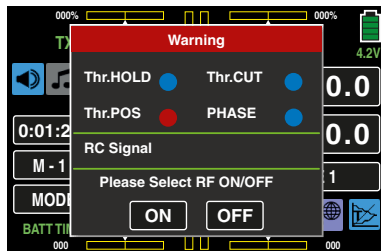
### Notice

Both gas engines and electric motors are stopped using the **THR.Limit** within the phase.

It is unnecessary to program two phases, "with throttle preset" and "without throttle preset" to phase a gas preset, as is sometimes used in other remote control systems. The **mz-24 Pro** transmitter allows the system speed to be increased below the hovering point much more flexibly and sensitively with the **THR.Limit** than by using a gas preset.

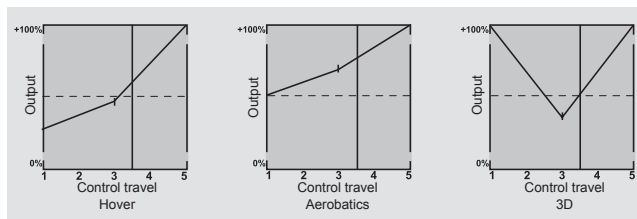


To start the gas motor, make sure that the THR.Limit is closed, i.e. the carburetor can only be adjusted by trimming its idle position. Refer to the **Safety Instructions** section (page 165) for additional information. If the throttle is set too high when the transmitter is turned on, the RF module remains off and an active warning box will appear along with an acoustic warning.



The following three diagrams show typical 3-point throttle curves for different phases such as hovering, aerobatics and 3-D flight.

### Example Throttle Curves for Different Phases:

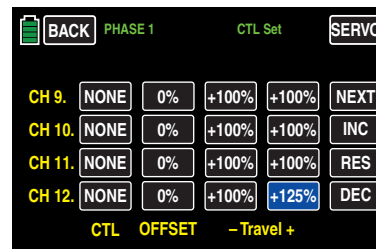


### Notices



- Use the **Throttle Limit Function** (page 94) of the BASE submenu **CTL Set**. The throttle servo is normally completely separate from the throttle curve at the left-stop of the proportional dial **DV1** (throttle limiter); the motor is idling and only reacts to CH1 trimming. This option allows you to start the motor from any phase and turn it off using digital trimming.

After starting the motor, slowly turn the throttle limiter to the opposite right-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, use CH12 in the FUNCTION submenu **D/R,EXP** to set the control travel value on the **Travel+** column according to each phase 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, normally extending from -100% to +100%.

The **Travel** setting of the throttle limiter may have to be adapted in each phase by changing the value in the **CH12** line of the FUNCTION submenu **D/R,Exp**.

The throttle curve should be adapted in the same manner as with a gas helicopter in flight.

### Tip

In order to measure the flight time of a (gas) helicopter, assign a control switch to the throttle limit servo and use it to start/stop a **Timer** (page 74).

### Helicopters with Governor

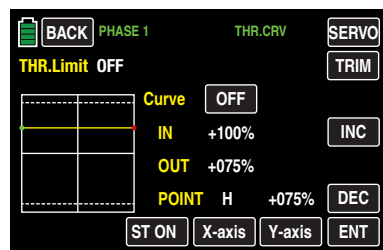
In contrast to speed **controllers** that only regulate performance like a carburetor, **governors** maintain a constant speed in the system that they are monitoring by independently regulating the provided output. With gas helicopters, the control independently controls the throttle servo like the motor control unit of an electric helicopter. *Therefore, governors 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**. Refer to **Receiver Configuration - Helicopter Models** (page 31) for additional information. Do not use the gas throttle limiter on output 8, 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** (this is different from the general connecting strategy). Only adapt the throttle curve so that it can assume the task of a normal servo.

Since the throttle curve 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 FUNCTION submenu **THR.CRV**. Each input value (pitch) results in the same output value (throttle) whose level determines the target speed.

To set the horizontal line, delete any previously set support points (1 - 5). Then set the support points **L** (input = 0%) and **H** (input = +100%) to the *same* value, as shown below:



The value to be set depends on the governor that is used as well as the desired target speed. This can be varied for specific phases.

**Tip**

After setting up a programmable mixer, the implemented governor function can be trimmed phase specifically. Press one of the two digital-trim buttons (D.TRIM) within a **maximum of ±37,5%**. Refer to the **Programming Example** (page 233). This options allows phase-specific governor trim to be corrected using only one control element.

**Notice**

» If the throttle curve is used to control a **governor**, all the mixers programmed in the FUNCTION submenu **THR.MIX** (page 176) must be left on **INH**.

**Throttle/Pitch Curve Adjustment**

The most important setting for helicopters is the coordination of throttle and pitch (i.e., the performance curve of the motor with collective blade adjustment).

The **mz-24 Pro** transmitter allows the throttle, pitch and torque compensating curves to be independently adjusted. Throttle and pitch control are always activated by separate servos activated together by the throttle/pitch control stick (except in the autorotation phase). The helicopter program automatically couples the servos. The trim lever for Control Function 1 acts only on the throttle servo.

These curves can be specified by up to 7 points (termed “support points”) along the entire control stick travel. During initial setup, fewer support points are required to set a pitch curve. However, it is recommended to start with at least three support points.

These three endpoints describe the linear characteristic of a pitch control curve: the two endpoints Pitch low (**L** = -100% control travel) and Pitch high (**H** = +100% control travel) and the control (placed in the center).

Before adjusting the throttle and pitch function, all servo linkage must first be mechanically pre-adjusted according to the helicopter's adjusting instructions.

**Notice**

» 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 be programmed: a point for the normal flight position above the center, and a point for inverted flight below the center.

**Throttle Curve Idle Setting**

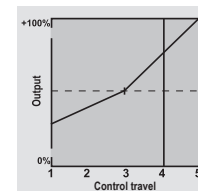
**Notice**

» Electric drives do not require an idle setting, therefore, an idle adjustment is unnecessary with this type of drive. However, the synchronization of the throttle and pitch curve(s) described here is similar to gas helicopters.

The **Idle Setting** (page 95), is done exclusively when the throttle limiter is closed. It is normally performed with the trim control of the CH1 function (and in special cases in conjunction with the throttle limiter).

Programming a corresponding value at the **L** point of the throttle curve adjusts the descent speed of the motor without influencing the hovering setting.

For example, use the phase programming to set different throttle curves. This higher system speed below the hovering point is useful for fast, steep landing approaches when the pitch is very low. It is also useful in performing aerobatics.



*The figure shows a curve with a throttle position that changes slightly below the hovering point in the control center.*

Different phase-dependent throttle curves are programmed for optimum hovering and aerobatics adjustment:

- 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 also needs to be adapted within the hovering range.

### Basic Settings

Although the pitch and throttle curves in the **mz-24 Pro** can be electronically adjusted over a wide range, all linkages in the model must be mechanically adjusted according to the helicopter instructions. Seek advice from a flying club or experienced helicopter pilots for help adjusting the basic settings.

For gas-powered models, the carburetor control must be adjusted so that the throttle is completely open at the maximum pitch position. When the throttle limiter is closed, the carburetor must be able to be completely closed with the CH1 trim control, and the servo may not mechanically over-travel.

For electric models, the motor control unit must be adjusted so that the throttle is at full power at the maximum pitch position. When the throttle limiter is closed, the motor control unit must reliably turn off the electric power.

Adjust these settings very carefully by simultaneously adapting the control linkage and/or changing the articulation point on the servo or carburetor arm. Only electronically fine-tune the throttle servo after these functions are set.

### CAUTION



**Before starting the motor the first time, become familiar with the dangers and safety precautions involved in handling motors and helicopters.**

After these basic settings are made, start the motor according to the motor operating instructions. Adjust the idling using the trim control of the throttle/pitch control stick. Set idling positions are displayed in the transmitter's main menu display by a horizontal bar correlating to the CH1 trim control position.

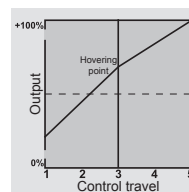
### Hover Settings

The model should lift off the ground and hover at the set speed when the pitch control stick is in the center position. If not, troubleshoot as follows:

#### 1. The model lifts off when the pitch control stick is past center position:

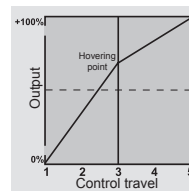
##### a) The speed is too low

Solution: Increase the value of point 1 in the **THR.CR.V** display.



##### b) The speed is too high

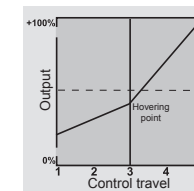
Solution: Increase the pitch angle of the rotor blades by increasing the value of point 1 in the **PIT.CR.V** display.



#### 2. The model lifts off before the pitch control stick reaches center position:

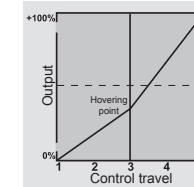
##### a) The speed is too high

Solution: Reduce the carburetor opening by reducing the value of point 1 in the **THR.CR.V** display.



##### b) The speed is too low

Solution: Reduce the rotor blades pitch angle by reducing the value of point 1 in the **PIT.CR.V** display.



### Notice



Keep adjusting until the model hovers at the right speed when the throttle/pitch control stick is in center position. All the other model parameter adjustments depend on this being perfectly aligned.

### Standard Adjustments

Standard adjustments are made to allow the model to hover and perform roundtrips in all phases at a *constant speed*. Do not attempt to make standard adjustments until the Hover Settings are perfectly aligned so the model hovers at the provided speed in normal flight when the throttle/pitch control stick is in center position.

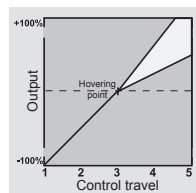
### Adjustments for Climbing

By combining the throttle/hovering setting (the pitch setting for the hovering point and the maximum pitch position of point H), users easily achieve a constant speed from hovering to maximum climb.

First, perform a slow vertical climbing flight by moving the pitch control stick to the end position. The motor

speed should remain constant, matching the hover speed 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 (value of point H). Conversely, if the speed increases while climbing, increase the pitch angle. In the **PIT.CRV** graph display, use the pitch control stick to move the vertical line to **point H** and change its value.

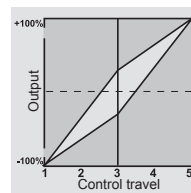


This picture shows changes of the maximum pitch setting.

Place the throttle in center position to make the model hover. If the model doesn't hover unless the pitch control stick is above center position, slightly increasing the pitch value during hovering (i.e. **point 1**) until the model hovers when the control stick is in the center position. If the model doesn't hover unless the pitch control stick is below center position, reduce the pitch angle.

In certain circumstances, it may be necessary to adjust the carburetor opening at the hovering point (**point 1**) of the **THR.CRV** display.

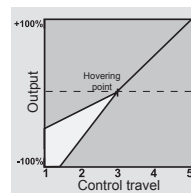
This picture illustrates the change of the hovering point, that is the minimum and maximum pitch were left at -100% and +100%.



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 speed remains constant while the model descends from forward flight at a great height while the pitch is completely pulled back and. Set the minimum pitch (point L) so that the model descends at an angle of 60-70°. In the **PIT.CRV** graph display, use the pitch control stick to move the vertical line to **point L** and change its value.



This picture shows an example of changes of the minimum pitch setting.

Once this flight response is achieved, switch to the **THR.CRV** display graph and adjust the minimum throttle value (**point L**) so that the speed neither increases nor decreases. The coordination of throttle and pitch is now complete.

### Safety 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 carburetor is opened too wide when the transmitter is turned on, a visual and acoustic warning will be generated and the automatic switch on of the RF module will be blocked. This is because if the carbu-

rettor 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 turned on, and the centrifugal clutch will engage immediately.

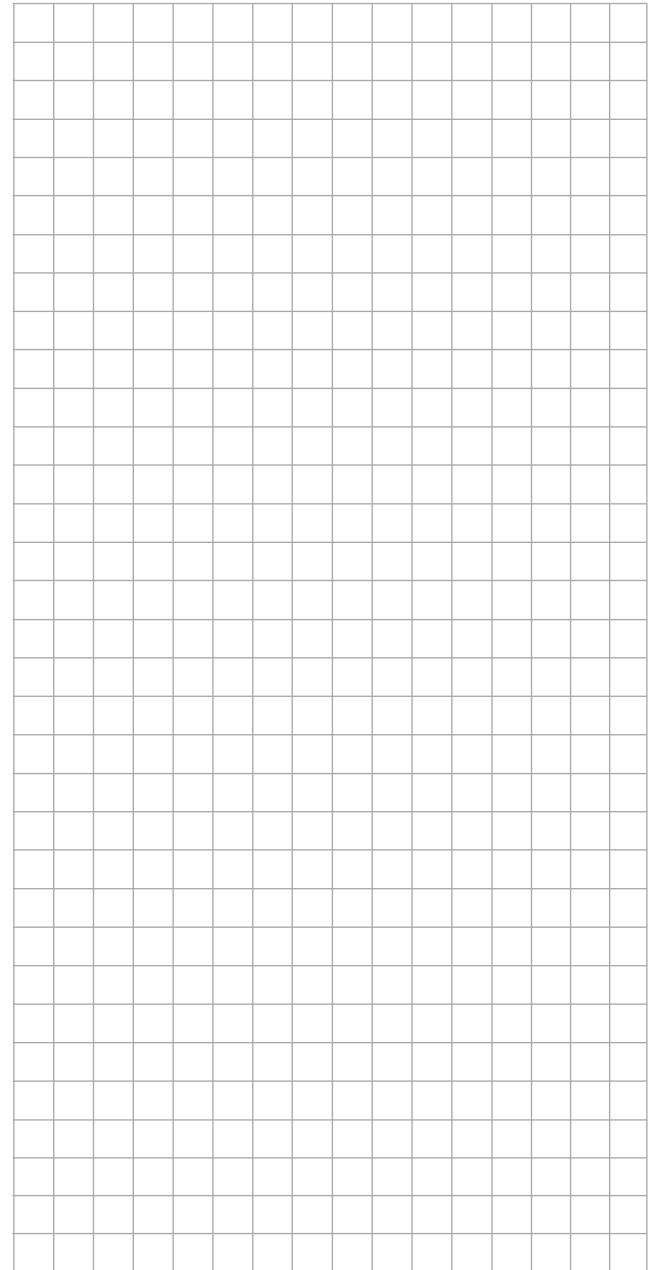
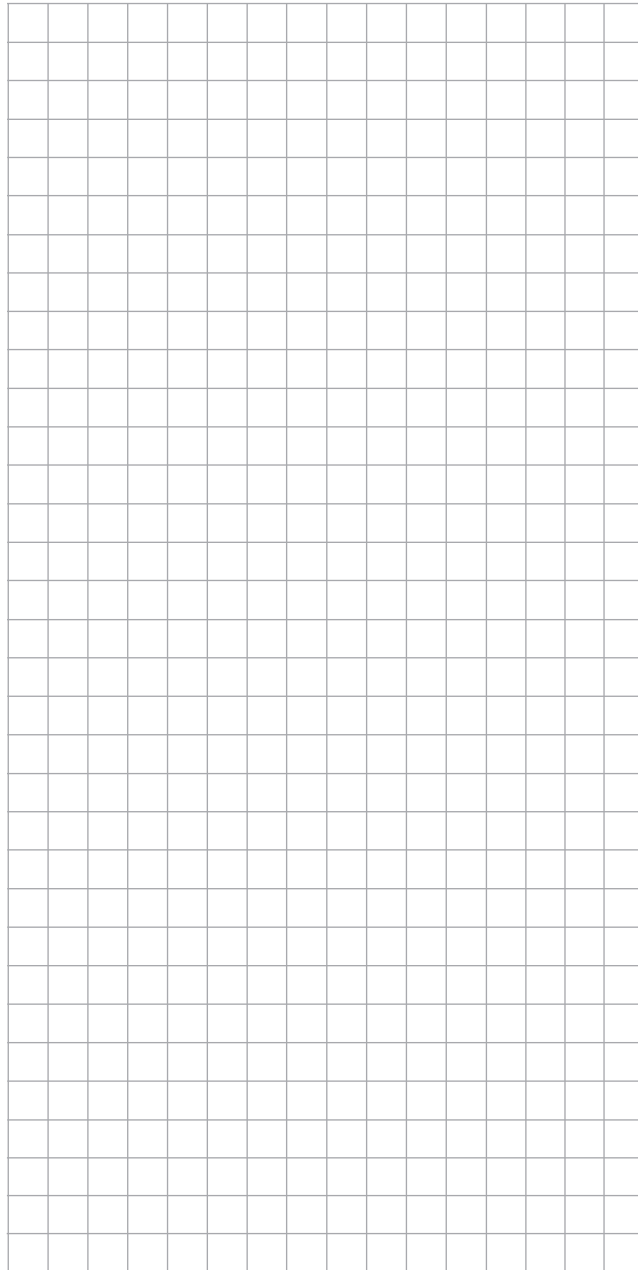
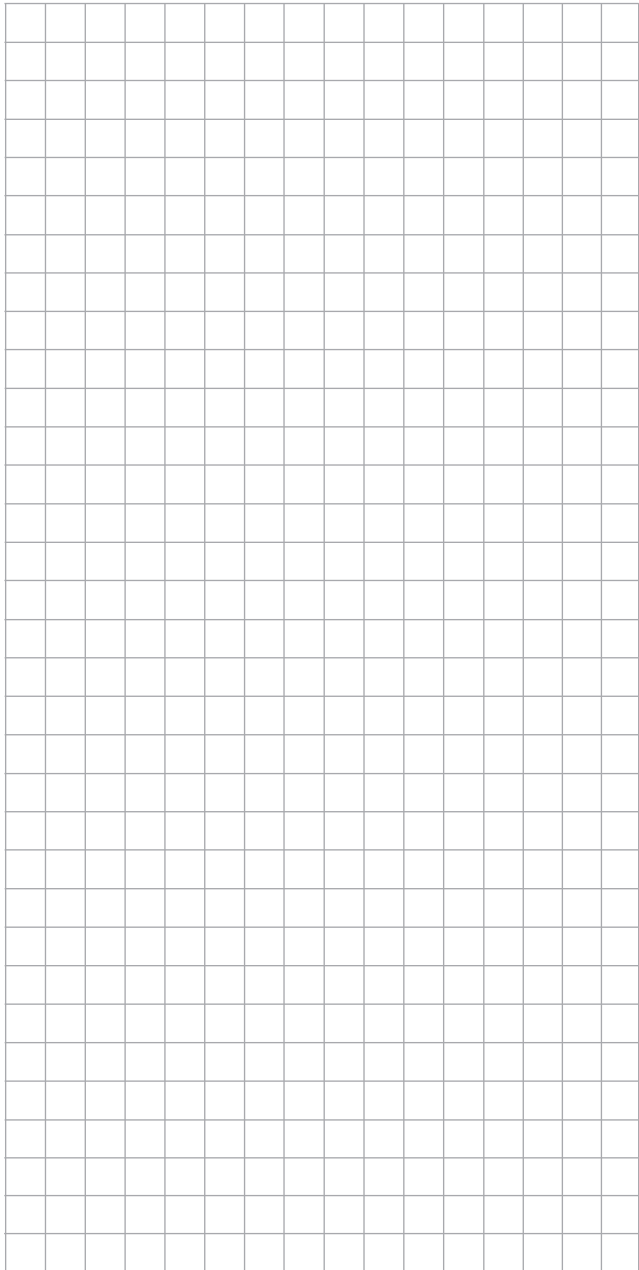
Always **hold the rotor head tightly when starting.**

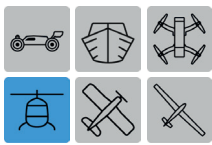
If the motor accidentally starts when the carburettor is open too wide, **do not panic! Keep a firm grip on the rotor head and do not let go.** Immediately turn down the throttle limiter even if there is a danger of the drive becoming damaged since **pilots are responsible for ensuring the helicopter 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, do not switch from idling to the flight setting while the motor is operating at a high speed. This sudden rotor speedup prematurely wears out the clutch and gearing. Additionally, the main rotor blades (generally loosely hinged) would not smoothly follow such a sudden acceleration and will swing out of their normal position and risk striking the tail boom. After starting the motor, **slowly** accelerate the system speed with the throttle limiter.





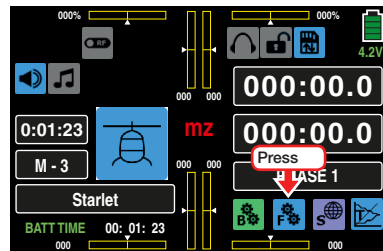
# Gyro/Governor

## Gyro and Governor Settings

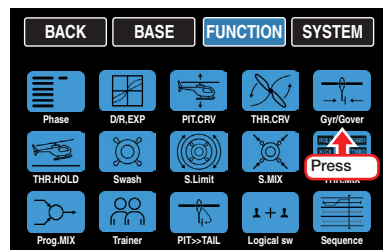
The **gyro** detects any yaw movement (left or right swinging) of the model and automatically sends a command to the tail rotor servo to correct and stop/limit the movement. The gyro will not allow the helicopter to turn until the tail rotor command is corrected.

The **governor** maintains a constant speed in the system being monitored by independently regulating the provided output and only requiring a speed setting (not a classic throttle curve).

To adjust these settings, from the main display press the **FUNCTION** menu gear icon (blue “F”) to bring up the FUNCTION submenu screen:



From the FUNCTION submenu display, press the **Gyr/Gover** icon:

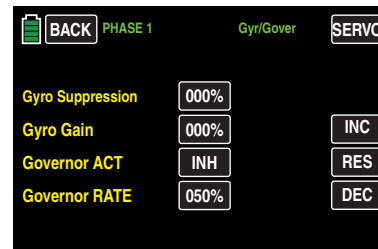


### Gyro/Governor Phase-Dependent Settings

This submenu allows for different phase-specific values to be programmed. Phase names are displayed in green in the upper left side of the screen next to the BACK button. Standard default naming for the phases are usually displayed as **NORMAL/PHASE 1**. (Additional phases will be named numerically, e.g.

Phase 2, Phase 3, etc.) To define multiple phases, refer to the FUNCTION submenu **Phase** section (page 120). Each new phase will need to be assigned to a different switch. To change the phases, activate the corresponding switch(es).

### Gyro Suppression Line



### Notice

Many current standard gyro systems do not require this option to be utilized; consult the gyro setting instructions in the model's manual. Using this option if it is not required may make it impossible to fly the helicopter.

If the model can use a gyro system in which the gyro's effect is set by the transmitter using an additional channel (CH7 in the *Graupner* remote-control system), this option can influence the effect of the gyro sensor (gyroscope) as the tail rotor control stick is moved. 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 be varied (depending on the phase) between a minimum and maximum using a control assigned in the **OFFSET** column of the BASE submenu **CTL Set**. For example, pilots may assign 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, pilots are 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 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 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 figure 5 on page 166).

With the *Graupner/JR-Gyro* NEJ-120 BB, No. **3277**, both the bottom and top values 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).

For example, the option to configure static or phase-specific gyro gain gives you the opportunity to exploit maximum stabilization for normal, slow flying, but reduces gyro gain for fast circuits and aerobatics.

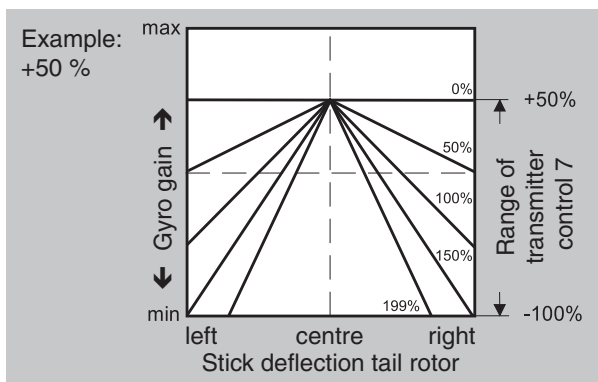
## Various Gyro Sample Settings

- **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.**

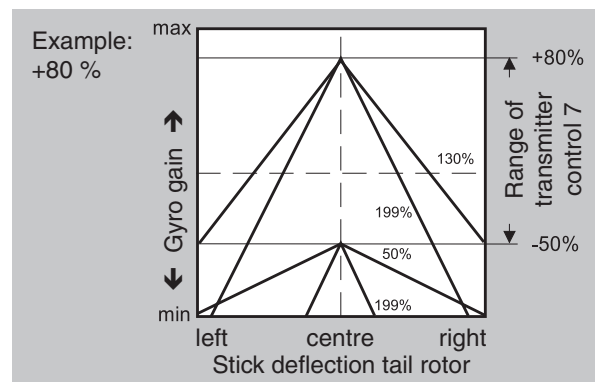
At 0% gyro suppression, gyro gain is constant for tail rotor control stick movement; at 50% suppression, gyro gain is reduced to half if the assigned control is moved to the +50% position (as shown below); and only at >150% suppression is gain reduced to zero with the control at this position, well before 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.

For example, for purposes of illustration, below are plotted 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 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 on its vertical axis. If the response is slower, there is 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, 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 tips on gyros with configurable multilevel gyro gain (e. g. NEJ-120 BB)

Since specifying 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. aerobatics) and control 2 must be used to set the stronger gyro gain (e.g. 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.

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 Gain Line

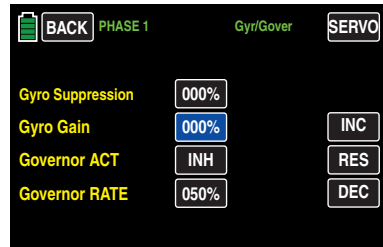
#### Notice

» An offset value input in this option and/or in the **CH7** line of the BASE submenu **CTL Set** automatically adds itself! For the sake of clarity, make sure to only enter and/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. Choose between two different modes of action in the transmitter.

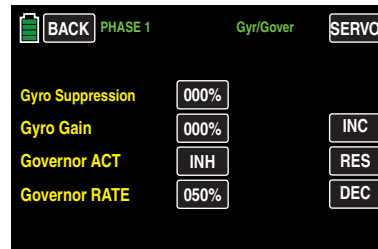
If the gyro has one of these options, the alternative offset setting enables both the normal gyro gain and "heading lock mode" as well as flying with maximum stabilization in normal, slow fights within this selected mode, and reducing the gyro gain in fast roundtrips and aerobatics.

Switching phases to enter different settings in the **Gyro Gain** line, with values between -125% and +125%:



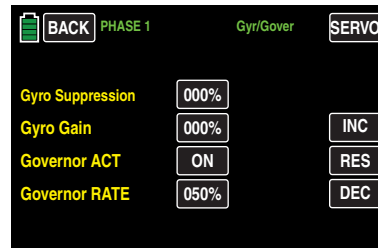
Based on these phase-specific settings, the gyro gain can also be smoothly varied with a control in the **OFFSET** column in the BASE submenu **CTL Set**.

### Governor ACT Line



This option is **INH** by default, meaning the control channel 8 can be used without restriction.

To connect a governor to output 8, press the value field of the **Governor ACT** line to turn it **ON**:

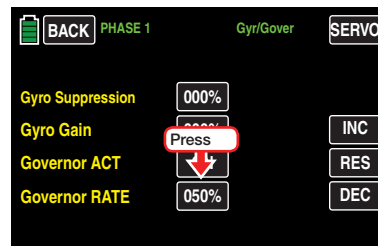


Press the value field again to turn the option off.

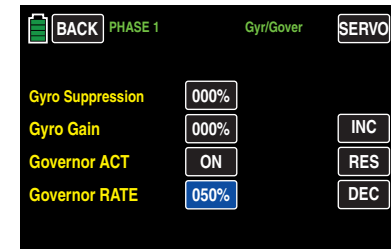
### Governor RATE Line

After you have activated the Governor ACT option by turning it **ON**, set the rotor speed to be maintained by the governor in the **Governor RATE** line by adjusting the percentage between 0% to 100%.

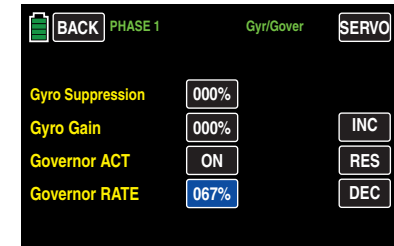
Press the value field of the line:



The field highlights blue:



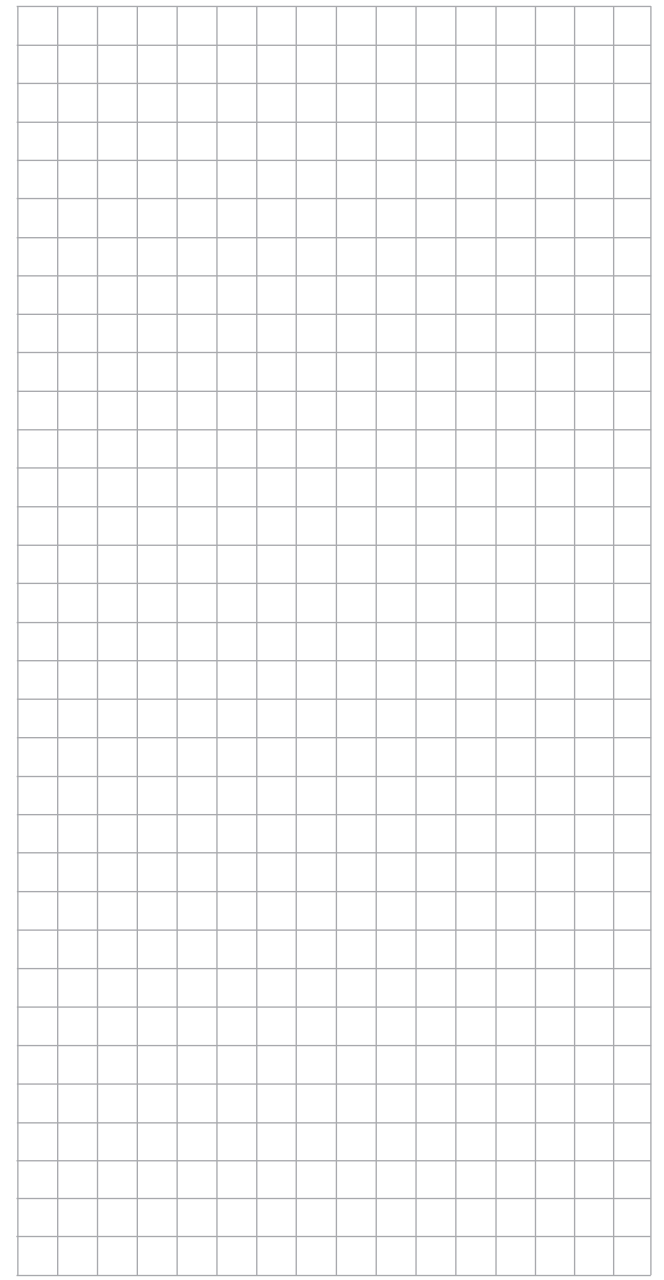
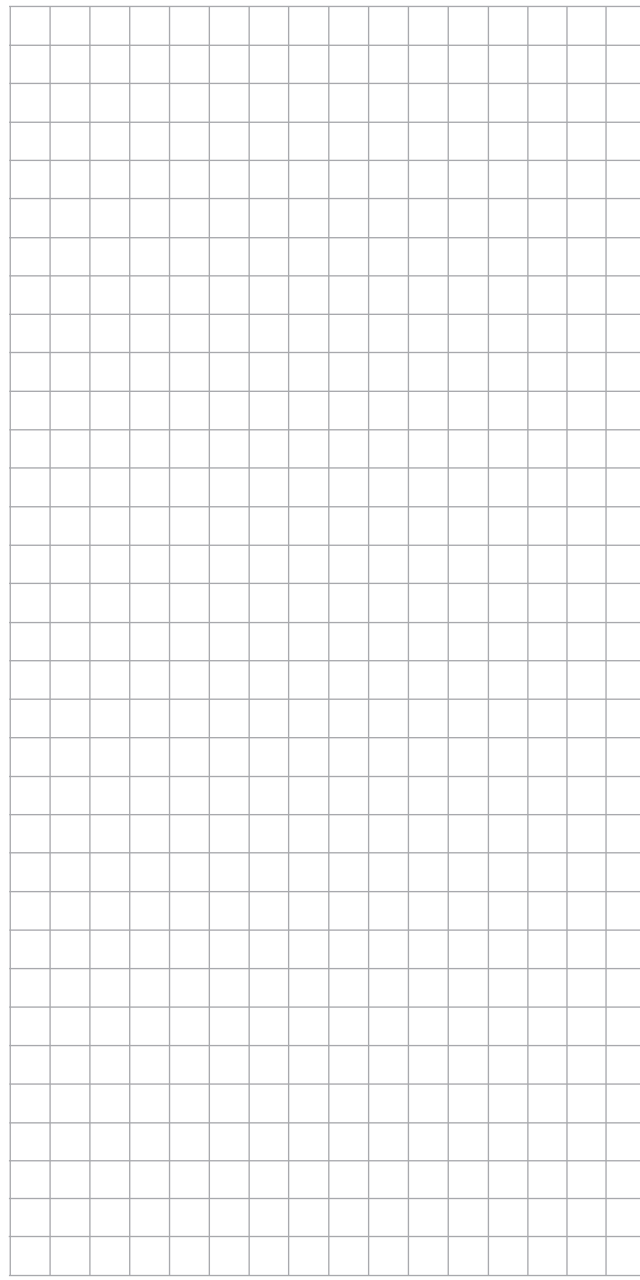
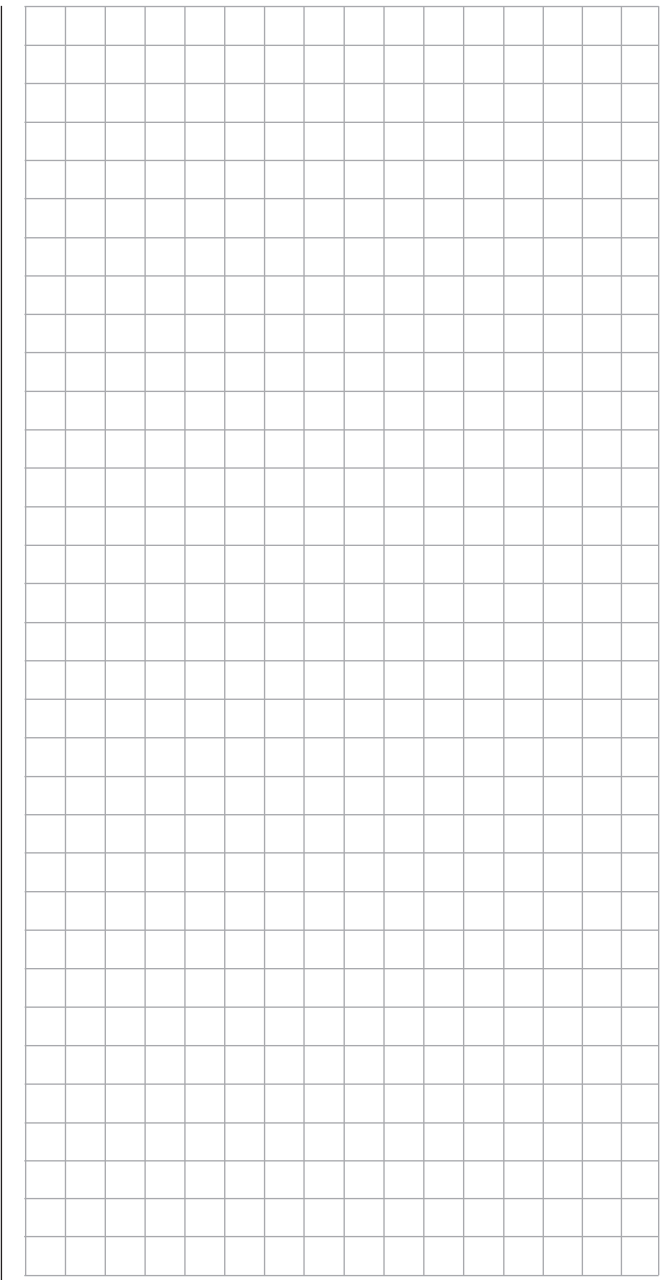
Press the **INC** or **DEC** buttons or the arrow keys (▲▼) to increase/decrease the value:

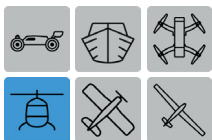


Press the **RES** button to reset the changed value back to the default.

To save and exit, press the **BACK** button at the top left of the display to return to the previous menu.





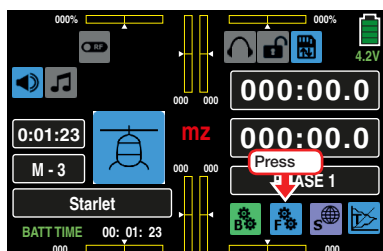


# THR.HOLD

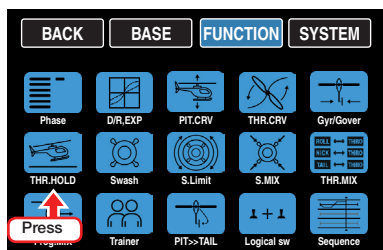
## Autorotation Throttle Position

Throttle hold sets the throttle to a percentage of the engine idle, regardless of collective pitch stick position. Throttle hold is used to practice autorotations, and as a safety measure in case of engine failure.

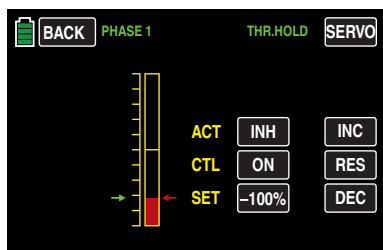
To adjust these settings, from the main display press the **FUNCTION** menu gear icon (blue "F") to bring up the FUNCTION submenu screen:



From the FUNCTION submenu display, press the **THR.HOLD** icon:



## Autorotation Throttle Position



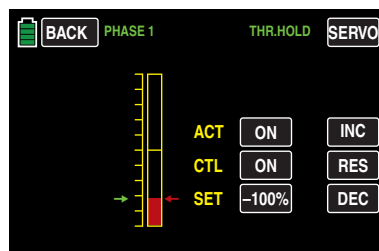
Autorotation (AR) allows a helicopter to make a controlled approach and landing in the event of motor failure or if power is deliberately cut mid-air with the throttle hold switch on the transmitter.

### Tip

An alternative emergency-off function is located in the BASE submenu **Thr.CUT** (page 66).

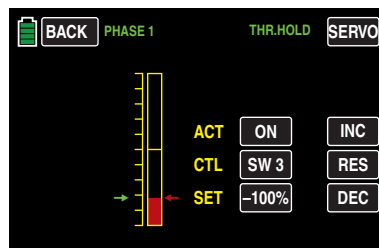
### • ACT Line

Once a switch is assigned to this function, the mode must be activated. Press the button in the **ACT** line to turn the mode **ON** or **OFF**:



### • CTL Line

Use the CTL line to assign a switch to the throttle hold mode. Refer to the BASE submenu **CTL Set** section (page 90) for additional information on switch assignments. Use the same switch for both Throttle Hold and Autorotation:

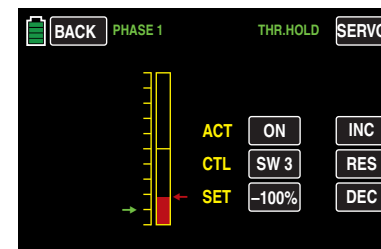


### • SET line

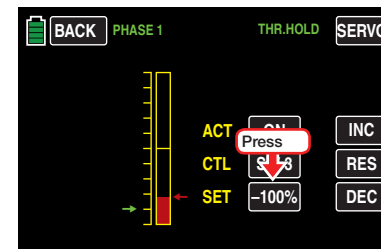
Use this option to move the throttle a percentage of its normal stick position in the event of engine failure or deliberate engine cut-off.

The green arrow (left of bar graph) indicates the current position of the throttle servo, measured by the actual position of the throttle/pitch control stick. The red arrow (right of bar graph) indicates the currently set autorotation throttle position. The default setting is -100%.

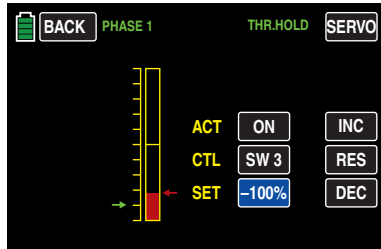
To change the current autorotation throttle position, use the throttle/pitch control stick to move the green arrow, and possibly the throttle trim, to the position that the throttle servo is to assume during autorotation, as shown below:



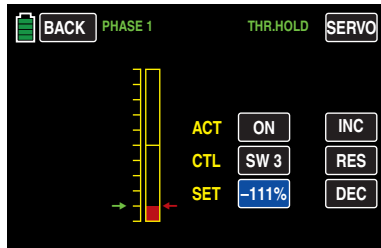
Once the arrows are placed, press the **SET** button:



The field highlights blue:

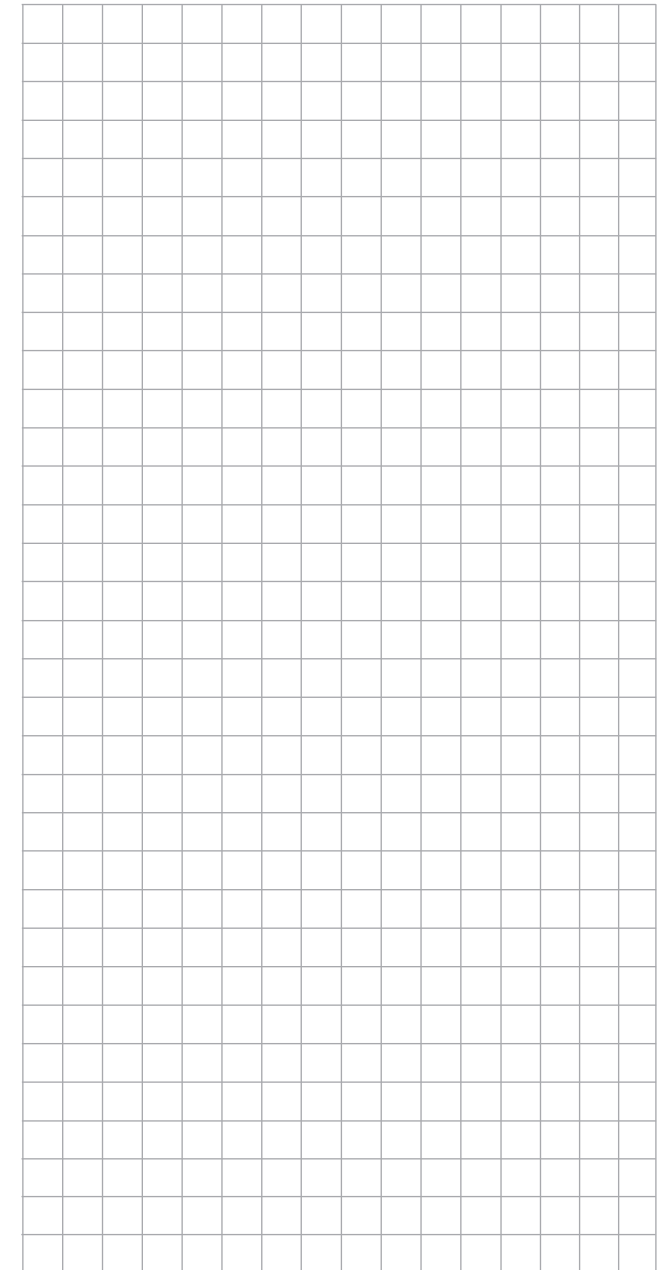
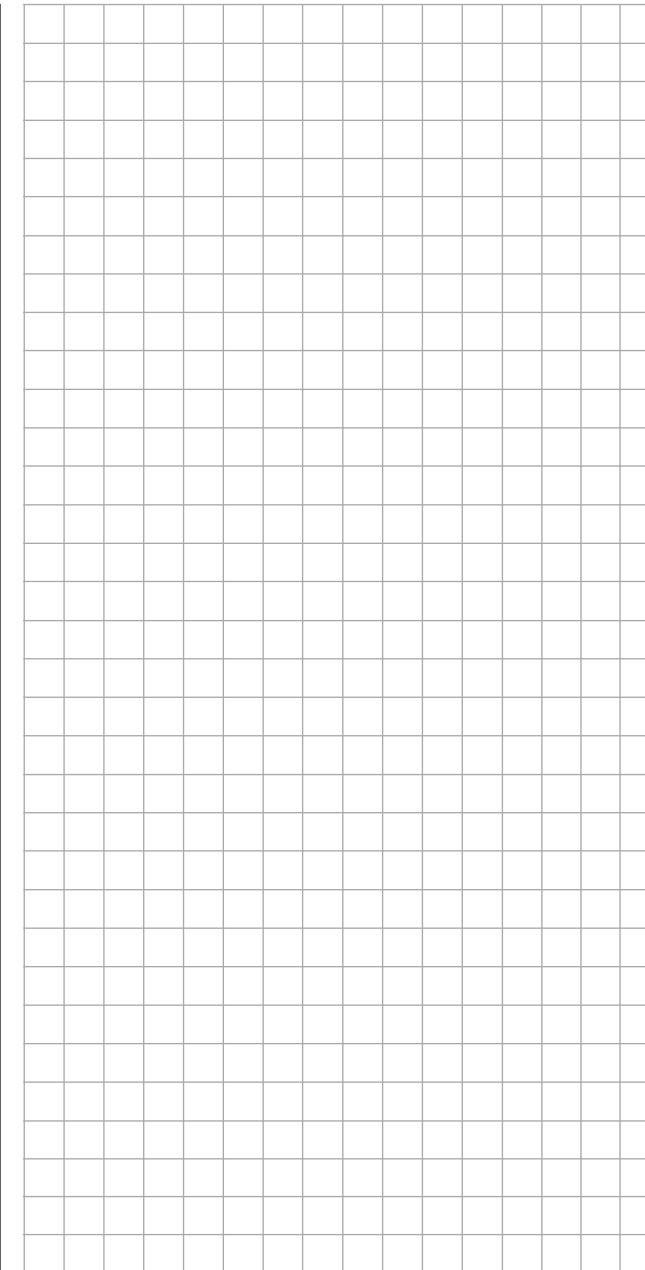


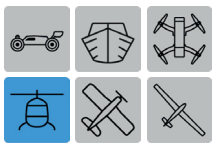
Press the **INC** or **DEC** buttons or the arrow keys (▲▼) to increase/decrease the value until the red and green arrows are equal:



Press the **RES** button to reset the changed value back to the default.

To save and exit, press the **BACK** button at the top left of the display to return to the previous menu.





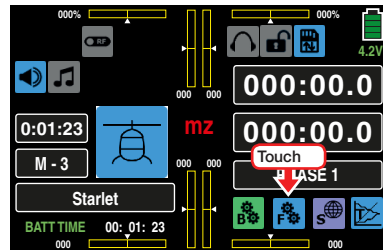
# Swash

## Pitch, Roll and Nick Mixer

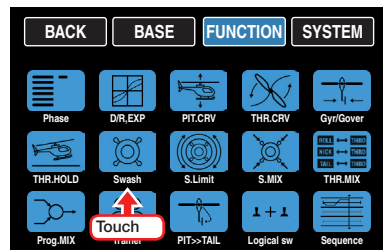
This submenu option is not available for the model setting 1SERVO NOR.

This function is used to fine tune the outputs of the mixing. Three interdependent servo linkages arranged around the swashplate share the workload of controlling control roll, control pitch and collective pitch. Swashplate mix numbers represent the % of servo function movement and the +/- symbols indicate direction the servo will move. For example, increasing a servo output to +70% will increase the servo function range and blade pitch while an output in one direction, while -70% will increase the servo function range and blade pitch in the opposite direction.

To adjust these settings, from the main display press the **FUNCTION** menu gear icon (blue "F") to bring up the FUNCTION submenu screen:



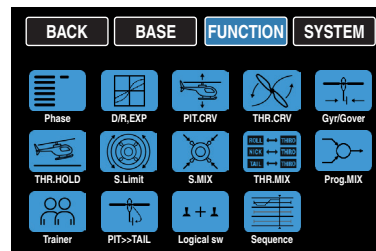
From the FUNCTION submenu display, press the **Swash** icon:



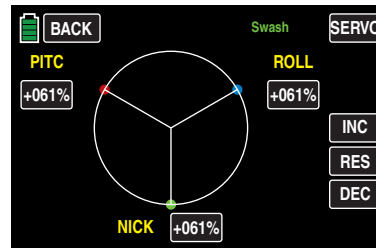
When setting up a model through the BASE submenu **Model Type**, the number of servos needed for pitch control is selected. Once this entry is made, the required mixers for the swashplate functions of roll, el-

evation and pitch axis are activated so that additional mixers do not need to be defined.

If the model is controlled using a *separate pitch servo*, the **Swash** submenu is unnecessary since three software program operates the swashplate servos separately for pitch, elevation and roll (i.e. without any mixer) and the **Swash** submenu will not appear in the FUNCTION menu if the **1SERVO NOR** option is selected during setup:

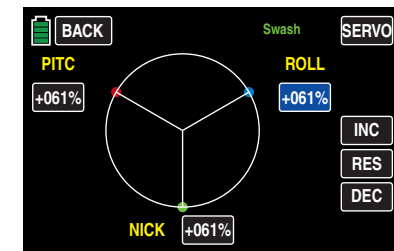


For all other swashplate linkages employing 2, 3 or 4 collective pitch servos, the mixer ratios and directions are set up by default. In the following examples, the swashplate type **3SERVO 140** was selected. The default preset is +61%:

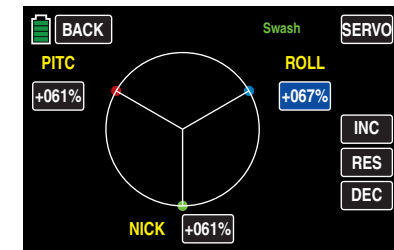


Values can be varied from -100% to +100% as needed.

To change the values, press to highlight the field of the mixer to be changed. In the example below, the ROLL needs to be increased to +67%:



Press the **INC** or **DEC** buttons or the arrow keys (▲▼) to increase/decrease the value:



Press the **RES** button to reset the changed value back to the default.

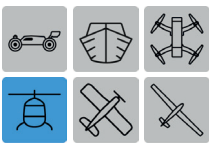
If the swashplate control (pitch, roll and elevation) does not respond to the control sticks properly, alter the mixer directions (+/-) before correcting the servo rotation direction.

### Notice



Ensure that changed mixer values do not result in the servos mechanically striking their end-stops.

To save and exit, press the **BACK** button at the top left of the display to return to the previous menu.

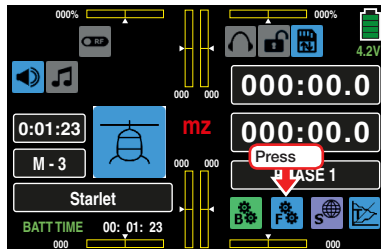


# S.Limit

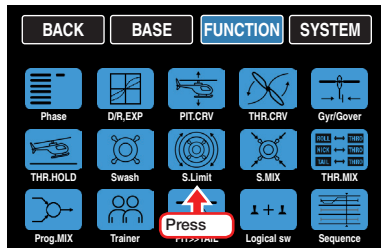
## Adjustable Limitation and Deflection Rotation

This function acts like a circular mechanical fence limiting the maximum possible tilting of the swashplate for aileron and elevator.

To adjust these settings, from the main display press the **FUNCTION** menu gear icon (blue "F") to bring up the FUNCTION submenu screen:

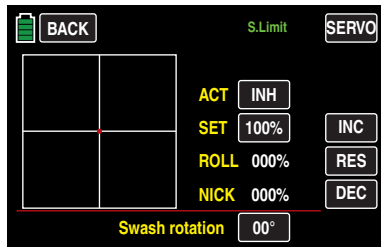


From the FUNCTION submenu display, press the **S.Limit** icon:

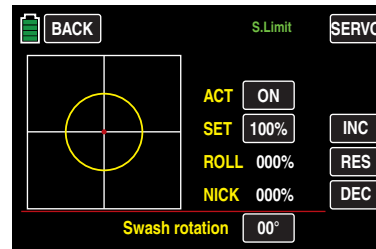


### Swashplate Limiter

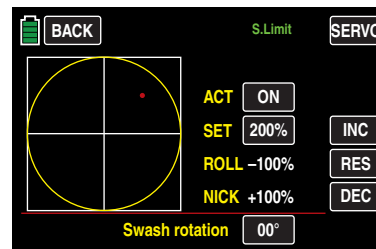
The normally square path of a control stick (marked with a red circle):



Turning the limiter **ON** in the **ACT** line limits the maximum control stick path to a circular area:



Limiting swashplate movements is important. 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 when 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 be disengaged.

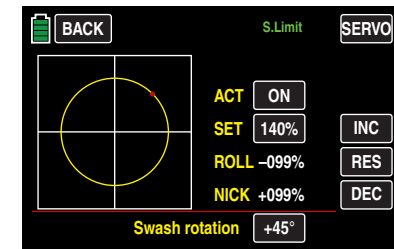


The limitation of the overall swashplate deflection or the swashplate tilt angle can be limited between 100% (deflection has circular limit to the value achievable with roll or elevation) and 200% (no effective limit). Press to highlight the value field in the **SET** line. Press the **INC** or **DEC** buttons or the arrow keys (▲▼) to increase/decrease the value. The function can be deactivated by selecting **INH** in the **ACT** line. Press the **RES** button to reset the changed value back to the default.

### Swash Rotation

With some rotor head controls, it is necessary to tilt the swashplate in different direction than the intended rotor plane angle during cyclical control, i.e. the point at which the rotor pitch is starting to change is typically before the point where it actually affects the model orientation. If a phase angle is added to a the head, the inputs are then out of line with the desired movement direction. This can cause banking.

For example, if a four-blade rotor is used, it may be necessary to turn the actuation 45° to the right or left so that the control linkage from the swashplate to the rotor head can be exactly vertical. The blades can now be controlled without undesirable differentiation, and 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.

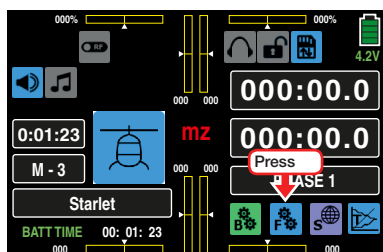


To save and exit, press the **BACK** button at the top left of the display to return to the previous menu.

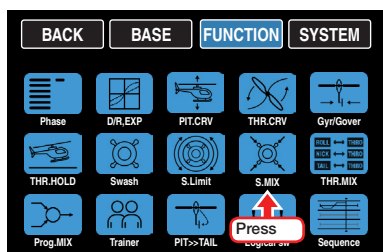
## Phase-Dependent Pitch, Roll and Nick Settings

The following trim options are used for compensating asymmetrical helicopter reactions to control commands and to adjust helicopters with multi-blade rotors. The following flight phase-dependent mixers can be adjusted: **ROLL >> NICK**, **NICK >> ROLL**, **PITC >> ROLL**, and **PITC >> NICK**.

To adjust these settings, from the main display press the **FUNCTION** menu gear icon (blue “F”) to bring up the FUNCTION submenu screen:



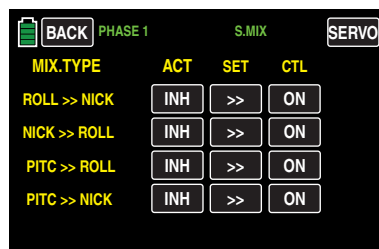
From the FUNCTION submenu display, press the **S. MIX** icon:



### Phase-Dependent Settings

This submenu allows for different phase-specific values to be programmed. Phase names are displayed in green in the upper left side of the screen next to the BACK button. Standard default naming for the phases are usually displayed as **NORMAL/PHASE 1**. (Additional phases will be named numerically, e.g. Phase 2, Phase 3, etc.) To define multiple phases, refer to the FUNCTION submenu **Phase** section (page 120). Each new phase will need to be assigned to a

different switch. To change the phases, activate the corresponding switch(es).



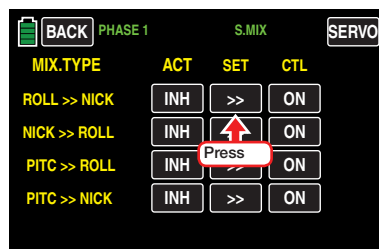
- **ACT Column (Active)**

To activate **ON** or inhibit **INH** a specific phase combination, press to change the value fields in the appropriate row.

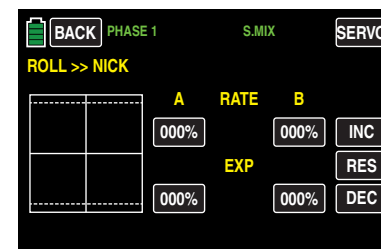
This turns on and off the effect of the control element on the selected mixer when the value field is **ON** and a switch is assigned to the specific phase (refer to the **CTL Column** section on page 175).

- **SET Column (Setting)**

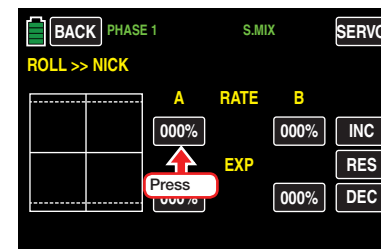
To bring up the phase settings screen, press the bracket buttons **>>** in the appropriate row:



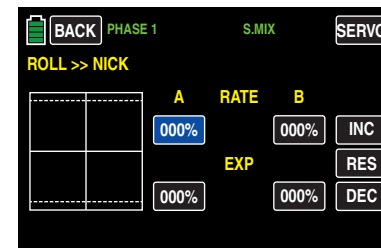
The settings display screen opens:



Based on the defaults shown here, adapt the current settings as needed by pressing the value field to be changed. In the example below, **RATE A** needs to be changed to **-012%**:



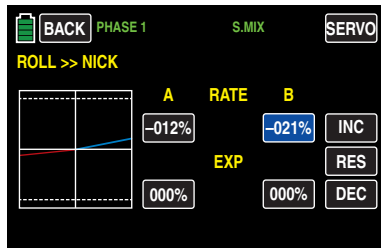
The value field highlights blue:



Press the **INC** or **DEC** buttons or the arrow keys (▲▼) to increase/decrease the value:



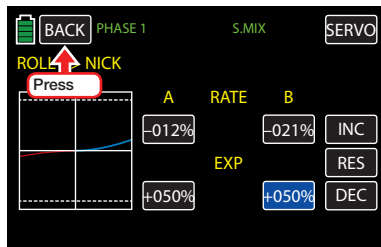
Use the same procedure for the value on the opposite side of the control travel. In the example below, **RATE B** needs to be changed to **-012%**:



Press the **RES** button to reset the changed value back to the default.

Make the necessary changes in the two EXP value fields as described in the **FUNCTION** submenu **D/R.EXP** section (page 124).

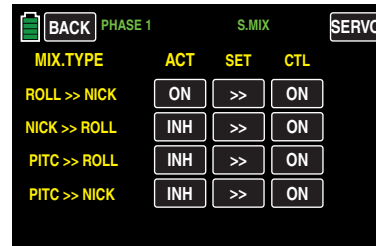
To save and exit back to the S.MIX main display, press the **BACK** button at the top left of the screen:



### Notice



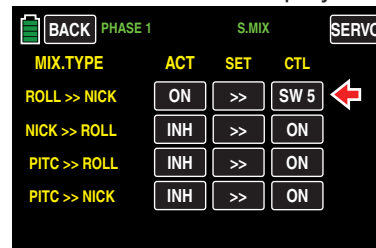
The mixed values portrayed in the above graphics are for demonstration purposes only and do not represent real values.



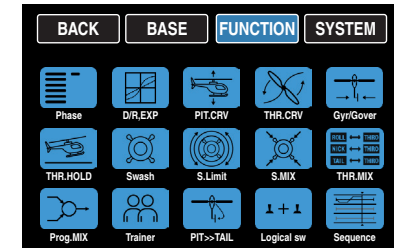
Select and adjust all mixers as previously described.

### • CTL Column (Control/Switch)

Press the field in the appropriate button to assign a control to the respective mixer. Refer to the **BASE** submenu **CTL Set** section (page 90) for information on setting switches. When the phase is activated by turning the **ON** button in the ACT Column, the assigned switch will perform the adjustments made in the SET display screen:



To save and exit to the **FUNCTION** menu, press the **BACK** button at the top left of the screen.



# THR.MIX



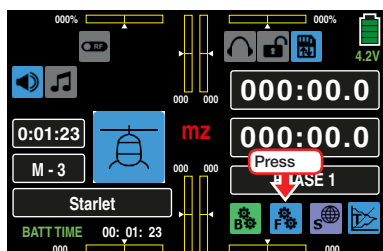
## Phase-Dependent Throttle Tracking with Roll, Elevation and Tail Settings

Use this function to individually adjust throttle tracking with roll, pitch and tail control.

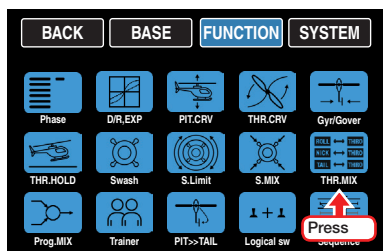
The throttle needs to follow an increase in pitch and should track with large cyclical control movements that tilt the swashplate in the desired direction. The motor output should be adapted when the thrust of the tail rotor is increased to maintain a constant system speed. This is useful for aerobatics (e.g. performing rolls) since cyclical control deflections are used with middle collective pitch values where the carburetor is about halfway open and require significantly higher motor output.

When using a **governor** to automatically maintain the rotor speed, the governor adapts the output as necessary. Adjust throttle tracking in these three mixers.

To adjust these settings, from the main display press the **FUNCTION** menu gear icon (blue "F") to bring up the FUNCTION submenu screen:

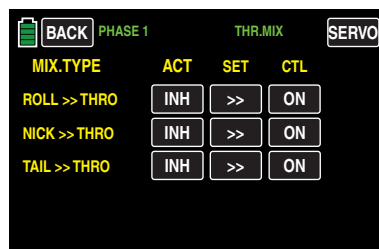


From the FUNCTION submenu display, press the **THR.MIX** icon:



### Phase-Dependent Settings

This submenu allows for different phase-specific values to be programmed. Phase names are displayed in green in the upper left side of the screen next to the BACK button. Standard default naming for the phases are usually displayed as **NORMAL/PHASE 1**. (Additional phases will be named numerically, e.g. Phase 2, Phase 3, etc.) To define multiple phases, refer to the FUNCTION submenu **Phase** section (page 120). Each new phase will need to be assigned to a different switch. To change the phases, activate the corresponding switch(es).



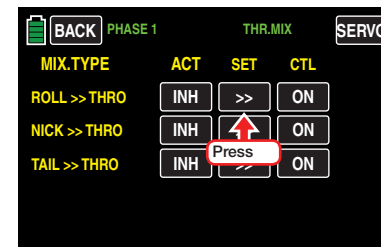
#### • ACT Column (Active)

To activate **ON** or inhibit **INH** a specific phase combination, press to change the value fields in the appropriate row.

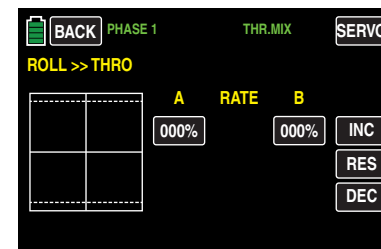
This turns on and off the effect of the control element on the selected mixer when the value field is **ON** and a switch is assigned to the specific phase (refer to the **CTL Column** section on page 175).

#### • SET Column (Setting)

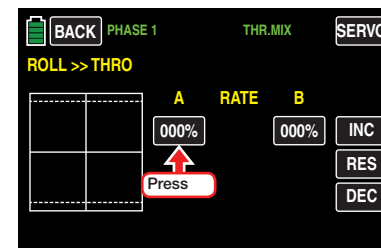
To bring up the phase settings screen, press the bracket buttons **>>** in the appropriate row:



The settings display screen opens:



Based on the defaults shown here, adapt the current settings as needed by pressing the value field to be changed. In the example below, **RATE A** needs to be changed to **-012%**:

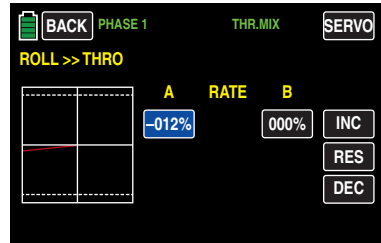




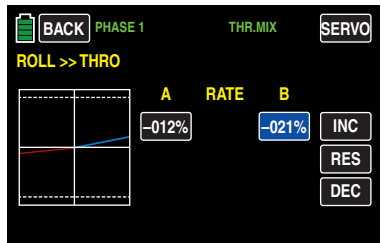
The value field highlights blue:



Press the **INC** or **DEC** buttons or the arrow keys (▲▼) to increase/decrease the value:

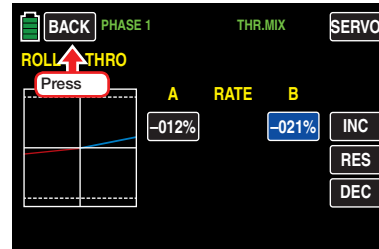


Use the same procedure for the value on the opposite side of the control travel. In the example below, **RATE B** needs to be changed to **-012%**:



Press the **RES** button to reset the changed value back to the default.

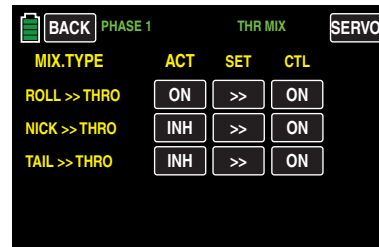
To save and exit back to the THR.MIX main display, press the **BACK** button at the top left of the screen:



### Notice



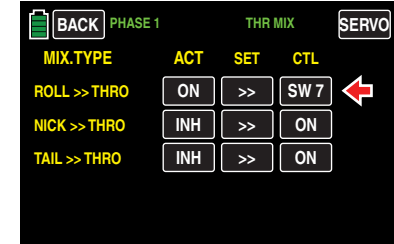
The mixed values portrayed in the above graphics are for demonstration purposes only and do not represent real values.



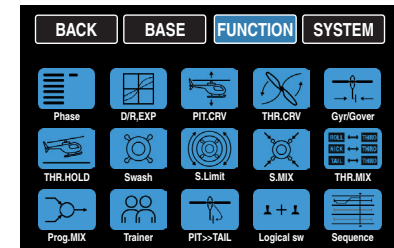
Select and adjust all mixers as previously described.

- CTL Column (Control/Switch)**  
 Press the field in the appropriate button to assign a control to the respective mixer. Refer to the BASE submenu **CTL Set** section (page 90) for information on setting switches.

When the phase is activated by turning the **ON** button in the ACT Column, the assigned switch will perform the adjustments made in the SET display screen:



To save and exit to the FUNCTION menu, press the **BACK** button at the top left of the screen.



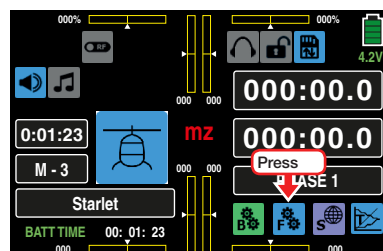
# PIT>>TAIL



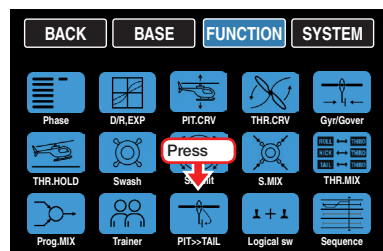
## Phase-Dependent Static Torque Compensation

Use this function to adjust the torque compensation curve with a linear mixer ratio. In normal flight, the tail rotor is adjusted so that it compensates for the torque of the main rotor during hovering. This 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 trimming the tail rotor to accommodate the weather, system speed and other influences.

To adjust these settings, from the main display press the **FUNCTION** menu gear icon (blue “F”) to bring up the FUNCTION submenu screen:



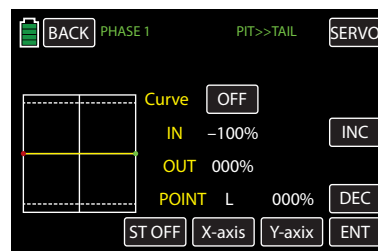
From the FUNCTION submenu display, press the **PIT>>TAIL** icon:



### Phase-Dependent Settings

This submenu allows for different phase-specific values to be programmed. Phase names are displayed in green in the upper left side of the screen next to the BACK button. Standard default naming for the phases are usually displayed as **NORMAL/PHASE 1**. (Additional phases will be named numerically, e.g. Phase 2, Phase 3, etc.) To define multiple phases,

refer to the FUNCTION submenu **Phase** section (page 120). Each new phase will need to be assigned to a different switch. To change the phases, activate the corresponding switch(es). 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:



If using the gyro sensor in NORMAL mode, or if the sensor can only handle NORMAL mode, adjust the mixer as follows:

### Notice



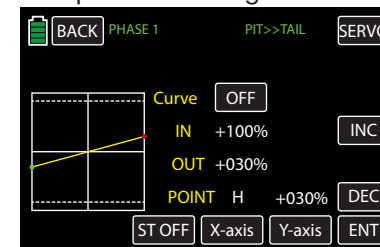
Consult the gyro setting instructions to avoid making adjustments that may make it impossible to fly the helicopter.

### Programming

Similar to adjusting the **PIT.CRV** (page 154), the control curve for the tail rotor can also be defined with up to 7 points. Modify the mixer as needed and at any time by specifying the 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 have differing main rotor torque compared to hovering. This will prevent the helicopter from rotating around the vertical axis, even during long vertical ascents and descents.

Change the trim using the digital tail rotor trim control while the helicopter is hovering:



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

During autorotation, 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 for. Therefore, all of the corresponding mixers are automatically turned off.

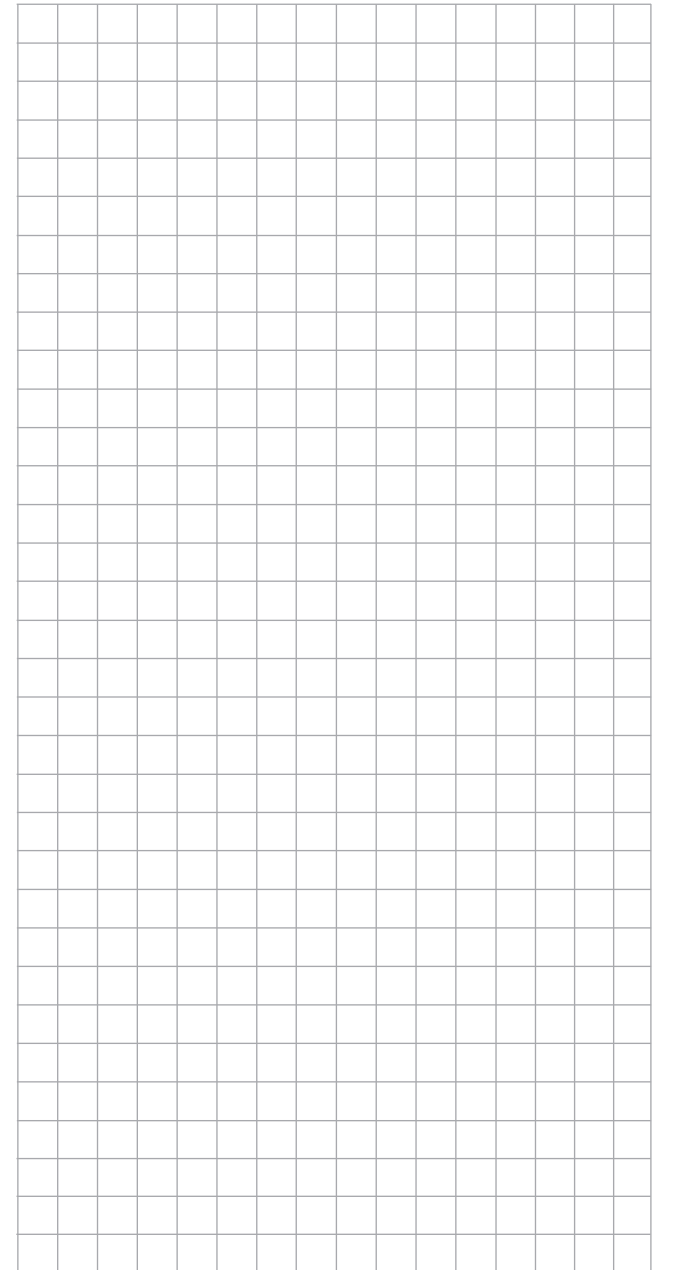
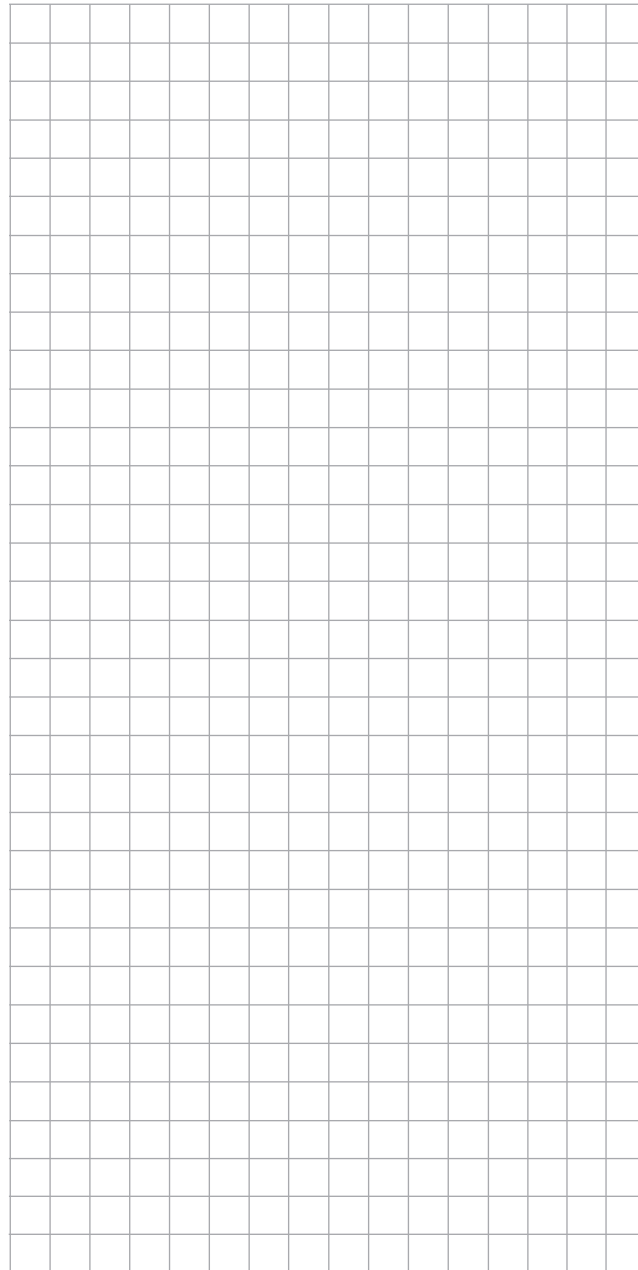
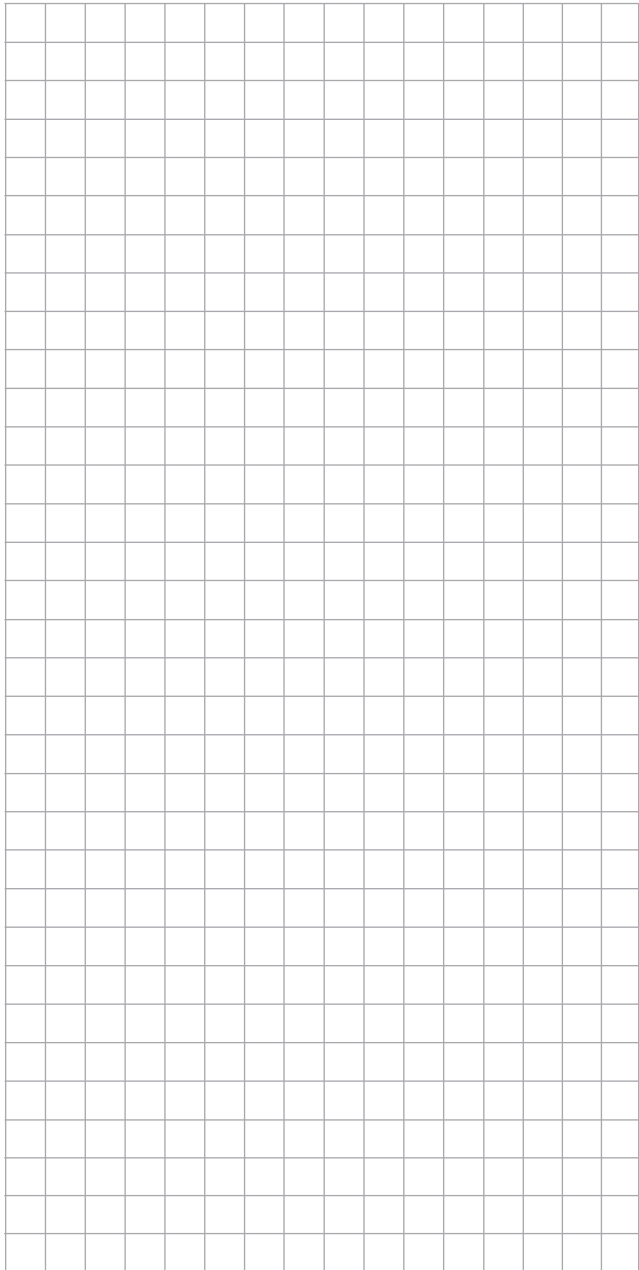
Since thrust is no longer necessary during autorotation (because of the lack of torque), the basic position of the tail rotor must also be different:

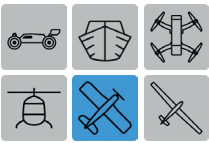
While the motor is turned off, place the helicopter in a horizontal position. Turn on the transmitter and receiver, select the phase **autorotation**, fold down the tail rotor blades, and change the mixer settings until the pitch angle of the tail rotor blades equals 0°. The tail rotor blades are then 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. This value should be between 0° and a pitch angle that is opposite the direction of the pitch angle during flight.

◀ Helicopter Model Function Menus

Fixed-Wing Model Function Menus ▶





# Idle LOW

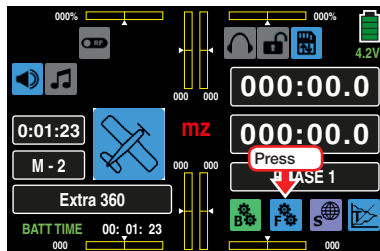
## Idle Stabilization Setting

This submenu option is not available for models using an electric motor.

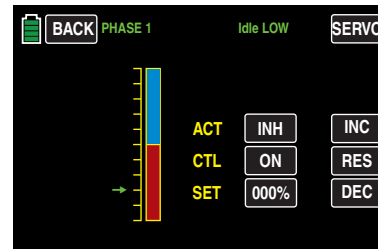
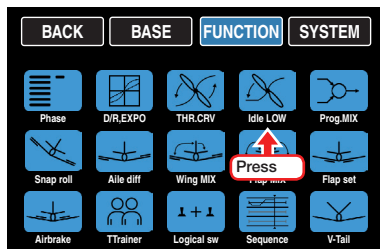
Use this function to set a gas motor's idle. Engines without a stable idle are not running up to proper specifications and can affect the performance of a model. For example, models can be damaged during the landing process because the engine may suddenly die.

Normally, the idle of a gas motor is set using the throttle digital trim control. The idle position of the throttle servo (which depends on the position of the trim control) can be adjusted as needed to a higher or lower idle with a switch. A value can be programmed to the switch within a range of  $\pm 20\%$ .

To adjust these settings, from the main display press the **FUNCTION** menu gear icon (blue "F") to bring up the FUNCTION submenu screen:

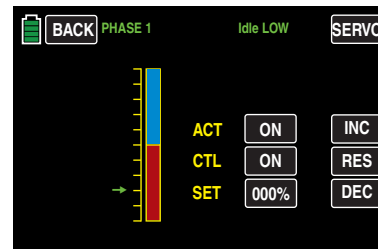


From the FUNCTION submenu, press the **Idle LOW** icon:

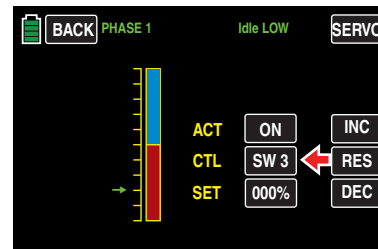


### Programming

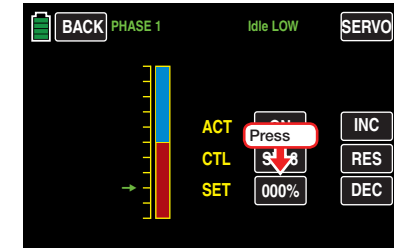
Press the value button in the **ACT** line to activate **ON** or inhibit **INH**:



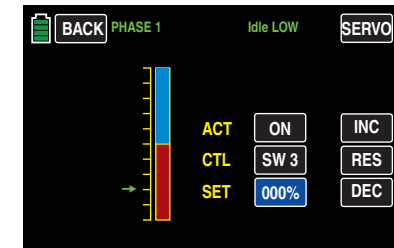
Press the value button in the **CTL** line to assign a control switch. Refer to the BASE submenu **CTL Set** section (page 90) for information on setting switches. When the phase is activated by turning the **ON** button in the ACT line, the assigned switch will perform the adjustments made in the SET line:



In the **SET** line, set the desired corrective value by pressing the value field:



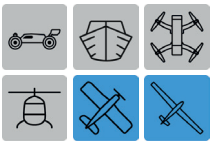
The field highlights blue:



Press the **INC** or **DEC** buttons or the arrow keys (▲▼) to increase/decrease the value.

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. Press the **RES** button to reset the changed value back to the default.

To save and exit, press the **BACK** button at the top left of the display to return to the previous menu.

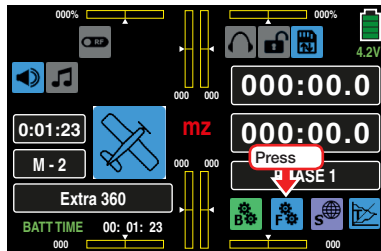


# Snap Roll

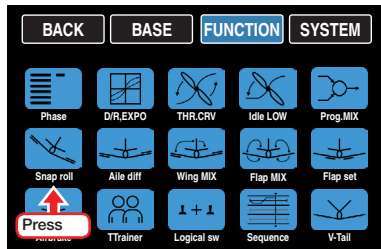
## Automated Programming

A snap-roll is a purposely accelerated stall resulting in a “spin”. This function enables up to four pre-programmed snap settings (positive right/negative, right, left and positive left/negative) per phase. 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 has been shifted to the preset position.

To adjust these settings, from the main display press the **FUNCTION** menu gear icon (blue “F”) to bring up the FUNCTION submenu screen:



From the FUNCTION submenu display, press the **Snap roll** icon:

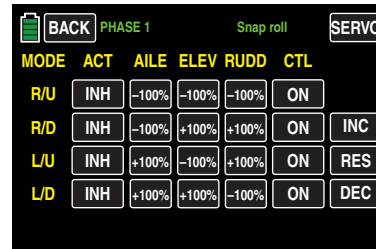


Some pilots automatically program snap rolls when flying.

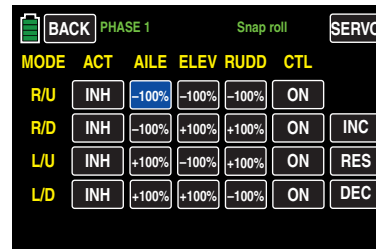
### Phase-Dependent Settings

This submenu allows for different phase-specific values to be programmed. Phase names are displayed in green in the upper left side of the screen next to

the **BACK** button. Standard default naming for the phases are usually displayed as **NORMAL/PHASE 1**. (Additional phases will be named numerically, e.g. Phase 2, Phase 3, etc.) To define multiple phases, refer to the FUNCTION submenu **Phase** section (page 120). Each new phase will need to be assigned to a different switch. To change the phases, activate the corresponding switch(es).

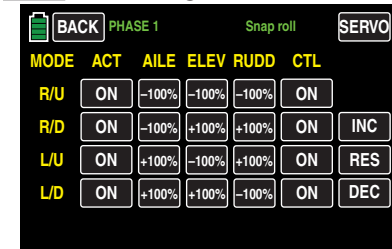


Set the values within a range of  $\pm 150\%$  in the appropriate column and row. Press the value field to highlight blue:



Press the **INC** or **DEC** buttons or the arrow keys ( $\blacktriangle$   $\blacktriangledown$ ) to increase/decrease the value. Press the **RES** button to reset the changed value back to the default.

Press the button in the **ACT** column to activate **ON** or inhibit **INH** the settings:



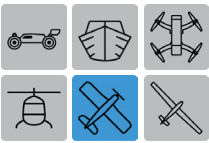
Press the value button in the **CTL** line to assign a control switch. Refer to the BASE submenu **CTL Set** section (page 90) for information on setting switches. When the phase is activated by turning the **ON** button in the ACT column, the assigned switch will perform the adjustments set on this screen.

### WARNING



**Never turn on a snap-roll program accidentally, especially during flight! If the programs are turned on at in the wrong location or time, it can cause significant property damage and/or injury.**

To save and exit, press the **BACK** button at the top left of the display to return to the previous menu.



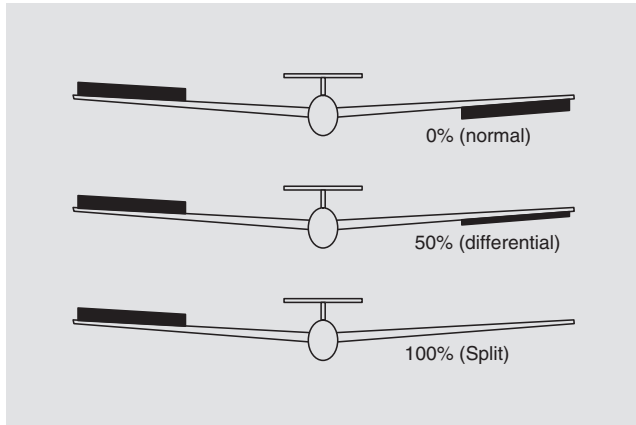
# Aile diff - Plane

## Aileron Travel and Differentiation Settings

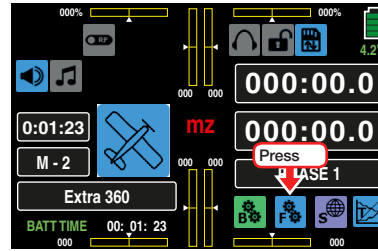
This submenu option is not available for models using the 1AILE and 1AILE1FLAP settings.

An aileron deflected downward generates greater aerodynamic resistance than one deflected upward. The asymmetrical resistance generates torque around the vertical axis which causes a turning out of the intended flight direction. This is a naturally occurring phenomenon for all winged models, however the effect comparatively is stronger on the longer glider wings and less on motorized airplanes whose lever arms are typically much shorter. This undesirable side-effect is called “adverse yaw” and must be compensated for by a simultaneous, counteracting rudder deflection.

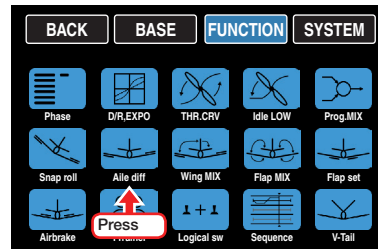
The rudder deflection also generates additional resistance and further impairs flight. If the rudder deflection is differentiated so that the downward deflection of the aileron is less than the upward deflection, the adverse yaw can be reduced or eliminated without having to manually compensate the rudder each time on the aileron control.



To adjust these settings, from the main display press the **FUNCTION** menu gear icon (blue “F”) to bring up the FUNCTION submenu screen:

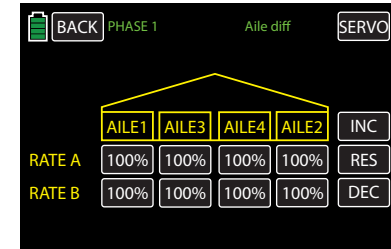
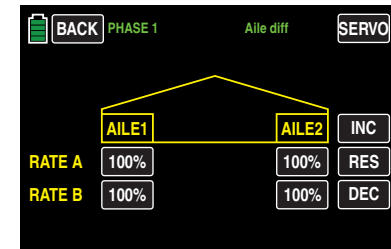


From the FUNCTION submenu, press the **Aile diff** icon:



### Phase-Dependent Settings

This submenu allows for different phase-specific values to be programmed. Phase names are displayed in green in the upper left side of the screen next to the BACK button. Standard default naming for the phases are usually displayed as **NORMAL/PHASE 1**. (Additional phases will be named numerically, e.g. Phase 2, Phase 3, etc.) To define multiple phases, refer to the FUNCTION submenu **Phase** section (page 120). Each new phase will need to be assigned to a different switch. To change the phases, activate the corresponding switch(es).



### Notice

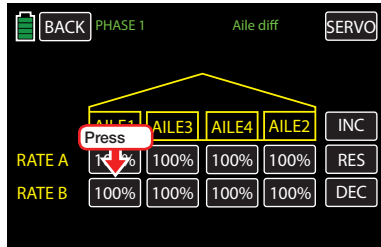
The available setting options depend on the number of ailerons selected during the basic settings of the model (BASE submenu **Model Type**).

### Programming

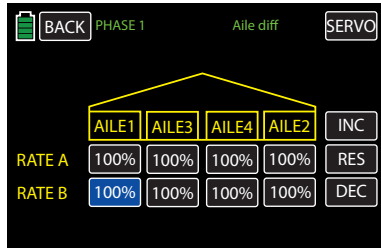
The adjustment range of 100% to both sides allows the adjustment of different deflections on the right side independent of the rotation direction of the aileron servos. 100% (travel) corresponds to normal deflection (no differentiation), and 0% (travel) corresponds to the split function.

High absolute values are required during stunt flying in order for the model to rotate precisely around the longitudinal axis when the aileron is deflected. Average values of about 50% are typical for supporting curved flight in a thermal air current.

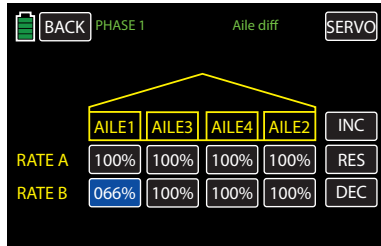
To change a value, press the appropriate value field. In the example below, the selected aileron travel must be changed to **066%**:



The field highlights blue:



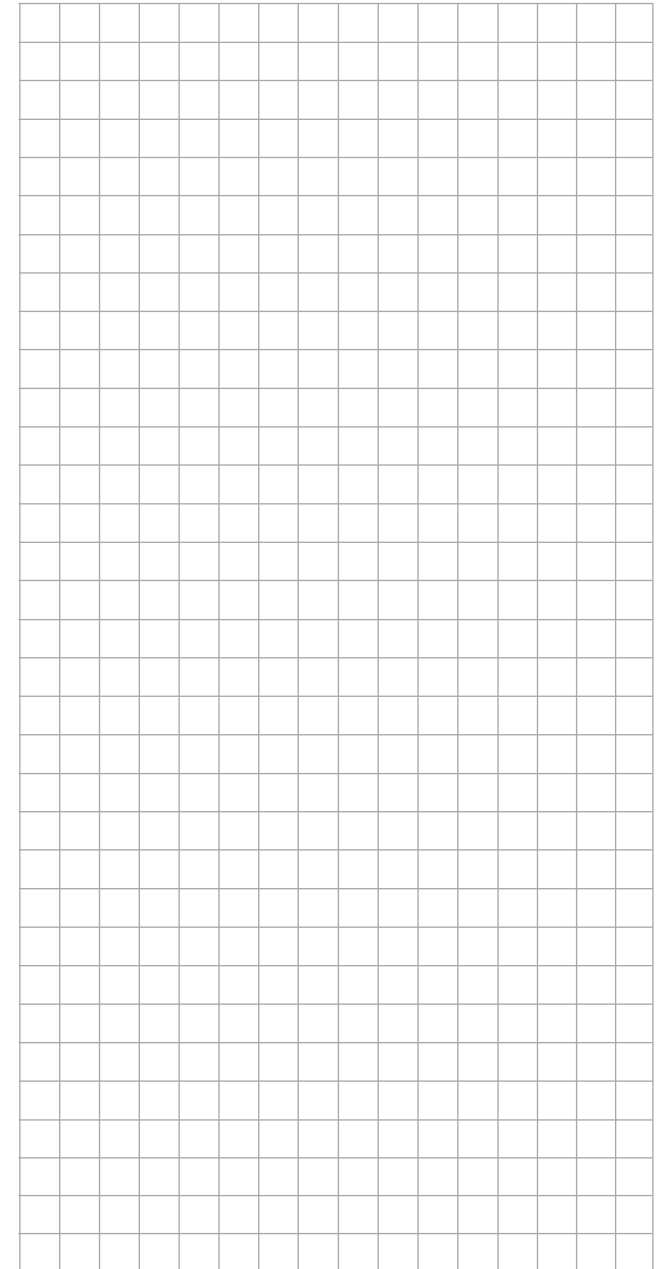
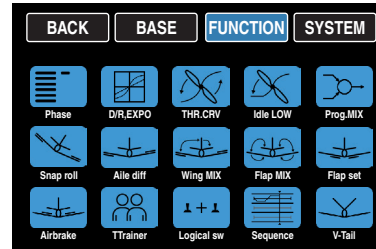
Press the **INC** or **DEC** buttons or the arrow keys (▲▼) to increase/decrease the value:

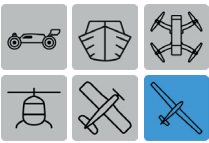


Use the same procedure to adjust the other differentiation values for all remaining ailerons.

Press the **RES** button to reset the changed value back to the default.

To save and exit, press the **BACK** button at the top left of the display to return to the previous menu.





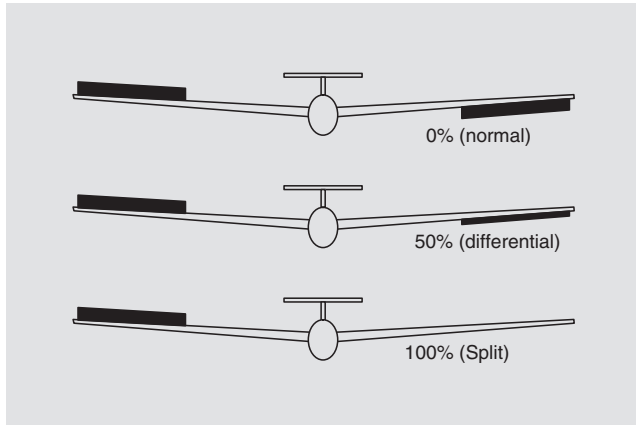
# Aile diff - Glider

## Aileron Travel, Differentiation and Differentiation Reduction Settings

This submenu option is not available for models using the 1AILE and 1AILE1FLAP settings.

An aileron deflected downward generates greater aerodynamic resistance than one deflected upward. The asymmetrical resistance generates torque around the vertical axis which causes a turning out of the intended flight direction. This is a naturally occurring phenomenon for all winged models, however the effect comparatively is stronger on the longer glider wings and less on motorized airplanes whose lever arms are typically much shorter. This undesirable side-effect is called "adverse yaw" and must be compensated for by a simultaneous, counteracting rudder deflection.

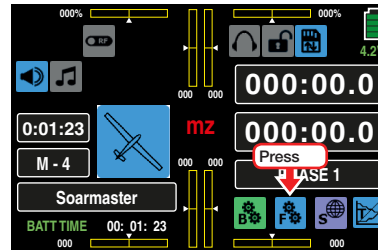
The rudder deflection also generates additional resistance and further impairs flight. If the rudder deflection is differentiated so that the downward deflection of the aileron is less than the upward deflection, the adverse yaw can be reduced or eliminated without having to manually compensate the rudder each time on the aileron control.



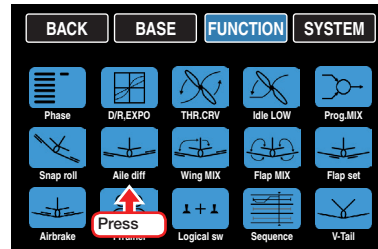
However, when the ailerons are raised as part of a butterfly configuration, the adjusted aileron differentiation has a disadvantageous effect, since the aileron effect is strongly impaired. Another excursion of the

one aileron is almost impossible, though depending on the position and degree of differentiation, often it does not have the neutral position. The automatic differentiation reduction option reduces the degree of aileron differentiation continuously and in an adjustable manner when the brake system is extended or even set them up, depending on the setting.

To adjust these settings, from the main display press the **FUNCTION** menu gear icon (blue "F") to bring up the FUNCTION submenu screen:



From the FUNCTION submenu display, press the **Aile diff** icon:

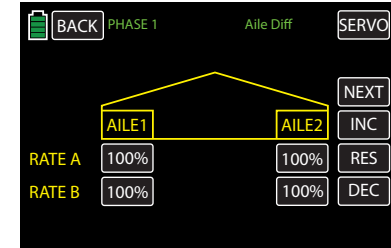


### Phase-Dependent Settings

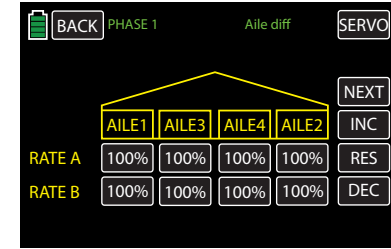
This submenu allows for different phase-specific values to be programmed. Phase names are displayed in green in the upper left side of the screen next to the BACK button. Standard default naming for the phases are usually displayed as **NORMAL/PHASE 1**. (Additional phases will be named numerically, e.g. Phase 2, Phase 3, etc.) To define multiple phases, refer to the FUNCTION submenu **Phase** section (page 120). Each new phase will need to be assigned to a

different switch. To change the phases, activate the corresponding switch(es).

This example shows the display for setting a minimum of two ailerons, such as **2AILE**:



This example shows the display for setting a maximum of four ailerons, such as **4AILE4FLAP**:



This example shows the display of differentiation (**Diff.**) and differentiation reduction (**Red.**), such as **4AILE4FLAP**:



### Notice

The available setting options depend on the number of ailerons selected during the basic settings of the model (BASE submenu **Model Type**).



## Display Page Travel Setting

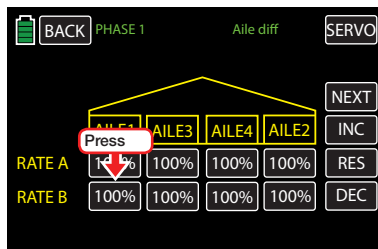
The adjustment range of 100% to both sides allows the adjustment of different deflections on the right side *independent of* the rotation direction of the aileron servos on this display page. 100% (travel) corresponds to normal deflection, and 0% (travel) corresponds to the split function.

### Notice

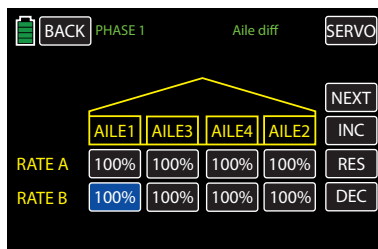


At least then, in case of use of the butterfly system of the differentiation reduction function, a differentiation should not be performed in this display page but by pressing the **NEXT** button to bring up the Differentiation/Reduction Display Page (page 185).

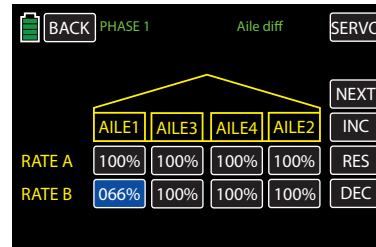
To change a value, press the appropriate value field. In the example below, the selected aileron travel must be changed to **066%**:



The field highlights blue:



Press the **INC** or **DEC** buttons or the arrow keys (▲▼) to increase/decrease the value:



Use the same procedure to adjust the other differentiation values for all remaining ailerons.

Press the **RES** button to reset the changed value back to the default.

## Differentiation/Reduction Display Page



### Notice

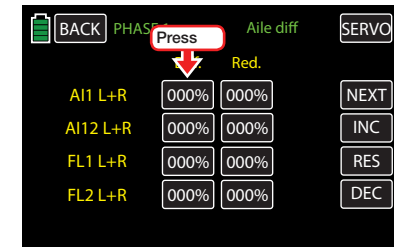


The available setting options depend on the number of ailerons selected during the basic settings of the model (BASE submenu **Model Type**).

#### • Programming the differentiation

The adjustment range of 100% to allows you to adjust different deflection on the right side *independent of* the direction of rotation of the servos. 000 % (differentiation) corresponds to normal deflection and 100 % (differentiation) of the split function.

To set the differentiation, press the appropriate value field of the **Diff.** column. In the example below, the selected aileron travel must be changed to **045%**:



The field highlights blue:



Press the **INC** or **DEC** buttons or the arrow keys (▲▼) to increase/decrease the value:



Use the same procedure to adjust the other differentiation values for all remaining flaps/aileron. Press the **RES** button to reset the changed value back to the default.

#### • Programming the reduction

A 000% value in the right column means that the "aileron differentiation" programmed in the trans-

mitter is held. A value equal to the set percentage of the aileron differentiation means that this is removed in maximum butterfly function (flaps completely out). In case of a reduction value bigger than the set aileron differentiation, this will be removed completely before the full deflection of the flap control stick.

To set the differentiation, press the appropriate value field of the **Red.** column. In the example below, the selected aileron travel must be changed to **045%**:



The field highlights blue:



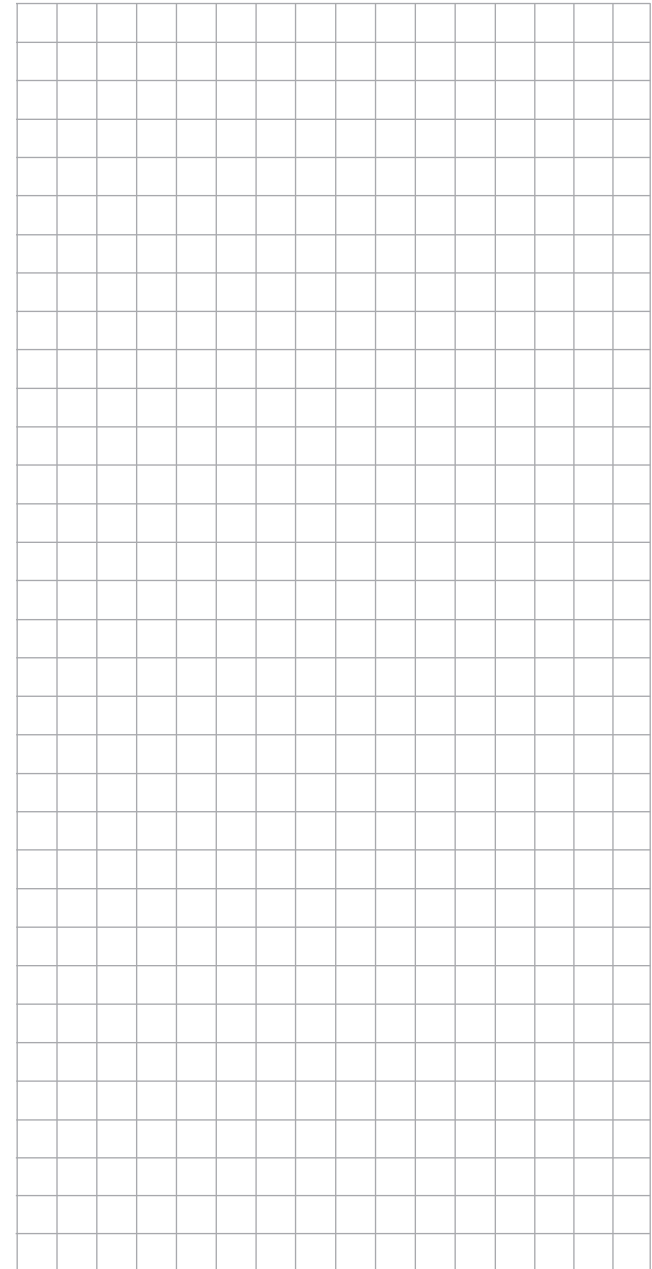
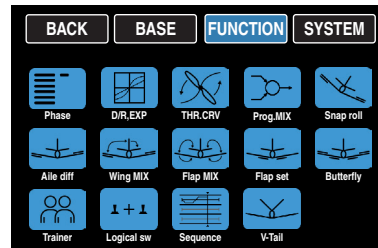
The adjustment range of  $\pm 150\%$  allows you to set the reduction of the set differentiation completely independently from the direction of rotation of the servos installed in the wings.

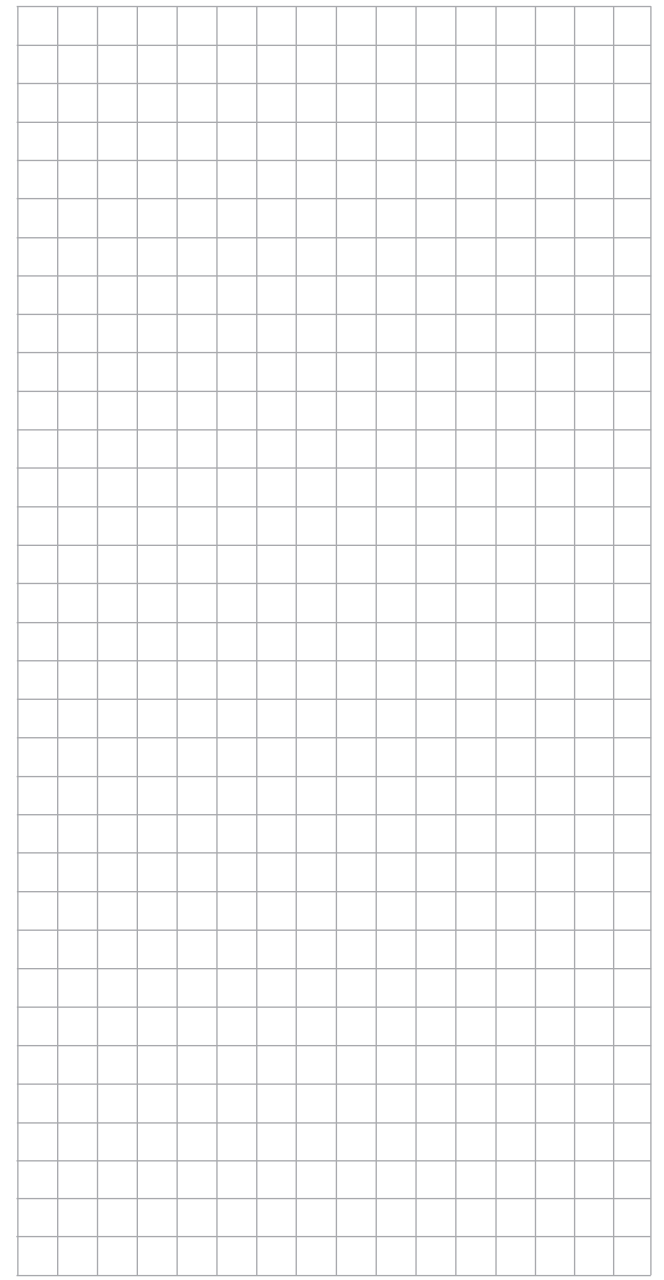
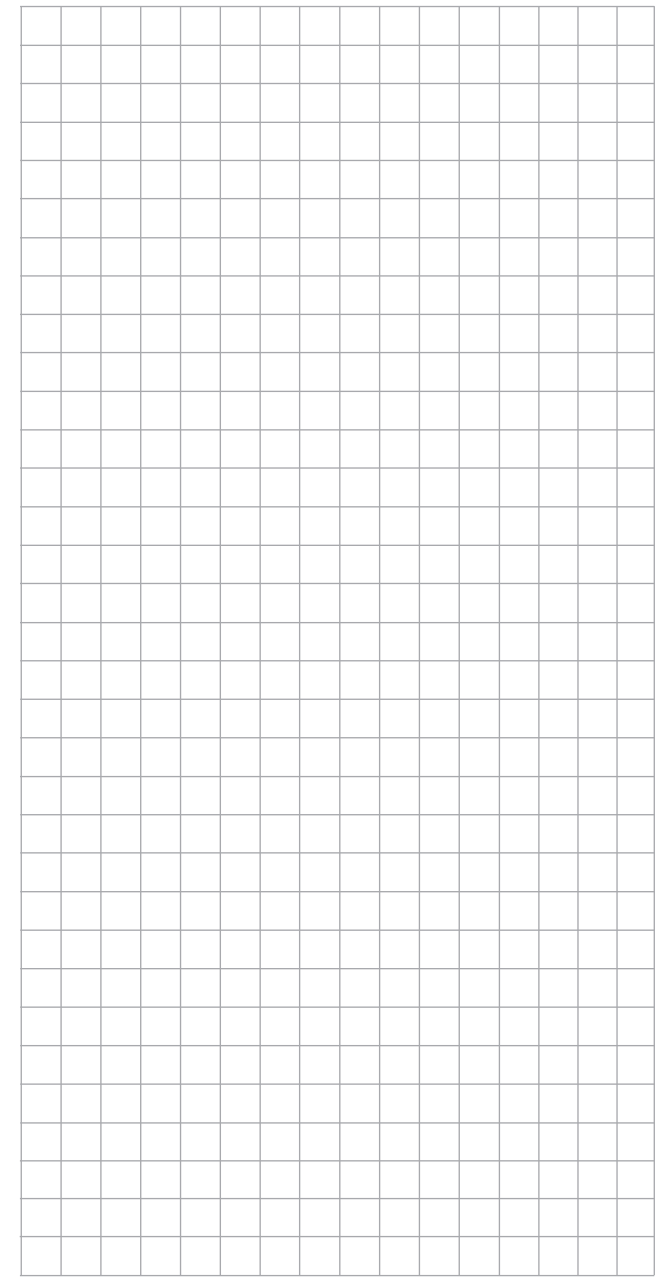
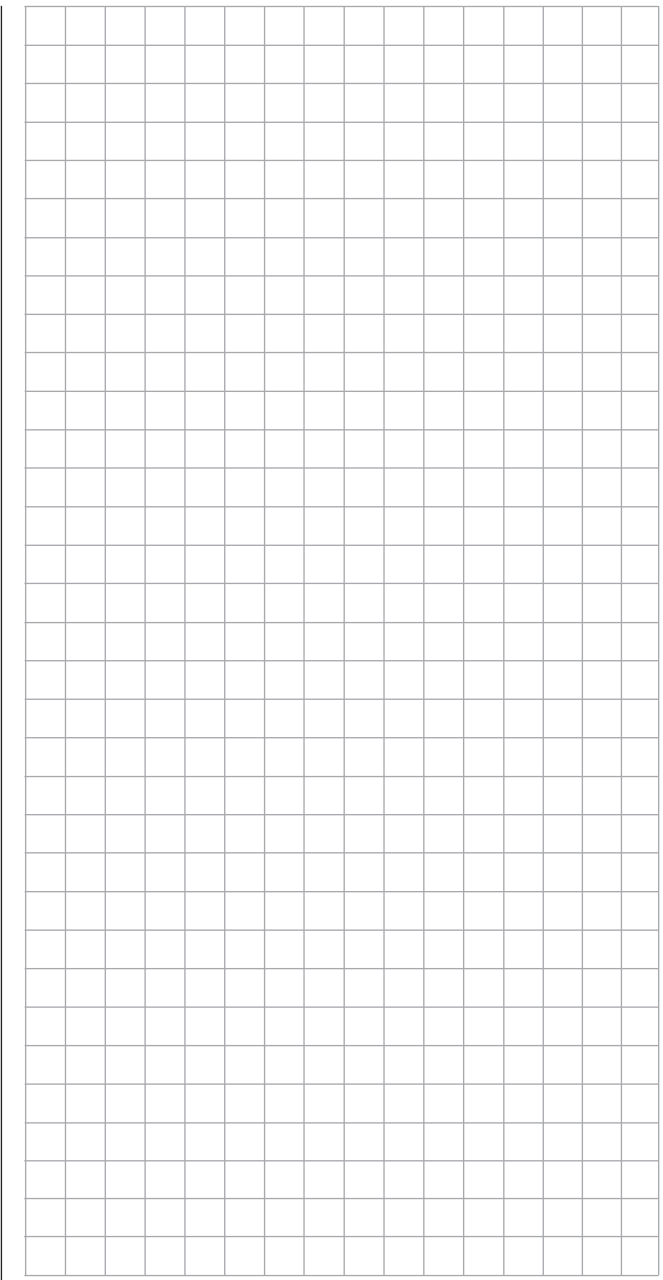
Press the **INC** or **DEC** buttons or the arrow keys ( $\blacktriangle$   $\blacktriangledown$ ) to increase/decrease the value:

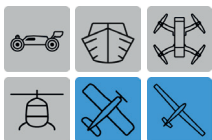


Use the same procedure to adjust the other differentiation values for all remaining flaps/ailerons. Press the **RES** button to reset the changed value back to the default.

To save and exit, press the **BACK** button at the top left of the display to return to the previous menu.





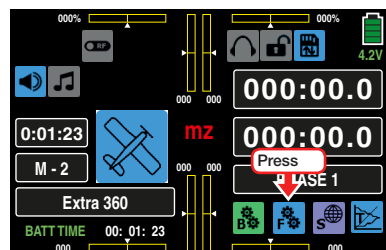


# Wing MIX

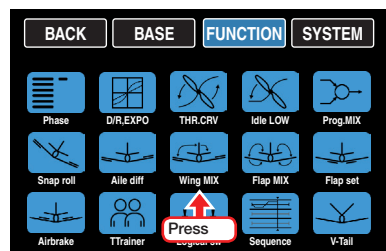
## Wing Mixer Adjustment

Use this function to adjust the rudders, ailerons and elevators to fix deflection direction during flight.

To adjust these settings, from the main display press the **FUNCTION** menu gear icon (blue "F") to bring up the FUNCTION submenu screen:



From the FUNCTION submenu, press the **Wing MIX** icon:



### Phase-Dependent Settings

This submenu allows for different phase-specific values to be programmed. Phase names are displayed in green in the upper left side of the screen next to the BACK button. Standard default naming for the phases are usually displayed as **NORMAL/PHASE 1**. (Additional phases will be named numerically, e.g. Phase 2, Phase 3, etc.) To define multiple phases, refer to the FUNCTION submenu **Phase** section (page 120). Each new phase will need to be assigned to a different switch. To change the phases, activate the corresponding switch(es).

### Programming

#### • ACT Column (Active)

To activate **ON** or inhibit **INH** a specific phase combination, press to change the value fields in the appropriate row.

This turns on and off the effect of the control element on the selected mixer when the value field is **ON** and a switch is assigned to the specific phase.

#### • SET Column (Setting)

To switch to the mix type setting display menu, press the appropriate **>>** button in the **SET** column. Refer to the specific sections below for information on the individual mix types (pages 188-191).

#### • CTL Column (Control/Switch)

Press the button in the appropriate row to assign a control to the respective mixer. Refer to the BASE submenu **CTL Set** section (page 90) for information on setting switches. When the phase is activated by turning the **ON** button in the ACT Column, the assigned switch will perform the adjustments made in the SET display screen.

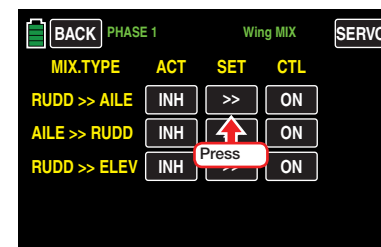
#### RUDD >> AILE Line (Rudder >> Aileron)

In aerobatic flight, the behavior of the longitudinal axis is influenced when the rudder is actuated. This is particularly problematic in "knife edge flying" since the wings are vertical in this flight position and the only lift is from the fuselage when the rudder is deflected. This can cause a model to rotate on the longitude axis as if the aileron were actuated. When the rudders are controlled, a correction is necessary along the longitudinal axis (aileron) within an adjustable range.

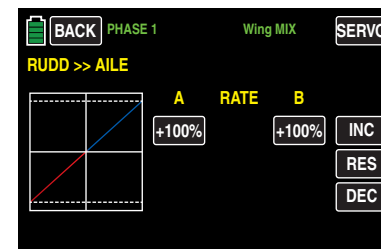
The setting range of  $\pm 150\%$  makes it possible to appropriately adapt the deflection direction. This mixer can be turned on and off so that the model can be used exclusively via the rudder. Turn mixer off with a

control (which cannot be independently reset), a control switch or a logical switch.

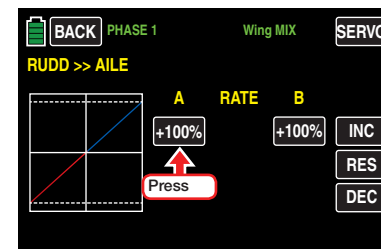
To set the mixer, press the **>>** button in the **RUDD >> AILE** line:



The RUDD >> AILE setting display opens:



Press the desired value field. In the example below, **RATE A** needs to be at **+50%**:



The field highlights blue:



Press the **INC** or **DEC** buttons or the arrow keys (▲▼) to increase/decrease the value.

Use the same procedure to adjust the other values. In the example below, **RATE B** now needs to be set at **+50%**:

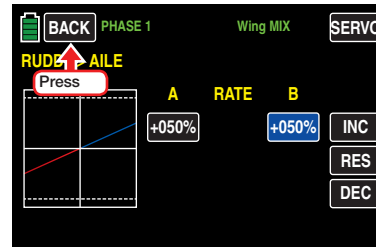


Press the **RES** button to reset the changed value back to the default.

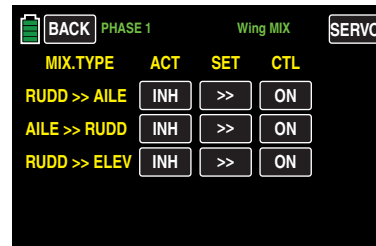
### Tip

Bring up the servo monitor in one of three ways: pressing the **SERVO** button in the upper right corner of the display, by simultaneously pushing both arrow keys (▲▼), or by pressing the BASE submenu Servo icon. To exit the Servo display, press the **BACK** button or push the **ESC** key to return to the previous menu.

To save and exit, press the **BACK** button at the top left of the display to return to the previous menu:



The main Wing MIX display appears:



### AILE >> RUDD Line (Aileron >> Rudder)

The rudder moves to an adjustable degree when the aileron is actuated. This can compensate for the negative torque in conjunction with **Aileron Differentiation** (page 184) which smooths flight in curves. The rudder remain separately controllable.

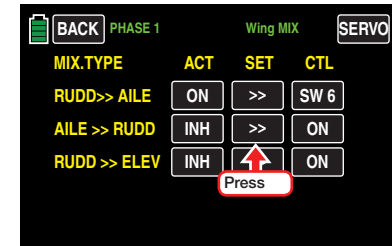
The setting range of  $\pm 150\%$  makes it possible to appropriately adapt the deflection direction. This mixer can be turned on and off so that the model can be used exclusively via the ailerons. Turn mixer off with a control (which cannot be independently reset), a control switch or a logical switch.

### Tip

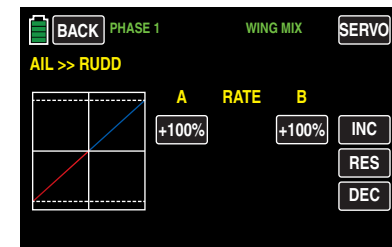
Normally, this mixer is adjusted so that the rudder extends on the side of aileron moving upward; an adjustment of 50% is generally appropriate.

The adjustment should normally be symmetrical with the neutral point of the aileron control stick.

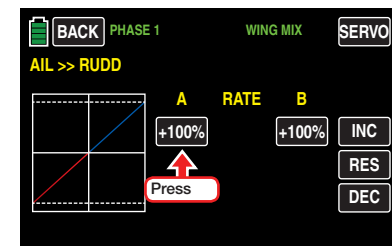
To set the mixer, press the **>>** button in the **AILE>>RUDD** line:



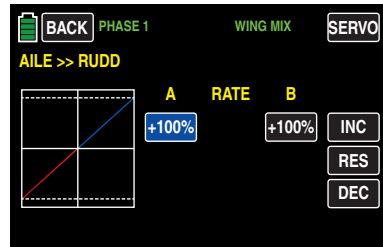
The AILE>>RUDD setting display opens:



Press the desired value field. In the example below, **RATE A** needs to be at **+50%**:

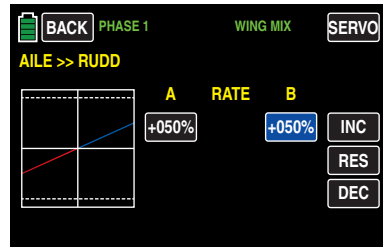


The field highlights blue:



Press the **INC** or **DEC** buttons or the arrow keys (▲▼) to increase/decrease the value.

Use the same procedure to adjust the other values. In the example below, **RATE B** now needs to be set at **+50%**:

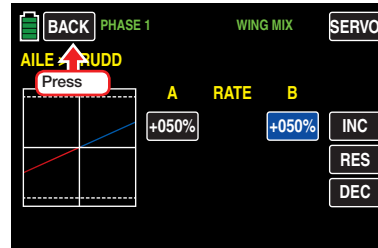


Press the **RES** button to reset the changed value back to the default.

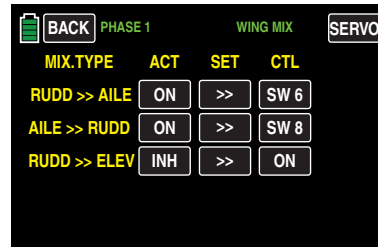
**Tip**

Bring up the servo monitor in one of three ways: pressing the **SERVO** button in the upper right corner of the display, by simultaneously pushing both arrow keys (▲▼), or by pressing the BASE submenu Servo icon. To exit the Servo display, press the **BACK** button or push the **ESC** key to return to the previous menu.

To save and exit, press the **BACK** button at the top left of the display to return to the previous menu:



The main Wing MIX display appears:



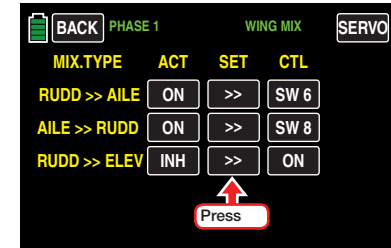
**RUDD >> ELEV Line (Rudder >> Elevator)**

In aerobatic flight, the behavior of the latitude axis is influenced when the rudder is actuated. This is particularly problematic in "knife edge flying" since the wings are vertical in this flight position and the only lift is from the fuselage when the rudder is deflected. Changes in direction can occur as if the elevator were actuated. When the rudders are controlled, a correction is necessary along the transverse axis (elevator) within an adjustable range.

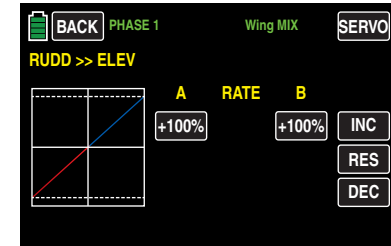
The rudder and elevator remain independently controlled.

The setting range of ±150% makes it possible to appropriately adapt the deflection direction. This mixer can be turned on and off so that the model can be used exclusively via the rudder. Turn mixer off with a control (which cannot be independently reset), a control switch or a logical switch.

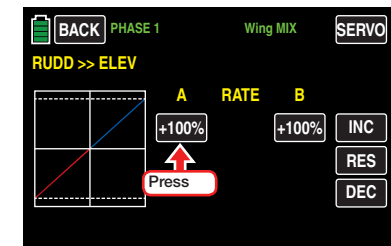
To set the mixer, press the **>>** button in the **RUDD>>ELEV** line:



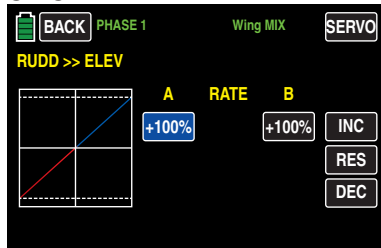
The RUDD>>ELEV setting display opens:



Press the desired value field. In the example below, **RATE A** needs to be at **+50%**:

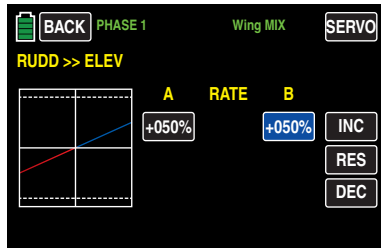


The field highlights blue:



Press the **INC** or **DEC** buttons or the arrow keys (▲▼) to increase/decrease the value.

Use the same procedure to adjust the other values. In the example below, **RATE B** now needs to be set at **+50%**:

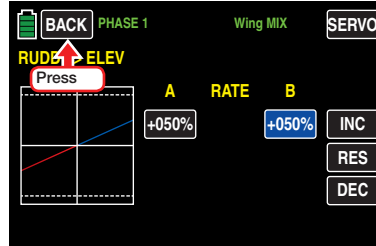


Press the **RES** button to reset the changed value back to the default.

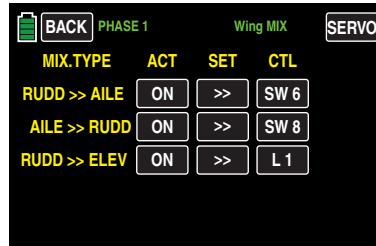
### Tip

Bring up the servo monitor in one of three ways: pressing the **SERVO** button in the upper right corner of the display, by simultaneously pushing both arrow keys (▲▼), or by pressing the BASE submenu Servo icon. To exit the Servo display, press the **BACK** button or push the **ESC** key to return to the previous menu.

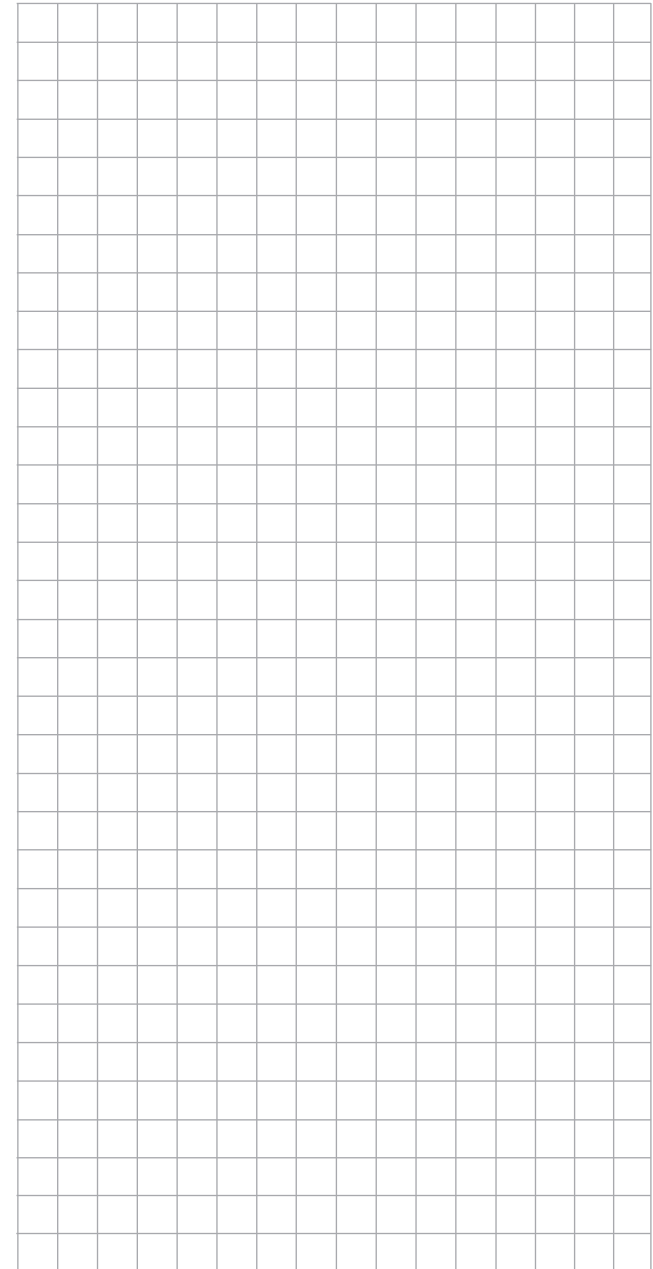
To save and exit, press the **BACK** button at the top left of the display to return to the previous menu:

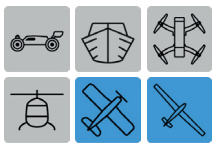


The main Wing MIX display appears:



To save and exit, press the **BACK** button at the top left of the display to return to the FUNCTION menu.





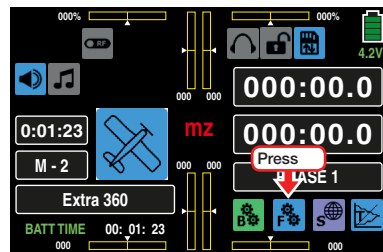
# Flap MIX

## Flap Mixer Adjustment

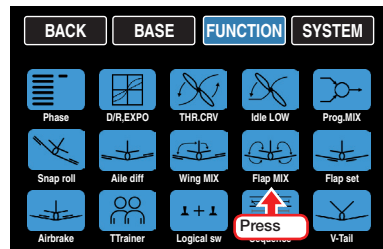
This submenu option is not available for models using the 1AILE and 2AILE settings.

Use this function to adjust the elevator, aileron and flaps to have better control in tighter curves, adjusting upward or downward torque, and aileron flap pair movement.

To adjust these settings, from the main display press the **FUNCTION** menu gear icon (blue "F") to bring up the FUNCTION submenu screen:



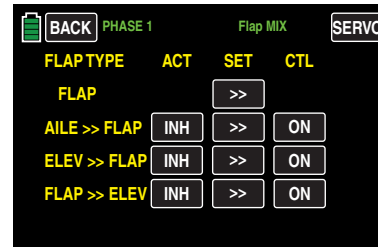
From the FUNCTION submenu, press the **Flap MIX** icon:



### Phase-Dependent Settings

This submenu allows for different phase-specific values to be programmed. Phase names are displayed in green in the upper left side of the screen next to the BACK button. Standard default naming for the phases are usually displayed as **NORMAL/PHASE 1**. (Additional phases will be named numerically, e.g. Phase 2, Phase 3, etc.) To define multiple phases, refer to the FUNCTION submenu **Phase** section (page 120). Each new phase will need to be assigned to a

different switch. To change the phases, activate the corresponding switch(es).

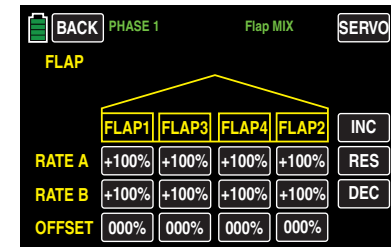
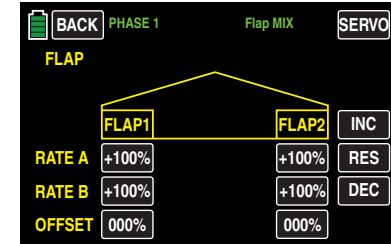
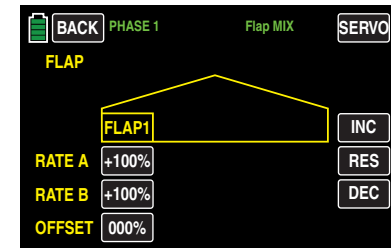


### Programming

- ACT Column (Active)**  
 To activate **ON** or inhibit **INH** a specific phase combination, press to change the value fields in the appropriate row.  
 This turns on and off the effect of the control element on the selected mixer when the value field is **ON** and a switch is assigned to the specific phase.
- SET Column (Setting)**  
 To switch to the mix type setting display menu, press the appropriate **>>** button in the **SET** column.
- CTL Column (Control/Switch)**  
 Press the button in the appropriate row to assign a control to the respective mixer. Refer to the BASE submenu **CTL Set** section (page 90) for information on setting switches. When the phase is activated by turning the **ON** button in the ACT Column, the assigned switch will perform the adjustments made in the SET display screen.

### FLAP Line

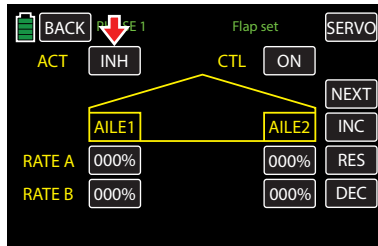
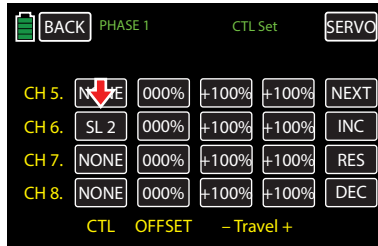
By pressing the **>>** button in the FLAP line, one of three display screens will appear, depending on the selected number of flaps:



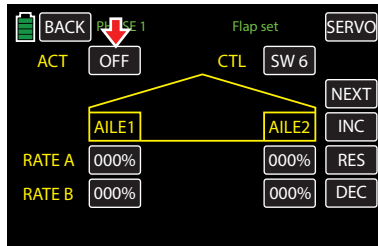
- Lines RATE A / B**  
 Determine the value input in the RATE A / B line the flap deflection grade through the selected control when the following situations occur:



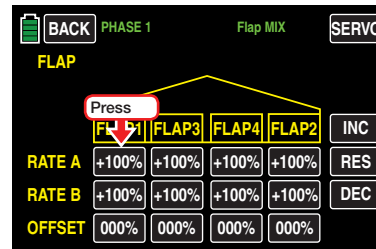
If a switch was assigned to CH6 in the BASE sub-menu **CTL Set** and in the FUNCTION sub-menu **Flap set** the **ACT** line is set to **INH**:



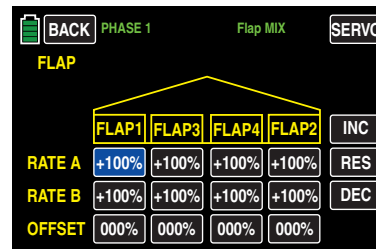
Or if a switch was assigned to CH6 in the BASE sub-menu **CTL Set** and in the FUNCTION sub-menu **Flap set** the **ACT** line is set to **OFF**:



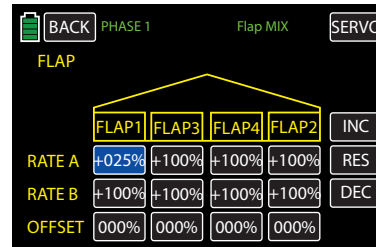
To change a previously input value, press the appropriate value field:



The field highlights blue:



Press the **INC** or **DEC** buttons or the arrow keys (▲▼) to increase/decrease the value within a range of ±125%:



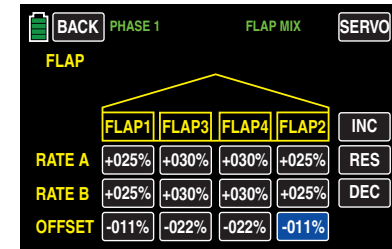
Use the same procedure to adjust the value for the downward deflection of the left flap (RATE B) and for the values of the right flap and for any second flap pair. Symmetrical and asymmetrical values are possible.

Press the **RES** button to reset the changed value back to the default.

### • OFFSET Line

Use to set the phase-specific positions for all of the flaps in the respective model. Set the individual flap positions assumed for each phase.

The adjustment range of ±100% allows the flaps to be moved to the desired position independent of the rotational direction of the flap servos, as shown below:



### Notices

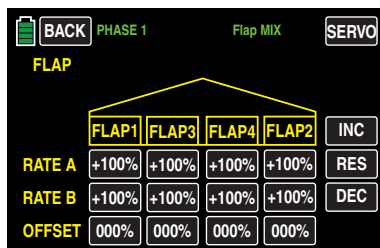


- The available setting options depend on the number of flaps selected during model setup in the BASE submenus **Model Sel** or **Model Type**.
- The flap offset entered here is independent from the connection set in the ACT line of the FUNCTION sub-menu **Flap set** (page 196).
- Use the BASE sub-menu **CTL Set** to assign the first aileron pair to **CH5**, and any required second flap pair to **CH12**, as shown below:





- In the OFFSET line the default offset positions of the aileron pairs are **000%**:



These offset values must be changed in OFFSET column of the BASE submenu **CTL Set** in the **CH6** line:

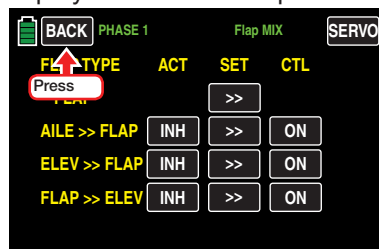


- When **ACT** = **INH** or **OFF** in the submenu **Flap set**, all the provided flaps move in the respective positions corresponding with the settings saved in **CTL Set** (control position), **Flap MIX** (offset value and travel setting) and **Flap set** (RATE values).
- When **ACT** = **ON** in the submenu **Flap set**, all the provided flaps move in the respective positions corresponding with the

settings saved in **CTL Set** (control position), **Flap MIX** (offset value and travel setting) and **Flap set** (RATE values).

Press the **RES** button to reset the changed value back to the default.

To save and exit, press the **BACK** button at the top left of the display to return to the previous menu:



## AILE >> FLAP Line

Use this line to adjust phase settings for flap pair movement when the aileron is actuated. Normally, the flaps follow the ailerons with less deflection, with a mixed amount less than 100%.

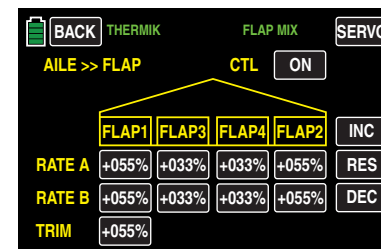
A setting range of  $\pm 125\%$  makes it possible to appropriately adapt the deflection direction to the ailerons depending on the flap servo rotation direction.

## Notice

Since all values are set separately, the aileron deflections of the flaps can also be different. When using a glider model, it is recommended using the "Diff." and "Red." columns in the FUNCTION submenu **Aile diff**.

In the **TRIM** line, set the aileron trim action grade on the aileron flaps function between 0 and 150%.

Set the individual values as described above. In the example below, the values have been changed as needed:

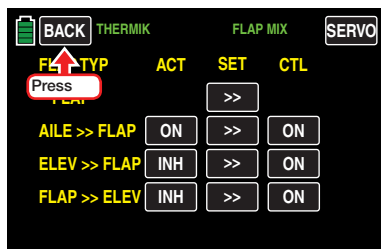


## Notice



The available setting options depend on the number of ailerons selected during the basic settings of the model (BASE submenu **Model Type**).

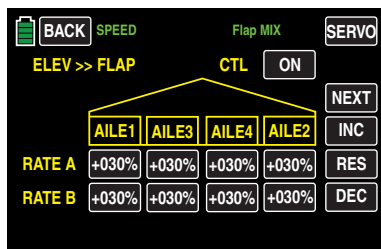
To save and exit, press the **BACK** button at the top left of the display to return to the previous menu:



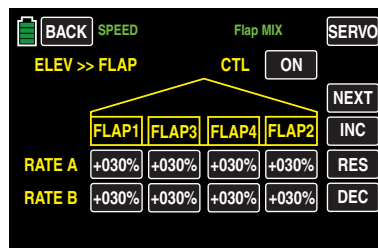
### ELEV >> FLAP line

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).

A symmetrical or an asymmetrical effect can be defined for each flap pair. Values of  $\pm 125\%$  are possible. The aileron uniform default values are  $+30\%$ :



The flaps uniform default values are  $+30\%$ :



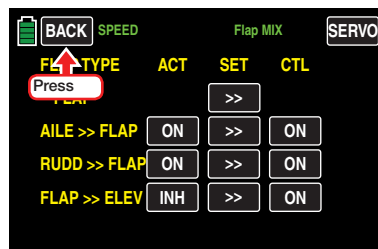
Adapt the individual values as described in the FLAP Line section (page 192).

## Notice



The available setting options depend on the number of ailerons selected during the basic settings of the model (BASE submenu **Model Type**).

To save and exit, press the **BACK** button at the top left of the display to return to the previous menu:



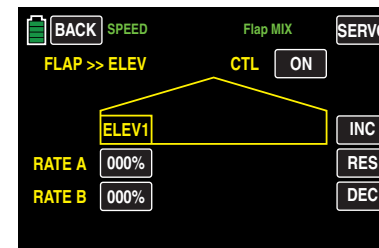
### FLAP >> ELEV line

When setting flaps, upward or downward torque can arise about the transverse axis. Elevated flaps also cause the models to fly faster. These reactions can be achieved with the mixer.

When setting the flaps, use this mixer to have the aileron position automatically track the flaps depending on the set value.

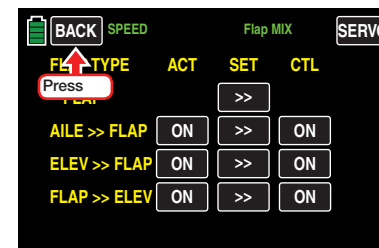
The setting can be symmetrical or asymmetrical to the flap control center point.

The adjustment range is  $\pm 125\%$ . This mixers normal settings lie within the single-digit to low double-digit range. By default,  $0\%$  is uniformly set:

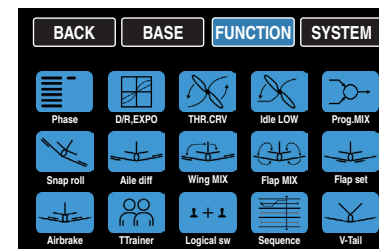


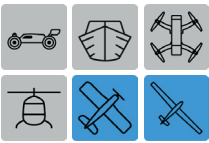
Adapt the individual values as described in the FLAP Line section (page 192).

To save and exit, press the **BACK** button at the top left of the display to return to the previous menu:



Press the **BACK** button at the top left of the display to return to the FUNCTION menu:



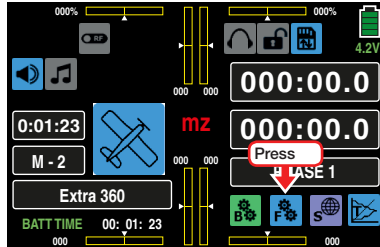


# Flap Set

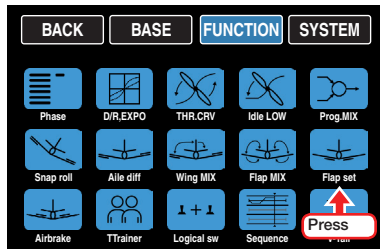
## Flap Servo Effect Adjustment

This submenu option is not available for models using the 1AILE setting.

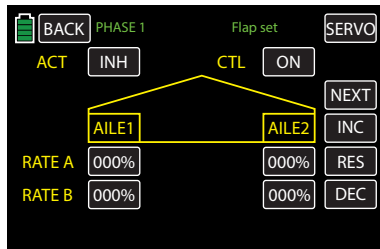
To adjust these settings, from the main display press the **FUNCTION** menu gear icon (blue "F") to bring up the FUNCTION submenu screen:



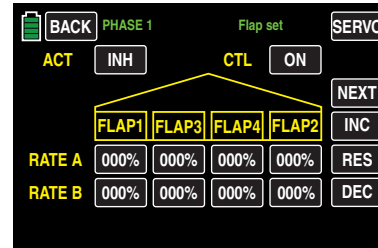
From the FUNCTION submenu, press the **Flap set** icon:



The display shows different views depending on the selected number of ailerons and flaps. This example shows the display for setting a minimum, such as **2AILE**:



This example shows the display for setting a maximum, such as **4AILE4FLAP**:

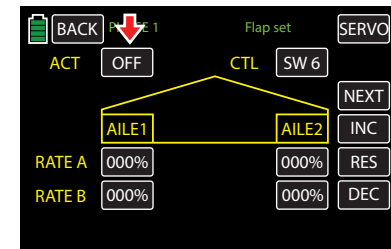
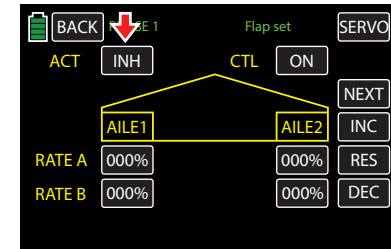


### Phase-Dependent Settings

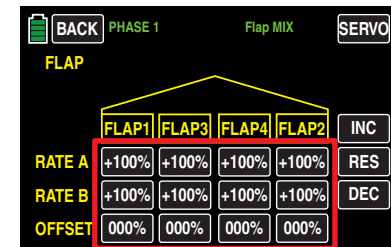
This submenu allows for different phase-specific values to be programmed. Phase names are displayed in green in the upper left side of the screen next to the BACK button. Standard default naming for the phases are usually displayed as **NORMAL/PHASE 1**. (Additional phases will be named numerically, e.g. Phase 2, Phase 3, etc.) To define multiple phases, refer to the FUNCTION submenu **Phase** section (page 120). Each new phase will need to be assigned to a different switch. To change the phases, activate the corresponding switch(es).

### Programming

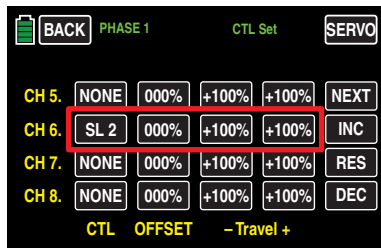
- **ACT Column** (Active)
- **ACT = INH or OFF**



When **ACT** is deactivated, the default (or previously set) values of the **Flap MIX** submenu **AILERON** option are valid on the standard flap servos CH6, CH7, CH9 and CH10, or in case of a model with only one flap servo the setting is valid only on servo CH6:



If a switch or control assigned to CH6 in the BASE submenu **CTL Set**, then all the provided flaps move in the respective positions corresponding with the settings saved in **CTL Set** (control position), **Flap MIX** (offset value and travel setting) and **Flap set** (RATE values):



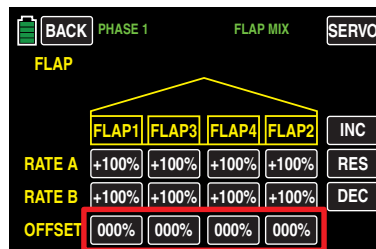
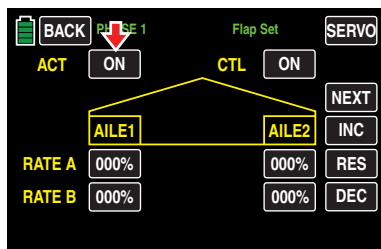
**Notice**



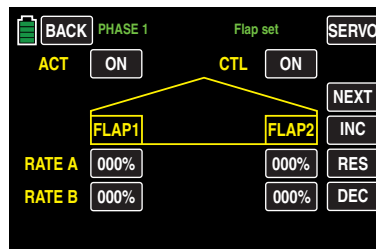
Because of redundancy, only set one of the aforementioned submenus with the precise values.

- **ACT = ON**

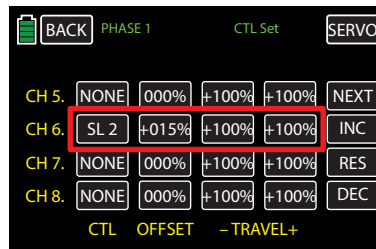
When **ACT** is activated, only the default (or previously set) offset values of the **Flap MIX** submenu AILERON option are valid:



Likewise, with the RATE setting of the **Flap set** submenu AILERON option, the standard flap servos CH6, CH7, CH9 and CH10 are valid, or in case of a model with only one flap servo the setting is valid only on servo CH6:



If a switch or control assigned to CH6 in the BASE submenu **CTL Set** has an offset value, then all the provided flaps move in the respective positions corresponding with the settings saved in **CTL Set** (control position), **Flap MIX** (offset value and travel setting) and **Flap set** (RATE values):



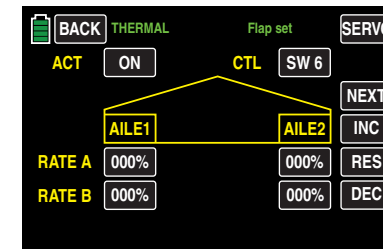
**Notice**



Because of redundancy, only set one of the aforementioned submenus with the precise values.

Specify the effect of the control elements assigned to CH6 in the BASE submenu **CTL Set**, by setting the phase trim on the aileron, flap, and elevator positions.

- **CTL Column (Control/Switch)**  
Press the field in the appropriate button to assign a control to the respective mixer. Refer to the BASE submenu **CTL Set** section (page 90) for information on setting switches.



## Notice

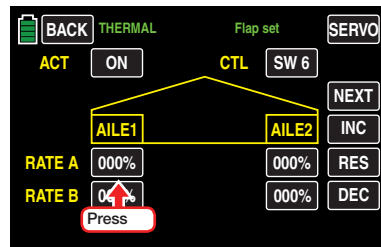


If you switch this function **OFF** via an assigned switch, not only is the phase trim deactivated, but also the functions described in the **Programming** section (page 196) under **ACT** = **INH** or **OFF**.

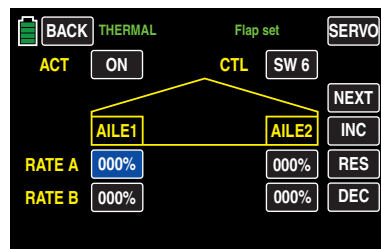
## Lines RATE A / B

A symmetrical or an asymmetrical effect can be defined for each flap pair. In the BASE submenu **CTL Set**, leave the assigned switch travel settings for the flap trimming at +100%. Then in this display, input values within 5 and 20%.

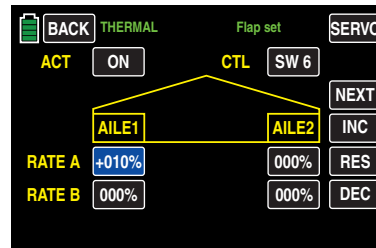
Switch to the appropriate phase, and press the value field to be changed:



The field highlights blue:



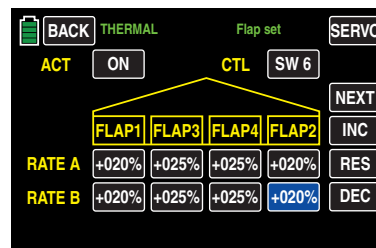
Press the **INC** or **DEC** buttons or the arrow keys (▲▼) to increase/decrease the value current value within a range of  $\pm 100\%$ :



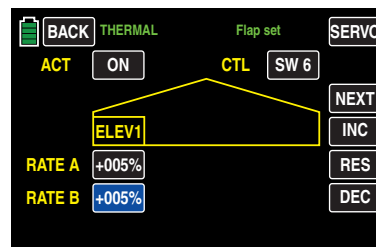
Use the same procedure to adjust the other values for all remaining fields, including inboard aileron AILE2L and AILE2R.

Press the **RES** button to reset the changed value back to the default.

To bring up the flaps setting screen, press the **NEXT** button at the right edge of the display. Use the same procedure described above to adjust all value fields:



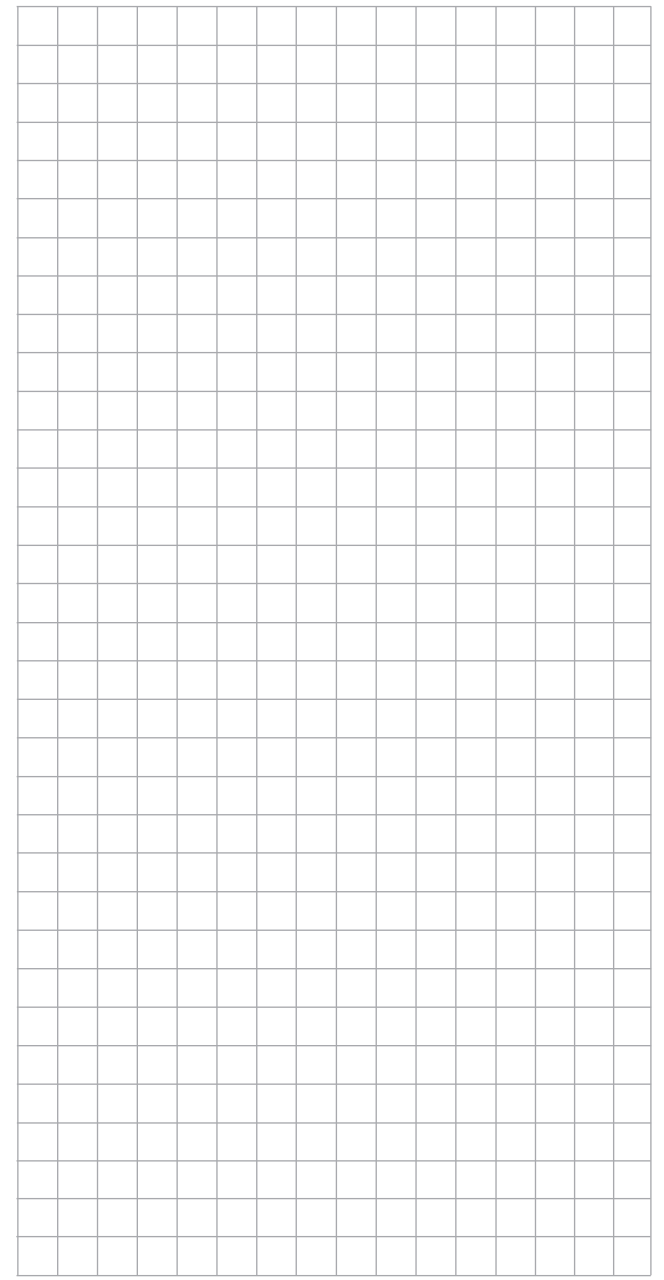
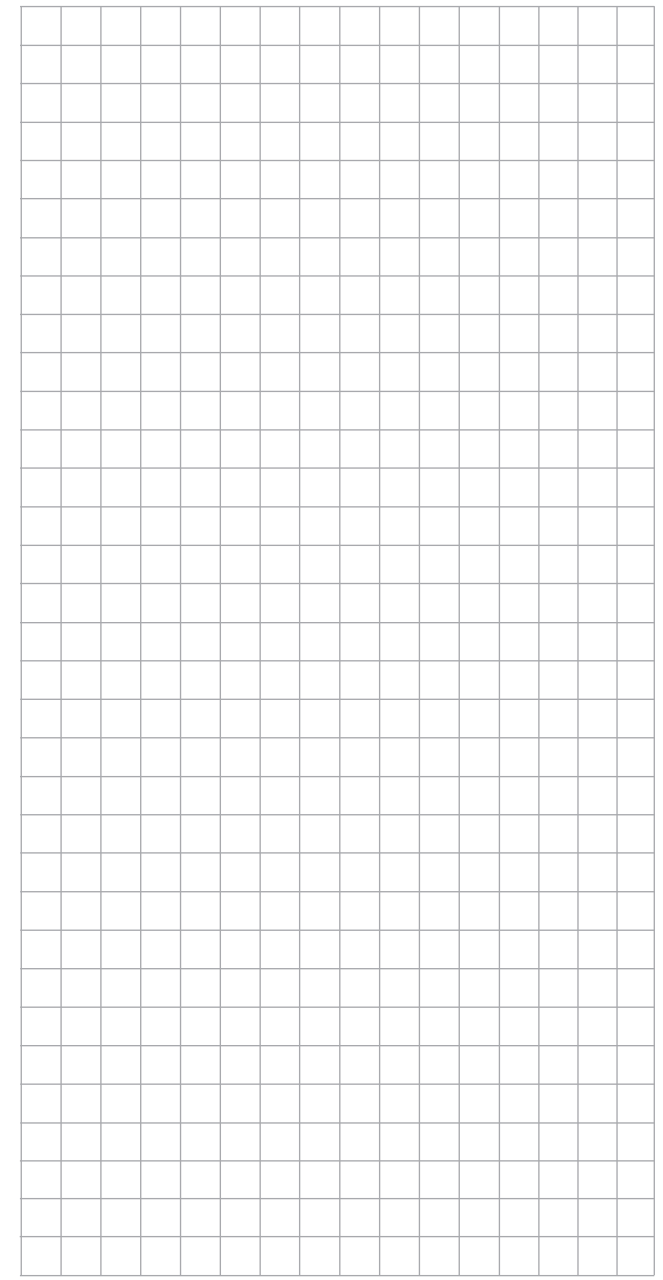
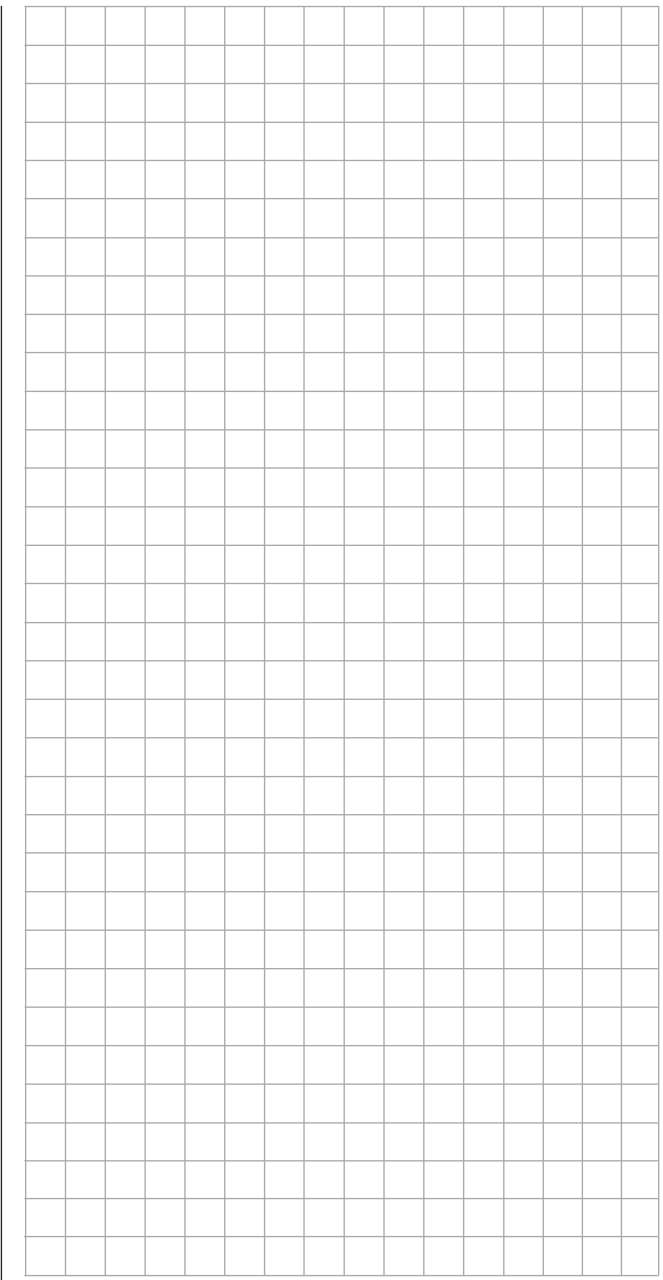
To bring up the elevator setting screen, press the **NEXT** button at the right edge of the display. Use the same procedure described above to adjust all value fields:

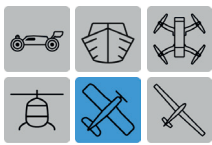


## Tip

Typically, in the BASE submenu **CTL Set**, no control is assigned to the inputs CH5-CH12. Assign a control or switch to set different flap positions within a phase as described in this section. By contrast, the Programming Example **Phase Specific Flaps Trimming** section (page 230) describes how to trim the flaps specifically for all phases through only one control element.

To save and exit, press the **BACK** button at the top left of the display to return to the previous menu.





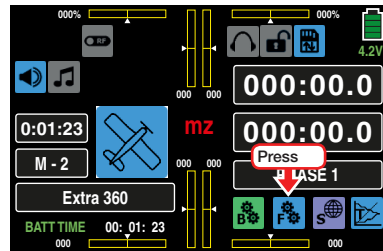
# Airbrake

## Airplane Braking System Adjustment

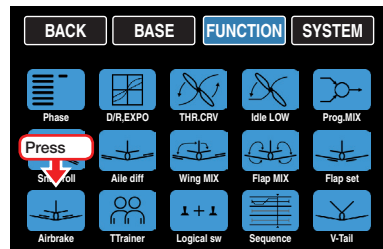
This submenu option is not available for certain model types and configurations.

Use this menu to configure the deflection direction of the flaps and elevator for braking.

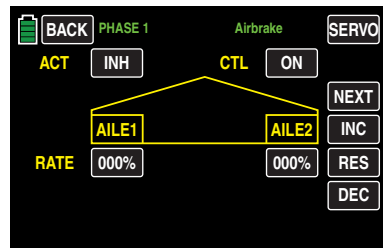
To adjust these settings, from the main display press the **FUNCTION** menu gear icon (blue "F") to bring up the FUNCTION submenu screen:



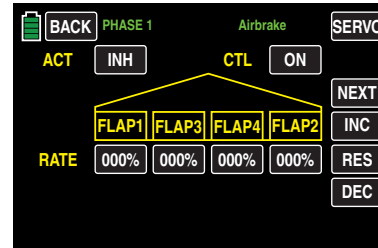
From the FUNCTION submenu, press the **Airbrake** icon:



The display shows different views depending on the selected number of ailerons and flaps. This example shows the display for setting a minimum, such as **2AILE**:



This example shows the display for setting a maximum, such as **4AILE4FLAP**:



### Phase-Dependent Settings

This submenu allows for different phase-specific values to be programmed. Phase names are displayed in green in the upper left side of the screen next to the BACK button. Standard default naming for the phases are usually displayed as **NORMAL/PHASE 1**. (Additional phases will be named numerically, e.g. Phase 2, Phase 3, etc.) To define multiple phases, refer to the FUNCTION submenu **Phase** section (page 120). Each new phase will need to be assigned to a different switch. To change the phases, activate the corresponding switch(es).

### Programming

Using either the ACT or CTL options, enter the flap and elevator deflection direction amount for braking. In order for these settings to be effective and retrievable (e.g. with a switch), program the option fields as described below:

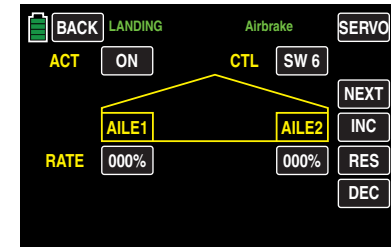
#### • ACT Line **(Active)**

To activate **ON** or inhibit **INH** a specific phase, press to change the value fields on the appropriate screen.

If this phase is assigned to a switch, this individually turns on and off the effect of the selected control element on the flap position for specific phases when the value field is **ON**.

#### • CTL Line **(Control/Switch)**

Use this field to assign a control or control switch to a specific phase mixer. Refer to the **Control and Switch Assignment** section (page 26) for information on assigning switches. In the example below, the phase titled **LANDING** is assigned to **S6**:

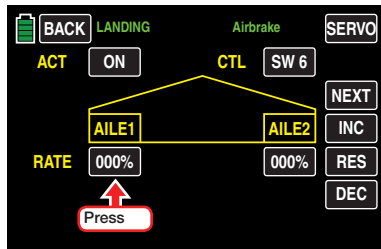


#### RATE Line

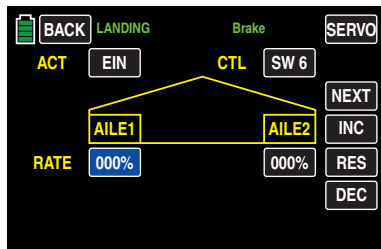
A symmetrical or an asymmetrical effect can be defined for each flap pair. In order to be able to define upward and downward deflections, the setting range is  $\pm 150\%$ .

Switch to the desired phase and press the value field to be set. In the example below, the phase titled **LANDING** needs the **AILE1 RATE** changed to **+023%**:

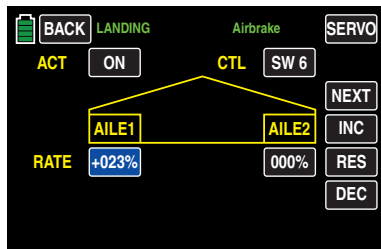




The field highlights blue:

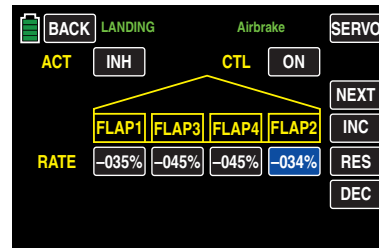


Press the **INC** or **DEC** buttons or the arrow keys (▲▼) to increase/decrease the value within a range of ±150%:



Use the same procedure to adjust the other values for all remaining ailerons, including inboard ailerons. Press the **RES** button to reset the changed value back to the default.

To bring up the flap setting screen, press the **NEXT** button at the right edge of the display. Use the same procedure described above to adjust all value fields:



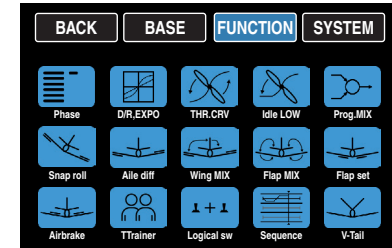
When activating the selected control, to prevent sudden deflection of the (brake) flaps adjusted, press the **NEXT** button at the right of the display to go to the AIRBREAK display screen. Use the same procedure described above to incorporate a delay for the deflection of the flaps:

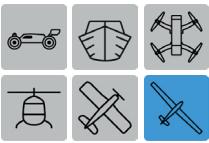


### Tip

To smoothly retract the flaps, use the FUNCTION sub-menu **PHASE** to set up a LANDING phase in addition to the NORMAL phase incorporated with a switching delay. For the switch, use the same control used to trigger the braking function.

To save and exit, press the **BACK** button at the top left of the display to return to the previous menu.



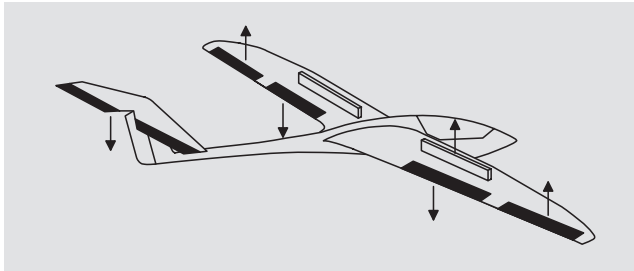


# Butterfly

## Glider Braking System Adjustment

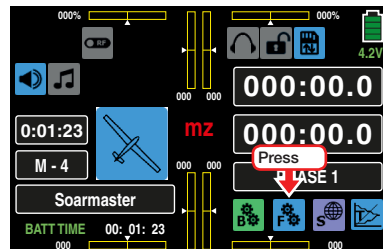
This submenu option is not available for certain model types and configurations.

Use this menu to set a special breaking flap arrangement: the *crow* or *butterfly* position. 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.

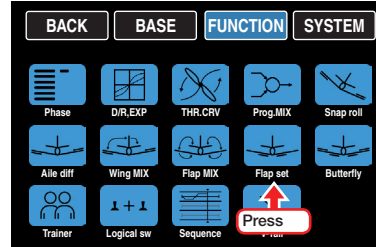


This interaction of the flaps, aileron and elevator control the gliding angle when approaching a landing. (The butterfly flap position is frequently used in sports models instead of brake flaps or spoilers).

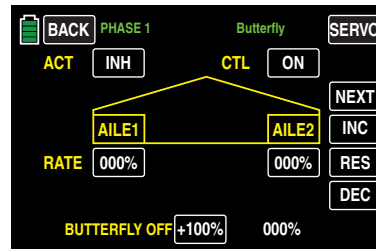
To adjust these settings, from the main display press the **FUNCTION** menu gear icon (blue “F”) to bring up the FUNCTION submenu screen:



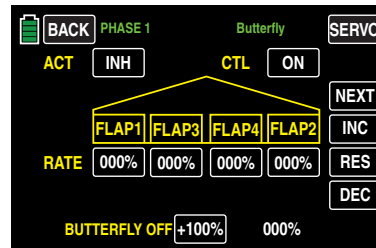
From the FUNCTION submenu, press the **Butterfly** icon:



The display shows different views depending on the selected number of ailerons and flaps. This example shows the display for setting a minimum, such as **2AILE**:



This example shows the display for setting a maximum, such as **4AILE4FLAP**:



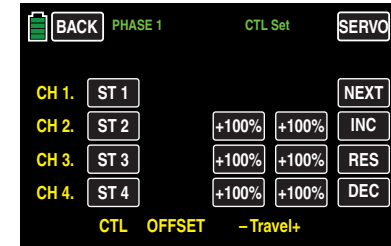
## Phase-Dependent Settings

This submenu allows for different phase-specific values to be programmed. Phase names are displayed in green in the upper left side of the screen next to the BACK button. Standard default naming for the phases are usually displayed as **NORMAL/PHASE 1**. (Additional phases will be named numerically, e.g. Phase 2, Phase 3, etc.) To define multiple phases, refer to the FUNCTION submenu **Phase** section (page 120). Each new phase will need to be assigned to a different switch. To change the phases, activate the corresponding switch(es).

## 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 CH1 input of the BASE submenu **CTL Set**).

In most cases, the selection is limited to preset control, and the airbrake is operated using the non-centralizing CH1 control stick:



The use of other control elements offers the possibility of being able to control the airbrakes alternatively through another accessory function control. This is useful if the CH1 control stick is going to be used for other functions.

## BUTTERFLY OFF Line

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 assigned control element actuation direction (by default the throttle control stick), when extending in the brake system:

- The actuating direction of the CH1 control stick for actuating an electric drive, if present, is fixed against the actuating direction for the extension of an airbrake system.

### Notice

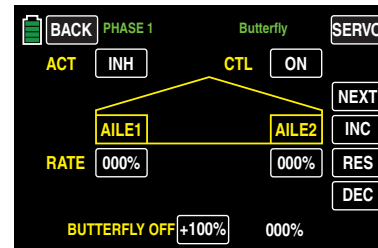


An inverted CH1 curve acts on the actuating direction of the butterfly control as "reversed". Only the output positions are changed, not the "correlated" fixed actuating directions.

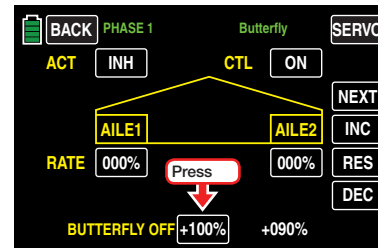
- The flaps are extended for brake offset values with a plus sign ( + ) when the corresponding control element such as the throttle control stick is moved *from front to rear* toward the pilot.
- The flaps are extended for brake offset values with a minus sign ( - ) when the corresponding control element 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, 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 that time, the effective control travel is automatically extended to 100%.

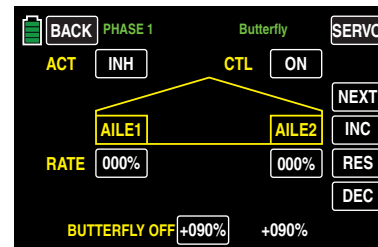
Move the control element assigned to the input CH1, (by default the throttle/brake control stick) to the position at which the flaps are to be retracted or closed. The current control position is numerically displayed in white to the right of the value field:



Once the desired position is reached, transfer it to the value field by pressing the button:



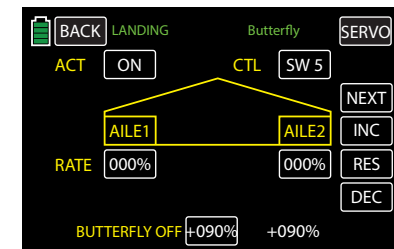
The current white control position is transferred to the value field:



After the brake offset, which is necessary for the correct operation of the flaps, set the **RATE** line of this display. If necessary, also in the following, with which percentage and in which direction your wing flaps and, if appropriate, also the elevator, should deflect to "brake". In order for these settings to be effective and retrievable with a switch, it is recommended to program the **ACT** and **CTL** line fields after setting the preferable offset point.

Before setting these fields, switch to the appropriate phase. In the example below, the phase titled **LANDING** is being programmed:

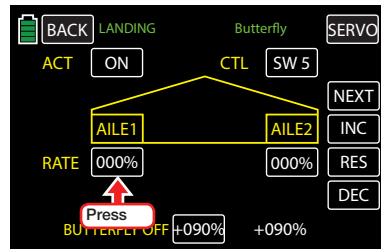
- ACT Line (Active)**  
To activate **ON** or inhibit **INH** a specific phase, press to change the value fields. If this phase is assigned to a switch, this individually turns on and off the effect of the selected control element on the flap position for specific phases when the value field is **ON**.
- CTL Line (Control/Switch)**  
Use this field to assign a control or control switch to a specific phase mixer. Refer to the **Control and Switch Assignment** section (page 26) for information on assigning switches. In the example below, the phase titled **LANDING** is assigned to **S5**:



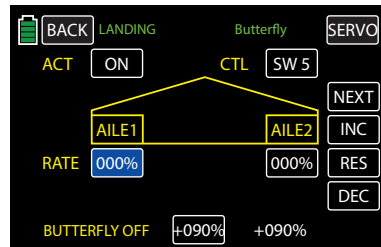
## RATE Line

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  $\pm 150\%$ .

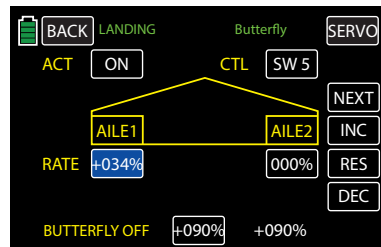
Switch to the desired phase and press the value field to be set. In the example below, the phase titled **LANDING** needs the **AILE1 RATE** changed to **+034%**:



The field highlights blue:



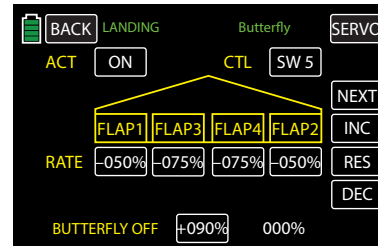
Press the **INC** or **DEC** buttons or the arrow keys (**▲▼**) to increase/decrease the value:



Use the same procedure to adjust the other values for all remaining ailerons, including inboard ailerons.

Press the **RES** button to reset the changed value back to the default.

To access the flaps setting screen, press the **NEXT** button at the right edge of the display using the procedure described above:

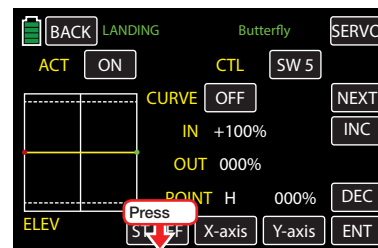


## Tips for Visualizing the Braking Effect:

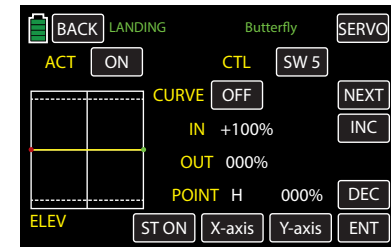
Spread the flaps and, from the front, look at the surface from above and below. The greater the projected surface of the protruding rudder, the greater the braking effect.

## Elevator Curve Display

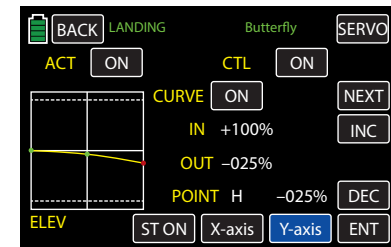
To access the control position display screen, press the **ST OFF** button at the bottom left of the display:



The green, vertical bar in the graphic display indicates the brake control position. The bar moves away from the edge of the graph as soon as the throttle/brake control stick is moved from its higher or lower end point.



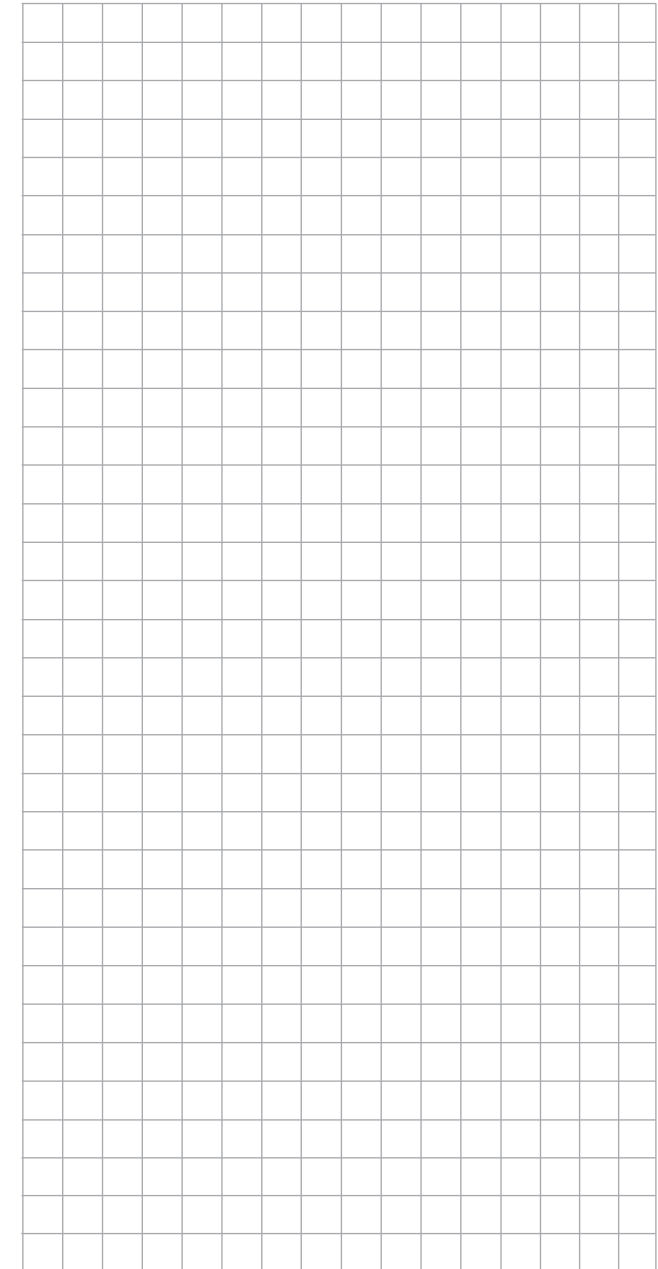
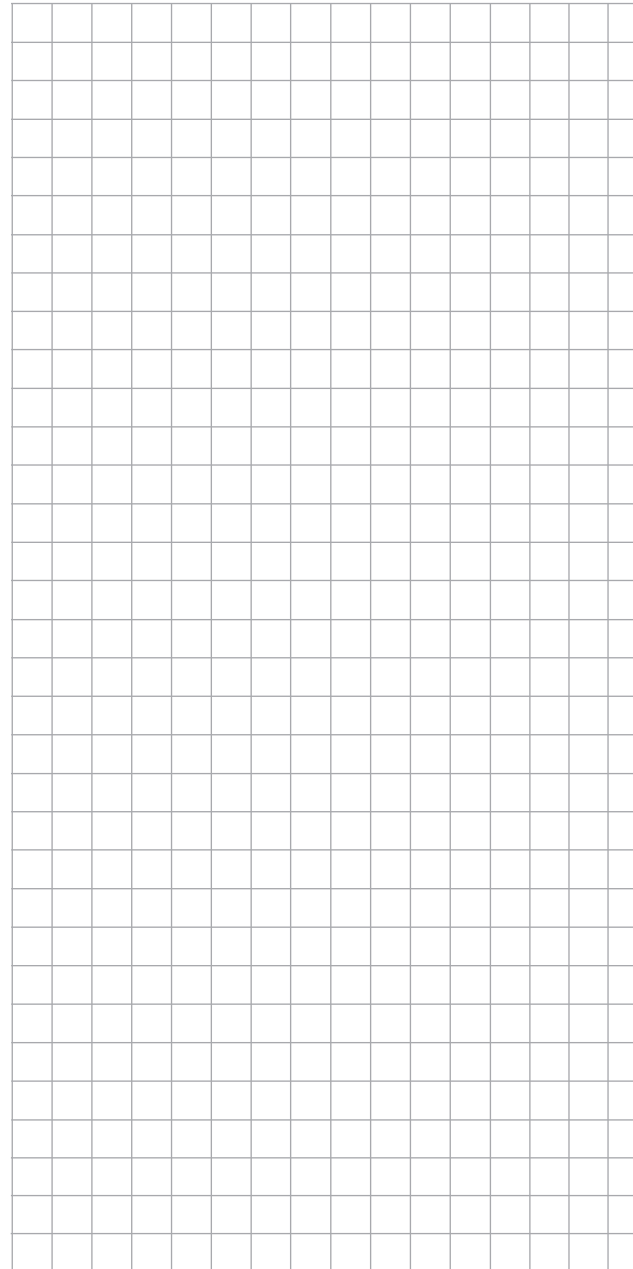
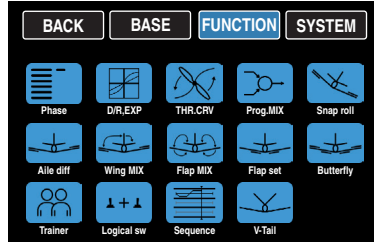
Move the elevator curve toward the opposite stop as needed, in direction of "brake active". The method for adjusting the curve of this 7-point curve mixer follows the same principles as those used for the curve mixer described in the FUNCTION submenu **THR.CRV**:



## Attention

**>>>** The chosen setting should be tested and adjusted at a sufficient height. Make sure that the model does not become too slow when the brake system is extended! If this occurs, there is risk that the model will crash or fall after the brake system is retracted (i.e. to lengthen a landing approach that is too short).

To save and exit, press the **BACK** button at the top left of the display to return to the previous menu:





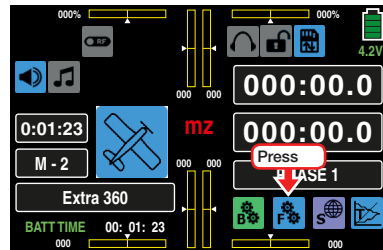
# V-Tail

## V-Tail Actuation Adjustment

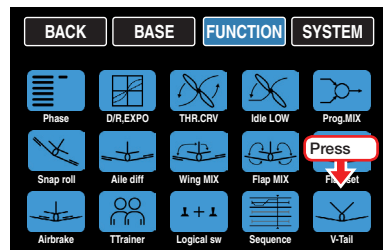
This submenu option is only available for model types with a V-Tail configuration.

The elevator and rudder are controlled by two separately-articulated rudders arranged in a V-shape. The coupling function for the rudder and elevator control is automatically transferred from the program.

To adjust these settings, from the main display press the **FUNCTION** menu gear icon (blue “F”) to bring up the FUNCTION submenu screen:



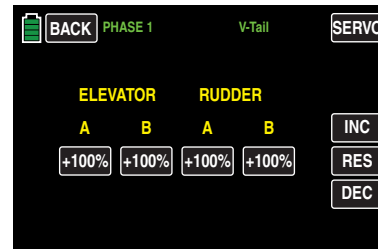
From the FUNCTION submenu, press the **V-Tail** icon:



### Phase-Dependent Settings

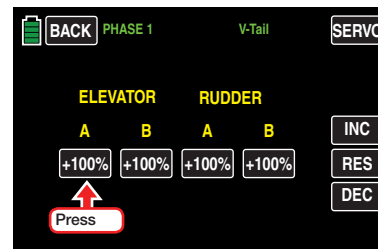
This submenu allows for different phase-specific values to be programmed. Phase names are displayed in green in the upper left side of the screen next to the BACK button. Standard default naming for the phases are usually displayed as **NORMAL/PHASE 1**. (Additional phases will be named numerically, e.g. Phase 2, Phase 3, etc.) To define multiple phases, refer to the FUNCTION submenu **Phase** section (page 120). Each new phase will need to be assigned to a

different switch. To change the phases, activate the corresponding switch(es).

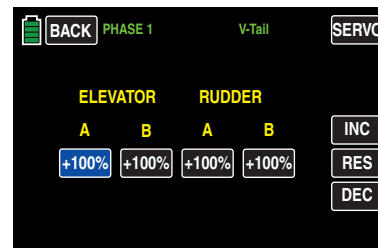


### Programming

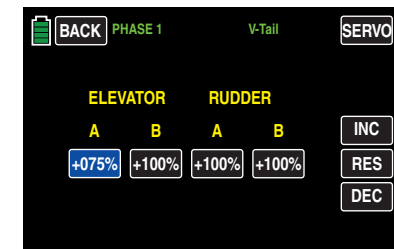
Press the appropriate value field to be changed:



The field highlights blue:



Press the **INC** or **DEC** buttons or the arrow keys (▲▼) to increase/decrease the value:



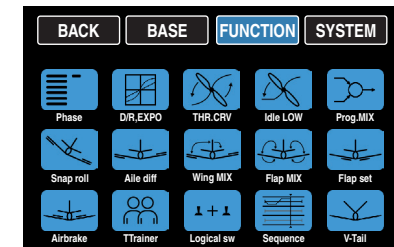
Use the same procedure to adjust the other value fields.

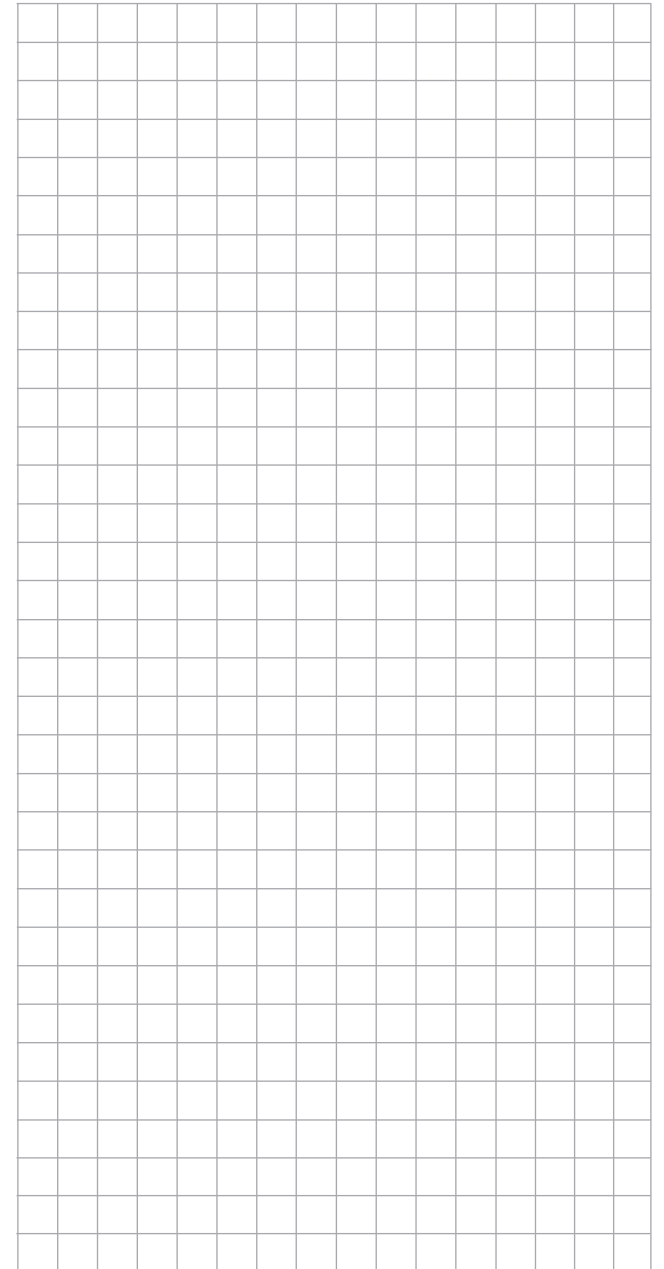
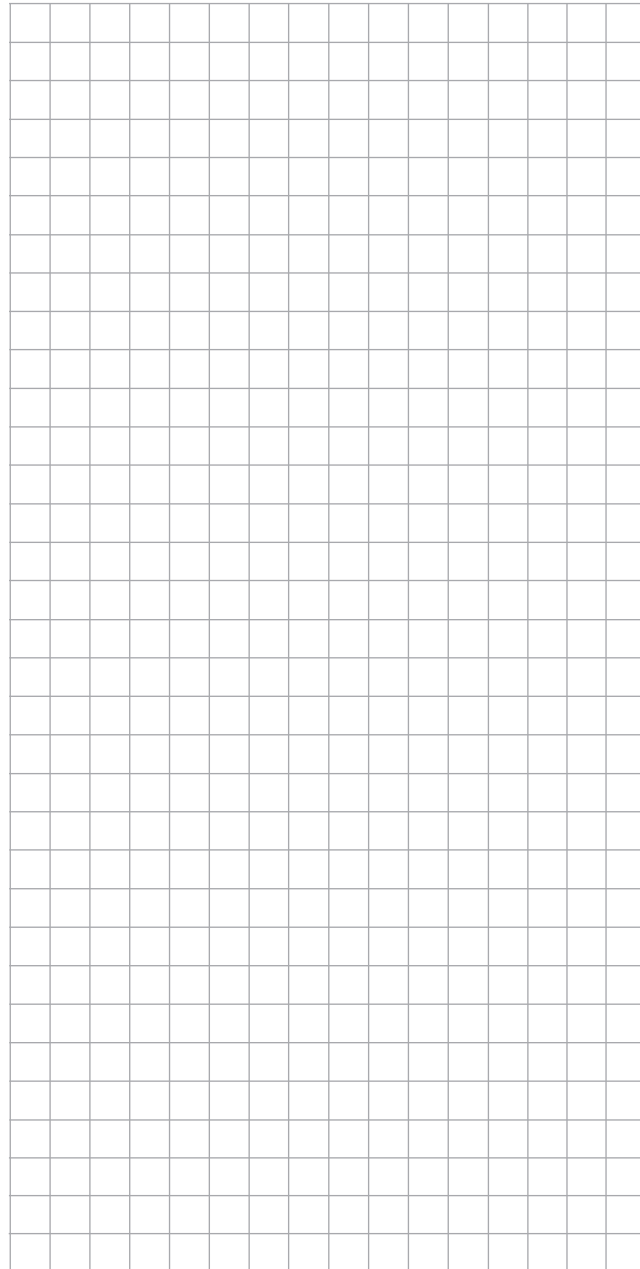
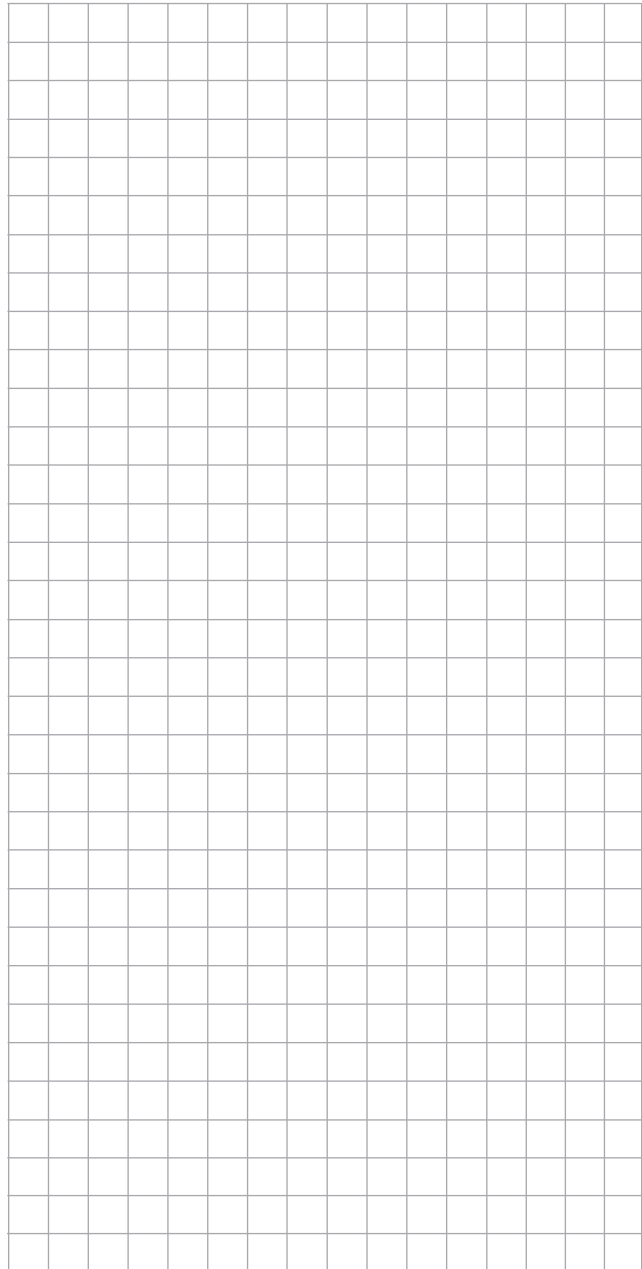
Press the **RES** button to reset the changed value back to the default.

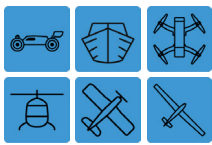
### Notice

Remember that the mixing travel of the mixers is cumulative with simultaneous control stick movement, and one or both servos may mechanically collide. To prevent this, reduce the related set mixing values.

To save and exit, press the **BACK** button at the top left of the display to return to the previous menu:





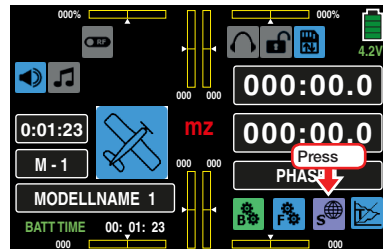


# ST mode

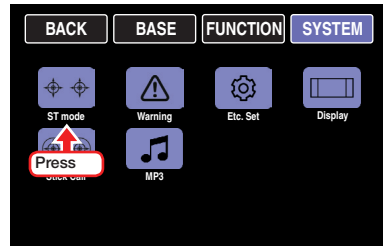
## Model-Specific Basic Control Settings

There are four different control function possibilities to assign to the control sticks. Individual options are chosen based on country settings, pilot preferences, or the model type.

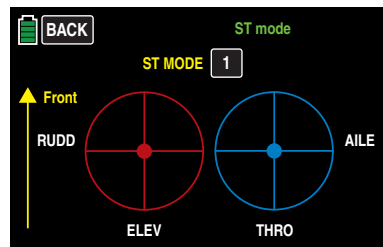
To adjust these settings, from the main display press the **SYSTEM** menu gear icon (purple "S") to bring up the SYSTEM submenu screen:



From the SYSTEM submenu, press the **ST mode** icon:



Mode 1 is the default:



### Notice

The mode setting selected in this menu does not depend on the model memory and is valid across all of the model memories and model types stored in the transmitter. Pay attention to the Car and

boat control assignments on the control codes of aircraft fractions in order to avoid conflicts after a model (type) change.

### Land and Water Models

To maintain compatibility, it is recommended to utilize the same control mode for land and water models as with an aircraft model. Connect control function 1 with the forward/backward function and the control function 4 with the direction function:

MODE 1 (throttle at right stick)	MODE 2 (throttle at left stick)
MODE 3 (throttle at right stick)	MODE 4 (throttle at left stick)

### Drone Model

MODE 1 (throttle/pitch right)	MODE 2 (throttle/pitch left)
MODE 3 (throttle/pitch right)	MODE 4 (throttle/pitch left)

### Helicopter Model

MODE 1 (throttle right)	MODE 2 (throttle left)
MODE 3 (throttle right)	MODE 4 (throttle left)

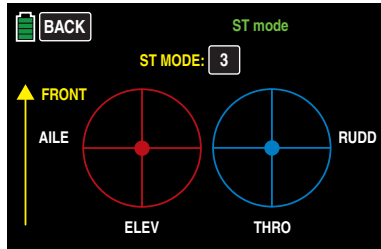
### Fixed-Wing Model

MODE 1 (throttle right)	MODE 2 (throttle left)
MODE 3 (throttle right)	MODE 4 (throttle left)

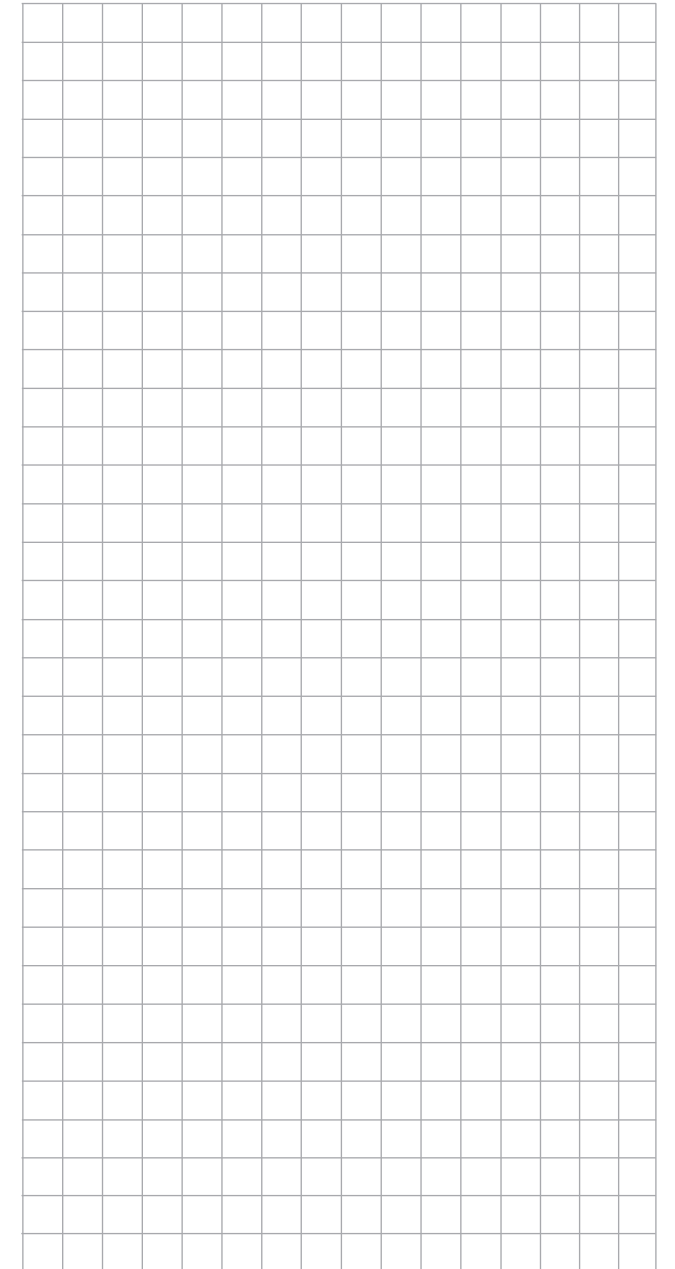
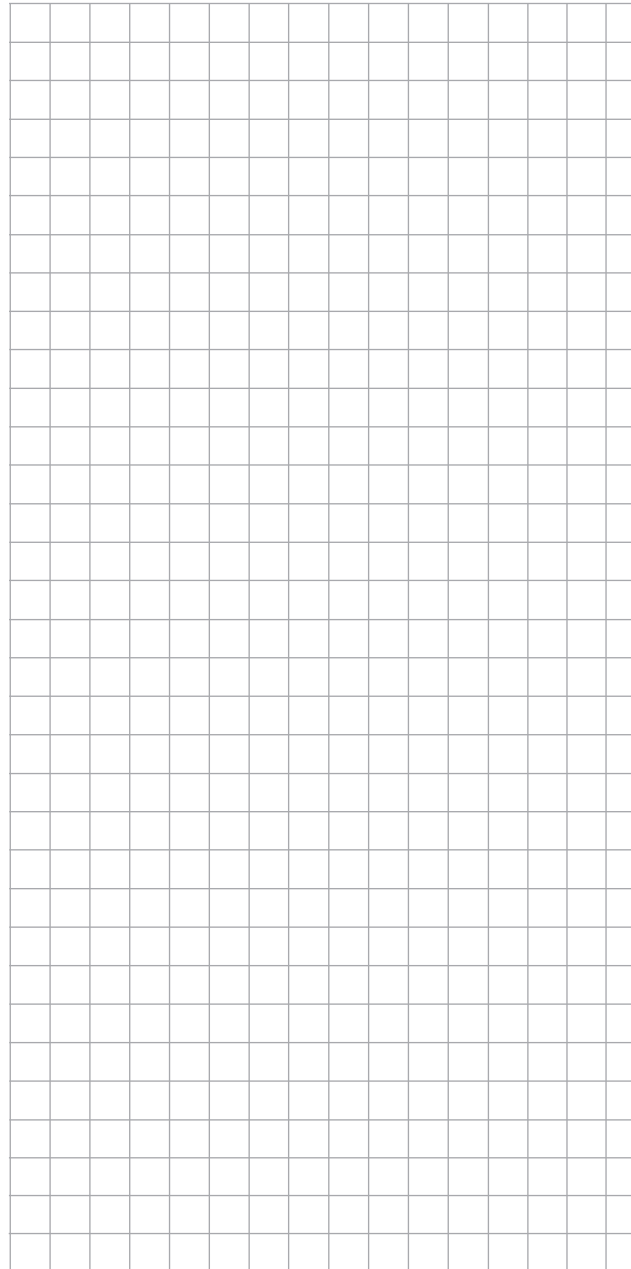
### Programming

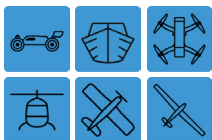
To switch to a control mode different from default, press the value field in the **ST MODE** line until the number of the appropriate control mode appears. In the example below, the mode has been changed to **ST Mode 3**:





Press the **BACK** button at the top left to return to the SYSTEM menu.



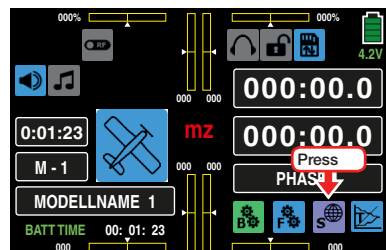


# Warning

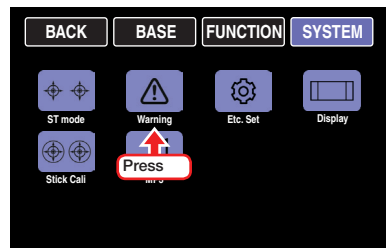
## Model Memory Specific Warning Settings

Use this menu to turn off or on the five visual and acoustic alarm triggers. Typically, only the throttle servo (**CH1-POS**) is actively monitored. Other option settings in this menu include **Throttle Hold**, **Throttle Cut**, **Phase** and **Power OFF time**.

To adjust these settings, from the main display press the **SYSTEM** menu gear icon (purple "S") to bring up the SYSTEM submenu screen:



From the SYSTEM submenu, press the **Warning** icon:

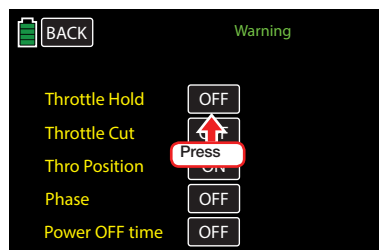


### Notice

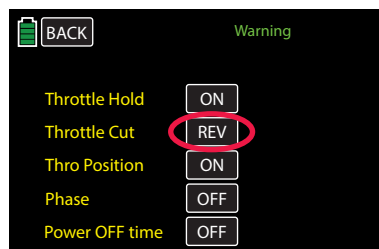
These settings are model memory specific. Re-set these options individually for each model memory.



To toggle between **ON** and **OFF**, press the value field in the option line, as shown below:

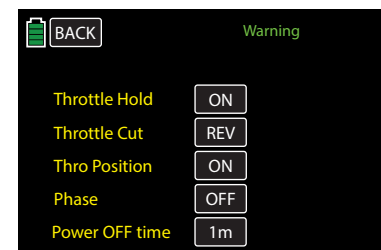


The **Throttle Cut** line provides the **REV** option:

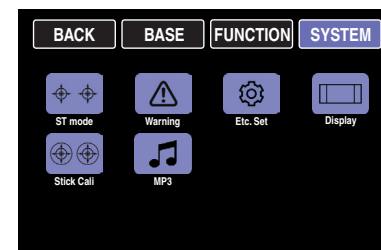


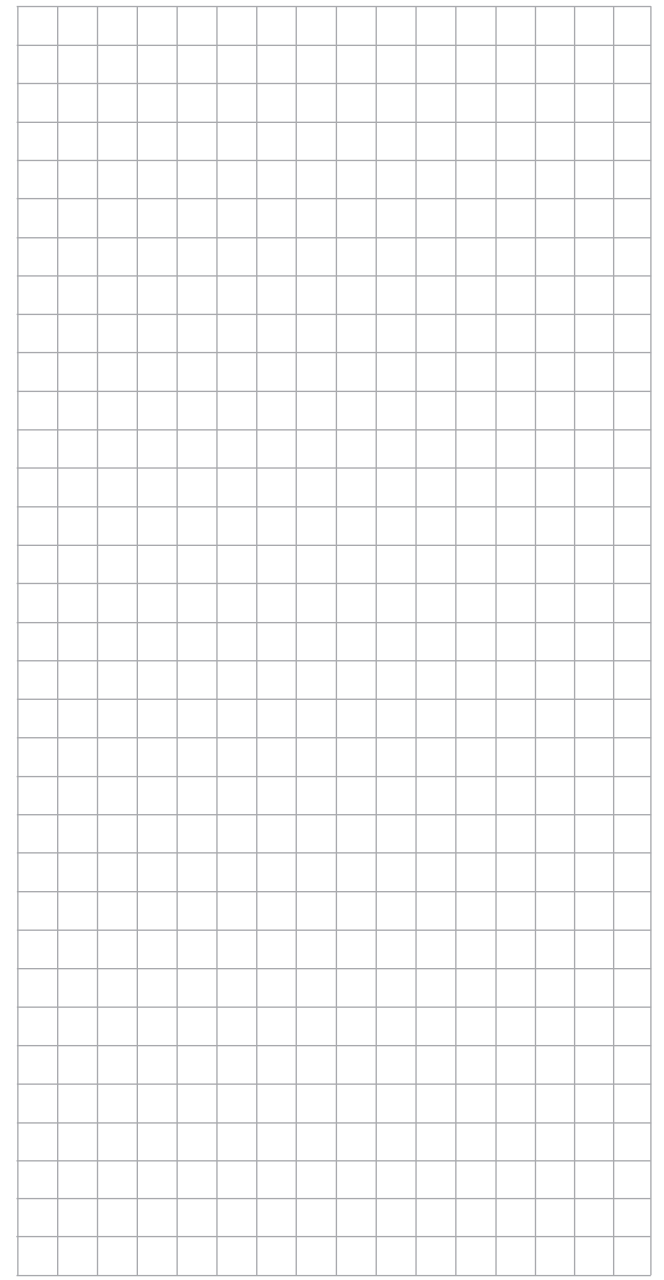
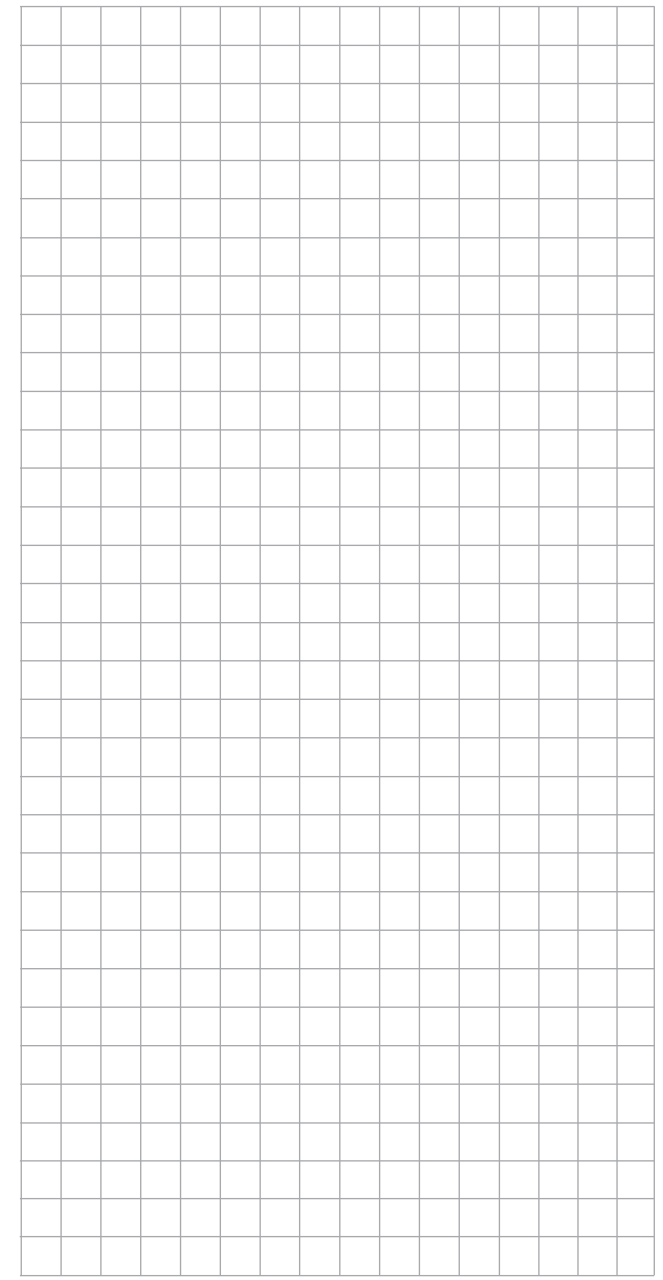
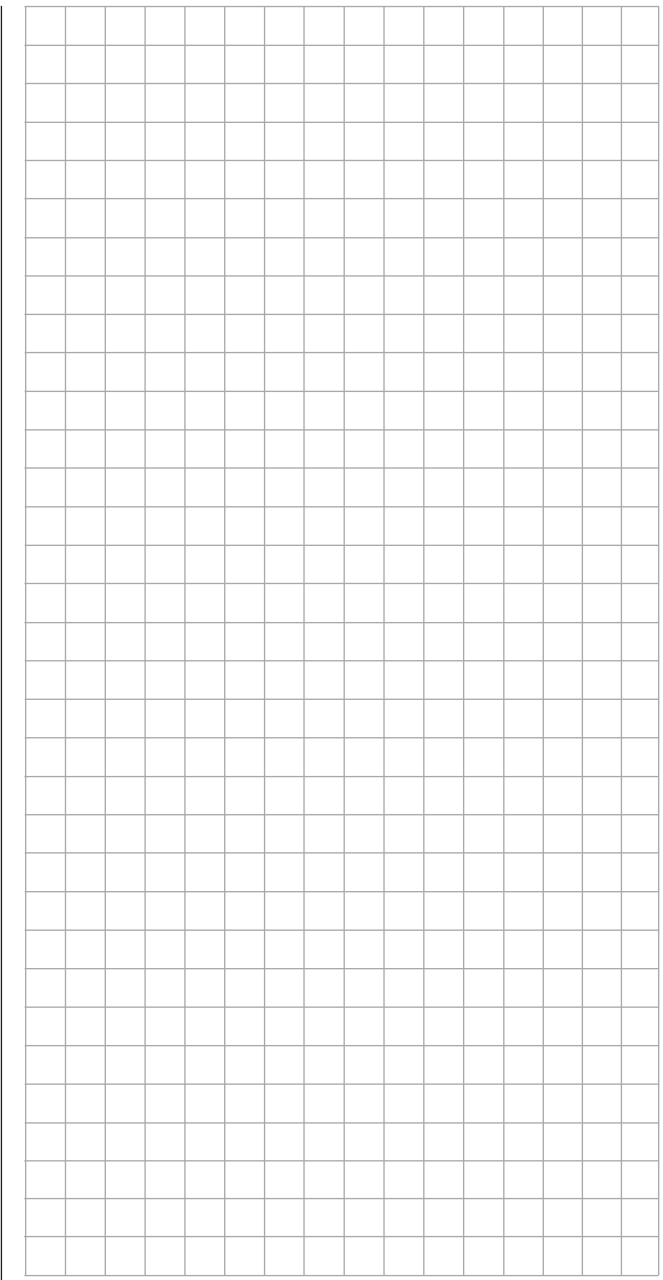
When the Throttle Cut is active, the **REV** option activates the option in reverse, as though the Throttle Cut is switched off.

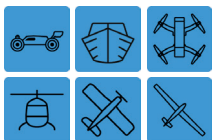
The **Power OFF time** option allows users to specify how long the transmitter should wait before beginning the shut-down process. The transmitter begins the shut-down process after three minutes of inactivity, and will give a warning before turning itself off. Choose the time it takes to turn off after the warning (in seconds and minutes): **OFF**, **30s**, **1m**, **5m**, **10m**, **20m**, **30m** and **60m**. Press the value field in the **Power OFF time** line to select:



Press the **BACK** button at the top left to return to the SYSTEM menu:





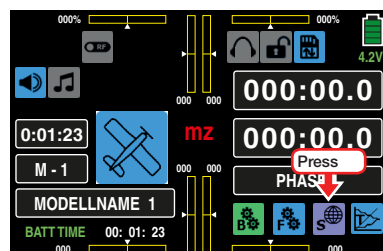


# Etc. Set

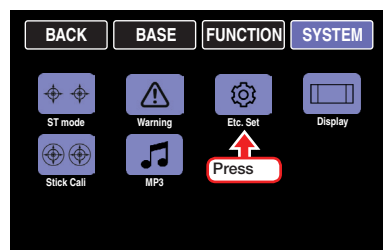
## Miscellaneous Transmitter Settings

This menu has miscellaneous user preference settings. Most notably is the **Touch unlock** option, allowing users to change the key lock deactivation from the standard method (simultaneously pushing the **ESC/ENT** keys), to a lock code password. Users can also change battery type and low-battery warning voltage, voice and vario volume as well as the choice to have a power-on melody play when turning on the transmitter.

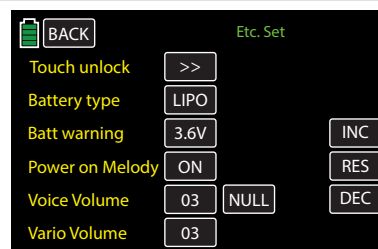
To adjust these settings, from the main display press the **SYSTEM** menu gear icon (purple “S”) to bring up the SYSTEM submenu screen:



From the SYSTEM submenu, press the **Etc. Set** icon:



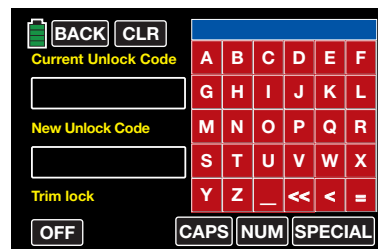
### Touch Unlock Line



To set an individual password press the **>>** button in the **Touch unlock** line:

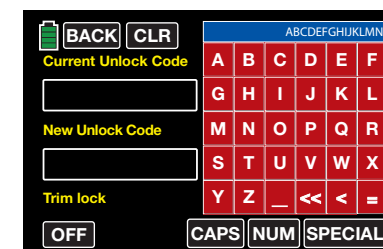


The red keyboard input menu opens:

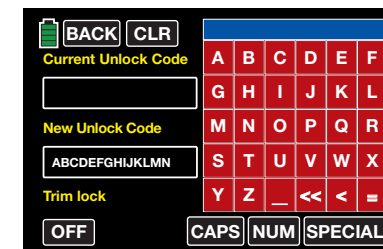


Refer to the **Model Name** section of the BASE submenu **Model Sel** (page 42) for more information on the red keyboard input menu.

Enter a password with a maximum of 14 characters. The entered characters will appear in the blue input field above the keyboard:



Press the **<** button to delete a single character, press the **<<** button to clear all characters in the blue input field. Press the **=** button to transfer the characters to the **New Unlock Code** field:



- **Locking the Display**

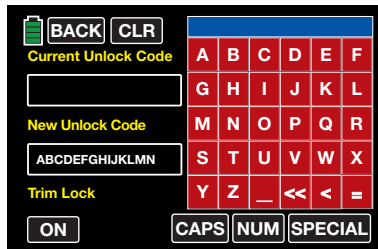
To lock the display (from anywhere except the red keyboard input menu display) simultaneously press the **ESC/ENT** keys for about one second until a short beep sounds. Release the keys. The the display touch-function is locked; the transmitter now will only react to the lateral buttons or control elements used to control the model.

**Notice**

**>>** Remember the password and/or write it down and keep it in a safe place. Locked transmitters will need to be sent to the *Graupner* Service Center for reset.

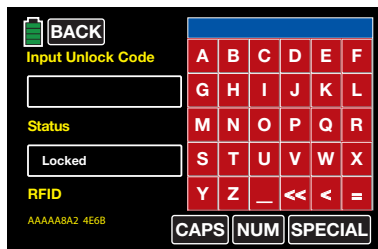
- **Locking the Display and Trim**

Before or after setting a lock code, press the **ON** / **OFF** value field in **Trim Lock** column in the lower part of the display, to turn the option on or off:

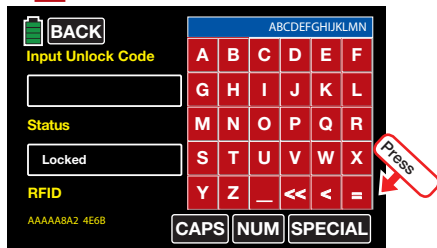


• **Unlocking the Display and Trim**

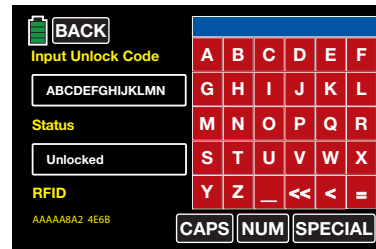
To unlock the display and trim, simultaneously press the **ESC/ENT** keys for about one second until a short beep sounds and the unlock display appears:



Enter the password into the blue input field and press the **=** button:

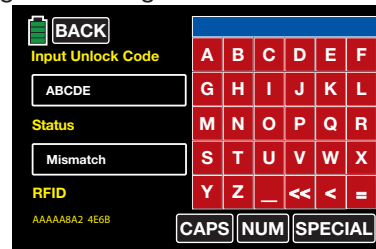


The entered characters transfer to the Input Unlock Code value field:



If the password is correct, the **Status** value field message will change from Locked to **Unlocked**, and the transmitter's display is available for immediate use. Press the **BACK** button at the top left of the display to exit the locking menu.

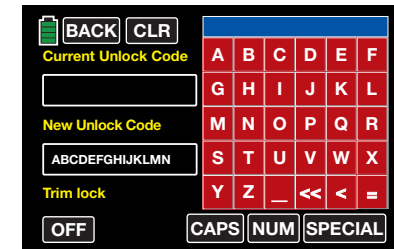
If the password is incorrect, the **Status** value field message will change from Locked to **Mismatch**:



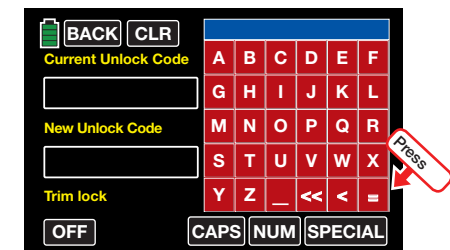
Re-enter a different password and press the **=** button. Repeat this process until the **Status** field changes to **Unlocked**. If the password cannot be correctly entered, send the transmitter to the *Graupner* Service Center for reset.

- **Exiting the Menu Without Setting a Password**  
BEFORE pressing the **BACK** button, which will save the password entered, it is possible to delete the password already transferred to the **New Unlock Code** value field.

The unwanted password is entered in the **New Unlock Code** value field, as shown below:



Press the **=** button to transfer the blank content of the blue input field into the **New Unlock Code** value field. The field is now empty; the password previously transferred in has been deleted:



- **Deleting the Password**

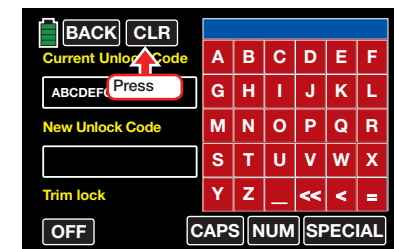
Delete the password in one of two ways:

**Variant 1**

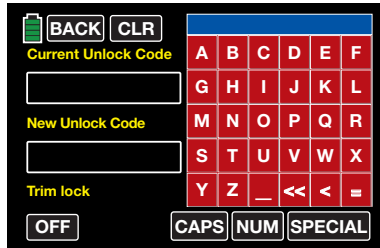
Press the **=** button to transfer the blank content of the blue input field into the **New Unlock Code** value field. The field is now empty; the password previously saved has been deleted.

**Variant 2**

Press the **CLR** button in the upper side of the display:



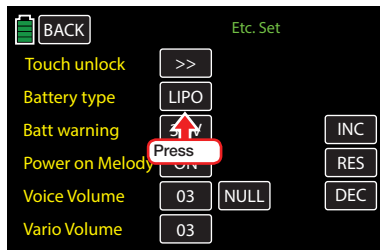
The fields are now empty; the password previously saved has been deleted.



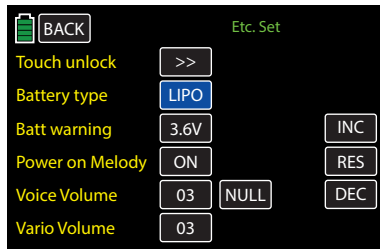
Press the **BACK** button to save and exit.

### Battery Type Line

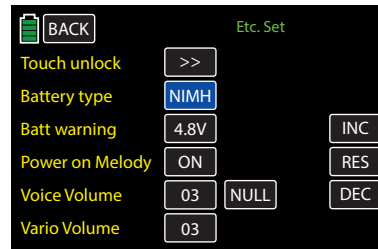
To enter or change the type of power supply battery, update the setting in the **Battery type** line. The transmitter can run on either a four-cell nickel-metal hydride battery (NIMH) or a 1s lithium-ion battery (LIPO). To make any necessary changes to the setting, press the value field in the **Battery type** line:



The field highlights blue:



Press the **INC** or **DEC** buttons or the arrow keys (▲▼) to select the appropriate value:

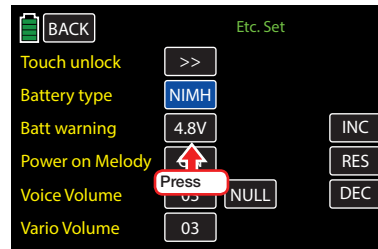


Press the **RES** button to reset the changed value back to the default.

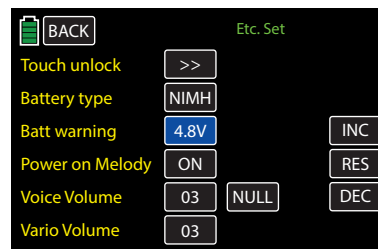
### Batt Warning Line

Use this setting to program the warning threshold of the display depending on the battery type selected in the line above. Nickel-metal hydride batteries can be set, in increments of 0.1V, between 4.5 and 5.5V. Lithium-ion/lithium polymer batteries can be set, in increments of 0.1V, between 3.4 and 4.2V. Do not set value too low or there will not be sufficient time to land the model after a battery warning.

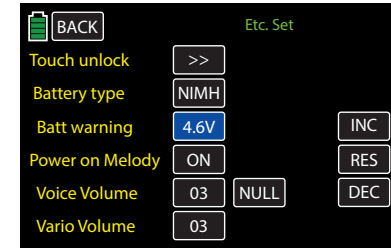
To make any necessary changes to the setting, press the value field of the **Batt warning** line:



The field highlights blue:

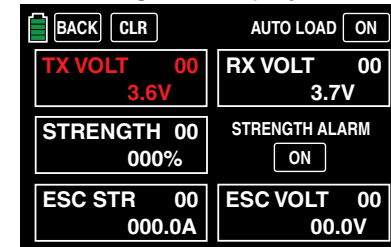


Press the **INC** or **DEC** buttons or the arrow keys (▲▼) to select the appropriate value:



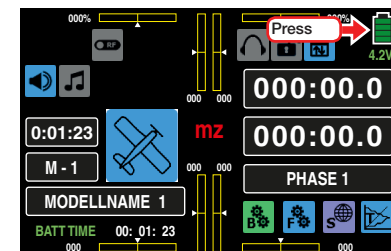
Press the **RES** button to reset the changed value back to the default.

Check the transmitter voltage at any time by pressing the red **mz** in the center of the main display menu to bring up the following data display:



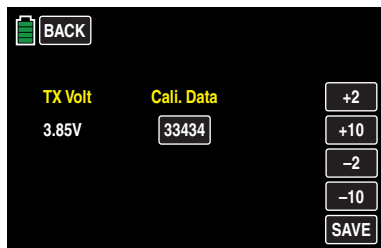
### Tip

In a special calibration menu that can be opened by touching the voltage display in the main display menu:



The voltage display and battery warning threshold of can be fine-tuned using a precision voltmeter. Press to highlight blue the **Cali. Data** column value field and press the **+2**, **+10**, **-2** or **-10** buttons to incremen-

tally increase/decrease the value in the field:

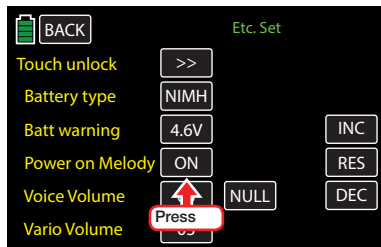


Press the **SAVE** and **BACK** buttons save the settings and exit to the main display menu.

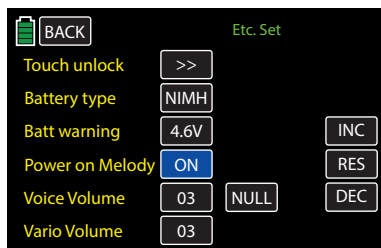
### Power on Melody Line

Use this setting to turn on or off the series of beeps that plays when the transmitter is switched on.

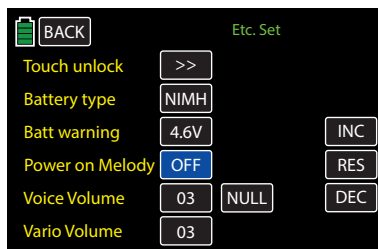
Press the value field in the **Power on Melody** line:



The field highlights blue:



Press the **INC** or **DEC** buttons or the arrow keys (▲▼) to toggle between **OFF** and **ON**:

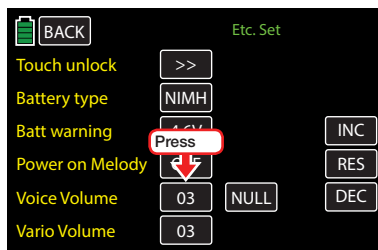


Press the **RES** button to reset the changed value back to the default.

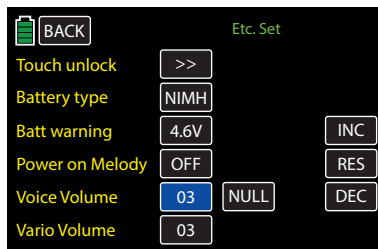
### Voice Volume Line

Use this setting to adjust the volume of the acoustic signals and voice triggers.

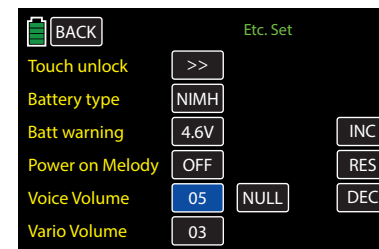
Press the value field in the **Voice Volume** line:



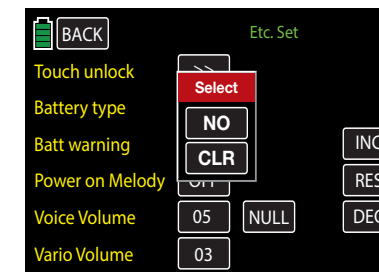
The field highlights blue:



Press the **INC** or **DEC** buttons or the arrow keys (▲▼) to increase/decrease the appropriate volume. **OFF** = No Sound; the volume increases incrementally up to **05** = Loudest:



To adjust the volume using a switch, press the **NULL** field. An active menu will appear. Assign a switch by moving the desired switch once active menu appears:



Press **NO** to cancel or **CLR** to return the switch to the default value (NULL).

### Vario Volume Line

Use this setting to adjust the volume of the Vario announcements by following the same settings described in the **Voice Volume Line** section (exception being there is no switch assignment available):



Press the **RES** button to reset the changed value back to the default. Press **BACK** to return to the SYSTEM menu.

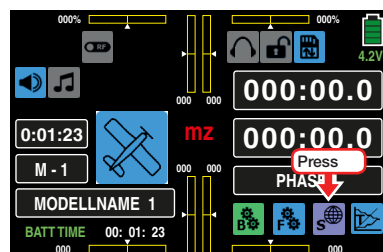
# Display



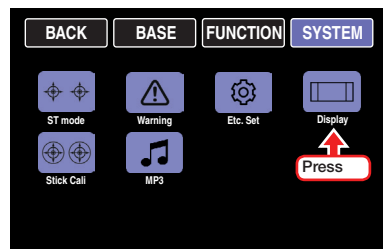
## Transmitter Display Settings

Use this menu to enter display settings such as screen brightness, turning on/off the back-lighting, adjusting the touchscreen sensitivity and turning on/off the outdoor display function. Personalize the radio face by changing the color of the *Graupner* logo. This menu also shows the transmitter's RFID number.

To adjust these settings, from the main display press the **SYSTEM** menu gear icon (purple "S") to bring up the SYSTEM submenu screen:



From the SYSTEM submenu, press the **Display** icon:



### Brightness Line

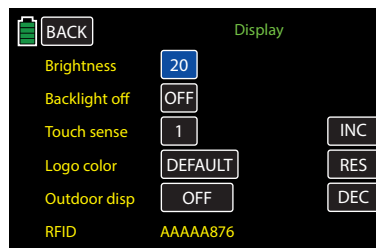
Use this option to make the transmitter displays easier to read in all weather conditions and temperatures. To make any necessary changes to the setting, press the value field of the **Brightness** line:



The field highlights blue:



Press the **INC** or **DEC** buttons or the arrow keys (▲▼) to select the appropriate value. The brightness can be adjusted in increments of 1 from 01 - 20:



Press the **RES** button to reset the changed value back to the default value (15).

### Notice

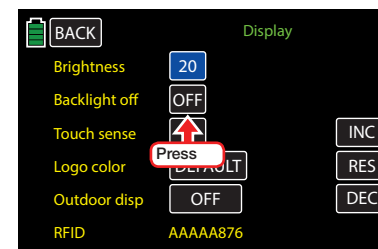
➤ If the transmitter's supply voltage has reached the warning threshold set in the SYSTEM submenu **Etc. Set**, the display brightness will be reduced to 05 to save energy. After charging the battery, reset the desired value in the Brightness field again.

### Backlight Off Line

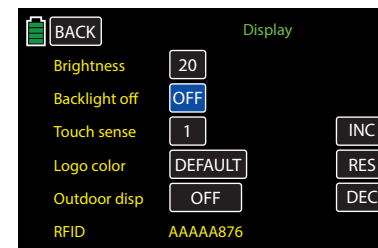
Use this option to specify how long the background lighting remains on when the transmitter is idle. This is an important battery saving feature.

Choose from the following settings (in seconds and minutes): **OFF** (backlight always on), **10s**, **30s**, **1m** and **3m**.

To make any necessary changes to the setting, press the value field of the **Backlight off** line:

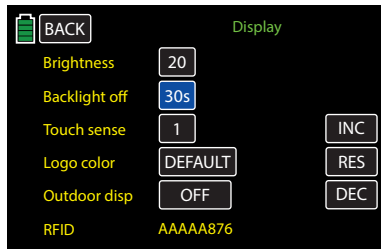


The field highlights blue:



Press the **INC** or **DEC** buttons or the arrow keys (▲▼) to select the appropriate value:





Press the **RES** button to reset the changed value back to the default value (OFF).

### Notice

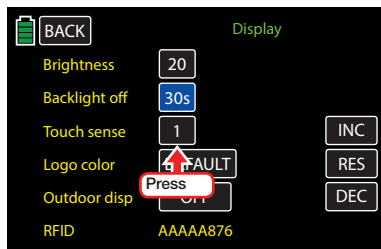


A display that has gone completely dark can be illuminated again by pressing one of the arrow keys (▲▼) to the right of the display.

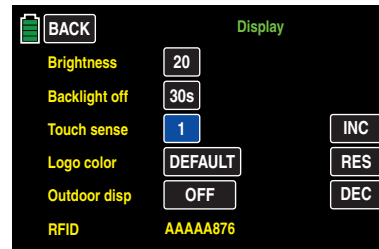
### Touch Sense Line

Use this option to adjust the reactivity of the transmitter's touch screen. The lower the number in this field, the more sensitive the touch-response will be. Raise the field value if the touch screen is too sensitive and over-reactionary.

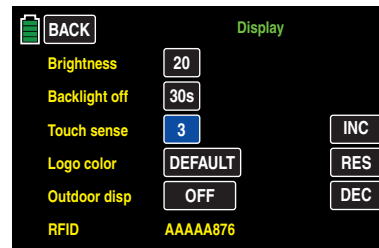
To make any necessary changes to the setting, press the value field of the **Touch sense** line:



The field highlights blue:



Press the **INC** or **DEC** buttons or the arrow keys (▲▼) to select the appropriate value:

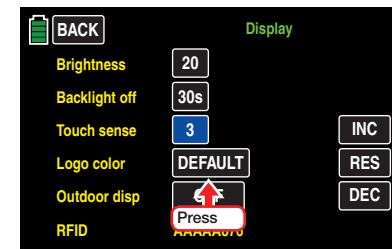


Press the **RES** button to reset the changed value back to the default value (1).

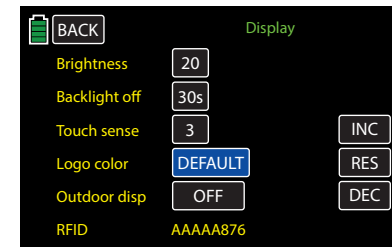
### Logo color Line

Use this option to personalize the transmitter face by changing the color of the Graupner logo. Six fun colors are available to suit personal preference.

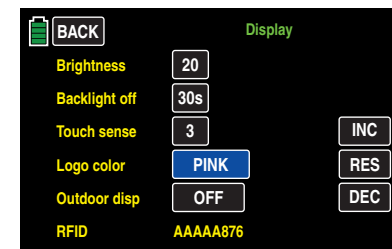
To make any necessary changes to the setting, press the value field of the **Logo color** line:



The field highlights blue:



Press the **INC** or **DEC** buttons or the arrow keys (▲▼) to select the appropriate value. Choose from the following colors: **DEFAULT, RED, GREEN, BLUE, PINK, YELLOW** and **SKYBLUE**:



Press the **RES** button to reset the changed value back to the default value (DEFAULT = blue).

## Outdoor Disp Line

Use this option to maintain the legibility of the display screens even in bright surroundings or sunlight. By turning this option on, legibility changes to “high contrast.”

To activate or deactivate this function, press the **ON** or **OFF** button in the **Outdoor disp** line:



The field value changes to the opposite function:



## Notice

» Activating the **Outdoor Disp** option will change the display screen shown in the **TELEMETRY** menu. Refer to the **Telemetry Data Display** section for more information (page 225).

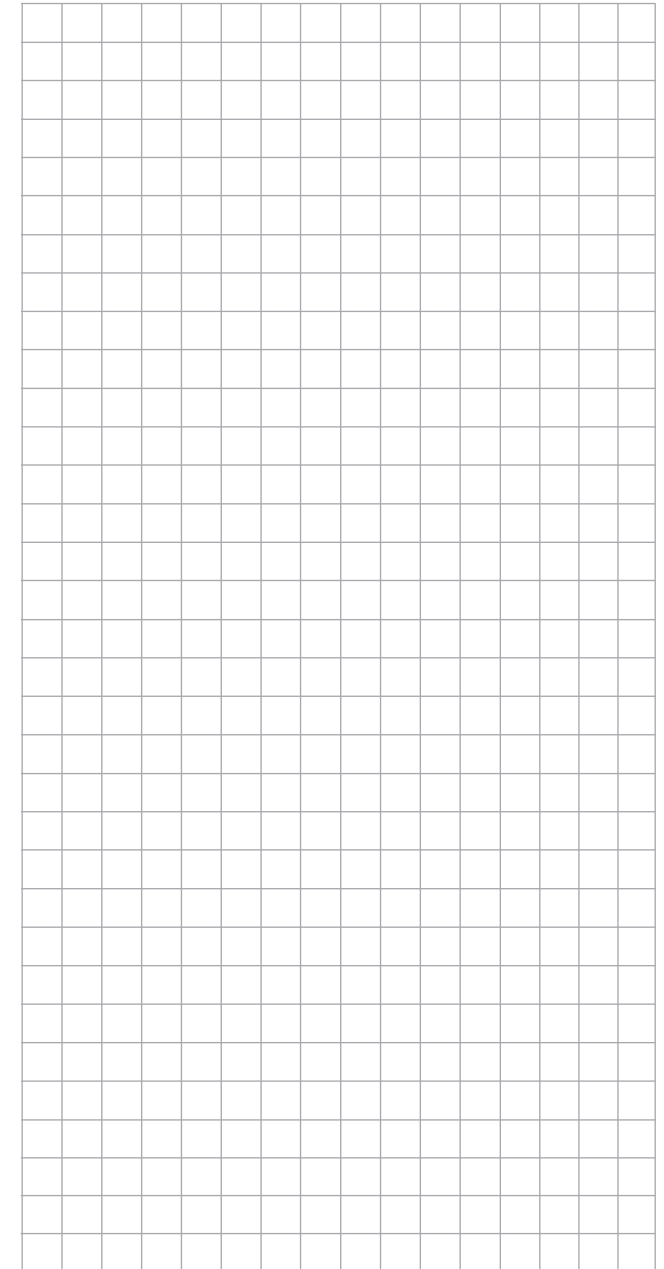
## RFID Line

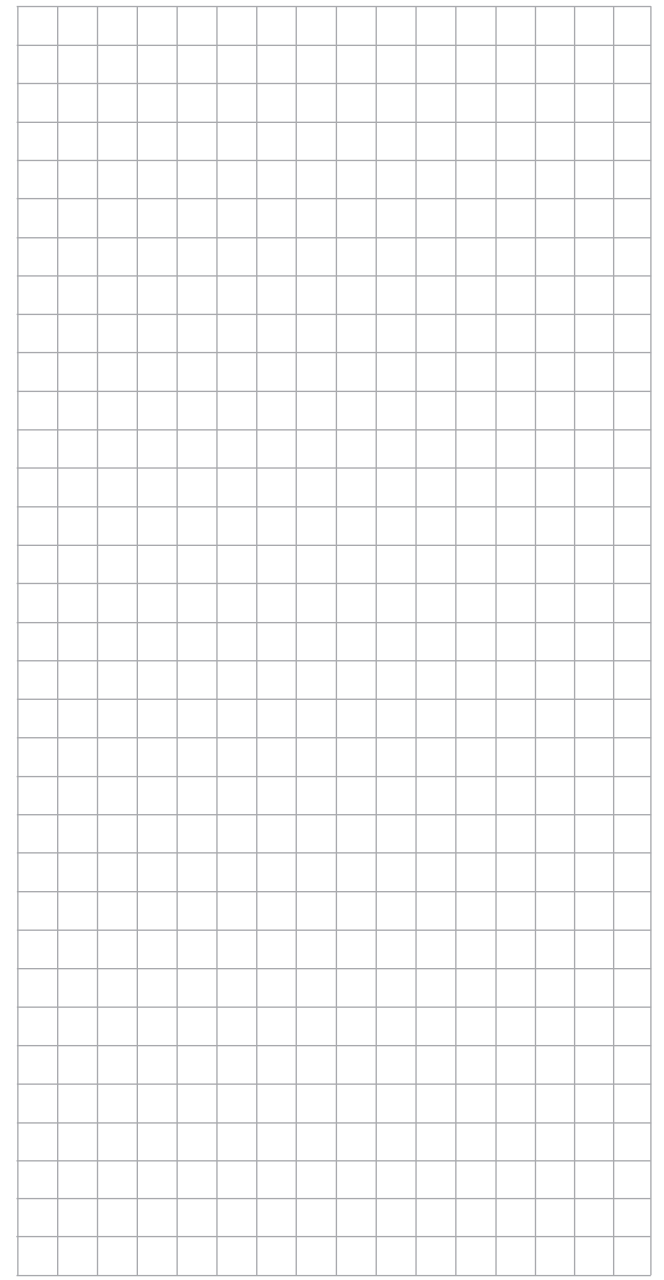
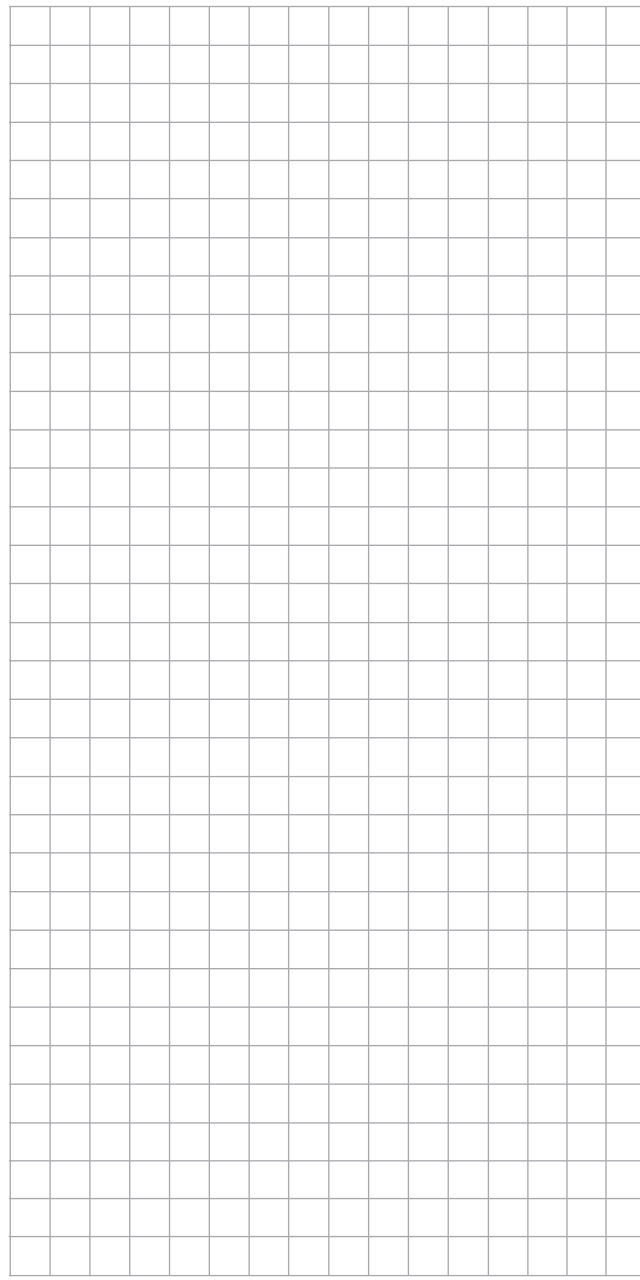
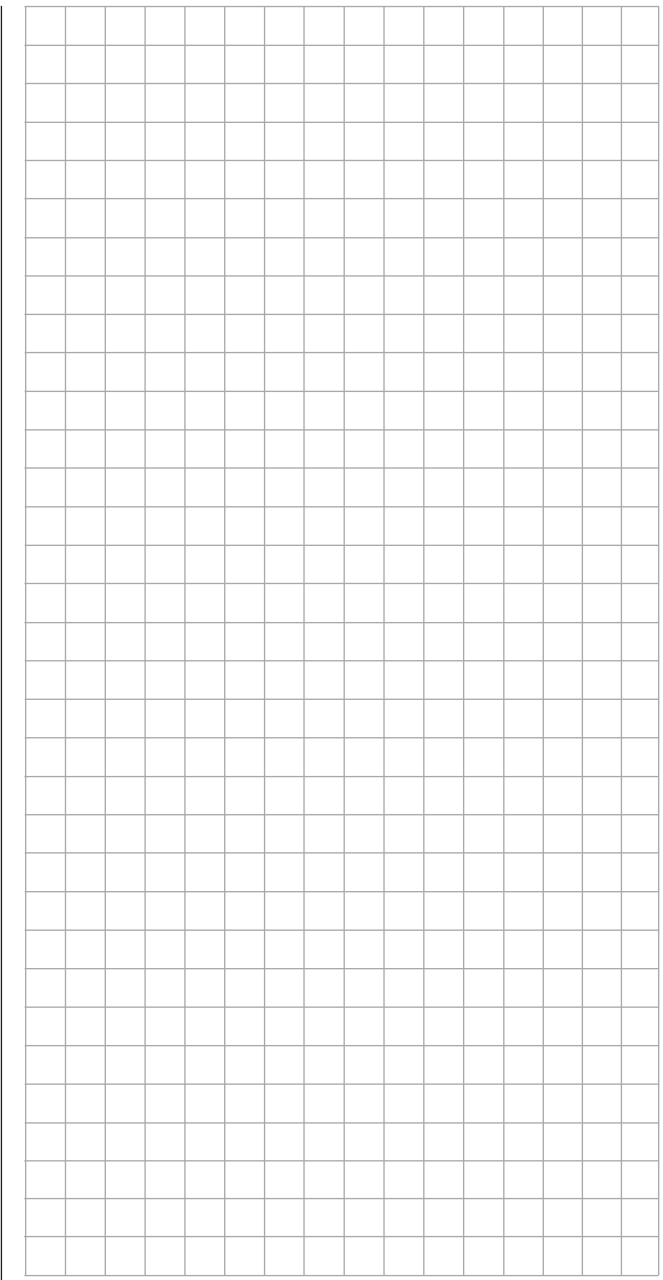
To determine the radio frequency identification of the transmitter, refer to the final line of the Display screen:

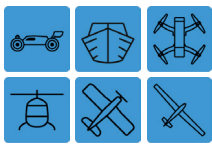


This identification is specific to each transmitter, is only issued once per transmitter, and cannot be changed. This ID is transmitted to the receiver during the HoTT-synchronization process, allowing it to always identify the radio signals of its bound transmitter.

Press **BACK** to return to the SYSTEM menu.





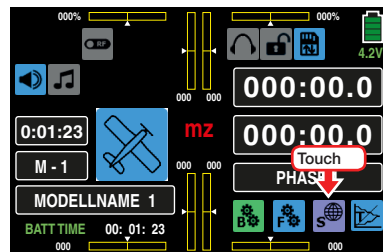


# Stick Cali

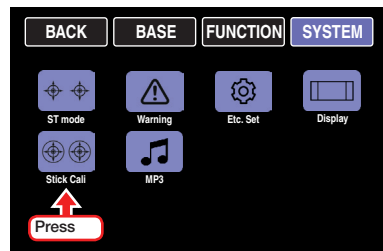
## Control Stick Center Position Calibration

If the center position of the self-centering control stick (controls 1 - 4) does not precisely correspond to 000% control travel, it can be checked and corrected. Maintaining 000% control travel is important for proper flight and function of the servo and controls.

To adjust these settings, from the main display press the **SYSTEM** menu gear icon (purple "S") to bring up the SYSTEM submenu screen:

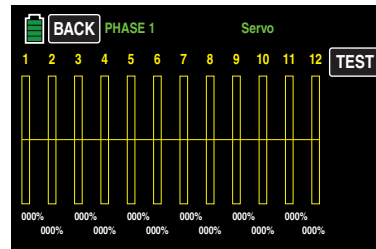


From the SYSTEM submenu, press the **Stick Cali** icon:

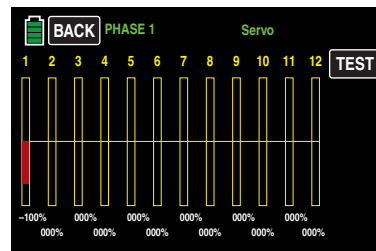


To calibrate the self-centering control stick, select a free model memory slot in the BASE submenu **Model Sel** to make a dummy model for calibration purposes only. Model type is irrelevant; it is only important that no trimming or programming has yet been performed. Open the BASE submenu **Servo** by simultaneously pressing the arrow keys (▲▼) on the left of the display.

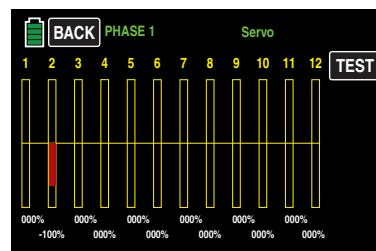
If all four of the transmitter's control stick functions are self-centering, this display should ideally look like the example shown here:



If all four of the transmitter's control stick functions are NOT self-centering, the graph bars show current setting percentages for control stick control functions which are not self-centering (traditionally CH1). For example, if the CH1 control stick is in its Idle LOW position, the display would appear follows:

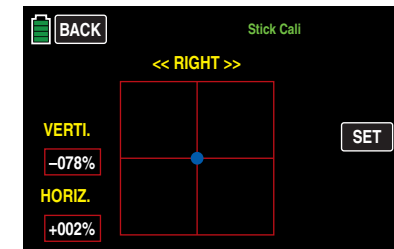


One at a time, put each control stick into their four possible limit positions *without* exerting force at the limit position. In each of these eight possible limit positions, the (side dependent) indication for exactly -100% or +100% should be displayed. For example, if Control 2 is at its right limit and the other three other control stick functions are in their respective middle positions, then the servo display should appear as follows:



Regardless of the number of self-centering control stick functions available on the transmitter, if these checks produce four 000% results and eight 100% results, then the transmitter's control sticks are optimally calibrated. Terminate this process and then, if necessary, delete the dummy model memory just created.

If the control sticks are not optimally calibrated, open the SYSTEM submenu **Stick Cali**. This display allows users to cycle through the four stick lever positions for calibration, starting with the neutral position of the right control stick system:



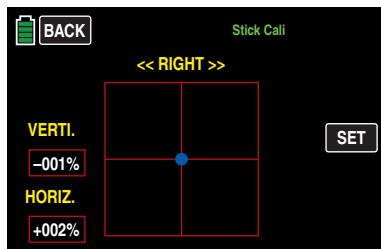
The blue dot shown in the above graphic indicates the stick position to be adjusted.

The horizontal and vertical percentages displayed in the VERTI and HORIZ column value fields indicate the current stick position.

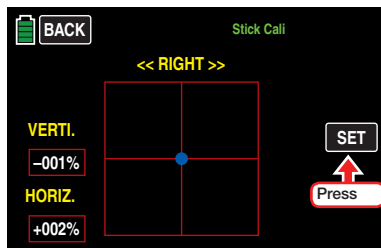
Although the right-hand stick is located exactly in the middle of its path (due to its horizontal self-centering), the example above shows an adjustment of +002%.

Vertically, the right stick is exemplary located on a randomly inclined position in the direction of the pilot (due to its non-self-centering characteristic as a CH1 control stick).

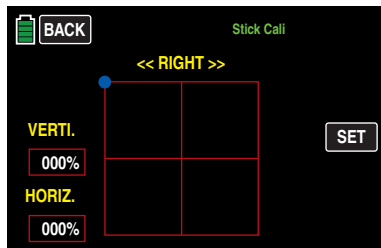
Before tapping the **SET** button on the right, the right control stick, which in this example is not self-centering, should be moved to the mechanical center:



As soon as this placement is achieved, press the **SET** button at the right edge of the display:

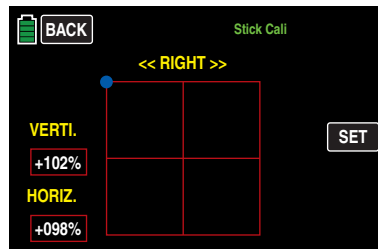


The neutral position of the right control stick is then calibrated, and the blue dot moves to the left, top corner of the grid:

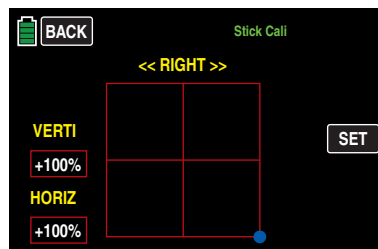


Move the right control stick to the front left corner *without* exerting pressure at the limit. If the transmitter

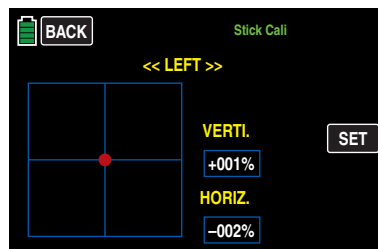
is incorrectly adjusted, the results can have the following result:



Press the **SET** button at the right edge of the display to transfer the 100% position to the memory; the selected dot then switches to the opposite corner:



Use the same calibration procedure for the opposite corner; the display screen will change color and positioning for left control stick calibration:

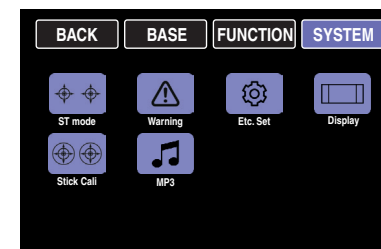


Use the same calibration procedure for calibrating the left control stick.

### Notice

» If the calibration of any of the control sticks is off or incorrect in any way, the entire process will have to be repeated.

Press **BACK** to return to the SYSTEM menu.

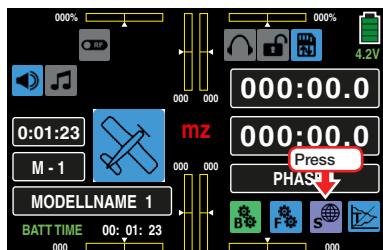


# MP3

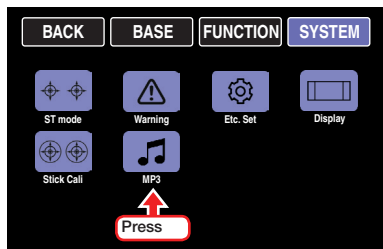
## MP3 Player Program

The MP3 Player menu can be accessed through the SYSTEM submenu in addition to a shortcut icon on the main display screen. For ease of use, four quick-controls are assigned to the keys on either side of the display screen.

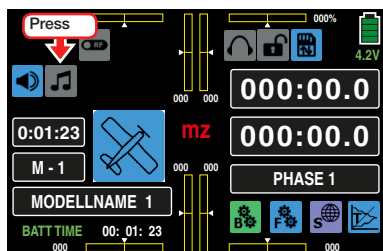
To adjust these settings, from the main display press the **SYSTEM** menu gear icon (purple "S") to bring up the SYSTEM submenu screen:



From the SYSTEM submenu, press the **MP3** icon:



Or use the shortcut MP3 icon in the main display:



Four quick-controls are assigned to the keys on either side of the display screen:

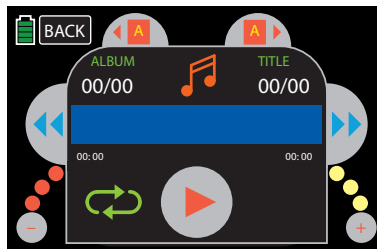
- **ENT** = Start / Stop
- (▲▼) = Volume Control
- (◀▶) = Forwards / Backwards
- **ESC** = Exit

### Notice

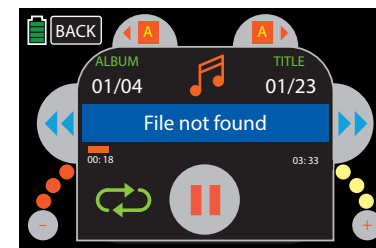
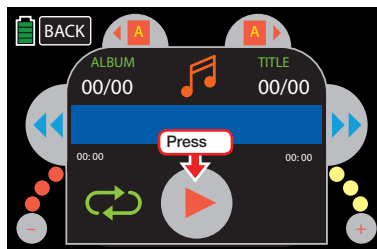


Note that for technical reasons NO data representation is possible during the reproduction of MP3 data.

The following menu display appears whether or not an SD card with MP3 files has been inserted:



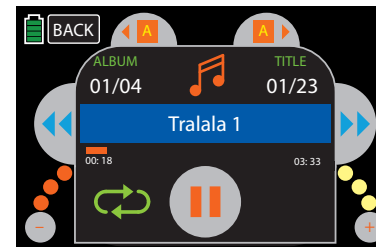
Press the large triangle "play" button or push the **ENT** button to start playing the first MP3 file of Album 1. The file starts playing immediately, but the album number, title and file information may appear after a slight delay depending, on the size of the MP3 file.



If no title starts and the text "File not found" is shown in the display, the transmitter did not find a suitable MP3 file on the inserted SD card, or there is no SD card in the card slot.

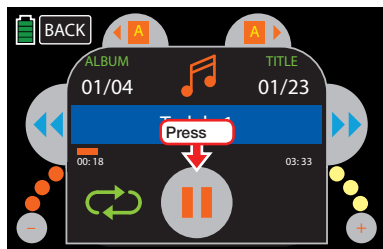
Insert a memory card, or remove the card from the transmitter and use a computer to check the SD card's content directory. The MP3 files may only be saved within the MP3 directory or one MP3 directory sub-folder. If these directories are empty, copy suitable MP3 files into the directory.

Use an SD card loaded with MP3 files in the MP3 directory, turn on the transmitter, and try playback again:

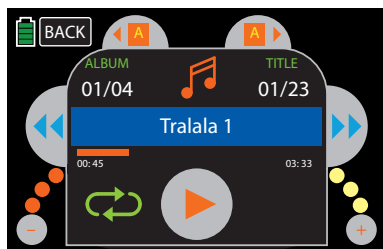


Album 1 will automatically play until stopped. To stop playback, press the stop/pause button or press the **ENT** button on the right side of the display.

Pressing the vertical “pause” button will stop playback:



Pressing the triangular “play” button will start playback:



Turning off the transmitter will also stop playback.

During playback, exit the submenu at any time by pressing the **BACK** button or by pressing the **ESC** button to the left of the display. Playback will continue and the transmitter can be used without restriction. Concurrently recording parallel data files (data-logs) is not possible while MP3 player is in use.

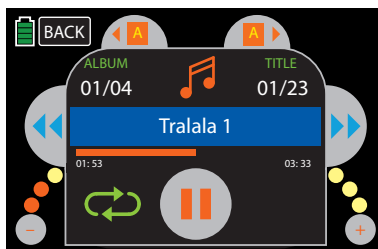
### Tip

Activated voice triggers will be displayed in the MP3 file folder that is being played.

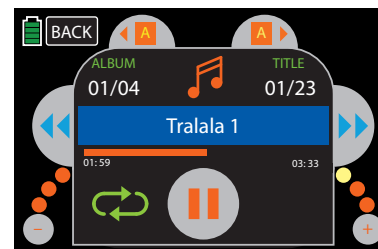
### Volume

To reduce the volume, press the ( ▼ ) down-arrow key to the left of the display or press the gray dot with the ( - ) minus-sign in the lower left corner of the display. Each time the button/key is pressed, the color of one of the three small circles (above the volume increase/

decrease circles) changes gradually from red-orange (louder) to yellow (softer) in half-circle increments:



Pressing the ( ▲ ) up-arrow key on the left of the display or pressing the gray dot with the ( + ) plus-sign in the lower right increases the volume in half-circle increments from yellow to red-orange:



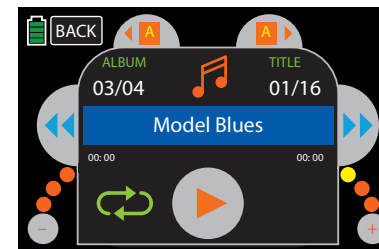
### Album

Change to the next album by pressing the right album selection field at the top of the display:



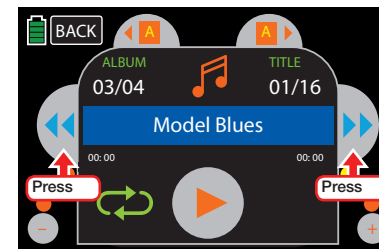
Conversely, move to the previous album by pressing the left album selection field.

Album and title information are updated in their respective fields as soon as an album or track is changed:

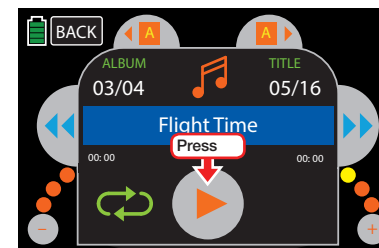


### Title

To change or select a track, press one of the two forward/back buttons on either side of the track display, or press one of the ( ◀ ▶ ) arrow keys to the right of the display:



To start playback of a selected track, either press the triangle button in the middle of the screen, or push the **ENT** key to the right of the display:



### Notices



- Songtitles are not always the same as MP3 filenames. Often titles are determined by corresponding metadata of the MP3 file.


## ◀ System Menu

- The blue title display field is only equipped to show characters from the Latin alphabet. If titles contain even one character from another alphabet, the title field will remain empty.


Within an album, tracks are played in alphabetical order, or numerical order if the related information is contained within the file name.


- The number of titles on the selected album is calculated from the number of MP3 files per directory.


### Control Panel

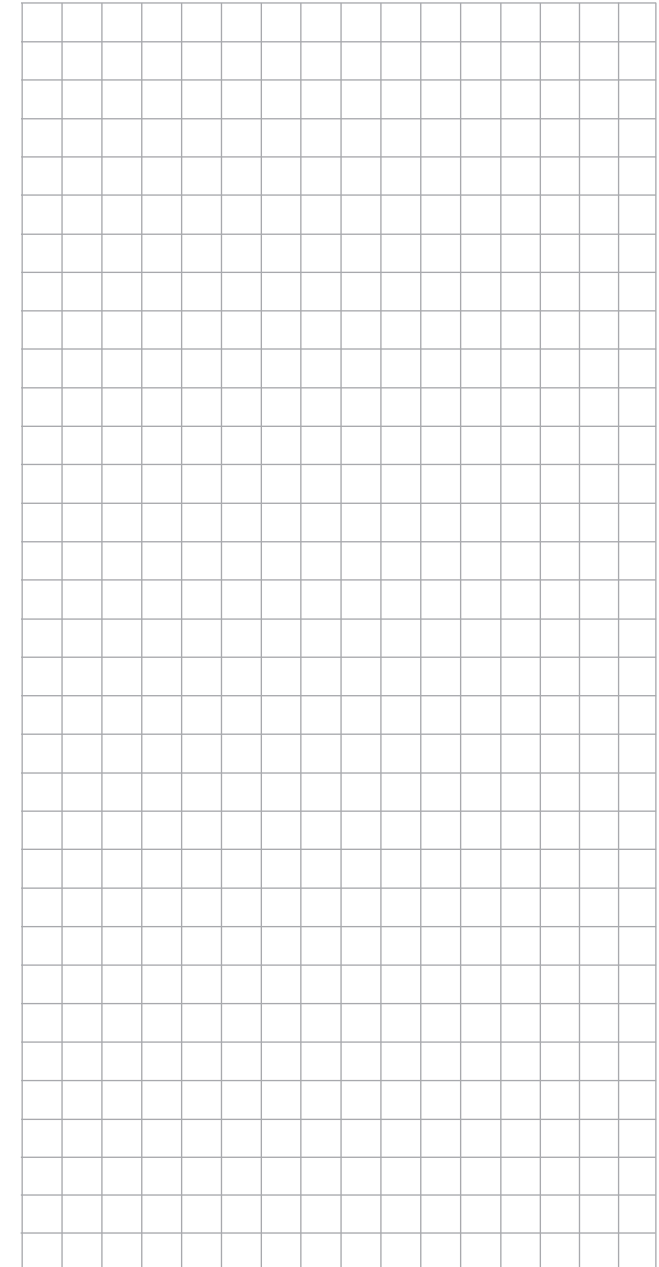
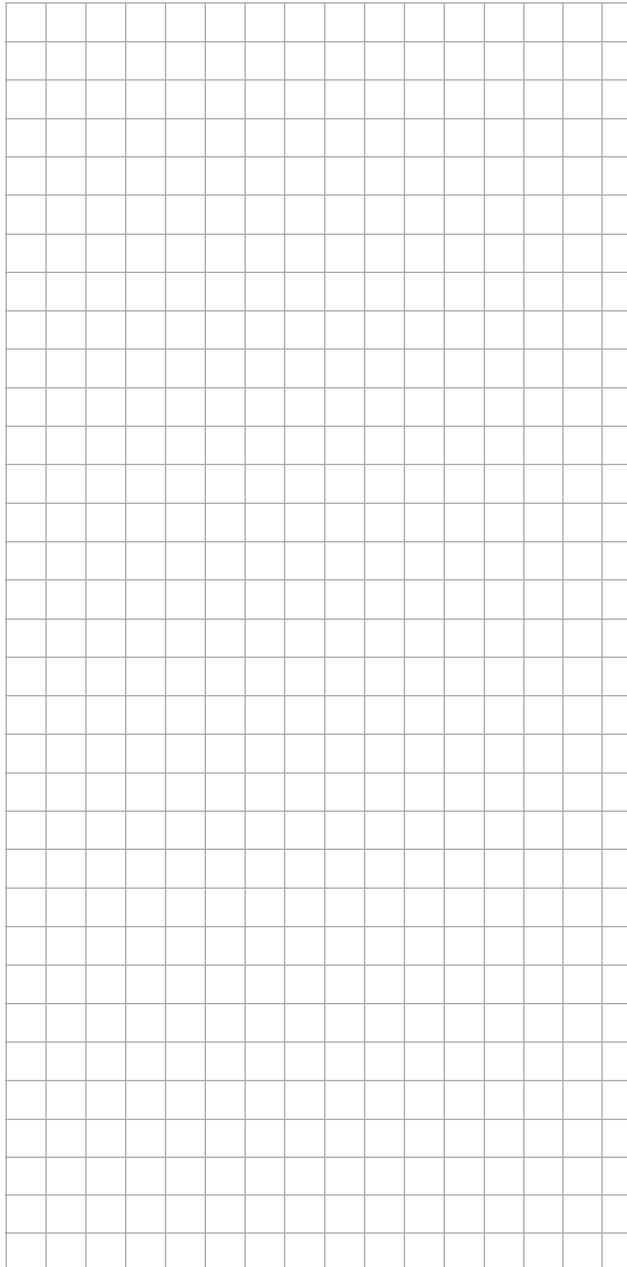
 Advance forward to the next title by pressing the right selection double-arrow button and move back to the previous title by pressing the left double-arrow button. This is similar to corresponding buttons standard on all music players. Additionally, use the selection arrow keys (◀▶) on the right of the display to perform the same forward/backward procedure.

Press the green curved-arrow field to cycle through the following three options:

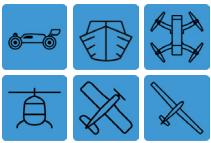
 **Album Repeat:** The selected album is continuously looped until manually stopped or the transmitter is turned off.

 **Title Repeat:** The current title continuously looped until manually stopped or the transmitter is turned off.

 **No Repeat:** Playback automatically stops at the end of the current title.



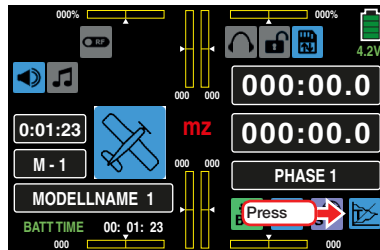




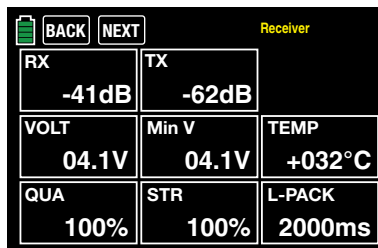
# Telemetry Data Display

The transmitter's main display is used for both operating functions and to graphically display telemetry data. Some of the telemetry data, such as battery voltage, appears on the main display. Additional telemetry information can be found in the **TELEMETRY** menu display.

To view telemetry data, press the **TELEMETRY** icon (blue "T") to bring up the TELEMETRY display screen:



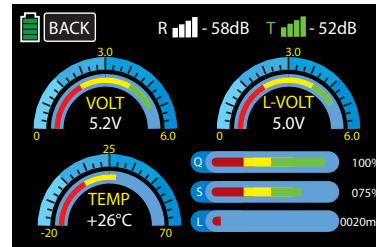
The Telemetry display has no submenu icons but has differing screens depending on system settings. By default, the receiver display appears:



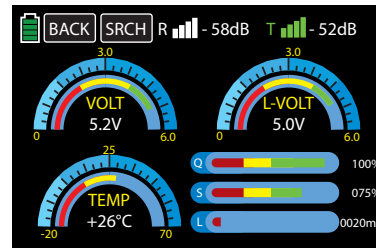
Note this display will only appear if the **Outdoor disp** function of the **SYSTEM** submenu **Display** is turned **ON**. If no sensors are connected to the receiver and the **Outdoor disp** option is **OFF** (as shown below):



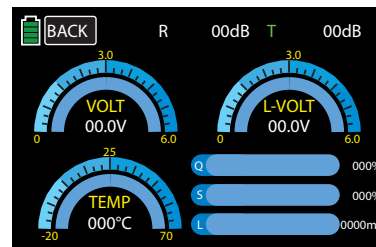
Then the display will appear as follows:



If at least one sensor has been connected to the receiver before the receiver is switched on, the transmitter scans the sensor(s) for approx. 30 seconds. The **SRCH** button appears in the upper left corner of the display during the search process:

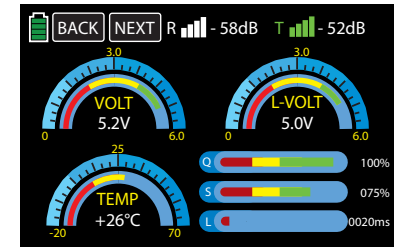


If the receiver is not within range or goes undetected, then no search button or field strength indicators (..||) will be visible along the top of the display screen:



Turn on the receiver, or bind a receiver to the active model memory. Refer to the **BASE** submenu **TX ctl** (page 68) for more information on binding.

Once the sensors search is complete, the **SRCH** button will change to a **NEXT** button:

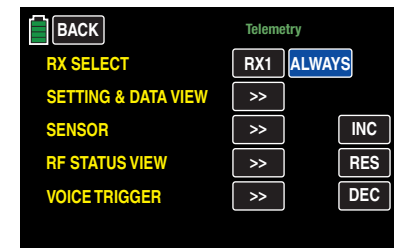


### Tip

Refer to the **RECEIVER** section (page 226) for more information on this display.

### Notice

Functions of this menu operate independently from settings in the **RX SELECT** line of the **BASE** submenu **Telemetry**:



### Sensor(s)

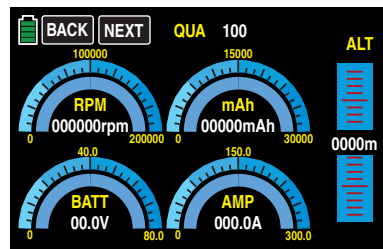
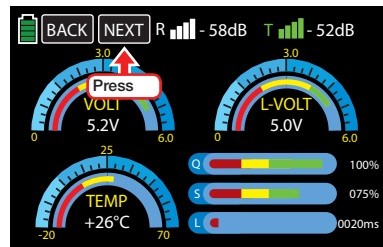
A receiver operated by telemetry can support a combination of up to four connected sensors.

Sensor data is only displayed to the graphs described below if they are properly connected to *before* the receiver is turned on, after all involved components have been switched on and after all back channels are recognized by the transmitter.

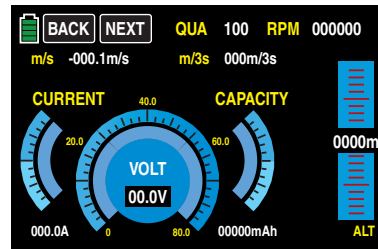
Also make sure the relevant receiver is bound in the **BIND ON/OFF** line of the **BASE** submenu **Tx ctl**, the transmitter is set in the **TX OUT SET** line of the same submenu, and that the receiver selected is turned on in the **RX SELECT** line of the **BASE** submenu **Telemetry**. If another receiver has been selected, only the data from the selected receiver is displayed in the Receiver display.

Sensors in the **SETTING & DATA VIEW** line of the **BASE** submenu **Telemetry** will only respond under the above prerequisites corresponding to the instructions for the respective sensor.

To switch between the displays of all automatically activated sensors, press the **NEXT** button at the top edge of the display:



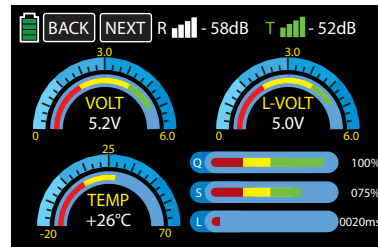
Continue pressing **NEXT** to view subsequent sensor displays:



### Tip

Further information on the modules cited below can be found in the **Appendix** (page 234) and on the Internet at [www.graupnerusa.com](http://www.graupnerusa.com).

### RECEIVER



This display graph shows data from the **SETTINGS & DATA VIEW** line of the **BASE** submenu **Telemetry**.

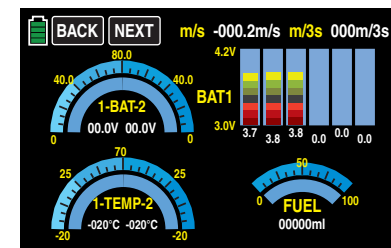
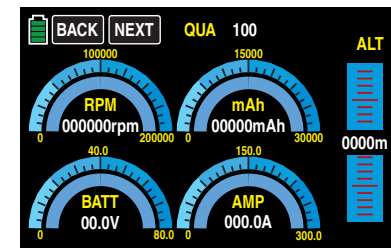
Value	Explanation
R - dB	Decibel level (in percent) of the transmitter signal arriving at the RECEIVER
T - dB	Decibel level (in percent) of the receiver signal arriving at the TRANSMITTER
VOLT	Power level (in volts) of the currently operating receiver power supply
L-VOLT	Lowest operating voltage (in volts) of the receiver power supply since the last startup

TEMP	Temperature (in Celsius) of the currently operating receiver
Q	Signal package quality (in percent) of the data sent from the transmitter arriving at the receiver
S	Signal strength (in percent) of the transmission from the transmitter arriving at the receiver
L	Shows the longest time (in milliseconds) data packets are lost during a transmission from the transmitter to receiver

### Tip

For additional information on the values mentioned above, refer to the Detailed explanations of the **SETTINGS & DATA VIEW** section (page 101).

### GENERAL MODULE



Press **NEXT** to switch between screen displays.

These screens display 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 the modules can be found in the **Appendix** (page 234) and on the Internet at [www.graupnerusa.com](http://www.graupnerusa.com).

Depending on the module configuration with additional sensors, the following data can be permanently shown on the display:

### 1. Display

At the top edge of the screen, the **QUA** line shows (in percent) the quality of the signal coming from the transmitter.

The graphic at the top left shows (in rotations per minute) the speed detected by a speed sensor connected to the module. The graphic at the top right shows (in milliampere hours) the remaining charge of the connected battery.

#### Notice



To correctly display the data, the relevant number of propellers and the battery charge information must be entered beforehand in the **FUNCTION** submenu **Telemetry**.

The graphic at the bottom left shows (in volts) the current voltage of the battery connected to the module. The graphic at the bottom right shows (in amps) the momentary flow of current. The graph along the right edge of the display shows (in meters) the present height relative to the location.

### 2. Display

At the top edge of the screen, the **m/s** and **m/3s** lines show (in meters per second and meters per every three seconds) the current ascent/descent of the model.

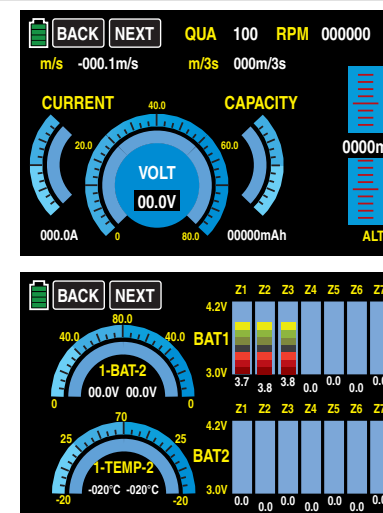
The two graphics to the left show the current voltage measured by the temperature and voltage sensors

(No. **33612** and **33613**) connected to the model from up to two batteries (BAT-1 and BAT-2). They also show the corresponding temperature: the arc's left side shows sensor 1 data and the arc's right side shows sensor 2 data.

The bar graph in the top right of the display shows the current cell voltages of up to six lithium polymer battery cells. Below that in the bottom right of the display is a graph showing (in milliliters) the cumulative fuel consumption measured by a sensor connected to the module.

Value	Explanation
<b>1-BAT-2</b>	Battery 1 data is shown on the arc's left side of the arc; Battery 2 data is shown on the arc's right side
<b>QUA</b>	Signal quality (in percent)
<b>FUEL</b>	Fuel level/tank display
<b>ml</b>	Fuel consumption (in milliliters)
<b>1-TEMP-2</b>	Sensor 1 temperature is shown on the arc's left side; Sensor 2 temperature is shown on the arc's right side
<b>BAT1</b>	Cell voltage of cells 1 - max. 6
<b>ALT</b>	Current altitude - available only with model <b>33611</b>
<b>m/s</b>	Ascent/descent (in meters per second) - available only with model <b>33611</b>
<b>m/3s</b>	Ascent/descent (in meters per three seconds) - available only with model <b>33611</b>
<b>VOLT</b>	Current voltage of the battery connected to the module
<b>AMP</b>	Momentary current (in amps)

## ELECTRIC AIR MODULE



Press **NEXT** to switch between screen displays.

These two screens display the data of an **Electric Air Module** connected to the receiver (No. **33620**). Further information on the modules can be found in the **Appendix** (page 234) and on the Internet at [www.graupnerusa.com](http://www.graupnerusa.com).

Depending on the configuration of the module with additional sensors, the following data can be permanently shown on the display:

### 1. Display

At the top edge of the screen, the **QUA** line shows (in percent) the quality of the signal coming from the transmitter. Directly below the **QUA** line is the **m/s** and **m/3s** line, showing (in meters per second and meters per every three seconds) the current ascent/descent of the model.

The graph along the right edge of the display shows (in meters) the present height relative to the location.

The central graphic shows 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 connection.

### Notice

**>>** To correctly display the data, the battery charge information must be entered beforehand in the **FUNCTION** submenu **Telemetry**.

## 2. Display

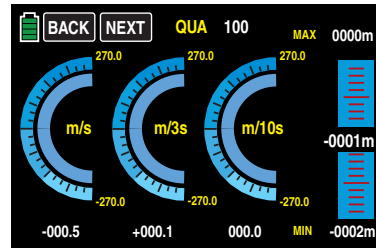
The two graphics to the left show the current voltage measured by the temperature and voltage sensors (No. **33612** and **33613**) connected to the model from up to two batteries (BAT-1 and BAT-2). They also show the corresponding temperature: the arc's left side shows sensor 1 data and the arc's right side shows sensor 2 data.

The bar graph in the top right of the display shows the current cell voltages of the (max.) 7-cell battery pack connected to balancer port 1 (L) and port 2 (H).

Value	Explanation
<b>QUA</b>	Signal package quality (in percent) of data sent from the transmitter arriving at the receiver
<b>m/s</b>	Ascent/descent (in meters per second)
<b>m/3s</b>	Ascent/descent (in meters per three seconds)
<b>A</b>	Actual current
<b>V</b>	Actual voltage
<b>mAh</b>	Battery capacity (in milliampere hours)
<b>ALT</b>	Current altitude
<b>1-BAT-2</b>	Battery 1 data is shown on the arc's left side of the arc; Battery 2 data is shown on the arc's right side
<b>1-TEMP-2</b>	Sensor 1 temperature is shown on the arc's left side; Sensor 2 temperature is shown on the arc's right side

**BAT1-BAT2** Cell voltage of cells 1 - max. 14  
L = Balance port 1  
H = Balance port 2

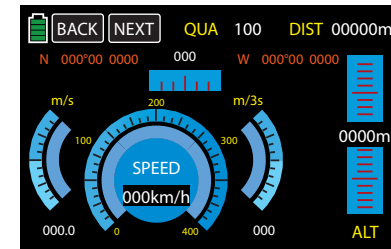
## VARIO



This screen displays the data from a Vario module connected to the receiver (No. **33601**).

Value	Explanation
<b>QUA</b>	Signal package quality (in percent) of data sent from the transmitter arriving at the receiver
<b>MAX</b>	Maximum level (in meters) relative to the starting location
<b>MIN</b>	Maximum altitude (in meters) below the starting location
<b>m/s</b>	Ascent/descent (in meters per second)
<b>m/3s</b>	Ascent/descent (in meters per three seconds)
<b>m/10s</b>	Ascent/descent (in meters per ten seconds)

## GPS



This display shows the data from a GPS module with an integrated Vario module connected to the receiver (No. **33600**).

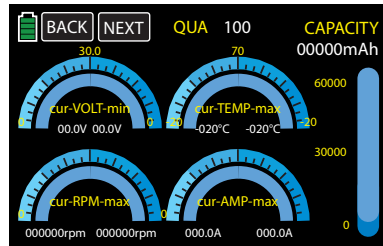
In addition to the current position data and model speed in the center of the display, the current height is displayed in relation to the starting location along with the ascent and descent of the module in m/s and m/3s; the current reception as well as the distance from the starting location are also shown.

Value	Explanation
<b>QUA</b>	Signal package quality (in percent) of data sent from the transmitter arriving at the receiver
<b>DIST</b>	Distance (in meters)
<b>N</b>	North/South coordinates in degrees, minutes and seconds (dd°mm ssss)
<b>W</b>	West/East coordinates in degrees, minutes and seconds (dd°mm ssss)
<b>m/s</b>	Ascent/descent (in meters per second)
<b>m/3s</b>	Ascent/descent (in meters per three seconds)
<b>km/h</b>	Above-ground speed (in kilometers per hour) calculated by the GPS system
<b>ALT</b>	Current altitude relative to starting location

**Notice**

» If the telemetry connection is interrupted for longer than three seconds (and if the transmitter is not switched off), the last successfully transmitted GPS coordinates are saved in the transmitter's flash memory drive. This saved data can be read on the GPS display using the transmitter control buttons by going back to the main display or navigating to the GPS display menu.

**ESC (Electronic Speed Controller)**



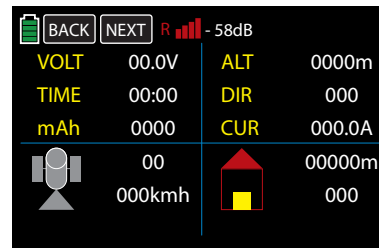
This display shows the data from a HoTT compatible brushless controller connected to the receiver with integrated telemetry.

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.

Value	Explanation
<b>QUA</b>	Signal package quality (in percent) of data sent from the transmitter arriving at the receiver
<b>cur-VOLT-min</b>	<i>In volts:</i> Left side: actual input voltage Right side: lowest input voltage since the device has been switched on

<b>cur-TEMP-max</b>	<i>In Celsius:</i> Left side: current controller temperature Right side: maximum controller temperature since the device has been switched on
<b>cur-RPM-max</b>	<i>In revolutions per minute:</i> Left side: current motor speed Right side: maximum motor speed since the device has been switched on
<b>cur-AMP-max</b>	<i>In amps:</i> Left side: Momentary current Right side: maximum current since the device has been switched on

**Microcopter Display**

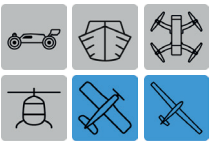


This screen displays the data of a HoTT-compatible microcopter. The display screen appears after the electric air, Vario and GPS module screens.

Value	Explanation
<b>VOLT</b>	Actual voltage
<b>Time</b>	Time device has been active
<b>mAh</b>	Battery charge used since the device has been turned on
<b>00</b>	Satellite position number
<b>km/h</b>	Above-ground speed (in kilometers per hour) calculated by the GPS system

<b>ALT</b>	Current altitude relative to starting location
<b>DIR</b>	Direction of movement
<b>CUR</b>	Momentary current (in amps)
<b>m</b>	Distance (in meters) from the starting location calculated by the GPS system
<b>000</b>	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 of the display.



# Programming Example

## Phase-Specific Flaps Trimming

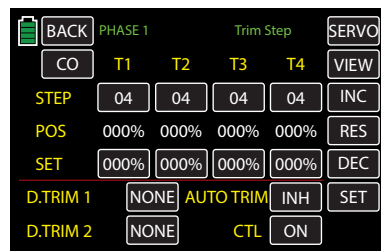
The following example shows how to correct the trimming of the phase-specific (and recallable) flaps trimming through only *one* control element in all the phases.

To understand this programming example make sure: individual menu descriptions are read and understood, be familiar with basic transmitter use, perform the fixed-wing **Receiver Configuration** according to the instructions (page 32), completely program the model into the transmitter, mechanically adjust the controls and understand the correct lateral deflection of all rudders. It helps, but does not hinder, if the model has already performed test flights and received the resulting adjustments.

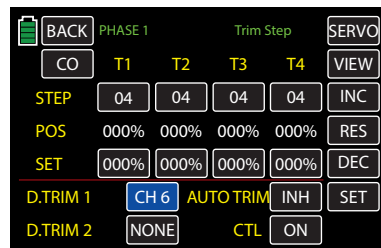
### Programming

Turn on the transmitter and start programming the flaps positions in the BASE submenu **Trim Step**.

### Trim Step



In one of the two **D.TRIM** lines press to highlight blue the **NONE** button. Press the **INC** or **DEC** buttons or the arrow keys (▲▼) to select **CH6**:



Back out and navigate to the FUNCTION submenu **Prog.MIX**.

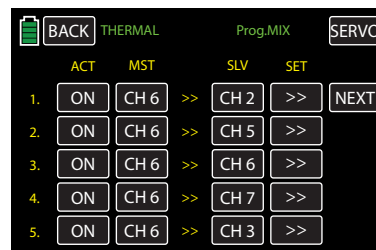
### Prog.MIX

Bring up the desired phase.

Program the mixer numbers into the phase according to the following schema:

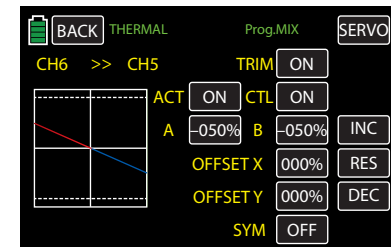
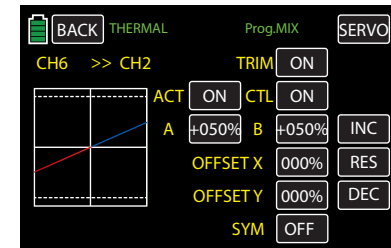
- Left/Right Ailerons:  
**CH6 >> CH2**  
**CH6 >> CH5**
- Single Left/Right Flaps Pair:  
**CH6 >> CH6**  
**CH6 >> CH7**
- Second Left/Right Flaps Pair:  
**CH6 >> CH9**  
**CH6 >> CH10**

For a model type with **2AILE 2FLAPS**, reference the "THERMAL" display example as follows:

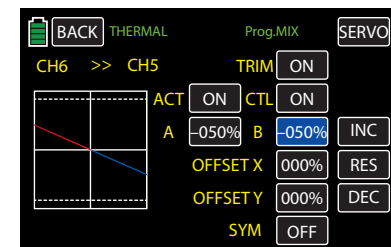
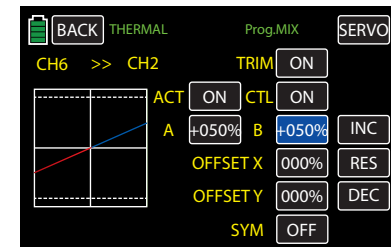


The mixing direction of the individual mixer pairs may need to be set individually, depending on the wing servos installation situation and the desired operating direction of the selected digital trim button.

Individually setting mixing directions allows for contrasting and parallel mixing directions for each flap pair:

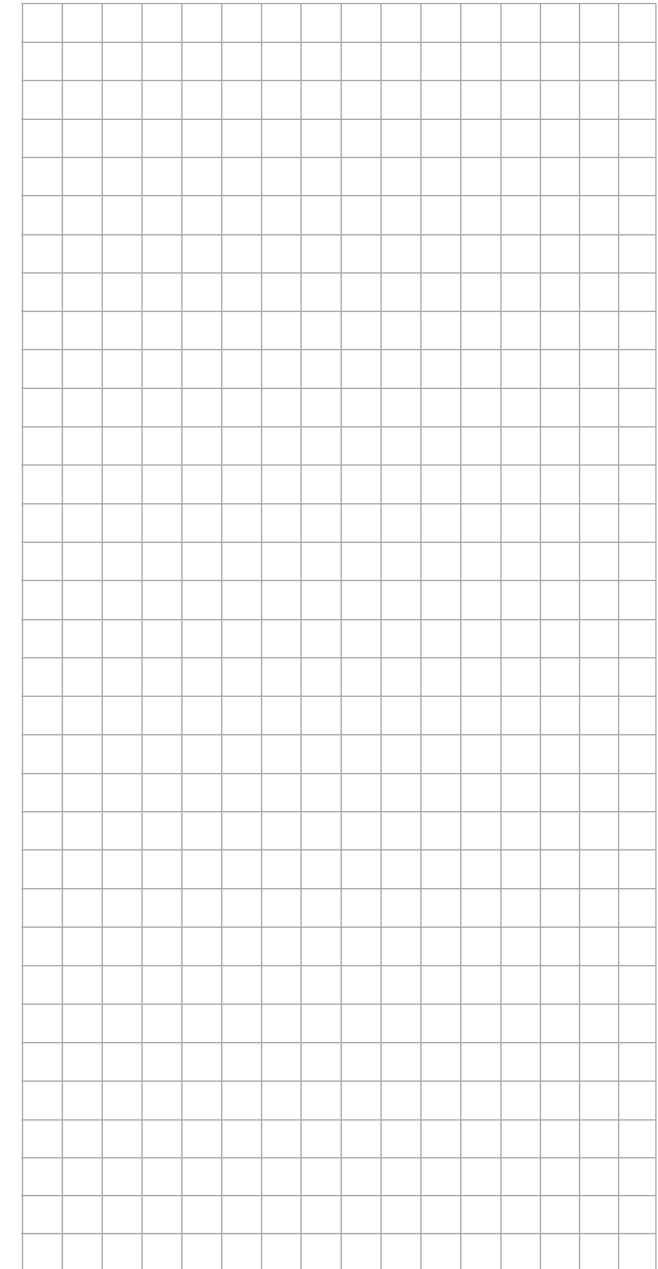
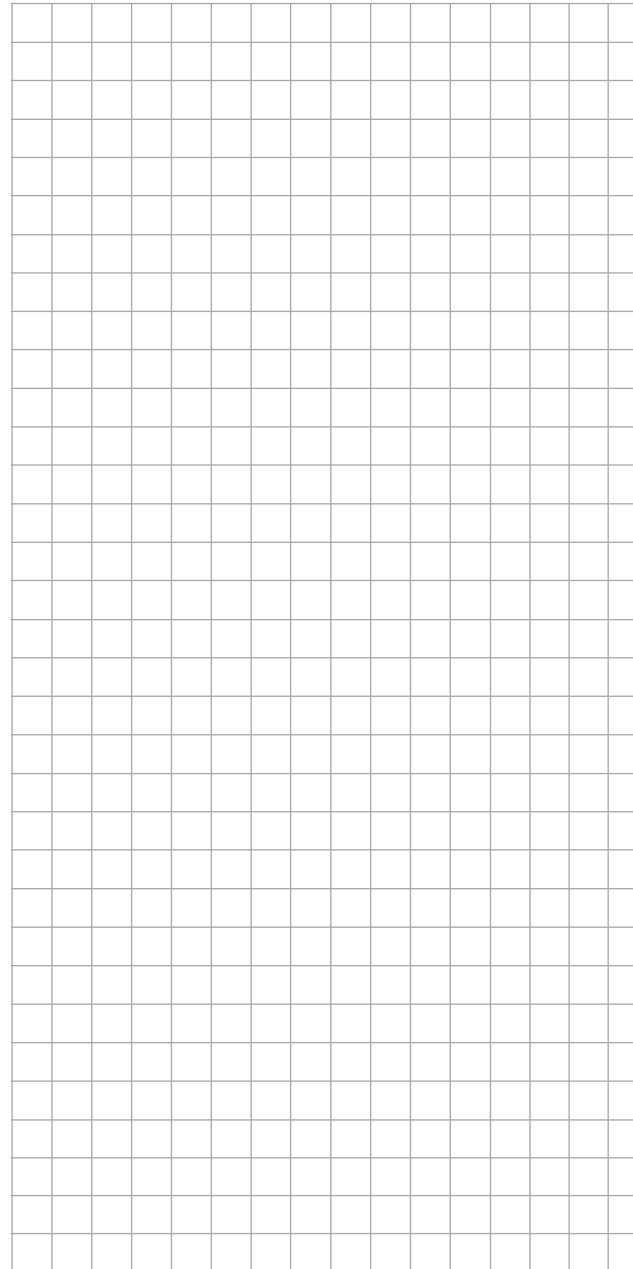
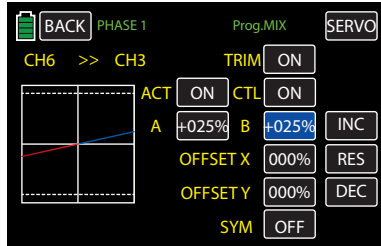


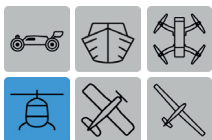
In both cases, the trimming distance (max. 37.5% at 125% admixture) is determined according to the mixing proportion:



Continue to set all flaps in each phase in the same manner.

Lastly, determine the proportional entrainment of the elevator via the mixing value and the mixing direction of the mixer **CH6 >> CH3**, as shown below:





# Programming Example

## Phase-Specific Pitch Trimming

The following example shows how to correct the trimming of the phase-specific (and recallable) pitch trimming through only *one* control element in all the phases.

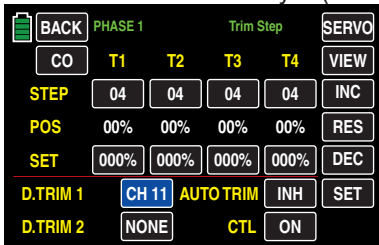
To understand this programming example make sure: individual menu descriptions are read and understood, be familiar with basic transmitter use, perform the fixed-wing **Receiver Configuration** according to the instructions (page 31), completely program the model into the transmitter, mechanically adjust the controls and understand the correct lateral deflection of all rudders. It helps, but does not hinder, if the model has already performed test flights and received the resulting adjustments.

### Programming

To start adjusting pitch trimming, open the BASE sub-menu **Trim Step** and assign a digital trim button.

### Trim Step

In the example below, the control channel CH11 is normally unassigned in helicopter models. In one of the two **D.TRIM** lines press to highlight blue the **NONE** button. Press the **INC** or **DEC** buttons or the arrow keys (▲▼) to select **CH11**:

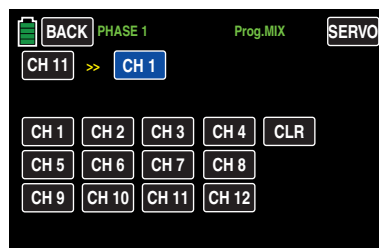


Back out and navigate to the FUNCTION sub-menu **Prog.MIX**.

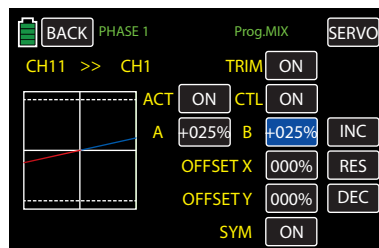
### Prog.MIX

Bring up the desired phase.

Create a mixer function **CH11 >> CH1** in any desired phase:

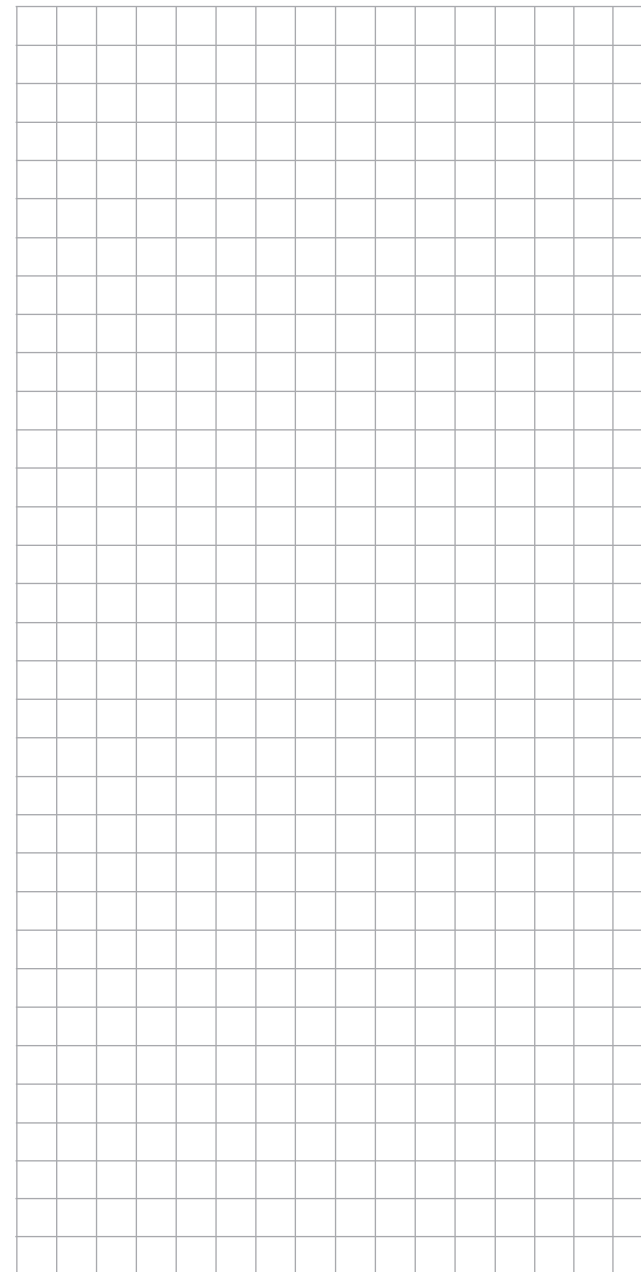


On the setting side of the mixer(s), define a symmetrical mixing proportion. In the example below, the proportion is **25%**:



Note that the operating direction of the digital trim button from the mixing direction and the trimming distance (max. 37.5% at 125% admixture) are determined proportionally from the adjusted mixing ratio.

The D.TRIM1 button used in this example acts equally on all available pitch servos without influencing the throttle servo due to internal coupling.







# Programming example



## Phase-Specific Trimming: RPM Setting for CH6 Governor

After programming the speed setting of the governor, use this option for additional programming via one of the two digital trim buttons to trim. Trimming during flight is possible.

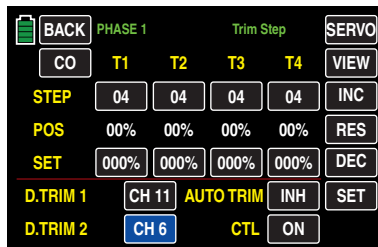
To understand this programming example make sure: individual menu descriptions are read and understood, be familiar with basic transmitter use, perform the fixed-wing **Receiver Configuration** according to the instructions (page 31), completely program the model into the transmitter, mechanically adjust the controls and understand the correct lateral deflection of all rudders. It helps, but does not hinder, if the model has already performed test flights and received the resulting adjustments.

### Programming

To start adjusting this setting, open the BASE sub-menu **Trim Step** and assign a digital trim button.

### Trim Step

In the example below, D.TRIM 2 is being programmed with the throttle control channel **CH6**:

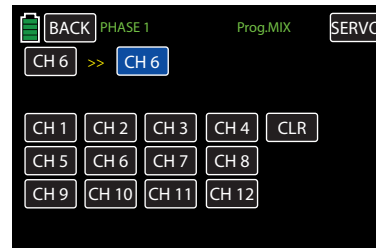


Back out and navigate to the FUNCTION sub-menu **Prog.MIX**.

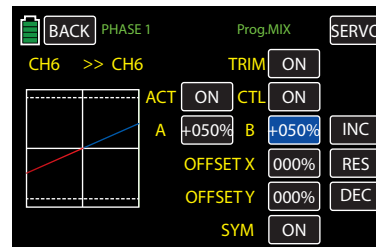
### Prog.MIX

Bring up the desired phase.

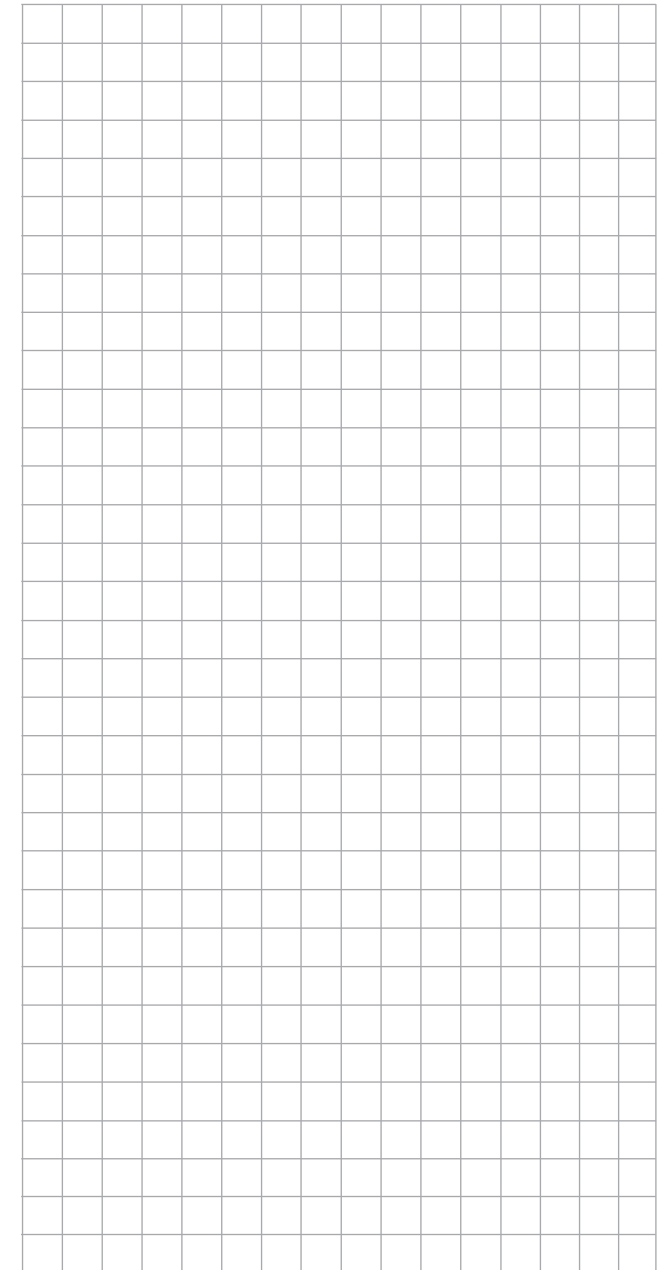
Create a *same-channel* mixer function **CH6 >> CH6** in any desired phase:



On the setting side of the mixer(s), define a symmetrical mixing proportion. In the example below, the proportion is **50%**:



Note that the operating direction of the digital trim button from the mixing direction and the trimming distance (max. 37.5% at 125% admixture) are determined proportionally from the adjusted mixing ratio.



# Appendix



## PRX (Receiver Power)

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. Compatible with different receiver batteries for uncomplicated, 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 battery failure.

- 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 switch and LED construction not to influence the characteristics and the optic of the model
- Flatter design of the fastening brackets, LEDs and switches for easy installation with an accompanying drilling template.



## Graupner HoTT GPS/Vario Module

No. 33600

Vario with altitude signals and five tones for ascending and descending, an integrated GPS with distance measurement, travel measurement, speed display, and flight direction/coordinates display.

- 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 Vario sensor can be connected directly to the telemetry input of the receiver.

Technical data for the Vario:

- Altitude measurement: -500m to +3000m
- Resolution: 0.1 m
- Vario sensitivity: programmable 0.5 m/3s, 1 m/3s, 0.5 m/s, 1 m/s, 3 m/s pro tone
- Average calculation: programmable 4 - 20 measurements per measured value



## Vario Module Graupner HoTT

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

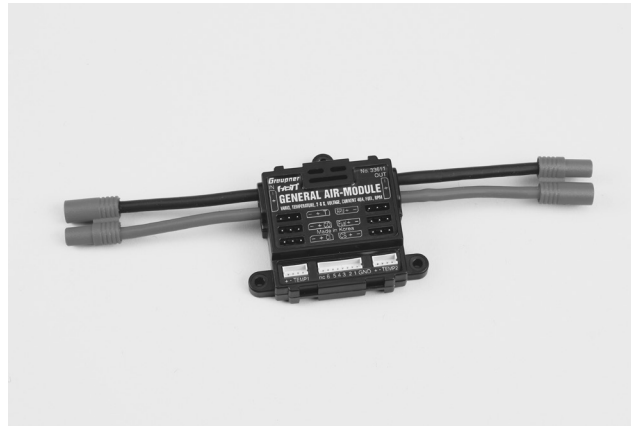
- Altitude measurement: -500 m to +3000 m
- Resolution: 0.1 m
- Vario sensitivity: programmable 0.5 m/3s, 1 m/3s, 0.5 m/s, 1 m/s, 3 m/s pro tone
- Average calculation: programmable 4 - 20 measurements per measured value



**Graupner HoTT General Engine Module**  
No. 33610

General sensor for *Graupner* HoTT receivers and models with gas engine 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
- 1x current and voltage and capacity measurement up to 40 A (short-term 1 sec 60 A) and up to 30 V
- 1x single cell monitoring for 2 - 6S lithium batteries (LiPo, lithium ion, LiFe), see [www.graupnerusa.com](http://www.graupnerusa.com) for the related items



**Graupner HoTT General Air Module**  
No. 33611

General sensor for *Graupner* HoTT receivers and models with gas engine 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 to +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
- 1x speed controller/servo input, 1x rotational speed regulation input, 1x speed controller/servo output for rotational speed regulation
- 1x current and voltage and capacity measurement up to 40 A (short-term 1 sec 60 A) and up to 30 V
- etc., see [www.graupnerusa.com](http://www.graupnerusa.com) for the related items



**Graupner HoTT Electric Air Module**  
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 to +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, lithium ion, LiFe)
- 1x Telemetry connection for receiver



**Graupner HoTT RPM Magnetic Sensor**  
No. 33616

For connecting to the General Engine (No. 33610) or General Air Module (No. 33611).

Select the number of blades in the module's **Telemetry** menu.

**Graupner HoTT RPM optical sensor**  
No. 33615

For connecting to the General Engine (No. 33610) or General Air Module (No. 33611).

Select the number of blades in the module's **Telemetry** menu.



**Graupner HoTT Smart-Box**  
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 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. 55g



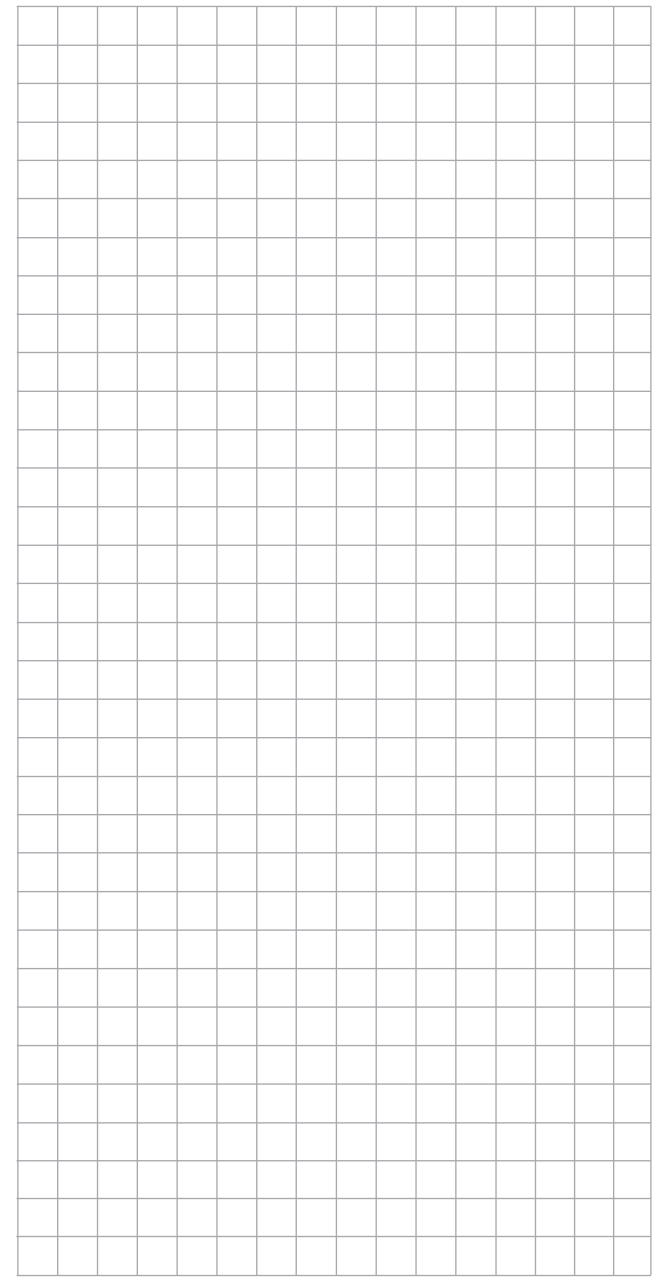
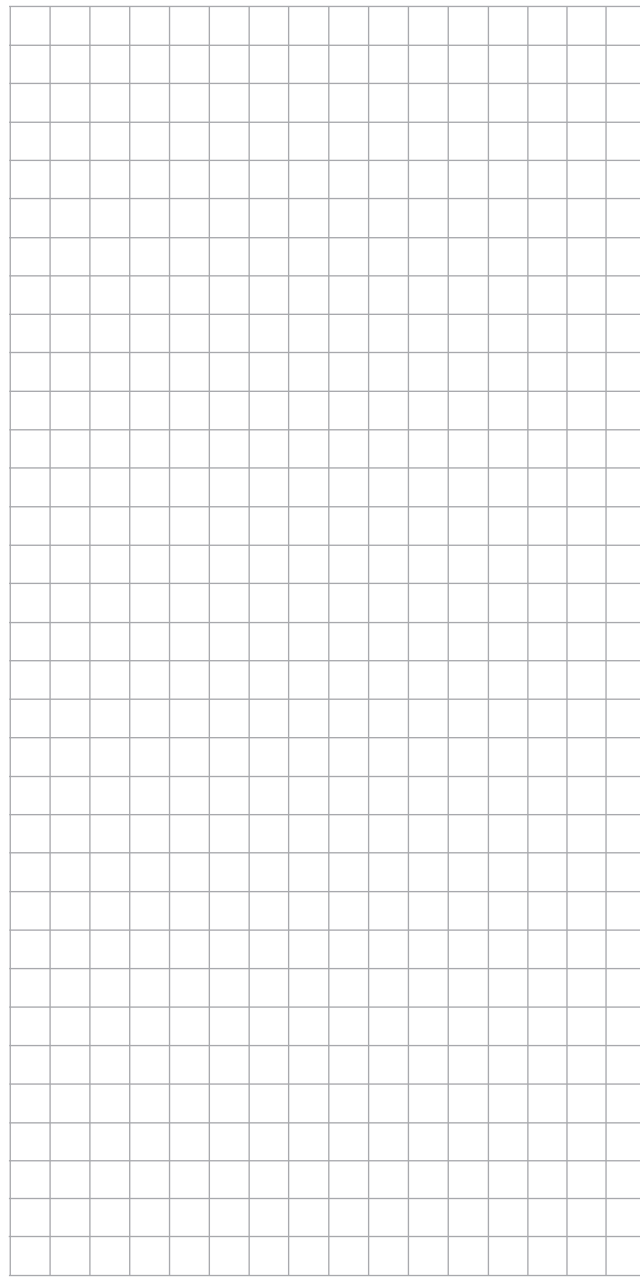
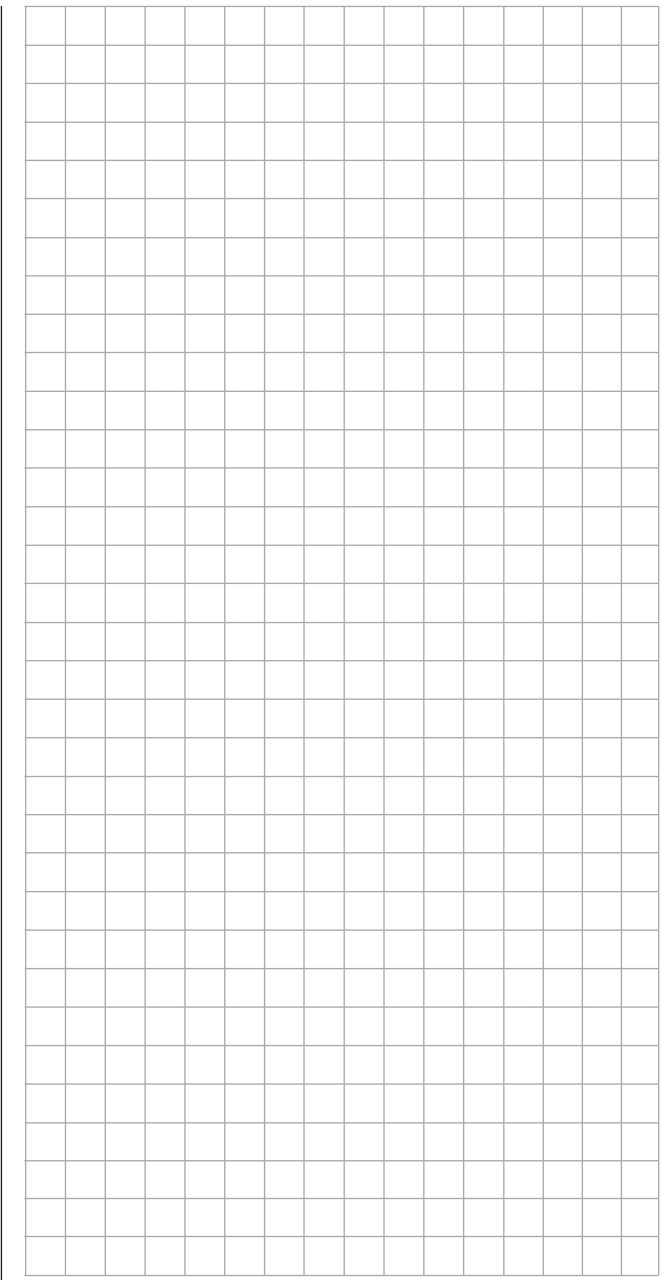
**Graupner HoTT USB Interface**  
No. 7168.6

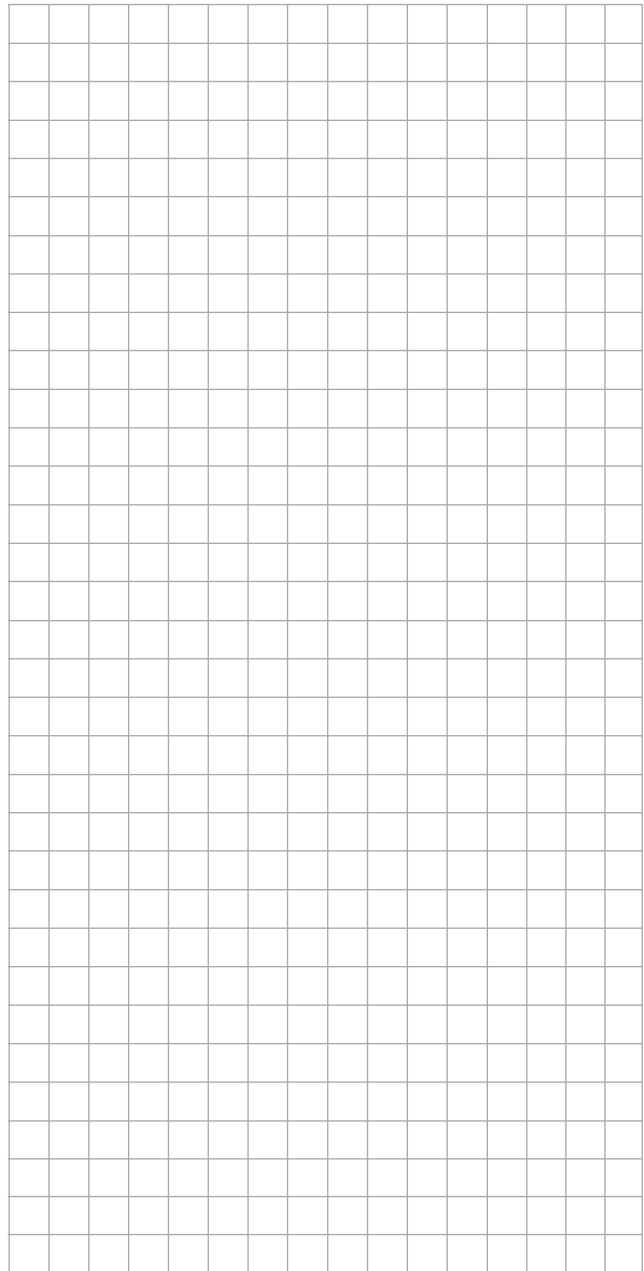
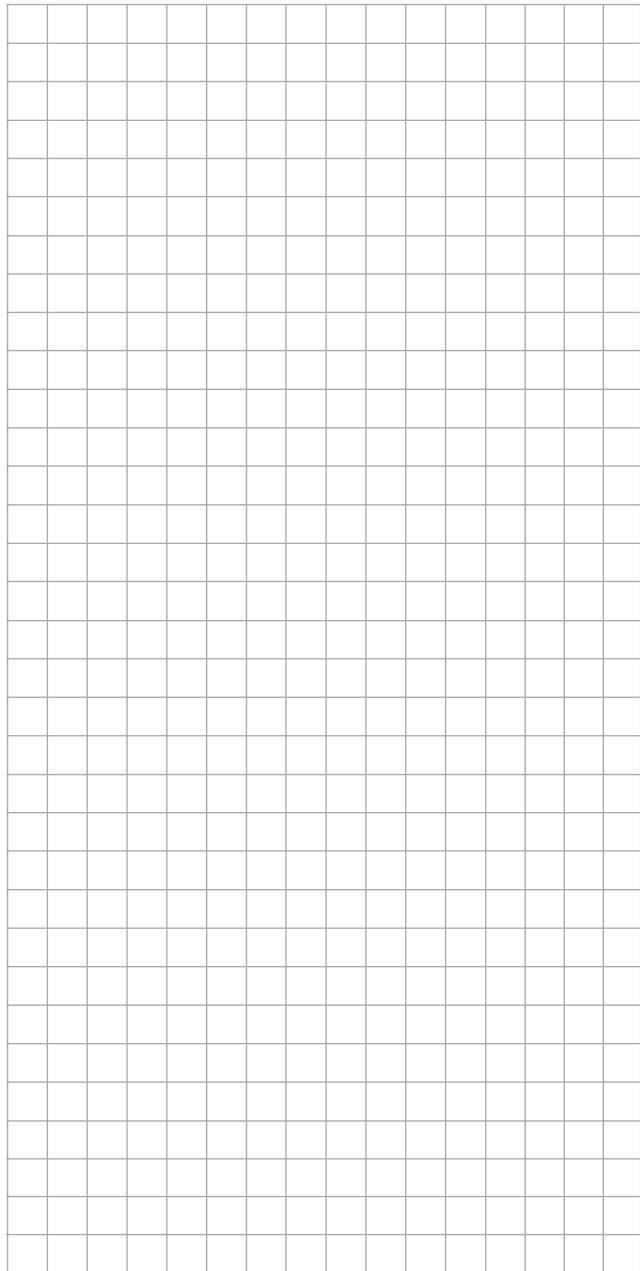
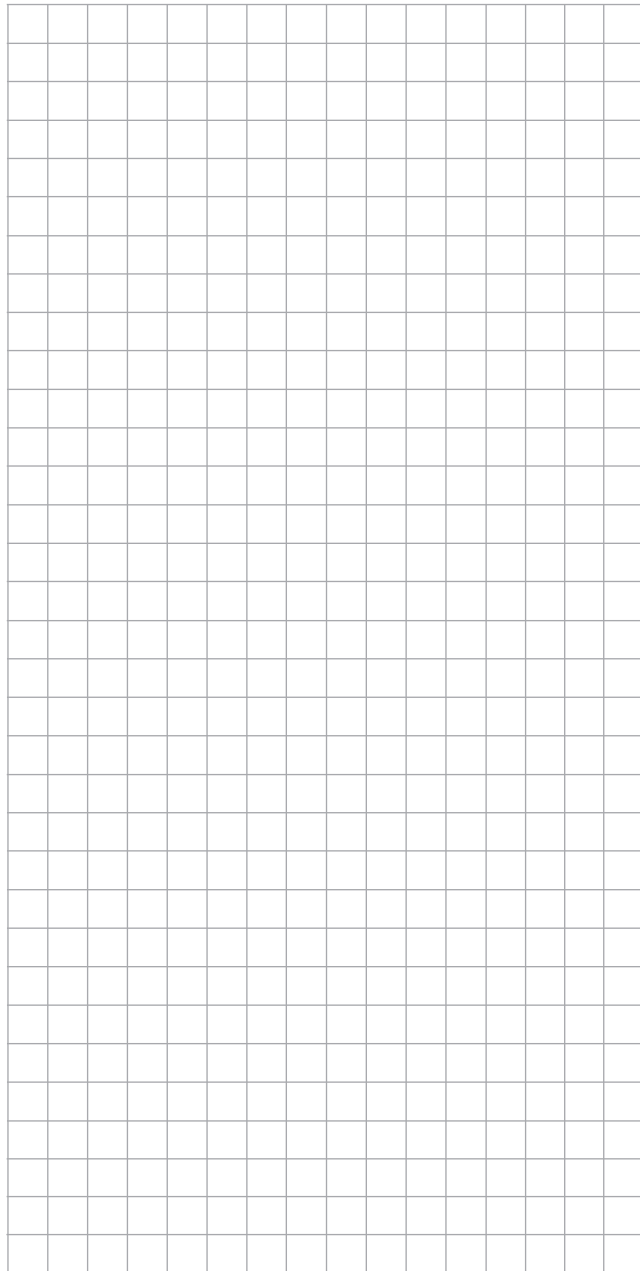
This adapter cable is required together with the separately available USB interface (order No. 7168.6), for updating receivers and sensors.

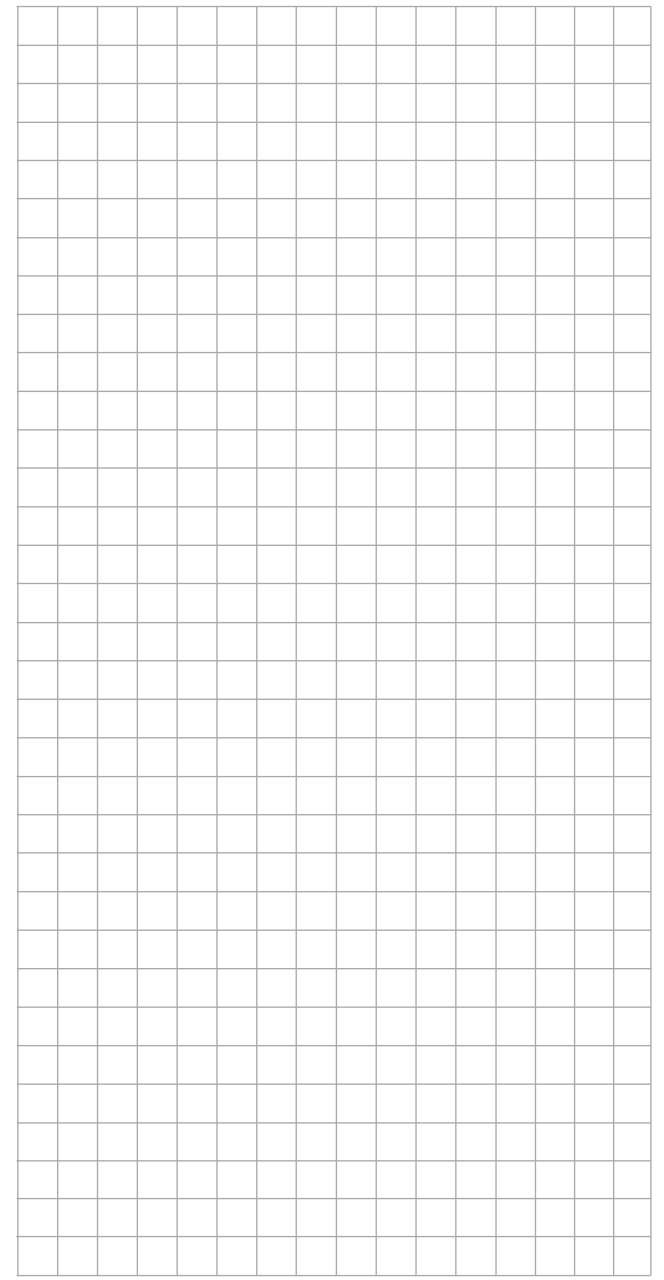
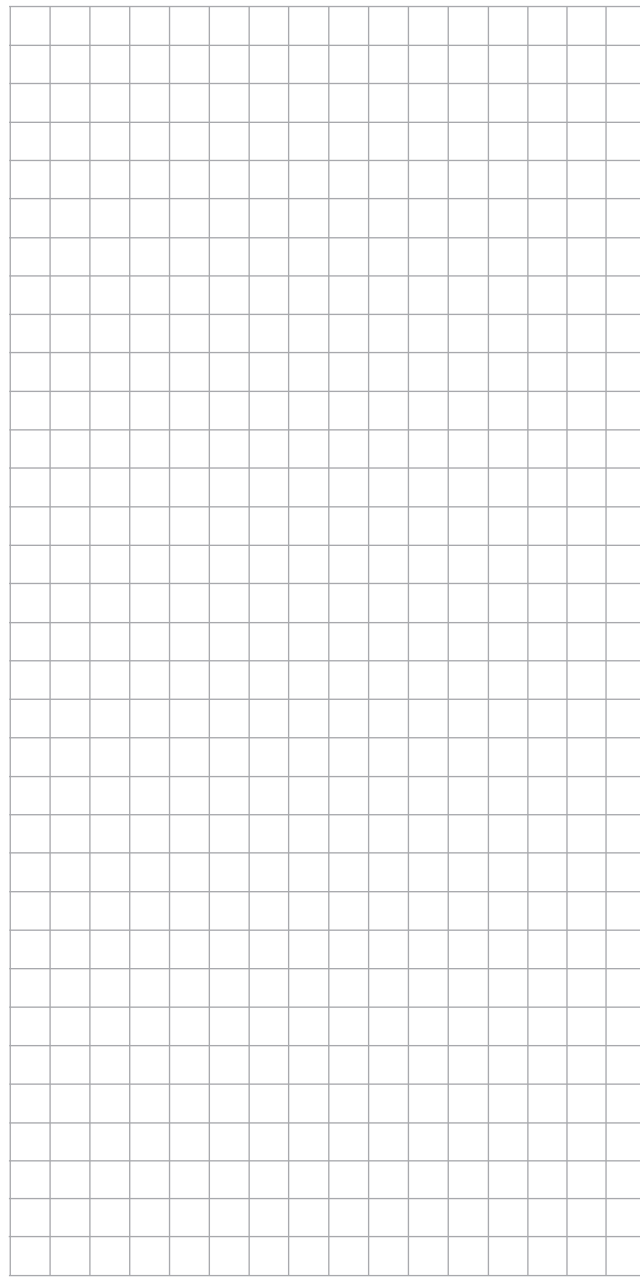
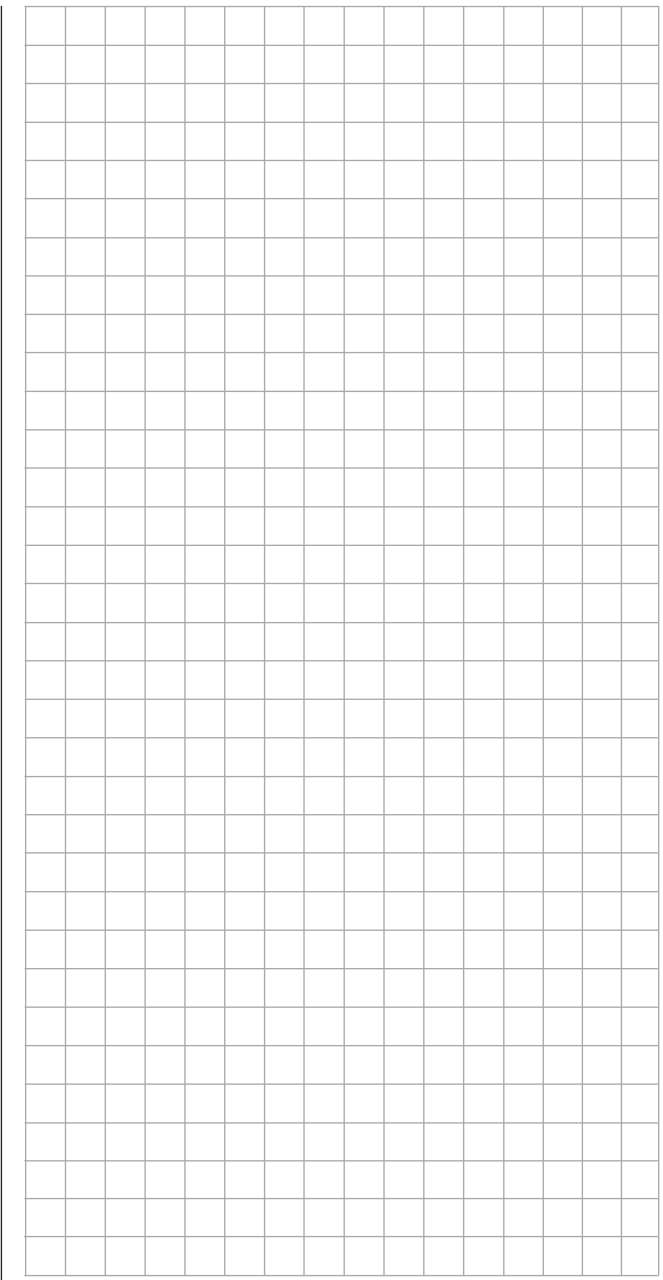


**Graupner HoTT Adapter Cable**  
No. 7168.6S

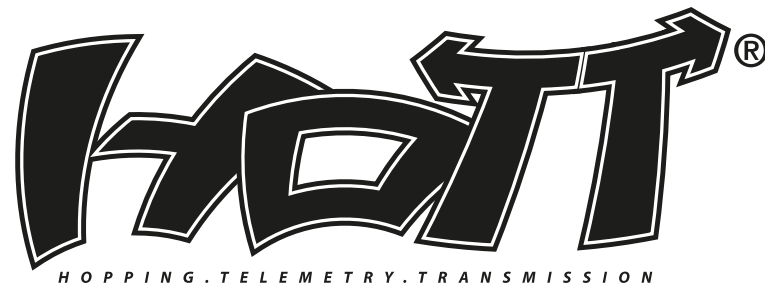
This adapter cable is required together with the separately available USB interface (No. 7168.6), for updating receivers and sensors. The **mz-24** HoTT Pro transmitter can be updated directly with the USB cable included in the delivery of the interface.







# **Graupner**



GRAUPNER USA  
3941 PARK DRIVE ST 20-571  
EL DORADO HILLS 95762  
UNITED STATES

<http://www.graupnerusa.com>

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PN.UG-01 (V2016/mg)

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