

MX-16iFS.1.gb

Graupner | **iFS**

INTELLIGENT-FREQUENCY-SELECT

COMPUTER-SYSTEM

MX-16 iFS

**3D-CYLINDER-
ROTARY-SELECT**



Programming Manual

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The sole purpose of this manual is to provide information; it is subject to amendment without prior notification. The *GRAUPNER* company accepts no responsibility or liability for errors or inaccuracies which may be found in the information contained in this manual.

Environmental protection



This symbol on the product, in the operating instructions or the packaging indicates that the product must not be discarded via the normal household refuse at the end of its useful life. Instead it must be taken to a collection

point for the recycling of electrical and electronic apparatus.

The materials can be re-used according to their identification code. You can make an important contribution to the protection of our shared environment by recycling old equipment and making use of its basic materials.

Dry and rechargeable batteries must be removed from the device and taken to the appropriate collection point. Please ask your local authority for the location of your nearest waste disposal site.

Safety Notes

Please read carefully!

We all want you to have many hours of pleasure in our mutual hobby of modelling, and safety is an important aspect of this. It is absolutely essential that you read right through these instructions and take careful note of all our safety recommendations.

If you are a beginner to the world of radio-controlled model aircraft, boats and cars, we strongly advise that you seek out an experienced modeller in your field, and ask him or her for help and advice.

If you ever dispose of this transmitter, these instructions must be passed on to the new owner.

Application

This radio control system may only be used for the purpose for which the manufacturer intended it, i.e. for operating radio-controlled models which *do not carry humans*. No other type of use is approved or permissible.

Safety notes

SAFETY IS NO ACCIDENT
and

RADIO-CONTROLLED MODELS
ARE NOT PLAYTHINGS

Even small models can cause serious personal injury and damage to property if they are handled incompetently, or if an accident occurs due to the fault of others.

Technical problems in electrical and mechanical systems can cause motors to rev up or burst into life unexpectedly, with the result that parts may fly off at great speed, causing considerable injury.

Short-circuits of all kinds must be avoided at all times. Short-circuits can easily destroy parts of the radio control system, but even more dangerous is the acute risk of fire and explosion, depending on the circumstances and the energy content of the batteries.

Aircraft and boat propellers, helicopter rotors, open gear-

boxes and all other rotating parts which are driven by a motor or engine represent a constant injury hazard. Do not touch these items with any object or part of your body. Remember that a propeller spinning at high speed can easily slice off a finger! Ensure that no other object can make contact with the driven components.

Never stand in the primary danger zone, i.e. in the rotational plane of the propeller or other rotating parts, when the motor is running or the drive battery is connected.

Please note that a glowplug engine or electric motor could burst into life accidentally if the receiving system is switched on when you are transmitting the transmitter. To be on the safe side, disconnect the fuel tank or the flight battery.

Protect all electronic equipment from dust, dirt, damp, and foreign bodies. Avoid subjecting the equipment to vibration and excessive heat or cold. Radio control equipment should only be used in "normal" ambient temperatures, i.e. within the range -15°C to +55°C.

Avoid subjecting the equipment to shock and pressure. Check the units at regular intervals for damage to cases and leads. Do not re-use any item which is damaged or has become wet, even after you have dried it out thoroughly.

Use only those components and accessories which we expressly recommend. Be sure to use only genuine matching *GRAUPNER* connectors of the same design with contacts of the same material.

When deploying cables ensure that they are not under strain, are not tightly bent (kinked) or broken. Avoid sharp edges, as they can chafe through insulating materials.

Before you use the system, check that all connectors are pushed home firmly. When disconnecting components, pull on the connectors themselves – not on the wires.

It is not permissible to carry out any modifications to the RC system components, as any such changes invalidate both your operating licence and your insurance cover.

Installing the receiving system and deploying the receiver aerial

In a model aircraft the receiver must be packed in soft foam and stowed behind a stout bulkhead, and in a model boat or car it should be protected effectively from dust and spray.

The receiver must not make direct contact with the fuselage, hull or chassis at any point, otherwise motor vibration and landing shocks will be transmitted directly to it. When installing the receiving system in a model with a glowplug or petrol engine, be sure to install all the components in well-protected positions, so that no exhaust gas or oil residues can reach the units and get inside them. This applies above all to the ON / OFF switch, which is usually installed in the outer skin of the model.

Secure the receiver in such a way that the aerial, servo leads and switch harness are not under any strain. The receiver aerial should be at least 5 cm away from all large metal parts and any wiring which is not connected directly to the receiver. This includes steel and carbon fibre components, servos, electric motors, fuel pumps, cabling of all kinds, etc..

Ideally the receiver should be installed well away from any other installed equipment in the model, but in an easily accessible position. Under no circumstances allow servo leads to run close to the aerial, far less coiled round it!

Ensure that cables are fastened securely, so that they cannot move close to the receiver aerial when the model is flying.

The orientation of the aerial is not critical, but mounting it vertically inside the model is generally advantageous.

Installing the servos

Always install servos using the vibration-damping grommets supplied. The rubber grommets provide some degree of protection from mechanical shock and severe vibration.

Installing control linkages

The basic rule is that all linkages should be installed in such

Safety Notes

a way that the pushrods move accurately, smoothly and freely. It is particularly important that all servo output arms can move to their full extent without fouling or rubbing on anything, or being obstructed mechanically at any point in their travel.

It is essential that you should be able to stop your motor at any time. With a glow motor this is achieved by adjusting the throttle so that the barrel closes completely when you move the throttle stick and trim to their end-points.

Ensure that no metal parts are able to rub against each other, e. g. when controls are operated, when parts rotate, or when motor vibration affects the model. Metal-to-metal contact causes electrical “noise” which can interfere with the correct working of the receiver.

Directing the transmitter aerial

Transmitter field strength is at a minimum in an imaginary line extending straight out from the transmitter aerial. It is therefore fundamentally misguided to “point” the transmitter aerial at the model with the intention of obtaining good reception.

When several radio control systems are in use on adjacent channels, the pilots should always stand together in a loose group. Pilots who insist on standing away from the group endanger their own models as well as those of the other pilots.

Pre-flight checking

Before you switch on the receiver, ensure that the throttle stick is at the stop / idle end-point.

**Always switch on the transmitter first,
and only then the receiver.**

**Always switch off the receiver first,
and only then the transmitter.**

If you do not keep to this sequence, i.e. if the receiver is at any time switched on when “its” transmitter is switched OFF, then the receiver is wide open to signals from other trans-

mitters and any interference, and may respond. The model could then carry out uncontrolled movements, which could easily result in personal injury or damage to property. Please take particular care if your model is fitted with a *mechanical gyro*: before you switch your receiver off, disconnect the power supply to ensure that the motor cannot run up to high speed accidentally.

As it runs down, the gyro can generate such a high voltage that the receiver picks up apparently valid throttle commands, and the motor could respond by unexpectedly bursting into life.

Range checking

Before every session check that the system works properly in all respects, and has adequate range. In this regard it is essential to read the notes on page 24 and the instructions supplied with the receiver you are using.

When operating a model, i.e. when flying or driving, do not operate the transmitter without the aerial fitted. Check that the transmitter aerial is firmly seated.

Operating your model aircraft, helicopter, boat or car

Never fly directly over spectators or other pilots, and take care at all times not to endanger people or animals. Keep well clear of high-tension overhead cables. Never operate your model boat close to locks and full-size vessels. Model cars should never be run on public streets or motorways, footpaths, public squares etc..

Checking the transmitter and receiver batteries

It is essential to stop using the radio control system and recharge the batteries well before they are completely discharged. In the case of the transmitter this means – at the very latest – when the message “**battery needs charging**” appears on the screen, and you hear an audible warning signal.

It is vital to check the state of the batteries at regular intervals – especially the receiver pack. When the battery is almost flat you may notice the servos running more slowly, but it is by no means safe to keep flying or running your model until this happens. Always replace or recharge the batteries in good time.

Keep to the battery manufacturer’s instructions, and don’t leave the batteries on charge for longer than stated. Do not leave batteries on charge unsupervised.

Never attempt to recharge dry cells, as they may explode. Rechargeable batteries should always be recharged before every session. When charging batteries it is important to avoid short-circuits. Do this by first connecting the banana plugs on the charge lead to the charger, taking care to maintain correct polarity. Only then connect the charge lead to the transmitter or receiver battery.

Disconnect all batteries and remove them from your model if you know you will not be using it in the near future.

Capacity and operating times

This rule applies to all forms of electrical power source: battery capacity is reduced every time you charge the pack. At low temperatures capacity is greatly reduced, i.e. operating times are shorter in cold conditions.

Frequent charging, and / or the use of maintenance programs, tends to cause a gradual reduction in battery capacity. We recommend that you check the capacity of all your rechargeable batteries at least every six months, and replace them if their performance has fallen off significantly.

Use only genuine *GRAUPNER* rechargeable batteries!

Suppressing electric motors

To a greater or lesser extent, all conventional electric motors produce sparks between commutator and brushes, depending on the motor type; the sparking generates serious interference to the radio control system. If an RC system is to

work correctly, it is therefore important to suppress the electric motors, and in electric-powered models it is essential that every motor should be effectively suppressed. Suppressor filters reliably eliminate such interference, and should always be fitted where possible.

Please read the notes and recommendations supplied by the motor manufacturer.

Refer to the main *GRAUPNER* FS catalogue or the Internet website at www.graupner.de for more information on suppressor filters.

Servo suppressor filter for extension leads

Order No. **1040**

Servo suppressor filters are required if you are obliged to use long servo extension leads, as they eliminate the danger of de-tuning the receiver. The filter is connected directly to the receiver input. In very difficult cases a second filter can be used, positioned close to the servo.

Using electronic speed controllers

The basic rule is that the electronic speed controller must be chosen to suit the size of the electric motor it is required to control.

There is always a danger of overloading and possibly damaging the speed controller, but you can avoid this by ensuring that the controller's current-handling capacity is at least half the motor's maximum stall current.

Particular care is called for if you are using a "hot" (i.e. upgrade) motor, as any low-turn motor (small number of turns on the winding) can draw many times its nominal current when stalled, and the high current will then burn out the speed controller.

Electrical ignition systems

Ignition systems for internal combustion engines can also produce interference, which has an adverse effect on the working of the radio control system.

Electrical ignition systems should always be powered by a separate battery – not the receiver battery.

Be sure to use effectively suppressed spark plugs and plug caps, and shielded ignition leads.

Keep the receiving system an adequate distance away from the ignition system.

Static charges

Lightning causes magnetic shock waves which can interfere with the operation of a radio control transmitter even if the thunderstorm actually occurs several kilometres away. For this reason ...

... cease flying operations immediately if you notice an electrical storm approaching. Static charges through the transmitter aerial can be life-threatening!

Caution

- In order to fulfil the FCC RF radiation regulations applicable to mobile transmitting apparatus, the equipment's aerial must be at least 20 cm from any person when the system is in use. We therefore do not recommend using the equipment at a closer range than 20 cm.
- Ensure that no other transmitter is closer than 20 cm from your equipment, in order to avoid adverse effects on the system's electrical characteristics and radiation pattern.
- Before you use the radio control system, the receiver must be programmed correctly to suit the country in which you are operating. This is essential in order to fulfil various FCC, ETSI and IC directives. Please refer to the instructions provided with your receiver.
The receiver included with the system is set up at the factory for use in most European countries.
- Never attempt to program the transmitter RF module whilst you are operating a model. For the same reason do not touch any of the programming buttons on the RF module at such times.

Care and maintenance

Don't use cleaning agents, petrol, water or other solvents to clean your equipment. If the case, the aerial etc. gets dirty, simply wipe the surfaces clean with a soft dry cloth.

Components and accessories

As manufacturers, the company of *GRAUPNER* GmbH & Co. KG recommends the exclusive use of components and accessories which have been tested by *GRAUPNER* and approved for their capability, function and safety. If you observe this rule, *GRAUPNER* accepts responsibility for the product.

***GRAUPNER* cannot accept liability for non-approved components or accessories made by other manufacturers. It is not possible for *GRAUPNER* to assess every individual item manufactured by other companies, so we are unable to state whether such parts can be used without incurring a safety risk.**

Liability exclusion / Compensation

We at *GRAUPNER* are unable to ensure that you observe the operating instructions, and are not in a position to influence the way you install, operate and maintain the radio control system components. For this reason we are obliged to refute all liability for loss, damage or costs which are incurred due to the incompetent or incorrect use and operation of our products, or which are connected with such operation in any way.

Unless otherwise prescribed by law, the obligation of the *GRAUPNER* company to pay compensation is limited to the invoice value of that quantity of *GRAUPNER* products which was immediately and directly involved in the event in which the damage occurred. This does not apply if *GRAUPNER* is found to be subject to unlimited liability according to binding legal regulation on account of deliberate or gross negligence.

MX-16iFS – the latest generation of radio control technology

2.4 GHz iFS technology (iFS = intelligent Frequency Select) with bi-directional communication between transmitter and receiver represents a further milestone in radio control technology. Several years of development and a comprehensive programme of testing have led to the introduction of this new *Graupner* iFS system. The development phase was accompanied by intensive practical testing which has confirmed the many advantages of the overall design.

The *Graupner*/JR MC-24 computer radio control system was introduced back in 1997, and the MX-16iFS retains many of its features, refined to meet the needs of the beginner. Although the MX-16iFS is intended primarily for the inexperienced user, it is still capable of controlling all current types of model, from fixed-wing model aeroplanes and helicopters to model boats and cars.

In the area of fixed-wing models and helicopters it is often necessary to employ complex mixer functions for the control surfaces or the swashplate actuation system. Computer technology enables you to activate a vast range of functions to cope with special model requirements – just by pressing a button. With the MX-16iFS all you do is select the appropriate model type, and the software then presents you automatically with the appropriate mixer and coupling functions. This means that the transmitter requires no additional modules in order to implement complex coupled functions, and you can forget all about old-fashioned mechanical mixers in the model. The MX-16iFS provides an extremely high level of safety and reliability in use.

The MX-16iFS offers twelve model memories, each of which can store model settings for different flight phases. Individual phases can be called up in flight simply by operating a switch, so that you can try out various settings

quickly and without risk. This can be for test purposes or for varying parameters for different phases of flight.

The large graphic screen makes operating the transmitter a simple, intuitive process. Mixers and other functions can be displayed in graphic form, and this is extraordinarily helpful.

The beginner soon becomes familiar with the wide range of functions available thanks to the clear, logically arranged program structure. Adjustments are made using just three buttons on the left, together with the rotary cylinder to the right of the high-contrast screen, and in this way you very quickly learn how to make full use of all the options you need, according to your experience in handling radio-controlled models.

The digital modulation of the “intelligent frequency select” process provides the extremely high servo travel resolution of 65,536 steps, guaranteeing ultra-fine control. In theory the *Graupner* iFS system permits the simultaneous use of up to 120 models, although in practice the mixed operation of different technical systems in the 2.4 GHz band – as required by the approval regulations – reduces this number considerably. Generally, however, it will always be possible to operate even more models simultaneously on the 2.4 GHz band than on the 35 / 40 MHz frequency bands which we have used to date. However, the actual limiting factor – as it has always been – is likely to remain the size of the (air-) space available. The simple fact that no frequency control procedure is necessary equates to an enormous gain in safety, especially at flying sites such as gliding slopes where groups of pilots may be distributed over a large area, with nobody in overall control.

The XZ-P1 iFS programming module, which is available as an optional accessory, provides a simple method of

programming the iFS RF transmitter module and the iFS receiver using a PC. Variable parameters include the output power of the RF module, the receiver output sequence and the Fail-Safe settings for each channel. Alternatively these functions can be programmed using push-buttons.

This manual describes each menu in detail, and also provides dozens of useful tips, notes and programming examples to complement the basic information. More general modelling terms, such as Transmitter controls, Dual-Rates, Butterfly (Crow) and many others, are all explained in the manual.

The Appendix contains comprehensive information on the Trainer (teacher / pupil) system. The manual concludes with a table of the transmitter output powers and national receiver settings approved for use in individual European countries, copies of the Conformity Declaration and the transmitter's Guarantee Certificate.

Please read the safety notes and the technical information. We recommend that you read right through the instructions with great care, and check all the functions as described in the text. This can be carried out simply by connecting servos to the supplied receiver, and watching their response as you program the transmitter. This is the quickest method of becoming familiar with the essential procedures and functions of the MX-16iFS.

Always handle your radio-controlled model with a responsible attitude to avoid endangering yourself and others.

All of us in the *GRAUPNER* team wish you every success and many years of pleasure with your MX-16iFS, which is an excellent example of the latest generation of radio control systems.

Kirchheim-Teck, March 2009

MX-16iFS COMPUTER SYSTEM

Eight-channel radio control system exploiting *Graupner* iFS technology (intelligent frequency select)



High-technology micro-computer radio control system with new high-speed single-chip micro-computer, flash memory and 10-bit A/D converter.

A computer radio control system with twelve model memories, carefully optimised and incorporating top-level technology.

Modern computer system incorporating *Graupner* 2.4 GHz iFS technology for unbeatable reliability.

Bi-directional communication between transmitter and receiver. Simplified, straightforward programming technique. The high-contrast graphic screen provides an efficient means of monitoring battery voltage, modulation, model type, model name, model memory number, set-up data, throttle and collective pitch curves and model operating time.

- Micro-computer radio control system incorporating the latest 2.4 GHz *Graupner* iFS technology
- Bi-directional communication between transmitter and receiver
- Ultra-fast transmission rate for extremely fast system response, plus 16-bit encoding for extremely high resolution of 65,536 steps per control channel
- Virtual elimination of interference caused by electric motors, servos and electrical charge effects (metal-to-metal noise)
- Removable folding stub aerial
- Methods of operation and programming based on the proven concepts of the MC-19 to MC-24
- High-contrast graphic screen for outstanding control of set-up parameters, operating modes, timers and operating voltage
- Eight control functions with extremely convenient, simplified method of assigning controls for auxiliary functions such as switches and proportional controls
- Unrestricted assignment of all switches to switched functions simply by operating the appropriate switch
- Twelve model memories for storing all model-specific programming and set-up parameters
- The latest back-up system, requiring no Lithium battery
- Standard equipment includes four switches (of which one is a three-position type), one momentary button, one analogue control, two digital controls; freely programmable for extreme flexibility
- Function encoder with rotary cylinder and three momentary buttons for simplified programming and accurate set-up
- Convenient mode selector provides simple method

MX-16iFS COMPUTER SYSTEM

Eight-channel radio control system exploiting *Graupner* iFS technology (intelligent frequency select)

of changing the stick mode (modes 1 - 4, e. g. throttle right / throttle left). When you change modes, all the affected settings are switched at the same time.

- Graphical servo display provides a straightforward overview of the servo set-up, and a swift method of checking servo travels
- Receiver output swap
- Fixed-wing menu for: 1 AIL, 2 AIL, 2 AIL + 2 FLAP, V-tail, delta / flying wing, two elevator servos
- Fixed-wing mixer: diff aile, diff.flaps, ail → rudd, ail → flaps, brake → elev, brake → flap, brake → aile, elev → flap, elev → aile, flap → elev, flap → aile and diff. reduction
- Heli menu: 1-point, 2-point, 3-point and 4-point link-ages (1 servo, 2 servo, 3sv(2roll), 3sv(2nick (pitch-axis)), 4 SV (90°))
- Servo travel adjustment $\pm 150\%$ for all servo channels, variable for each end-point separately (Single Side Servo Throw)
- Sub-trim for fine-tuning the neutral position of all servos
- Servo reverse, programmable for all servos
- EXPO / DUAL-RATE system, separately variable, can be switched in-flight
- Mixer functions:
Aileron differential mixer, butterfly mixer, flaperon mixer and three freely programmable mixers
- Convenient swashplate programs for model helicopters
- Programmable Fail-Safe function in receiver with “hold-mode” and “move to preset position” function, variable separately for each servo channel
- Stopwatch / count-down timer with alarm function

- Model memory copy function
- Integral DSC socket for use with flight simulators and Trainer systems



The sets contain

Order No. **23000:**

MX-16iFS micro-computer synthesizer transmitter with integral 8NH-2000 TX NiMH battery (type may differ), XR-16ifs 2.4 GHz bi-directional receiver, one DS 8077 servo, switch harness

Order No. **23000.99:**

MX-16iFS micro-computer synthesizer transmitter with integral 8NH-2000 TX NiMH battery (type may differ), XR-16ifs 2.4 GHz bi-directional receiver

Please refer to the table on page 126 for details of approved transmitter power outputs in individual countries.

Specification of MX-16iFS transmitter

Frequency band	2,4 ... 2,4835 GHz Intelligent Frequency Select
Transmitter output power	Please refer to the table on page 126 for details of approved output powers in individual countries.
Control functions	8 functions, 4 with trims
Servo resolution	65,536 steps (16 bit)
Temperature range	-15 ... +55°C
Aerial	SMA connector, folding, removable
Operating voltage	9,6 ... 12 V
Current drain approx.	185 mA
Dimensions approx.	190 x 195 x 85 mm
Weight approx.	850 g with Transmitter Battery

Accessories

Order No.	Description
1121	Neckstrap, 20 mm wide
70	Neckstrap, 30 mm wide
3097	Wind-shield for hand-held transmitter

See page 124 for MX-16iFS Trainer leads

Replacement parts

Order No.	Description
23050	iFS transmitter aerial

Specification of XR-16ifs receiver

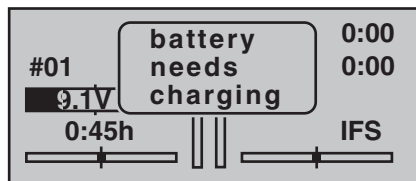
Operating voltage	4,8 ... 6 V
Current drain approx.	70 mA
Frequency band	2,4 ... 2,4835 GHz
National settings	The approved national settings are listed in the table on page 126, and also in the instructions supplied with the receiver.
Servo resolution	65,536 steps (16 bit) servo signal accuracy ± 10 ns
Aerial	Length approx. 3 cm, completely enclosed in receiver case
Servo functions	8
Temperature range	-15° ... +55° C
Dimensions approx.	54 x 29 x 14 mm
Weight approx.	19 g

Operating Notes

Transmitter power supply

The MX-16iFS transmitter is fitted as standard with a high-capacity 8NH-2000 TX NiMH battery (Order No. **2498.8TX**) (type may differ). When delivered, the standard rechargeable battery is not charged.

When you are using the transmitter you can monitor the battery voltage on the LCD screen. If the voltage of the transmitter battery falls below a certain point, you will hear an audible warning signal. The screen then displays a message reminding you that the transmitter battery needs to be recharged.



Always recharge the transmitter battery in good time. When you see this message, cease operations immediately and recharge the transmitter battery.

Charging the transmitter battery

The rechargeable transmitter battery can be charged via the charge socket fitted to the right-hand side of the case. Leave the battery inside the transmitter for charging, to avoid premature damage to the internal battery socket.

The transmitter must be switched "OFF" for the whole period of the charge process. Never switch on the transmitter when it is still connected to the charger; even a very brief interruption in the process can cause the charge voltage to rise to the point where the transmitter is immediately damaged. For this reason check carefully that all connectors are secure, and are making really good contact.

Polarity of the MX-16iFS charge socket

Commercially available battery charge leads produced by other manufacturers are often made up with the opposite polarity. For this reason use genuine **GRAUPNER** charge leads exclusively.



Charging the transmitter battery using an automatic charger

The transmitter is designed as standard for use with automatic battery chargers. However, this requires care on your part:

The transmitter charge socket is not protected against short-circuit and / or reversed polarity. It is therefore essential to use the correct procedure when connecting the charge lead: first connect the banana plugs on the charge lead to the charger, and only then connect the other end of the lead to the transmitter charge socket. When the charge lead is connected to the transmitter, never allow the bare ends of the plugs to touch! To avoid damage to the transmitter, the charge current must never exceed 1 A. If necessary, limit the current on the charger itself.

Charging the transmitter battery using a standard charger

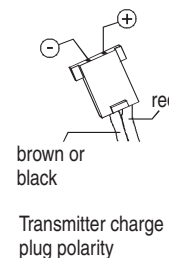
It is also possible to charge the transmitter battery using a charger with no automatic termination (cut-off) circuit. The basic rule in this case is to charge the battery for fourteen hours, assuming that it is *initially flat*. The charge current should be one tenth of the capacity printed on the battery. This means 200 mA for the standard transmitter battery. However, you are responsible for terminating the charge process manually if you use a standard charger ...

Removing the transmitter battery

The first step in removing the transmitter battery is to open the battery compartment cover in the back of the case. This is accomplished by pushing it in the direction of the arrow; it can then be lifted off:



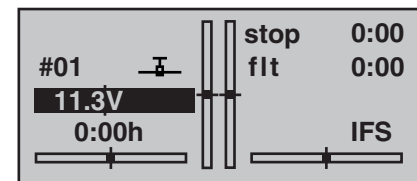
Disconnect the plug at the end of the transmitter battery lead by pulling carefully on the lead, or by engaging a finger nail behind the lug on the top of the connector. However, don't pull the plug down or up; keep it as parallel as possible to the surface of the transmitter.



Battery timer, bottom left corner of the screen

This timer displays the cumulative operating time of the transmitter since the last time the transmitter battery was charged.

This timer is automatically reset to "0:00" when the transmitter detects that the voltage of the transmitter battery is significantly higher than the last time it was switched on, e. g. as a result of a charge process.



Receiver power supply

A wide range of rechargeable four-cell and five-cell NiMH batteries varying in capacity is available for use as the receiver power supply. If you are using digital servos we recommend that you use a five-cell (6 V) pack of generous capacity. If your model is fitted with a mixture of digital and analogue servos, it is important to check the maximum permissible operating voltage of all the types. The PRX unit, Order No. **4136**, provides a stabilised receiver power supply with a user-variable voltage from one or two receiver batteries; see Appendix.

For reasons of safety battery boxes or dry cells should never be used.

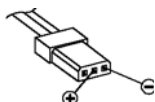
For this reason you should make it a standard part of your routine to check the state of your batteries at regular intervals. Don't wait until you notice the servos running more slowly than usual before recharging the packs.

Note:

Please refer to the main GRAUPNER FS catalogue or visit the Internet site at www.graupner.de for full details of batteries, chargers, measuring equipment and battery monitor units.

Charging the receiver battery

The charge lead, Order No. **3021**, can be connected directly to the NC receiver battery for charging. If the battery is installed in a model and you have installed one of the following switch harnesses: Order No. **3046**, **3934** or **3934.1** or **3934.3**, the battery can be charged via the separate charge socket, or the charge socket which is built into the switch. The switch on the switch harness must be left at the "OFF" position for charging..



Polarity of receiver battery connector

General notes on battery charging

- Observe the recommendations provided by the charger manufacturer and the battery manufacturer at all times.
- Keep to the maximum permissible charge current stated by the battery manufacturer.
- The maximum charge current for the transmitter battery is 1.5 A. Limit the charge current to this value on the charger.
- If you wish to charge the transmitter battery at a current higher than 1.5 A, you must first remove the pack from the transmitter, otherwise you risk damaging the circuit board through overloading the conductor tracks, and / or overheating the battery.
- Carry out a series of test charges to ensure that the automatic charge termination circuit works correctly with your battery. This applies in particular if you are using an automatic charger designed for NiCd batteries to recharge the standard NiMH battery.
- You may need to adjust the Delta Peak trigger voltage, if your charger provides this option.
- Do not discharge the battery or carry out a battery maintenance program via the integral charge socket. The charge socket is not suitable for this application.
- Always connect the charge lead to the charger first, and only then to the transmitter or receiver battery. Observing this rule eliminates the danger of accidental short-circuits between the bare contacts of the charge lead plugs.
- If the battery becomes hot when on charge, it is time to check the pack's condition. Replace it if necessary, or reduce the charge current.
- **Never leave batteries unsupervised when on charge.**

Recommended battery chargers (optional accessories)

Order No.	Description	220 V mains conn.	12 V DC connect.	Suitable for the following battery types				Integral charge lead
				NC	NiMH	LiPo	Lead-ac.	
6409	Ultramat 6	x	x	x	x	x		
6410	Ultramat 10	x	x	x	x	x		
6411	Ultramat 8	x	x	x	x	x		
6412	Ultramat 12		x	x	x	x	x	
6414	Ultramat 14	x	x	x	x	x		
6419	Ultramat 5		x	x	x			
6427	Multilader 3	x		x	x			x
6442	Ultramat 17	x	x	x	x	x	x	
6444	Ultra Duo Plus 50	x	x	x	x	x	x	
6455	Multilader 7E	x		x	x		x	

To recharge the MX-16iFS system you will also need the transmitter charge lead, Order No. **3022**, and the receiver battery charge lead, Order No. **3021**, unless stated otherwise in the table.

Please refer to the main GRAUPNER FS catalogue or visit the Internet site at www.graupner.de for the full range of chargers, and details of those listed above.

Disposing of dry cells and rechargeable batteries

Never dispose of exhausted batteries in the household refuse. As end-user you are legally required (by the "Battery Regulation") to return old and exhausted batteries. They should and must be taken to your local toxic waste collection point so that the materials can be re-used or re-cycled. Alternatively they can also be returned to any retail outlet where batteries are sold.

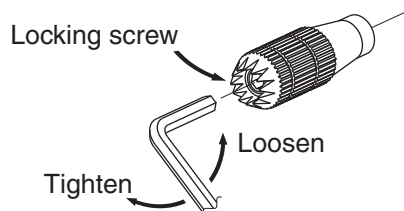
Betriebshinweise

Adjusting stick length

Both sticks are infinitely variable in length over a broad range, enabling you to set them to suit your personal preference.

Loosen the locking screw using a 2 mm allen key, then screw the stick top in or out to shorten or extend it.

Tighten the grub screw again carefully to lock the set length.



Opening the transmitter case

Please read the following notes carefully before you open the transmitter. If you have no experience in such matters, we recommend that you ask your nearest **GRAUPNER** Service Centre to carry out the work for you.

The transmitter should only be opened in the following cases:

- When a self-neutralising stick needs to be converted to non-neutralising action, or a non-neutralising stick to a self-neutralising action.
- If you wish to adjust the stick centring spring tension.

Before opening the transmitter check that it is switched off (move Power switch to “OFF”).

There is no need to remove the transmitter battery. However, if you leave it in place be sure not to switch the transmitter on (“ON” position). If you wish to remove the transmitter battery, please read the section on page 10.

Locate the six recessed screws on the back on the transmitter, and undo them using a PH1-size cross-point screwdriver (see drawing right). Hold the two case sections together with your hand, and turn the unit over to allow these six screws to fall out onto the table. Now carefully raise the case back and fold it open to the left, as if you were opening a book.

CAUTION

A two-core lead connects the case back to the transmitter electronics in the front section. Please take great care not to damage this cable!

Important:

- **Do not modify the transmitter circuit in any way, as this invalidates your guarantee and official ap-**

proval for the system.

- **Do not touch any part of the circuit boards with any metal object. Avoid touching the contacts with your fingers.**
- **Never switch the transmitter on while the case is open.**

Please note the following points when closing the transmitter:

- Make sure that no cables are jammed between the transmitter case sections when you close the back.
- Ensure that the DSC socket engages in its mounting.
- Check that the two case sections fit together flush all round before fitting the retaining screws. Never force the two case components together.
- Fit the case screws in the existing threads, and tighten them gently. Over-tightening them will strip the threads in the plastic.

Location of the transmitter case screws



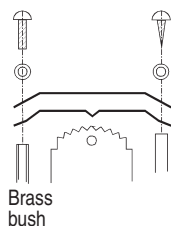
Changing the stick mode

Either or both sticks can be converted from self-neutralising to non self-neutralising action: start by opening the transmitter as described on the previous page.

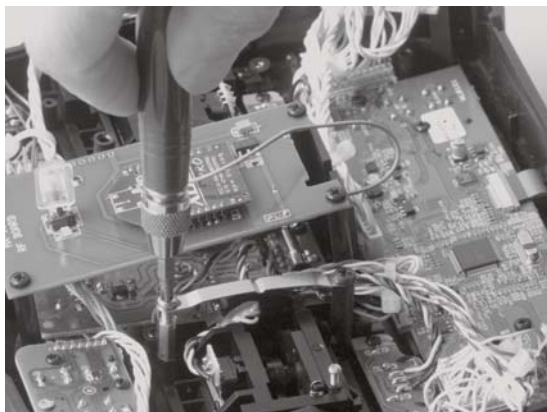
The procedure for changing the default stick mode setting is as follows:

1. Use a pair of tweezers to disconnect the spring from the centring lever on the stick whose mode you wish to change. If you are not sure, move the appropriate stick to make it obvious. Raise the lever and disconnect it.

2. Locate the ratchet spring and fix it to the plastic pillar using the (black) self-tapping screw supplied. You can now set the strength of the ratchet spring on the side of the hexagonal bush by screwing the M3 screw in or out.



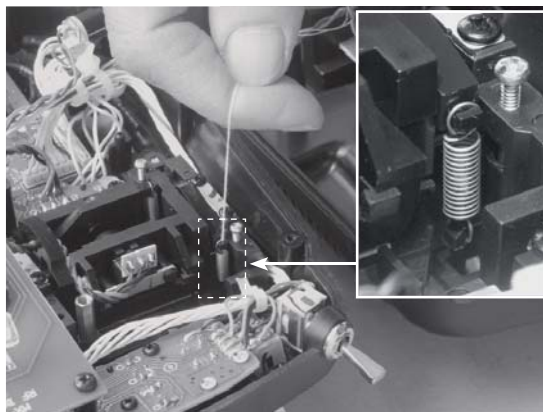
3. Check that the stick works as you prefer, then close the transmitter case once more.



Resetting the spring to “self-neutralising” action

Open the transmitter as already described.

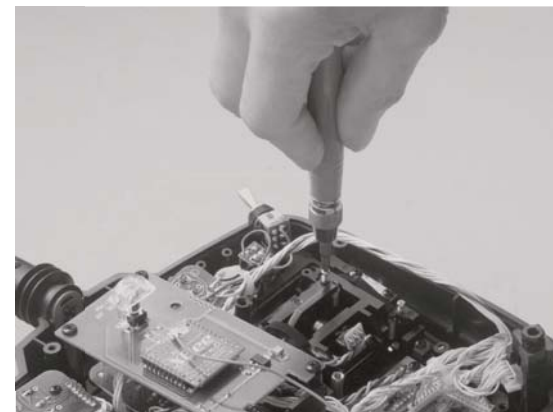
1. Disconnect and remove the ratchet spring: see picture left.
2. Now re-connect the (previously removed) centring spring to the side of the stick where the ratchet spring was located.
3. First loosen the stick centring spring adjuster screw slightly – see picture right – and then draw a length of thin thread through the upper loop of the spring – but don't tie it. Now use a pair of tweezers to connect the spring to the bottom loop of the adjustment system, and then engage the top end of the spring to the centring lever using the thread. Once the spring is correctly fitted, the thread can be removed again.
4. The tension of the stick centring spring can be adjusted as described in the next section.



Stick centring spring tension

The stick centring force can be adjusted to suit the pilot's personal preference. The adjustment system is located adjacent to the stick centring spring. Rotate the adjuster screw using a cross-point screwdriver until the spring tension feels right to you:

- Turn to the right = harder spring tension;
- Turn to the left = softer spring tension.



Description of transmitter

Transmitter controls

Attaching the transmitter neckstrap

You will find a strap lug mounted in the centre of the front face of the MX-16iFS transmitter, as shown in the drawing on the right. This lug is positioned in such a way that the transmitter is perfectly balanced even when suspended from a neckstrap.

Order No. **1121** Neckstrap, 20 mm wide

Order No. **70** Neckstrap, 30 mm wide

Important note:

In the transmitter's standard form any servos connected to the receiver can initially only be operated using the dual-axis sticks. For maximum flexibility, all the other transmitter controls (CTRL 5 ... 7, SW 1 ... 7) are "free" in software terms, and can be assigned to any channels you like, enabling you to set up the system to suit your personal preference or the requirements of a particular model. This is carried out in the »**contr set.**« menu, as described on pages 58 and 60.

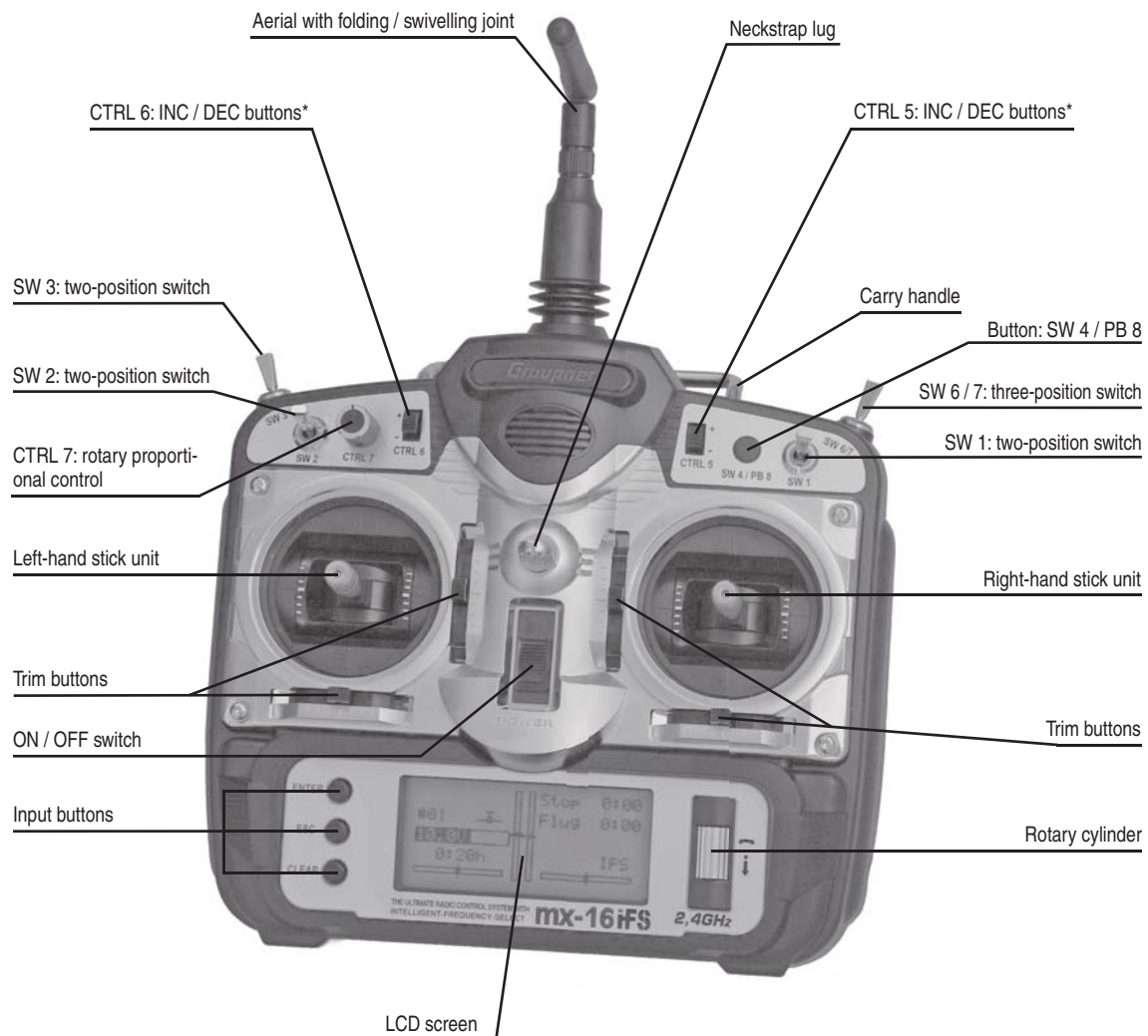
* INC/DEC buttons (CTRL 5 and 6)

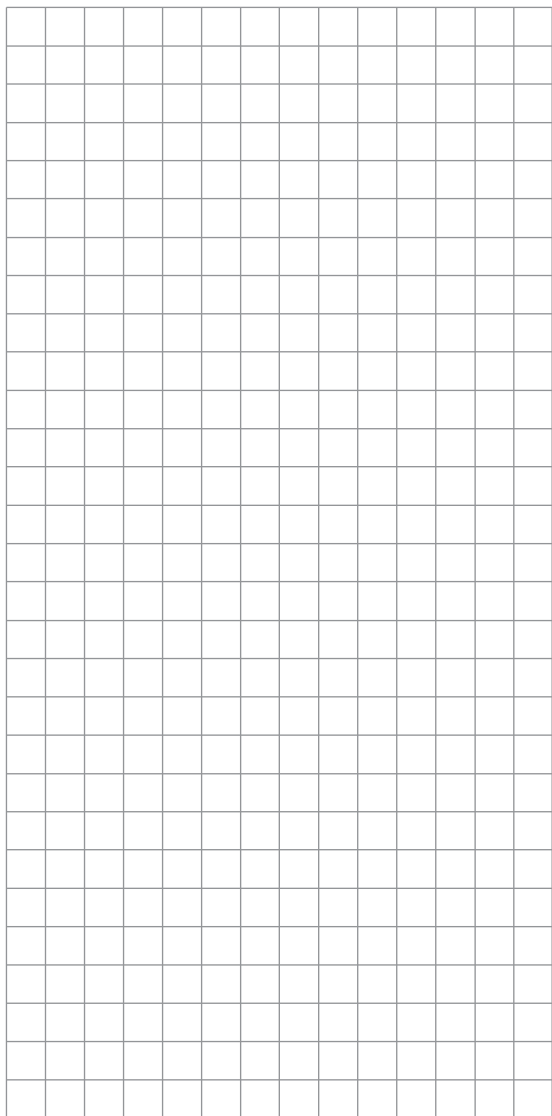
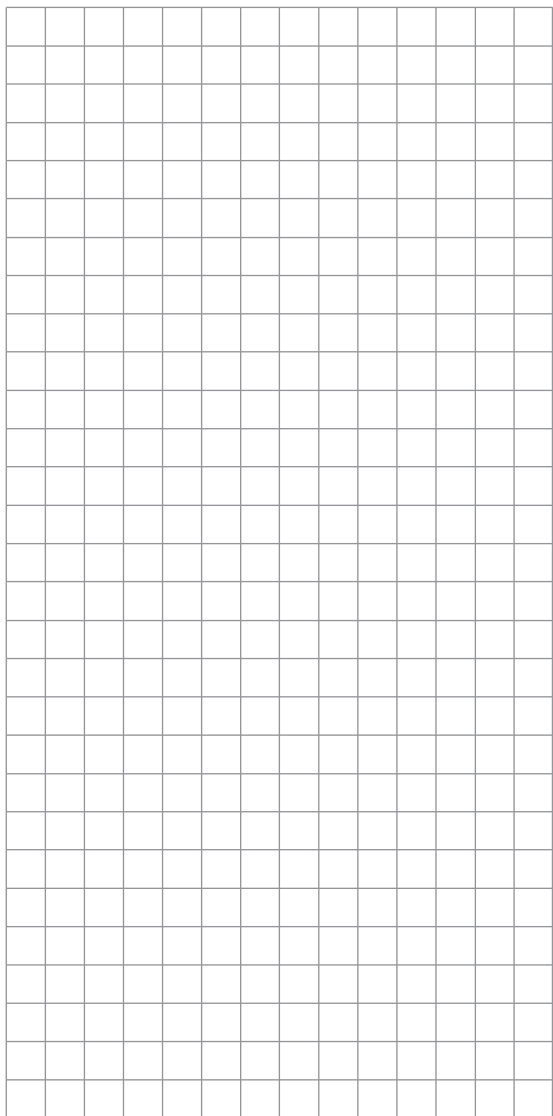
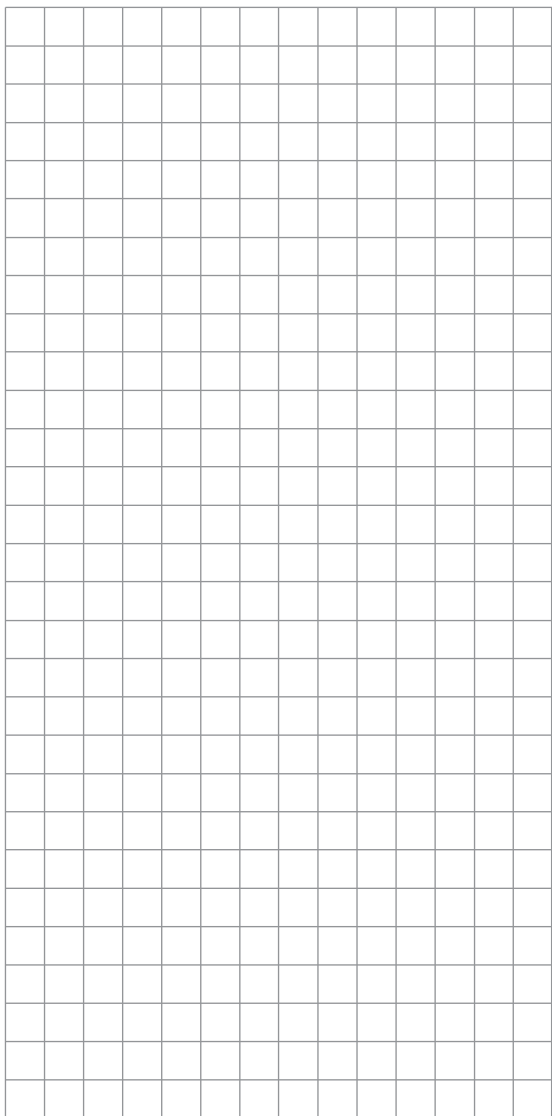
Each time you press the button the servo travel changes by 1% of the set maximum; the system works as follows:

INC – in the positive direction;

DEC – in the negative direction.

The button position is also stored separately for each flight phase.

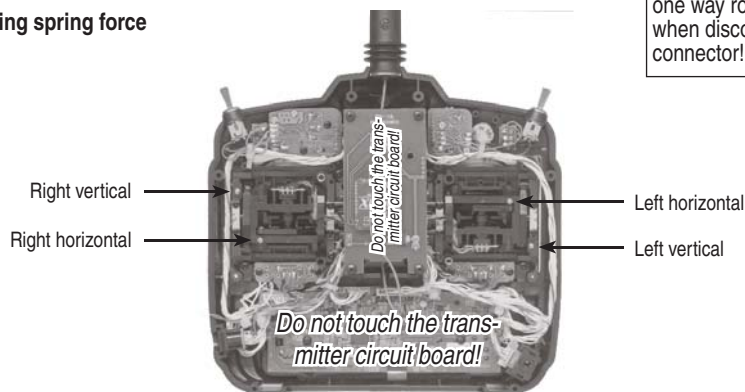




Transmitter back panel



Adjusting the centring spring force



Caution

The battery lead is polarised, i.e. it can only be plugged in one way round. Don't use force when disconnecting the battery connector!

DSC Direct Servo Control

The original function of this socket was for “Direct Servo Control”, and that’s why the abbreviation is still in use. However, for technical reasons “direct servo control” is no longer possible with iFS systems using the diagnosis lead.

The MX-16iFS transmitter’s standard two-pole socket is now used as a Trainer (buddy box) socket (Teacher or Pupil), and as an interface for flight simulators.

For the DSC connection to work you must check the following:

1. Carry out any adjustments required in the appropriate menus:
See page 122 for information on setting up the MX-16iFS transmitter to work as part of a Trainer system.
2. **ALWAYS** leave the transmitter’s On / Off switch in the “**OFF**” position when using a flight simulator and when using the transmitter as a Pupil unit in a Trainer system, for only in this position is the RF section of the transmitter module switched off (no RF signal) even when the DSC lead is plugged in. At the same time the transmitter’s current drain is reduced slightly.
3. Connect the appropriate two-pole barrel connector to the DSC socket on the back of the transmitter (switched off).
This renders the transmitter ready for use, and the LCD screen operates. At the same time the letters “**DSC**” appear to the left of the “iFS” symbol on the screen.
4. Connect the other end of the connecting lead to the appropriate apparatus, taking into account the operating instructions supplied with that equipment.

Important:

Ensure that all connectors are firmly seated in

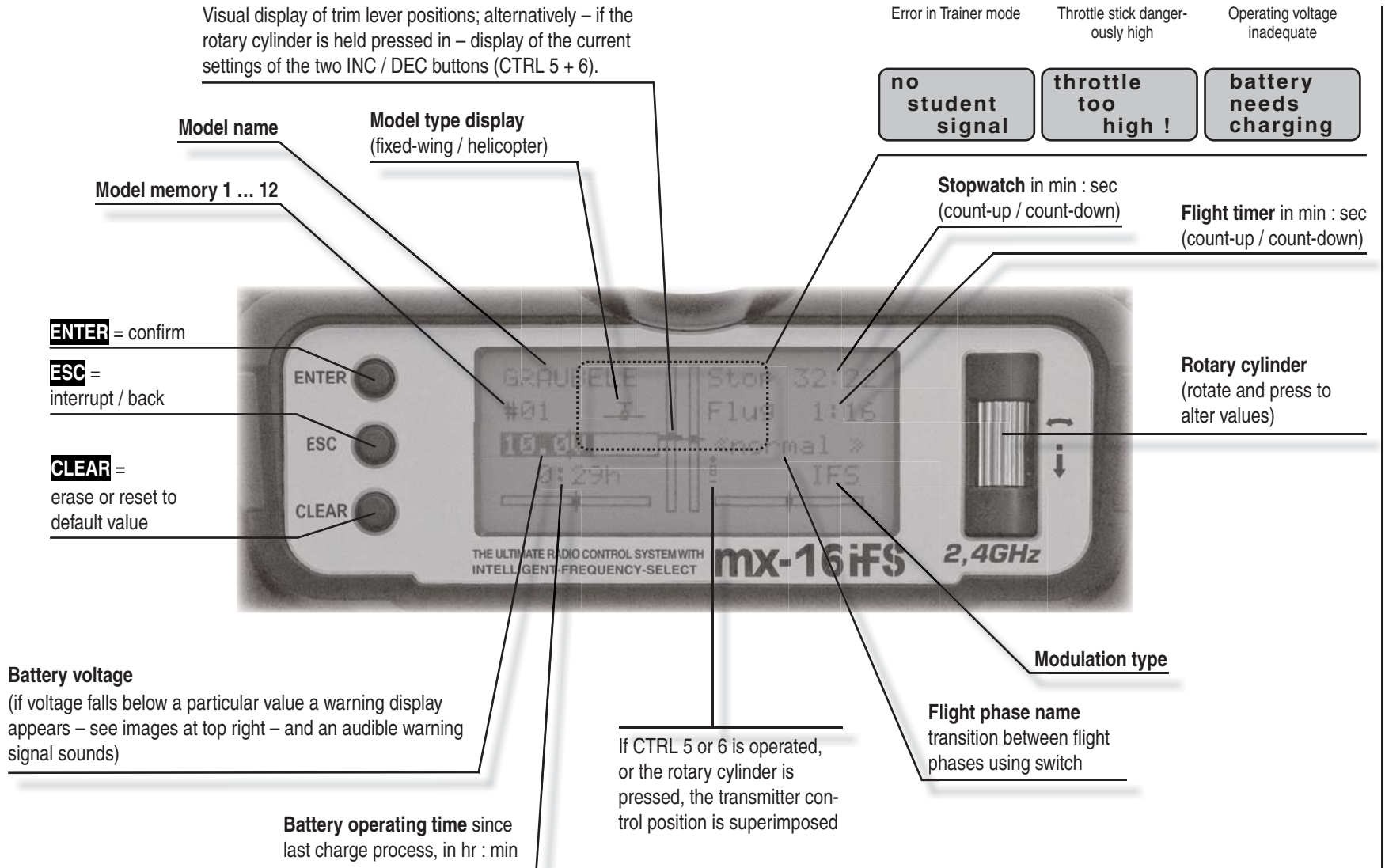
their sockets.

Note regarding flight simulators:

The range of flight simulators available commercially is now very wide, and you may find that it is necessary to swap over certain contacts at the battery plug or the DSC module. This work must be carried out by a GRAUPNER Service Centre.



LCD screen and operating buttons



Controlling the “Data Terminal”

Input buttons and basic method of using the rotary cylinder



ENTER, ESC, CLEAR





Buttons to the left of the screen

- **ENTER**
Pressing **ENTER** takes you from the basic display (which appears when you switch the transmitter on) to the menu select screen. You can also call up a selected menu by pressing **ENTER**.
- **ESC**
Pressing the **ESC** button returns you step by step within the function select system, taking you right back to the basic display. If you make a change in the meantime, the change is retained.
- **CLEAR**
Resets a changed parameter value in the active input field to the default value.



Rotary cylinder to the right of the screen

The **rotary cylinder** is responsible for several tasks:

1. If it is **not pressed**, it selects the desired menu from the multi-function list.
When you have called up a menu point, the rotary cylinder is also used to alter already entered values using the function fields (see right column), which appear in inverse video (light characters on a dark background).
In the ‘not pressed’ state you will obtain better grip on the cylinder by rotating it at the *bottom* end. 
2. If it is **pressed in**, you can use it to switch between the individual lines within a menu.
In the ‘pressed’ state you will obtain better grip on the cylinder by rotating it at the *top* end. 

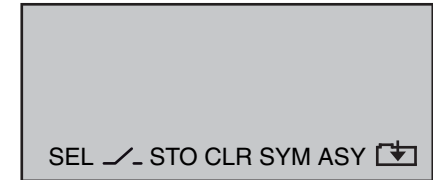
3. A **brief press on the rotary cylinder** at the top end of the cylinder changes the input field or confirms an input. 
4. At the transmitter's basic display the **screen contrast** can be adjusted with the rotary cylinder pressed in; see next double page. 
5. At the transmitter's basic display the two central – vertical – **trim displays** show the positions of the two INC / DEC controls (CTRL 5 and 6) for as long as the rotary cylinder is held pressed in; see next double page. 
6. A brief press on the rotary cylinder takes you from the transmitter's basic display to the **Servo display**; see next double page. 

Function fields

SEL, STO, CLR, SYM, ASY, , 



Function fields

In the bottom line of the screen function fields appear which can be selected using the rotary cylinder; these fields vary according to the menu selected.



A function field is activated by pressing the rotary cylinder.

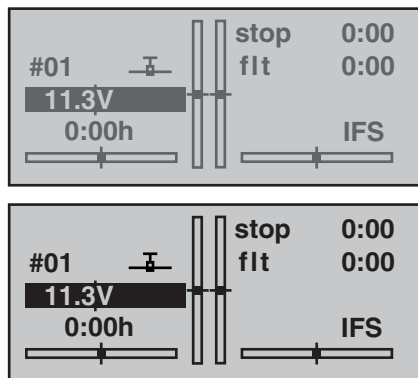
Function fields

- **SEL** select
-  Switch symbol field (assigning switches of all kinds)
- **STO** store (e.g. transmitter control position)
- **CLR** clear: reset to default value
- **SYM** adjust values symmetrically
- **ASY** adjust values asymmetrically
-  Switch to second page (next menu) within a menu

Adjusting screen contrast

The contrast of the mx-16iFS transmitter's LCD screen is variable, to ensure that you can read the information clearly in all weathers and at all temperatures.

Adjust the control by holding the rotary cylinder pressed in and rotating it when the transmitter screen is showing the basic display: turn it to left or right as required:



Position display

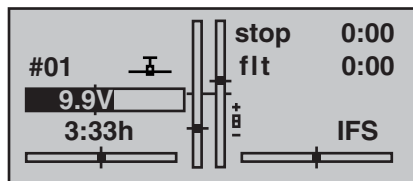
INC / DEC button, CTRL 5 + 6

Holding the rotary cylinder pressed in while you are at the transmitter's basic display calls up a visual display of the current positions of the two INC / DEC buttons (CTRL 5 + 6). This display disappears again when you release the rotary cylinder. At the same time a small symbol appears on the left, adjacent to the channel display:



When you hold the rotary cylinder pressed in, the position display on the basic transmitter screen (consisting of the two central vertical bars) also changes: it switches from a display of the current trim position to the current position of the INC / DEC buttons, CTRL 5 + 6, but only for as long as you hold the rotary cylinder pressed in. Since the position of these two controls is stored separately for reach flight phase, you will need to switch between the individual flight phases if you wish to see the positions in those phases.

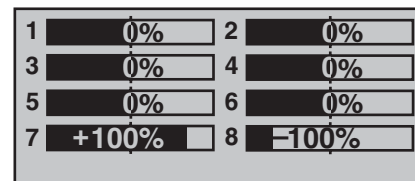
As you would expect, the left-hand bar represents the position of the INC / DEC button CTRL 6, located to the left of the aerial base, and the right-hand bar shows the position of CTRL 5 (however, both horizontal bars continue to show the current position of the corresponding transmitter stick trim levers):



As soon as you release the rotary cylinder, the screen reverts to a display of the current position of the four trim levers of the two dual-axis stick units.

Servo display

Pressing the rotary cylinder at the transmitter's basic display calls up a visual representation of the current servo positions on the transmitter screen.



This display shows the current position of every servo in the form of a bar diagram, taking into account the transmitter control and servo settings, the Dual Rate / Expo functions, the inter-action of all active mixers etc.. The display is accurate, and covers the range -150% to +150% of normal travel. 0% means the exact centre position. This allows you to check your settings quickly without even having to switch the receiver on. However, this does not mean that you don't need to bother checking all the programming steps on the model; you must do this carefully before operating it for the first time, as this is the only reliable method of picking up and correcting errors.

For fixed-wing model aircraft the display shows the information arranged in the following way:

- Bar 1 = Throttle / brake servo
- Bar 2 = Aileron or left aileron
- Bar 3 = Elevator
- Bar 4 = Rudder
- Bar 5 = Right aileron
- Bar 6 = (Left) camber-changing flap / free channel
- Bar 7 = Right camber-changing flap / free channel
- Bar 8 = Free channel /second elevator servo

... and for model helicopters:

Bar 1 = Collective pitch or roll (2) or pitch-axis (2) servo

Bar 2 = Roll (1) servo

Bar 3 = Pitch-axis (1) servo

Bar 4 = Tail rotor servo (gyro)

Bar 5 = Pitch axis (2) servo / free channel

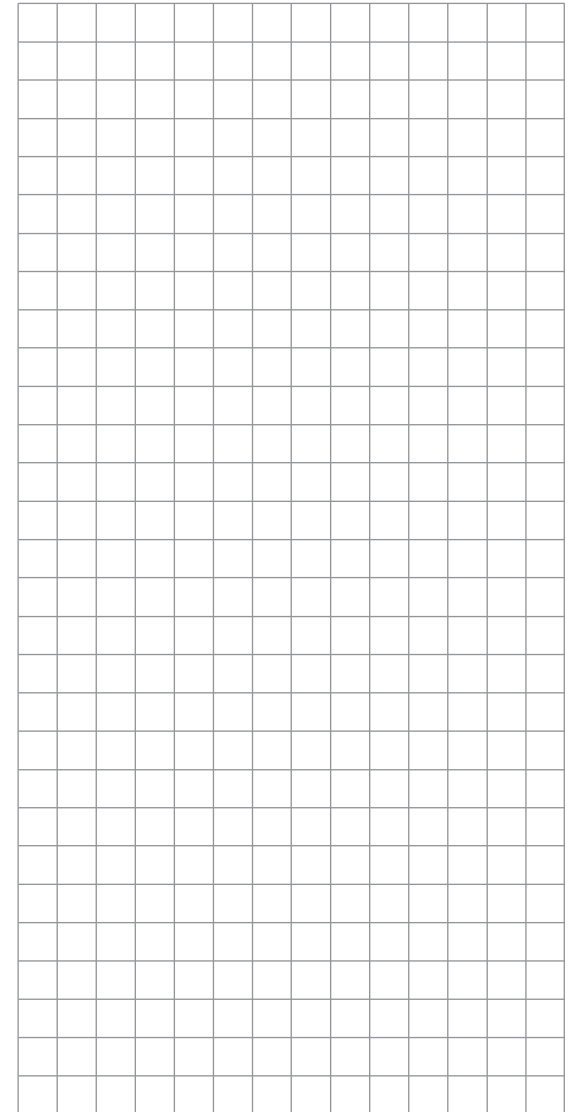
Bar 6 = Throttle servo / speed controller

Bar 7 = Gyro gain / free channel

Bar 8 = Speed governor / free channel

Note:

Please note, however, that the servo display always refers to the original servo sequence, i.e. if you swap over the receiver outputs using the sub-menu "receive out" in the »**base sett.**« menu (see pages 49 or 53), the display does not reflect this. The same applies if you use the receiver interchange facility (see page 26, or the instructions supplied with the receiver).



Using the transmitter for the first time

Preliminary notes, programming the iFS RF module

For more information please visit the Internet site at www.graupner.de)

Preliminary notes

In theory the *Graupner* iFS system permits the simultaneous use of up to 120 models, although in practice the mixed operation of different technical systems in the 2.4 GHz band – as required by the approval regulations – reduces this number considerably. Generally, however, it will always be possible to operate even more models simultaneously on the 2.4 GHz band than on the 35 / 40 MHz frequency bands which we have used to date. However, the actual limiting factor – as it has always been – is likely to remain the size of the (air-) space available. The simple fact that no frequency control procedure is necessary – a great convenience in itself – equates to an enormous gain in safety, especially at flying sites where groups of pilots may be distributed over a large area, with nobody in overall control.

Battery charged?

When you take receipt of your transmitter, the battery will be in the discharged state, so you must first charge it as described on pages 10 / 11. If you do not do this, the battery will soon fall below the pre-set threshold voltage, and you will see and hear a warning signal to remind you to recharge it.

**battery
needs
charging**

Aerial fitted?

For normal operations (flying or driving a model) ensure that the iFS aerial is screwed in place and firmly seated. However, hand-tight is quite sufficient – don't use a tool!

Switching the transmitter on

When you switch the transmitter on, the Status LED on the *Graupner* iFS RF module (on the back of the transmitter) briefly lights up *orange*, then *red* for a second before it starts *flashing red*. Red flashes mean that there is no connection with a *Graupner* iFS receiver. When the connection is made, the Status LED constantly *flashes green*.

The receiver supplied in the set is bound to the transmitter at the factory; the MX-16iFS transmitter can operate up to eight servos in conjunction with this unit.

If telemetry sensors are connected to the receiver, the Status LED *flashes orange* when telemetry data is received (this function is in preparation).

IMPORTANT NOTE:

- *In the interest of maximum possible flexibility, control channels 5 ... 8 are not assigned to transmitter controls by default; this also helps to eliminate the danger of inadvertently using them incorrectly. For the same reason virtually all the mixers are inactive by default. This means that in its standard form the transmitter can only control servos connected to receiver output sockets 1 ... 4 using the primary dual-axis sticks. In contrast, any servos connected to receiver sockets 5 ... max. 8 remain fixed at their centre position. This situation only changes when you have assigned a control element to the desired control functions 5 ... 8 in the »contr set.« menu; see page 58 or 60.*
- *The basic procedure for programming a new model memory can be found on page 42, and in the programming examples starting on page 96.*

Expanded programming mode for the RF module

This mode enables the user to alter a number of characteristics and parameters. **During this procedure any *Graupner* iFS receiver which has already been "bound" to the associated *Graupner* iFS RF module MUST be switched off before the transmitter is switched on.**

This is the procedure for switching to the expanded programming mode: locate the programming button on the RF module and hold it pressed in while you switch the transmitter on. Hold the button pressed in until the Status LED first goes out, then glows *green* and finally glows a constant *red* (this process takes about seven seconds). Release the button: you are now in expanded programming mode.

Note:

If the LED glows orange, you have held the button pressed in for too long. (In so doing you have activated a function which is intended for the X1-PZ iFS programming adapter.) If this should happen, repeat the procedure.

The individual set-up options can now be selected in sequence with brief presses of the programming button. The display of the Status LED changes in accordance with the following table. You can quit the "expanded programming mode" again at any time simply by switching the transmitter off.

Status LED	Function
Constant RED	Output power adjustment
Constant GREEN	Hopping mode adjustment

(further set-up facilities are in preparation)

Setting the output power stage (value range: 1 ... 5)

With the LED glowing a constant *red*, hold the programming button pressed in until the LED goes out. The LED now *flashes green* slowly to indicate the currently set power output: 1 x flash for stage 1, ... 5 x flash for stage 5. At the end of the flashing sequence you can set a new value within a period of five seconds.

To change the output power, press the programming button briefly a specific number of times, i.e. corresponding to the output power stage: one press for stage 1, ... five presses for stage 5. As an example: if you wish to set the output power to the lowest value, you must press the programming button once briefly; if you wish to set output stage “3”, press the button three times in rapid succession. Every button-press is confirmed by the LED glowing *red* briefly.

If you do not press the programming button within five seconds, or if you enter an invalid value, the LED briefly flashes alternately *red / green* (error indicator); in this case the set value is not altered. Once you have successfully set a new “value”, the LED confirms this by flashing *green / red / orange* in rapid succession. In either case this procedure takes you back to the start of the expanded programming mode, where you can select the set-up options.

The power output stages stated in the table below **MUST** be observed, to ensure that the system fulfils the legal requirements of the country concerned:

Country	Approved power settings
North America and Australia	Hopping mode 1 ... 3 Output stages 1 ... 5

Country	Approved power settings
Japan and Europe	Hopping mode 1: Output stages 1 ... 2 Hopping mode 4 + 5: Output stages 1 ... 5

Note:

- *The Status LED of Graupner I iFS receivers glows green in normal use if the output power is set to a stage higher than 1, and red if output stage 1 is set.*
- *If you have set Hopping Mode 1 at the transmitter – the default setting is “4” – then the green Status LED on the transmitter glows constantly, instead of flashing as in modes 2 ... 5.*

Setting the Hopping Mode (Value range: 1 ... 5)

With the LED glowing a *constant green*, hold the programming button pressed in until the LED goes out. The LED now *flashes green slowly* to indicate the currently set Hopping stage. By default this is Hopping Mode 4, so the LED initially flashes green four times.

At the end of the flashing sequence you can set a new value within a period of five seconds. Press the programming button a specific number of times, corresponding to the desired hopping mode. For example, to set Hopping Mode 3, you would now press the programming button three times.

If you do not press the programming button within five seconds, or if you enter an invalid value, the LED briefly flashes alternately *red / green* (error indicator); in this case the set value is not altered. After this you will be returned to expanded programming mode.

Once you have successfully stored a new “value”, the

LED confirms this by flashing *green / red / orange* in rapid succession.

Hopping mode	Setting
Predictive, single frequency	1
FCC constant (USA, twelve channels)	2
FCC adaptive* / constant (USA, twelve channels)	3
ETSI constant (Europe, sixteen channels)	4
ETSI adaptive* / constant (Europe, sixteen channels)	5

* Adaptive mode is currently under development, and the specification may change.

Unless the iFS system is re-certificated in the USA (this has already occurred in Europe), the frequencies for the United States of America, and other states which acknowledge them, are the same as for predictive single frequency mode.

CAUTION:

The hopping information is transmitted during the binding process; see below. If you change the hopping mode or the output stage, you MUST then re-bind all your receivers.

Using the receiving system for the first time

Preliminary notes, programming the XR-16ifs receiver

(See also the instructions supplied with your particular receiver. For more information please visit the Internet site at www.graupner-ifs-system.de)

Receiving system

The MX-16ifs radio control set includes an XR-16ifs 2.4 GHz bi-directional receiver which is suitable for connection to a maximum of eight servos.

When you switch the receiver on, its Status LED initially glows constantly for about three seconds, and then starts *flashing red*. The latter means that no connection with a *Graupner* iFS RF module exists (at this stage).

To be able to create a connection, the *Graupner* iFS receiver must first be “bound” to “its” *Graupner* iFS RF module (transmitter); this procedure is known as “binding”. However, binding is only necessary once for each receiver / RF module combination (and can be repeated whenever you wish – for instance, if you change the transmitter). The components in your system have already been bound at the factory.

The set you have purchased implements iFS Version 3, which differentiates between primary, subsidiary and supplementary receivers:

At the “Binding” stage – see below – receivers defined as primary units can only be operated separately with a *Graupner* iFS RF module. This eliminates the danger that a (primary) receiver in another model might respond to the same transmitter signal when it is switched on.

At the “Binding” stage – see below – receivers defined as subsidiary units are operated in “Slave mode”, and are subordinate to the primary (“Master”) receiver. Subsidiary receivers can therefore be operated in parallel with primary receivers. They are intended primarily for use in large model aircraft, with the aim of avoiding long cable connections to the control surface servos, and the associated losses. A separate power supply can be used to prevent further unnecessary voltage drop. However, subsidiary receivers can also be employed at

completely different locations from the model, e. g. as monitor receivers on the ground.

The use of multiple receivers can also make sense in large model boats such as the Seabex One; with models such as the Adolph Bermphohl, Theodor Heuss or Bernhard Gruben ocean-going rescue cruisers the subsidiary receiver can be used to control the ship’s boat using one and the same transmitter.

The purpose of supplementary receivers (Order No. **23608**, see Appendix) is quite different to that of subsidiary receivers: it is to enhance safety. For example, installing two supplementary receivers in the wingtips and another in the fin ensures that visual contact is maintained virtually constantly, with the result that at least one receiver can pick up the transmitter signal in any flight attitude.

Note:

*The “programming button” referred to in the following sections is located on the circuit board, and can be operated using a blunt instrument such as a 1.5 mm allen key. **PLEASE DO NOT USE A SCREWDRIVER** to push the button, as the risk of damaging the circuit board is too great.*

“Binding” the *Graupner* iFS receiver

Graupner iFS receivers must be “instructed” to communicate exclusively with a single *Graupner* iFS RF module (transmitter). This procedure is termed “Binding”, and is only required *once* for each new receiver.

During this procedure any other *Graupner* iFS main receiver MUST be switched off BEFORE you switch the transmitter on.

Now switch the *Graupner* iFS receiver on, and wait until the status LED flashes *red*. Hold the programming button on the receiver pressed in until its LED lights up *green*. Now release the programming button, and the Status LED will *flash orange*, indicating that the receiver is now waiting for a *Graupner* iFS transmitter to initiate the “binding” process.

At the transmitter end

Locate the *Graupner* iFS RF module’s programming button on the back of the transmitter, and hold it pressed in while you switch the transmitter on. Hold the button pressed in while the Status LED first goes out, and then *glows green*, then release the programming button.

As soon as you release the programming button, the transmitter and receiver should bind together: all the Status LEDs will simultaneously switch to *green* if the binding process has been completed successfully. If one Status LED *does not light up green*, repeat the whole procedure.

Binding subsidiary receivers

In Hopping Modes 2 ... 5 any number of subsidiary receivers can be bound in common with a (single) primary receiver. (In contrast, multi-receiver operation is NOT possible with Hopping Mode 1.)

With the transmitter *switched off*, switch your subsidiary

Graupner IFS receiver on. After a few seconds the Status LED starts *flashing red*. Press and hold the programming button until the LED goes out, then *glows green*. Release the button at this point, and the Status LED will *flash orange*.

Press and hold the programming button again until the Status LED *changes from flashing orange to constant orange*, indicating that the receiver is now waiting to be "bound" as a subsidiary receiver. Leave the receiver switched on until the binding procedure is complete!

Repeat this procedure for as many subsidiary receivers as you wish to use. Please note that you must always have one primary receiver, and this is the last one to be set to binding mode; see left.

Caution:

- ***The transmitter's hopping mode and the output stage MUST be defined before you initiate the binding process – see previous double page!***
- ***To conclude the binding procedure switch off the receiver(s) and also the transmitter, and leave them switched off for a few seconds before switching the transmitter back on, followed by the receiver(s). Your Graupner IFS system is ready for use, BUT ONLY AFTER YOU SWITCH IT OFF, THEN ON AGAIN.***
- ***Always switch the transmitter on first, and only then the receiver or receivers.***
- ***If a connection exists, the Status LED on the transmitter RF module will glow a constant green, as will that of the receiver, provided that a power output stage between 2 ... 5 has been set at the transmitter; it will glow red if the output power has been set to 1 - see earlier.***

- ***After switching the model off at the end of a flight, it is ESSENTIAL also to switch the transmitter off before another model can be operated; this is due to the "binding" process. For the same reason please ensure that your last model really is switched off before you switch the next model on. This is the reason: if you have two or more receivers which are bound to the same transmitter module, and they are switched on simultaneously before the associated transmitter is switched on, "any" of the receivers will bind itself to the transmitter. Other receivers will not bind themselves unless they are configured as subsidiary receivers; see above.***

Range-checking

When using the Graupner IFS system range checks should be carried out as described in the following paragraph. Ask a friend to help you when carrying out a range check.

1. Install the receiver in the model in the appropriate manner, taking into account the information in the Installation Notes on page 30.
2. Install the antenna on the transmitter if not there.
3. Turn on the radio system so servo movement can be observed.
4. Using flat ground (pavement, low cut grass, or dirt) place the R/C device so that the receiver antenna is no less than 6" / 15 cm from the ground. This might require you elevating the R/C device during the testing.
5. Hold the transmitter at waist-height, away from your body.
6. Press and **hold** the programming button on the transmitter module.

7. Walk to a distance of at least 125 feet / 40 meters. If at any time you experience a pause in controls, try to reproduce it again and release the button to see if the pause no longer occurs. If the problem does not occur now, check to make sure that your receiver is at least 6" / 15 cm from the ground while testing.
8. With the programming button still pressed down, walk away from the R/C device while moving the sticks until there is intermittent control. If it does not respond 100% fully, do not use the system and contact Graupner GmbH & Co. KG for assistance!
9. If the model is powered, switch the power plant on and check that it does not cause interference to the radio control system.
10. This completes the range test.

Note:

In the case of "small" receivers, intended for use in model cars and / or park-fly model aircraft, you should carry out the check as described above, but at a range of about 25 m.

Caution:

During normal operations (i.e. when controlling a model) never press and hold the programming button on the transmitter module!

Altering the servo outputs

The XR-16iFS receiver includes the option to assign the control channels to any receiver outputs you like. However, when using the receiver in conjunction with the MX-16iFS transmitter, we recommend that you leave the assignment at the 1 : 1 default setting, and if necessary make use of the "receiv out" option in the »**base set.**« menu.

National settings

Please refer to the instructions supplied with the receiver, and the paragraph on page 126.

FAIL-SAFE settings

In its factory default state the receiver is set to maintain the servos at the last valid position detected by the receiver ("hold mode") if a Fail-Safe event should occur. We strongly recommend that you make use of the system's safety potential by programming the fail-safe throttle position of a glow-powered model to idle, or the throttle position of an electric-powered model to "motor stopped". In this way you ensure that the model is much less likely to cause havoc if subjected to interference; if this should occur on the ground, the model could otherwise cause serious personal injury or damage to property.

A further option can be set which defines the period (1 ... max. 5 sec.) after which the Fail-Safe function is to become active.

The factory default setting is two seconds.

Low voltage warning

If the receiver LED *glows orange*, then the low voltage warning indicator is active. This means that the voltage is or was below about 4.4 V, although the collapse might have been brief due to a momentary heavy load.

Please ensure that the batteries are fully charged before you fly your model. Check that control surface linkages are free-moving; it is good practice to measure the voltage drop over the switch harness installed in the model.

Although the iFS system continues to work down to voltages below 3.5 V before it automatically restarts, the warning indicator should not be ignored, as in most cases it is a clear indication of a power supply which is not "fit for purpose".

Safe model operation depends upon many factors, but one of them is certainly a reliable receiver power supply. If your model's linkages are free-moving, the battery is fully charged, the conductors of the battery connecting leads are of adequate cross-section, the contact resistance at the connectors is minimal, etc., but the receiver LEDs insist on glowing a constant *red* (output stage 1) or *green* (output stages 2 ... 5), then the servos are drawing an excessive current for the system. If this should occur, consider using a higher-capacity battery, perhaps with five cells, or the PRX stabilised receiver power supply, Order No. **4136**, described in the Appendix.

Servo sockets and polarity

The servo sockets of the *Graupner* iFS receiver are numbered. The socket marked "B/T" is intended for the battery, but also doubles as the data socket for the telemetry sensor.

Never connect this socket with reversed polarity! This would cause the receiver to switch itself on,

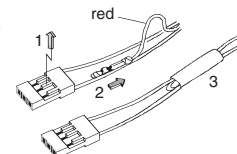
and appear to be working normally, but it would not function correctly!

The power supply voltage is through-connected via all the numbered sockets. The function of each individual channel is determined by the transmitter you are using, rather than by the receiver. Example: the throttle servo socket is defined by the radio control system, and may differ according to the make and type. In the case of *JR* radio control systems the throttle function is assigned to channels 1 or 6, whereas it is allocated to channel 3 in the case of Futaba radio control systems.

Concluding notes:

- *The much higher servo resolution of the iFS system results in a more direct response compared with previous technologies. Please take a little time to become accustomed to the feeling of finer control!*
- *If you wish to use a speed controller with integral BEC* system in parallel with a separate receiver battery, in most cases (depending on the speed controller) the positive terminal (red wire) must be removed from the three-pin connector, as shown in the diagram. Be sure to read the appropriate notes in the instructions supplied with your speed controller before doing this.*

Carefully raise the central lug of the connector slightly (1), withdraw the red wire (2) and insulate the bare contact with tape to avoid possible short circuits (3).



Observe the installation notes regarding the servos, receiver and receiver aerial, which you will find on page 30.

* Battery Elimination Circuit

Expanded receiver programming mode

The expanded programming mode enables the user to alter various receiver characteristics and parameters. Always read the instructions supplied with your particular XR receiver before making any changes of this type! If necessary you can also find information on this subject in the Download area of our website at www.graupner.de.

Important note:

For the procedure described in the following section it is ESSENTIAL to switch off every transmitter with a Graupner iFS RF module to which the associated Graupner iFS receiver has already been "bound", before you switch the receiver on.

To enter expanded programming mode, first switch the receiver on and wait until the Status LED *flashes red* at a moderate rhythm. Now use a blunt instrument – such as a 1.5 mm allen key – to hold the programming button on the receiver pressed in while the Status LED first goes out, then lights *green*, and finally glows a constant *red* (the process takes about seven seconds). Now release the button.

As soon as the receiver is in expanded programming mode, the Status LED glows a *constant red*, as you are now automatically located at the first set-up option (see table below). The remaining set-up options can be selected in sequence with brief presses on the programming button. The display of the Status LED changes in accordance with the following table:

LED	Option
Constant RED	1 Receiver output setting
Constant GREEN	2 National setting
Constant ORANGE	3 (This function is currently not used)
Rapid flashing RED	4 Fail-Safe setting (channels)
Rapid flashing GREEN	5 Fail-Safe setting (time)
Rapid flashing ORANGE	6 Telemetry set-up*

* Telemetry applications not currently available..

Option 1: Assigning the control channels to the receiver outputs

(value range: 1 ... max. number of receiver channels)

Note:

The Graupner iFS receiver includes the option to assign the control channels to any receiver outputs you like. However, when using the receiver in conjunction with the MX-16iFS transmitter, we recommend that you leave the assignment at the 1 : 1 default setting, and if necessary make use of the "receiv out" option in the »base set.« menu; see pages 49 and 53.

With the Status LED glowing *constant red* – see above – press and hold the programming button until the LED goes out.

The LED now flashes *orange* repeatedly, the number of flashes corresponding to the number of servo sockets, followed by a one-second pause. After first selecting this set-up option (channel 1) the Status LED also flashes once, followed by a one-second pause.

Every brief press on the programming button cycles through to the next servo output: this begins with 1 (1 x flash) and ends with the number of channels of your receiver ("8" for an eight-channel receiver, "10" for a ten-channel receiver, etc.).

To assign a different channel to the selected receiver output, press and hold the programming button until the Status LED goes out. The LED now *flashes green* repeatedly, the number of flashes corresponding to the number of the currently assigned channel.

When the Status LED has indicated the current assignment by *flashing green*, you have a period of five seconds to enter a new assignment; this is accomplished by briefly pressing the programming button the appropriate number of times.

Note:

For the control channel you can enter values within the range 1 to 16, even if the receiver features fewer servo sockets. For example, if you wish to use the MX-16iFS with a six-channel receiver, it is possible to assign control channel 7 or 8 to any of the otherwise unoccupied outputs 1 ... 6.

If you do not press the programming button within the five-second period, or if the value you enter is higher than permissible, the LED *flashes alternately red and green* (error indicator), and a new assignment is not carried out. You are then returned to the channel select point for the assignment process.

However, if a new assignment takes place successfully, the LED *flashes green / red / orange* in rapid sequence, in order to indicate that the change has been implemented.

The option of assigning control channels to any receiver

outputs is very practical, especially if the transmitter only has limited functionality, or if you wish to re-direct channels to different outputs. The default setting is 1 : 1, i.e. the control channels are passed to the receiver outputs bearing the same number.

Instead of using a Y-lead you can also assign the same control function to two or more receiver outputs, e. g. "Throttle", in order to operate two or more servos with one control function. For example, you could leave one servo at the "normal" output (e. g. for "throttle" control – channel 1 for fixed-wing models or channel 6 for model helicopters in the case of most *Graupner/JR* systems), and assign the second or subsequent servos to one or more of the higher-numbered outputs which are not used as standard. All the outputs are totally synchronised, i.e. the delay which is occasionally observed with earlier systems is entirely absent. Any servo adjustment which is carried out in the »servo set.« menu (see page 56), applies to all the servos set up in this way.

Option 2: National setting

(value range: 1 ... 2)

This setting applies exclusively to Hopping Mode 1, and has no effect if any other hopping mode is selected. You can therefore skip the next section, provided that you have not changed the hopping mode from the default setting "4".

The national setting is necessary in order to satisfy various directives (FCC, ETSI, IC, etc.). With the Status LED *glowing a constant green* – see table in the centre column on page 27 – press and hold the programming button until the LED goes out. The LED now *flashes green repeatedly*, the number of flashes corresponding to the code number of the set country. If the default

value (1) is set, the Status LED therefore flashes once. When the flashing stops, you have a five-second period to change the country code. This is accomplished by pressing the programming button repeatedly, the number of presses corresponding to the codes stated in the table below.

Example:

If the country is to be, say, France, press the programming button twice briefly. If you do not press the programming button within five seconds, or if you enter a value which is higher than the permissible range, then the LED flashes alternately red and green (error indicator), and no new national assignment is carried out; you are then returned to the select point for the programming options. However, if a change is carried out successfully, the LED flashes green / red / orange in rapid sequence to confirm the successful operation.

Country	Setting
All countries except France	1
France	2*

* Open-air operation. Transmitter power "1" or "2" must be selected.

Option 3: Output signal setting

This function is currently not supported. It is planned for future versions which will permit different methods of actuating servos, such as sequential, in groups, TruDig-ital™, etc..

Option 4: Fail-Safe settings "hold" or "Pos" for channels

(value range: 1 ... max. number of receiver outputs)

In the receiver's default state the servos maintain the

position last detected as valid ("hold") when interference occurs, since this is the default setting for all channels. As described in the following section, or in the instructions supplied with your particular receiver, it is also possible to set whether the channel maintains the last correctly received servo position if interference occurs ("hold"), or – after a period of time – takes up a position defined using the next option; this can be set separately for each channel.

With the Status LED *flashing red at a rapid rhythm* – see table in the centre column on page 27 – press and hold the programming button until the LED goes out. The LED then *flashes orange repeatedly*, the number of flashes corresponding to the number of servo outputs, followed by a one-second pause. After you initially select this set-up option (channel 1), the Status LED therefore flashes once followed by a one-second pause.

Every brief press on the programming button cycles through the next servo output: this starts with 1 (1 x flash) and ends with the number of channels your receiver supports, so that – for example – the *Graupner* IFS eight-channel receiver offers eight possible set-up positions, whereas, for example, the *Graupner* IFS ten-channel receiver features ten possible set-up positions.

In order to change the fail-safe setting of the selected receiver output, press and hold the programming button until the Status LED goes out. The LED then *flashes green*, either once for "hold" or twice for "position".

Once the Status LED has *flashed green* to indicate the current setting, you have a period of five seconds to enter a new setting. This is accomplished by pressing the programming button briefly the appropriate number of times: once for "hold", twice for "position".

If you do not press the programming button within the five-second period, or if you enter an invalid number, then the LED *flashes alternately red and green* (error indicator), and no new setting is adopted. You are then returned to the channel select point for this function. However, if a new setting is carried out successfully, the LED *flashes green / red / orange* in rapid succession to indicate that the change of setting has been adopted.

The actual fail-safe positions for the selected channels can only be set later, after you have left expanded programming mode; see right-hand page.

Example:

If you are programming a fixed-wing model aircraft and wish to set the motor to "position", whilst leaving all the other channels to "hold", set channel 1 to 2 x flashing, and leave all the other channels to 1 x flashing.

The only way of quitting the fail-safe channel setting is to switch the receiver power supply off.

Option 5: Fail-safe setting – "hold time"

(value range: 1 ... 5 seconds)

The fail-safe time is the number of seconds in which no valid control data is received, before the receiver switches to fail-safe or hold-mode.

When this "hold time" has elapsed, the receiver switches over to "fail-safe": the channels programmed to "position" take up the prescribed fail-safe position, while the remaining channels maintain the position last picked up as valid ("hold").

After selecting this set-up option (the LED *flashes green* at a rapid rate – see table in the centre column of page 27) press and hold the programming button until the LED goes out. The LED now *flashes green repeatedly*,

the number of flashes corresponding to the number of seconds selected. For example, if the default value (2) is set, the Status LED flashes twice.

After the Status LED has *flashed green* to indicate the current setting, you have a period of five seconds to enter a new setting. This is accomplished by pressing the programming button briefly the appropriate number of times.

Example:

If you want the fail-safe time to be one second, press the programming button once briefly. For three seconds, press it three times briefly, etc..

If you do not press the programming button within the five-second period, or if you enter an invalid number, then the LED *flashes alternately red and green* (error indicator), and no new setting is adopted. You are then returned to the channel select point for this function. However, if a new setting is carried out successfully, the LED *flashes green / red / orange* in rapid succession to indicate that the altered setting has been adopted.

Option 6: Telemetry setting

This option is currently at the development stage.

Quitting expanded programming mode

You can quit expanded programming mode at any time simply by switching off the receiver power supply.

Defining Fail-Safe positions

Switch the transmitter and receiver on "normally", and wait until you can control the servos with the sticks. Press and hold the programming button on the *Graupner* iFS receiver until the Status LED goes out. The indicator now starts to *flash alternately red and green* for

a period of about eight seconds.

Within this time you should move the sticks and other transmitter controls – those that have already been defined – to the positions which correspond to the servo settings in the model which you wish to adopt as the Fail-Safe positions; these settings are then stored in the receiver when the LED goes out.

Resetting the receiver to the default settings (RE-SET)

This reset procedure resets all the settings, including the binding settings. This means that the "binding" procedure must be repeated with this receiver and a *Graupner* iFS transmitter module.

To carry out the reset hold the programming button pressed in while you switch the receiver on. As soon as the Status LED *flashes red*, you can release the programming button.

This completes the reset.

Optional programming adapter: XZ-P1 iFS

Order No. **23300**

This adapter, which is available as an optional accessory (see Appendix), is a convenient means of programming all the necessary settings in the iFS RF module and the iFS receiver using a PC and a wireless link.

To switch the receiver into computer programming mode, press and hold the programming button while you switch the receiver on. The Status LED will *glow orange*.

Installation Notes

Installing the receiver

Regardless of which *Graupner* IFS receiver you are using, the procedure is always the same:

Please note that the receiver aerial must be arranged at least 5 cm away from all large metal parts and leads which are not attached or connected directly to the receiver. This includes steel and carbon fibre components, servos, fuel pumps, cables of all sorts, etc.. Ideally the receiver should be installed in an easily accessible position in the model, away from all other installed components. Under no circumstances run servo leads immediately adjacent to the receiver aerial, far less coil them round it!

Please note that acceleration forces which occur in flight might cause cables to shift when the model is operating. For this reason ensure that all leads are prevented from moving close to the aerial. Moving connections or cables can cause interference to the system.

Tests have shown that a vertical (upright) installation of the aerial gives the best results during long approaches.

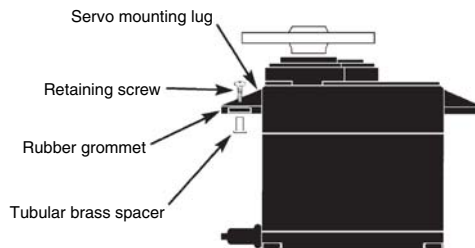
The servo sockets of *Graupner* IFS receivers are numbered. The socket marked "B/T" is intended for the battery, but will also be used in future for the data connection of the telemetry sensor.

The power supply is through-connected using all the numbered receiver sockets.

The function of each individual channel is determined by the transmitter in use, rather than by the receiver. Please bear this in mind in particular if you wish to bind the receiver to a different make of transmitter fitted with a *Graupner* IFS RF module.

The following section contains notes and helpful ideas on installing radio control components in the model:

1. Wrap the receiver in foam rubber at least 6 mm thick. Fix the foam round the receiver using rubber bands, to protect it from vibration, hard landings and crash damage.
2. All switches must be installed in a position where they will not be affected by exhaust gases or vibration. The switch toggle must be free to move over its full range of travel.
3. Always install servos using the vibration-damping grommets and tubular metal spacers supplied. The rubber grommets provide some degree of protection from mechanical shock and severe vibration. Don't over-tighten the servo retaining screws, as this will compress the grommets and thereby reduce the vibration protection they afford. The system offers good security and vibration protection for your servos, but only if the servo retaining screws are fitted and tightened properly. The drawing below shows how to install a servo correctly. The brass spacers should be pushed into the rubber grommets from the underside.



4. The servo output arms must be free to move over their full arc of travel. Ensure that no parts of the me-

chanical linkage can obstruct the servo in its movement.

The sequence in which the servos are connected to the receiver is dictated by the model type. Please see the socket assignments listed on pages 37 / 38 and 41.

Be sure to read the safety notes on pages 3 ... 5.

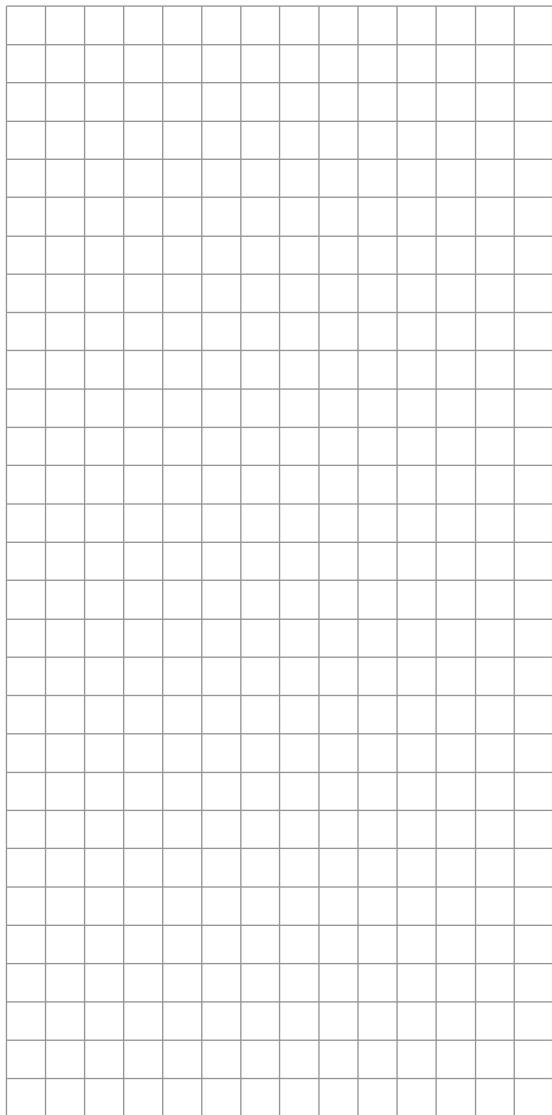
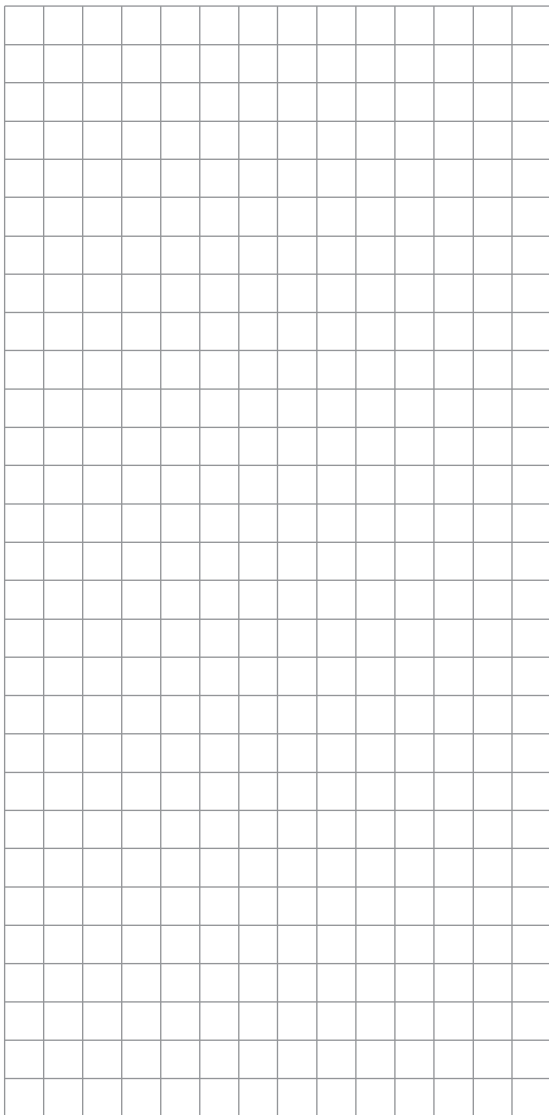
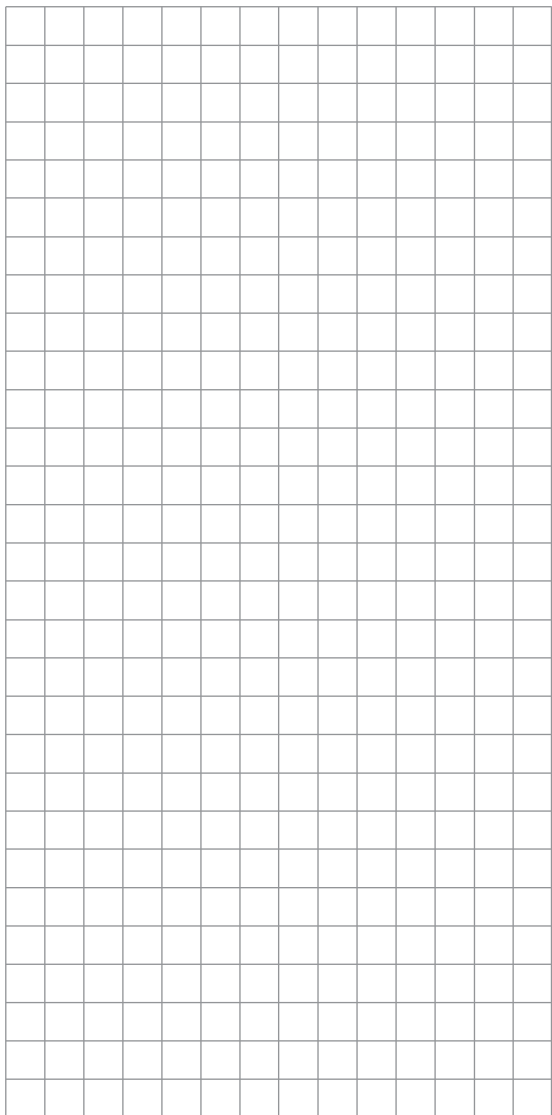
If the receiver is ever switched on when the transmitter is off, the servos may carry out uncontrolled movements. You can avoid this by switching the system on in this order:

**Always switch the transmitter on first,
then the receiver.**

When switching the system off:

**Always switch the receiver off first,
then the transmitter.**

When programming the transmitter you must always ensure that any electric motors in the system cannot possibly burst into life accidentally, and that an I.C. engine fitted with an automatic starter cannot start unintentionally. In the interests of safety it is always best to disconnect the flight battery, or cut off the fuel supply.



Definition of terms

Control functions, transmitter controls, function inputs, control channels, mixers, switches, control switches

To make it easier for you to understand the MX-16iFS manual, the following section contains definitions of many terms which crop up again and again in the remainder of the text.

Control function

The term “control function” can be thought of as the signal generated for a particular function which needs to be controlled – initially independent of its subsequent progress through the transmitter. In the case of fixed-wing model aircraft the control functions include throttle, rudder and aileron, whereas collective pitch, roll and pitch-axis are typical of those used for helicopters. The signal of a control function may be assigned directly, or to several control channels simultaneously via mixers. A typical example of the latter is separate aileron servos, or pairs of roll-axis or pitch-axis servos in a model helicopter. The essential feature of a control function is its influence on the mechanical travel of the corresponding servo.

Transmitter control

The term “transmitter control” refers to the mechanical elements on the transmitter which are operated directly by the pilot. Their movements in turn generate corresponding movements in the servos, speed controllers etc. at the receiver end. The transmitter controls include the following:

- The two dual-axis stick units for the control functions 1 to 4; for both model types (“fixed-wing” and “helicopter”) these four functions can be interchanged in any way you wish using the “Mode” function, e.g. throttle left or right, without having to re-connect the servos. The dual-axis stick function for throttle (or airbrakes) is often referred to as the Ch 1 (Channel 1) control.
- The rotary proportional control fitted at top left (CTRL 7).

- The INC / DEC buttons (CTRL 5 + 6) located on either side of the aerial base.
- Switches SW 1 ... 8, if they have been assigned to a control channel in the »**contr set.**« menu.

When a proportional transmitter control is operated, the servo or servos follow the position of the control directly, whereas a switched channel provides just the two or three set servo positions.

Function input

This is an imaginary point on the signal path, and must not be considered the same as the point on the circuit board where the transmitter control is connected! The two menus “stick mode” and »**contr set.**« affect the course of the signal “after” this point, and it is possible (and likely) that there will be differences between the number of the transmitter control (as stated above) and the number of the subsequent control channel.

Control channel

There is a point on the signal path where the signal contains all the control information required for a particular servo – this may be directly generated by a transmitter control or indirectly via a mixer – and from this point on we call the signal a “control channel”. This signal is specific to an individual servo, and is only affected by any adjustments carried out in the »**servo set.**« menu before leaving the transmitter via the RF module in order to actuate the corresponding servo in the model.

Mixer

The transmitter’s software includes a wide range of mixer functions. Their purpose is to enable a control function to affect multiple servos at the branching point of the mixer input, or alternatively to allow several control functions to affect one servo. For more information please refer to

the numerous mixer functions as described in the section starting on page 72 of the manual.

Switch

The three standard switches SW 1 ... 3, the three-position switch SW 6/7 and the momentary button variants SW 4 / PB 8 can also be incorporated into the programming of the transmitter controls. However, all these switches are also capable of controlling various program options, e.g. starting and stopping timers, switching mixers on and off, transferring control in Trainer mode etc.. Each physical switch function can be assigned to as many functions as you wish.

Numerous examples are described in the manual.

Transmitter control switch

It is often desirable to switch a function on or off automatically at a particular position of another transmitter control, e.g. at a defined position of one of the dual-axis sticks. Typical examples are switching a stopwatch on and off to allow you to record the motor run time, extending spoilers automatically (and many others). The MX-16iFS software includes a total of two (three – for helicopters) “control switches” of this type.

Two transmitter control switches are available for the Ch 1 stick in each model memory, both for fixed-wing model aircraft and helicopters. For helicopters a third is present in the form of the throttle limiter; see pages 33 and 62.

This manual includes a range of instructive examples which make programming as simple as child’s play. Please refer to the programming examples in the section starting on page 94.

Assigning switches and control switches

The basic procedure

At many points in the program there is the option of using a switch (SW 1 ... 4, SW 6/7, PB 8) or a control switch (C1 ... 3; see below) to operate a function, or to switch between settings, such as the DUAL RATE / EXPO function, flight phase programming, mixers and more. The MX-16iFS allows you to assign several functions to a single switch.

The process of assigning switches is exactly the same in all the relevant menus, and we will explain the basic programming procedure at this point so that you can concentrate on the special features when reading the detailed menu descriptions.

A switch symbol appears in the bottom line of the screen at all programming points where switches can be assigned:



If you move to this field using the rotary cylinder, the switch symbol field is highlighted (inverse video – black background):



This is the procedure for assigning a switch:

1. Press the rotary cylinder.

The following message appears on the screen:

**push desired switch
into position ON**

2. Now simply move the switch you wish to use to the "ON" position, press the push-button, or move the Ch 1 stick from the "OFF" position in the direction of "ON". Please note: the so-called control switches assigned to this transmitter control (see right) carry out the task of an ON / OFF switch in software; the same applies to the throttle limiter (see page 62) which is

available in the "Helicopter" model type. This completes the assignment process.

3. Changing the direction of switching:

If the switch turns out to work in the wrong direction, you can correct it as follows: move the switch to the desired OFF position, select the switch symbol once more and assign the switch again, this time with the switch direction you prefer.

4. Erasing a switch:

Activate the switch symbol as described under Point 2, then press the **CLEAR** button.

Special feature: SW 4 / PB 8

This "push-button" can be assigned in two ways:

- A brief press as On / Off switch "4", i.e.. the switched state ("on" or "off") changes every time you press the button.
- A longer press as momentary button "8", i.e.. the switch is only ON as long as the button is held pressed in.

Note:

Every time you switch the transmitter on, switch 4 always defaults to the "OFF" position.

Transmitter control switches

Many functions are best controlled automatically by a particular position of the Ch 1 transmitter stick (or the throttle limiter in the case of helicopters), rather than by a conventional physical switch.

Typical applications:

- *Automatically switching an on-board glowplug energizer on and off according to the throttle position of the Ch 1 stick ("C1" or "C2"). In this case the switch for the plug energizer is controlled by a mixer at the*

transmitter.

- *Automatically switching a stopwatch on and off to record the pure "flight time" of a model helicopter; this is accomplished using the "C3" switch of the throttle limiter.*
- *Automatically switching the "ail → rudd" mixer off when the airbrakes are extended, in order to keep the wings parallel with the ground when landing on a slope face, without the (usually coupled) rudder affecting the model's heading.*
- *Automatically extending landing flaps with coupled elevator trim adjustment on the landing approach, as soon as the throttle stick is reduced below the set threshold point.*
- *Automatically switching a stopwatch on and off in order to time the run of an electric motor.*

For both model types the MX-16iFS transmitter's software caters for these purposes with two "control switches" of this type; they can be assigned to the Ch 1 stick: "C1" is switched on at around -80% of full travel, while "C2" is switched on at around +80%. The Helicopter program also includes an extra control switch "C3" on the throttle limiter close to the 100% point; see pages 33 and 62.

All these control switches can be included without restriction in the free programming of the switches, i.e.. they can be assigned to a function instead of a physical switch. This means that you are able to assign one of the control switches C1 ... C2 (or C1 ... C3) instead of a physical switch at any point in the software where switches are assigned. All you have to do is move the Ch 1 stick or the throttle limiter control (by default the rotary proportional control CTRL 7) from the desired "OFF" position in the direction of "ON".

Digital trims

Description of function, and Ch 1 cut-off trim

Digital trims with visual and audible indicators

Both the dual-axis stick units are fitted with digital trim systems. When you give the trim lever a brief push (one “click”), the neutral position of the associated stick channel changes by one increment. If you hold the trim lever in one direction, the trim value changes continuously in the corresponding direction with increasing speed.

The degree of trim offset is also “audible”, as the pitch of the tone changes to reflect the setting. When you are flying a model, you can find the trim centre position easily without having to look at the screen: if you over-run the centre setting, the trim stays in the centre position for a moment.

The current trim values are automatically stored when you switch from one model memory to another. The digital trims are also stored separately for each flight phase within a model memory, with the exception of the “Ch 1” (Channel 1) trim, which is the throttle / airbrake trim on a fixed-wing model.

The Ch 1 trim includes another special function which makes it easy to re-locate the idle throttle setting of a glowplug motor.

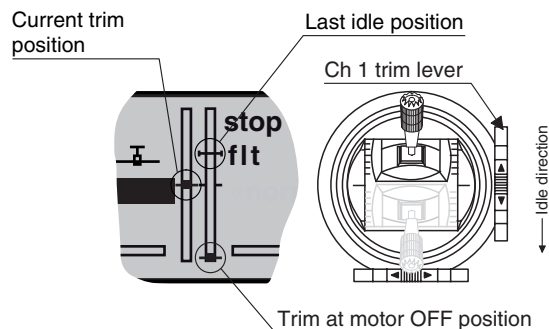
However, since the trim functions described in these instructions only affect the “Motor off” direction, the trim display on the transmitter’s screen will vary according to your individual set stick mode, i.e. the “forward” or “back” throttle / collective pitch minimum position of the Ch 1 stick, and also according to “left stick” or “right stick” for throttle / collective pitch. The illustrations in these instructions always refer to “Throttle / Collective pitch right” for both model types, and to “Throttle back” for fixed-wing models and “Collective pitch forward” for model helicopters.

1. Fixed-wing models



The Ch 1 trim features a special cut-off trim which is designed for glowplug motors: you initially use the trim lever in the usual way to select a reliable idle setting for the motor.

If you now move the Ch 1 trim lever to its end-point in the direction of “motor cut-off”, pushing the lever in a single movement, a marker appears on the screen in the last position. You can now return to the idle setting for starting the motor simply by pushing the stick one click in the direction of “open throttle”.



The cut-off trim feature is disabled if you enter “no” or “no / inv” in the “motor on C1” line within the **»base sett.«** menu (page 47).

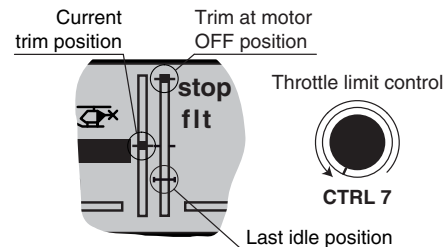
Note:

*Since this trim function is only effective in the “Motor off” direction, the above illustration will not apply if you change the direction of the Ch 1 stick for throttle minimum from “back” (which is reflected in the illustration above) to “forward” in the “Motor” line of the **»base sett.«** menu.*

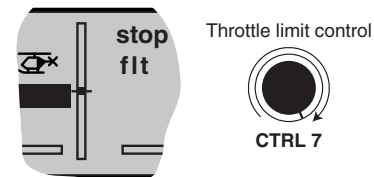
2. Model helicopters



In helicopter mode the Ch 1 trim has another feature in addition to “cut-off trim”, as described under “Fixed-wing models” on the left; this time in conjunction with the “Throttle limit function” (see page 62): while the throttle limit slider is in the bottom half of its travel, i.e. in the “start-up range”, the Ch 1 trim lever acts as idle trim on the throttle limit, and the idle trim is displayed on the screen:

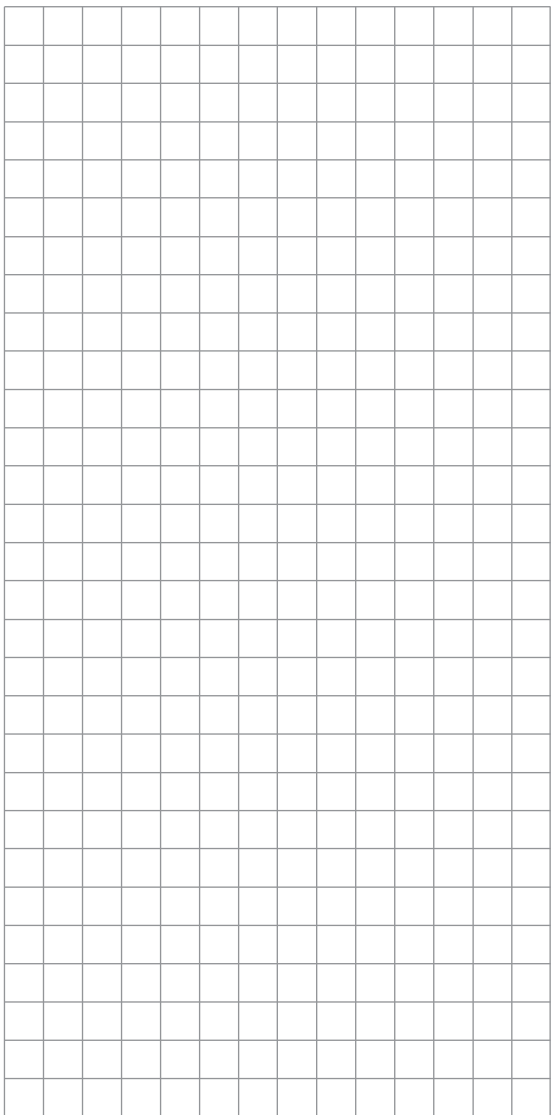
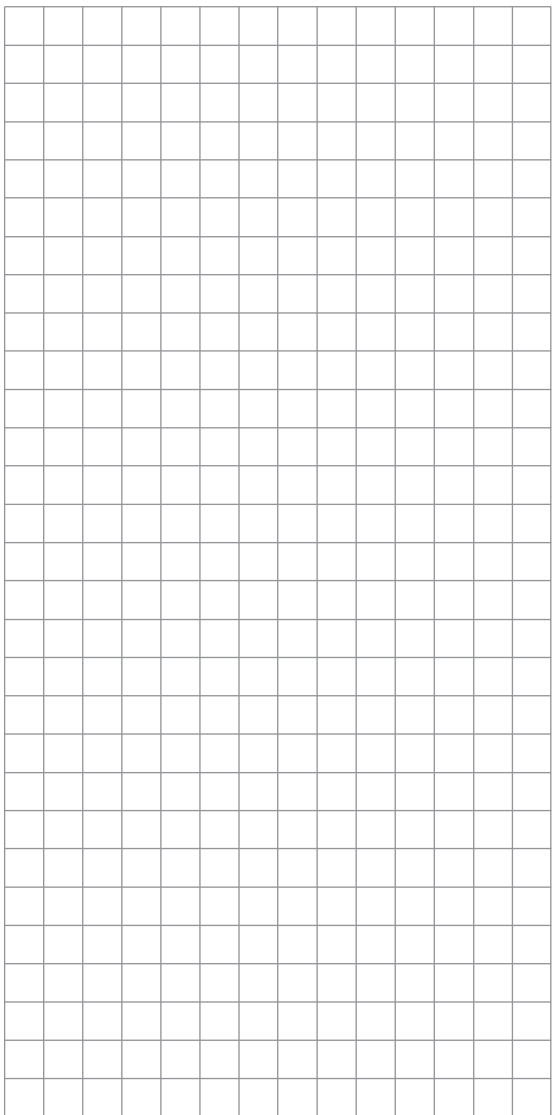
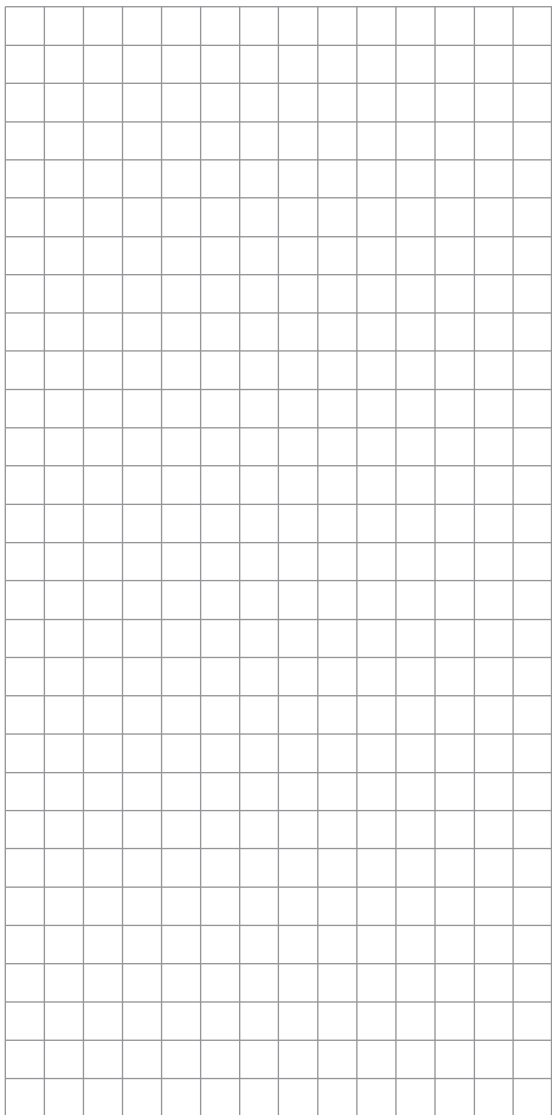


In contrast to a fixed-wing model aircraft, this display is suppressed if the throttle limit control is moved to the “right” half of its travel.



Note regarding helicopters:

The Ch 1 trim only affects the throttle servo and not the collective pitch servos; it also works evenly over the full stick travel. Please note that the helicopter throttle servo must be connected to receiver output 6 (see Receiver socket assignment, page 41).



Fixed-wing model aircraft

This program provides convenient support for normal model aircraft with up to two aileron servos and two flap servos, V-tail models, flying wings and deltas with two elevon (aileron / elevator) servos and two flap servos. The majority of power models and gliders belong to the "normal" tail type with one servo each for elevator, rudder, ailerons and throttle or electronic speed controller (airbrakes on a glider). There is also the special model type "2 elev sv" which provides a means of connecting two elevator servos to channels 3 and 8 in parallel.

If your model features two separate aileron servos (and also in some cases two flap servos), the aileron travel of both pairs of control surfaces can be set up with differential movement in the »wing mixer« menu, i.e. the down-travel can be set independently of the up-travel. Finally the program caters for camber-changing flaps, which can be operated by any of the transmitter controls "CTRL 5 ... 7". Alternatively a phase-specific trim is available for flaps, ailerons and elevator in the »phase trim« menu.

If the model features a V-tail instead of a conventional tail, you need to select the tail type "V-tail" in the »base sett.« menu, as this automatically superimposes the

elevator and rudder control functions in such a way that each tail panel can be actuated by a separate servo. For deltas and flying wings it is easy to set up mixed elevons, i.e. the aileron and elevator functions can be carried out via common control surfaces at the trailing edge of the right and left wing. As standard the program contains the appropriate mixer functions for the two servos.

Up to three flight phases can be programmed in each of the twelve model memories.

The digital trim positions are stored separately for each flight phase, with the exception of the Ch 1 trim. The Ch 1 trim provides a simple means of re-locating the correct idle throttle setting.

Two timers are available at all times when flying. The screen also displays the transmitter operating time since the battery was last charged.

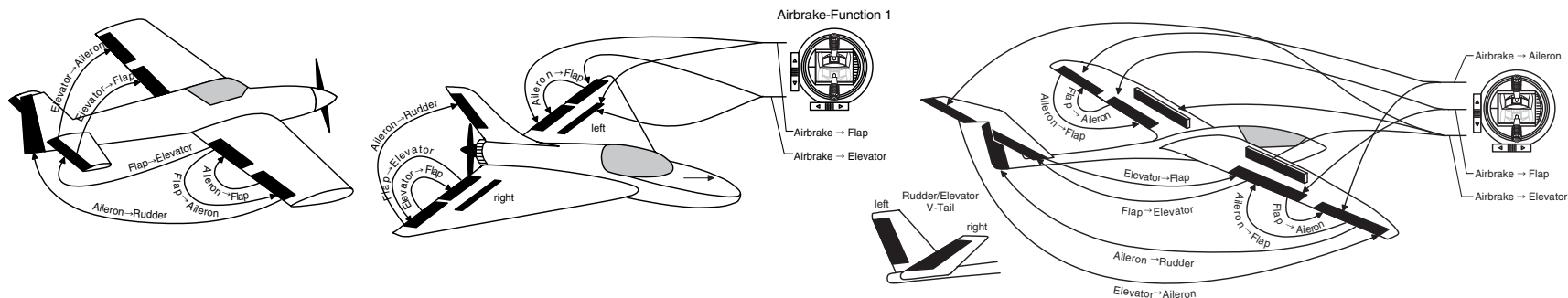
The switches SW 1 ... 8 and the transmitter controls CTRL 5 ... 7 can be assigned to any of the inputs 5 ... 8 in the »cont set.« menu.

"Dual Rate" and "Exponential" can be programmed separately for aileron, rudder and elevator, giving two

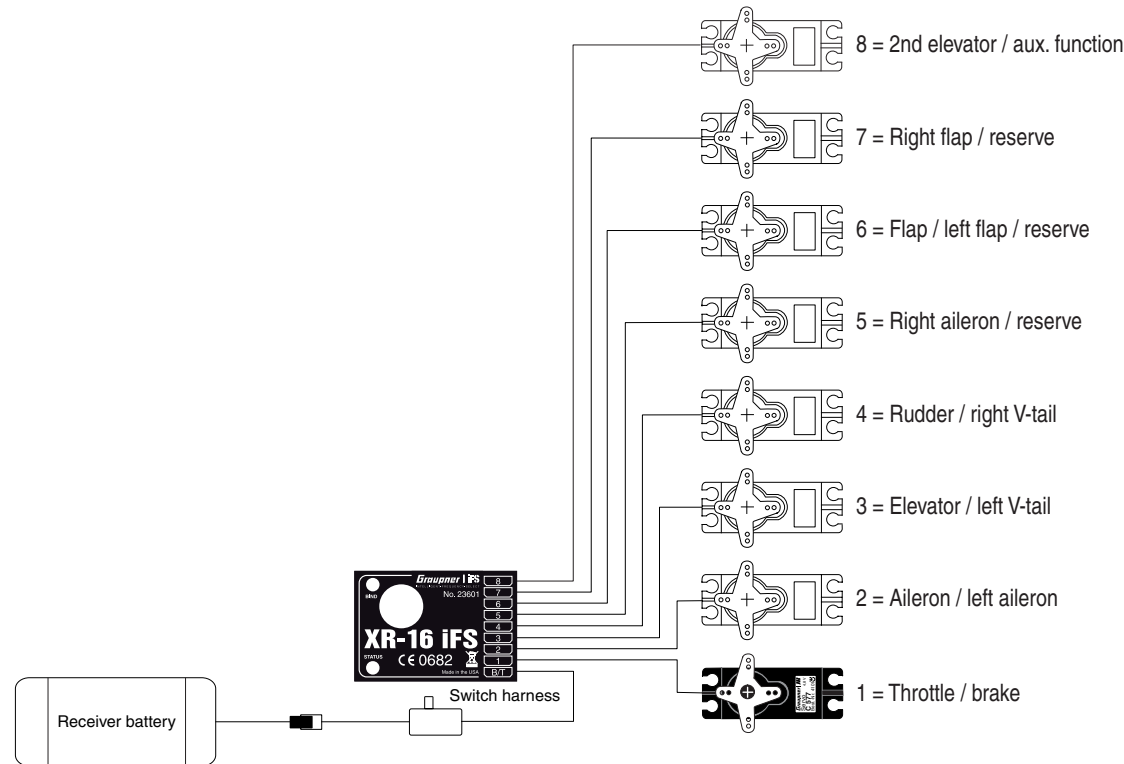
modes of control.

Depending on the model type you have selected, the »wing mixer« menu presents you with up to twelve additional pre-defined mixers and coupling functions which you can simply select and set up when necessary, in addition to three free mixers:

1. Aileron differential (switchable)
2. Flap differential (switchable)
3. Aileron → rudder (switchable)
4. Aileron → flap (switchable)
5. Airbrake → elevator (switchable)
6. Airbrake → flap (switchable)
7. Airbrake → aileron (switchable)
8. Elevator → flap (switchable)
9. Elevator → aileron (switchable)
10. Flap → elevator (switchable)
11. Flap → aileron (switchable)
12. Differential reduction



Receiver socket assignment for models with up to two ailerons and two flaps, plus “normal” tail type, V-tail, and two elevator servos (3 + 8)



Installation notes

The servos MUST be connected to the receiver outputs in the following order:

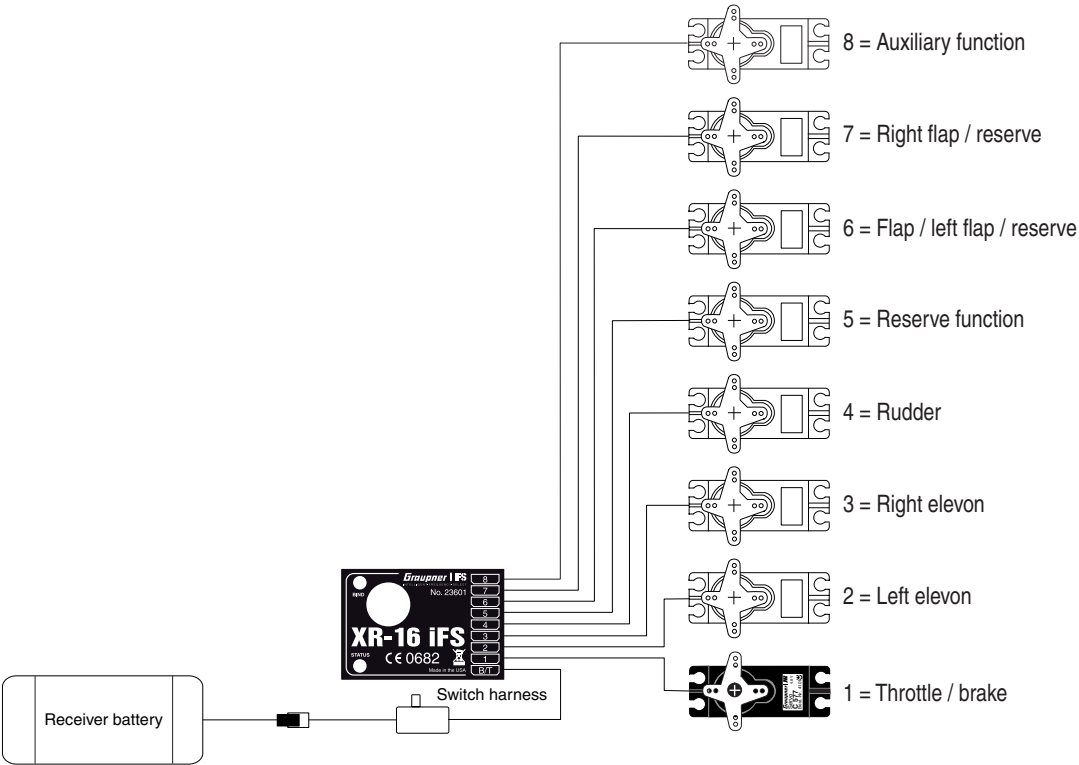
Outputs not required are simply left vacant. Please note the following points in particular:

- If you are using only one aileron servo, receiver output 5 (right aileron) is left unused; it can also be used for another purpose if you select “1 aile” in the »**base sett.**« menu.
- If you are using only one flap servo, receiver output 7 (right flap) MUST be left unused, assuming that you have selected “2 ail 2 fl” in the »**base sett.**« menu.

If you are using a *GRAUPNER* transmitter to control a model which was formerly flown using a different make of transmitter fitted with a *Graupner* iFS RF module, e.g. when using the *MX-16iFS* for Trainer mode operations, it may be necessary to re-arrange the servo sequence at the receiver outputs as shown in the diagram on the left. However, an alternative method is to use the “receiv(er) out(put)” sub-menu of the »**base sett.**« menu; see page 49. Different methods of installing servos and control linkages may make it necessary to reverse the direction of rotation of some servos when programming. In both cases this is carried out in the »**servo set.**« menu; see page 56.

Please also read the information on the following pages.

Receiver socket assignment for models of the “Delta / Flying wing” type, with up to two flaps



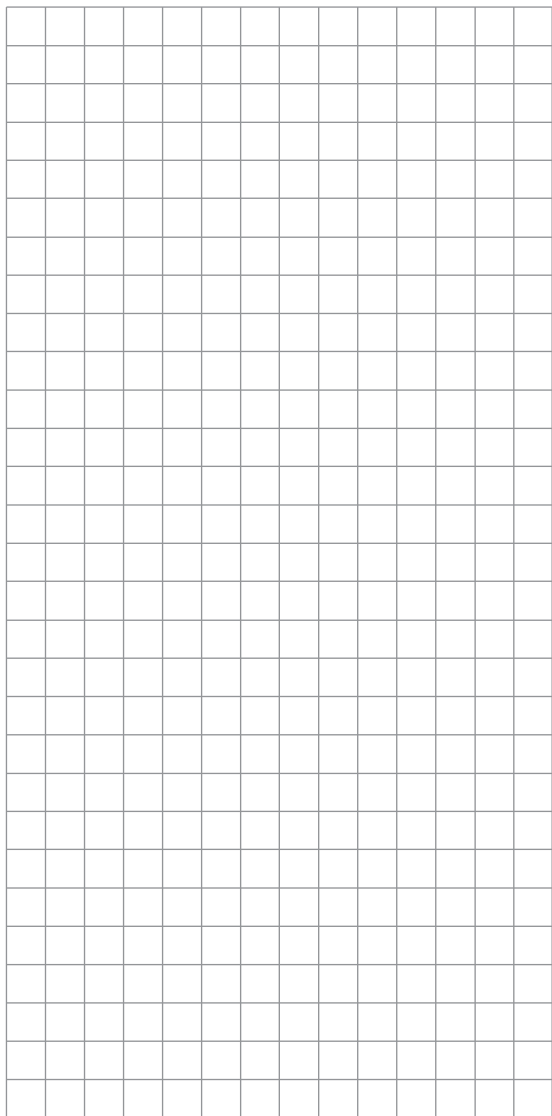
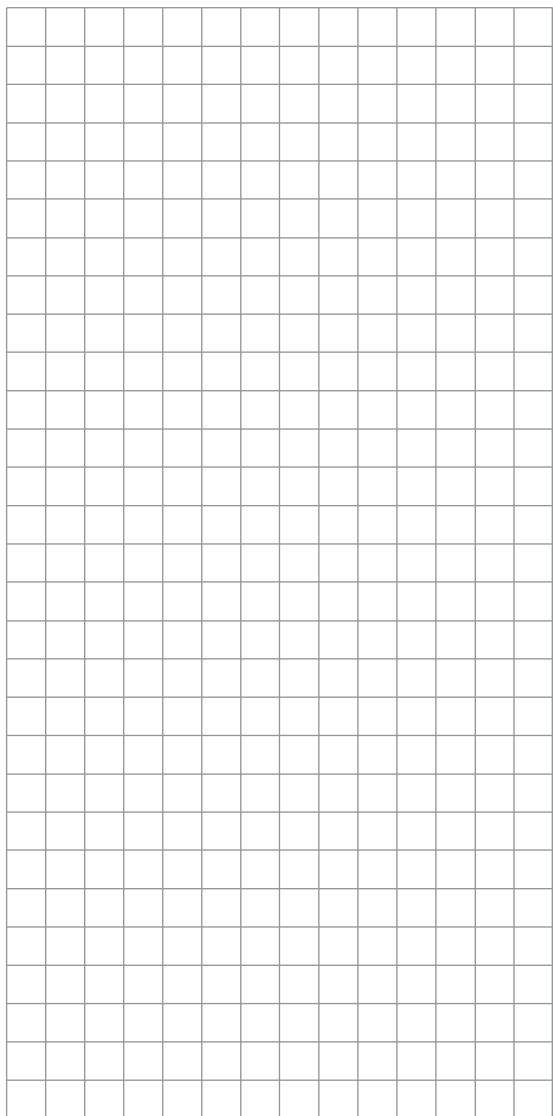
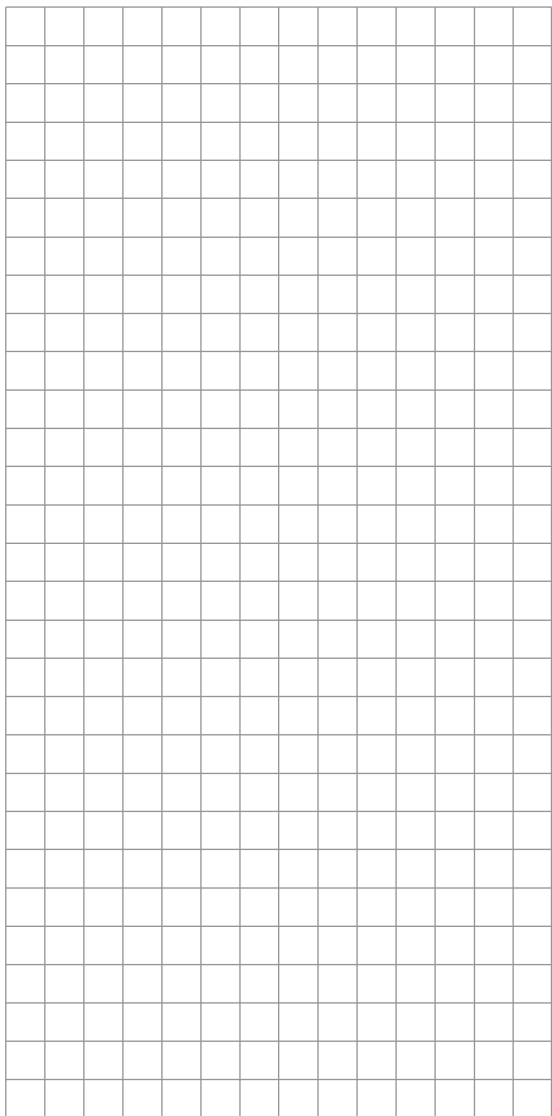
As there are several possible combinations of servo orientation and control surface linkage, you may find that the direction of rotation of one or more servos is incorrect. Use the following table to solve the problem.

Model type	Servo rotating in wrong direction	Remedy
V-tail	Rudder and elevator reversed	Reverse servos 3 + 4 in the » servo set. « menu
	Rudder correct, elevator reversed	Swap over servos 3 + 4 at the receiver
	Elevator correct, rudder reversed	Reverse servos 3 + 4 in the » servo set. « menu, AND swap over at the receiver
Delta, flying wing	Elevator and ailerons reversed	Reverse servos 2 + 3 in the » servo set. « menu
	Elevator correct, ailerons reversed	Reverse servos 2 + 3 in the » servo set. « menu, AND swap over at the receiver
	Ailerons correct, elevator reversed	Swap over servos 2 + 3 at the receiver

All menus which are relevant to fixed-wing models are marked with an “aeroplane” symbol in the “Program descriptions”:



This means that you can easily skip irrelevant menus when programming a fixed-wing model aircraft.





Model helicopters

The continued development of model helicopters and helicopter components, such as gyros, speed governors, rotor blades etc., has led to the current position where helicopters are capable of sophisticated 3-D aerobatics. In contrast, if you are a beginner to helicopter flying, you need a simple set-up so that you can quickly get started on the initial stages of hovering practice, and then gradually work up to more complex models which exploit all the options provided by the MX-16iFS.

The helicopter program of the MX-16iFS can cope with all current model helicopters equipped with 1 ... 4 servos for collective pitch control, entirely regardless of whether they are powered by a fuel-driven or electric motor.

Each model memory can include two flight phases plus auto-rotation.

Two timers are constantly included in the basic screen display. At the same time the period which has elapsed since the last charge process is also displayed.

You can return to the correct idle position for the digital Ch 1 trim simply by pressing a button.

“Dual Rate” and “Exponential” are available for roll, pitch-axis and tail rotor; they can be coupled together, and programmed to provide two settings.

All the transmitter controls (CTRL) and switches (SW) can be assigned to inputs 5 ... 8 in virtually any order. This is carried out in the »**contr set.**« menu.

In addition to three linear mixers, which can be assigned to any functions and can also be switched on and off, the »**heli mixer**« menu provides five-point curves for the collective pitch, throttle and tail rotor mixers, variable separately for each flight phase; these provide non-linear mixer characteristics.

1. *Collective pitch*
2. *C1 → throttle*
3. *C1 → tail rotor*

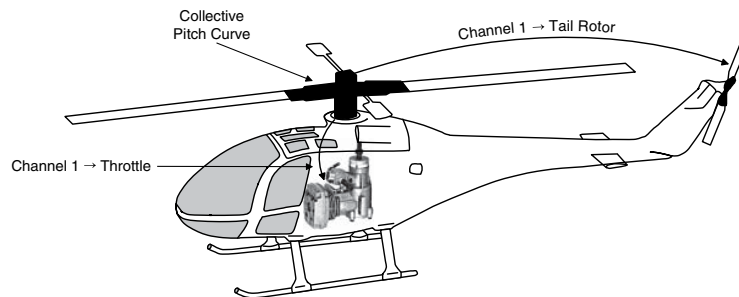
Such advanced features are not needed by the begin-

ner, who will initially simply set the hover point to coincide with the centre point of the stick arc, and adjust the collective pitch travel as required.

Moreover the »**heli mixer**« menu offers two additional set-up options in the lines “Gyro” and “I8”.

The mixer inputs for collective pitch, roll and pitch-axis can then be adjusted in the »**swashp.mix**« menu.

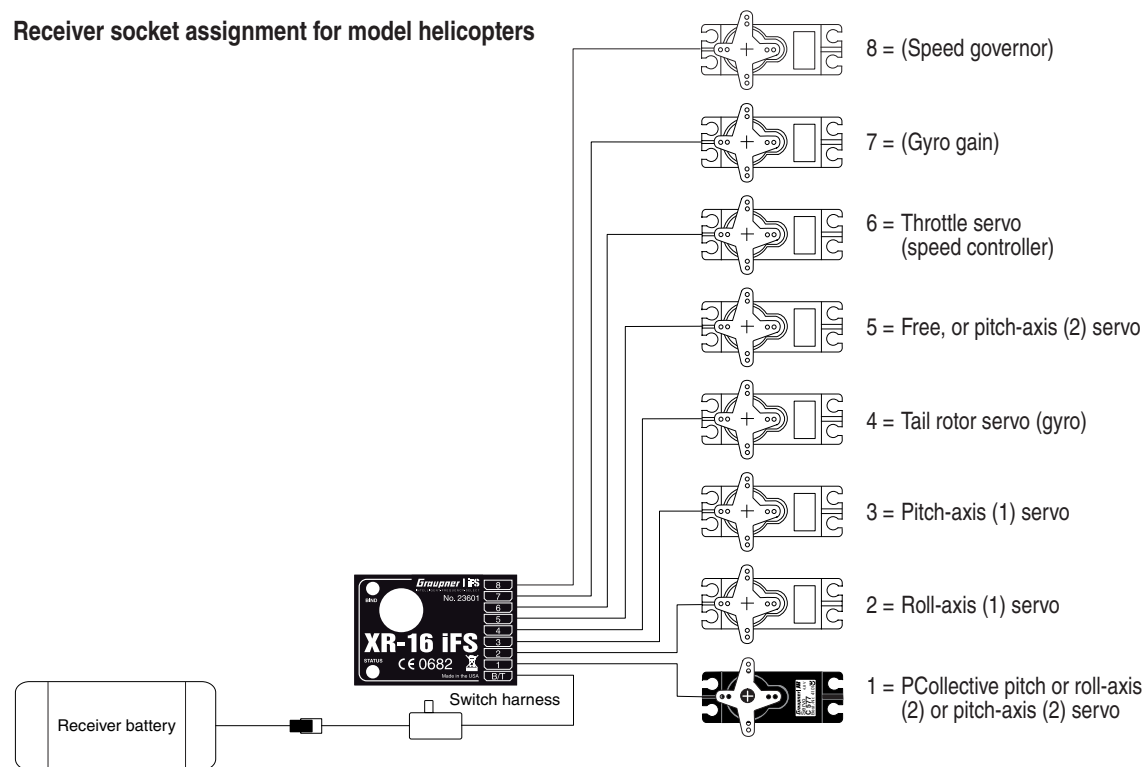
The throttle limit function in the »**contr set.**« menu provides an effective means of starting the motor in any flight phase. By default the proportional rotary control CTRL 7 is assigned to this input, and this control function determines the maximum throttle servo position, i.e. the trim lever controls the motor over the idle range. Only when the rotary knob is turned in the direction of full-throttle do the programmed throttle curves take effect. If you have set up the two timers, they also start recording the flight time automatically at this pint. See page 52 for more information on this.



Note for modellers upgrading from earlier **GRAUPNER** systems:

Compared with the previous receiver channel sequence, servo socket 1 (collective pitch servo) and servo socket 6 (throttle servo) have been interchanged. The servos **MUST** be connected to the receiver output sockets in the order shown at bottom right. Outputs not required are simply left vacant. For more information on the different types of swashplate, please refer to the »**base sett.**« menu described on page 51.

Receiver socket assignment for model helicopters



All menus which are relevant to model helicopters are marked with a "helicopter" symbol in the "Program descriptions":



This means that you can easily skip irrelevant menus when programming a model helicopter.

Installation notes

The servos **MUST** be connected to the receiver outputs in the order shown on this page. Outputs not required are simply left vacant.

Please note the additional information on the following pages.

Note:

To be able to exploit all the convenience and safety features of the throttle limiter (see page 62), the speed controller should be connected to receiver output "6", and not to receiver output "8", as shown in the drawing on the left. See page 81 for more details.

If you are using a **GRAUPNER** transmitter to control a model which was formerly flown using a different make of transmitter fitted with a *Graupner* IFS RF module, e.g. when using the **MX-16iFS** for Trainer mode operations, it may be necessary to re-arrange the servo sequence at the receiver outputs as shown in the diagram on the left. However, an alternative method is to use the "receiv(er) out(put)" sub-menu of the »**base sett.**« menu; see page 53. Different methods of installing servos and control linkages may make it necessary to reverse the direction of rotation of some servos when programming. In both cases this is carried out in the »**servo sett.**« menu; see page 56.

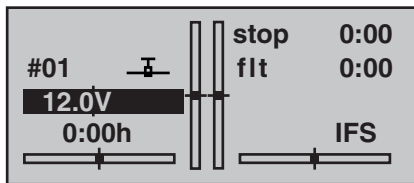


Detailed description of programming

Reserving a new memory

If you have already read through the manual to this point, you will undoubtedly have made your first attempt at programming the system already. Even so, it is important to describe each menu here in detail, to ensure that you have comprehensive instructions for each application you are likely to encounter.

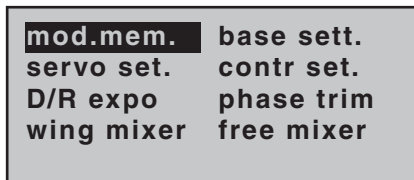
In this section we start with setting up a “free” model memory prior to “programming” a new model:



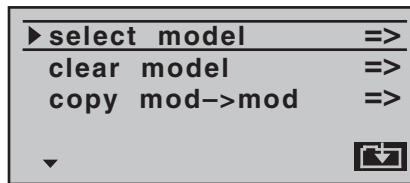
Note:

You can adjust the screen contrast at any time by turning the rotary cylinder when held in.

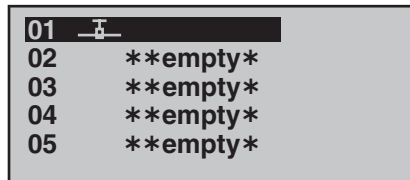
From the basic display press the **ENTER** button to move to the “Multi-function list”. You can return to the basic screen at any time by pressing **ESC**. If necessary, select the »mod. mem.« (Model memory) menu from the list using the rotary cylinder ...



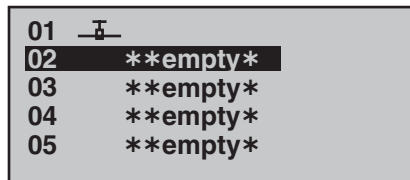
... then press **ENTER** or the rotary cylinder.



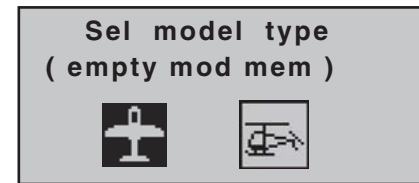
Now press **ENTER** or the rotary cylinder again to move on to the “select model” sub-menu.



In the transmitter's default state the first model memory is already initialised with the “Fixed-wing model” model type, while the remainder are not yet occupied; these are entitled “**empty*”. If you want to set up a fixed-wing model, then you can immediately start the programming procedure after leaving the “select model” sub-menu and the »mod. mem.« menu by pressing **ESC** each time ... alternatively you can select one of the free model memories, and press **ENTER** or the rotary cylinder.



You are now invited to select the basic model type, i.e. either “Fixed-wing” or “Helicopter”:



Use the rotary cylinder to select the appropriate model type, then press **ENTER** or the rotary cylinder to confirm your choice. The screen switches back to the basic display: the model memory is now reserved for your chosen model type.

However, if you wish to get started with a **helicopter**, then select one of the model memories entitled “**empty*”, and confirm your choice with a brief press on the rotary cylinder or the **ENTER** button. You are now requested to define the basic model type, i.e. either “fixed-wing” or “helicopter”. Use the rotary cylinder to select the corresponding symbol, then press the rotary cylinder or the **ENTER** button again briefly. This initialises the selected model type for the model memory you just selected, and you can now start programming your model in this memory.

It is now only possible to change this memory to a different model type if you first erase the model memory (»mod. mem.« menu, page 44).

Note:

- If you wish to erase the model memory which is currently active in the basic display, you will have to define one of the two model types “fixed-wing” or “helicopter” immediately after completing the erase procedure. You cannot avoid making this choice by switching the transmitter off. If you wish to remove a model memory which you inadvertently occupied, you can simply erase it from a different model memory.

However, if you erase a model memory which is not currently active, after the procedure you will see the memory marked as “**empty*” under “Model Select”.

- All the transmitter's functions are barred, and the transmitter does not broadcast a signal, until you confirm the model type you have selected. If you switch the transmitter off before you set the model type, the screen will automatically switch to the Model Type Select display when turned on again. You must always define a model type!
- If the warning

**throttle
too
high !**

appears on the screen, move the throttle stick back in the direction of idle.

This warning only appears in accordance with the settings you have entered in the “motor on C1” or “pitch min.” section of the »**base sett.**« menu, as described on pages 46 and 50. If you are setting up a non-powered fixed-wing model, enter “no” or “no / inv” at this point; this disables the throttle warning message, and makes available the “Brake → N.N.” mixers in the »**wing mixer**« menu, which would otherwise be suppressed.

- If the transmitter's model memories are already occupied, then a pictogram of the selected model type appears in the appropriate model memory, followed by a blank line, or the model's name if a name has been entered in the »**base sett.**« menu (pages 46 and 50).
- If the battery voltage is too low, the software prevents

you switching model memories in the interests of safety. In this case the screen displays this message:

**not possible now
voltage too low**

Basically there are now four different methods of assigning the four control functions aileron, elevator, rudder and throttle / airbrakes (fixed-wing model), and roll, pitch-axis, tail rotor and throttle / collective pitch (model helicopter) to the two primary dual-axis sticks. Which of these options is adopted depends on the personal preference of the individual model flyer. This function is set in the “**stick mode**” line for the currently active model memory in the »**base sett.**« menu (page 46 or 50):

model name<	>
► stick mode	1
motor on C1	no
tail type	normal
▼▲	SEL

As mentioned earlier, for maximum flexibility the transmitter controls 5 ... 8 are not assigned to transmitter controls by default, and can be assigned to any channels you like; this also helps to avoid accidental mishandling.

This means that **in the default state of the equipment only those servos connected to receiver outputs 1 ... 4 can be controlled by the two dual-axis sticks, whereas servos connected to sockets 5 ... max. 8 remain steadfastly at their centre position.** If you set up a new model helicopter, servo 6 also responds to the controls. In both model types this situation only changes once you have carried out the appropriate assignments in the »**contr sett.**« menu.

You will find a description of the basic steps for programming a fixed-wing model aircraft in the Programming Examples section starting on page 96; for model helicopters the equivalent section starts on page 116.

In contrast, the following menu descriptions are arranged in the order that they are listed in the individual menus in the multi-function list.

* N.N. = Nomen Nominandum (name to be stated)



Model memories

Calling up a model, erasing a model, copying model → model

The section on pages 18 and 19 explains the basic method of using the buttons, while the previous double page explains how to move to the Multi-function list and reserve a new model memory. At this point we now wish to start with the “normal” description of the individual menu points in the sequence in which they occur on the transmitter itself. For this reason we start with the menu ...

Model memory

mod.mem.	base sett.
servo set.	contr set.
D/R expo	phase trim
wing mixer	free mixer

The transmitter can store up to twelve complete sets of model data, including the digital trim values set by the four trim levers. The trims are automatically stored, which means that the settings you have carefully established through test-flying are never lost when you swap models. If you have entered a model name in the »**base sett.**« menu (pages 46 and 50), the name appears in all three sub-menus of the »**mod. mem.**« menu following the model number and a pictogram of the selected model type.

Use the rotary cylinder to select the »**mod. mem.**« menu, and press **ENTER** or the rotary cylinder:

Select model

▶ select model	=>
clear model	=>
copy mod->mod	=>
▼	

If you now press the **ENTER** button or the rotary cylinder again, you move to the “select model” sub-menu:

01	GRAUBELE
02	ULTIMATE
03	STARLET
04	BELL47G
05	**empty*

Now use the rotary cylinder to select from the list the model you wish to use, and confirm your selection by pressing the **ENTER** button or the rotary cylinder. Pressing **ESC** takes you back to the previous menu page without switching models.

Notes:

- If the warning message “Throttle too high” appears when you switch models, the throttle stick (Ch 1) is set towards full throttle and should be moved back to idle.
- If the battery voltage is too low, it may not be possible to switch model memories for safety reasons. In this case the screen displays the following message:

not possible now voltage too low

Clear model

Hold the rotary cylinder pressed in and select the “clear model” sub-menu, then press **ENTER** or the rotary cylinder:

select model	=>
▶ clear model	=>
copy mod->mod	=>
▼ ▲	

Use the rotary cylinder to select from the list the model you wish to erase ...

model to be cleared :	
01	GRAUBELE
02	ULTIMATE
03	STARLET
04	BELL47G

... then press **ENTER** or the rotary cylinder. The program responds with the security query:

model	
01	GRAUBELE
to be erased ?	
NO	YES

If you answer **NO**, the process is interrupted, and you are returned to the previous screen page. If you answer **YES** with the rotary cylinder and confirm your choice with **ENTER** or by pressing the rotary cylinder, then the selected model memory is erased.

Caution:

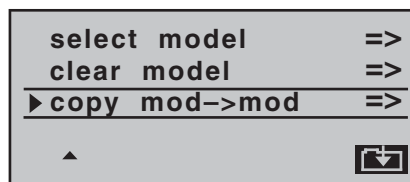
The erasure process is irrevocable. All model memory data is reset to the factory default settings.

Note:

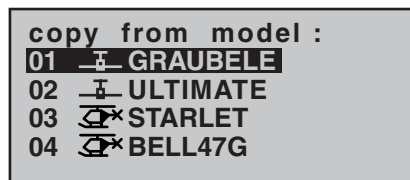
If you wish to erase the currently active model memory in the basic display, you will be required to define the model type "Helicopter" or "Fixed-wing" immediately. However, if you erase a non-active model memory, then the message "**empty*" appears in the Model select menu.

Copy model → model

Hold the rotary cylinder pressed in, select the "Copy model → model" sub-menu, and press **ENTER** or the rotary cylinder:



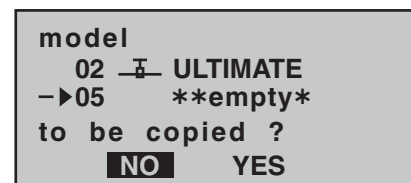
Select the model to be copied using the rotary cylinder ...



... then press **ENTER** or the rotary cylinder again. In the "Copy to model" window you can now select the target memory and confirm your choice with **ENTER** or the rotary cylinder. Alternatively you can interrupt the process with **ESC**. It is possible to overwrite a model memory which already contains model data.



When you confirm the selected model memory by pressing the **ENTER** button or the rotary cylinder, the security query appears:



Selecting **NO** interrupts the process, and returns you to the previous page. If you select **YES** with the rotary cylinder, and confirm your choice with **ENTER** or the rotary cylinder, then the selected model is copied into the chosen target model memory.



Basic settings

Basic model-specific settings for fixed-wing model aircraft

Before you start programming specific parameters, some basic settings must be entered which apply only to the currently active model memory. Select the »**base sett.**« menu with the rotary cylinder, and press **ENTER** or the rotary cylinder:

mod.mem.	base sett.
servo set.	contr set.
D/R expo	phase trim
wing mixer	free mixer

Model name

▶ model name< >	
stick mode	1
motor on C1	no
tail type	normal
▼ ▲ SEL	

Press **ENTER** or the rotary cylinder to move to the next screen page (▶), where you can select characters to assemble the model name. You can enter up to nine characters to define a model name:

0123456789: ; <=>?
A B C D E F G H I J K L M N O
P Q R S T U V W X Y Z
model name < GRAU B >

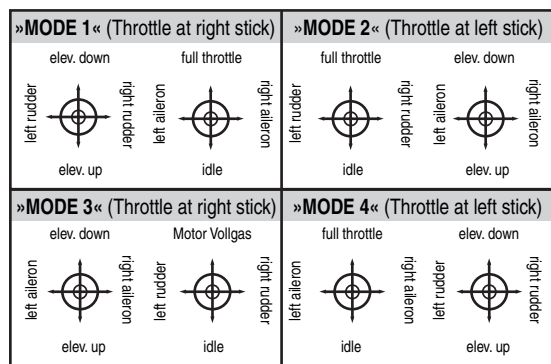
Use the rotary cylinder to select the first character in the symbol field. A brief press on the rotary cylinder (or turning it when pressed) moves to the next position in the name, at which point you can again select a character. Pressing **CLEAR** inserts a space at that point.

You can move to any character position within the input field with the rotary cylinder pressed in; it is indicated by a double arrow <—> above the input field while the rotary cylinder is held pressed in.

The model name entered in this way appears in the basic display, and also in the sub-menus of the »**mod. mem.**« menu.

Stick mode

Basically there are four possible ways of arranging the principal control functions of a fixed-wing model on the two dual-axis sticks: the primary functions are aileron, elevator, rudder and throttle (or airbrakes). Which of these options you select depends on your individual preferences and flying style:



When you select "stick mode" with the rotary cylinder pressed in, you will see **SEL** at the bottom edge of the screen:

model name< GRAUBELE >	
▶ stick mode	1
motor on C1	no
tail type	normal
▼ ▲ SEL	

Press the **ENTER** button or the rotary cylinder, and the current stick mode is highlighted (inverse video – black background). Now use the rotary cylinder to select one of the options 1 to 4.

Pressing **CLEAR** resets the function to stick mode "1".

motor on C1

model name< GRAUBELE >	
stick mode	1
▶ motor on C1	no
tail type	normal
▼ ▲ SEL	

When you select "motor on C1" with the rotary cylinder pressed in, you will see **SEL** at the bottom edge of the screen. Press the rotary control briefly: the current setting is highlighted. Now use the rotary cylinder to switch between the four possible options:

"idle fr.": The idle position of the throttle / airbrake stick (Ch 1) is forward, i.e. away from the pilot.

The throttle warning message "Throttle too high" is *activated* (see page 18). In the »**wing mixer**« menu the "Brake → N.N.*" mixers are *disabled*.

"idle re.": The idle position of the throttle / airbrake stick (Ch 1) is back, i.e. towards the pilot. The throttle warning message "Throttle

- too high" is *activated* (see page 18). In the »**wing mixer**« menu the "Brake → N.N.*" mixers are *disabled*.
- "no": The brake system is "retracted" in the forward position of the throttle / brake stick. In the »**wing mixer**« menu the "Brake → N.N.*" mixers are *activated*. The throttle warning message "Throttle too high" is *disabled*.
- "no/inv" The brake system is "retracted" in the back position of the throttle / brake stick. In the »**wing mixer**« menu the "Brake → N.N.*" mixers are *activated*. The throttle warning message "Throttle too high" is *disabled*.

Notes:

- Depending on your choice in this menu, the Ch 1 trim acts "normally" (over the full control travel), or just at the idle end of the range, i.e. only at the "back" or "forward" end of the stick travel.
- Cut-off trim: this special function is described on page 34.

Tail

model name<GRAUBELE>	
stick mode	1
motor on C1	no
▶ tail type	normal
▼▲	SEL

When you select "tail type" with the rotary cylinder pressed in, you will see **SEL** appear at the bottom edge

of the screen. Press the **ENTER** button or the rotary cylinder: the current setting is highlighted. Now use the rotary cylinder to select the option which matches your model:

„normal“: This setting caters for all models in which each of the functions elevator and rudder is operated by one servo.

„V-tail“: The elevator and rudder controls are operated by two control surfaces set in a V-shape, each controlled by a separate servo. The two-way coupling function for the rudder and elevator control systems is automatically carried out by the transmitter software. If necessary, the ratio of rudder travel to elevator travel can be adjusted in the »**D/R expo**« menu (page 66).

„Delt/FIW“: The mixed elevon (aileron and elevator) control system requires two or four separate servos, one or two in each wing. However, the elevator trim only affects servos 2 + 3, even if you select "2ail 2fl" – see right-hand column.

„2 elev sv“: This option is designed for model aircraft with two elevator servos. When the elevator stick is moved, the servo connected to receiver output 8 moves in parallel with servo 3. The elevator trim lever affects both servos.

Note regarding "2 elev sv":

In this mode a transmitter control which is assigned to input 8 in the »**contr set.**« menu is de-coupled from servo "8"; this is for safety reasons.

Ailerons / Camber-changing flaps

stick mode		1
motor on C1		no
tail type		normal
▶ aile / flap		1aile
▼▲		SEL

When you select the "aile / flap" line with the rotary cylinder pressed in, you will see **SEL** appear at the bottom edge of the screen. Press **ENTER** or the rotary cylinder, and the current setting is highlighted. Now use the rotary cylinder to select one of the three options.

- "1aile" Both ailerons are actuated by a single servo.
- "2aile" Each aileron is actuated by a separate servo.
- "2ail2fl" Each aileron is actuated by a separate servo; there are also one or two camber-changing flap servos.

The mixers and associated adjustment facilities which appear in the »**wing mixer**« menu (see section starting on page 72) vary according to the data you enter here. The software provides a maximum of twelve ready-made mixers for up to two aileron servos and two camber-changing flap servos.

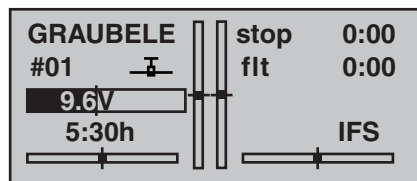
Note:

If your model is equipped with only one flap servo, you should still select "2ail 2fl", but leave the "ail → flaps" mixer in the »**wing mixer**« menu (see page 72) at 0%. In contrast, all the other wing mixers can be used in the usual way.

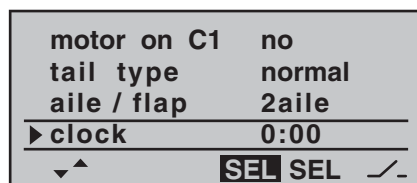
* N.N. = Nomen Nominandum (name to be stated)

Timers

Two timers are shown in the basic display: one stopwatch and one flight timer.



You can assign a physical switch or a control switch to these two timers in the “Timers” line ...



... using the switch symbol on the right-hand side. The assigned switch starts both timers, and also halts the stopwatch.

The method of assigning a physical switch or a control switch is described on page 33.

The flight timer always starts simultaneously with the stopwatch, but continues to run even when the stopwatch is halted (switched off). It can only be stopped by pressing **ESC** with the stopwatch halted.

Once stopped, pressing **CLEAR** resets both timers to the initial value.

Switching between “count-up” and “count-down”

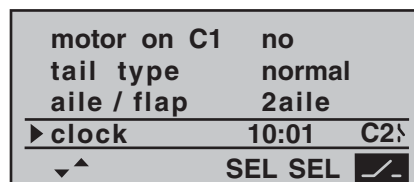
Count-up timer (stopwatch function)

If you assign a switch and start the stopwatch with the initial value of “0:00”, the timer runs up until the maximum of 999 minutes and 59 seconds, then re-starts at 0:00.

Count-down timer (alarm timer function)

You can use the left-hand **SEL** field to select a starting time within the range 0 to 180 minutes; using the right-hand **SEL** field the range is 0 to 59 seconds. Any combination of times can also be selected.

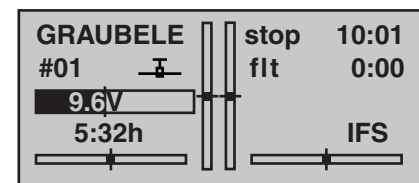
(**CLEAR** = “0” or “00”).



Procedure

1. Select the **SEL** field with the rotary cylinder.
2. Press the rotary cylinder.
3. Select the required time in the highlighted minutes and seconds fields using the rotary cylinder.
4. Press the rotary cylinder to conclude the input process.

Once you have switched back to the basic display, press the **CLEAR** button first with the stopwatch halted, so that the stopwatch switches to the “Timer” function; see top right in the next illustration.



When you operate the assigned switch, the stopwatch starts from the set initial value, counting down (“Timer function”). When the set time has elapsed, the timer does not stop, but continues to run so that you can read off the time elapsed after reaching zero. To make this clear, the over-run time is shown highlighted (inverse video).

Sequence of sounds

- 30 sec. before zero: triple beep
- single beep every two seconds
- 20 sec. before zero: double beep
- single beep every two seconds
- 10 sec. before zero: single beep
- single beep every second
- 5 sec. before zero: single beep every second at higher rate
- zero: longer beep; display switches to inverse video

The “alarm timer” is reset by pressing the **CLEAR** button once you have halted the timer.


Note:

A count-down timer is indicated in the basic display by a flashing colon (:) between the minutes field and the seconds field.

Phase 2 / Phase 3


clock	10:01	C2\
phase 2	takeoff	
▶ phase 3	speed	
train./stu.		
		SEL / -

When you select “phase 2” and / or “phase 3”, you will see **SEL** at the bottom edge of the screen. Press **ENTER** or the rotary cylinder, and the current setting is shown highlighted. If you do not wish to use the default names, use the rotary cylinder to select a suitable name from the pre-sets. Press the rotary cylinder to return to the function line.

Move to the switch symbol  using the rotary cylinder, then press the rotary cylinder again briefly. A switch can be assigned to the flight phase as described on page 33.

For more information on flight phase programming please refer to page 70, in the section entitled »Phase trim«.

Trainer / student


clock	10:01	C2\
phase 2	takeoff	
phase 3	speed	
▶ train./stu.		
		

In this menu line you can assign a “transfer switch” for Trainer (teacher / pupil) mode operations, after pressing the rotary cylinder or **ENTER**, as described on page 33. The switch is used to transfer control from one transmitter to the other.

For more information on Trainer systems please refer to page 122.

Receiver output

For maximum flexibility in terms of receiver socket assignment, the MX-16iFS software provides the means to swap over the servo outputs 1 to max. 8; this is carried out on the second page of the “Receiver output” sub-menu.

phase 2	takeoff
phase 3	speed
train./stu.	
▶ receiv out	=>
	

Press the rotary cylinder or the **ENTER** button to move to the next page of the display. Here you can assign the “control channels” for servos 1 ... 8 to any receiver output you wish to use. However, please note that the display in »servo display« – which you can reach by pressing the rotary cylinder from the basic display – refers exclusively to the “control channels”, i.e. the outputs are *not* swapped over.

▶S	1	→	output	1
S	2	→	output	2
S	3	→	output	3
S	4	→	output	4
▼ SEL				

With the rotary cylinder held pressed in, select the servo / output combination you wish to change, then press **ENTER** or the rotary cylinder. Now you can assign the desired servo(s) to the selected output using the rotary cylinder ... or alternatively press **CLEAR** to revert to the

default sequence.

Please note that any subsequent changes to servo settings, such as servo travel, Dual Rate / Expo, mixers etc., **must be carried out according to the original (default) receiver socket sequence.**

Note:

It is also possible to swap over the outputs of XR-series receivers at the receiver itself, as described on page 26 and in the instructions supplied with the actual receiver. However, we strongly recommend that you use only one of the two options, as a combination will soon lead to confusion.

Typical applications:

- If you wish to use a smaller receiver with six or even just four servo sockets, it may be necessary to re-assign the receiver sockets in order to be able to operate a second camber-changing flap, a second aileron servo or a speed controller.
- It may also prove necessary to swap servos for Trainer mode operations, if you are using a model set up for another make of equipment fitted with a Graupner/iFS RF module, to avoid having to re-connect the servos at the receiver.



Basic settings

Basic model-specific settings for model helicopters

Before you start programming specific parameters, some basic settings must be entered which apply only to the currently active model memory. Select the »**base sett.**« (Basic model settings) menu with the rotary cylinder, and press **ENTER** or the rotary cylinder:

mod.mem. **base sett.**
servo set. **contr set.**
D/R expo **heli mixer**
free mixer

Model name

► **model name** < >
stick mode 1
swashplate 1 servo
rotor direct left
SEL

Press **ENTER** or the rotary cylinder to move to the next screen page (◀▶), where you can select characters to assemble the model name. You can enter up to nine characters to define a model name:

0123456789: ; < = > ?
A B C D E F G H I J K L M N O
P Q R S T U V W X Y Z
model name <STAR▶

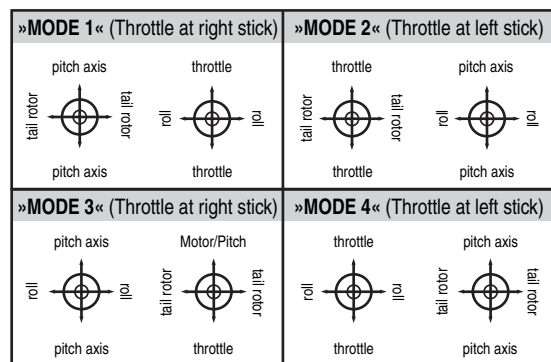
Use the rotary cylinder to select the first character in the symbol field. A brief press on the rotary cylinder (or turning it when held in) moves to the next position in the name, at which point you can again select a character. Pressing **CLEAR** inserts a space at that point.

You can move to any character position within the input field using the rotary cylinder pressed in; it is indicated by a double arrow <—> above the input field while the rotary cylinder is held pressed in.

The model name entered in this way appears in the basic display, and also in the sub-menus of the "Model memory" menu point.

Stick mode

Basically there are four possible ways of arranging the principal control functions of a model helicopter on the two dual-axis sticks: the primary functions are roll, pitch-axis, tail rotor and throttle / collective pitch. Which of these options you select depends on your individual preferences and flying style.



When you select "stick mode" with the rotary cylinder pressed in, you will see **SEL** at the bottom edge of the screen:

model name <STARLET >
► stick mode 1
swashplate 1 servo
rotor direct left
SEL

Press **ENTER** or the rotary cylinder, and the current stick mode is highlighted (inverse video – black background). Now use the rotary cylinder to select one of the options 1 to 4.

Pressing **CLEAR** resets the function to stick mode "1".

Swashplate type

model name <STARLET >
stick mode 1
► swashplate 1 servo
rotor direct left
SEL

You will require a particular program variant to suit the number of servos which operate the collective pitch function.

Select "swashplate" with the rotary cylinder pressed in, and **SEL** appears at the bottom edge of the screen. Press the rotary cylinder. The current number of collective pitch servos is highlighted on the screen. You can now determine the required variant using the rotary cylinder:

- „1 servo“: The swashplate is tilted by one roll servo and one pitch-axis servo. Collective pitch is controlled by *one* separate servo.
- The »**swashp.mix**« menu point is suppressed in the multi-function menu if you select "1 servo" as the swashplate

type. This is because model helicopters with only one collective pitch servo are controlled without transmitter mixers for the swashplate functions collective pitch, pitch-axis and roll.

„2 servo“: The swashplate is moved axially by two roll servos for collective pitch control; pitch-axis control is de-coupled by a mechanical compensating rocker (HEIM mechanics).

„3sv (2roll)“: A symmetrical three-point swashplate linkage using three linkage points arranged equally at 120°, actuated by one pitch-axis servo (front or rear) and two roll servos (left and right). For collective pitch control all three servos move the swashplate axially.

„3sv (2nick)“: A symmetrical three-point linkage as above, but rotated through 90°, i.e. one roll servo on one side, and two pitch-axis servos front and rear.

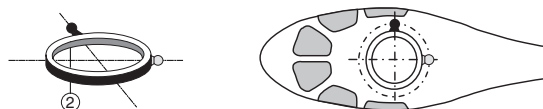
„4sv (90°)“: Four-point swashplate linkage using two roll and two pitch-axis servos.

CLEAR resets the swashplate type to “1 servo”.

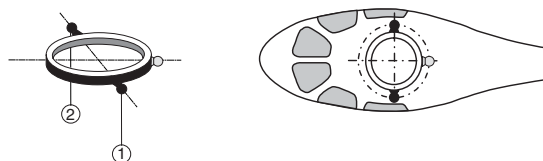
Note:

With the exception of the “1 servo” pre-set, the swashplate mixer ratios are set in the »**swashp.mix**« menu.

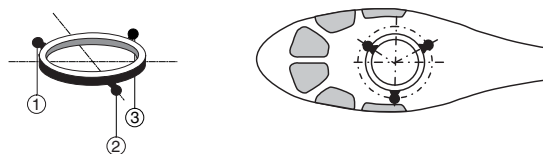
Swashplate type: 1 servo



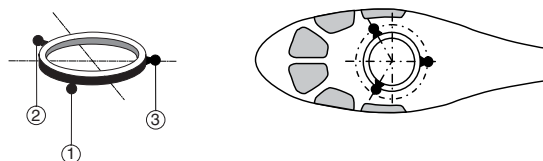
Swashplate type: 2 servos



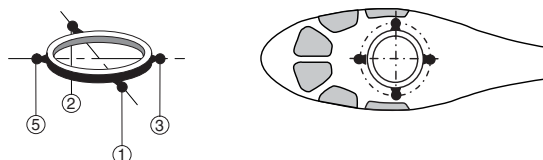
Swashplate type: 3 servos (2 nick (pitch-axis))



Swashplate type: 3 servos (2 roll)



Swashplate type: 4 servos (90°) 2 pitch-axis / 2 roll



Direction of rotation of main rotor

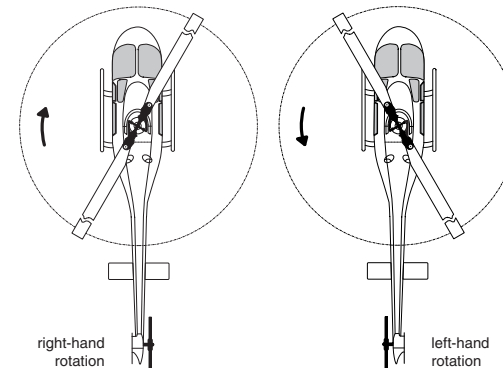
model name<STARLET >	
stick mode 1	
swashplate 3sv(2roll)	
▶ rotor direct	left
SEL	

In the “rotor direction” line you enter the direction of rotation of the main rotor using the rotary cylinder, after pressing **ENTER** or the rotary cylinder:

“right”: the main rotor spins clockwise as viewed from above.

“left”: the main rotor spins anti-clockwise as viewed from above.

CLEAR switches to “left”.



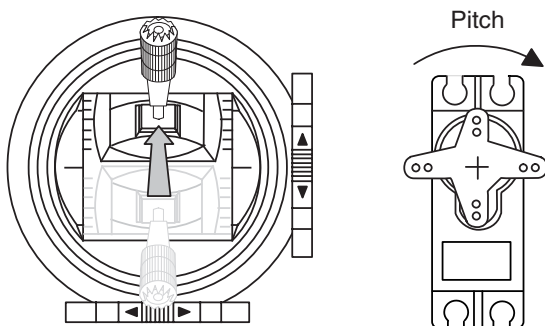
The program requires this information in order to set up the mixers to work in the correct “sense”; this applies to the mixers which compensate for rotor torque and motor power. You will find these in the »**heli mixer**« menu:

Pitch
Ch1 → throttle
Ch1 → tail rotor

(Collective) pitch min

stick mode	1
swashplate	3sv(2roll)
rotor direct	left
► pitch min	front
▼▲	SEL

At this point you can set up the direction of operation of the throttle / collective pitch stick to suit your preference: press the rotary cylinder briefly, then use the rotary cylinder to select the appropriate setting. This setting is crucial to the correct operation of all the other options in the helicopter program which affect the throttle and collective pitch functions, i.e. the throttle curve, idle trim, tail rotor mixer etc..



The meaning is as follows:

- “front”: minimum collective pitch when the collective pitch stick (Ch 1) is “forward” (away from you);
- “rear”: minimum collective pitch when the collective pitch stick (Ch 1) is “back” (towards you).

Pressing **CLEAR** sets the collective pitch min. position to “forward”.

Note:

- The Ch 1 trim always affects the throttle servo only.
- By default what is known as the “throttle limiter” is set (see page 62); this limits the travel of the throttle servo in the direction of maximum throttle, acting separately from the collective pitch servos. This point can be programmed using the “Lim” input in the »contr set.« menu.

Timers

Two timers are shown in the basic display: one stopwatch and one flight timer.

STARLET	stop	0:00
#02	flt	0:00
9.6V		
5:36h	IFS	

A physical switch or a control switch – e.g. the control switch C3 located on the throttle limiter – can be assigned to these two timers in the “timers” line ...

swashplate	3sv(2roll)
rotor direct	left
pitch min	front
► clock	0:00
▼▲	SEL SEL

... using the switch symbol on the right-hand side. The assigned switch starts both timers, and also halts the stopwatch.

The method of assigning a physical switch or a control switch is described on page 33.

The flight timer always starts simultaneously with the stopwatch, but continues to run even when the stop-

watch is halted (switched off). It can only be stopped by pressing **ESC** with the stopwatch halted.

Once stopped, pressing **CLEAR** resets both timers to the initial value.

Switching between “count-up” and “count-down”

Count-up timer (stopwatch function)

If you assign a switch and start the stopwatch with the initial value of “0:00”, the timer runs up until the maximum of 999 minutes and 59 seconds, then re-starts at 0:00.

Count-down timer (alarm timer function)

You can use the left-hand **SEL** field to select a starting time within the range 0 to 180 minutes; using the right-hand **SEL** field the range is 0 to 59 seconds. Any combination of times can also be selected.

(**CLEAR** = “0” or “00”).

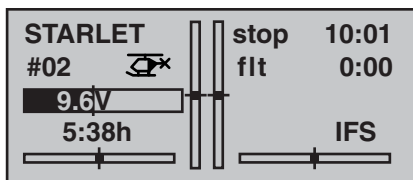
swashplate	3sv(2roll)
rotor direct	left
pitch min	front
► clock	10:01 C3
▼▲	SEL SEL

Procedure

- Select the **SEL** field with the rotary cylinder.
- Press the rotary cylinder.
- Select the required time in the highlighted minutes and seconds fields using the rotary cylinder.
- Press the rotary cylinder to conclude the input process.

Once you have switched back to the basic display, press the **CLEAR** button first with the stopwatch halted, so

that the stopwatch switches to the "Timer" function; see top right in the next illustration.



When you operate the assigned switch, the stopwatch starts from the set initial value, counting down ("Timer function"). When the set time has elapsed, the timer does not stop, but continues to run so that you can read off the time elapsed after reaching zero. To make this clear, the over-run time is shown highlighted (inverse video).

Sequence of sounds

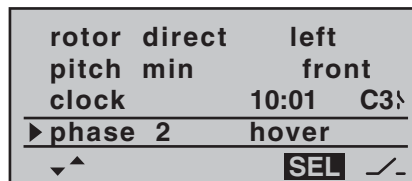
- 30 sec. before zero: triple beep
 - single beep every two seconds
- 20 sec. before zero: double beep
 - single beep every two seconds
- 10 sec. before zero: single beep
 - single beep every second
- 5 sec. before zero: single beep every second at higher rate
- zero: longer beep; display switches to inverse video

The "alarm timer" is reset by pressing the **CLEAR** button once you have halted the timer.

Note:

A count-down timer is indicated in the basic display by a flashing colon (:) between the minutes field and the seconds field.

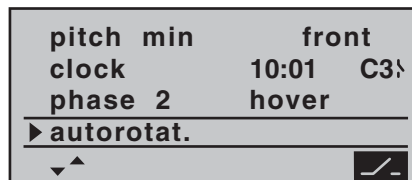
Phase 2



In the "phase 2" line you use the **SEL** field to select a suitable name from the six default names provided, using the rotary cylinder. You can also assign a switch using the switch symbol at bottom right.

More on the meaning of flight phases and how to program them can be found in the section entitled "Flight phase-specific mixers for collective pitch, throttle and tail rotor" starting on page 78.

Auto-rotation



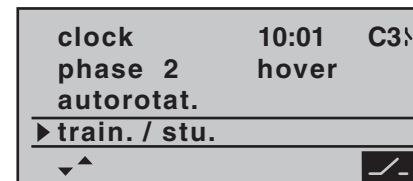
The name "Auto-rotation" is permanently assigned to Phase 3, and cannot be altered. The only available option is to assign a switch to it using the switch symbol at bottom right of the screen.

For more information on programming flight phases please refer to the »heli mixer« section starting on page 78.

Note:

The "Auto-rotation" flight phase ALWAYS has precedence over all other flight phases.

Trainer / student

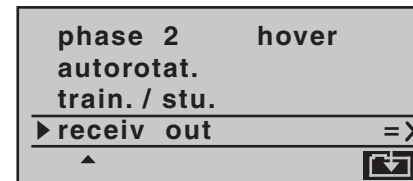


In this menu line you can assign a "transfer switch" for Trainer (teacher / pupil) mode operations, after pressing the rotary cylinder or **ENTER**, as described on page 33. The switch is used to transfer control from one transmitter to the other.

For more information on Trainer systems please refer to page 122.

Receiver output

For maximum flexibility in terms of receiver socket assignment, the MX-16iFS software provides the means to swap over the servo outputs 1 to max. 8; this is carried out on the second page of the "Receiver output" sub-menu.



Press the rotary cylinder or the **ENTER** button to move to the next page of the display. Here you can assign the "control channels" for servos 1 ... 8 to any receiver output you wish to use. However, please note that the display in »servo display« – which you can reach by pressing the rotary cylinder from the basic display – refers exclusively to the "control channels", i.e. the outputs

With the rotary cylinder held pressed in, select the servo / output combination you wish to change, then press **ENTER** or the rotary cylinder. Now you can assign the desired servo(s) to the selected output using the rotary cylinder ... or alternatively press **CLEAR** to revert to the default sequence.

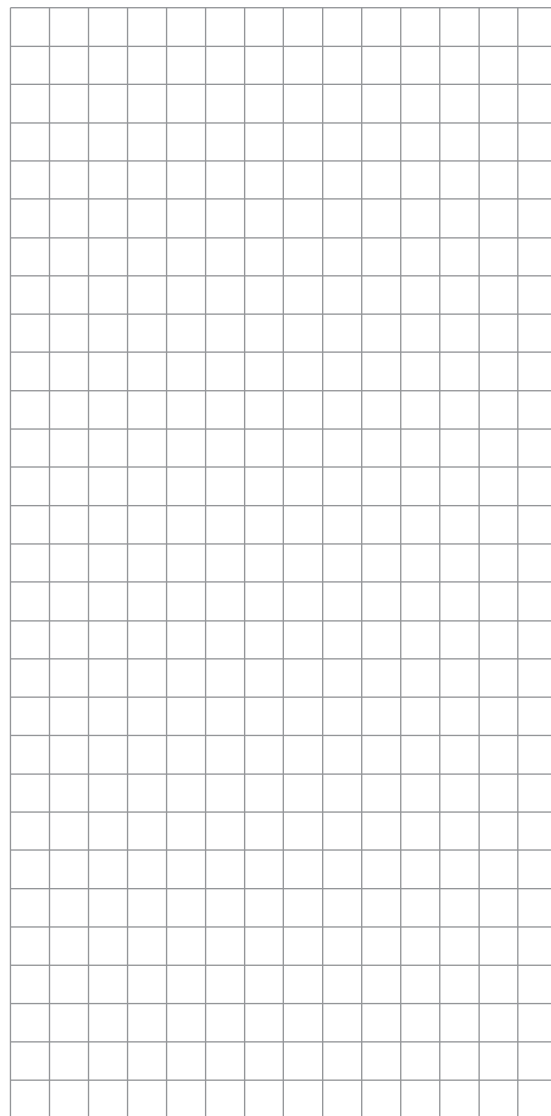
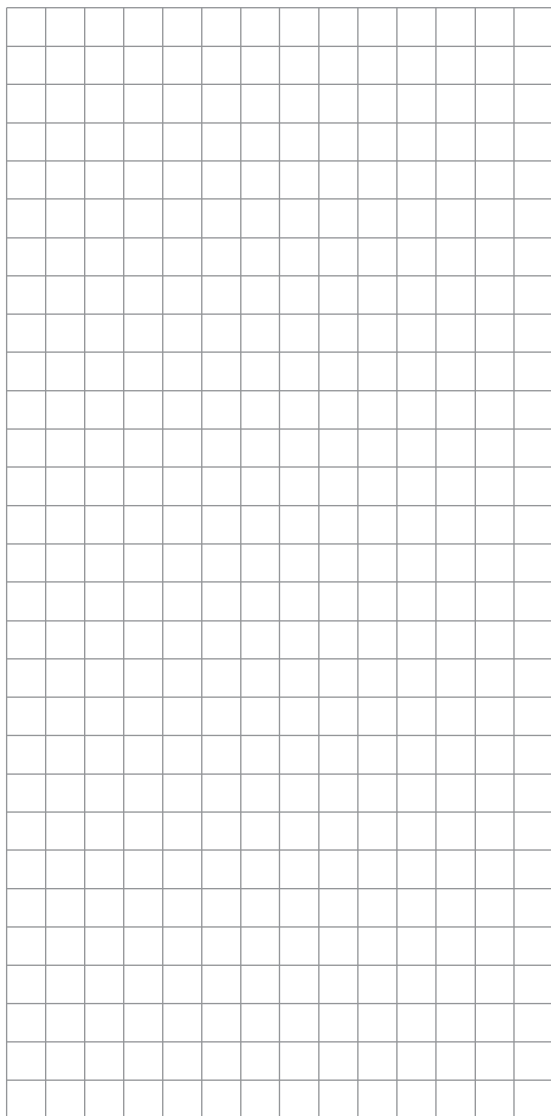
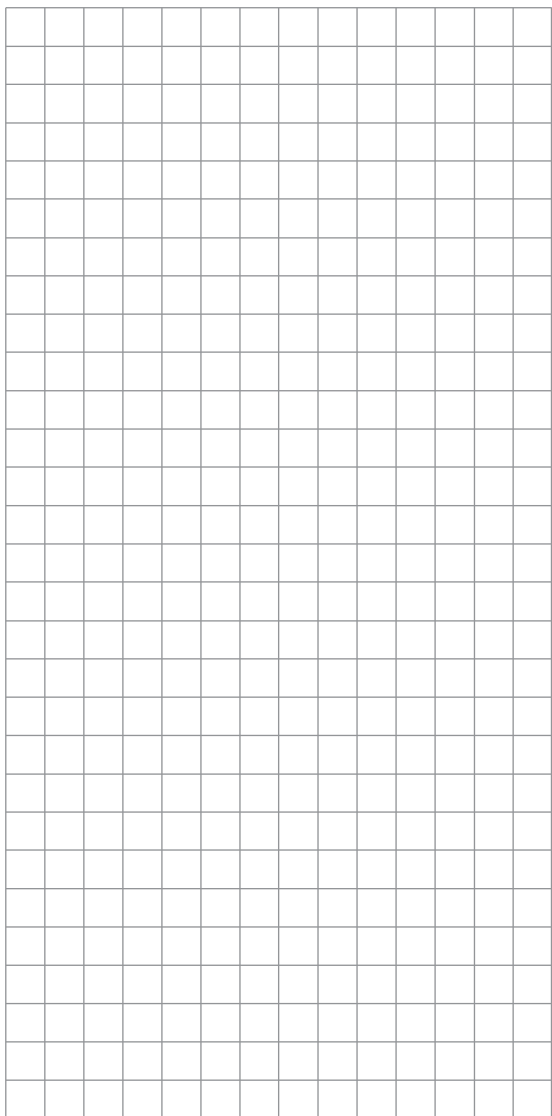
Please note that any subsequent changes to servo settings, such as servo travel, Dual Rate / Expo, mixers etc., **must be carried out according to the original (default) receiver socket sequence.**

It is also possible to swap over the outputs of XR-series receivers at the receiver itself, as described on page 26 and in the instructions supplied with the actual receiver. However, we strongly recommend that you use only one of the two options, as a combination will soon lead to confusion.

- *In the helicopter program of the MX-16iFS the outputs for one collective pitch servo and the throttle servo have been interchanged compared to all earlier GRAUPNER/JR mc-systems. The throttle servo is now assigned to receiver output "6" and the collective pitch servo to output "1". You may therefore wish to retain the earlier configuration.*
- *It may also prove necessary to swap servos for Trainer mode operations, if you are using a model set up for another make of equipment fitted with a Graupner/iFS RF module, to avoid having to re-connect the servos at the receiver.*

S	6	→	output	1
S	2	→	output	2
S	3	→	output	3
S	4	→	output	4
S	5	→	output	5
▶S	1	→	output	6
S	7	→	output	7
S	8	→	output	8
▼	SEL			

[illegible]





Servo settings

Servo direction, centre, travel

►S1=>	0%	100%	100%
S2=>	0%	100%	100%
S3=>	0%	100%	100%
rev cent - trav +			
▼ SEL SEL SYM ASY			

In this menu you can adjust parameters which only affect the servo connected to a particular receiver output, namely the direction of servo rotation, neutral point and servo travel. Always start with the servo setting in the left-hand column.

Basic procedure:

1. Select the relevant servo (1 to 8) with the rotary cylinder held pressed in.
2. Use the rotary cylinder to select **SEL**, **SYM** or **ASY** in the bottom line, prior to making the adjustments required.
3. Press **ENTER** or the rotary cylinder: the corresponding input field is highlighted (inverse video).
4. Set the appropriate value using the rotary cylinder.
5. Finally press **ENTER** or the rotary cylinder again to conclude the input process.

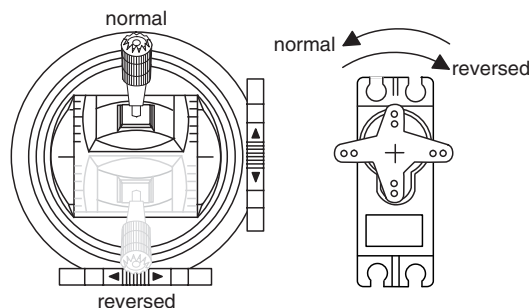
Important:

The numbers in the servo designations refer to the receiver output socket to which a particular servo(s) is connected, assuming that these have not been swapped over. This means that changing the stick mode does not affect the numbering (i.e. receiver socket sequence) of the servos.

Column 2 “rev”

The direction of servo rotation can be adjusted to suit the actual installation in your model. This means that you don't need to concern yourself with servo directions when installing the mechanical linkages in the model, as you can reverse them as and when necessary. The direction of rotation is indicated by the symbols “=>” and “<=”. Be sure to set the direction of servo rotation *before* you make adjustments to the remaining options!

Pressing **CLEAR** resets the direction of rotation to “=>”.



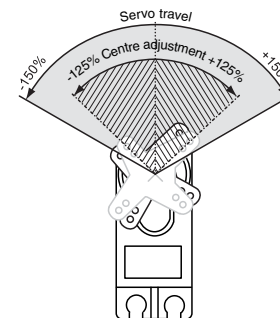
Column 3 “cent”

The facility to offset the servo travel centre is intended for adjusting servos whose centre setting is not standard (servo centre point at 1.5 ms), and also for *minor* adjustments, e.g. when fine-tuning the neutral position of the model's control surfaces.

The neutral position can be shifted over the range -125% to +125% of normal servo travel, *within* the maximum servo travel of $\pm 150\%$, regardless of the trim lever position and any mixers you have set up. The setting affects the associated servo directly, independently of all other trim and mixer settings.

However, please note that an extreme shift of the servo's neutral point may result in servo travel to one side of neutral only, as total servo travel is limited to $\pm 150\%$ for both electronic and mechanical reasons.

Pressing **CLEAR** resets the value to “0%”.



Column 4 “- trav +”

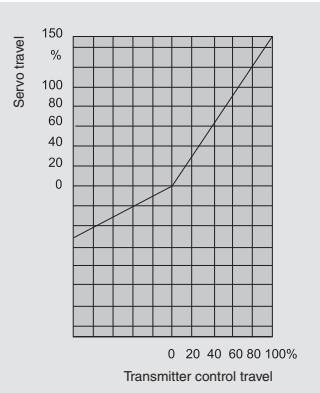
In this column you can adjust servo travel symmetrically or asymmetrically (different each side of neutral). The adjustment range is 0 ... 150% of normal servo travel. The reference point for the set values is the setting in the “Centre” column.

To set a “symmetrical” travel, i.e. to adjust travel equally on both sides of neutral, select **SYM**; select **ASY** to set asymmetrical travel. In the latter case move the associated transmitter control (stick, proportional rotary knob or switch) to the appropriate end-point; when you press the rotary cylinder the highlighted servo travel field switches between the left field (negative direction) and the right field (positive direction).

Pressing **CLEAR** resets the changed parameter to 100%.

Important:

In contrast to the »contr set.« menu, this setting affects the servo directly, regardless of how the control signal for this servo is generated, i.e. either directly by a stick channel, or by means of any type of mixer function.



The graph alongside shows an example of asymmetrical servo travel, with a setting of -50% and +150%.





Transmitter control settings

Basic procedures for assigning transmitter controls and switches

►I5	empty	+100%	+100%
I6	empty	+100%	+100%
I7	empty	+100%	+100%
		- trv	+
▼	SEL	SYM	ASY

In addition to the two dual-axis stick units for the control functions 1 to 4, the MX-16iFS is fitted as standard with a range of supplementary controls:

- Two INC / DEC buttons: CTRL 5 and 6 ("transmitter controls 5 ... 6")
- One three-position switch: SW 6/7 (assigned to "ctrl8" in this menu)
- One rotary proportional knob: CTRL 7 ("transmitter control 7")
- One push-button: SW 4 / PB 8 ("SW 4" or "SW 8")
- Three two-position switches: SW 1 to SW 3 ("SW 1 ... 3")

The two dual-axis stick units directly affect the servos connected to receiver outputs 1 ... 4 (assuming that you have set up a newly initialised model memory with the model type "Fixed-wing model"). In contrast, the "supplementary" transmitter controls listed above are inactive when the transmitter is in its default state (as delivered).

As already mentioned on page 14, this means that the transmitter in its basic form only controls servos connected to receiver outputs 1 ... 4 using the primary sticks – even when you have initialised a new model memory with the model type "Fixed-wing model". Any servos connected to receiver sockets 5 ... 8 simply stay at their centre point when you operate the associated transmitter controls.

This may seem rather inconvenient at first sight, but it is the only way to ensure that you can select any of

the "supplementary" transmitter controls for any task you like, and that you are not required deliberately to "program away" the transmitter controls which are not required for a particular model.

Any superfluous transmitter control will have an effect on your model if you operate it by mistake – unless it is inactive, i.e. unless you have assigned 'no function' to it.

That is why you can select these "supplementary" transmitter controls with complete freedom in the "Transmitter control settings" menu and assign them to any function input (see page 32) you like, as this method ensures that the transmitter meets your own requirements exactly. This also means that each of these transmitter controls can be set to operate several function inputs simultaneously. For example, the same toggle switch SW X, which you assign to an input in this menu, can also be assigned as the On / OFF switch controlling the "clocks" in the »**base sett.**« menu.

Note:

The current positions of the INC / DEC buttons (CTRL 5 + 6) assigned to inputs 5 ... 8 are stored separately for each memory, i.e. the settings are not lost when you change flight phases or switch to a different model.

The basic procedure

1. Select the appropriate input E5 ... E8 with the rotary cylinder held pressed in.
2. Use the rotary cylinder to select **SEL**, **SYM** or **ASY** so that you can carry out the adjustments you wish to make.
3. Press the rotary cylinder: the input field you wish to modify is highlighted.
4. Operate the transmitter control you wish to use, and

set the desired value using the rotary cylinder.

5. Press the rotary cylinder to conclude the input process and return to the function field.

Column 2 "Assigning transmitter controls and switches"

Select one of the inputs with the rotary cylinder held pressed in.

Use the rotary cylinder to select **SEL**, or (if **SEL** is already highlighted), press the rotary cylinder briefly to move to the assignment facility:

►I5	empty	+100%	+100%
operate desired switch or control			
▼	SEL	SYM	ASY

Move the appropriate transmitter control (CTRL 5 to 7), or operate the selected switch (SW 1 to 4, 6/7, 8). Note that the transmitter needs some "beeps" to detect the two INC / DEC buttons (CTRL 5 and 6) and the rotary proportional control, i.e. they need to be operated for longer than the other controls. If the travel is not sufficient for the transmitter to detect it, move the control in the opposite direction. If you assign one of the two-position switches, then this control channel works like an On / Off switch. It is then possible to switch to and fro between two end-point values using this simple switch, e.g. motor ON / OFF. The three-position switch SW 6/7, which you will find in the »**contr set.**« menu as "ctrl8", provides a centre position in addition to the two end-points.

Pressing the **CLEAR** button with the switch assignment activated – see illustration above – resets the input to "empty".

Tips:

- When assigning the switches please take care to set them to the appropriate direction of travel, and ensure that all inputs not required are left at or set to “empty”, to eliminate the possibility of errors if unused transmitter controls are operated accidentally.
- You can alter the effective end-points of an assigned switch by adjusting servo travel as described in the next section.

The screen now displays either the transmitter control number or the switch number, followed by a switch symbol which indicates the direction of operation, e.g.:

I5	1	+100%	+100%
▶I6	ctrlI7	+100%	+100%
I7	empty	+100%	+100%
▼^		- trv	+
		SEL	SYM ASY

Column 3 “- trv +”

Hold the rotary cylinder pressed in to select one of the inputs 5 to 8.

Use the rotary cylinder to select **SYM** or **ASY** in the “- trv +” column, and press the rotary cylinder briefly to activate travel adjustment. You can now use the rotary cylinder to set the control travel within the range -125% to +125%, either symmetrically (**SYM**) to both sides ...,

I5	1	+100%	+100%
▶I6	ctrlI7	+111%	+111%
I7	empty	+100%	+100%
▼^		- trv	+
		SEL	SYM ASY

... or asymmetrically (**ASY**):

I5	1	+100%	+100%
▶I6	ctrlI7	+ 88%	+111%
I7	empty	+100%	+100%
▼^		- trv	+
		SEL	SYM ASY

If you wish to make asymmetrical adjustments, you must move the transmitter control or switch in the appropriate direction before altering the setting. When the field is highlighted, you can change the setting.

Negative and positive parameter values are possible; this enables you to set the appropriate direction of movement of the transmitter control to suit your model. Pressing **CLEAR** resets the control travel in the highlighted field to 100%.

Important:

In contrast to servo travel adjustments, changing the transmitter travel setting affects all mixer and coupling

inputs, i.e. all servos which are affected by that transmitter control.



Transmitter control settings

Basic procedures for assigning transmitter controls and switches

►I5	empty	+100%	+100%
thr	empty	+100%	+100%
gyr	empty	+100%	+100%
		- trv	+
▼	SEL	SYM	ASY

In addition to the two dual-axis stick units for the control functions 1 to 4, the MX-16iFS is fitted as standard with a range of supplementary controls:

- Two INC / DEC buttons: CTRL 5 and 6 ("transmitter controls 5 ... 6")
- One three-position switch: SW 6/7 (assigned to "ctrl8" in this menu)
- One rotary proportional knob: CTRL 7 ("transmitter control 7")
- One push-button: SW 4 / PB 8 ("SW 4" or "SW 8")
- Three two-position switches: SW 1 to SW 3 ("SW 1 ... 3")

The two dual-axis stick units directly affect servos connected to receiver outputs 1 ... 4 and 6 (assuming that you have set up a newly initialised model memory with the model type "Helicopter"). In contrast, the "supplementary" transmitter controls listed above are inactive when the transmitter is in its default state (as delivered). The exception is the rotary proportional knob CTRL 7 (throttle limiter), which acts upon servo 6 by default.

As already mentioned on page 14, this means that the transmitter in its basic form only controls servos connected to receiver outputs 1 ... 4 using the primary sticks. Any servos connected to receiver sockets 5, 7 and 8 simply stay at their centre point when you operate the associated transmitter controls.

This may seem rather inconvenient at first sight, but it is the only way to ensure that you can select any of

the "supplementary" transmitter controls for any task you like, and that you are not required deliberately to "program away" the transmitter controls which are not required for a particular model.

Unless it is inactive, any superfluous transmitter control will have an effect on your model if you operate it by mistake, i.e. unless you have assigned 'no function' to it.

That is why you can select these "supplementary" transmitter controls with complete freedom in the "Transmitter control settings" menu, and assign them to any function input (see page 32) you like, as this method ensures that the transmitter meets your own requirements exactly. This also means that each of these transmitter controls can be set to operate several function inputs simultaneously. For example, the same toggle switch SW X which you assign to an input in this menu, can also be assigned as the On / OFF switch controlling the "clocks" in the »**base sett.**« menu.

Notes:

- *The current positions of the INC / DEC buttons (CTRL 5 + 6) assigned to inputs 5 ... 8 are stored separately for each memory, i.e. the settings are not lost when you change flight phases or switch to a different model.*
- *Input 6 must always be left "empty" for helicopter applications; for more details see the section entitled "Throttle" on page 62.*

The basic procedure

1. Select the appropriate input I5, (gas), gyr, I8 or Lim (Limit) with the rotary cylinder pressed in.
2. Use the rotary cylinder to select **SEL**, **SYM** or **ASY** so that you can carry out the adjustments you wish

to make.

3. Press the rotary cylinder: the input field you want to modify is now highlighted.
4. Operate the transmitter control you wish to use, and set the desired value using the rotary cylinder.
5. Press the rotary cylinder to conclude the input process.

Column 2 "Assigning transmitter controls and switches"

Select one of the inputs with the rotary cylinder held pressed in.

Use the rotary cylinder to select **SEL**, or (if **SEL** is already highlighted), press the rotary cylinder briefly to move to the assignment facility:

►I5	empty	+100%	+100%
operate desired switch or control			
▼	SEL	SYM	ASY

Move the appropriate transmitter control (CTRL 5 to 7), or operate the selected switch (SW 1 to 4, 6/7, 8). Note that the transmitter needs some "beeps" to detect the two INC / DEC buttons (CTRL 5 and 6) and the rotary proportional control, i.e. they need to be operated for longer than the other controls. If the travel is not sufficient for the transmitter to detect it, move the control in the opposite direction. If you assign one of the two-position switches, then this control channel works like an On / Off switch. It is then possible to switch to and fro between two end-point values using this simple switch, e.g. motor ON / OFF. The three-position switch SW 6/7, which you will find in the »**contr set.**« menu as "ctrl8", provides a centre position

in addition to the two end-points.

Pressing the **CLEAR** button with the switch assignment activated – see illustration above – resets the input to “empty”.

Tips:

- When assigning the switches please take care to set them to the appropriate direction of travel, and ensure that all inputs not required are left at or set to “empty”, to eliminate the possibility of errors if unused transmitter controls are operated accidentally.
- You can alter the effective end-points of an assigned switch by adjusting servo travel as described in the next section.

The screen now displays either the transmitter control number or the switch number, followed by a switch symbol which indicates the direction of operation, e.g.:

►I5	3□	+100%	+100%
thr	empty	+100%	+100%
gyr	ctrl6	+100%	+100%
		- trv	+
▼	SEL	SYM	ASY

Column 3 “- trv +”

Hold the rotary cylinder pressed in to select one of the inputs I5, throttle, gyr, I8 or lim.

Use the rotary cylinder to select **SYM** or **ASY** in the “- trv +” column, and press the rotary cylinder to activate travel adjustment. You can now use the rotary cylinder to set the control travel within the range -125% to +125%, either symmetrically (**SYM**) to both sides ...,

I5	3□	+100%	+100%
thr	empty	+100%	+100%
►gyr	ctrl6	+ 88%	+ 88%
		- trv	+
▼ ^	SEL	SYM	ASY

... or asymmetrically (**ASY**).

I5	3□	+100%	+100%
thr	empty	+100%	+100%
►gyr	ctrl6	+ 88%	+111%
		- trv	+
▼ ^	SEL	SYM	ASY

If you wish to make asymmetrical adjustments, you must move the transmitter control or switch in the appropriate direction before altering the setting. When the field is highlighted, you can change the setting.

Negative and positive parameter values are possible; this enables you to set the appropriate direction of movement of the transmitter control to suit your model. Pressing **CLEAR** resets the control travel in the highlighted field to 100%.

Important:

In contrast to servo travel adjustments, changing the transmitter travel setting affects all mixer and coupling

inputs, i.e. all servos which are affected by that transmitter control.

“Throttle”

I5	3	+100%	+100%
►thr	empty	+100%	+100%
gyr	ctrl6	+ 88%	+111%
		- trv	+
▼▲	SEL	SYM	ASY

In principle all transmitter controls (rotary proportional knob, INC / DEC buttons) and switches present on the transmitter can be assigned to the individual inputs within the Helicopter program.

However, please note that some inputs available in the “Transmitter control settings” menu are already pre-defined for helicopter-specific functions, and for this reason cannot be used without restriction.

For example, the receiver sequence printed on page 41 shows that the throttle servo (or the speed controller of an electric-powered model helicopter) must be connected to receiver output “6”, i.e. control channel “6” is reserved for motor speed control.

However, in contrast to a fixed-wing aircraft, the throttle servo or speed controller is not directly controlled by the throttle stick or any other transmitter control, but via a complex mixer system – see »heli mixer« menu, starting on page 78. The “throttle limit function” (described on the next page) also has an influence on this mixer system.

Assigning a transmitter control or switch in the “Throttle” line, or its supplementary control signal, would only unnecessarily “confuse” this complex mixer system.

For this reason the “Throttle” input MUST always be left “empty” when you are programming a model helicopter.

„Gyro“

I5	3	+100%	+100%
►thr	empty	+100%	+100%
►gyr	ctrl6	+ 88%	+111%
		- trv	+
▼▲	SEL	SYM	ASY

If the gyro you are using features infinitely variable gain control, then you can pre-set the static gyro effect by setting an “offset” within the range $\pm 125\%$, separately for each flight phase, in the “Gyro” line of the »heli mixer« menu – see the section starting on page 78.

Once you have entered these pre-defined – static – gain settings (if need be set separately for each flight phase in the »heli mixer« menu), you can use a transmitter control such as one of the two INC / DEC buttons (CTRL 5 or 6) to vary gyro gain around the set “offset point”; all you have to do is assign that transmitter control in the “Gyro” line of this menu: in the centre position of the transmitter control this corresponds to the setting selected in the »heli mixer« menu (see page 78). If the transmitter control is moved from this centre point in the direction of full travel, gyro gain is increased; towards the opposite end-point it is reduced. This is a fast, simple method of fine-tuning gyro gain when the model is in flight – perhaps to suit varying weather conditions – or alternatively to find the optimum setting. In software terms you can also limit the gain range to both sides by restricting the transmitter control travel. **However, please be sure to read the set-up notes provided with your gyro before carrying out these adjustments, as you could render your helicopter uncontrollable if you make a mistake.**

Throttle limit function

“Lim” input

Meaning and application of “throttle limit”

gyr	ctrl6	+ 88%	+111%
I8	empty	+100%	+100%
►lim	ctrl7	+100%	+100%
		- trv	+
▲	SEL	SYM	ASY

As mentioned previously under “Throttle”, the power output of the engine or motor of a model helicopter is not controlled directly using the throttle (Ch 1) stick – in contrast to fixed-wing model aircraft. Instead it is controlled indirectly by the throttle curve settings which you set up in the »heli mixer« menu. Alternatively the throttle is controlled by the speed controller if the unit you are using is a governor or regulator.

Note:

Naturally it is possible to set up different throttle curves to suit different stages of flight using flight phase programming.

However, this certainly means that a helicopter’s motor never gets anywhere near its idle speed during “normal” flying, so it is impossible to start or stop the motor easily unless some other means is used. This applies whether a speed governor or a conventional throttle control system is in use.

The “Throttle limiter” function solves this problem in an elegant manner: a separate transmitter control – as standard this is the rotary proportional control CTRL 7 at top left of the transmitter – is employed to limit the setting of the throttle servo or the speed controller to any speed you like, which means that you can throttle right back to the idle position for starting the motor. In the other case, the throttle servo can only follow the throttle

curve, and therefore reach its full-throttle setting, if you release full servo travel using the throttle limit control. That is why the "Lim" input is reserved in the Helicopter program for the "Throttle limiter" function.

For this reason the right-hand positive value in the "Travel" column must be large enough to ensure that it does not limit the full-throttle setting available via the Ch 1 stick when the control is at its maximum position. Usually this means a value in the range +100% to +125%. The left-hand negative value in the "Travel" column of the input should be set in such a way that the throttle is closed completely when the digital Ch 1 trim is used, so that you can reliably stop the motor. For the same reason you should leave this value of the throttle limit slider at +100%, at least for the time being.

This variable "limiting" of throttle travel provides a convenient means of starting and stopping the motor. However, it also gives an additional level of safety if, for example, you have to carry your helicopter to the flight line with the motor running: you simply move the control to its minimum position, and this prevents any accidental movement of the Ch 1 stick affecting the throttle servo. If the carburettor is too far open (or the speed controller not at "stop") when you switch the transmitter on, you will hear an audible warning, and the screen displays the message:

**throttle
too
high !**

Important note:

Setting the "Lim" function input to "empty" does not switch off the Throttle limit function; it just switches the limiter to "half-throttle".

Tip:

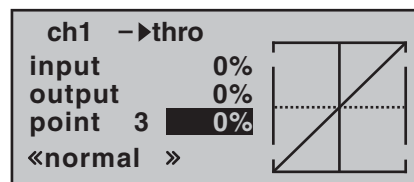
You can call up the »Servo display« menu to check the influence of the throttle limit slider. Move to this menu by briefly pressing the rotary cylinder from the basic transmitter display. Bear in mind that servo output 6 controls the throttle servo on the MX-16iFS.

Basic idle setting

Start by turning the throttle limiter – by default the rotary proportional knob CTRL 7 located at top left of the transmitter – clockwise to its end-point. Move the throttle / collective pitch stick to the maximum position, and ensure that a standard throttle curve is active in the "Channel 1 → throttle" sub-menu of the ...

»heli mixer« (page 78)

... menu. If you have already altered the standard throttle curve which is present when you first initialise a model memory, then this should be reset to the values "Point 1 = -100%", "Point 3 = 0%" and "Point 5 = +100%" – at least temporarily.



Note:

Since the throttle trim lever has no effect when the throttle limiter is open, its position is not relevant at this point.

Now – without starting the glow motor – adjust the mechanical linkage of the throttle servo so that the carburettor barrel is fully open; if necessary, carry out fine-tuning using the travel setting for servo 6 in the

»servo set.« menu.

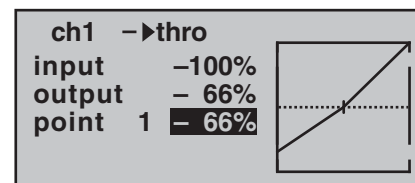
Now close the throttle limiter completely by turning the rotary proportional knob CTRL 7 anti-clockwise to its end-point. Use the trim lever of the throttle / collective pitch stick to move the trim position marker to the motor OFF position (see illustration in the centre column of the next page).

Note:

In contrast, when the throttle limiter is closed, the position of the throttle / collective pitch stick is not relevant; it can therefore be left in the maximum collective pitch position, i.e. the throttle linkage can be adjusted between full-throttle (throttle limiter open) and "motor OFF" (throttle limiter closed) using just the throttle limiter.

Now, with the throttle limiter closed, adjust the mechanical throttle linkage so that the carburettor is just fully closed. However, do check carefully that the throttle servo is not stalled at either of its extreme end-points (full-throttle / motor OFF).

To complete this basic set-up you still have to adjust the idle trim range to coincide with point "1" of the throttle curve. This is accomplished by setting point "1" of the "Ch 1 → throttle" mixer in the »heli mixer« menu to a value of about -65 to -70%:



To check that the setting is exact, i.e. that there is a seamless transition from idle trim to the throttle curve, you need to close the throttle limiter and move the

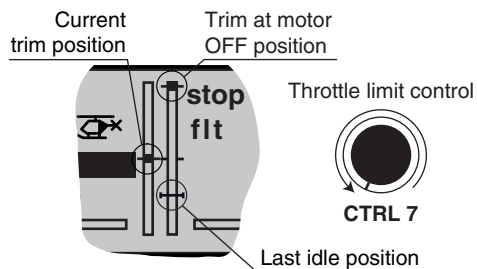
collective pitch stick to and fro slightly at the minimum end-point. When you do this, the throttle servo must not move! In any case fine-tuning must be carried out with the model flying.

The motor is always started with the throttle limiter completely closed; this has the effect that the idle speed is controlled solely using the trim lever of the throttle / collective pitch stick.

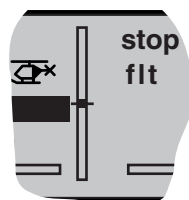
Throttle limit in conjunction with the digital trim

When used with the throttle limit control, the Ch 1 trim places a marker at the set idle position of the motor; at this point the motor can be stopped using the trim. If the trim is in its end-range (see screen-shot down in this column), then a single click immediately takes you back to the marker, i.e. to the pre-set idle position (see also page 24).

The cut-off trim only acts as idle trim on the throttle limit in the bottom half of the travel of the throttle limit control, i.e. the marker is only set and stored within this range.



For this reason the Ch 1 trim display is also completely suppressed as soon as the throttle limit control is moved to the right of the centre position.

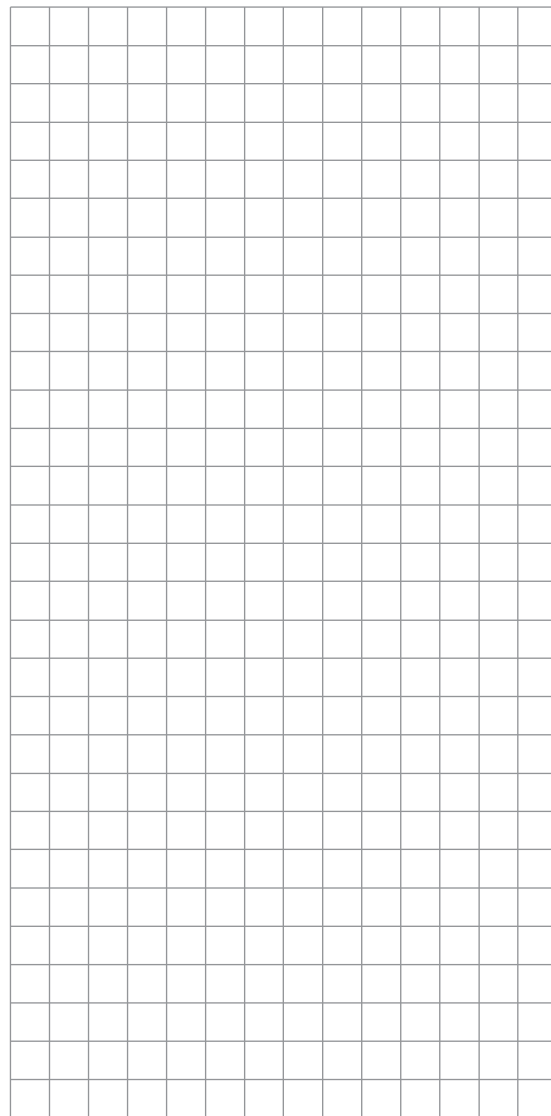
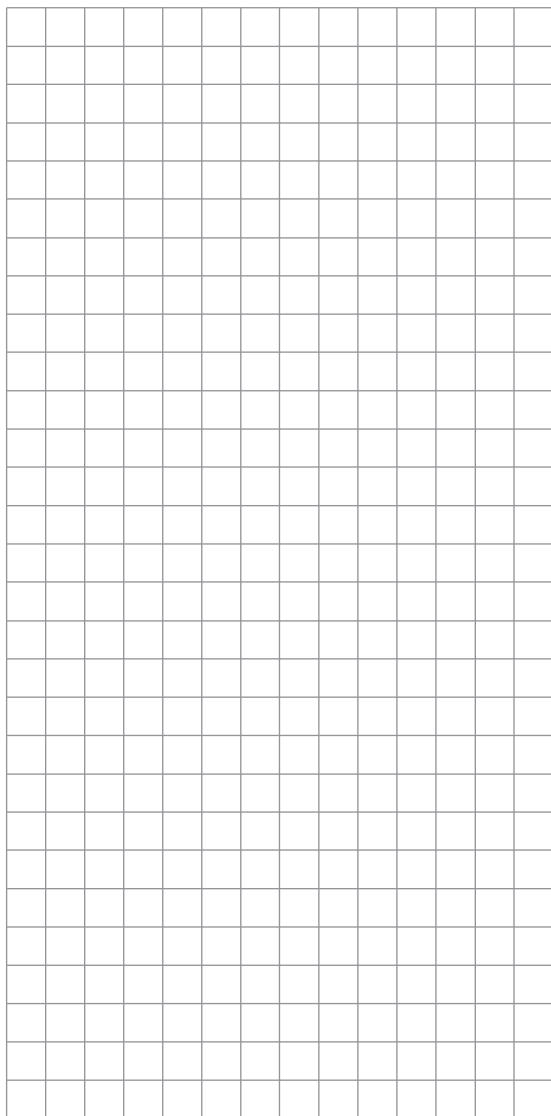
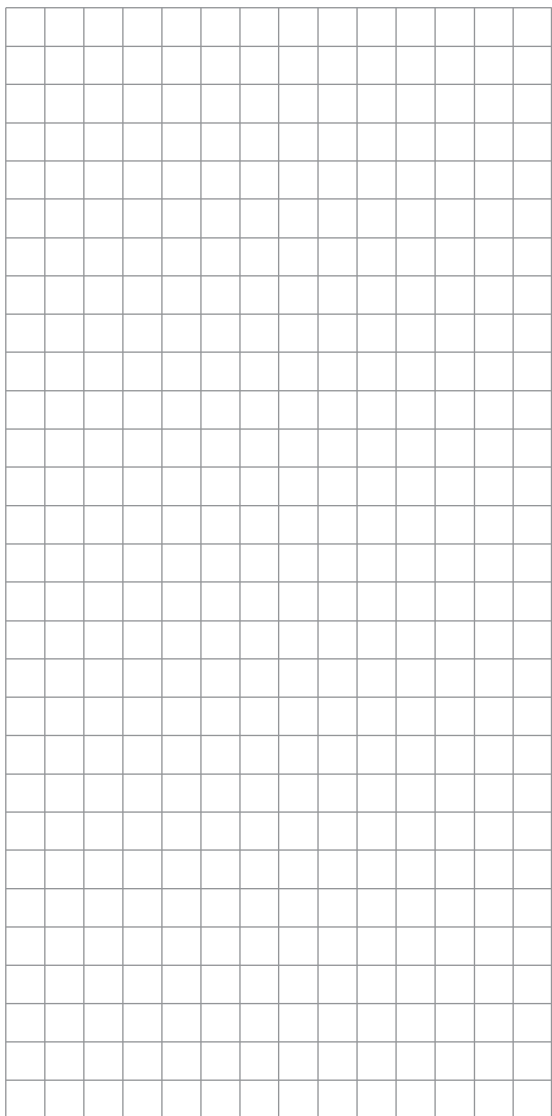


Throttle limit contro



Note:

Since this trim function is only effective in the "Motor off" direction, the illustration above changes if you alter the transmitter control direction for the collective pitch minimum position of the Ch 1 stick from "forward" (reflected in the picture above) to "back" in the "Collective pitch min." line of the »**base sett.**« menu. In the same way the effects shown in the illustration swap sides if you change the stick mode from collective pitch right (reflected in the pictures above) to collective pitch left in the "Stick mode" line of the »**base sett.**« menu; see page 50.





Dual Rate / Expo

Switchable control characteristics for aileron, elevator and rudder

► aile	100%	0%	
elev	100%	0%	
rudd	100%	0%	
	DUAL	EXPO	
▼	SEL	SEL	↗

The Dual Rate / Expo function provides a means of switching to reduced control travels, and of influencing the travel characteristics, for aileron, elevator and rudder (control functions 2 ... 4). This can be carried out in flight by means of switches.

Dual Rate works in a similar way to transmitter control travel adjustment in the »**contr set.**« menu, i.e. it affects the corresponding stick function, regardless of whether that function controls a single servo or multiple servos via any number of complex mixer and coupling functions. For each switch position the servo travels can be set to any value within the range 0 to 125% of full travel.

Expo works in a different way. If you set a value greater than 0%, exponential provides fine control of the model around the centre position of the primary control functions (aileron, elevator and rudder), without forfeiting full travel at the end-points of stick movement. If you set a value lower than 0%, travel is increased around the neutral position, and reduces towards the extremes of travel. The degree of "progression" can therefore be set to any value within the range -100% to +100%, where 0% equates to normal, linear control characteristics.

Another application for exponential is to improve the linearity of rotary-output servos, which are the standard nowadays. With a rotary servo the movement of the control surface is inevitably non-linear, as the linear movement of the output disc or lever diminishes progressively as the angular movement increases, i.e. the

rate of travel of the control surface declines steadily towards the extremes, dependent upon the position of the linkage point on the output disc or lever. You can compensate for this effect by setting an Expo value greater than 0%, with the result that the angular travel of the output device increases disproportionately as stick travel increases.


Like Dual Rates, the Expo setting applies directly to the corresponding stick function, regardless of whether that function controls a single servo or multiple servos via any number of complex mixer and coupling functions.

The Dual Rate and Expo functions can be switched together if you assign a switch to the function. The result of this is that Dual Rates and Expo can be controlled simultaneously using a single switch, and this can be advantageous – especially with high-speed models.

The basic set-up procedure

1. Hold the rotary cylinder pressed in to select the desired line: "aile", "elev" or "rudd".
2. Use the rotary cylinder to select **SEL** under the DUAL or EXPO column, so that you can make adjustments at that point.
3. Press the rotary cylinder. The appropriate input field is now highlighted.
4. Set the desired value using the rotary cylinder.
5. Press the rotary cylinder to conclude the input process and return to the function field.

Dual Rate function

If you wish to switch between two possible D/R settings, select the  symbol and assign a physical switch as described in the section "Assigning switches and control switches" on page 33.

► aile	100%	0%	
push desired switch into position ON			
	DUAL	EXPO	
▼	SEL	SEL	↗

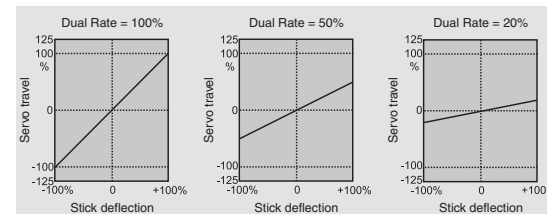
Select the left-hand **SEL** field to change the Dual Rate value, and use the rotary cylinder in the highlighted field to set the values for each of the two switch positions separately.

Pressing **CLEAR** in the highlighted field resets an altered value to 100%.


Caution:


The Dual Rate value should always be at least 20% of total control travel, otherwise you could lose all control of that function.

Examples of different Dual Rate values:



Exponential function

If you wish to switch between two settings, select the  field and assign a switch as described on page 33. The assigned switch appears in the screen together with a switch symbol which indicates the direction of operation when you move the switch.

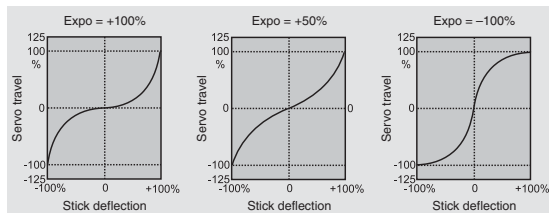
ail	100%	+	11%	2
elev	100%	+	22%	2
rudd	100%		0%	
	DUAL		EXPO	
	SEL		SEL	

For example, the system enables you to fly with a linear curve characteristic in the one switch position, and to pre-set a value other than 0% in the other switch position.

To change the Expo value, first select the **SEL** field, then use the rotary cylinder in the highlighted field to set separate values for each of the two switch positions:

Pressing **CLEAR** in the highlighted field resets an altered value to 100%.

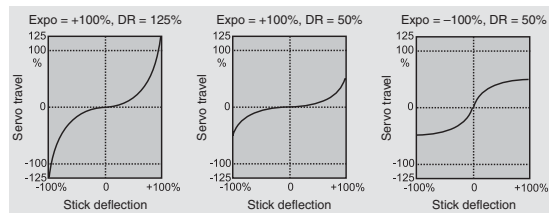
Examples of different Expo values:




In these examples the Dual Rate value is 100% in each case.

Combined Dual Rate and Expo

If you enter values for both Dual Rates and Expo, the two functions are superimposed as follows:



e.g. "switch back":

►ail	88%	0%	2
elev	77%	0%	2
rudd	100%	0%	
	DUAL	EXPO	
▼	SEL	SEL	

and after moving switch "2" to the "forward" position:

►	ail	111%	+	11%	2	☐
	elev	111%	+	22%	2	☐
	rudd	100%		0%		
		DUAL		EXPO		
▼		SEL		SEL		—/—



Dual Rate / Expo

Switchable control characteristics for roll, pitch-axis and tail rotor

►roll	100%	0%	
nick	100%	0%	
tail	100%	0%	
	DUAL	EXPO	
▼	SEL	SEL	↗

The Dual Rate / Expo function provides a means of switching to reduced control travels, and influencing the travel characteristics, for the roll, pitch-axis and tail rotor servos (control functions 2 ... 4). This can be carried out in flight by means of a switch.

A separate curve for control function 1 (motor / collective pitch) can be set individually for throttle, collective pitch and tail rotor in the »heli mixer« menu. These curves feature up to five separately programmable points; see the section starting on page 78 and also page 118.

Dual Rate works in a similar way to transmitter control travel adjustment in the »contr set.« menu, i.e. it affects the corresponding stick function, regardless of whether that function controls a single servo or multiple servos via any number of complex mixer and coupling functions. For each switch position the servo travels can be set to any value within the range 0 to 125% of full travel.

Expo works in a different way. If you set a value greater than 0%, exponential provides fine control of the model around the centre position of the primary control functions (roll, pitch-axis and tail rotor), without forfeiting full travel at the end-points of stick movement. If you set a value lower than 0%, travel is increased around the neutral position, and diminishes towards the extremes of travel. The degree of "progression" can be set within the range -100% to +100%, where 0% equates to normal, linear control characteristics.

Another application for exponential is to improve the

linearity of rotary-output servos, which are the standard nowadays. With a rotary servo the movement of the control surface is inevitably non-linear, as the linear movement of the output disc or lever diminishes progressively as the angular movement increases, i.e. the rate of travel of the control surface declines steadily towards the extremes, dependent upon the position of the linkage point on the output disc or lever. You can compensate for this effect by setting an Expo value greater than 0%, with the result that the angular travel of the output device increases disproportionately as stick travel increases.


Like Dual Rates, the Expo setting applies directly to the corresponding stick function, regardless of whether that function controls a single servo or multiple servos via any number of complex mixer and coupling functions.

The Dual Rate and Expo functions can also be switched together if you assign a switch to the function. The result of this is that Dual Rates and Expo can be controlled simultaneously using a single switch, and this can be advantageous – especially with high-speed models.

The basic set-up procedure

1. Hold the rotary cylinder pressed in to select the desired line: "aile", "elev" or "rudd".
2. Use the rotary cylinder to select **SEL** under the DUAL or EXPO column, so that you can make adjustments at that point.
3. Press the rotary cylinder. The appropriate input field is now highlighted.
4. Set the desired value using the rotary cylinder.
5. Press the rotary cylinder to conclude the input process and return to the function field.

Dual Rate function

If you wish to switch between two possible D/R settings, select the  symbol and assign a physical switch as described in the section "Assigning switches and control switches" on page 33.

►roll	100%	0%	
push desired switch into position ON			
	DUAL	EXPO	
▼	SEL	SEL	↗

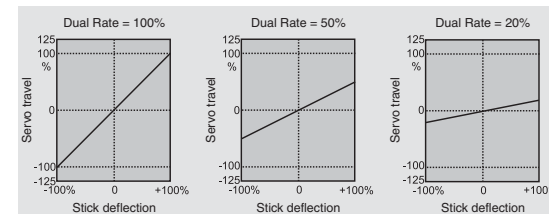
Select the left-hand **SEL** field to change the Dual Rate value, and use the rotary cylinder in the highlighted field to set the values for each of the two switch positions separately.

Pressing **CLEAR** in the highlighted field resets an altered value to 100%.


Caution:


The Dual Rate value should always be at least 20% of total control travel, otherwise you could lose all control of that function.

Examples of different Dual Rate values:



Exponential function

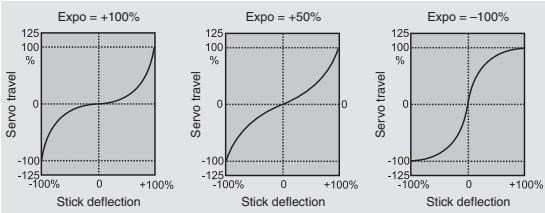
If you wish to switch between two settings, select the  field and assign a switch as described on page 33. The assigned switch appears in the screen together with a switch symbol which indicates the direction of operation when you move the switch.

roll	100%	+ 11%	2
nick	100%	+ 22%	2
tail	100%	0%	
	DUAL	EXPO	
	SEL	SEL	

For example, the system enables you to fly with a linear curve characteristic in the one switch position, and to pre-set a value other than 0% in the other switch position.

To change the Expo value, first select the **SEL** field, then use the rotary cylinder in the highlighted field to set separate values for each of the two switch positions: Pressing **CLEAR** in the highlighted field resets an altered value to 100%.

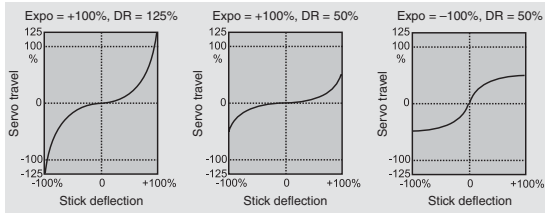
Examples of different Expo values:




In these examples the Dual Rate value is 100% in each case.

Combined Dual Rate and Expo

If you enter values for both Dual Rates and Expo, the two functions are superimposed as follows:



e.g. “switch back”:

roll	88%	0%	2
nick	77%	0%	2
tail	100%	0%	
	DUAL	EXPO	
	SEL	SEL	

and after moving switch “2” to the “forward” position:

▶ roll	111%	+	11%	2
nick	111%	+	22%	2
tail	100%		0%	
	DUAL		EXPO	
▼	SEL		SEL	↘



Phase trim

Flight phase-specific trims for flaps, ailerons and elevator

If you have not assigned a switch to “Phase 2” and / or “Phase 3” in the »**base sett.**« menu, i.e. you have not assigned names and switches to these alternative phases, you automatically remain in flight phase 1 – “normal”.

The number and name of this flight phase are permanently assigned, and cannot be altered. For this reason the “normal” phase is not stated as Phase 1 in the »**base sett.**« menu; it is simply hidden.

clock	0:00	C2↖
phase 2	takeoff	
▶ phase 3	speed	
train. / stu.		
▼▲		SEL ↗

If you select the »**phase trim**« menu with this basic arrangement, i.e. without setting up flight phases, you will find just the “normal” line on the screen, whose pre-set values of 0% are not usually altered.

P H A S E T R I M			
*normal	0%	0%	0%
FLAP AILE ELEV			

Note:

In this menu you will have at least one control function (ELEV), and a maximum of three functions (ELEV, AILE and FLAP), available for phase-specific trim settings, depending on the settings you have entered in the “Aileron / flap” line of the »**base sett.**« menu (see page 47).

If you wish to enter values other than “0”, e.g. to have more lift at launch, or to be able to fly more slowly

when thermalling, or faster when flying speed tasks, but WITHOUT having to change the basic settings each time, then you need to use alternative flight phases. This is done by activating “Phase 2” and, if necessary, “Phase 3” in the »**base sett.**« menu.

This is accomplished by moving to the »**base sett.**« menu and assigning a relevant name and switch to “Phase 2” and (if required) “Phase 3”. If you decide to use the three-position switch SW 6/7 as the phase switch, then it is advisable to assign it to “Phase 2” and “Phase 3” at the extremes, with “normal” at the centre position.

Note:

At the centre position of SW 6/7 the switch symbols on the screen should look as in the picture at top right.

The default name for “Phase 2” is “takeoff”, while that for “Phase 3” is “speed”. However, you can assign your own choice of names at any time by selecting **SEL** and pressing the rotary cylinder. The names available are as follows:

- takeoff
- thermal
- dist(ance)
- speed
- aerobat(ic)
- landing
- ait-tow
- test

clock	0:00	C2↖
phase 2	takeoff	7↖
▶ phase 3	speed	6↖
train. / stu.		
▼▲		SEL ↗

Once assigned, these names will appear in the transmitter’s basic display, and in the »**phase trim**« menu.

Setting up flight phase trims

In the »**phase trim**« menu you can adjust the trims for the previously selected flight phases.

The first step is to switch to the phase which you wish to adjust (the “*” at far left indicates the currently active phase).

P H A S E T R I M			
*normal	0%	0%	0%
takeoff	0%	0%	0%
speed	0%	0%	0%
FLAP AILE ELEV			

Select the desired control function using the rotary cylinder, then press it before turning it again to set the required trim values.

You can activate the different phases by operating the assigned phase select switch or switches. Note that the servos do not change from one setting to another abruptly; they move smoothly with a transition time of around one second.

Values can be set within the range -99% to +99%, in a similar way to transmitter control centre offset, or the offset setting of other radio control systems. However, typical values are normally in single figures or low double figures.

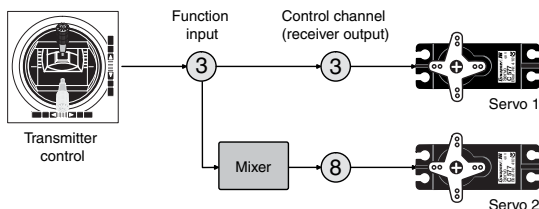
What is a mixer?

The basic function

In many models it is often desirable to use a mixer to couple various control systems, e.g. to link the ailerons and rudder, or to inter-connect a pair of servos where two control surfaces are actuated by separate servos. In all these cases the signal which flows directly from the “output” of a transmitter stick to the associated servo is “bled off” at a particular point - this effect can also “concealed” in transmitter control options such as »D/R expo« or »contr set.« – and the derived signal is then processed in such a way that it affects the “input” of another control channel, and therefore eventually another receiver output.

Example:

Controlling two elevator servos using the elevator stick:



The MX-16iFS transmitter software contains a large number of pre-programmed coupling functions as standard, designed to mix together two (or more) control channels. The mixer required in this example is supplied “ready-made” in the software, and just has to be activated in the “tail” line of the »**base sett.**« menu in the form of “2 elev sv”.

The software also includes three freely programmable linear mixers in the fixed-wing and helicopter programs, all of which can be used in each model memory.

For more information please refer to the general notes on »**free mixer**« in the section of this manual starting on page 88.

Fixed-wing mixers

diff	ail.	+	0%
diff.	flaps	+	0%
►ail	→rudd	+	0%
ail	→flaps	+	0%
brak	→elev	+	0%
brak	→flap	+	0%
brak	→aile	+	0%
elev	→flap	+	0%
elev	→aile	+	0%
flap	→elev	+	0%
flap	→aile	+	0%
diff	red	+	0%

(The display varies according to the information you have entered in the “Motor on Ch 1” and “aile / flap” lines in the »**base sett.**« menu. The selection above equates to the setting “no (motor)” and “2ail 2fl”.)

The MX-16iFS transmitter’s program contains a series of pre-programmed coupling functions, and all you have to do is set the mixer ratios and (optionally) assign a switch. The number of pre-programmed mixer functions in the mixer list will vary according to the pre-set “model type” (tail type, number of wing servos, with or without motor – see the section starting on page 46). For example, if your model is not fitted with camber-changing flaps, and you have not entered any flap servos in the »**base sett.**« menu, the software automatically suppresses all the flap mixers, as are the “Brake → N.N.*” mixers if you enter “Idle forward” or “Idle back” in the “Motor on Ch 1” line. This makes the menus clearer and easier to understand, and also avoids potential programming errors.

* N.N. = Nomen Nominandum (name to be stated)

Notes:

- There are various alternative methods of positioning the camber-changing flaps; these include:

- Settling on just one position per flight phase, simply by setting appropriate trim values in the »**phase trim**« menu;
- Controlling the flaps manually using any transmitter control assigned to “Input 6” (in the »**contr set.**« menu – see page 58), after setting the basic flap positions in the »**phase trim**« menu, as described earlier. Ideally the transmitter control would be one of the INC / DEC controls (CTRL 5 or 6), as their positions are stored separately for each flight phase.

The selected transmitter control directly operates the two flap servos connected to receiver outputs 6 and 7, assuming that you have specified flaps in the “Aile / flap” line of the »**base sett.**« menu. The same control determines the flap setting of the ailerons via the percentage value entered in the “flap → aile” mixer line.

For finer control of the flap positions, we recommend that you reduce their travel to about 25% in the »**contr set.**« menu.

- It is also possible to leave the default setting of “0%” in the appropriate line “flap → aile” of the »**wing mixer**« menu, and to assign the same transmitter control to both input 6 and input 5 in the »**contr set.**« menu. The magnitude of the effect on the two pairs of wing flaps can then be adjusted using the servo travel adjustment facility.
- If a transmitter control is assigned to input “7”, it will be de-coupled by the software if two camber-changing flaps are defined; this is intentional, as it elimi-

notes the danger of errors when a flap command is given.

The basic programming procedure

1. Hold the rotary cylinder pressed in to select the desired mixer.

The bottom line of the screen will now display **SEL** on its own, or with the  symbol.

2. Use the rotary cylinder to select one of these two fields.
3. Press the rotary cylinder: the appropriate input field is now highlighted.
4. Set the desired value using the rotary cylinder, and assign a switch if required.

Negative and positive parameter values are possible; this may be necessary to obtain the correct direction of servo rotation (control surface deflection).

Pressing **CLEAR** in the inverse field resets an altered value to the default value.

5. Press the rotary cylinder to conclude the input process.

Mixer neutral point (offset)

The neutral point of the mixers

Aileron → N.N.*

Elevator → N.N.*

Flap → N.N.*

is by default the zero point of the transmitter control, i.e. that is the point at which they have no effect. At the end-point of the transmitter control the full mixer value is applied.

The default neutral point ("offset") of the mixers

Airbrake → N.N.*

* N.N. = Nomen Nominandum (name to be stated)

at which the airbrakes are *always* retracted, is the forward position of the Ch 1 stick (throttle / airbrakes) if you select "no" in the "Motor at Ch 1" line of the »**base sett.**« menu, and is the back position of the Ch 1 stick if you select "no/inv".

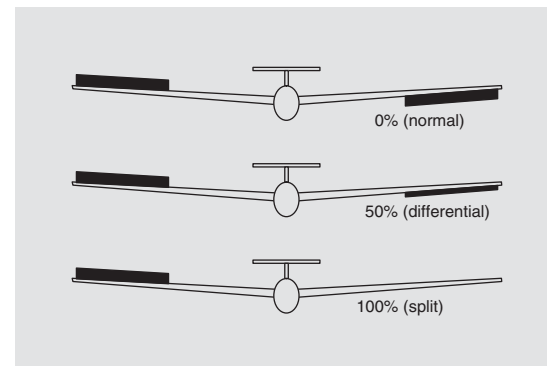
diff aile. (differential aileron travel)

Aileron differential compensates for an unwanted side-effect which occurs when ailerons are deflected: the problem known as "adverse yaw". When ailerons are deflected, the drag generated by the down-going aileron is greater than that produced by the up-going aileron.

The differential drag causes a yawing motion around the vertical axis in the opposite direction to the desired turn. This effect is much more pronounced in model gliders with high aspect ratio wings than in power models with their much shorter moment arms, and usually has to be countered by giving a simultaneous rudder deflection in the opposite direction to the yaw. However, this in turn causes additional drag and reduces the aircraft's efficiency even further.

Aileron differential reduces the angular travel of the down-going aileron relative to the up-going aileron, and this reduces the drag and therefore the adverse yaw. However, electronic differential can only be applied if each aileron is actuated by its own servo, usually mounted in the wings themselves. The shorter pushrods also result in virtually slop-free aileron linkages with reliable centring.

Mechanical solutions are also possible, but they usually have to be "designed in" when the model is built, and the degree of differential cannot be altered subsequently. In any case significant mechanical differential tends to cause additional slop in the control system. Electronic differential offers the following important advantages:



It is easily possible to vary the degree of differential without affecting the travel of the up-going aileron. At one extreme it is possible to suppress the down-aileron deflection completely, i.e. only the up-going aileron moves at all, and this arrangement is sometimes called the "split" setting. Split ailerons not only tend to suppress adverse yaw, but can even generate positive yaw, which means that the model yaws in the direction of the turn when an aileron command is given. In the case of large model gliders, smooth turns can then be flown using ailerons alone, which with most models of this type is usually by no means the case.

The adjustment range of -100% to +100% makes it possible to set the correct direction of differential regardless of the direction of rotation of the aileron servos. "0%" corresponds to a normal linkage, i.e. no differential, while "-100%" or "+100%" represents the "split" function.

For aerobatic flying it is necessary to set low absolute differential values, to ensure that the model rotates exactly along its longitudinal axis when an aileron command is given. Moderate values around -50% or +50% are typical for making thermal turns easier to fly. The split setting (-100%, +100%) is popular with slope

flyers, when ailerons alone are often used for turning the model.

Pressing **CLEAR** resets the value to 0%.

Note:

Although it is possible to enter negative values in order to reverse the direction of servo rotation, this is not usually necessary if the correct channels are used.

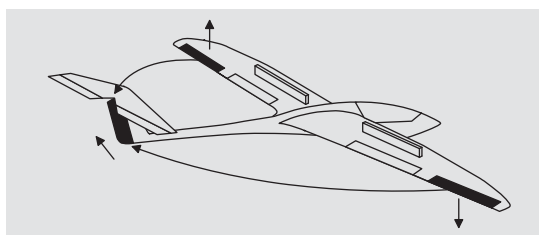
diff. flaps (Camber-changing flap differential)

The aileron / flap mixer (see below) is designed to superimpose an aileron function on the flaps. Flap differential works like aileron differential, and produces a reduced flap movement in the down-direction when these surfaces are used as supplementary ailerons. The adjustment range of -100% to +100% makes it possible to set the correct direction of differential regardless of the direction of rotation of the servo. "0%" corresponds to a normal linkage, i.e. the servo travel is the same up and down. A setting of "-100%" or "+100%" means that the down-travel of the flaps is reduced to zero when an aileron command is given ("split" setting). Pressing **CLEAR** resets the value to 0%.

Note:

Negative values are not usually necessary if the correct channels are used.

ail → rudd (Aileron → rudder)

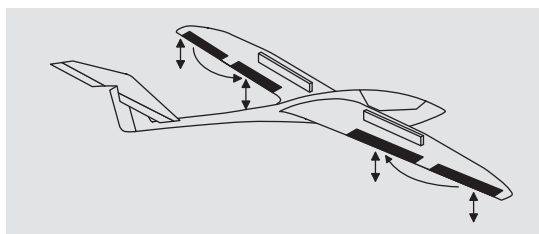


In this case the rudder automatically "follows" when an aileron command is given, and the mixer ratio (degree of following) can be set by the user. Coupled aileron / rudder (sometimes abbreviated to CAR; also known as "combi-switch") is especially useful for suppressing adverse yaw in conjunction with aileron differential, and this combination usually makes smooth turns very easy to fly. Naturally, the rudder can still be controlled separately by means of its dedicated stick. If an (optional) switch (SW 1 ... 4) is assigned to this function, the mixer can be turned on and off in flight, so that you can control the ailerons and rudder separately if and when you so desire.

Pressing **CLEAR** resets the value to 0%.

Often a value around 50% fits.

ail → flaps (Aileron → flap)



This mixer feeds a variable amount of the aileron signal

into the flap channel. When an aileron command is given, the flaps "follow" the ailerons, although usually through a smaller angle, i.e. the mixer ratio is generally less than 100%. The adjustment range of -150% to +150% allows the user to set up the flap direction to match that of the ailerons.

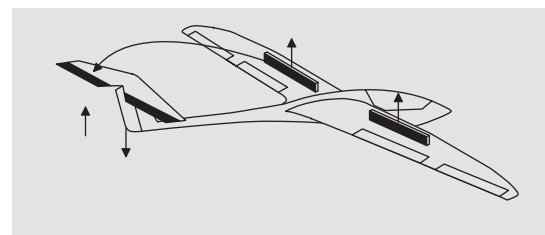
The flaps should not deflect more than about 50% of the (mechanical) travel of the ailerons.

Pressing **CLEAR** resets the value to 0%.

Note:

If your model is equipped with only one flap servo, you should still select "2fl" in the "aile / flap" line of the »base sett.« menu (see page 47) but leave this "aile → flap" mixer at 0%. In contrast, all the other wing mixers can be used in the usual way.

brak → elev (Airbrake → elevator)



Extending any form of airbrakes usually generates an unwanted change in pitch trim (nose up or nose down); this is especially marked when a butterfly (crow) braking system is deployed (see next page).

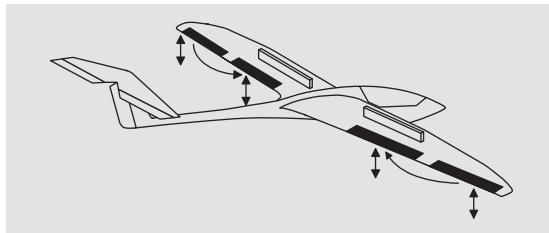
This mixer feeds a corrective signal to the elevator to compensate for this unwanted moment. The adjustment range is -150% to +150%.

Pressing **CLEAR** resets the value to 0%.

"Usual" values are generally in single to low double

figures. It is essential to check and adjust this setting at a safe height.

brak → flap (Airbrake → flap)

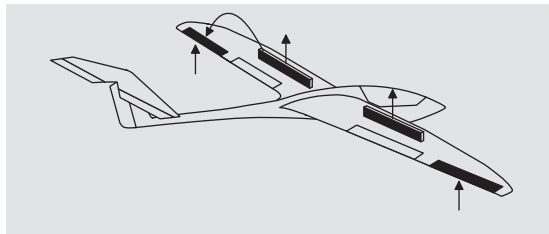


When you operate the brake function (Ch 1 stick), both flap servos move together for the landing approach; the mixer ratio can be set to any value in the range -150% to +150%. Down-flap is usually selected.

Pressing **CLEAR** resets the value to 0%.

At this point you select the value which causes the flaps to deflect down as far as possible when the airbrake function is deployed. However, please ensure that none of the servos concerned strikes its mechanical end-stops (servos stalled).

brak → aile (Airbrake → Aileron)



When you operate the brake function, both aileron servos move together for the landing approach; the mixer ratio can be set to any value in the range -150%

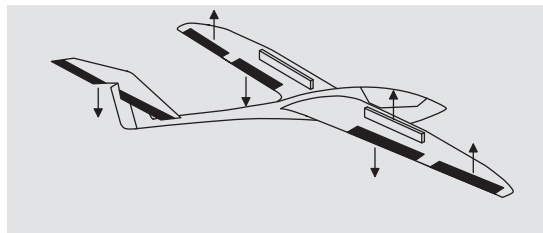
to +150%.

Pressing **CLEAR** resets the value to 0%.

It can also be useful to deflect both ailerons up *slightly* when the airbrakes are extended.

Combination of the “brak → N.N.*” mixers: “Crow” or “Butterfly” setting

If you have set up all three airbrake mixers for your model, it is then possible to program a special configuration known as the “crow” or “butterfly” arrangement for glide path control. In the butterfly setting *both ailerons are deflected up* by a moderate amount, and *both flaps down* by the maximum possible amount. The third mixer provides elevator trim to counteract any unwanted pitch trim change and maintain the model’s airspeed at a safe level. This is necessary to avoid the danger of the model slowing up excessively; if the landing approach is started too soon, and has to be extended by retracting the airbrakes again, the model could then stall abruptly.



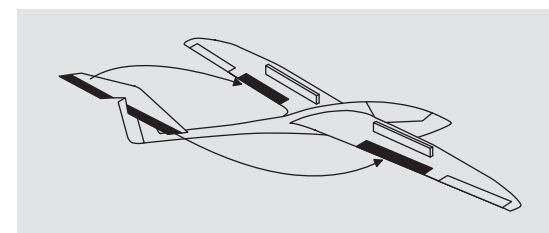
This inter-action between the flaps, ailerons and elevator is used to control the glide angle on the landing approach. Optionally the butterfly setting can also be used without the airbrakes or spoilers; nowadays this is very commonly used for sports and competition aircraft.

Note:

If your model features full-span (strip) ailerons which also double as camber-changing flaps, the two mixers “Brake → aileron” and “Brake → elevator” can be combined for glide path control. In this case up-flap is applied, but the flaps can still be controlled as ailerons. Elevator pitch trim compensation is generally required.

If you have programmed aileron differential, the response of the ailerons will inevitably be adversely affected by the extreme “up” deflection of the ailerons in the butterfly setting, because the differential travel reduces or entirely suppresses the down-aileron deflection. However, the “up” travel of the ailerons is also greatly restricted because they are already at or close to their “up” end-point. The remedy here is to apply “differential reduction”, which is explained in its own section later.

elev → flap (Elevator → flap)



The flaps can be used to enhance the effect of the elevator in tight turns and aerobatics, and this mixer feeds part of the elevator signal to the flap servos. The mixer direction must be set so that the flaps move down when up-elevator is applied, and vice versa.

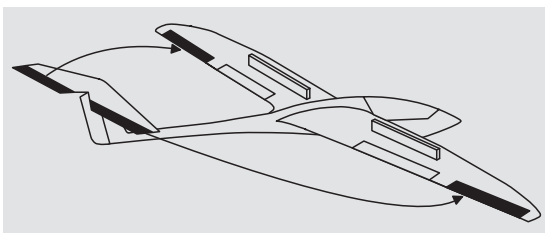
Pressing **CLEAR** resets the value to 0%.

For this mixer the “usual” settings are in the low two-digit range.

* N.N. = Nomen Nominandum (name to be stated)

elev → aile

(Elevator → aileron)



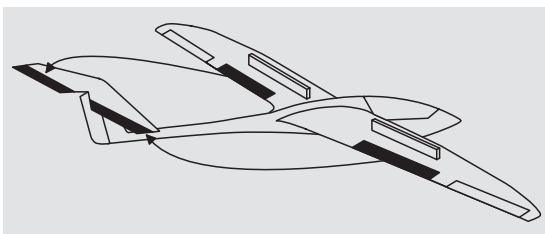
This mixer allows the ailerons to reinforce the elevator response in the same way as the previous mixer.

Pressing **CLEAR** resets the value to 0%.

For this mixer the “usual” settings are again in the low two-digit range.

flap → elev

(Flap → elevator)

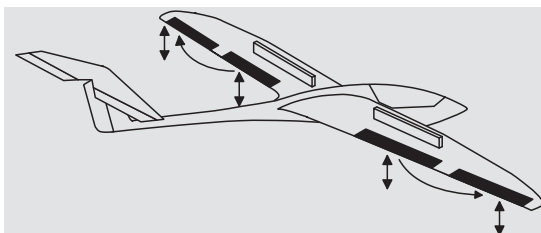


When the camber-changing flaps are lowered, either using »**phase trim**« or by means of a transmitter control assigned to input “6”, a pitch trim change (up or down) may occur. Alternatively it may be desirable for slight down-elevator to be applied automatically when the flaps are raised by a small amount, in order to increase the model's basic airspeed. This mixer can be used to achieve both purposes.

When the flaps are deployed, this mixer causes the elevator setting to be corrected automatically according to the flap deflection.

flap → aile

(Flap → aileron)



This mixer causes a variable proportion of the flap signal to be mixed in with the aileron channels 2 and 5 so that the ailerons follow the movement of the flaps, albeit normally with a smaller deflection. The net result is more even lift distribution over the full wingspan.

Pressing **CLEAR** resets the value to 0%.

Note:

*If you assign a transmitter control to inputs 5 and 6 in the »**contr set.**« menu for adjusting the flap positions, then you should leave the value for this mixer at 0%. See the notes on page 72 in this regard.*

diff-red

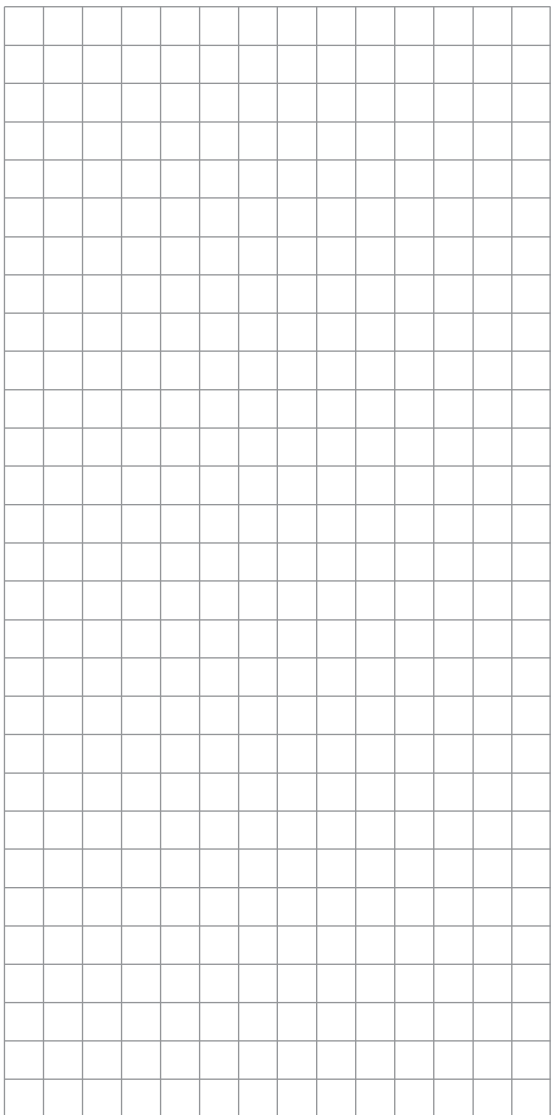
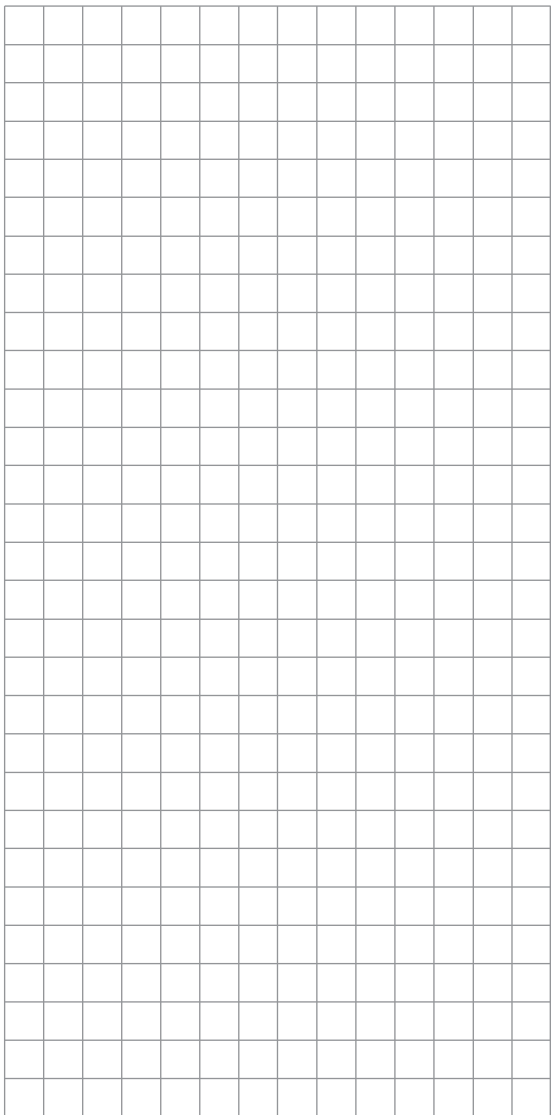
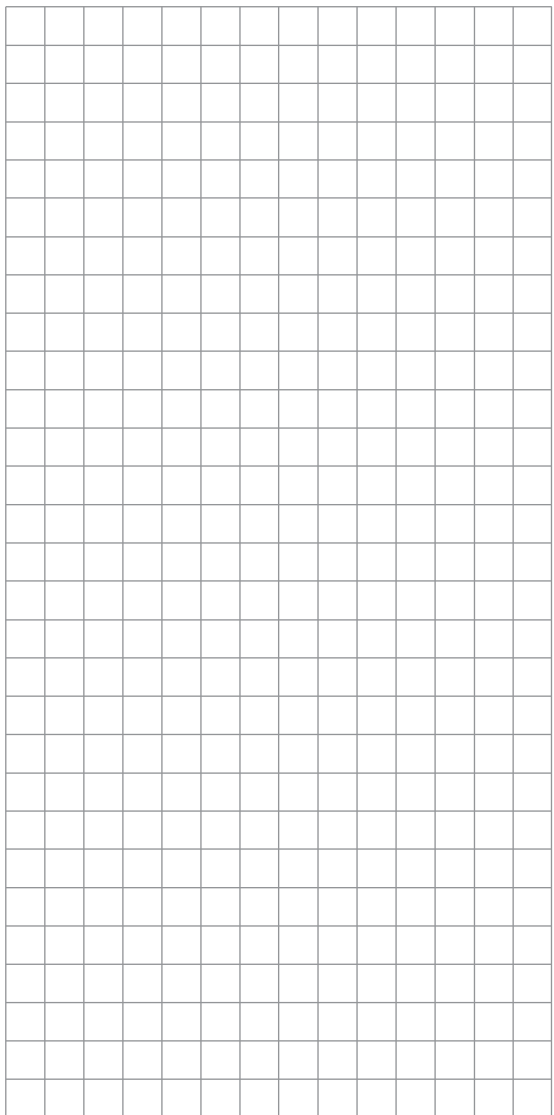
(Differential reduction)

The problem of reduced aileron response in the butterfly configuration has been mentioned earlier: if aileron differential is employed, the aileron response on the landing approach may be adversely affected through the extreme “up” deflection of the ailerons, permitting virtually no further up-movement; on the other hand the “down” travel has already been reduced by the programmed differential setting. The overall result is significantly reduced aileron response compared with the normal setting of the control surfaces.

In this case you really should use “differential reduction” if at all possible. This reduces the degree of aileron

differential when you invoke the butterfly setting using the airbrake stick. Differential is reduced progressively, or even eliminated altogether, as the airbrake stick is moved towards its end-point.

A value of 0% at this point means that the full programmed aileron differential is retained. A value of 100% means that the aileron differential is completely eliminated at the *maximum* butterfly setting, i.e. when the airbrakes and other glide path control surfaces are fully extended. If you set a value above 100%, the aileron differential is eliminated even before full travel of the airbrake stick is reached.





Helicopter mixers

Flight phase-specific mixers for collective pitch, throttle and tail rotor

In the »**base sett.**« menu a method of switching flight phases can be activated by assigning the appropriate switches to “Phase 2” and “Auto-rotation”. You can then switch between the phases “normal” and a second phase – to which you assign a more appropriate name yourself, if necessary – using one of the switches SW 1 ... 4. The third phase – Auto-rotation – has precedence over the other two phases. **Please note that switching to auto-rotation always has priority over the other two phases.**

If you have not yet assigned switches for the flight phases, you should do so now. Use the rotary cylinder to move to the switch symbol at bottom right, then press the rotary cylinder briefly.

pitch min	front
clock	10:01 C3\
phase 2	hover 3\
▶ autorotat.	1\
▼▲	

Phase 1 always bears the designation “normal”. Both the number and name of this phase are permanently assigned, and cannot be altered. For this reason the “normal” phase is not stated as Phase 1 in the »**base sett.**« menu; it is simply concealed.

“Phase 2” is assigned the default name “hover”, but you can change this if you prefer. Hold the rotary cylinder pressed in to select one of the following names:

- hover
- aerobat(ic)
- aero 3D
- speed
- test

Description of the helicopter mixers

Five-point curves are available for setting up the control characteristics of “collective pitch”, “Ch 1 → throttle” and “Ch 1 → tail rotor”. Using these curves it is possible to program non-linear mixer ratios along the travel of the transmitter stick for these mixers. Move to the display page for setting 5-point curves by pressing the **ENTER** button or the rotary cylinder (see below).

In contrast, the mixers “Ch 1 → throttle” and “Ch 1 → tail rotor” are not required for the “Auto-rotation” flight phase (described in the section starting on page 86); instead they are automatically switched to a (variable) pre-defined value.

A value must be entered in the “Gyro” and “Input 8” lines: press the rotary cylinder, then enter a value in the highlighted field using the rotary cylinder – in a similar fashion to changing the transmitter centre position or the offset position with other radio control systems. Pressing the **CLEAR** button resets this parameter value to 0%. All these options are required for the basic process of setting up a model helicopter.

The name of the currently selected flight phase is displayed in the »**heli mixer**« menu as well as in the transmitter’s basic display; this is designed to ensure that any changes you make actually apply to the appropriate flight phase. Note that the servos do not change from one setting to another abruptly; they move smoothly with a transition time of around one second. This does not apply to auto-rotation: when you switch INTO auto-rotation, the change takes place immediately.

If you operate the switch selected for a particular flight phase, the associated flight phase is superimposed at the bottom edge of the screen, e.g. “normal”:

▶ptch	=>
ch1 ->thro	=>
ch1 ->tail	=>
gyro	0%
inp8	0%
«normal »	

Now you can program the settings for this flight phase.

ptch (Pitch curve (Ch1 → collective pitch))

Select the “ptch” line and press **ENTER** or the rotary cylinder:

ptch	
input	0%
output	0%
point 3	0%
«normal »	

The control curve can be based on a maximum of five nodes, known as “reference points”, which can be placed along the length of the control travel; separate curves can be programmed for each flight phase.

However, in most cases it is sufficient to use a smaller number of reference points when defining the collective pitch curve. As a basic rule we recommend that you start with the three default reference points offered by the software. These three points, i.e. the two end-points “Point 1” (collective pitch minimum), “Point 5” (collective pitch maximum) and “Point 3”, exactly in the centre of the travel, initially describe a linear characteristic for the collective pitch curve; this is represented in the picture above.

The programming procedure in detail

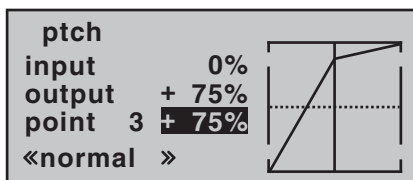
Start by switching to the desired flight phase, e.g. "normal".

The throttle / collective pitch stick can now be used to move the vertical line in the graph between the two end-points "Point 1" and "Point 5"; at the same time the momentary position of the stick is displayed in numeric form in the "Input" line (-100% to +100%).

The point where the vertical line crosses the curve is termed the "Output", and this point can be varied within the range -125% and +125% at a maximum of five reference points. This control signal, modified in this way, affects the collective pitch servos only. In the picture on the left the stick is exactly at the 0% position at "Point 3", and also generates an output signal of 0% due to the linear nature of the graph.

By default only points "1" (collective pitch minimum at -100%), "3" (hover point at 0%) and "5" (collective pitch maximum at +100% travel) are active.

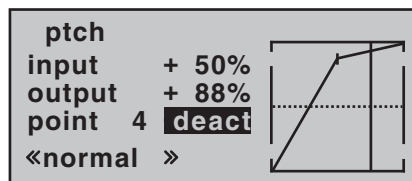
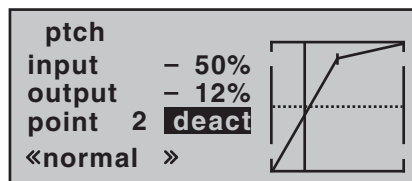
To set a point you use the associated stick to move the vertical line to the point you wish to change. The number and current curve value of this point are displayed in the bottom line in the left-hand half of the screen. The rotary cylinder can now be used to change the current curve value in the highlighted field to any value within the range -125% to +125%, without affecting the adjacent points.



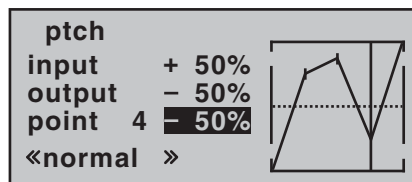
In this example we have moved reference point "3" to

+75%.

However, points "2" and "4" can optionally be activated, even though they are disabled by default:



This is accomplished using the stick to move the vertical line to the appropriate area. As soon as the message "inactive" appears in the highlighted value field, you can activate the associated point by turning the rotary cylinder; it can then be adjusted in the same manner as the other points ...

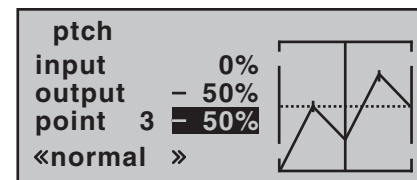


... or reset to "inactive" by pressing the **CLEAR** button. Points "1" and "5", however, CANNOT BE DISABLED.

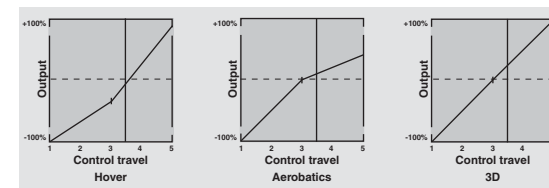
Note:

The following illustration, and all the other pictures on this page, show a control curve which we prepared for illustration purposes only. Please note that the curve

characteristics by no means represent real collective pitch curves!

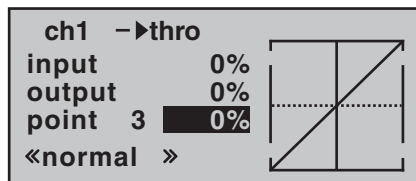


Typical collective pitch curves for different flight phases:



ch1 → thro

(Throttle curve)



Helicopter with glow or electric motor with STANDARD SPEED CONTROLLER

This display refers *only* to the control curve of the throttle servo or speed controller.

The method of setting up a throttle curve for a model helicopter fitted with a speed governor or regulator is discussed later.

The throttle curve can be defined using up to five points, in a similar way to the collective pitch curve (see previous page).

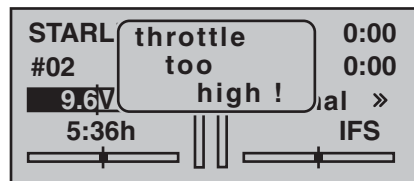
- In all cases the control curve must be set up in such a way that the throttle is fully open, or the speed controller of an electric helicopter is at full power, at the end-point of the throttle / collective pitch stick, (exception: auto-rotation – see page 86).
- The hover point is normally located at the centre of the stick travel, and the throttle setting should be adjusted relative to the collective pitch curve in such a way that the correct system rotational speed is obtained at this point.
- At the minimum position of the throttle / collective pitch stick the throttle curve should initially be set up so that the (glow) motor runs at a distinctly higher speed compared to the idle setting, with the clutch reliably engaged.

In all flight phases the motor (glow or electric) is

started and stopped using the throttle limiter (see below).

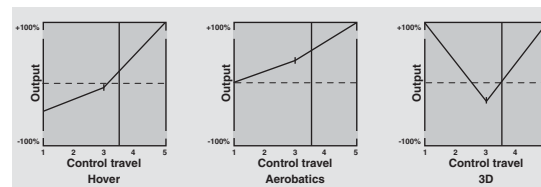
If you are used to a different radio control system which uses two separate flight phases for this – “with idle-up” and “without idle-up” – please note that the throttle limiter renders this complication superfluous, as the increased system rotational speed below the hover point in the MX-16iFS program is more flexible, and can be fine-tuned more accurately, than the “idle-up” system used with earlier MC radio control systems.

Ensure that the throttle limiter is closed before you start the glow motor, i.e. the throttle can only be adjusted within its idle range using the idle trim. Be sure to read the safety notes on page 85 which refer to this. If the idle is set too high when you switch the transmitter on, you will see and hear a clear warning!



The following three diagrams show typical 3-point throttle curves for different flight phases, such as hover, aerobatics and 3-D flying.

Typical throttle curves for different flight phases:



Notes on using the “Throttle limit” function:

- We strongly recommend that you make use of the throttle limit function (»**contr set.**« menu, page 62). When you use this function the throttle servo is completely disconnected from the throttle / collective pitch stick when the proportional throttle limit control is at its left-hand end-point; the motor runs at idle and only responds to the Ch 1 trim. This feature enables you to start the motor from within any flight phase.
- Once the motor is running, turn the throttle limiter slowly to the opposite end-point, so that full control of the throttle servo is returned to the throttle / collective pitch stick. It is important that the throttle limiter should not restrict the throttle servo at its top end-point; you can avoid this by setting the control travel to +125% in the “lim” line of the »**contr set.**« menu.
- Since electric motors by their nature require no idle setting, the only important point when setting up an electric-powered model helicopter is that the adjustment range of the throttle limiter should be set significantly higher and lower than the adjustment range of the speed controller, which is usually from -100% to +100%. It may therefore be necessary to set the “Travel” value of the throttle limiter to an appropriate point in the “Lim” line of the »**contr set.**« menu. However, the throttle curve itself has to be fine-tuned with the helicopter in flight, just like a glow-powered machine.
- Releasing the full throttle range, and imposing the throttle limiter again, trips the switching threshold of the control switch “C3” (i.e. in either direction); this switch can be used for automatically starting and stopping the stopwatch to record the flight time, or some similar purpose; see page 33.

When you select auto-rotation, the mixer automatically switches the value to a variable pre-set value; see the section starting on page 86.

Helicopter with speed GOVERNOR (REGULATOR)

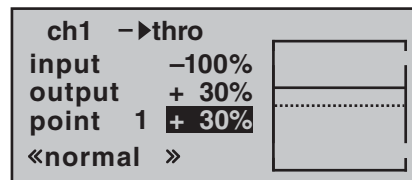
In contrast to speed *controllers*, which simply adjust power output in the same way as a carburettor, speed *governors* maintain a constant rotational speed in the system which they regulate; they accomplish this by adjusting the power output as required. In the case of a glow-powered helicopter the governor automatically controls the throttle servo; in an electric-powered machine the governor does the same with the speed controller. *For this reason speed governors do not require a classic throttle curve; they just need a pre-set rotational speed.* Once this is set, the system rotational speed does not alter unless the system requires more power from the motor than is available.

In most cases a speed *governor* is connected to receiver output 8; see receiver socket sequence on page 41. If this socket is already in use, then the throttle limiter function is not used, since this only affects output 6 – which is now not occupied – via the “Ch 1 → throttle” mixer.

However, if you wish to be able to exploit the convenience and safety features of the throttle limiter, the speed governor should be connected to receiver output 6 – in contrast to the usual socket sequence – and the throttle curve adjusted so that it can simply assume the role of the “usual” transmitter control.

In this case the “throttle curve” only determines the nominal rotational speed of the speed controller, and this nominal value is required to remain constant over the full range of collective pitch; for this reason a horizontal line should be set in the “Ch 1 → throttle” mixer, i.e. every (collective pitch) input value results in the same (“throt-

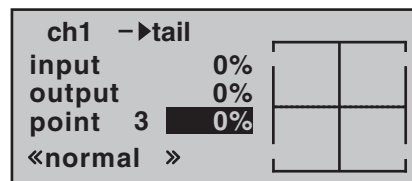
tle”) output value. The “height” of the line in the graph determines the nominal system rotational speed. Initially, then, reference point “3” should be erased, and reference points “1” (input = -100%) and “5” (input = +100%) set to the *same* value; for example:



The value to be set varies according to the speed governor you are using, and also to the desired nominal rotational speed; you may wish to vary it, of course, in the various flight phases.

When you select auto-rotation, the mixer automatically switches the value to a variable pre-set value; see the section starting on page 86.

ch1 → tail (static torque compensation)



The default setting is a torque compensation curve with a uniform linear mixer input of 0%, as is required for a gyro sensor operating in “heading lock mode”; see illustration above.

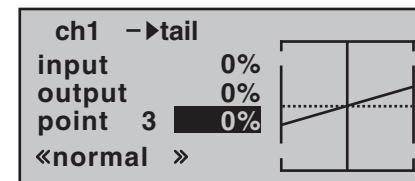
Important note:

It is absolutely essential to read and observe the set-up instructions supplied with your gyro before entering any settings at this point, as a mistake here could

render your helicopter completely uncontrollable.

If you use your gyro sensor in “normal” operating mode, or if the gyro only offers “normal mode”, then you should set up the mixer as follows:

The tail rotor control curve can be defined using up to five points, in a similar way to the collective pitch curve (see previous page). You can therefore modify the mixer at any time when required, and enter symmetrical or asymmetrical mixer inputs both above and below the hover point. However, please ensure at the outset that you have entered the correct direction of main rotor rotation in the »base sett.« menu.



Starting from -30% at Point 1 and +30% at Point 5, this mixer should be set up in such a way that the helicopter does not rotate around the vertical (yaw) axis (i.e. does not deviate from the hover heading) during a long vertical climb or descent, due to the change in torque of the main rotor. At the hover the yaw trim should be set using the (digital) tail rotor trim lever only.

For a reliable torque compensation setting it is essential that the collective pitch and throttle curves have been set up correctly, i.e. that main rotor speed remains constant over the full range of collective pitch.

When you select auto-rotation, this mixer is automatically switched off.

gyro (adjusting gyro gain)

Most modern gyro systems feature proportional, infinitely variable adjustment of gyro gain as well as a means of selecting either of two different methods of working from the transmitter.

If the gyro you wish to use features at least one of these options, then it offers you the possibility of pre-setting both “normal” gyro effect and – if available – “heading lock mode”, and also of flying normal, slow circuits with maximum gyro stabilisation, but reducing the gyro effect for high-speed circuits and aerobatics. This is generally similar to the transmitter control centre adjustment or offset adjustment provided by other radio control systems.

We recommend that you set up switchable flight phases for this, and set different gain settings for each phase in the “gyro” line; values between -125% and +125% are possible.

ptch	=>
ch1 ->thro	=>
ch1 ->tail	=>
►gyro	0%
«normal »	SEL

Based on the offset values determined for each flight phase, gyro gain can be varied proportionally by means of a transmitter control assigned in the “gyro” line in the »**contr set.**« menu (see page 62). This could be transmitter control 5 (CTRL 5), which would provide infinitely variable gyro gain control:

- At the centre position of this transmitter control the gyro effect always corresponds to the settings selected here.
- If you press the INC / DEC button in the direction of

full travel (away from centre), the gyro gain increases accordingly ...

- ... and diminishes again if you press it in the direction of the opposite end-point.

Important note:

It is absolutely essential to read and observe the set-up instructions supplied with your gyro before entering any settings at this point, as a mistake here could render your helicopter completely uncontrollable.

Adjusting the gyro sensor

If you wish to set up a gyro to achieve maximum possible stabilisation of the helicopter around the vertical axis, please note the following points:

- The mechanical control system should be as free-moving and accurate (slop-free) as possible.
- There should be no “spring” or “give” in the tail rotor linkage.
- You must use a powerful and – above all – fast servo for the tail rotor.

When the gyro sensor detects a deviation in yaw, the faster it adjusts the thrust of the tail rotor, the further the gyro gain adjuster can be advanced without the tail of the model starting to oscillate, and the better the machine’s stability around the vertical axis. If the corrective system is not fast enough, there is a danger that the model’s tail will start to oscillate even at low gyro gain settings, and you then have to reduce gyro gain further using the INC / DEC buttons to adjust the pre-set “Gyro” value to eliminate the oscillation.

If the model is flying forward at high speed, or hovering in a powerful headwind, the net result of the stabilising effect of the vertical fin combined with the gyro’s stabilis-

ing effect may be an over-reaction which manifests itself as tail oscillation. In order to obtain optimum stabilisation from a gyro in all flight situations, you should make use of the facility to adjust gyro gain from the transmitter via the INC / DEC buttons (CTRL 5).

inp8 (Input 8)

ch1 ->thro	=>
ch1 ->tail	=>
gyro	0%
►inp8	0%
«normal »	SEL

The adjustment facilities in this line of the menu are only relevant if your model helicopter is fitted with a speed governor (regulator) which maintains a constant system rotational speed, and you wish to control it using the “classic” method. The settings should then be entered in accordance with the instructions supplied with the governor you intend to use.

However, it is more convenient – and also safer – to adopt the method described previously on this page, using the “Ch 1 → throttle” mixer.

Adjusting the throttle and collective pitch curves

A practical procedure

Although the throttle and collective pitch control systems are based on separate servos, they are always operated in parallel by the throttle / collective pitch stick (except when auto-rotation is invoked). The Helicopter program automatically couples the functions in the required way. In the MX-16iFS program the trim lever of control function 1 only affects the throttle servo, i.e. it acts as idle trim (see "Digital trims" on page 34).

The process of adjusting "throttle" and collective pitch correctly, i.e. setting the motor's power curve to match the collective pitch setting of the main rotor blades, is the most important aspect of setting up any model helicopter. The program of the MX-16iFS provides independent adjustment facilities for the throttle, collective pitch and torque compensation curves.

These curves can be defined using a maximum of five reference points. To define the control curves all you have to do is set individual values for these five points in order to determine each control curve.

However, before you set up the throttle / collective pitch function it is important to adjust the mechanical linkages to all the servos accurately, in accordance with the set-up notes provided by the helicopter manufacturer.

Note:

The hover point should always be set to the centre position of the throttle / collective pitch stick.

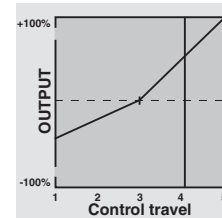
Idle setting and throttle curve

Note:

Since electric power systems by their nature require no idle setting, it is not necessary to adjust the idle value. However, the matching of the throttle and collective pitch curve(s) must still be carried out as described here, in a similar way to a glow-powered helicopter.

The idle setting is adjusted solely using the trim lever of the Ch 1 function, with the throttle limiter closed, as described in detail on pages 63 and 64. Reference point 1 of the throttle curve defines the throttle setting when the helicopter is in a descent, but without affecting the hover setting.

This is a case where you can exploit flight phase programming to use different throttle curves. An increased system rotational speed below the hover point proves to be useful in certain circumstances; for example, for fast, steep landing approaches with greatly reduced collective pitch, and for aerobatics.



The diagram shows a curve with a slightly altered throttle setting below the hover point at the centre of stick travel.

Different throttle curves are programmed for each flight phase, so that you can use the optimum set-up both for hovering and aerobatics:

- Low system rotational speed with smooth, gentle control response and low noise at the hover.
- Higher speed for aerobatics with motor power settings close to maximum. In this case the throttle curve also

has to be adjusted in the hover range.

The basic set-up procedure

Although the MX-16iFS transmitter provides a broad range of adjustment for the collective pitch and throttle curves, it is essential that you first adjust all the mechanical linkages in the model according to the information supplied by the helicopter manufacturer, i.e. all the system linkages should already be approximately correct in mechanical terms. If you are not sure of this, any experienced helicopter pilot will be glad to help you with this basic set-up.

The throttle linkage must be adjusted in such a way that the throttle is just at the "fully open" position at the full-throttle setting, or the speed controller or an electric helicopter is set to full-power. When the throttle limiter is at the idle position, the Ch 1 trim lever should just be able to close the throttle completely, without the servo striking its mechanical end-stop (quick throttle adjustment using the "digital trim": see page 34). With an electric helicopter the motor should stop reliably when the throttle limiter is closed.

Take your time, and carry out these adjustments very carefully by adjusting the mechanical linkage and / or changing the linkage point on the servo output arm or the throttle lever. Only when you are confident that all is well should you think about optimising and fine-tuning the throttle servo using the transmitter's electronic facilities.

Caution:

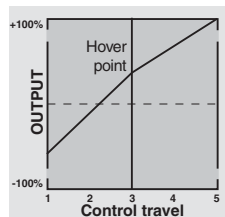
Read all you can about motors and helicopters, so that you are aware of the inherent dangers and the cautionary measures required before you attempt to start the motor for the first time!

With the basic set-up completed, it should be possible to start the motor in accordance with the operating instructions supplied with it, and adjust the idle setting using the trim lever of the throttle / collective pitch stick. The idle position which you set is indicated in the transmitter's basic screen display by a horizontal bar in the display of the Ch 1 trim lever's position. Refer to page 34 of this manual for a full explanation of the digital trims.

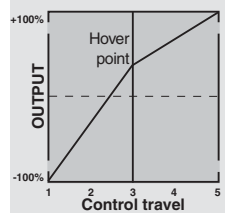
Around the mid-point of the collective pitch stick the model should lift off the ground and hover at approximately the rotational speed you wish to use. If this is not the case, correct the settings as follows:

1. The model does not lift off until the collective pitch stick is above the centre point.

- a) Rotational speed too low
Remedy: increase the value for the throttle servo parameter at Point 3 of the stick travel in the "Ch1 → throttle" mixer, as shown in the graph.

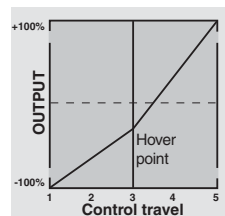
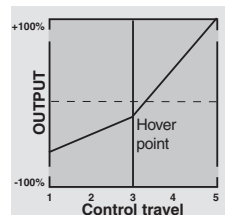


- b) Rotational speed too high
Remedy: increase the blade pitch angle for collective pitch at Point 3 of the stick travel in the "Ch1 → collective pitch curve" menu, as shown in the graph.



2. The model lifts off below the centre point.

- a) Rotational speed too high
Remedy: reduce the throttle opening in the "Ch1 → throttle" mixer at Point 3 of the stick travel, as shown in the graph.
- b) Rotational speed too low
Remedy: reduce the blade pitch angle for collective pitch at Point 3 of the stick travel in the "Ch1 → collective pitch curve", as shown in the graph.



Important:

It is important to persevere with this adjustment procedure until the model hovers at the correct rotational speed at the centre point of the throttle / collective pitch stick. All the other model settings depend upon the correct setting of these parameters!

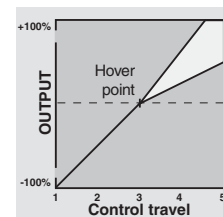
The standard set-up

The remainder of the standard adjustment procedure is completed on the basis of the fundamental set-up which you have just carried out, i.e. we now assume that the model hovers in normal flight at the centre point of the throttle / collective pitch stick, with the correct rotor speed. This means that your model helicopter is capable of hovering and also flying circuits in all phases whilst maintaining a *constant system rotational speed*.

The climb setting

The combination of throttle hover setting, collective pitch setting for the hover and the maximum collective pitch setting (Point 5) now provides you with a simple method of achieving constant system rotational speed from the hover right to maximum climb.

Start by placing the model in an extended vertical climb, holding the collective pitch stick at its end-point: motor speed should not alter compared with the hover setting. If motor speed falls off in the climb, when the throttle is already fully open and no further power increase is possible (this assumes that the motor is correctly adjusted), then you should reduce maximum blade pitch angle at full deflection of the collective pitch stick, i.e. the value at Point 5. Conversely, if motor speed rises during the vertical climb, you should increase the pitch angle. This is done on the "Collective pitch" graphic page by moving the vertical line to Point 5 using the collective pitch stick, and changing its value accordingly using the rotary cylinder.



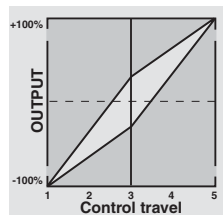
This diagram only shows the changes to the collective pitch maximum value.

Now bring the model back to the hover, which again should coincide with the mid-point of the Ch 1 stick. If you find that the collective pitch stick now has to be moved from the mid-point in the direction of "higher", then you should correct this deviation by slightly increasing the collective pitch angle at the hover – i.e. Point 3 – until the model again hovers at the stick centre point.

Conversely, if the model hovers below the mid-point, correct this by reducing the pitch angle again.

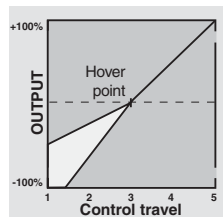
You may find that it is also necessary to correct the throttle opening at the hover point (Point 3) in the “Ch 1 → throttle” menu.

This diagram only shows the change in the hover point, i.e. collective pitch minimum and maximum have been left at -100% and +100% respectively.



Continue adjusting these settings until you really do achieve constant main rotor speed over the full control range between hover and climb.

The descent adjustment should now be carried out from a safe height by fully reducing collective pitch to place the model in a descent from forward flight; adjust the collective pitch minimum value (Point 1) so that the model descends at an angle of 60 ... 80°. This is done on the “Collective pitch” graphic page by moving the vertical line to Point 1 using the collective pitch stick, and adjusting the value accordingly using the rotary cylinder.



As an example, this diagram shows only the changes in the collective pitch minimum value.

Once the model descends reliably as described, adjust the value for “Throttle minimum” – the value of Point 1 on the graph of the “Ch 1 → throttle” mixer – so that system rotational speed neither increases nor declines.

This completes the set-up procedure for throttle and collective pitch.

Important final notes

Before you start the motor, check carefully that the throttle limiter is completely closed, so that the throttle can be controlled by the Ch 1 trim lever alone. If the throttle is too far open when you switch the transmitter on, you will see and hear a warning. If you ignore this and start the motor with the throttle too far advanced, there is a danger that the motor will immediately run up to speed after starting, and the centrifugal clutch will at once engage. For this reason you should:

**always grasp the rotor head firmly
when starting the motor.**

However, if you accidentally start the motor with the throttle open, the rule is this:

Don't panic!

Hang on to the rotor head regardless!

Don't let go!

Immediately close the throttle, even though there may be a risk of damaging the helicopter's drive train, because:

**it is vital that YOU ensure
that the helicopter cannot possibly
move off by itself in an uncontrolled manner.**

The cost of repairing a clutch or even the motor itself is negligible compared to the damage which a model helicopter can cause if its spinning rotor blades are allowed to wreak havoc.

**Make sure that nobody else is standing in
the primary hazard zone around the helicopter.**

You must never switch abruptly from idle to the flight setting by suddenly increasing system rotational speed.

This causes the rotor to accelerate quickly, resulting in premature wear of the clutch and gear train. The main rotor blades are generally free to swivel, and they may be unable to keep pace with such swift acceleration, in which case they might respond by swinging far out of their normal position, perhaps resulting in a boom strike. Once the motor is running, you should **slowly** increase system rotational speed *using the throttle limiter*.



Helicopter mixers

Auto-rotation settings

Auto-rotation allows full-size and model helicopters to land safely in a crisis, i.e. if the power plant should fail. It can also be used if the tail rotor should fail, in which case cutting the motor and carrying out an auto-rotation landing is the only possible way of avoiding a high-speed uncontrollable rotation around the vertical axis, invariably terminating in a catastrophic crash. And that is the reason why switching INTO auto-rotation occurs with zero delay.

When you switch to the auto-rotation phase the helicopter mixers change as shown in this screen shot:

►ptch	=>
thro	- 90%
tail	0%
gyro	0%
inp8	0%
«Autorot »	⏏

During an auto-rotation descent the main rotor is not driven by the motor; it is kept spinning only by the airflow through the rotor disc caused by the speed of the descent. The rotational energy stored in the still spinning rotor can be exploited to allow the machine to flare out, but this can only be done once. For this reason “autos” are only likely to be successful if the pilot has plenty of experience in handling model helicopters, and has also set up the appropriate functions with great care.

Once you have sufficient experience you should practise auto-rotation landings at regular intervals, not only so that you can demonstrate your all-round flying skill by flying the manoeuvre in competitions, but also so that you are in a position to land the helicopter undamaged from a great height if the motor should fail. For this purpose the program provides a range of adjustment

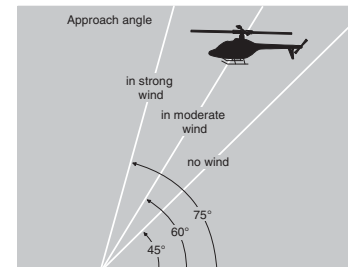
facilities which are designed to help you fly your helicopter in its unpowered state. Please note that the rotation setting takes the form of a complete third flight phase, for which all the adjustment facilities are available which can be varied separately for all flight phases, especially trims, collective pitch curve settings etc..

ptch (Pitch curve (ch1 → Pitch))

In powered flight the maximum blade pitch angle is limited by the motor power which is available; however, in auto-rotation the angle is only limited by the point at which the airflow over the main rotor blades breaks away. Nevertheless, to provide sufficient upthrust even when rotational speed is falling off, it is necessary to set a greater maximum collective pitch value. Press the rotary cylinder or **ENTER** to select the graph page of “Collective pitch”, and then move the vertical line to Point 5 using the transmitter stick. Start by setting a value which is about 10 to 20% higher than the normal collective pitch maximum. *Do not initially set a much higher value* compared with normal flight, because collective pitch control will then differ too greatly from the machine’s usual response after you have thrown the switch. The danger is that you will over-control the helicopter, and it may balloon up again during the flare following the auto-rotation descent. If this happens, the rotational speed of the main rotor will quickly decline to the point where it collapses, and the helicopter ends up crashing to the ground from a considerable height.

Under certain circumstances the collective pitch minimum setting may also differ from the normal flight setting; this depends on your piloting style for normal flying. In any case you must set a sufficiently generous collective pitch minimum value at Point 1 to ensure that your model can be brought from forward flight at moderate

speed into a descent of around 60 ... 70° when collective pitch is reduced to minimum. Most helicopter pilots already use such a setting for normal flying, and if this applies to you, you can simply adopt the same value. If you normally allow your model to “fall” at a shallower angle, increase the value for “Point 1”, and vice versa.



Approach angle under varying wind conditions.

For auto-rotation the collective pitch stick itself may not be positioned right at the bottom of its travel; typically it will be between the hover position and the bottom end-point, giving the pilot scope for correction if necessary, i.e. the chance to adjust the model’s pitch inclination using the pitch-axis control.

You can shorten the approach by pulling back slightly on the pitch-axis stick and gently reducing collective pitch, or alternatively extend the approach by pushing forward on the pitch-axis stick and gently increasing collective pitch.

thro (Throttle curve)

In a competition the pilot is expected to cut the motor completely, but for practice purposes this is certainly inconvenient, as after every practice “auto” you would have to start the motor again.

For practice, then, you should set the value in this line so that the motor runs at a reliable idle during auto-

rotation; for an electric helicopter the motor should be reliably “off”.

tail (static torque compensation)

For normal flying the tail rotor is set up in such a way that it compensates for motor torque when the helicopter is hovering. This means that it already generates a certain amount of thrust even in its neutral position. The level of thrust is then varied by the tail rotor control system, and also by the various mixers which provide all manner of torque compensation, while the tail rotor trim is also used to compensate for varying weather conditions, fluctuations in system rotational speed and other influences.

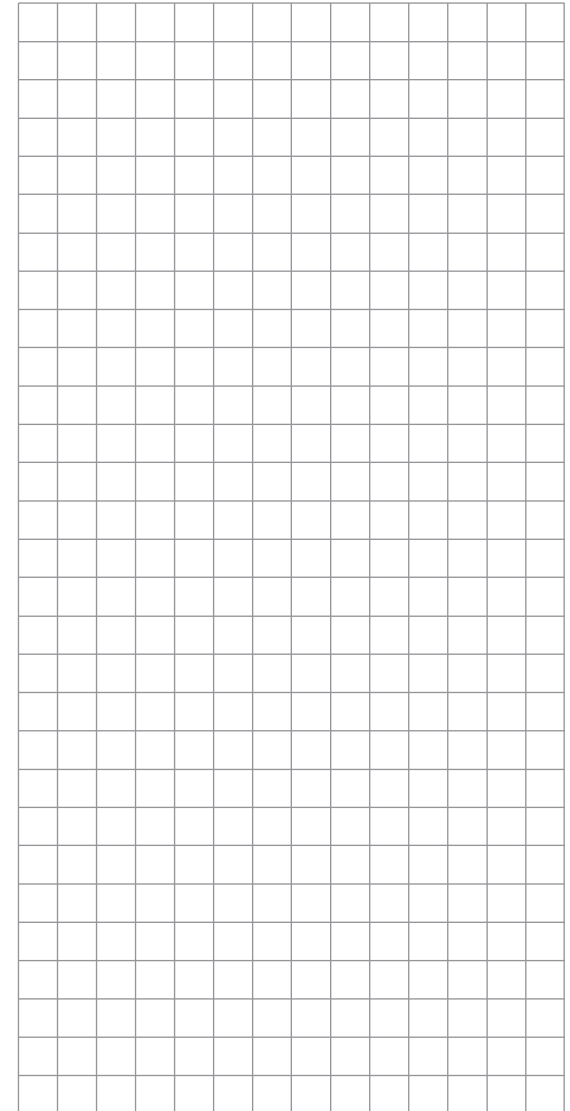
However, in an auto-rotation descent the main rotor spins according to the windmill principle, i.e. it is not driven by the motor, and therefore there is no torque effect for which compensation is required, i.e. which the tail rotor would have to correct. For this reason all the appropriate mixers are automatically switched off in auto-rotation mode.

However, the basic tail rotor setting has to be different for auto-rotation, as the compensatory thrust described above is no longer required.

Stop the motor and place the helicopter horizontal on the ground. With the transmitter and receiving system switched on, select the «**Auto-rotation**» flight phase. Fold both tail rotor blades down and change the blade pitch angle to zero degrees using the “Tail rotor” menu. Viewed from the rear, the tail rotor blades should now lie parallel to each other.

Depending on the friction and running resistance of the gearbox, you may find that the fuselage still yaws slightly in an auto-rotation descent. If necessary, the relatively

slight torque which causes this effect must then be corrected by adjusting the tail rotor blade pitch angle. This value will always be a small figure between zero degrees and a pitch angle opposed to the direction of tail rotor pitch required for normal flight.





In software terms the default setting for any “free mixer” is that it is constantly switched on, but it is also possible

To identify this special arrangement, this mixer input control function in the software is designated “S” for “switch channel”. If you do not want the “target channel” to be affected by the “normal” transmitter control, the control can be de-coupled from the function input of the associated control channel by entering “empty” in the »**contr set.**« menu; see pages 58 and 60. The following menu description includes an example which makes this function clear.

88 **Program description: free mixers**




Free mixers

Linear mixers

Regardless of the selected model type, three linear mixers are available for each of the twelve model memories, with the additional possibility of non-linear characteristic curves.

In this first section we will concentrate on the programming procedure for the first screen page. We will then move on to the method of programming mixer ratios, as found on the second screen page of this menu.

The basic programming procedure

1. Select mixer 1 ... 3 with the rotary cylinder pressed in.
2. Press the rotary cylinder. The input field "fro(m)" is highlighted (inverse video).
3. Define the mixer input "from" using the rotary cylinder.
4. Press the rotary cylinder, move to **SEL** under the "to" column using the rotary cylinder, and press the rotary cylinder once more.
The input field "to" is now highlighted.
5. Define the mixer input "to" using the rotary cylinder.
6. Press the rotary cylinder, and (optionally) move to **SEL** under the "type" column using the rotary cylinder; you can now include the Ch1 ... Ch 4 trim lever for the mixer input signal ("tr" for trim) ...
... and / or move to the switch symbol, press the rotary cylinder again, and assign a switch if desired.
7. Press the rotary cylinder, move to  using the rotary cylinder, and press **ENTER**.
8. Define the mixer ratios on the second screen page.
9. Press **ESC** to switch back to the first page.

"fro(m)" column

Press the rotary cylinder, then rotate it to select one of the *control functions* 1 ... 8 or S in the highlighted field of the selected mixer line.

In the interests of clarity, the control functions 1 ... 4 are abbreviated as follows when dealing with the fixed-wing mixers:

c1	Throttle / airbrake stick
ar	Aileron stick
el	Elevator stick
rd	Rudder stick

... and in the Heli program:

1	Throttle / collective pitch stick
2	Roll stick
3	Pitch-axis stick
4	Tail rotor stick

Note:

Don't forget to assign a transmitter control to the selected control functions 5 ... 8 in the »contr set.« menu.



"S" for switch channel

The letter "S" (switch channel) in the "from" column has the effect of passing a *constant* input signal to the mixer input, e.g. in order to apply a little extra up-elevator trim when an aero-tow coupling is closed, as mentioned earlier.

Once you have assigned a control function or the letter "S", an additional **SEL** field appears in the ...

"to" column.

At this point you can define the *control channel* as the mixer destination, i.e. the mixer output. At the same time additional fields appear in the bottom line of the screen:

M1		6 → el	1 → =>
M2		c1 → el	C1 → =>
▶ M3		S → el	3 → =>
type fro to			
▲		SEL SEL	 

In this example three mixers have already been defined. The second mixer ("Brake → elev") is already familiar to us from the »wing mixer« menu. As a general rule you should always use these pre-programmed mixers first if possible.

However, if you need asymmetrical mixer ratios on both sides of centre, or have to offset the mixer neutral point, then you should set or leave the pre-set mixers at "0", and program one of the free mixers instead.

Erasing mixers

If you need to erase a mixer that you have already defined, simply press the **CLEAR** button in the highlighted field of the "fro(m)" column.

Mixer switches

In our example above, a physical switch "1" and the control switch "C1" have been assigned to the two linear mixers 1 and 2, and switch 3 to mixer 3.

The switch symbol to the right of the switch number shows the current status of that switch.

Any mixer to which no switch has been assigned in the  column is permanently switched on.

“Typ(e)” column (including the trim)

If you wish, and if you are using one of the primary control functions 1 ... 4 (sticks), you can set the trim value of the digital trim lever to affect the mixer input. Use the rotary cylinder to select “tr” in the highlighted field for the mixer you are programming.

The effect of the *Ch 1 trim lever* on the mixer output varies according to the function which has been assigned to it in the »**base sett.**« menu (pages 46 and 50) in the “motor on C1” column for fixed-wing models.

Additional special features of free mixers

If you set up a mixer whose input is the same as its output, e.g. “c1 → c1”, exotic results can be obtained in conjunction with the option of switching a free mixer on and off. You will find one typical example of this on pages 102 ... 104.

Before we come to setting mixer ratios, we have to consider what happens if a mixer input is allowed to act on the pre-set coupling of aileron servos, flap servos or collective pitch servos:

• Fixed-wing models:

Depending on the number of wing servos set in the “Aileron / Flap” line of the »**base sett.**« menu, receiver outputs 2 and 5 are reserved for the aileron servos, and outputs 6 and 7 for the two flap servos, as special mixers are assigned to these functions.

If mixer outputs are programmed to this type of coupled function, you have to consider their effect on the associated pair of wing flaps, according to the control channel:

Mixer	Effect
N.N.* → 2	Servo pair 2 + 5 responds with aileron function
N.N.* → 5	Servo pair 2 + 5 responds with flap function
N.N.* → 6	Servo pair 6 + 7 responds with flap function
N.N.* → 7	Servo pair 6 + 7 responds with aileron function

• Model helicopters:

Depending on the type of helicopter, up to four servos may be employed for collective pitch control; these will be connected to receiver outputs 1, 2, 3 and 5. The MX-16iFS software links them together to provide the functions collective pitch, roll and pitch-axis.

It is **not advisable** to mix one of the transmitter controls into these occupied channels using the free mixers available outside the »**heli mixer**« menu, as you may inadvertently generate some extremely complex and unwanted inter-actions. One of the few exceptions to this rule is “Collective pitch trim via a separate transmitter control”; see example 2 on page 93.

Important note:


When dealing with the inter-action of multiple mixers on one control channel, it is essential to remember that the mixed travels of the individual mixers are cumulative when multiple stick commands are made simultaneously, and there is then a danger that the servo concerned may strike its mechanical end-stops. If you encounter this problem, simply reduce the servo travel in the

* N.N. = Nomen Nominandum (name to be stated)

»**servo sett.**« menu, and / or reduce the mixer values.

Mixer ratios and mixer neutral point

Now that we have explained the wide-ranging nature of the mixer functions, we can move on to the method of programming linear and non-linear mixer curves.

For each of the three available mixers the mixer curves are programmed on a second page of the screen display. Select the number of the mixer you wish to adjust, and move to the  symbol at bottom right of the screen using the rotary cylinder. A brief press on the rotary cylinder or **ENTER** now takes you to the graphic page.

Setting up linear mixer values

In the next section we will describe a typical practical application, by defining a linear mixer curve intended to solve the following problem:

We have a powered model with two flap servos connected to receiver outputs 6 and 7, which were programmed as “... 2fl” in the “Aileron / Flap” line of the »**base sett.**« menu. These control surfaces are to be employed as landing flaps, i.e. when the associated transmitter control is operated, they deflect down only. However, this flap movement requires an elevator trim correction to counteract the resultant pitch trim change.

In the »**contr sett.**« menu, assign the rotary proportional control CTRL 7 to input 6. The control assigned to input 6 now controls the two servos connected to receiver outputs 6 and 7 in the standard way, operating as simple wing flaps.

»**contr set.**« menu

I5	empty	+100%	+100%
►I6	ctrl7	+100%	+100%
I7	empty	+100%	+100%
		- trv	+
▼▲	SEL	SYM	ASY

Note:

If you assign a transmitter control to input 7 and select two flap servos, input 7 is automatically blocked to avoid possible malfunctions.

Rotate the transmitter control to its left-hand end-point, and adjust the landing flap linkages so that they are in the neutral position at this setting. If you now turn the knob to the right, the flaps should deflect down; if they move up, you must reverse the direction of servo rotation.

Now we turn to the first mixer on the screen on page 89; this is the mixer "6 → el", to which switch 1 has been assigned:

►M1		6-►el	1} =>
M2		c1-►el	C1} =>
M3		S-►el	3 =>
	typ	fro	to
▼	SEL	SEL	↙⏏

Use the rotary cylinder to move to the ⏏ symbol at bottom right of the screen. Pressing the rotary cylinder now switches to the second screen page:

MIX 1	6-►el	off
-------	-------	-----

If this display appears, you have not activated the mixer by operating the assigned external switch – in this case "1". To correct this, operate the switch:

MIX 1	6-►el	
►trv +	0%+	0%
offs	0%	
▼	SYM	ASY

The full-height vertical line in the graph represents the current position of the transmitter control assigned to input 6. (In the above graph this is located at the left-hand edge because CTRL 7 is at its left-hand end-point, as already mentioned.) The full-length horizontal line shows the mixer ratio, which currently has the value of zero over the whole stick travel; this means that the elevator will not "follow" when the flaps are operated.

The first step is to define the **offset** (mixer neutral point). To do this press the rotary cylinder and move to the "Offs" line:

MIX 1	6-►el	
trv +	0%+	0%
►offs	0%	
▲	SYM	ASY

The dotted vertical line indicates the position of the mixer neutral point ("offset"), i.e. that point along the

control travel at which the mixer has NO influence on the channel connected to its output. By default this point is set to the centre position.

However, in our example the neutral (retracted) position of the flaps is located at the left-hand stop of the rotary proportional control, and in this position the elevator must not be affected. We therefore have to shift the mixer neutral point exactly to that position. Turn the control to the left-hand end-stop – if you have not already done so – and select **STO** using the rotary cylinder. Press the rotary cylinder, and the dotted vertical line now moves to this point – the new mixer neutral point – which *always* retains the "OUTPUT" value of zero in accordance with the mixer definition.

As it happens, this setting is difficult to show in a screen shot, so we will change the "offset" value to only -75%.

MIX 1	6-►el	
trv +	0%+	0%
►offs	- 75%	
▲	STO	CLR

Note:

If you wish, you can move the mixer neutral point back to centre by selecting **CLR** using the rotary cylinder, and pressing the rotary cylinder.

Symmetrical mixer ratios

The next step is to define the mixer values above and below the mixer neutral point, starting from the current position of the mixer neutral point. Select the **SYM** field, so that you can set the mixer value symmetrically relative to the offset point you have just programmed. Press the rotary cylinder, then set the values in the two highlighted fields within the range -150% to +150%. Remember that *the set mixer value always refers to the signal from the associated transmitter control (control signal)!* Setting a negative mixer value reverses the direction of the mixer.

Pressing the **CLEAR** button erases the mixer ratio in the highlighted field.

The “optimum” value for our purposes will inevitably need to be established through a flight testing programme.

MIX 1	6→el	
trv + 20%+ 20%		
offs - 75%		
▼	SYM	ASY

Since we previously set the mixer neutral point to -75% of control travel, the elevator (“el”) will already exhibit a (slight) “down-elevator” effect at the neutral point of the landing flaps, and this, of course, is not wanted. To correct this we shift the mixer neutral point back to -100% control travel, as described earlier.

MIX 1	6→el	
trv + 20%+ 20%		
offs - 100%		
▲	STO	CLR

If you were now to reset the offset from -75% to, say, 0% control travel, the screen would look like this:

MIX 1	6→el	
trv + 20%+ 20%		
offs 0%		
▲	STO	CLR

Asymmetrical mixer ratios

For many applications it is necessary to set up different mixer values on either side of the mixer neutral point.

If you set the offset of the mixer used in our example (“6→el”) back to 0%, as shown in the picture above, then select the **ASY** field and turn the rotary proportional control in the appropriate direction, the mixer ratio for each direction of control can be set separately, i.e. to left and right of the selected offset point:

MIX 1	6→el	
trv + 44%+ 22%		
offs 0%		
▼	SYM	ASY

Note:

If you are setting up a switch channel mixer of the “S→N.N.” type, you must operate the assigned switch to

* N.N. = Nomen Nominandum (name to be stated)

achieve this effect. The vertical line then jumps between the left and right sides.

Examples:

- To open and close the aero-tow release the switch SW 3 has already been assigned to control channel 8 in the »**contr set.**« menu.

I6	ctrl7	+100%	+100%
I7	empty	+100%	+100%
►I8	3	+100%	+100%
▲	SEL	SYM	ASY

In the meantime you have carried out a few aero-tow flights, which showed that you always needed to hold in slight up-elevator during the tow. You now wish to set the elevator servo (connected to receiver output 3) to slight “up” trim when the tow release is closed. In the screen familiar from page 89 we have set up the third linear mixer to accomplish this, using the switch channel “S” as the mixer input. Now move the selected switch to the OFF position, and select the symbol ...

M1	6→el	1 =>
M2	c1→el	C1 =>
►M3	S→el	3 =>
▲	typ	fro to
	SEL	SEL

... to move to the second page. Hold the rotary cylinder pressed in to select the “Offs” line, and press the rotary cylinder again: the offset value jumps to +XXX% or -XXX%, depending on the selected switch position.



Swashplate mixers

Collective pitch, roll and pitch-axis mixers

MIX 3	S → el	
trv +	0%+ 0%	
offs	+100%	
▲	STO CLR	

Now hold the rotary cylinder pressed in again to move to the "Travel" line, where you set the required mixer input – after moving the selected switch to the mixer ON position.

MIX 3	S → el	
trv +	10%+ 10%	
offs	+100%	
▼	SYM ASY	

2. The following example applies to model helicopters:

In the Helicopter program you may wish to assign one of the two INC / DEC buttons (CTRL 5 or 6) to the collective pitch trim function. This is the procedure: in the »**contr set.**« menu assign one of these two transmitter controls to input "18". Now simply define a free mixer "8 → 1" with a symmetrical mixer ratio of, say, 25%. Due to the internal coupling, this transmitter control now acts equally on all the collective pitch servos you are using, without affecting the throttle servo.

MIX 1	8 → 1	
trv +	25%+ 25%	
offs	0%	
▼	SYM ASY	

S P - MIXER	
▶pitch	+ 61%
roll	+ 61%
nick	+ 61%
▼	SEL

In the "Swashplate" line of the »**base sett.**« menu you have already defined the number of servos which are installed in your helicopter to provide collective pitch control; see page 50. With this information the MX-16iFS program automatically superimposes the functions for roll, pitch-axis and collective pitch as required, i.e. you do not need to define any additional mixers yourself.

If you have a model helicopter which only has a *single collective pitch servo*, the "Swashplate mixer" menu point is – of course – superfluous, since the three swashplate servos for collective pitch, pitch-axis and roll are controlled independently of each other. In this case the swashplate mixer menu does *not* appear in the multi-function list. With all other swashplate linkages employing 2 ... 4 collective pitch servos, the mixer ratios and directions are set up by default, as can be seen in the screen shot above. The pre-set value is +61% in each case, but the value can be varied within the range -100% to +100% using the rotary cylinder, after first pressing the rotary cylinder.

Pressing the **CLEAR** button resets the mixer input in the highlighted field to the default value of +61%.

If the swashplate control system (collective pitch, roll and pitch-axis) does not follow the transmitter sticks in the proper manner, then the first step is to change the mixer directions (+ or -), before you attempt to correct the directions of servo rotation.

HEIM mechanics with two collective pitch servos:

- The *collective pitch mixer* acts on the two collective pitch servos connected to receiver sockets 1 + 2;
- the *roll mixer* also acts on the two collective pitch servos, but the direction of rotation of one servo is reversed, and
- the *pitch-axis mixer* acts on the pitch-axis servo alone.

Note:

Ensure that the servos do not strike their mechanical end-stops if you change the servo mixer values.

MX-16iFS programming techniques

Preparation, using a fixed-wing model aircraft as an example

Programming model data into an MX-16iFS ...

... is easier than it might appear at first sight.

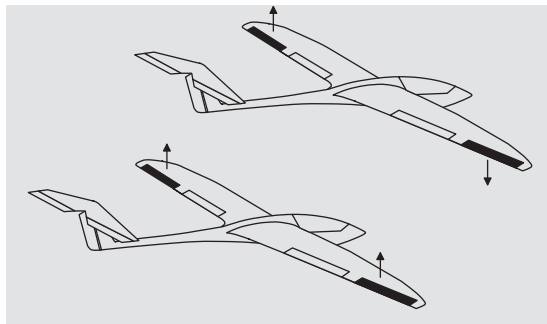
There is one basic rule which applies equally to all programmable radio control transmitters: if the programming is to go “smoothly” and the systems work as expected, the receiving system components must first be installed correctly in the model, i.e. the mechanical systems must be first-rate. This means: ensure that each servo is at its correct neutral position when you fit the output lever or disc and connect the linkage to it. If you find this is not the case, correct it! Remove the output arm, rotate it by one or more splines and secure it again. If you use a servo tester, e.g. the Digital Servo Analyzer, Order No. **763**, to centre the servos, you will find it very easy to find the “correct” position.

Virtually all modern transmitters offer facilities for offsetting the neutral position of servos, but this is no substitute for a correct mechanical installation; this function is only intended for fine tuning. Any substantial deviation from the “0” position may result in additional asymmetry when the signal undergoes further processing in the transmitter. Think of it this way: if the chassis of a car is distorted, you may be able to force the vehicle to run straight by holding the steering wheel away from centre, but it does not make the chassis any less bent, and the basic problem remains.

Another important point is to set up the correct control travels wherever possible by using the appropriate linkage points in the mechanical system; this is much more efficient than making major changes to the travel settings at the transmitter. The same rule applies: electronic travel adjustment facilities are designed primarily to compensate for minor manufacturing tolerances in the servos and for fine adjustment, and not to compensate

for poor-quality construction and defective installation methods.

If two separate aileron servos are installed in a fixed-wing model aircraft, the ailerons can also be employed as flaps by deflecting both of them down, and as air-brakes by deflecting both of them up – simply by setting up a suitable mixer (see the section starting on the next double page). Such systems are generally more often used in gliders and electric gliders than in power models.



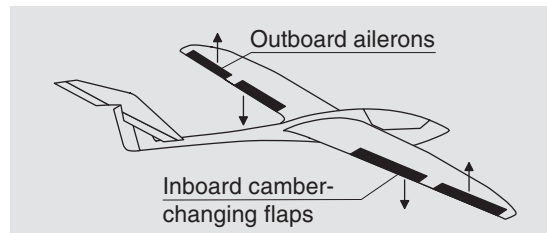
In such cases the servo output arms should be offset forward by one spline relative to the neutral point, i.e. towards the leading edge of the wing, and fitted on the servo output shaft in that position.

The mechanical differential achieved by this asymmetrical installation takes into account the fact that the braking effect of the up-going ailerons increases with their angle of deflection, and this means that much less travel is usually required in the down-direction than the up-direction.

Similar reasoning applies to the installation of the flap linkage when separately actuated flap servos are installed, designed to be used in a butterfly (crow) system. Here again an asymmetrical linkage point is useful. The braking effect of the crow system is provided primarily

by the down-movement of the flaps rather than the up-movement of the ailerons, so in this case the servo output arms should be angled aft, i.e. offset towards the trailing edge of the wing, as this makes greater travel available for the down-movement. When this combination of lowered flaps and raised ailerons is used, the ailerons should only be raised to a moderate extent, as their primary purpose in this configuration is to stabilise and control the model rather than act as brakes.

You can “see” the difference in terms of braking effect by deploying the crow system, then looking over and under the wing from the front: the larger the projected area of the deflected control surfaces, the greater the braking effect.



(This type of asymmetrical installation of the servo output arms can also make sense when you are setting up split flaps or landing flaps on a power model.)

Once you have completed your model and set up the mechanical systems accurately in this way, you are ready to start programming the transmitter. The instructions in this section are intended to reflect standard practice by describing the basic general settings first, and then refining and specialising them to complete the set-up. After the initial test-flight, and in the course of continued test-flying, you may need to adjust one or other of the model's settings. As your piloting skills improve

and you gain experience, you might feel the need to try out different control systems and other refinements, and to cater for these requirements you may find that the text deviates from the obvious order of options, or that one or other of the options is mentioned more than once. On the other hand, it may certainly occur that not every step described in these instructions is relevant to a particular model, just as some users might miss the description of a particular step which is relevant to his model only ...

At this point, just before you start programming the model data, it is worthwhile thinking carefully about a sensible layout of the transmitter controls.

If the model in question is one with the emphasis on “power” – whether the power of an electric motor or internal combustion engine (glow motor) – you will probably encounter few problems in this matter, because the two stick units are primarily employed to control the four basic functions “power control (= throttle)”, “rudder”, “elevator” and “aileron”. Nevertheless, you still have to call up the ...

»base sett.« (pages 46 ... 49)

model name	<GRAUBELE>
stick mode	1
► motor on C1	no
tail type	normal
▼▲	SEL

... menu and define your preferred throttle direction, i.e. throttle minimum forward (“Idle front”) or back (“Idle rear”), because the program’s default setting is “no” (no motor) when you first set up a model memory. The basic difference between “no” or “no/inv” and

“throttle min. front / rear” is the effect of the Ch 1 trim. The trim is effective over the full stick travel if “no (/ inv)” is entered, but it only affects the idle range if you enter “throttle min. front or rear”. However, it also affects the “direction of effect” of the Ch 1 stick, i.e. if you switch from “front” to “rear” or vice versa, you do not also have to reverse the direction of the throttle (or brake) servo. For safety reasons you will also see a warning message if you switch the transmitter on with the throttle stick positioned too far towards “full-throttle” – but only if you have already set “throttle min. front or rear”:



Your choice of “no” (no motor) or “throttle min. front or rear” also affects the range of mixers available in the »wing mixer« menu. The mixers “Brake → N.N.*” are only present if you choose “no” (no motor) or “no/inv”, otherwise they are suppressed.

In addition to these basic matters you will certainly need to consider carefully how best to control any “auxiliary functions” present on your model.

In contrast, if your model is a glider or electric glider the whole situation may be rather different. The immediate question is: what is the best way of operating the motor and braking system? Now, some solutions have proved to be practical, and others less so.

For example, it is not a good idea to be forced to let go of one of the primary sticks in order to extend the airbrakes or deploy the crow braking system when your

glider is on the landing approach. It surely makes more sense to set up switchable functions for the Ch 1 stick (see example 4 on page 102), or to assign the braking system to the throttle stick, and shift the motor control to a slider – or even a switch. With this type of model the electric motor is often little more than a “self-launching system”, and is used either to drag the model into the sky at full power, or to pull it from one area of lift to the next at, say half-power, and for such models a throttle switch is usually quite adequate. If the switch is positioned where you can easily reach it, then you can turn the motor on and off without having to let go of the sticks – even on the landing approach.

Incidentally, similar thinking can be applied to flap control systems, regardless of whether they are “just” the ailerons, or full-span (combination) control surfaces which are raised and lowered in parallel.

Once you are satisfied that all these preparations have been completed successfully, programming can commence.

* N.N. = Nomen Nominandum (name to be stated)



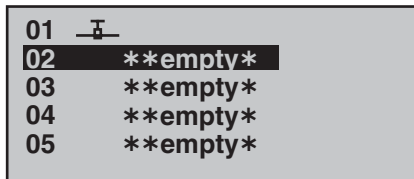
First steps in programming a new model

Example: non-powered fixed-wing model aircraft

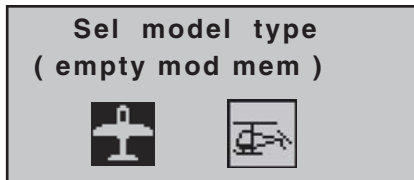
When programming a new model you should start with the ...

“select model” (page 44)

..., sub-menu in the »mod.mem.« menu, where you select a vacant memory and confirm your choice by pressing the **ENTER** button or the rotary cylinder.



Once you have selected a free model memory, you are immediately requested to select the type of model to be programmed:



Since in this example we are setting up a fixed-wing model, we simply confirm the fixed-wing model symbol with **ENTER** or a brief press on the rotary cylinder. The screen now reverts to the basic display.

Notes:

- Naturally you can also use the pre-defined model memory 01 for programming your first model; this is the “fixed-wing model” type by default.
- Once you have called up the “Model select” option it is not possible to interrupt the process, i.e. you must choose one or other model type. However, if you make a mistake you can always correct it simply by

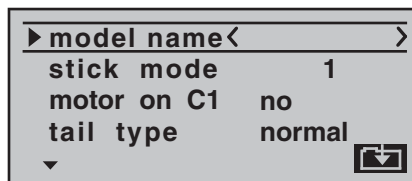
erasing the model memory.

- If the battery voltage is too low, you will not be able to change model memories for safety reasons. The screen then displays an appropriate message:

not possible now
voltage too low

Now that you have overcome this first hurdle, you can start programming the actual transmitter settings to suit the model in the ...

»base sett.« (pages 46 ... 49)



... menu. At this point you can enter the “Model name” by selecting the symbol in order to move to the character table:



You should also check the settings for “Stick mode” and “motor on C1” and change them if necessary:

- “no”:
The brake system is “retracted” at the forward position of the throttle / brake stick; in the »wing mixer« menu the “Brake → N.N.” mixers are v.
The warning message “Throttle too high” – see page

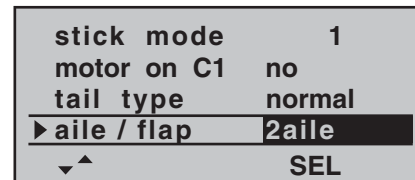
18 or 46 ... 47 – is disabled.

- “no/inv”:
The brake system is “retracted” at the back position of the throttle / brake stick; in the »wing mixer« menu the “Brake → N.N.” mixers are activated.
The warning message “Throttle too high” – see page 18 or 46 ... 47 – is disabled.
- “Throttle min. fr(ont) or re(ar)”:
Ch 1 trim works on idle range (front or rear) only. If the throttle stick is in the “full-throttle” direction when you switch the transmitter on, you will be warned of this with the message “Throttle too high”.
The “Brake → N.N.” mixers in the »wing mixer« menu are disabled.

Note:

As mentioned previously, selecting “motor” or “no motor” also affects the range of mixers available in the »wing mixer« menu. For this reason we shall initially consider “no” (no motor) in the following programming example.

In the next two lines you select the basic arrangement of the servos in the model, and inform the transmitter of your choice:



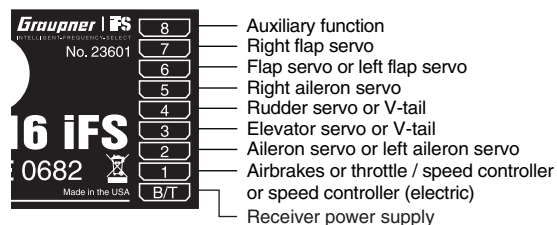
- tail type: “normal”, “V-tail”, “delt/FIW” oder „2elev sv“
- aile / flap: 1 or 2 aileron servos and 0 or 2 flap servos

* N.N. = Nomen Nominandum (name to be stated)

Note:

If your model is fitted with only one camber-changing flap servo, you should still select "... 2fl". Later, in the »wing mixer« menu (see page 72), you should select the "ail → flaps" mixer and set it to 0%. You can still exploit all the other mixers available at that point in the usual way.

At this juncture – if not before – you should check that the servos are connected to the receiver in the standard GRAUPNER sequence:



Notes:

- If you set up a V-tail, but the "up / down" and / or "left / right" functions work the wrong way round, please refer to the table in the right-hand column on page 38 for the remedy. The same procedure can be used if you set up flaperons (superimposed ailerons and flaps), and they work the wrong way round.
- The following settings apply to a model with a "normal" tail and no motor ("no"); if your model has a V-tail, the settings can be adopted virtually unchanged. However, if the model is a delta or flying wing, the situation is not quite so straightforward. A special programming example covering this model type will be found in the section starting on page 108.

»servo set.«

(page 56)

►S1	=>	0%	100%	100%
S2	=>	0%	100%	100%
S3	=>	0%	100%	100%
	rev	cent	- trav	+
▼	SEL	SEL	SYM	ASY

In this menu you can set various parameters relating to the servos, i.e. "direction of rotation", "neutral setting" and "servo travel", to suit the requirements of the model.

By "requirements" we mean adjustments to servo centre and servo travel which are needed to compensate for minor tolerances in servos and slight inaccuracies on the model itself.

Note:

The facilities provided in this menu for setting asymmetrical servo travels are NOT intended as a means of setting up differential travel on ailerons and / or camber-changing flaps. There are more suitable options for this in the form of specific functions in the »wing mixer« menu; see the first two options in the picture on the right.

Once you have completed the settings described thus far, a fixed-wing or powered model aircraft (the latter if you enter the idle direction of the throttle stick in the "motor on C1" line of the »base sett.« menu) will, in principle, fly.

However, there are no "refinements" in this set-up, and it is the refinements which will give you more long-term pleasure in your flying. Assuming that you are already capable of controlling your model safely, it's time to get a taste of these extra facilities; to this end we now move on to the ...

»wing mixer«

(pages 72 ... 76)

diff	ail	.	+	0%
diff.	flaps		+	0%
►ail	→	rudd	+	0%
ail	→	flaps	+	0%
brak	→	elev	+	0%
brak	→	flap	+	0%
brak	→	ail	+	0%
elev	→	flap	+	0%
elev	→	ail	+	0%
flap	→	elev	+	0%
flap	→	ail	+	0%
diff	-	red	+	0%
▼	▲		SEL	/-

Note:

This menu will show a varying range of options depending on the information you have entered in the »base sett.« menu. In the illustration above, the full range is shown, as generated by the entries "2ail 2fl" in the "ail/flap" line, and "no(inv) in the "Motor in C1" line.

Of particular interest at the moment are "diff aile." (aileron differential) and the "ail → rudd" (aileron → rudder) mixer, in some cases the combi-switch (coupled aileron and rudder) and perhaps the mixers "brak → aile" and "brak → flap".

As already described in detail on page 73, the purpose of "diff aile." (aileron differential) is to eliminate adverse yaw.

When a model aircraft turns, the down-going aileron produces more drag than the up-going one if both move through the same angle, and this causes the model to yaw in the opposite direction to the turn. This can be eliminated by setting differential servo travel. A value be-

tween 20% and 40% is usually a good starting point, but the “perfect” setting nearly always has to be established by practical testing.

The same applies to the “**diff.flaps**” (flap differential) option if your model also features two camber-changing flap servos, assuming that the flaps are also to be used as ailerons, e.g. using the “ail → flaps” mixer.

The “**ail → rudd**” (aileron à rudder) mixer serves a similar purpose, but also makes many models generally easier to handle when turning. A value of around 50% is usually a practical starting point. However, it is advisable to be able to switch this function off, particularly if you have ambitions as an aerobatic pilot; this is done by assigning a physical switch to the mixer (for example, the writer switches this mixer off “automatically” when he switches into the “Speed” flight phase, simply by assigning the same switch to both options).

It is usually only necessary to set up a “**brak → elev**” (brake → elevator) mixer if your model suffers a marked pitch trim change (model balloons up or dives) when you deploy any form of braking system. This problem usually only arises if ailerons are set to deflect “up” for braking, or are used in combination with a butterfly (crow) system. If you set up such a mixer it is important to test the setting at a safe height, and adjust the trim compensation if necessary.

If you have selected “2 aile” or “2ail2fl” in the “Aileron / Flap” line of the »**base sett.**« menu ...

stick mode	1
motor on C1	no
tail type	normal
► aile / flap	2aile
▼▲	SEL

... and if you wish to be able to deflect both ailerons up using the throttle / brake stick (Ch 1), then a suitable value should be entered in the “brak → aile” line.

diff aile.	+	0%
ail ->rudd	+	0%
brak ->elev	+	0%
► brak ->aile	+	0%
▼▲	SEL	/-

In principle the same applies to the “**brak → flap**” line, which also becomes available if you have selected “2ail 2fl”, although the set value should ensure that the flaps deflect as far as possible in the downward direction when the brake stick is operated. It is important to ensure that the servos do not strike their mechanical end-stops.

If the ailerons are set up to act as simple brakes, or as part of the braking arrangement in a butterfly (crow) system, then you should *always* enter a value for “**diff-red**” (“differential reduction” – see page 76) – setting 100% is the safe option here!

Differential reduction means that aileron differential is suppressed proportionally when you operate the airbrake stick. The purpose of this is to increase the down-going aileron travel on the landing approach, with the aim of improving aileron response.

If the wing is equipped with two camber-changing flap servos in addition to two separately actuated ailerons, then the “**ail → flap**” (aileron à flap) mixer transfers the aileron movements to the flaps; we suggest that the flaps should not follow the movement of the ailerons to a greater extent than about 50%.

Note:

If you have only installed one flap servo, then leave this

mixer at 0%.

The “**flap → aile**” (flap à aileron) mixer works in the opposite direction; depending on the layout of the model we suggest values between about 50% and 100% for this option. The flaps are controlled using the transmitter control or switch assigned to the input “E6”. Preferably, however, the INC / DEC buttons (CTRL 5 and 6) should be used for this, as their position is automatically stored separately for each flight phase.

Note:

*We strongly recommend that you reduce the travel of the flaps in the »**contr set.**« menu, as this gives finer control of the flap positions using the selected transmitter control.*

The remaining options in the »**wing mixer**« menu are designed to provide further fine-tuning of multi-flap wing systems, and are largely self-explanatory.

When you have completed the model-specific settings up to this point, you are probably ready to consider the model's first flight. At this juncture you should certainly take the time to carry out a series of “dry runs”, i.e. check all the settings thoroughly while the model is still on the ground. Remember that a serious programming error may damage more than just the model. If you are not sure of any point, please ask an experienced model pilot for advice.

If during the test phase you realise that one or other of the settings needs to be changed in order to tailor the model's control response to your preferences – perhaps the servo travels are too great or too small overall – then we suggest that you turn to the following menu ...

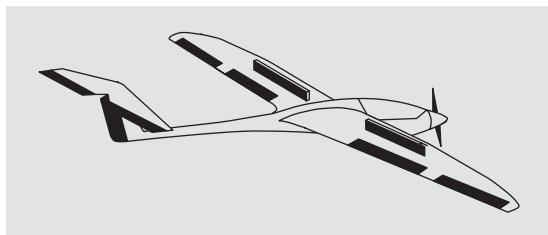
►aile	111%	+	11%	2
elev	111%	+	22%	2
rudd	100%		0%	
	DUAL		EXPO	
▼	SEL		SEL	↙

... in order to adjust the overall set-up to suit your requirements and flying style.

Dual Rates are used to adjust the magnitude of the stick's effect (see page 66). However, if it is only the model's control response around neutral which is too powerful for comfortable flying, i.e. the maximum travels are acceptable, then "Exponential" can be employed, either instead of Dual Rates or in addition to them. If a physical switch is assigned to this function, you can switch between two Dual Rate / Expo settings while the model is flying.



Expanded programming: including an electric power system



An electric power system can be controlled in various ways:

The simplest method of including such a power plant in a model program is to use the throttle / brake stick (Ch 1). However, in the preceding programming instructions we have already reserved the Ch 1 transmitter control for the airbrakes, which means that we have to explore other possibilities for controlling the motor: one is to use the switchable solution described in the section starting on page 102, and another is to use an alternative transmitter control. One suitable option is the three-position switch "SW 6/7", and another is the rotary proportional control "CTRL 7", located at top left of the transmitter. (The two INC / DEC buttons – CTRL 5 and 6 – are less suitable, as you would find it difficult to cut the motor or increase speed quickly enough in an emergency.) However, another alternative would be one of the two-position switches. The main reason for your choice ought to be that the switch is within easy reach of your fingers, as this makes it much easier to hand-launch your model.

Example 1

Using the rotary proportional control CTRL 7

If this transmitter is used, the set-up is extremely easy. All you have to do is connect the speed controller to any of the receiver servo sockets 5 ... 8 which is vacant.

However, please bear in mind that outputs 2 + 5 and 6 + 7 may already be linked together, depending on the model type you have selected and the number of aileron and flap servos in your model.

Connect your speed controller to the next vacant input, and assign the rotary proportional control (CTRL 7) to the selected input – for example, "I8". This is accomplished in the ...

»contr set.« menu. (page 58)

I6	empty	+100%	+100%
I7	empty	+100%	+100%
►I8	ctrl7	+100%	+100%
		-	trv +
▲		SEL	SYM ASY

Hold the rotary cylinder pressed in to select the desired line. A further press on the rotary cylinder activates "Switch / transmitter control assignment". Now turn the rotary proportional knob. After a brief delay the entry "ctrl7" will appear in the highlighted field.

In the third column you can adjust servo travel to suit the speed controller you are using; alternatively you could use the "- Travel +" column in the ...

»servo set.« menu. (page 56)

S6	=>	0%	100%	100%
S7	=>	0%	100%	100%
►S8	=>	0%	100%	100%
		rev	cent	- trav +
▲		SEL	SYM	ASY

The last stage is to check the settings, so move to the basic display and then on to »Servo display«. In the "OFF" position of the rotary cylinder CTRL 7 the control channel you have selected – in our example this is channel "8" – should be at -100%, and at the "full-throttle" setting at +100%.

Example 2

Using a two-position switch, SW 1 ... 4

This variant implements a pure ON / OFF function, and results in an "abrupt" motor start-up ... unless the speed controller you are using features what is known as a "soft start" function.

At the receiving end you need either a simple electronic switch or – if you want a smoother motor start – a suitable speed controller.

The settings for this arrangement are entered in the ...

»contr set.« menu. (page 58)

I6	empty	+100%	+100%
I7	empty	+100%	+100%
►I8	3	+100%	+100%
		-	trv +
▲		SEL	SYM ASY

First check which receiver socket (5 or higher) is available to connect your speed controller. If you have

assigned two aileron servos in the »**base sett.**« menu, and if you have not connected any other auxiliary function, then this would be channel 6; if your model features two aileron servos and two flap servos, then channel 8 would be available for connecting the speed controller; the latter option is the one we will use in this example. Hold the rotary cylinder pressed in to select the desired line in the menu. Press the rotary cylinder again to activate “Switch or transmitter control assignment”. Now move the selected switch from the “OFF” position to the “ON” position. The highlighted field now shows the switch number together with a symbol which indicates the direction of switching.

In the third column you can adjust servo travel to suit the speed controller you are using; alternatively you could use the “Servo travel” column in the ...

»**servo set.**« menu. (page 56)

S6 =>	0%	100%	100%
S7 =>	0%	100%	100%
►S8 =>	0%	100%	100%
rev cent - trav +			
▲SEL	SEL	SYM	ASY

The last stage is to check the settings, so move to the basic display and then on to »**Servo display**«. In the “OFF” position of the switch, the control channel you have selected – in our example this is channel “8” – should be at -100%, and at the “full-throttle” setting at +100%.

Example 3

Using the three-position switch SW 6/7

This variant implements a three-stage solution for switching an electric motor on and off, and also results in an “abrupt” motor start-up ... unless the speed controller you are using features what is known as a “soft start” function.

At the receiving end you need a suitable speed controller.

First check which receiver socket (5 or higher) is available to connect your speed controller. If you have assigned two aileron servos in the »**base sett.**« menu, and if you have not connected any other auxiliary function, then this would be channel 6; if your model features two aileron servos and two flap servos, then channel 8 would be available for connecting the speed controller; the latter option is the one we will use in this example.

Move to the ...

»**contr set.**« menu. (page 58)

I6	empty	+100%	+100%
I7	empty	+100%	+100%
►I8	ctrl8	+100%	+100%
- trv +			
▲	SEL	SYM	ASY

Hold the rotary cylinder pressed in to select the desired input. Press the rotary cylinder again to activate “Switch / transmitter control assignment”. Move the switch SW 6/7. The highlighted field now shows “ctrl8”.

In the third column you can adjust servo travel to suit the speed controller you are using; alternatively you could use the “Servo travel” column in the ...

»**servo set.**« menu. (page 56)

S6 =>	0%	100%	100%
S7 =>	0%	100%	100%
►S8 =>	0%	100%	100%
rev cent - trav +			
▲SEL	SEL	SYM	ASY

The last stage is to check the settings, so move to the basic display and then on to »**Servo display**«. In the (upper) “OFF” position of the three-position switch the control channel you have selected – in our example this is channel “8” – should be at -100%. If you now move the switch to the centre position, the bar should be in the middle, and at the (lower) “full-throttle” setting it should be at +100% or vice versa.

✈ Controlling the electric motor and butterfly (crow) system using the Ch 1 stick

(Butterfly / crow system as landing aid: ailerons up, flaps down)

Example 4

Before we start the programming of this fourth example, and turn our attention to expanding the basic programming we have already discussed, we need to consider briefly the position of the throttle / brake stick at "motor OFF" or "brake OFF". Usually the Ch 1 stick is moved forward to open the throttle, and back to extend the brakes. However, if you adopt this "classic" configuration, and switch, say, from "motor OFF" (stick "back") to the braking system, "full brake" would immediately be applied, and vice versa: if you switch from "brakes retracted" to power, this would instantly switch to "full power".

It is certainly possible to make a "virtue" out of this "vice": a "glider pilot" – usually flying with "brakes retracted = forward" will only switch to motor "ON" when necessary, and then reduce power to suit the situation (and – we hope – does not forget to move the Ch 1 stick back to the "forward" position when switching back). In contrast, a typical "power pilot" would probably operate with the opposite priority, i.e. he would only switch to "brake" when necessary, etc.. In any case, it is possible to avoid these inter-connected effects by positioning the "zero point" of both systems so that they coincide. The above considerations mean that a "glider pilot" will probably prefer the "zero point forward" arrangement, while a "power pilot" might well decide on "zero point back".

The MX-16iFS transmitter can cope with whichever arrangement you prefer. However, the following section assumes that both "OFF" positions will be set to "forward". If you prefer the alternative arrangement, there is no problem: the only difference compared with the version described here is that you would select "no/inv" in the "motor on C1" line of the »**base sett.**« menu. All

the other settings can be adopted as described.

In the ...

»**base sett.**« (pages 46 ... 49)

model name	<GRAUBELE>
stick mode	1
► motor on C1	no
tail type	normal
▼	SEL

... menu leave the "motor on C1" line at "no", or switch to "no/inv" if preferred. This is essential, otherwise the "brak → N.N.*" mixers which we need will be suppressed in the »**wing mixer**« menu.

Important note:

As it is essential to set the motor to "no", this also automatically disables the "Throttle too high" power-on warning! For this reason please take great care to set the Ch 1 stick to the correct position before you switch the receiving system on.

The next step is to ensure that the speed controller connected to receiver output 1 is switched off "at the right end". To accomplish this you may have to move to the ...

»**servo sett.**« (page 56)

►S1	<=	0%	100%	100%
S2	=>	0%	100%	100%
S3	=>	0%	100%	100%
	rev	cent	- trav	+
▼	SEL	SEL	SYM	ASY

... menu and reverse the direction of servo 1.

For safety's sake you should check this setting now,

* N.N. = Nomen Nominandum (name to be stated)

before you continue with the programming procedure.

Take the transmitter and model to a location where it is safe to run the motor. Switch the transmitter on, and move the Ch 1 stick to the motor "OFF" position, i.e. either fully forward or back. Hold your model firmly, or ask a friend to hold it for you. Check that the propeller is free to rotate without causing havoc, then connect the flight battery and switch your model's receiving system on.

If the motor does NOT run when the stick is the appropriate "forward" or "back" position, then everything is in order. However, check the system anyway by gradually advancing the stick until the motor begins to run. When you are satisfied, stop the motor, then switch off the receiving system in the model and finally switch off the transmitter.


Note:

If the motor does not start, or spins in the wrong direction, there are other problems which you must correct before you resume programming. For example, check the wiring of your motor, and refer to the operating instructions supplied with your speed controller.

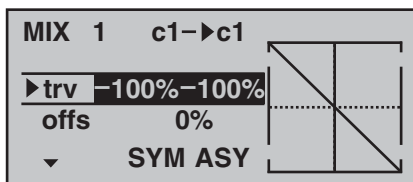
Once you are confident that the direction of the Ch 1 stick is "correct" as far as the motor is concerned, the next step is to ensure that you can switch its effect on the motor on and off, so that you can also control the braking system. This is carried out in the ...

»**free mixer**« (page 89 ... 93)

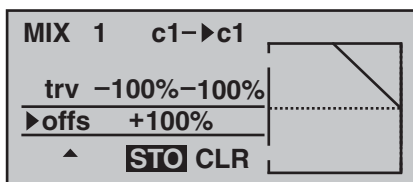
►M1		c1 -►c1	1	=>
M2		?? -►??		
M3		?? -►??		
	typ	fro	to	
▼	SEL	SEL	/-	↩

... menu where you need to program a free mixer "c1 → c1". When you have done this, move to the  (switch) column and assign your selected "change-over switch" to this mixer; for example SW 1. This is done by activating the switch assignment with a brief press on the rotary cylinder, and moving the switch from "forward" to "back", i.e. towards you.

With the mixer switched on, move to the second screen page, and there set a starting point of -100% for the **SYM**metrical mixer value.



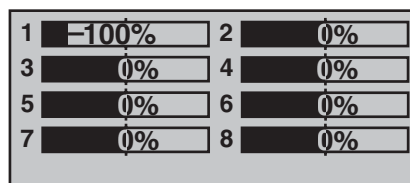
Now hold the rotary cylinder pressed in to move to the "Offs" line. The **SYM** and **ASY** fields are now replaced by **STO** and **CLR**. With the **STO** button highlighted, move the Ch 1 stick to the "forward" end-point and press the rotary cylinder briefly: the value to the right of "Offs" now changes from 0% to approx. +100% and the graphic display of the mixer curve displayed on the right also changes accordingly:



Return to the basic display by pressing **ESC**, then press the rotary cylinder briefly to move to the ...

»Servo display«

(page 20)



... menu where you can immediately check the effect of the settings you have entered so far: with the mixer switched off, the bar display for Channel 1 follows the movement of the Ch 1 stick. With the mixer switched on it stops – as shown – at around -100%.


Note:

If you carry out this test with the receiving system and power system switched on, please take great care that you operate the change-over switch only in the "motor OFF" position! If you ignore this, there is a danger that the power system will be severely overloaded by being switched on abruptly, and it could even suffer damage. For the same reason you should be careful only to use the change-over switch at the "motor OFF" setting when you are flying the model.

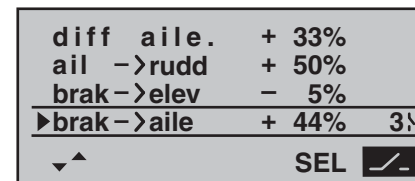
To conclude the programming procedure, move the selected "change-over switch" back to the "motor ON" position, i.e. "forward"; move back to the multi-function menu and from there to the ...

»wing mixer«

(page 72 ... 76)

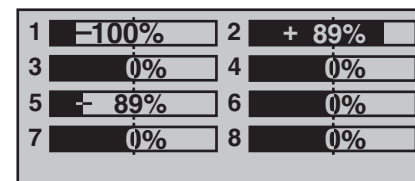
... menu where you can – assuming that you have not already done this in your general model programming – select the "brake → aile" line and set the desired aileron travel when the Ch 1 stick is operated in the *up* direction ("Brake"). In the  (switch) column press the rotary

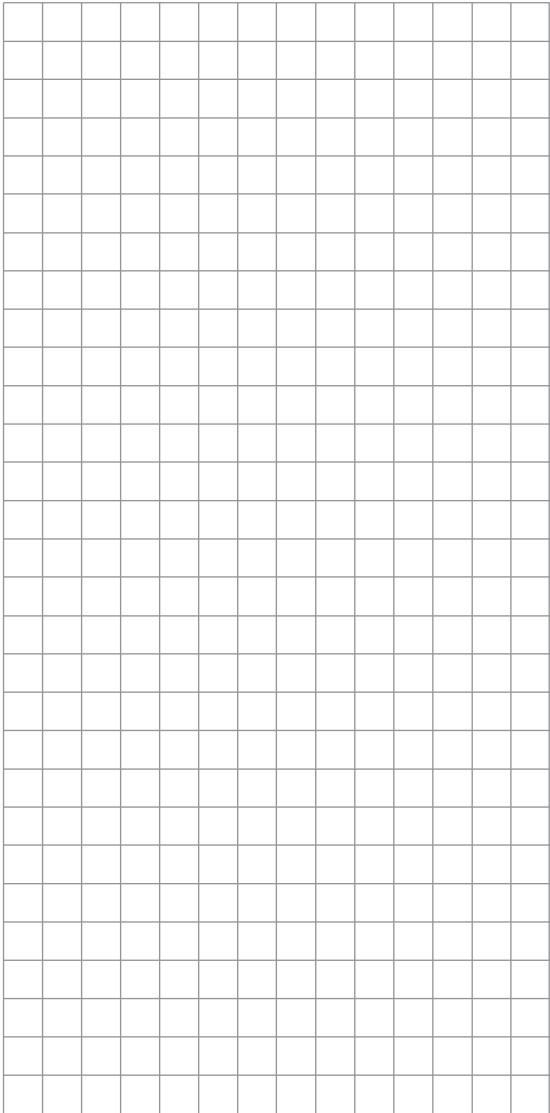
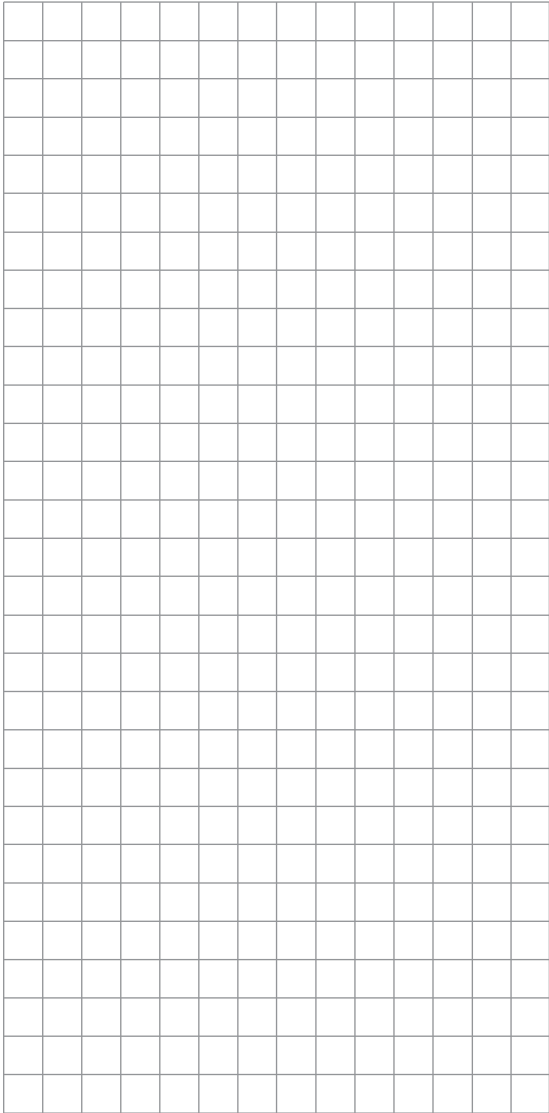
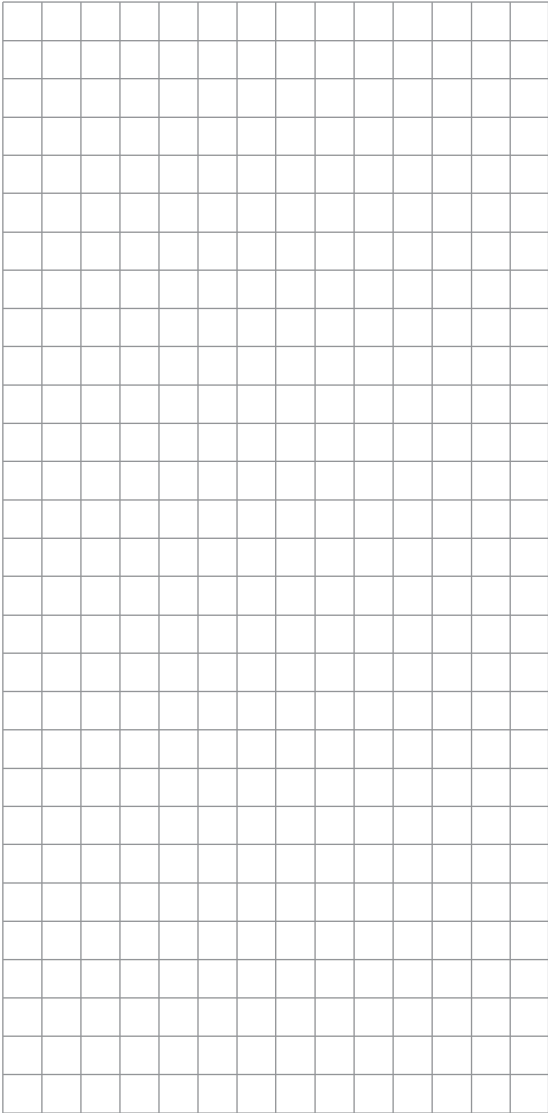
cylinder briefly, then assign your selected "change-over switch" by moving your preferred switch from "forward" to "back".



If your model also features camber-changing flaps, and you have therefore selected "2ail 2fl" in the "aile / flap" line of the **»base sett.** menu, locate the "change-over switch" you have just operated (in this case switch 1), move it "forward" again and switch to the "brak → flap" line with the rotary cylinder pressed in. You can now set the desired down-deflection of the flaps when the Ch 1 stick is moved (this flap position is termed "crow" or "butterfly"; see also page 75), and assign the external switch which also acts as the change-over switch, as already described.

If you now switch back to the **»Servo display«** menu and move the Ch 1 stick alone, you will see that the bar display for Channel 1 either remains at around -100% while the displays for channels 2 + 5 (and also the flaps 6 + 7, if set up) follow the stick movement, or the other way round: when the switch is operated, the latter stay at around the mid-point, and only the Channel 1 display moves.







Operating the timers using the Ch 1 stick or a switch SW 1 ... 7

If, following on from the model programming described on the preceding pages, you have decided on **Example 4**, or you are using the Ch 1 stick (throttle / brake stick) to control motor power – independently of this programming example – then you can use the associated control switch to turn the stopwatch on and off automatically. To assign this control switch, move the Ch 1 stick to the Idle position, then move to the “clock” line in the ...

»base sett.« menu. (pages 46 ... 49)

motor on C1	no
tail type	normal
ail / flap	2aile
► clock	0:00 C2\
▼▲	SEL SEL /-

Select the switch symbol and press the rotary cylinder briefly to activate the switch assignment. Now move the throttle / brake stick from its idle position in the direction of “full throttle”. After a short period the switch “C1” or “C2” will appear on the screen as a switch at a particular position of the Ch 1 stick. If you now move the stick back towards idle, you will see that the switch symbol changes again at around 80% of stick travel: between the “idle position” and the switching point the switch symbol is “open”, beyond this it is “closed” (“Control switches”: see page 33.)

If you now return to the transmitter’s basic display to check the system, you will see that the stopwatch and flight timer start running when you move the stick past the switching point in the direction of full-throttle, and that the *stopwatch* alone halts again when you move the stick back to the idle position.

When the stopwatch is halted, you can stop the flight

timer by pressing **ESC**, and then reset both timers to their starting value by pressing **CLEAR** ... or re-start them by moving the stick beyond the switching point again.

GRAUBELE	stop	0:55
#01	flt	11:11
9.6V		
6:54h		IFS

Tip:

When using an electric motor the motor run is usually limited by the capacity of the battery, and in this case you would normally set the stopwatch to “count down”. Simply enter the maximum permitted motor run in the “clock” column, e.g. “5 min.”. As described on pages 48 and 53, the piezo buzzer starts to emit warning tones “30 sec” before “zero”.

motor on C1	no
tail type	normal
ail / flap	2aile
► clock	5:00 C2\
▼▲	SEL SEL /-

With the stopwatch halted, press the **CLEAR** button in the basic display, so that the stopwatch switches to the “Timer” function. The timer can now be started and stopped using the throttle control.

Alternatively, if you control your motor using one of the switches SW 1 ... 4 or 6/7, as described in **Examples 2** and **3**, you do not need any of the previously described control switches. All you need to do is locate the switch which you use to turn your motor on and off, and assign

the same switch to the “clocks”, with the same switching direction, so that they start running at the same moment as you turn the motor on.

In contrast, if you have decided on the solution described in **Example 1**, then unfortunately there is no alternative but to operate the motor and timers separately.


Using flight phases

Within any of the twelve model memories you can program up to three different flight phases (states of flight), each incorporating settings which can be entirely different from the others.

Each flight phase can be called up by means of a switch. Flight phases represent the simplest and most convenient method of switching between different model settings in flight, and are programmed for different stages of a typical flight, such as “normal”, “thermal”, “speed”, “distance” etc..

We assume that you have already programmed the model in the transmitter’s model memory, set it up carefully, test-flown it and trimmed it out properly. First move to the ...

»**base sett.**« (pages 46 ... 49)


clock	0:00	C2↘
phase 2	takeoff	
▶ phase 3	speed	
train. / stu.		
▼▲		SEL 

... menu and then to the line “phase 2” and / or “phase 3”, where you can either accept the default name or assign a specific, more appropriate name to each flight phase. The purpose of this name is just to help you differentiate between the flight phases. It will later appear in the transmitter’s basic screen display, and also in the »**phase trim**« menu.

A physical switch must be assigned so that you can select the different flight phases. The ideal unit for switching up to three flight phases is the three-position switch SW 6/7, located at front right on the transmitter; this is perfect for switching between up to three flight phases.

Each of the two end-points of this switch should be assigned to one flight phase, *starting from the centre position*. We recommend that the switch direction should match the phase numbering: as shown in the left-hand illustration, for example, “phase 2” is “up” from the centre position, while “phase 3” is “down” of it.

Select the appropriate line, name, and switch assignment in the “usual” way, i.e.. using the rotary cylinder.

clock	0:00	C2↘
phase 2	takeoff	6↘
▶ phase 3	speed	7↘
train. / stu.		
▼▲		SEL 

Note:

The names you assign to the various phases are of no significance in programming terms – with the exception of Phase 1, which is assigned the name “normal”, and is always active when flight phases 2 and 3 are disabled.

For general model flying three flight phases are usually quite sufficient:

- “Takeoff” or “thermal” for launch and “staying up”,
- “normal” for normal conditions, and
- “speed” for flying in “top gear”.

At this point all three phases have been set up and assigned names; however ... if you operate the phase switch you will soon notice that nothing has changed, i.e.. all the settings for the control surfaces, and especially the wing flaps, are the same.

To change these settings, call up the ...

»**phase trim**« menu. (page 70)

Move the phase switch (or switches) to the appropriate

position, and enter the desired values in the standard way by turning and pressing the rotary cylinder, in a similar way to the method of adjusting transmitter control centres and offsets with other radio control systems.

P H A S E T R I M			
normal	0%	0%	0%
*takeoff	+10%	+ 5%	+ 2%
speed	– 7%	– 5%	– 1%
FLAP AILE ELEV			

If you now switch the receiving system on (or move to »**Servo display**«) and select the different phases in turn, you will see a difference in control surface response which is reflected in the bar display for the servos.

Note:

*Depending on the information you have entered in the “aile / flap” line of the »**base sett.**« menu, the “ELEV” column alone, the “AILE” and “ELEV” columns, or – as shown above – “FLAP”, “AILE” and “ELEV” may appear on the screen.*

Programming example: servos running in parallel

In some cases a second servo is required to run in parallel with an existing servo; for example, if a second elevator or rudder is to be actuated by a separate servo, or where a second servo is needed to cope with very high control forces, or where two servos are required for a large control surface due to the high forces involved. This task could be solved simply by connecting both servos together in the model using a conventional Y-lead. However, this has the drawback that the linked servos cannot be adjusted individually from the transmitter, i.e. you forfeit the basic advantage of the computer radio control system: separate adjustment of individual servos from the transmitter.

Another option would be to use a “magic box” module (Order No. **3162** – available in the *Graupner* range) instead of a simple Y-lead. This unit allows one transmitter channel to control up to four servos, which can then be adjusted in direction of rotation, centre and travel; see the Appendix for further details.

However, the simplest method is to use the transmitter’s software facilities. For example, it is easy to set up ...

Two elevator servos

... to operate in parallel. First move to the ...

»base sett.« (pages 46 ... 49)

model name<GRAUBELE>	
stick mode	1
motor on C1	no
►tail type	2 elev sv
▼▲	SEL

... menu and set “2 elev sv” in the “Tail” line.

The two elevator servos are then connected to receiver output sockets 3 and 8.

Two rudder servos

In this example we will connect two rudders “in parallel” using the »free mixer« menu. The second rudder could be connected to receiver output 8, which is not already in use.

The first step is to move to the ...

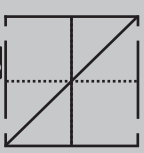
»free mixer« (pages 89 ... 93)

►M1	tr	rd → 8	=>
M2		?? → ??	
M3		?? → ??	
typ		fro	to
▼	SEL	SEL	↔

... menu and set up a mixer “tr rd → 8”. In the “Type” column select the “tr” setting, so that the rudder trim affects both rudder servos.

Finally switch to the graphics page and set a **SYM**metrical mixer input of +100%:

MIX 1	tr rd → 8
►trv	+100%+100%
offs	0%
▼	SYM ASY



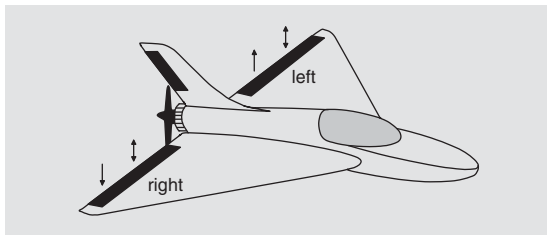
Once again, for safety reasons it is really essential that you set or leave input 8 to “empty” in the »contr set.« menu.

As an added refinement, you may want both rudders to deflect outwards only, as part of a braking system controlled by the Ch 1 stick. This can be accomplished by setting up two additional mixers “c1 → 4” and “c1 → second rudder channel”, with suitable servo travel settings. An offset of +100% is then selected for both

mixers, as the Ch 1 stick is (usually) at its top end-point when the airbrakes are retracted, and the winglet rudders are only required to deflect outward proportionally when the brakes are extended.

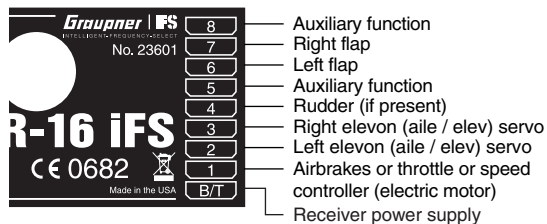
Programming example: Delta / flying wing

On page 94, where the section on fixed-wing model programming starts, you will find general notes regarding installing and setting up the RC system in a model, and – of course – this applies equally to deltas and flying wings. The information on test-flying and refining the settings is also relevant, including the section on programming flight phases.

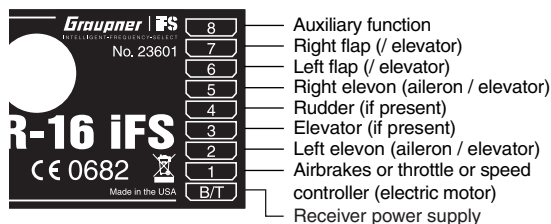


In their characteristic shape and geometry, deltas and flying wings differ very significantly from “normal” models even at first sight, but the differences in the requisite servo arrangement are rather more subtle. The “classic” model delta or flying wing generally has only two control surfaces, which act both as ailerons (in opposite directions) and as elevators (in the same direction), in a similar way to the superimposed rudder / elevator functions of a V-tail. More modern designs tend to be more complex; one (or two) inboard control surfaces may be used purely as elevators, while the outboard ailerons also act as elevators, but to a reduced extent. If a flying wing has four or even six wing control surfaces, it is certainly feasible nowadays to set them up with camber-changing flap functions and / or even a butterfly (crow) system.

However, most of these models still rank as “classic” deltas and flying wings, and for them the servos should be connected to the receiver as follows (see also page 38):



If your delta or flying wing is of more “modern” configuration, the “normal” servo sequence has proved useful; this arrangement can also be used for canards:



Depending on the receiver servo sequence you select, you should first move to the ...

»**base sett.**« (pages 46 ... 49)

... menu and select the following options in each line:

„**motor on C1**“: • “no”:

The brake system is “retracted” at the “*forward*” position of the throttle / brake stick, and the “Brake → N.N.*” mixers in the »**wing mixer**« menu are *activated*.

The warning message “Throttle too high” (see page 18) is *disabled*.

- “no/inv”:

The brake system is “retracted” at the “*back*” position of the throttle / brake stick, and the “Brake → N.N.*” mixers in the »**wing mixer**« menu are *activated*.

The warning message “Throttle too high” (see page 18) is *disabled*.

- “idle fr(ont)” or “idle re(ar)”:

The Ch 1 trim operates either forward or back. If you switch the transmitter on with the throttle stick too far in the direction of full-throttle, you will see the warning message “Throttle too high” on the screen.

The “Brake → N.N.*” mixers in the »**wing mixer**« menu are *disabled*.

“**tail type**”:

“delt/FIW” or “normal” type

“**aile/flap**”:

Two ailerons “2 aile” and – if present – two flaps “2ail 2fl”.

The primary function of these settings is to define the range of wing mixers which the software will make available. If you select the “**delt/FIW**” (Delta / flying wing) tail type, the software automatically superimposes the elevator and aileron functions. In this case the mixer ratios can be adjusted by varying the Dual Rate settings in the »**D/R expo**« menu (see page 66).

If you select “**delt/FIW**”, all settings of the “N.N.* → elev” wing mixers in the ...

* N.N. = Nomen Nominandum (name to be stated)

»wing mixer« (pages 72 ... 76)

diff aile.	+	0%
ail ->rudd	+	0%
►brak->elev	+	0%
diff-red	+	0%
▼▲	SEL	/-

... menu affect the elevator (up / down) function of the two elevon (combined aileron / elevator) servos, as well as the flap / elevator servos.

Notes:

- The flap mixers and flap differential only appear in the list if you have also entered "2 fl" in the "aile / flap" line at the "Delta / Flying wing" model type; see illustration on the right.
- In principle the same applies to the "Brake → N.N.*" mixers. These are also suppressed if you have decided on "Throttle min forward / back" in the "motor on C1" line of the »base sett.« menu.
- Even if you have selected "2aile 2fl", the (digital) elevator and aileron trims only affect aileron / elevator. If you wish to circumvent this it is simpler to program your model as described in the following section.

Programming a model delta using the "normal" tail setting

Alternatively, if you select the "normal" tail type in the »base sett.« menu, and connect the servos to the receiver as shown in the lower of the two receiver socket sequence diagrams on the previous page, then the aileron function of the two elevon servos will work correctly, but not the elevator function.

In the "normal" tail type you have to force the two aileron servos and the two flap servos to move in the

same direction and provide an elevator effect when an elevator command is given. The procedure starts by selecting the ...

»wing mixer« (pages 72 ... 76)

diff aile.	+	0%
diff. flaps	+	0%
ail ->rudd	+	0%
ail ->flaps	+	50%
brak->elev	+	0%
brak->flap	+	50%
brak->aile	+	66%
elev ->flap	+	77%
►elev ->aile	+	77%
flap ->elev	+	0%
flap ->aile	+	0%
diff-red	+	0%
▼▲	SEL	/-

... menu where you set values other than zero for the fixed-wing mixers "Elevator → N.N.*".

(The following settings are model-specific, and you must check carefully that they work correctly on your model before accepting them.)

With this set-up the tailless model is considered to be a "normal" four-flap wing (two ailerons and two flaps), and therefore has all the options associated with this wing type. The method involves the "Elevator → N.N.*" mixers, which were originally intended only for pitch trim compensation and non-standard applications. In this case they are "abused" by setting higher values than normal, in order to transfer the elevator signal to the control surfaces of the tailless model.

However, none of the fixed-wing mixers includes the

* N.N. = Nomen Nominandum (name to be stated)

digital trim of the elevator stick – so an alternative has to be found.

Start by switching to the ...

»contr set.« (page 58)

I5	ctrl6	+	15%	+	15%
►I6	ctrl6	+	15%	+	15%
I7	empty	+	100%	+	100%
▼▲	SEL	SYM	ASY	- trv	+

... menu and assign the same transmitter control to the inputs 5 and (if required) 6, e.g. the INC / DEC buttons, CTRL 6; this is used because its positions are stored separately for each flight phase. Now move to the "Travel" column and reduce the travel of the transmitter control for these two inputs symmetrically to around 50%, or even less, because: the lower this value, the finer the trim control.

However, if you prefer to use the normal elevator trim lever, set the "Elevator → N.N.*" mixers to 0%, and instead set up free linear mixers to do the job.

This is done by calling up the ...

»free mixer« (pages 89 ... 93)

M1	tr	el -> 5	=>
►M2	tr	el -> 6	=>
M3	??	->??	
▼▲	typ	fro	to
	SEL	SEL	/-

... menu and setting up one linear mixer "tr el → 5" (for the simplest case), and possibly "tr el → 6". Move to the graphic page of this menu to set the required mixer ratios. Check the settings, and above all the direction of

effect, in the »**Servo display**«, or on the model itself, and change the prefixes if necessary.

If you carry out the programming as described above, the ailerons will also move in the same direction, like flaps, when you move the elevator stick. The effect of the “tr” option is that the elevator trim lever also affects the associated mixer when you operate the elevator stick. Since an additional transmitter control is no longer required for this arrangement, you should disable input 5 and (if used) input 6 in the second column of the »**contr set**.« menu; simply set these inputs to “empty”.

Many years ago, when the mc-20 was the top-of-the-line transmitter, the author flew a model delta programmed exactly in this way, with the following additional refinements: “flap settings” used as trim, and butterfly (crow) as landing aid – the latter exploiting the “brake → aile” and “brake → flap” wing mixers to provide complete compensation for pitch trim changes. In this case the term “ailerons” means the outboard wing control surfaces, and “flap” the inboard pair of control surfaces.

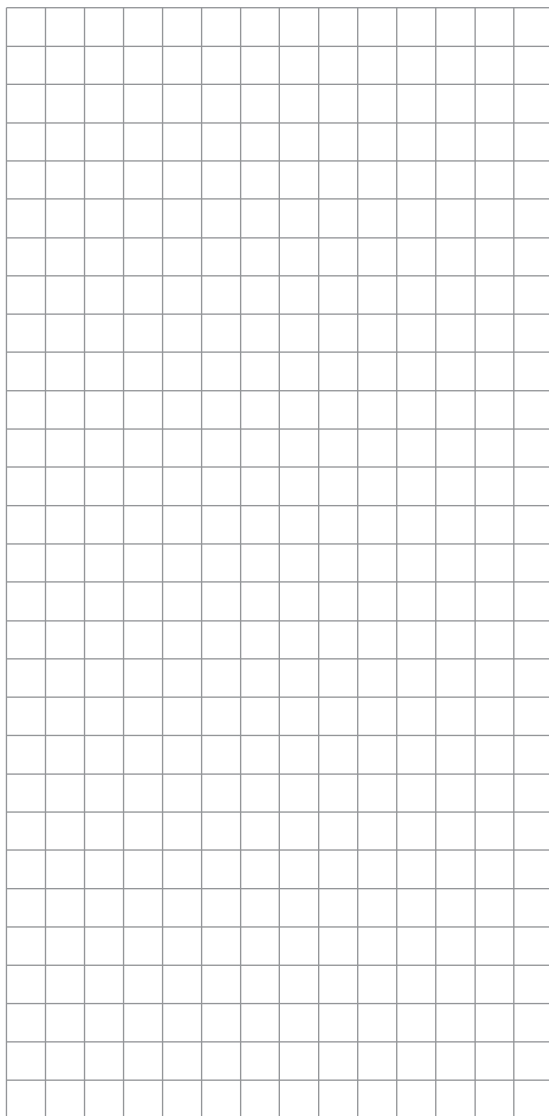
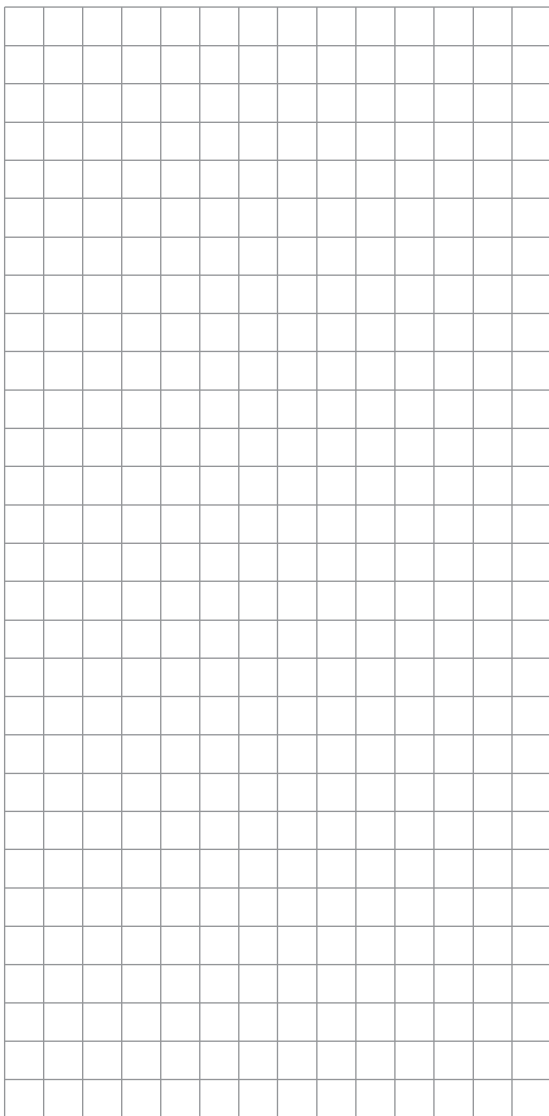
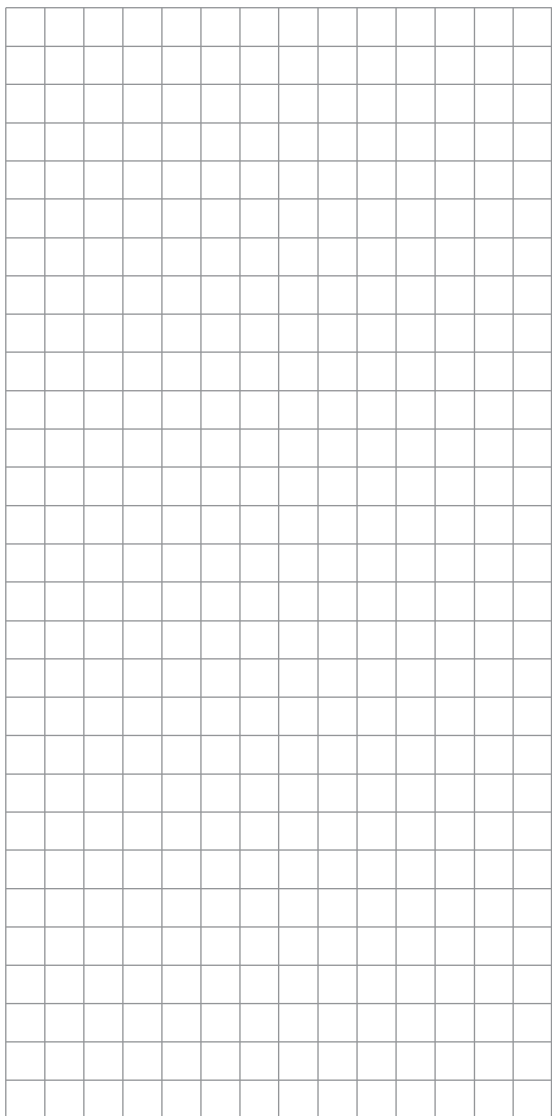
A modern sweptback flying wing can be controlled in a similar fashion. These models also feature inboard and outboard control surfaces: the former forward of the Centre of Gravity, the latter aft of it. Deflecting the inboard control surface(s) *down* increases lift and produces an *up-elevator effect*. Deflecting them up creates the opposite effect. In contrast, the outboard ailerons act in the reverse direction: a *down*-deflection produces a *down-elevator effect*, and vice versa. In this case there are really no limits to what you can achieve with careful thought and the sophisticated mixers of the MX-16iFS. However, please note that you should be extremely careful when setting differential travel with such a configuration, regardless of the type of servo arrange-

ment you have selected. This is because differential travels tend to produce an asymmetrical elevator effect on a tailless model, rather than the desired adverse yaw reduction. For this reason it is advisable to start with a differential setting of 0%, at least for the first few flights. When you are familiar with the model and feel the need to experiment, it may then be feasible under certain circumstances to try differential settings deviating from zero.

For larger models it could be advisable to install winglets fitted with rudders, i.e. small vertical surfaces at the wingtips. If these are actuated by two separate servos, they can be controlled as described in the example on page 107 dealing with “Servos running in parallel”.

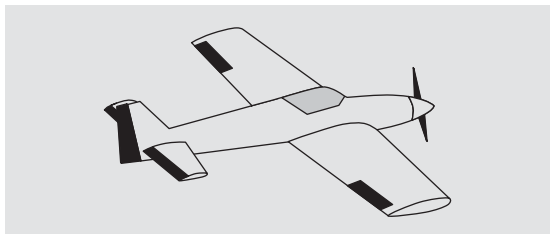
You may also want both rudders to deflect outwards when a braking system is operated using the Ch 1 stick, and this can be accomplished as follows: if you have selected the “**normal**” tail type, set up two further mixers “**c1 → 4**” and “**c1 → second rudder control channel**” with suitable travel settings. The offset should be +100%, as the Ch 1 stick is usually at the forward end-point when the airbrakes are retracted, and the winglet rudders are required to deflect outwards proportionally when the brakes are extended.





Programming example: F3A model aircraft

F3A models belong to the category of powered fixed-wing model aircraft designed for competition flying. They may be powered by an internal combustion engine or an electric motor. Electric-powered models are eligible to fly in the international F3A “pattern” class, and also in the F5A electric aerobatic class.



In this programming example we assume that you have already read through the description of the individual menus, and are therefore familiar with the general method of handling the transmitter.

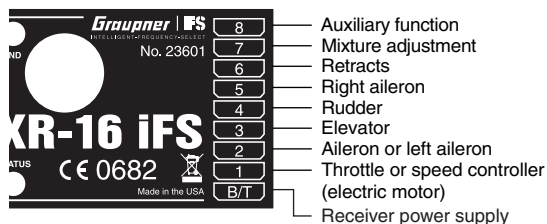
On page 94, where the section on fixed-wing model programming starts, you will find general notes on installing and setting up the RC system in a model, and – of course – this applies equally to F3A models, and therefore does not need to be repeated at this point.

If an F3A model is accurately built, it usually exhibits flying characteristics which are almost completely neutral. The perfect aerobatic model has a very smooth but precise control response, and any movement around any one of its flight axes should not affect the other axes.

F3A models are flown using aileron, elevator and rudder controls. The use of separate servos for each aileron is almost universal. The flying controls are supplemented by control of motor power (throttle function) and in many cases a retractable undercarriage. As a result the servo assignment for channels 1 to 5 is no different to the

fixed-wing models we have already described.

The auxiliary function “Retracts” is usually assigned to one of the auxiliary channels 6 to 8. Ideally the retracts are operated using a switch without a centre detent, or the momentary button SW 4. An optional “extra” – used only if necessary – is mixture adjustment control for the carburettor. This is generally operated by one of the two INC / DEC buttons (CTRL 5 or 6) on the transmitter, connected to one of the auxiliary channels not already in use.



When assigning functions to the auxiliary channels at the transmitter, it is advisable to ensure that the controls required are within easy reach, since the advanced aerobatic pilot has very little time to think about letting go of the sticks – especially when flying under competition conditions.

Programming

The basic programming of the transmitter has already been described in detail in the section starting on page 96, so this section concentrates on tips specific to F3A models.

In the ...

»servo set.« (page 56)

►S1	=>	0%	100%	100%
S2	=>	0%	100%	100%
S3	=>	0%	100%	100%
rev cent – trav +				
▼	SEL	SEL	SYM	ASY

... menu you can adjust the servo settings to suit your model.

It has proved advisable to use at least 100% servo travel, as precision of control can be perceptibly better if relatively large servo travels are employed. This should be borne in mind when building the model and designing the control surface linkages. Any minor corrections required can be made in the third column during the initial test flights.

The next step is to select the ...

»base sett.« (pages 46 ... 49)

... menu and activate the idle trim for Channel 1 (normally “idle re(ar)”; i.e. full-throttle forward). The digital trim now works at the idle end of stick travel. The “cut-off trim” enables you to switch immediately from the “motor stopped” position to the idle position you have previously established just by applying a single “click” on the trim lever (see page 34).

model name<EXTRA >	
stick mode	1
►motor on C1	idle re
tail type	normal
▼▲	SEL

The remaining settings should be adjusted if required to suit your personal preferences.

You may find it necessary to assign transmitter controls to particular inputs to operate the retractable undercarriage and carburettor mixture adjustment. This is carried out in the...

»**contr set.**« menu. (page 58)

For example, you may like to assign a particular transmitter control – perhaps one of the ON / OFF switches SW 1 ... 4 – to the input “I8” for the retracts, and a proportional control – e.g. the INC / DEC button CTRL 6 – to the input “I7”, for mixture adjustment:

I6	empty	+100%	+100%
I7	ctrl6	+100%	+100%
►I8	2	+100%	+100%
		- trv	+
▲	SEL	SYM	ASY

The retracts are extended and retracted when you operate the switch “SW 2”. You may need to adjust the travel of the transmitter control, and perhaps reverse that channel by setting a negative prefix for servo travel. F3A models fly fairly fast, and respond very “solidly” to corrective movements of the servos. However, in competition flying it is vital that all abrupt control movements and corrections should be kept to a minimum, as the judges will invariably notice any lack of smoothness and dock a few points, so it is advisable to set exponential control characteristics on the stick functions.

Move to the ...

»**D/R Expo**« menu. (page 66)

Exponential values of around +30% on aileron, elevator and rudder have proved to be a good starting point, and you can set them in the right-hand column of this menu. These values provide smooth, well-defined control of

the typical F3A model. Many experts use higher values; even up to +60% exponential.

ail	100%	+	33%	
elev	100%	+	33%	
►rudd	100%	+	33%	
	DUAL		EXPO	
▲	SEL		SEL	/-

Since F3A models generally have two aileron servos, it has proved useful to deflect both ailerons *slightly* “up” for the landing. In most cases this causes the model to fly a little more slowly and with a more stable attitude on the landing approach.

To achieve this you will need to program mixers in the ...

»**free mixer**« menu. (section starting on page 89)

Both ailerons are usually required to deflect “up” as a landing aid, in parallel with the movement of the throttle stick, but only from the half-throttle setting in the direction of idle. From that point on, the further the stick is moved towards the idle position, the more the ailerons deflect up. The reverse occurs when you open the throttle: the ailerons are returned to neutral to avoid the model suddenly ballooning up.

A little down-elevator must usually be mixed in to ensure that the aeroplane does not climb when the ailerons / flaps are extended.

To meet these requirements you need the two mixers shown in the illustration below.

M1		c1 → 5	3I	=>
►M2		c1 → el	3I	=>
M3		?? → ??		
	typ	fro	to	
▼▲	SEL	SEL	/-	

The mixers are activated using one and the same external switch, e.g. switch No. “3”, which therefore has to be assigned to *both* mixers, with the same direction of effect.

Move to using the rotary cylinder, press **ENTER** or the rotary cylinder to move to the mixer inputs on the second screen page, and set the appropriate mixer ratios. In both cases the mixer neutral point should be left at the centre position of the Ch 1 stick travel.

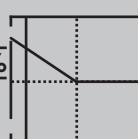
For this reason you should now select the **ASY** field, move the Ch 1 stick to the Idle range, and enter the following values:

MIX 1: -60% ... -80% and

MIX 2: -5% ... -10%.

Example of MIX 1:

MIX 1	c1 → 5	
►trv	- 66%+	0%
offs		0%
▼	SYM	ASY



This completes the basic set-up for a typical F3A model.

Correcting model-specific errors

It is an unfortunate fact of life that even very carefully built models exhibit minute faults and inaccuracies which produce unwanted deviations when the model is flying;

the mixers of a computer radio control system are then required to compensate for these deficiencies. In this section we will describe how to carry out the adjustments required, but please note the following points before we get started: it is vital to ensure that the model is built as accurately as humanly possible, is balanced perfectly around the lateral and longitudinal axes, and that motor downthrust and sidethrust are set correctly.

1. Rudder causes unwanted movement around the longitudinal and lateral axes

It is often the case that a rudder command causes the model to rotate slightly around the longitudinal and / or lateral axis. This is particularly troublesome in what is known as knife-edge flight, where the model's total lift is generated by the fuselage, aided by the rudder deflection. The result is that the model rotates and changes heading slightly, as if the pilot were applying aileron or elevator at the same time. These tendencies have to be corrected with compensation around the lateral axis (elevator) and around the longitudinal axis (aileron).

These corrections can be achieved easily with the MX-16iFS, exploiting the »free mixer« once again. For example, if the model rotates to the right around the longitudinal (roll) axis when the rudder is deflected to the right for a knife-edge pass, then a mixer is set up which deflects the ailerons slightly to the left. Heading changes around the lateral (elevator) axis can be corrected in a similar way using a mixer acting upon the elevator:

- a) Correction around the lateral axis (elevator)
MIX "rd → el"
ASYmmetrical setting. The exact values required must be found by flight testing.

- b) Correction around the longitudinal axis (aileron)
MIX "rd → ar"
ASYmmetrical setting. The exact values required must be found by flight testing.

In most cases relatively small mixer values are called for – typically below 10% – but this does vary from model to model.

2. Vertical climb and descent

Many models exhibit a tendency to deviate from the ideal line in vertical climbs and descents. To correct this we need an elevator neutral position which varies according to the throttle setting. For example, if the model tends to pull out of a vertical descent by itself when the motor is throttled back, slight down-elevator must be mixed in at this throttle setting.

MIX "c1 → el"

As a rule you will need to set mixer values below 5%, but once again there is no substitute for test-flying.

3. Rolling (movement around the longitudinal axis) at idle

When you reduce the throttle setting, the model may tend to roll slightly in one direction. Clearly an aileron correction must be made. However, it is much more elegant to let a mixer correct this effect for you than to move the stick manually. Once again, a mixer needs to be set up:

MIX "c1 → ar"

As a rule you will need to set mixer values below 5%, but once again test-flying is called for.

The adjustment process should only be carried out in calm weather. Often all you need to do is apply the mixer in the control segment between half-throttle and idle. To achieve this, leave the Offset point at the

centre position, and set up the mixer **ASY**mmetrically.

4. Rolling when ailerons and flaps are extended

If you fly the landing approach with both ailerons deflected up, the model may show a tendency to roll slightly due to minor variations in aileron servo travel (or constructional inaccuracies); i.e. the model may turn to either side by itself. Once again, this tendency can easily be corrected using a mixer to vary the compensation according to the position of the ailerons / landing flaps.

MIX "c1 → ar"

It is essential to provide a means of switching the mixer on and off using the switch which controls the aileron / landing flap function (see previous page), to ensure that this mixer only has any effect when the aileron / landing flap function is activated. The optimum value has to be found by test-flying.

And finally a few words on the ...

"FAIL-SAFE settings"

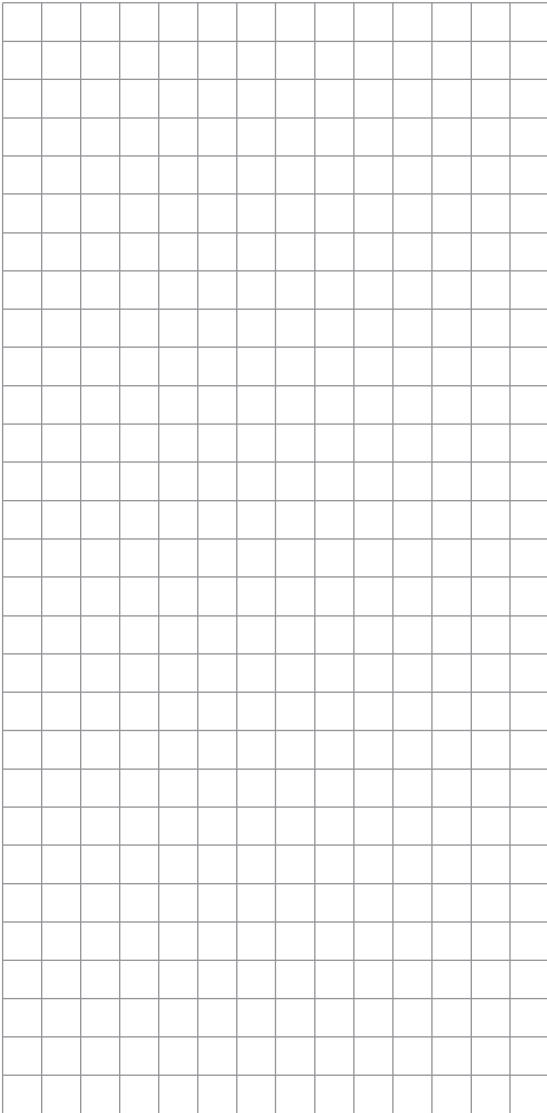
We strongly recommend that you make use of the safety potential of this option by at least setting the throttle position (glow-powered models) to idle, or the electric motor to stop, if a fail-safe event should be triggered. This simple precaution ensures that the model is much less likely to cause havoc and cause property damage or personal injury.

In the receiver's default state the servos remain in their last valid position ("hold mode") when interference occurs. However, you can program any individual servo output of your receiver to either "fail-safe position" or "hold", as described on page 28 and in the instructions supplied with the receiver. You can also define the length of time (1 ... max. 5 seconds) after which the fail-safe

function takes effect.

Summary

The settings described on this page are intended primarily for the expert flyer. Please bear in mind that refining the flying characteristics of a model to this extent involves tremendous effort, time, sensitivity and expertise. Some experts continue the programming procedure even when they are flying. It is not advisable to try this if you are just a moderately advanced pilot making your first attempt with an F3A aerobatic model. You would be well advised to request help from an experienced pilot, and carry out the fine-tuning adjustments mentioned here one by one, with the expert at your side, until your model exhibits the neutral flying characteristics you desire.





Programming example: model helicopter

In this programming example we assume that you have already read and understood the descriptions of the individual menus, and are by now familiar with the general handling of the transmitter. We also assume that you have assembled and adjusted the helicopter exactly according to the kit instructions. The electronic facilities provided by the transmitter should never be used to compensate for major mechanical inaccuracies.

As so often in life, there are various ways and means of reaching a particular destination when programming the MX-16iFS. In this example our intention is to provide a sensibly structured course of action, so that you have a clear idea of logical programming techniques. Where there are several possible methods, we first describe the simplest and most easily understood solution. It is likely that the helicopter will work perfectly when set up in this way, but naturally you are still free to try out other solutions at a later stage, in case they suit you better.



As our programming example we take the *GRAUPNER STARLET 50* helicopter, with right-hand rotation, three swashplate linkage points distributed evenly at 120° ("3sv (2 roll)" type), a beginner's set-up without enhanced throttle curve, without heading-lock gyro system, no method of influencing the gyro's "normal operating mode" from the transmitter, and with no speed governor (regulator).

We have deliberately chosen this simple programming project in order to demonstrate that it is possible to set up a helicopter which flies extremely well with relatively little programming effort.

Nevertheless, we do not want to forfeit all the possible refinement facilities: after the basic description you will also find set-up notes on gyro gain, speed governors and flight phase programming.

Note:

If, in contrast to the glow-powered machine described here, your main interest lies in electric-powered model helicopters, then please read on! Apart from the idle adjustments, which naturally do not apply, you can adopt most of the settings described in the following section virtually unchanged.

To initiate this typical programming exercise move to the »**mod. mem.**« menu, then to the ...

«select model»

(page 44)

... sub-menu, where you select a free model memory using the rotary cylinder:

01	
02	**empty*
03	**empty*
04	**empty*
05	**empty*

After a brief press of the rotary cylinder or pressing **ENTER**, you can use the rotary cylinder to select ...

**Set model type
(empty mod mem)**



... the model type "Helicopter". Confirm your choice with a brief press on the rotary cylinder, or by pressing **ENTER**, and the screen immediately switches to the basic display.

Notes:

- Once you have called up the "Model select" option it is not possible to interrupt the process, i.e. you must choose one or other model type. Even if you switch the transmitter off, then on again, you still have to make this choice. However, if you make a mistake you can always correct it simply by erasing the model memory.
- If the warning message "Throttle too high" appears, you can erase it by turning the rotary proportional knob CTRL 7 anti-clockwise to its end-point.
- If the battery voltage is too low, you will not be able to change model memories for safety reasons. In this case the screen displays an appropriate message:

**not possible now
voltage too low**

The memory should now be assigned an appropriate name, which is entered in the ...

»base sett.«

(pages 50 ... 54)

▶ model name<		>	
stick mode	1		
swashplate	1 servo		
rotor direct	left		
▼		⏏	

... menu using the characters which are available in the "model name" line of the second menu page:

0123456789: ; <=>?	
ABCDEFGHIJKLMNO	
PQRSTUVWXYZ	
model name<STAR	
>	

Once you have entered the "Model name" you should check that the "Stick mode" is correct:

model name<STARLET		>	
▶ stick mode	1		
swashplate	1 servo		
rotor direct	left		
▼	▲	SEL	

In the next three lines we come to the first settings which are specific to helicopters:

stick mode	1
swashplate	3sv(2roll)
rotor direct	right
▶ pitch min	front
▼	▲
SEL	

In the "swashplate (type)" line select the number of servos which are used to actuate the swashplate.

In the second line – "Rotor direct(ion)" – we enter the direction of rotation of the main rotor as viewed from above. In the "(Collective) pitch min." line set "front" or "rear" to suit your personal preference. This setting applies equally to all subsequent mixers, and it is therefore vital that you do not change it later in order to alter individual mixer directions, such as the direction of collective pitch or throttle.

At this point, if you have not already done so, the servos should be connected to the receiver in the following sequence:

Graupner | **IFS**
INTELLIGENTE FREIHEITSDIENSTLEISTUNG
 No. 23601

-16 iFS
CE 0682

Made in the USA

8

7

6

5

4

3

2

1

B/T

Auxiliary function (speed governor)

Gyro gain

Throttle servo (speed controller)

Free or auxiliary function

Tail rotor servo (gyro system)

Pitch-axis servo

Roll 1 servo

Roll 2 servo

Receiver power supply

The mixer ratios and mixer directions for the swashplate servos for collective pitch, roll and pitch-axis are set in the ...

»swashp.mix« menu.

(page 93)

S P - M I X E R	
▶ptch	+ 61%
roll	+ 61%
nick	+ 61%
▼	SEL

You will find that they are pre-set to +61% in each case. If the swashplate does not respond correctly to the stick movements, the first step is to change the mixer directions from "+" to "-" if necessary. The second recourse is to reverse the servo directions in the »servo set.« menu.

Note:

Compared with earlier systems, please note that the first collective pitch servo and the throttle servo have been interchanged in later GRAUPNER MC and MX radio control systems.

Now move to the ...

»servo set.«

(page 56)

▶S1 =>	0%	100%	100%
S2 =>	0%	100%	100%
S3 =>	0%	100%	100%
rev cent		- trav +	
▼ SEL	SEL	SYM ASY	

... menu, where you can set up the travels and directions of rotation of the individual servos. The basic aim here should be to keep servo travels at ±100% wherever possible, as this maintains best possible resolution and accuracy. Use "rev" if necessary to change the direction of rotation of any servo; do check carefully that the direction you set really is correct. The tail rotor servo, in particular, must operate in such a way that the nose (!) of the helicopter moves in the same direction as the movement of the tail rotor stick.

A glance at the ...

»contr set.«

(page 60)

gyr	empty	+111%	+ 88%
l8	empty	+100%	+100%
▶lim	ctrl7	+100%	+100%
		- trv +	
▲	SEL	SYM ASY	

... menu will show you that transmitter control "7", i.e.

the rotary proportional control CTRL 7, is assigned to the "lim" input, whereas all other inputs are programmed to "empty" by default. The "lim" input serves as throttle limiter. It acts solely on output "6", to which the throttle servo is connected.

Just to remind you:

- The throttle limiter does not control the throttle servo; it simply limits the travel of this servo in the forward direction, according to the setting of the throttle limiter. The throttle servo is usually controlled by the collective pitch stick via the throttle curve or curves you have set in the »heli mixer« menu, for which reason input 6 should always be left "empty". For more details please refer to the sections on pages 62 and 63 of the manual.
- Moreover the Ch 1 trim only affects a helicopter's throttle servo. This section does not describe the special features of this trim ("cut-off trim") again, as it is covered on page 34. (Thanks to the digital trims, trim values are automatically stored when you switch models and when you switch between flight phases.)
- You will find a detailed description of the basic idle set-up procedure and the method of adjusting idle and throttle limit in the section starting on page 62.

Now select the **ASY** field in the "Travel" column, and increase the value in the highlighted field from +100% to +125%, with the throttle limiter at its forward end-stop:

gyr	empty	+111%	+ 88%
l8	empty	+100%	+100%
►lim	ctrl7	+100%	+125%
		- trv	+
▲		SEL	SYM ASY

This ensures that the throttle limiter cannot possibly

restrict the full throttle travel dictated by the collective pitch stick when the model is in flight.

Set-up note for electric helicopters:

Since electric motors by their nature require no idle setting, the only important point when setting up an electric-powered model helicopter is that the adjustment range of the throttle limiter should be set significantly higher and lower than the adjustment range of the speed controller. It may therefore be necessary to set the "Travel" value of the throttle limiter to an appropriate point in the "Lim" line of the »contr set.« menu, such as 110%, symmetrical. However, further fine-tuning can be carried out exactly as described here for the glow-powered machine.

An additional function needs to be activated in the ...

»base sett.« menu. (pages 50 ... 54)

Even if you are a beginner to flying and are not yet ready for this, it is advisable at least to define the auto-rotation switch, so that you have an "emergency cut" switch for the motor. This is carried out by selecting the "Auto-rotation" line with the rotary cylinder pressed in, and then moving one of the ON / OFF switches (SW 1 ... 4) to the "ON" setting. On the right of the screen the switch number (in our example "1") appears:

pitch min	front
clock	10:01 C3
phase 2	hover
►autorotat.	1l
▼▲	✍

This switch should be located at a position on the transmitter where you can easily reach it without letting go of the stick, e.g. above the collective pitch stick.

Note:

For more information on setting up this "emergency OFF switch" please refer to the section in the centre column of the following page.

And another tip:

Please make it a habit to give all the switches a common "on" direction; then a quick glance at the transmitter before flying will soon reassure you that all switches are "off".

If you wish, you could at this point move to the line above and assign a flight phase switch for flight phase 2, which is already assigned the name "hover", but this simple programming example deliberately excludes such refinements.

You have now completed the basic settings at the transmitter, i.e. the procedure which you will need to use time and again when setting up new models.

The actual helicopter-specific set-up is carried out primarily in the ...

»heli mixer« menu. (pages 78 ... 87)

►ptch	=>
ch1 -►thro	=>
ch1 -►tail	=>
gyro	0%
inp8	0%
✎	

In the very first line you will see the "ptch" function, and pressing **ENTER** or the rotary cylinder takes you to the appropriate sub-menu. At this point you will see a graphic representation of the collective pitch curve. This is initially defined by only three reference points, and in most cases this is quite adequate.

Tip:

Always try to manage with these three reference points initially, as additional points just complicate matters, and extra complexity is just what you don't need at the moment.

The reference point for hovering should generally be the mechanical centre-point of the collective pitch stick, as this position feels completely natural to most pilots. You can, of course, set up the curve to locate the hover at a different point, but you should not be tempted to do this unless you know exactly what you are doing. Start by setting the collective pitch stick to centre. Assuming that you previously adjusted the servos in accordance with the manufacturer's instructions, the servo output arms will now (usually) be at right-angles to the servo case. If you have not already done so, adjust the mechanical linkages to the rotor head so that all the blades are set to a collective pitch angle of 4° to 5° positive for the hover. All known helicopters will fly at this approximate setting.

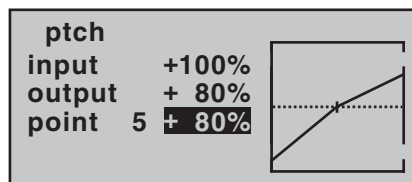
Now push the collective pitch stick fully forward to the maximum collective pitch point (the full-length vertical line indicates the current position of the stick.) Adjust Point 5 on the collective pitch curve using the rotary cylinder, with the aim of producing a maximum collective pitch setting of around 9° at the main rotor blades. This point should be at a value of around +50%.

Note:

A rotor blade set-up gauge, e.g. the GRAUPNER item, Order No. 61, is very useful when setting up blade pitch angles, as you can read off the angles directly.

Now pull the collective pitch stick right back to the collective pitch minimum position. Set the blade pitch angle

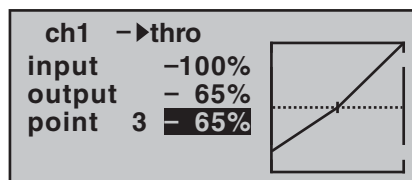
for Point 1 to 0 to -4°, depending on your piloting ability. This produces a slightly angled line at the hover point, forming what is known as the collective pitch curve. It might look approximately like this:



If you now switch to the auto-rotation phase – you will see the name of the flight phase “Autorot” at the bottom of the screen – the “old” collective pitch curve will re-appear. In this phase you should set the same values as in the normal phase, with the following exception: increase the pitch angle at Point 5 (collective pitch maximum) by about 2°. This gives slightly more pitch for flaring the model when practising “autos” at a later (!) date.

Once you have set up the collective pitch curve, operate the auto-rotation switch again, then press **ESC** to return to the helicopter mixer menu select point. Now we move on to the “ch1 → throttle” line, where you can set up the throttle curve.

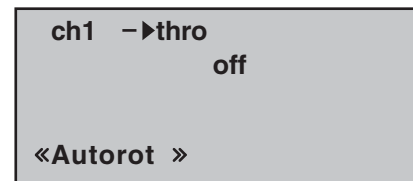
The first step here is to enter the idle trim range by adjusting the throttle curve. Move the collective pitch stick to the minimum position, and set Point 1 to a value of around 65%.



With the throttle limiter *closed* and the idle trim fully

open, pull the collective pitch stick to the “fully back” position and move it slightly to and fro: the throttle servo should not respond to this movement. This arrangement gives you a seamless transition from idle trim to the throttle curve. You will probably need to make further adjustments to the throttle curve, but this must be carried out later as part of the flight-testing process.

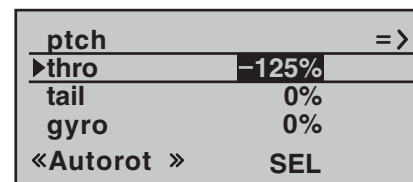
If you now switch temporarily from this graph to the auto-rotation flight phase, you will see – instead of the usual display – the following:



This means that the throttle servo has switched to a fixed value, which can be adjusted as follows:

Press **ESC** to return to the menu list. Assuming that you are still in the auto-rotation phase, this will now include new sub-menus.

The important line is “Throttle”, where you should set a value of around +125% or -125%, depending on the direction of servo rotation.



This setting ensures that the motor stops reliably in the auto-rotation phase (to allow you to cope with an emergency). Later, when you have gained sufficient experience to practise auto-rotation landings, the setting

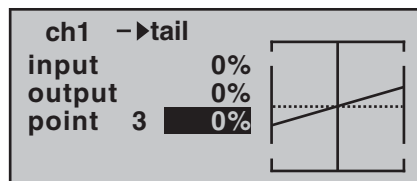
should be changed to a value which provides a reliable idle.

Set-up note for electric helicopters:

Since the motor must be stopped completely if an emergency occurs with an electric-powered model helicopter, this setting can be adopted unchanged.

At present the remaining sub-menus are of no interest. Simply switch "Auto-rotation" off, and move back to the first menu list.

Call up the set-up page of the "ch1 → tail (rotor)" menu: this is where you set static torque compensation (DMA) for the tail rotor. Once again, please restrict yourself to the three default reference points; everything else is the preserve of the experienced pilot. For the initial set-up – intended for a heading-lock gyro system – the uniform pre-set values of 0% should be changed to -30% at Point 1 (collective pitch minimum) and +30% at the opposite end, Point 5 (collective pitch maximum), although you may find it necessary to adjust the settings slightly later:



Now switch back to the auto-rotation phase for a moment. The set-up curve is disabled here, with the result that the tail rotor servo no longer responds to collective pitch commands (when the main rotor is not powered, there is no torque to be corrected).

The – static – pre-set of the gyro effect principle ("normal" or "heading lock" mode), and also the gyro gain can

now be altered by setting a value other than "0" in the "Gyro" line:

ptch	=>
ch1 ->thro	=>
ch1 ->tail	=>
▶gyro	0%
inp8	0%
SEL	

Please be sure to read and observe the set-up instructions supplied with your gyro at this point, otherwise there is always a possibility that your helicopter will be uncontrollable!

If your gyro features gain control from the transmitter – unlike the model we are using in this example – you will need another free proportional control for it, e.g. the INC / DEC button CTRL 5. This can be assigned to the "Gyro" input in the ...

»contr set.« menu. (page 60)

15	empty	+100%	+100%
thr	empty	+100%	+100%
▶gyr	ctrl5	+100%	+100%
		- trv +	
SEL		SYM	ASY

Hold the button pressed forward; the beep sound will rise steadily. When it falls silent, move to the **ASY** field in the "Travel" column using the rotary cylinder. Press the rotary cylinder, and you will be able to set a maximum gyro gain such as 50% in the now highlighted field; this represents a safe fixed value which is maintained as long as the button is at its forward end-stop. You will probably need to adjust the value in the course of flight-testing.

Additional notes on setting up gyros can be found on page 81.

Further adjustments

If you have followed this programming example, you will have a helicopter which is set up properly, and in an ideal state for hovering practice and simple circuits. Of course, you may wish to activate further functions depending on your skill and flying experience. If you wish to fly using different rotor speeds and trim set-ups, you will need to activate a series of "flight phases", which can be called up via switches which you assign. The first step in this process is to call up the ...

»base sett.« (page 50 ... 54)

pitch min	front
clock	0:00
▶phase 2	hover 2\
autorotat.	3l

... menu, assign a switch to "Phase 2", e.g. SW 2, and enter a relevant name (if you wish).

It is important to be quite clear in your mind that auto-rotation always has absolute priority over any other phases. This simply means: if you operate the auto-rotation switch, you immediately move to the auto-rotation phase from either of the other two flight phases ("normal" phase and "phase 2").

Now move back to the »heli mixer« menu, switch to "Phase 2" (which you have just set up), and modify the settings accordingly. Since the MX-16iFS features digital trims, in the Heli program all the trim positions for the control functions "roll", "pitch-axis" and "tail rotor" are stored separately for each flight phase, in addition to the

other menu settings which you entered separately for each flight phase (see page 78).

For example, if the motor run is limited by the fuel tank size or battery capacity, you should set the stopwatch to count down. Enter the maximum possible motor run time, e.g. “5 min.”. The transmitter’s piezo buzzer now starts emitting warning sounds starting at “30 s” before “zero”, as described on page 53. You could assign the transmitter control switch “C3” to this timer, by first activating switch assignment and then turning the throttle limit control from its idle position in the direction of full-throttle:

pitch min		front	
► clock		5:00	C3↓
phase 2		hover	2↓
autorotat.			3↓

With the stopwatch halted, press the **CLEAR** button at the basic display, so that the stopwatch switches to “Timer” function. The timer then starts automatically when you move the throttle limit slider towards full-throttle, and stops again when you move the limiter back to the idle range.

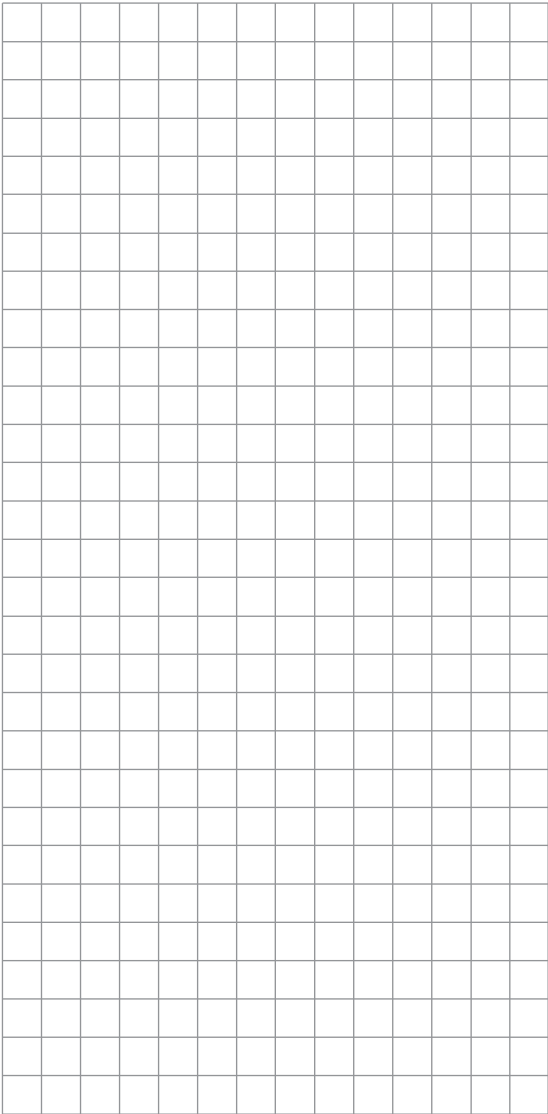
Suggested refinement: speed governor

At some time you may wish to install a speed governor (regulator) in your helicopter, e.g. the mc-Heli-Control, to try flying with a system rotational speed which is automatically maintained at a constant value. It makes sense to couple the individual rotor speeds with the flight phases, as this enables you to carry out further fine-tuning.

The basic requirement when programming the transmit-

ter is to install and program the speed governor exactly in accordance with the manufacturer’s instructions. Of course, the MX-16iFS provides further facilities to allow you to implement different rotational speeds in the individual flight phases. A practical suggestion, which includes the throttle limiter function, can be found in the section starting on page 81.

If you have set up your helicopter as described in this programming example, you will find that it is capable of carrying out extremely challenging flight tasks even though it is not suitable for competition work. We suggest that you should not make use of additional functions until your model is flying perfectly, so that you will be in a position to recognise and appreciate any improvements. Whenever possible, it is always best to implement additional refinements one at a time, otherwise you won’t know which change has brought about any improvement. Bear in mind that the good pilot is not recognised by the number of complex functions with which he can cope, but by the results he can obtain when flying a relatively simple set-up.





Trainer system

Total control transfer

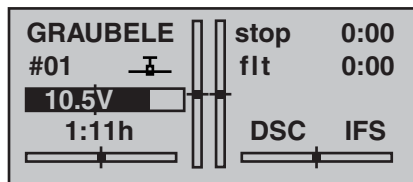
MX-16iFS as Pupil transmitter

The model to be controlled by the pupil **MUST** be programmed completely in a model memory of the Teacher transmitter, i.e. with all its functions including trims and any mixer functions, and the iFS receiver of the model must be “bound” to the *Teacher transmitter*. In principle, however, an MX-16iFS Pupil transmitter can also be linked to a Teacher transmitter operating on the “classic” 35 / 40 MHz band, since the PPM signal required for this is present at the DSC socket of the MX-16iFS.

The control functions of the Pupil transmitter must act directly on the control channels, i.e. the receiver outputs, without the intervention of any mixers. To accomplish this it is best to set up a free model memory in the Pupil transmitter with the required model type (“Fixed-wing” or “Helicopter”). Assign the model name “PUPIL”, and set up the stick mode (Mode 1 ... 4) and “Idle / collective pitch forward / back” to suit the pupil’s preference. All the other settings should be left at the appropriate default values. If you select the “Helicopter” model type, the idle trim must also be set accordingly on the Pupil transmitter. All other functions are carried out by the Teacher transmitter.

Important:

ALWAYS leave the On / Off switch on the Pupil transmitter at the “OFF” position, as this is the only way to ensure that an RF signal is not radiated by the transmitter module, even when the DSC lead is plugged in. At the transmitter’s basic display the message “DSC” will appear to the left of “iFS”.



The two transmitters should now be inter-connected using the appropriate Trainer lead: see the picture on the left of the next double page.

When assigning the control functions the usual conventions should be observed:

Channel	Function
1	Throttle / Collective pitch
2	Aileron / Roll
3	Elevator / Pitch-axis
4	Rudder / Tail rotor

MX-16iFS as Teacher transmitter (total control transfer)

The model to be controlled by the pupil **MUST** be programmed **COMPLETELY** in a model memory of the MX-16iFS Teacher transmitter, i.e. with all its functions including trims and any mixer functions, and the iFS receiver must be “bound” to the Teacher transmitter. The two transmitters should now be inter-connected using the appropriate Trainer lead: see the diagram on the right-hand page; note that the Teacher transmitter **MUST always be switched on before the Trainer lead is connected.**

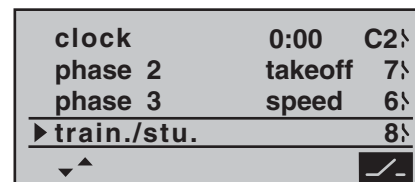
Total control transfer is the only option when using the MX-16iFS transmitter with a Pupil transmitter.

The MX-16iFS Teacher transmitter can also be linked to any suitable Pupil transmitter, even those operating on

the “classic” 35 / 40 MHz band; see right-hand picture on the next double page. For example, an MX-16iFS Teacher transmitter can also be connected to an MX-16s Pupil transmitter. **In such cases the basic requirement for a correct link with a Pupil transmitter is that PPM modulation is ALWAYS set on the Pupil transmitter, regardless of the modulation used by the Teacher transmitter.**

If you are using a Trainer lead with the Order No. **3290.7** or **3290.8**, connect the plug marked “M” (“Master”) to the socket on the Teacher transmitter, and the plug marked “S” (“Student” or “Slave”) to the Pupil transmitter’s socket. Both transmitters must be prepared as described in the operating instructions supplied with them.

Select the “Trainer” line in the »**base sett.**« menu, and assign a Trainer change-over switch. Ideally this should be the momentary button SW 4 / PB 8, assigned as “push-button 8” (see page 33), so that the flight tutor can instantly resume control from the Teacher transmitter at any time.



As long as this button is held pressed in, the system is in Pupil mode. As soon as the button is released, the Teacher transmitter resumes full control.

The basic display of the MX-16iFS Teacher transmitter does not change when Pupil mode is selected.

Checking the functions

Operate the assigned Trainer change-over switch:

- The Pupil system is working properly if no error message appears in the basic display of the Teacher transmitter when you operate the assigned change-over switch.
- However, if the basic display shows the message

no
student
signal

then there is a problem with the connection; at the same time you will hear a warning signal. In this case all the functions remain under the control of the Teacher transmitter, regardless of the position of the Trainer change-over switch. This ensures that the model is not uncontrollable at any time.

Important note:

*It is absolutely essential to check that all functions can be transferred correctly **BEFORE** you start using a Trainer mode system.*

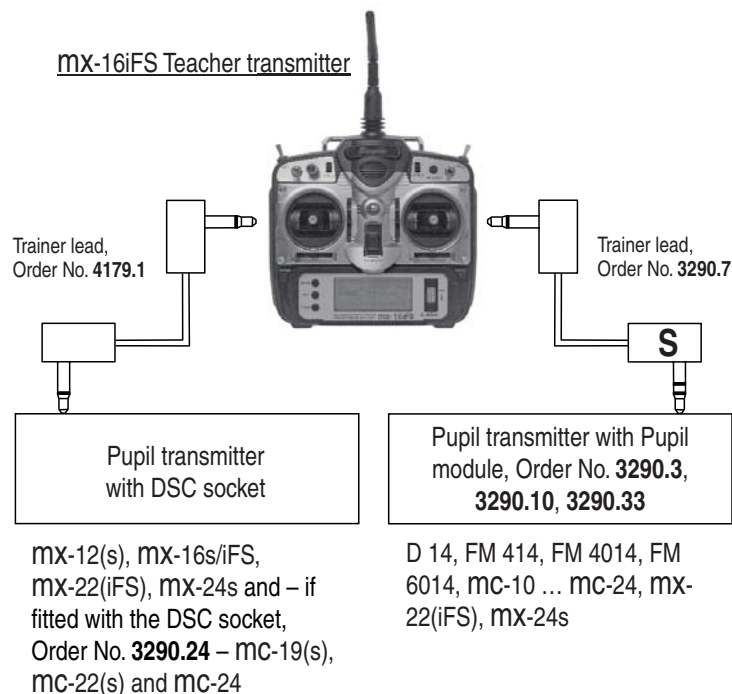
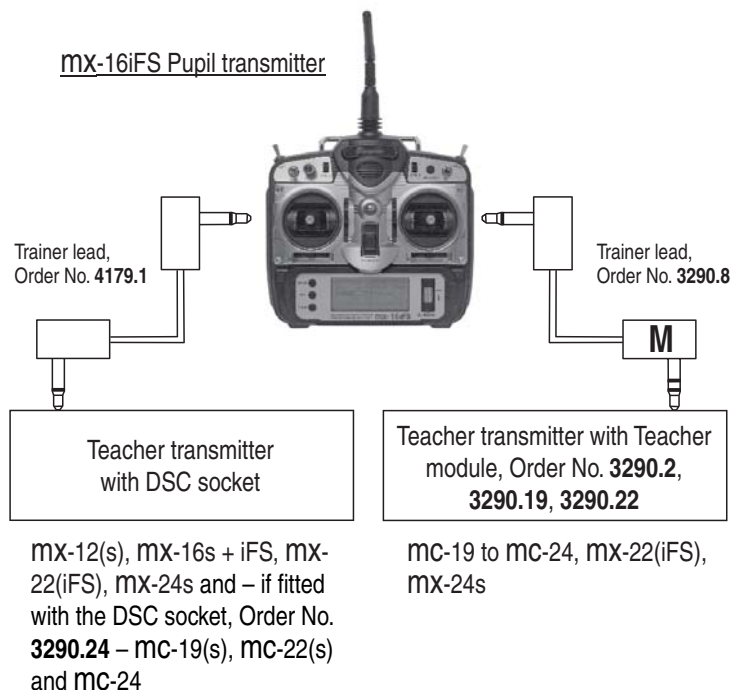
Possible errors

- The iFS receiver is not bound to the Teacher transmitter.
- The interface in the Pupil transmitter, which replaces the RF module, is not connected correctly.
- The Pupil transmitter is not ready for use.
- The Pupil transmitter is not set to PPM mode.
- The Trainer lead is not properly connected.

Appendix

Trainer mode operations with the MX-16iFS transmitter

Due to the steadily growing product range please refer to www.graupner.com for the latest information.



Trainer lead:

4179.1 for Trainer mode operations with the MX-16iFS in combination with any *GRAUPNER* transmitter fitted with a DSC socket.

3290.8 Trainer lead for use with an MX-16iFS Pupil transmitter and a *GRAUPNER* Teacher transmitter with opto-electronic Teacher socket.

3290.7 Trainer lead for use with an MX-12, MX-16s/iFS, MX-22(iFS) and MX-24s Teacher transmitter and a *GRAUPNER* Pupil transmitter with opto-electronic Pupil socket.

For more detailed information about the opto-electronic modules for the Teacher and Pupil transmitters listed on this page, please refer to the operating instructions supplied with your transmitter, or the main *GRAUPNER* FS catalogue.



PRX (Power for Receiver)

Order No. 4136

A highly developed, stabilised receiver power supply with intelligent power management.

This unit guarantees a stabilised, user-variable power supply for the receiver, with the aim of further enhancing the reliability of the power supply. It is suitable for use with a wide range of receiver batteries, and therefore forms a simple means of providing a reliable power supply in a very wide range of models. If the battery voltage should collapse – even if only briefly – while the system is operating, the unit stores the event and indicates it subsequently. The user is therefore warned of an inadequate or even failing receiver battery, and can implement suitable counter-measures in good time.

- For use with one or two receiver batteries. (simultaneous discharging when used with two batteries)
- For use with five-cell or six-cell NiMH batteries or two-cell LiPo or LiFe batteries. *GRAUPNER/JR* G3.5, G2 and BEC connectors
- Three user-selectable output voltage levels for powering the receiver (5.1 V / 5.5 V / 5.9 V)
- Two ultra-bright LEDs indicate the operational state of Battery 1 and Battery 2 separately.
- Integral high-quality On / Off switch.
- Heavy-duty construction for handling high currents.
- Low-profile switch and LEDs, to avoid spoiling the model's appearance.
- In-line arrangement of mounting lugs, LEDs and switch for simple installation using the drilling template supplied.



magic box

Order No. 3162

The magic-box opens up a wide range of potential applications to the demanding RC modeller. The magic-box enables you to distribute one servo function to a maximum of four servos, speed controllers, etc..

A selector switch is used to select each of the connected servos individually, after which two buttons are used to program its direction of rotation, travel, centre and end-points accurately and permanently. At any time all the settings can be changed and the new settings stored. If the jumper is connected, power to the magic-box and the servos connected to it is supplied via the RC system; alternatively an external battery can be used, connected to the gold-contact socket.

- Centre adjustment, variable by $\pm 25\%$.
- End-point adjustment, variable by $\pm 25\%$ for each servo and each side of centre.
- Servo travel, variable by $\pm 50\%$ for each servo.
- Direction of servo rotation, can be reversed separately for each servo.
- Total reset function: resets all settings to the factory default values.



XZ-P1 iFS programming adapter

Order No. 23300

The programming adapter is connected to one of your PC's USB sockets using a Mini-USB-B / USB-A connecting lead (standard item supplied with digital video and stills cameras), and enables the user to program the settings of *Graupner* iFS RF modules or *Graupner* iFS receivers wirelessly, and also to update the firmware of current *Graupner* iFS RF modules and *Graupner* iFS receivers.

The associated PC software is self-explanatory and easy to use; it can be downloaded at any time from the iFS website. A graphic 2.4 GHz band scanner is also available as a useful option for the unit; this gives a swift overview of the conditions on the band.

Dimensions: 31 x 31 x 13 mm

Approved transmitter output stages and national receiver settings

In order to fulfil various directives including FCC, ETSI, IC etc., and other statutory regulations valid in individual countries, this radio control system is only approved for use with the transmitter output stages and national receiver settings stated below. Please observe the legal restrictions which apply to you. It is prohibited to use the radio control system with settings other than those stated below.

Approved transmitter output stages

The output stages stated in the table below **MUST** be observed, otherwise the system will not satisfy the statutory regulations which apply in your country.

Country	Approved settings
North America and Australia	Hopping mode 1 ... 3
	Output stages 1 ... 5
Japan and Europe	Hopping mode 1:
	Output stages 1 ... 2
	Hopping mode 4 + 5:
	Output stages 1 ... 5

These settings are carried out using the methods described in the section starting on page 22.

Approved national receiver settings

The national setting is required in order to fulfil various directives such as FCC, ETSI, IC etc..

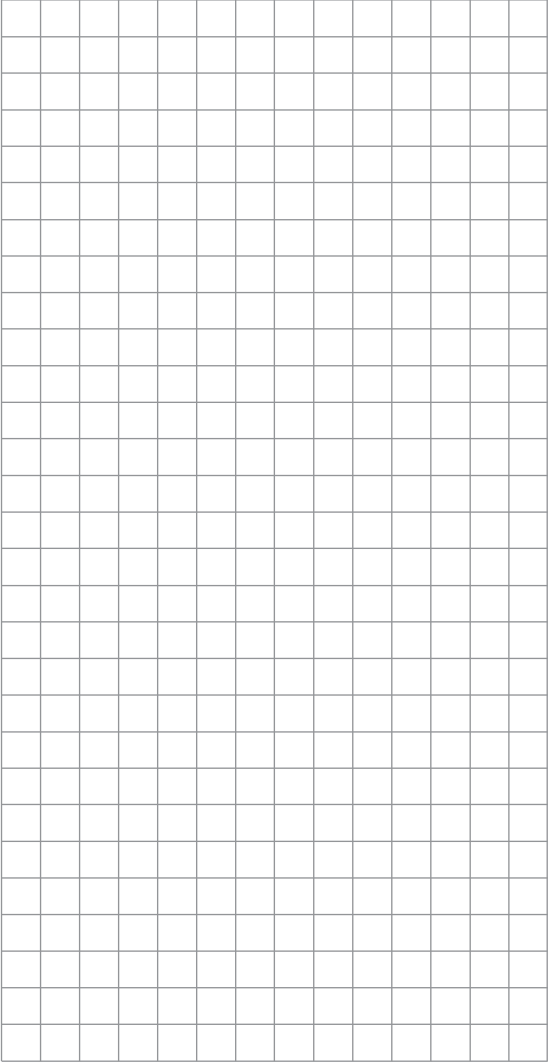
Note:
This setting refers exclusively to Hopping Mode 1; it is not applicable to any other Hopping Mode.

Country	Setting
All countries except France	1
France	2*

* Open-air operation. Transmitter output "1" must be selected.

These settings must be carried out using the methods described in the section starting on page 24, and in the instructions supplied with the receiver.

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**Konformitätserklärung gemäß dem Gesetz über Funkanlagen und
Telekommunikationsendrichtungen (FTEG) und der Richtlinie 1999/5/EG (R&TTE)**
Declaration of Conformity in accordance with the Radio and Telecommunications Terminal Equipment
Act (FTEG) and Directive 1999/5/EG (R&TTE)

Graupner GmbH & Co. KG
Henriettenstraße 94-96
D-73230 Kirchheim/Teck

erklärt, dass das Produkt:
declares that the product

**XM-J1 IFS, XM-J2 IFS, XM-J3 IFS, XM-J4 IFS,
XM-M1 IFS, XM-M2 IFS, XM-F1 IFS, XM-F2 IFS,
XR-6 IFS, XR-12 IFS, XR-16 IFS, XR-20 IFS, XR-24 IFS,
XD-6 IFS, XZ-P1 IFS, XZ-R1 IFS,
mc-19 IFS, mc-22 IFS, mc-24 IFS, mx-16 IFS, mx-22 IFS**

Gerätekategorie:
Equipment class

2

den grundlegenden Anforderungen des § 3 und den übrigen einschlägigen Bestimmungen des
FTEG (Artikel 3 der R&TTE) entspricht.
complies with the essential requirements of § 3 and the other relevant provisions of the FTEG (Article 3 of the
R&TTE Directive).

Angewendete harmonisierte Normen:
Harmonised standards applied

EN 60950:2006

Gesundheit und Sicherheit gemäß § 3 (1) 1. (Artikel 3 (1)a))
Health and safety requirements pursuant to § 3 (1) 1. (Article 3 (1) a))

**EN 301 489-1 V1.7.1
EN 301 489-3 V1.4.1**

Schutzanforderungen in Bezug auf elektromagnetische
Verträglichkeit § 3 (1) 2, Artikel 3 (1) b))
Protection requirement concerning electromagnetic compatibility
§ 3 (1) 2, Article 3 (1) b))

EN 300 328 V1.7.1

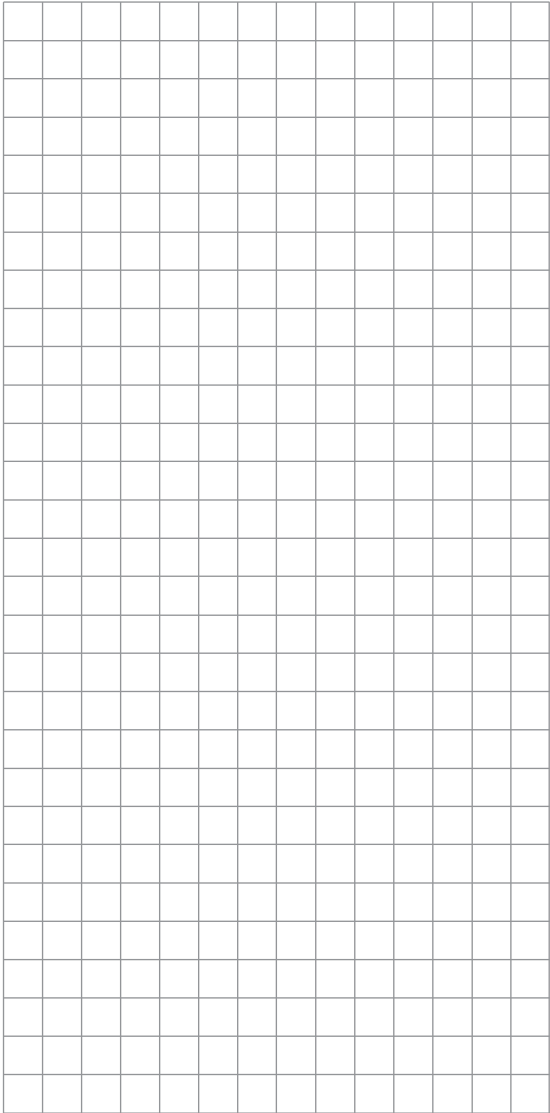
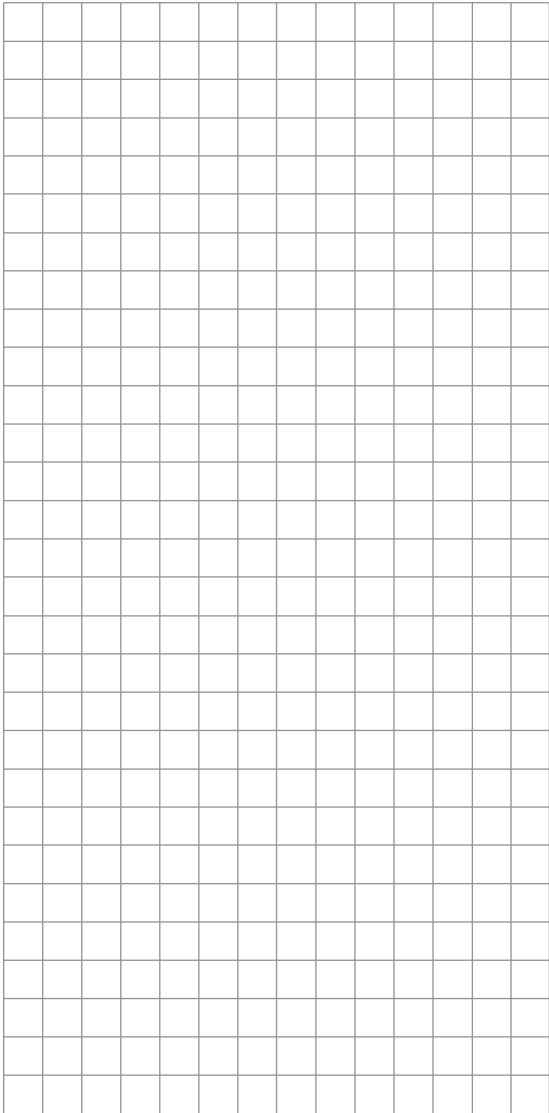
Maßnahmen zur effizienten Nutzung des Frequenzspektrums
§ 3 (2) (Artikel 3 (2))
Measures for the efficient use of the radio frequency spectrum
§ 3 (2) (Article 3 (2))

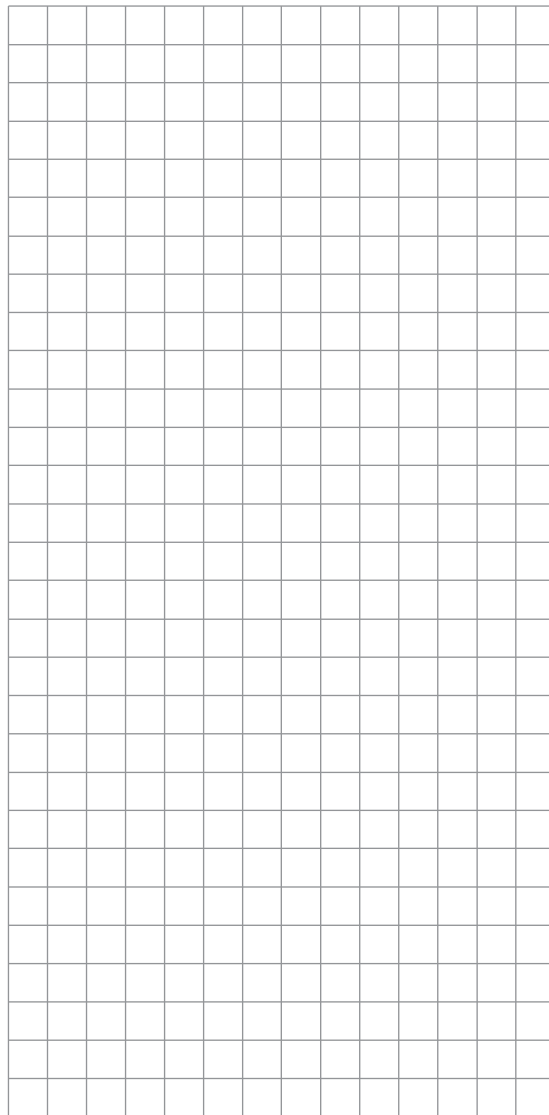
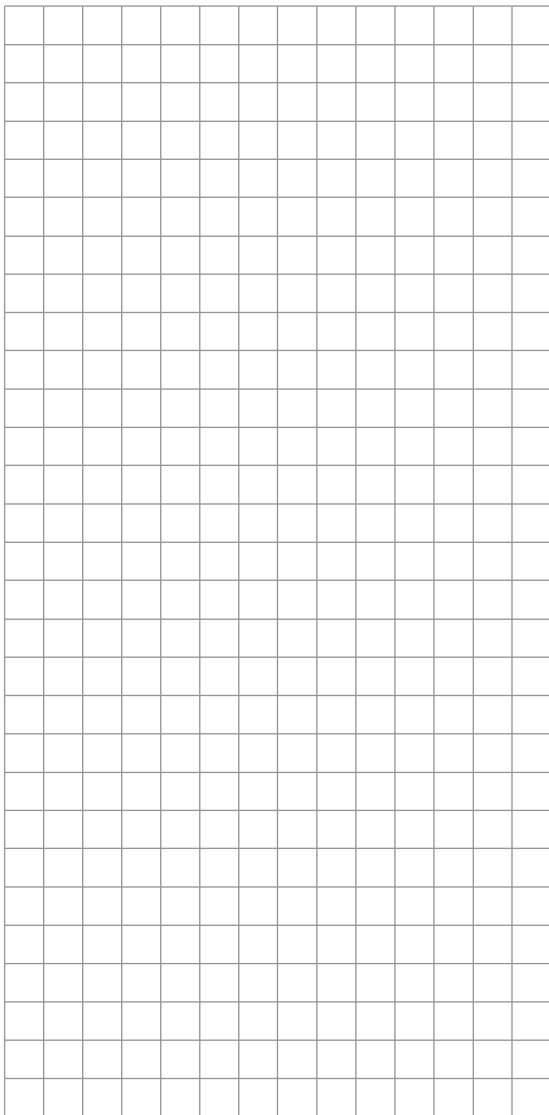
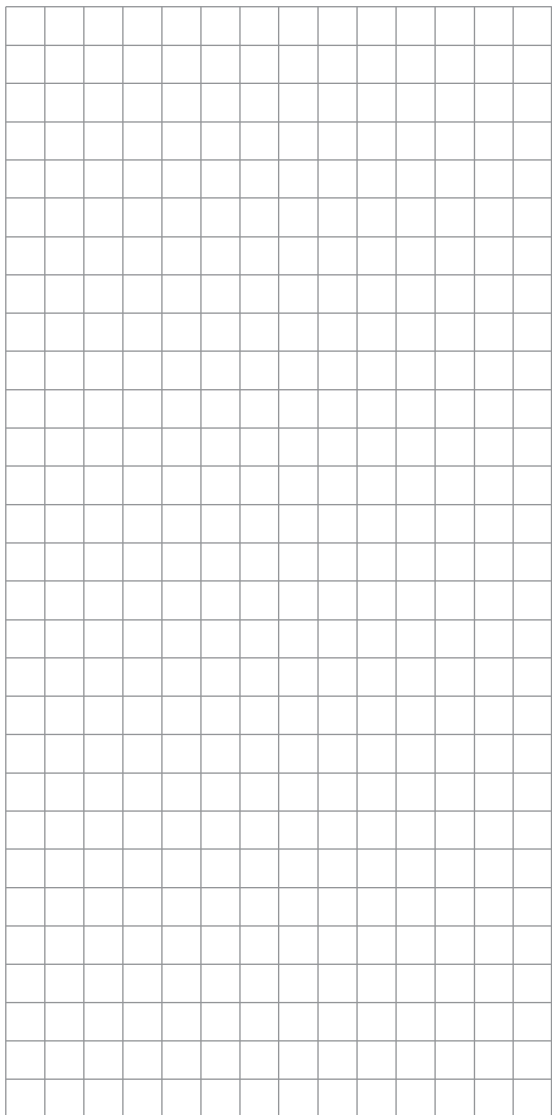


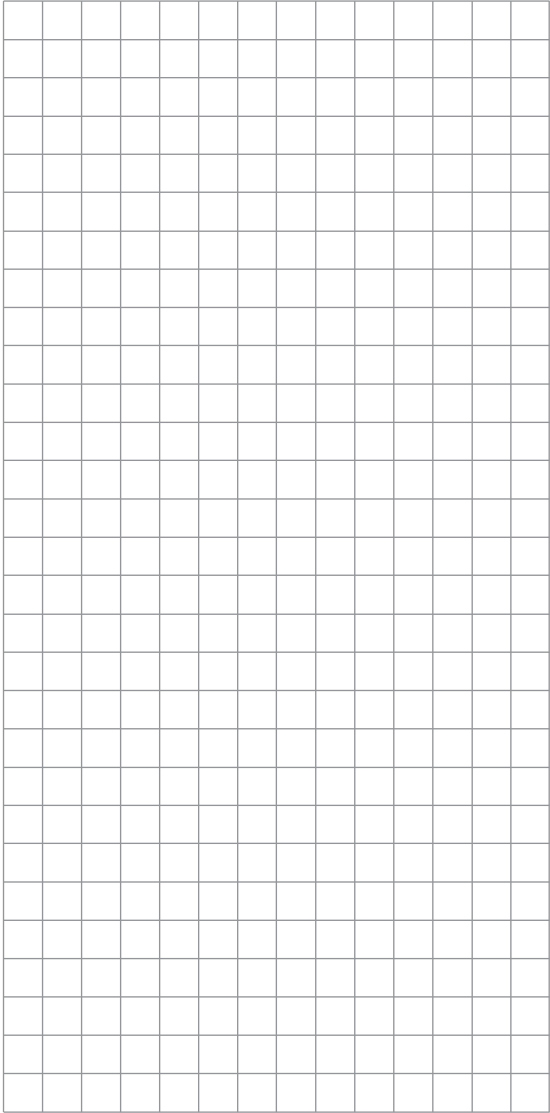
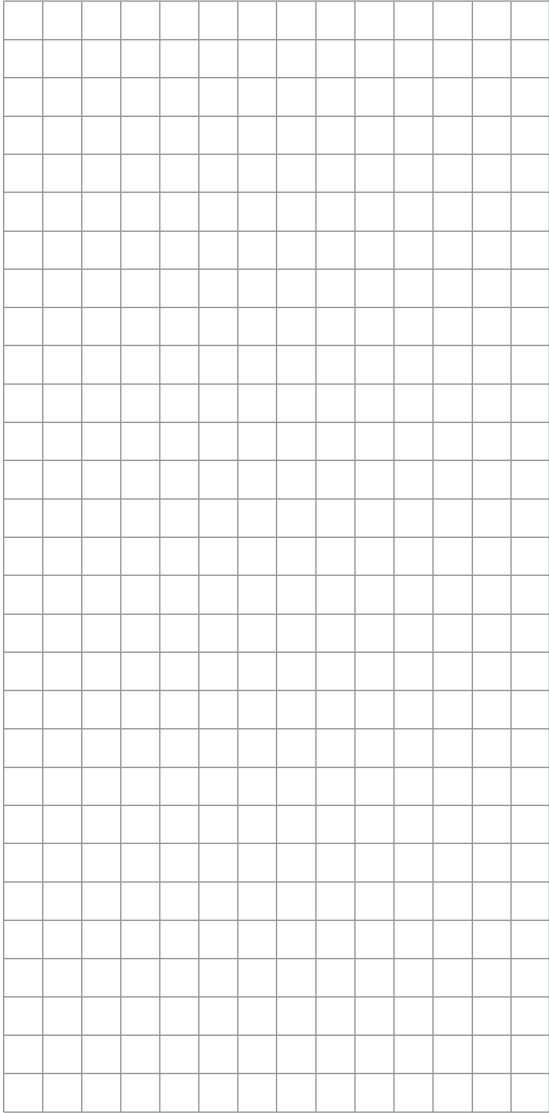
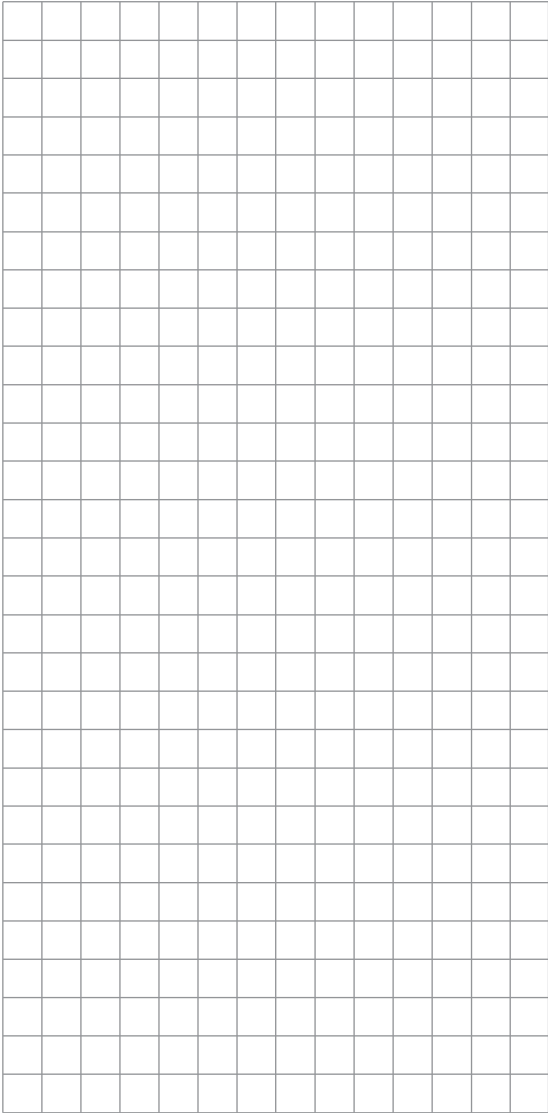
Kirchheim, 07. Juli 2008

Hans Graupner, Geschäftsführer
Hans Graupner, Managing Director

Graupner GmbH & Co. KG Henriettenstraße 94-96 D-73230 Kirchheim/Teck Germany
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MX-16iFS Set

- ☐ Order No. **23000**
☐ Order No. **23000.99**

Übergabedatum:

Date of purchase/delivery:

Date de remise :

Name des Käufers:

Owner's name:

Nom de l'acheteur :

Straße, Wohnort:

Complete address:

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Firmenstempel und Unterschrift des Einzelhändlers:

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