Programming a Helicopter, model type "HE"

The initial set-up of the transmitter for helicopter models is achieved using the System Menu, see pages 14 – 17. The basic set-up depends less on the model itself than on the general control preferences of the pilot.

The most important setting, above all others, is the control mode (MOD), including whether the throttle stick should pushed or pulled for maximum pitch (THR). Both settings should be reviewed in all cases before beginning with the set-up of the model.

The model dependent parameter settings are grouped in the Set-Up Menu, that is activated from the initial position of the transmitter and/or leaving the System Menu by pressing of the key ENTER.

In both menus, the desired functions are displayed by scrolling through the options by pressing the ROLL UP and/or ROLL DN buttons.

Connection of external control elements to the transmitter board for the helicopter program

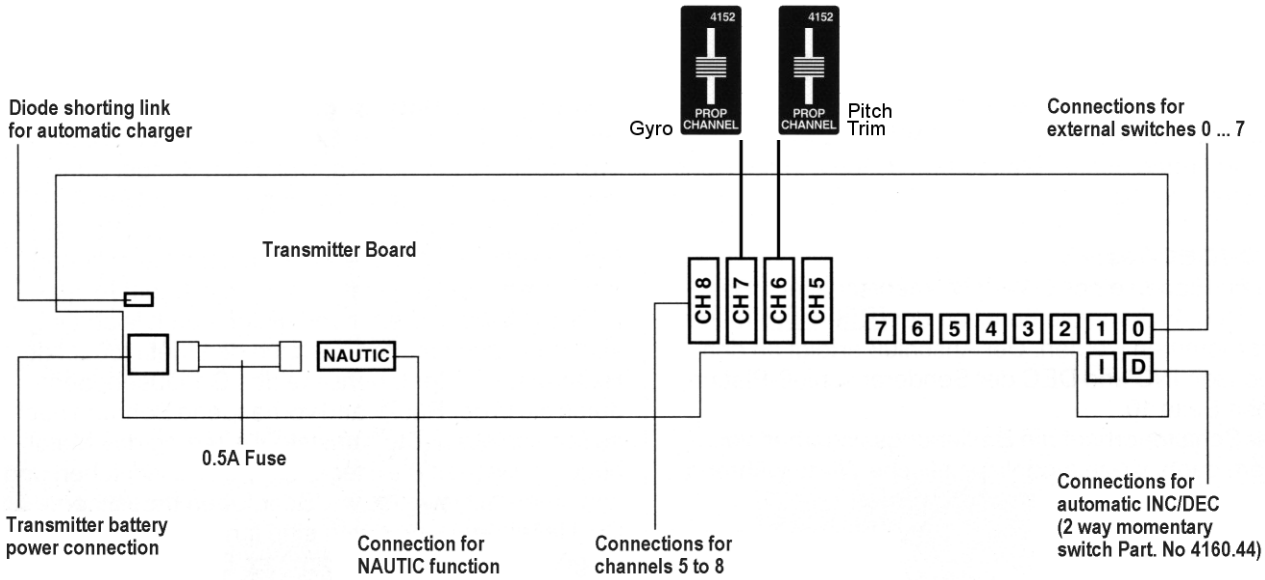
In the helicopter program, you can connect up to eight external switches, which have the following functions :

0 Dual Rate / Exponential Roll
1 Dual Rate / Exponential Pitch
2 Dual Rate / Exponential Tail Rotor
3 Autorotation
4 Throttle and Collective Pitch curve (1)
5 Throttle and Collective Pitch curve (2)
6 Static & Dynamic mixers and freely programmable mixer B
7 Gyro control and freely programmable mixer A

Also on the board of the transmitter are additional connectors that allow the installation of two slider controls for the following functions:

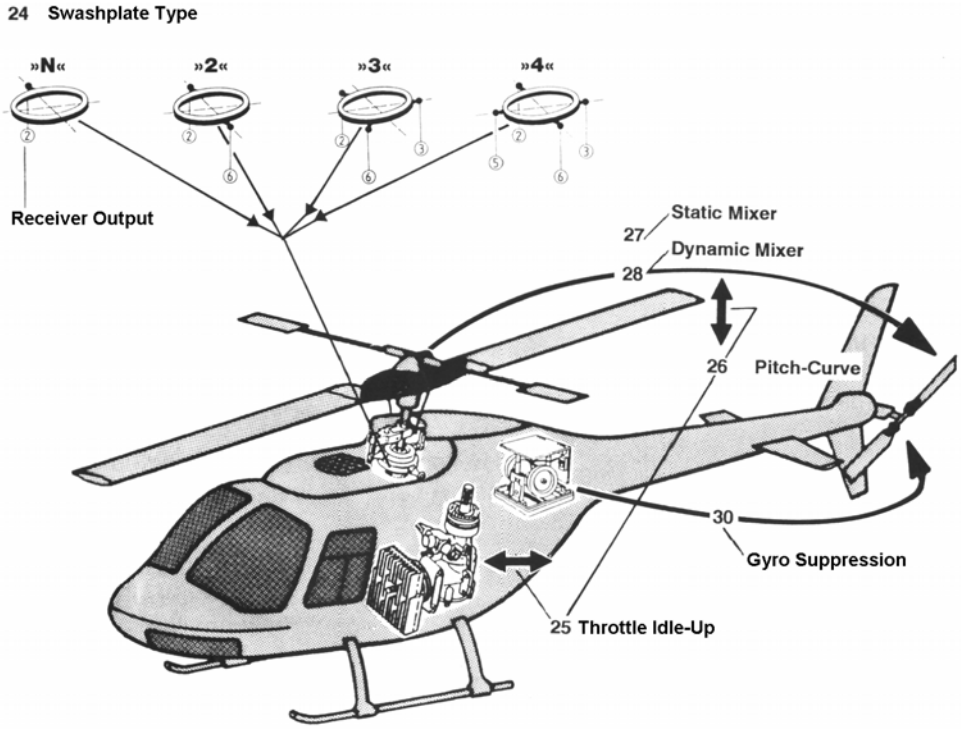
CH6 Collective Pitch Trim
With this slider control the Collective Pitch setting can be adjusted independently to the throttle servo up to around 25% of the maximum servo travel.

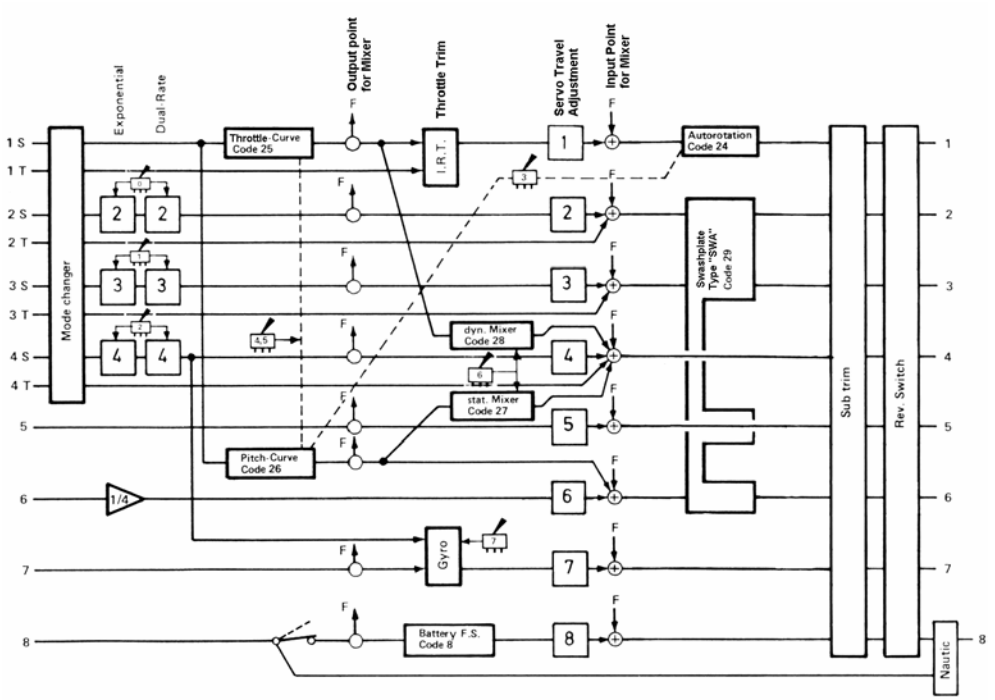
CH7 Setting for the Gyro



HELICOPTER MODELS

Block Diagram for the HELICOPTER “HE” Program





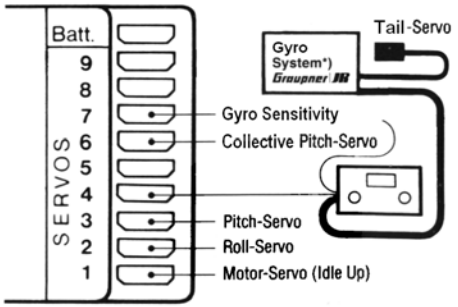
Allocation of Receiver Connections (Ch 1 – 8)

The servos must be connected to the radio receiver as shown in the diagrams below:

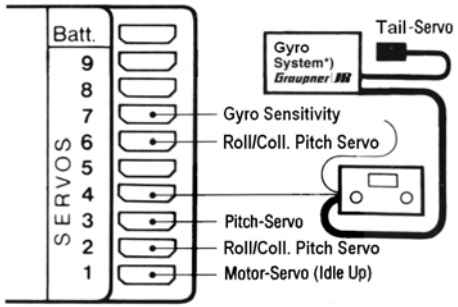
*) Gyro	Part No
Mini-Gyro	3274
NEJ-120BB	3277
NEJ-120BB ECO	3278

*) Gyro	Part No
NEJ-1001	3906
Piezo 2000	3285

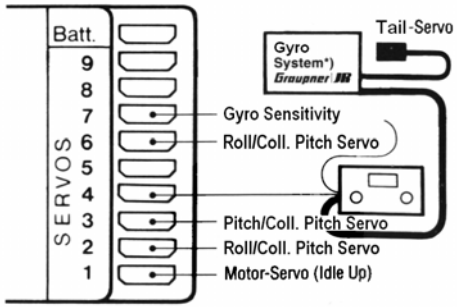
Swashplate Type N



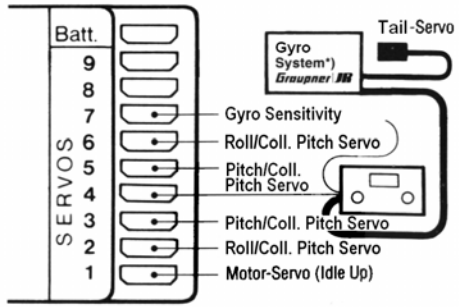
Swashplate Type 2



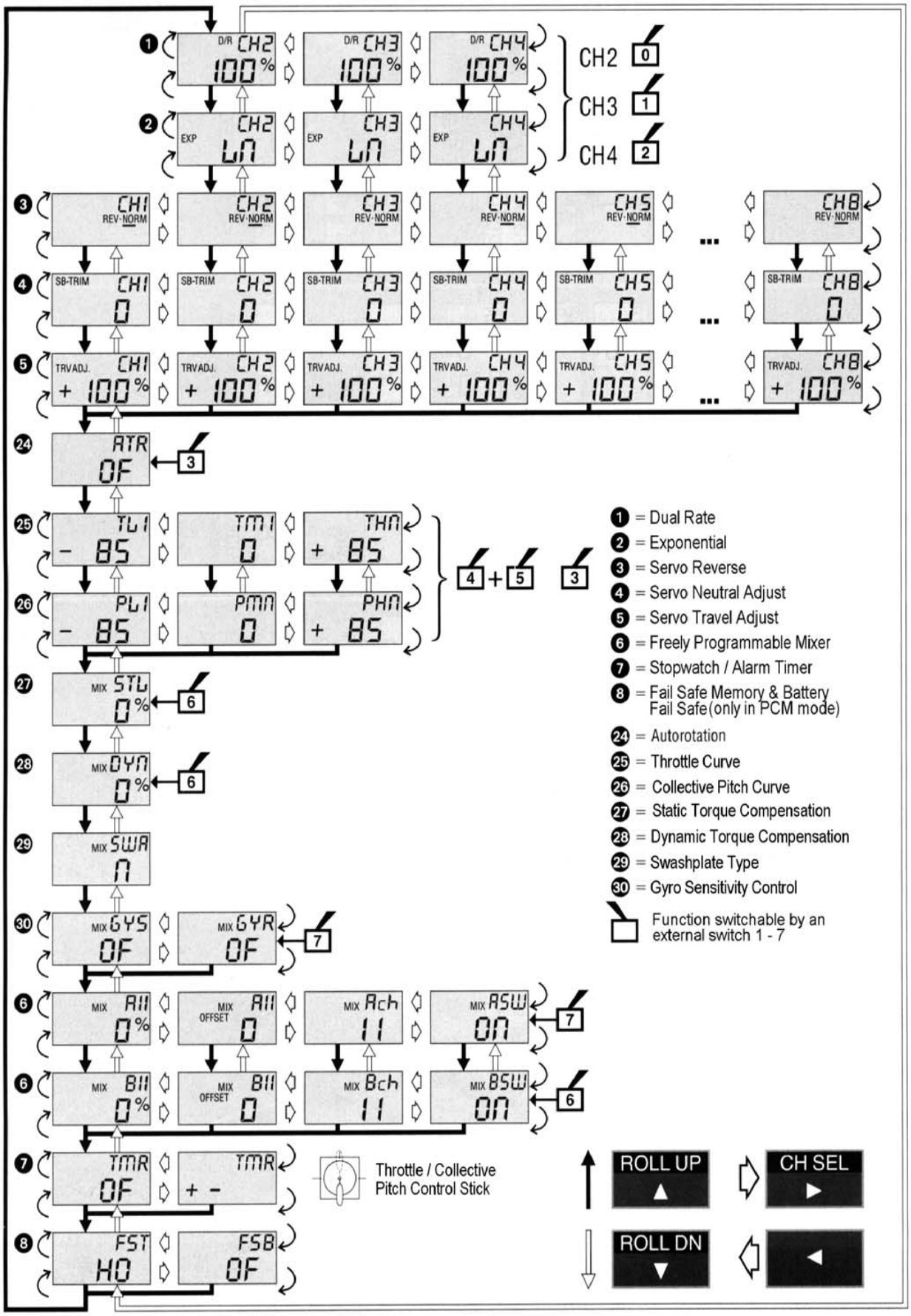
Swashplate Type 3



Swashplate Type 4



Block Diagram HELICOPTER "HE"



Set-up Diagram

TYP HE Model Type “FL” = STANDARD

All the mixers and adjustment values are set to 0 (= mixer off).
To adjust the mixer and adjustment values, while flying, we recommend fitting the 2-way momentary switch, Part No. 4160.44 (see page 10)

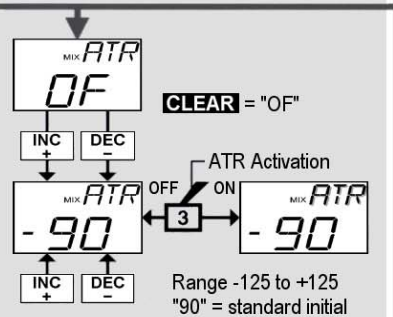
❶-❺, ❼, ❽

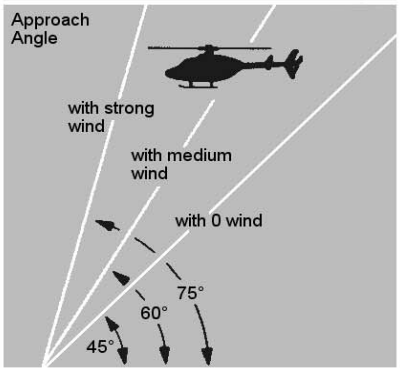
Adjustments ❶-❼, ❽ are available for all model types

- ❶ DUAL RATE Functions 2 - 4 (0 - ±125%), Page 81
- ❷ EXPONENTIAL Functions 2 - 4 (linear - +100%), Page 81
- ❸ SERVO REVERSE Channel 1 - 8 (Reverse / Normal), Page 68
- ❹ SERVO SUB-TRIM Channel 1 - 8 (0 - ±125 steps), Page 68
- ❺ SERVO TRAVEL ADJUST Channel 1 - 8 (0 - ±160%), Page 68
- ❼ STOPWATCH and ALARM TIMER Page 82
- ❽ FAIL SAFE MEMORY and BATTERY FAIL SAFE (only in PCM mode) Page 83

❷❹ ATR

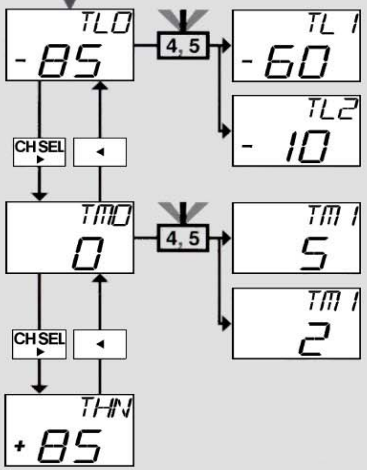
Autorotation
The functions throttle and collective pitch are separated, with the throttle servo taking a preset position. For autorotation an external switch connected to socket 3 is necessary. **CLEAR** deactivates the functions ("OF"), to prevent inadvertent change over to ATR. With ATR activated the static (ST...) and dynamic (DYN) torque compensation are switched off. The minimum, hovering and maximum collective pitch settings still apply.



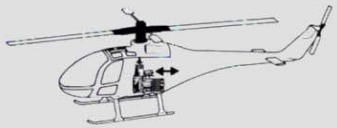


❷❺ TL/M/H ...

Throttle Curves (Throttle Low / Hover / High)
Three different throttle curves can be set and switched between during the flight. The full throttle position (THN) is the same for all three curves, but different values can be set for hovering flight (TM0, 1, 2) and minimum throttle (TL0, 1, 2).

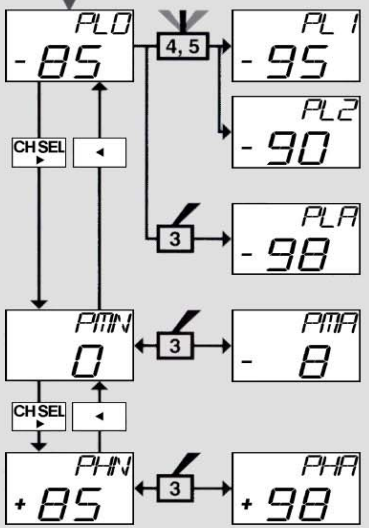


Select the desired value with **INC** or **DEC**. Range -125 to +125



❷❻ PL/M/H ...

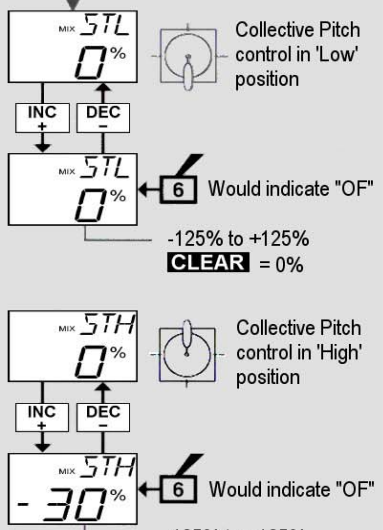
Collective Pitch Curves (Pitch Low / Hover / High)
Three different collective pitch curves can be set and switched between during the flight. The maximum collective pitch (PHN) and hover pitch (PMN) are fixed together for all three curves; a separate value can be set for for pitch minimum (PL0,1,2). Additionally a fourth, separate pitch curve can be programmed and be activated with the ATR switch attached to socket 3.



Select the desired value with **INC** or **DEC**. Range -125 to +125

❷❼ MIX STL/H

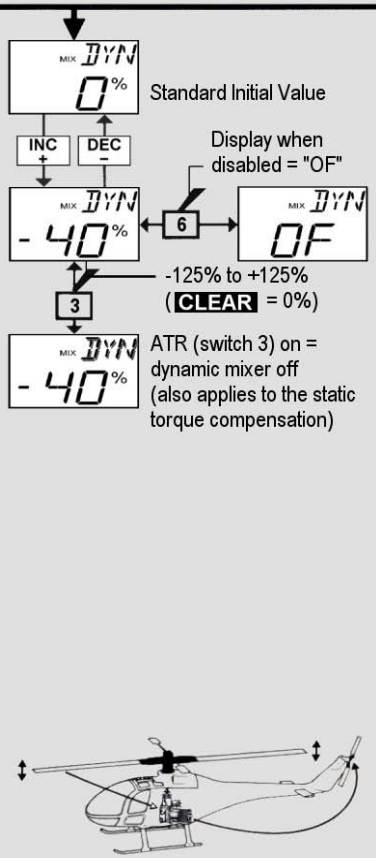
Static Torque Compensation
Using **INC** / **DEC** the low (STL) and high collective pitch (STH) static torque mix for Pitch ➡ Tail Rotor pitch. The position of the tail rotor Servos depends on the maximum and minimum pitch values set here. The mix direction must be selected according to the direction of rotation or the main rotor. Using an external switch at socket 6 the mix can be switched off; with autorotation the mix is automatically switched off.



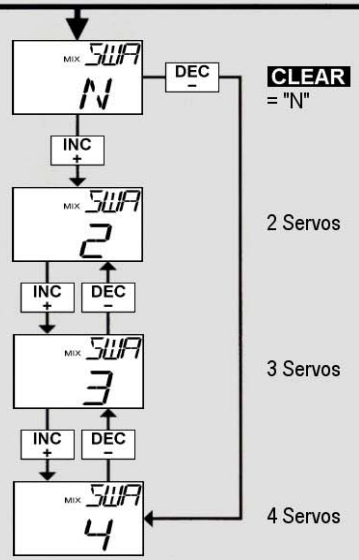
All mixer data can be set to 0, i.e. switched off using the CLEAR key. Display "OF" = the external mixer is switched off.

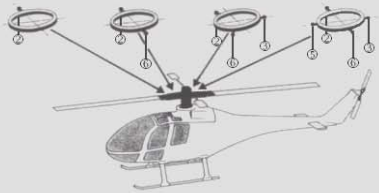
㉘ MIX DYN

Dynamic Torque Compensation
This throttle to tail rotor mixer works during changes in pitch and roll of the main rotor and is primarily intended for helicopters without collective pitch. Mix proportion and direction are set using **INC** / **DEC** (range: 0 to ±125%). This mixer can be switched off with an external switch connected to socket 6 . When in autorotation mode the mix is automatically turned off (flashing announcement "DYN").



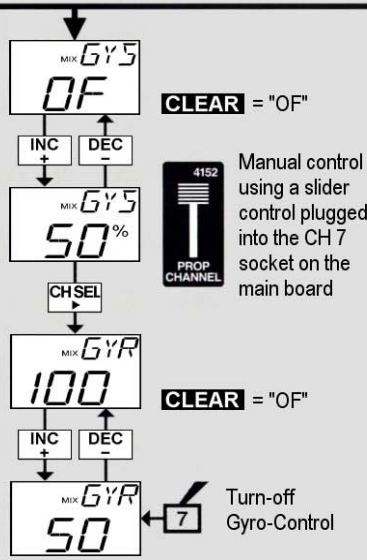
㉙ MIX SWA





㉚ MIX GYS

Gyro Gain Control
With a proportional module, Part No 4111 or 4152 connected to function socket 7 the gyro effect can be altered. The gain of the automatic gyro effect of the Gyro sensor with increasing tail rotor control stick movement can be reduced.
This gyro gain effect can also be disabled using a switch attached to socket 7.

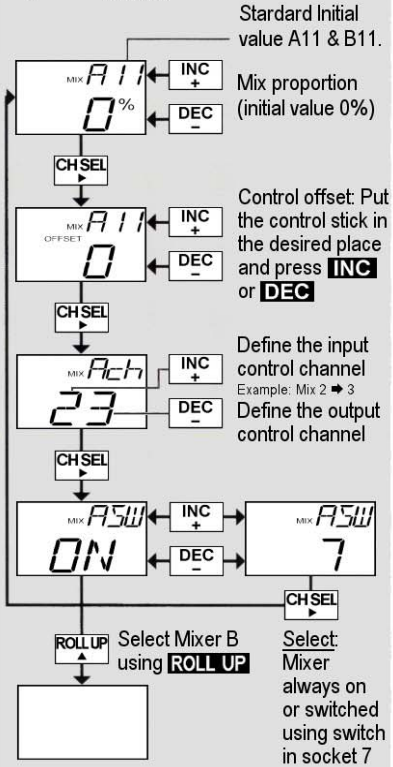


Gyro effect is presettable within a range of 50 to 100% of tail rotor control stick deflection

⑥ MIX A11, B11

2 Freely Programmable Mixers
Both the channels (1-8) to be linked by the mixer, the mix portion and mix direction (±125%) can be individually selected.
The mixers can be continually "ON" or using external switches, turned on and off.

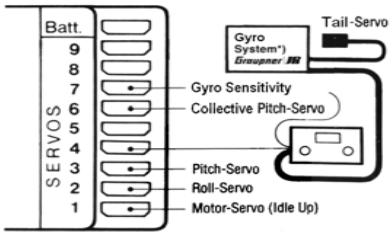
Mixer	External Switch
B	Socket 6
A	Socket 7



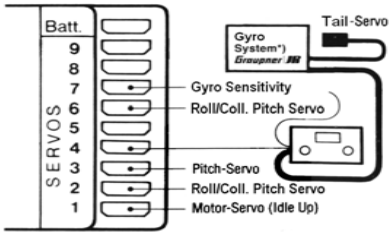
Connections to the receiver (Ch 1 to 8)

The servos must be connected to the receiver outputs as shown below:

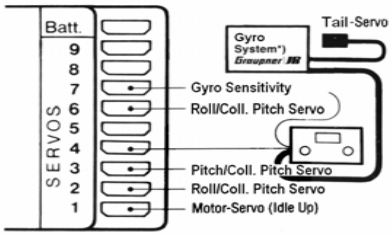
Swashplate Type N



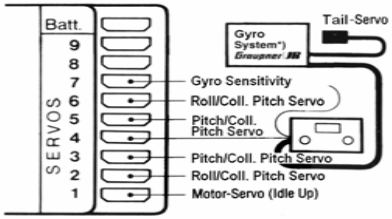
Swashplate Type 2



Swashplate Type 3



Swashplate Type 4



HELICOPTER Adjustment Instructions

Programming System
The following programming guidance orients itself around the practical programming conditions and not at the consequence of the options in the transmitter. For the initial programming of a helicopter it is advisable to observe this order since it represents a logical operational sequence.

SYSTEM Menu
(The options are described in further detail on the pages indicated for each option)

Model Selection (see page 17)
The mc-16/20 transmitter permits the storage of 20 model settings. If you get into the habit of adjusting the controls so that the trim levers are centred, it is much simpler when changing models as you don't need to reset the trim positions for the selected model.

Model Name (see page 16)
To simplify selecting the correct model settings in the 20 memory model names can be entered, which can consist of three letters and/or numbers. This name is indicated in the upper display line, as long as the stopwatch is not in use.

Model Reset (see page 17)
With the reset option it is possible to set all the model parameters back to the default values. You should use this option when setting up a new model where the current setting in that memory is a model of same type (HE in this case). With a change of model type the reset is automatically performed.

Model Type (see page 15)
The mc-16/20 transmitter supports 5 different model types. The model type selection must take place at the beginning of reprogramming a model as the other options available are dependant on the model type selected.

Control Mode (see page 15)
There are four different control modes which affect assignment of the four control functions (fore/aft, roll, tail rotor pitch and throttle/collective pitch) to the two control sticks. The control mode to be used depends on the preference of the individual model flyer.
For controlling a model helicopter it is preferred to have the controls for fore/aft and roll (thus the entire cyclic control) on a common stick, and the other stick to have the tail rotor and throttle/collective pitch. Therefore control mode 2 or 3 is recommended.

Throttle/Collective Pitch Direction (THR)
(see page 16)
This option permits the flyer to select the direction of operation of the throttle & collective pitch control stick to suit their preferred direction.
After call this setting, the direction can be swapped, between pushing and pulling for increased pitch, by pressing the INC or DEC buttons. The current active setting is indicated in the display:
NORM = Push for increased pitch
REV = Pull for increased pitch

All the other function options of the helicopter program depend on this setting, as it affects the throttle and collective pitch functions, thus for example throttle and collective pitch curves, mixers for torque compensation, etc.

SET-UP MENU
Adjust the values for the model.
The remaining model-dependent value setting takes place in the set-up menu. To access the set-up menu from the basic operating screen of the transmitter (e.g. after switching on), the keys ROLL UP and ROLL DN are pressed simultaneously (marked on the keyboard as ENTER).

SWASHPLATE TYPE

Swashplate Mixer
(access via Set-Up Menu)

Four different programs exist for the control of the swashplate:

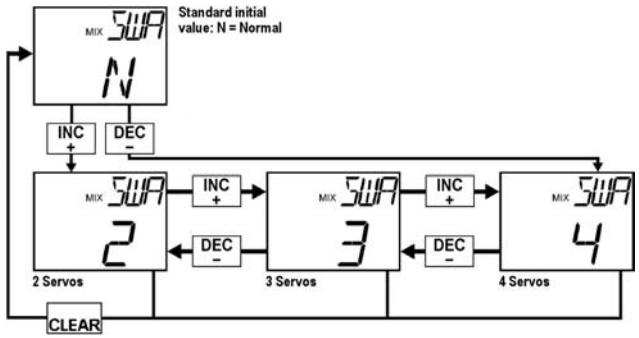
"N" (Normal) The swashplate is tilted for roll by a servo; the collective pitch control is by a separate servo. Type "N" also includes those helicopters with mechanic mixers to achieve the collective and cyclic blade control.

"2" The swash plate is axially moved for collective pitch by two roll / collective pitch servos; fore & aft pitch control is decoupled by a mechanical mixer (HEIM mechanics).

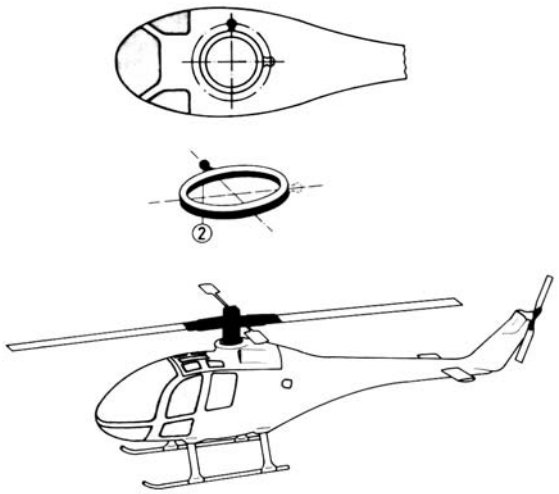
"3" Symmetrical three point control of the swashplate using three coupling points at 120°, to which a fore & aft pitch / collective pitch servo (in front or at the rear) and two roll / collective pitch servos (laterally on the left and right) are connected. For collective pitch all three servos move together to move the swashplate axially.

"4" Four point control of the swashplate with two roll / collective pitch and two fore & aft pitch / collective pitch servos.

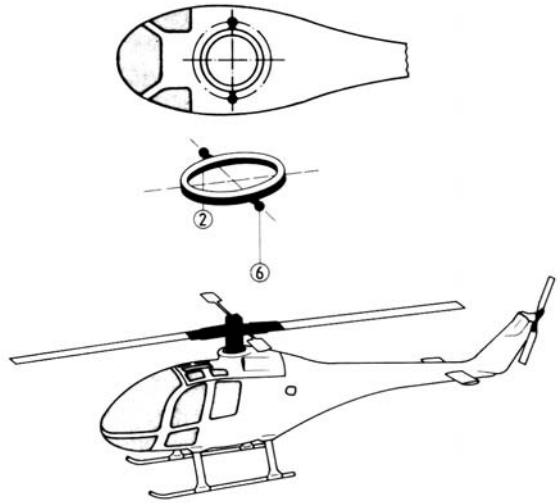
The selection of the code is achieve using the INC / DEC buttons.



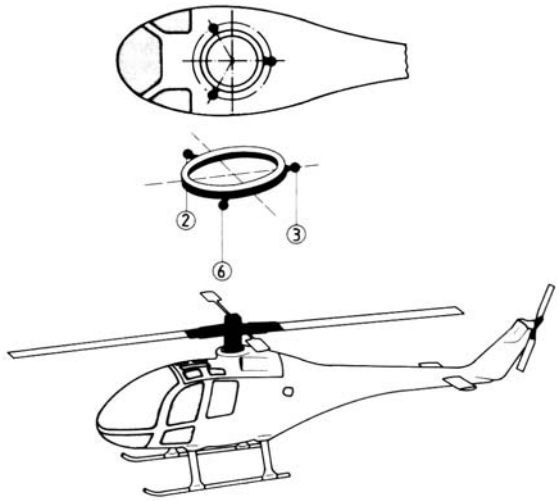
Program »N«
1 Servo



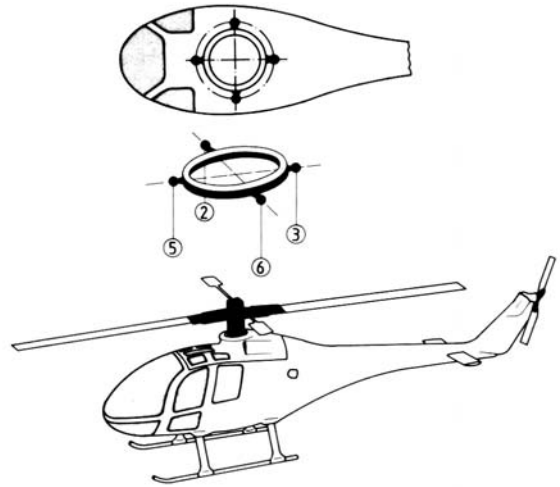
Program »2«
2 Roll servos



Program »3«
2 Roll servos and 1 Pitch servo



Program »4«
2 Roll servos and 2 Pitch servos

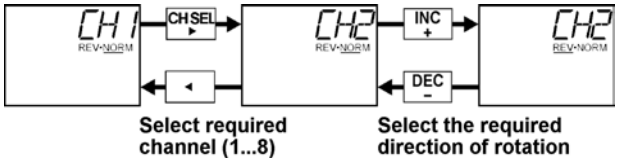


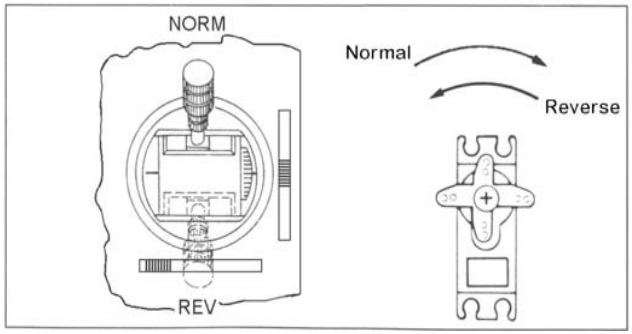
SERVO REVERSE

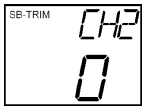
Reversing the Rotation of the Servos
(access via Set-Up Menu)

Reversing the direction of servo rotation.
The set servo rotation is shown in the display for all servo functions 1…8; you will see the cursor line under either “REV” or “NORM”. This eliminates the need to reconnect plugs in the transmitter or reverse the servos themselves. Press the CH SEL button repeatedly until the required channel you wish to alter appears in the display, then swap the direction using the INC or DEC buttons. The CLEAR button will always reset the direction to “NORM”.

Note:
The channel number refers to the receiver output to which the servo in question is connected. Any agreement with the numbering of the channel inputs is coincidental, and is unlikely to be the case when complex mixes are in use. For this reason a change in stick mode does not affect the numbering and direction of rotation of the servos.



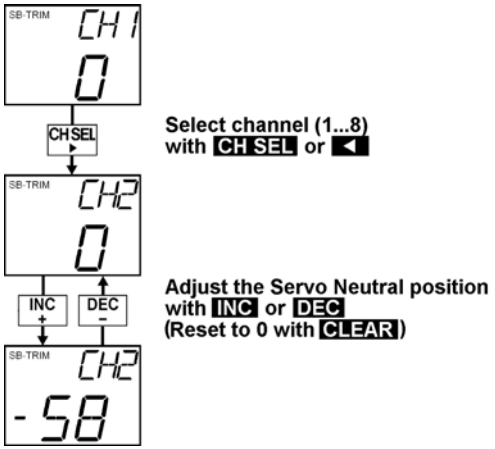


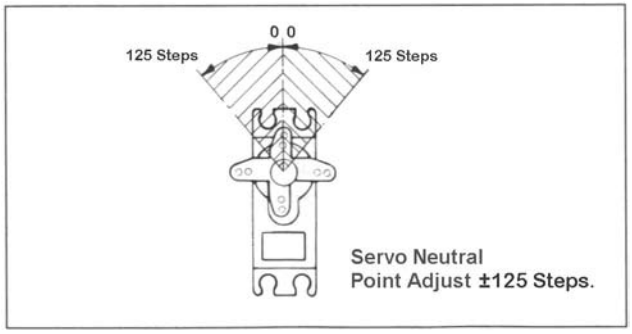


SERVO NEUTRAL POSITION

Servo Neutral Position
(access via Set-Up Menu)

This can be used to adjust for non-standard pulse width servos (≠1.5ms) or other reasons.
The neutral position can be shifted within the range ±125 steps (approximately 70% travel) using the “SB TRIM” option, regardless of the trim lever position and any mixer settings.
Select the channel you want to adjust using the CH SEL button and then press INC or DEC repeatedly to shift the centre point, until the servo neutral is correct for you application. The CLEAR button can be used to reset the adjustment to 0, i.e. the servo the return to its original neutral position. This setting refers directly to the servo concerned, and is not affected by other trim and mixer settings.

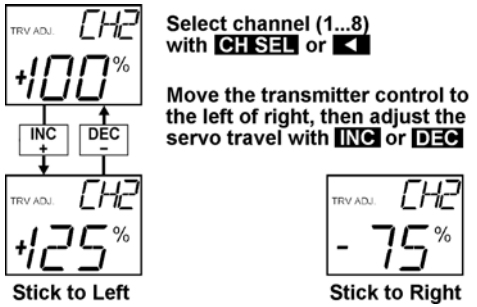


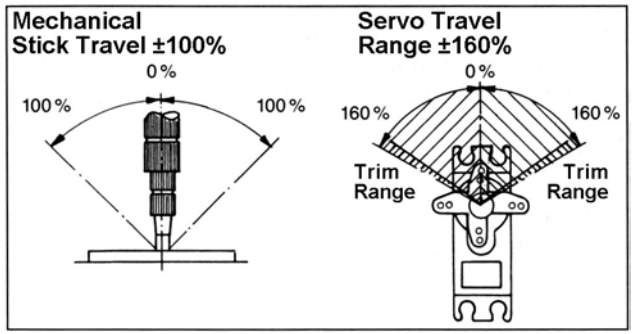


SERVO TRAVEL

Servo Travel Adjustment
(access via Set-Up Menu)

The abbreviation “TRV ADJ” stands for Travel Adjust and provides adjustment of servo travel separately for either side of centre. The adjustment range is 0…160% of normal servo travel.
It can be determined from the block diagram what impact this setting has on the servo concerned. Some mixers are not affected by this setting as they feed directly into the „Input Point for Mixers“, whilst the output of others are adjusted according to this setting.
Press the CH SEL button repeatedly until the correct servo function (1…8) appears in the display. The bottom line of the display shows the servo travel set, with the prefix (+ or -) indicating the side of centre. If you wish to adjust (& display) a setting, you need to move the associated control (stick, slider, switch) to the relevant end-point. Adjust the travel with the INC or DEC buttons, and reset it to 100% with CLEAR.





Setting the Throttle and Collective Pitch curves: Fundamental Explanations

Setting the Throttle and Collective Pitch
The tuning of throttle and collective pitch, and thus the performance curve of the engine and collective pitch control, is the most important adjustment procedure with a helicopter model. The goal of this tuning is it to achieve a constant main rotor speed throughout the entire collective pitch range in flight, and to ensure that at the point at which the helicopter hovers is achieved with the throttle / collective pitch stick as near as possible to a central position.

Firstly a wide-spread misunderstanding must be clarified for model helicopter pilots:
The model helicopter throttle servo must NEVER be connected just to an auxiliary channel and operated via a proportional module alone!!!

Although throttle and collective pitch are controlled by separate servos, these are always operated together by the throttle / collective pitch control stick (the only exception is Autorotation). This coupling is done by the helicopter program in the transmitter. The trim levers for the throttle / collective pitch control stick work, in the helicopter program, exclusively on the throttle servo and then only in the minimum throttle position of the control stick.
A proportional module attached to CH 6 permits a shift of the collective pitch range around by range of ±25% without influencing the throttle servo.

The helicopter program of the mc-16/20 transmitter permits the programming of independent throttle and collective pitch curves.

In addition to the central position and two end positions appropriate to the throttle / collective pitch control stick, individual values entered for the collective pitch and throttle are stored in each case.

No-load setting and throttle preselect
The no-load operation setting makes it possible to set the engine RPM for no-load, without influencing the hovering flight setting.
With the option “TL1” the throttle servo position is set in such a way that with the control stick in the idle position one achieves stable no-load operation. With the trim lever and the idle setting, the engine can be turned off.
During flight it is possible to switch over to a limited throttle setting (i.e. minimum RPM), which is generally called “Idle-up”.
The “Idle Up” setting acts to prevent excessive rotor RPM and is primarily for use when the collective pitch is taken under the point of hovering flight, for example with fast, steep approach flights. Therefore it may only be effective below the hovering flight position (central position) of the pitch control stick. Occasionally a changeover of the throttle curve is used for an increase in the system RPM for certain flight manoeuvres, usually for helicopter models whose rotor construction does not permit a constant RPM for hovering flight and aerobatics. In addition it is used to ensure the settings for both hovering flight and aerobatics are optimal: Low system RPM for calm, soft stick reactions and low noise in hovering flight, higher RPM for aerobatics, within the range of the maximum power of the engine. In this case the throttle curve is also changed within the hovering flight range.

In order to allow for all these requirements, the mc-16/20 transmitter possesses a changeover system for throttle and collective pitch curves which goes far beyond simple idle-up. If you attach additional external switches to connections 4 and 5 on the transmitter plate, they allow up to two alternative throttle and pitch curves to be programmed and called up during flight.

The announcement appearing in the display for the option of “TL...” depends on the switch positions:

“TL1:” Both switches in the OFF position
”TL0:” Switch 4 = ON, switch 5 = OFF
”TL2:” Switch 4 = ON or OFF, switch 5 = ON

Preferable to two independent switches is the use of the 3-way differential switch, Part No 4160.22, which then gives the following switching:

Lower position: Throttle / Pitch Curve 0
Centre position: Throttle / Pitch Curve 1
Upper position: Throttle / Pitch Curve 2

In this case use curve 0 for the basic adjustment in place of curve 1

Not only can the throttle minimum values for all three switching positions be set differently, but also the values for hovering flight throttle and minimum collective pitch. The value for full power is set and shared for all switching positions together, likewise hovering flight collective pitch and maximum collective pitch.

Throttle and Collective Pitch curves: Practical Procedure

Basic Adjustment
Although the pitch and throttle curves can be set electronically over a wide range in the mc-1620 transmitter, the hovering point of the helicopter should be at least approximately correctly preset mechanically (see introduction). If you pay attention to the instructions of the respective helicopter kit for adjusting the controls this is usually the case.

The control of the carburettor must be so adjusted such that the throttle servo can move during operation of the throttle control stick, (including both end positions of the trim lever), over the full travel, without the carburettor hitting a mechanical stops. The carburettor must be completely open with the control stick in the full power position, and with the control stick and trim at the lower end the carburettor should be completely closed, without the servo stalling.

This setting should be achieved as best as possible mechanically by adjusting the control linkages and changing of the position on linkages on the servo and carburettor horns.

Only the remaining small adjustment should thereafter be made electronically, with the servo travel setting (“TRV ADJ”, “CH1”). This basic adjustment is the basis for all further settings and must therefore be completed as accurately as possible.

With this basic adjustment the engine should be able to be started and the idle speed adjusted using the trim lever.

The model should then with the throttle / collective pitch control stick in central position, take off and with the intended RPM hover.

If that is not the case, then one proceeds as follows:

1.) The model takes off only with the stick above the central position.

a) The rotor RPM is too low.

Remedy: Using the “TM…” setting open the carburettor slightly at the stick central position.

b) The rotor RPM is too high.

Remedy: Using setting “PM...”, increase of the blade angle (collective pitch) for the stick central position.

2.) The model takes off with the stick below the central position.

a) The rotor RPM is too high.

Remedy: Using the “TM…” setting close the carburettor slightly at the stick central position.

b) The rotor RPM is too low.

Remedy: Using setting “PM...”, decrease of the blade angle (collective pitch) for the stick central position.

WARNING:
A long time should be taken over this setting, ensuring the model hovers at the correct RPM with the throttle / collective pitch expensive stick in the central position. The correct execution the remaining model parameters is dependent on this!

Climbing Flight Setting
The combination of the options “TM...” (hovering flight throttle) with “PHN” (maximum collective pitch) and “PMN” (hovering collective pitch) it makes possible to achieve problem-free flight from hovering to maximum climb rate with a constant rotor RPM.

To do this, proceed as follows:
First perform a long vertical climb, with the collective pitch stick in it’s end position. Whilst doing this the rotor RPM should not change relative to that during hovering flight. This is dependent on the power of the engine and on the model weight. If the rotor RPM drops in the climb and the carburettor is already completely open, thus no further increase in output power is possible, using “PHN” (maximum collective pitch) reduce the maximum blade angle; with rising rotor RPM in the climb, increase the value of “PHN”.
If this setting is correct, bring the model back to hovering flight, which should be achieved with a central position of the collective pitch stick.
If the stick position for hovering flight has moved away from centre towards the maximum point, compensate for this using “PMN” (hovering collective pitch), by increasing it’s value, until the model hovers with the stick in the central position. In the opposite case, with the model hovering with the stick below the central position, the value of “PMN” is reduced accordingly. It may also be necessary to reduce the setting of “TM…” (hovering flight throttle), until an constant rotor RPM for hovering flight and climb results.

Descending Flight Setting
During the previous setting it was assumed that any external switches possibly attached for throttle and pitch curve change-over were in the basic position, i.e. that for the hovering flight throttle setting "TM0" (or without an external switch the only option available is "TM1" which was used instead of "TM0").

This switching position is always selected when starting the engine and the rotor. To fly you move the switch from the start into the flight position, (throttle preselect is switched on and the display shows "TM1").

Before the next setting you should transfer the value for hovering flight throttle "TM0", determined during the preceding adjustments into "TM1". Switching from the start to the flight position should show no effect now.

The switch is brought to the flight position and the rotor is started.

The descending flight setting is adjusted as follows. Let the model, from forward flight at a reasonable height, sink with the collective pitch stick fully back. "PL1" (pitch minimum) should be adjusted so that the model descends at an angle of 60 – 80°. Once this is achieved one sets the throttle preselect value ("TL1") so that the rotor RPM neither increases or decreases. Once this has been managed, the basic tuning of throttle and pitch is complete.

Alternative Flight Setting
For special applications you can program an alternative flight setting, which can be switched to when required.
It is possible for example to set "TL2" to "0" whereby a throttle hold results. The throttle is no longer affected below the point of hovering flight as the collective pitch reduces, but remains to a constant value. Above the point of hovering flight the throttle control takes place normally via the throttle / collective pitch control stick.
With some model helicopters such a setting can have advantages during aerobatics, for example with models with four-stroke motors.

A further application possibility for this alternative setting is the hovering flight figures of the FAI competition program. In order to achieve the full rotor RPM in the take-off phase, you again select “0” for “TL2”. For the normal flying operation this setting is not recommended as during steep descending flight the rotor RPM will increase rapidly leading to flight instability. After the hovering flight figures are completed you switch back to the normal flight setting ("TM1") for the aerobatics figures.

Important Notes
Before starting the engine you should make sure that throttle selector switch is in the start position, otherwise after starting the engine will immediately increase to high RPM and the centrifugal clutch will engage.

Therefore always hold the rotor head when starting

If the engine should be started inadvertently with throttle pre-select switched on:

Do not panic!

Hold the rotor head rigidly!

Do not release it under any circumstances!

even if the result is that the clutch is damaged! The repair of a clutch is negligible compared to the damage, which uncontrolled with the rotor blades can cause striking things around the model.

The changeover from start to flight setting should not be done at the no load pitch position.
The rotor is accelerated suddenly which can lead to a premature lock of clutch and transmission system. Also the free moving main rotor blades do not stabilise during such a jerky acceleration and can swivel far from their normal positions, which can in extreme cases lead to a tail boom strike.

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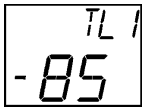


Throttle Curve

Throttle Curve (Low, Middle, High)
(access via Set-Up Menu)

Three different profiles for the carburettor response can be adjusted and called up in flight by external switches; the function of the throttle pre-select is included in this changeover.

The curves are determined in each case by three points:

- The low collective pitch / throttle stick position, called "TL..." (Throttle Low),
- The middle collective pitch / throttle stick position, called "TM..." (Throttle Middle),
- The high collective pitch / throttle stick position, called "TH…" (Throttle High).

The three sets of adjustment are successively called using the CH SEL button.

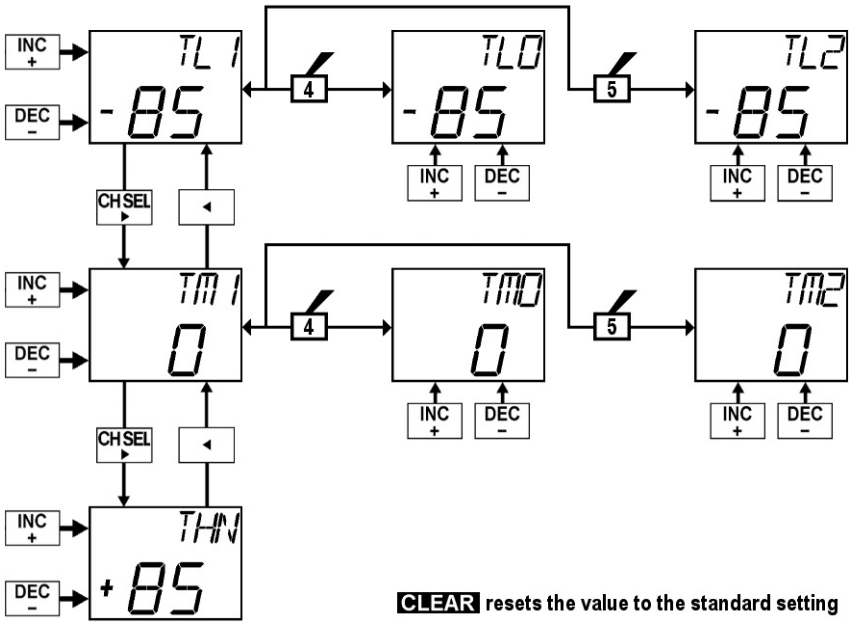
Selection of which of the three possible curves are to be adjusted is by operation of the external switches connect to the transmitter board connections 4 and 5; the display announcement changes accordingly:

Switch 3 = OFF, ATR inactive

Both switches in OFF position	“T…1”
Switch 4 = ON, Switch 5 = OFF	“T…0”
Switch 4 = ON or OFF, Switch 5 = ON	“T…2”

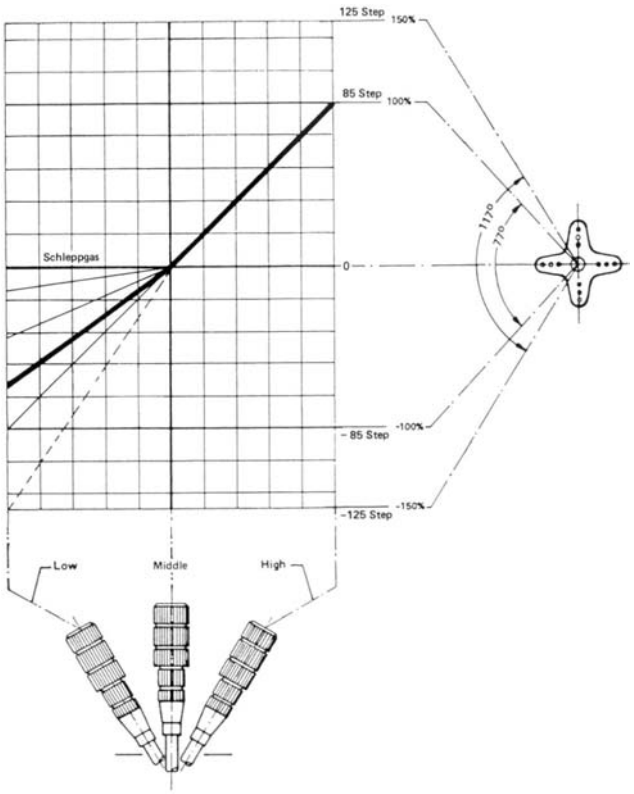
Switch 3 = ON, ATR activated
Switch 4 and 5 = ON or OFF
The appropriate notice flashes as warning that the autorotation changeover is activated and the indicated value is not effective; instead the throttle servo takes the position programmed in the setting for autorotation (ATR).

Setting
After selection of the point required using the CH SEL button and operation of the appropriate external switches, the value displayed can be set using the INC and/or DEC buttons over a range of 0... ±125 steps; pressing the CLEAR button resets the value to the standard setting.

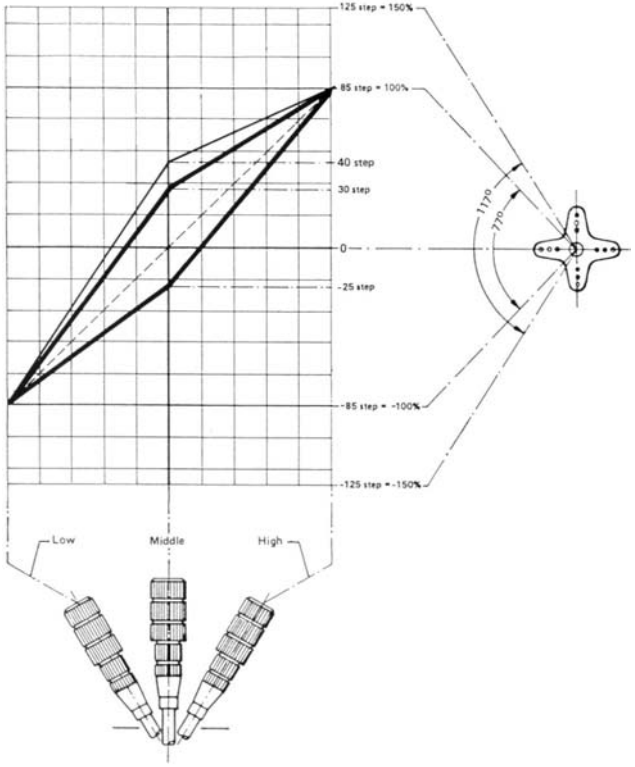


Examples of setting the Throttle pre-select

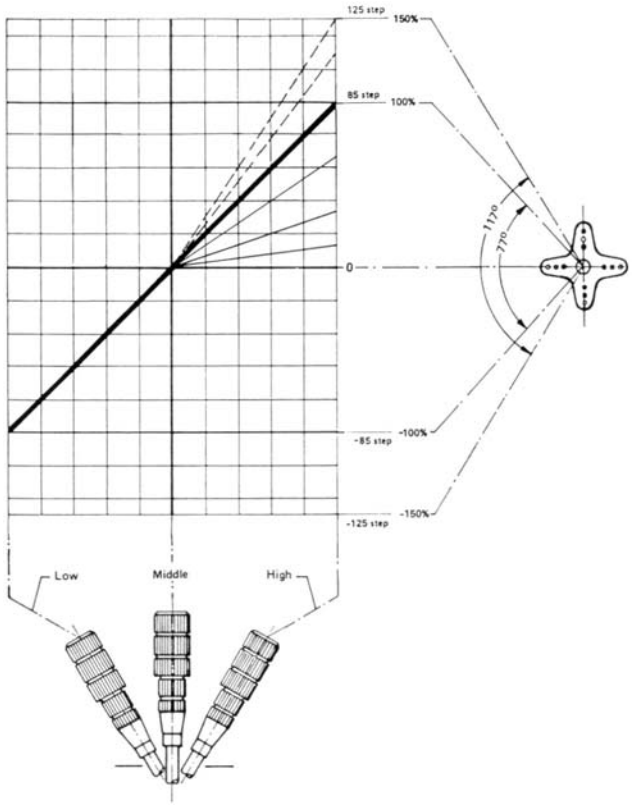
Throttle Low – "TL0", "TL1", "TL2"
With this option you can programme three alternative throttle pre-selects for different flight tasks.

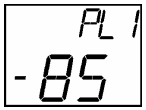


Throttle Middle – "TM0", "TM1", "TM2"
With "TM0" through "TM2", three alternative hover point throttle settings can be programmed.



Throttle High – "THN"
When a helicopter program is initialised the Throttle High value is automatically set at +85 steps = 100% servo travel and can be adjusted with the INC or DEC buttons to optimally suit the mechanical range of the carburettor.





Pitch Curve

Pitch Curve (Low, Middle, High)
(access via Set-Up Menu)

Four different profiles for the collective pitch response can be adjusted and called up in flight by external switches. Three curves are available for normal flight (under motor power), and a separate curve is available for autorotation.

The curves are determined in each case by three points:

- The low collective pitch / throttle stick position, called "PL..." (Pitch Low),
- The middle collective pitch / throttle stick position, called "PM..." (Pitch Middle),
- The high collective pitch / throttle stick position, called "PH…" (Pitch High).

The three sets of adjustment are successively called using the CH SEL button.

Selection of which of the possible curves to be adjusted achieved is by operation of the external switches connect to the transmitter board connections 3, 4 and 5; the display changes accordingly:

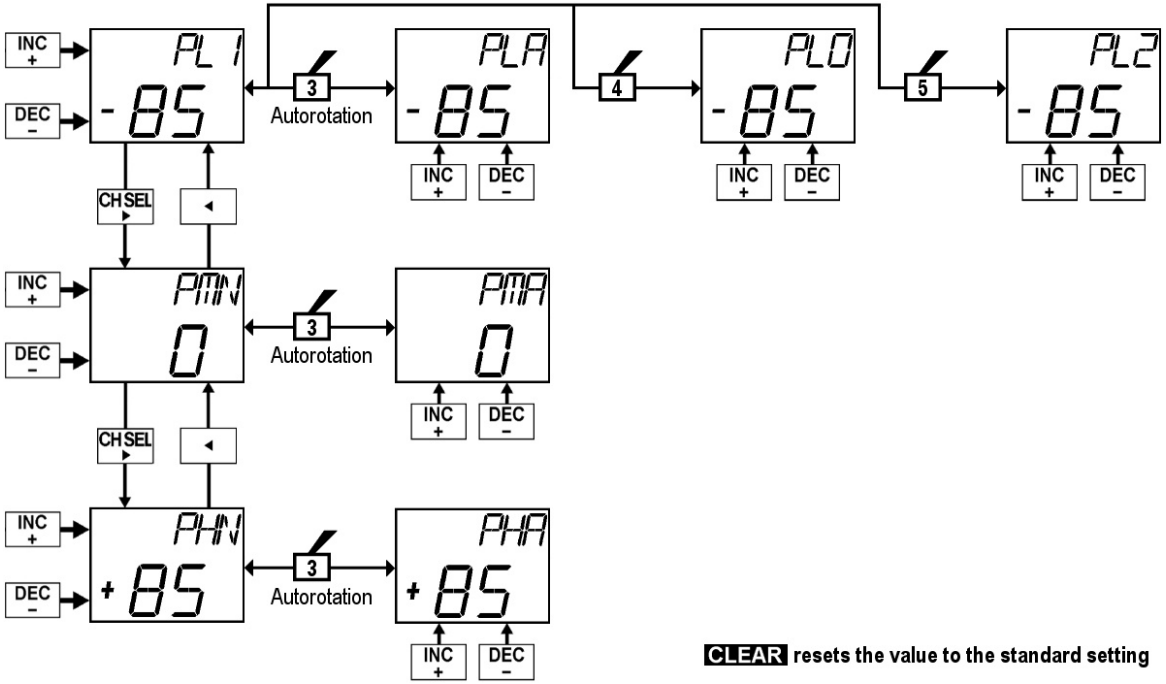
Switch 3 = OFF, ATR inactive

Both switches in OFF position	“PL1”
Switch 4 = ON, Switch 5 = OFF	“PL0”
Switch 4 = ON or OFF, Switch 5 = ON	“PL2”

Switch 3 = ON, ATR activated

Switch 4 and 5 = ON or OFF	“P…A”

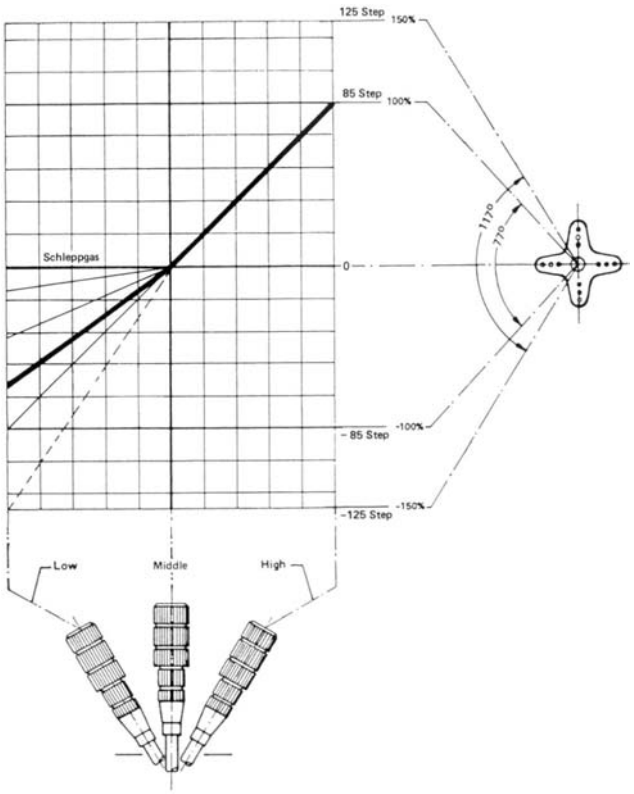
Setting
After selection of the point required using the CH SEL button and operation of the appropriate external switches, the value displayed can be set using the INC and/or DEC buttons over a range of 0... ±125 steps; pressing the CLEAR button resets the value to the standard setting.



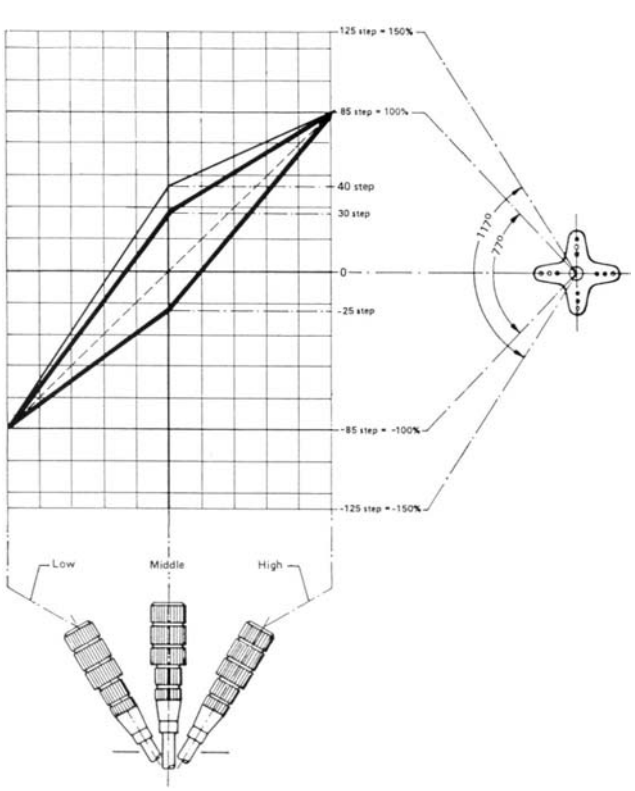
CLEAR resets the value to the standard setting

Examples of setting the Throttle pre-select

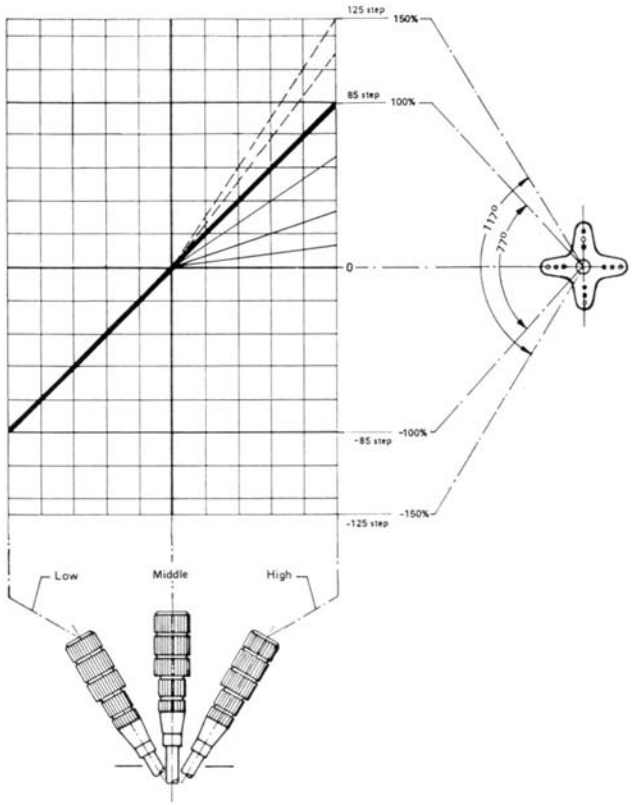
Pitch Low – "PL0", "PL1", "PL2"
For the three throttle pre-select settings "TL0", "TL1" and / or. "TL2" different low collective pitch values are programmable.
Operation of the autorotation switch in socket 3 allows a fourth low collective pitch value "PLA" to be programmed.



Pitch Middle – "PLM"
With this option the pitch value for the hovering flight is set.
Using the autorotation switch in socket 3 allows "PMA" to be selected and a collective pitch value for the autorotation landing to be set..



Pitch High – "PHN"
With pitch High the upper collective pitch value is adjusted.
Operating the autorotation switch in socket 3 allows selection of "PHA" and an increased collective pitch value to be programmed for autorotation landings..



AUTOROTATION

Switching to Autorotation
(access via Set-Up Menu)

Autorotation is a helicopter flight condition, in which the main rotor is no longer powered by the engine but by the air flow trough the rotor in descending flight. So that sufficient main rotor RPM remains, the rotor blades must be brought, with the collective pitch control stick, to a suitably small angle of incidence. The ground approach angle lies depends on the wind strength and is between 45° (zero wind) and 80° (strong wind). Landing from this descending flight is achieved by increasing the blade angle, using the energy stored in the rotor to create lift.

Using autorotation both a full-size as well as model helicopters able to safely land without power, e.g. with engine breakdown.

Also in case of a loss of the tail rotor, immediate shutdown of the engine and the landing using autorotation is the only possibility, otherwise an uncontrollable spin develops around the vertical axis and the model will crash.

A requirement to be able to do this is a suitably trained pilot, who is familiar with the aircraft and in this flight condition. Fast reactions and a good judgement by eye are also needed, since the rotational energy stored in the rotor is available only for a very limited time at the point of landing as rotor speed decreases rapidly when producing lift.

With autorotation as task in competitions, the engine is required to be turned off. However, during training autorotation landings it is favourable to keep the engine at idle so if necessary the autorotation can be aborted and the model is able to resume normal powered flight.

The mc-16/20 transmitter offers the ability to switch the use of autorotation, using an external switch attached to socket 3 of the transmitter board.

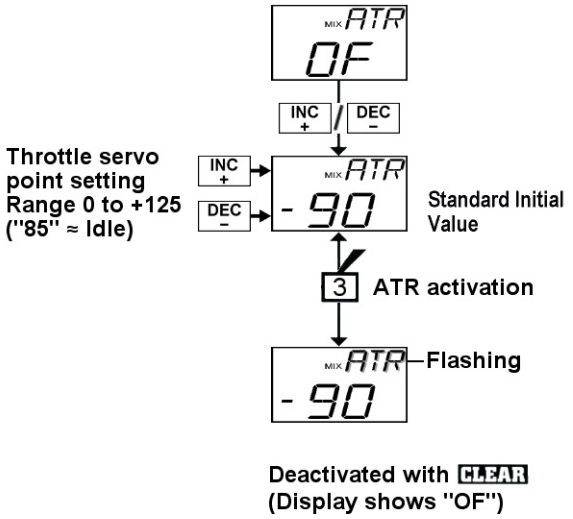
The throttle function is separated from the control stick, which still controls the collective pitch; the throttle servo takes a position set in the "ATR" program.

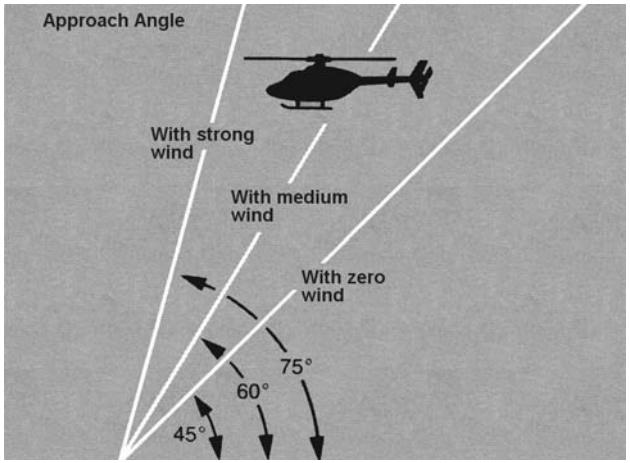
Additionally the activation of the autorotation switch causes the following:

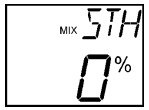
- The mixers "ST..." for the static and "DYN" for dynamic torque compensation are switched off. The announcements "STH", "STL" or "DYN" flash in the display.
- The set values of the throttle curves are no longer effective, which is indicated by "TL0", "TL1" or "TL2" flashing in the display.
- The autorotation pitch curve setting become effective as set using "PLA", "PMA" and "PHA" (see page 73).

Set-Up
After selection the display initially shows "ATR OF" - The autorotation program is switched off. The program is switched on by the INC or DEC key and the position of the throttle servo for autorotation can now be adjusted over the range of 0 to +125.

In order to prevent inadvertent switching on autorotation, and turning the engine off, the autorotation option can be deactivated using the CLEAR button (announcement "ATR OF").







STATIC TORQUE COMPENSATION

Static Mixer
(access via Set-Up Menu)

Using this option the static torque compensation (Pitch ➔ Tail) can be adjusted, separately for the climbing, indicated "STH", and descending flight, indicated "STL" representing above and below the collective pitch control stick central position.

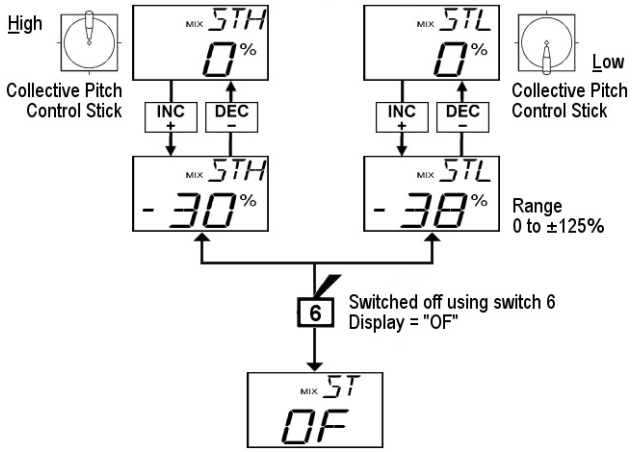
It is the goal of this option is to find settings to compensate for the change in torque, compared to that for hovering flight, to prevent the helicopter turning during climbing and descending flight. It is not intended to trim for hovering flight which is carried out exclusively with the tail rotor trim lever.

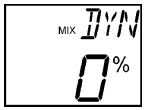
Required for a useful setting of torque compensation is that the pitch and gas curves were correctly set, ensuring a constant rotor speed through the entire range of collective pitch (see page 70).

The **mix direction** depends on the direction of the main rotor rotation: For anti-clockwise rotating systems (anti-clockwise as seen from above, e.g. HEIM-system) positive values are to be set, for clockwise rotating rotors use negative values.

Set-Up:
A separate setting is made for both directions of stick movement, which swap as the control stick is brought into the relevant position, using the INC or DEC buttons, in a range from -125% to +125%.
CLEAR puts the mix proportion back to 0%.
Using switch 6 this mixer can be turned off at the same time as the dynamic torque mixer.

Note:
During autorotation the static mixer is automatically turned off, which is indicated by the flashing announcement "STL" or "STH".





DYNAMIC TORQUE COMPENSATION

Dynamic Mixer
(access via Set-Up Menu)

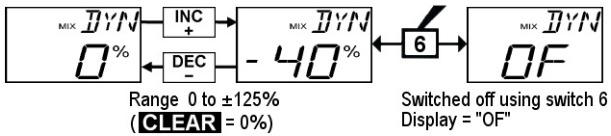
With the dynamic mixer Throttle ➔ Tail momentary torque fluctuations can be compensated for, which are caused by acceleration delay in the drive.
It is mainly intended for older helicopters without collective pitch and RPM controls lift, however, it can be used with helicopters that, although equipped with collective pitch control, do not maintain constant system RPM, but with the collective pitch control change the RPM at the same time. This applies particularly to older models, for example the BELL 212 TWIN JET.

The mixer limits the tail rotor adjustment temporarily and thereby compensates the brief torque changes.
The size of overshoot is set using INC / DEC.
CLEAR puts the mix proportion back to 0%.
Using switch 6 this mixer can be turned off at the same time as the static torque mixer.

The **mix direction** depends on the direction of the main rotor rotation: For anti-clockwise rotating systems (anti-clockwise as seen from above, e.g. HEIM-system) positive values are to be set, for clockwise rotating rotors use negative values.

With **modern helicopters**, which are flown with constant RPM throughout the entire collective pitch range, **this mixer is not needed** and therefore should not be activated.

Note:
During autorotation the dynamic mixer is turned off automatically, which is indicated by the flashing announcement "DYN.



Gyro Control

Automatic Gyro Gain Control
(access via Set-Up Menu)

With this option you can reduce the effect of the Gyro sensor with increasing tail rotor stick excursion. This will only work with a gyro system which allows the gain to be control from an auxiliary channel of the transmitter.
In central position of the tail rotor control stick and a proportional module attached at socket CH 7 of the transmitter plate the set gyro effect results. With manipulation of the tail rotor control this effect is reduced to the value, which corresponds to lower setting of the control slider (CH7).The position of the tail rotor control stick at which this minimum value is reached can be adjusted.
The automatic gyroscope gain reduction can be switched off using a switch attached to switch position 7 on the transmitter board.

Basic adjustment of the Gyro sensor
In order to obtain as optimal a stabilisation of the helicopter around the vertical axis as possible by the gyroscope, the following suggestions should be considered:

- The control linkage to the tail rotor should be as low-friction and as free from play as possible.
- The control linkage should be rigid (no flexing).
- A strong and above all fast servo should be used.

The faster the reaction of the Gyro sensor in recognising a turn of the model, and then making the necessary change to the tail rotor thrust to correct the turn, the further gyroscope gain effect be increase by rotating the gain adjusters. This should be done so that the tail of the model does not begin to oscillate, and will give better is stability around the vertical axis. Otherwise the danger exists that the tail of the model would begin to oscillate during small gyro signals.

In addition, during high forward speeds and/or when hovering with a strong head wind the stabilising effect of the vertical fin in addition to the gyro's effect can lead to a over reaction, where oscillating of the tail again becomes noticeable.

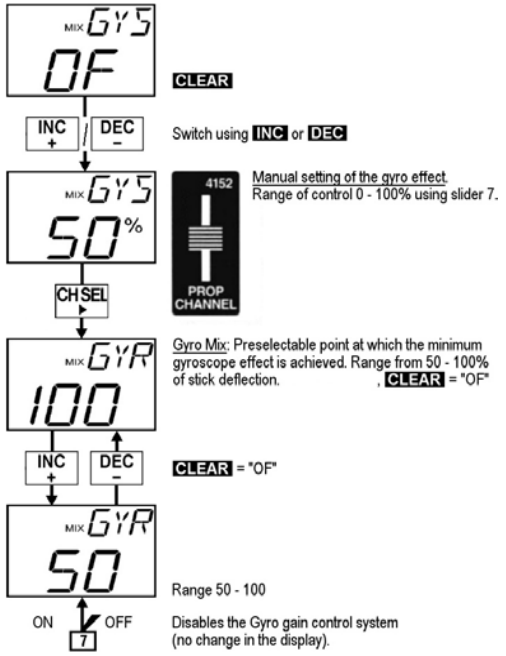
In order to achieve an optimum stabilisation in each situation, the gyro effect can be adapted from the transmitter using a slider control in connection 7. In the upper end position of the control only gyro adjuster 2 is effective. This is adjusted in such a way that with zero wind in hovering flight the model does not oscillate. In the lower end position of the control 7 only gyro adjuster 1 is effective. If you rotates this to the minimum gyroscope effect, the gyro effect can be set anywhere between "0" and the maximum effect set (with adjuster 2) using control 7.
Under normal conditions you would however normally set adjuster 1 so that the model does not oscillate with the maximum speed or extreme head wind. You can then vary the gyro sensitivity from the transmitter to suit the weather conditions and the intended flight program.

Notice:
The effective stabilisation amount provided by the Gyro sensor depends on the settings of the two adjusters on the gyro:

Adjuster 1 set the minimum gyro effect and adjuster 2 the maximum effect.

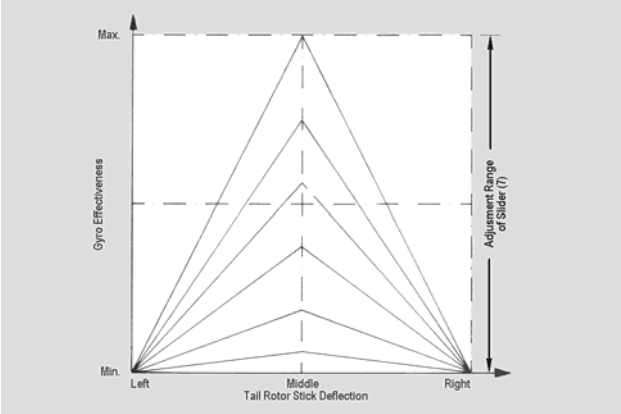
The effect can be set between these two limits using the slider control on channel 7.

Setting the Gyro control (Automatic Gain)
After selection of this option the display initially shows "GYS OF" (gain system is not programmed). The option is switched on with the INC or DEC buttons, and the display will now show the gyro effect setting, from the control slider, where "100%" correspond to the upper limit and "0%" the lower limit. With CH SEL the Gyro control setting screen is selected. Using the INC and/or DEC buttons the tail rotor control stick displacement point can be specified, at which the gyro effect is reduced to the value given by the low position of slider 7. "100%" means full-scale (slow gain reduction) and "50%" half travel of the tail rotor control stick (fast gain reduction). After swapping back with the CH SEL button you can now observe the gyro gain reduction effect in the display when moving the control stick. Witt CLEAR the gyro control can be switched off again, which can also be done with switch 7.



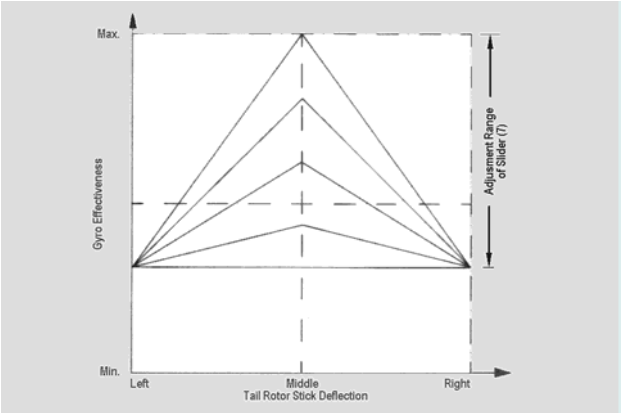
Example:

1. Adjuster 1: Left stop, Adjuster 2: Maximum, Gyro Mix at 100%



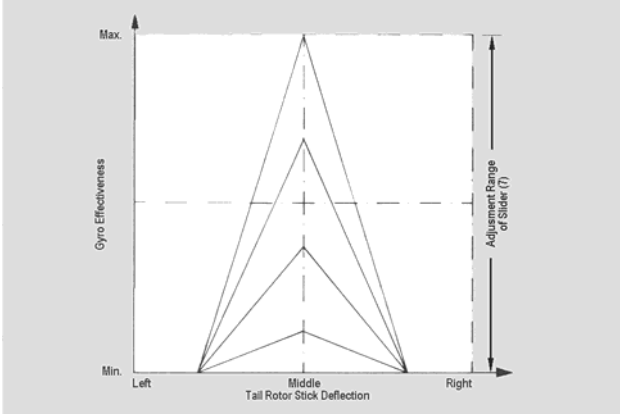
With the slider control 7 the gyro effect can be set anywhere from "0" up to the maximum. During operation of the tail rotor control the gyros effect has a linear reduction, where the "0" value is reached at stick full travel position.

2. Adjuster 1: 30%, Adjuster 2: Maximum, Gyro Mix at 100%



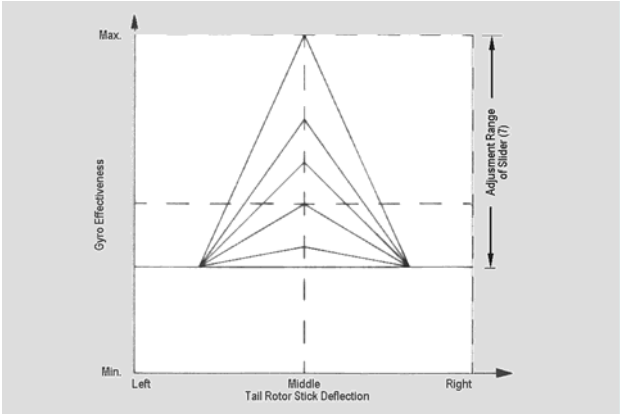
The gyro effect can be varied with slider control 7 between the two adjusted values. Automatic gyro gain takes place only down up to the value set with adjuster 1.

3. Adjuster 1: Left stop, Adjuster 2: Maximum, Gyro Mix at 60%

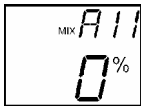


In contrast to example 1 the gain reduction is when the tail rotor control stick has moved 60% of its travel.

4. Adjuster 1: 30%, Adjuster 2: Maximum, Gyro Mix at 60%



The minimum gyro effect is reached with 60% stick deflection. This is not, however, at "0" gain, as in the previous example, but corresponds to the setting of adjuster 1 of the Gyro sensor.



Freely Programmable Mixer

Free Programmable Mixer
(access via Set-Up Menu)

Additional to the pre-programmed mixer functions contained in the helicopter program are two freely selectable mixers, which are characterized by the letters A and B and the number of the input function and the output channel. The lower display line will show either the mix portion and direction, or "OF" if the mixer is switched off using the associated external switch.

Setting example for mixer "A"

1. Channel Selection.
Firstly the CH SEL button is pressed until in the upper display line "Ach" appears. Using the INC key the number of the input channel 1 to 8 is entered (left digit), with the DEC key the channel of the receiver output 1 to 8 (right digit). Pressing the CLEAR button performs a reset and sets input function and output channel to "1", mix proportion and offset to 0% and the mixer switch on "ON".

2. Allocation of a mixer switch.
Pressing the CH SEL button changes the display to "ASW" (A-Switch). This is where it is specified whether the mixer remains constantly switched on, (display "ON" is shown), or whether it is turned on and off by an assigned external switch. The selection is made with the INC or DEC keys. The lower line of the display shows the transmitter board socket for the external switch allocated:

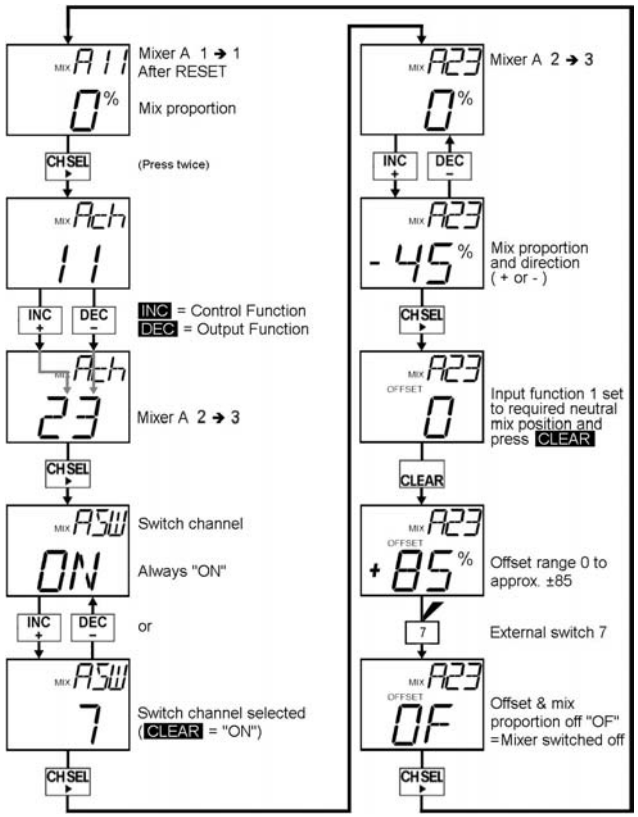
Mixer	Transmitter Socket
A	7
B	6

Note:
Switch 6 also simultaneously switches the mixers for static and dynamic torque compensation, and switch 7 the automatic gyro gain reduction.

3. Setting mix proportion and mix direction.
By pressing the CH SEL button the option for adjusting the mix proportion and direction appears. Using the INC and/or DEC buttons the mix proportion can be set between 0 and ±125%, symmetrically to the neutral point (pressing CLEAR resets the value to 0%). If an external switch was assigned, the mixer can be switched off now and the display will show "OF".

4. Specify the mixer neutral point (offset setting).
If CH SEL is pressed again, you arrives at the offset setting. To set the offset place the control stick in the desired position and press the CLEAR key. The offset is indicated in the display. (value range: approx. -85 to +85).
If an external switch has been assigned and is switched off, the display shows "OF".
(If you want to change the stored offset, the mixer offset setting is re-entered and the new position stored as above).
Thus the programming of mixer A is completed. The setting of mixer B is completed in the same way.

Note:
In the helicopter programs control function 6 cannot be used as input signal for a mixer as it does not possess an “output point for mixers” (see the block diagram on page 62). The signal from this channel only affects receiver output 6 directly and servo travel is limited to 25% of the normal value. Dependent on the type of swashplate (Swash Mixer) certain control paths are linked with one another (as with all finished mixers). For example, the basic standard mixer "N" links control function 1 with channel 6. The mix proportions of a finished and a freely programmable mixer can be overlaid in such a way that a servo movement is changed.



❶

DUAL-RATE

Switchable Servo Travel
(access via Set-Up Menu)

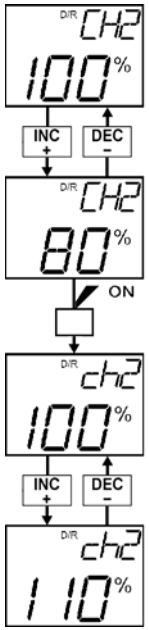
The Dual-Rate function lets you switch to a different amount of travel while the model is in flight, using an external switch. The travel for each of the two switch positions can be set to any value within the range 0 to 125% of normal servo travel. The “D/R” switches must first be connected to main circuit board in the transmitter (see page 10). After selecting the “D/R” code the first step is to select the channel (channel 2 to 4) using CH SEL:

Transmitter Ch.	Function	External Switch
2	Roll	socket 0
3	Fore & Aft Pitch	socket 1
4	Tail Rotor	socket 2

Move the switch to the appropriate position, then set the required servo travel using INC and DEC.

Switch position in the display:
ch = closed (ON)
CH = open (OFF)

Additionally without switches fitted this option can be used for travel adjustment.



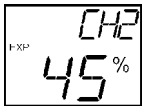
Select servo function (2,3 or 4) using the CH SEL or ◀ button. Set the required value using INC or DEC

External switch "ON" (see table above) Display changes from CH (OFF) to ch (ON) and shows the relevant pre-set value.

Previously set value

Set the required value using INC or DEC. Press CLEAR to quickly reset to 100%.

❷



EXPONENTIAL

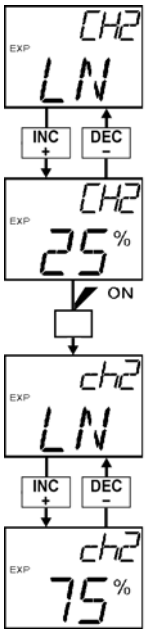
Progressive Servo Travel
(access via Set-Up Menu)

Exponential travel reduces the servo travel around the neutral position of the stick. Travel progressively increases towards the stick end-points, so that full servo travel is still available at the extremes. The degree of progression can be set from linear “LN” (or 0%) to 100%. The Exponential function therefore has no effect when set to “LN”. Dual-Rates and the Exponential function are controlled by the same switch, see EXPO-/DUAL-RATE:

Transmitter Ch.	Function	External Switch
2	Roll	socket 0
3	Fore & Aft Pitch	socket 1
4	Tail Rotor	socket 2

Switch position in the display:
ch = closed (ON)
CH = open (OFF)

Additionally without switches this option can be used for adjusting the control stick characteristics.



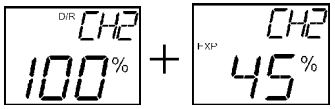
Select servo function (2,3 or 4) using the CH SEL or ◀ button. Set the required value using INC or DEC

External switch "ON" (see table above) Display changes from CH (OFF) to ch (ON) and shows the relevant pre-set value.

Previously set value

Set the required value using INC or DEC. Press CLEAR to quickly reset to LN = 0%.

❶ ❷

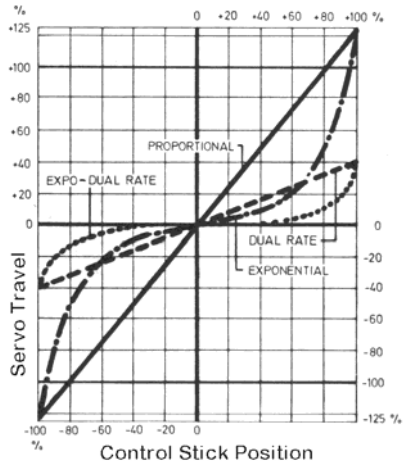


EXPO-/ DUAL-RATE

Coupled Dual-Rate & Exponential
(access via Set-Up Menu)

The Dual-Rate function provides a means of adjusting servo travel symmetrically around the neutral position to any point between 0 and 125%, and switching between the 2 settings by means of an external switch. The Exponential function alters the servo response curve. As the external switches affecting control functions 2…4 control the Dual-Rate and Exponential functions simultaneously, it is possible for you to set-up the controls of your model very precisely, to suit your exact requirement. You can program two independent values, separately for roll, fore & Aft pitch and tail rotor, such as a 20% servo travel for one external switch position and 125% for the other position, with an exponential curve of, say, linear or 80%. Note that this Exponential setting defines the “degree of progression” (the shape of the curve), not the extent of the servo travel.
Note: For safety reasons the lowest the Dual-Rate value should be set to is 20% travel.

Characteristic Curves for various settings.

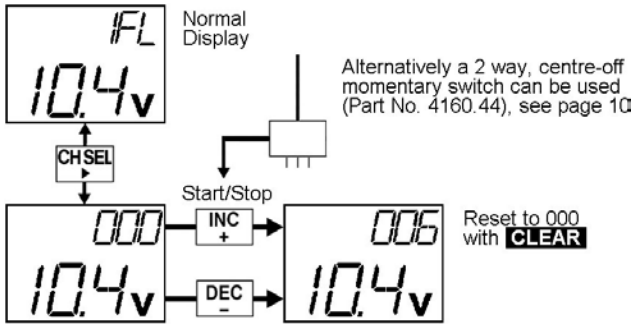


Dual-Rate	=	Linear reduction or increase of servo travel (0% to 125%)
Exponential	=	Progressive control characteristic with 100% servo travel
Expo-/Dual-Rate	=	Combined Exponential and Dual-Rate function

STOPWATCH and ALARM TIMER

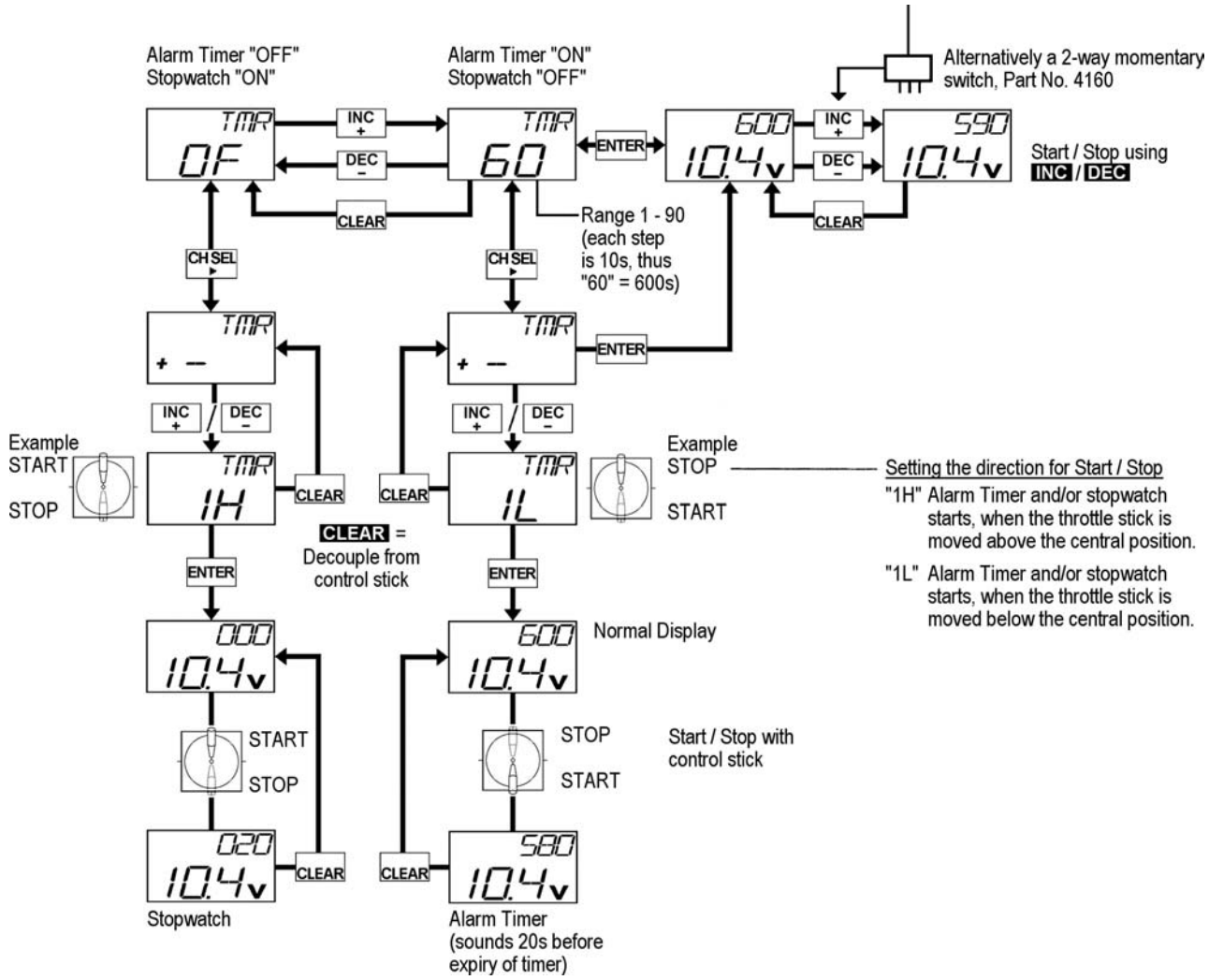
Stopwatch and Countdown Clock
(access via Set-Up Menu)

In normal operating mode the display can be set to timer display with the CH SEL button. The default, without having called code “TMR”, is a stopwatch (0...999s). The Start/Stop is using either INC or DEC and reset to “000” is by using CLEAR. If the transmitter is switched off & back on, the display last selected appears, i.e. either model name or "000".



The code “TMR” allows the application possibilities to be extended:

1. **Countdown Clock** (Alarm Timer), which has an audible warning tone. The start time is set by the user and ranges from 10s to 900s. 20s before the end of the time, an internal buzzer sounds every 2s, below 10s every second to 0s. The clock then continues to run counting up to 999s. This additional time is shown by a "+" displayed in the lower line before the battery voltage. Start/Stop of timing is controlled by the INC / DEC buttons.
2. **Throttle Stopwatch**, as normal except the start/stop is controlled by the throttle stick. The switching point set independently to the position of the control lever centre. Additionally it can be determined whether the timer start is by pushing or pulling the throttle stick. With this option the true engine run time can be measured.
3. **Alarm Timer**, a countdown timer as 1 above, but controlled by the throttle stick as in option 2.



FST HO FAIL SAFE MEMORY and SB-TRIM CH2 0 Receiver Battery FAIL SAFE

Storage of Fail Safe data; only in PCM mode
(access via Set-Up Menu)

This function is only possible when in PCM mode and with receiver models mc-12, mc-18, mc-20 and DS 20 mc!

FAIL SAFE MEMORY

The higher working reliability of Pulse Code Modulation (PCM) in relation to the simple Pulse Position Modulation (PPM) results from the fact that the microprocessor built in the receiver recognizes, whether a received control signal was falsified or damaged by external interference. In these cases the receiver automatically replaces this disturbed signal by the last correctly received, which was stored in the receiver just in case. In this way brief interference, where the radio signal is weak or the like, is managed which would otherwise lead to the well-known "glitching".

When a longer lasting disturbance to the transmission between transmitters and receivers occurs, the mc-16/20 software offers two different options of FAIL SAFE programming. Using the INC / DEC keys, the "FST" (Fail Safe Time) can be selected:

1. HOLD program (display "HO"):
   In this case the Servos stops, in the case of a transmission disturbance to the receiver, in the position set by the last intact control signal. It remains in that position until a new, recognizable, control signal is detected by the receiver.
2. Variable programmable fail-safe with delay option (display: 0.3, 0.5 or 1.0):
   The servo moves to a pre-programmed set position, until the receiver receives an intact control signal. It is possible to set a delay time from the beginning of the interference to the operation of the fail safe program. This is settable in three steps (0.3s, 0.5s and 1.0s using the INC/DEC keys, taking into account different model speeds.

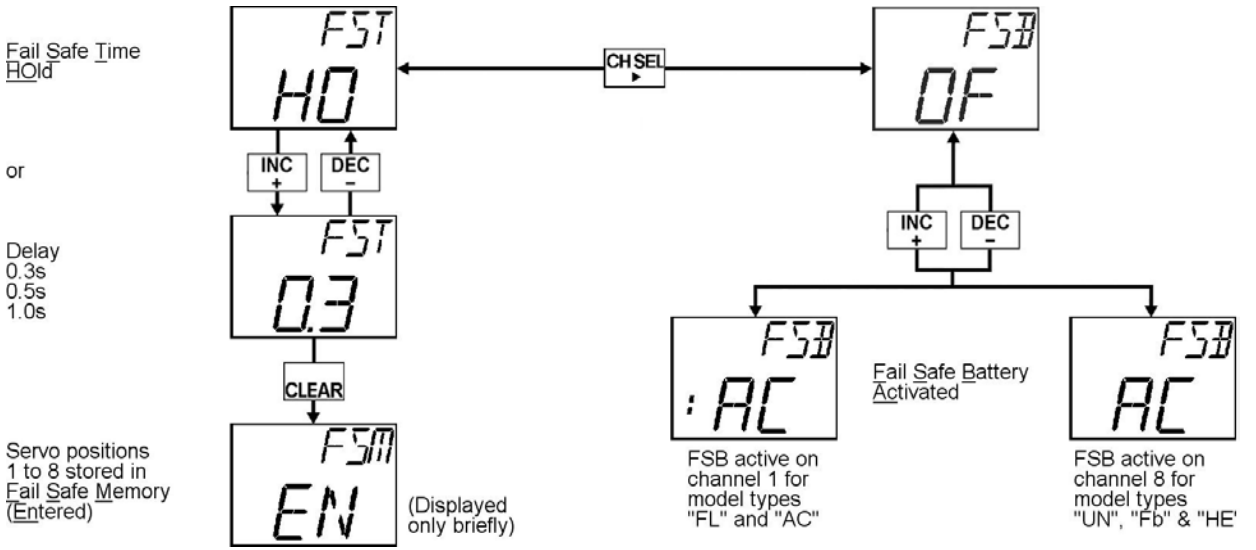
The desired positions of the servos on control functions 1 to 8, during the operation of fail safe, are simultaneously set at the transmitter and then the CLEAR key is pressed. These momentary positions are stored now as the fail safe positions. During operation these values are transferred to the receiver's memory, so that the receiver can fall back to them during interference. Storing is confirmed, in the display, by the brief display of "FSM EN", (Fail Safe Memory Entered). The fail-safe servo positions can be reset at any time, even in flight, by selecting the code and pressing CLEAR to be overwrite the existing settings.

This function is only possible when in PCM mode and with receiver models mc-12, mc-18, mc-20 and DS 20 mc!

Receiver Battery FAIL SAFE

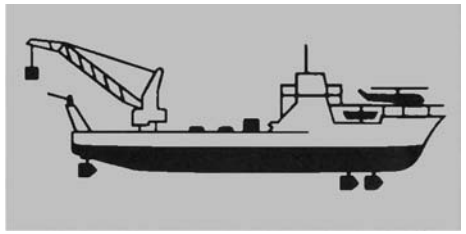
The output channel for the Receiver Battery FAIL SAFE is preset for model types "FL" and "AC" on channel 1 (throttle/spoiler), and for the types "UN", "Fb", "HE" on the channel 8.

As soon as the voltage of the receiver battery falls below a certain value, the associated servo goes to it's central position, to indicate the low battery voltage. By movement of control stick (1 or 8) the FAIL SAFE servo is release, so that servo again operates as desired by the pilot. The model must be landed immediately after the first FAIL SAFE message.



NAUTIC Multi-Prop Modules

Only available in PPM Mode



Optional Transmitter Module

NAUTIC Multi-Proportional Module
Part No. **4141**
Up to two modules are connectable,
(Described on page 92)

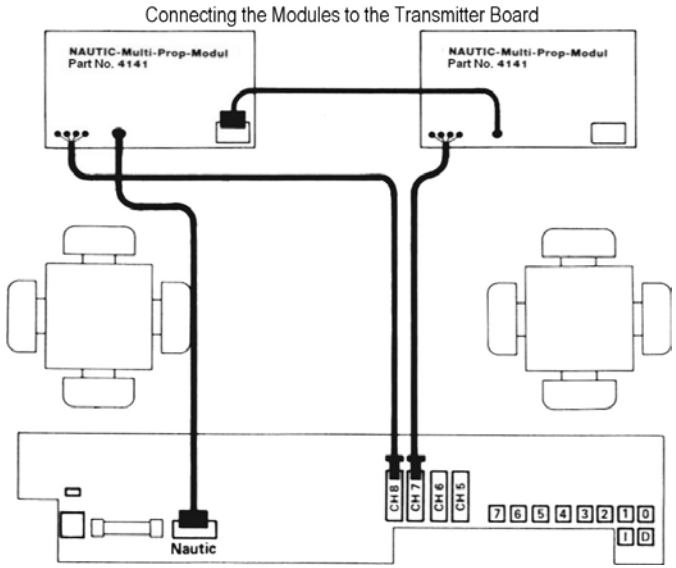
Function Notes
The NAUTIC Multi-Prop module allows two proportional function channels be split into eight proportional channels, i.e. at the receiver connections three additional servo connections are available per module. Two prop. module can transmitter lateral be inserted

Fitting and connection to the mc-16/20 transmitter.
The modules are installed as shown in the instructions on page 8/9 of this manual.
If the NAUTIC program in system menus "NA7" and/or. "NA8" are switched to "ON" (sees page 16), control paths 7 and/or 8 are automatically reserved for NAUTIC modules dependent on the model type.

Model Type	NAUTIC Channels
FL (Standard)	7 and 8
UN (Unifly)	7 and 8
Fb (F3B/Butterfly)	7 and 8
AC (Acrobatic)	7 only
HE (Helicopter)	7 only

The 5-pole connector of the module should to be inserted, e.g. into socket "CH7", and the 4-pole plug on the single-wire cable connected to the "NAUTIC" socket on the transmitter plate. If necessary a second module can be connected to "CH8". The 4-pole plug of the 2nd module is connected to the module already inserted.

Connecting the Modules to the Transmitter Board



Both model types "AC" and "HE" can additionally, if necessary, use channel 5 as well as channel 7 for the NAUTIC modules, under the following conditions:

1. Servo reverse (page 21) NORM
2. Servo Neutral Point (page 21) 0
3. Servo Travel (page 21) ±146%
   The setting is most easily done before inserting the proportional or switch modules (Part No. 4152 or 4151). During the servo travel setting when the NAUTIC modules are connected the display can flicker, which makes reading the exact value more difficult.
4. AC: Code “AUTOLANDING”
   if using ch 7 (page 57, 58) OFF
5. HE: Code “GYRO-CONTROL”
   if using ch 7 (page 78, 79) OFF
6. HE: Code “SWASHPLATE TYPE”
   if using ch 7 (page 66) Type 2 or 3

The transmitter set-up for the NAUTIC modules is now complete.

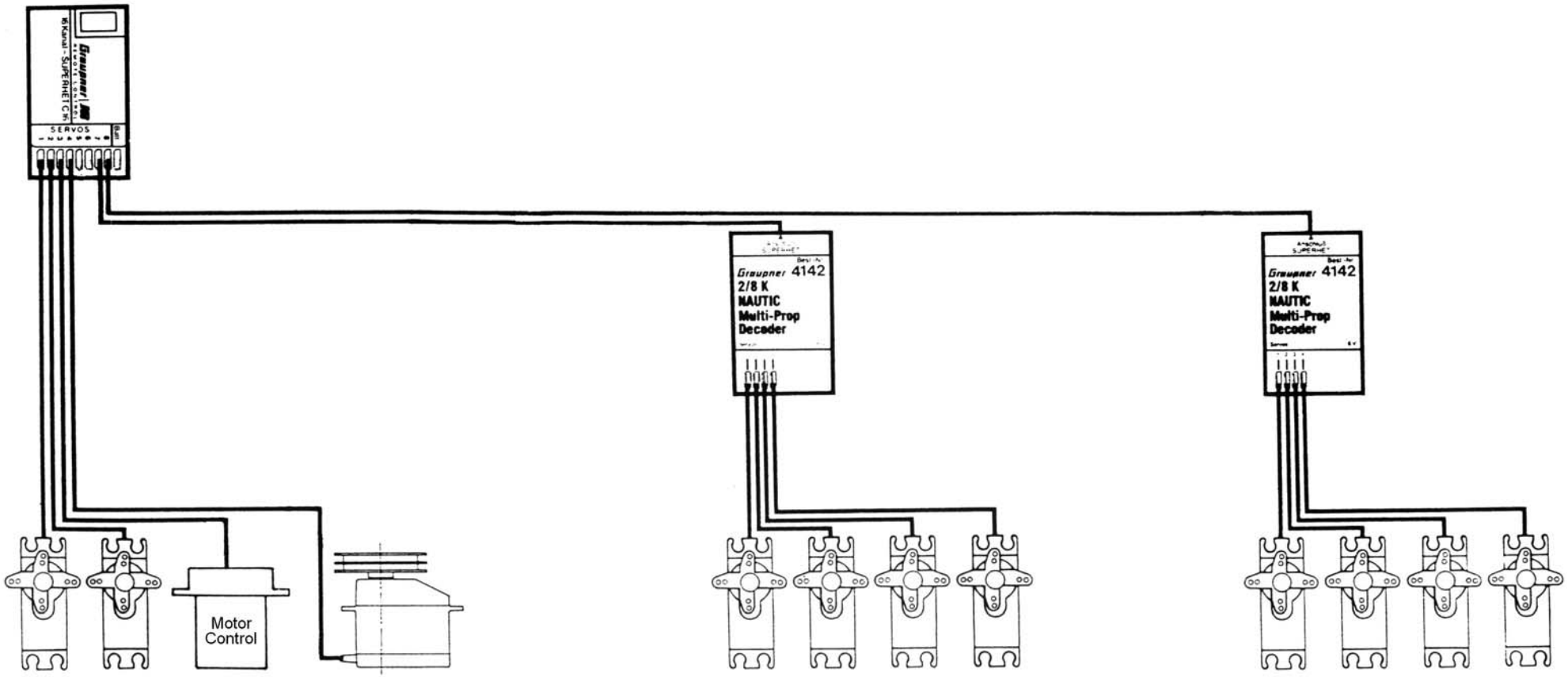
Receiver Requirements

NAUTIC Multi-Prop Decoder
Part No. **4142**
(Described on page 92)

Remark
For each NAUTIC Multi-Prop module a NAUTIC Multi-Prop decoder is necessary.

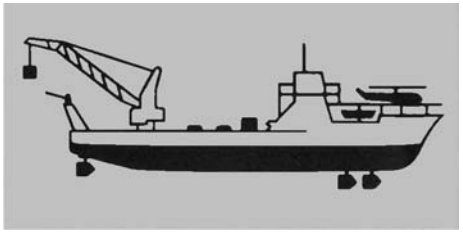
Note:
The NAUTIC Multi-Prop decoder extends two proportional channels (1 servo each), for a transmitter fitted with the NAUTIC Multi-Prop module, to eight proportional channels (4 servos each).

For a trouble free function at least three of the four possible servos should be attached to the NAUTIC Multi-Prop decoder.
An external power supply is not necessary. The servos are supplied via the receiver battery, which should be of sufficient capacity, e.g. 4.8V / 1.4Ah, Part No. 3448.

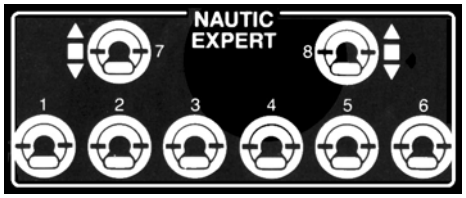


NAUTIC Expert Switch Function Modules

Only available in PPM Mode



Optional Transmitter Module



16 Channel NAUTIC Expert Module
Part No. **4108**
Up to two modules are connectable, (Described on page 92)

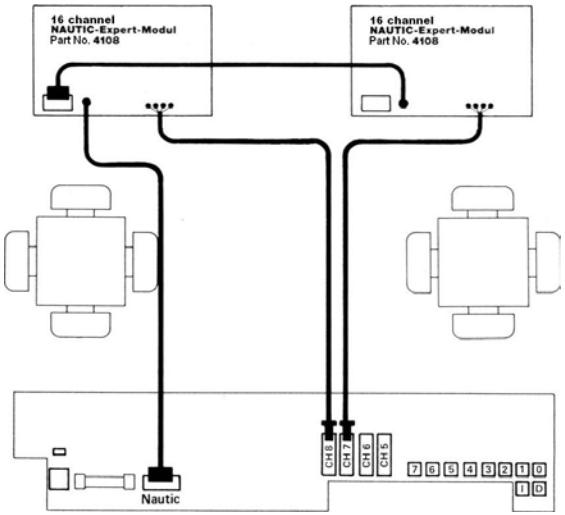
Function Notes

The NAUTIC Expert module extends two proportional channels to 16 signal paths. All eight switches have a central position, providing a genuine forwards–stop–backwards function, if at the receiver a switch module, Part No. 3754.1 or a Dual-Switch **module Part No. 3754.2 is used. Of the 8 switches, 3 switches are sprung-off and 2 are sprung-off in one direction. The remaining 3 switches are intended for forwards–stop–backwards functions and are not self-centring. Transmitter-laterally two modules with altogether 32 switching functions can be installed onto the module blow-out.**

Fitting and connection to the mc-16/20 transmitter.
The modules are installed as shown in the instructions on page 8/9 of this manual.
If the NAUTIC program in system menus "NA7" and/or. "NA8" are switched to "ON" (sees page 16), control paths 7 and/or 8 are automatically reserved for NAUTIC modules dependent on the model type.

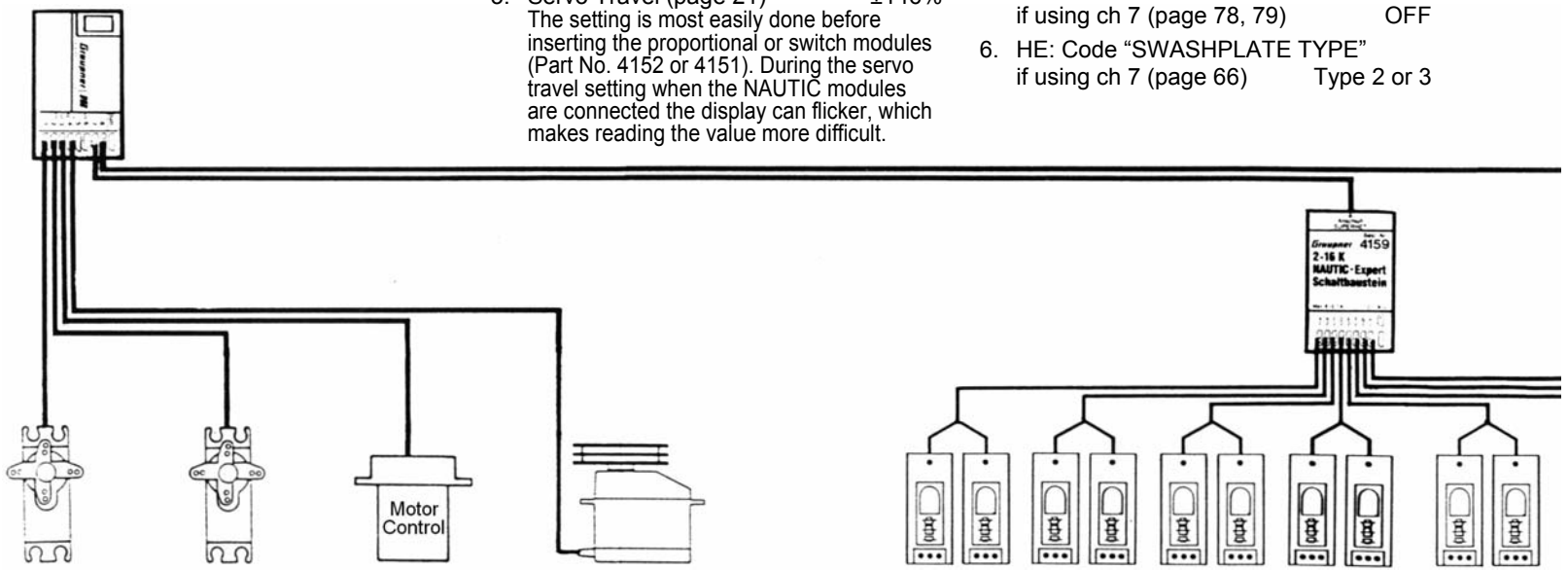
Model Type	NAUTIC Channels
FL (Standard)	7 and 8
UN (Unifly)	7 and 8
Fb (F3B/Butterfly)	7 and 8
AC (Acrobatic)	7 only
HE (Helicopter)	7 only

The 5-pole connector of the module should to be inserted, e.g. into socket "CH7", and the 4-pole plug on the single-wire cable connected to the "NAUTIC" socket on the transmitter plate. If necessary a second module can be connected to "CH8". The 4-pole plug of the 2nd module is connected to the module already inserted.



Both model types "AC" and "HE" can additionally, if necessary, use channel 5 as well as channel 7 for the NAUTIC modules, under the following conditions:

1. Servo reverse (page 21) NORM
2. Servo Neutral Point (page 21) 0
3. Servo Travel (page 21) ±146%
   The setting is most easily done before inserting the proportional or switch modules (Part No. 4152 or 4151). During the servo travel setting when the NAUTIC modules are connected the display can flicker, which makes reading the value more difficult.
4. AC: Code "AUTOLANDING" if using ch 7 (page 57, 58) OFF
5. HE: Code "GYRO-CONTROL" if using ch 7 (page 78, 79) OFF
6. HE: Code "SWASHPLATE TYPE" if using ch 7 (page 66) Type 2 or 3



Receiver Requirements

Part No.	Module	Comments
4159	2 / 16 channel NAUTIC Expert switch element (see page 92)	This module is required for the transmitter switch module to work
3941.6	Socket with 3-core lead	For connecting devices, max. 0.7A / channel
3936 or 3936.1	Y-lead 320 with 100mm cable length	For connecting NAUTIC Switch or Dual-Switch modules
3754.1	NAUTIC Switch Module	Direct link or 2 modules using a Y-lead
3754.2	NAUTIC Dual-Switch Module	Direct link to 2 channels or 1 channel using a Y-lead

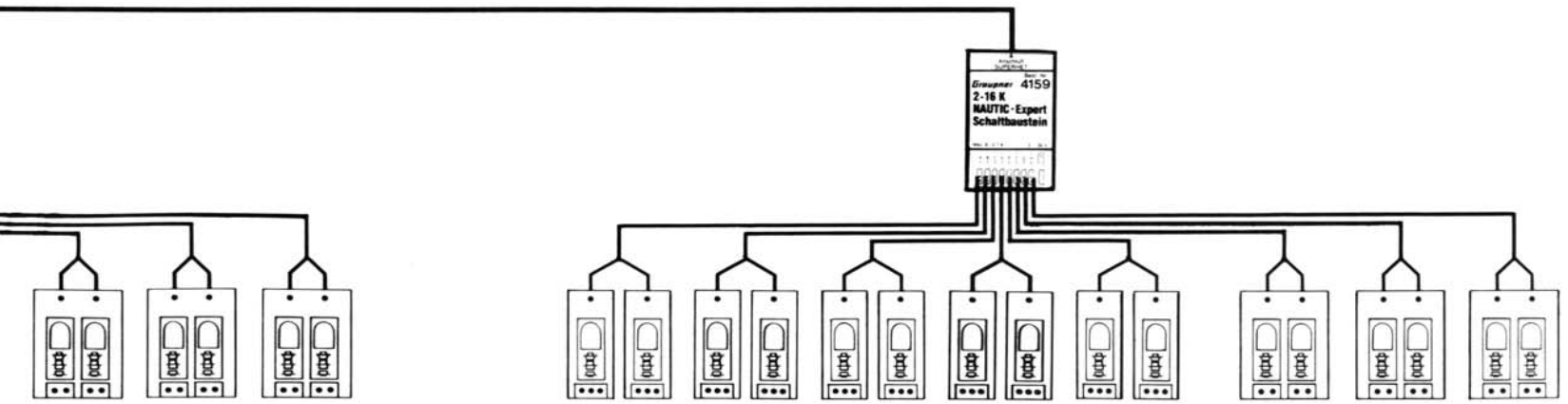
Connection

16 switching functions are available per switching component, and 8 devices, like lamps, LEDs, etc., (electrical motors excluded), with a power requirement of up to 0.7A for each can be directly attached. For each female connector there are two switching functions are possible via the three-core cable Part No. 3941.6 (fig. 2). For electric motors and devices with higher currents the NAUTIC switch or NAUTIC Dual-Switch module is available (fig. 3 + 4). In order to achieve the forward-stop-backwards function, the Dual-Switch module is connected to via a Y-lead. For correct operation one plug of the Dual-Switch module must be inserted in the opposite polarity (sand off the edges of this plug as necessary).

For directly attached consumers and for switching the relays an external power supply is necessary, e.g. a GRAUPNER receiver battery of sufficient capacity, see page 5. Other batteries to a maximum of 30V can be connected with a cable Part No. 3941.6.

Note:

When building your own switch modules, a protection diode is to be soldered across the terminals of the relay coil.



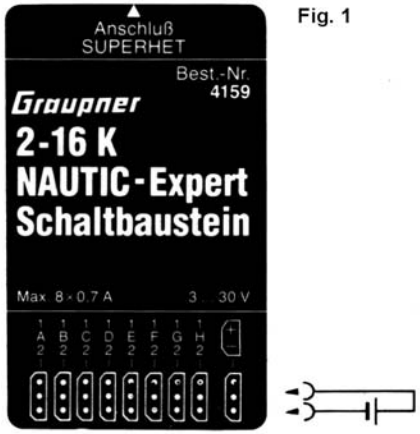


Fig. 1

Fig. 2
Three core cable with socket
Part No. **3941.6**

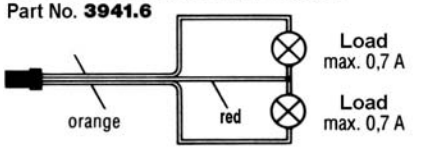


Fig. 3

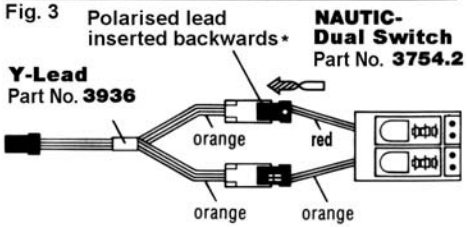
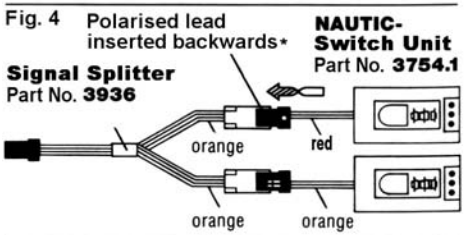
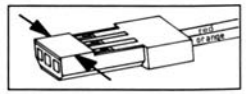


Fig. 4

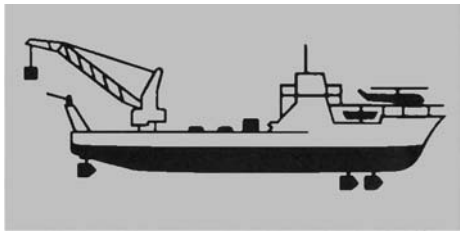


*Taper the other edges of the socket



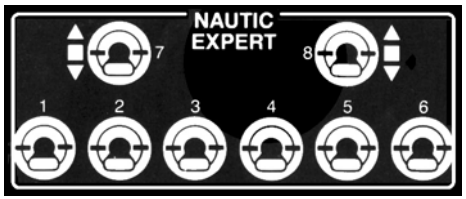
NAUTIC Multi-Prop and Expert Switch Modules

Only available in PPM Mode



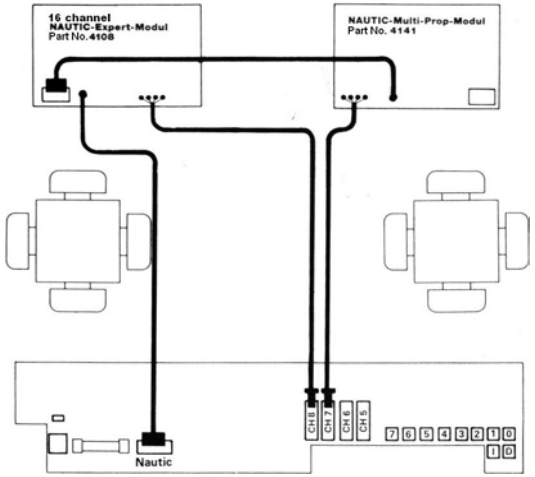
Optional Transmitter Module

NAUTIC Multi-Proportional Module
Part No. **4141**
(Described on page 92)



16 Channel NAUTIC Expert Module
Part No. **4108**
(Described on page 92)

Function Notes
In the case of using a combination of NAUTIC Expert and NAUTIC Multi-Prop modules, 2 channels (sockets CH7 and CH8 on the transmitter board) are extended to 16 switched outputs and 4 proportional channels (4 servos). The connection of both modules takes place as previous described on pages 84 and/or 86.

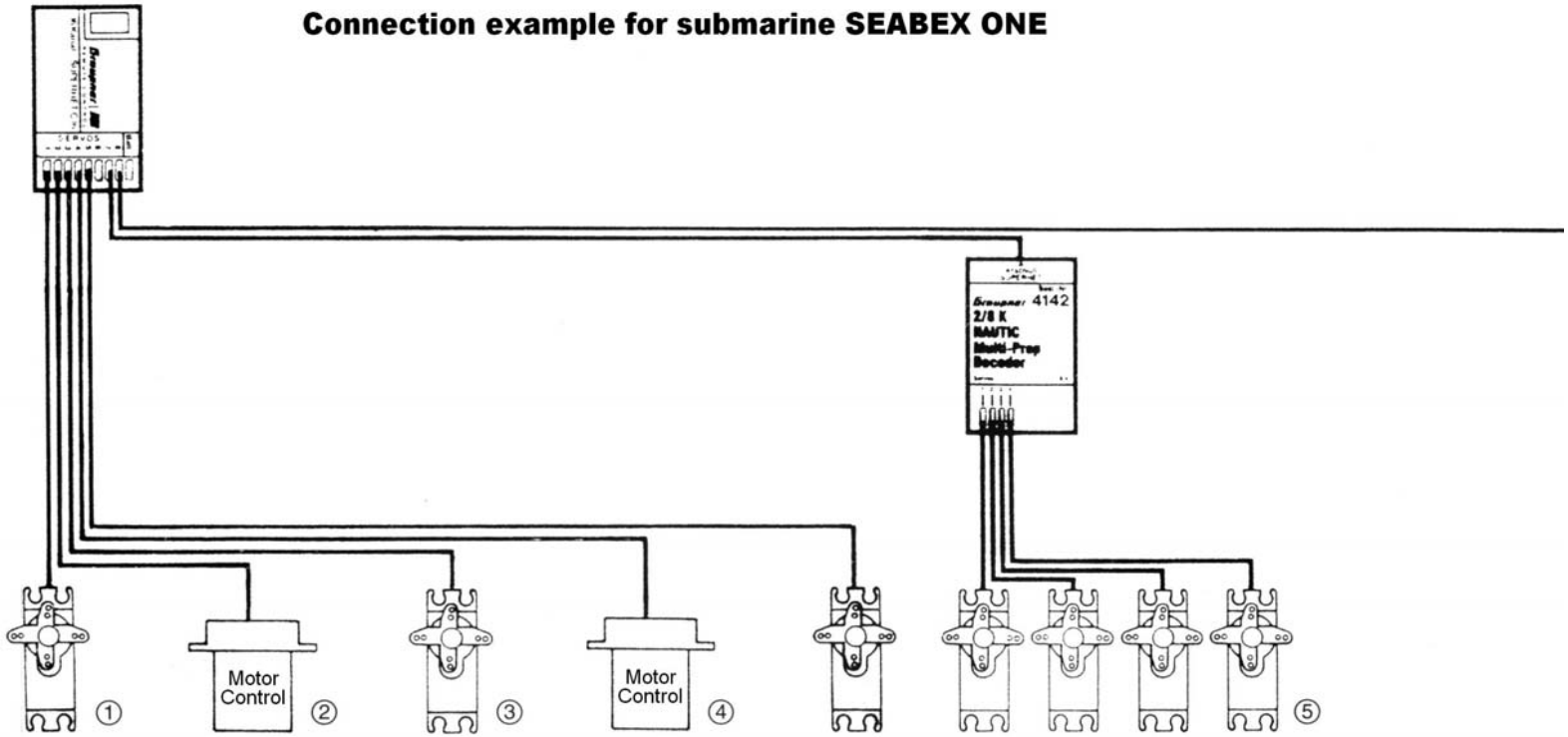


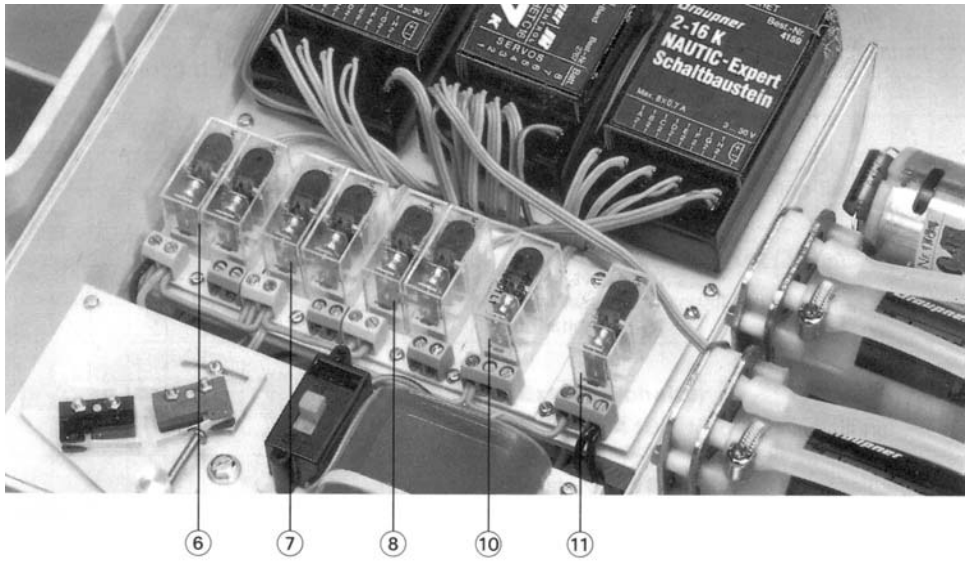
Receiver Requirements

Part No.	Module	Comments
4142	NAUTIC Multi-Prop Decoder	4 servos connected
4159	2-16 channel NAUTIC Expert Switch Module	For 16 switch functions
3941.6	Socket with 3-core lead	For connection of devices max. 0.7 A per signal path
3939 or	Y-Lead 320 with 100 mm	For connection of NAUTIC
3936.1	cable length	Switch or Dual-Switch modules
3754.1	NAUTIC Switch module	Direct connection or via a Y-Lead
3754.2	NUATIC Dual-Switch	Connection 2 channels via a Y-Lead

◁ Connection of the modules to the transmitter board

Connection example for submarine SEABEX ONE





Connection example for submarine SEABEX ONE

Proportional Functions

① Tail propeller direction drive servo right/left

② Tail propeller motor drive forward–stop–backward

③ Tail propeller direction drive servo right/left

④ Tail propeller motor drive forward–stop–backward

⑤ Other proportional function as required

Dual-Switch Functions

(Connected via a Y-Lead, Part No. 3636)

⑥ Crane jib up/down

⑦ Crane rotate left/right

⑧ Crane hook up/down

⑨ Anchor chain up/down

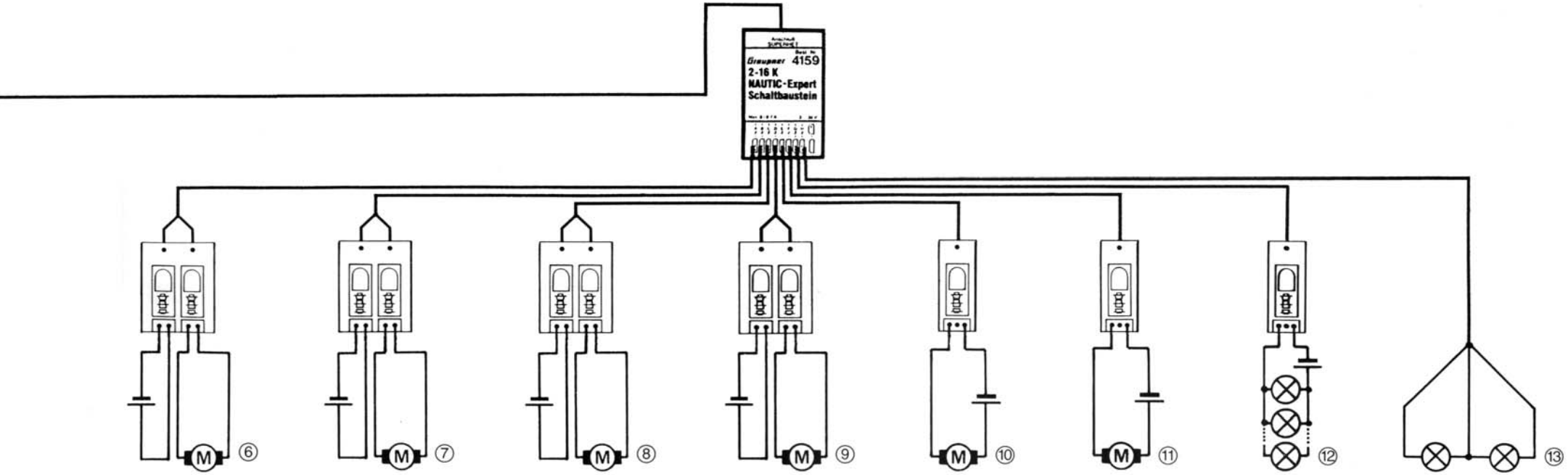
Switch Functions

⑩ Fire pump on/off

⑪ Helicopter rotor on/off

⑫ Ships lighting on/off

⑬ Low current application on/off (Connected by a 3-lead cable, Part No. 3641.6)



ERROR MESSAGE

Storage Error

This message appears in the case of an error of the internal memory, i.e. all the entered data has been deleted and the memory contents reverted to the standard values!
The error can be caused by the complete discharge of the lithium battery on the transmitter plate. It has a duration of up to approx. 5 years and it ensures that the data stored in the memory remains, even when the transmitter remains switched off for a long period of time or excessive discharge of transmitter battery. As soon as the lithium battery voltage drops, the announcement appears after switching on.

appears in the display, and an acoustic warning signal sounds. The error message is cleared by pressing any key.
When this error message appears your transmitter should be returned to a GRAUPNER Service Centre. To avoid damage, the changing of the lithium battery should be undertaken by a GRAUPNER Service Centre.

For You Notes

Switches & Modules


4160.11


4160.44


4160.22

Momentary Switch
Part No. **4160.11**
Sprung-off for momentary switching functions.

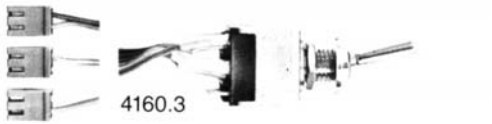
2-way Momentary Switch
Part No. **4160.44**
Used in place of INC/DEC for and required as a start/stop key for stopwatch

Differential Switch (3-way switch)
Part No. **4160.22**
For switching between 2 mixing functions.


4160


4160.1


4160.2


4160.3

External Switches

Part No. **4160** for switching one function – long arm

Part No. **4160.1** for switching one function – short arm

Part No. **4160.2** for simultaneous switching of 2 functions – short arm

Part No. **4160.3** for simultaneous switching of 3 functions – short arm

On/Off switching of special functions, e.g. Mixers


4147.1


4147.2


4147.3

Locking External Switches

Part No. **4147.1** for switching of one function

Part No. **4147.2** for simultaneous switching of 2 functions

Part No. **4147.3** for simultaneous switching of 3 functions

Locking switches have a mechanical locking device, which prevents unplanned operation during use. Only by simultaneous lifting and moving the lever can the switch operated.
Important mixing functions, which inadvertent use could lead to the crash of the flight model, should be secured with locking switches.

4151

4152

2 channel Switch Module
Part No. **4151** with long arm
Part No. **4151.1** with short arm

The switch has 3 positions, so that for example electric motors can be switched forward-stop-backwards. Also for suitable on/off functions, like switching loads, lamps, etc.

2 channel Switch Module
Part No. **4151.2** with short arm
Part No. **4151.3** with long arm

Self-centring on/off switch module. Suitable for switching electric motors, other loads, lamps, etc.

2 channel Proportional Module
Part No. **4152**

Linear control channel, or can be used as proportional control, e.g. with mixers.


4111

Rotary Proportional Control
Part No. **4111**

Rotary control channel, or can be used as proportional control, e.g. with mixers.

4158

External Multiple Switch Module
Part No. **4158**

Three toggle switches without central position, for the operation of Exponential / Dual-rate options or other switching functions. For further auxiliary functions, e.g. mixers, it can be retrofitted with other external switch (Part Nos. 4160, 4160.1, 4160,2 or 4160.3).

NAUTIC Modules

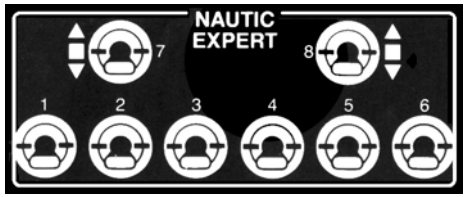
NAUTIC Multi-Prop Module
Part No. **4141**

The module extends proportional functions by using 2 channels to make 8 channels. This module can be inserted at the module places of the transmitter. Thus the ship modeller has a large number of proportional functions available for multi-function ships. At the receiver the NAUTIC Multi-Prop decoder (Part No. 4142) is necessary.

NAUTIC Multi-Prop Decoder
Part No. 4142

The NAUTIC Multi-Prop Decoder allows 2 proportional channels, when using the transmitter Multi-Prop module (Part NO 4141), to become 8 proportional channels. Thus an extension to the Multi-System of 3 servos is possible per Multi-Prop Decoders connected to the servo socket of the receiver.

Power Required, ca.	**10 mA**
Dimensions, ca.	**69 x 42 x 20 mm**
Weight, ca.	**27g**



16 Ch NAUTIC Expert Switch Module
Part No. **4108**

This module extends 2 channels to 16 switch outlets. All 8 switches have a central position, which makes it possible to switch a function forward-stop-backwards where required.

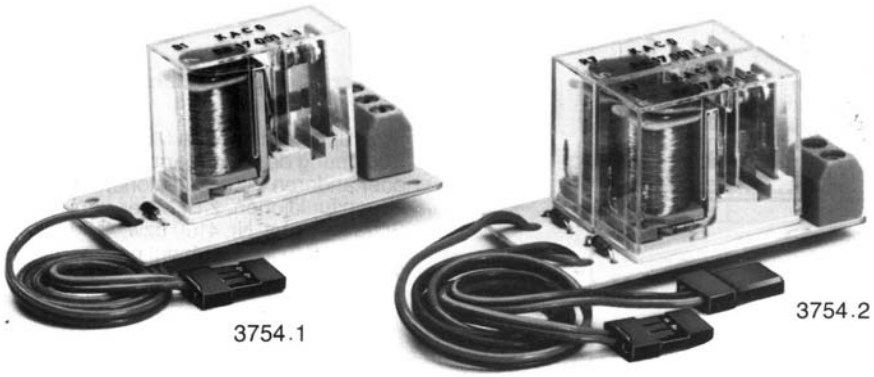
3 switches are sprung-off and 2 are sprung-off in one direction. 2 models can be mounted in the transmitter, and together providing 32 switch functions.

For each module, the receiver requires a 2-16K NAUTIC Expert Switch module (part No. 4159).

2-16K NAUTIC Switch Block
Part No. **4159**

With the retrofitting of the transmitter with the NAUTIC Expert module, Part No. 4108, and the receiver connected to 2 NAUTIC Expert switch blocks it is possible to extend to 32 switch outlets.

The devices can be supplied from a common power source or, if using the appropriate wiring leads, by several power sources.



NAUTIC Switch Module
Part No. **3754.4**

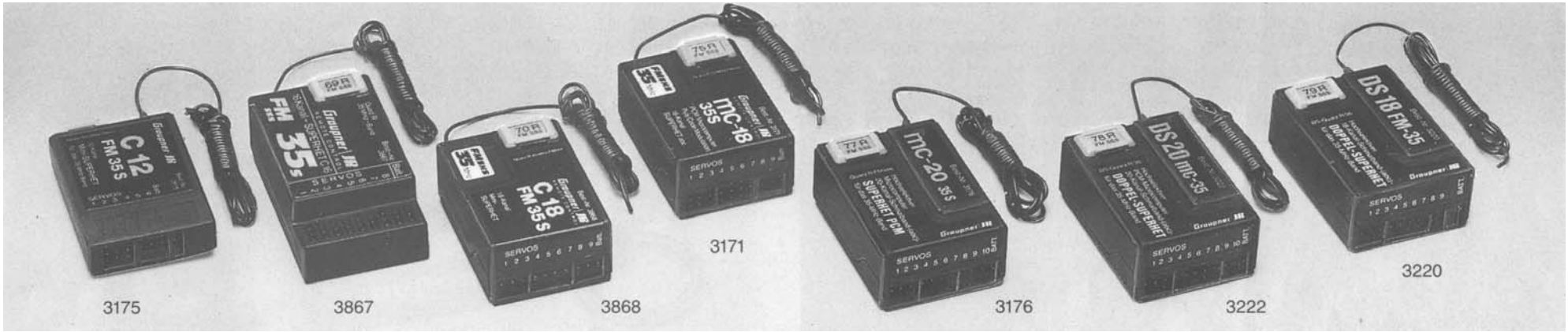
NAUTIC Dual-Switch Module
Part No. 3754.2

The modules are attached via their leads to the 2-16K NAUTIC Expert Switch Block, Part No. 4159.
The high-quality, durable relays permit the switching of devices of high power, e.g. electric motors, lamps, pumps etc. The 2 relays of the Dual-Switch Module, Part No. 3754.2, are wired in such a way that an attached electric motor can be operated forward-stop-backwards. The loads are attached using the screw terminal strips.

Technical Data

	Switch Module 3754.1	Dual-Switch Module 3754.2
Receiver Voltage	4.8 – 12V	4.8 – 12V
Max. Current	16A	16A
Switching Voltage	24V	24V
Dimensions, ca.	50 x 27 x 26 mm	50 x 30 x 26 mm
Weight, ca.	25g	45g

Receivers



Miniature SUPERHET C 12
12 Channel Narrow Band Receiver
Part No. **3175** for the 35MHz band
Part No. **4075** for the 40MHz band

Miniature SUPERHET C 16
16 Channel Narrow Band Receiver
Part No. **3867** for the 35MHz band
Part No. **4067** for the 40MHz band

Miniature SUPERHET C 18
18 Channel Narrow Band Receiver
Part No. **3868** for the 35MHz band
Part No. 4068 for the 40MHz band

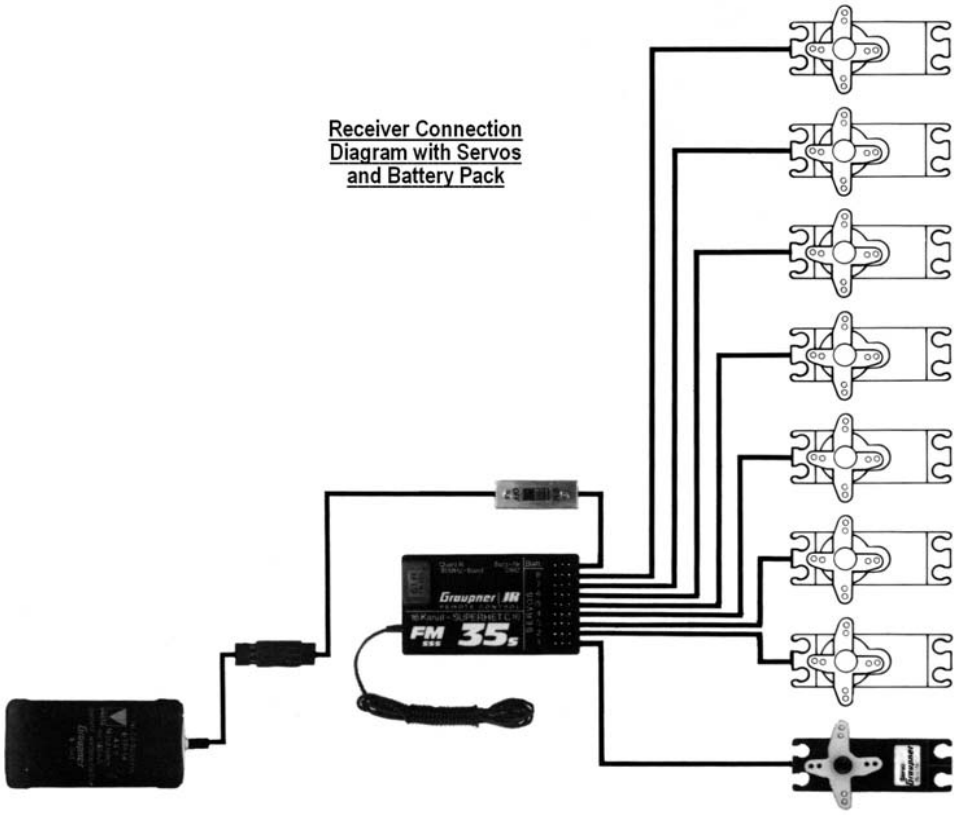
Miniature SUPERHET C 19 (not shown)
18 Channel Narrow Band Receiver
Part No. **3179** for the 35MHz band
Part No. **4074** for the 40MHz band

Mini SUPERHET mc-18
18 Ch FM/PCM Narrow Band Receiver
Part No. **3171** for the 35MHz band
Part No. **4071** for the 40MHz band

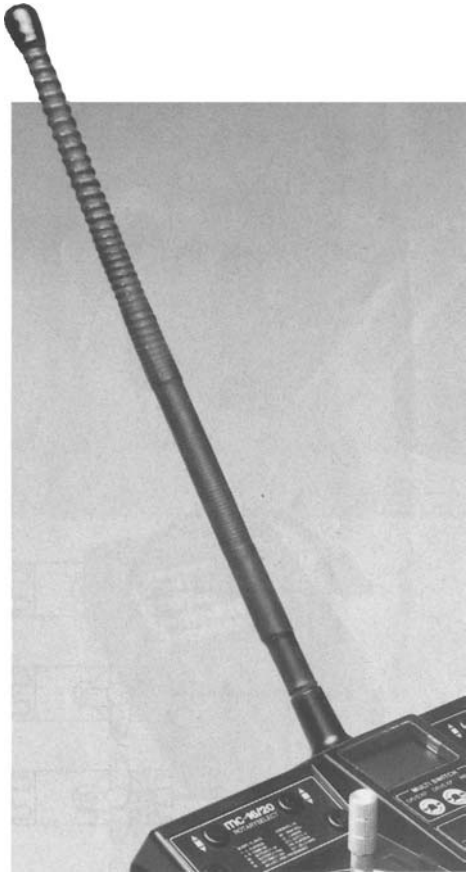
Mini SUPERHET mc-20
20 Ch FM/PCM Narrow Band Receiver
Part No. **3176** for the 35MHz band
Part No. **4046** for the 40MHz band

Mini SUPERHET DS 18
18 Ch PPM Narrow Band Receiver
Part No. **3220** for the 35MHz band
Part No. **4041** for the 40MHz band

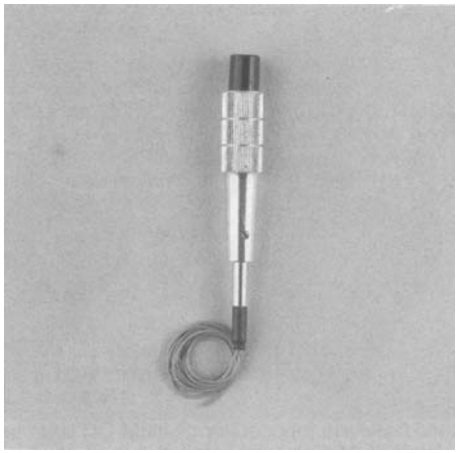
Mini SUPERHET DS20 mc
20 Ch FM/PCM Narrow Band Receiver
Part No. **3222** for the 35MHz band
Part No. **4042** for the 40MHz band



Accessories for Transmitters



Flexible Antenna
Flexible short antenna for optimal freedom of movement and unrestricted use of the transmitter. The radiation achieved is similar to that of the telescopic antenna at full length. For models needing high safety requirements, e.g. for speed and large-scale models and for longer distances, you should use the telescopic antenna supplied with the transmitter.
Dimensions max, ca. 400 mm
Part No. 1149.35 for 35MHz band
.40 for 40MHz band



Push Button
Part No. **4144***
With pressure on the button the switch is operated and it releases to the "off" only when pressing the button again position. The Push Button can be changed, by removing a locking link, to a momentary button, where the function remains "on" only whilst the button is pressed.

HF Transmitter Module (shown on page 11)

Part No. **4824.35** for 35MHz band
4824.40 for 40MHz band

For technical data see page 99.

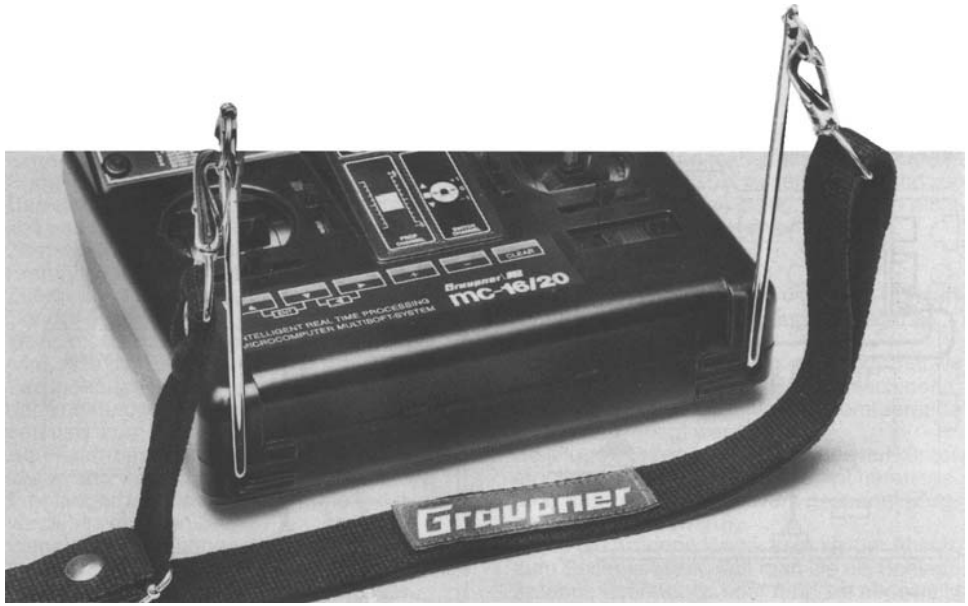
By fitting the appropriate quartz crystal the frequency channel is selected. The crystal inserted in the transmitter must carry the same channel number as that inserted in the receiver.
Only original GRAUPNER FMsss quartz crystal should be used (see page 98)!

2 Function Stick Switch
Part No. **4143***
A control stick with a single pole for operating 2 functions. For special applications, particularly for competition pilots.

3 Function Stick Switch
Part No. **4113***
A control stick with an integral switch with centre-off position for operating 3 functions.
Suitable for special functions, e.g. for high-speed and F3B-models to switch between start, neutral and speed settings or with F3E models as a motor switch for off, half and full throttle.

Rotary Proportional Control Stick
Part No. **4112***
A rotary proportional control integrated in a control stick for trim and setting functions, or as automatic an engine speed controller. It is also usable for similar special functions.

*Installation has to be made by a GRAUPNER service centre.



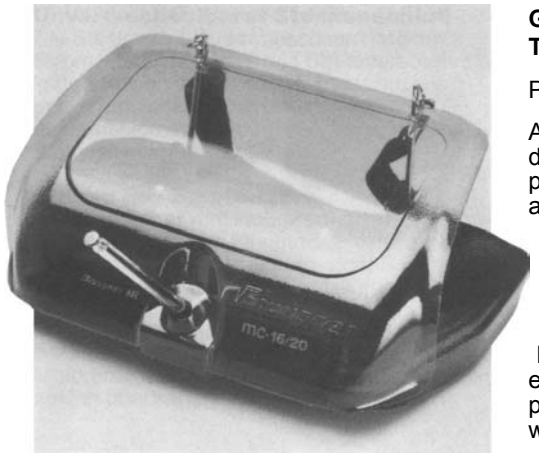
Transmitter Suspension System
Part No. **1127**

The retaining arms can be locked in the stowed and working positions. The entire transmitter upper surfaces is accessible and unhindered. It features holes for the attachment of a neck strap.

Neck Strap
Part No. **1125**

Adjustable length, 30mm wide and fitted with attachment clips.

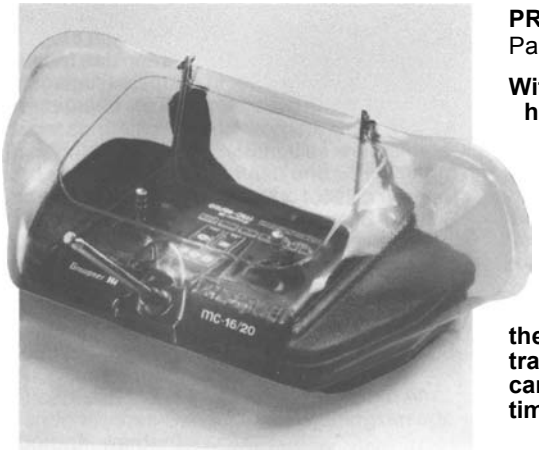
PROFI Transmitter Tray
Part No. **3082**
Wide hand rest surfaces make possible sensitive, precise steering even over extended periods.
The outer is shaped with a double bowl technology. Two user removable covers provide access to storage boxes for small articles such as crystals , other small accessories or to accommodate sunglasses etc,.



GRAUPNER for the PROFI Transmitter Tray Rain Cover

Part No. **3085** (for Transmitter Tray 3082)

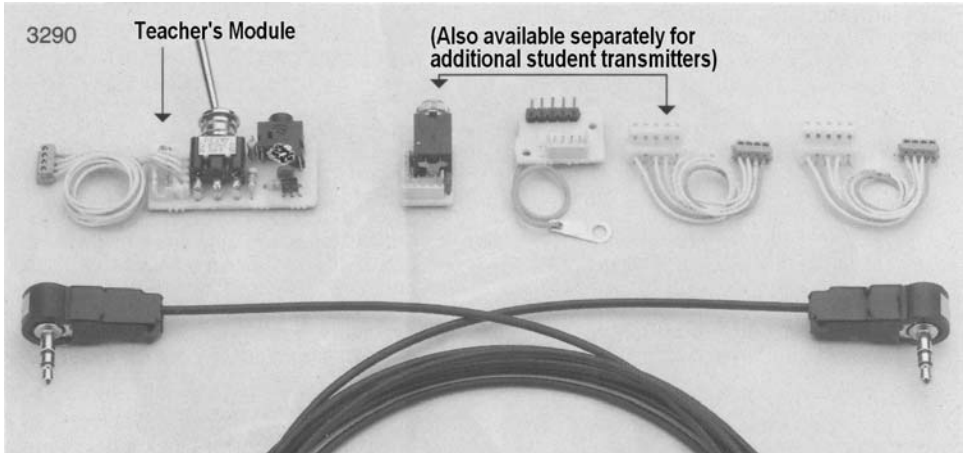
An ergonomically designed rain cover developed by an experienced competition pilot. Both the transmitter and the hands are protected from unexpected rain. Full freedom of movement, for the operation of the transmitter, is ensured.
The cover is made from high-quality, smoke coloured, transparent plastic.
To fit the rain cover it is simply pushed between the transmitter and the tray and engaged at the transmitter mounting points. It can just as simply be removed whenever required.



PROFI Transmitter Cover II
Part No. **3087** (for Transmitter Tray 3082)

With the transmitter desk Saver II, from high-quality transparent plastic, both the transmitter and the hands are protected against influences of the weather such as rains and snow. Also with low temperatures outside and an icy wind the hand protections make sensitive control possible. The transmitter tray cover is simply pushed onto the tray and engaged at the transmitter tray mounting points. Just as simply it can be also be removed again at any time.

Teach – Pupil System with Fibre-Optic Cable



Opto-electrical Teach-Pupil System with Fibre-optic cable
Part No. **3290**

The teacher and pupil transmitters may be operated only in the PPM mode.

For connection between transmitter types D 14, FM 414, FM 4014, FM 6014, FM 6014 / PCM 18, mc-14, mc-15, mc-16, mc-16/20, mc-17, mc-18 and mc-20.

With this option and operation of the integrated momentary switch allows all control functions of the teacher's transmitter to be transferred to the pupil's transmitter.

It is necessary that the pupil's transmitter contains all the same programming, mixing and coupling functions as the teacher's transmitter as this data is not transferred.

For the installation of the teacher-pupil training system in teacher transmitter, it is required to drill a further hole into the right or left facia plate using a 6 mm drill. Please you make sure that no metal debris enters the inside the transmitter – there is a **risk of short circuits!**

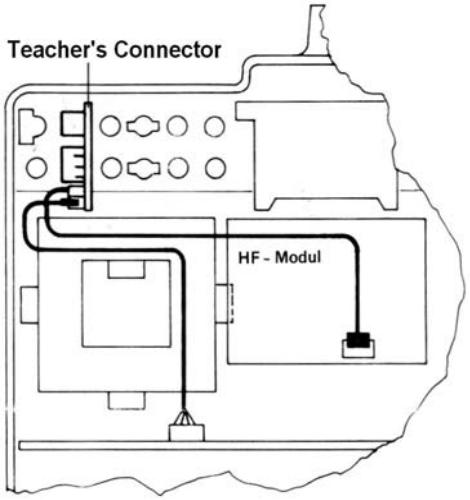
Function Notes
Switch the transmitters into PPM mode.

Plug M of the teacher-pupil cable into teacher's transmitter, and insert plug S into the pupil's transmitter. Both the teacher and pupil transmitters, must be equipped with suitable transmitter battery.
The HF radiation takes place from the teacher's transmitter and an appropriate crystal must be the installed. The pupil's transmitter needs no HF module

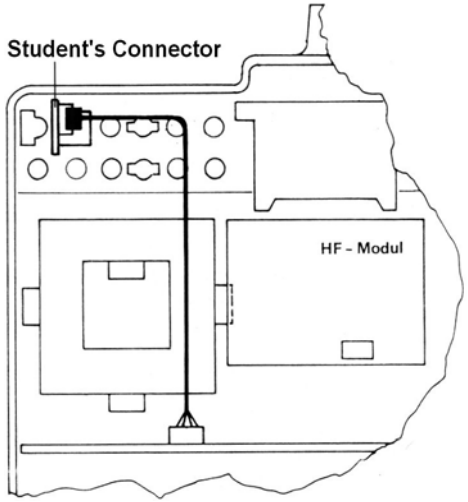
The change-over of control from teacher to pupil takes place by the teacher holding the momentary switch on his transmitter. The teacher need only release the switch to regain control of the model, resume normal flight attitude before handing control back to the pupil again.

Replacement Parts
Part No **3290.4** Fibre-optic cable for teacher-pupil system.

Module for additional pupil transmitters
Part No. 3290.3



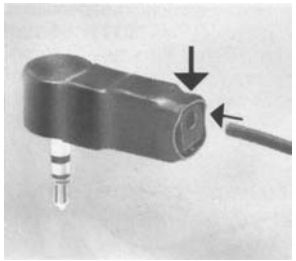
Installation in the Teacher's Transmitter
After installation of the teacher printed circuit board in teacher transmitter (board with switch and socket).
Disconnect the plug on the transmitter board from the HF Module and plug this into the socket on the teacher PCB.
Connect the lead soldered to the teacher PCB to the HF Module.



Installation in the Pupil's Transmitter
After installation of the board, unplug the HF Module lead at the transmitter board and connect the lead from the module in it's place.

Troubleshooting:

- The interface is not correctly connected to the HF Module.
- Pupil's transmitters is not switched on.
- Pupil's transmitters is not in PPM mode.
- The fibre-optic cable is damaged.
- The optical cable has worked loose from one of the sockets. In this case release the clamping device in the plug by pressing down as shown and push the fibre-optic cable back in.



Supplementary Information

Use of the Remote Control System

Treat your remote control equipment carefully to ensure that it is always reliable and ready for use.
Switch on the transmitter first, only then switch on the receiver.
Switch off the receiver first and only then switch off the transmitter.
If this sequence is not observed, i.e. the receiver is switched on first with transmitter switched off, the receiver can affected by other signals and unpredictable results can occur. The servos may jitter applying a high load to the battery and cause it to discharge quicker than expected.
If you notice the movement of the servos becoming slower, the receiver battery is discharging and it should charged or a new battery fitted.
Extended the transmitter antenna fully before commencing to fly.
In the direction the antenna points only a small field strength is generated. It is therefore wrong to point the antenna towards the model for best reception.
With simultaneous use of remote control sets on adjacent channels the pilots should stand together in a loose group.
Plots not standing in the group endanger both their and other models.

Polarised Connectors

The plugs of the servos and the power supplies are polarized can be inserted into the receiver one way round. This is achieved by one side having a bevelled edge and the receiver sockets being shaped accordingly.

Installation of Receivers

The receiver be mounted in foam rubber to protect it from impacts. It should also be fitted behind a strong frame and/or in vehicles or ship models protected from dust and water splashes.
The receiver should not be fitted directly the fuselage, chassis or hull, since otherwise engine vibrations, impacts or landing shocks will transfer directly to it.
The receiver should be installed in such a way that the antenna, servo and power leads are not under tensions or otherwise stressed.

Receiver Antenna

The receiver antenna is connected directly to the case. The length is approx. 100 cm.
The antenna should be routed as straight as possible and as far from electric motors, servos, metallic linkages or power cables.
For flying models the antenna should be routed out of the fuselage by the shortest possible route and attached to the vertical fin (you should use some strain relief!).
If the antenna should be longer than the distance to the vertical fin, let it continue as trailing antenna or route it to the wing tip edge of the horizontal stabilise. Each such bend in the antenna brings a loss of range.
With ships the position of the receiver should be such that the receiver and the antenna as far from drive electric motors, power cables and metal parts.
A blade antenna with a free length or 80 – 100 cm is preferred for ship models over every other antenna type.
With model cars, blade antennas work satisfactorily. Here shortened antennas can be used as the operating range is relatively short.

Power Supply

The power supply for the receiver comes from a rechargeable NiCd 4.8V battery (see page 5 or the main GRAUPNER catalogue). The battery should be wrapped in foam and securely mounted to a strong frame. The cables should be loosely routed making sure that they remain so during any movement of the battery.
The battery can be connected directly to the receiver or by a switch harness.

Examination before Starting

You should check for correct function and range before each use. Switch on the transmitter then the receiver. Remove the transmitter antenna. Check at an appropriate distance from the model that all the controls function perfectly and move in the correct direction.
This check should also be done motor running (an assistant can hold the model.

Installation of Control Linkages

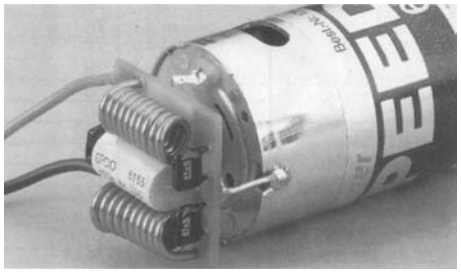
The installation should be done so that the linkages run freely and are low-friction. Linkages and controls that are difficult to operate absorb battery power, reduce the actual working time and unfavourably affect the control position accuracy.
Particularly important is that all control horns can move through their full travel and are not mechanically limited. Taking account of these criteria, the linkages and hinges in the model should be checked. Of particular importance is the motor throttle linkage. The "full power" position must be determined by the stick position and definitely not by the mechanical limits of carburettor. As the model maybe at full throttle for considerable periods the additional drain of a stalled servo would discharge the battery faster than expected. Likewise the idle setting must be achieved by the stick position and not mechanically by limits of the carburettor.

Suppression of Electric Motors

Even high quality electric motors produce sparks at the interface between the brushes and the commutator. Depending on the electric motor, these sparks can cause interference with the radio signal. Therefore, in models with electric drive, the motor must be carefully suppressed. Radio noise filter suppressors reduce these malfunctions to a great extent and are allow the radio system to operate normally. Radio noise filters are to be installed as close as possible to the motor (see figure). Each electric motor should be fitted with it's own radio noise filter. When using suppression filters consideration should be made of the manual of the respective electric motor. Interference suppression should be checked before use of the model, to ensure sufficient range between transmitter and receiver is available.

Suppression Filter

Part No. **3361** 18A
Part No. **3362** 36A
Pre-built Units. Simply soldered between the electric motor and the power cables (see figure). The range of the remote control system is better when using optimal interference suppression and the safety of operation of the model is increased.
The filter absorbs the noise spikes created by electric motors and therefore protects electronic speed controllers.
Electric RC car models with mechanical speed controllers have only basic filtering from the factory. When subsequently fitting an electronic speed controller the motor must then be adequately suppressed.



Servo Extension Lead Suppression.

Part No. **1040**
A servo lead suppression is needed when using long servo leads as the filters in the receiver are insufficient. A filter should be fitted next to the receiver. In critical cases a second filter at the servo can be fitted.
Length approx. 200 mm, weight approx. 3g

Servo Plug

Servo plugs are removed from the receiver socket by pulling about 5-10 cm away from the plug inline with the pin connections.

Battery Capacity & Period of Use

This applies to all battery source: At low temperatures the capacity decreases considerably, therefore the periods of use in cold weather are shorter. The available battery power must be checked more frequently.

Quartz Crystals, Frequency Pennants

Frequency Band	Permitted uses	Channel No.	Transmitter Frequency MHz	FMsss-Quarze Transmitter Part No.	FMsss-Quarze Receiver Part No.	Präzisions-Quarze Transmitter Part No.	Präzisions-Quarze Receiver Part No.	DS Doppelsuper-Quarze Part No.	Flagge Part No.	Permitted in these Countries (without guarantee) D	B	A	DK	F	I	L	N	NL	S	CH
35 MHz-Band **Band A**	FE (nur für Flugmodelle zugelassen)	61	35,010	**3864.61**	**3865.61**	**3264.61**	**3265.61**	**3270.61**	**35.61**											
		62	35,020	**.62**	**.62**	**.62**	**.62**	**.62**	**.62**											
		63	35,030	**.63**	**.63**	**.63**	**.63**	**.63**	**.63**											
		64	35,040	**.64**	**.64**	**.64**	**.64**	**.64**	**.64**											
		65	35,050	**.65**	**.65**	**.65**	**.65**	**.65**	**.65**											
		66	35,060	**.66**	**.66**	**.66**	**.66**	**.66**	**.66**											
		67	35,070	**.67**	**.67**	**.67**	**.67**	**.67**	**.67**											
		68	35,080	**.68**	**.68**	**.68**	**.68**	**.68**	**.68**											
		69	35,090	**.69**	**.69**	**.69**	**.69**	**.69**	**.69**											
		70	35,100	**.70**	**.70**	**.70**	**.70**	**.70**	**.70**											
		71	35,110	**.71**	**.71**	**.71**	**.71**	**.71**	**.71**											
		72	35,120	**.72**	**.72**	**.72**	**.72**	**.72**	**.72**											
		73	35,130	**.73**	**.73**	**.73**	**.73**	**.73**	**.73**											
		74	35,140	**.74**	**.74**	**.74**	**.74**	**.74**	**.74**											
		75	35,150	**.75**	**.75**	**.75**	**.75**	**.75**	**.75**											
		76	35,160	**.76**	**.76**	**.76**	**.76**	**.76**	**.76**											
		77	35,170	**.77**	**.77**	**.77**	**.77**	**.77**	**.77**											
		78	35,180	**.78**	**.78**	**.78**	**.78**	**.78**	**.78**											
		79	35,190	**.79**	**.79**	**.79**	**.79**	**.79**	**.79**											
		80	35,200	**.80**	**.80**	**.80**	**.80**	**.80**	**.80**											
Band B Nur für Geräte, die für das Band B zugelassen sind. Nachstimmen bisheriger Geräte über den Service.	(nur für Flugmodelle zugelassen)	182	35,820	**.182**	**.182**	**.182**	**.182**	**.182**	**.182**											
		183	35,830	**.183**	**.183**	**.183**	**.183**	**.183**	**.183**											
		184	35,840	**.184**	**.184**	**.184**	**.184**	**.184**	**.184**											
		185	35,850	**.185**	**.185**	**.185**	**.185**	**.185**	**.185**											
		186	35,860	**.186**	**.186**	**.186**	**.186**	**.186**	**.186**											
		187	35,870	**.187**	**.187**	**.187**	**.187**	**.187**	**.187**											
		188	35,880	**.188**	**.188**	**.188**	**.188**	**.188**	**.188**											
		189	35,890	**.189**	**.189**	**.189**	**.189**	**.189**	**.189**											
		190	35,900	**.190**	**.190**	**.190**	**.190**	**.190**	**.190**											
		191	35,910	**.191**	**.191**	**.191**	**.191**	**.191**	**.191**											
40 MHz-Band	MF	50	40,665	**4064.50**	**4065.50**			**3240.50**	**40.50**											
		51	40,675	**.51**	**.51**			**.51**	**.51**											
		52	40,685	**.52**	**.52**			**.52**	**.52**											
		53	40,695	**.53**	**.53**			**.53**	**.53**											
	Nur für Schiffs- und Automodelle zugelassen	54	40,715	**.54**	**.54**			**.54**	**.54**											
		55	40,725	**.55**	**.55**			**.55**	**.55**											
		56	40,735	**.56**	**.56**			**.56**	**.56**											
		57	40,765	**.57**	**.57**			**.57**	**.57**											
		58	40,775	**.58**	**.58**			**.58**	**.58**											
		59	40,785	**.59**	**.59**			**.59**	**.59**											
		81	40,815	**.81**	**.81**			**.81**	**.81**											
		82	40,825	**.82**	**.82**			**.82**	**.82**											
		83	40,835	**.83**	**.83**			**.83**	**.83**											
		84	40,865	**.84**	**.84**			**.84**	**.84**											
		85	40,875	**.85**	**.85**			**.85**	**.85**											
		86	40,885	**.86**	**.86**			**.86**	**.86**											
		87	40,915	**.87**	**.87**			**.87**	**.87**											
		88	40,925	**.88**	**.88**			**.88**	**.88**											
		89	40,935	**.89**	**.89**			**.89**	**.89**											
		90	40,965	**.90**	**.90**			**.90**	**.90**											
		91	40,975	**.91**	**.91**			**.91**	**.91**											
		92	40,985	**.92**	**.92**			**.92**	**.92**											

Technical Data

Technical Data – Computer Transmitter **mc**-16/20	
Transmission System	FM/FMsss switchable to PCM with single chip micro computer system
HF System	Changeable module for 10 kHz channel spacing 35 or 40 MHz frequency
Quartz FMsss Crystals	35 MHz band, channels 61 – 80 and 182 to 191 40 MHz band, channels 50 – 59 and 81 to 92
Channel Spacing	10 kHz
Control Channel max.	16
Control Channel Basic	8 channel proportional, all electronic trims
Channel Expansion	8 channel proportional or switched
Channel Signal Timing	1.5 ms ± 0.5 ms, including trims
Control Signal Steps	512 step with single chip micro computer system
Antenna	Telescopic, 10 section, approx. 1470 mm long
Battery Voltage	9.6 to 12V
Current Drain, ca.	75mA (without HF module)
Weight with Battery, ca.	1000 g
Dimensions, ca.	215 x 192 x 75 mm

Technical Data – HF Transmitter Module	
Part No. – HF Module	4824.35 for 35 MHz band 4824.40 for 40 MHz band
Emission Classes	F1D, F3D
Power requirement with basic equipment	2W
Channel Spacing	10 kHz
Battery Voltage	9.6 to 12V
Current Drain, ca.	150mA
Temperature Range	–15 to +55°C
Dimensions, ca.	65 x 47 x 55 mm
Weight, ca.	35 g

Receiver Type	C 12 FM 12 Ch SUPERHET	C 16 FM 16 Ch SUPERHET	C 18 FM 18 Ch SUPERHET	C 19 FM 19 Ch SUPERHET	**mc**-18 18 Ch PCM	**mc**-20 20 Ch PCM	DS 18 FM 18 Ch PPM	DS 20 **mc** 20 Ch PCM
Receiver for 35 MHz band for 40 MHz band	Part No. 3175 Part No. 4075	Part No. 3867 Part No. 4067	Part No. 3868 Part No. 3869	Part No. 3179 Part No. 4074	Part No. 3171 Part No. 4071	Part No. 3176 Part No. 4076	Part No. 3220 Part No. 4041	Part No. 3222 Part No. 4042
Battery Voltage	4.8 – 6V	4.8 – 6V	4.8 – 6V	4.8 – 6V	4.8 – 6V	4.8 – 6V	4.8 – 6V	4.8 – 6V
Current Drain, ca.	10 mA	10 mA	10 mA	12 mA	19 mA	17 mA	35 mA	19 mA
Channel Spacing	10 kHz	10 kHz	10 kHz	10 kHz	10 kHz	10 kHz	10 kHz	10 kHz
Sensitivity, ca.	10µV	10µV	10µV	10µV	10µV	10µV	5µV	5µV
Servos outputs	6	8	9	9	9	10	9	10
Temperature Range, ca.	–15 to +55°C	–15 to +55°C	–15 to +55°C	–15 to +55°C	–15 to +55°C	–15 to +55°C	–15 to +55°C	–15 to +55°C
Antenna Length, ca. (mm)	1000	1000	1000	1000	1000	1000	1000	1000
Dimensions, ca. (mm)	53 x 36 x 15	62 x 36 x 21	51 x 36 x 21	51 x 36 x 16	51 x 36 x 21	53 x 38 x 21	53 x 38 x 21	53 x 38 x 21
Weight, ca. (g)	29	45	45	35	38	45	45	45

General Permissions

Transmitter and Receiver for the 27 and 40 MHz bands are registered and can be used without charge.

General permission for a Radio concerning the remote control of models

(Version dated 15.4.1987)

1. Establishing and operating radio communication systems for remote control flight , ships and other vehicle models for sport purposes with a Federal Post Office permission character and the additional marking "MF" or a Federal Post Office certification number (FTZ-Series test number) of the identification letter row "MF..." is hereby generally approved on 27.6.1966 due to §§ the 1 and 2 of the law over telecommunication installations in the version of the proclamation on 17.3.1977, changed by the law, for the area of application of this law.

2. For this permission, following conditions apply:

a) the radio communication systems for the remote control of models must carry a Federal Post Office permission character valid and intended for this device type and the additional "MF" marking or a Federal Post Office certification number (FTZ-Series test number) for the identification letter row "MF..." and

b) may only be equipped for those following specified frequencies:

(Frequency "First Choice")

13.560 MHz	40.665 MHz
26.995 MHz	40.675 MHz
27.045 MHz	40.685 MHz
27.095 MHz	40.695 MHz
27.145 MHz	
27.195 MHz	
27.255 MHz	

or

(Frequency "Second Choice")

27.005 MHz	40.715 MHz 1)
27.015 MHz	40.725 MHz
27.025 MHz	40.735 MHz
27.035 MHz	40.765 MHz
27.055 MHz	40.775 MHz
27.065 MHz	40.785 MHz
27.075 MHz	40.815 MHz
27.085 MHz	40.825 MHz
27.105 MHz	40.835 MHz
27.115 MHz	40.865 MHz
27.125 MHz	40.875 MHz
27.135 MHz	40.885 MHz
	40.915 MHz
	40.925 MHz
	40.935 MHz
	40.965 MHz
	40.975 MHz
	40.985 MHz 1)

c) Other telecommunication installations, which serve public purposes, and radio communication systems, those on frequencies outside of the frequency ranges

13.553 – 13.567 MHz
26.957 – 27.283 MHz
40.66 – 41.00 MHz

Maybe operated but not distributed.

d) Radio communication systems for the remote control of models may not be changed electrically and/or mechanically.

e) Connecting of a radio communication system for the remote control of models with other telecommunication installations is inadmissible.

3. Pertinent traffic instructions, liability instructions and-accident prevention instructions for remote-controlled models remain unchanged.

4. Terms of the permission. This "general permission" is given under the following terms, the component of permission are:

a) The aforementioned operating frequencies are for the joint use of high frequency devices and radio communication systems of different kinds! The owner of a radio communication system and the owner of permission do not therefore enjoy, for its radio communication system for the remote control of models, any protection from disturbances by high frequency devices, by other radio communication systems, which are operated in the frequency ranges mentioned, or by other radio communication systems, which are duly operated.

b) All parts of the radio communication system are to be kept in the correct working condition. Failures are to be eliminated immediately.

c) For the examination of the equipment, which is contained within this permission, for the use to be held ready or operated, the owner and owner of this permission have approved the Federal Post Office to enter properties and/or areas, on and/or in which radio communication systems for the remote control of models are, to permit at the normal business hours or to obtain this power. The nominated officer of the Federal Post Office thereby can request information to be given about these equipments.

d) Nominees of the Federal Post Office and Police can demand an inspection of the radio communication systems, falling under this general permission, be permitted

e) The owner of such a radio communication system and owner of this permission are obligated to follow each change or addition of permission immediately and to bear any necessary costs.

f) The Request of the Federal Post Office to cease use of a set of radio communication system for the remote control of models must be followed by the owner and owner of this permission without delay. If it requires, the Federal Post Office, can remove the radio communication system, or parts from it is, to be kept under closer supervision during the suspension of service arranged.

g) If this permission expires, then the arrangement over the removal of the radio communication system of the Federal Post Office is to be obeyed.

5. This "general permission" can be rescinded altogether or, for individual radio communication systems for the remote control of models, also for an individual user by the responsible local regional directorate.

A revocation is permissible in particular if the terms of the permission are not kept. Instead of recalling a permission, the Federal Post Office can arrange that due to offences against the terms the radio communication systems are to be put out of operation. Only on adherence to the terms again may operation be allowed.

The Federal Post Office can supplement or change the conditions and terms of this permission at any time.

1) The frequencies between 40,700 MHz and 41,000 MHz may not be used for flight models.

Auxiliary information for manufacturers, trading companies, salesmen and purchasers

1. Radio communication systems for the remote control of models do not require detailed special permission, if the individual equipment is recognizable and entitlement proven by a Federal Post Office permission character and the additional marking "MF" and/or a Federal Post Office certification number (FTZ-series test number) to the identification letter row "MF..." carries. Permission fees are not raised.

2. Only on radio communication systems for the remote control of models which comply with the central office for permissions in the telecommunication system and/or are examined and certified electrical and mechanical designs by the telecommunication technically engineering central office may carry the Federal Post Office permission character with the additional marking "MF" and/or a Federal Post Office certification number (FTZ–series test number) of the identification letter row "MF..." assigned on their case.

3. A Federal Post Office permission character and the additional marking "MF" can only be assigned to a company if a design of this series is presented to the central office for telecommunication system approvals, 6600 Saarbrucken, for examination, and the examination demonstrates that the design corresponds to the appropriate technical regulations (FTZ guideline 17 R 2012) for radio communication systems for the remote control of models.

The applicant must commit themselves, in relation to the Federal Post Office, to

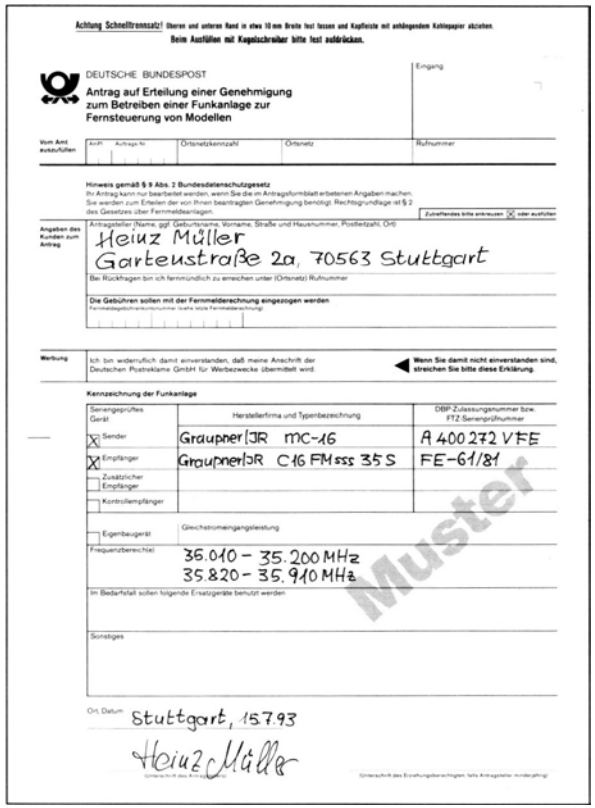
a) That only such examined and certified designs that comply (electrically and mechanically) are marked with the assigned Federal Post Office permission character and the additional marking "MF".

b) To attach to all equipment which can be brought under this Federal Post Office permission character in traffic, a reproduction of this "general permission".

4. It is recommended to the purchaser of a radio communication system, for the remote control of models, to request in his own interest a reproduction of this "general permission" from the salesman or previous owner of the equipment.

Sample licence request form for transmitters and receivers in the 35 MHz Band

You are responsible for registering transmitters and receivers for the 35-MHz-Band at the telecommunication office of the Federal Post Office. The fee for an operating permit that is valid for 10 years permit is currently DM 50. The request form is attached to the transmitter.



Achtung Schnelltrennsatz! Oberen und unteren Rand in etwa 10 mm Breite fest lassen und Kopfleiste mit anhängendem Kohlepapier abziehen.
Beim Ausfüllen mit Kugelschreiber bitte fest aufdrücken.

DEUTSCHE BUNDESPOST

Antrag auf Erteilung einer Genehmigung zum Betreiben einer Funkanlage zur Fernsteuerung von Modellen

Eingang

Vom Amt auszufüllen | Amt | Antrags-Nr. | Ortsnetzkennzahl | Ortsnetz | Rufnummer

Hinweis gemäß § 9 Abs. 2 Bundesdatenschutzgesetz
Ihr Antrag kann nur bearbeitet werden, wenn Sie die im Antragsformblatt erbetenen Angaben machen. Sie werden zum Erteilen der von Ihnen beantragten Genehmigung benötigt. Rechtsgrundlage ist § 2 des Gesetzes über Fernmeldeanlagen.

Zutreffendes bitte ankreuzen X oder ausfüllen

Angaben des Kunden zum Antrag

Antragsteller (Name, ggf. Geburtsname, Vorname, Straße und Hausnummer, Postleitzahl, Ort)

Heinz Müller
Gartenstraße 2a, 70563 Stuttgart

Bei Rückfragen bin ich fernmündlich zu erreichen unter (Ortsnetz) Rufnummer

Die Gebühren sollen mit der Fernmelderechnung eingezogen werden
Fernmeldegebührenkontonummer (siehe letzte Fernmelderechnung)

Werbung

Ich bin widerruflich damit einverstanden, daß meine Anschrift der Deutschen Postreklame GmbH für Werbezwecke übermittelt wird.

Wenn Sie damit nicht einverstanden sind, streichen Sie bitte diese Erklärung.

Kennzeichnung der Funkanlage

Seriengeprüftes Gerät	Herstellerfirma und Typenbezeichnung	DBP-Zulassungsnummer bzw. FTZ-Serienprüfnummer
X Sender	Graupner JR MC-16	A 400 272 VFE
X Empfänger	Graupner JR C16 FM sss 35 S	FE-61/81
Zusätzlicher Empfänger		
Kontrollempfänger		
Eigenbaugerät	Gleichstromeingangsleistung	
Frequenzbereich(e)	36.010 – 35.200 MHz 35.820 – 35.910 MHz	

Im Bedarfsfall sollen folgende Ersatzgeräte benutzt werden

Sonstiges

Muster

Ort, Datum: Stuttgart, 15.7.93

Heinz Müller
Unterschrift des Antragstellers

Unterschrift des Erziehungsberechtigten, falls Antragsteller minderjährig

Customer Approvals
for Transmitter mc-16/20

35 MHz

GRAUPNER / JR mc-16

Approval Number
A 400272 V FE

BUNDESAMT FÜR ZULASSUNGEN IN DER TELEKOMMUNIKATION

ZULASSUNGSURKUNDE

Zulassungsnummer: A400272V

Zus. Kennzeichen: FE

Objektbezeichnung: Graupner/JR mc 16

Zulassungsinhaber: Johannes Graupner
Henriettenstr. 94-96
D-7312 Kirchheim/Teck

Zulassungsart: Allgemeinzulassung

Objektart: Funkanlage zur Fernsteuerung von Flug-Modellen

Die Zulassungsurkunde mit Ausstellungsdatum 18. Juli 1989 wird hiermit ungültig.

Das Zulassungsobjekt erfüllt die technische Vorschrift der Richtlinie FTZ 17 R 2012, Ausgabe März 1985.

Saarbrücken, den 13.01.93

Im Auftrag

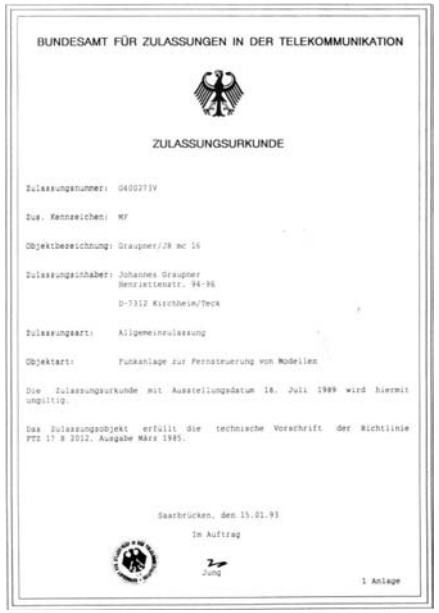
Jung

1 Anlage

40 MHz

GRAUPNER / JR mc-16

Approval Number
G 400273 V MF



BUNDESAMT FÜR ZULASSUNGEN IN DER TELEKOMMUNIKATION

ZULASSUNGSURKUNDE

Zulassungsnummer: G400273V

Zus. Kennzeichen: MF

Objektbezeichnung: Graupner/JR mc 16

Zulassungsinhaber: Johannes Graupner
Henriettenstr. 94-96
D-7312 Kirchheim/Teck

Zulassungsart: Allgemeinzulassung

Objektart: Funkanlage zur Fernsteuerung von Modellen

Die Zulassungsurkunde mit Ausstellungsdatum 18. Juli 1989 wird hiermit ungültig.

Das Zulassungsobjekt erfüllt die technische Vorschrift der Richtlinie FTZ 17 R 2012, Ausgabe März 1985.

Saarbrücken, den 15.01.93

Im Auftrag

Jung

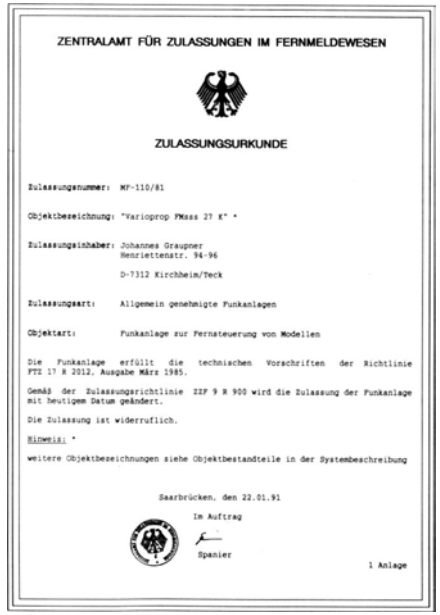
1 Anlage

for FM and PCM Receivers

35 MHz

C 16 FMsss 35 S
C 18 FMsss 35 S
mc-18 35 S
mc-20 35 S

Approval Number
FE-61/81



ZENTRALAMT FÜR ZULASSUNGEN IM FERNMELDEWESEN

ZULASSUNGSURKUNDE

Zulassungsnummer: MF-110/81

Objektbezeichnung: "Varioprop FMsss 27 K" *

Zulassungsinhaber: Johannes Graupner
Henriettenstr. 94-96
D-7312 Kirchheim/Teck

Zulassungsart: Allgemein genehmigte Funkanlagen

Objektart: Funkanlage zur Fernsteuerung von Modellen

Die Funkanlage erfüllt die technischen Vorschriften der Richtlinie FTZ 17 R 2012, Ausgabe März 1985.

Gemäß der Zulassungsrichtlinie ZZF 9 R 900 wird die Zulassung der Funkanlage mit heutigem Datum geändert.

Die Zulassung ist widerruflich.

Hinweis: *

weitere Objektbezeichnungen siehe Objektbestandteile in der Systembeschreibung

Saarbrücken, den 22.01.91

Im Auftrag

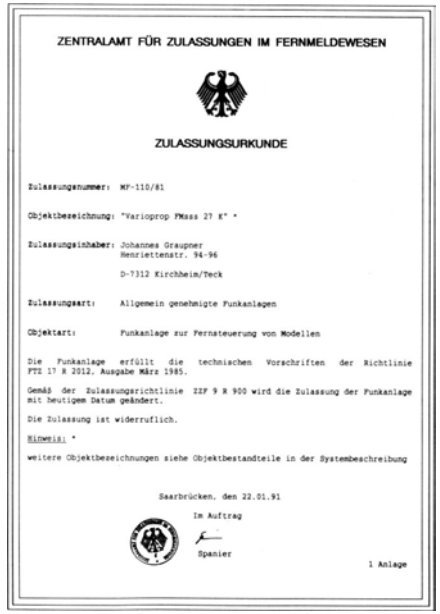
Spanier

1 Anlage

40 MHz

C 16 FMsss 40 S
C 18 FMsss 40 S
mc-18 40 S
mc-20 40 S

Approval Number
MF-110/81



ZENTRALAMT FÜR ZULASSUNGEN IM FERNMELDEWESEN

ZULASSUNGSURKUNDE

Zulassungsnummer: MF-110/81

Objektbezeichnung: "Varioprop FMsss 27 K" *

Zulassungsinhaber: Johannes Graupner
Henriettenstr. 94-96
D-7312 Kirchheim/Teck

Zulassungsart: Allgemein genehmigte Funkanlagen

Objektart: Funkanlage zur Fernsteuerung von Modellen

Die Funkanlage erfüllt die technischen Vorschriften der Richtlinie FTZ 17 R 2012, Ausgabe März 1985.

Gemäß der Zulassungsrichtlinie ZZF 9 R 900 wird die Zulassung der Funkanlage mit heutigem Datum geändert.

Die Zulassung ist widerruflich.

Hinweis: *

weitere Objektbezeichnungen siehe Objektbestandteile in der Systembeschreibung

Saarbrücken, den 22.01.91

Im Auftrag

Spanier

1 Anlage

Customer Approvals for FM Receivers

35 MHz

C 12 FM 35 S

Approval Number
A 012804 B FE

BUNDESAMT FÜR ZULASSUNGEN IN DER TELEKOMMUNIKATION

ZULASSUNGSURKUNDE

Zulassungsnummer: A0128048

Zus. Kennzeichen: FE

Objektbezeichnung: "C 12 FM 35 S"

Zulassungsinhaber: Johannes Graupner
Henriettenstr. 94-96
D-7312 Kirchheim/Teck

Zulassungsart: Allgemeinzulassung

Objektart: Funkanlage zur Fernsteuerung von Flug-Modellen

Das Zulassungsobjekt erfüllt die technische Vorschrift der Richtlinie FTZ 17 R 2012, Ausgabe März 1985.

Die Zulassungsurkunde mit Ausstellungsdatum 04.06.1991 wird hiermit ungültig.

Saarbrücken, den 17.12.92

Im Auftrag

Jung

1 Anlage

40 MHz

C 12 FM 35 S

Approval Number
G 012803 B MF

ZENTRALAMT FÜR ZULASSUNGEN IM FERNMELDEWESEN

ZULASSUNGSURKUNDE

Zulassungsnummer: G0128038

Zus. Kennzeichen: MF

Objektbezeichnung: C 12 FM 40 S, C 12 FM 27 S,

Zulassungsinhaber: Johannes Graupner
Henriettenstr. 94-96
D-7312 Kirchheim/Teck

Zulassungsart: Allgemein genehmigte Funkanlagen

Objektart: Funkanlage zur Fernsteuerung von Modellen

Die Funkanlage erfüllt die technischen Vorschriften der Richtlinie FTZ 17 R 2012, Ausgabe März 1985.

Gemäß der Zulassungsrichtlinie ZZF 9 R 900 wird die Funkanlage mit Wirkung vom 04. Juni 1991 zugelassen.

Die Zulassung ist widerruflich.

Saarbrücken, den 11.02.92

Im Auftrag

Jung

1 Anlage

35 MHz

C 19 FM 35 S

Approval Number
A 106898 D FE

BUNDESAMT FÜR ZULASSUNGEN IN DER TELEKOMMUNIKATION

ZULASSUNGSURKUNDE

Zulassungsnummer: A106898D

Zus. Kennzeichen: FE

Objektbezeichnung: C 19 FM 35 S

Zulassungsinhaber: Johannes Graupner
Henriettenstr. 94-96
D-7312 Kirchheim/Teck

Zulassungsart: Allgemeinzulassung

Objektart: Funkanlage zur Fernsteuerung von Flug-Modellen

Das Zulassungsobjekt erfüllt die technische Vorschrift der Richtlinie FTZ 17 R 2012, Ausgabe März 1985.

Saarbrücken, den 21.05.93

Im Auftrag

Jung

1 Anlage

40 MHz

C 19 FM 40 S

Approval Number
G 106897 D MF

BUNDESAMT FÜR ZULASSUNGEN IN DER TELEKOMMUNIKATION

ZULASSUNGSURKUNDE

Zulassungsnummer: G1068970

Zus. Kennzeichen: MF

Objektbezeichnung: C 19 FM 40 S

Zulassungsinhaber: Johannes Graupner
Henriettenstr. 94-96
D-7312 Kirchheim/Teck

Zulassungsart: Allgemeinzulassung

Objektart: Funkanlage zur Fernsteuerung von Modellen

Das Zulassungsobjekt erfüllt die technische Vorschrift der Richtlinie FTZ 17 R 2012, Ausgabe März 1985.

Saarbrücken, den 21.05.93

Im Auftrag

Jung

1 Anlage

Customer Approvals
for PCM Receivers and Dual-Conversion Superhet

35 MHz

mc-12 PCM 35 S

Approval Number
A 103692 C FE

BUNDESAMT FÜR ZULASSUNGEN IN DER TELEKOMMUNIKATION

ZULASSUNGSURKUNDE

Zulassungsnummer: A103692C

Zus. Kennzeichen: FE

Objektbezeichnung: mc-12 PCM 35 S

Zulassungsinhaber: Johannes Graupner
Henriettenstr. 94-96
D-7312 Kirchheim/Teck

Zulassungsart: Allgemeinzulassung

Objektart: Funkanlage zur Fernsteuerung von Flug-Modellen

Saarbrücken, den 14.07.92

Im Auftrag

Jung

1 Anlage

35 MHz

DS 18 FM 35
DS 20 mc-35

Approval Number
A 400090 A FE

BUNDESAMT FÜR ZULASSUNGEN IN DER TELEKOMMUNIKATION

ZULASSUNGSURKUNDE

Zulassungsnummer: A400090A

Zus. Kennzeichen: FE

Objektbezeichnung: "DS 20 mc-35" oder "DS 18 FM 35 MHz"

Zulassungsinhaber: Johannes Graupner
Henriettenstr. 94-96
D-7312 Kirchheim/Teck

Zulassungsart: Allgemeinzulassung

Objektart: Funkanlage zur Fernsteuerung von Flug-Modellen

Das Zulassungsobjekt erfüllt die technische Vorschrift der Richtlinie FTZ 17 R 2012, Ausgabe März 1985.

Die Zulassungsurkunde mit Ausstellungsdatum 03.07.1991 wird hiermit ungültig.

Saarbrücken, den 17.12.92

Im Auftrag

Jung

1 Anlage

40 MHz

mc-12 PCM 40 S

Approval Number
G 103691 C MF

BUNDESAMT FÜR ZULASSUNGEN IN DER TELEKOMMUNIKATION

ZULASSUNGSURKUNDE

Zulassungsnummer: G103691C

Zus. Kennzeichen: MF

Objektbezeichnung: mc-12 PCM 40 S

Zulassungsinhaber: Johannes Graupner
Henriettenstr. 94-96
D-7312 Kirchheim/Teck

Zulassungsart: Allgemein genehmigte Funkanlagen

Objektart: Funkanlage zur Fernsteuerung von Modellen

Saarbrücken, den 14.07.92

Im Auftrag

Jung

1 Anlage

40 MHz

DS 18 FM 40
DS 20 mc-40

Approval Number
G 400091 A MF

ZENTRALAMT FÜR ZULASSUNGEN IM FERNMELDEWESEN

ZULASSUNGSURKUNDE

Zulassungsnummer: G400091A

Zus. Kennzeichen: MF

Objektbezeichnung: "DS 20 mc-40" oder "DS 18 FM 40 MHz"

Zulassungsinhaber: Johannes Graupner
Henriettenstr. 94-96
D-7312 Kirchheim/Teck

Zulassungsart: Allgemein genehmigte Funkanlagen

Objektart: Funkanlage zur Fernsteuerung von Modellen

Die Funkanlage erfüllt die technischen Vorschriften der Richtlinie FTZ 17 R 2012, Ausgabe März 1985.

Gemäß der Zulassungsrichtlinie 22F 9 R 900 wird die Zulassung der Funkanlage mit heutigem Datum geändert.

Die Zulassung ist widerruflich.

Saarbrücken, den 03.07.91

Im Auftrag

Spanier

1 Anlage

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