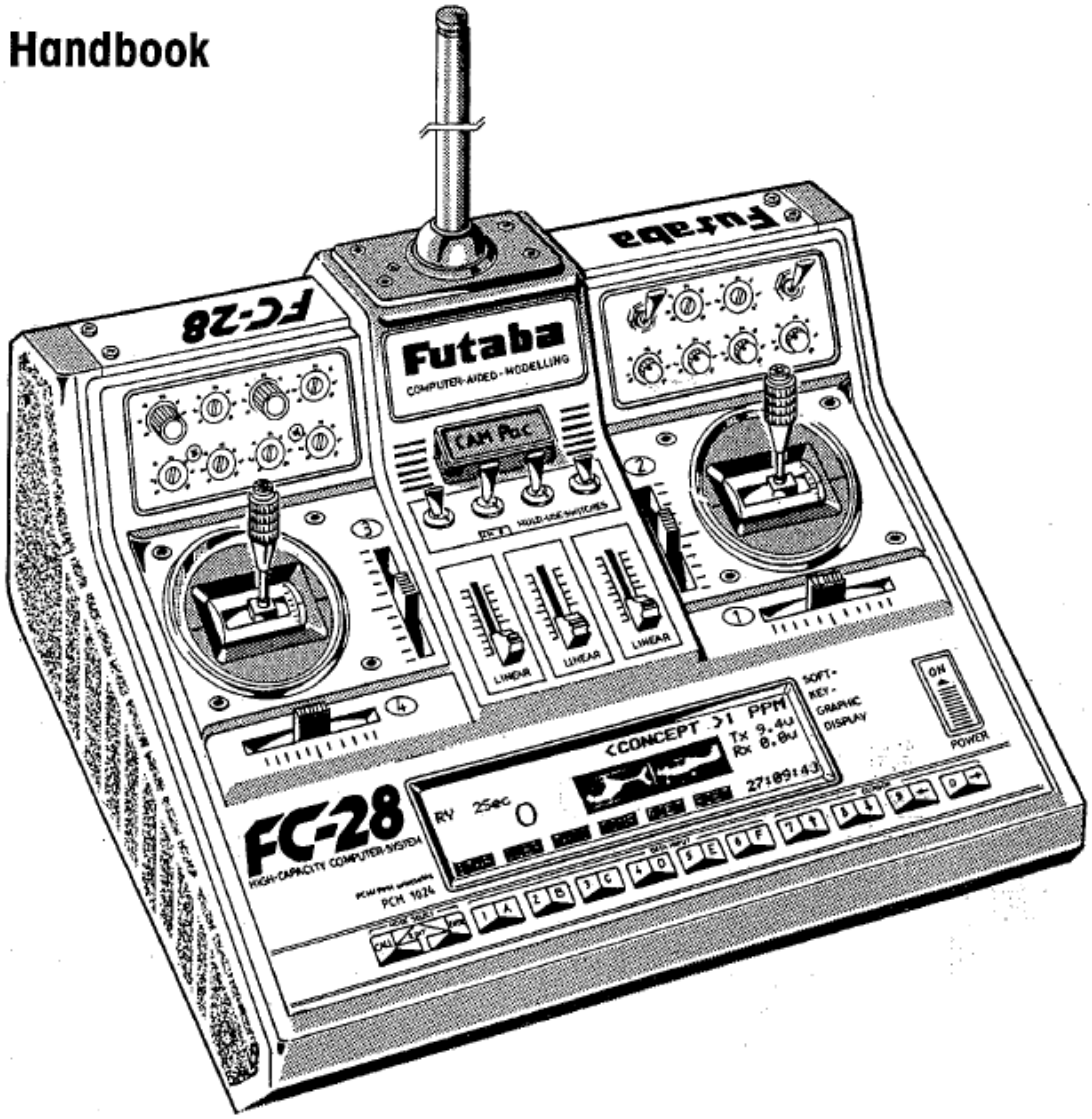
FC-28

Digital Proportional Computer System

Handbook



Futaba
RADIO CONTROL SYSTEMS

General information

Design Features

FC-28 Transmitter

- The ergonomic transmitter design is ideal for hand-held or tray operation with maximum comfort. For protection, the FC-28 system is supplied in a durable aluminium carrying case.
- Large, high resolution 'super-twisted' graphic display of all program data.
- Graphic display of the numerous program stages for ease of operation.
- All program changes become effective immediately, without having to be stored in the memory - 'real-time' programming.
- Uncomplicated programming using the 'direct function call mode' or 'graphics menu system'.
- Standard functions and mix programs to suit glider, aerobatic or helicopter use.
- Innovative change-over program for various pre-programmed flight modes (Quattro rate).
- CAMPac system with unlimited model memory option. Six model memories are incorporated in the transmitter plus four additional model memories in each CAMPac.
- Model memory copy function to safeguard existing programs or to simplify the programming of new models.
- Trim storage for all model memories so that the stick trims of each model may be returned to neutral.
- Servo reversal for all channels.
- Precise servo paths may be programmed with ATV, AFR, EXPO1, EXPO2 and VTR.
- DSC (direct servo control) option for function testing without RF output from the transmitter.
- Data transfer from one transmitter to another.
- Quattro rate allows four different parameters of mixing and servo path for each model memory. These can be switched in and out in flight - manually or automatically.
- Unrestricted selection of all joystick functions, switches and sliders.
- Switchable for PCM or PPM operation.
- Built-in optical tachometer for propellers with 1 - 5 blades.
- Timer functions include count up, count down and rhythm.
- Joysticks fitted with four ball bearings to ensure maximum control precision.
- SMT (Surface Mount Technology) for maximum quality of PC boards.
- Adjustable stick length and spring tension. Long stick option for tray operation
- Plug-in RF module.
- Automatic transmitter cut-off when joysticks have not been used for thirty minutes.
- Long operating periods possible with the 8/1400 mAh transmitter batteries.

P-R129DP Dual conversion receiver

- Dual conversion technology for extreme suppression of VHF and harmonic interference.
- Two ceramic filters.
- Combines 1024 PCM coding with new channel filters to provide maximum selectivity and reception safety.
- Failsafe and battery failsafe functions for all channels.
- Automatic control of pre-selector stage for optimum analog pulse conversion.
- SMT (Surface Mount Technology) for maximum quality of PC boards.

P-S9201 Servo

- High torque and speed, dust-shielded, watertight, bell-type armature motor with samarium-cobalt magnets.
- New indirect drive potentiometer to safeguard against damage from vibration and impact.
- Special Futaba servo electronics offering maximum starting power and reset position with minimum lag.
- Robust design of glass reinforced moulded case.

Technical Data

FC-28 Transmitter

9 channel transmitter	:PCM/PPM operation
Frequency	:35/40 Mhz
Modulation	:FM PPM/PCM switchable
Operating Voltage	:9.6v (1400mAh nicad)
Current drain	:140mAh
Weight	:1590g
Dimensions	:240 x 210 x 60mm

P-R129DP Receiver

9 channel double superhet receiver

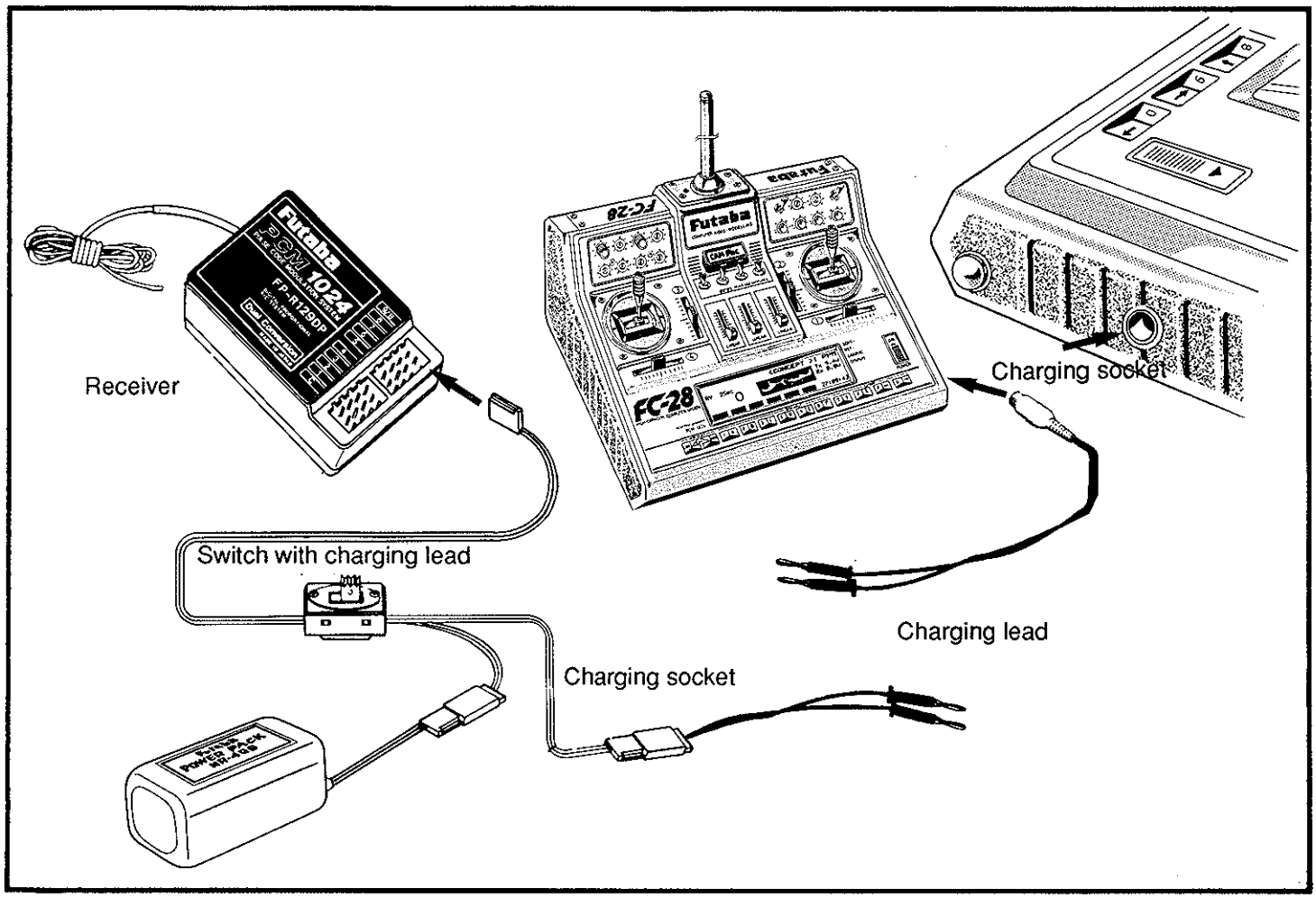
Frequency	:35/40MHz
Intermediate frequency	:ZF1=10, 7MHz, ZF2=455Khz
Operating voltage	:4.8v - 6v
Current drain	:20mA
Weight	:46g
Dimensions	:62.5 x 36.5 x 60mm

P-S9201 Servo

Neutral pulse	:1.52ms, positive
Operating angle	:2 x 45 degrees
Operating speed	:0.22 sec/60°
Output torque	:5.0Kg/cm=50Ncm
Power requirement	:4.8 - 6v
Weight	:45g
Dimensions	:38.5 x 19.5 x 34.5mm

General information

Charging the receiver and transmitter batteries



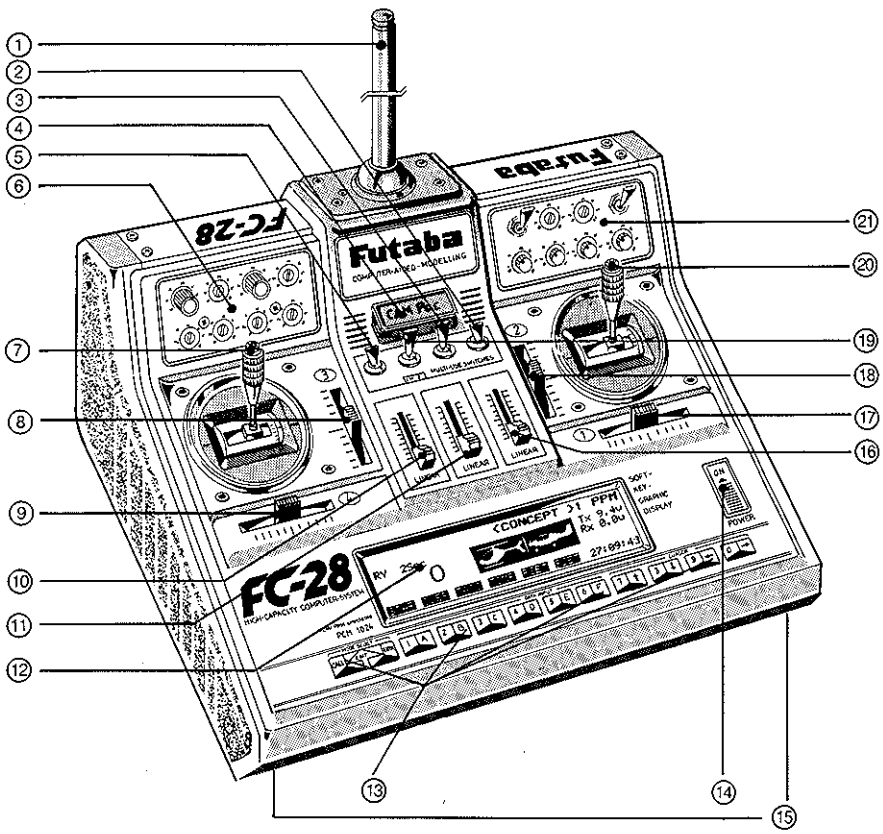
- First, connect the charging lead banana plugs to the battery charger, then connect the lead to the transmitter and receiver charging sockets. If you do not wish to disconnect the receiver battery when charging, you will require a switch cable with charging lead (Order No. P-R4-SWJ).
- The batteries must be charged prior to use. Charge for 15 hours at 50mA (500 mA-batteries) or 20 hours at 100 mA (1400 mA-batteries).
- Quick-charging the transmitter batteries must not be carried out at currents above **3A**.

Note: The transmitter is fitted with a one-way diode to protect the system from being reverse charged. Do not charge with a peak detecting charger.

After any lengthy storage period, i.e. following purchase or after a winter break, the batteries should be discharged and recharged 2 or 3 times prior to operation to ensure full capacity and operating time.

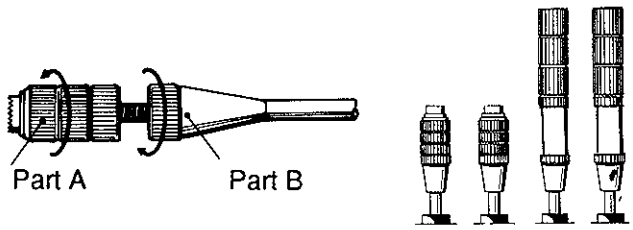
The FC-28 transmitter

Transmitter controls



1 Aerial
2 Two position switch
3 Two position switch
4 CAMpac socket
5 Two position switch
6 Optional switch/trimmer site 1
7 Joystick - function 3 & 4
8 Trim - function 3
9 Trim - function 4
10 Slider - function 5
11 Slider - function 6
12 Large format graphic LCD
13 Soft touch keys
14 Transmitter On/Off switch
15 Case locks
16 Slider - function 7
17 Trim - function 1
18 Trim - function 2
19 Three position switch - function 8
20 Joystick - function 1 & 2
21 Optional switch/trimmer site 2

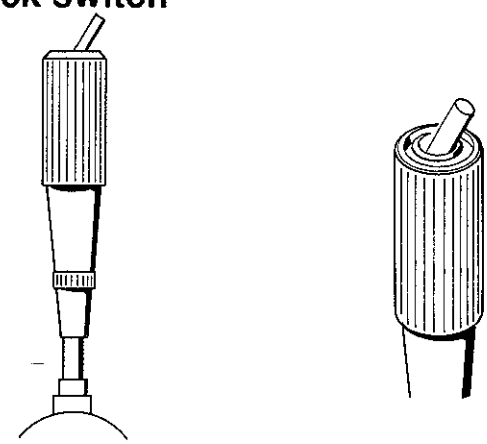
Adjusting the stick length



The stick length can be adjusted to suit the pilot: Loosen Part A and B (see diagram). Adjust Part A to the desired stick length and lock with Part B.

The short sticks are particularly suited to pilots who prefer to hand-hold the transmitter, whereas the long sticks are best for pilots who wish to use the transmitter in a tray.

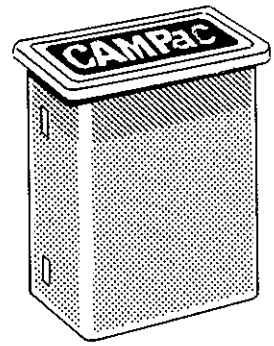
Stick switch



The optional long sticks can be fitted with a switch as a free unit with an ON/OFF function. This stick switch can only be fitted by Futaba service agents.

The FC-28 transmitter

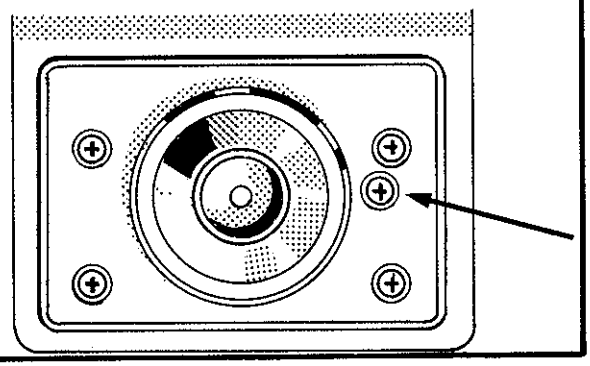
CAMPac



CAMPacs are memory modules for expanding the model memory of the transmitter. Each CAMPac can store data for either 1 or 4 additional models (depending on the CAMPac used). A new CAMPac must be 'initialized' prior to storing model data in the memory for the first time. Insert the new CAMPac into the CAMPac socket and switch ON the transmitter. An audible signal indicates when initialization is complete.

Warning: CAMPacs are static memory modules and are therefore sensitive to static charging and discharging. The housing should never be opened and the plugs never bridged or touched.

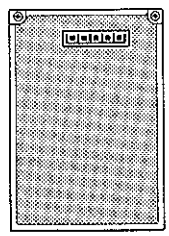
Aerial ball and socket



The stiffness of the aerial ball and socket's movement can be made lighter or stiffer to suit.
Turning the indicated Phillips screw to the right (clockwise) = stiffer movement.
Turning the screw to the left (anti-clockwise) = lighter movement.

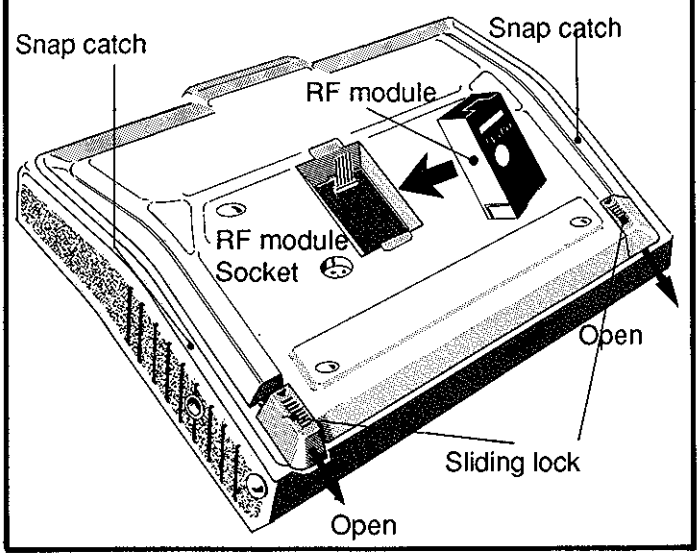
Adjusting screw

RF Module



The FC-28 transmitter features a plug-in RF module which determines the output frequency band. The transmitter crystal is located in the module. To change the crystal, remove the transmitter module by depressing the two snap catches and pulling it out towards the rear. It is normal for the module to warm up a little in operation. The RF module is automatically switched-out when the DSC lead is used (See page 10).

Detaching the transmitter's back panel

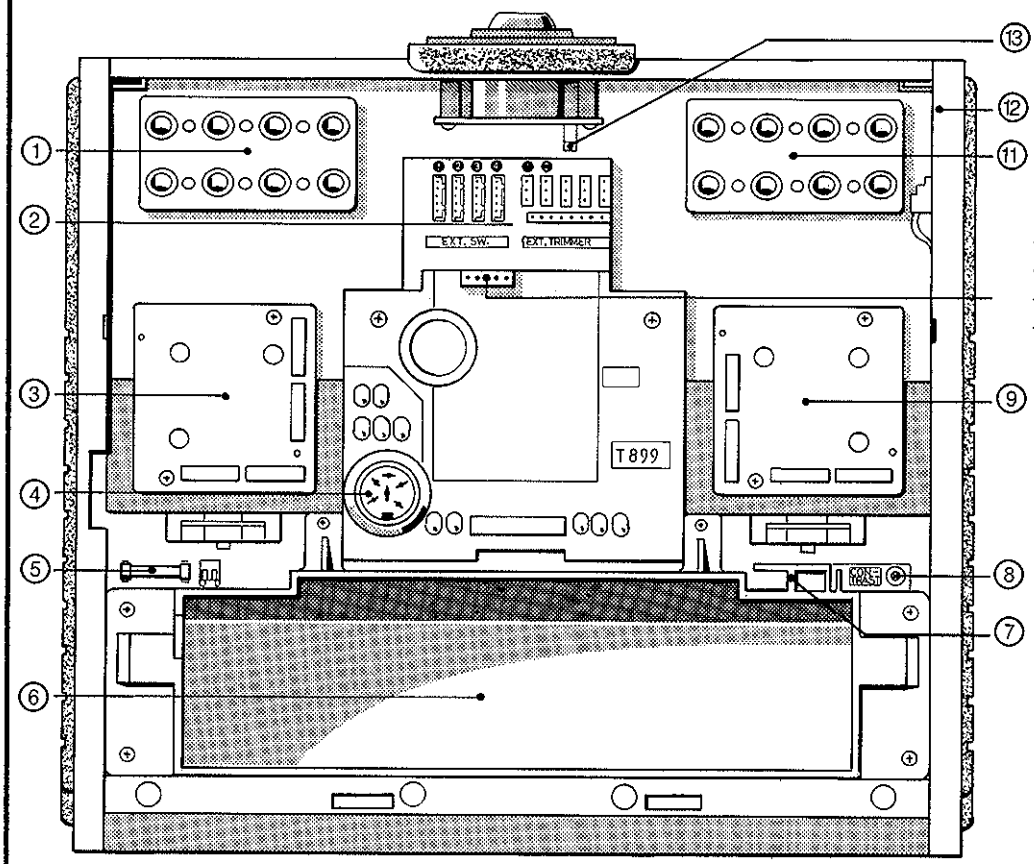


To remove the back of the transmitter case, remove the RF module and pull both rear sliding locks back to their stops. Lift the bottom part of the transmitter case at both catches. Whilst overcoming the slight resistance given by the two snap catches on the sides, lift off the back towards the rear.

Close the transmitter ensuring that the RF module's contact pins are inserted into the recess in the bottom part of the housing. First, locate the top of the base (below the aerial ball) and then squeeze both snap catches on the sides at the same time, until they catch. Now the sliding locks can be closed and the module re-fitted.

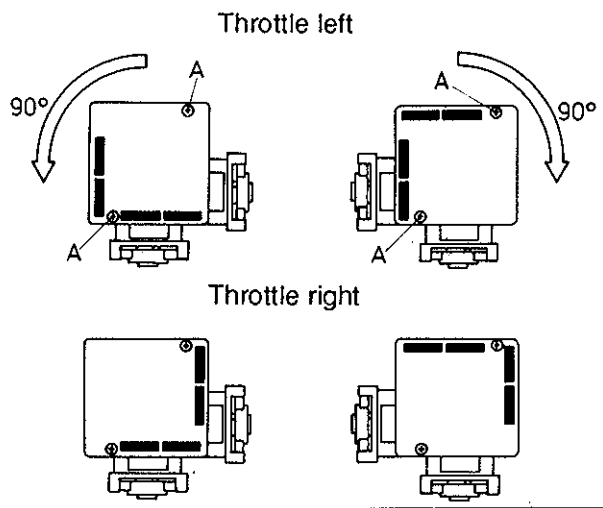
The FC-28 transmitter

Inside the transmitter



1 Switch/trimmer option site 1
2 External switch/trimmer sockets
3 Right joystick backplate
4 DSC/trainer socket
5 Internal fuse
6 Transmitter nicad
7 Spare crystal holder
8 LCD contrast control
9 Left joystick backplate
10 RF module pins
11 Switch/trimmer option site 2
12 Optical tacho sensor
13 Cable clip

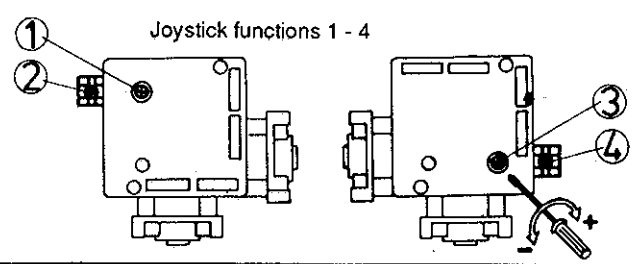
Activating the throttle ratchet



When the transmitter is despatched from Futaba, the throttle ratchet is not operational. To activate the ratchet, remove the back of the transmitter, remove the two backplate retaining screws 'A' on the appropriate joystick and rotate the backplate as shown in the diagram. Re-fit the retaining screws to inhibit the spring tension and simultaneously activate the throttle ratchet.

This completes the mechanical identification of the throttle channel. To complete the electric identification, see function 21 - FUNCTION change.

Adjusting the stick tension



The joystick tension can be adjusted by the pilot, as required, by simply turning screws 1 - 4 (as shown in the illustration) using a Phillips screwdriver.

Turning the screws clockwise = 'harder' tension
Turning the screws anti-clockwise = 'softer' tension

The FC-28 transmitter

Transmitter expansion

Although the FC-28 system is one of the most comprehensive, it is possible to customise the transmitter to suit personal preferences with the expansion options. Adding extra switches allows new functions to be performed and these can be fitted to either side of the transmitter and made to perform any specific task. So, the FC-28 transmitter can be tailored to suit the individual pilot's needs.

Fitting switches

If a switch is to be fitted at option sites 1 or 2, the clear plastic mask which covers the relevant site must be removed by lifting under the appropriate 'thumbnail' recess. Remove the back of the transmitter, as detailed previously. Take off the switch fixing nut and fit the switch - from the rear - in the required position. Secure the switch with its retaining nut. Break the appropriate opening out of the cover (by twisting) using taper-nosed pliers or tweezers.

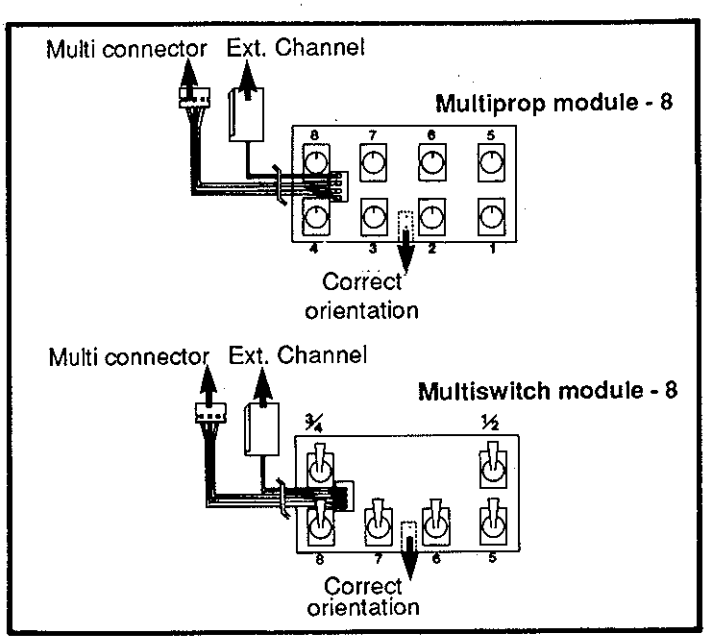
Now the enclosed switch identification label can be stuck on to the plastic cover (from the inside - mirror writing) in the correct position to mark the switch or trimmer's function. Refit the cover.

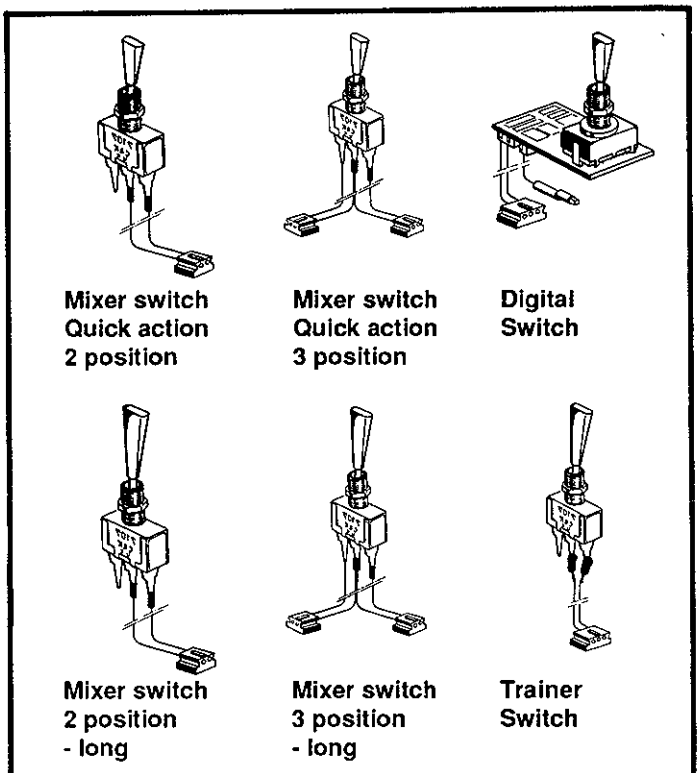
Fitting mixer/trim modules

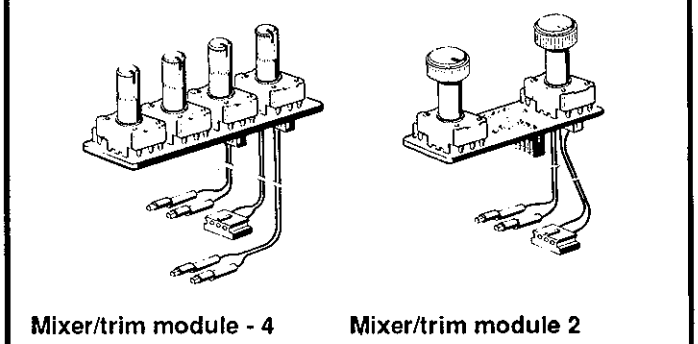
First, lift off the plastic cover. Fit the trim module from the rear in the required position and retain with the screws provided. Break out the openings in the plastic cover where required, apply identification labels as detailed above and refit the cover.

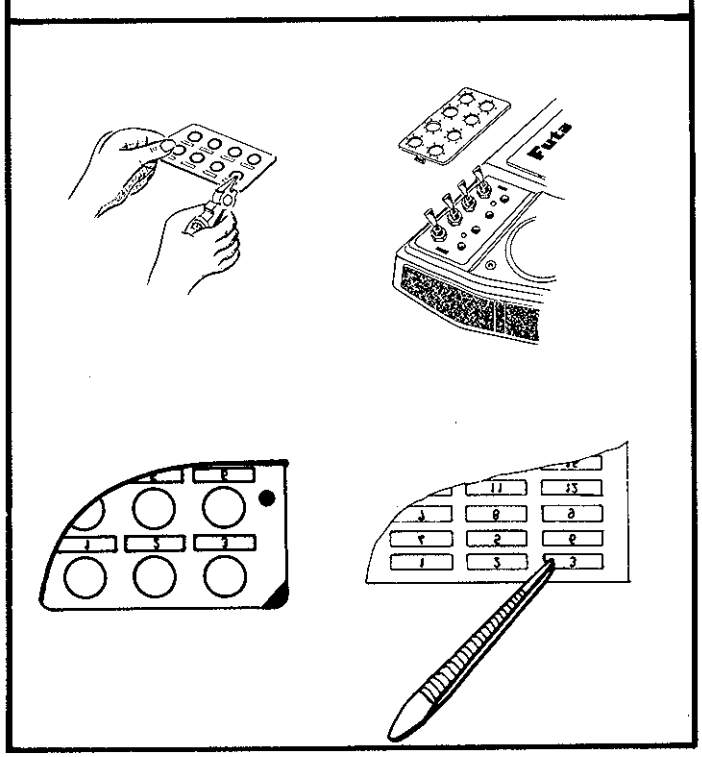
Fitting multi-switch or multi-prop units

The fitting of these units is the same as the mixer/trim modules but ensure that they are fitted the correct way up to ensure that the PC board does not touch the metal sections of the transmitter case.









The FC-28 transmitter

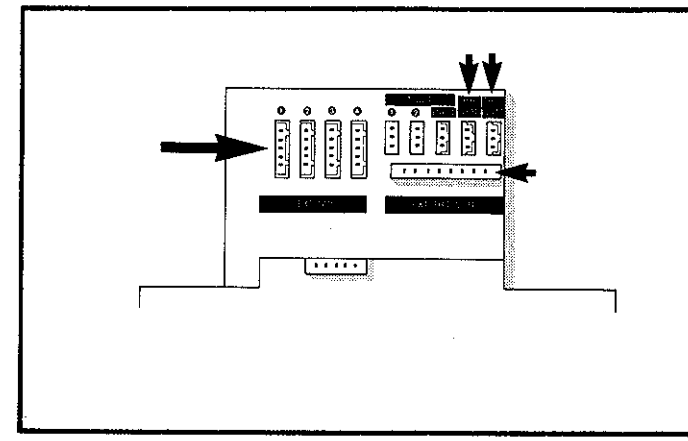
Expansion options - transmitter connections

Switches

Switches are connected to the sockets marked 'EXT. SW.' - connections 1 - 8. It is impossible to make the connections incorrectly, as the plugs are shaped to fit one way only. After fitting and connecting the switches, activate their functions in 'Selection of mix switches' program (09).

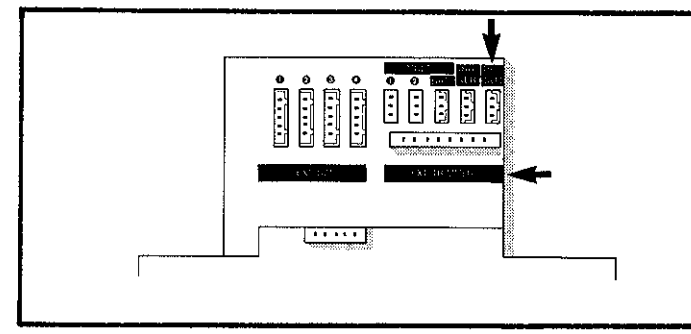
Exception: The Trainer switch and DIGITAL SWITCH.

A trainer switch must be connected to the socket marked 'TRAINER'. The digital switch's three pole plug is connected to the TRIM BATT socket and the single pole plug connected to the EXT Trimmer socket.



Mixer/trim module

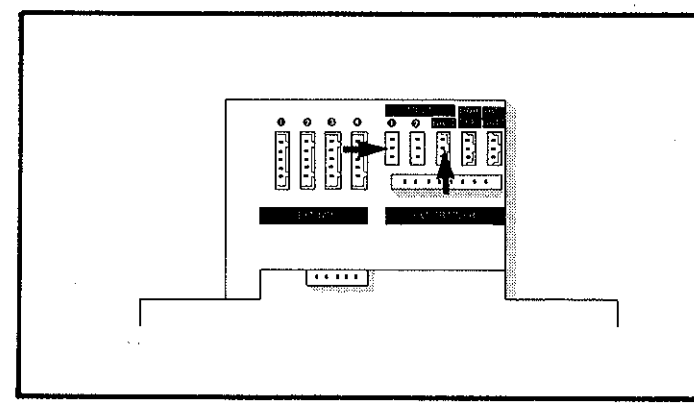
Connect the trim module cable with the single pole plug into the 'EXT: TRIMMER' (1-8) socket and the two pole plug into the 'TRM. BATT' socket. Again, it is impossible to make the wrong connections due to the shape of the plugs. To connect additional trim modules, the single pole plug is connected to 'EXT. TRIMMER' as above, but the two pole plug is inserted into the socket of the first trim module. Any further trim modules are connected in this way by connecting the two pole plug to each preceding trim module.



Multi-Prop module

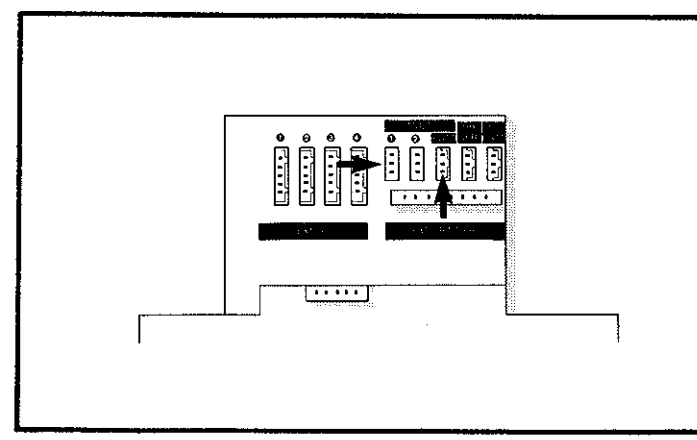
Connect the single pole plug into the 'MULTI 1' or '2' socket. The cable with the three pole plug should now be connected to the 'MULTI BATT' socket. If an additional unit is fitted, its three pole plug is fitted to the free socket on the first Multi-prop module.

Activate the module in the MULTI menu 27.



Multi-Switch module

Connect the single pole plug into the 'MULTI 1' or '2' socket. The three pole plug is then connected to the MULTI BATT socket. If more than one switch unit is to be fitted, the second three pole plug is connected to the free socket in the first module, as above. Before the modules can be operated, it is necessary to activate them in the MULTI menu 27.



The FC-28 transmitter

Trainer operation

To train beginners, two FC-28 transmitters may be coupled with a trainer cable to allow alternate control of the model from the 'teacher's' transmitter to the 'beginner's'. The transmitter used by the 'teacher' requires a 'Trainer switch' fitted at Option site 1 or 2.

NOTE: Prior to operation, both transmitters must be programmed for the same functions (e.g. servo direction, sequence of functions, mixing etc.). Complete model programs can be copied from one transmitter to the other using the 'Transmit' program, when coupled with the trainer cable (see Data Transfer 04 on the next page). This is particularly useful when sophisticated models are flown, to ensure that both transmitters are running exactly the same programs.

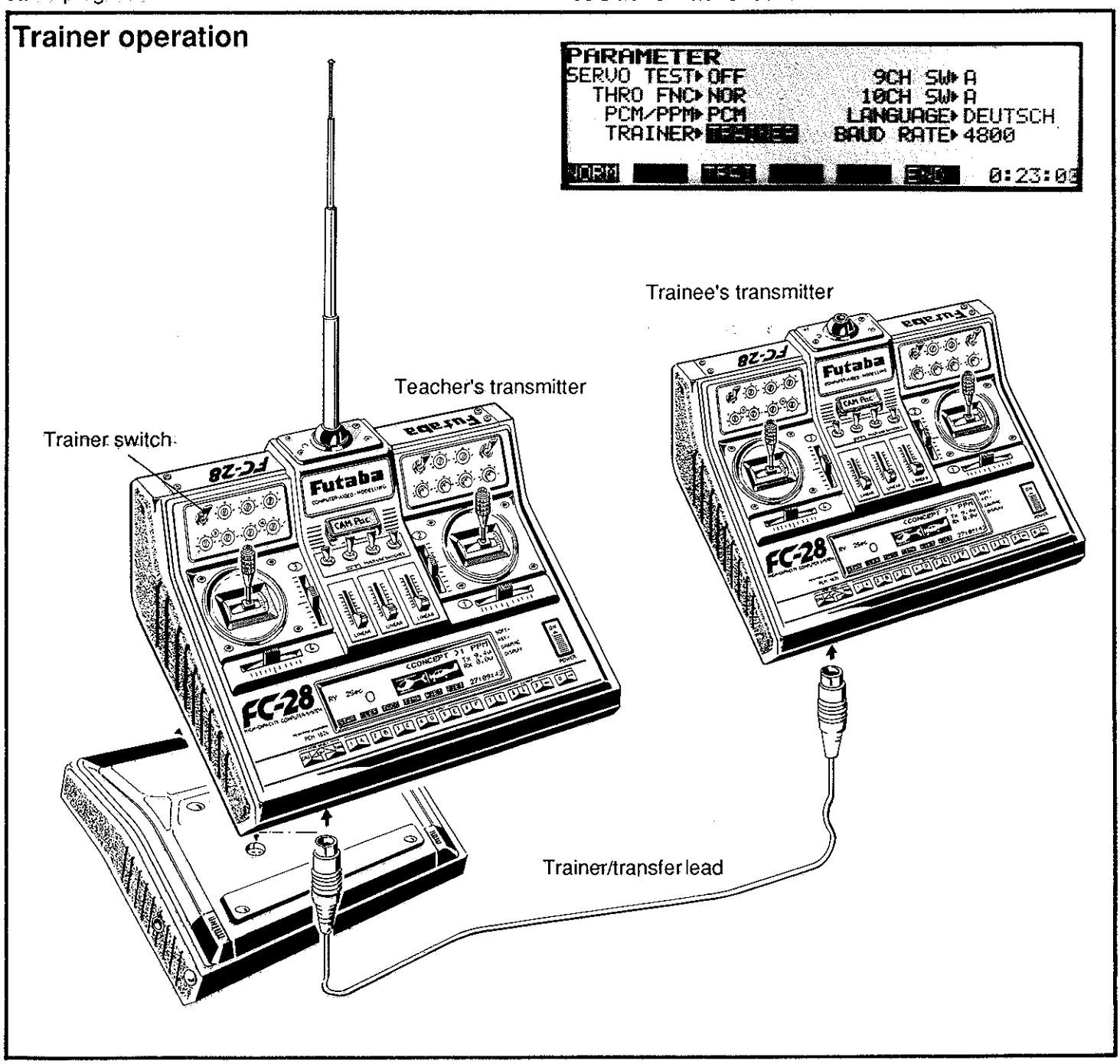
Operation

The teacher's transmitter must be fitted with an RF module and a matching pair of crystals in both the transmitter and receiver.

The trainee's transmitter does not require an RF module. Any module fitted in the trainee's transmitter is automatically 'switched out'. **Do not switch on the trainee's transmitter during training.**

Once the teacher's transmitter has been switched ON, the control is transferred to the trainee's transmitter by the sprung loaded 'trainer switch'. As soon as the 'trainer switch' is released, there is an automatic changeover back to the teacher's transmitter. The teacher's transmitter must be operated with the aerial extended; **the trainee's transmitter should not have the aerial extended.**

Trainer operation



The FC-28 transmitter

Data Transfer (TRAN) 04

With this function, it is possible to copy one or all six models' data from one transmitter to another.

Connect a trainer lead between the two transmitters and switch both transmitters ON. Select the '04 - DATA TRANS' menu on both transmitters.

If the data for only one model is to be transferred, select that model on the sender's transmitter. Press the 'TRAN' key, followed by '1MDL', for the selected model to be transferred.

On the receiving transmitter, press the 'RECI' key, followed by '1MDL'.

On the sending transmitter, press the 'TRAN' key once more to confirm that the transfer details are correct.

Upon successful data transfer, an audible 'bleep' will sound. If the transmission should fail, a message appears in the display.

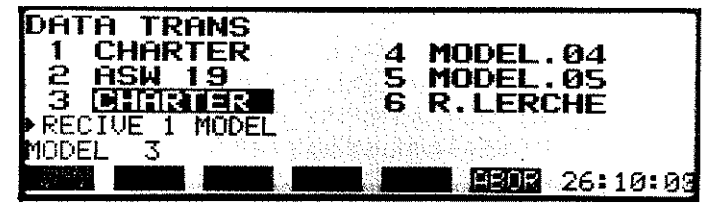
If the data for all model memories is to be transferred, press the 'TRAN' key, followed by 'ALL'.

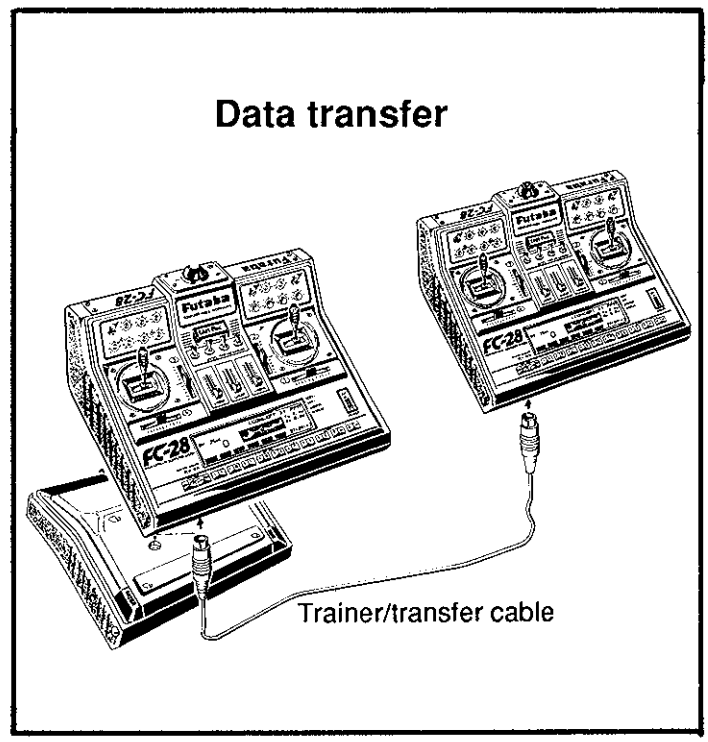
On the receiving transmitter, press the 'RECI' key, followed by 'ALL'.

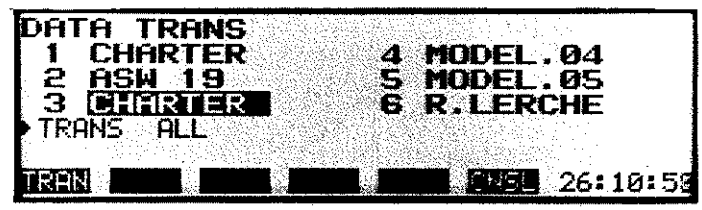
On the sending transmitter, press the 'TRAN' key once more to confirm that the transfer details are correct.

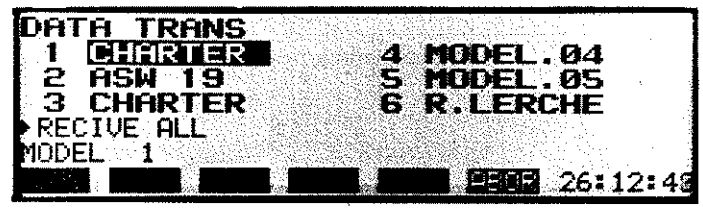
Upon successful data transfer, an audible signal will sound. If the transmission should fail, a message appears in the display.

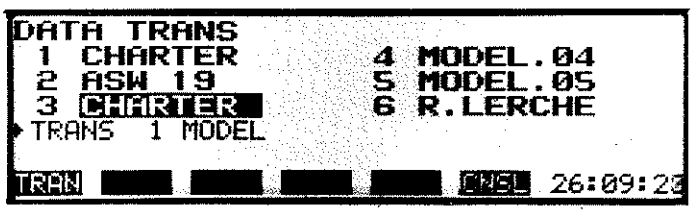
During the data transfer process, it is possible to abort the transmission with the 'CNSL' key (CANCEL) or 'ABOR' (ABORT).











Copying from CAMPac to CAMPac

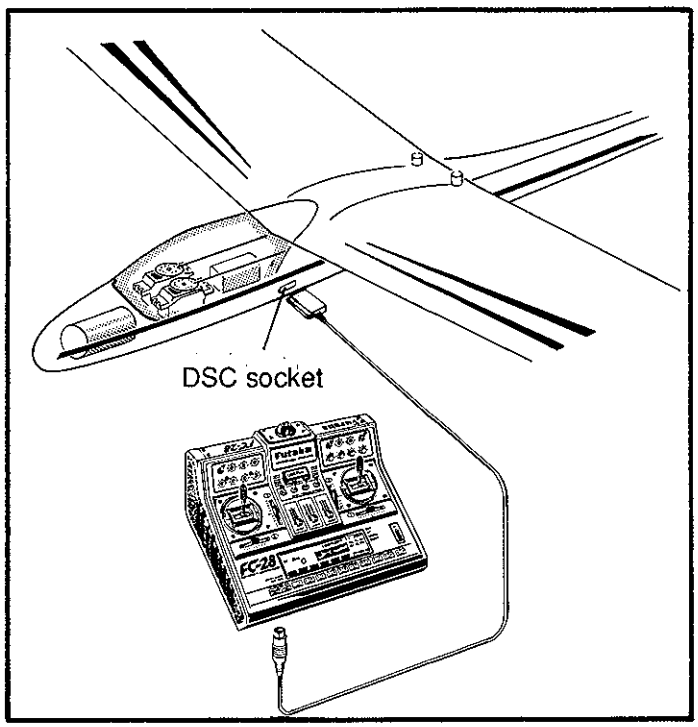
To copy a model memory from one CAMPac to another, first select the model you wish copy. Remove the CAMPac from its socket and replace with the second CAMPac, onto which the model memory is to be copied. Press the 'COPY' key, and acknowledge with 'yes'. An audible 'bleep' will sound to confirm the successful transfer of data.

Transmitter and receiver

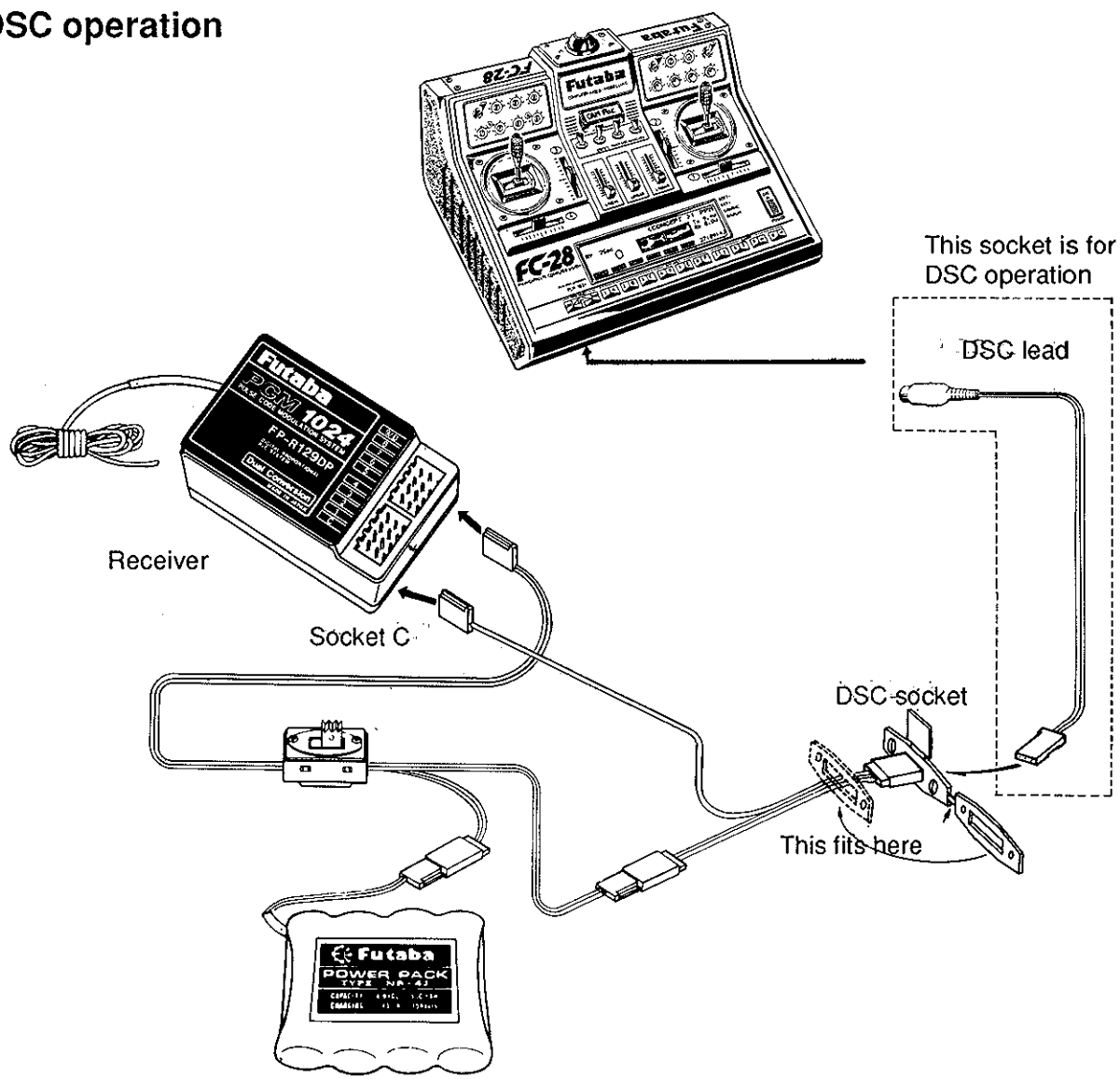
DSC operation

When the transmitter and receiver are linked with a DSC lead, it is possible to operate the servos without any RF output from the transmitter. The receiver battery voltage is also displayed in the transmitter display, marked 'Rx' under the Tx voltage. This function is particularly useful to check a model when another pilot is operating on the same frequency. The information is sent to the receiver via the DSC lead - Direct Servo Control lead.

When the DSC lead is connected to the transmitter's DSC socket, the transmitter is automatically switched on - but without RF output. Connect the DSC lead to the receiver DSC socket as shown in the diagram below.



DSC operation



The FC-28 transmitter

Transmitter tray

The transmitter tray is an optional accessory to allow the transmitter to be comfortably hung around the neck - reducing fatigue and increasing control. When used with the long stick option, the tray provides a particularly sensitive method of control. The console features a tool tray plus aerial compartment and can be stored with the transmitter in its aluminium case.

Warning: If the optional long sticks have been fitted, they must be removed before storing the transmitter, in its tray, in the aluminium case.

Receiver and servos

Sequence of receiver connections

For certain functions, the servos must be connected to the receiver in a fixed order to ensure that the transmitter mixing operations are carried out with the minimum of difficulty. For this reason, always connect the first four servos (aileron, elevator, throttle and rudder) to the receiver in the correct sequence, as shown in the table on the right.

Function	Receiver output
Aileron	Channel 1
Elevator	Channel 2
Throttle	Channel 3
Rudder	Channel 4

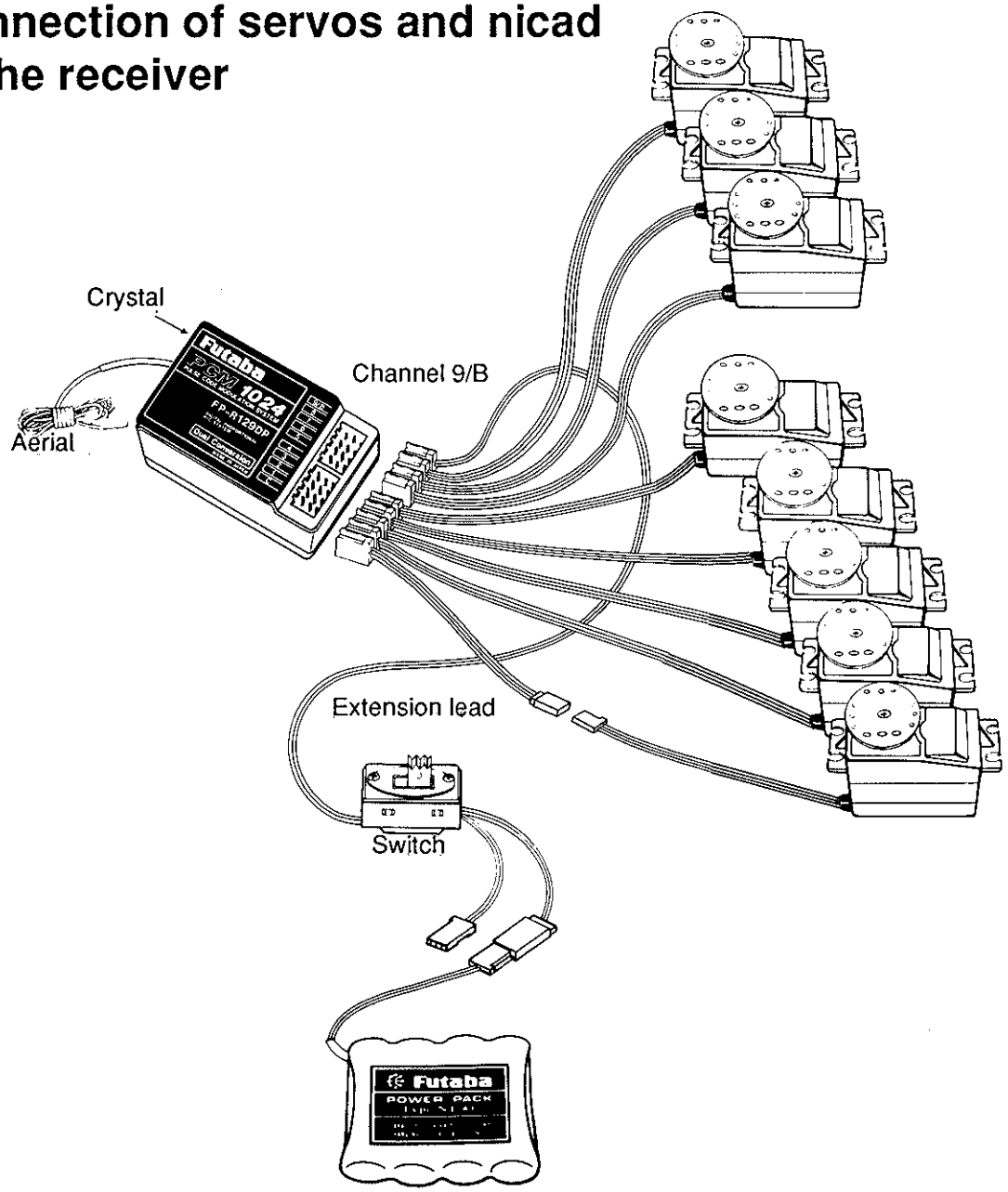
The servo connections for any other functions will depend on the mix program used - see Mixing Type - Menu 13.

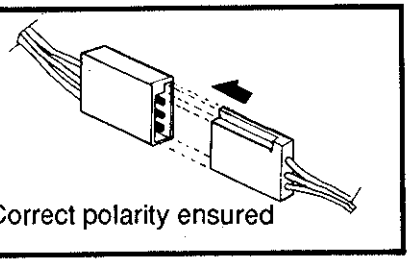
Operating the system for the first time

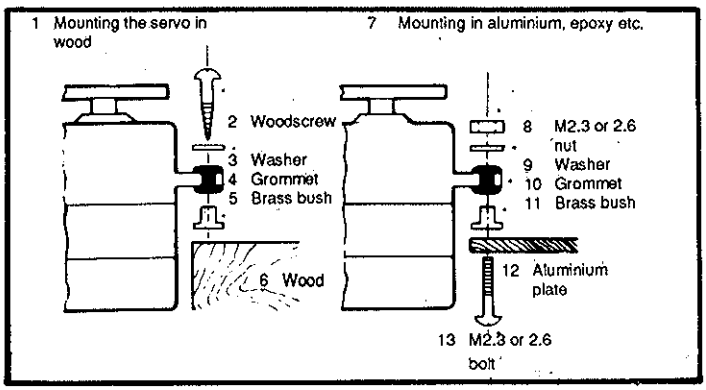
- Connect the servos, switch and ni-cad as illustrated overleaf. The transmitter and receiver aerials must be fully extended before operation.
- First, switch ON the transmitter, then the receiver - never the other way round. Switch OFF in the reverse sequence (receiver first).
- Once the transmitter and receiver have been switched ON, the servos should take up their neutral positions. Check each function by operating the transmitter controls.
- Once the servos have been connected to the control surfaces, check the operation of the individual functions. If any control surface moves in the wrong direction, the servo sense may be reversed using the Menu 'Servo-Reversal'. If the rudder joystick is moved to the RIGHT, the rudder should deflect to the RIGHT.
- Ensure that each servo can operate through its full travel without any mechanical limitation, thus protecting the receiver battery from high power consumption caused by a stalled servo.
- Watch out for clicking pulses which may be caused by metal to metal 'noise' and vibration.
- The operation of the receiver switch should be free, with no mechanical limitations in travel. When fitted to i/c powered models, always mount the switch on the opposite side to the exhaust, in order to prevent the ingress of exhaust residue or oil.
- Always extend the receiver aerial to its full length - **never** shorten or coil it.
- Ensure that all cables are laid in a neat and orderly manner, without being under any tension and without the risk of them being squashed. Do not lay the cables in a criss-cross fashion; it is better to have a clear cable arrangement and to fasten the cables to the side wall of the fuselage with tape.
- The servos must be fitted with the rubber grommets provided. When screwing down, make sure that these grommets are not excessively compressed, otherwise the anti-vibration benefit will be lost.
- Always wrap the receiver and ni-cad in thick foam rubber to protect them from vibration. Secure the ni-cad and receiver from moving. The receiver can be placed in a small plastic bag first, which is sealed around the cable exits with an elastic band or tape, as further protection from water or fuel.
- Always test the range - not only when flying a new model for the first time - in order to prevent crashes. With the transmitter aerial retracted and the motor running, test that the receiver and servos are operating correctly at a distance of 50 meters. If any function gives cause for doubt, do not fly until locating the problem.

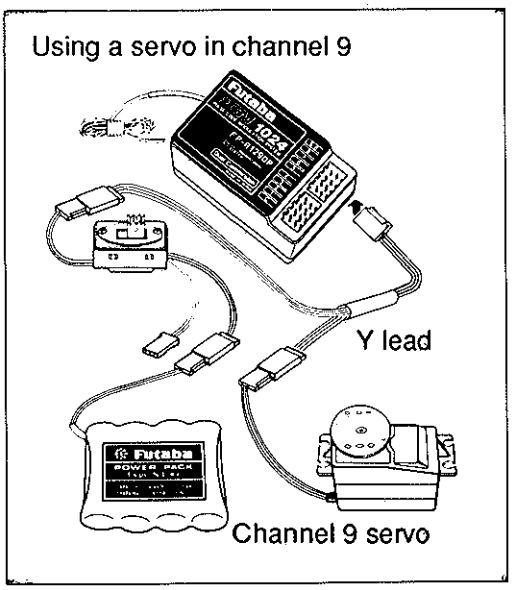
Receiver and servos

Connection of servos and nicad to the receiver

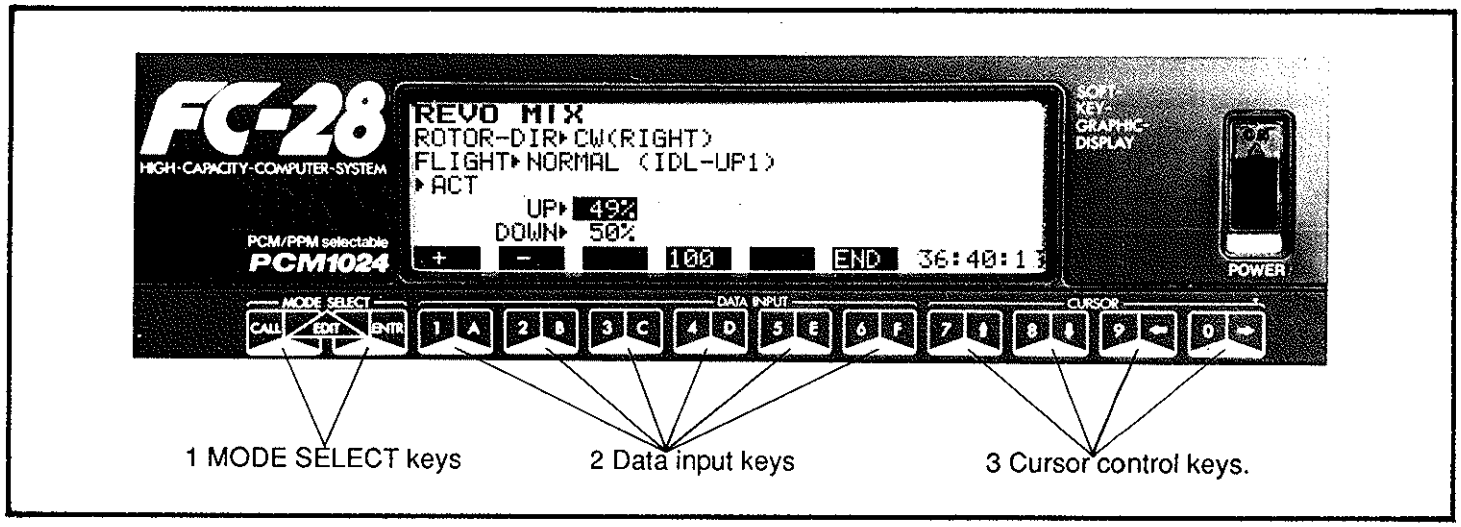








Operation and programming



The keyboard

Each function or option forms a menu and this menu must be called up before any settings can be altered or programmed.
The various transmitter applications and functions can be called in one of two ways: either by using the 'direct input number system' or by the 'graphics menu system'. When the number system is employed, the required menu or display is called up by entering the menu number.
When the graphics menu system is used, the required menu or display is called up by selection from the table of contents (EDIT).

Once the required menu or display has been called up, the simple operating system is the same for both options. The input keys' functions (DATA INPUT) will then be displayed in the bottom line of the screen (graphics user guide). The system's display appears as soon as the transmitter has been switched ON. The main EDIT menu is displayed by simultaneously pressing the two 'MODE SELECT' keys.

The cursor (dark display area) must be moved to the required character (or line) of the display using the 'cursor control keys' (keys 7 -10) in order to access the required menu or display.

The cursor is moved down using the ⇓ key and up with the ⇑ key, to the right with ⇒ and to the left with ⇐.

The 'DATA INPUT' keys (1 - 6, A - F) are then used for selecting the required display. Each of the keys' functions will be given in the bottom display line as they will depend on the cursor position.

Example: The data of a model memory is to be reset, which requires access to the reset (RSET) menu. Switch the transmitter ON. Simultaneously press the two 'MODE SELECT' keys. Move the cursor to the required line using the '⇓' CURSOR control key. Press the 'RSET' DATA

Operating and programming system

Before being able to use the FC-28 system to greatest effect, one must first learn how to operate and program the transmitter. It is best to work systematically and also to be patient. The FC-28 transmitter offers a large range of options which requires more than half an hour to become familiar with! The principal of operation is, however, very simple so that once this has been grasped, no further reference to the instruction manual should be necessary. For this reason, the following pages are written to clarify the options available and to provide an easy to follow explanation of the operating system. After reading this manual, the functions and options that at first seem complicated should become more logical.

The description of the operating system in this manual is followed by an explanation of the various functions and options. For practical reasons it is not possible to describe all the functions in their programming sequence. Therefore, many options are augmented with practical examples that make reference to other functions.

Why program at all?

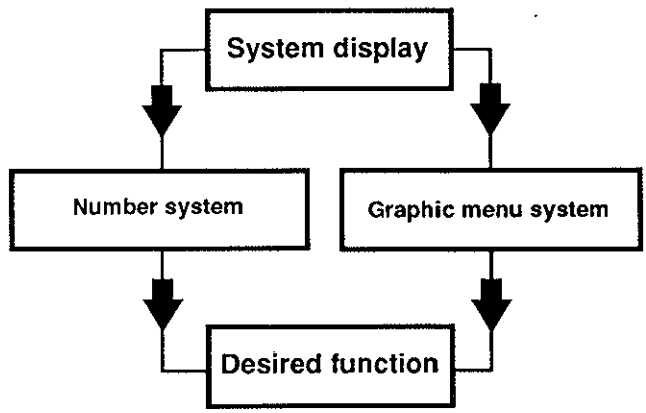
The FC-28 transmitter offers a practically unlimited range of pre-programmed facilities and functions. These functions must simply be activated and adjusted. In principle, the functions of the transmitter need only be activated as required, without any further need for re-programming. This ensures that the minimum of effort is required.

If a certain function is to be performed by the transmitter, the user must first communicate the requirements. This is known as 'programming' and involves certain definite routines which are known as the transmitter's 'operating system'. With this operating system, the user is in a position to communicate requirements to the transmitter and provide solutions for any task.

Operation and programming

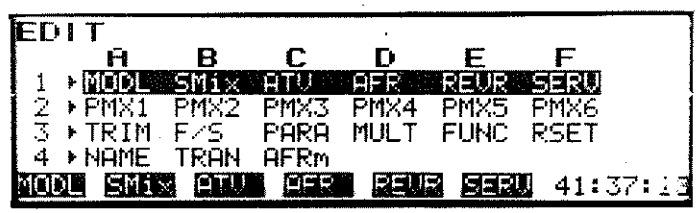
Selecting the desired function

The programming system used for the FC-28 has been designed to be very 'user friendly'. There are two ways of accessing a desired function: the Number System and the Graphic Menu System. Both methods allow quick access and all entered data takes immediate effect, without the need to store in the computer's memory.



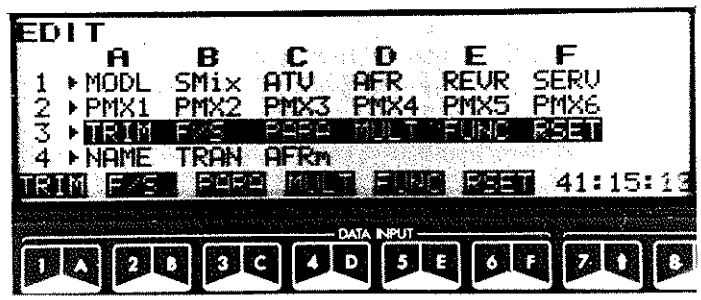
Graphic menu system

The first display to appear when the transmitter is switched on is the 'System Display'. To access the EDIT menu, both 'Mode Select' keys must be pressed simultaneously (CALL + ENTR). A cursor bar will appear in the first line with the options listed immediately above the data input keys. Pressing any one of the Data Input keys will access the highlighted option above that key. Use the ⇓ key to move the cursor bar to lines 2, 3 or 4. The new options now appear above the Data Input keys.



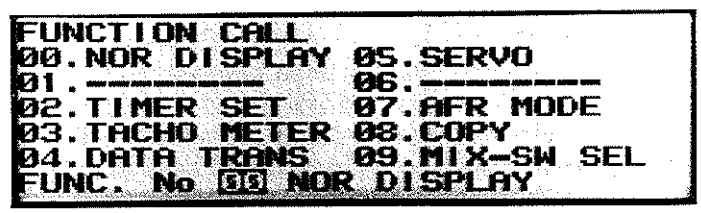
Example

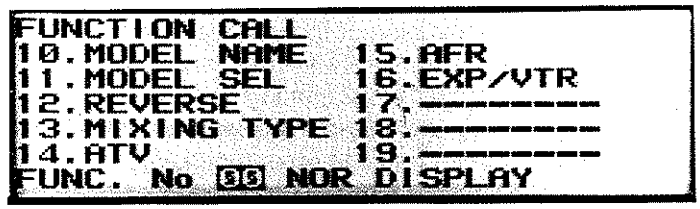
To reset all programmed data for the model in use:
The required function is 'RSET', so press the ⇓ key twice to bring the cursor bar to line 3. 'RSET' now appears above key '6F'. Press '6F' to access the function. Press 'RSET' and confirm with 'yes'.



Direct input number system

Switch on the transmitter and the System Display will be shown. Access to the EDIT menu is called up by simultaneously pressing the 'Mode Select' keys, as above. Activate the direct input number system using the 'CALL' key (Function Call mode). This display always consists of 10 menu numbers. The next 10 menus will be displayed by keying 'CALL'. As soon as the required menu has been located, enter the menu number (using keys 1 - 0). The selected menu number and menu title will be displayed on the bottom line. The selected menu may now be accessed by pressing the 'ENTER' key.

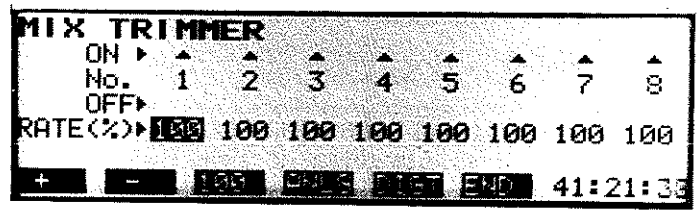




Operation and programming

Menu based operations

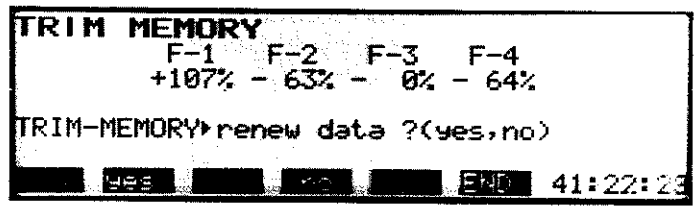
The choice of operating systems - graphic menu system or number system - is only given when selecting the required menu or display. Within the menu or display, all operations are performed using the graphic menu system. The cursor is placed within the display, and the appropriate functions of keys A - F underneath are displayed on the bottom line. The cursor is moved by the cursor keys (7 - 0) to the required place in the menu or display and keys A - F are used for altering values, for reversing, adjusting etc. When the 'END' key is pressed, the display will return to the previous statement for exiting the menu.



The following method is used for operating and setting functions:

1) Select function
2) Activate and set function
3) Exit function by pressing 'END'
4) Call up next function
5) Set function

All alterations of values and settings become effective immediately - without having to be stored in the memory (real time programming).



Note: Any changes made will only affect the ACTIVE model memory, without altering the data of any other model memories.

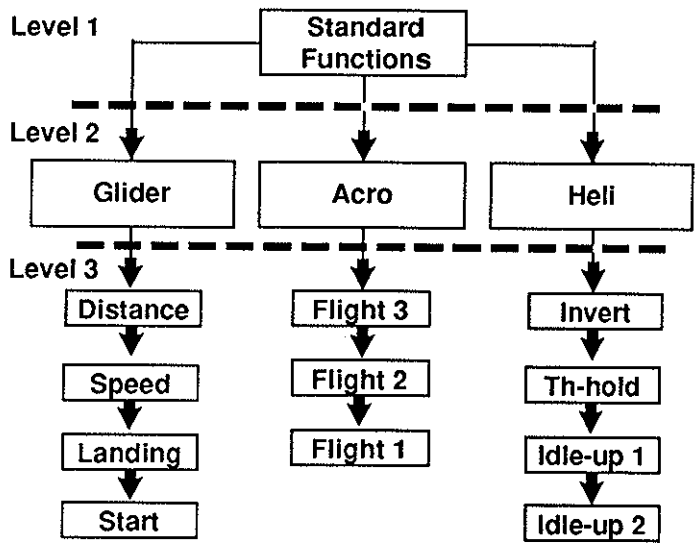
With some programming steps, each entry must be acknowledged with 'yes' or 'no' for safety's sake.

Note: If an additional 'yes' acknowledgement is required, the settings will **not** be stored if 'END' is pressed before 'yes'.

Function summary

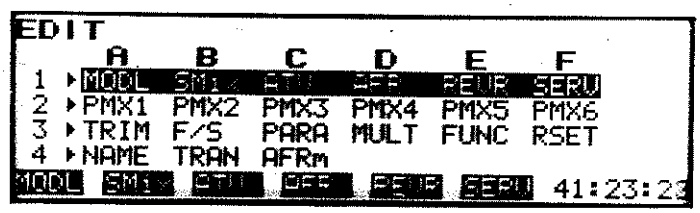
The transmitter can be programmed on three operating levels:

1) Standard functions
2) Mixer programs
3) Programming as a function of the flight mode



Operating level 1 is the simplest to program and applications are extended considerably by operating level 2. Operating level 3 provides a multitude of new applications involving far more programming options. Hence, operating level 1 offers training in the use of operating levels 2 and 3.

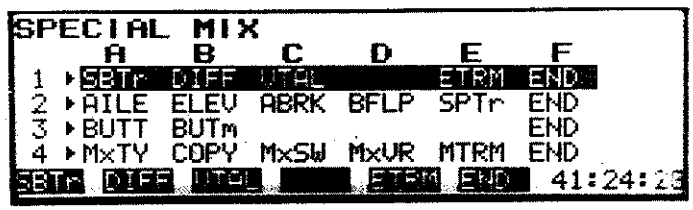
Mixer type STANDARD (Operating Level 1)
In this operating level, the transmitter will only provide menus 02 - 45 for programming simple requirements, such as travel adjustment, PPM/PCM change-over, adapting the transmitter to the suit the pilot, free mixer programs, servo reversal etc. (see list, page 24). All transmitters leave Futaba programmed in Mixer type STANDARD.

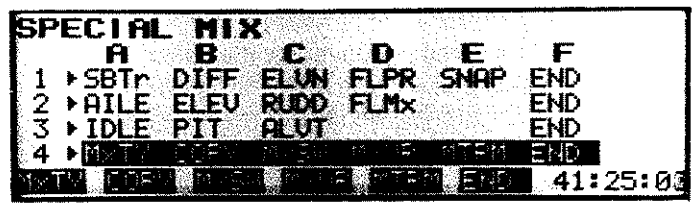


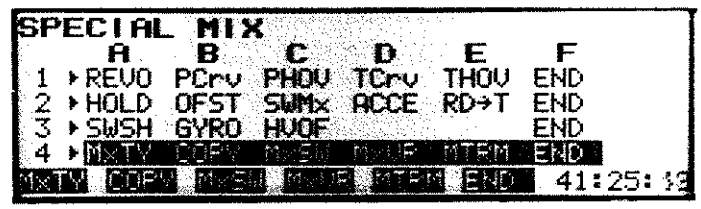
Operation and programming

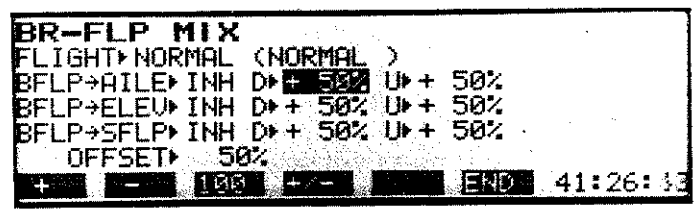
Mixer types GLIDER, ACRO, HELI

Operating level 2 provides, with various mixer types, any conceivable combination of mixers and controls. All mixers are completely programmed and need only be activated and adjusted as required.









Procedure

Select a mixer type for the model which will satisfy the model requirements as closely as possible: Glider (GLID) with 5,4 or 2 servos in the wing; Aerobatic (ACRO) or Helicopter (HELI).

There are two methods of changing the mixer type. The first, using the direct number call system is completed as follows: Select menu No 13 (MIXING TYPE) then GLID, ACRO or HELI from the option menu. Confirm the selection with 'yes'. Change-over is complete when a series of indicator arrows passes across the screen. Method 2, using the graphic menu system, is achieved by selecting SMix (special mix) from the EDIT menu then, using the cursor control keys to move the highlight bar and select mix type (MxTY). Select GLID, ACRO or HELI from the option menu and confirm with 'yes'. Selecting GLID (glider) will give a further WING TYPE option of 5 servos, 4 servos or 2 servos (5SRV, 4SRV, 2SRV). Select the desired configuration and press 'END' to leave the display.

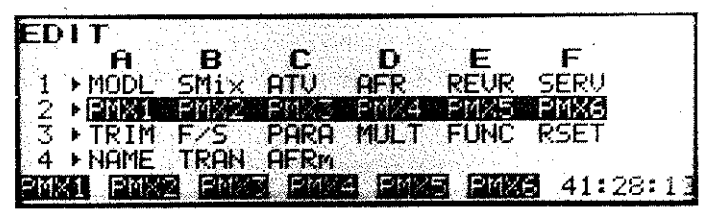
The next questions must be asked, with reference to the various mixes:

What - in the transmitter's language - is the name of the mix function to be programmed?

Are the mix settings to be altered or switched ON or OFF in flight?

Freely programmable mixes are available for the few instances where a special mix program does not exist and these can be made to perform a number of different tasks.

Mix programs can be called up in the EDIT display using 'SMIX' followed by simply selecting the desired mix program. Of course, the options available depend on the model type selected



Operation and programming

Quattro Mix, Quattro rate (operating level 3)

With this completely innovative function, most pre-programmed settings of mixers and travel can be changed over in flight, without involving any other model memories.

This function is, for example, particularly advantageous for gliders, which require flight modes for START, DISTANCE, SPEED or LANDING - all of which allow different settings for flaps, elevators etc.

For i/c powered aircraft, different settings can be programmed for normal wind, side wind or head wind.

The helicopter program allows various flight modes - hover, aerobatics, autorotation and inverted flight.

Each of these modes can be programmed to freely selectable external switches and each mode can be called up individually - one after another - in flight.

Servo path change-overs are programmed in the AFR-MODE 07 menu or directly by AFRm. When the menu has been accessed, the option of 'MANU' (manual) or 'AUTO' (automatic) may be programmed, followed by the required switches for manual operation or the throttle stick positions for AUTO operation.

Flight mode dependent mixer shifts are programmed by assigning the mixer switches (SMix, Menu Mix Sw 09) to the required flight modes.

Flight mode dependent programming offers the option of adapting the transmitter to any flight condition required by the model at a particular time. For example, if a model is at the start of a flight, all settings required for this 'START' flight mode may be called up by one switch. As soon as the switch is used, all pre-programmed START settings become active.
There are up to 5 different flight modes available for each model memory. Most mixes, as well as AFRs may be programmed for each flight mode.

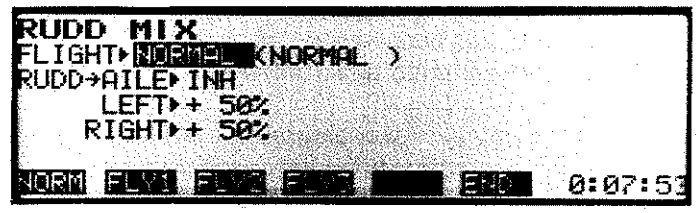
A glider, for example, may have the following flight modes: Normal, Start, Distance, Speed and Landing.

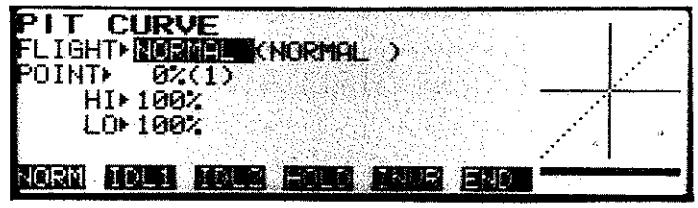
The ACRO program, for powered aerobatic aircraft, may include different settings, depending on the wind direction, such as: Normal, Fly 1, Fly 2, Fly 3 and Fly 4.

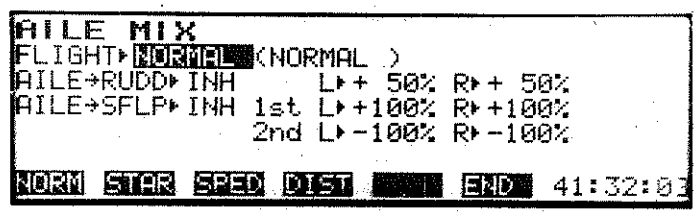
The flight modes for helicopters include: Normal, Idle-up 1(hover), Idle-up 2 (aerobatics), Throttle hold (autorotation) and Inverted flight.

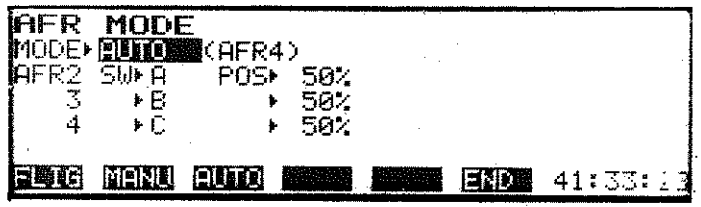
Each of these flight modes may be programmed to switches to be activated during flight.

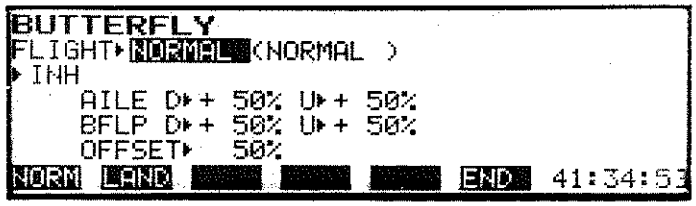
Flight mode dependent mixer programming is available when the mixer offers a 'FLIGHT' function in the menu. Here, the mix value may be input for each flight mode.











Operation and programming

Understanding the operating system

There are two methods of accessing the programming options: Direct Number Call and Graphic Menu System. After accessing the desired option menu, all further commands are given using the Graphic Menu System.

Options that require confirmation with 'yes' will not be stored until 'yes' has been keyed. All variations to servo paths, mixer programs etc. affect only the model selected.

Before setting up new mixer programs, ask these questions: Which mix program fulfils the specific needs of the model best?

What is the mix program called and where in the menu can it be found?

Does the mixing function need to be switched; if so, must a switch be allocated for it?

There are three levels of programming:

1) Standard functions
2) Standard mixer program
3) Advanced mixing

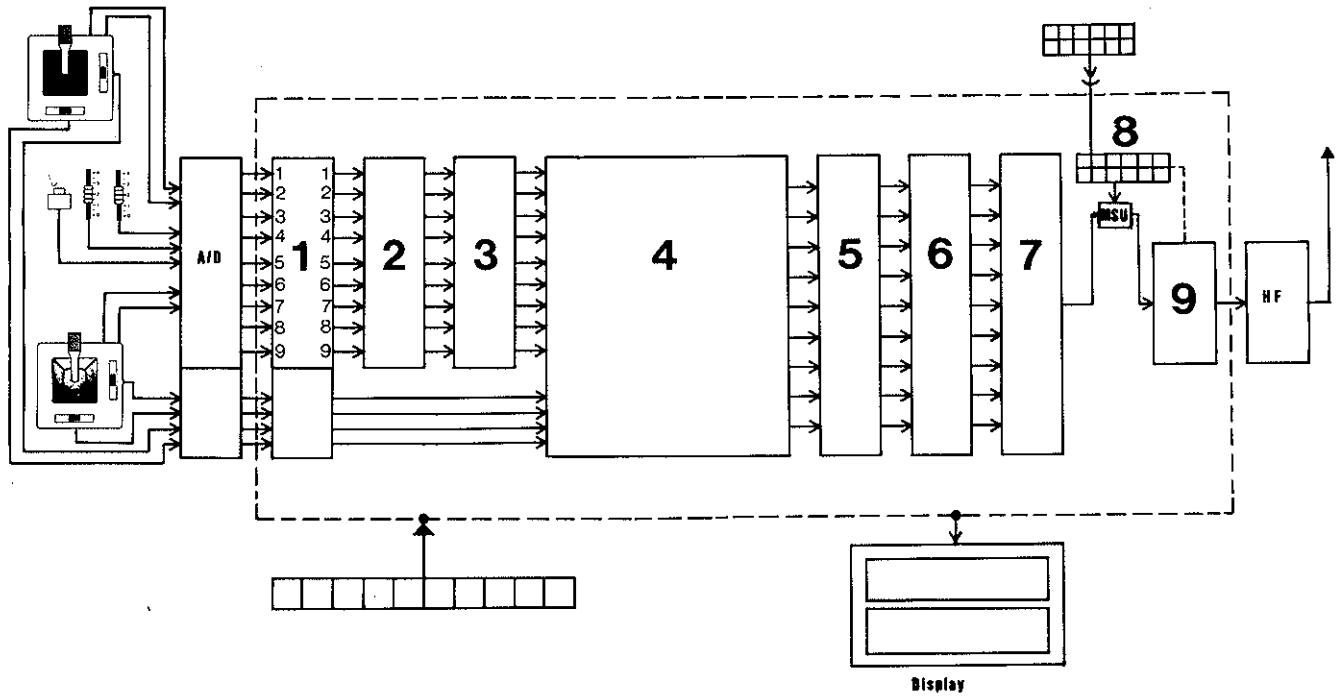
Before setting up new mixer programs, ask these questions: **Which mix program fulfils the specific needs of the model?**

What is the mix program called and where in the menu can it be found?

Does the mixing function need to be switched; if so, must a switch be allocated for it?

The answer to the last question may be found in the table at the end of the of this manual.

Operations diagram



To gain a better understanding of the programming processes involved in certain functions, the following description explains the internal sequence, shown above in the 'Operations diagram'. The diagram provides extremely simplified details of the process.

Description of function sequences

Each joystick, switch or slider corresponds to a definite 'bit' of information and is transmitted as 'analogue positional information' to the A-D converter. This unit converts the analogue information to 'digital positional information', since the processor within the transmitter can only process digital information. Trim information is also converted.

All the information shown within the broken line in the diagram above is 'digital information'.

Function co-ordination, FUNCTION CHANGE No 21

The joysticks, sliders and switched functions are co-ordinated in Function Block 1 - part of the digital electronics section - by simply deciding the sequence of functions assigned to the next function block.

Setting the characteristics of functions, AFR/EXPO No 15/16

Transmitter control paths are changed in Function Block 2, either by linear reductions (AFR) or by setting an exponential or VTR characteristic.

Operation and programming

The trims remain unaffected by these settings. After co-ordination and completion of these changes, the function information is then fed to the processor, together with the trim information.

Freely programmable mixer PMIX

Freely programmable mixers are programmed in Function Block 3, where any function can be mixed to another, or to itself.

Internal processing - mixers

The entire processing of the function information, i.e. mixer programming, takes place in Function Block 4. This block is of paramount importance and is responsible for the extensive range of options offered by the transmitter.

Extra trims, SUB TRIM, No 51

Neutral servo positions are affected in Function Block 5. These have nothing to do with the mechanical joystick trims, since they are used to balance the servo setting differences.

Servo travel adjustment, ATV No 14

Servo travel, is set in Function Block 6.

Servo reverse, REVERSE No 12

Any servo reversing is carried out in Function Block 7.

Model Memory

All the information programmed for a particular model is assigned to the model memory and then 'filed' in a memory section. The 'external' CAMPac model memories are not involved in the internal functional sequences. The activation of a model memory is achieved by Model Select. Only then is it possible to change any of the stored data within that memory.

PCM/PPM coding

The complete sets of model information are coded in Function Block 9, either into a PPM or PCM signal. For this reason, the coder draws on additional information provided by the appropriate model memory.

This concludes the internal function sequence and all data specific to a particular model has been set and programmed. The signal formed in this manner is boosted and transmitted via the RF module and aerial.

Keyboard and display

Input to the computer is by a keyboard and the output display is a large LCD. It is important to gain a thorough understanding of the internal function sequence to clarify several points:

1) Adjustments made **prior** to the processor section will all be processed together and therefore have a bearing on the results. This means that control characteristics set will be reflected in the mixer settings.

2) Joystick trims remain unaffected by servo path settings.

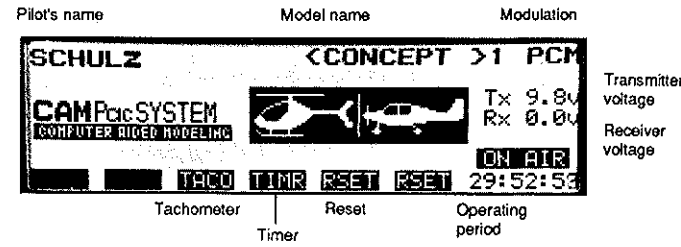
3) Setting up mixes using freely programmable mixers always results in all the mixed functions being processed, in addition to those programmed in the processor.

4) Only the information already processed will be affected by servo travel adjustments and the trim path will be adjusted accordingly.

5) Sub trims have no effect on mixer settings.

6) Servo reversal is carried out at the end of the function sequence so that in practical terms, this reversal corresponds to the receiver output into which the servo is connected.

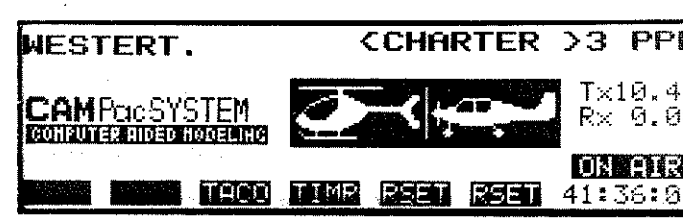
System display



This display appears immediately the transmitter is switched ON.
The user's name (when programmed) appears at the left hand side of the top line.
The current model memory will flash in the display to remind the pilot to check whether the displayed model is the actual model being flown. This flashing can be cancelled by pressing the 'ENTER' key.

The characters 'TX' are followed by the operating voltage of the transmitter. The characters 'RX' are followed by the receiver battery's operating voltage. The displayed value will be 0.0v until the DSC lead is connected between the transmitter and receiver.

The black 'ON AIR' line indicates whether or not there is any RF output. If this display fails to appear when an RF module with crystal has been fitted, there may be a malfunction.

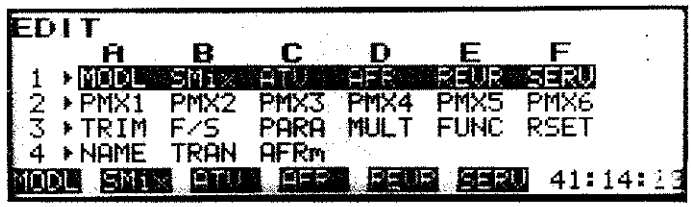


The total operating time of the transmitter is displayed in the bottom right hand corner. Each operating period is added as it is switched on, until reset to 00:00 (by pressing the two RSET keys simultaneously).
The bottom line always displays the function of the operating keys underneath.

Standard functions

Standard functions

Using the cursor, or the direct number call system, the following menus are available:



No:	Name	Abbreviation
02	TIMER SET	TIM
03	TACHOMETER	TACO
04	DATA TRANSFER	TRAN
05	SERVO	SERV
07	AFR MODE	AFRm
08	COPY	COPY
09	MIX SWITCH SELECT	MxSW
10	MODEL NAME	NAME
11	MODEL SELECT	MODL
12	REVERSE	REVR
13	MIXING TYPE	MxTY
14	ATV	ATV
15	AFR	AFR
16	EXPO/VTR	AFR

21	FUNCTION CHANGE	FUNC
22	FAIL SAFE	F/S
23	BATTERY FAIL SAFE	BF/S
27	MULTI	MULT
28	PARAMETER	PARA
29	TRIM RATE	RATE
30	TRIM MEMORY	MEMO
32	RESET	RSET
40	PROGRAMMABLE MIX1	PMX1
41	PROGRAMMABLE MIX2	PMX2
42	PROGRAMMABLE MIX3	PMX3
43	PROGRAMMABLE MIX4	PMX4
44	PROGRAMMABLE MIX5	PMX5
45	PROGRAMMABLE MIX6	PMX6

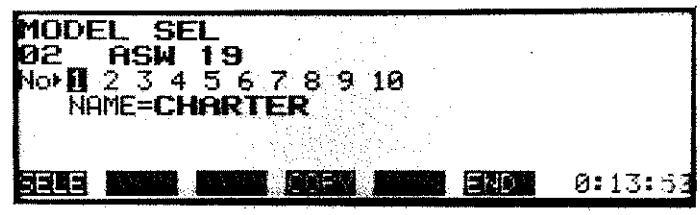
When programming a new model memory, always follow the sequence shown here since this will ensure minimum programming complications. Any alterations to the program sections and settings will affect only the model memory in use, without changing any other model memories.

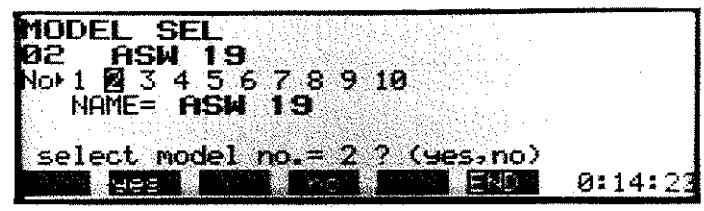
Model Memory (MODEL SELECT) 11

This function is used to select the required model memory. The specific data of any model can be stored in each memory. The transmitter has 6 model memories and each CAMPac has an additional 1 or 4.

Model memory selection:

Select the required memory number with the cursor keys, then press 'SELE'. The program will now require an acknowledgement (yes or no). If acknowledged with 'yes', the required model memory will be activated.

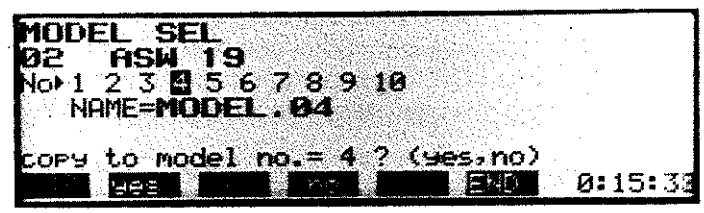




Copy function (COPY)

This option is used for copying data from one model memory to another, so that similar models do not require total re-programming, but only adjusting for the differences. It is also possible to obtain 'safety copies' in this way - prior to changing the settings on any model.

Select the model memory to be copied (SELE and 'yes'). Select the model memory to which the required model memory is to be copied. Press the 'COPY' key and acknowledge with 'yes'. The model memory has now been copied. Select the new model memory with 'SELE' and 'yes'. The new model memory can now be given a name (Menu 10, Model Name).

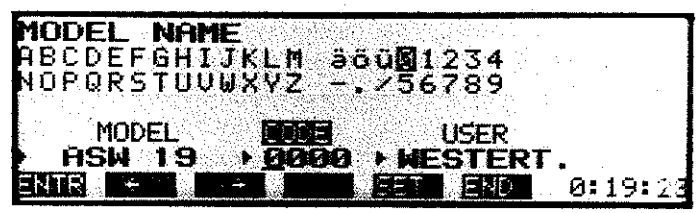


If a previously programmed model memory is to be re-programmed, cancel all old memory data by using Menu 'RESET' (RST - Menu 32) and then proceed with the 'Basic Settings' Menu.

Standard functions

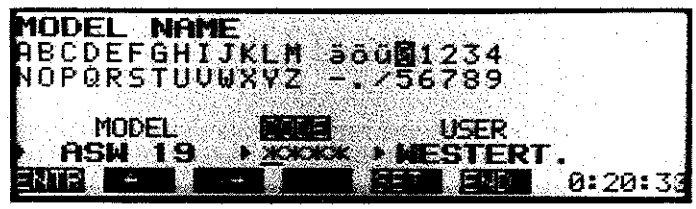
Model Name, user name, code number (model name) 10

Each model memory can be identified with a name (using a maximum of 8 characters). The pilot's name can also be entered in the transmitter's memory with a maximum of 10 characters. Your own security code number can also be programmed to protect the user name, after which no changes to the user name can be made without first re-keying the security number.



- The current model memory can be given a name with up to 8 characters
- The user can input his name with a maximum of 10 characters
- The user's name can be protected with a 4 digit security code which must be re-keyed before the user name can be changed.

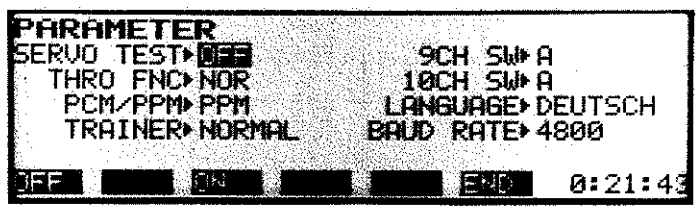
The letters and characters are selected with the cursor controls (9 and 0) and the highlighted character entered by pressing the 'ENTR' key. The second cursor, which underlines each letter of the input name, can be controlled with keys B and C. Selected characters are always input at the small cursor's position.
Once the input of MODEL, CODE or USER has been completed, press the 'SET' key for storing the entry.
If you should forget your security code number, please contact your Futaba Service Agent.



Basic settings (parameter) 28

This menu is used to enter the basic settings of various model data.

SERVO TEST:	All servos travel slowly across the full-scale deflection.
THRO FNC:	Selection of no-load trim for throttle 'NORM' - rear trim rate (low throttle) 'REVR' - front trim rate (high throttle)
PCM/PPM:	Selectable between PCM or PPM transmission depending on receiver used. Futaba FM receivers can be operated in the PPM mode. **After selection, the transmitter must be switched OFF then ON again for the change-over to take place.**
TRAINER:	Selects transmitter in 'trainer transmission' (NORM) or 'trainee transmission' (TRAI).
9CH SW:	Switch selection for channel 9.
10CH SW:	Switch selection for channel 10.



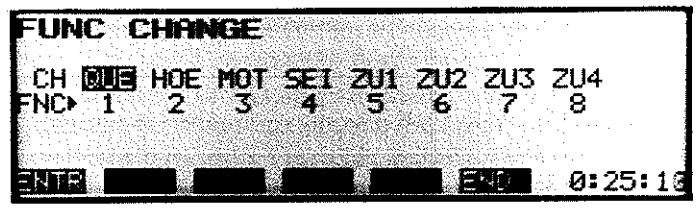
LANGUAGE:	Programming language selection (individual terms).
BAUD RATE:	Selection of transmission speed for 'COPY' - program.

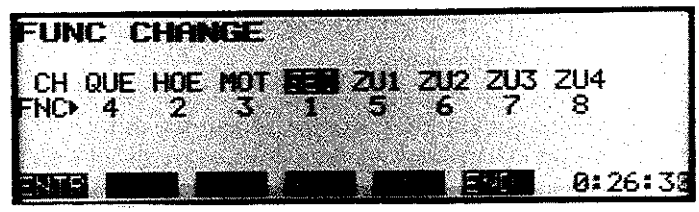
For the standard programming of any memory using this menu, only the PCM/PPM and THRO FNC must be programmed depending on the model or receiver used.

Standard functions

Transmitter configuration change (function change) 21

This option determines the function configurations, selected by the pilot, to suit the model and personal style. All functions are freely selectable - you decide which slider or switch will activate the air brakes or which joystick controls the throttle (Mode 1 or 2) etc. This will not affect the servo connections to the receiver. The abbreviations on the 'CH' (channel) line identify the various channels or model functions. The identification sequence remains the same - even when functions are exchanged - so the relevant servos are connected to the receiver in the same identification sequence. The numbers displayed on the line underneath refer to the numbers of the joysticks (1 - 4) or switches/sliders. The slider on the left is No. 5, centre No. 6, right No. 7. The 3 position switch is No. 8.





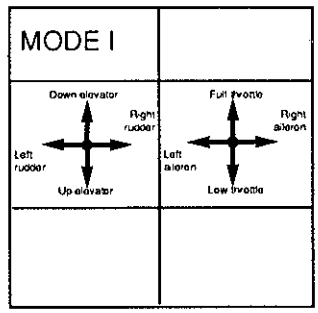
Programming:

Move the cursor, using the cursor control keys, to the required channel. Press 'ENTR'. Move the cursor to the channel to be exchanged with the first one and press 'ENTR'. Acknowledge the entry with 'yes' - and the two channels have been exchanged. In this way, it is possible to arrange all channels in the required sequence.
Example: If you wish the throttle to be changed from the left hand joystick to the right hand one, activate the throttle ratchet as previously described, move the cursor to ELE and press ENTR. Move the cursor to THR and press ENTR. Confirm with 'yes'. This modified configuration may now be copied to all the other model memories in order to save time with further programming.

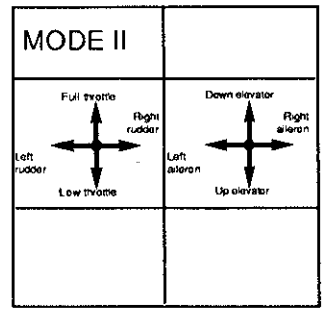
Control stick options

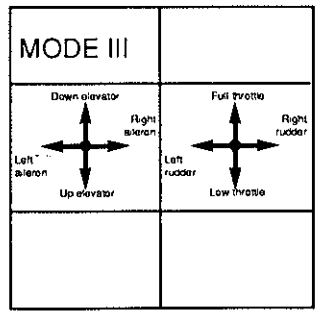
Mode	Order			
I	AIL 1	ELE 3	THR 2	RUD 4
II	AIL 1	ELE 2	THR 3	RUD 4
III	AIL 4	ELE 3	THR 2	RUD 1
IV	AIL 4	ELE 2	THR 3	RUD 1

MODE 1
Throttle right

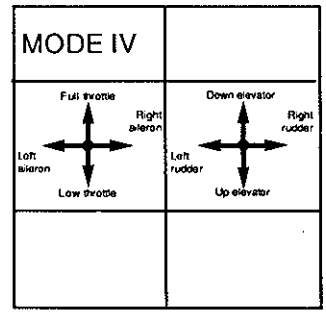


MODE 2
Throttle left





MODE 3
Throttle right



MODE 4
Throttle left

Abbreviations

Abb	Function	Abb	Function
AIL	Aileron	SF1	Flap channel 1
ELE	Elevator	SF2	Flap channel 2
THR	Throttle	AI2	Aileron channel 2
RUD	Rudder	FPR	Flapperon
ABR	Airbrake	PIT	Pitch
AUX	Auxiliary	GYR	Gyro
AU1	Auxiliary 1	BFL	Butterfly
AU2	Auxiliary 2	GER	Gear/retracts
AU3	Auxiliary 3	FLP	Flaps
AU4	Auxiliary 4		

Standard functions

Servo Reverse 12

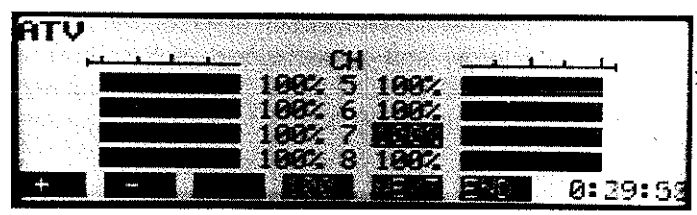
This option is used to reverse the direction of servo rotation for each function.

Call up the required function with the cursor. Press the 'REVR' key to reverse the servo direction. Press the 'NORM' key to return the direction of rotation to normal.

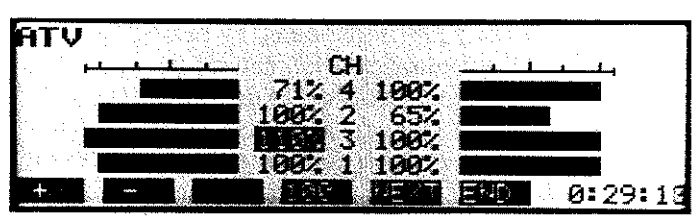
Servo travel adjustment (ATV) 14

The ATV function provides separate adjustment of servo travel to either side of centre individually for all 8 functions. Any reduction of servo travel with ATV will proportionally reduce the trim, dual rate and any Quattro-rate proportion which may have been set.

On the graphics display, ATV percentages are shown as bar charts for the first four channels. The cursor must be placed on the correct side of the function to be reduced - use the cursor control keys for up and down to select the function. Reduce or increase the travel using '+' or '-' keys. Press the 'NEXT' key to display the following 4 functions.

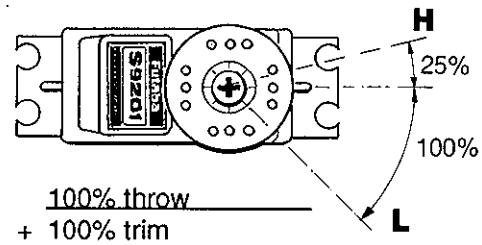


If the servo throw has been reduced to 50% with ATV, followed by a reduction in AFR (see below) to 50%, the resulting throw will be 25%.



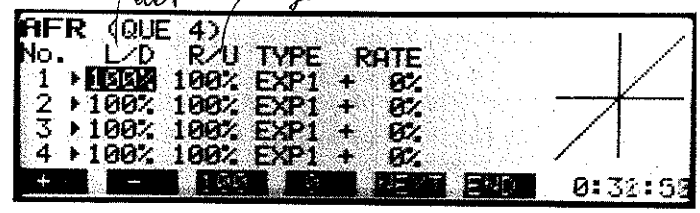
Setting the control characteristics (AFR) 15

AFR offers the option of limiting the full deflection of any function without a reduction of the trim path or dual rate proportions. AFR has the effect of placing 'mechanical' limits on the function. Any entered mix proportions will be reduced as well.

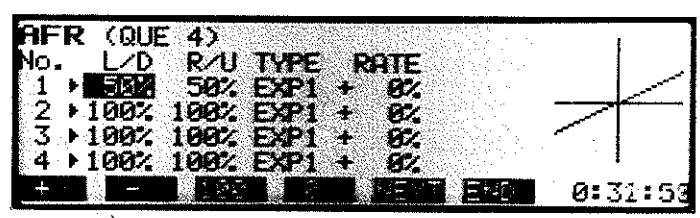


100% throw
\+ 100% trim
100% servo travel

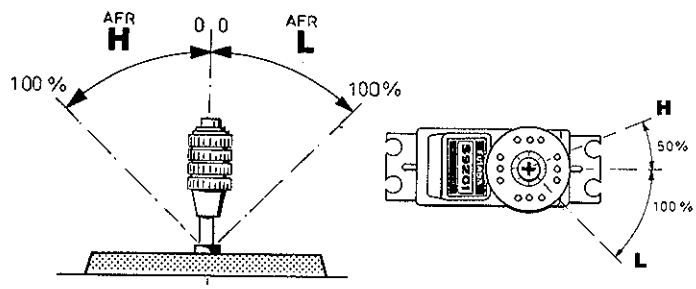
The AFR function forms the left hand part of the first line (No. 1) and is identified by L/D (Left/Down) and R/U (Right/Up). The channel which is to be reduced appears in the uppermost display line after AFR (AIL - AU2). The reduction will only affect the side on which the cursor has been placed. The cursor can be moved to the other side by moving the appropriate joystick, switch or slider.



After setting, call up the next channel using the 'NEXT' key. Reduce or increase the deflection using '+' or '-'. The reduction wil be displayed as a percentage on the display.



Initially, only line No. 1 will be available (for lines No. 2, 3 and 4 - see Menu AFR Mode 07).



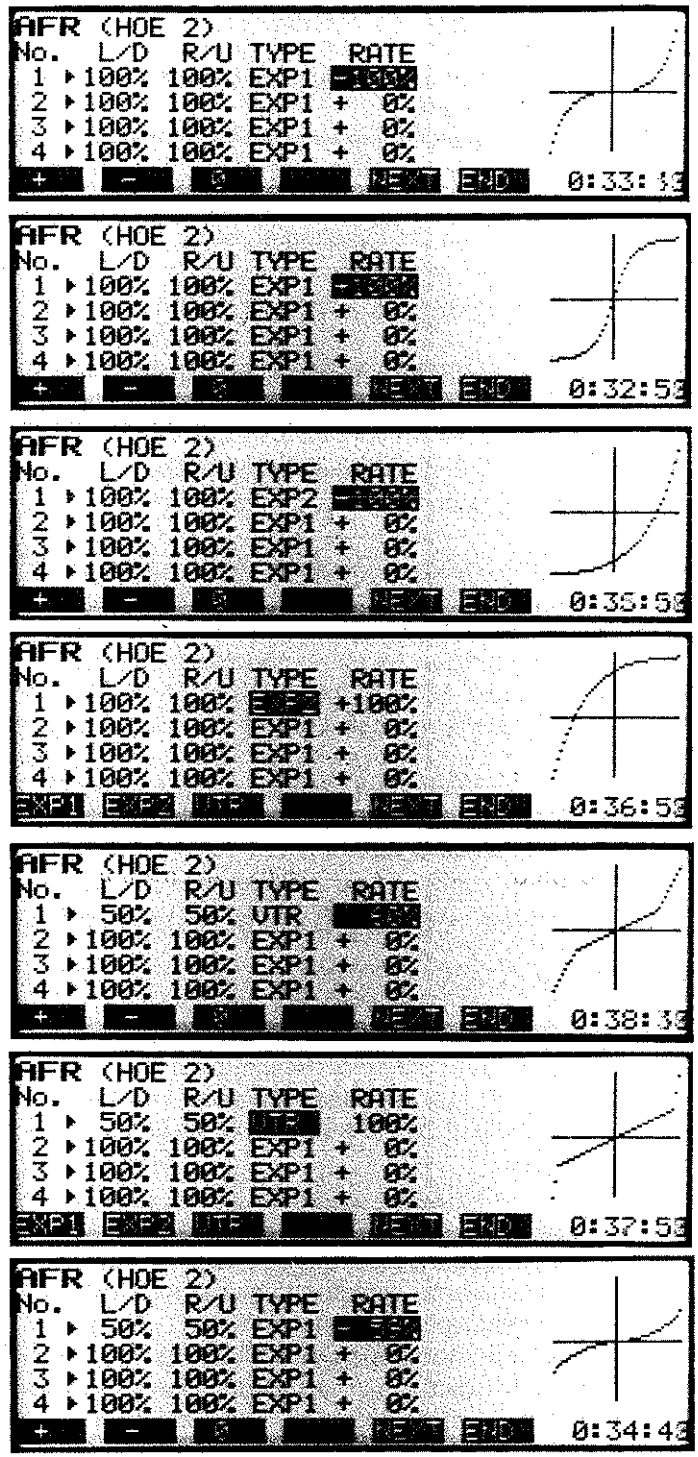
Standard functions

EXPONENTIAL/VTR 16

The exponential and VTR functions enable the servo response to matched to suit either the pilot's preferences or the control characteristics required by the model.
With EXPO 1, the servo deflections are made smaller around the centre position, increasing towards the end of the servo throw. The higher the value of exponential (set with +or-) the 'softer' the stick response at the centre. This is particularly useful for self neutralizing stick functions such as elevator, aileron and rudder.

With EXPO 2, the servo movement is increased at the centre of the throw and is decreased at full throw - depending on the setting (+/-) made. This is particularly suitable for non-neutralizing control functions. (e.g: carburettor linkage).

VTR produces a low servo deflection at the centre position, which increases after a certain pre-selected point. The change over point from 'weak' to 'strong' and the effect around the neutral position can be set. VTR produces the effect of joystick priority linear dual rates.
The full deflection of each servo remains the same for all three examples above. With Expo 1 and 2, the total throw for each side of neutral may be reduced. Place the cursor on the '100%' and reduce the throw with '-'. Control the cursor using the relevant joystick or slider, as with ATV and input the reduction in throw for the other side of neutral.



Programming

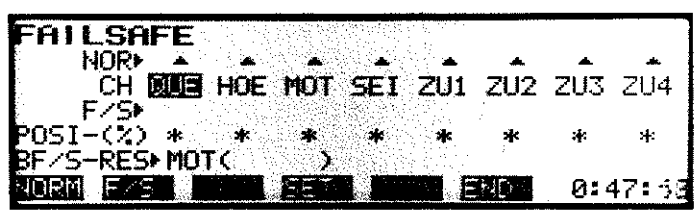
Select EXP1, EXP2 or VTR after placing the cursor on TYPE and adjust the amount of effect with '+' or '-'. The effect is shown on the graph to the right of the display.

VTR: Place cursor on 'L/D' or 'R/U', adjust the effect using '+' or '-'. Adjust the VTR change-over point with '+' or '-' with the cursor on 'RATE'. Always set the effect first.
Initially, only line No. 1 will be available (lines No. 2, 3, 4, see Menu AFR-Mode 07).

Fail Safe 22

With this function it is possible to programme any servo to either hold their last position or move to a preset position in the event of loss of signal or interference. This fail-safe option is only available when operating in PCM mode with a PCM receiver.

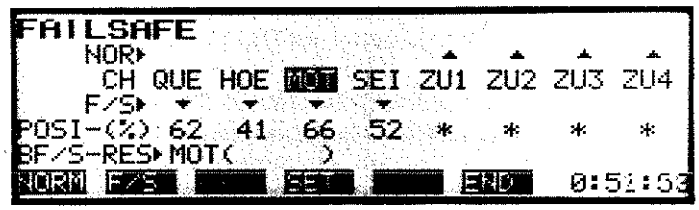
1) Fail Safe normal (NOR): The servos hold their last position
2) Fail Safe (F/S): The servos return to a pre-set position.



Standard functions

The other failsafe option available is the Battery Failsafe. This function allows the throttle to return to a pre-set position (usually idle) if the receiver battery should fall below a certain safe voltage.
Again, this option is only available when the system is used in PCM mode with a PCM receiver.

Programming



Fail safe normal

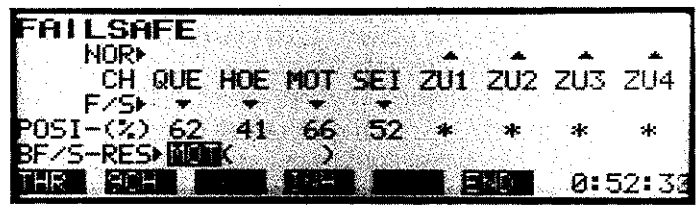
Any functions identified by the small arrow on 'NOR' line remain in their last position before a malfunction.

Fail Safe

All servos which are to take up a pre-programmed position after 1 second of malfunction, must be programmed by moving the small arrow above the channel (NOR) to below the line (F/S) using the F/S key. Then move the appropriate joystick or slider to the required position and press 'SET'. In the event of malfunction, the servo will return to this position - which is now displayed as a percentage of the total throw. The trim positions are also stored.

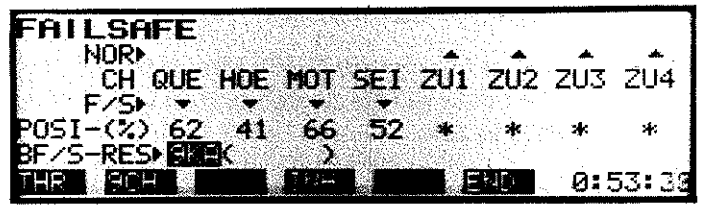
Test: After programming, simply switch OFF the transmitter whereupon the servos should move to their programmed F/S positions.

Battery fail safe 23



Battery Fail Safe - Throttle: If the receiver nicad voltage falls below a minimum limit in flight, the throttle is reduced to a preset position. This is programmed by moving the cursor to BF/S-RES, holding the throttle stick in the required (low) position and pressing 'THR' to store (display RESET). If the voltage of the receiver batteries should now drop below the minimum limit, the throttle servo will move to this programmed F/S position.

If the throttle is moved back to the preset position, full control is regained for a short time.

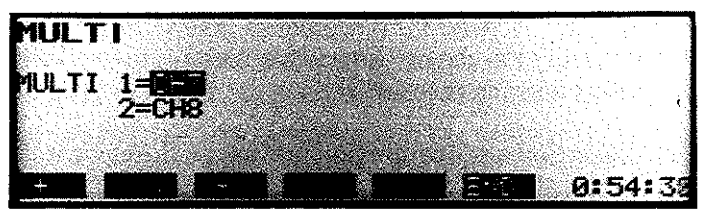


Battery Fail Safe - Channel 9:

Move the cursor to line BF/S-RES, press the '9CH' key in order to store the current channel 9 servo position. Call up either a visual or an audible display. Switch 'A' must be programmed for channel 9.

Multi Switch, Multi Prop program 27

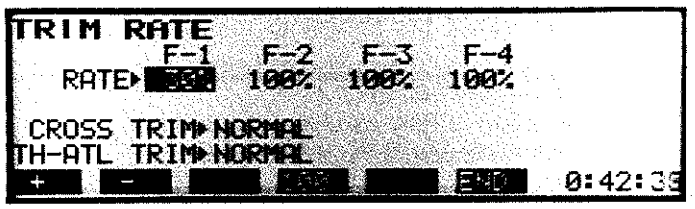
When a multi switch or multi prop module is fitted, it must be activated in MULTI (27) menu. Select the required channel which will operate the module (CH1-8) using the '+' or '-' keys. **Warning:** With the multi switch or multi prop activated, no mixing functions or alterations with ATV or AFR can be made to the multi channel.

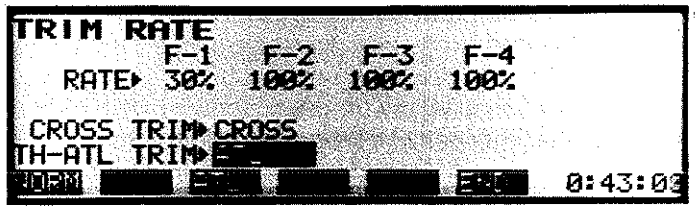


Standard functions

Trim Rate 29

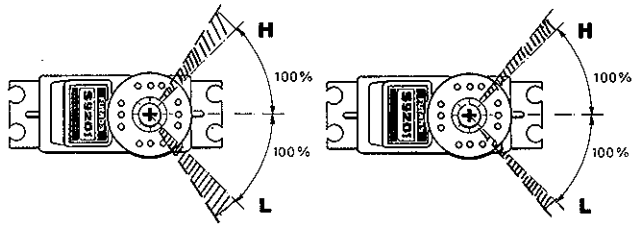
The effect of the stick trims can be reduced - in 1% steps - down to a minimum of 30% of the normal trim travel with this function. By setting 'CROSS TRIM' it is possible to exchange (cross-over) the function 2 and 3 trims (elevator and throttle) without affecting the stick functions. This is particularly useful for Mode 2 flyers (throttle left) as the elevator trim may be adjusted without releasing the aileron/elevator joystick. 'TH-ATL' offers the option of selecting the throttle trim function either as normal (NORM) or no-load trim (ATL) which only gives trim effect at low (rear) or high (front) stick settings. With rear ATL operating, the tick-over speed may be adjusted without affecting the full throttle setting. See menu 28, Basic settings for the option of front or rear ATL trim.





100% trim = 25% of the servo travel

ATL trim



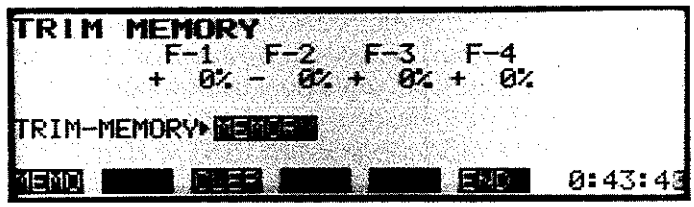
Trim effect

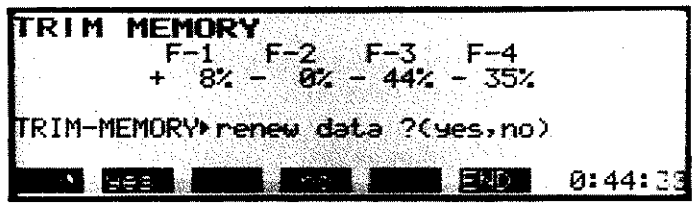
Trim Memory 30

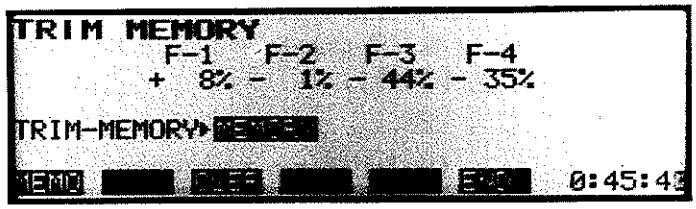
This function offers the option of storing the trim settings so that after setting, the trim levers may be neutralised with the trim effect stored. The trim memory affects only the model program in use and stores all trim positions - except for throttle. If the stored trim value, when added to trim lever value, exceeds the full trim path magnitude, additional trim amounts will not be stored.

Press MEMO, followed by 'yes' to set the trim memory. Neutralise trims. Any further changes of trim may be entered by MEMO.

To clear the trim memory press CLER, followed by 'yes' to confirm. All trim data will be cleared and all stored trim values returned to zero.





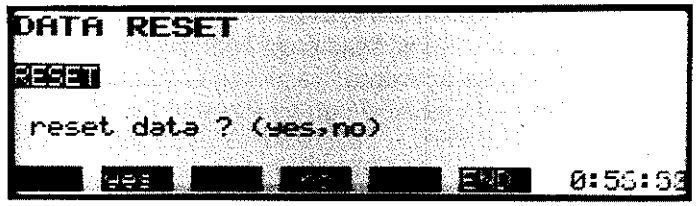


Resetting entries (Reset) 32

It is possible to reset all data and inputs stored in a model memory, including all settings, transmitter configurations and any mixer switches or mixers.

Press the 'RSET' key, and acknowledge entry by pressing the 'yes' key. During the reset process, a series of arrows travels across the screen. An audible 'bleep' is then given to confirm reset completion.

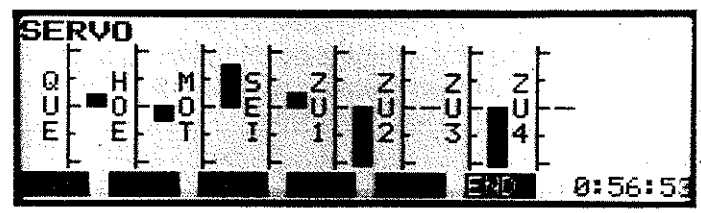
The 'Basic Settings' (parameter) and the model name will not be reset by this process.



Standard functions

Servo display (SERVO) 05

The functions of individual controls, mixers, switches etc., are displayed on a bar chart. When operating a slider, joystick or switch, the movement can be followed on the graphics display. Any reduction of servo throw etc. is also shown by a reduced chart display for that particular function.

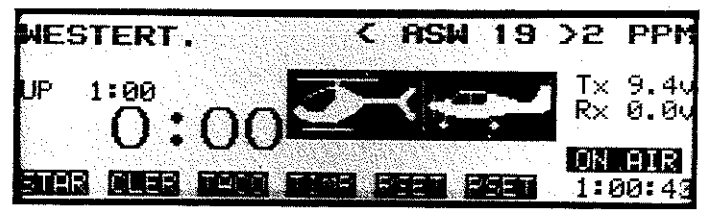


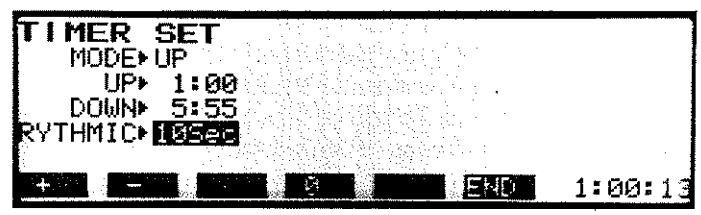
Timer 02

The integral timer provides 4 functions:

Display of operating period
Incremental function - (count up)
Decremental function - (count down)
Rhythmic timer

The timer is coupled to an audible 'bleep' which starts to sound every second, 20 seconds prior to the end of the time setting. The rhythmic timer sounds a signal using a programmed pulse. The timer is shown in the system display (first displayed when the transmitter is switched ON) unless the timer is inhibited (INH) in TIMR



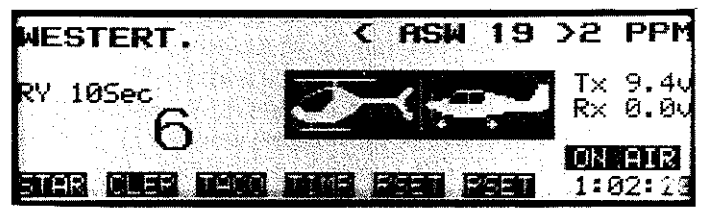


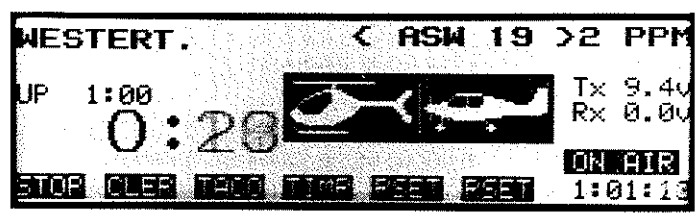
Setting

Select the timer operating mode (up, down, rhythmic) and enter the required time settings using the cursor and entry keys. Return to the system display by pressing 'END'.

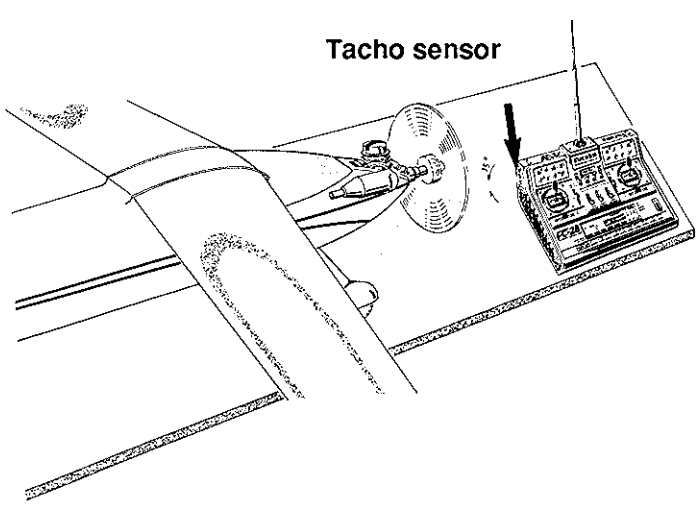
Start: Key 'STAR'
Stop: Key 'STOP'
Reset: Key 'CLER'

The operating period (total transmitter ON time) is displayed in the bottom right hand corner. The time display can be reset to 0: 00: 00 by simultaneously pressing keys 'RES' and 'RES' in the system display.

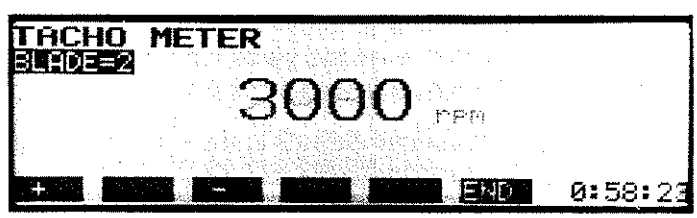




Tachometer 03



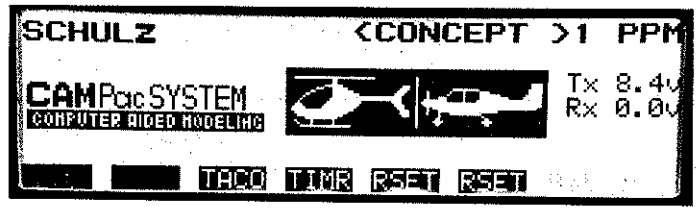
The integral optical tachometer will measure the speed of propellers with 1 - 5 blades up to a maximum speed of 50,000 rpm. Select the number of propeller blades using the '+' or '-' keys. Hold the transmitter so that the left hand side faces the rotating propeller at a safe distance (30cm). The rpm will appear in the graphic display.



Standard functions

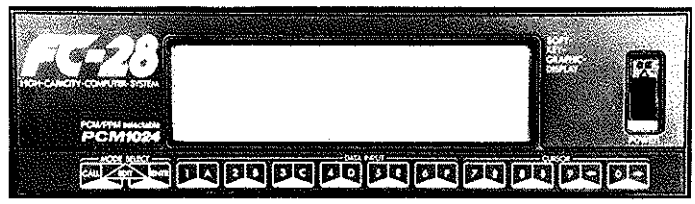
Low battery warning

If the transmitter battery voltage should fall below 8.4 volts during operation, an alarm sounds and the system display 'blinks' as a warning to land the model.



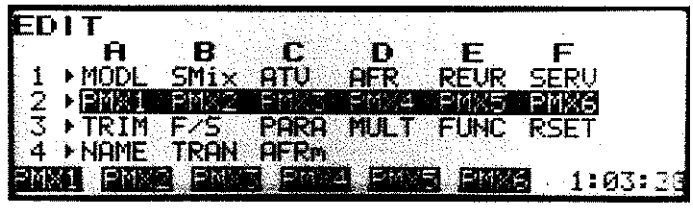
Auto cut-off

If no transmitter function is operated for 30 minutes, the transmitter automatically switches off. To switch the transmitter back on, simply switch OFF then ON. This auto cut-off feature is particularly useful if the transmitter is inadvertently left switched ON before storage.



Free program mixers

These mix facilities may be used for programming simple mix functions as well as the complicated integration of several other functions. There are 6 freely programmable mixes available at all times. 'Programmable' in this case means that the user is able to decide - without restriction - which function to mix with another one. The mix may be programmed to be kept operational at all times, or an additional external switch may be allocated to switch the mix ON or OFF in flight. The mix value and direction may be set separately for each side of centre. When mixing joystick functions, the user may decide whether or not to have the trim affecting the mixed channel. Mix offset is also freely selectable.



What is a mix?

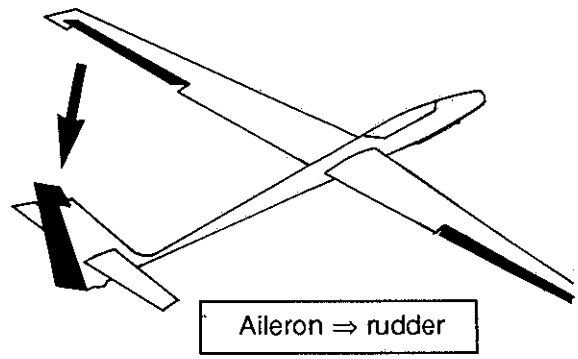
One refers to 'mixing' when a function has been activated with the intention of influencing another function. For example: When moving the ailerons one way, the rudder is to be deflected in the same direction without having to move the rudder joystick. This is a 'locked-in' mix, where only one direction has been 'mixed'.

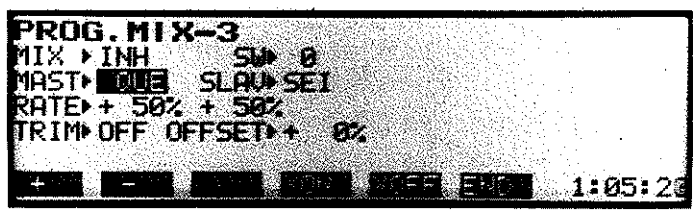
In the menu, an arrow pointing in one direction is used for mixes between one MASTER channel and one SLAVE channel. The function in front of the arrow is always the MASTER and the function after the arrow is always the SLAVE.

MASTER: Any function that has a mixed effect on another function. In the example above, the **aileron** is the master function.

SLAVE: Any function that is affected by the action of another function is said to be the **slave** function. In the example above, the rudder is the slave function.

Mix direction: If the rudder deflects to the 'LEFT' when the ailerons are operated to the 'RIGHT', the sense of the mix direction must be reversed.





Standard functions

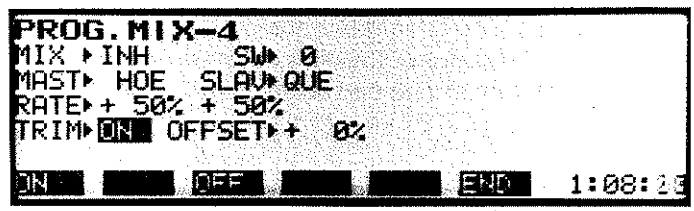
A mix of two **equal** functions is referred to as a 'double mix', or 'cross mix' and will have two master functions - for example V-Tail, where both control surfaces are to be mixed in the same direction when controlling the elevator and in opposite directions when controlling the rudder. Therefore both the rudder and elevator functions may be described as the master function.

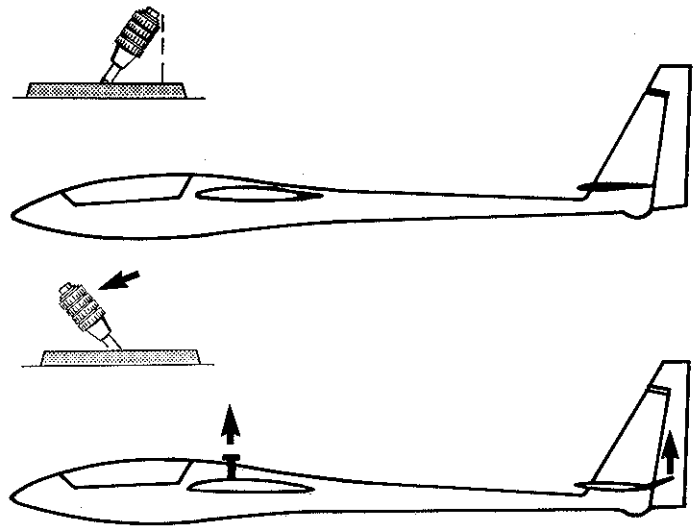
In the menu's display, double mixes are indicated by arrows pointing in both directions, with each function being both master and slave.

These 'programmable mixes' are nothing more than 'locked mixes'. However, double mixes can be programmed by combining two programmable mixes.

Offset: The mixing position of the master function is the offset point, i.e. the mid-position of the aileron joystick, from which the lock-in and mixing will be of equal magnitude on both sides.

It is also possible, however, to arrange the offset on any other point of the master function's deflection. This is particulary important where there is only mixing on one side of the master function. This arrangement is most frequently used when the master function is non-centring, such as the throttle joystick or on slider controls.
Example: The elevator is to be balanced when operating the airbrakes from the throttle stick. When the airbrakes are retracted, the throttle stick is at the 'full throttle' position with the stick to the top of the transmitter. It is this position which is programmed as the offset point, so that the elevator mixing only takes effect when the airbrakes are extended.





Programming:

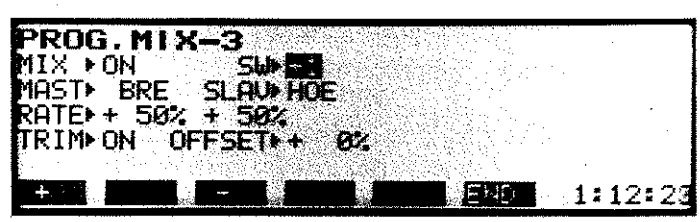
Activate the mix on the MIX line using 'ACT'.

Program a switch number to follow the 'SW' statement, if the mix is to be switched ON or OFF during flight. Figure '0' means that the mix will always be switch on. Figures 1 to 8 correspond to the external switch connections (EXT.SW:) 1 - 8 on the PC board, and A,B and C to the integral switches at the centre of the transmitter.

Switch direction:

The direction in which the switches operate can also be determined when programming. Prior to allocating a particular switch, simply move the appropriate switch to the desired 'OFF' position, then enter the switch number with '+' or '-'.

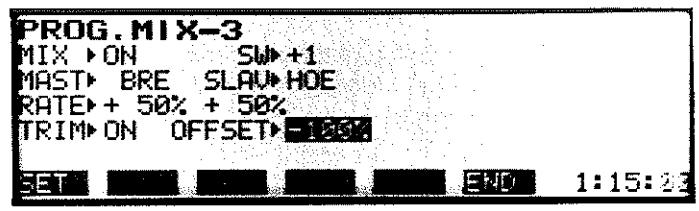
To change the switching direction of a ready-programmed switch, first enter any other switch number using '+' or '-' then move the desired switch into the new 'OFF' position and re-select the switch with '+' or '-'. The switch will now be displayed with a '-' sign, e.g. switch 'A' becomes switch '-A'.



Standard functions

Move the cursor to 'MAST' (master) and enter the desired function which is to lock in another function after activating. Move the cursor to 'SLAV' (slave) and enter the desired slave function. Move the cursor to the 'RATE' line, where the slave function's deflections can be entered for each side of centre. Move the master function's joystick or slider from one side of centre to the other to control the cursor's movement from either side of centre on the slave function. Stick trim mixing can be selected on the 'TRIM' line.

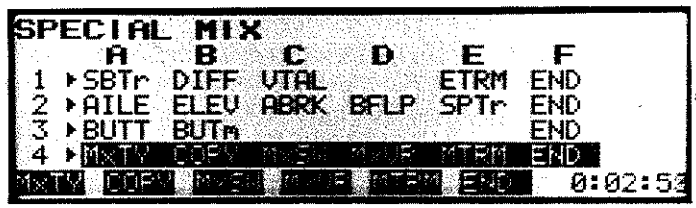
Move the cursor to the 'OFFSET' position. Now enter the offset point. This point is always 0% for self-centring functions such as aileron, elevator and rudder and should not be altered. If the throttle stick, slider or switch is used as the master function, it must be moved to the desired position from where the mix is to be effective (for example, throttle stick forward = retract flaps). Press 'SET' to enter this position and the programmed offset point will be displayed in %.



Further programmable mix settings are given on pages 120-122, 'Practical Tips'.

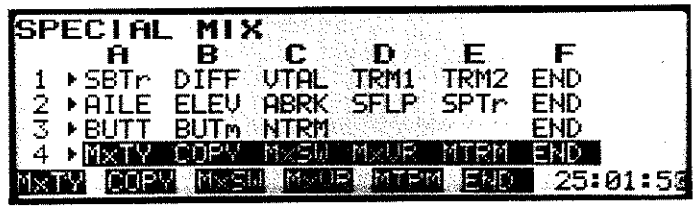
Mixer type 13

The FC-28 software provides completely programmed mixers which have been organised to suit typical models such as glider, helicopter or aerobatic. All the user must do is decide which mixer arrangement is the best for his model and for the requirements of that model. Once the selection has been made, all that remains is to activate and set the individual mixers within that model type.

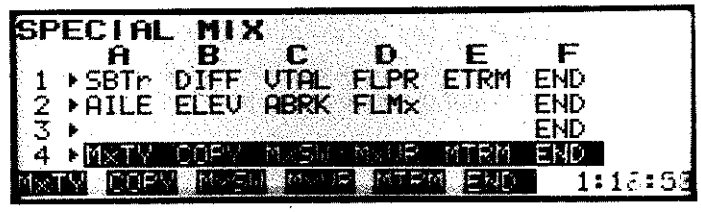


Selection of Mixer Program

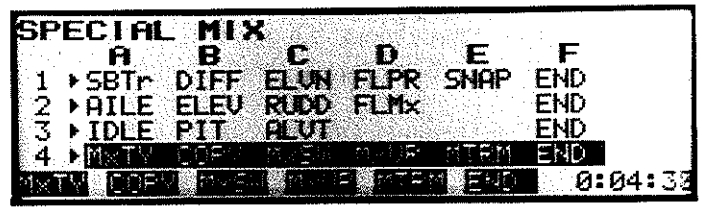
Select, either directly by keying '13' or from the EDIT menu using 'SMix' and 'MxTY'. Decide between 'Standard' (STND), 'Glider' (GLID), 'Aerobatic' (ACRO) and 'Helicopter' (HELI). The appropriate mixer types and servo connections can be found from the table on page 32.

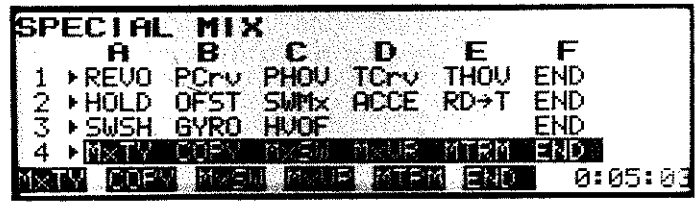


The receiver's channel 5 and 6 outputs are automatically programmed for the speed flap connections when mixer types Glider 5 or Glider 4 are selected. Receiver outputs 1 and 7 are automatically programmed for aileron connection with these mixes. With Glider 2, the aileron connections are changed to receiver outputs 1 and 5 when programming the 'Flapperon Mixer'.



Warning: If the mix type is changed, all settings programmed in the special mix (SMix) menus within the active model memory will be reset to their factory values.





Mix Programs

Selection of mix programs

To save time when programming, special mixes and functions are grouped together to form 'Mix Programs'. These mix programs are designed to suit standard types of model, such as glider, aerobatic and helicopter. Each mix program contains the optimum number of mixes and functions for the specific model being programmed. If the model being flown does not require all the mix functions provided within the mix program, then the mixes not required may, of course, be inhibited.

Special mixes, i.e. those functions which are specifically tailored to a particular type of model are only available after the mix program has been selected. For example, helicopter functions such as revo-mix, hovering throttle and pitch curve will only be available after selecting mix program HELI.

All functions and mixes within each mix program are already programmed and only require activating and adjusting. Default values are also entered, such as 100% for ATV, 50% each side for revo mix, or 30% for flap deflection. Of course, these values may be adjusted, but are given as a guide. Some functions are already activated in each mix program. In mix program HELI, the throttle and pitch are already mixed and revo mix is activated etc. In mix program ACRO, differential is activated as it is assumed that this style of model will be fitted with separate servos on each aileron. In all of these cases, the mix may be inhibited (INH) if desired.

If a particular mix or function is to be switched ON or OFF in flight, then a switch must be fitted and programmed. This is also true for programmed settings that must be adjusted in flight. For each of these, a trimmer must be fitted and programmed.

If the model being flown requires a number of spare channels for auxiliary functions, then inhibit mixes that are not required in the mix program to free these channels.

Before selecting a mix program, use the diagrams as a reference to choose the mix program that is going to best suit the model being flown.

Always select the correct mix program before entering any values or adjusting any mixes as a change of mix programs (e.g. from GLIDER 2 to ACRO) will reset all special mix functions to their factory default values.

Always check the servo connection table for each mix program, as the servos do not necessarily plug into the receiver in the same order in each mix program.

Channels 5 - 8 are often used as slave channels in a mix program and may not be available as free channels unless a mix is inhibited.

Mix programs

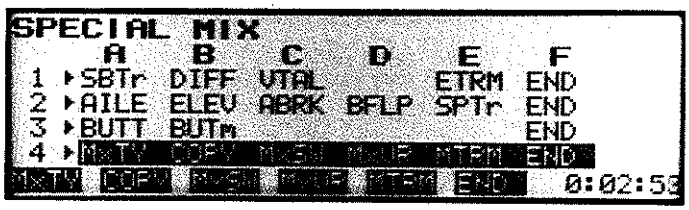
Function tables - a summary

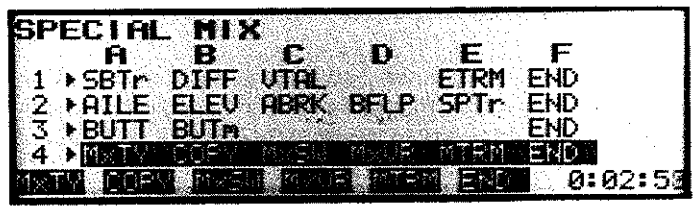
Mix program GLIDER 5

Function	Abbr.	No
Selection of mix switches	MxSW	09
Mix trims	MxVR	50
Selection of mix trims	MxVR	79
Sub trim	SBTr	51
Aileron differential	DIFF	56
V Tail mixer	VTAL	57
Airbrake ⇒ elevator mix	ABRK	61
Elevator trim 1 and 2	ETRM	62
Butterfly, Airbrake⇒aileron +airbrake⇒brake flap mixer	BUTT	72
Butterfly⇒elevator (Butterfly mix)	BUTm	73
Speed flap trim	SPTr	74
Brake flap mixer Brake flap⇒aileron, brake flap⇒ elevator, brake flap⇒speed flap	BFLP	75
Aileron mixer. Aileron⇒rudder (combi sw), aileron⇒speed flap	AILE	76
Elevator⇒brake flap mixer	ELEV	77

Mix program GLIDER 4

Function	Abbr.	No
Selection of mix switches	MxSW	09
Mix trims	MxVR	50
Selection of mix trims	MxVR	79
Sub trim	SBTr	51
Aileron differential	DIFF	56
V Tail mixer	VTAL	57
Airbrake ⇒ elevator mix	ABRK	61
Elevator trim 1 for aileron, speed flap, elevator - with delay	TRM1	62
Elevator trim 2 for aileron, speed flap, elevator - with delay	TRM2	63
Neutral trim for aileron + speed flap	NTRM	66
Butterfly, Airbrake⇒aileron +airbrake⇒brake flap mixer	BUTT	72
Butterfly⇒elevator (Butterfly mix)	BUTm	73
Speed flap trim	SPTr	74
Speed flap mixer, Speed flap⇒ aileron, speed flap⇒elevator	SFLP	75
Aileron mixer. Aileron⇒rudder (combi sw), aileron⇒speed flap	AILE	76
Elevator⇒brake flap mixer	ELEV	77





Servo connections for mix program GLIDER 5

Function	Receiver output	Abbreviation
Aileron 1	1	AIL
Elevator	2	ELE
Airbrakes	3	ABR
Rudder	4	RUD
Speed flap 1	5	SF1
Speed flap 2	6	SF2
Aileron 2	7	AI2
Brake flaps	8	BFL
Servo connections for V-Tail, receiver outputs 2 + 4		

Servo connections for mix program GLIDER 4

Function	Receiver output	Abbreviation
Aileron 1	1	AIL
Elevator	2	ELE
Airbrakes	3	ABR
Rudder	4	RUD
Speed flap 1	5	SF1
Speed flap 2	6	SF2
Aileron 2	7	AI2
Free channel	8	BFL
Servo connections for V-Tail, receiver outputs 2 + 4		

Mix programs

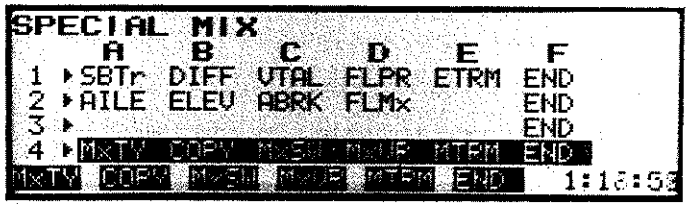
Function tables - a summary

Mix program GLIDER 2

Function	Abbr.	No
Selection of mix switches	MxSW	09
Selection of mix trims	MxVR	79
Sub trim	SBTr	51
Aileron differential	DIFF	56
V Tail mixer	VTAL	57
Airbrake ⇒ elevator mix	ABRK	61
Elevator trim 1 and 2	ETRM	62
Flapperon mixer. Speed flap⇒aileron	FLPR	65
Flapperon⇒aileron mixer	FLMx	75
Aileron⇒rudder (combi sw)	AILE	76
Elevator⇒flapperon mixer	ELEV	77

Mix program ACRO

Function	Abbr.	No
Selection of mix switches	MxSW	09
Mix trims	MxVR	50
Selection of mix trims	MxVR	79
Sub trim	SBTr	51
Aileron differential	DIFF	56
Aileron ⇒ rudder mixer	RUDD	57
Delta mix, aileron⇒elevator (elevon)	ELVN	9
Throttle idle-up 1 and 2	IDLE	61
Snap roll. Mixing aileron, elevator and rudder	SNAP	62
Flapperon mixer.Speed flap⇒aileron	FLPR	65
Propeller pitch mixing	PIT	70
Ailevator mix. Elevator ⇒ aileron	ALVT	72
Flapperon ⇒ elevator mix	FLMx	75
Aileron⇒rudder (combi sw)	AILE	76
Elevator⇒flapperon mixer	ELEV	77



Servo connections for mix program GLIDER 2

Function	Receiver output	Abbreviation
Aileron 1	1	AIL
Elevator	2	ELE
Airbrakes	3	ABR
Rudder	4	RUD
Aileron 2(flprn)	5	SF1
Free channel	6	SF2
Aileron 2(diff)	7	AI2
Free channel	8	BFL
Servo connections for V-Tail, receiver outputs 2 + 4 For flaperons, aileron outputs are 2 + 5 are used For differential ailerons outputs are 2 + 7 are used.		

Servo connections for mix program ACRO

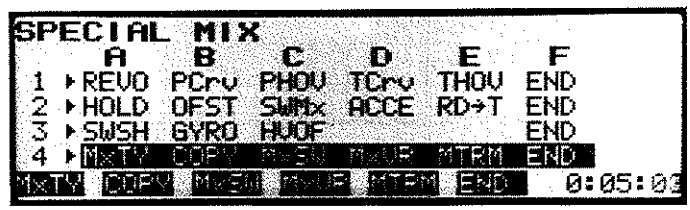
Function	Receiver output	Abbreviation
Aileron 1	1	AIL
Elevator	2	ELE
Airbrakes	3	ABR
Rudder	4	RUD
Aileron 2 (flprn)	5	SF1
Free channel	6	SF2
Aileron 2 (diff)	7	AI2
Free channel	8	BFL
Servo connections for delta, receiver outputs 1 + 2. When differential ailerons are programmed, use outputs 2 + 7. With flaperons, use outputs 2 + 5.		

Mix programs

Function tables - a summary

Mix program HELI

Function	Abbr.	No
Mixer switch selection	MxSW	09
Mix trimmer	MxVR	50
Mixer trim selection	MxVR	79
Pitch ⇒ tail (Revo mix)	REVO	51
Hovering throttle	THOV	52
Hovering pitch	PHOV	53
9 point throttle curve	TCrv	54
Throttle hold	HOLD	56
9 point pitch curve	PCrv	57
Aileron, elevator, rudder offset mix	OFST	59
Swashplate type	SWSH	60
Hovering offset	HVOF	68
Swashplate mixing	SWMx	69
Swashplate ⇒ throttle mix	SWMx	69
Gyro mix	GYRO	72
Acceleration mix	ACCE	73
Rudder ⇒ throttle mix	RD-T	74



Servo connections for mix program HELI

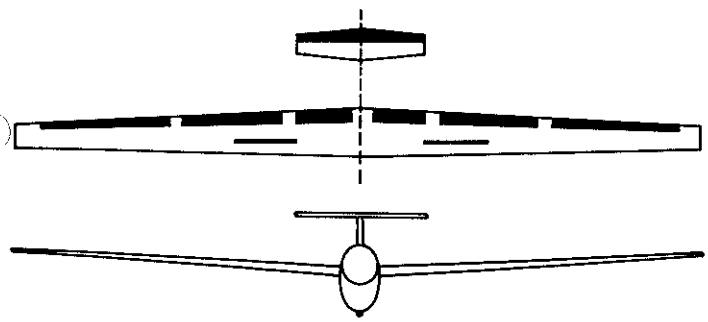
Function	Receiver output	Abbreviation
Roll (Aileron)	1	AIL
*Nick (Elevator)	2	ELE
Throttle	3	THR
Tail rotor (rudder)	4	RUD
Gyro	5	GYR
Pitch	6	PIT
Free channel	7	AU1
Free channel	8	AU2
When the gyro function is not used, channel 5 becomes a free channel. * Nick refers to fore/aft cyclic.		

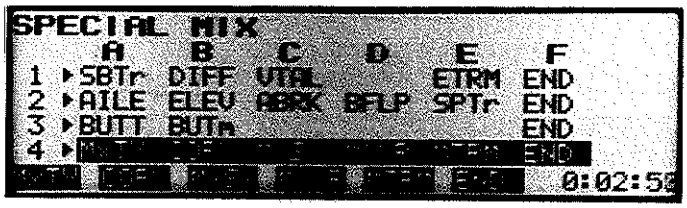
Mix program - Glider 5

Mix program GLIDER 5

This mix program has been developed for gliders fitted with brake flaps, in addition to the usual speed flaps (see sketch). These brake flaps are controlled by a single servo and therefore always move in the same direction. Mix program GLIDER 5 can also be used for controlling flying wings.

By selecting mix program GLIDER 5, the receiver outputs 5 and 6 are automatically programmed for the speed flap servos. Aileron differential is already activated and the aileron servos must be connected to the receiver outputs 1 and 7.





Function characteristics

In the following, all functions within mix program GLIDER 5 are described individually to familiarise the user with the operation and optional functions.

Certain parts of a function must be accessed in the display with the 'cursor control keys' and these will not be pointed out each time. All descriptions refer to 'NORMAL' flight mode. **The statement on the 'Flight' line, which occurs in numerous menus, is displayed in flight mode dependent programming (see page 79).**

Function table

All functions identified with an 'x' may be made to be flight mode dependent.

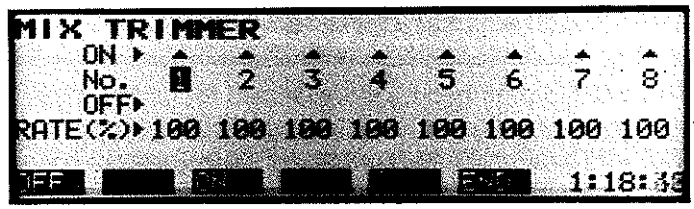
Function	Abbr.	No
Mixer switch selection	MxSW	09
Mix trimmer	MxVR	50
Mixer trim selection	MxVR	79
Sub trim	SBTr	51
Aileron differential	DIFF	56x
V Tail mixer	VTAL	57
Airbrake ⇒ elevator mix	ABRK	61x
Elevator trim 1 and 2	ETRM	62x
Butterfly, Airbrake⇒aileron +airbrake⇒brake flap mixer	BUTT	72x
Butterfly⇒elevator (Butterfly mix)	BUTm	73x
Speed flap trim	SPTr	74x
Brake flap mixer Brake flap⇒aileron, brake flap⇒ elevator, brake flap⇒speed flap	BFLP	75x
Aileron mixer. Aileron⇒rudder (combi sw), aileron⇒speed flap	AILE	76x
Elevator⇒brake flap mixer	ELEV	77x

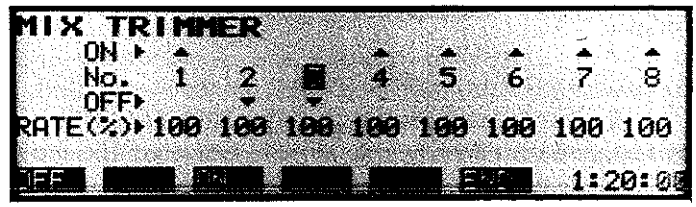
Servo connections for mix program GLIDER 5

Function	Receiver output	Abbreviation
Aileron 1	1	AIL
Elevator	2	ELE
Airbrakes	3	ABR
Rudder	4	RUD
Speed flap 1	5	SF1
Speed flap 2	6	SF2
Aileron 2	7	AI2
Brake flaps	8	BFL
Servo connections for V-Tail, receiver outputs 2 + 4. Output 8 becomes a free channel when the brake flap mixer is inhibited. Output 7 becomes a free channel when the differential program is inhibited.		

Mix program - Glider 5

Mix trimmer function (MTRM) 50





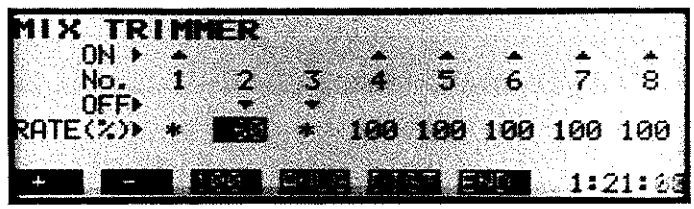
In this menu, you can decide whether or not to activate additional external mixer trimming (ON/OFF) and whether the adjustment is to be analog (ANLG) when using a rotary trimmer or digitally (DIGT) when using a spring loaded digital switch. For 'analog' adjustment, you must fit and connect trimmers (supplied in pairs or fours) to the 'EXT. TRIMMER' sockets on the PC board. For 'digital' adjustment, you must fit a digital switch to the EXT.TRIMMER socket.

Each trimmer socket can be activated (arrow in the ON position) or switched off (arrow in the OFF position). The trimmer is selected with the cursor. The trim rate of each trimmer connected can be varied from 15% to 50% of the programmed values of any mixer.

Select the type of trimmer by keying 'ANLG' (analog) or 'DIGT' (digital).

Digital Switch

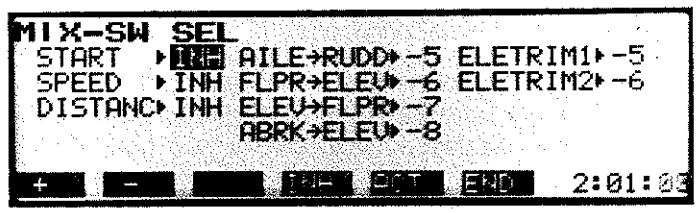
Instead of adjusting the trim effect using a rotary mix trimmer, a digital switch may be used if installed in the transmitter. This switch is connected in the same way as a mix trimmer. If a digital switch has been connected to trim socket 1, this connection must be programmed for 'digital' operation by keying 'DIGT' (asterisk displayed underneath the trim function). The programmed function's setting may then be changed in flight by simply 'pressing the key'. The programmed setting is altered by 1% for each switch movement in one direction (+ or -), thus ensuring that the changes are made in a specific way, e.g. 10 movements equalling a change of 10%. As with any setting, the alterations made with the digital switch are stored immediately, too. The maximum alteration of any setting using the digital switch will not exceed 100% of the programmed setting. All functions that can be trimmed with external trimmers can also be trimmed by a digital switch.



Selection of mix switches (MxSW)09

Certain functions within mix program GLIDER 5 may be switched ON or OFF during flight, so they require a switch. In the display, therefore, all functions will be shown which can be switched ON or OFF by a switch, following which the required function is simply selected using the cursor control. The required switch can then be allocated by entering '+' or '-'.

In this instance, numbers 1 - 8 refer to EXTERN SW. sockets 1 - 8 on the PC board and the switches A, B and C correspond to the integral switches in the centre of the transmitter.



Mix program - Glider 5

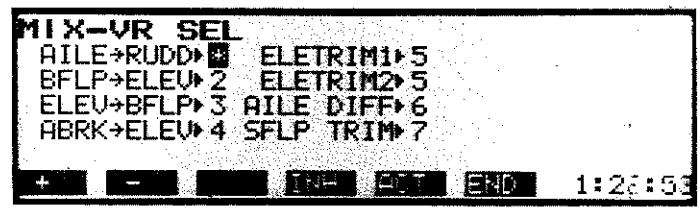
Initially, program all functions by suggesting a switch with a '-' sign, which means that the switch has yet to be connected or allocated. This should then be altered when a switch is actually programmed.

The various functions shown in the display are not connected and each function can be programmed on its own to be switch operated. It is also possible to program ONE switch for several functions. Any switch programmed for a flight mode cannot then be programmed for other functions.

The switch direction may be reversed (see page 29)

Selection of mix trims (MxVR) 79

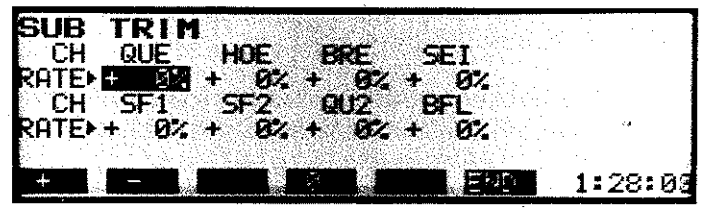
Mix program GLIDER 5 provides the option of trimming numerous functions when flying. To do this, an additional trimmer must be fitted for each function. The required function can then be selected using the cursor control keys and the trimmer selected using '+' or '-'. For example, if trimmer no.1 is to be programmed for a function, it must be fitted connected to socket 1 (EXT. Trimmer). The trimmer effect can be switched off by using 'INH' or re-activated using 'ACT'. There is also the option of programming ONE trimmer for several functions.



Additional trimming (SBTr) 51

With this option, the first 8 functions of the transmitter can be adjusted at their neutral positions. This will be required when the neutral position of any servo is not quite correct. The adjustment option corresponds to the trim path of stick trims.

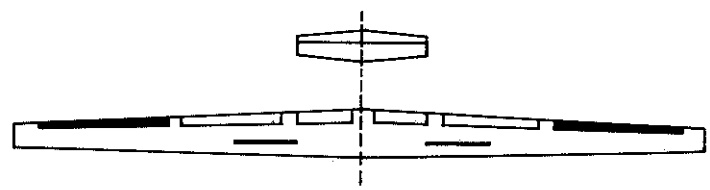
Adjust each servo centre position using '+' or '-'. Reset each servo centre by pressing '0'.



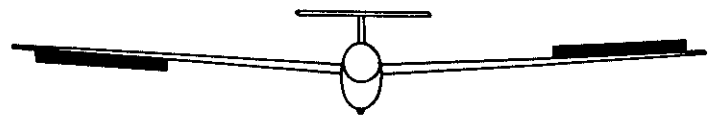
Aileron differential (DIFF) 56

This function offers the option of separate adjustment of the amount of each aileron deflection 'UP' and 'DOWN'. Each aileron requires a separate servo. For the receiver output connections, see table.

Set the amount of aileron deflection of the second aileron servo using '+' or '-' or '100' (for full movement) and the direction of the second servo using '+/-'.



Without differential

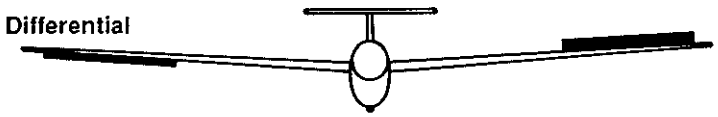


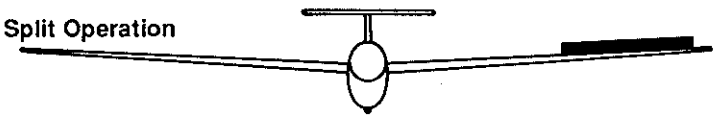
Mix program - Glider 5

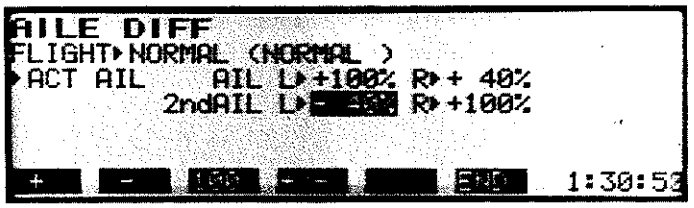
When the aileron differential has been activated, it is not possible to activate menu 65, FLAPPERON (Display prompts 'off other mix'). If Flapperon or Elevon are to be operated together with differential, switch off differential (INH) and activate Flapperon or Elevon (ACT). Then set the amount of differential in the Flapperon or Elevon menu.

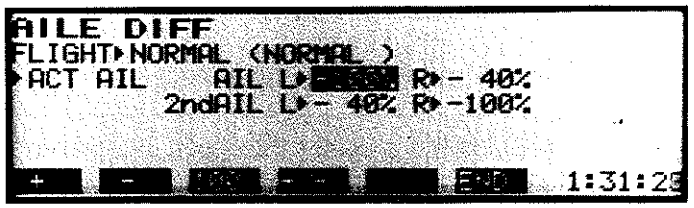
Move the aileron stick to the RIGHT and set the 1st servo deflection with '+' or '-'. Move the stick to the LEFT and set the 2nd servo's deflection. The mix direction may be reversed if necessary using '+/-'.

Program a trimmer in 'Selection of mix trims' (MxVR 79).





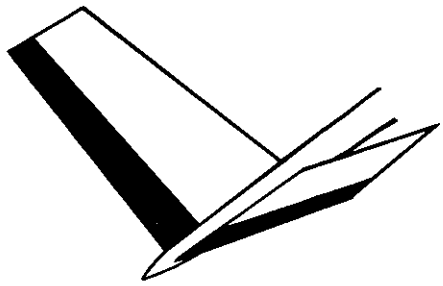




V-Tail 57

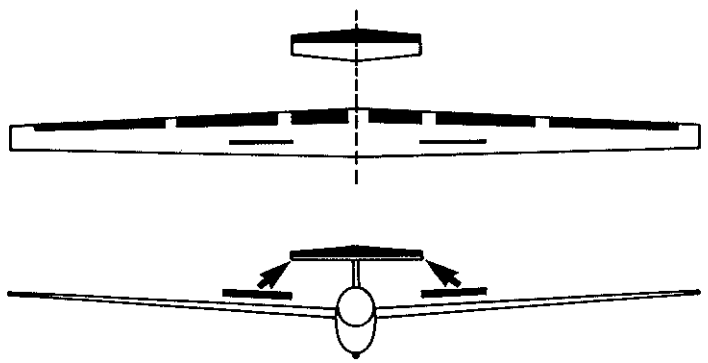
This function enables the control of combined elevator and rudder with V-Tail models. The amount of elevator or rudder deflection can be set separately for up/down and left/right. A separate servo must be connected for each surface in receiver outputs 2 and 4.

Activate the mixer using 'ACT'. To set the individual throw of each servo, select the rate and adjust the value with '+' or '-'. Set the surface direction using '+/-'.



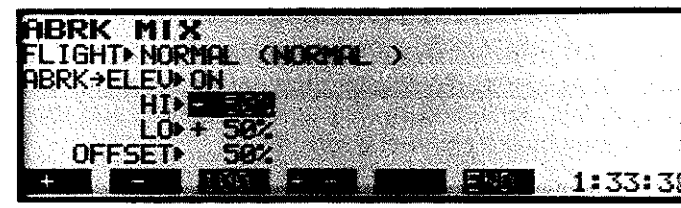
Air brake⇒elevator mixer (ABRK) 61

This function mixes the elevator to the airbrakes to compensate for the loss of lift when the airbrakes are extended with the throttle stick. This will prevent the model from 'stalling'. The elevator's compensating deflection may be set on either side (HI, LO) of the throttle stick movement. The mixer may be switched ON or OFF in flight using a switch. The offset point is freely adjustable. In addition, the setting may be trimmed using an external trimmer.

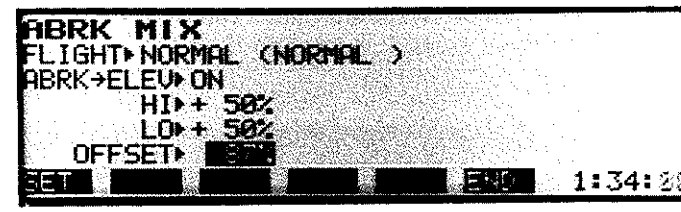


Mix program - Glider 5

Activate the mixer using 'ACT'. Retract the air brakes using the throttle stick and leave the throttle in this retracted position. Move the cursor to 'Offset' and press 'SET' to program this position of the throttle stick. This is now the position (see page 29) from which the elevator compensation will be effective when the airbrakes are extended.



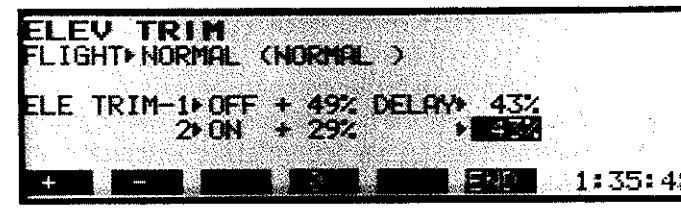
Move the cursor to HI or LO and set the required value using '+' or '-'. If the elevator compensation setting is single-sided, for example HI (high) = 100%, LO (low) = 0%, the elevator compensation will range from one full deflection to the centre of the throttle stick deflection and there will be no compensation from the centre to the lowest throttle stick position. If the elevator compensation acts in wrong direction, reverse the sense of the mix direction using '+/-'.



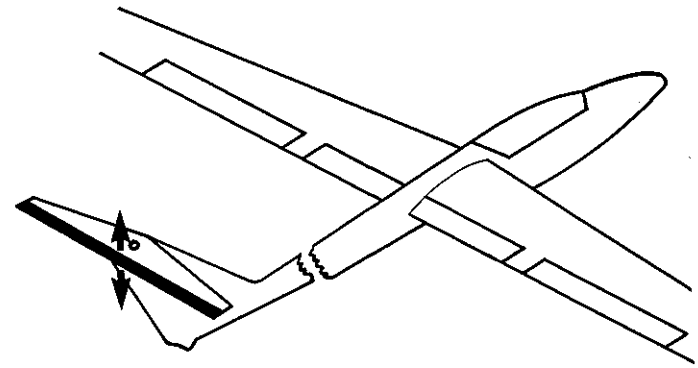
A switch can be allocated in 'Mixer switch selection' (MxSw 09) and a trimmer allocated in 'Mixer trimmer selection' (MxVR 79). The mix can be programmed to be dependent on the flight mode selected.

Elevator trim (ETRM) 62

With this function, the elevator offset (trim) may be switched, during operation, to various pre-programmed positions. This setting may then be trimmed during flight using an additional external trimmer. It is also possible to set a delay so that the elevator moves to the new programmed position slowly, thus avoiding any sudden trim changes. There is also the option of programming two independent elevator offset settings, whilst retaining the effect of the stick trim.



This function is designed primarily for use in connection with flight mode dependent programming, when the same switch is used to activate the function as well as change the flight mode.

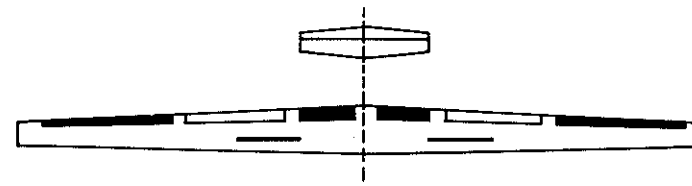


Activate the function using 'ACT' Set the elevator trim position using '+' or '-'. Set the required delay using '+' or '-'.

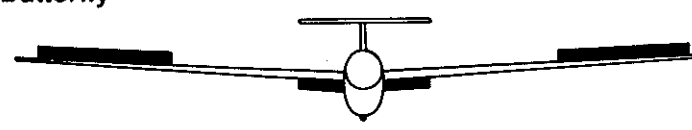
Select the switch to activate the function and flight mode in 'Mixer switch selection' (MxSW, 09). Select the trimmer using 'Mix trimmer selection' (MxVR 79).

Butterfly function (BUTT) 72

With this function, both ailerons are deflected upwards and at the same time, both brake flaps deflected down, thus putting the mode into an extreme braking mode. Although the ailerons and flaps still function in principle, only the DOWN going surface will operate. For example if the model is given a command of right aileron, only the left aileron will move downwards, as the right aileron is already fully deflected upwards. When the butterfly function has been activated, the switch will only deflect the brake flaps up to their offset point, thus retaining control of both the brake flaps and ailerons. This function may be



Butterfly



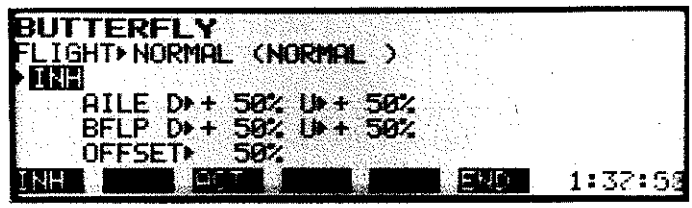
Mix program - Glider 5

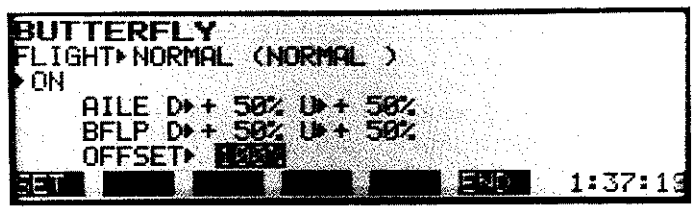
operated by a switch but is more normally controlled by the throttle stick. Activate the function by pressing 'ACT'. Butterfly is now controlled by the channel 6 slider, the ailerons are controlled by the aileron joystick and the brake flaps by the channel 8 switch.

If the butterfly function is to be controlled by the throttle stick, the order of functions must be changed in 'FUNC'. If the throttle is controlled by the left hand joystick, functions 3 and 6 must be swapped. If the throttle is controlled by the right hand joystick, functions 2 and 6 must be exchanged.

Set the mix ratios using '+' or '-'. The mix direction may be reversed using '+/-'. To set the offset point, move the throttle to the forward stop and press 'SET'. In this throttle stick position, all flaps should now be in their neutral position.

Program the operating switch in MxSW 09. The butterfly function may also be flight mode dependent.



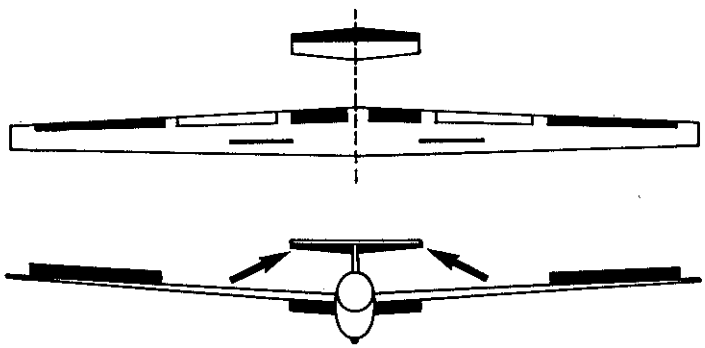


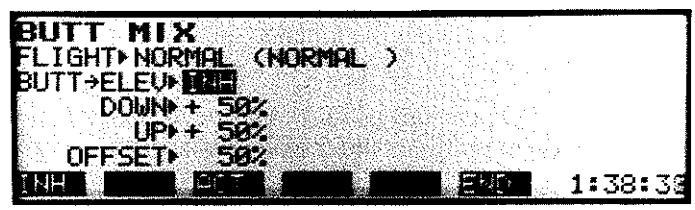
Butterfly to elevator mix (BUTm) 73

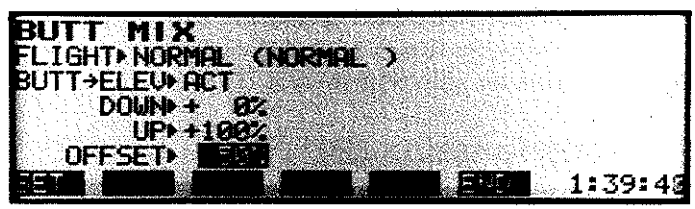
This function permits elevator compensation of any trim changes that occur with the butterfly function. The amount of compensation may be set separately for each side of neutral (UP, DOWN). Offset is freely selectable, but should, of course, be identical to the butterfly offset position (throttle stick at the forward stop).

Activate the mix by pressing 'ACT'. Move the throttle stick to the front stop and leave in this position. Move the cursor to the 'Offset' line and press 'SET'. This programs the position at which the elevator compensation will be triggered, after activating the butterfly function.

Move the cursor to UP or DOWN and set the compensation value using '+' or '-'. If the elevator compensation setting is single sided, for example UP = 100% and DOWN = 0% the elevator will range from full deflection to the centre position of the throttle with no elevator compensation from the throttle's centre position to its position. Reverse the direction of the mix if required using '+/-'. The mix can be programmed to be flight mode dependent.





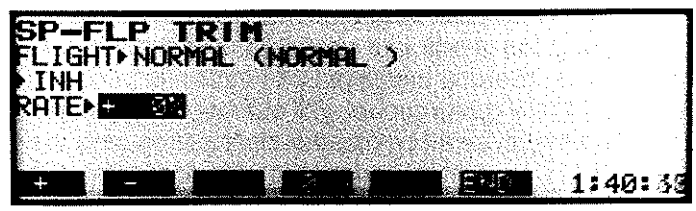


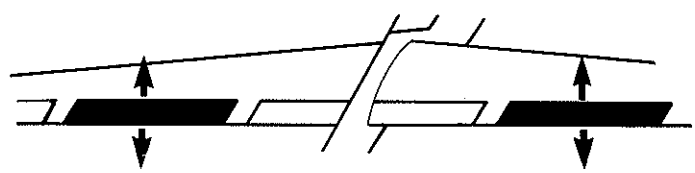
Speed flap (SPTr) 74

With this function, the speed flap offset can be trimmed further, without any pre-programmed functions being altered by the mix ratio. This setting may be adjusted by an external trimmer during operation.

Activate the function by pressing 'ACT'. Set the trim position of the speed flaps using '+' or '-'. Program the trimmer in MxVR.

This function can be programmed to be flight mode dependent.





Mix program - Glider 5

Brake flap mix (BFLP) 75

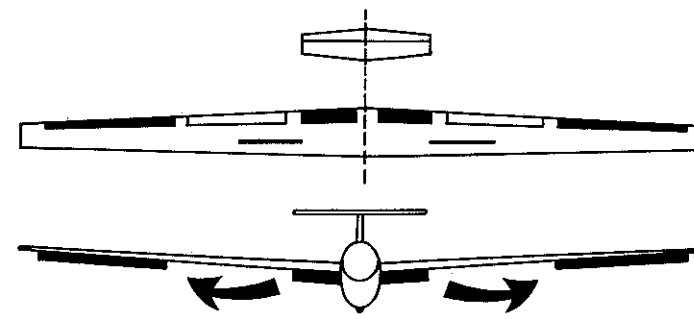
This option acts as a 'brake flap master function' (function 8). This means that all functions that can be mixed to the brake flap deflection can be set on this display. The deflections can be set separately for each side of neutral (UP and DOWN) The offset position of the brake flap control is freely programmable. All mixes can be programmed to be flight mode dependent.

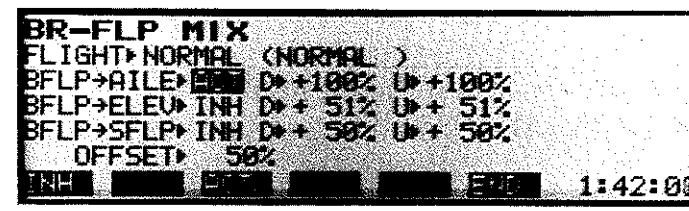
Brake flap⇒aileron mixer (BFLP-AILE)

This mix gives the option of mixing in the ailerons when extending the brake flaps so that the ailerons can be used as brake flaps too.

Activate the mix using 'ACT'. Set the brake flaps to full deflection one side to allow the setting of the aileron deflection upon using brake flaps. Adjust using '+' or '-'. The direction may be reversed using '+/-'.

To set the offset point, move the brake flap slider until the brake flaps are in their neutral position. Press 'SET' to store.





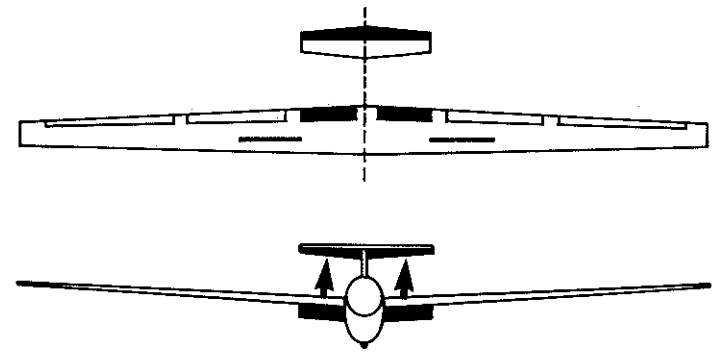
Brake flap⇒elevator mixer (BFLP-ELEV)

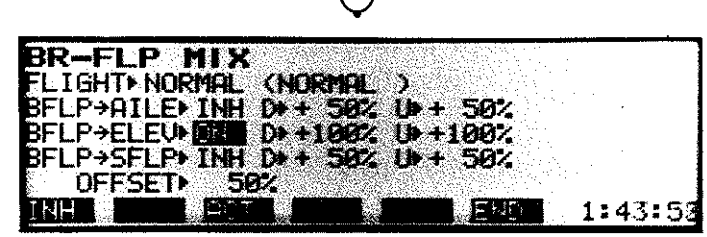
This mix is used to balance the trim changes that occur when the brake flaps are extended, using elevator compensation. The mix can be switched ON or OFF in flight and the settings adjusted with an external trimmer.

Activate the mixer using 'ACT'. Move the brake flaps to full deflection to set the elevator compensation. Adjust using '+' or '-'. The mix direction may be reversed using '+/-'.

To set the offset position, move the brake flap slider control until the brake flaps are in their neutral position. Press 'SET' to store this position.

Program the operating switch in MxSW 09 and the trimmer in MxVR 79.



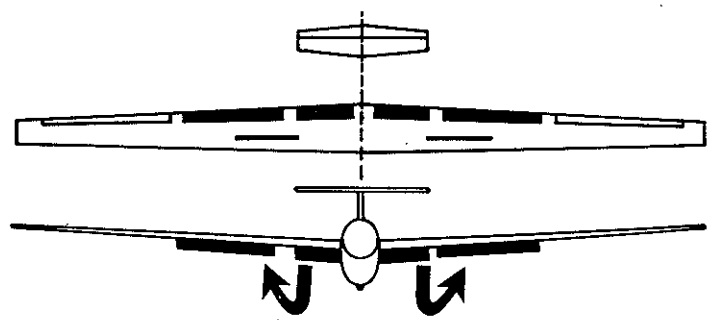


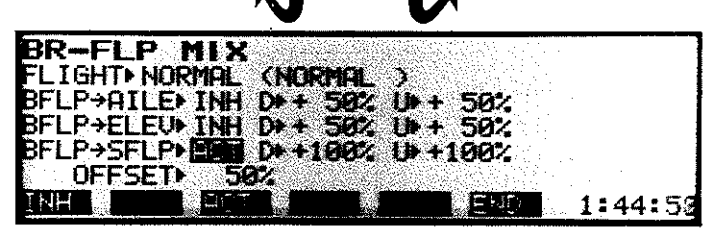
Brake flap⇒speed flap mixer (BFLP-SFLP)

This option is used to mix in the speed flaps when operating the brake flaps, so that the speed flaps can be used as brake flaps too.

Activate the mix using 'ACT'. Move the brake flaps to full deflection to adjust the speed flap deflection. Adjust using '+' or '-'. The mix direction may be reversed using '+/-'.

To set the offset point, move the brake flap slider until the flaps are in their neutral position. Press 'SET' to store.



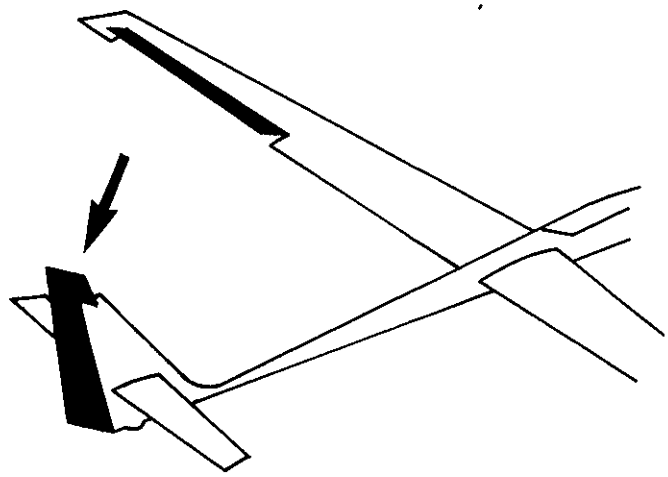


Mix program - Glider 5

Aileron mix (AILE) 76

This option acts as an 'aileron master function'. This menu comprises all the mixes using the aileron function (functions 1 and 7) as the 'master function'. This means: all functions that can be mixed to the ailerons can be set within this display. All deflections can be set separately for each side of neutral (LEFT and RIGHT).

The speed flap deflections can be differential as well and all mixes can be programmed to be flight mode dependant.

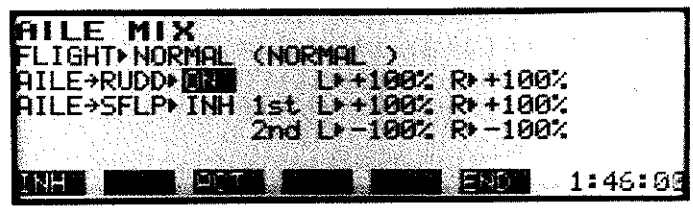


Aileron⇒rudder mix, combi switch (AILE-RUDD)

This function allows the mixing of rudder to ailerons so that when the ailerons are operated, rudder can be programmed to act with it. There is a mix override that still allows the rudder to be controlled by the rudder joystick, independently of the ailerons. The mix may be switched ON or OFF using an external switch and the mix amount adjusted by a trimmer.

Press 'ACT' to activate the mix. Deflect the ailerons fully and set the rudder deflection using '+' or '-'. The mix direction may be reversed using '+/-'.

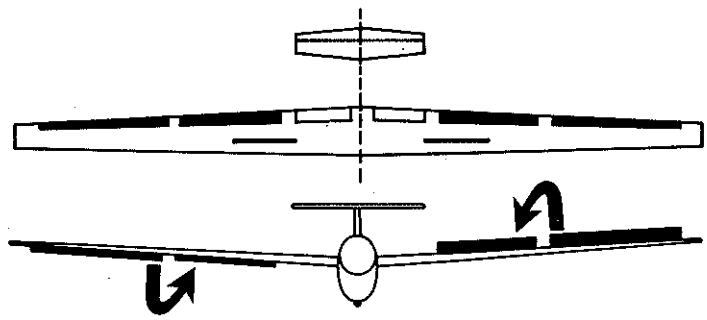
Program a switch using MxSW 09 and a trimmer using MxVR 79.

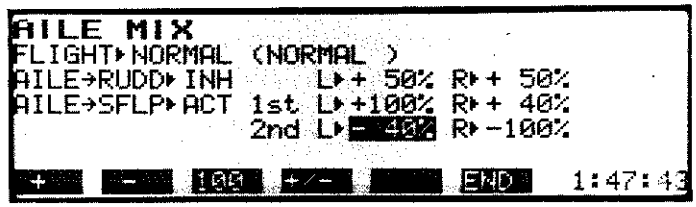


Aileron⇒speed flap mix (Aile⇒SFlp)

This function allows the speed flaps to be used as combined ailerons, but still retain their speed flap function when controlled from their slider. The speed flaps' aileron deflections can be set separately for either side of neutral.

Press 'ACT' to activate the mixer. Fully deflect the aileron stick to set the speed flaps' aileron differential. Set the deflection of the first servo using '+' or '-'. Set the second servo's deflection using '+' or '-' to the same value. The UP moving aileron should always move further than the DOWN moving aileron. The speed flaps' aileron differential should match the ailerons', but the overall movement should be a little less.





Mix program - Glider 5

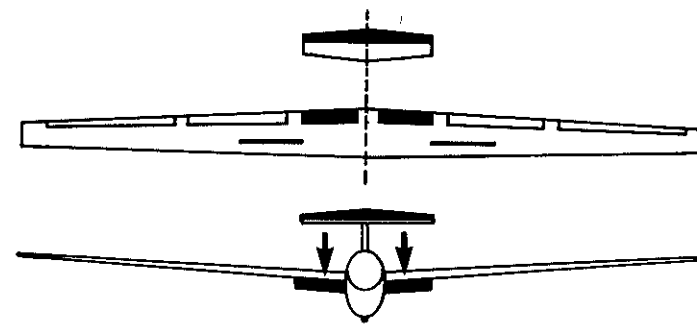
Elevator ⇒ brake flap mixer (ELEV) 77

With this option, the brake flaps can be mixed to move either with or against the elevator. For gliders, this arrangement may be used for increasing the lift when turning (all flaps down with the elevator moving UP). With flying wing models, the combination of all flaps moving together will provide a powerful elevator effect. The brake flap deflections can be set separately for either side of neutral (DOWN, UP). The mix can be switched ON or OFF in operation and the setting adjusted using an external trimmer.

This option may also be used as a delta mix in conjunction with the mixes 'aileron⇒speed flap' and 'brake⇒speed flap'. To do this, the delta servos must be connected to receiver outputs 5 and 6 (speed flaps).

Press 'ACT' to activate the mix. Move the elevator stick to its full DOWN position. Set the DOWN brake flap deflection using '+' or '-'. Move the elevator stick to the full UP position and set the UP brake flap deflection using '+' or '-'. The mix direction may be reversed using '+/-'.

Program a switch in MxSW 09 and a trimmer in MxVR 79.

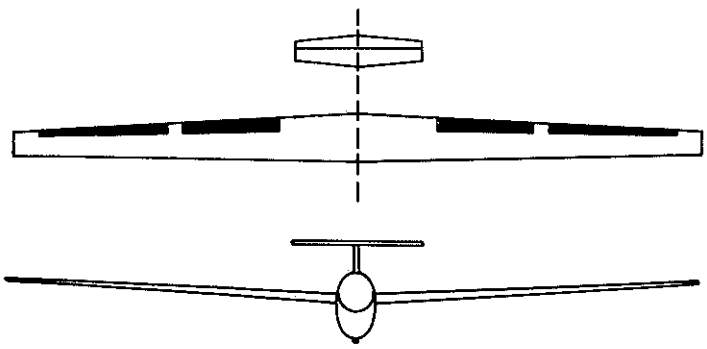


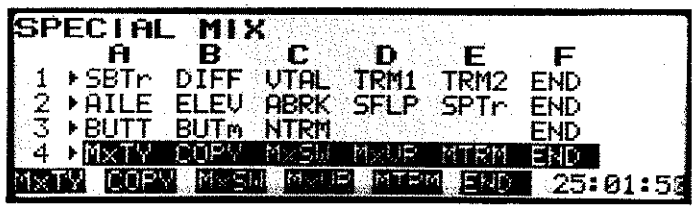
Mix program - Glider 4

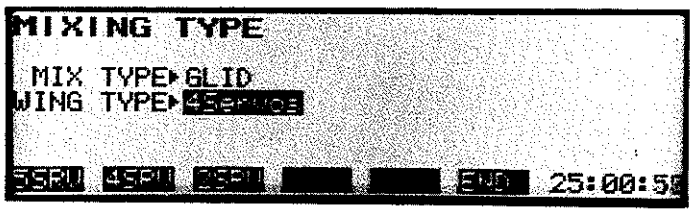
Mix program GLIDER 4

This mix program is designed for gliders equipped with ailerons and speed flaps with each surface controlled by a single servo. The program is also suitable for flying wings with four control surfaces in the wing.

In mix program GLIDER 4, receiver outputs 5 and 6 are automatically programmed for the speed flaps. Aileron differential is already programmed and the aileron servos should be connected to receiver outputs 1 and 7.







Function characteristics

All functions included within mix program GLIDER 4 are individually described in this manual to allow the user to familiarise himself with operation and the function options. Details of practical uses of these functions are given on pages 97 - 106.

Certain parts of each menu must be accessed in the display with the cursor control and this will not be pointed out each time. All descriptions refer to the 'Normal' flight mode. **The statement on the FLIGHT line which occurs in almost all functions, is displayed in the flight mode dependent program (page 79).**

All functions identified by an 'X' may be given a program dependent on flight mode.

Function	Abbr.	No
Mixer switch selection	MxSW	09
Mix trimmer	MxVR	50
Mixer trim selection	MxVR	79
Sub trim	SBTr	51
Aileron differential	DIFF	56x
V Tail mixer	VTAL	57
Airbrake ⇒ elevator mix	ABRK	61x
Elevator trim 1 for ailerons, speed flaps, elevator, with delay	TRM1	62x
Elevator trim 2 for ailerons, speed flaps, elevator, with delay	TRM2	63x
Neutral trim for ailerons + speed flap	NTRM	66x
Butterfly, Airbrake⇒aileron +airbrake⇒brake flap mixer	BUTT	72x
Butterfly⇒elevator (Butterfly mix)	BUTm	73x
Speed flap trim	SPTr	74x
Speed flap mixer, Speed flap⇒ aileron, speed flap⇒elevator	SFLP	75x
Aileron mixer. Aileron⇒rudder (combi sw), aileron⇒speed flap	AILE	76x
Elevator⇒brake flap mixer	ELEV	77x

Servo connector mix program GLIDER 4

Function	Receiver output	Abbreviation
Aileron 1	1	AIL
Elevator	2	ELE
Airbrakes	3	ABR
Rudder	4	RUD
Speed flap 1	5	SF1
Speed flap 2	6	SF2
Aileron 2	7	AI2
Free channel	8	BFL
Servo connections for V-Tail, receiver outputs 2 + 4. Output 7 becomes a free channel when the differential program is inhibited.		

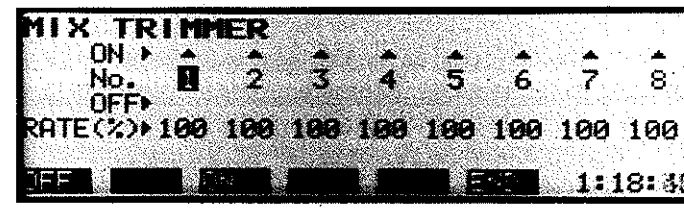
Mix program - Glider 4

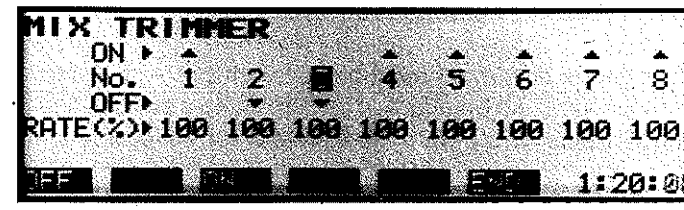
Mix sub trims (MTRM) 50

This function determines the effect of the mix trims over the following range:

Trim effective yes/no
Trim effect, magnitude,
Trim effect analogue (ANLG)
Trim effect digital (DIGT)

Each trim socket must be selected by the cursor. If a trimmer is placed in socket 1, the program 'Selection of mix trims' must relate to this trim. The trim number (NO) corresponds to the socket number on the board EXT TRIMMER:
Each trim may be switched ON or OFF using 'ON' (arrow at the top) or 'OFF' (arrow at the bottom).
This concludes the basic setting of values without trim effect. The trimmers are activated to trim the required setting of a function during operation. Once the trim effect has been switched off, the optimum value obtained can be stored using '+' or '-'. It is therefore possible on one hand to find and store the optimum settings in flight, then store the values, disconnect the trimmer and operate with fewer trimmers.

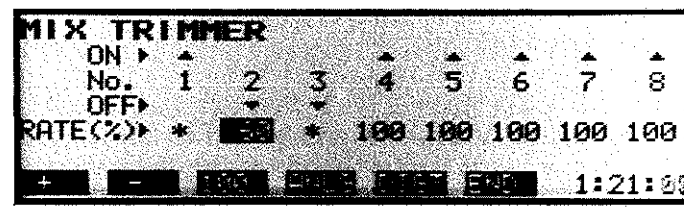




The magnitude of the trim rate (RATE) may be varied from 100%, which is 25% of the programmed servo throw, down to 30%, which is just 7% of the total servo throw, thus giving a much more precise trim effect. Set the rate using '+', '-' or '100'.

Digital switch

Instead of adjusting the trim effect using a rotary mix trimmer, a digital switch may be used if installed in the transmitter. This switch is connected in the same way as a mix trimmer. If a digital switch has been connected to trim socket 1, this connection must be programmed for 'digital' operation by keying 'DIGT' (asterisk displayed underneath the trim function). The programmed function's setting may then be changed in flight by simply 'pressing the key'. The programmed setting is altered by 1% for each switch movement in one direction (+ or -), thus ensuring that the changes are made in a specific way, e.g. 10 movements equalling a change of 10%. As with any setting, the alterations made with the digital switch are stored immediately, too. The maximum alteration of any setting using the digital switch will not exceed 100% of the programmed setting. All functions that can be trimmed with external trimmers can also be trimmed by a digital switch.



Selection of mix switches (MxSW) 09

Numerous functions within mix program GLIDER 4 may be switched ON or OFF during operation. Each of these require a switch. All functions that can be switched ON and OFF are shown in this display. The required function is selected using the cursor control and the desired switch can be programmed using '+' or '-'.

The switch numbers 1 - 8, A, B, C, correspond to the sockets 'EXTERN.SW' (1-8) inside the transmitter and the integral switches A, B and C at the centre of the transmitter. If, for example, switch 1 is to be programmed, a switch must be connected to socket 1 on the PC board.

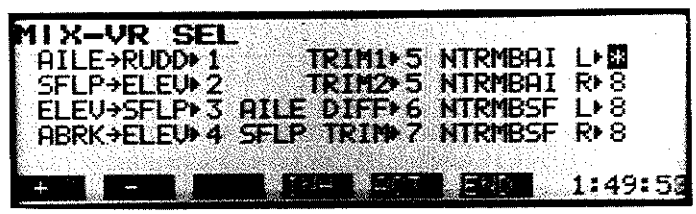
Mix program - Glider 4

Initially, program all functions by suggesting a switch with a '-' sign, in which case all the displayed functions can be activated without fitting a switch. This programming suggestion should then be altered when a specific switch is to be programmed. An alteration of this suggestion without programming a specific switch will have the effect that the relevant function can then only be activated by a switch.

The various displayed functions are not connected and each function can be used on its own using a switch. It is also possible to program ONE switch for several functions. Any switch programmed for a flight mode, however, cannot be programmed for other functions, as well.
The switch direction may be reversed (See page 29)

Selection of mix trims (MxVR) 79

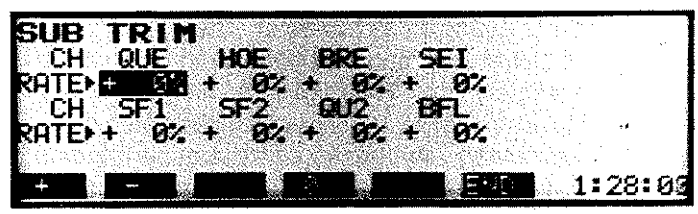
Mix program GLIDER 4 provides the option of sub-trimming numerous functions during operation. To do this, a trimmer must be fitted for each function. All the functions will be displayed which may be trimmed. The required function can then be selected simply using the cursor control keys. The trimmer socket for that function may be programmed using '+' or '-'. For example, if trimmer No. 1 is programmed for a function, a trimmer must be connected to socket 1 (Ext. Trimmer). The trim rate can be switched off with 'INH' and re-activated using 'ACT'. There is also the option of programming ONE trimmer for several functions.



Sub-trim (SBTr) 51

With this function, each of the 8 channels may be sub-trimmed around their neutral positions. This function is required whenever the servos do not return to their neutral positions. It is **not** the purpose of this function to trim the model's control surfaces. We recommend that all servos are trimmed with 'Sub-trim' before beginning the programming of a new model.

Select the required channel using the cursor, and trim using '+' or '-'. Fast reset using 'O'.

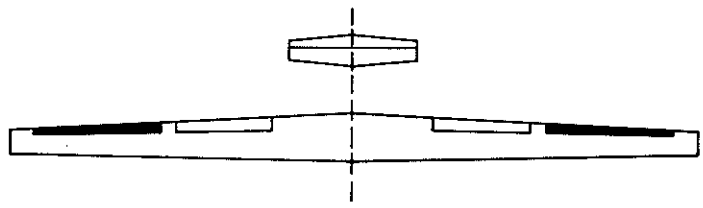


Aileron differential (DIFF) 56

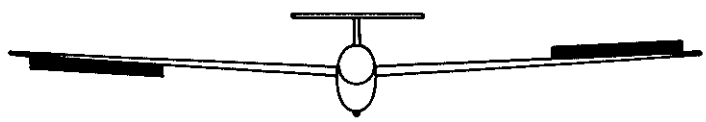
With this function, the amount each aileron travels 'up' and 'down' can be set. Each aileron requires a separate servo, which should be connected to receiver outputs 1 and 7. The function's settings may be adjusted in flight by connecting a sub-trimmer.

Activate the aileron differential by keying 'ACT'.

To set the differential, move the aileron stick to full deflection one way. The differential setting, depending on the model should be made so that the 'up' moving aileron travels 100% and the 'down' moving aileron travels only 50%. This helps to prevent 'adverse yaw'.



Without differential

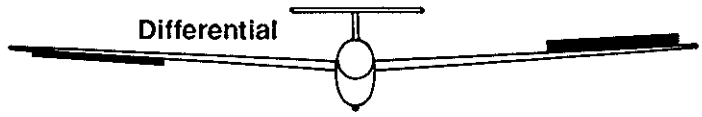


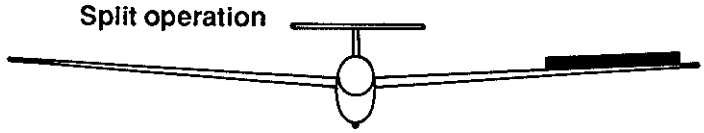
Mix program - Glider 4

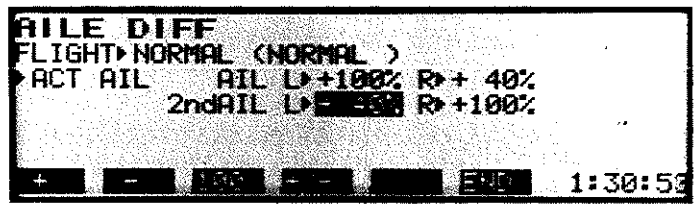
To program the travel of the 1st aileron servo, move the aileron joystick fully to the RIGHT and enter the value using '+' or '-'. If the deflections remain the same, simply deflect the aileron stick to the other side and repeat the programming of the 1st servo (AIL). Set the 2nd servo (2nd AIL) in the same way. If a servo moves the wrong way, reverse the direction using '+/-'.

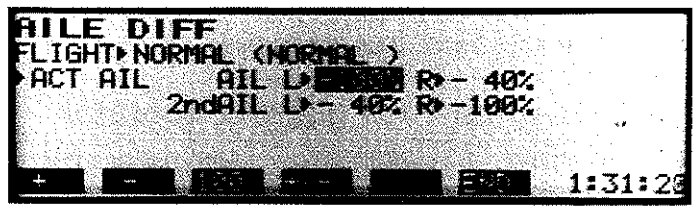
Program the trimmer in MxVR 79, 'Selection of mix trims'

The amount of aileron differential may also be programmed to be flight mode dependent.





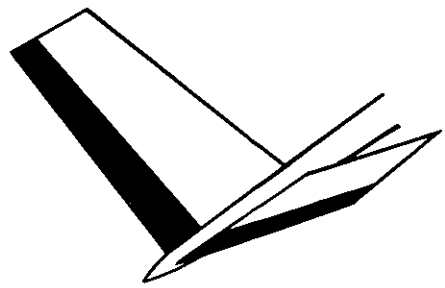


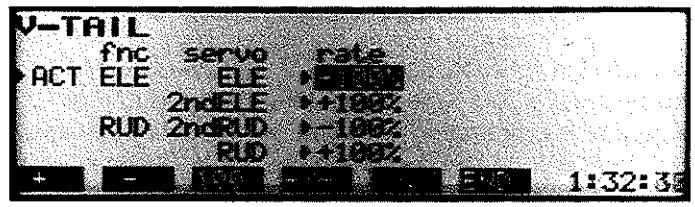


V-Tail 57

This function enables the control of combined elevator and rudder fitted to V-Tail models. The amount of elevator or rudder deflection can be set separately for up/down and left/right. A separate servo must be fitted on each surface and connected to receiver outputs 2 and 4.

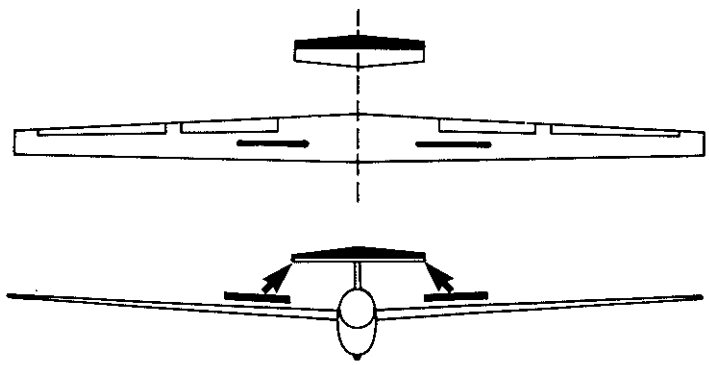
Activate the mix using 'ACT'. To set the individual throw of each servo, select the rate and adjust the value with '+' or '-'. Set the control direction using '+/-'.





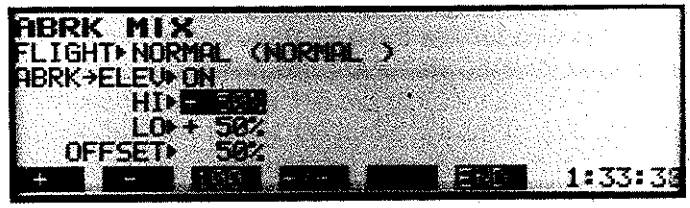
Air brake ⇒ elevator mix (ABRK) 61

This mix allows elevator to compensate for any loss of lift when extending the air brakes with the throttle stick. This will prevent the model from 'stalling'. The amount of elevator compensating may be set separately for each side (HI, LO) of the throttle stick's neutral position. The function may be switched ON or OFF in operation using a switch. The offset point is freely selectable. The setting may also be sub-trimmed using an external trimmer.

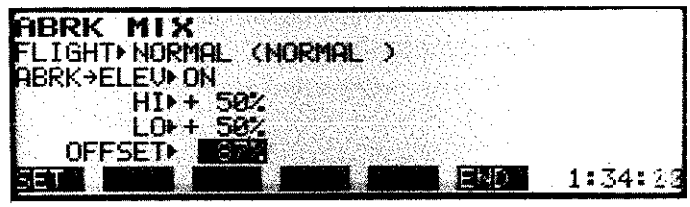


Mix program - Glider 4

Activate the mix using 'ACT'. Retract the air brakes using the throttle stick. Move the cursor to 'Offset' and press SET' to program the position of the throttle stick in which the elevator compensation will become effective when extending the air brakes (Offset: see page 29).



Move the cursor to HI or LO and set the compensation value using '+' or '-'. If the elevator compensation setting is to be one sided, for example HI (high) = 100%, LO (low) = 0%, the elevator compensation will range from one full deflection to the centre of the throttle stick deflection, and there will be no elevator compensation from the centre to the other final deflection of the throttle stick. If the elevator compensation acts in the wrong direction, reverse the direction of the mix using '+/-'.

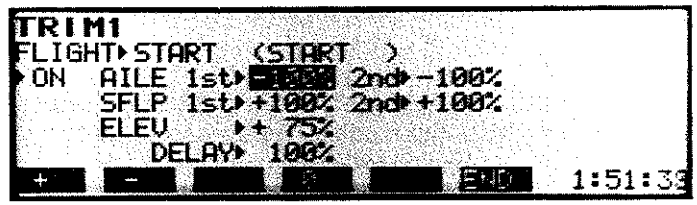


Select the operating switch in 'Selection of mix switches' (MxSw, 09) and the trimmer in 'Selection of mix trimmers' (MxVR 79).

The mix may be flight mode dependent.

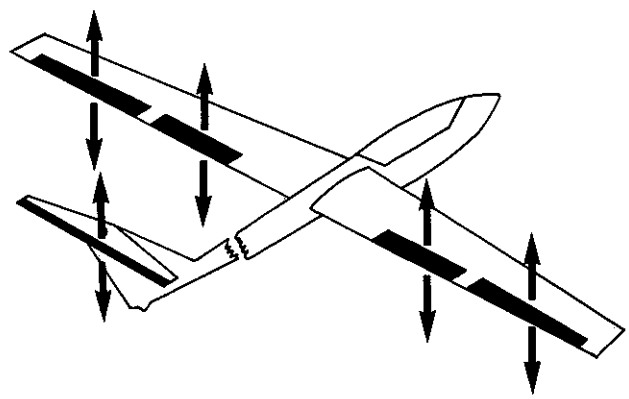
Trim program 1 for aileron, elevator, speed flap 62

With this function, the neutral positions of aileron, elevator and speed flap can be changed in operation to various pre-programmed positions. Each servo requires a separate setting for aileron and speed flap. These settings may then be trimmed in flight using external sub-trimmers. It is possible to set a delay so that the surfaces move to their programmed positions slowly, to avoid any sudden trim changes. The joystick trims remain effective at all times.



This function is designed primarily for use with flight mode dependent programming, when the same switch is used for activating this function as well as a new flight mode.

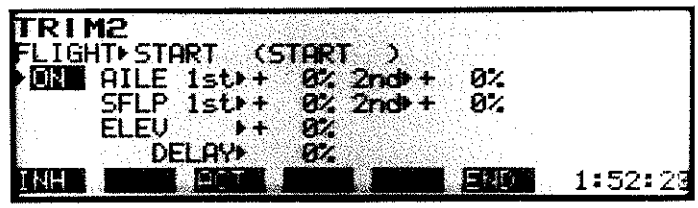
Activate the function using 'ACT'. Set the rudder trim position with '+' or '-' and the required delay with '+' or '-'. Program the operating switches in 'Selection of mix switches' (MxSW,09) and the trimmers in 'Selection of mixer trims' (MxVR 79).



Trim program 2 for aileron, elevator, speed flap 63

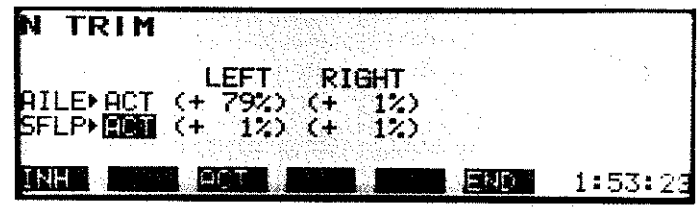
The function and method of programming is the same as that for Function No. 62.

With these two trim programs, each flight mode may be trimmed to optimum effect. Only one of these two trim programs may be activated at any one time, i.e. if one trim program has been called, the other one is switched off automatically. Hence, both these trim programs can be activated by one switch, as required.



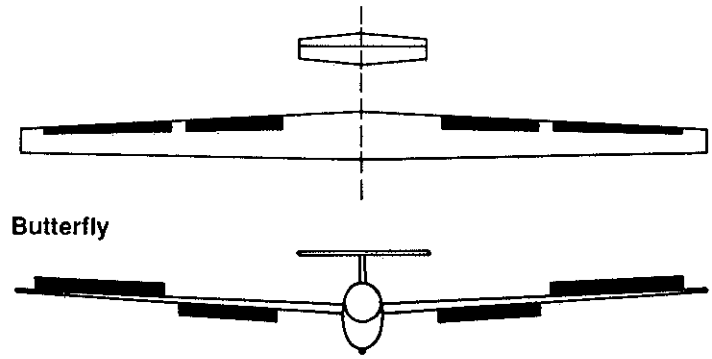
Mix program - Glider 4

Aileron and speed flap sub-trims (NTRM) 66



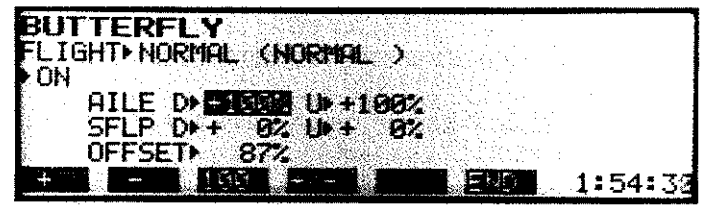
With this function, the offset trim positions of the ailerons and speed flaps can be set separately for each side of neutral. This allows each surface to be individually and independently offset. These settings must be made with trimmers, as it is not possible to input the values in the normal way with '+' or '-'.
Press 'ACT' to activate the function. Fit two trimmers and program these in 'Selection of mix trims' (MxVR, 79) - NTRM-AI and NTRM-SF and adjust each servo trim position as required.

Butterfly function (BUTT) 72



With this function, both **ailerons** are simultaneously deflected upwards and both **speed flaps** deflected down, thus putting the model into an extreme braking mode. Although the control of the ailerons is maintained in principle, only the control surface that would normally deflect 'DOWN' will operate (e.g. the LEFT aileron when a command of 'right' is given). With the speed flaps, only the flap deflecting 'UP' will operate, thus retaining the control of both ailerons and speed flaps. This function can be activated by a switch but it is normally controlled by the throttle joystick. The offset position of this option is freely selectable.

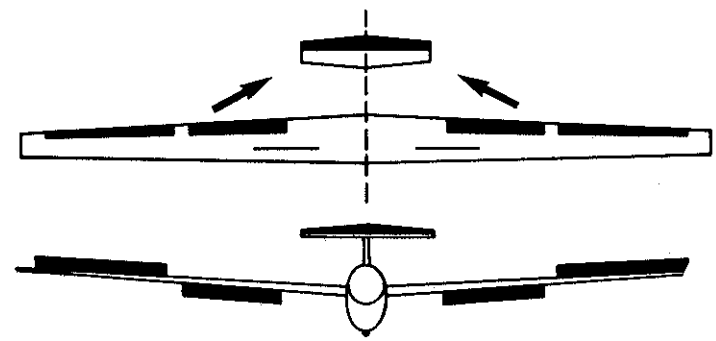
Activate the function by pressing 'ACT'. The butterfly function is now controlled by the function 6 slider. The ailerons remain controlled by the aileron joystick and the speed flaps by the function 5 switch.



If the butterfly function is to be controlled by the throttle stick, the function arrangement (FUNC) must be altered. If the throttle is controlled by the left hand joystick (mode II), functions 3 and 6 must be exchanged. If the throttle is controlled by the right hand joystick (mode I), functions 2 and 6 must be exchanged.
Set the mix ratios using '+' or '-'. The mix direction can be reversed using '+/-'.
To set the offset point, move the throttle stick to the front stop and press 'SET'. In this throttle stick position, all surfaces should now be in their 'neutral' positions.

If this function is to be switched OFF or ON in operation, program a switch in 'Selection of mix switches' (MxSW,09) for the 'Butterfly' - function.
The butterfly option may also be programmed to be flight-mode dependent.

Butterfly ⇒ elevator mix (BUTm) 73

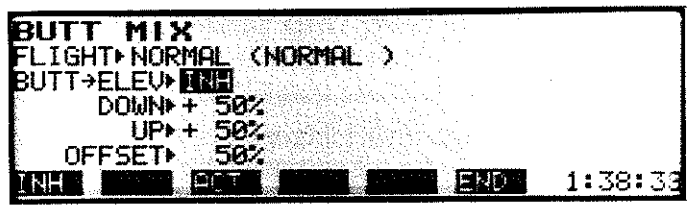


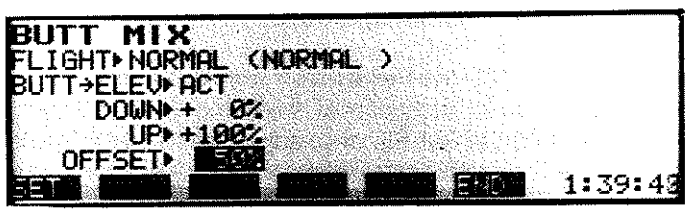
This function allows 'elevator compensation' of any trim changes that occur when using the butterfly function. The amount of compensation may be set separately for each side of neutral (UP, DOWN). The offset position is freely selectable but should, of course, be identical to the offset position of the butterfly function (throttle stick at front).

Mix program - Glider 4

Activate the mix by pressing 'ACT'. Move the throttle stick to the front stop and leave it in this position. Move the cursor to 'Offset' and press 'SET' to program the throttle stick position from which the elevator compensation is triggered when activating the butterfly function (offset, see page 29).

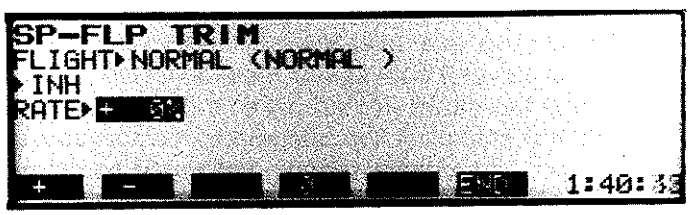
Move the cursor to either UP or DOWN and set the compensation value using '+' or '-'. If the elevator compensation setting is one-sided, for example HI (High) = 100%, LO (Low) = 0%, the elevator compensation will range from one full deflection to the centre position of the throttle stick, with no compensation from the centre to the other full deflection of the throttle stick. If required, reverse the mix direction using '+/-'.
This mix can be programmed to be flight mode dependent.

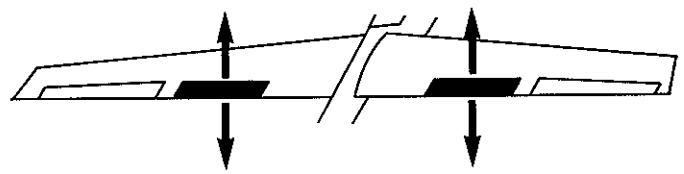




Speed flap trim (SPTr) 74

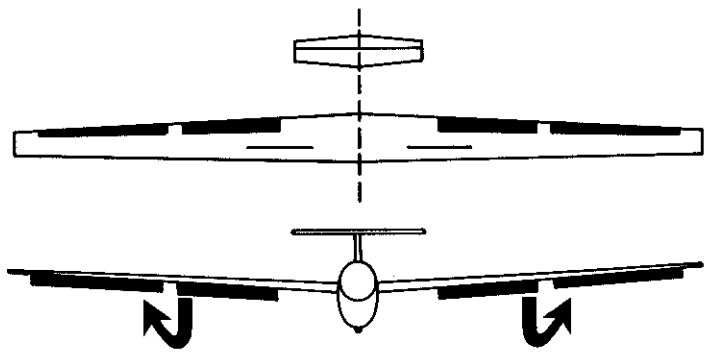
With this function, the speed flap offset may be sub-trimmed, without any mix ratios which may have been set being altered. Both speed flap servos will be sub-trimmed together, and may be sub-trimmed during operation.
Activate the function by pressing 'ACT'. Set the trim position of the speed flaps using '+' or '-'. Program the trimmer in 'Selection of mix trimmers' (MxVR).
This mix can be programmed to be flight mode dependent.





Speed flap mix (BFLP) 75

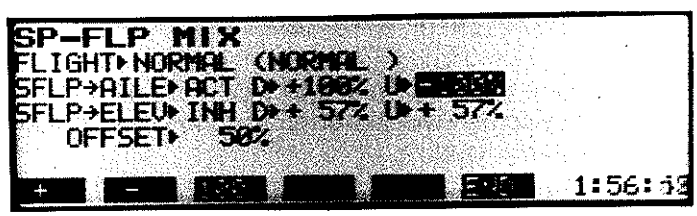
This menu displays all mixes operating with the speed flaps acting as the 'master function' (function 5 + 6). That is to say: all functions which may be mixed to the speed flaps' deflection, can be set within this display. All deflections can be set separately for either side of neutral and the offset position of the slider control is freely programmable.
All mixes shown here can be programmed to be flight mode dependent.



Speed flap ⇒ aileron mix (SFLP⇒AILE)

This option allows the mixing of the ailerons when extending the speed flaps so that ailerons can be used as speed flaps as well. Another name for this is 'FLAPPERON mix'.

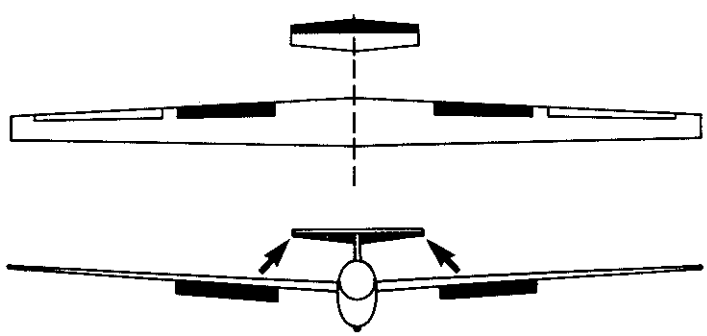
Activate the mix by pressing 'ACT'. Move the speed flaps to full deflection one way, in order to set the 'aileron' deflection upon activating the speed flaps. Adjust using '+' or '-'. The mix direction may be reversed with '+/-'.



Speed flap ⇒ elevator mix (SFLP⇒ELEV)

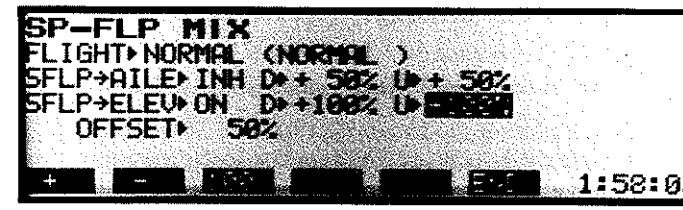
This mix will balance, using 'elevator compensation', any trim changes that occur when the speed flaps are extended. This mix may also be used as a 'Delta mix' in conjunction with the aileron⇒speed flap mix.

The mix can be switched ON or OFF in flight and the setting may be sub-trimmed.



Mix program - Glider 4

Activate the mix by pressing 'ACT'. Fully deflect the speed flaps one way to set the 'elevator' deflection upon activating the speed flaps. Adjust using '+' or '-'. The mix direction may be reversed using '+/-'.

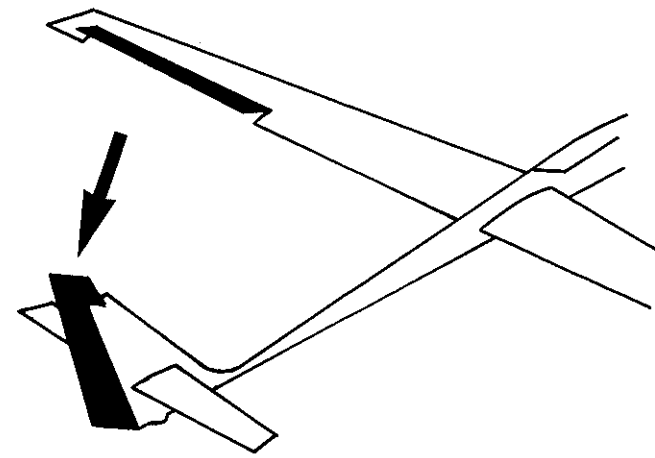


To switch this function ON or OFF in operation, program a switch in 'Selection of mix switches' (MxSW, 09). Program a trimmer in 'Selection of mix trims' (MxVR, 79).

Aileron mix (AILE) 76

This menu displays all mixes operating with the 'ailerons' (channels 1 + 7) as the 'master function'. This means that: all functions which may be mixed to the 'ailerons', can be set in this display. The deflections can all be set separately for each side of neutral, and the speed flap deflection may also be set differentially.

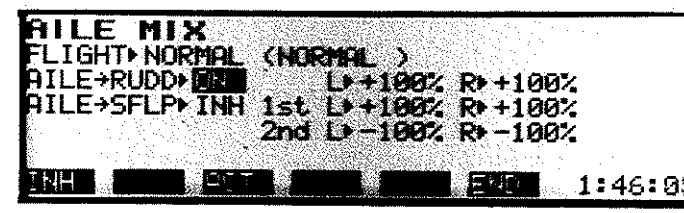
All these mixes can be programmed to be flight mode dependent.



Aileron ⇒ rudder mix - Combi-switch (AILE-RUDD)

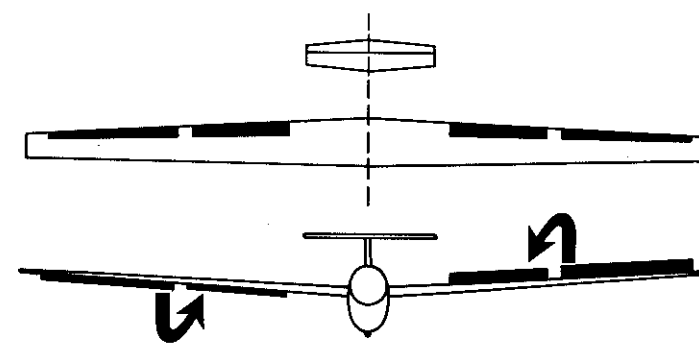
This option allows the mixing of the rudder to the ailerons so that when the ailerons are operated, the rudder is mixed to act with them. There is a mix override that allows the rudder to still be controlled with the rudder joystick, independently of the ailerons. The mix may also be switched ON or OFF in flight using an external switch and the mix amount adjusted using a trimmer.

Press 'ACT' to activate the mix. Fully deflect the ailerons and set the rudder deflection using '+' or '-'. The mix direction may be reversed using '+/-'.
If this function is to be switched ON or OFF in operation, a switch for the 'AILE-RUDD' mix must be programmed in 'Selection of mix switches' (MxSW, 09). Program the trimmer in 'Selection of mix trims' (MxVR, 79).

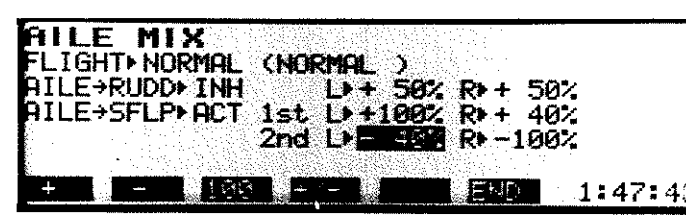


Aileron ⇒ speed flap mix (AILE ⇒ SFLP)

This function allows the deployment of speed flaps acting as ailerons. When using the ailerons, the speed flaps move in the same direction as the ailerons whilst still being able to be used as speed flaps from their slider control. The amount of deflection may be set for either side of neutral.

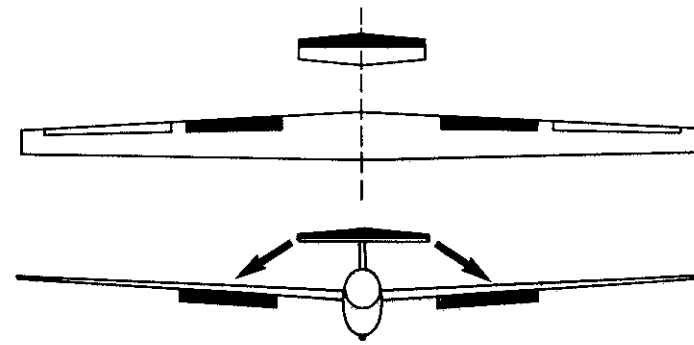


Press 'ACT' to activate the mixer. Fully deflect the aileron stick to set the differential of the speed flaps. Set the first aileron servo deflection using '+' or'-'. If the deflections do not change, simply move the aileron joystick to the other side. Set the second servo in the same way. UP deflections should always be set larger than DOWN deflections. The differential should be set in the same proportion as the ailerons, although the overall deflections should be a little less.



Mix program - Glider 4

Elevator ⇒ speed flap mix (ELEV) 77



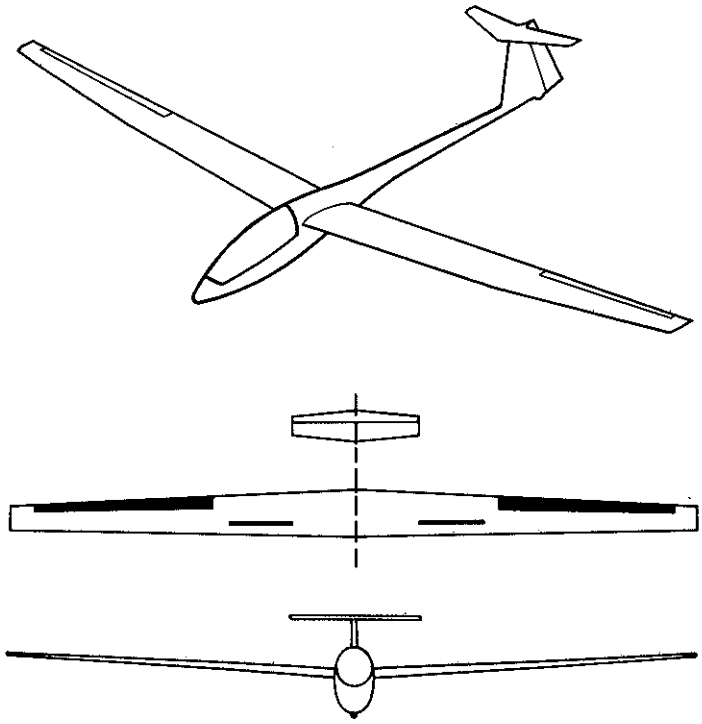
With this option, all flaps programmed as speed flaps can be mixed to move with, or in opposition to the elevator. For gliders, this arrangement may be used for increasing lift when turning (all flaps down when elevator moves UP). When used to control flying wing models, the combination of all flaps will produce an elevator effect. The speed flap deflections can be set separately for each side of neutral and the mix may be switched ON or OFF in flight. The setting may also be adjusted in flight using a trimmer.

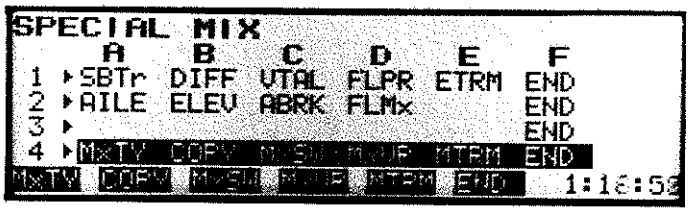
Press 'ACT' to activate the mix. Move the elevator joystick to the full 'DOWN' position. Set the speed flap DOWN deflections using '+' or '-'. Move the elevator stick to full 'UP' position. Set the UP speed flap deflections using '+' or '-'. The mix direction may be reversed using '+/-'.

If the mix is to be switched ON or OFF in flight, a switch must be programmed in 'Selection of mix switches' (MxSW, 09). Program the trimmer in 'Selection of mix trimmers' (MxVR, 79).

Mix program - Glider 2

Mix program - GLIDER 2





Function characteristics

All the options within mix program GLIDER 2 are described individually to allow the user to get familiar with the operation and functions. Details of the practical use of these functions are given on pages 97 - 106, Programming examples.

Certain parts of each menu must be accessed with the 'cursor control' and this will not be pointed out each time. All descriptions refer to the' NORMAL' flight mode. **The statement on the 'FLIGHT' line which occurs in almost all functions, is described in 'flight mode dependent programming' (page 79).**

Function table

All functions identified by an 'x' may be programmed to be flight mode dependent.

Function	Abbr.	No
Mixer switch selection	MxSW	09
Mix trimmer	MxVR	50
Mixer trim selection	MxVR	79
Sub trim	SBTr	51
Aileron differential	DIFF	56x
V Tail mixer	VTAL	57
Airbrake ⇒ elevator mix	ABRK	61x
Elevator trim 1 and 2	ETRM	62x
Flaperon mix, speed flap⇒aileron	FLPR	65x
Flaperon ⇒ elevator mix	FLMx	75x
Aileron ⇒ rudder (combi sw.)	AILE	76x
Elevator ⇒ flaperon mix	ELEV	77x

Servo connections for mix program GLIDER 2

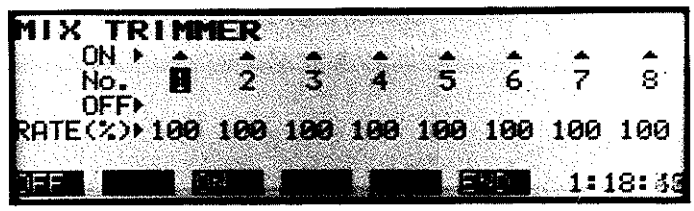
Function	Rx output	Abbreviation
Aileron 1	1	AIL
Elevator	2	ELE
Airbrakes	3	ABR
Rudder	4	RUD
Aileron 2 (flaperon)	5	SF1
Free channel	6	SF2
Aileron 2 (differential)	7	AI2
Free channel	8	BFL
Servo connections for V-Tail, receiver outputs 2 + 4 When DIFF has been programmed, channel 5 is free, when FLAPERON has been programmed, channel 7 is free. When neither DIFF nor FLAPERON are activated, both channel 5 and 7 are free.		

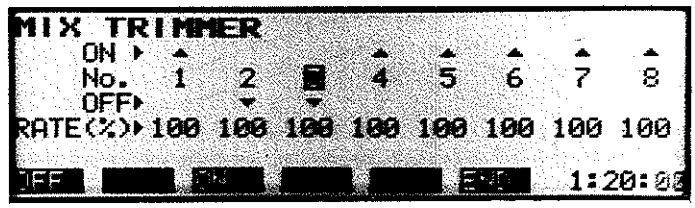
Mix program - Glider 2

The function of mix sub-trims (MTRM) 50

This option determines the effect of mix trims over the following:
- trim effective yes/no
- trim effect, magnitude
- trim effect analog (ANLG)
- trim effect digital (DIGT)

Each trim socket must be selected with the cursor. If a trimmer is connected to socket 1, the trimmer is identified in 'Selection of mix trimmer' as trimmer 1. The trimmer number (NO) always corresponds to the EXT TRIMMER socket number.



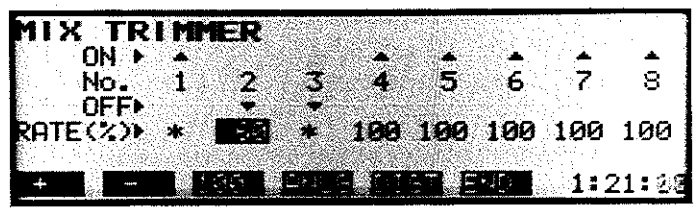


Each trim may be switched ON or OFF using 'ON' (arrow at the top) or 'OFF' (arrow below).

This concludes the basic setting of trimmers with trim effect. The trimmers are used in flight to trim the settings for optimum performance. The values trimmed in flight may then be input using '+' or '-' and the trimmer's effect switched off. In this way, the optimum settings can be achieved in flight but still operate the system with fewer trimmers.

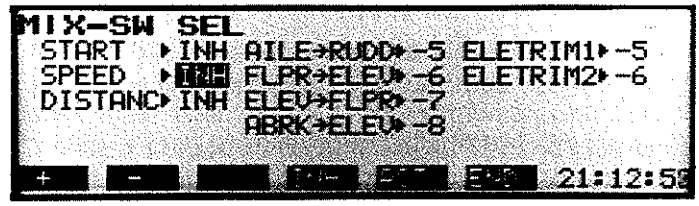
Digital Switch

Instead of adjusting the trim effect using mix trimmers, a 'digital switch' may be installed and used in the same way. This switch is connected in the same way as a mix trimmer. If a digital switch has been connected to trim socket 1, the switch must be programmed for 'digital' operation using 'DIGT' (asterisk displayed below the trim function). The setting of a function can then be changed in flight by simply 'pressing the key'. The programmed setting is altered by 1% for each switch movement in one direction (+ or -), thus allowing all changes to be made in a specific way: 10 movements equals a change of 10%. As with any trimmer, the alteration of any settings with the digital switch are stored immediately. The maximum alteration of any setting by a digital switch cannot exceed 100% of the set value. All functions that can be trimmed with a rotary trimmer may be trimmed with a digital switch.



Selection of mix switches (MxSW) 09

Numerous functions within mix program GLIDER 2 may be switched ON or OFF during operation. Each of these will require a switch. In this display, all functions that can be switched ON or OFF by a switch are shown. The switches are programmed by selecting the desired function with the cursor and selecting a switch with '+' or '-'.



Switch numbers 1 - 8 correspond to the EXT.SWITCH sockets on the PC board. Switches A, B and C are the integral switches mounted at the centre of the transmitter. If, for example, a switch is connected to EXT.SWITCH socket 1, then the desired function must be programmed with switch No. 1.

Mix program - Glider 2

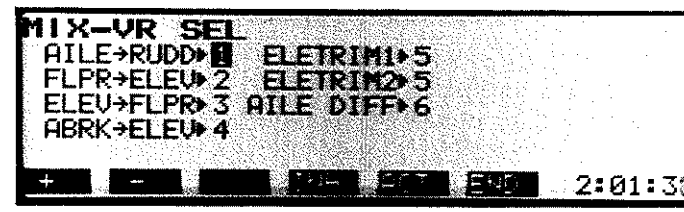
Initially, program all functions by suggesting a switch that has a '-' sign. This allows the displayed functions to be activated without a switch. This programming suggestion should only be altered when the correct switch is to be programmed. If the switch suggestion is changed, without fitting a switch, then the function will remain OFF until such a switch is fitted. The programmed suggestion may then only be recalled by pressing 'RESET' and by re-programming the entire mix program. This does however, cancel all settings within the model memory - each of which must then be re-input.

The various functions within the display are not connected and each function can be programmed on its own using a switch. It is also possible to program ONE switch for several functions. Any switch programmed for a flight mode, however, cannot be programmed for other functions.

The switch direction may be reversed (see page 29).

Selection of mix trims (MxVR) 79

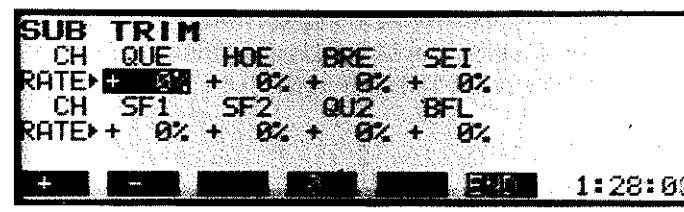
Mix program GLIDER 2 also provides the option of sub-trimming numerous functions during operation. To do this, a trimmer must be fitted for each function. All functions that can be sub-trimmed are shown in this display. The required function is selected using the cursor, and the trimmer socket be programmed using '+' or '-'. For example, if trimmer No. 1 is programmed to trim a function, a trimmer must be connected to the EXT.TRIMMER socket No.1. The trim rate can be switched off with 'INH' and re-activated using 'ACT'. There is also the option of programming ONE trimmer for several functions.



Sub-trim (SBTr) 51

With this function, each of the 8 channels may be sub-trimmed around their neutral positions. This function is required whenever the SERVOS do not centre to their precise neutral position. It is **not** the purpose of this function to trim the model's surfaces. We recommend that all servos are centred prior to programming a new model memory.

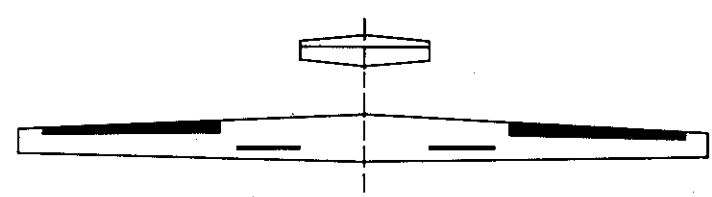
Select the required function using the cursor and trim with '+' or '-'. Fast reset to zero using '0'.



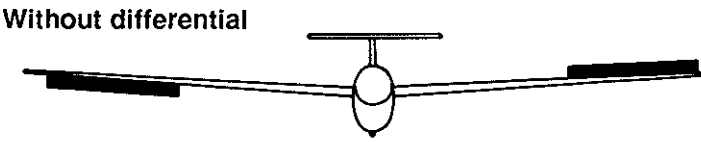
Aileron differential (DIFF) 56

This function offers the option of separate adjustment of the amount of each aileron deflection 'UP' and 'DOWN'. Each aileron requires a separate servo, connected to receiver outputs 1 and 7.

Set the second aileron servo's deflection using '+' or '-' or '100' (for full movement) and the direction of the second servo using '+/-'.



Without differential



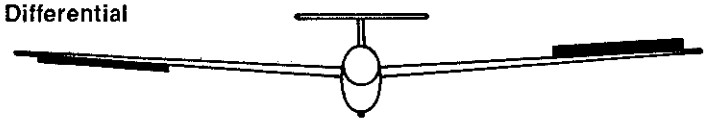
Mix program - Glider 2

When aileron differential has been activated, it is not possible to activate menu 65, FLAPPERON (Display prompts 'off other mix'). If Flapperon or Elevon are to be operated together with differential, switch off differential (INH) and activate Flapperon or Elevon (ACT). Differential may now be set in these menus.

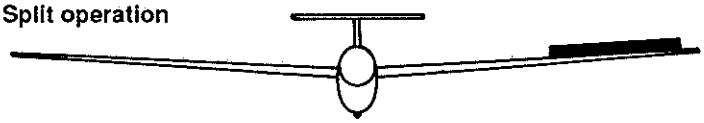
Move the aileron stick to the RIGHT and set the 1st servo's deflection with '+' or '-'. Move the stick to the LEFT and set the 2nd servo's deflection. The mix direction may be reversed if necessary using '+/-'.

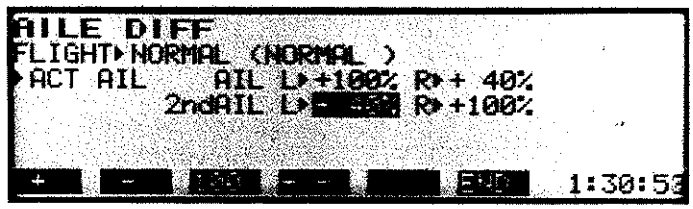
Program a trimmer in 'Selection of mix trims' (MxVR 79).

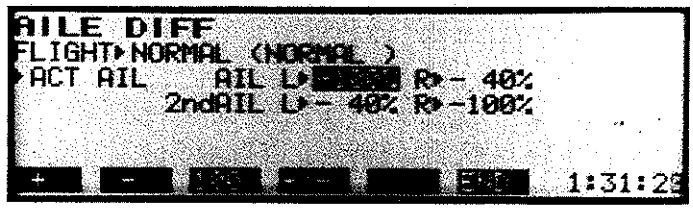
Differential



Split operation



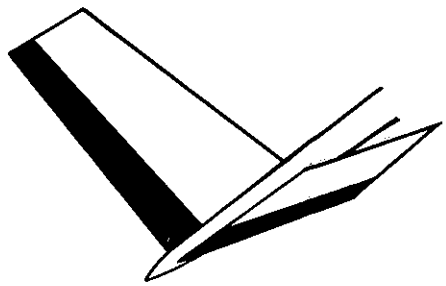


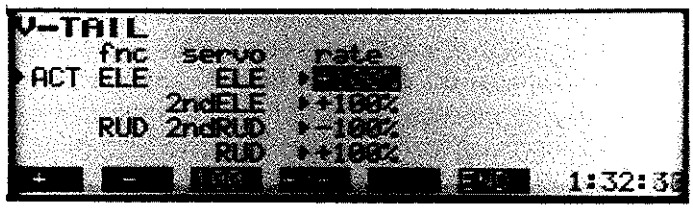


V-Tail 57

This function enables the control of combined elevators and rudder with V-Tail models. The amount of elevator or rudder deflection can be set separately for up/down and left/right. A separate servo has to be connected for each surface in receiver outputs 2 and 4.

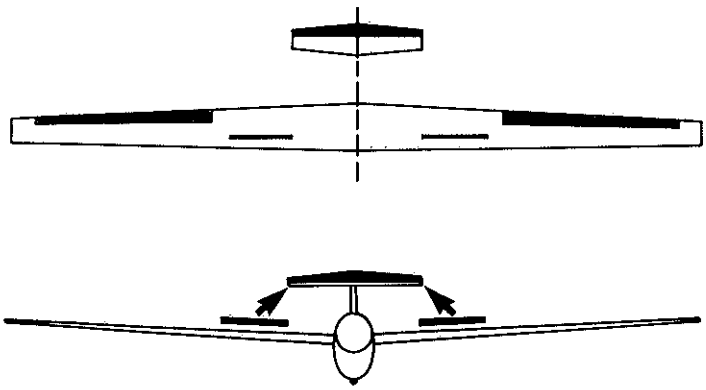
Activate the mixer using 'ACT'. To set the individual throw of each servo, select the rate and adjust the value with '+' or '-'. Set the surface direction using '+/-'.





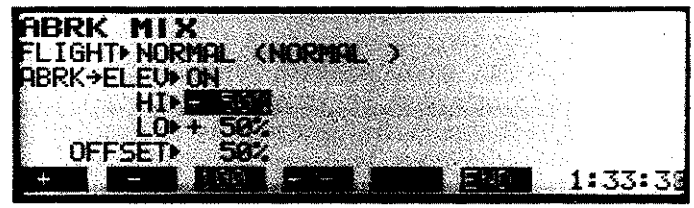
Air brake ⇒ elevator mix (ABRK)61

This mix option allows the loss of lift when using the airbrakes to be compensated for with elevator. This will prevent the model from 'stalling'. The amount of elevator compensation may be set for either side of neutral (HI, LO) and the function may be switched ON or OFF during flight with a switch. The throttle joystick, which operates the airbrakes, has a freely selectable offset position from which the elevator compensation becomes effective. The amount of compensation may be sub-trimmed in flight using a trimmer.

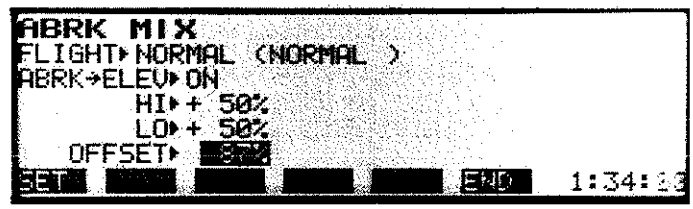


Mix program - Glider 2

Activate the mix using 'ACT'. Retract the air brakes using the throttle stick and leave the joystick in this position. Move the cursor to 'Offset' and press 'SET' to program the offset position - the point from which the elevator compensation will begin when the air brakes are extended (Offset: see page 29).



Move the cursor to HI or LO and set the elevator compensation using '+' or '-'. If the elevator compensation setting is one sided, for example HI (high) = 100%, LO (low) = 0%, the elevator compensation will range from one full deflection to the centre of the throttle stick's throw, and no elevator compensation from the centre to the throttle's rear stop position. If the elevator compensation acts in the wrong direction, reverse the mix direction with '+/-'.

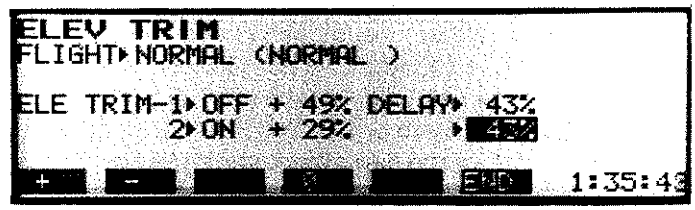


Program a switch in 'Selection of mix switches' (MxSw, 09) and a trimmer in 'Selection of mix trims' (MxVR, 79).

This mix can be programmed to be flight mode dependent.

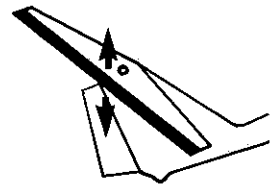
Elevator trim (ETRM) 62

With this function, the elevator may be programmed to move to a pre-set trim position. The trim setting can be sub-trimmed in flight and it is possible to set a delay so that the elevator moves slowly to its new position to avoid any sudden trim changes. Two individual trim settings are available, and neither affect the normal stick trim effect.



This function is designed primarily for use with flight mode dependent programming, therefore it is usual to have this function controlled by the same switch that selects a new flight mode.

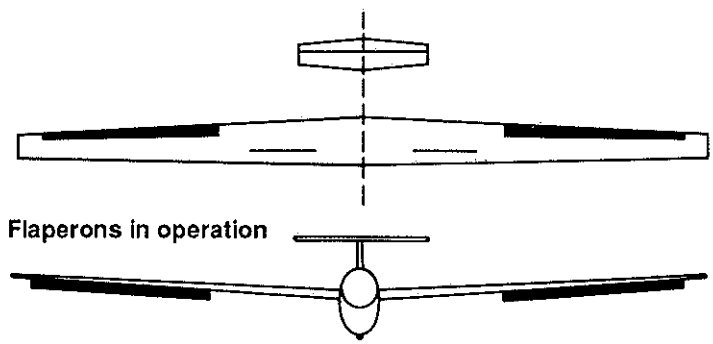
Activate the function using 'ACT'. Set the elevator trim position using '+' or '-'. Set the required delay using '+' or '-'.



This function may be programmed to be flight mode dependent.

Flaperon mix, speed flap ⇒ aileron (FLPR) 65

This mix allows the ailerons to be used as speed flaps, whilst still retaining aileron control (flaperon). The speed flap deflections may be set separately for each side of neutral. The speed flaps are normally controlled with the channel 5 slider. The aileron servo are connected to the receiver outputs 1 and 5. When this option is used, aileron differential may be programmed in the flaperon menu and this setting may then be sub-trimmed in flight.



Flaperons in operation

Mix program - Glider 2

This function can only be activated if the 'differential' function (DIFF) has been inhibited. If the differential function remains activated, the display will prompt 'off, other mix'. If this happens, first switch off the 'differential' function with inhibit (INH), then activate the 'flaperon' function with 'ACT'. Any settings that have already been programmed in the differential menu will automatically be set when flaperon is activated, provided that the servos have been connected to receiver outputs 1 and 5.

To set new values of differential, move the aileron stick fully to one side and leave the channel 5 slider in its neutral position. The settings made should cause the up-moving aileron to move its full travel (100%) and the down-moving aileron to move less (approximately 50%). Of course, the true value of differential can only be obtained by flying the model and adjusting the settings. Differential is used to prevent or reduce 'adverse yaw'.

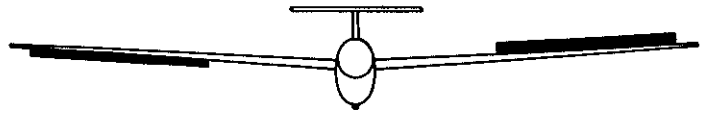
Set the 1st servo's deflection using '+' or '-'. If the deflections remain unchanged, simply move the aileron stick to the other side and repeat the programming of the 1st servo (AIL). Then set the 2nd servo in the same way. If any servo moves the wrong way, reverse the mix direction using '+/-'.

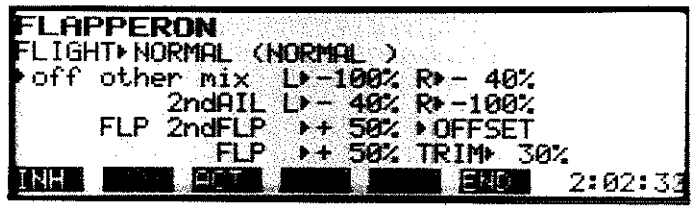
To obtain the full effect of the channel 5 slider, initially set the TRIM to 100%. Now move the slider to its front stop to set the ailerons' speed flap deflections. Set the deflection of the 1st servo using '+' or '-' on the 'FLP' line and the deflection of the 2nd servo on the '2nd FLP' line. If either servo moves in the wrong direction, reverse the direction of the mix with '+/-'. Both ailerons should deflect exactly the same amount when used as speed flaps, otherwise a rolling moment will be induced when the speed flaps are used.

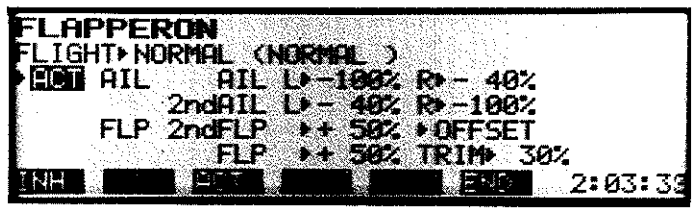
If the channel 5 slider's offset position is to be changed from its central default setting, move the slider into the new position and press 'SET' on the 'Offset' line.

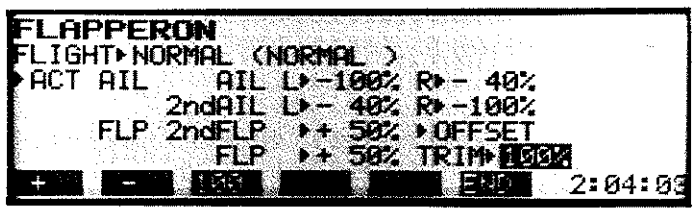
Program a trimmer in 'Selection of mix trims' (MxVR, 79) after 'AILE DIFF'.

Aileron differential in flaperon





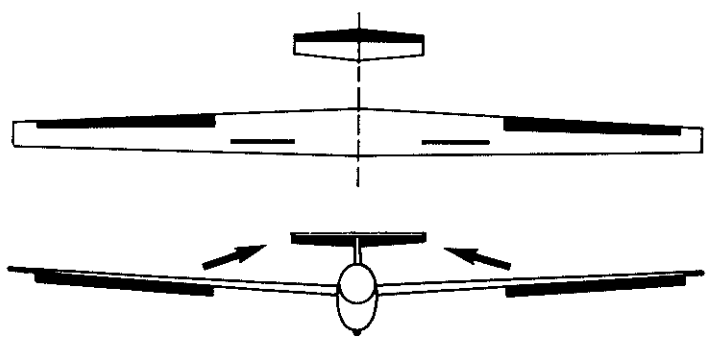


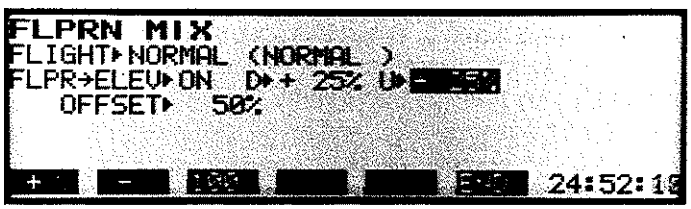


Flaperon ⇒ elevator mix (Flaperon Mix) 75

This mix will balance any trim changes when the flaperons are used with elevator compensation. The amount of compensation can be set separately for each side of neutral (D, U) and the offset point from which the elevator compensation is activated is freely selectable. This mix may be switched ON or OFF with a switch and sub-trimmed in flight.

The mix can also be used with a freely programmable mixer so that when the air brakes are operated, both ailerons will move upwards to create a more pronounced 'brake' effect.





Mix program - Glider 2

Press 'ACT' to activate the mix. Push the channel 5 slider to its front stop. Set the elevator compensation for this side of the slider's neutral position using '+' or '-'. Pull the slider to its rear stop and set the elevator compensation for this side of neutral. To set the offset position, if it is not to be at the slider's mechanical centre, move the slider to its desired position, place the cursor on 'Offset' and press 'SET'.
Now program a switch in 'Selection of mix switches' (MxSW, 09) and a trimmer in 'Selection of mix trimmers' (MxVR, 79).

This mix can be programmed to be flight mode dependent.

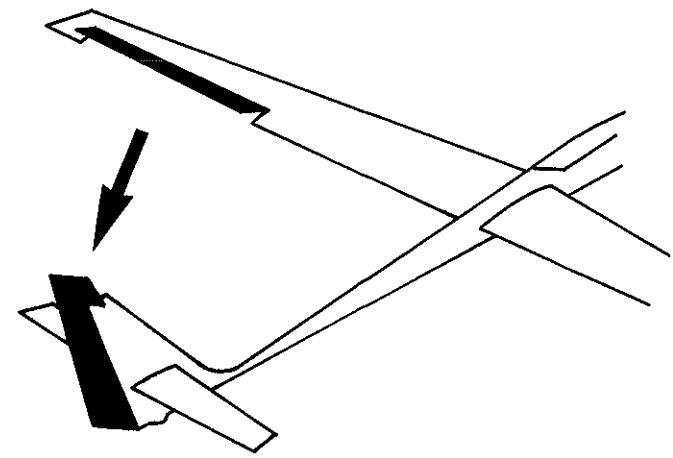
Aileron ⇒ rudder mix, combi switch (AILE-RUDD) 76

This function allows the mixing of the rudder to the ailerons so that when the ailerons are operated, an amount of rudder can be programmed to act with it. There is a mix override that allows the rudder to still be controlled by the rudder joystick, independently of the ailerons. The mix may be switched ON or OFF using an external switch and the mix amount adjusted by a trimmer.

Press 'ACT' to activate the mix. Deflect the ailerons fully and set the rudder deflection using '+' or '-'. The mix direction may be reversed using '+/-'.

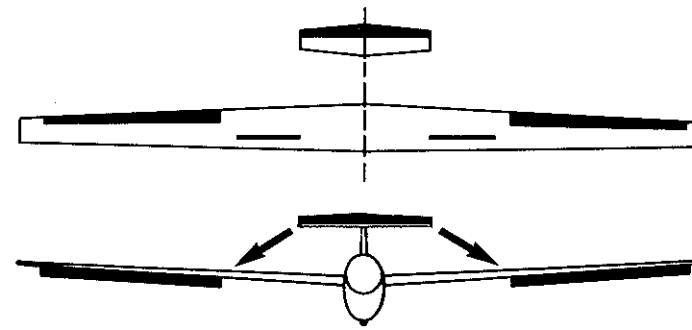
Now program a switch using 'Selection of mix switches' (MxSW, 09) and a trimmer using 'Selection of mix trims' (MxVR 79).

This mix can be programmed to be flight mode dependent.



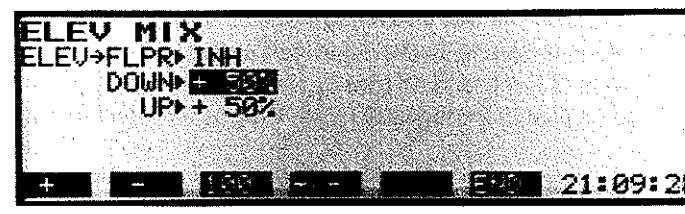
Elevator ⇒ flaperon mix (ELEV) 77

With this mix, ailerons programmed as flaperons can be mixed to act either with, or in opposition to, the elevator. With gliders, this mix may be used for increasing lift in turns or with aerobatic models to sharpen the 'corners' of square manoeuvres. The aileron deflections can be set separately for each side of the speed flaps' neutral position. This mix can be used as a Delta mix in conjunction with the flaperon mix.
The mix can be switched ON or OFF in operation and the mix amount be adjusted using a sub-trim.



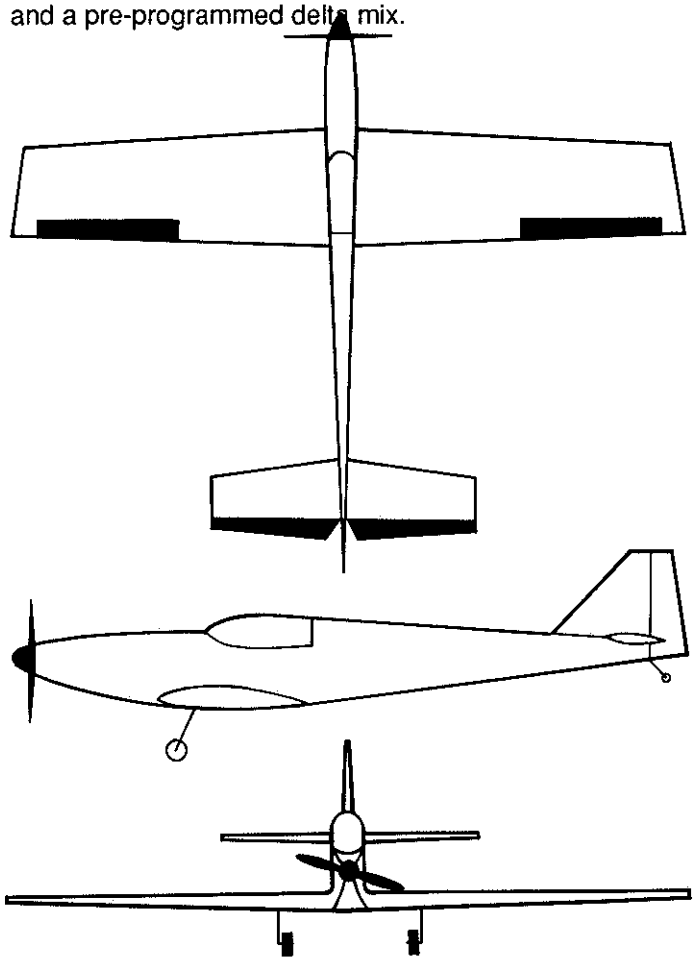
Press 'ACT' to activate the mix. Move the elevator joystick to the full 'DOWN' position and set the ailerons' speed flap deflections with the elevator in this position using '+' or '-'. Now move the elevator joystick to its full 'UP' position and set the ailerons' speed flap deflections with '+' or '-'. The direction of the mix can be reversed with '+/-'.
Now program a switch using 'Selection of mix switches' (MxSW, 09) and a trimmer using 'Selection of mix trims' (MxVR 79).

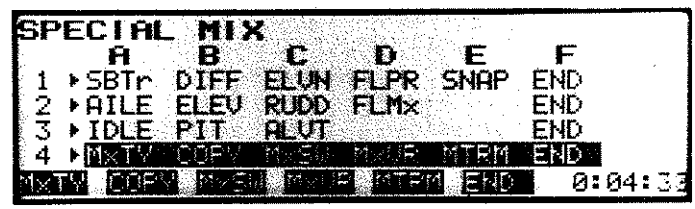
This mix can be programmed to be flight mode dependent.



Mix program - Acro

This mix program is designed for engine powered aerobatic models equipped with ailerons that may also be used as speed flaps (flaperons). In addition, the mix program offers automatic propeller pitch adjustment (when using variable pitch props), and aileron⇒elevator mix (ailevator) and a pre-programmed delta mix.





Function characteristics

All functions within Mix program ACRO are described individually in the following text to allow the user to become familiar with the operation and optional functions. Details of the practical use of some of the functions may also be found on pages 90 - 96, Programming examples.

Certain parts of a menu must be accessed in the display with the 'cursor control' keys and this will not be pointed out each time. All descriptions refer to the 'NORMAL' flight mode. **The statement on the 'FLIGHT' line which occurs in almost all functions, is described in 'flight-mode dependent programming' (page 79).**

Function table

All functions identified by an 'X' may be given a program dependent on flight mode.

Function	Abbr.	No
Mixer switch selection	MxSW	09
Function of mix trimmer	MxVR	50
Mixer trim selection	MxVR	79
Sub trim	SBTr	51
Aileron differential	DIFF	56x
Rudder ⇒ aileron mix	RUDD	57x
Delta mix	ELVN	59x
Idle up 1 and 2	IDLE	61
Snap roll function - pre-set aileron, elevator and rudder positions	SNAP	62x
Flaperon mixer, speed flap⇒aileron	FLPR	65x
Pitch mix	PIT	70
Elevator⇒aileron mix (ailevator)	ALVT	72x
Flaperon⇒elevator mix (flaperon)	FLMx	75x
Aileron ⇒ rudder mix (combi switch)	AILE	76x
Elevator⇒Flaperon mix	ELEV	77x

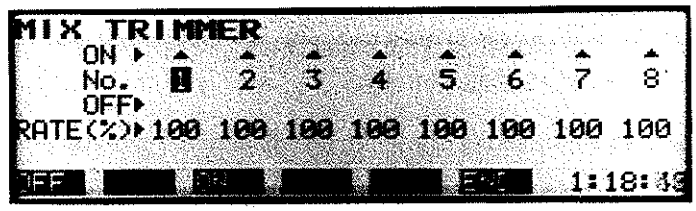
Servo connections for Mix program ACRO

Function	Receiver output	Abbreviation
Aileron 1	1	AIL
Elevator	2	ELE
Throttle	3	THR
Rudder	4	RUD
Elevator 2	5	GER
Aileron 2 (Flaperon)	6	FLP
Aileron 2 (Diff)	7	AI2
Propeller pitch	8	AUX
Servo connections for Delta, receiver outputs 1+2, (+6,7). With Differential activated, output 6 is free, with Flaperon activated, output 7 is free. Without propeller pitch, output 8 becomes free. When differential and flaperon are inhibited, outputs 6 and 7 become free.		

Aileron differential is automatically activated when Mix program ACRO is selected. The aileron servos are then connected to the receiver's 1 and 7 outputs.

Mix program - Acro

Mix trimmer function (MTRM) 50



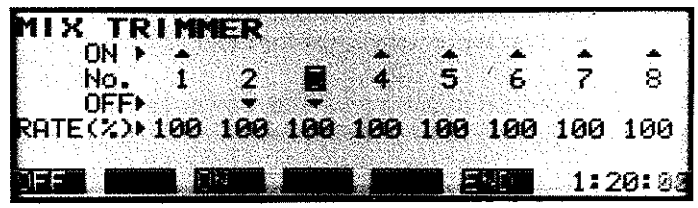
In this menu, you can decide whether or not to activate additional external mixer trimming (ON/OFF) and whether the adjustment is to be analog (ANLG) when using a rotary trimmer or digitally (DIGT) when using a spring loaded digital switch. For 'analog' adjustment, you must fit and connect trimmers (supplied in pairs or fours) to the 'EXT. TRIMMER' sockets on the PC board. For 'digital' adjustment, you must fit a digital switch to the EXT.TRIMMER socket.

Each trimmer socket can be activated (arrow in the ON position) or switched off (arrow in the OFF position). The trimmer is selected with the cursor. The trim rate of each trimmer connected can be varied from 15% to 50% of the programmed values of any mixer.

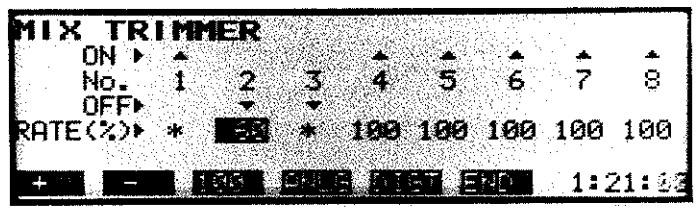
Select the type of trimmer by keying 'ANLG' (analog) or 'DIGT' (digital).

Digital Switch

Instead of adjusting the trim effect using mix trimmers, a 'digital switch' may be installed and used in the same way. This switch is connected in the same way as a mix trimmer. If a digital switch has been connected to trim socket 1, the switch must be programmed for 'digital' operation using 'DIGT' (asterisk displayed below the trim function). The setting of a function can then be changed in flight by simply 'pressing the key'. The programmed setting is altered by 1% for each switch movement in one direction (+ or -), thus allowing all changes to be made in a specific way: 10 movements equals a change of 10%. As with any trimmer, the alteration of any settings with the digital switch are stored immediately. The maximum alteration of any setting by a digital switch cannot exceed 100% of the set value. All functions that can be trimmed with a rotary trimmer may be trimmed with a digital switch.



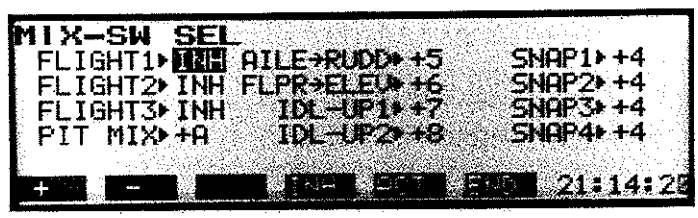
The amount of trim effect can be varied from 100% to 30%. When set to 100%, the total trim path corresponds to 25% of the total servo throw. When set to 30%, the trim path corresponds to just 7% of the total servo throw. This reduction in trim rate allows minute changes of trim. Set the rate (RATE) with '+', '-' or '100'.



Selection of mix switches (MxSW) 09

Numerous functions within Mix program ACRO may be switched ON or OFF during operation. Each of these will require a switch. In this display, all functions that can be switched ON or OFF by a switch are shown. The switches are programmed by selecting the desired function with the cursor and selecting a switch with '+' or '-'.

Switch numbers 1 - 8 correspond to the EXT.SWITCH sockets on the PC board. Switches A, B and C are the integral switches mounted at the centre of the transmitter. If, for example, a switch is connected to EXT.SWITCH socket 1, then the desired function must be programmed with switch No. 1.



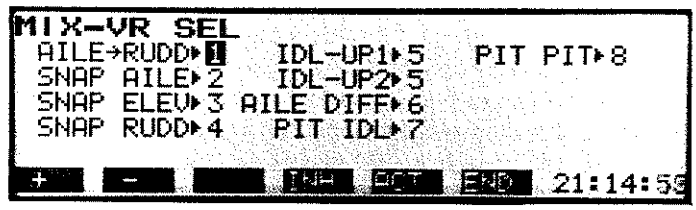
Mix program - Acro

Initially, program all functions by suggesting a switch with a '-' sign, which means that the switch has yet to be connected or allocated. This should then be altered when a switch is to be programmed.

The various functions shown in the display are not connected and each function can be programmed on its own using a switch. It is also possible to program ONE switch for several functions. Any switch programmed for a flight mode cannot then be programmed for other functions.

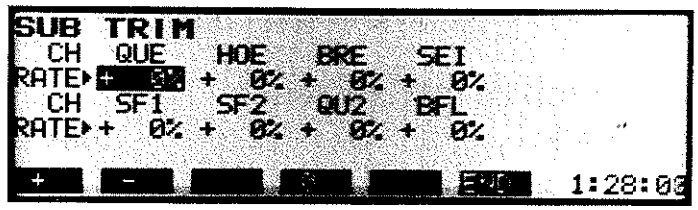
The switch direction may be reversed, see page 29.

Selection of mix trims (MxVR) 79



Mix program ACRO provides the option of trimming numerous functions when flying. To do this, an additional trimmer must be fitted for each function. The required function can then be selected using the cursor control, and the trimmer selected using '+' or '-'. For example, if trimmer no.1 is to be programmed for a function, it must be connected to socket 1 (EXT. Trimmer). The trimmer effect can be switched off by using 'INH' and is re-activated using 'ACT'. There is also the option of programming ONE trimmer for several functions.

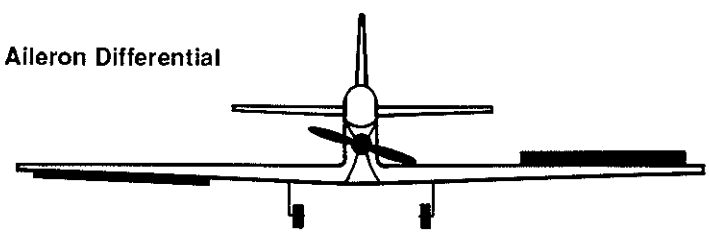
Additional trimming (SBTr) 51



With this option, the first 8 transmitter channels can be sub-trimmed around their neutral positions. This is required when the neutral position of any servo is not quite correct. The adjustment follows the trim path.

Adjust each servo centre position using '+' or '-'. Fast reset to neutral using '0'.

Aileron differential (DIFF) 56

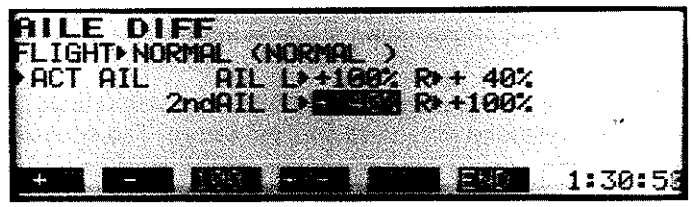


This function offers the option of separate adjustment of the amount each aileron travels 'UP' and 'DOWN'. Each aileron requires a separate servo - see the table opposite for receiver connections.

Set the second aileron servo's throw using '+' or '-' or '100' (for full movement) and the direction of the second servo using '+/-'.

Mix program - Acro

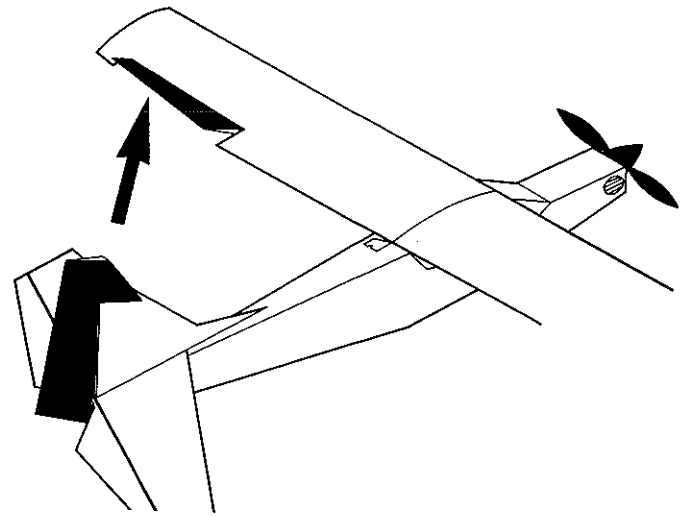
The differential setting should cause the up-moving aileron to travel its full amount (100%) and the down-moving aileron to travel only 50% to reduce 'adverse yaw'.



Move the aileron joystick fully to the RIGHT. Set the deflection of the 1st servo using '+' or '-'. If the servo throw remains the same, simply deflect the aileron stick to the other side and repeat the programming of the 1st servo (AIL). Set the 2nd servo (2nd AIL) in the same way. If either servo moves the wrong way, simply reverse the mix direction using '+/-'.

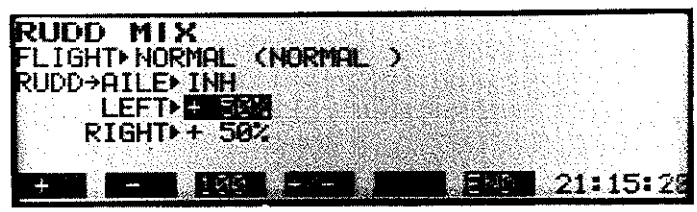
Program a trimmer in 'Selection of mix trims' (MxVR 79). Aileron differential may be programmed to be flight mode dependent.

Rudder⇒aileron mix (RUDD) 57



This function is designed to compensate, with the appropriate aileron movement, the trim changes caused when using the rudder. The mix amount may be programmed separately for each side of the rudder's neutral and the mix may be switched ON or OFF in flight using a switch.

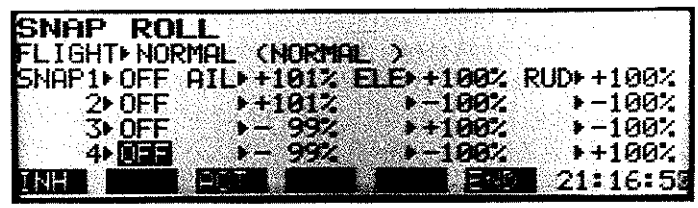
Press 'ACT' to activate the mix. Move the rudder joystick fully to the left and set the aileron compensation with '+' or '-'. Move the joystick fully to the right and set the aileron deflection in the same way. If the ailerons move the wrong way, reverse the mix direction with '+/-'.



The mix may be programmed to be flight mode dependent.

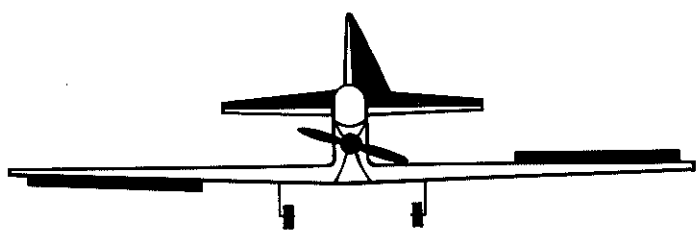
Snap roll function (SNAP) 62

With this function, the ailerons, elevator and rudder may be sent to pre-set positions, using one or more switches, independently of each other. Note: During the period when the switch is operated, the joysticks' control of the three functions is inhibited. For this reason, it is normal to use spring loaded switches for the snap roll function. As soon as the snap roll switch is released, control is regained by the joysticks. The amount of servo throw for each function can be sub-trimmed in operation.



Activate the function using 'ACT', then program the required operating switch. Switch the function ON and set the deflections for the ailerons, elevator and rudder using '+' or '-'. Since four different snap rolls may be programmed in each flight mode, it is possible to set a snap roll for each direction in advance and to call these up in operation. The four options are:

Snap upwards to the right Snap upwards to the left
Snap downwards to the right Snap downwards to the left

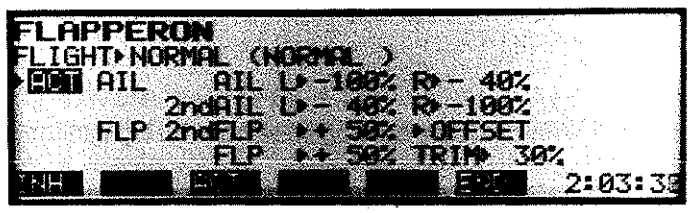


Program the operating switches in 'Selection of mix switches' (MxSW, 09) and trimmers in 'Selection of mix trims' (MxVR, 79). This function may be programmed to be flight mode dependent.

Mix program - Acro

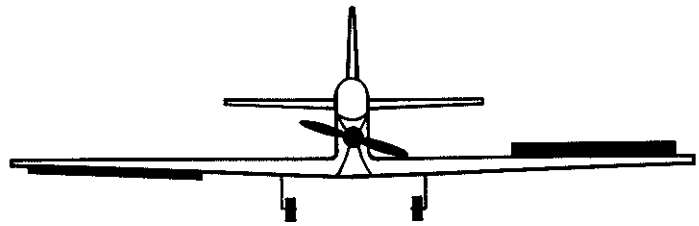
Flaperon mix, speed flap ⇒ aileron (FLPR) 65

This mix allows the ailerons to be used as speed flaps, whilst still retaining aileron control (flaperon). The speed flap deflections may be set separately for each side of neutral. The speed flaps are normally controlled by the channel 5 slider. The aileron servos are connected to receiver outputs 1 and 5. When this option is used, aileron differential may be programmed in the flaperon menu and the settings made may be sub-trimmed in flight.



This function can only be activated if the 'differential' function (DIFF) has been inhibited. If the differential function remains activate, the display will prompt 'off, other mix'. If this message appears, switch off the 'differential' function with inhibit (INH), then activate the 'flaperon' function with 'ACT'. Any settings that have already been programmed in the differential menu will automatically appear when flaperon is activated, but the servos must be connected to receiver outputs 1 and 5.

Flaperon
Ailerons operating

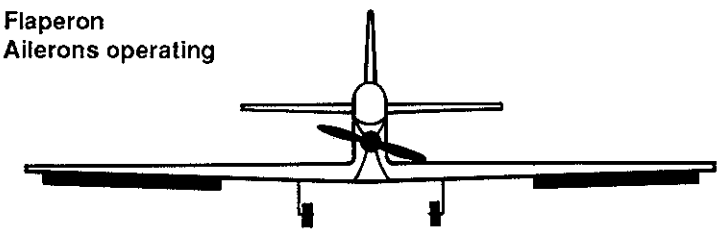


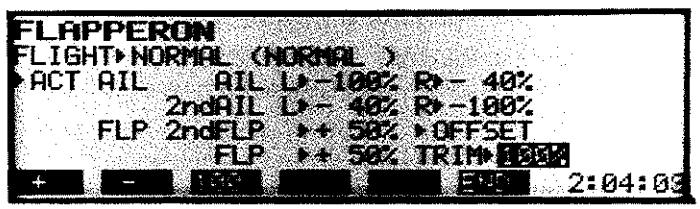
To set the differential, move the aileron stick fully to one side leaving the channel 5 slider in its neutral position. The settings made should cause the up-moving aileron to travel its full amount (100%) and the down-moving aileron to travel less than its full travel (approximately 50%). Of course, the true value of differential can only be obtained by flying the model and adjusting the settings. Differential is used to prevent or reduce 'adverse yaw'.

Set the 1st servo's deflection using '+' or '-'. If the deflections remain unchanged, simply move the aileron stick to the other side and repeat the programming of the 1st servo (AIL). Then set the 2nd servo in the same way. If any servo moves the wrong way, reverse the mix direction using '+/-'.

To gain the full effect of the channel 5 slider, initially set the TRIM to 100%. Now move the slider to its front stop to set the ailerons' speed flap deflections. Set the deflection of the 1st servo using '+' or '-' on the 'FLP' line and the deflection of the 2nd servo on the '2nd FLP line. If either servo moves in the wrong direction, reverse the direction of the mix with '+/-'. Both ailerons should deflect exactly the same amount when used as speed flaps, otherwise a rolling moment will be induced when the speed flaps are used.

Flaperon
Ailerons operating





If the offset position of the channel 5 slider is to be changed from its central default setting, move the slider into the new position and press 'SET' on the 'Offset' line.

Program a trimmer in 'Selection of mix trims (MxVR, 79)' after 'AILE DIFF'.

Mix program - Acro

Propeller pitch adjustment (PIT) 70

This function allows the use of variable pitch airscrews to maintain a constant speed through aerobatics. The propeller pitch (PITCH) is adjusted automatically from the throttle joystick. The change-over point may be set and the maximum and minimum pitch settings sub-trimmed in operation. The change from high pitch to low pitch may be programmed with a delay and the function operated by a switch in operation.

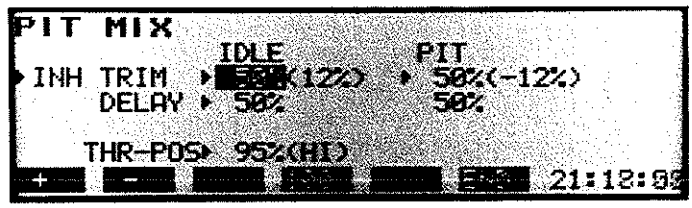
The propeller pitch servo should be connected to receiver output 8.

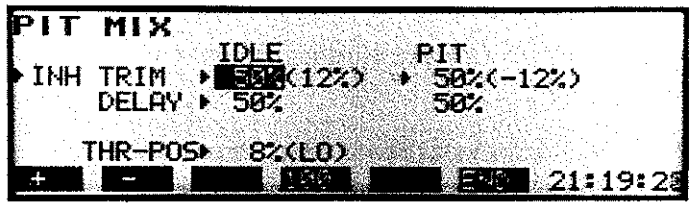
Press 'ACT' to activate the function. Set the idle up trim rate (TRIM IDLE) and pitch (TRIM PIT) using '+' or '-'. The higher the value set, the larger the sub-trim range of both the idling position and maximum pitch. The idling trim operates from 0-50% of the throttle stick's movement and the propeller pitch trim from 50-100%.

Place the cursor on the change-over point (THR-POS). Move the throttle stick into the position which is to change over the propeller setting. Press 'SET' to store.

Now set the DELAY for idling (IDLE) and maximum pitch (PIT). The idling delay prevents the engine from 'racing' when the throttle stick is moved from idle to full throttle with out the propeller pitch increasing. The maximum pitch delay prevents the engine racing when the throttle is pulled back to idle when the propeller is already moving at minimum pitch.

Now program a switch in 'Selection of mix switches' (MxSW, 09) and a trimmer in 'Selection of mix trims' (MxVR 79).





Idle up 1 and 2 (IDLE)

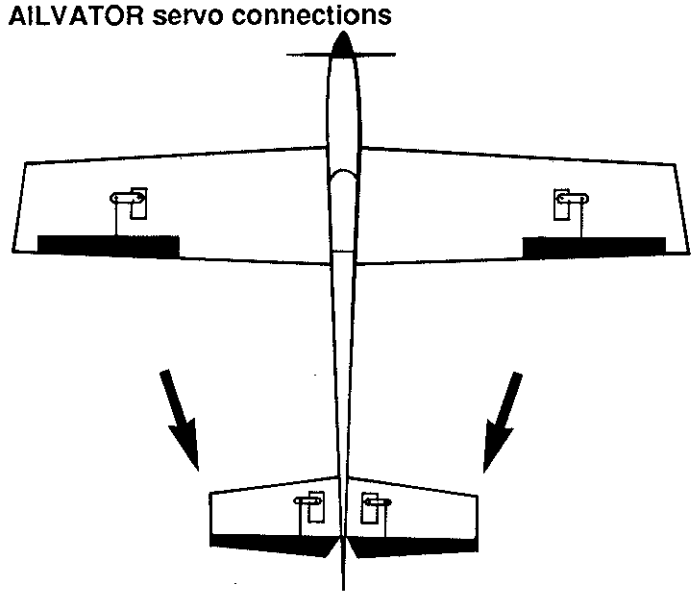
This function provides the option of calling up two pre-programmed idling positions using an additional switch for each. Both programmed settings may be sub-trimmed.

Press 'ACT' to activate the function. Set the required idling speed of the engine using '+' or '-'.

Aileron ⇒ elevator mix (Ailevator, ALVT) 72

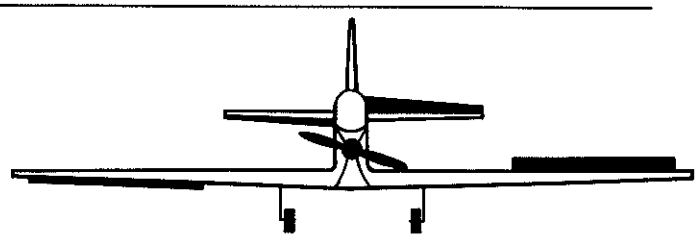
With this function, the elevator may be used in aileron mode, i.e. each elevator half moving in opposite directions when aileron is applied. This function requires a separate servo for each elevator half, connected to receiver outputs 6 and 7. It is particularly suitable for the optimum control of aerobatic models and flying wings. The range of settings includes elevator throw - up and down, 'aileron' throw and 'aileron' differential in the ailevator mode.

AILVATOR servo connections



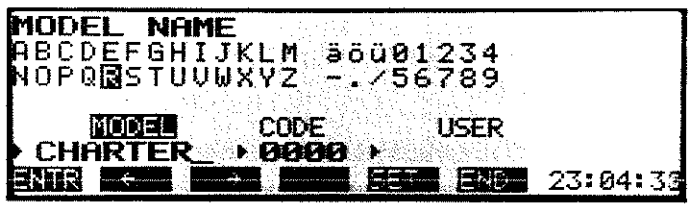
Mix program - Acro

Press 'ACT' to activate the function. Move the aileron stick fully one way to set the 'aileron' deflections of the elevator. The up-moving elevator half should move 100% of its travel and the down-moving elevator half should move around 50% of its total throw when acting as ailerons. The settings are of course approximate and depend on the model being flown.

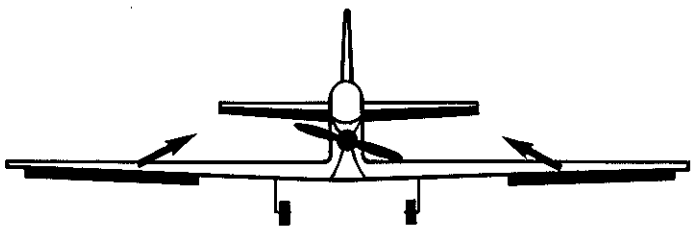


Ailevator - combined elevator/ailerons

Set the deflection of the 1st elevator servo using '+' or '-'. If there is no change in the elevator's movement, simply move the aileron stick in the other direction to set the 1st servo/elevator half (3rd AIL). Then set the second elevator half (4th AIL) in the same way. If any servo moves the wrong way, reverse the mix direction using '+/-'.



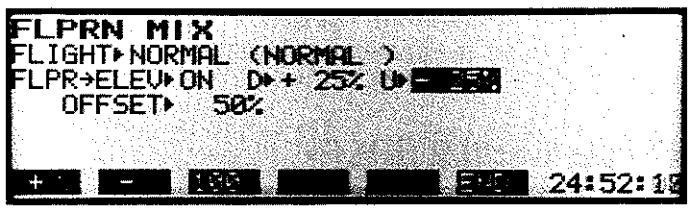
Flaperon ⇒ elevator mix (Flaperon Mix) 75



This mix will balance any trim changes when the flaperons are used with elevator compensation. The amount of compensation can be set separately for each side of neutral (D, U) and the offset point from which the elevator compensation is activated is freely selectable. This mix may be switched ON or OFF with a switch or sub-trimmed in flight.

The mix can also be used with a freely programmable mixer so that when the air brakes are operated, both ailerons will move upwards to create a more pronounced 'brake' effect.

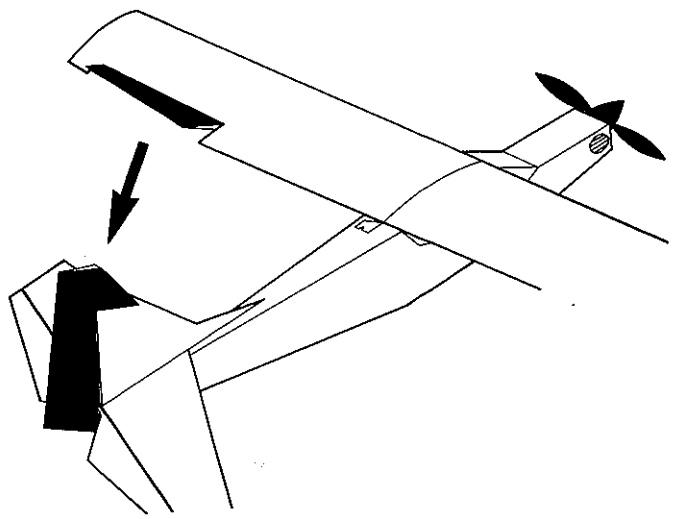
Press 'ACT' to activate the mix. Push the channel 5 slider to its front stop. Set the elevator compensation for this side of the slider's neutral position using '+' or '-'. Pull the slider to its rear stop and set the elevator compensation for this side of neutral. To set the offset position, if it is not to be at the slider's mechanical centre, move the slider to its desired position, place the cursor on 'Offset' and press 'SET'.
Now program a switch in 'Selection of mix switches' (MxSW, 09) and a trimmer in 'Selection of mix trims' (MxVR, 79).



This mix may be programmed to be flight mode dependent.

Aileron ⇒ rudder mix, combi switch (AILE-RUDD) 76

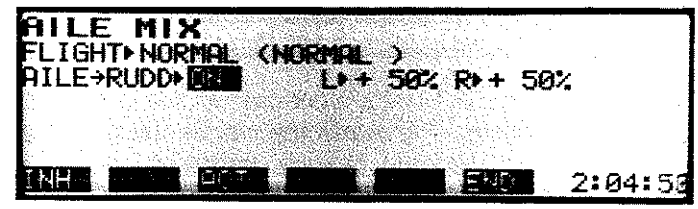
This function allows the mixing of the rudder to the ailerons such that when the ailerons are operated, an amount of rudder can be programmed to act with it. There is a mix override that allows the rudder to still be controlled by the rudder joystick, independently of the ailerons. The mix may be switched ON or OFF using an external switch and the mix amount adjusted by a trimmer.



Mix program - Acro

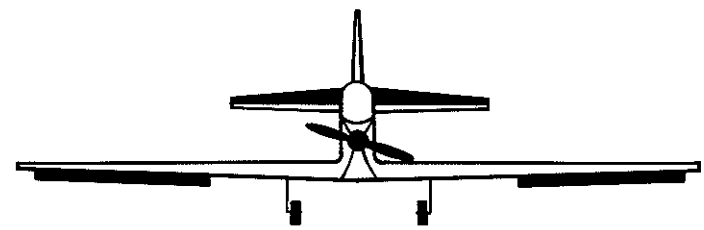
Press 'ACT' to activate the mix. Deflect the aileron joystick fully and set the rudder deflection using '+' or '-'. The mix direction may be reversed using '+/-'.
Now program a switch in 'Selection of mix switches' (MxSW, 09) and a trimmer in 'Selection of mix trimmers, (MxVR 79).

This mix can be programmed to be flight mode dependent.

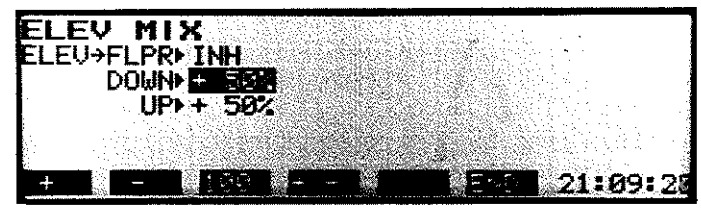


Elevator ⇒ Flaperon mix (ELEV) 77

With this option, ailerons programmed as speed flaps (flaperons) may be mixed to operate in opposition to the elevator (elevator up, ailerons down) to increase the lift when banking or for 'square' manoeuvres. The aileron deflection may be set for either side of neutral. The mix may also be used for Delta models.



Press 'ACT' to activate the mix. Move the elevator joystick to give full DOWN. Set the aileron's speed flap deflection using '+' or '-'. Move the elevator sick to full UP and set the aileron's flap deflection with '+' or '-'. Reverse the direction of the mix if necessary with '+/-'. This mix may also be programmed to be flight mode dependent.

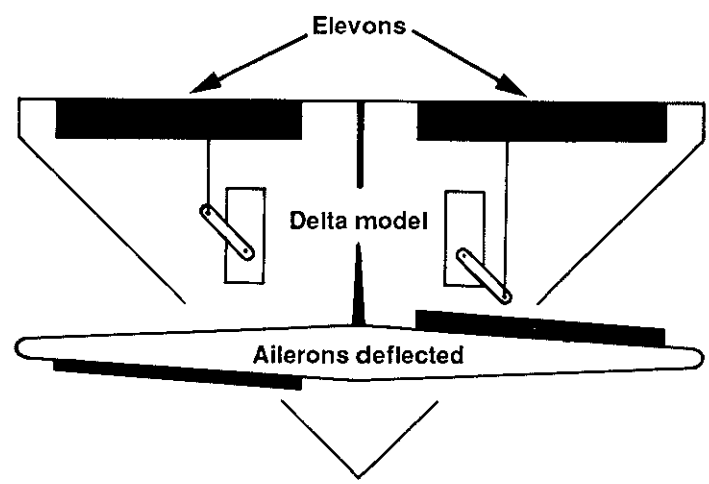


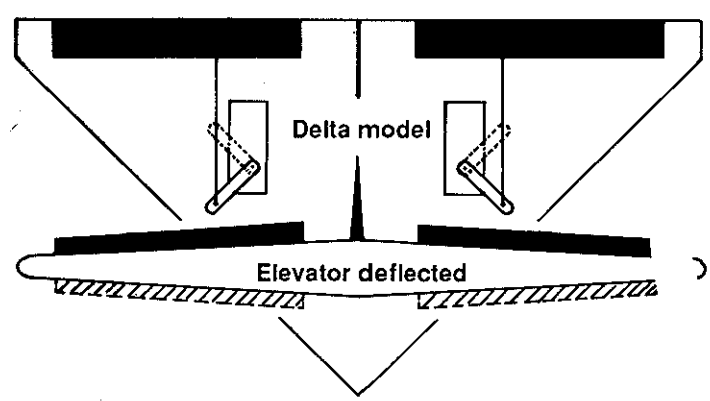
Delta (ELVN) 59

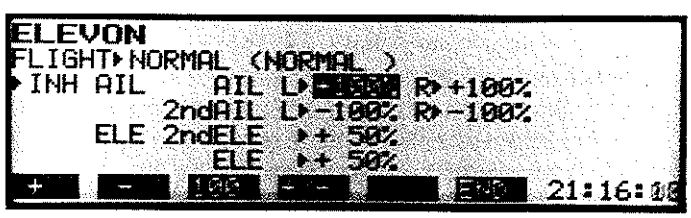
This function allows the mixing of ailerons and elevators (elevons) on delta models. The aileron control may be differential and the amount of movement of the aileron and elevator controls can be adjusted separately for either side of neutral. Connect the servos to receiver outputs 1 and 2.

Activate the function using 'ACT'. Move the aileron joystick fully to the RIGHT and set the differential using '+', '-' or '100'. Move the aileron joystick fully to the LEFT and set the differential using '+', '-' or '100'. If necessary, reverse the direction of the mix using '+/-'.

Now set the elevator throw with '+' or '-'. If either servo moves the wrong way, the mix direction can be reversed with '+/-'.







Mix program - Heli

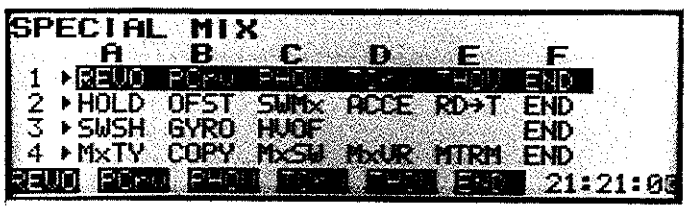
Mix program HELI

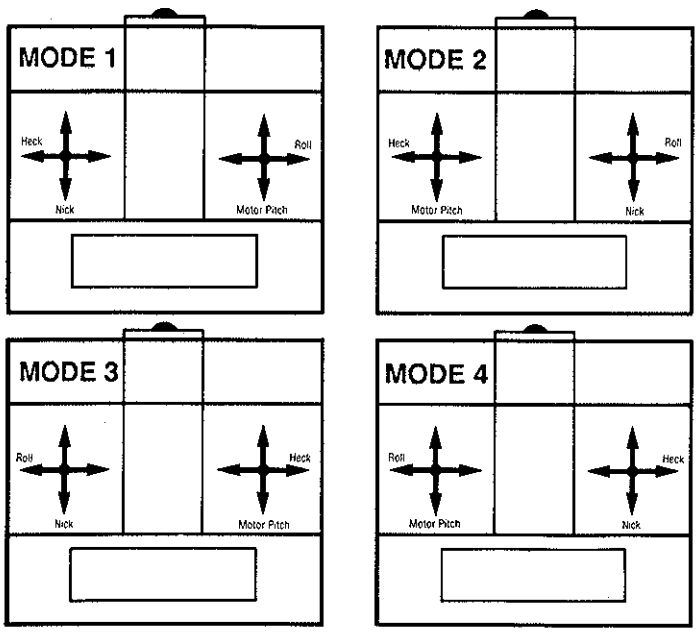
Mix program HELI offers a comprehensive array of helicopter functions. The many options are designed to be suitable from basic 4 channel beginners' helicopters through to the most sophisticated competition models requiring CCP mixing. All of the functions are pre-programmed and need only be activated and adjusted.

The throttle stick has the task of controlling both the throttle and the pitch. Once mix program HELI has been selected, the pitch and throttle functions are automatically assigned to the throttle stick. However, the throttle stick trim only affects the throttle. The throttle servo should be connected to receiver output 3 and the pitch servo to output 6. Revo mix (tail compensation) is automatically activated but may be inhibited if desired. Most of the functions within mix program HELI serve only one purpose - to maintain a constant rotor speed in any flight mode, which is considered to be one of the most important factors for balanced operation of a helicopter. In the following text, these functions are identified by the statement - 'CONSTANT ROTOR SPEED'.

When using mix program HELI, the throttle trim must be programmed for no-load (ATL) operation. The selection of trim at low throttle 'front' (NORM) or high (REVR) may be made in the 'Basic Settings' menu (PARA).

The full benefits of mix program HELI will only be achieved by flight mode dependent programming.





Mix program HELI function table

All functions identified by an 'X' may be given a program dependant on flight mode.

Function	Abbr.	No
Selection of mix switches	MxSW	09
Mix trims	MxVR	50
Selection of mix trims	MxVR	79
Pitch ⇒ tail mixing (Revo mix)	REVO	51x
Hovering throttle	THOV	52x
Hovering pitch	PHOV	53x
9 point throttle curve	TCrv	54x
Throttle maximum		54x
Throttle minimum		54x
Throttle hold	HOLD	56
9 point pitch curve	PCrv	57x
Pitch maximum		57x
Pitch minimum		57x
Aileron, elevator, rudder offset mix	OFST	59x
Swashplate type	SWSH	60
Hovering offset	HVOF	68
Swashplate mixing	SWMx	69
Swashplate ⇒ throttle mix	SWMx	69
Gyro mix	GYRO	72x
Acceleration mix	ACCE	73
Rudder ⇒ throttle mix	RD-T	74

Servo connections for Mix program ACRO

Function	Receiver output	Abbreviation
Roll (aileron)	1	AIL
Nick (elevator)	2	ELE
Throttle	3	THR
Tail rotor (rudder)	4	RUD
Gyro	5	GYR
Pitch	6	PIT
Free	7	AU1
Free	8	AU2

Function characteristics

Certain parts of a function must be accessed in the display with the 'cursor control' keys and this will not be pointed out each time. All descriptions refer to the 'NORMAL' flight mode. **The statement on the 'FLIGHT' line which occurs in almost all functions, is described in the 'flight mode dependent programming' (page 79).**

Mix program - Heli

The function of mix sub-trims (MTRM) 50

This option determines the effect of mix trims over the following:
- trim effective yes/no
- trim effect, magnitude
- trim effect analog (ANLG)
- trim effect digital (DIGT)

Each trim socket must be selected with the cursor. If a trimmer is connected to socket 1, the trimmer is identified in 'Selection of mix trimmer' as trimmer 1. The trimmer number (NO) always corresponds to the EXT TRIMMER socket number.

Each trim may be switched ON or OFF using 'ON' (arrow at the top) or 'OFF' (arrow below).

This concludes the basic setting of trimmers with trim effect. The trimmers are used in flight to trim the settings for optimum performance. The values trimmed in flight may then be input using '+' or '-' and the trim effect switched off. In this way, the optimum settings can be achieved in flight but still operate the system with fewer trimmers.

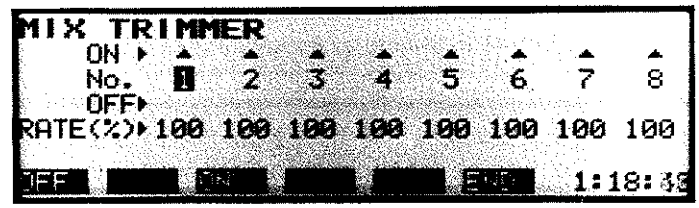
Digital Switch

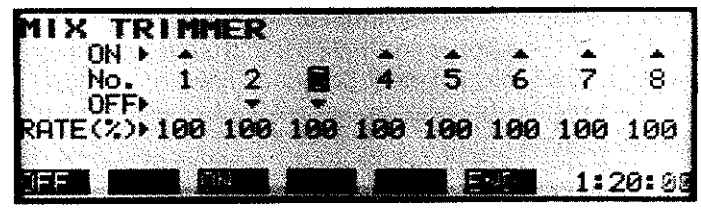
Instead of adjusting the trim effect using mix trimmers, a 'digital switch' may be installed and used in the same way. This switch is connected in the same way as a mix trimmer. If a digital switch has been connected to trim socket 1, the switch must be programmed for 'digital' operation using 'DIGT' (asterisk displayed below the trim function). The setting of a function can then be changed in flight by simply 'pressing the key'. The programmed setting is altered by 1% for each switch movement in one direction (+ or -), thus allowing all changes to be made in a specific way: 10 movements equals a change of 10%. As with any trimmer, the alteration of any settings with the digital switch are stored immediately. The maximum alteration of any setting by a digital switch cannot exceed 100% of the set value. All functions that can be trimmed with a rotary trimmer may be trimmed with a digital switch.

Selection of mix switches (MxSW) 09

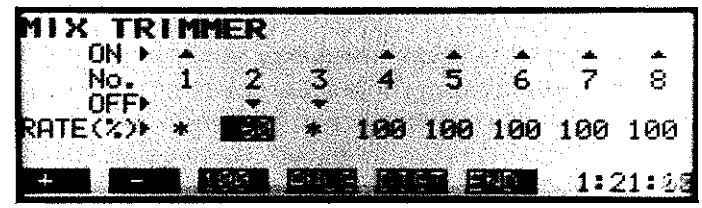
Numerous functions within Mix program HELI may be switched ON or OFF during operation. Each of these will require a switch. In this display, all functions that can be switched ON or OFF by a switch are shown. The switches are programmed by selecting the desired function with the cursor and selecting a switch with '+' or '-'.

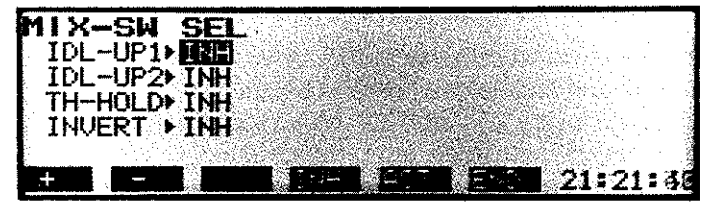
Switch numbers 1 - 8 correspond to the EXT.SWITCH sockets on the PC board. Switches A, B and C are the integral switches mounted at the centre of the transmitter. If, for example, a switch is connected to EXT.SWITCH socket 1, then the desired function must be programmed with switch No. 1.





The amount of trim effect can be varied from 100% to 30%. When set to 100%, the total trim path corresponds to 25% of the total servo throw. When set to 30%, the trim path corresponds to just 7% of the total servo throw. This reduction in trim rate allows minute changes of trim. Set the rate (RATE) with '+', '-' or '100'.



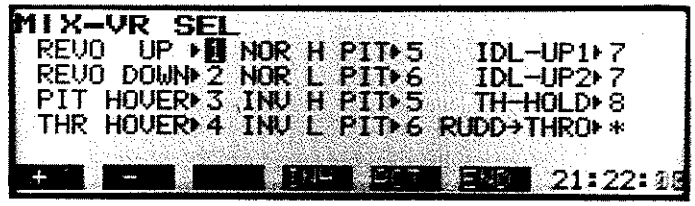


Mix program - Heli

Initially, program all functions by suggesting a switch that has a '-' sign. This allows the displayed functions to be activated without a switch. This programming suggestion should only be altered when the correct switch is to be programmed. If the switch suggestion is changed, without fitting a switch, then the function will remain OFF until such a switch is fitted. The programmed suggestion may then only be recalled by pressing 'RESET' and by re-programming the entire mix program. This does however, cancel all settings within the model memory - each of which must then be re-input.

The various functions within the display are not connected and each function can be programmed on its own using a switch. It is also possible to program ONE switch for several functions. Any switch programmed for a flight mode, however, cannot be programmed for other functions.

The switch direction may be reversed (see page 29).



Selection of mix trims (MxVR) 79

Mix program HELI provides the option of trimming numerous functions when flying. To do this, an additional trimmer must be fitted for each function. The required function can then be selected using the cursor control keys, and the trimmer selected using '+' or '-'. For example, if trimmer no.1 is to be programmed for a function, it must be connected to socket 1 (EXT. Trimmer). The trim effect can be switched off by using 'INH' and is re-activated using 'ACT'. There is also the option of programming ONE trimmer for several functions.

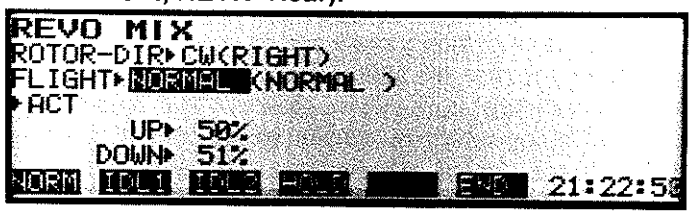
Revo mix (REVO) 51

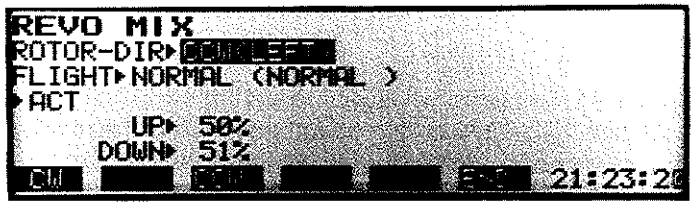
This function offers the option of compensating torque changes from the main rotor system (throttle or pitch changes) using automatic tail rotor balance. The tail rotor servo will be mixed to 'PITCH'. It is possible to select the main rotor system's direction of rotation (the compensation direction depends on the direction of the main rotor rotation) and the tail rotor balance can be adjusted separately for maximum (UP) and minimum pitch (DOWN).

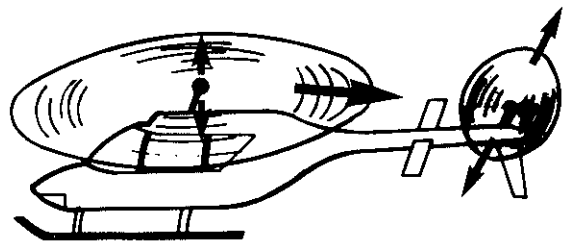
Activate the function using 'ACT'. Move the pitch joystick to maximum and set the tail rotor balance (for maximum pitch) 'UP' using '+', '-' or '100'. Move the pitch joystick to minimum and set the tail rotor balance using '+', '-' or '100'.

Preparation

Before proceeding to the following settings, program the throttle trim as idle trim (ATL) (TRIM RATE 29), and determine the position of maximum pitch (PARA, 28 - NORM=Front, REVR=Rear).







Mix program - Heli

Hovering throttle (THOV) 52

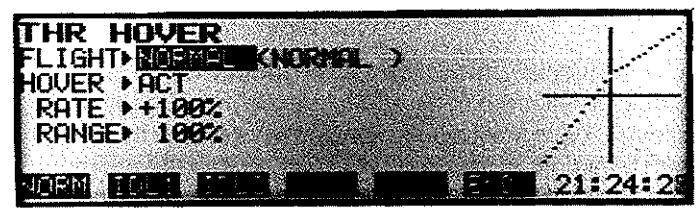
With this function, the engine speed may be changed in the hovering position (mid throttle) without affecting either the high or low throttle settings. It is also possible to set the effective offset range of the speed change. The hovering throttle setting may also be sub-trimmed in operation.

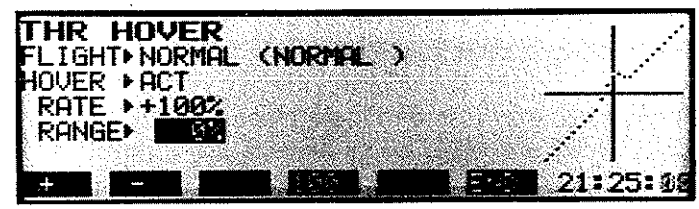
This function may also be programmed for flight modes IDL1 and IDLE2 and any settings stored for these flight modes may be retrieved by switches.

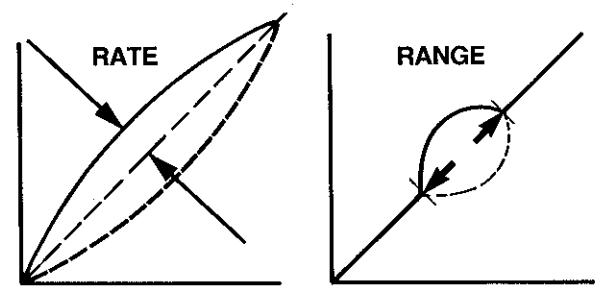
Set the speed change (RATE) and the effective range (RANGE) using '+' or '-'.

The HOVER function may be switched off using 'INH'.

Program a trimmer in 'Selection of mix trims' (MxVR 79).







Hovering Pitch setting (PHOV) 53

With this function, the main blade pitch angle may be altered in the hovering stick position, without affecting the maximum or minimum pitch settings. There is also the option of setting the effective offset range of the pitch adjustment and the hovering pitch setting may be trimmed in flight using an external trimmer. The channel 6 slider may be used for trimming as well, for raising or lowering the entire pitch curve, including the maximum and minimum pitch.

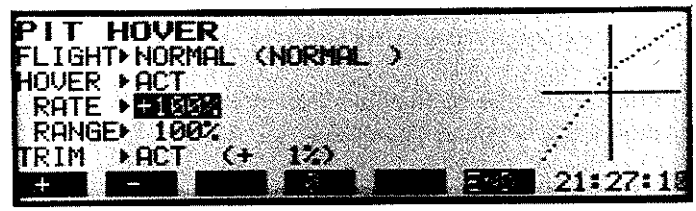
The function may also be programmed for flight modes IDLE1, IDLE 2 and HOLD and any settings stored for these flight modes may then be retrieved using switches.

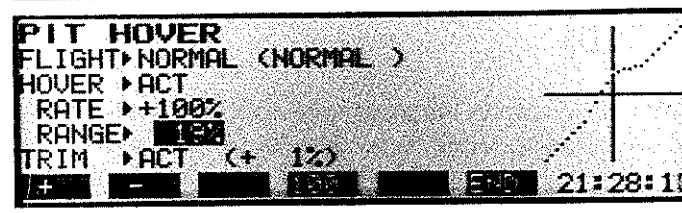
Set the hovering pitch (RATE) and the effective range (RANGE) using '+' or '-'.

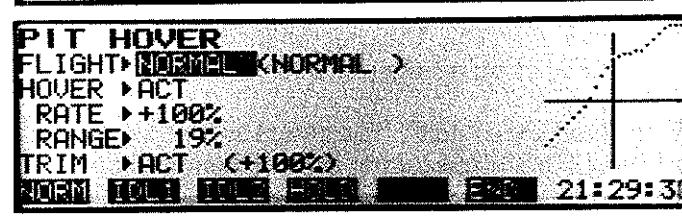
Activate the pitch trim by pressing 'ACT'. The entire curve may be trimmed using the channel 6 slider. The trim offset values are displayed in brackets ().

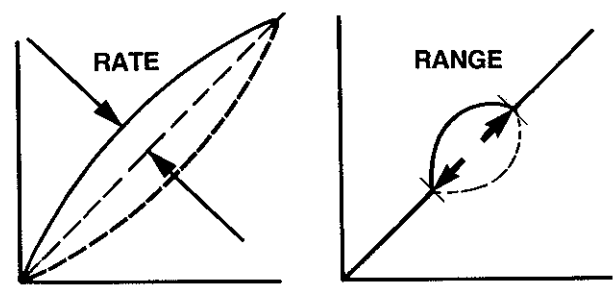
The hover (HOVER) function may be switched off by using 'INH'.

Program a trimmer in 'Selection of mix trims' (MxVR 79).







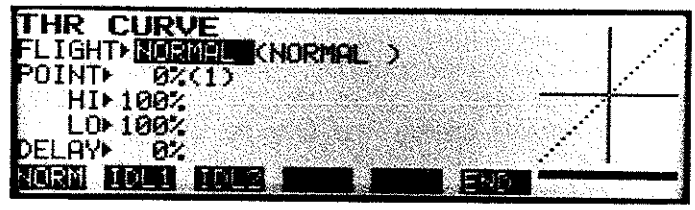


Mix program - Heli

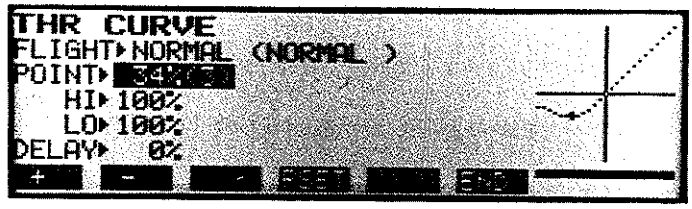
Idle-up, 9 point throttle curve (TCrv) 54

Function: CONSTANT ROTOR SPEED

With this function, the entire throttle range may be set. The throttle curve, from minimum to maximum, is made up of 9 points. Each point may be separately set over the range from minimum to maximum throttle, so that the optimum throttle positions may be programmed over the pitch's 9 setting points. This function is also used for setting **maximum and minimum throttle.**

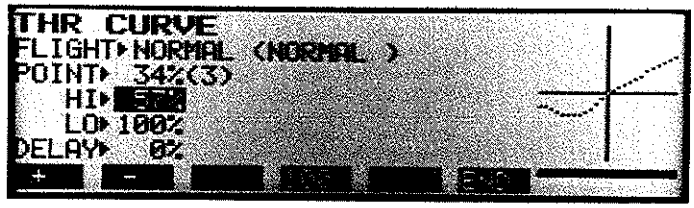


The function may also be programmed for flight modes IDL1, IDLE2 and HOLD. The settings stored for these flight modes may then be retrieved by switches. There is also the option of setting a delay so the throttle servo does not 'jump' to its new position when switching to new flight modes.



Select the required POINT on the throttle curve using the cursor control keys '⇐⇒' (distance of points: 12%). The cursor identifies in brackets () the point which may then be adjusted. Program the throttle settings using '+' or '-'. Cancel any entry using RSET.

Maximum throttle (HI) is set by moving the pitch (throttle) stick to the front stop and entering '+' or '-'. Minimum throttle (LO) is set by moving the pitch (throttle) stick into the idle position which may then be set using '+' or '-'. The throttle stick trim remains effective at all times.

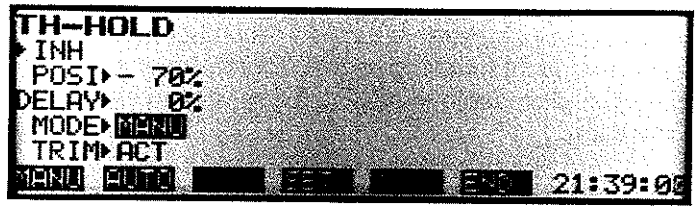


Set the throttle servo DELAY using '+' or '-'.

Further examples of this function are provided in the section 'Programming examples'.

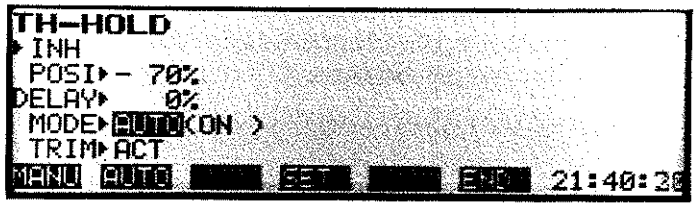
Autorotation - throttle hold (HOLD) 56

This function allows the programming of the throttle servo when activating a throttle hold switch. The programmed position may also be delayed and autorotation may be triggered manually or automatically. The function requires a switch for operation. The programmed settings may be sub-trimmed using an external trimmer.



Firstly, program a throttle hold switch in 'Selection of mix switches' (MxSW 09) for the autorotation function (TH-HOLD).

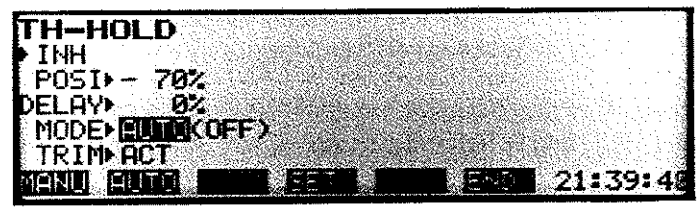
Then switch ON to set the required throttle servo position (engine OFF or idling) using '+' or '-'. The throttle servo will then move to the required position with delay (if required and programmed) as soon as the autorotation switch is used.



If autorotation is to be triggered by a switch, enter the statement MANU on the MODE line.

Mix program - Heli

If programmed for AUTO, throttle hold may be initiated from the pitch joystick. To do this, first program the joystick position from which autorotation is to be triggered (normally the low throttle position) by moving the joystick back to this point and pressing 'SET' to store. If the autorotation switch is now switched ON, and the joystick pulled back to its set position, the autorotation function takes effect and the throttle reduces to its programmed position. The change-over is indicated in brackets () (OFF, ON).



This AUTO function is particularly useful for practising autorotation landings as the throttle hold switch may be switched ON first, then the helicopter flown to the desired spot before activating the throttle hold function by reducing the throttle stick.

Note: When autorotation is ON, whether manually or automatically initiated, the throttle function is inhibited from the pitch function until the autorotation switch (throttle hold) is switched OFF.

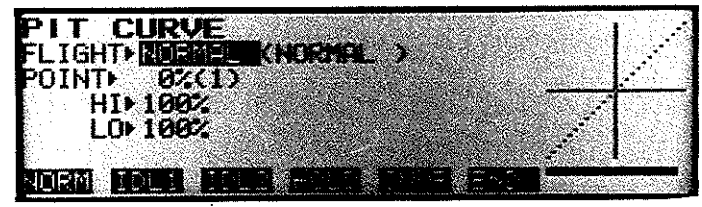
The throttle TRIM may be left active (ACT) or inhibited (INH). This provides the option of deciding whether to have the engine cut when in autorotation, or to reduce to idle - without changing the programmed throttle setting. This arrangement is particularly useful for autorotation practice.

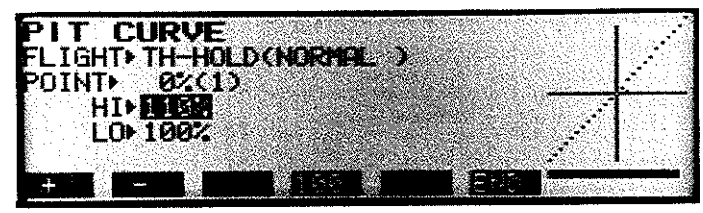
Program the optional trimmer in 'Selection of mix trims' (MxVR, 79).

Pitch curve - 9 point (PCrv) 57

Function: CONSTANT ROTOR SPEED

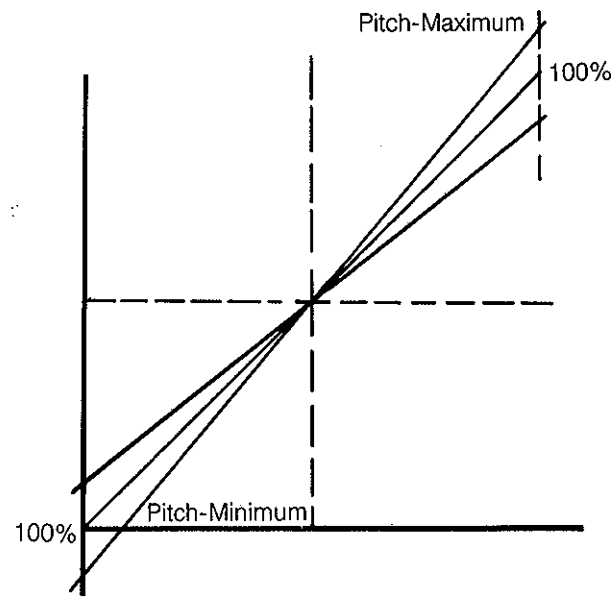
With this function, the entire range of the pitch servo path may be set. The total servo throw, from minimum to maximum pitch, is made up of 9 individual points. Each point may be programmed separately over the pitch range. This function is also used to set the **maximum and minimum pitch.** Each of these settings may be trimmed in operation.





The function may also be programmed for flight modes IDL1, IDLE 2, HOLD and INVERT. The settings stored for these flight modes may then be retrieved by switches.

Select the required POINT on the pitch curve using the cursor control keys '⇐ ⇒' (distance between points = 12%). The cursor identifies in brackets () the point which may be adjusted. Program the pitch setting at each point using '+' or '-'. The minimum (negative) pitch is set by moving the pitch joystick to the rear stop and entering '+' or '-'.



Further examples of this function are given in 'Programming examples'.

Program optional trims in 'Selection of mix trims' (MxVR, 79).

Mix program - Heli

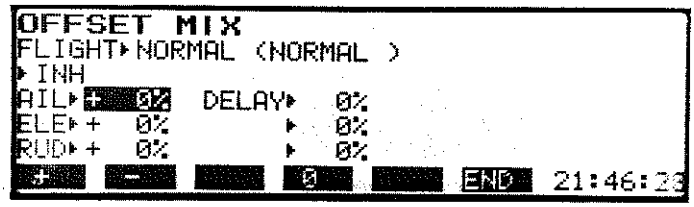
Offset position (OFST) 59

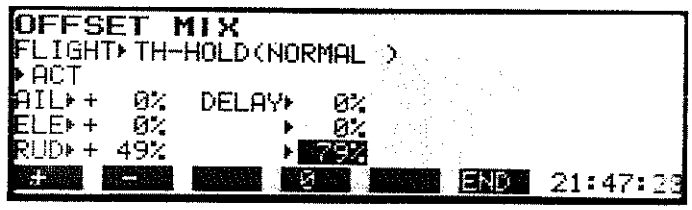
This function allows the setting of offset positions for roll (aileron), nick (elevator) and yaw (tail rotor) in each flight mode (Idle up 1, Idle up 2, and autorotation). A delay may be set for each position.

The settings entered for flight modes IDL 1, IDLE 2 and HOLD may be retrieved with switches.

Press 'ACT' to activate the function. Set all offset positions (AIL, ELE and RUD) and delay (DELAY) using '+' or '-'.

This function is particularly useful for flight mode dependent programming. Advice and suggestions may be found in the section 'Programming examples'.





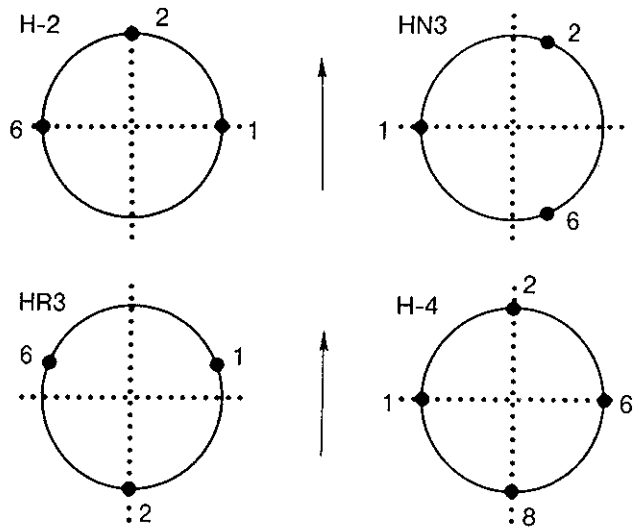
Swash plate type (SWSH) 60

With this function, Mix program HELI may be set to suit the particular type of swash plate being used. All changes take effect immediately the appropriate swash plate is selected. The mix program provides 5 swash plate variations:

H-1: Standard swash plate - Schluter (old), Kyosho etc.
H-2: Heim system - 2 roll servos (see sketch)
H-4: 2 nick (elevator) servos, 2 roll servos (see sketch)
HN3: 2 nick (elevator) servos, 1 roll servo (see sketch)
HR3: 2 roll servos, 1 nick (elevator) servo (see sketch)

Select the required swash plate configuration with HN3, HR3, H-4, H-2 or H-1.

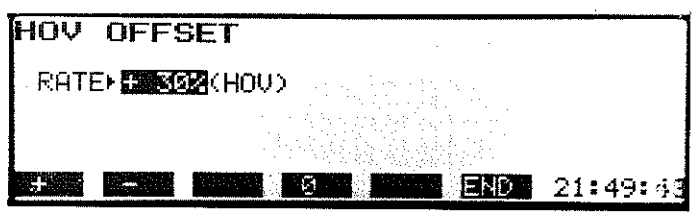
Connect the servos to the receiver, using the swash plate sketch as a guide, where the numbers refer to the receiver outputs.

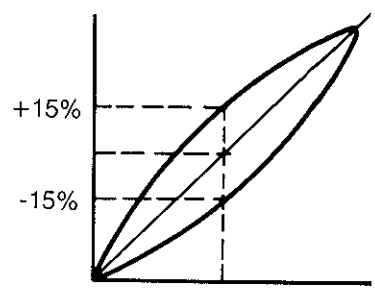


Hovering offset (HVOF) 68

This function is required if hovering flight is not to be at the mechanical centre of the pitch joystick. The offset position may be shifted by +/- 15% of the total pitch range. The programmed offset is display visually (in brackets) as well as audibly (double bleep). The function also has the purpose of determining the point from which the pitch mix moves between maximum (HI) and minimum (LO) pitch.

Program the hovering position using '+' or '-'.





Mix program - Heli

Swash rotation (SWMx) 69

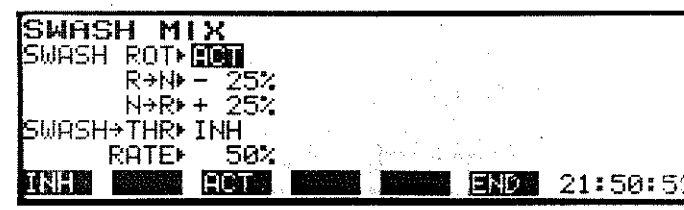
FOR CCPM SET-UP

This function allows the mixing of the roll and nick (aileron and elevator) functions of multi-blade rotors which do not have exactly vertical linkages to the rotor head so the swash plate tilt does not correspond to the desired rotor plane tilt. This problem may be solved by a 'virtual' - not actual - 'swash rotation', i.e. by servo control.

Activate the mix using 'ACT'. Set the 'rotation' on the R-N line using '+' or '-'. Then set the rotation on the N-R line using '+' or '-'.

If a rotation of - 25% is programmed in the first line (R-N), set a rotation on the second line (N-R) of + 25%. There will be no rotation when the settings are - 50% (R-N) and + 50% (N-R).

The swash rotation has been properly set when a multi-blade rotor head makes the appropriate analog deflections (not at the swash plate). Check as follows: set one rotor blade precisely for a direction of flight, then verify the angle of the various blades.

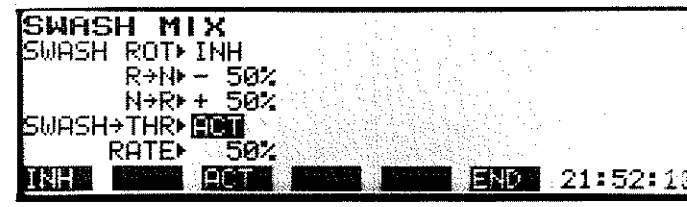


Swash plate ⇒ throttle mix (SWASH⇒THR) 69

FOR CCPM SET-UP

This option provides an adjustable mix of the throttle servo when operating the cyclic controls (roll, nick), to compensate for the loss of lift when using these functions by increasing the throttle when a control command is given, regardless of the direction of the control deflection.

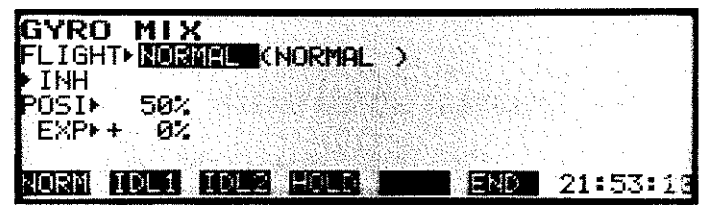
Set the throttle deflection using '+' or '-'.

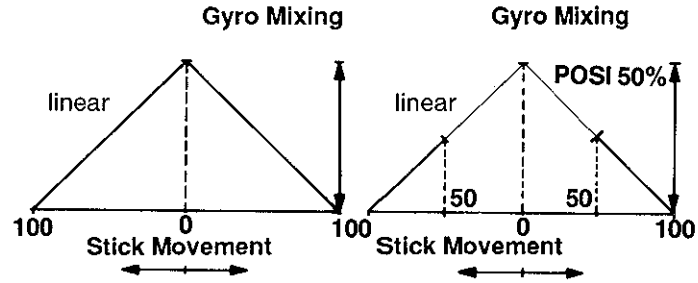


Gyro mix (GYRO) 72

This function allows a reduction of gyro effect when the tail rotor joystick is operated. This allows the high gyro setting required to damp the tail when hovering to be reduced when making turns. You may decide the position (POSI) from which the gyro fade will take effect with a maximum setting of 2/3rds of the joystick deflection. The fade out setting may also be exponential (EXP). This mix will, of course, only operate with linear gyros when a free transmitter channel can be used for setting gyro sensitivity. The maximum and minimum gyro sensitivity depends on the basic settings of the gyro controls (see the operating instructions supplied with the gyro).

The function may also be programmed for flight modes IDL 1, IDLE2 and HOLD. The settings entered for these flight modes may then be retrieved by switches.





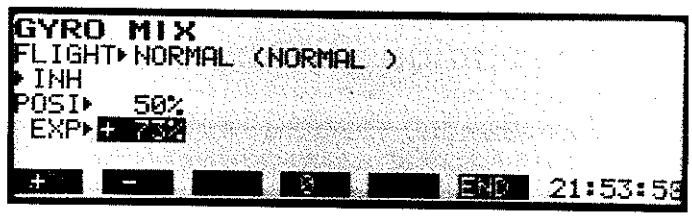
Mix program - Heli

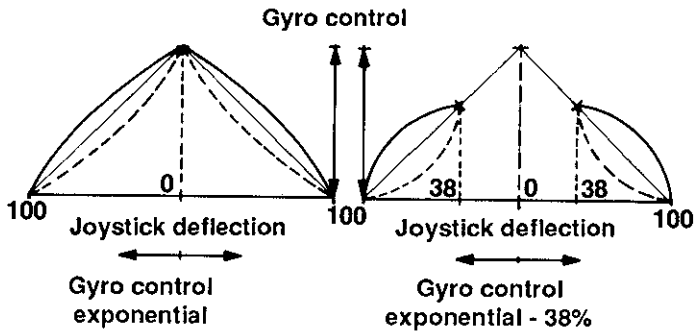
The channel 5 slider is used to adjust the basic gyro sensitivity setting.

Activate the mix using 'ACT'. Set the operating position (POSI) of the tail rotor and the control characteristics (EXP) using '+' or '-'.

For a greater understanding of this function, initially connect a servo to the receiver's output 5 socket to program the transmitter, then replace the servo with the gyro's sensitivity lead.

If this option is left inhibited (INH), channel 5 becomes an additional free channel.

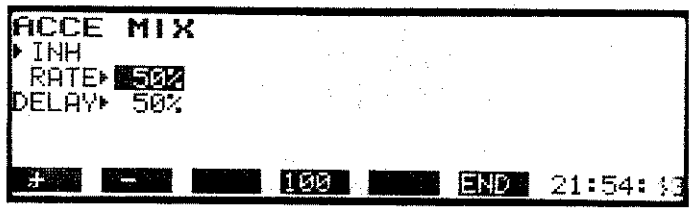


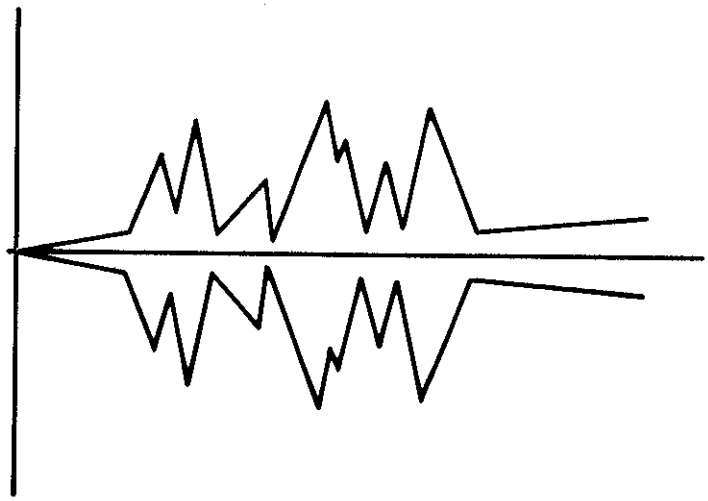


Acceleration mix (ACCE) 73

This mix is used to program brief, automatic deflections of the tail rotor servo when the throttle is opened sharply. It should not be confused with Revo Mix, which holds the deflection as the throttle is opened. Both the compensation value (amount of deflection) and period (how long the deflection is made for) may be set.

Activate the mix using 'ACT'. Set the compensation value (RATE) and DELAY using '+' or '-'.



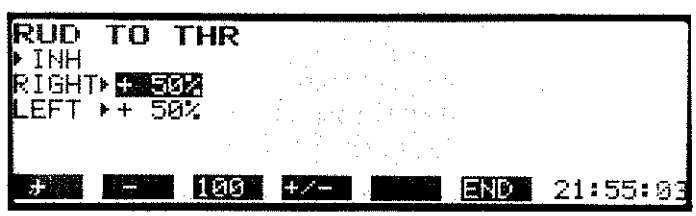


Tail rotor⇒throttle mix (RD-T) 74

Function: CONSTANT ROTOR SPEED

As the tail is used, there is a change in the amount of engine power required for a constant rotor speed and without throttle compensation, the engine speed may fluctuate when the tail rotor control is operated. The power compensation (increase or decrease) may be set separately for either side of the tail rotor's neutral position.

Activate the mix by pressing 'ACT'. Move the tail rotor joystick to the right and program the required power setting using '+' or '-'. Move the tail rotor joystick to the left and program the required setting using '+' or '-'.



Flight dependent programming

Flight mode dependent programming

The FC-28 transmitter has an in-depth flight mode dependent programming option for mixing and many other functions, which is a totally new concept in R/C design. Some applications have always been 'flight mode dependent': Dual rate, for example, is clearly a function which provides different servo paths for each of 'two' flight modes. Helicopter pilots have always been familiar with flight modes such as hover (Idle-up 1), fast forward flight (Idle-up 2), inverted flight (invert) and autorotation (throttle hold). All these 'flight modes' are well known and require quite different settings and mixes.

However, the innovative FC-28 software design allows a comprehensive application of this facility. The FC-28 provides a minimum of 4 flight modes (quattro rate) for many functions, i.e. not only servo path settings, but also mix functions, trim settings etc. In practice, this generates 4 additional data storage facilities for each model memory - one might even describe this feature as a 'model sub-memory'. The quattro rate system also provides new application options which were inconceivable to date.

Travel change over - Adjustable Function Rate Mode - (AFRm) 07

There are two methods available to select one of the four AFR modes available for each model memory. The first is to allocate a switch for each in the AFRm menu by first keying manual (MANU) on the MODE line. The required switch may then be entered for each AFR mode using '+' or '-'. The second method is automatic (AUTO), with each AFR mode being re-called with the throttle joystick.

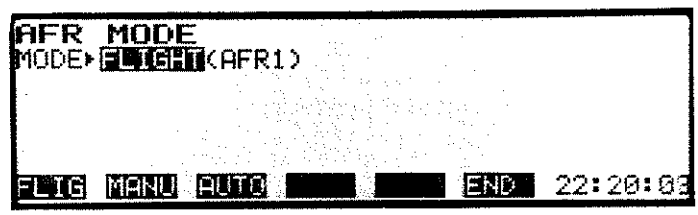
MANUAL change over

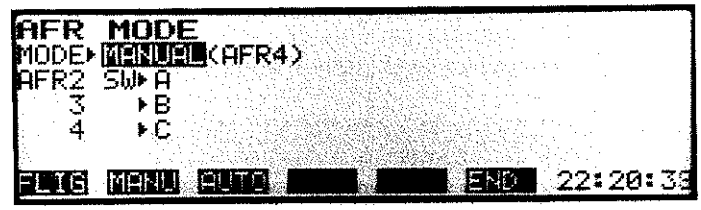
Activate the change over using the 'MANU' key. Program each switch using '+' or '-'. The FC-28 transmitter is supplied with the three external switches - A, B and C already allocated to the four flight modes, but they may be exchanged for additional switches when fitted. The current flight mode is displayed in brackets on the MODE line (AFR 1 - AFR 4). To reverse the switch direction, simply allocate the desired switch then press 'INH'.

AUTOMATIC change over

Activate the change over using 'AUTO'. Program all four AFRs on individual switches as above using '+' or '-', or allocate the same switch for all four. With this automatic option, the four AFR settings may now be retrieved by switch or by the throttle joy stick. See overleaf to set the throttle position which activates each AFR mode. The current flight mode is displayed in brackets on the MODE line (AFR 1 - AFR 4). To reverse the switch direction, simply allocate the desired switch then press 'INH'.

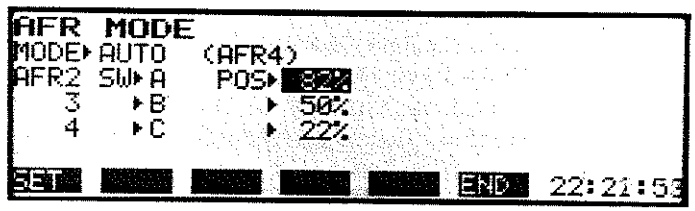
If AFRm is set to FLIGHT (FLIG), then the four AFR modes will be called up automatically from the current flight mode. In this case, the first flight mode will call up AFR1, the second will call up AFR 2 etc.





Flight dependent programming

To program the throttle positions which will activate, in turn, each AFR mode, move the cursor to 'POS' on AFR-line 2 (AFR2). Move the throttle stick into the position in which AFR-mode 1 is to be changed to AFR-mode 2 and press 'SET'. AFR-mode 2 will be switched on automatically with the throttle stick in this position. Program AFR-lines 3 and 4 in the same way as line 2, moving the throttle stick each time into the desired position.

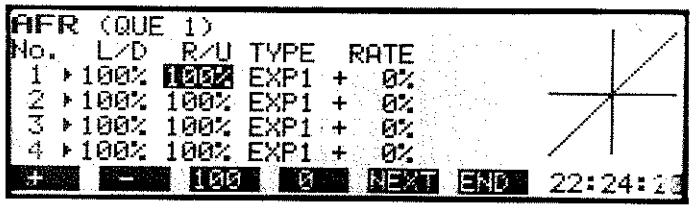


This automatic change-over will only take place if the AFR-switch or switches are 'OFF'. If the switches are ON, they will over-ride the automatic change-over as the switches have a higher priority than the throttle joystick.

In this 'AUTO' mode, all AFR modes can be retrieved by moving the throttle stick into certain positions, which is particularly useful for fast models, as the throw of each control surface may be reduced automatically as the throttle is increased and the throws increased when the throttle is reduced for landing.

Dual Rate, Trial Rate, Quattro Rate (AFR) 15/16

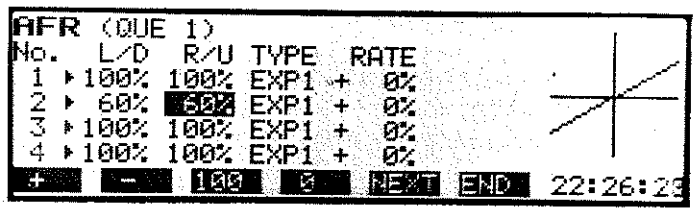
This function is used for setting the individual AFR changes. The cursor is moved across AFR lines 1 - 4 using the AFR-switches, for programming a reduction in throw or control characteristic (curve) on each line (please refer to page 23, AFR). A maximum of 4 path reductions or curves can be programmed (AFR1 -4) for each channel. The current channel being programmed is displayed in brackets on the top line and can be altered using 'NEXT'.



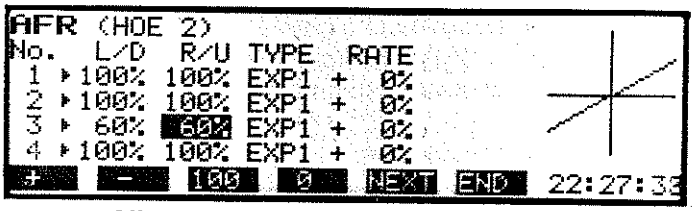
Examples:

Dual rate for aileron and elevator

Select the aileron function (using 'NEXT' if necessary). With the AFR1 switch in the OFF position (cursor on line 1), set the aileron movement for either side of neutral to 100% with '+' or '-'. Move the aileron joystick from left to right to control the cursor.



Select AFR 2 (cursor on line 2). Enter the required reduction in throw for each side of neutral using '+' or '-'.



Select the ELEVATOR using 'NEXT'. Set the dual rate reduction in throw in AFR 2 in the same way as described above. Continue programming throw reductions for other channels in the same way.

When AFR 2 is selected now, the aileron and elevator throws will be reduced to their set values.

For any further changes, it is possible to program AFR lines 3 and 4 with the required reductions or curves.

Aileron		Elevator	
100%	100%	100%	100%
60%	60%	100%	100%
100%	100%	60%	60%
100%	100%	100%	100%

Flight dependent programming

Flight mode change-over (Quattro rate mixing)

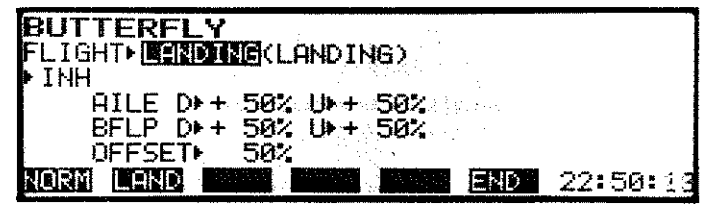
With this function, different mixer settings can be matched to current flight modes. It is possible to set the following flight modes in each model type.

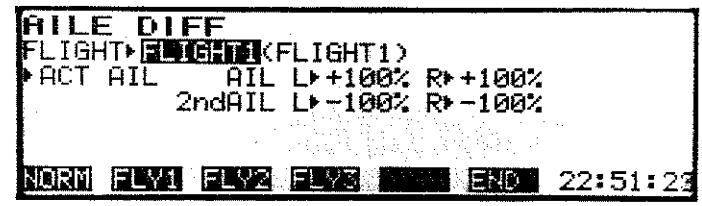
Mix program GLIDER offers 'NORMAL', 'START', 'SPEED', 'DISTANCE' and 'LANDING'.

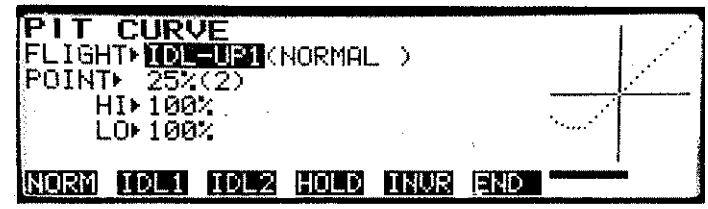
Mix program ACRO offers 'NORMAL', 'FLIGHT1', 'FLIGHT2' and 'FLIGHT3'

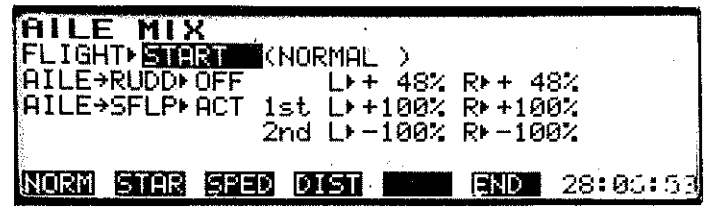
Mix program HELI offers 'NORMAL', 'IDLE UP 1', 'IDLE UP 2', 'TH-HOLD' (autorotation) and 'INVERT' (inverted flight).

Because many flight modes are just variations of the NORMAL flight mode, it is possible to set up the NORMAL flight mode then copy the settings to another or all other flight modes. These may then be modified to suit the particular duties of that flight mode. Select 'COPY' in the SPECIAL MIX program. On entering the program, the cursor rests on NORMAL. This is the flight mode which will be copied to another mode. It can be changed by selecting another flight mode. Move the cursor to the 'ALL' statement. If the selected flight mode is only to be copied to one other flight mode, select the desired flight mode, move the cursor to 'COPY' and press the COPY key. A series of arrows passes from left to right to confirm completion.



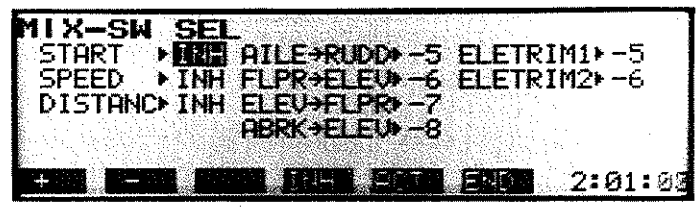






Mixer Switch (MxSW) 09

A switch must be defined for each flight mode, by programming in 'Selection of mixer switches' (MxSW, 09). Once activated, each switch will call up the next flight mode. These switches need not be the same as the switches that control the four AFR modes.



Examples:

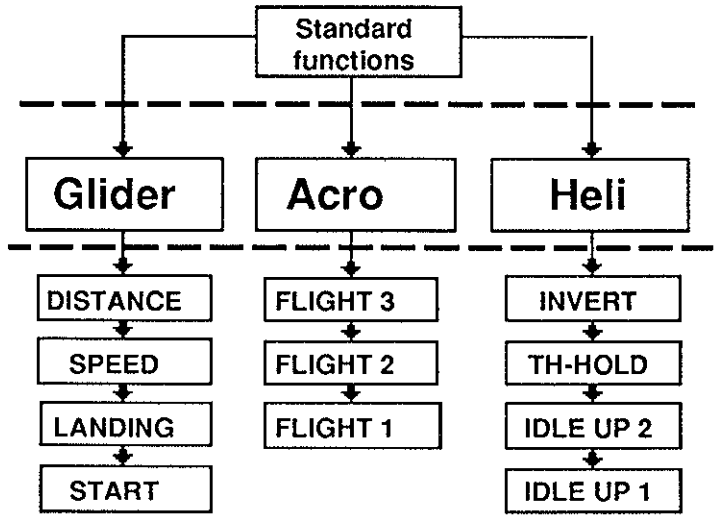
As most mixer programs are entered, there is a FLIGHT statement which should always be followed by 'NORMAL' and (NORMAL). This indicates that any programming changes will only affect the NORMAL flight mode. If a flight mode switch is operated, the statement in brackets () will change to the appropriate flight mode. However, any programming changes that are to be made to the new flight mode will only be effective if the NORMAL statement is changed (using the cursor to select) to the desired flight mode.

Switch priority

Once the switches have been selected to change over the flight modes, these may be used to change the AFR modes too. So long as the AFRm menu is set to 'FLIGHT', the AFR settings will automatically be called up. If AFRm has been set up with manual (MANU) or automatic (AUTO) the flight mode switches will have no effect on AFR.

Flight dependent programming

The flight mode change-over switches are arranged in a definite priority sequence. There is always one flight mode which has priority over all the others: This is known as the mode with 1st priority. The flight mode with 2nd priority retains priority over flight modes 3 and 4.



The priority of flight modes in mix program GLIDER is:

1. DISTANCE
2. SPEED
3. LANDING
4. START

The priority of flight modes in mix program ACRO is:

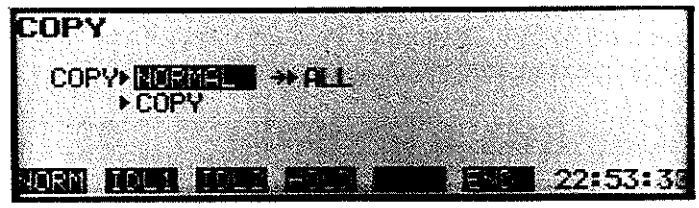
1. FLIGHT 3
2. FLIGHT 2
3. FLIGHT 1

The priority of flight modes in mix program HELI is:

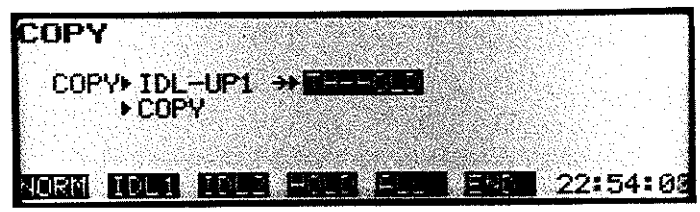
1. INVERT
2. TH-HOLD
3. IDLE-UP 2
4. IDLE-UP 1

Copying flight modes (COPY) 07

This function has the purpose of keeping programming effort to a minimum when setting up new flight modes. The settings that have already been programmed in a flight mode may simply be copied to other flight modes. This means that there is no need to repeat all the settings in each mode. The copying process is the same as that for copying model memories.

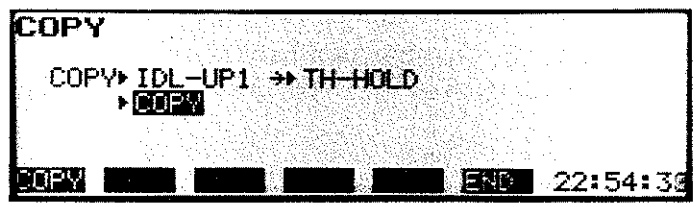


First, enter the flight mode that is to be copied - after the COPY statement. During the first attempt to copy, the first flight mode shown will be NORMAL (NORM), since all settings were originally made in this flight mode.



Next, input the TARGET flight mode after the arrow, where the NORMAL flight mode is to be copied.

Place the cursor on 'COPY' and press the COPY key to activate the copying process. The copy is complete when an audible 'bleep' sounds and a series of arrows crosses the screen.



It is possible to copy all flight modes in this way.

Programming examples

Since there are so many options available with the FC-28 system, it is not possible to list every feature, function and option in order for each model type. This section of the manual is therefore devoted to detailing practical examples and programming suggestions for the various types of model.
The descriptions follow the recommended sequence for the quickest and easiest method of programming the various functions.

Simple sport aircraft

The following examples refer to a simple sport model fitted with only 4 servos, controlling ailerons, rudder, elevator and throttle.
The following also applies to all other models of a similar design, as well as models controlled by only 2 or 3 servos. Since no mixing functions are required, the mix program STANDARD will suffice.

Preparation:

Connect all servos to their surfaces. Connect the servos, nicad and switch harness to the receiver.

Aileron	Receiver output 1
Elevator	Receiver output 2
Throttle	Receiver output 3
Rudder	Receiver output 4

Selecting a model memory (MODL) 11

This function allows the user to select the required model memory before programming any settings.

Select the required memory number using the cursor then press 'SELE'. Acknowledge the input with 'YES' and the memory is activated.

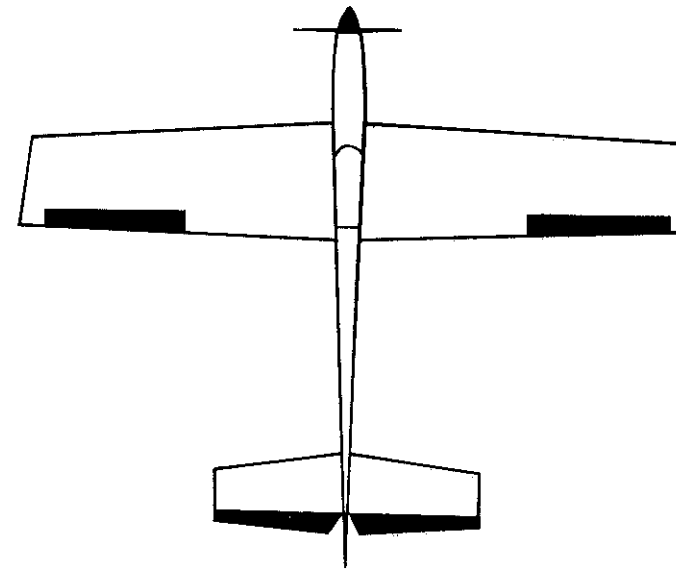
Cancelling model memory contents (RSET) 32

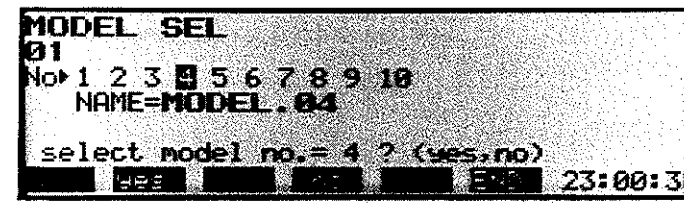
All previously input data of the current model memory may be reset, prior to programming a new model. Select the RESET function and press 'RSET'. This function does not affect any other model memory and will not erase the current model name and any settings made in 'Parameters', such as PCM/PPM etc.

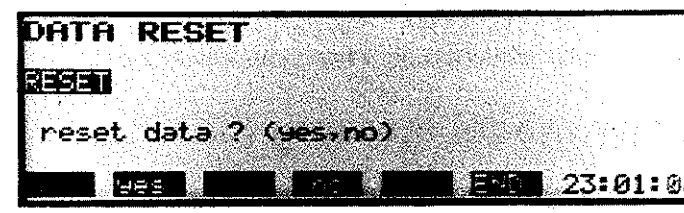
Model name, user name, code number 10

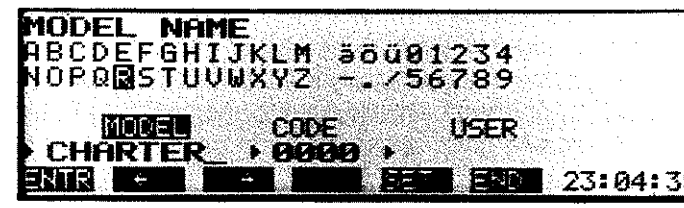
Each model memory may be identified with a name containing a maximum of 8 characters.

The user name may be programmed into the transmitter's memory with a maximum of 10 characters. A code number may also be entered to secure the user's name. Once this number has been input, it must be re-keyed before the user's name can be changed. Ensure that the security code is memorized, as no further changes may be made to the user's name without it.







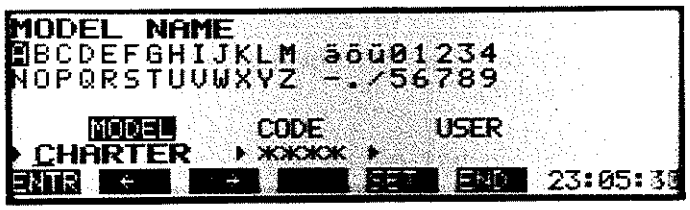


Programming examples

Input

The letters and characters are selected with the cursor controls. The highlighted character is entered by pressing the 'ENTR' key.
There is a second cursor, controlled by keys B and C. This cursor underlines the input characters and confirms the character input point.
Once the input of MODEL, CODE or USER name has been completed, press the 'SET' key to confirm the entry.

If a code number has been programmed and then forgotten, contact your Futaba Service Agent.

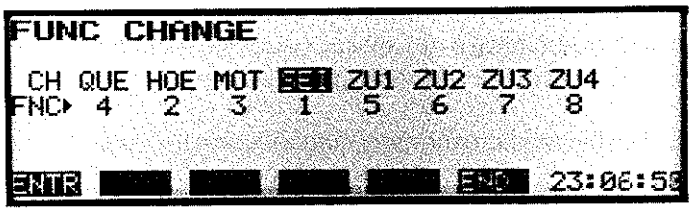


Function change (FUNC) 21

This option allows the configuration of the transmitter to be changed by the pilot to suit personal preferences. All functions are freely selectable, i.e. you may decide which slider or switch operates which channel. Any changes made will not affect the servo connections at the receiver - these always remain the same. The abbreviation on the 'CH' line identify the various channels. The order in which they appear does not change, but the function number below the abbreviation does. The joystick channels are identified with numbers 1, 2, 3 and 4; the left hand slider is channel 5, centre is 6 and right hand 7; the 3 position switch is number 8.

Programming

Call up the first channel that is to be changed using the cursor controls. Press 'ENTR'. Call up the channel which is to be exchanged using the cursor control keys and press 'ENTR'. Acknowledge the entry using 'yes' and the two channels will exchange. In this way, all functions may be changed to their desired sequence. Any arranged configuration may then be copied to all other model memories if desired.

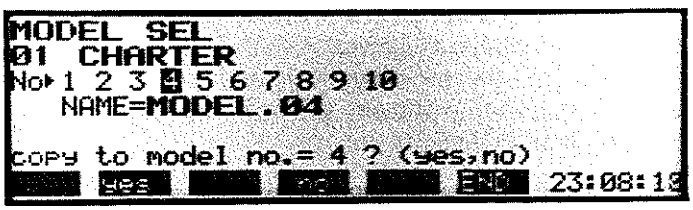


Example

If the transmitter is to have the throttle operated by the right hand joystick rather than the left, select 'ELE' with the cursor keys and press 'ENTR'. Select the throttle (THR) and press 'ENTR'. Confirm with 'yes'. The transmitter is now configured to mode 1 - only the throttle ratchet needs to be transferred to the right hand joystick (see page 5)

Copy model memory (MODL) 11

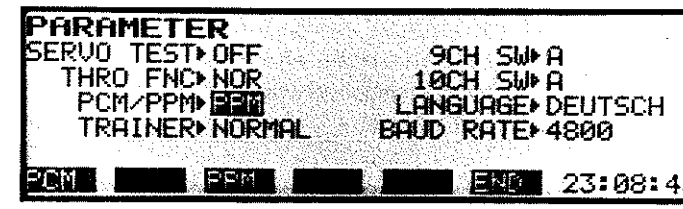
With this function it is possible to copy all the stored data within a model memory to another free model memory. This allows 'safety' copies to be made and similar models do not require re-programming completely - only the differences adjusting.
Select the model which is to be copied with 'SELE' and 'yes'. Select the model memory to which it is to be copied with 'COPY' and 'yes'. The new model memory may now be selected and given a new name in menu 10 (model name).



Programming examples

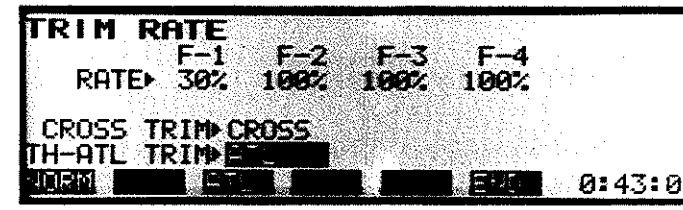
Basic settings (Parameter) 28

In this menu, the options include the transmitter modulation (PCM/PPM). In PPM modulation, standard FM receivers may be operated.
When changing the modulation from PCM to PPM, the transmitter must be switched OFF and then ON again to activate the change.
Also in this menu the language for many of the menus may be changed, with the options of German or French being available.
With standard programming, only the 'PCM/PPM' and 'THRO FNC' functions need to be programmed, depending on the model or receiver being used.



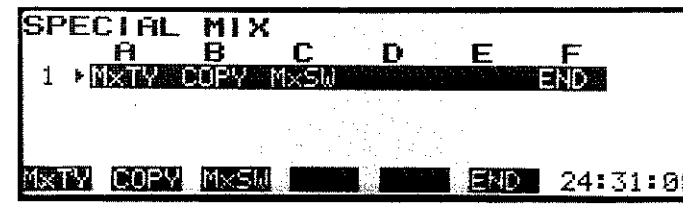
Trim rate (TRIM) 30

The effect of the stick trims can be reduced to 30% of the total normal effect with this function. By setting the 'CROSS TRIM' function, it is possible to exchange function 2 and 3 trims, without changing the stick effect. 'TH-ATL' offers the option of no-load throttle trim, where the trim only operates when the stick is below centre. The trim has no effect on the full throttle setting. This effect can be reversed - from 'front' to 'rear' - where the trim has no effect on the LOW throttle setting in menu 28 Basic Settings.



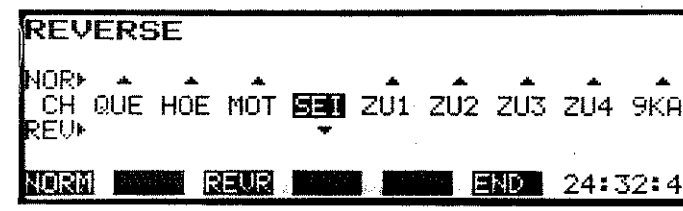
Mixer type (MxTY) 13

The FC-28 transmitter provides the option of completely programmed mixers for various model types. For this example of a simple i/c powered model, only model type STND (standard) needs to be selected. For more complicated aircraft the options include ACRO (aerobatic), GLIDER with 2 servos, 4 servos or 5 servos in the wing and HELI (helicopter).



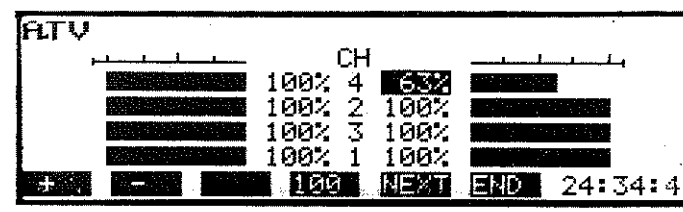
Servo reverse (REVR) 12

With this option, it is possible to reverse the servo rotation of all channels.
Call up the required function with the cursor. Press the 'REVR' key to reverse the function. Pressing the 'NORM' key returns the servo direction to normal. When the servo is NORMAL rotation, an arrow points above the servo abbreviation. With REVERSE rotation, the arrow points below.



Servo travel adjustment (ATV) 14

The ATV function allows the servo travel, either side of centre, to be adjusted on all channels. ATV will also reduce the trim path and dual rate in proportion to the reduction in total throw.
On the graphics display, ATV is represented as a bar chart for four functions. The cursor must be placed on the correct side of neutral to change the ATV. The cursor is controlled by the relevant joystick or slider. Move the cursor up and down using the cursor control keys and press the 'NEXT' key to access the next four channels. Reduce or increase the throw using '-' or '+'.



Programming examples

ATV provides a very simple solution to many linkage problems. Controls that require a limited servo movement such as throttle and retracts, can be adjusted very easily with ATV. The size of servo horn is now less important as any excess throw may be reduced with ATV. This ensures that a servo is never 'stalled'.

ATV is also particularly useful when trimming models. For example, if a model rolls quicker one way, ATV can be used to reduce the movement on one side of the aileron control. With elevator, more 'down' than 'up' can be set to give equal sized loops and outside loops.

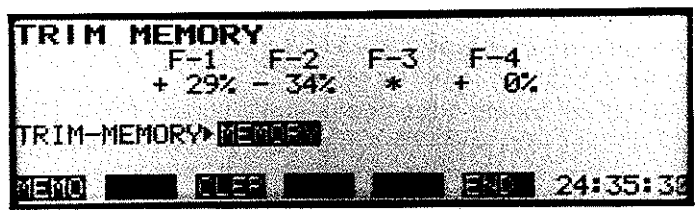
Trim memory (TRIM) 30

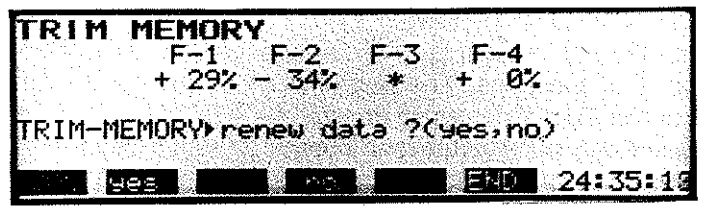
This function allows the option of storing the trim settings so that all mechanical trims may be brought back to their centralised position as the trim positions will normally be different for each model memory. It is possible to save the settings for all the stick trims and external trimmers, but not the throttle ATL trim. The maximum trim value that can be stored is 200% of the total trim path. Settings above this limit will not be stored.

Storage:

Trim the model in flight using the stick trims and any external trimmers. Without moving the obtained trim positions, press the 'MEMO' key and acknowledge with 'yes'. All trims may now be returned to their neutral positions as the trim effect has now been stored. If the stored trims are to be reset, simply correct the trim positions on the transmitter and press 'MEMO' to re-input the correct settings.

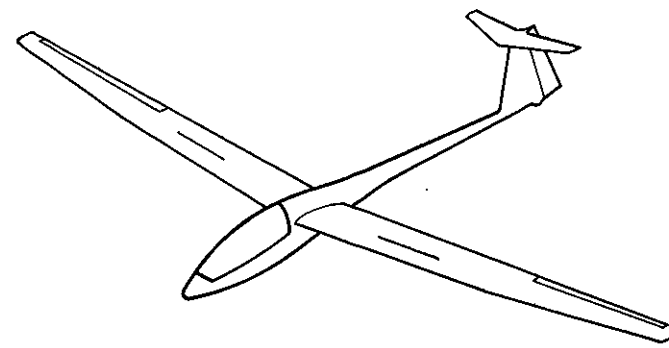
All the stored trim settings may be removed from the model memory by pressing 'CLER'.





Programming examples

Gliders



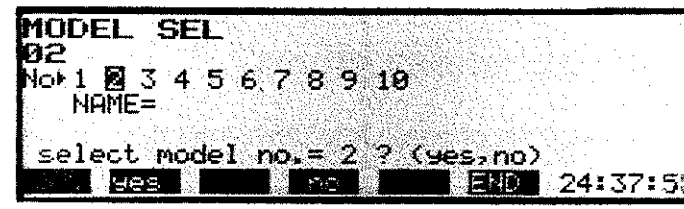
The basic glider mix program is GLIDER 2. This assumes the model is fitted with 2 servos in the wing (one on each aileron), and a single servo on each of the following - rudder, elevator and airbrakes.

When the mix program is selected, aileron differential is already activated. Of course, this feature may be inhibited if desired.

The servos should be connected to the receiver in the following order:

Aileron 1	Receiver output 1
Elevator	Receiver output 2
Airbrakes	Receiver output 3
Rudder	Receiver output 4
Aileron 2	Receiver output 7

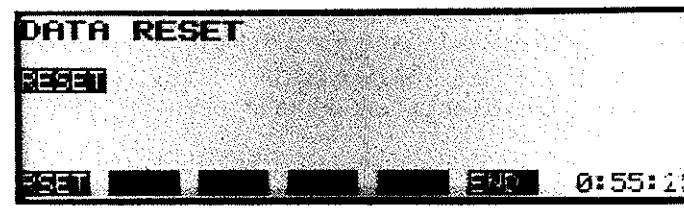
Selecting a model memory (MODL) 11



This function allows the user to select the required model memory before programming any settings.

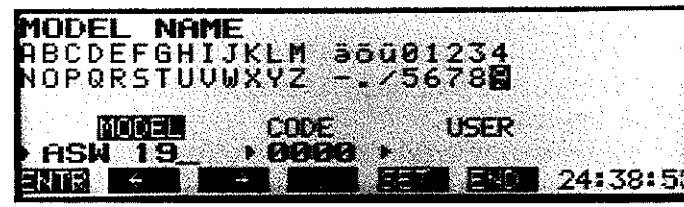
Select the required memory number using the cursor then press 'SELE'. Acknowledge the input with 'YES' and the memory is activated.

Cancelling model memory contents (RSET) 32



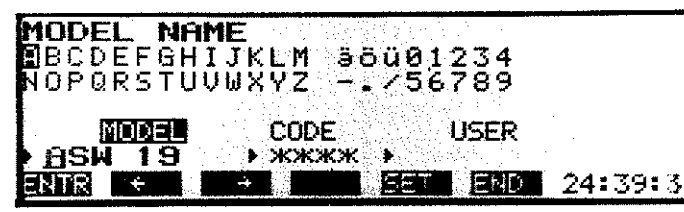
All previously input data of the current model memory may be reset, prior to programming a new model by selecting the RESET function and pressing 'RSET'. This function does not affect any other model memory and will not erase the current model name and any settings made in 'Parameters', such as PCM/PPM etc.

Model name, user name, code number 10



Each model memory may be identified with a name containing a maximum of 8 characters.

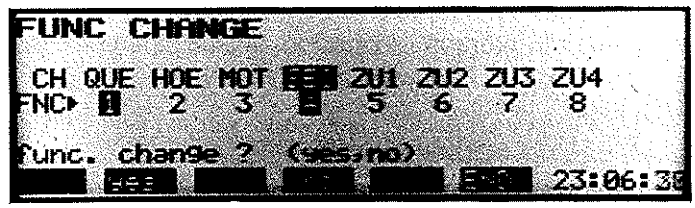
The user name may be placed into the transmitter's memory with a maximum of 10 characters and a code number may be entered to secure the user's name. Once this security number has been input, it must be re-keyed before the user's name can be changed.



Programming examples

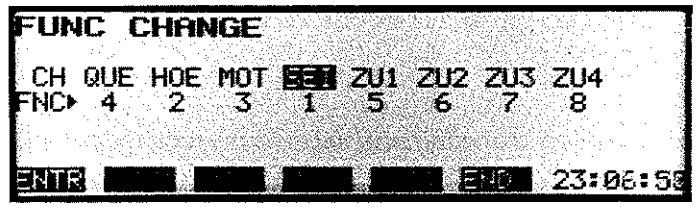
Function change (FUNC) 21

This option allows the configuration of the transmitter to be changed by the pilot to suit personal preferences. All functions are freely selectable. You may decide which slider or switch operates which channel. Any changes made will not affect the servo connections at the receiver - these always remain the same. The abbreviation on the 'CH' line identifies the various channels. The order in which they appear does not change, but the function number below the abbreviation does. The joystick channels are identified with the numbers 1, 2, 3 and 4; the left hand slider is channel 5, centre is 6 and right hand 7; the 3 position switch is number 8.



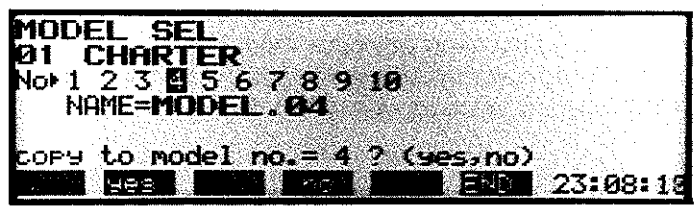
Programming

Call up the first channel that is to be changed using the cursor controls. Press 'ENTR'. Call up the channel which is to be exchanged using the cursor control keys and press 'ENTR'. Acknowledge the entry using 'yes' and the two channels will exchange. In this way, all functions may be changed to their desired sequence. Any arranged configuration may then be copied to all other model memories if desired.



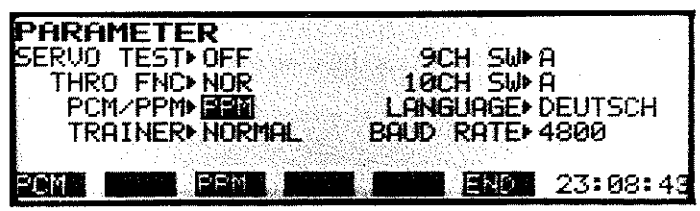
Copy model memory (MODL) 11

With this function it is possible to copy all the stored data within a model memory to another free model memory. This allows 'safety' copies to be made and similar models do not require programming completely - only the differences adjusting.
Select the model which is to be copied with 'SELE' and 'yes'. Select the model memory to which it is to be copied with 'COPY' and 'yes'. The new model memory may now be selected and given a new name in menu 10 (model name).



Basic settings (Parameter) 28

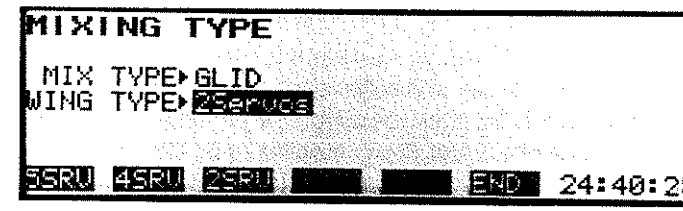
In this menu, the options include transmitter modulation (PCM/PPM). In PPM modulation, standard FM receivers may be operated.
When changing the modulation from PCM to PPM, the transmitter must be switched OFF and then ON again to activate the change.
Also in this menu the language for many of the menus may be changed, with the options of German or French being available.



Programming examples

Mixer type (MxTY) 13

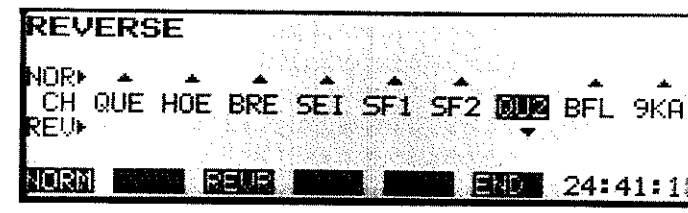
For this example, a simple model glider, the mix program GLIDER 2 is the most suitable. Select 'GLID' and confirm with 'yes'. Move the cursor to the 'WING TYPE' line and press the '2SRV' key (2 servos). The aileron servos must be connected to receiver outputs 1 and 7. The differential aileron menu is already activated, but both ailerons' movements are factory set to 100%.



Servo reverse (REVR) 12

With this option, it is possible to reverse the servo rotation for all channels.

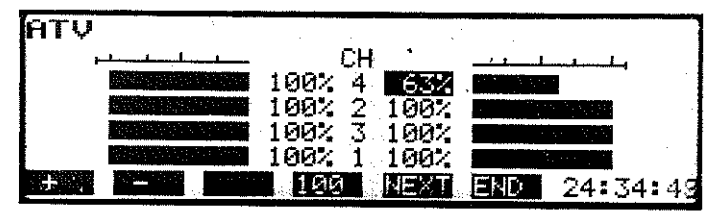
Call up the required function with the cursor. Press the 'REVR' key to reverse the function. Pressing the 'NORM' key returns the servo direction to normal. When the servo is in NORMAL rotation, an arrow points above the servo abbreviation. With REVERSE rotation, the arrow points below.



Servo travel adjustment (ATV) 14

The ATV function allows the servo travel either side of centre to be adjusted for all channels. ATV will also reduce the trim path and dual rate in proportion to the reduction in total throw.

On the graphics display, ATV is represented as a bar chart for four functions. The cursor must be placed on the correct side of neutral to change the ATV values. The cursor is controlled by the relevant joystick or slider. Move the cursor up and down using the cursor control keys. Press the 'NEXT' key to access the next four channels. Reduce or increase the throw using '-' or '+'.



The standard setting is 100% (45° each side of neutral) and this can be reduced to 30% or increased to 110%.

To ensure the best power and mechanical efficiency from your servos, it is preferable to use smaller servo horns and maximum movement rather than using large horns and cutting the movement down with ATV.

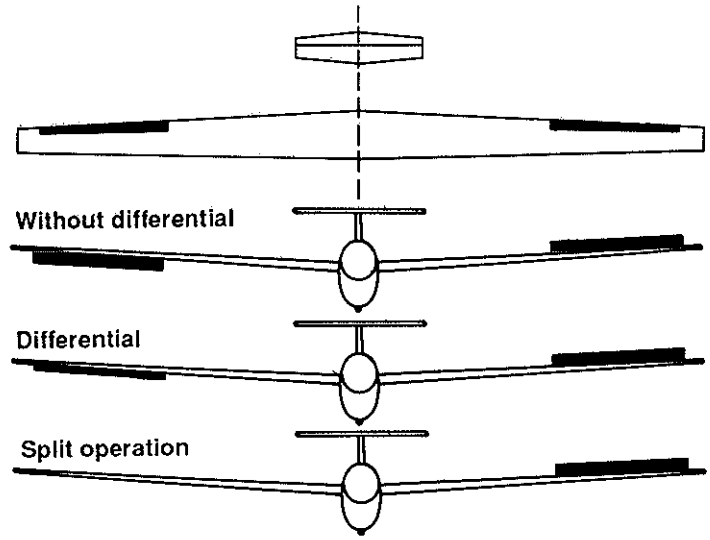
Programming examples

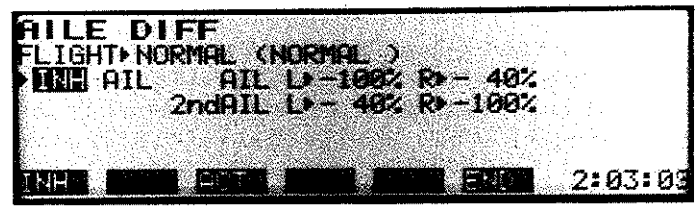
Aileron differential (DIFF) 56

This function allows the separate adjustment of aileron movement 'up' and 'down' for each aileron. This function requires a separate servo for each aileron. With most glider applications, the up-going aileron should always deflect further than the down-moving one. This helps to eliminate 'adverse yaw' caused by the drag of the down-going aileron.

The function is automatically activated when choosing mix program GLIDER 2. Using the cursor control keys to select which side of neutral (up or down) set the amount of movement required for the first aileron servo using '+' or '-' (or '100' to reset the value to 100% - full travel). Set the second aileron servo to the same differential value. Each or both servos may be reversed using '+/-'. If both ailerons travel up and down together rather than in opposition, change the direction of only one servo. If the ailerons operate correctly but in the wrong direction, reverse both. The usual amount of differential to set as a starting point is 100% travel UP and 30-40% travel 'DOWN'.

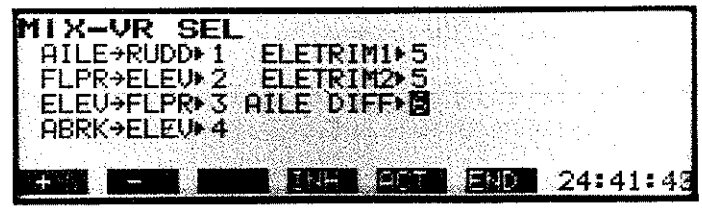
When differential is activated, neither ELEVON or FLAPERON can be selected (message reads 'off other mix'). This does not mean that the differential option is lost with ELEVON or FLAPERON, but it is set in those particular menus.





Selection of mix trims (MxVR)79

For trimming the programmed settings in flight, a trimmer must be assigned to aileron differential. In this menu, all functions that can be trimmed with external trimmers are shown. Select the AILE-DIFF function with the cursor and program the required trimmer socket using '+' or '-'. If a trimmer is to be fitted to socket no 1 on the transmitter PC board, switch number 1 must be allocated to this function. The trim rate may be switched off using 'INH' or re-activated using 'ACT'.



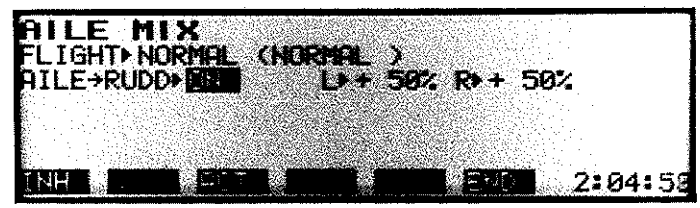
Aileron⇒rudder mixer 76

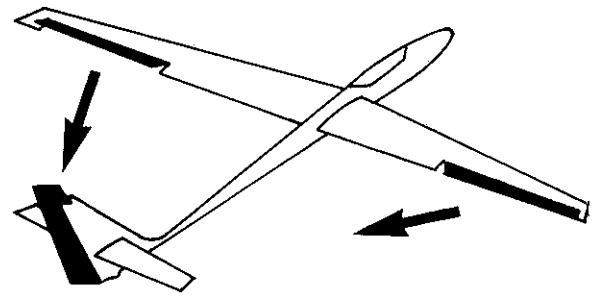
Combi switch (AILE-RUDD)

This menu gives the option of mixing rudder to ailerons so that the rudder deflects to the left when a left aileron command is given.

The rudder may still be operated independently of the ailerons, i.e. moving the rudder joystick does not move the ailerons. The operating switch may be switched ON or OFF in flight and the mix amount may be trimmed with an external trimmer.

Activate the mix using 'ACT'. Fully deflect the aileron joystick and increase or decrease the rudder mix using '+' or '-' until the desired proportion is obtained. If the rudder deflects in the wrong direction, the mix may be reversed with '+/-'.





Programming examples

Selection of mix switches (MxSW) 09

If the aileron to rudder mix is to be switched ON or OFF in flight, a switch must be programmed for 'AILE-RUDD' in this menu. Also displayed are all the other functions that may be controlled with external switches. Using the cursor, select the 'AILE-RUDD' function and program the required switch number using '+' or '-'.

The switch identifiers 'A', 'B' and 'C' refer to the three ready-fitted switches in the centre of the transmitter. Statements 1-8 correspond to the external switches that may be fitted to the EXT.SWITCH sockets on the PC board.

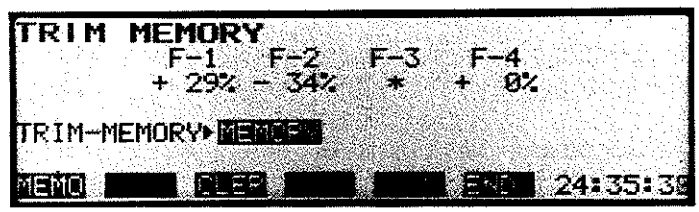
The direction of the switch may be reversed. Firstly, move the switch to the desired OFF position then program the switch number. If the switch is already programmed, the direction may be reversed by allocating a different switch number (by pressing + or -) moving the switch to the new OFF position then re-programming the correct switch number.

Flying the model

The model is now ready for flying, during which the control surfaces may be trimmed for accurate neutral, performance and control. If there are any deviations from the neutral positions of the stick trims or external trimmers the amounts can be stored in the model memory (see below). After storing the trim values, the trimmers and stick trims may be returned to their neutral position.

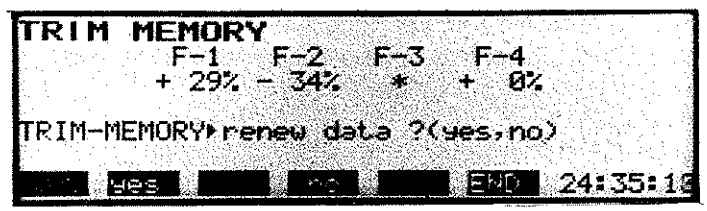
Trim memory (TRIM) 30

This function allows the option of storing the trim settings so that all mechanical trims may be brought back to their centralised position as the trim positions will normally be different for each model memory. It is possible to save the settings of all stick trims and trimmers, but not the throttle ATL trim. The maximum trim value that can be stored is 200% of the total trim path. Settings above this limit will not be stored.



Storage:

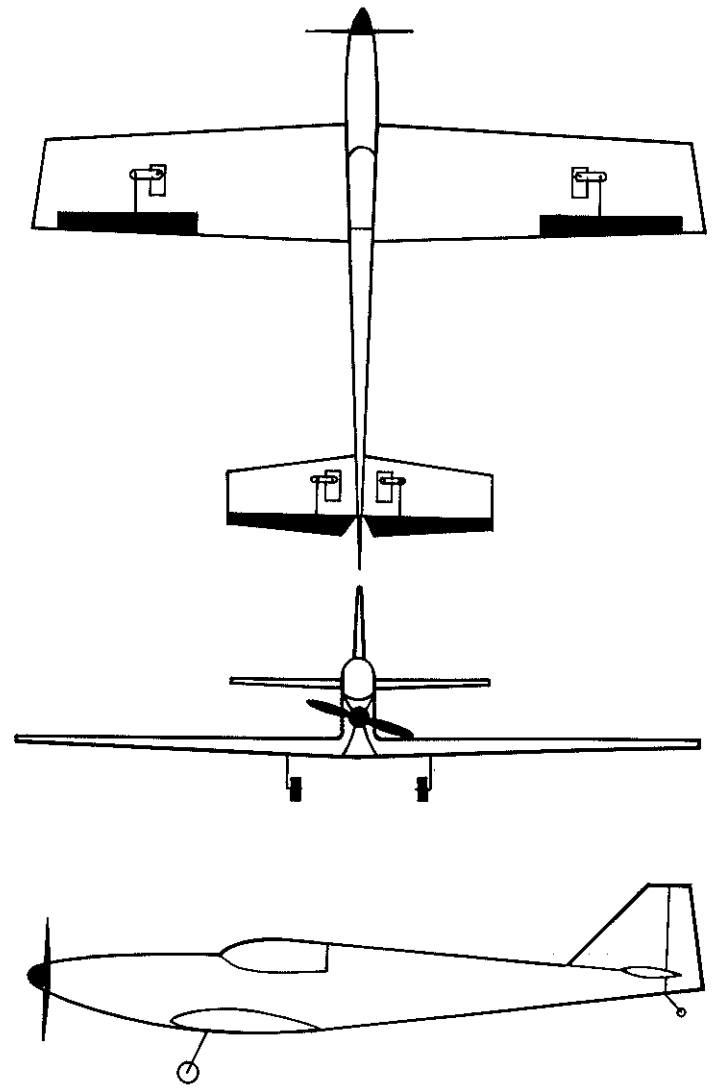
Trim the model in flight using the stick trims and any external trimmers. Without moving the obtained trim positions, press the 'MEMO' key and acknowledge with 'yes'. All trims may now be returned to the neutral positions as the trim effect has now been stored. If the stored trims are to be reset, simply correct the trim positions on the transmitter and press 'MEMO' to re-input the correct settings.



The stored trim settings may be removed from the model memory by pressing 'CLER'.

Programming examples

Powered aerobatic model



Mix program ACRO is best suited to F3A aerobatic models that are fitted with 2 aileron servos, 2 elevator servos, rudder, throttle, retracts and engine mixture control.
The ailerons may operate with differential and be programmed to act as flaps (flaperons). The elevators may also function as 'ailerons'; this feature is known as 'ailevator', where the elevator halves move in opposition to each other - mixed with ailerons. There may also be simultaneous elevator compensation when the flaps (flaperons) are used and the control of aileron, elevator and rudder may be switched between 3 different AFR modes. The switch used to retract the undercarriage is usually used to simultaneously activate a second flight mode, and the throttle linkage is usually exponential.
Therefore, the following functions must be programmed: flaperon, flaperon to elevator mix, ailevator, AFR change-over, flight mode change-over.

Preparation:

Connect all servos to their respective control surfaces. Complete the receiver and nicad installation.
The sequence of programming steps for the standard functions will only be briefly repeated here so that it can be memorized. The description concentrates on explaining the special functions.

First steps:

Select a new model memory	(MODL)	11
Cancel memory contents	(RSET)	32
Enter model name, name of owner and code number	(MODL)	10
Function change	(FUNC)	21
Copy model memory	(MODL)	11
Basic settings	(PARA)	28
Select mix program	(MxTY)	13

The mix program we must select here is ACRO, which concludes all the preparation and transmitter settings that can be completed at this stage. The following mixes will be activated later: FLAPERON (FLPR, 65), FLAPERON⇒elevator mix (FLMx, 75) and AILEVATOR (ALVT, 72).

The receiver may now be switched on.

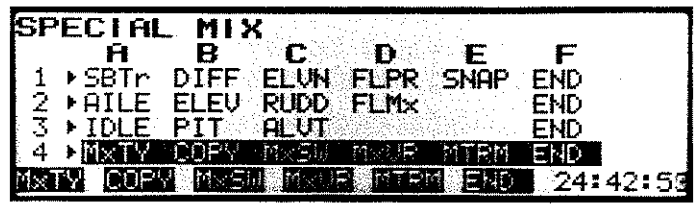
Servo reverse	(REVR)	12
Servo path setting (throw)	(ATV)	14

The servo travel settings complete the mechanical requirements of all control surface linkages. With this model, ATV is most useful to set the servo throw for the carburettor linkage.

The servo paths (ATV) for aileron and elevator cannot yet be set until the appropriate mixes (flaperon and ailevator) have been activated.

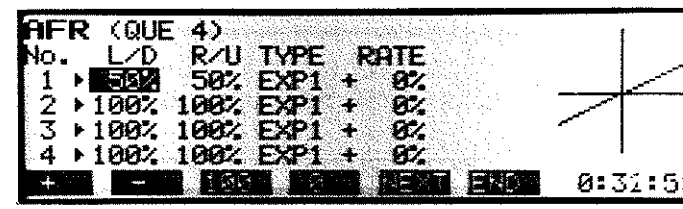
Servo connections at the receiver:

Aileron 1	Receiver output 1
Elevator 1	Receiver output 2
Throttle	Receiver output 3
Rudder	Receiver output 4
Elevator 2	Receiver output 5
Aileron 2 (with flaperon)	Receiver output 6
Engine mixture control	Receiver output 7
Retracts	Receiver output 8



Programming examples

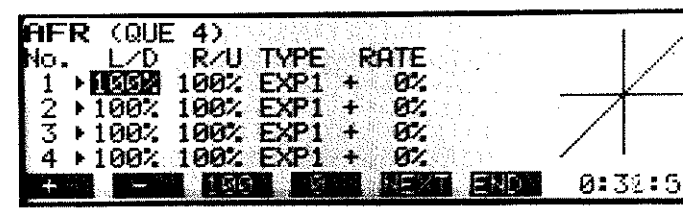
Adjustable function rate (AFR) 15



This menu allows the option of limiting the full deflection of any function without reducing the trim path or dual rate proportions. The function has the effect of putting 'mechanical limits' on a joystick or slider control. Any mix that has already been entered will be reduced in the same proportion.

On entering the menu, the first screen displays the aileron channel (AIL 1). Four separate lines of information are shown. The first is for AFR mode 1, the second for AFR mode 2, the third for AFR mode 3 and the fourth for AFR mode 4. As the AFR mode (AFRm - see below) has not yet been activated, changes can only be made to line 1 (AFR 1). Before setting a reduction in movement on one side of neutral, the cursor must be placed on the appropriate side. The cursor is controlled by the function's relevant joystick or slider. In this first screen (AIL 1), the aileron joystick moves the cursor. Input any increase or reduction in movement with '+' or '-'. Call up the next channel (elevator 1 - ELE 1) using 'NEXT' and increase or reduce the throw with '+' or '-' in the same way. The reduction in movement will be shown as a percentage of the total throw.

If desired, the throw can be reset to full movement by pressing '100' (100%) or reduced to no movement by pressing '0'.



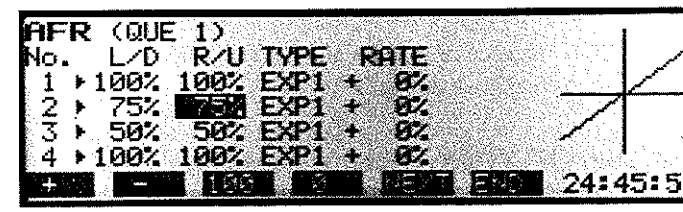
AFR mode (AFRm) 07

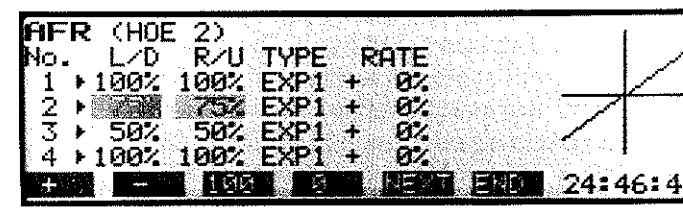
As shown above, four separate AFR settings can be programmed for each channel. These can be re-called in one of three ways; the first option is FLIGHT (FLIG) which is pre-set. Once the flight modes (Quattro Rate) have been set up, the AFR change-over will be automatic, i.e. NORMAL will call up AFR mode 1, FLIGHT 1 will call up AFR 2, FLIGHT 2 will call up AFR 3 and FLIGHT 3 will call up AFR 4.

By pressing the MANUAL (MANU) key, you are given the option of allocating each AFR mode to a switch. These are factory set to the three switches in the centre of the transmitter - A, B and C. These, of course may be changed to any other external switch by programming a different switch number (1 - 8) using '+' or '-'. After allocating a switch, the switch direction may be reversed by pressing 'INH'. Check that the switches operate correctly by moving each one and confirming the AFR change over displayed in brackets ().

The third method is AUTOMATIC (AUTO). This allows AFR change-over as the throttle is advanced. The joystick position at which each AFR (1 - 4) is called up may be set in the following way. Move the throttle joystick to the position where AFR 2 should be called up. Move the cursor to 'POS' on the AFR2 line and press 'SET'. Move the cursor to the 'POS' on the AFR 3 line, move the joystick into the required position and press 'SET'. Program AFR 4 in the same way. The allocated switches may still be used as they will over-ride the automatic throttle call up.

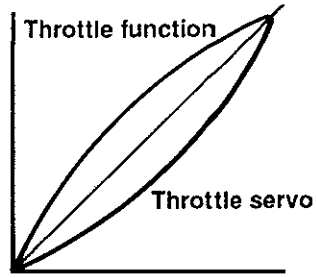
Now go back to the AFR menu 15 and set the required reductions in movement for AFR modes 2, 3 and 4.





Programming examples

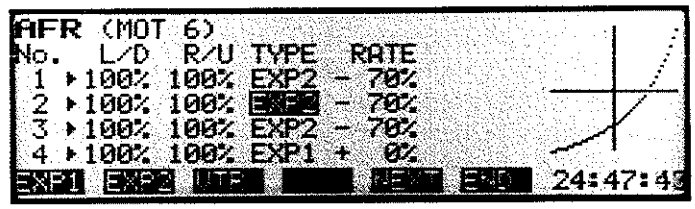
Exponential control 16



The exponential and VTR functions allow the characteristics of each transmitter function to be matched to the pilot's preference or to suit a specific mechanical need.

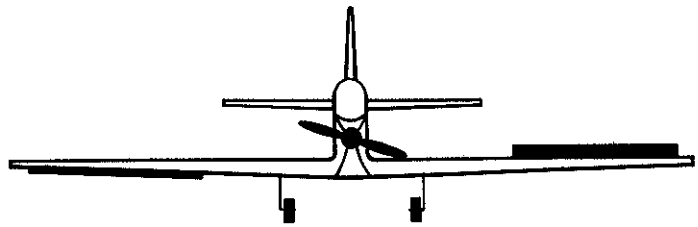
With EXPO 1, and depending on the settings made, there will be small servo deflections at the centre of the joystick or slider and large movements towards the end of the joystick movement. This is particularly useful for self-centring functions such as elevator, aileron and rudder and this gives a 'softer' feel to the controls - without compromising the performance by reducing the full throw.

EXPO 2 is used to program a large movement at the beginning of the joystick's movement, which steadily weakens towards the end of the stick's travel. This is primarily used with non-centring functions such as throttle.



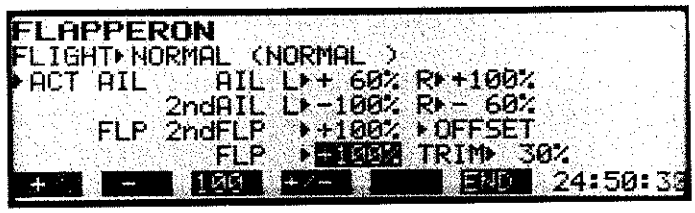
VTR (Variable Trace Ratio) allows a linear, low servo rate around the centre stick position, but after a certain programmable point is reached, the servo movement is increased - rather like an automatic dual rate with stick priority.

Programming:



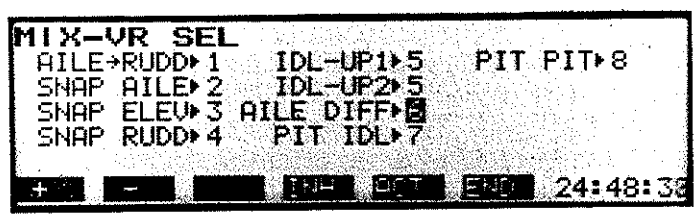
For exponential control, select the required characteristics using 'EXP 1' or 'EXP 2'. Place the cursor on 'RATE' and adjust the strength of the effect with '+ or '-'. With EXP 1, positive values (+) increase the stick effect around the neutral point and negative values (-) reduce the effect. With EXP 2 negative (-) values increase the servo movement at the start of the joystick or slider movement.

For VTR effect, always set the throw at 'low rate' first (around centre stick) - cursor on L/D, R/U and adjust with '+' or '-' , as described previously in AFR to reduce the throw. Now move the cursor to 'RATE' and adjust the change-over position using '+' or '-'.



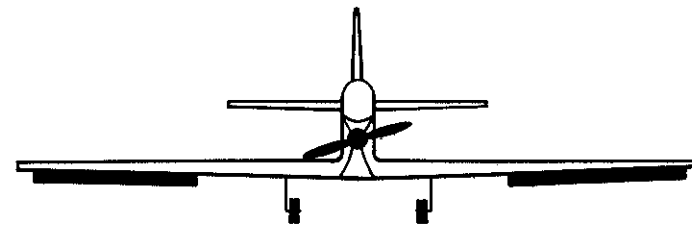
Flaperon mix - aileron differential 65

Activate the FLAPERON mix using 'ACT' if the ailerons are to be used as combined flaps. This mix can also be used to program aileron differential. If the display reads 'off other mix' this indicates that aileron differential (DIFF) is still activated in its own menu (AILE DIFF, 68) and must be inhibited (INH) before continuing. In mix program ACRO, the aileron differential mix is already activated. Move the channel 6 slider into its neutral position. Move the aileron joystick to the left and reduce the down-going aileron deflection after the letter 'L' with '-'. Move the aileron stick to the right and reduce the down-going aileron on the '2nd aileron' line after the letter 'R', entering the same amount as above. As the exact amount of differential can only be determined by flying the model, a sub trimmer may be added to adjust the settings during flight.

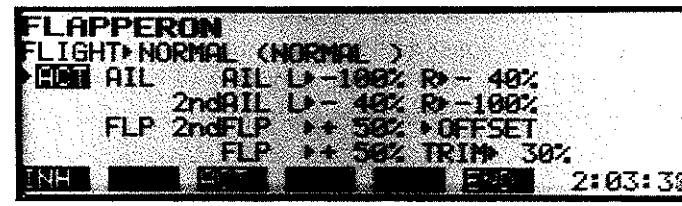


Programming examples

Flaperon mix - (FLPR) 65



The rate already programmed for both flap deflections (2nd FLP and FLP) amounts to 100% each. Since the ailerons' flap deflections should not be very large, the slider control rate (TRIM) is left unchanged at 30%.
It is planned to call up two different flap settings in flight with a switch: when landing, we require slightly lowered flaps and during normal flight the flaps are to be in their neutral position.
For easier control, the slider is always left at the rear stop position and the change-over between the various flap positions is controlled by a switch.

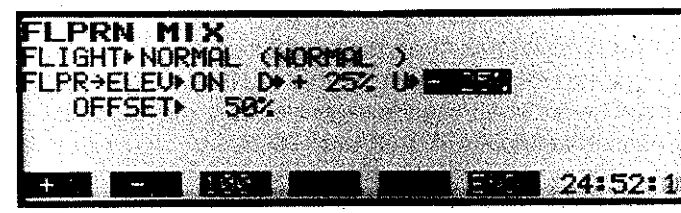


Programming elevator compensation (FLMx) 75

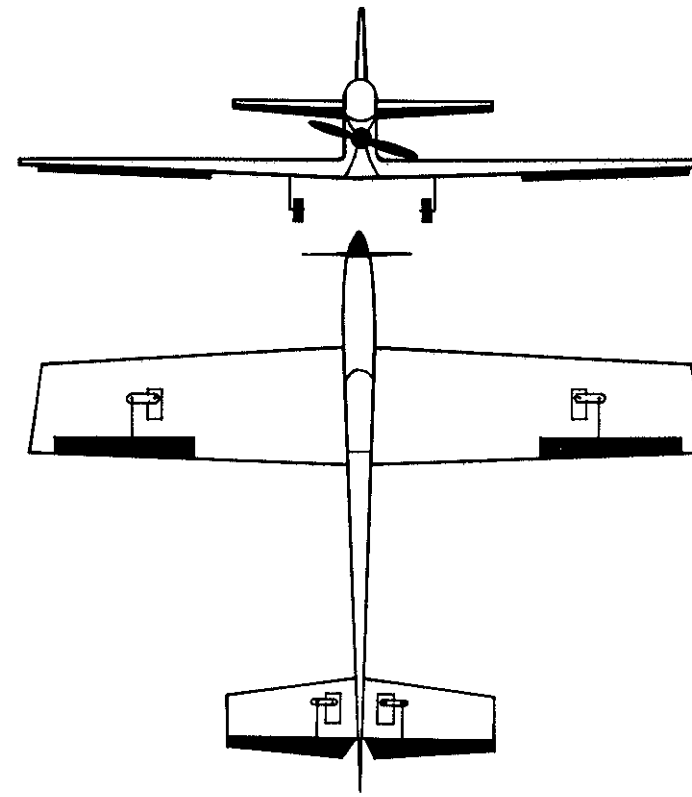
First, program a switch for this mix function using the 'Selection of mix switches' menu.

Selection of mix switches (MxSW) 09

To program a switch for elevator compensation, place the cursor on the 'FLPR-ELEV' function, then allocate the desired switch using '+' or '-'.
The switch direction may be reversed by moving the desired switch to the 'OFF' position prior to programming the switch number. If the switch is already programmed, select a different switch number, move the switch to its new 'OFF' position then re-enter the correct switch number. Reversal is complete when the switch sign has changed, i.e. 1 becomes -1.



Elevator mix compensation (flaperon⇒elevator) 77



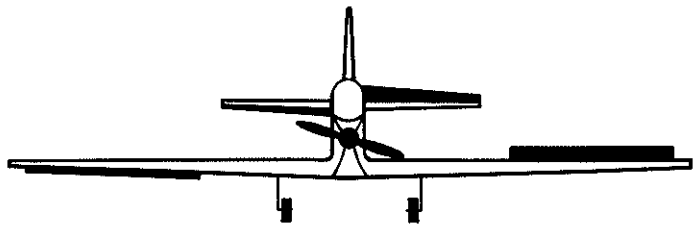
Activate the mixer with 'ACT'. Move the channel 6 slider to its rear stop to extended flaps. Set the elevator compensation separately for each side of the slider control's neutral (D, U) using '+' or '-'. The elevator's deflection should be kept small, otherwise the model's reaction to elevator compensation will be excessive.
Do not program any offset.

Ailevator (ALVT) 72

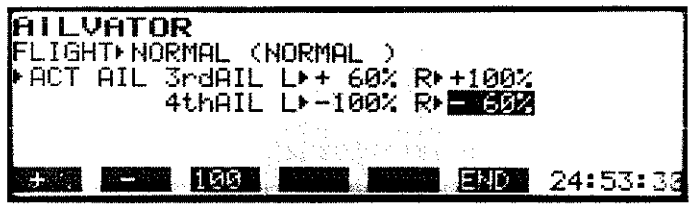
With this mix, the separately controlled elevator halves are programmed to act as 'ailerons', with each half moving in opposition when aileron control is given. The 'elevator' control remains the same. Activate the function using 'ACT'. Both servos will now be controlled together when operating the elevator joystick. It is important that both surfaces move the same amount and that the servo paths are matched - otherwise an aileron effect will result when giving an elevator command. If the total throw of each surface is slightly different, despite accurate mechanical linkages, the difference may be corrected using the ATV function.

Programming examples

The setting options in the display allow differential to be set when the elevators are acting in 'aileron' mode. Deflect the aileron joystick to the left. On the '3rd AIL L' line, reduce the deflection of the down-moving elevator half. On the '4th AIL R' line, reduce the down-moving elevator half by the same amount. Of course, the up-moving deflections may be reduced if desired, although the differential should be maintained. The actual deflections required can only be found by flying, as they will depend on the type of model being flown.



If when giving an aileron command, both elevator surfaces move together, one ailevator servo must be reversed. This can be done with '+/-'.



Using retracts

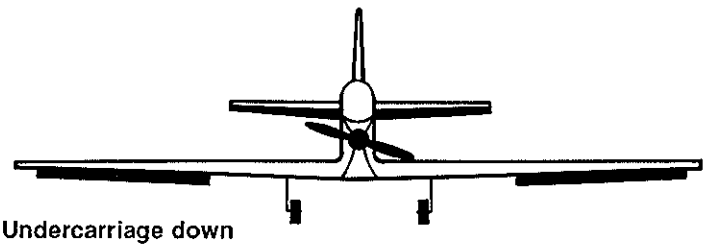
The retract servo should be connected to the receiver's output 8 socket, so that the undercarriage may be controlled by the channel 8 switch.

All the preceding settings have been programmed in the 'NORMAL' flight mode (FLIGHT line), i.e. the landing mode (with wheels down).

Flight mode change-over

It is intended that we should switch to FLIGHT (FLY1) flight mode when we retract the undercarriage.

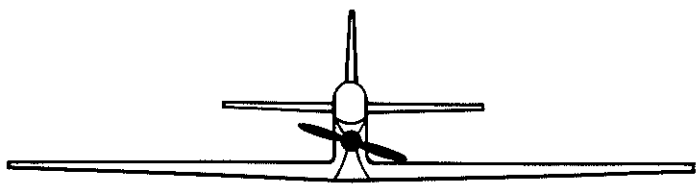
NORMAL flight mode (start) remains selected, so long as the undercarriage is down. In this flight mode, the flaps should be trimmed slightly down and the elevator compensation acting.



Undercarriage down

The change-over for the FLIGHT (FLY1) flight mode is to be called up by the switch that we are using to retract the undercarriage. Upon change-over to the new flight mode, the flaps should also return to their neutral position and the elevator compensation switched off.

For easier control, the channel 6 slider should remain at its lower stop, and not be used.



Undercarriage up

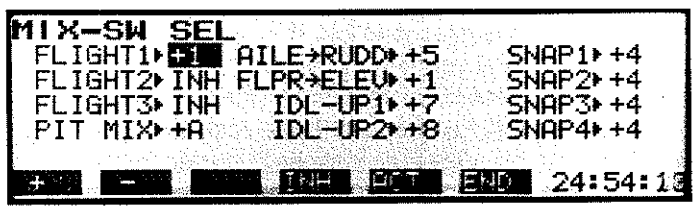
FLY1 flap programming

Move the flap slider control to the lower stop - for flying both modes.

Flight mode switch

Program a switch for FLIGHT 1 in 'Selection of mix switches' (MxSW, 09) for changing over the flight mode, in which the 'FLIGHT' settings are programmed and the undercarriage retracted.

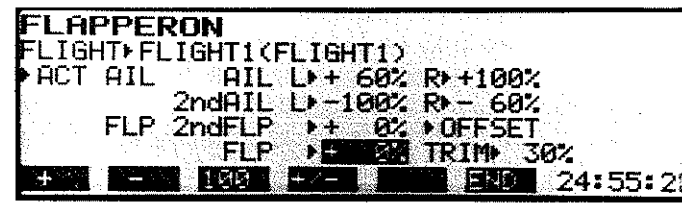
Program the same switch as used for the elevator compensation, to provide the option of changing over the elevator compensation simultaneously with the flight mode.



Programming examples

Programming flaperon mix for FLY 1

Move the cursor to the FLIGHT line. Switch ON the FLY1 switch. Program the aileron differential with the same amounts as NORMAL, unless the model requires different settings for flight and landing. Both flap settings require programming with '0' (2nd FLP and FLP).

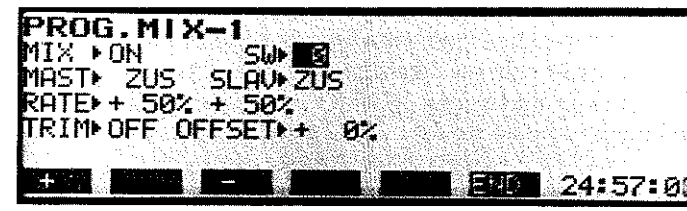


When the flight mode switch is switched ON, both the flaps and the elevator compensation will deflect as required.

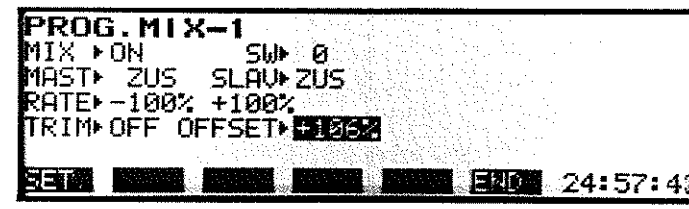
Now connect the retract switch using a 'freely programmable mix' (see below).

Freely programmable mix

Call up a freely programmable mix (PMX1) and activate (MIX ACT). Again, program the mix switch (SW) to the same switch used for changing the flight mode. Program AUX (auxiliary function 8) both as 'master' and 'slave'. Program the values -100% and +100% on the RATE line. Use the 3 position channel 8 switch to move the cursor from one figure to the other. To program the offset position, move the switch into the position where the undercarriage is to be EXTENDED. Press 'SET' to program this switch position as the offset. Then move the switch to the RETRACTED position.



Whenever the flight mode switch is activated now, the retractable undercarriage will be mixed in and retract. If the undercarriage does not move, program the opposite position (retracted undercarriage) as the offset position for channel 8. The sign of one of the two setting values (RATE 100%) must be changed using '+/-'.



Now all the required functions have been programmed, all settings may now be changed over with only one switch. In addition, the control path for the aileron and elevator can be switched to one of three settings with the AFR switches.

The retracts may still be operated with the channel 8 switch.

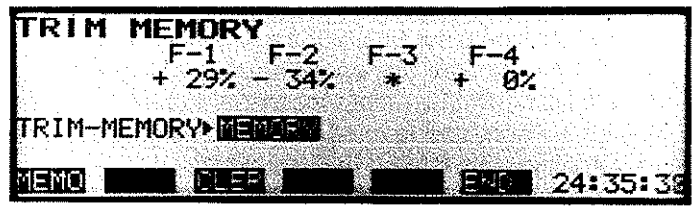
Flying the model

The model is now ready for flying, where all settings may be trimmed further for optimum performance and control. In flight, the surfaces are trimmed with the joystick trims until the model flies in a straight line. If there are any slight deviations from the trims' neutral positions, they may be stored in the model memory so that the trims may be returned to neutral with the control surfaces still remaining slightly offset. Use the 'Trim Memory' function to do this.

Programming examples

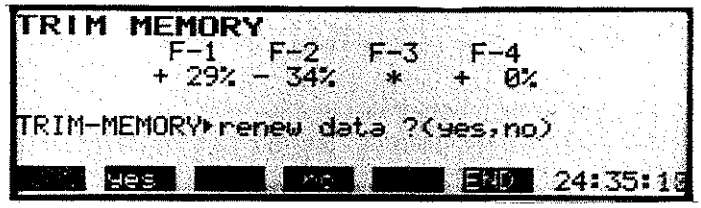
Trim memory (TRIM) 30

This function allows the storing of trim settings so that all mechanical trims may be brought back to their neutral position as the trim positions will normally be different for each model memory. It is possible to save all the stick trims and the values of any external trimmers, but not the throttle ATL trim. The maximum trim value that can be stored is 200% of the total trim path. Settings above this limit will not be stored.



Storage:

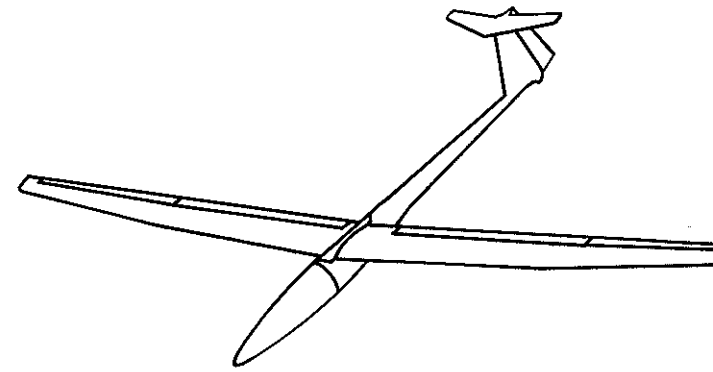
Trim the model in flight using the stick trims and any external trimmers. Without moving the obtained trim positions, press the 'MEMO' key and acknowledge with 'yes'. All trims may now be returned to their neutral positions as the trim effect has now been stored. If the stored trims are to be reset, simply correct the trim positions on the transmitter and press 'MEMO' to re-input the correct settings.



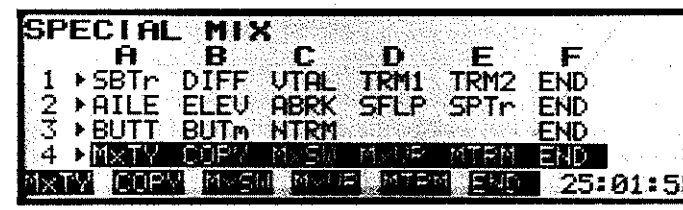
All the stored trim settings may be removed from the model memory by pressing 'CLER'.

Programming examples

F3B Glider



For this particular type of model, we require separate controls for ailerons, speed flaps, rudder and elevator.
It is intended to have the speed flaps mixed with the ailerons - each with differential control. The speed flaps are operated by the three position channel 8 switch, giving full up, full down and neutral. Any deflection of the speed flaps should also be compensated for with elevator. Whenever the elevator is used, both ailerons and speed flaps are to deflect slightly in opposition (elevator UP, ailerons/speed flaps DOWN) to increase lift in turns. The brake function is controlled by the throttle stick using the BUTTERFLY function controlling ailerons and speed flaps, with automatic elevator compensation. Also, the differential should be switched off whenever the Butterfly function is used.
The appropriate settings for START, SPEED and LANDING flight modes are to be changed over as required, including a simultaneous delayed trim change for elevator, aileron and speed flaps.



Functions:

Sub-trim (SBTr)
Aileron differential (DIFF)
Aileron ⇒ speed flap mix (AILE, Aile ⇒ Sflp)
Speed flap ⇒ aileron mix (SPFL, Spfl ⇒ Aile)
Speed flap ⇒ elevator mix (SPFL, Spfl ⇒ Elev)
Butterfly mix (BUTT)
Butterfly ⇒ elevator mix (BUTm)
Flight modes for these mixes
Trim Program 1 dependent on flight mode

Servo connections to the receiver:

Aileron 1	Output 1
Elevator	Output 2
Rudder	Output 4
Speed flap 1	Output 5
Speed flap 2	Output 6
Aileron 2	Output 7

Preparation:

Connect all servos to their control surfaces. Install the receiver, nicad and switch harness.
The sequence of programming steps for the standard functions will only be briefly repeated here so that it can be memorized. The following description concentrates on explaining the special functions.

First steps by keyword:

Select a new model memory	(MODL) 11
Cancel memory contents	(RSET) 32
Enter model name, name of owner, and code number	(MODL) 10
Function change	(FUNC) 21
Copy model memory	(MODL) 11
Basic settings	(PARA) 28
Select mix program	(MxTY) 13

The most suitable mix program for this model is GLIDER 4, which concludes all the preparation and transmitter settings that can be completed at this stage.

Now, the receiver can be switched on.

Servo reverse	(REVR) 12
Servo path setting (throw)	(ATV) 14

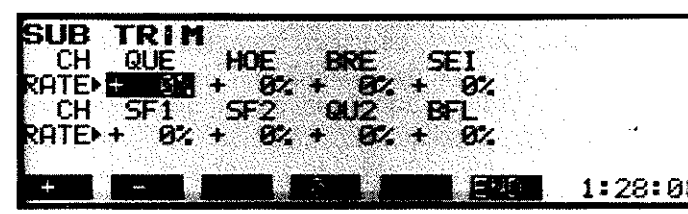
The servo path setting completes the mechanical requirements of all control surface linkages. Servo path settings must be made for both aileron servos (functions 1 and 7). The speed flap UP deflection (function 8, 3 position switch) must be programmed for '0%'.

Although we are describing an F3B model here, the following applies to all models of a similar layout.

Sub trim (SBTr) 51

This function has the purpose of moving the servos into their neutral position. This allows any small deviations from neutral to be trimmed and moving all servo horns into their precise neutral position when all stick trims and trimmers are centralised.

Select the required functions using the cursor and change the neutral positions using '+' or '-'.



Programming examples

Aileron differential (DIFF) **56**

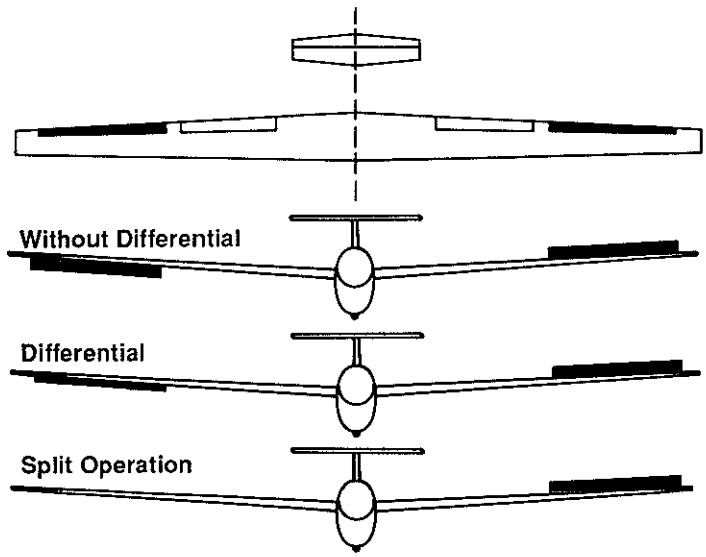
This function is activated automatically when selecting mix program GLIDER 4. The function offers the option of separate adjustment of aileron deflection 'UP' and 'DOWN'. Each aileron requires a separate servo. The servos should be connected to receiver outputs 1 and 7.

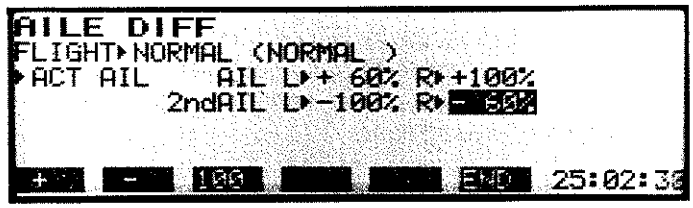
Set the second aileron servo's deflection using '+', '-' or '100' (for full movement) and the direction of the second servo using '+/-'.

When the aileron differential has been activated, it is not possible to activate menu 65, FLAPPERON (Display prompts 'off other mix'). If Flapperon or Elevon are to be operated together with differential, switch off Differential (INH) and activate Flapperon or Elevon (ACT). Then set the amount of differential in the Flapperon or Elevon menu.

Move the aileron stick to the RIGHT and set the 1st servo's deflection with '+' or '-'. Move the stick to the LEFT and set the 2nd servo's deflection. The mix direction may be reversed if necessary using '+/-'.

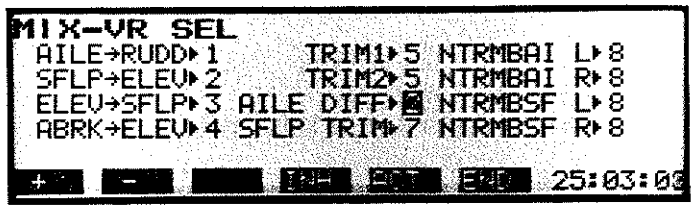
As the true amount of differential can only be found by flying the model, a trimmer may be fitted to adjust the settings in flight (see below).





Selection of mix trims (MxVR) **79**

To trim the programmed differential in flight, a trimmer must be assigned to aileron differential. Select the AILE-DIFF function with the cursor and program the required trimmer socket using '+' or '-'. For example: if trimmer No. 1 is to be programmed for this function, then the trimmer must be connected to socket 1 (Ext. trimmer, inside the transmitter). The trim rate may be switched off using 'INH' and re-activated using 'ACT'.

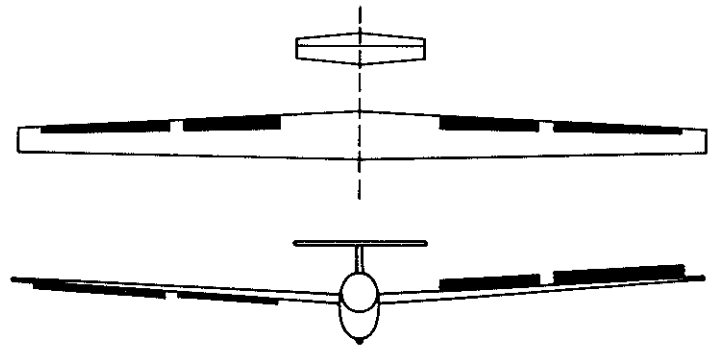


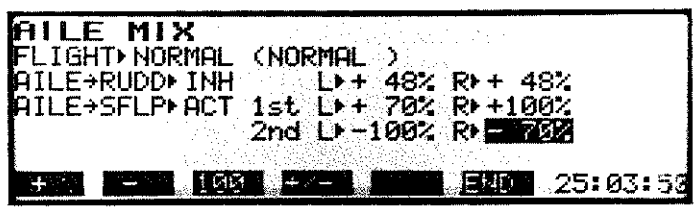
Aileron ⇒ speed flap mix (AILE) 76

Acting with the aileron function, the speed flap mix is designed to produce speed flap deflections in the aileron mode, so that both the ailerons and speed flaps act as ailerons. The speed flap differential in this function is programmed separately.

Press 'ACT' to activate function. Move the speed flap slider (channel 6) into its neutral position. Later on, the slider control will be exchanged for the 3 position channel 8 switch using Function Change (FUNC).

Move the aileron stick fully to the left. Set the direction of each speed flap's travel when operating the ailerons. If necessary, move the cursor to the set values and press '+/-' to reverse the servo direction. Move the aileron stick to the right and repeat the procedure. The speed flaps should now deflect the same way as the ailerons when used in the aileron mode.



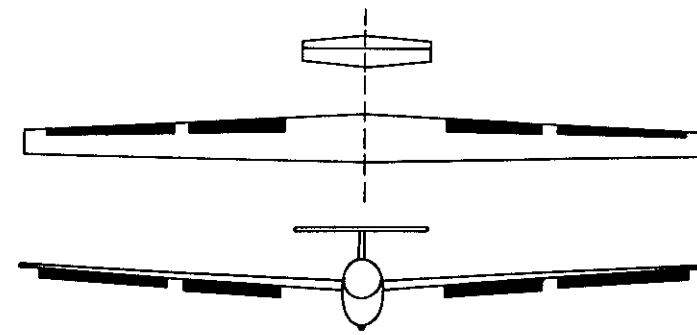


Programming examples

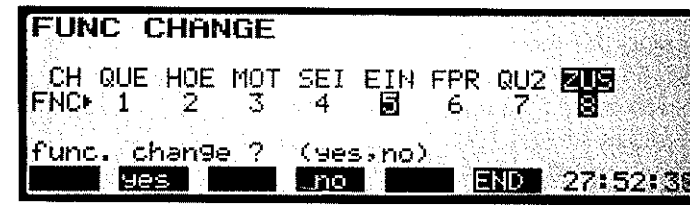
Now set the speed flap differential. Deflect the aileron stick to the left and reduce the deflection of down-moving servo on '1st' line after letter 'L'. Deflect the aileron stick to the right and reduce the deflection of the down-moving servo on the '2nd AIL' line after letter 'R'. Enter the same value here as entered in the first line.
For aerodynamic reasons, the speed flaps should always deflect less than the ailerons.

Speed flap ⇒ aileron mix (SPFL) 75

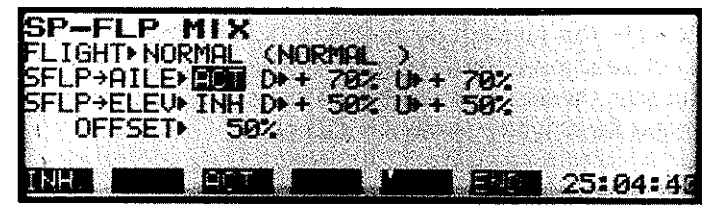
With this mix, the ailerons are programmed to act as speed flaps, as well as ailerons. This has the effect of combined aileron deflections together with the speed flaps to increase or reduce lift over the full length of the wing.



Since the speed flaps are still controlled by the 3 position switch (channel 8) we must exchange functions 8 and 5 in FUNC to give proportional control, as described earlier.



Press 'ACT' to activate the function. Move the speed flap's 3 position switch to its lowest stop and place the cursor after 'D'. Now set the direction of the speed flap's 'aileron' movement using '+/-' so that the speed flaps deflect in the same direction as the ailerons. If the 3 position switch is in its lower position, the speed flaps should move down (if necessary, reverse the SF1 and SF2 functions). The aileron deflections in the speed flap mode (when moving the 3 position up and down) should now be set using '+' or '-' for each side of the speed flap deflection. The aileron deflections, in the speed flap mode, are set a little lower than the aileron deflections for aerodynamic reasons.



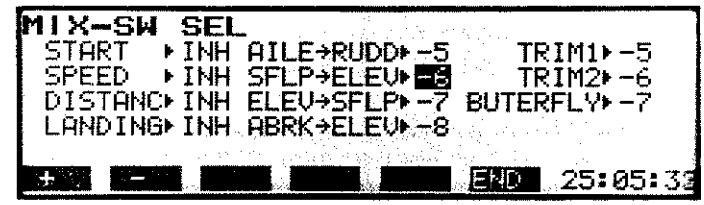
Programming elevator compensation (FLMx) 75

Program a switch for this mix using 'Selection of mix switches, 09'.

Selection of mix switches (MxSW) 09

Place the cursor on 'SFLP-ELEV' and select the required switch using '+' or '-'.

Numbers 1-8 refer to external switches connected to the PC board at 'Extern Sw.' and A, B and C refer to the three switches fitted at the centre of the transmitter. If, for example, switch No. 1 is to be programmed, then a switch must be connected to socket 1 (Extern Switch).



The switch direction may be reversed. First, move the switch into its 'OFF' position before allocating the switch to the function. If the switch is already programmed, select another switch, move the switch to its new 'OFF' position then select the correct switch number. The direction and the sign in front of the switch number will change, e.g. switch '1' becomes '-1'.

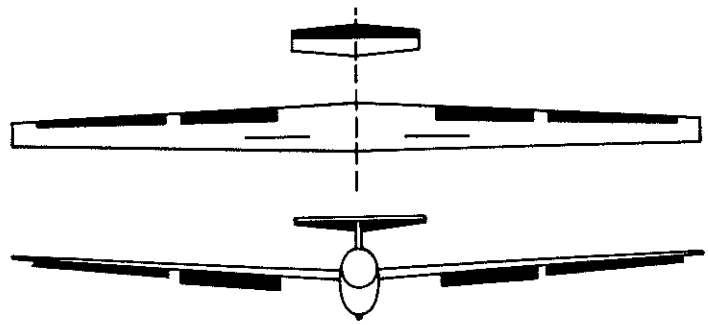
Programming examples

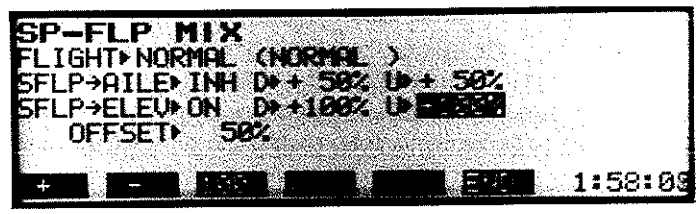
Elevator compensation (SFLP⇒ELEV)

Press 'ACT' to activate mix. Move the 3 position switch to its lower stop to extend the speed flaps. Set the elevator compensation separately for each side of neutral (D, U) using '+' or '-'. Do not program too large an elevator compensation otherwise the model's reaction to the compensation will be excessive.

If the elevator deflects the wrong way, reverse the direction of the mix using '+/-', after placing the cursor after the letter 'D'. There should be a slight 'DOWN' deflection of the elevator with elevator compensation, when the speed flaps extend downwards (increased lift).

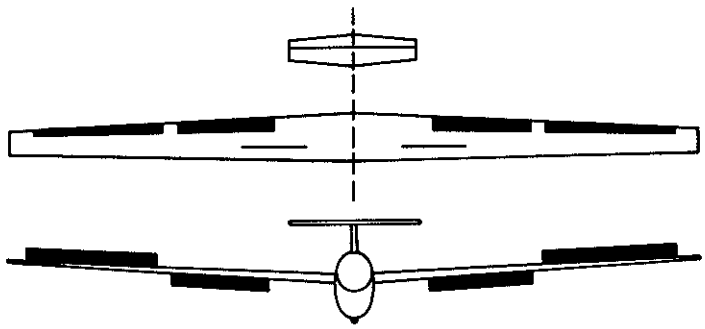
The offset is not programmed here and the speed flap slider control should produce the desired effect in its mechanical offset position.



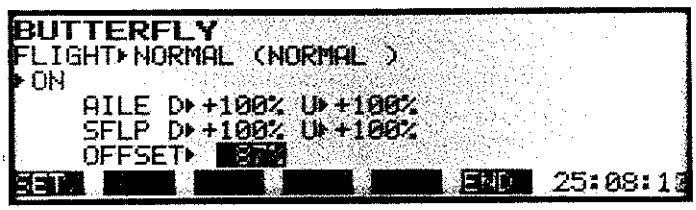


Butterfly mix (BUTT) 72

With this function, both ailerons are simultaneously deflected upwards and both speed flaps downwards, thus putting the model into an extreme braking mode. Although the control of ailerons and speed flaps is maintained in principle, only the control surface that would normally deflect 'DOWN' will operate (e.g. the LEFT aileron when a command of 'right' is given). With the speed flaps, only the flap deflecting 'UP' will operate, thus retaining the control of both ailerons and speed flaps when Butterfly is in use.



Activate the function by pressing 'ACT'. The butterfly function is now controlled by the function 6 slider control, the ailerons are controlled by the aileron joystick and the speed flaps by the channel 5 slider.



The butterfly function is normally controlled by the throttle stick. Program the offset position at the throttle's front stop where both the ailerons and speed flaps will be in their neutral positions.

If the butterfly function is to be controlled by throttle stick, the function arrangement must be changed in FUNC, as previously described. If the system has been set as mode 1 (throttle on the right) channels 2 and 6 must be exchanged. If the system has been set as mode 2 (throttle on the left) then channels 3 and 6 must be exchanged.

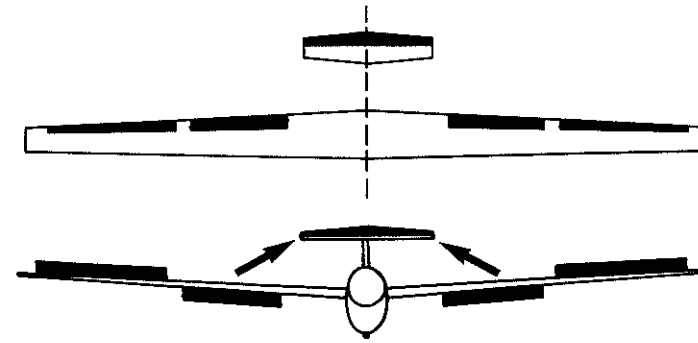
Call up the butterfly function in the display. Move the throttle stick to its front stop. The speed flap slider control should be positioned in neutral.

Place the cursor on OFFSET. Program this throttle stick position using 'SET'. Set the aileron (AILE) and speed flap (SFLP) mix ratios with '+' or '-'. If the throttle is now moved back to its rear stop, the ailerons should move UP and the speed flaps DOWN. The mix directions for aileron and speed flap may be changed separately (cursor after the letter 'D') using '+/-'.

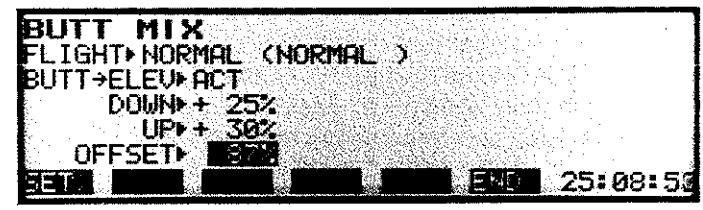
Programming examples

Butterfly ⇒ elevator mix (BUTm) 73

This function permits elevator compensation for any trim changes that occur with the butterfly function. The amount of compensation may be set separately for each side of neutral (UP, DOWN). Offset is freely selectable, but should, of course, be identical to the butterfly offset position (throttle stick at the forward stop).



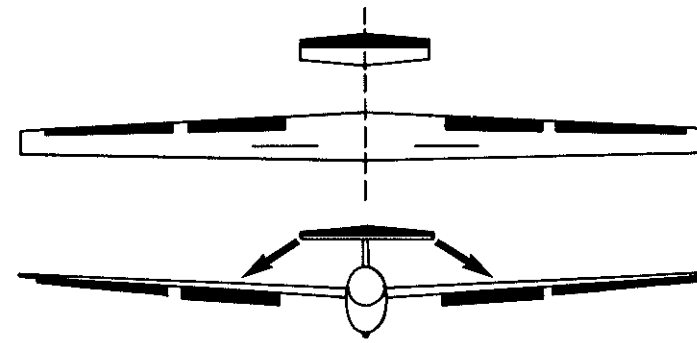
Activate the mix by pressing 'ACT'. Move the throttle stick to its front stop and leave in this position. Move the cursor to the 'Offset' line and press 'SET'. This programs the position at which the elevator compensation will be triggered when using the butterfly function.



Move the cursor to UP or DOWN and set the compensation value using '+' or '-'. If the elevator compensation setting is single sided, for example UP = 100% and DOWN = 0% the elevator will range from full deflection to the centre position of the throttle with no elevator compensation from the throttle's centre position to full (top) position. Reverse the direction of the mix if required using '+/-'.

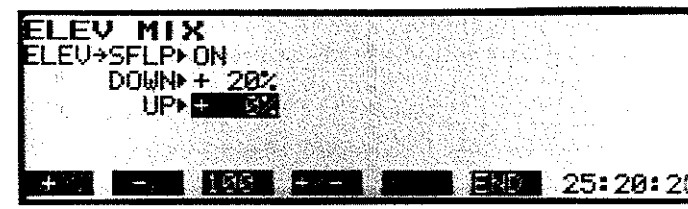
Elevator⇒speed flap mix (ELEV) 77

With this function, the speed flaps are moved in opposition to the elevator to increase lift in turns. When giving 'UP' elevator, the speed flaps should deflect 'DOWN'. With DOWN elevator, the speed flaps should not move at all.



Press 'ACT' to activate the mix. The setting for DOWN = 0%, to ensure that the speed flaps do not move when DOWN elevator is given.

Fully deflect the elevator joystick 'UP' and set the speed flap deflections using '+' or '-'. Program the deflections to around 10 to 20% to begin with.

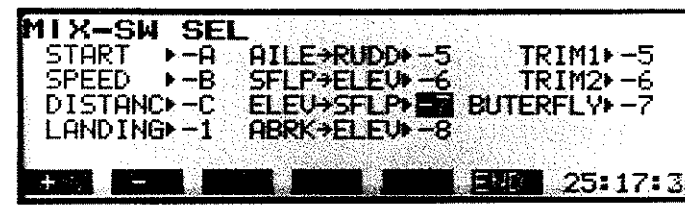


The ailerons will now act as speed flaps when the speed flaps are used, since the speed flap ⇒ aileron mix has been switched on.

Since this mix is to be switched ON or OFF in flight, program a switch for the ELEV-SFLP function in 'Selection of mix switches' (see below).

Selection of mix switches (MxSW) 09

Place the cursor on the 'ELEV-SFLP' function and program the desired switch for elevator compensation using '+' or '-'.



The switch direction may be reversed by moving the desired switch to its OFF position before selecting the correct switch number. If the switch has already been programmed, select another switch number, move the switch into its new OFF position then re-select the correct switch number. The switch direction and switch sign will now be reversed, e.g. switch '1' becomes '-1'.

The mix may now be switched ON or OFF in flight.

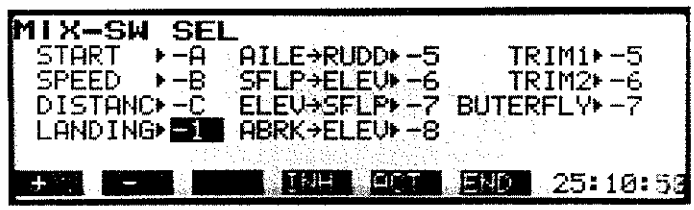
Programming examples

Flight mode dependent programming of an F3B model

With F3B models, the different flight performances required from one model vary enormously: NORMAL timed flight, DISTANCE flight and SPEED flight. In addition, each flight involves two further phases, i.e. START and LANDING.
Each of these 'flight modes' require quite different settings which are possible by flight mode dependent programming.
All previous settings and functions have been programmed in the NORMAL flight mode (FLIGHT line).
If a flight mode is to be changed over, the NORMAL flight mode is generally used for all basic settings. The NORMAL flight mode is then copied to the other flight modes (start, speed, distance and landing) using the COPY function. Any changes can then be made without reprogramming the basic data.
For this example, the NORMAL flight mode is used for normal flight and 4 further flight modes may be called up by switches.
Flight mode change-overs should not produce any sudden control surface deflections and for this reason delays may be programmed to move the control surfaces to their new positions. The stick trims remain effective at all times.

Changing flight modes

To change from one flight mode to another during flight, a switch must be programmed in 'Selection of mix switches 'MxSW, 09)' for each flight mode. Any switches programmed to change flight modes, cannot be used to switch mixes ON and OFF.
The settings programmed within each flight mode will now be activated with each change to another 'flight mode'.



The program for this F3B model should include flight modes for NORMAL, START, SPEED, DISTANCE and LANDING. Flight mode NORMAL will be programmed for timed flight.

Programming switches for flight modes

Move the cursor to 'START' in 'Selection of mix switches' and program the switch which is to call up this flight mode using '+' or '-'. Program switches for SPEED, DISTANCE and LANDING flight modes in the same way.

Conditions for flight mode changes

Timed flight

For this flight mode, the required setting should result in 'minimum sink'. Slightly extend the speed flaps downwards leaving the elevator trim in offset. These settings are programmed in the NORMAL flight mode, which is the first to be programmed.

Programming examples

START flight mode

For winch launching, all settings should aim for 'maximum lift'. The speed flaps should be extended downwards for generating an increase in lift and the elevator trim should be set slightly upwards.

DISTANCE flight mode

For distance flight, adjust the settings to gain optimum 'slip' by moving the speed flaps into their neutral position and by trimming the elevator slightly for 'down'. When using the elevator, the speed flaps should be mixed to elevator so that they produce extra lift when using UP elevator in base turns. This function may also be switched ON or OFF in flight.

SPEED flight mode

For SPEED flight, we require 'maximum speed' whilst retaining an acceptable glide angle, by trimming the speed flaps slightly upwards (depending on wing section) and the elevator trimmed 'down' depending on the glide angle required.

LANDING flight mode

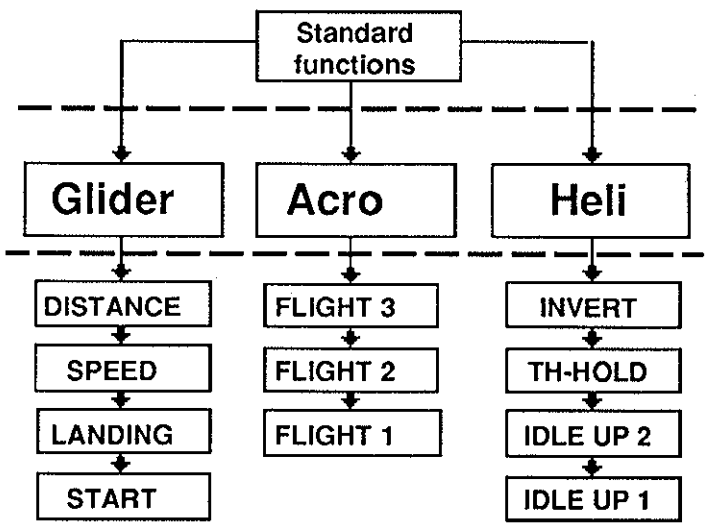
For landing, activate the butterfly function. In all other flight models, moving the throttle stick should cause both ailerons to deflect UP, without any elevator compensation. By selecting the LANDING flight mode, the butterfly function (ailerons up, speed flaps down) is to be fully effective inclusive of elevator compensation.
The speed flap switch may always be left in its neutral position - irrespective of flight mode.

Priority of switches

Flight modes and switches are activated in the following sequence of priority:

1. DISTANCE
2. SPEED
3. LANDING
4. START

For example, none of the other flight mode switches will operate when DISTANCE is switched on. When the SPEED flight mode has been switched on, only the DISTANCE flight mode can over-ride it. Once LANDING has been switched on, it can be over-ridden by SPEED and DISTANCE. Once START has been switched on, it may be over-ridden by all other flight mode switches. All switches should be switched ON in the same direction so that it is easier to determine which switch/flight mode is active at any moment.



Programming flight modes

Copying flight modes (COPY)

The (NORMAL) settings made so far are programmed in all other flight modes, thus transferring the settings and activation of individual functions by means of one programming step.

Programming examples

To copy the NORMAL mode to ALL flight modes, simply place the cursor on COPY and press the 'COPY' key. This completes the basic programming of this F3B model for all flight modes and any functions activated in the NORMAL mode will now be active in all other flight modes too. We must now adjust the settings in each flight mode to achieve the desired performance.

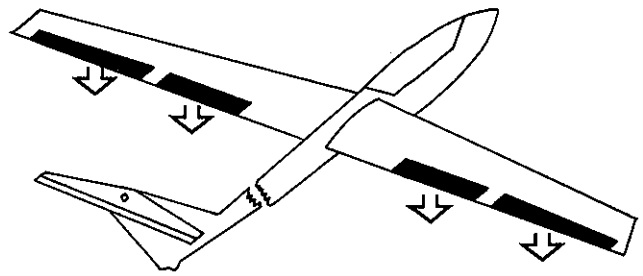
Timed flight (NORMAL)

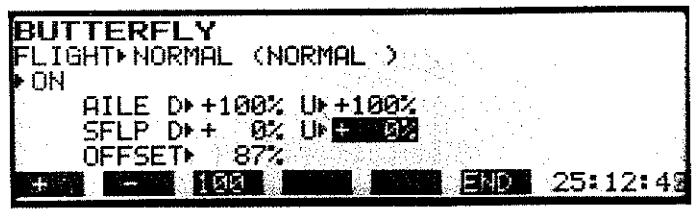
In this flight mode, the required setting is for 'minimum sink'. Slightly extend the speed flaps downwards, leaving the elevator trim in offset. The butterfly effect is to be limited to the ailerons, without any elevator compensation.

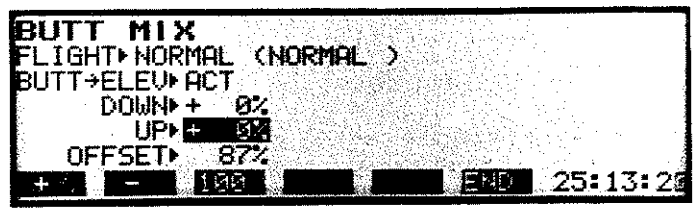
As these settings are programmed in the NORMAL flight mode, ensure that the NORMAL mode is displayed in the 'FLIGHT' line when adjusting each function. Also, do not activate any of the flight mode switches - NORMAL flight mode must be displayed in the brackets.

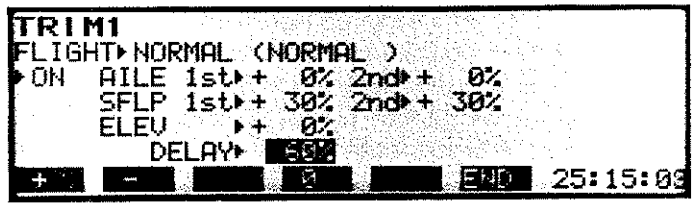
Switch off the speed flap rate in the butterfly mix (BUTT) by programming a value of '0%' on the SFLP line. Switch off the elevator compensation in the butterfly⇒elevator mix (BUTm) by programming '0%' for both values.

In Trim Program 1, set the desired offset positions of the ailerons and speed flaps using '+' or '-', including a DELAY value so that the control surfaces move slowly to their programmed positions when the NORMAL flight mode is selected. Set the DELAY using '+' or '-'. It is advisable to set the same delay for each setting and each flight mode.









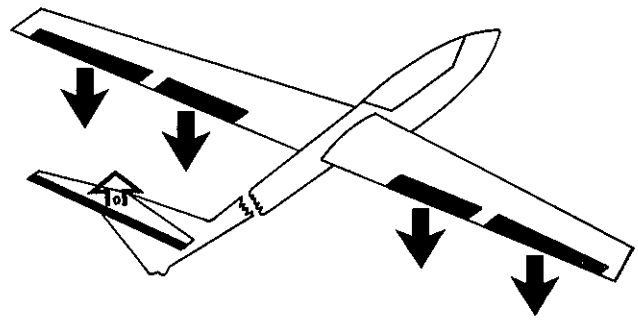
START

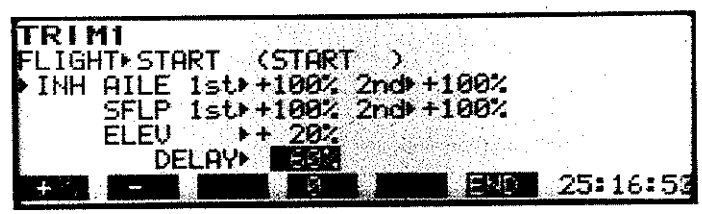
For winch launching, the model's performance should aim at 'maximum lift'. The speed flaps should be extended downwards, using Trim Program 1, to generate increased lift and the elevator trim should be set slightly upwards.

Ensure that the START flight mode is displayed on the FLIGHT line when programming all functions in this flight mode. Also, activate the START flight mode switch, checking that START appears in brackets () on the flight line.

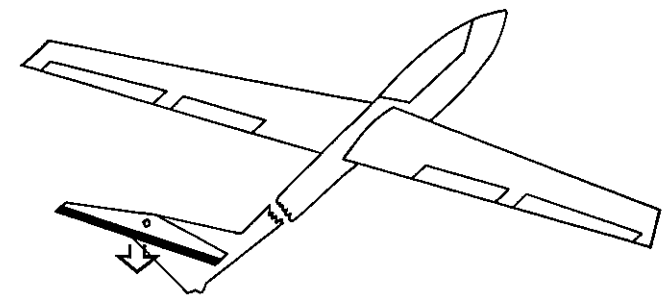
Set the offset positions of the ailerons and speed flaps using '+' or '-' in Trim Program 1. Program the elevator trim setting (slightly UP) as required using '+' or '-'.

Enter the DELAY values in the same way as the NORMAL flight mode to avoid any sudden trim changes when switching to START flight mode. It is advisable to set the same delay for each setting and each flight mode.



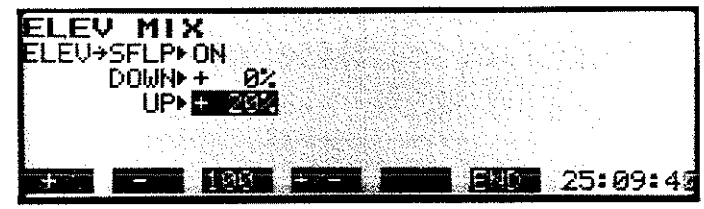


Programming examples



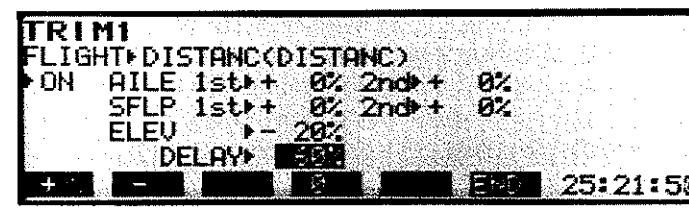
DISTANCE

For distance flight, we must adjust the settings to produce optimum 'slip' by moving the speed flaps into their neutral position and by trimming the elevator slightly 'down'. We also require speed flap compensation when the elevator is used (flaps DOWN when the elevator moves UP) to increase lift in base turns. This elevator ⇒ speed flap mix is usually achieved with an additional switch. It then possible to use the mix in any of the various flight modes, if desired.

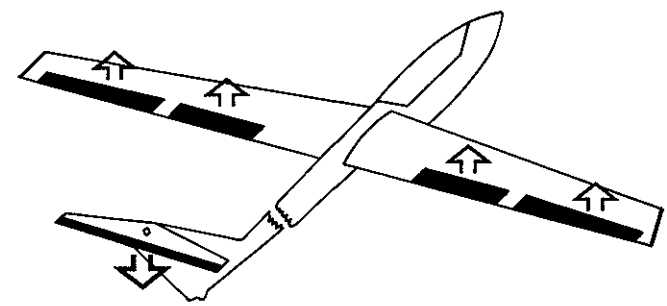


Ensure that the DISTANCE flight mode is displayed on the flight line before changing any settings for this flight mode. Also, activate the DISTANCE flight switch. The DISTANCE flight mode should now be displayed in brackets.

Set the offset positions for this flight mode in Trim Program 1 using '+' or '-'. Program the elevator trim (slightly 'down') as required using '+' or '-'.



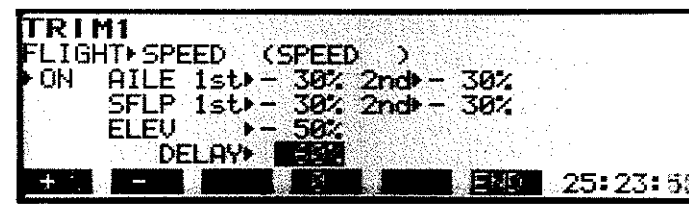
Now enter the DELAY to match the NORMAL and START flight mode values.



SPEED

For SPEED flight, we desire 'maximum speed' whilst retaining an acceptable glide angle, by trimming the speed flaps slightly upwards (depending on the wing section) and the elevator 'down' - depending on the glide (dive) angle required.

Ensure that the SPEED flight mode is displayed on the flight line before changing any settings for this flight mode. Also, activate the SPEED flight switch. The SPEED flight mode should now be displayed in brackets.

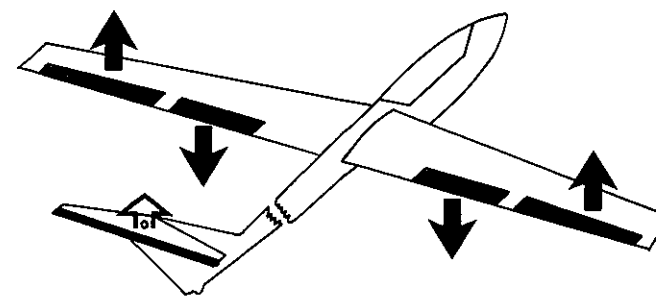


Set the offset positions for this flight mode in Trim Program 1 using '+' or '-'. Program the elevator trim (slightly 'down') as required using '+' or '-'.

Now enter the DELAY to match the NORMAL, START and DISTANCE flight mode values.

LANDING

For landing, we must activate the butterfly function. In all other flight modes, moving the throttle joystick should move both ailerons UP, without any elevator compensation. After selecting the LANDING flight mode, bringing back the throttle should move the ailerons UP, the speed flaps DOWN and elevator compensation activated.

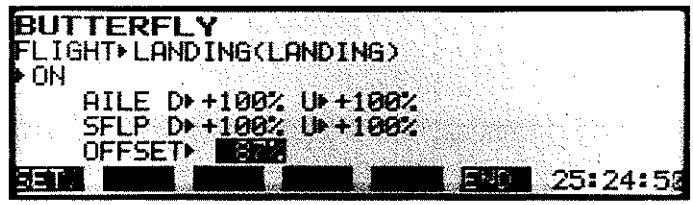


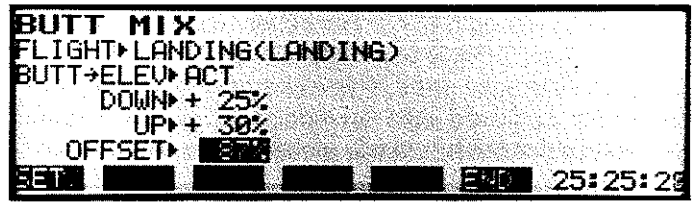
Programming examples

Ensure that LANDING flight mode is displayed on the FLIGHT line before changing any settings for this flight mode. Also, activate the LANDING flight mode switch, checking that LANDING appears in brackets () on the flight line.

Note: As described earlier, the LANDING flight mode can only over-ride START or NORMAL flight modes.

The speed flap switch should always remain in its neutral position in all flight modes.



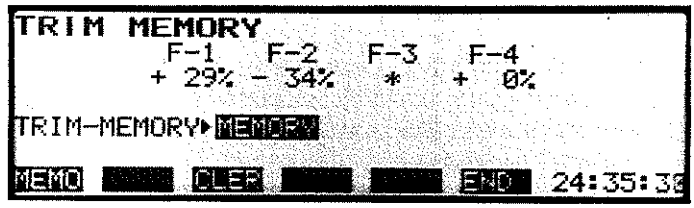


Flying the model

The model is now ready for flying when all the settings in each flight mode may be trimmed for optimum performance. If there is any deviation from neutral trim, the trim values may be stored - using Trim Memory - and the mechanical trims brought back to their centred positions.

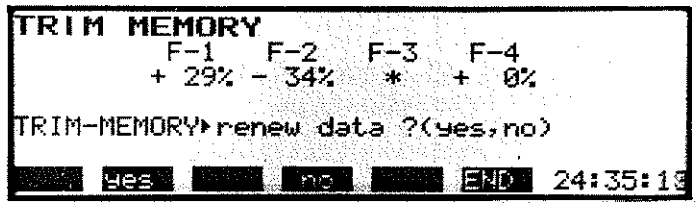
Trim Memory 30

This function offers the option of storing the trim settings so that after adjusting, the trim levers may be neutralised with the trim effect stored. The trim memory affects only the model program in use and stores all trim positions - except for throttle. If the stored trim value, when added to trim lever value, exceeds the full trim path magnitude, additional trim amounts will not be stored.



Press MEMO, followed by 'yes' to set the trim memory. Neutralise trims. Any further changes of trim may be entered by MEMO.

To clear the trim memory press CLER, followed by 'yes' to confirm. All trim data will be cleared and all stored trim values returned to zero.



Programming examples

Helicopters

The first helicopter to be programmed is fitted with a standard 2 blade rotor, fly bar and an uncomplicated (Schluter/Kyosho - i.e. with one pitch servo) swash plate. Both the throttle and pitch are controlled by separate servos and a gyro with adjustable gain is used to stabilise the tail.
With this example we have control over the following functions: Pitch, throttle, elevator, aileron, tail rotor and gyro fade out - with the pitch and throttle controlled by the throttle stick. The throttle's front stop equals maximum pitch. The revo mix should result in tail compensation when the pitch is changed. Separate idle-up settings are programmed and called up by switches for hover and aerobatic flying. For autorotations, the throttle hold switch should cut the engine, increase both the positive and negative pitch and the tail rotor should move to a pre-set position. The throttle should also increase as required when aileron and elevator controls are used.

Functions set in Stage I:

Tail rotor balance (REVO)
Gyro gain (GYRO)
Gyro fade out (GYRO)
Maximum pitch setting (PCrv)
Minimum pitch setting (PCrv)

Functions set in Stage II:

Throttle curve for idle up 1 (TCrv)
Throttle curve for idle up 2 (TCrv)
Throttle hold - motor setting (HOLD)
Hovering pitch (PHOV)
Hovering throttle (THOV)
Pitch trim(PHOV)

Functions set in Stage III:

Tail rotor to throttle mixing (RD-T)
Offset mix for rudder, aileron and elevator (OFST)
Automatic throttle hold position (HOLD)

Model 2 with CCPM and 3 blade head

Swashplate type (SWSH)
Swashplate mixing (SWMx)
Swashplate to throttle mixing (SWMx)

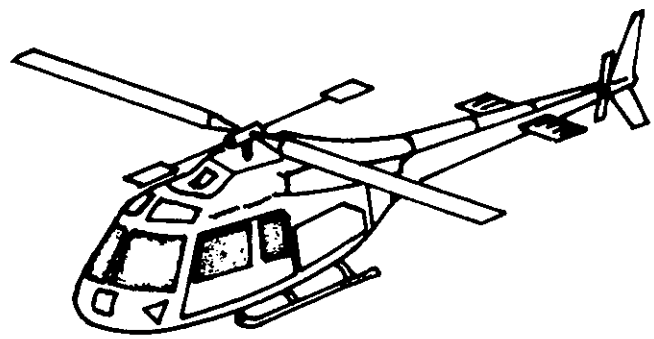
Servo connections to the receiver

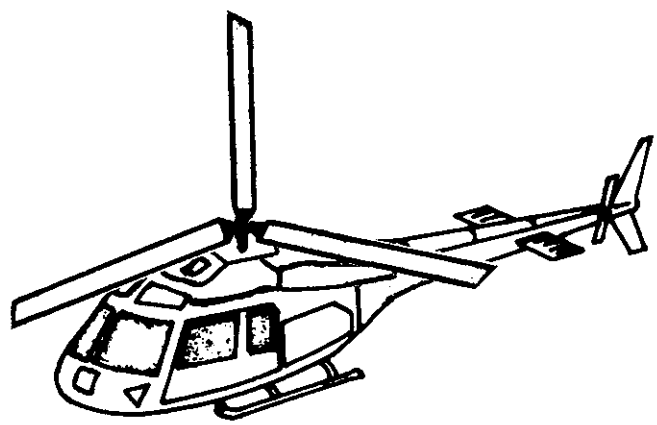
Roll (aileron)	Output 1
Nick (elevator)	Output 2
Throttle	Output 3
Tail rotor (rudder)	Output 4
Gyro	Output 5
Pitch	Output 6

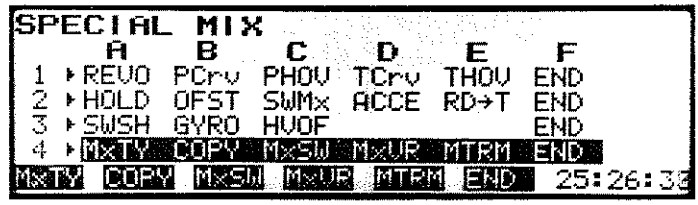
The above requirements are not programmed all at once, but in three stages. In this way, those that are new to helicopters may learn whilst programming, making the programming of the transmitter quick and easy.

Once the initial three stages have been familiarised and tested in practice, the user may go on to program sophisticated models with multi-bladed heads etc.

A mix program has been set up with the same basic settings as the example above, but is fitted with a 3 blade head and Heim/Schluter swashplate (with CCP mixing - i.e. more than one pitch servo).







Programming examples

Stage 1

The following programming example applies to all model helicopters that have a separate servo on both throttle and pitch functions. The climbing and descending of the helicopter is controlled by the changing of collective pitch of the main rotor blades. The amount of adjustment of pitch varies from model to model, but is usually set at around -2° to +8°. In flight, the rotor speed should always remain constant. So, an increase in rotor pitch should be matched with an increase in throttle. This type of linear throttle and pitch control is used for practising hovering flight and provides an uncomplicated set-up for beginners.

We must program the following:

Tail-rotor compensation (REVO)
Gyro-fade out (GYRO)
Maximum pitch setting (PCrv)
Minimum pitch setting (PCrv)

Preparation:

Connect all servos to their various controls. Complete the radio and receiver installation.
The sequence of programming steps for all standard functions will only be mentioned briefly. The following description concentrates on explaining functions which are only applicable to helicopters.

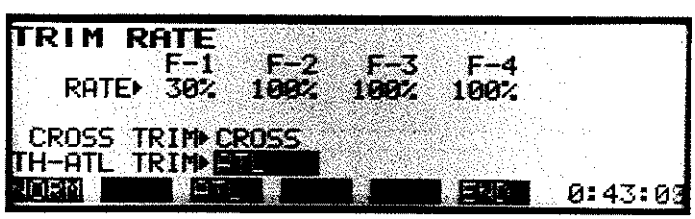
First steps by keyword:

Select a new model memory	(MODL)	11
Cancel memory contents	(RSET)	32
Enter model name, name of owner and code number	(MODL)	10
Function change	(FUNC)	21
Copy model memory	(MODL)	11
Select mix program (SMIX)	(MxTY)	13

We must select mix program HELI, which automatically mixes pitch and throttle. The throttle stick trim will only affect the throttle function. The pitch trim is controlled by the function 6 slider and may be switched off in PHOV. The revo mix (REVO) is already activated in this mix program.

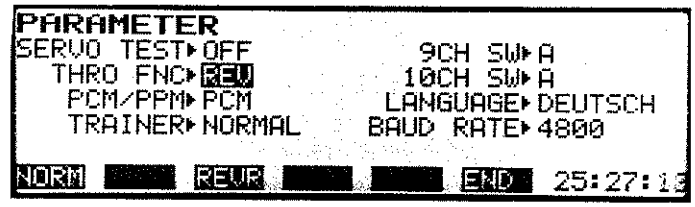
Trim rate	(TRIM)	29

Now program the throttle trim to act in ATL mode. Place the cursor on TH-ATL TRIM and activate with 'ATL'.



Basic settings (PARA) **28**

Now, set the modulation (PCM or PPM) to match the receiver being used in the model. Enter ENGLISH as the programming language and set the direction of the throttle stick function: Full power and full pitch at the front stop (pushing the stick away) is NORMAL (NOR), full power and full pitch at the rear stop (Pulling back the stick) is REVERSE (REV).

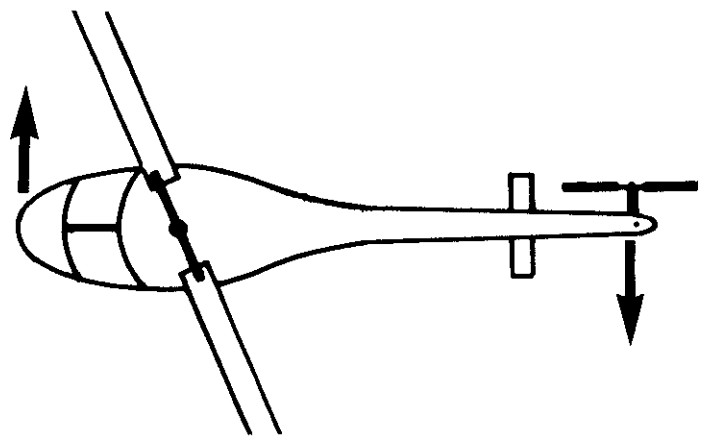


This concludes the basic settings that can be completed without the model. Now, the receiver can be switched on and the following programmed:

Servo reverse	(REVR)	12
Servo path setting	(ATV)	14

The servo path setting is used to reduce or increase the throw of each servo. Using the instructions supplied with the helicopter, use ATV to gain the correct control throws. It is particularly important to ensure that no servo is restricted mechanically. A 'stalled' servo drains the battery quickly and damages the servo.

When everything has been set, moving the throttle stick should control the throttle, pitch and tail compensation. The pitch should move from maximum to minimum resulting in a change of main blade pitch from -2° to +8° and the throttle from idle to full power. The swash plate should tilt to the right when a right aileron command is given, tilt forwards when a down elevator command is given. When the tail rotor stick is moved to the right, the helicopter's nose should move to the right.



Programming examples

Tail rotor compensation (REVO) 51

With a helicopter, the tail rotor must compensate for the torque of the main rotor blades - which tries to 'spin' the helicopter the other way. This is why when stationary in the hover, the tail must always generate enough thrust in the opposite direction to balance the main blades' torque.

However, a change of throttle or pitch will cause a change in torque and consequently the amount of tail compensation required to stop the helicopter from spinning will change. These torque changes may be counteracted automatically with 'tail rotor compensation', or 'REVO mix'. Since this compensation is constant (static) i.e. more pitch = more torque = more tail compensation, the function is known as static tail rotor compensation.

Call up the revo mix function (REVO). It is automatically activated when selecting mix program HELI. First, set the main rotor direction so that the computer knows which way to compensate with the tail rotor. Helicopters whose main blades turn anti-clockwise (when viewed from above) should have a tail compensation causing the helicopter to turn to the RIGHT when moving from minimum to maximum pitch.

The correct amount of compensation can be set for each side of the neutral position of the throttle stick. These two settings allow the compensation to be set on the pitch 'UP' and 'DOWN' side.

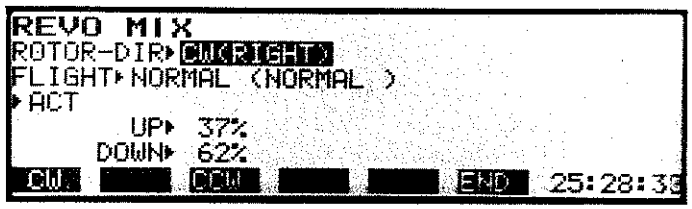
The pre-programmed values (50%) will be adequate for initial flying attempts. Precise settings, however, may only be determined by flying the helicopter. The settings may be trimmed in flight by fitting two sub-trims and programming as detailed below.

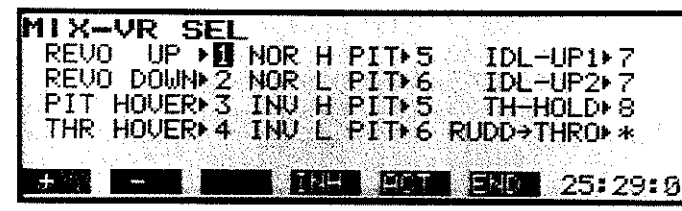
Selection of mix trims (MxVR) 79

Once the function 'Selection of mix trims (MxVR, 79)' has been called up, trimmers may be allocated for REVO UP and REVO DOWN. Select REVO UP with the cursor and program the required trimmer using '+' or '-'. Program a separate trimmer for REVO DOWN in the same way. If choosing trimmer 1 for example, then a trimmer must be fitted to the trimmer 1 socket on the transmitter's PC board.

The trim rate may be switched off using 'INH' or activated using 'ACT'

After flying the model and finding the optimum REVO mix settings, for example 37% UP and 62% DOWN, these values may be entered using '+' or '-' and the trimmers inhibited. This way the trimmers may be re-allocated to other functions and the revo mix settings stored safely, without the risk of inadvertant alteration.

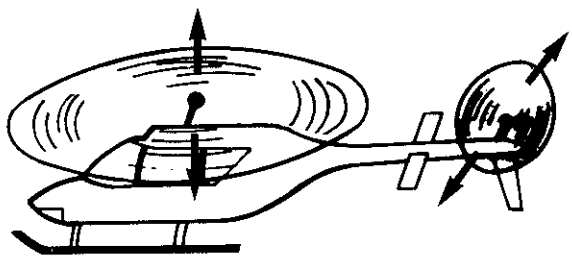




Setting the gyro (GYRO) 72

The gyro or 'auto pilot' has a similar task to static tail rotor compensation in that it too prevents any unwanted 'swing' of the tail. To do this, the gyro compensates with the tail rotor.

In contrast to static tail rotor compensation, which moves the tail a set amount with an increase or decrease in pitch the gyro 'reacts' to all torque changes - irrespective of direction - and automatically moves the tail servo. A helicopter may try to rotate for many reasons, including gusts of wind but it is mainly due to the non-linear changes of engine power. The gyro reacts and compensates for these changes in a fraction of a second - much quicker



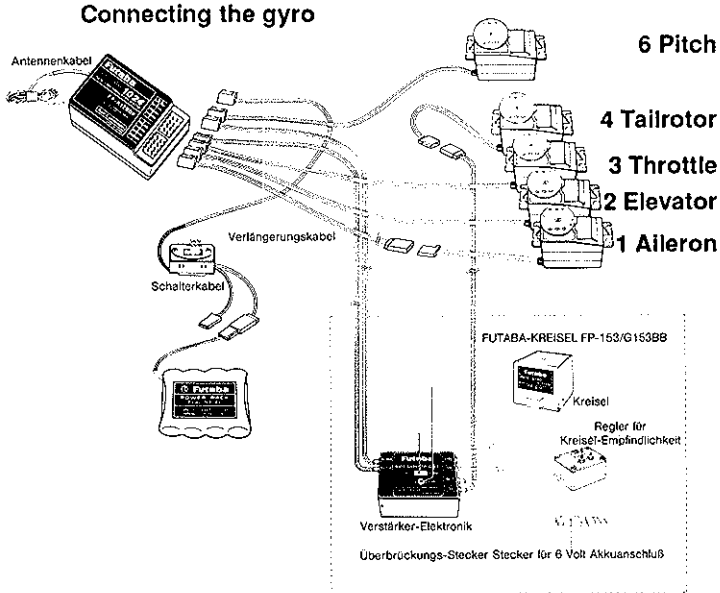
Programming examples

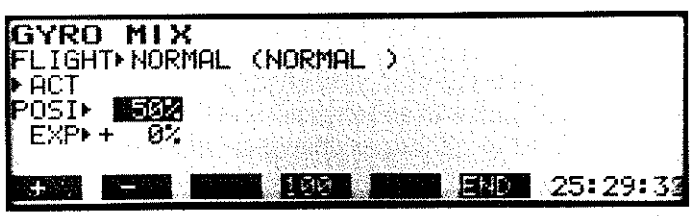
As the gyro cannot determine the reason for the helicopter trying to turn, the result is that the gyro also tries to compensate for the pilot making a deliberate turn. This can be prevented by 'Gyro fade out'.

The gyro is connected to receiver output 4 - between the receiver and the tail rotor servo. Uncomplicated, budget gyros fade out by themselves, as the deflection of the tail rotor stick increases, in which case no fade out need be set.

If the gyro has a sensitivity channel, this should be connected to the receiver's channel 5 output. Fade out is now capable with the optimum amount of control and adjustment. Gyros of this type are fitted with control over the minimum and maximum gain. The transmitter is programmed to allow maximum gain at the centre stick position and minimum gain when the tail rotor stick is at full deflection one way - left or right.

Connecting the gyro





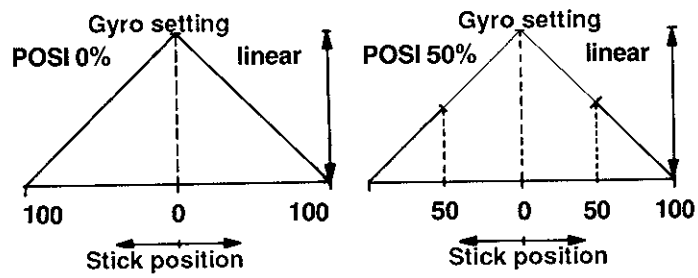
To check the gyro action, hold the helicopter and turn it quickly and suddenly around its vertical axis. The tail should compensate briefly, moving the tail servo in the opposite direction of rotation.

If the gyro responds in the wrong direction, the gyro must be reversed either by using the gyro's reverse switch or by turning its installation throught 180° (see instructions supplied with the gyro).

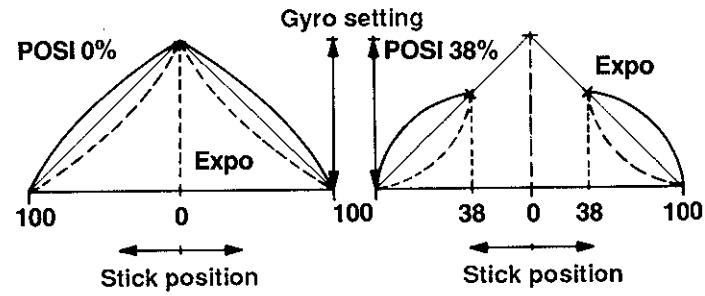
Setting the gyro fade-out (Linear gyros)

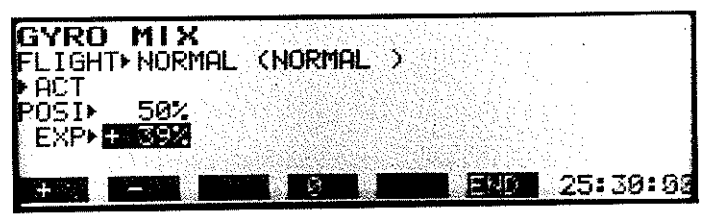
Call up the GYRO function and activate using 'ACT'. Initially, a servo may be connected to the receiver's channel 5 output to gain a better understanding of how this function works. The function 5 slider may be used for setting the basic gyro sensitivity.

A linear fade out may be entered, i.e. the gyro rate is at maximum gain when the tail rotor joystick is centralised. As soon as the stick is moved in any direction, the sensitivity may be reduced to zero (setting 0%). On the other hand, the fade out setting may be started when the stick reaches a certain position (i.e. 2/3rds of the stick movement in one direction). In this case, the gyro gain remains maximum with small deflections of the stick and the fade out will only begin after the selected position.



The rate/fade out may also be exponential. This gives a low fade out in the centre stick position which progressively increases as the stick deflections increase. For this exponential effect, program the settings with a negative sign '-'. If a positive sign '+' is used, the fade-out will be maximum at the centre stick position and slowly reduced as the stick deflection increases.





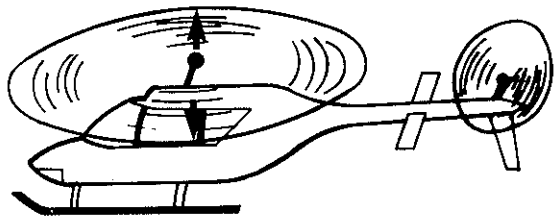
Once this function has been understood, connect the gyro's sensitivity channel to the receiver's channel 5 output. Use the instructions supplied with the gyro when connecting and installing the gyro.

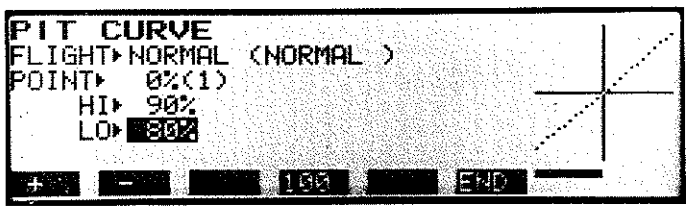
The channnel 5 slider may now be used for adjusting the basic gyro sensitivity.

Programming examples

Setting maximum and minimum pitch (PCrv) 57

This function is used to set the maximum and minimum pitch. Initially, set up the helicopter's pitch to that recommended in the instructions supplied with the model. The precise pitch settings may be programmed later.





Set the maximum pitch value on the 'HI' line and set the minimum pitch value on the 'LO' line. To do this, move the throttle stick above or below neutral as required and enter the values using '+' or '-'.

Once these settings have been made, the helicopter is ready for its first flight. After the pilot has learnt how to hover and control the helicopter, he should move on to Stage II.

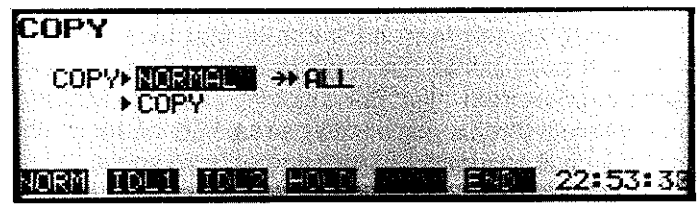
Stage II

Using the settings laid out here in Stage II, the helicopter should be able to perform aerobatics and autorotation landings. Stage II is designed to refine and optimize the settings already made in Stage I. Trained helicopter pilots, however, may enter the settings of stage I and stage II in one go. The sequence is the same.

Adjust the NORMAL pitch setting to give approximately -4° to +10° (depending on the type of helicopter).

As all the settings have already been made in NORMAL flight mode, this mode must be copied to all the other modes - IDLE UP 1, IDLE UP 2 and HOLD. This ensures that all functions which have already been activated will be active in each of these new flight modes. Use the COPY function to achieve this in the following way:

Call up the COPY function. Move the cursor to COPY, and press the 'COPY' key to copy from NORMAL to all other flight modes. Any functions that are used exclusively for IDLE UP 1 or 2 will not be copied to the HOLD flight mode (e.g. throttle curves etc).



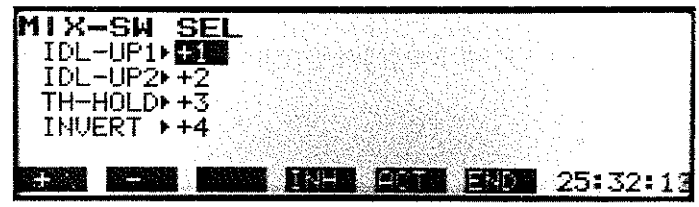
We must now program the following:

Switches for IDLE UP 1, IDLE UP 2, HOLD
Throttle curve for idle up 1 (TCrv)
Throttle curve for idle up 2 (TCrv)
Autorotation throttle setting OFF (HOLD)
Hovering pitch setting (PHOV)
Hovering throttle setting (THOV)
Pitch trim (PHOV)
Maximum pitch for idle up 1, 2 and autorotation (PCrv)

To complete the settings in Stage II, program a switch for each flight mode (IDLE UP 1, IDLE UP 2 and HOLD) as shown below.

Selection of mix switches (MxSW) 09

Use this function to allocate switches for IDLE UP 1, IDLE UP 2 and HOLD. Place the cursor on each of these functions in turn and program a switch using '+' or '-'. A three position switch may be used for IDLE UP 1 and 2.



As previously described, numers 1 - 8 refer to switches connected to the EXTERN.SWITCH sockets on the PC board and statements A, B and C refer to the switches already mounted at the centre of the transmitter.

The switch direction may be reversed in the following way. Move the switch into the desired 'OFF' position , then program the switch number. If the switch has already been programmed, select a different switch number, move the switch into its 'new' OFF position and re-key the correct switch number. The direction change is confirmed with a change in sign, e.g. switch 1 becomes switch -1.

Programming examples

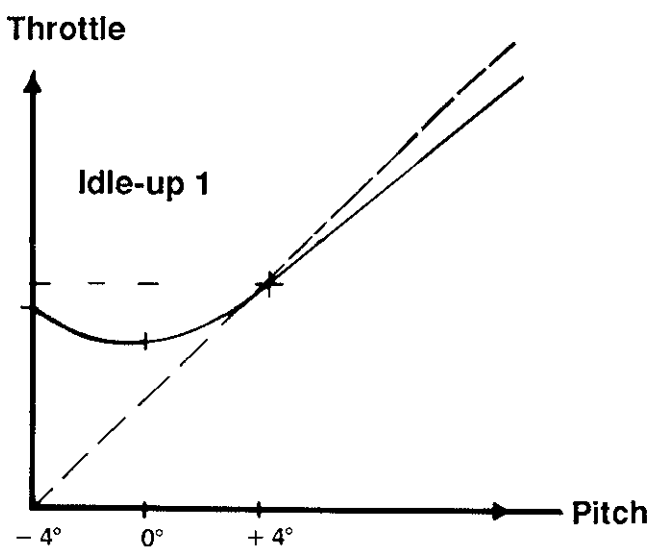
IDLE UP 1 (TCrv) **54**

This function has the purpose of maintaining a fixed rotor speed throughout all manoeuvres. Each change of pitch therefore requires a corresponding change of throttle. To do this, mix program HELI provides the option of setting the engine control from minimum to maximum throttle over a 9 point curve. Each of the nine points may be separately set from minimum to maximum throttle to allow the optimum throttle position to be reached for any pitch setting - thus ensuring a constant rotor head speed. With idle up it is therefore possible to reduce the pitch below that required for hovering without reducing the rotor head speed. This feature is particularly important, if not essential, when flying aerobatic manoeuvres when negative pitch is required.

To allow the helicopter to be started safely, the idle up switch is left switched OFF. Once the engine is running correctly and the pilot ready to fly the model, the idle up switch is switched ON. The engine speed should then increase to the required rotor speed. The rotor speed should now remain constant, no matter what position the pitch joystick is moved to. To prevent a sudden run up of head speed, it is possible to set a delay that slowly changes the flight mode from NORMAL to IDLE UP 1. However, when IDLE UP is switched OFF, the throttle returns quickly to its normal throttle setting - without delay.

To gain precise control over the power required for any pitch setting, it quickly becomes obvious why a 9 point curve is required.

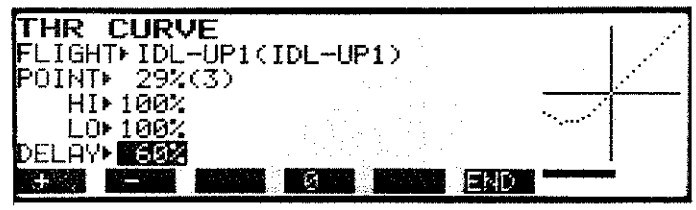
With the throttle stick pulled back the pitch should be set at -4°. As the throttle/pitch is advanced, the throttle must be reduced to maintain a constant system speed when the pitch reaches 0°. If the pitch is increased further, more power is required to maintain rotor head speed. With this 9 point throttle curve, these changing requirements may be precisely set for the entire range of rotor blade pitch angles.



Call up the throttle curve function (TCrv). Move the cursor to the FLIGHT line and press 'IDL1' . Switch ON the IDLE UP 1 switch. The settings we are now going to enter will all be carried out in the IDLE UP 1 flight mode.

Move the throttle to its front stop (full power) and set the maximum throttle on the HI line using '+' or '-'. Return the throttle stick to its rear stop (low power) and set the idling throttle using '+' or '-'.
Now move the cursor to POINT. Each point is separated by 12.5% of the total throttle travel and each may be adjusted in 1% steps up to a maximum of 100%. Each of the nine points may be selected using the ⇐ and ⇒ cursor control keys before adjusting. The point selected and its value (in %) will be displayed on the POINT line and identified by a small cross on the throttle curve.

Point 1 is set to provide sufficient power to maintain system speed when the throttle stick is at its rear stop (minimum pitch position). Now select point 2 and advance the throttle stick until the throttle bar graph in the display matches the position of point 2 on the curve. Set the point value using '+' or '-' to maintain system speed. Select point 3 and set in the same way with '+' or '-'. Continue moving up the throttle curve in point steps setting the desired values with '+' or '-' required to balance the pitch to maintain a constant rotor speed. Of course, the precise setting of each point can only be made after flying the helicopter and adjusting the values to suit.



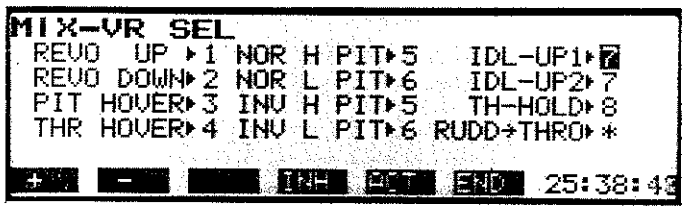
We must now set the delay value. This will allow a slow run-up to system speed once IDLE UP 1 is selected. Without any delay, switching from NORMAL to IDLE UP 1 would impose many stresses on the helicopter and blades as the throttle servo advances to its new low throttle position. Set the delay with '+' or '-'.

A sub trim may be fitted and programmed for adjusting idle up 1 in flight. This only raises or lowers the bottom end of the idle up curve (from minimum to mid-pitch stick position) and allows adjustment of the idling setting.

Programming examples

Selection of mix trims (MxVR) **79**

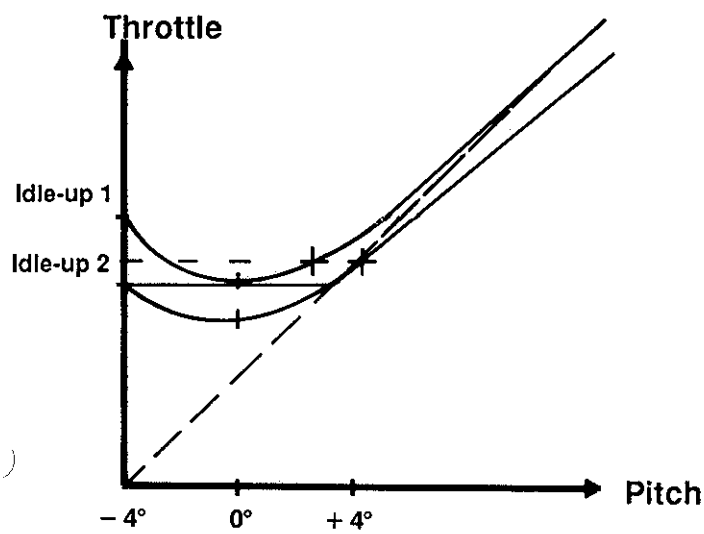
Call up the 'Selection of mix trims' function and allocate a separate trimmer for IDLE UP 1 and IDLE UP 2 by selecting the function with the cursor and programming the trimmer socket using '+' or '-'. If trimmer socket 1 is to be programmed for IDLE UP 1, then allocate trimmer '1' to IDLE UP 1 and connect the trimmer to the number 1 socket on the PC board (EXT.TRIMMER). The trim rate may be switched off using 'INH' or activated using 'ACT'.



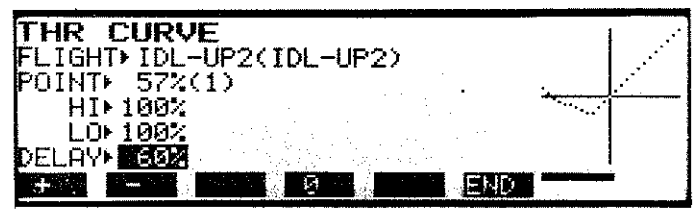
Once the optimum settings for IDLE UP 1 have been found by flying the model, the trimmer may be inhibited using 'INH' and the obtained value programmed in IDLE UP 1 using '+' or '-'. In this way, optimum settings may be programmed without the risk of inadvertent adjustment, and the trimmers may be used for adjusting different functions.

IDLE UP 2 (TCrv) **54**

This second idle up function (IDLE UP 2) provides the option of setting a second system speed. This is usually set higher than that for IDLE UP 1 and used for aerobatic flying. All settings are made in IDLE UP 2 mode and are called up by a switch. The settings are made in the same way as those in IDLE UP 1, but with larger values to give a higher system speed.



Move the cursor to the FLIGHT line and select 'IDL 2'. Switch ON the IDLE UP 2 switch. Move the throttle stick to its front stop and program the full throttle setting on the HI line using '+' or '-'. Now move the throttle stick to its rear stop and set the low throttle setting on the LO line using '+' or '-'.



Now move the cursor to POINT. Each point is separated by 12.5% of the total throttle travel and each may be adjusted in 1% steps up to a maximum of 100%. Each of the nine points may be selected using the ⇐ and ⇒ cursor control keys before adjusting. The point selected and its value (in %) will be displayed on the POINT line and identified by a small cross on the throttle curve.

Point 1 is set to provide sufficient power to maintain system speed when the throttle stick is at its rear stop (minimum pitch position). Now select point 2 and advance the throttle stick until the throttle bar graph in the display matches the position of point 2 on the curve. Set the point value using '+' or '-' to maintain system speed. Select point 3 and set in the same way with '+' or '-'. Continue moving up the throttle curve in point steps setting the desired values with '+' or '-' required to balance the pitch and maintain a constant rotor speed. Of course, the precise setting of each point can only be made after flying the helicopter and adjusting the values to suit.

We must now set the delay value. This will allow a slow run-up to system speed once IDLE UP 2 is selected. Without any delay, switching from IDLE UP 1 to IDLE UP 2 would impose many stresses on the helicopter and blades as the throttle servo advances to its new low throttle position. Set the delay with '+' or '-'.

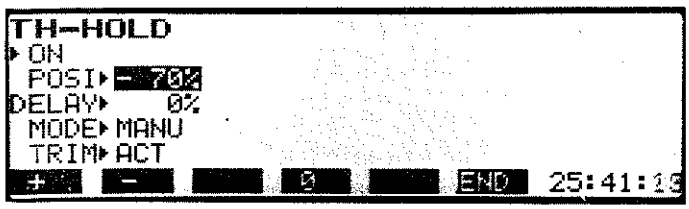
We have already fitted and allocated a trimmer to adjust IDLE UP 2 (see IDLE UP 1) which will allow changes to be made to the low to middle pitch stick settings in flight.

Once the optimum settings have been found by flying the model, the trimmer may be switched off (INH) and the trimmer value input in IDLE UP 2 with '+' or '-'. In this way, the optimum settings may be stored and the trimmer allocated to another function. The settings are also safe from any inadvertent changes.

Programming examples

Autorotation (HOLD) 56

This function allows the engine to be cut and tail rotor compensation switched off in flight for autorotation landings. The operating switch should have already been allocated in 'Selection of mix switches' (MxSW, 09).

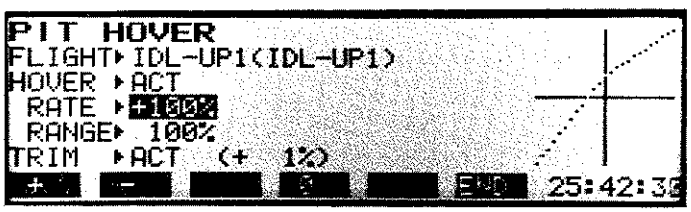


Call up the function and activate with 'ACT'. Operate the autorotation switch and the throttle should close to its factory set value of 70%. To modify this setting, move the cursor to the POSI line and adjust with '+' or '-'. The throttle trim can be set to active (ACT) which allows the option of keeping the engine idling during autorotation practice by pushing the trim forward. If the trim is pulled back, the engine will cut when the switch is operated. If no trim effect is required, inhibit the trim using 'INH'

The throttle delay should be switched off for autorotation training, otherwise the engine may take too long to provide the appropriate system speed.

Hovering pitch (PHOV) 53

This function is used to maintain a constant system speed. Hovering pitch allows the amount of pitch to be modified

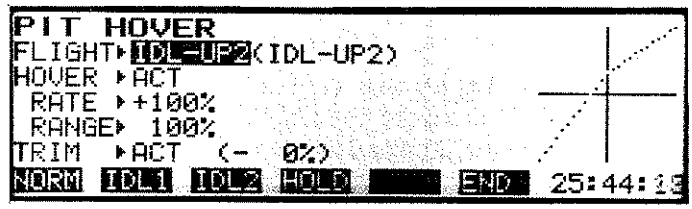


at the hovering stick position. The pitch may be increased or decreased and the range of total pitch that is affected by the function may be adjusted. RATE describes the amount of pitch change and RANGE describes the range of pitch that is affected by the change (see illustration).

Select the hovering pitch function. Switch ON idle up 1, then move the cursor to the FLIGHT line and activate IDL 1. All further settings will now only affect IDLE UP 1.

Fly the helicopter in a stable hover. If the pitch stick must be held above its centre position when hovering, then the RATE must be increased using '+'. If the helicopter hovers with the stick below centre, reduce the RATE with '-'. To limit this new RATE setting to only the hovering part of the stick's movement, restrict the range of the settings using RANGE. The complete pitch curve may be raised or lowered with the channel 6 slider after pressing 'ACT' on the TRIM line.

Now move the cursor to the FLIGHT line and select IDLE UP 2 (IDL2). All further settings will now only affect this flight mode.

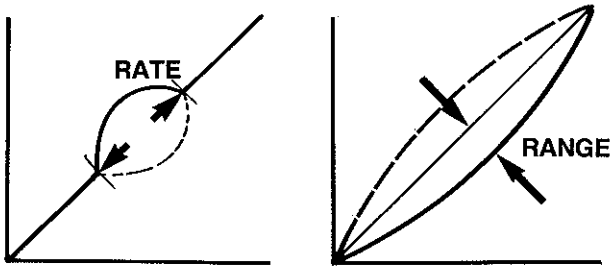


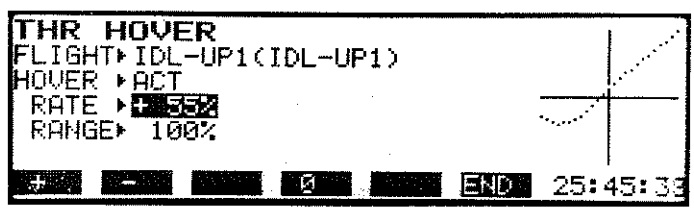
Hover the helicopter using IDLE UP 1. Switch ON IDLE UP 2 and if there is any change in the required stick position to hover the helicopter, adjust the hovering pitch setting as described in IDLE UP 1. Increase the hovering pitch with '+' values or decrease it with '-' values. Limit the range of the effect to the hovering stick position using RANGE.

The complete pitch curve may be raised or lowered with the channel 6 slider after pressing 'ACT' on the TRIM line.

Hovering throttle (THOV) 52

In much the same way as idle up, this function is used to maintain system speed. However, hovering throttle only affects the throttle in the hovering stick position - no other throttle settings are affected. As with hovering pitch, the RATE may be adjusted (increasing the values increases the engine speed) or the RANGE (determines how much of the throttle curve is affected by the changes). This function is used to maintain rotor speed when hovering pitch has been adjusted and a change to the system speed at the hovering point has been affected.



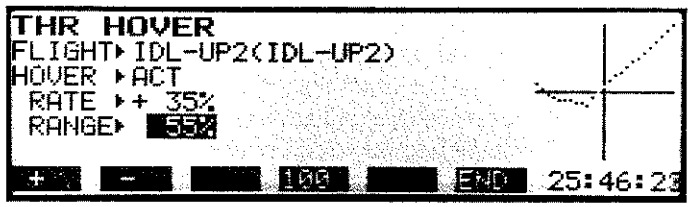


Programming examples

Select the hovering throttle function (THOV). Switch ON idle up 1 , move the cursor to the FLIGHT line and select IDL1. All further settings will now only affect this flight mode.

Hover the helicopter. At the pitch stick's hovering position, the system speed should be the same. If the speed is too low, input a positive '+' value on the RATE line. If the speed is too high, reduce it using negative '-' values. This completes the basics settings for IDLE UP 1.

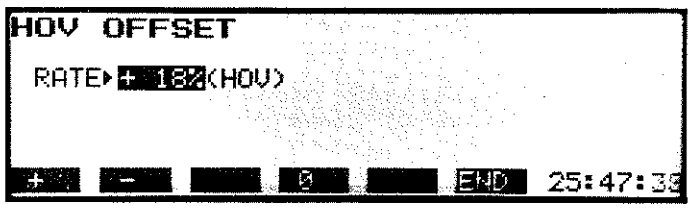
To set the hovering throttle for IDLE UP 2, switch ON the IDLE UP 2 switch. Move the cursor to the FLIGHT line and activate IDL2.

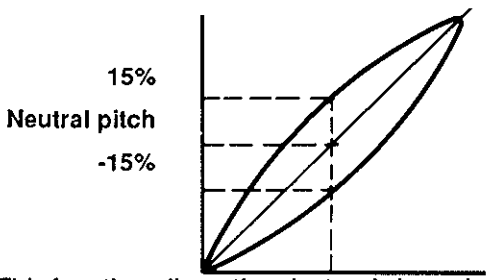


All further settings will only affect this flight mode now.

Hover the helicopter with IDLE UP 2. At the hovering point, if the rotor speed increases, reduce the RATE with '-'. If the speed decreases, increase the RATE with '+'. To limit the effect to only the hovering stick position, reduce the RANGE with '-'.

Hovering offset (HVOF) **53**



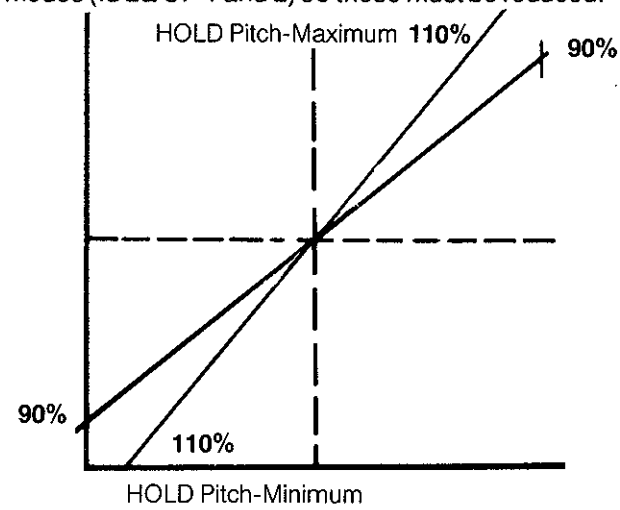


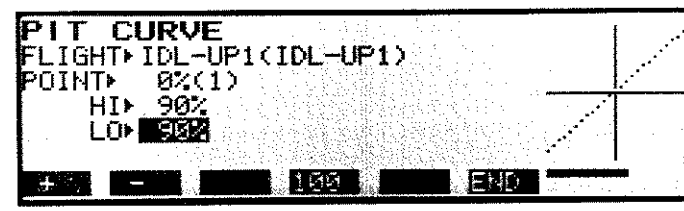
This function allows the electronic hovering position (normally the mechanical centre of the stick) to be varied above or below centre by +/- 15% of the total range to suit the pilot.

Call up the function. Set the required hovering position using '+' or '-'. Now move the pitch joystick and a double 'bleep' will sound and 'HOV' will be displayed in brackets at the newly programmed hovering position.

Maximum pitch for idle up and autorotation

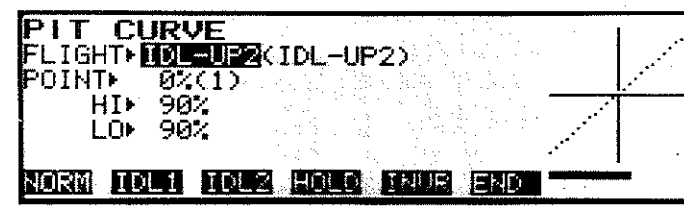
This function provides the option of changing the maximum pitch in various flight modes. To provide additional pitch for autorotation landings, the maximum pitch may be increased. This new setting will be too large for normal flight modes (IDLE UP 1 and 2) so these must be reduced.





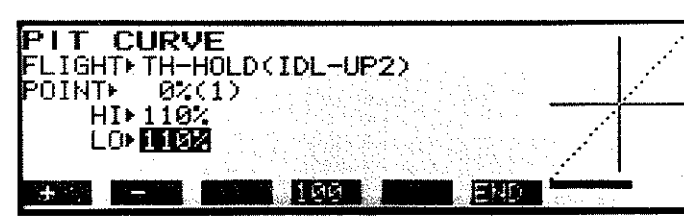
Call up the function and switch ON IDLE UP 1 switch. Place the cursor on the FLIGHT line and activate 'IDL1. Limit the maximum pitch (HI) to 90%.

Switch ON IDLE UP 2. Place the cursor on FLIGHT line and activate 'IDL2'. Limit the maximum pitch (HI) settings to 90%.



Switch ON HOLD. Place the cursor on the FLIGHT line and activate 'HOLD'. Increase the maximum pitch settings to 100%.

The above procedure will now provide a larger pitch path for autorotation landings.

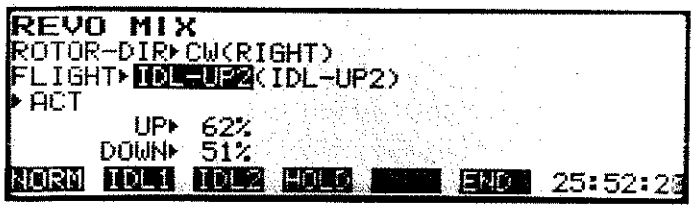


Programming examples

Tail rotor compensation (REVO) 51

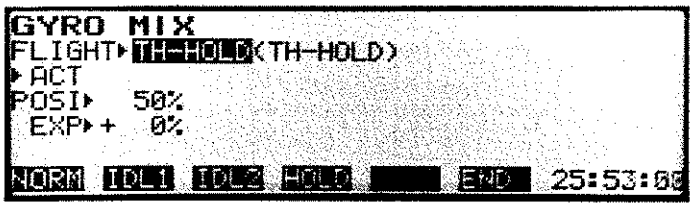
The tail rotor compensation must now be altered to suit the different needs of IDLE UP 1, IDLE UP 2 and HOLD.

Select the tail rotor compensation function and switch ON either IDLE UP 1, 2 or HOLD. Now place the cursor on the FLIGHT line and activate either IDL1, IDL2 or HOLD. Adjust the settings using '+' or '-'.



Gyro fade out (GYRO) 72

Gyro fade out must now be matched to IDLE UP 1, 2 and HOLD flight modes in the same way as tail rotor compensation above.



The settings shown in Stage II allow precise control over the average sport helicopter. They permit light aerobatics and provide almost optimum conditions for maintaining constant rotor speed throughout manoeuvres.

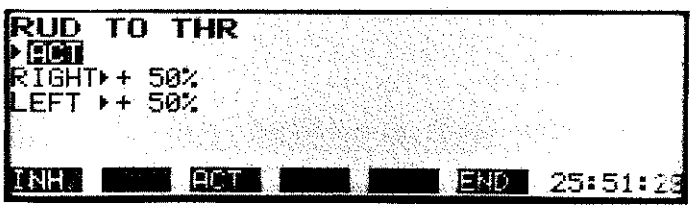
Stage III

The settings made in Stage III allow the optimum 'fine tuning' of the settings made in Stage II. The aim again is to maintain a constant rotor speed in all flight modes. The autorotation settings are more sophisticated, too. Before going on to Stage III, all settings must have been completed in Stage I and II.

We must program the following:

Tail rotor ⇒ throttle mixing (RD-T)
Tail rotor offset for autorotation (OFST)
Automatic autorotation change over (HOLD)

Tail rotor ⇒ throttle mixing (RD-T) 74



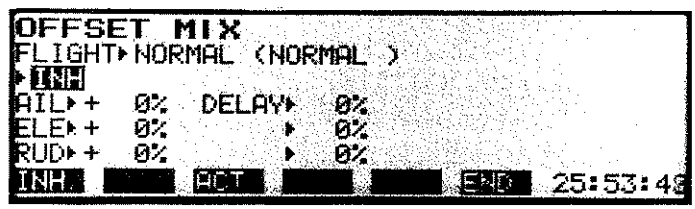
When using the tail rotor, the engine power required to maintain system speed changes. With this function, the throttle is mixed to the tail rotor control, so that it can be reduced or increased automatically. Since the power requirements are different for left and right tail deflections, the mixing is adjustable on both sides of neutral.

Call up the function and activate using 'ACT'. Deflect the tail rotor stick fully to the right and set the throttle requirements on the RIGHT line with '+' or '-'. Move the tail rotor stick to the left and set the power requirements on the LEFT line using '+' or '-'.

Tail rotor offset in autorotation (OFST) 59

With this function, the user may input a tail rotor servo offset position when the autorotation switch (HOLD) is used. For helicopters without tail drive in autorotation, the offset should be switched off as no torque compensation is required. With a driven tail, the neutral position must be altered to avoid a braking effect on the tail and main rotors.

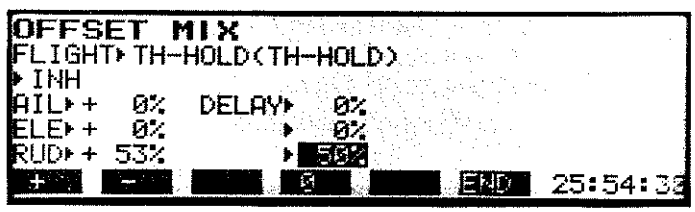
The tail rotor will always cause the tail boom to 'drift' due to friction in the bearings which can be compensated for with a servo offset position that generates slight negative thrust. All the above can be balanced with the aid of this function.



It is also possible to set offset values for elevator (ELE) and aileron (AIL) in any of the individual flight modes. Since the option is flight mode dependent, different offsets may be input in IDLE UP 1, IDLE UP 2 and HOLD.

To prevent any sudden trim changes, a delay should be input for each offset position.

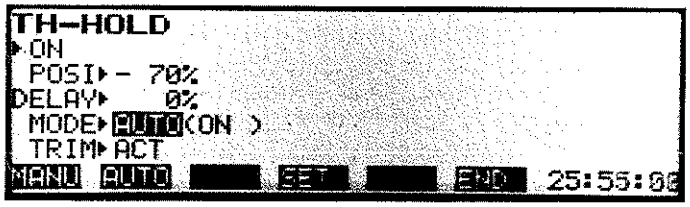
Call up the function and switch ON the HOLD function. Move the cursor to the FLIGHT line and activate 'HOLD'. Set the required tail rotor compensation using '+' or '-'.



Programming examples

Automatic autorotation change over (HOLD) 56

The autorotation function has already been set up and activated. However, the function may be triggered automatically from the pitch joystick. As the pilot prepares for an autorotation landing, he switches ON the HOLD switch. The function is now 'primed' but will not operate and will not reduce the engine to idle or cut until the pitch joystick is brought below a pre-set position.



Call up the function. Move the cursor to the MODE line and press 'AUTO'. Now move the pitch joystick to the position below which the hold function is to activate and press 'SET'. This position is now stored.

Model 2

With 3 servo CCPM and 3 blade rotor

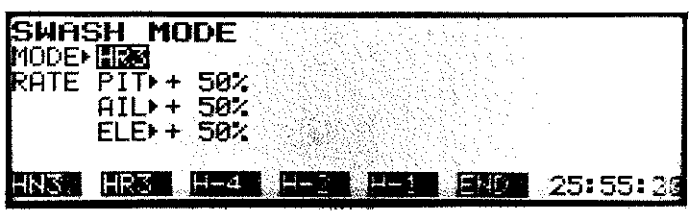
All the settings described for Model 1 must be completed before programming Model 2. Therefore, when programming a model using a swash plate controlled by 3 servos and fitted with a 3 (or 4) blade head, Stages I, II and III must be completed.

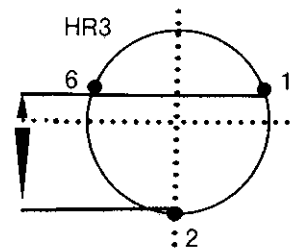
We must now program the following:

Swashplate type (SWSH)
Swashplate rotation (SWMx)
Swashplate ⇒ throttle mix (SWMx)

Swashplate type (SWSH) 60

Use this function to select the type of swashplate used in the model. In this case, using a three servo system, we must program type 'HR-3' since two servos are used for roll control. Call up the function, select 'HR-3' and acknowledge with 'yes'. All functions that are specifically related to this type of swashplate are now automatically programmed.





Connect the servos to the receiver in the following way:

Nick (elevator) servo	Receiver output 2
Roll (aileron) servo	Receiver output 1
Roll (aileron) servo 2	Receiver output 6

Now that the above servos are mixed, their individual deflections are reduced. This should be increased by using larger control horns on the servos - not by adjusting ATV. The pre-programmed values are automatically reduced from 100% to 50% and these values should only be adjusted for asymmetric linkages.

When using the PITCH function, all servos will now move in the same direction and the same amount to lift the swashplate. If the swashplate should tilt to one side, i.e. a servo is moving in the wrong direction, it must be reversed in 'Servo reverse'. If the swash plate moves DOWN and reduces the pitch when the pitch should be increased, the direction of the mix must be altered using '+/-'.

If the elevator (nick) joystick is pushed forward, the front of the swashplate should move DOWN, when the two servos are in front of the swashplate centre-line (see diagram). If the swashplate tilts back, then the direction of the mix should be reversed with '+/-' on the ELE line.

If the aileron (roll) joystick is moved to the RIGHT, then the swashplate should tilt to the RIGHT, where the two servos in front of the swashplate centre move in opposite directions, whilst the servo at the back remains stationary. If the swashplate tilts to the LEFT, the direction of the mix must be reversed on the AIL line with '+/-'.

When the swashplate is operated, it should only move in the desired direction. There should be no interaction with pitch when aileron is given etc. If this does not happen, then check the lengths of the servo control horns and links and that the pre-set deflection values of 50% have not been altered. Continue this check, and make the necessary adjustments until the swashplate corresponds exactly to the control movements.

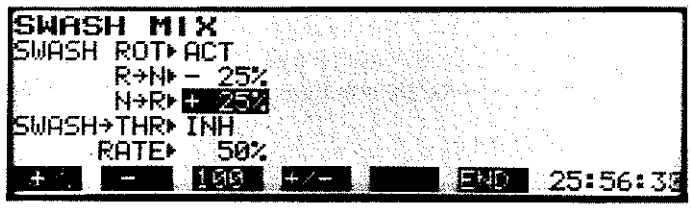
Programming examples

Swash rotation (SWMx) 69

With multi blade rotors, the accurate control of the rotor head can only be achieved with vertical linkages or swash rotation - mixing the aileron and elevator functions (roll and nick) so that they act together to produce the correct tilt at the rotor head.

Without any facility of virtual swash plate rotation, accurate control of the rotor head may not be possible.

Both NICK (elevator) and ROLL (aileron) are mixed for swash plate rotation. However, the swash plate will then tilt in a direction which does not correspond to the intended rotor disc tilt. Therefore, the required simple control movements can no longer be made at the swash plate, but at the rotor head. The swash plate rotation is not 'actual', but only 'virtual', i.e. by using servo control.

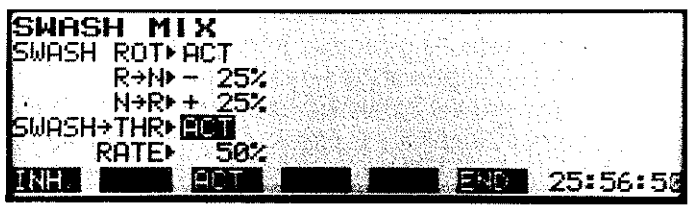


Call up the function and activate with 'ACT' on the SWASH ROT line. Set the 'rotation' using '+' or '-' on the R-N and N-R lines. If a rotation of -25% is programmed for R-N, a rotation of +25% must be programmed for N-R.

The swash plate rotation is rotating correctly when the multi blade rotor head (not the swash plate) makes the appropriate analog cyclic deflections. Check this by positioning a rotor blade in the precise direction of flight and then operate the cyclic control movements. These should now produce accurate deflections at the rotor head, not the swashplate.

Swash plate ⇒ throttle mix (SWMx) 69

This function is used to mix engine with aileron and elevator, so that the required increase in power is automatically given when aileron and elevator controls are used, regardless of control direction.



Call up the function and activate with 'ACT' on the SWASH⇒THR line. Set the required compensation on the RATE line using '+' or '-', after moving the aileron or elevator stick to full deflection.

This completes the programming of all settings required for operating the most sophisticated helicopters. The only improvement imaginable would be programming for inverted flight. This would involve the programming of all settings in the INVERT flight mode.

Helicopters fitted with a speed governor which cannot be influenced by throttle mixing intended to maintain head speed should have the functions inhibiting (with INH). If the governor is of the type that can be influenced by such functions, then set up the correct mixing as described previously as the settings will reinforce the performance of the governor.

Completing the settings required for a complicated or sophisticated helicopter is a time consuming project. However, it is the only way of guaranteeing the performance achieved by the experts. It goes without saying that the settings cannot be made all at once. Anyone that is new to helicopter flying would be advised to follow the examples here and proceed in stages. The settings with-ing Stage II should not be attempted until all the settings within Stage I have been completed and mastered in operation.

Practical tips

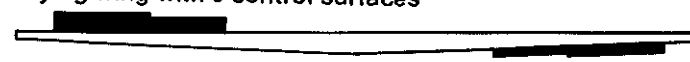
Flying wings

Mix program GLIDER 5 is the most suitable for flying wings with three control surfaces on each wing (see diagram). The mixes used to fly the model are: AILE (Aile⇒SFLP), BFLP (BFLP⇒AILE + BFLP⇒SFLP) ELEV ⇒BFLP. These mixes provide the option of controlling the outer surfaces (ailerons) together with the centre flaps initially used as speed flaps using the BFLP⇒SFLP mix.

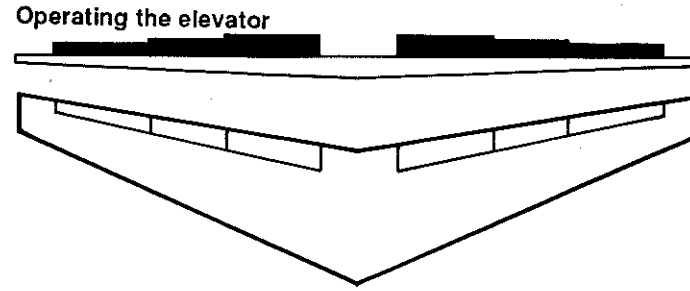
Activate the inner flaps (BFLPs) in elevator mode using the ELEV⇒BFLP mix. Since both the centre flaps and ailerons are mixed with the inner flaps, the result is an elevator deflection across all flaps.

Mix program GLIDER 4 is best suited for flying wing models with 2 control surfaces in each wing. These four wing control surfaces are mixed in the same way as the ailerons, speed flaps and elevators of the F3B example.

Flying wing with 6 control surfaces

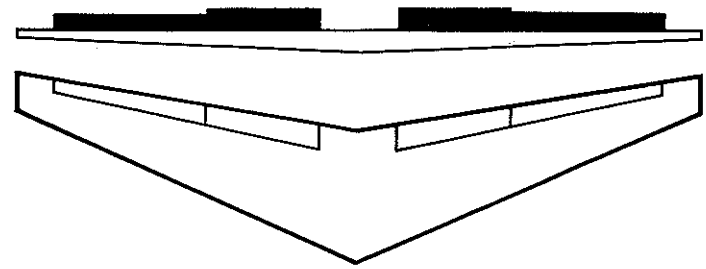


Operating the elevator



Flying wing with 4 control surfaces

Operating the elevator



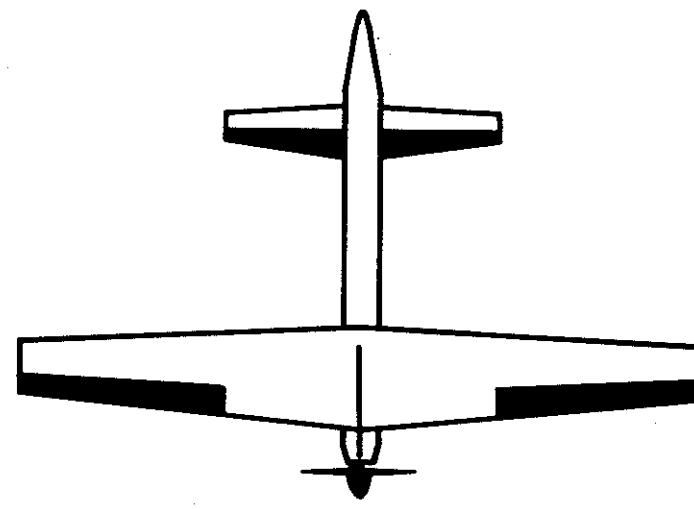
Canards

Canards do not always require specific programs because the horizontal stabiliser is positioned in front of the main wing. It is, however, extremely advantageous to use the horizontal stabiliser not only in elevator mode, but also in aileron mode, which is achieved by the AILEVATOR mix found in the ACRO mix program. Using two free sub trims, the stabiliser surfaces may be operated as separate speed flaps - which is extremely useful for experimental determination of the setting angle.

Connect the aileron servos to receiver outputs 1 and 7 and the stabiliser servos to receiver outputs 2 and 5.

Program the following :

Mix program ACRO
AILEVATOR mix (ALVT)
Differential (DIFF)
PMX1 Flaperon (FPR) ⇒ elevator (ELE)
PMX2 Flaperon (FRP) ⇒ gear (function 5)



Practical tips

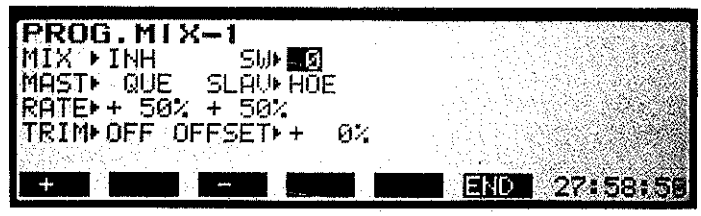
Freely programmable mixers

Freely programmable mixers are used to solve mixing problems when a specific mix is required that is not included within a mix program. The combination of several free mixes provides a range of options to satisfy every requirement. Ultimately, the software may be programmed at will in this way. Many of the following examples may also be programmed using a mix program, but whenever a mix program does not provide a particular function, that function may then be programmed using the freely programmable mixes.

Please remember that in principal the freely programmable mixes are always programmed PRIOR to the mix programs. The servos should be connected to the receiver in the normal sequence, depending on the mix program being used.

Freely programmable mixes in double mix functions

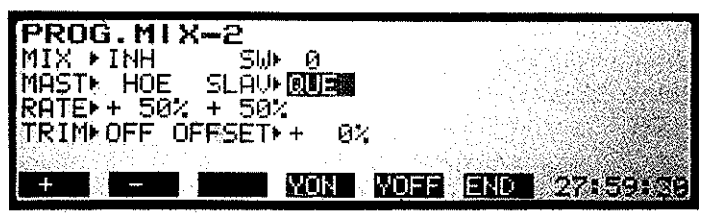
When flying a delta, we require aileron to be mixed to elevator and elevator to be mixed to aileron. Call up the mix PMX1 and activate on the MIX line using 'ACT'.
Enter figure '0' following the SW statement, which in this case means that the mix is switched ON at all times.



Place the cursor on MAST (master). Enter the AIL (aileron) function. Move the cursor to SLAV (slave) and enter the ELE (elevator) function. Whenever the aileron is activated now, the elevator will be 'locked in'.

Place the cursor on the RATE line to set the deflections of the 'slave' function separately for each side. Move the master function (aileron) joystick from one side to the other to control the cursor from one side of the aileron deflection to the other. Since the mix ratio is equal on each side of the aileron deflection, program 100% for both.
Determine, on the TRIM line, whether or not to activate the stick trims, by programming ON here. There is no need to enter any offset position since all functions mixed are self neutralising.

Call up PMX2 and activate the mix on the MIX line with 'ACT'.
Again, enter figure '0' following the SW statement. Place the cursor on MAST (master) and enter the ELE function (elevator). Now move the cursor to SLAV (slave) and enter the AIL function (aileron). Whenever the elevator is activated now, the ailerons will be locked in.



Place the cursor on the RATE line to set the deflections of the slave function for either side of neutral. Activate the master function (elevator) joystick from one side to the other to control the cursor from one side of the deflection to the other. Since the mix ratio is to be equal for each side of the elevator's deflection, program 100% for both.

Once again, program ON on the TRIM line. There is no need for any offset point.

Practical tips

This completes the programming of the delta mix. All that remains is to program the appropriate mix directions using '+/-' so that the surfaces deflect in opposite directions when an aileron command is given, but move in the same direction when elevator is given.

Combination of free-program mixes (XON/YON function)

This function is used to program several mixes 'one after the other'. The following principle of the process will explain the function:
Mixes 1-6 are arranged in a definite priority, i.e. these mixes can only be programmed in a sequence corresponding to this priority. Mix No. 1 should be programmed before all others. Next is Mix No 2, mix No 3 etc.
Therefore, if several mixes are to be linked, the user must consider which mix to program first with PMX 1 and which mix is to follow in sequence.
This process is governed by the following:
PMX1 must be programmed so that the slave in that mix will be the master for other mixes. Locked in mixes have priority over any two P-Mixes programmed as double mixes.

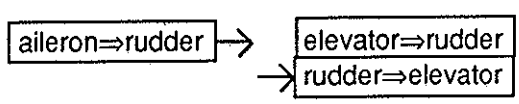
The above can best be explained with an example:
A glider's V-Tail is to be programmed with freely programmable mixes. The rudder is also to be locked in when the ailerons are operated (combi switch)

This involves the following mixes:
elevator ⇒ rudder
rudder ⇒ elevator
aileron ⇒ rudder

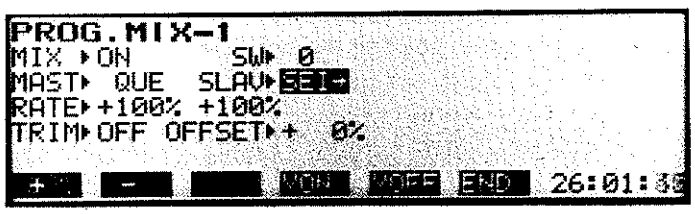
The two mixes - elevator⇒rudder and rudder⇒elevator - are intended to act as double mixes for the V-tail. The slave function of the aileron⇒rudder mix is used to act as the master function of the rudder⇒elevator mix. The resulting priority of mixes, therefore, is as follows:

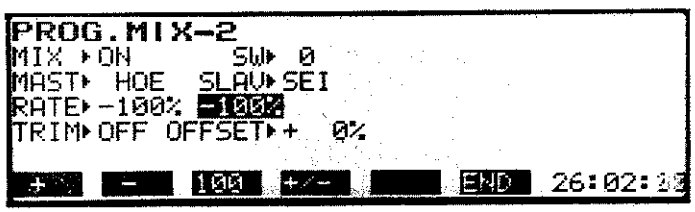
	PMX1:	aileron⇒rudder
double mix:	PMX2:	elevator⇒rudder
	PMX3:	rudder⇒elevator

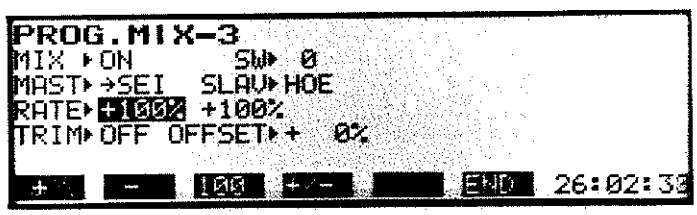
Program and activate the mixes in this order. A switch must be programmed for the aileron⇒rudder mix (combi switch), since this mix is to be operated by a switch. To link this mix (PMX1) with the next mix, use the YON function to place an arrow after the SLAV:RUD, i.e. the link with the following mixes will start with this function.
With the XON function, place an arrow in front of RUD in the rudder⇒elevator mix on the MAST line - thus defining the latter as the mix to receive information from PMX1.
This process is shown by the following diagram:



Each mix is enclosed in a box and the link is indicated by the XON function and YON function arrows.







Practical tips

With a combination of mixes all kinds of seemingly impossible mixes are now available. Since the freely programmable mixes are available in addition to each mix program, the number of functions is almost endless.

Freely programmable mixes - Further examples:

The retracts are normally operated by a slider control. It would be better, however, to operate them from a switch since only two setting (UP and DOWN) are required for operation.

Call up a mix (PMX1) and activate (MIX ACT). Switch No 1 is programmed as the mix switch (SW) and a switch for operating the retracts is connected to the EXT.SWITCH socket 1. The channel 5 slider is identified with GER. Therefore GER (channel 5 slider) is programmed as both 'master' and 'slave' function. On the RATE line, program the values -100% to +100% (when operating the slider control, the cursor jumps from one side of neutral to the other). For programming the offset position, the retract slider control must be moved to the position where the undercarriage is DOWN. Store the position with 'SET' and this point is now programmed as the offset point. Return the slider to the retracted position.

If when the programmed mix switch (no 1) is used the retractable undercarriage remains stationery, program the opposite position of the slider control as the offset point. One of the two setting values (RATE 100%) must now be programmed with another sign using '+/-'.

The slider control must always remain in the opposite position to the offset point so the switch operates the mix ON and OFF.

Function tables

Standard functions

NO.	NAME	ABBR.
02	TIMER SET	TIM
03	TACHO METER	TACO
04	DATA TRANSFER	TRAN
05	SERVO	SERV
07	AFR MODE	AFRm
08	COPY	COPY
09	MIX SWITCH SELECT	MxSW
10	MODEL NAME	NAME
11	MODEL SELECT	MODL
12	REVERSE	REVR
13	MIXING TYPE	MxTY
14	ATV	ATV
15	AFR	AFR
16	EXPO/VTR	AFR
21	FUNCTION CHANGE	FUNC
22	FAIL SAFE	F/S
23	BATTERY FAIL SAFE	BF/S
27	MULTI	MULT
28	PARAMETER	PARA
29	TRIM RATE	RATE
30	TRIM MEMORY	MEMO
32	RESET	RSET
40	PROGRAMMABLE MIX	PMX1
41	PROGRAMMABLE MIX	PMX2
42	PROGRAMMABLE MIX	PMX3
43	PROGRAMMABLE MIX	PMX4
44	PROGRAMMABLE MIX	PMX5
45	PROGRAMMABLE MIX	PMX6

Mix program GLIDER 2

Function table

No.	Function	Abbr.	Master Ch.	Slave Ch.	Switch	Trimmer
09	MIX SWITCH SEL.	MxSW				
50	MIX TRIMMER	MxVR				
79	MIX VR SELECT	MxVR				
51	SUB TRIM	SBTr				
56	AILERON DIFF	DIFF	1	7		X
57	V-TAIL	VTAL	2,4	4,2		
61	AIRBRAKE-ELEV	ABRK	3	2	X	X
62	ELEVATOR TRIM	ETRM	2	X	X	
65	FLAPPERON	FLPR	1,5	1,5		
75	FLAPPERON ELEV	FLMx	5	2	X	X
76	AILE-RUDDER	AILE	1	4	X	X
77	ELEV-FLAPPERON	ELEV	2	1,5	X	X

Mix program GLIDER 5

Function table

No.	Function	Abbr.	Master Ch.	Slave Ch.	Switch	Trimmer
09	MIX SWITCH SEL.	MxSW				
50	MIX TRIMMER	MxVR				
79	MIX VR SELECT	MxVR				
51	SUB TRIM	SBTr				
56	AILERON DIFF	DIFF	1	7		X
57	V-TAIL	VTAL	2,4	4,2		
61	AIRBRAKE-ELEV	ABRK	3	2	X	X
62	ELEVATOR TRIM	ETRM	2	X	X	
72	BUTTERFLY	BUTT	F-6	1,7,8	X	
73	BUTT-ELEVATOR	BUTm	F-6	2		
74	SPEEDFLAP TRIM	SPTr		5,6		X
75	BRAKE-FL.-SPFLP	BFLP	8	5,6		
75	BRAKE-FL.-ELEV	BFLP	8	2	X	X
75	BRAKE-FL.-AILE	BFLP	8	1,7		
76	AILE-SPEEDFLP	AILE	1	5,6		
77	ELEV-BRAKEFLP	ELEV	2	8	X	X

Mix program GLIDER 4

Function table

No.	Function	Abbr.	Master Ch.	Slave Ch.	Switch	Trimmer
09	MIX SWITCH SEL.	MxSW				
50	MIX TRIMMER	MxVR				
79	MIX VR SELECT	MxVR				
51	SUB TRIM	SBTr				
56	AILERON DIFF	DIFF	1	7		X
57	V-TAIL	VTAL	2,4	4,2		
61	AIRBRAKE-ELEV	ABRK	3	2	X	X
62	TRIM-1	TRM1		1,7,2,5,8	X	X
63	TRIM-2	TRM2		1,7,2,5,8	X	X
66	NEUTRAL TRIM	NTRM		1,7,5,8		Xx4
72	BUTTERFLY	BUTT	F-6	1,7,8	X	
73	BUTT-ELEVATOR	BUTm	F-6	2		
74	SPEEDFLAP TRIM	SPTr		5,6		X
75	BRAKE-FL.-ELEV	BFLP	5	2	X	X
75	BRAKE-FL.-AILE	BFLP	5	1,7		
76	AILE-RUDDER	AILE	1	4	X	X
76	AILE-SPEEDFLP	AILE	1	5,6		
77	ELEV-BRAKEFLP	ELEV	2	5,6	X	X

Function tables

Mix program ACRO

Function table

No.	Function	Abbr.	Master Ch.	Slave Ch.	Switch	Trimmer
09	MIX SWITCH SEL.	MxSW				
50	MIX TRIMMER	MxVR				
79	MIX VR SELECT	MxVR				
51	SUB TRIM	SBTr				
56	AILERON DIFF	DIFF	1	7		X
57	RUDDER-AILE	RUDD	4	1		
59	ELEVON	ELVN	1,2	1,2		
61	IDLE UP	IDLE		3	X	X
62	SNAP ROLL	SNAP		1,2,4	X	X
65	FLAPPERON	FLPR	1,5	1,5		
70	PITCH MIX	PIT	3	3,8	X	Xx2
72	AILVAITOR	ALVT	1	2,5		
75	FLAPPERON-ELEV	FLMx	5	2	X	X
76	AILE-RUDDER	AILE	1	4	X	X
77	ELEV-FLAPERON	ELEV	2	1,5	X	X

Repair and service

For optimum repair and service speed, please observe the following:

1. Only send the radio system - not the entire model.
2. Charge the batteries fully prior to despatch to the service centre.
3. Ensure that all parts are securely packed - return the radio in its original packing if possible.
4. The fewer the parts sent, the quicker and simpler the repairs will be.
5. Always enclose a brief, precise description of the defects to save time and money in locating the fault.
6. Always enclose a list of the parts sent and a return name and address.

Mix program HELI

Function table

No.	Function	Abbr.	Master Ch.	Slave Ch.	Switch	Trimmer
09	MIX SWITCH SEL.	MxSW				
50	MIX TRIMMER	MTRM				
79	MIX VR SELECT	MxVR				
51	REVO MIX	REVO	6	4		Xx2
52	HOVER THROTTLE	THOV		3		X
53	PITCH HOVER	PHOV		6		X
54	THROTTLE CURVE	TCrv	3	3	X	
	THR.CRV ID UP1	TCrv			X	
56	THROTTLE HOLD	HOLD		3	X	X
57	PITCH CURVE NOR	PCrv	3	6		
	PIT.CRV ID UP1	PCrv			X	
	PIT.CRV ID UP2	PCrv			X	
	PIT.CRV HOLD	PCrv			X	
	NORMAL LO PITCH	PCrv				X
	NORMAL HI PITCH	PCrv				X
	ID UP1 LO PITCH	PCrv				X
	ID UP1 HI PITCH	PCrv				X
	ID UP2 LO PITCH	PCrv				X
	ID UP2 HI PITCH	PCrv				X
	HOLD LO PITCH	PCrv				X
	HOLD HI PITCH	PCrv				X
	FLY INVERTED			1,2,4	X	X
	INVERT.PIT.HI	PCrv		1		X
	INVERT.PIT.LO	PCrv		1		X
59	OFFSET MIX	OFST		1,2,4		
60	SWASH MODE	SWSH				
68	HOVER OFFSET	HVOF				
69	SWASH-MIX	SWMx	1,2	3		
69	SWASH-MIX	SWSH	1,2	1,2		
72	GYRO MIX	GYRO	4	5		
73	ACCELER.MIX	ACCE	6	4		
74	RUDDER TO THR	RD-T	4	3		X

Servo horns

Both the horn and the servo output shaft are splined to enable mechanical changes of the servo neutral position.

Setting the neutral position:

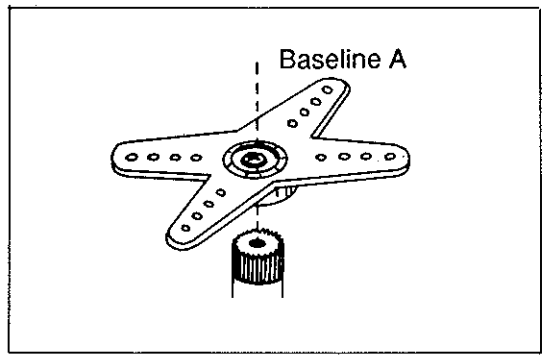
Remove the horn fixing screw, lift off the horn and re-fit in the required neutral position. Re-fit the fixing screw.

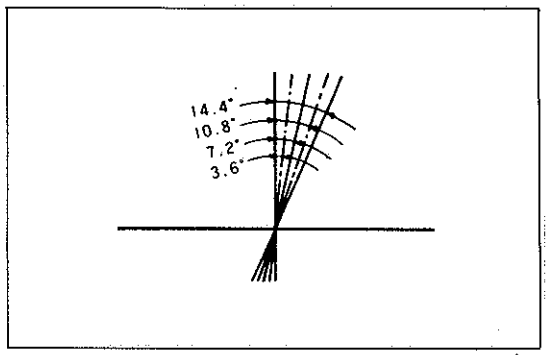
Effect:

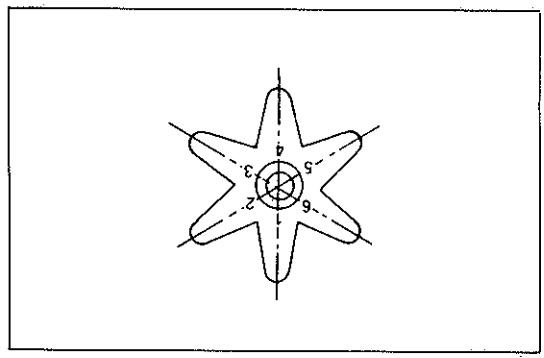
For the smallest possible adjustment to the RIGHT (3.6°), arm 2 of the four armed horn must be placed nearest to the baseline A, so that arm 3 is adjusted by 7.2° and arm 4 by 10.8°. For the smallest possible adjustment to the LEFT, arm 4 must be placed on the next position to baseline A.

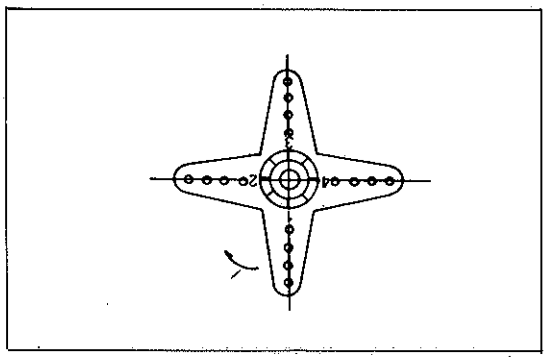
Divisions:

The output shaft and output horn are divided into 25 segments. Therefore, any change of setting equals 360°/ 25 = 14.4° per segment. The minimum adjustment depends on the number of lever arms. For a 4 armed lever, this adjustment amounts to 360°/ (25 x 4) = 3.6°, for a 6 armed lever this equals 2.4°. Arm 2 can be moved by 2.4° to the right, arm 3 by 4.8° to the right, arm 6 by 2.4° to the left, arm 5 by 4.8° to the left, arm 4 by 7.2° to the left and right.

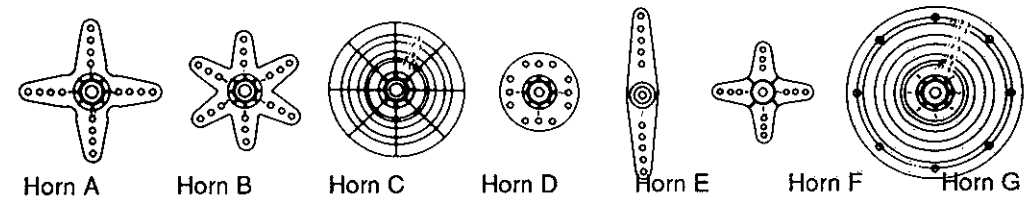








Currently available servo horns



Horn A (FSH-6X) | Horn B (FSH-6S) | Horn C (FSH-6R) | Horn D (FSH-6W) | Horn E | Horn F | Horn G

General information

By choosing the Futaba FC-28 system, you have selected a high quality radio with the largest range of options and features available. All components are manufactured to the highest standards and designed for ease of use. The system will satisfy even the most demanding expert. In this handbook you find examples and programming hints to enable you to learn the programming system and obtain the best results from your new radio. Please read this manual carefully and take your time to understand each programming stage. Once familiarised, adjustments and programming new models will be simple - with no further reference to this manual necessary.
NOTE: When learning how to use this system, it is important that you do not leave the module fitted if the aerial is left retracted whilst going through lengthy 'experimental' programs.

We wish you continued pleasure and success with your new FC-28 system.

Index

General information

Function summary

Standard functions

HELI functions

Mix functions

Abbreviations

Abbreviation	English
2ndAIL	Second aileron (differential)
3rd AIL	Third aileron
4thAIL	Fourth aileron
5SRV	5 Servos
ABOR	Abort
ABRK	Airbrake
ABRK mix	Airbrake mix
ABRK-ELEV	Air brake - elevator mix
ACCE	Acceleration mix
ACRO	Aerobatic (mix program)
ACT, act	Active
AFRm	AFR mode
AILE-RUDD	Aileron-rudder mix
AILE-SFLP	Aileron-speedflap mix
AILE-DIFF	Aileron differential
AIL, AILE	Aileron
ALVT	Ailevator
ANLG	Analog
ATL	Adjustable throttle limit
ATV	Adjustable travel volume
AUTO	Automatic
BAUD RATE	Transmission rate (baud)
BFLP	Brake flaps
BFLP-AILE	Brake flap-aileron mix
BFLP-ELEV	Brake flap-elevator mix
BFLP-SFLP	Brake flap-speed flap mix
BF/S	Battery failsafe
BLADE	Propeller blade
BUTT	Butterfly function
BUTT-ELEV	Butterfly-elevator mix
BUTm	Butterfly mixing
CH	Channel
CLER	Clear
CNSL	Cancel
CODE	Security code number
COPY	Copy
DELAY	Delay
DIFF	Differential
DIGT	Digital
DIST	Distance (flight mode)
D, DN	Down
D/R	Dual rate
EDIT	Edit
ELE-TRIM	Elevator trim
ELEV	Elevator
ELEV-BFLP	Elevator-brake flap mix
ELEV-FLPR	Elevator-flaperon mix
ELEV-SFLP	Elevator-speed flap mix
ELVN	Elevons
ENTR	Enter
ETRM	Elevator trim
FAILED	Failed
FLIG	Flight (normal flight mode)
FLMx	Flap mix
FLPR-ELEV	Flaperon-elevator mix
FLPRN	Flaperon
FLPR-MIX	Flaperon mix
FUNC	Function change
func,FNC,FUNC	Function
FUNCTION CALL	Function call mode
F/S	Failsafe
GLID	Glider
GYRO	Gyro sensitivity
HELI	Helicopter
HOLD	Throttle hold
HOVER	Hover
HVOF	Hovering offset
H, HI	High
IDLE-UP	Idle up
IDL,IDLE	Idle
INH, inh	Inhibit
INV,INVERT	Inverted
L	Left
LAND	Landing (flight mode)
L, LO	Low

Abbreviation	English
L/D	Left/down
MANU	Manual
MAST	Master function
MEMO	Memory
MIX TYPE	Mix type
MODE	Mode
MODL	Model select
MODL2	Model 2
MTRM	Mix trimmer
MULT	Multi channel
MxSW	Mix switch
MxTY	Mix type
MxVR	Mix trimmer
NAME	Name set
NORM, NOR	Normal
NO.	Number
NTRM	Neutral trim
N-R	Nick-roll (ele-ail)
OFF	Off
ofs	Offset
OFST	Offset mix
ON	On
PARA	Parameter
PCM	Pulse code modulation
PCrv	Pitch Curve
PHOV	Hovering pitch
PIT	Pitch
PMX1-6	Freely programmable mix 1-6
POINT	Point
POSI	Position
PPM	Pulse position modulation
RATE	Rate
RD-T	Rudder-throttle mix
RECI	Receiver
REVO	Revolution mix (revo mix)
REVR,REV	Reverse
RSET, RES	Data reset
RUDD-AILE	Rudder-aileron mix
RUDD, RUD	Rudder
RX	Receiver
R-N	Roll-nick (aileron-elevator)
R, RIGH	Right
R/U	Right/Up
SBT	Sub trim
SELE	Select
SERV	Servo
SET	Setting
SFLP-AILE	Speed flap-aileron mix
SFLP-ELEV	Speed flap-elevator mix
SLAV	Slave
SMix	Special mix
SNAP	Snap roll
SPED	Speed (flight mode)
SPTr	Speed flap trim
STAR	Start (flight mode)
SW	Switch
SWMx	Swashplate mix (rotation)
SWSH	Shashplate
TACO	Tachometer
TCrv	Throttle curve
THOV	Hovering throttle
THR FNC	Throttle function
THR-POS	Throttle position
THR,THRO	Throttle
TIMR	Timer
TRAINER	Trainer
TRAN	Data transfer
TRIM	Trim rate
TRIM-MEMO	Trim memory
TX	Transmitter
TYPE	Type
USER	User
U,UP	Up
VTAL	V-Tail
VTR	Variable trace ratio
WING TYPE	Wing type