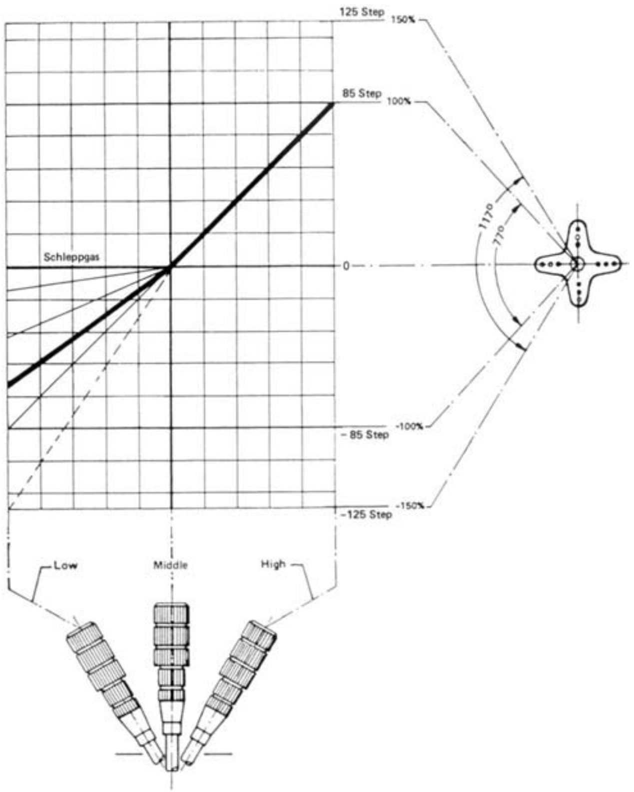
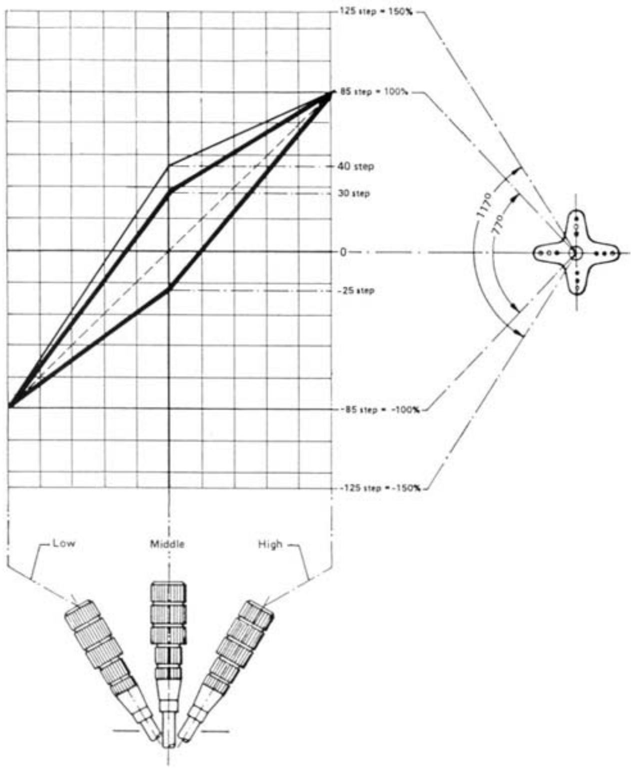
Examples of setting the Throttle pre-select

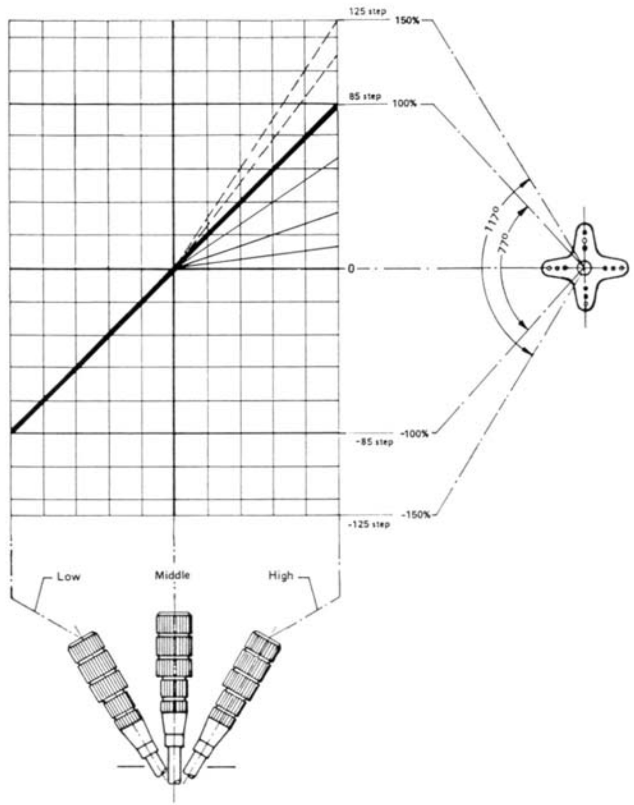
Throttle Low – "TL0", "TL1", "TL2"
With this option you can programme three alternative throttle pre-selects for different flight tasks.

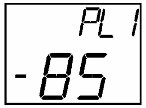


Throttle Middle – “TM0”, “TM1”, “TM2”
With “TM0” through “TM2”, three alternative hover point throttle settings can be programmed.



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





Pitch Curve

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

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

The curves are determined in each case by three points:

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

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

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

Switch 3 = OFF, ATR inactive

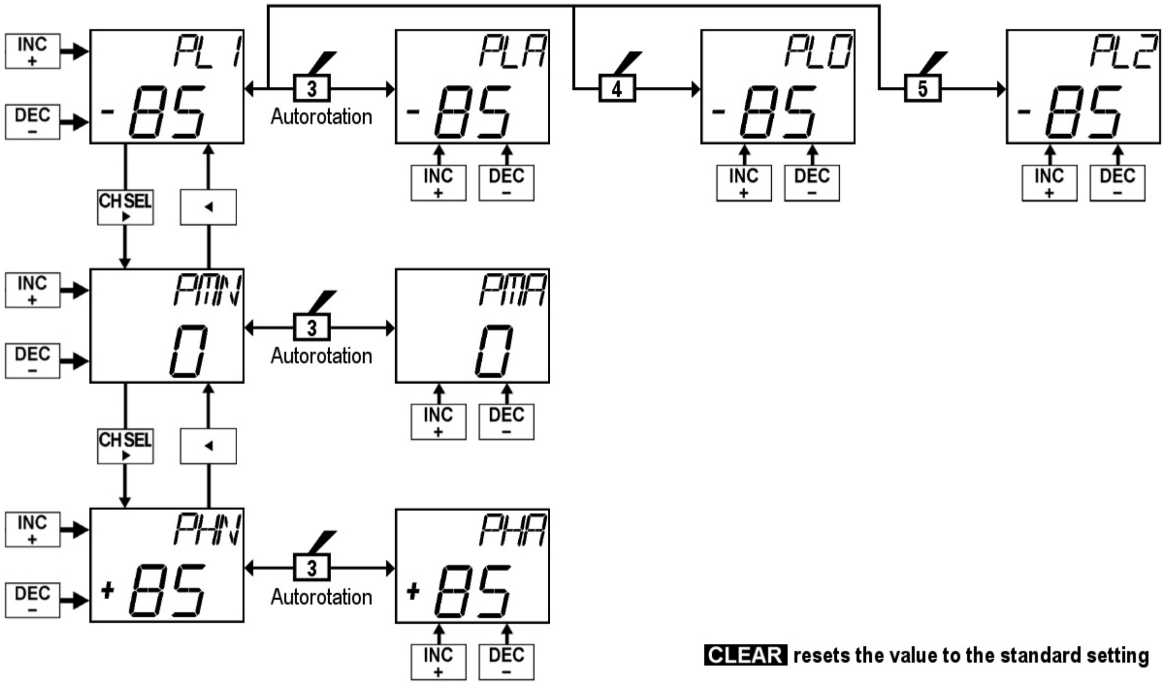
Both switches in OFF position	"PL1"
Switch 4 = ON, Switch 5 = OFF	"PL0"
Switch 4 = ON or OFF, Switch 5 = ON	"PL2"

Switch 3 = ON, ATR activated

Switch 4 and 5 = ON or OFF	"P…A"

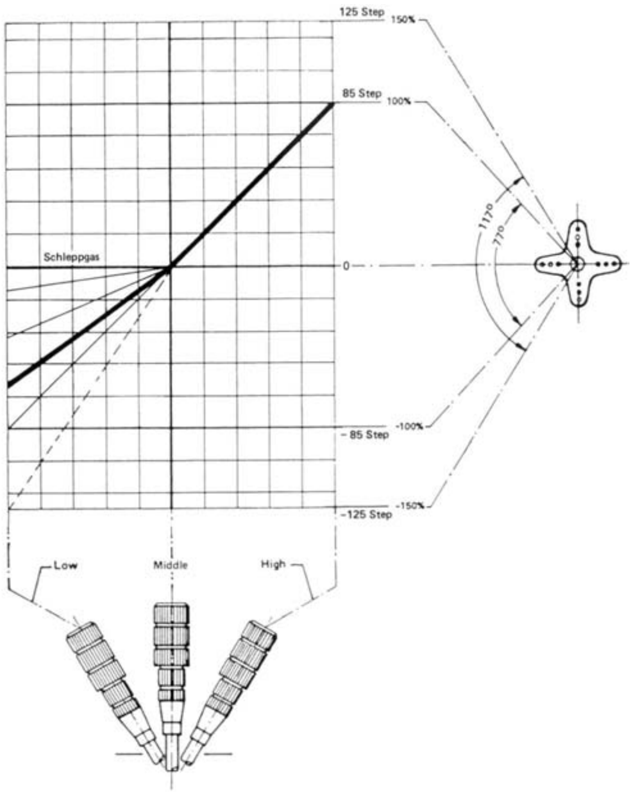
Setting

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

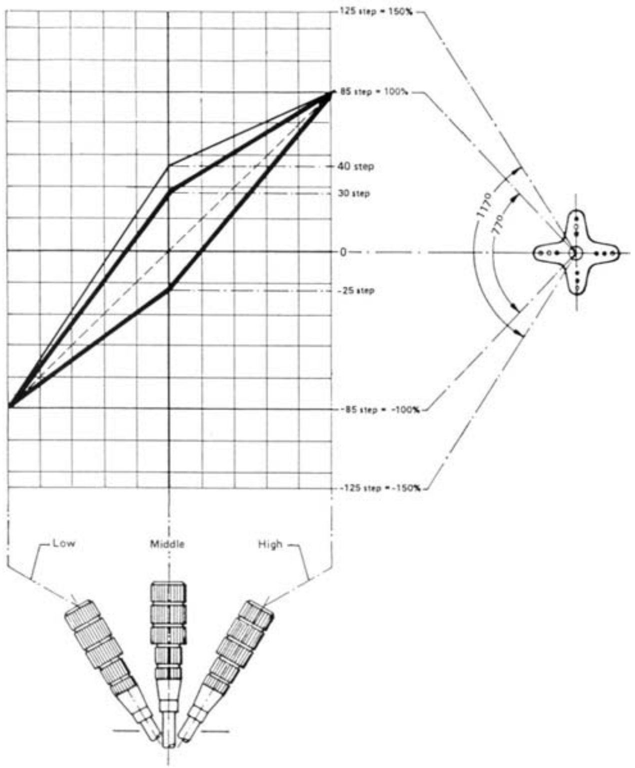


Examples of setting the Throttle pre-select

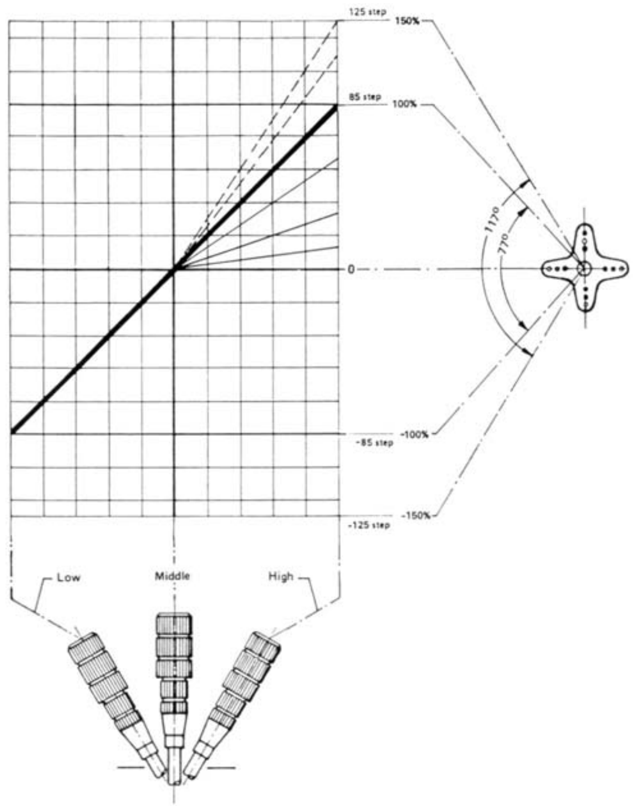
Pitch Low – "PL0", "PL1", "PL2"
For the three throttle pre-select settings "TL0", "TL1" and / or. "TL2" different low collective pitch values are programmable.
Operation of the autorotation switch in socket 3 allows a fourth low collective pitch value "PLA" to be programmed.



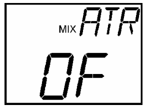
Pitch Middle – “PLM”
With this option the pitch value for the hovering flight is set.
Using the autorotation switch in socket 3 allows "PMA" to be selected and a collective pitch value for the autorotation landing to be set..



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



24



AUTOROTATION

Switching to Autorotation
(access via Set-Up Menu)

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

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

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

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

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

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

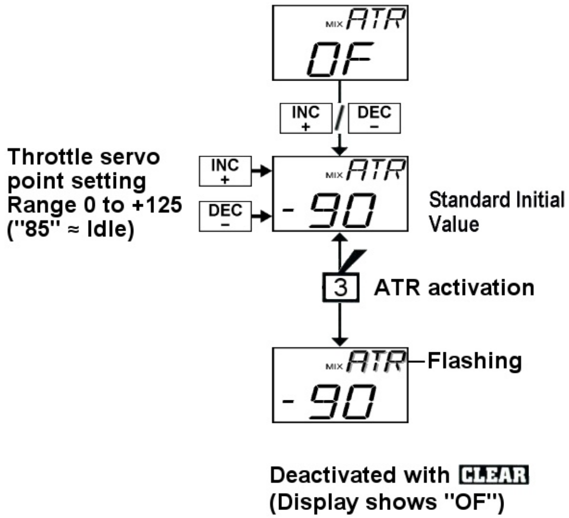
The throttle function is separated from the control stick, which still controls the collective pitch; the throttle servo takes a position set in the "ATR" program.

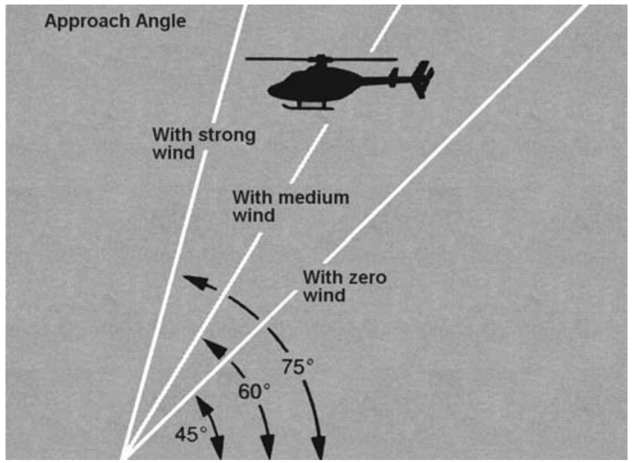
Additionally the activation of the autorotation switch causes the following:

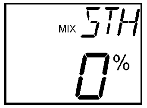
- The mixers "ST..." for the static and "DYN" for dynamic torque compensation are switched off. The announcements "STH", "STL" or "DYN" flash in the display.
- The set values of the throttle curves are no longer effective, which is indicated by "TL0", "TL1" or "TL2" flashing in the display.
- The autorotation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

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

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







STATIC TORQUE COMPENSATION

Static Mixer
(access via Set-Up Menu)

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

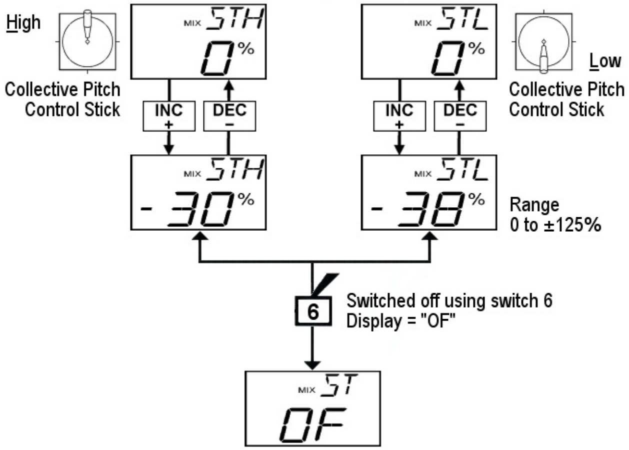
It is the goal of this option is to find settings to compensate for the change in torque, compared to that for hovering flight, to prevent the helicopter turning during climbing and descending flight. It is not intended to trim for hovering flight which is carried out exclusively with the tail rotor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

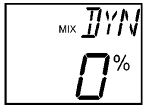
Required for a useful setting of torque compensation is that the pitch and gas curves were correctly set, ensuring a constant rotor speed through the entire range of collective pitch (see page 70).

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

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

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





DYNAMIC TORQUE COMPENSATION

Dynamic Mixer
(access via Set-Up Menu)

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

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

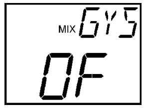
The **mix direction** depends on the direction of the main rotor rotation: For anti-clockwise rotating systems (anti-clockwise as seen from above, e.g. HEIM-system) positive values are to be set, for clockwise rotating rotors use negative values.

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

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

Range 0 to ±125%
(CLEAR = 0%)

Switched off using switch 6
Display = "OF"



Gyro Control

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

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

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

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

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

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

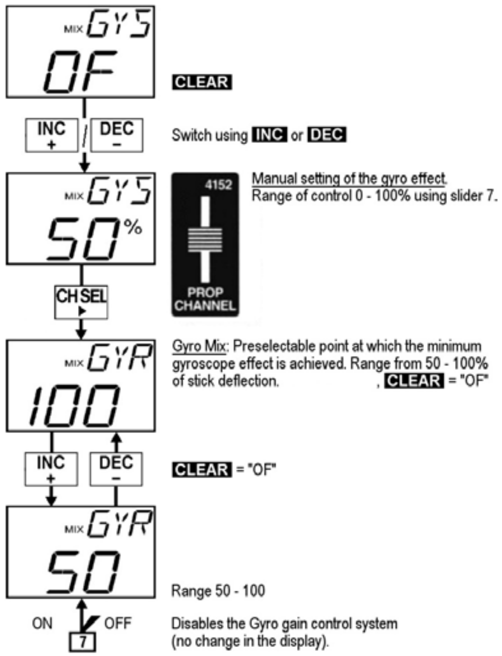
In order to achieve an optimum stabilisation in each situation, the gyro effect can be adapted from the transmitter using a slider control in connection 7. In the upper end position of the control only gyro adjuster 2 is effective. This is adjusted in such a way that with zero wind in hovering flight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

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

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

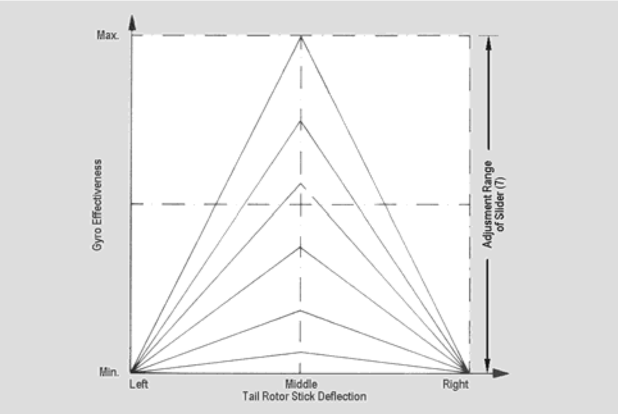
The effect can be set between these two limits using the slider control on channel 7.

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



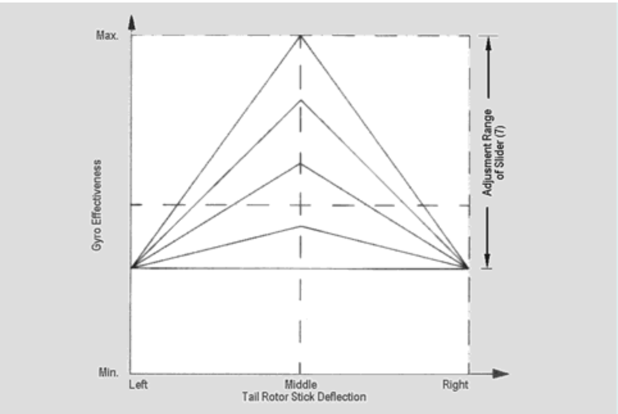
Example:

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



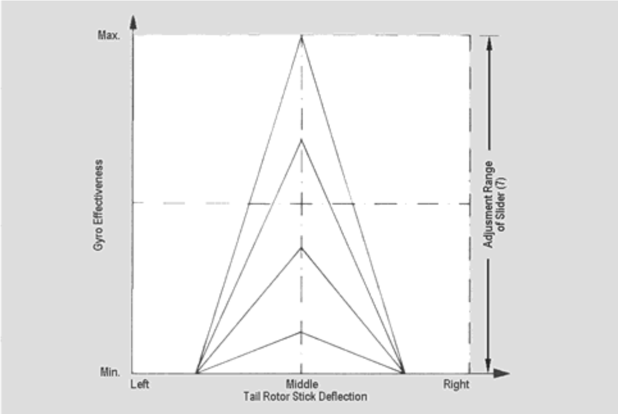
With the slider control 7 the gyro effect can be set anywhere from "0" up to the maximum. During operation of the tail rotor control the gyros effect has a linear reduction, where the "0" value is reached at stick full travel position.

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



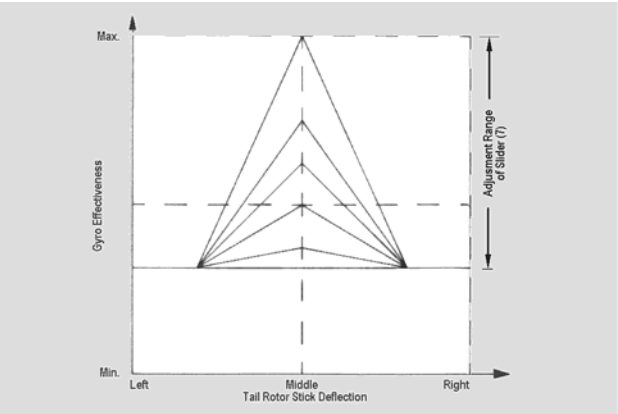
The gyro effect can be varied with slider control 7 between the two adjusted values. Automatic gyro gain takes place only down up to the value set with adjuster 1.

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

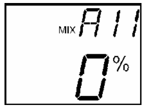


In contrast to example 1 the gain reduction is when the tail rotor control stick has moved 60% of its travel.

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



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



Freely Programmable Mixer

Free Programmable Mixer
(access via Set-Up Menu)

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

Setting example for mixer "A"

1. Channel Selection.

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

2. Allocation of a mixer switch.

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

Mixer	Transmitter Socket
A	7
B	6

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

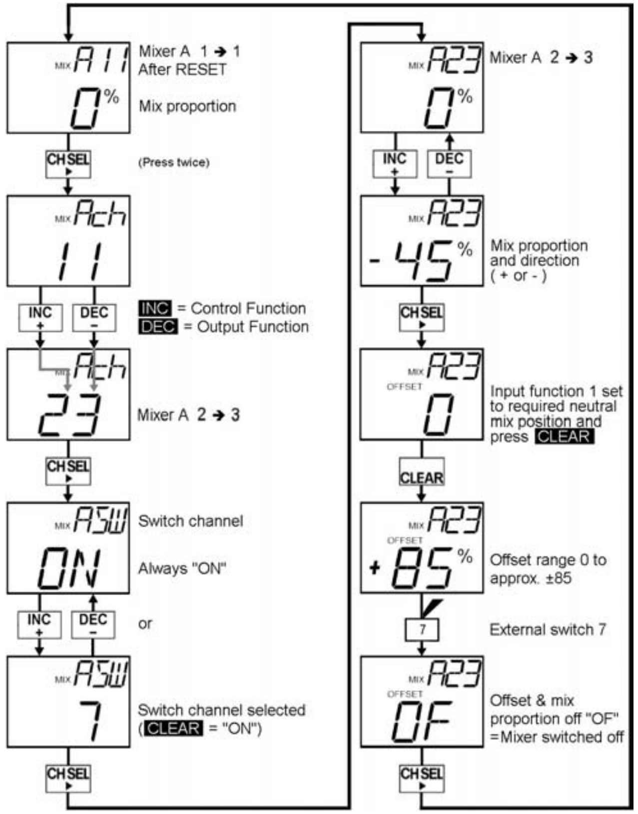
3. Setting mix proportion and mix direction.

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

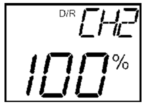
4. Specify the mixer neutral point (offset setting).

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

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



1



DUAL-RATE

Switchable Servo Travel
(access via Set-Up Menu)

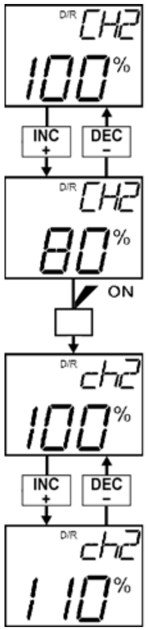
The Dual-Rate function lets you switch to a different amount of travel while the model is in flight, using an external switch. The travel for each of the two switch positions can be set to any value within the range 0 to 125% of normal servo travel. The “D/R” switches must first be connected to main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

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

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

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

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



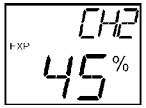
Select servo function (2,3 or 4) using the CH SEL or ◀ button. Set the required value using INC or DEC

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

Previously set value

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

2



EXPONENTIAL

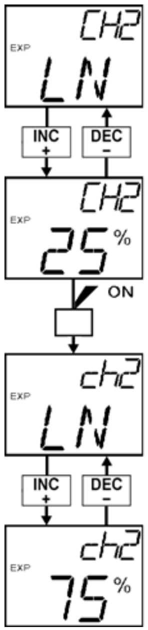
Progressive Servo Travel
(access via Set-Up Menu)

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

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

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

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



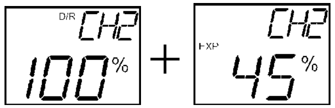
Select servo function (2,3 or 4) using the CH SEL or ◀ button. Set the required value using INC or DEC

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

Previously set value

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

1 2

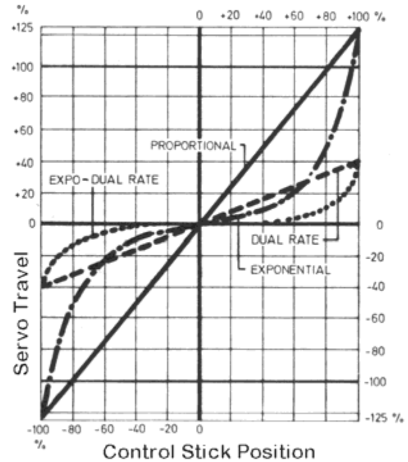


EXPO-/ DUAL-RATE

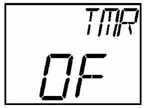
Coupled Dual-Rate & Exponential
(access via Set-Up Menu)

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

Characteristic Curves for various settings.



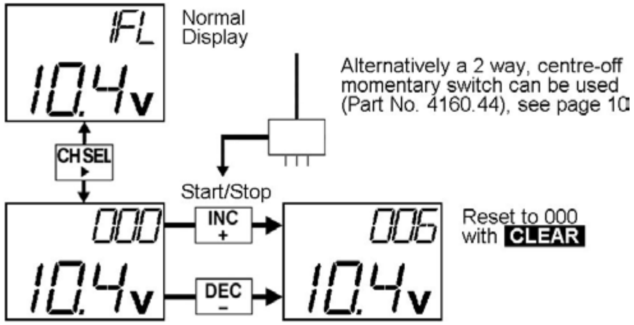
Dual-Rate	=	Linear reduction or increase of servo travel (0% to 125%)
Exponential	=	Progressive control characteristic with 100% servo travel
Expo-/Dual-Rate	=	Combined Exponential and Dual-Rate function



STOPWATCH and ALARM TIMER

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

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



The code "TMR" allows the application possibilities to be extended:

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